PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM

OCTOBER 24, 2006

LAST UPDATED MARCH 11, 2020[1]

[1]See document revision change log on last page of this PDF.

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
COOPERATIVE AGREEMENT
AMENDMENT No. 1

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
COOPERATIVE AGREEMENT
AMENDMENT No. 1
OCTOBER 21, 2019

The Governors of the States of Colorado, Nebraska, and Wyoming and the Secretary of the Interior ("Signatories") approved the Platte River Recovery Implementation Program ("Program") Cooperative Agreement ("Program Agreement") on December 6, 2006. In the Program Agreement, the Signatories agreed to participate in the Program described in the Program Document dated October 24, 2006, and its attachments. This Amendment No. 1 to the Program Agreement demonstrates the Signatories' consent to additional funding responsibilities as required by Section III.B.1.d. of the Program Document.

I. Amendment No. 1

Subject to legislative approval as provided in Section II.G. of the Program Agreement, the Signatories hereby agree to the First Increment Extension contributions described in Attachment A to the Addendum to the Final Platte River Recovery Implementation Program – First Increment Extension dated June 7, 2017.

II. Date of Amendment No. 1

The date of this Amendment shall be the date of signing by the final Signatory.

III. Terms and Conditions

All other terms and conditions of the Program Agreement shall remain in full force and effect except where specifically modified by this Amendment No. 1.

IV. Signatures

For the Department of the Interior

Secretary DAVID L. BERNHARDT Department of the Interior	12/ 20/2019 Date

IV. Signatures (Continued)

For the State of Colorado

Governor JARED POLIS
State of Colorado

NOV 25 2019

Date

IV. Signatures (Continued)

For the State of Nebraska

Pete Ricketts

Governor PETE RICKETTS
State of Nebraska

11/25/19

Date

IV. Signatures (Continued)

For the State of Wyoming

Governor MARK GORDON
State of Wyoming

9-December 2019
Date

ADDENDUM TO THE FINAL PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM – FIRST INCREMENT EXTENSION

ADDENDUM TO THE FINAL PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM FIRST INCREMENT EXTENSION

June 07, 2017

I. PREAMBLE

The Platte River Recovery Implementation Program (Program; PRRIP) became effective January 1, 2007 following signatures by the Governors of Colorado, Wyoming, and Nebraska and the U.S. Secretary of the Interior. PRRIP provides Endangered Species Act (ESA) compliance for water related activities within the three states and Federal Government while working to provide recovery benefits for four endangered and threatened species.

The First Increment of the Program began in 2007 and extends through 2019. The Program's long-term goal is to improve and maintain the associated habitats of the target species. This includes: (1) improving and maintaining migrational habitat for whooping cranes and reproductive habitat for least terns and piping plovers; (2) reducing the likelihood of future listing of other species found in this area; and (3) testing the assumption that managing flow in the central Platte River also improves the pallid sturgeon's lower Platte River habitat.

The Program signatories committed to achieving the following objectives by the end of the First Increment of the Program:

(1) providing water capable of improving the occurrence of Platte River flows in the central Platte River associated habitats relative to the present occurrence of species and annual pulse target flows by an average of 130,000 to 150,000 acre-feet per year at Grand Island, through reregulation and water conservation/supply projects. Department of the Interior (DOI) and the states agree that United States Fish and Wildlife Service (FWS) target flows will be examined through the Adaptive Management Plan (AMP) and peer review and may be modified by FWS accordingly. DOI and the states have agreed, however, that during the First Increment, species and annual pulse target flows serve as an initial reference point for determining periods of excess and shortage in the operation of Program reregulation and water conservation/supply projects.

(2) protecting, restoring where appropriate, and maintaining at least 10,000 acres of habitat in the central Platte River area between Lexington and Chapman, Nebraska.

During the First Increment ESA compliance is measured through progress in achieving ten Program Milestones that are related to the First Increment Objectives. Milestones and current Program status are presented in **Table 1**. Given the status of the Water Action Plan identified in **Table 1**, the primary purpose of this Extension is to fulfill the Program's obligations under the Water Action Plan as described in this document.

The First Increment land objective and associated milestone have been achieved. The Program currently protects in excess of 12,000 acres in the Associated Habitat Reach (AHR). The First Increment water objective (Milestone #4) is not achievable by the end of 2019, and due to reliance on water projects being developed by the Governance Committee (GC), the Nebraska Depletions Plan (Milestone #9) is also not achievable by 2019. All State water projects and the Colorado, Wyoming, and Federal depletions plans are operational. The Program currently provides approximately 90,000 acre-feet towards the First Increment objective of 130,000 to 150,000 acre-feet. Additional water projects in the planning and/or design phase are expected to provide an additional 40,000 acre-feet of water. However, they will not be operational prior to the end of the First Increment in 2019 and may require more funding than what is currently available during the First Increment. As such, Milestone 4 will not be achieved.

Table 1. Platte River Recovery Implementation Program ESA Compliance Milestones (Final Program Document, Attachment 2, Pages 1-2).

Milestone	Program Status (as of November 2016)
1. The Pathfinder Modification Project will be operational and physically and legally capable of providing water to the Program by no later than the end of Year 4 of the First Increment.	Achieved
2. Colorado will complete construction of the Tamarack I and commence full operations by the end of Year 4 of the First Increment.	Achieved
3. CNPPID and NPPD will implement an Environmental Account for Storage Reservoirs on the Platte System in Nebraska as provided in FERC licenses 1417 and 1835.	Achieved
4. The Reconnaissance-Level Water Action Plan, as may be amended by the Governance Committee, will be implemented and capable of providing at least an average of 50,000 acre-feet per year of shortage reduction to target flows, or for other Program purposes, by no later than the end of the First Increment.	Not Achievable by end of 2019
5. The Land Plan, as may be amended by the Governance Committee, will be implemented to protect and, where appropriate, restore 10,000 acres of habitat by no later than the end of the First Increment.	Achieved
6. The Integrated Monitoring and Research Plan, as may be amended by the Governance Committee, will be implemented beginning Year 1 of the Program.	Achieved
7. The Wyoming Depletions Plan, as may be amended with the approval of the Governance Committee, will be operated during the First Increment of the Program.	Achieved
8. The Colorado Depletions Plan, as may be amended with the approval of the Governance Committee, will be operated during the First Increment of the Program.	Achieved
9. The Nebraska Depletions Plan, as may be amended with the approval of the December 7, 2005 Milestones Document 2 Governance Committee, will be operated during the First Increment of the Program.	Not Achievable by end of 2019
10. The Federal Depletions Plan, as may be amended with the approval of the Governance Committee, will be operated during the First Increment of the Program.	Achieved

Implementation of the AMP, including Integrated Monitoring and Research Plan (IMRP) activities, is ongoing and has focused on testing of the flow-sediment-mechanical (FSM) and mechanical creation and maintenance (MCM) management strategies. Accordingly, the Program's IMRP milestone has been achieved. However, the objective of examining FWS target flows through the AMP has not yet been achieved. Design, implementation, and assessment of target flow-related management actions will not be possible prior to the end of 2019.

Section II.D of the 2006 Final Program Agreement makes provision for the Agreement to be extended or amended by the written agreement of all signatories. This proposal presents a 13-year Extension (2020-2032) of the First Increment. The Extension would not change First Increment objectives, milestones, or the implementation framework. It would provide additional time to complete and operate Program water projects and to conduct the monitoring and research necessary to determine the best use of Program water to benefit the target species. This knowledge is necessary to provide a sound base upon which to structure a Second Increment.

II. PROPOSED FIRST INCREMENT EXTENSION ACTIVITIES

Proposed Extension activities are organized according to the existing Program land, water, and adaptive management plan structure. These activities will be implemented in 2020-2032 and will reflect GC decisions through the end of the First Increment. Accomplishment of Extension activities is dependent upon what is practicably achievable given available funding and resources, as described in this document.

A. Land Plan

The First Increment milestone of protecting 10,000 acres has been achieved. Restoration and management of habitat lands is ongoing. Extension Land Plan activities will proceed under the same principles that have guided land acquisition and management since Program initiation. Land acquisition will proceed under a willing buyer/willing seller approach and all management activities will be conducted in accordance with the Program's Good Neighbor Policy.

Land Acquisition

- Review and renew (as appropriate) existing leases and management agreements.[1]
- At the request of owners, evaluate existing conservation lands for inclusion in the Program under management or sponsorship agreements.
- Acquire an interest in at least an additional 1,500 acres of complex habitat with the intent of establishing a new habitat complex.

Land Management

- Manage lands acquired by PRRIP for the benefit of the target species and species of concern when not in conflict with the target species.
- Conduct land management actions within the framework of the Land Plan and the AMP.

B. Water Plan

- The Program is committed to achieving the minimum water milestone of 130,000 acre-feet in annual reductions to target flow shortages. However:
  - The Program recognizes there are fiscal constraints to achieving this milestone, and
  - Scientific investigations need to be completed to confirm the need for 130,000 acre-feet in annual reductions to target flow shortages.
- The Program will invest the resources available to achieve at least 120,000 acre-feet in annual reductions to target flow shortages as quickly as possible during the Extension and will also invest in the science necessary to determine if the additional 10,000 acre-feet is justified.
- The Program is committed to finding the additional resources necessary to achieve that additional 10,000 acre-feet if justified by the science.
- Extension Water Plan activities will proceed under the same principles that have guided water supply and management since Program initiation. Water acquisition will proceed under a willing buyer/willing seller approach and all water management activities will be conducted in accordance with the Program's Good Neighbor Policy.

Water Conservation and Supply

- Design, construct, and implement Water Action Plan (WAP) projects in time to enable scientific evaluation prior to the end of the Extension term.
- Revise state and federal depletions plans to remain consistent with operational or statutory requirements.[2]
- Renew water project agreements as deemed necessary to achieve water milestone.

---

[1] Renew Cottonwood Ranch sponsorship agreement (2,650 acres), Broadfoot South lease (15 acres), and complex management and land use agreements (1,140 acres).

[2] The Program will cooperate with Nebraska as it finalizes its Depletion Plan.

Program Water Management

- Aggressively continue to implement channel conveyance improvements at North Platte choke point through efforts directed toward achieving and maintaining at least 3,000 cfs conveyance capacity while remaining below flood stage, with additional capacity developed as practicably achievable with available resources.
- Implement water releases including short-duration high flows (SDHF) and target flows once Program water projects are operational and choke point conveyance issues are resolved.
- The Program will continue to evaluate the efficacy of available Program water and choke point capacity through time to ensure Program water meets its intended purposes.

C. Adaptive Management Plan

The First Increment milestone of implementation of the PRRIP Integrated Monitoring and Research Plan (IMRP) has been achieved. During the Extension, AMP implementation will include evaluation of FWS target flows in addition to current Program management actions.

Management Actions

- Continued implementation of the management actions specified in the AMP related to SDHF, sediment augmentation, and least tern, piping plover, and whooping crane habitats.
- Contribute to reach-scale phragmites and invasive species control efforts.
- Utilization of Program water assets to implement and evaluate flow-related management actions including SDHF and species-related target flows.

Integrated Monitoring and Research

- The IMRP will continue to provide the framework for monitoring the implementation and effectiveness of Program management actions during the Extension.
- Pallid sturgeon activities in the Extension will be guided by the results of the incremental four-step process adopted by the GC at the September 2016 meeting.
- The Program will continue to consider the emerging science related to climate change in management and decision making.

Independent Science Review

- Retain a six-member Independent Scientific Advisory Committee.
- Continue peer review and publication of key Program science products relevant to decision making.

III. FIRST INCREMENT EXTENSION FUNDING

Federal and State contributions will continue throughout the Extension using the existing 50/50 cost share with credits for in-kind contributions from the States. Key budget items and projected new money expenditures for the Extension are contained in **Attachment A**. All Government funding commitments made in this proposed Program Extension are subject to approval and appropriation by the appropriate state and federal legislative bodies.

IV. FIRST INCREMENT EXTENSION ORGANIZATIONAL STRUCTURE

First Increment governance and organizational structure will be retained throughout the Extension.

Attachment A

PRRIP First Increment Extension Budget and Cash Flow Requirements[3]

Activity	Estimated Cash Requirements in 2020 Dollars (Millions)	Cash Equivalent Credit (Millions)
Water (120 – 130 KAF of total water/Yr)		
• Three States Water Projects (80 KAF/Yr)		$50.000
• Channel Capacity Improvements	$ 4.550	
• Water Conservation/Supply (40-50 KAF/Yr)	$84.561	
Subtotal – Water	$89.111	$50.000
Land (Additional Acres)		
• Acquisition (1,500 Acres)	$12.548	
• Land Management	$ 4.135	
Subtotal – Land	$16.683	
Monitoring, Research, & Program Implementation		
• Adaptive Management Plan	$10.782	
• Monitoring and Research	$14.774	
• Independent Science Review	$ 3.588	
• Program Implementation and Governance	$33.886	
Subtotal – Monitoring, Research, & Program Implementation	$63.030	
Totals	$168.824	$50.000
Less: First Increment Funding Carried Forward	$62.824	
Total 2020 -2032 First Increment Extension	$106.000	$50.000

Total 2020 – 2032 First Extension Cash and Cash Equivalent Costs = $156.00

2020 – 2032 First Increment Extension Contributions (Values in Millions)					
Contributions	**Total**	**DOI**	**Colorado**	**Nebraska**	**Wyoming**
Cash	$106.000	$78.000	$24.900	$ 0.000	$ 3.100
Cash Equivalent	$ 50.000	$ 0.000	$ 6.250	$31.250	$12.500
Totals	$156.000	$78.000	$31.150	$31.250	$15.600

[3] All Government funding commitments made in this proposed Program Extension are subject to approval and appropriation by the appropriate state and federal legislative bodies.

FINAL
PLATTE RIVER RECOVERY
IMPLEMENTATION PROGRAM

Table of Contents

List of Attachments

Platte River Recovery Implementation Program

October 24, 2006

In the Platte River Recovery Implementation Program Cooperative Agreement ("Program Agreement"), the Department of the Interior ("DOI") and the States of Colorado, Nebraska and Wyoming ("the states") agreed to participate in the basin-wide cooperative program described in this Program Document and its attachments relating to four target species (interior least tern, whooping crane, piping plover and pallid sturgeon) listed as threatened or endangered pursuant to the Endangered Species Act ("ESA"), 16 U.S.C. 1531 et seq., and their associated habitats.[1] The Platte River Recovery Implementation Program ("Program") builds upon the July 1, 1997 Cooperative Agreement for Platte River Research and Other Efforts Relating to Endangered Species Habitats Along the Central Platte River, Nebraska ("July 1997 Cooperative Agreement"). The Program includes certain activities and contributions from the states and the federal government to be conducted during incremental time periods as described below. The signatories have agreed that implementation of this Program will be through a Governance Committee consisting of representatives of the signatories and stakeholders as described in the Program Organizational Structure in Attachment 6.

I. PROGRAM PURPOSES

A. The purpose of this Program is to implement certain aspects of the U.S. Fish and Wildlife Service's (FWS') recovery plans for the target species that relate to their associated habitats by providing for the following:

1. securing defined benefits for the target species and their associated habitats to assist in their conservation and recovery through a basin-wide cooperative approach agreed to by the three states and DOI;

---

[1] For purposes of this Program Document and its attachments, the term "associated habitats" means, with respect to the interior least tern, whooping crane, and piping plover, the Platte River valley beginning at the junction of U.S. Highway 283 and Interstate 80 near Lexington, Nebraska, and extending eastward to Chapman, Nebraska, including designated critical habitat for the whooping crane and that portion of any designated critical habitat for piping plover within that Lexington to Chapman reach. With respect to the pallid sturgeon, the term "associated habitat" means the lower Platte River between its confluence with the Elkhorn River and its confluence with the Missouri River. "Associated habitats" may, to the extent approved by the Governance Committee, include any critical habitat in the Lexington to Chapman reach of the Platte River basin which is subsequently designated by the U.S. Fish and Wildlife Service for the target species. The Governance Committee may agree to undertake, fund or give credit for land activities outside the associated habitats to provide biological benefits to the target species.

2. providing ESA compliance[2] for existing and new water related activities[3] in the Platte River basin[4];

3. helping prevent the need to list more basin associated species pursuant to the ESA;

4. mitigating the adverse impacts of new water related activities on (1) the occurrence of FWS target flows (as described in Section III. E.1.a.) and (2) the effectiveness of the Program in reducing shortages to those flows, such mitigation to occur in the manner and to the extent described in Section III.E.3 and in the approved depletions plans; and

5. establishing and maintaining an organizational structure that will ensure appropriate state and federal government and stakeholder involvement in the implementation of the Program.

B. When doing so will not reduce resources available to target species, the Program will also manage Program lands to benefit non-target listed species and non-listed species of concern and to reduce the likelihood of future listing. When feasible, the Program will provide regulatory certainty with respect to those non-target, listed species.

---

[2] "ESA compliance" means: (1) serving as the reasonable and prudent alternative to offset the effects of water-related activities that FWS found were likely to cause jeopardy to one or more of the target species or to adversely modify critical habitat before the Program was in place; (2) providing offsetting measures to avoid the likelihood of jeopardy to one or more of the target species or adverse modification of the critical habitat in the Platte River basin for new or existing water-related activities evaluated under the ESA after the Program was in place; and (3) avoiding any prohibited take of target species in the Platte River basin.

[3] For purposes of this Program Document and its attachments, the term "water related activities" means activities and aspects of activities which (1) occur in the Platte River basin upstream of the confluence of the Loup River with the Platte River; and (2) may affect Platte River flow quantity or timing, including, but not limited to, water diversion, storage and use activities, and land use activities. Changes in temperature and sediment transport will be considered impacts of a "water related activity" to the extent that such changes are caused by activities affecting flow quantity or timing. Impacts of "water related activities" do not include those components of land use activities or discharges of pollutants that do not affect flow quantity or timing. "Existing water related activities" include surface water or hydrologically connected groundwater activities implemented on or before July 1, 1997. "New water related activities" include new surface water or hydrologically connected groundwater activities including both new projects and expansion of existing projects, both those subject to and not subject to section 7(a)(2) of the ESA, which may affect the quantity or timing of water reaching the associated habitats and which are implemented after July 1, 1997.

[4] Platte River basin includes the basins of the South, North, and Platte Rivers.

II. PROGRAM GOALS

The Program's long-term goal is to improve and maintain the associated habitats. This goal includes: (1) improving and maintaining migrational habitat for whooping cranes, and reproductive habitat for least terns and piping plovers; (2) reducing the likelihood of future listings of other species found in this area; and (3) testing the assumption that managing flow in the central Platte River also improves the pallid sturgeon's lower Platte River habitat.[5]

III. PROGRAM ELEMENTS

A. General Description

1. Elements. The Program has three elements: (1) increasing streamflows in the central Platte River during relevant time periods through reregulation and water conservation/supply projects; (2) enhancing, restoring and protecting habitat lands for the target species; and (3) accommodating new water related activities in a manner consistent with long-term Program goals.

2. Increments. The Program will be implemented in increments. The First Increment of the Program begins January 1, 2007, and shall continue for thirteen years from that date or until any later date agreed upon by the Governance Committee in approval of an extension, subject to appropriations as described in Section II.G of the Program Agreement. Subsequent increments, if agreed to by the Secretary of the Interior and Governors of the three states, will be implemented for such periods of time as may be set forth in a replacement or extended cooperative agreement.

3. Objectives.

a. Long term Objectives. The long-term objectives for the Program are:

(1) to provide sufficient water to and through the central Platte River habitat area to meet the general goal set forth in Section II above by reregulation and water conservation/supply projects;

(2) to perpetually protect, restore where appropriate, and maintain approximately 29,000 acres of suitable habitat primarily in habitat complexes in the central Platte River area located between Lexington and Chapman, Nebraska.[6]

---

[5] The Integrated Monitoring and Research Plan (Attachment 3, Section V) addresses how the assumption is to be tested, including steps that will be taken to determine habitat needs of the pallid sturgeon.

[6] Non-complex habitat approved for acquisition by the Governance Committee will count toward the 29,000 acre objective because it will provide demonstrable benefits to target

b. First Increment Objectives. DOI and the states commit to achieving the following objectives by the end of the First Increment of the Program:

(1) providing water capable of improving the occurrence of Platte River flows in the central Platte River associated habitats relative to the present occurrence of species and annual pulse target flows[7] (hereinafter referred to as "reducing shortages to target flows") by an average of 130,000 to 150,000 acre-feet per year at Grand Island, through reregulation and water conservation/supply projects.[8] DOI and the states agree that FWS' target flows will be examined through the Adaptive Management Plan and peer review and may be modified by FWS accordingly. DOI and the states have agreed, however, that during the First Increment, species and annual pulse target flows serve as an initial reference point for determining periods of excess and shortage in the operation of Program reregulation and water conservation/supply projects.

(2) protecting, restoring where appropriate, and maintaining at least 10,000 acres of habitat in the central Platte River area between Lexington and Chapman, Nebraska. The Governance Committee may agree to undertake, fund or give credit for land activities outside this area to provide biological benefits to the target species.

c. Subsequent Increments. DOI and the states agree that the objectives of any subsequent Program increment will be defined as set forth in Section III.F below before the conclusion of an increment.

4. Progress toward Meeting Objectives and ESA Compliance. ESA compliance will be measured through the achievement of the First Increment Milestones (Attachment 2). Any milestones or other measures of ESA compliance to be used during subsequent increments will be developed prior to

---

species. The definitions of complex and non-complex habitat may be changed by the Governance Committee but are initially set forth in the Land Plan (Attachment 4).

[7] See "Water Plan Reference Materials" (Attachment 5, Section 11). The states have not agreed that these recommendations are biologically or hydrologically necessary to benefit or recover the target species.

[8] To the extent that FWS uses Program water for purposes other than reducing shortages to target flows, such use shall not decrease the target flow shortage reduction credited to the Program's initial three water projects or to any subsequently approved Program water project.

the beginning of such increments. Milestones may be revised by the Governance Committee so long as they are consistent with the Program and First Increment objectives.

Included in Attachment 2 are explanatory materials and estimated time frames for anticipated interim steps that will be taken towards meeting each milestone to assist the Governance Committee in managing, assessing, and, as appropriate, adjusting work carried out during the First Increment. The explanatory information and related interim steps and schedules are included as background information only and are not to be considered as individual milestones for purposes of ESA compliance.

B. Modification of the Program

1. Amendments by the Secretary of the Interior and Governors of Colorado, Nebraska, and Wyoming during the First Increment.

   The following changes to the Program will require unanimous consent of the Secretary of the Interior and the Governors of Colorado, Nebraska and Wyoming, and will require a formal amendment of the Program Agreement and this Program Document:

   a. Change of the First Increment objectives of providing water capable of reducing the shortage to target flows by an average of 130,000 to 150,000 acre feet per year and of protecting, restoring where appropriate, and maintaining 10,000 acres of habitat for the target species;

   b. Change to Section IV of the Program Document regarding regulatory certainty afforded under the Program;

   c. Change to underlying principles of the Program that limit it to acquiring interest in land only from willing participants (Section III.D), that provide that the Program will pay taxes or their equivalent (per Section III.D.1.c), and that define July 1, 1997 as the date for new and existing water-related activities;

   d. Increase of signatories' funding responsibilities under the Program; or

   e. Establishment of a subsequent increment of the Program.

2. Modifications by the Governance Committee. Changes to the Program not reserved to the signatories above may be made by the Governance Committee.

C. **Flexibility and Change During the First Increment**.

The Governance Committee will administer the Program during the First Increment using a flexible and incremental approach. To further the First Increment objectives, the Program Document and its attachments describe certain activities and criteria such as Milestones, Adaptive Management Plan, Land Plan, and Water Plan, land and water acquisition and management criteria, management actions, and others. These activities and criteria were based on the information available at the time the Program was established. Changes to Program activities and criteria may be justified by new information. This includes: 1) information learned as the result of implementation of the Land, Water, and Adaptive Management Plans; 2) information from other sources including relevant data from non-Program sources on target species and habitats; and, 3) practical considerations such as land availability, economics, budgetary and time constraints, and the ability or inability, notwithstanding good faith efforts of the participants, to achieve predicted outcomes of Program management hypotheses. Accordingly, except as noted in Section III.B.1 above, the Governance Committee may change the Program's First Increment Milestones and other activities and criteria, provided such changes are consistent with accomplishing the First Increment Objectives. These changes may be made and the Program will continue to provide ESA compliance during the First Increment, so long as the First Increment Milestones, as may be amended, are being met.

1. Adaptive Management Plan. The Adaptive Management Plan, set forth in Attachment 3, describes a systematic process administered by the Governance Committee for continually improving Program management by: 1) designing certain Program management activities to test alternative hypotheses and 2) applying information learned from research and monitoring of Program management. The process also includes the flexibility to use information and experience from all sources.

   The Adaptive Management Plan describes experiments that have uncertain outcomes. Changes in adaptive management activities and the Adaptive Management Plan are expected. Achieving particular results through implementation of the Adaptive Management Plan is not the basis for determining ESA compliance during the First Increment.

   The Adaptive Management Plan will be implemented within the existing Program defined contributions of money, land, and water unless amended in accordance with Section III.B.1 above. The Governance Committee recognizes the importance of the Adaptive Management Plan.

   a. Habitat and Species Baseline. The Program uses a 1997 starting point, where possible, to assess its effects. This baseline (Baseline Document for Fulfillment of Platte River Cooperative Agreement Milestone R1-1, (Baseline Document)) provides a summary of information available prior to the Program about the target species and their habitat. Where data are sufficient and methodologies are replicable, this information may be used to assess First Increment activities and criteria. The information available at Program inception did not provide a complete summary of the condition of the species or a comprehensive summary of the habitat available for the target species. Where data were not sufficient or replicable or disagreement exists as to then-current hypotheses regarding the species and their habitats, the Integrated Monitoring and Research Plan (Attachment 3, Section V) includes measures to fill data gaps and assess trends in species and habitat conditions. Historic information, models, and conceptions of the species and their habitat will be rigorously evaluated and modified as data and information become available.

b. Integrated Monitoring and Research Plan and Protocols. Adaptive management requires systematic observation and evaluation of the target species and the associated habitats to observe their response to the different Program activities. The Governance Committee will use the Integrated Monitoring and Research Plan (Attachment 3, Section V) to monitor and evaluate the impacts of the activities implemented in the First Increment of the Program on Program lands and the associated habitats and the response of the target species to those impacts. The monitoring and research protocols may be modified by the Governance Committee per Section III.B.2 above.

2. Assessments of Activities and Criteria During the First Increment. Program activities and criteria that guide such Program activities shall be periodically evaluated by the Governance Committee. The Governance Committee evaluations will: (1) assess whether the Program activity and criteria being examined is working as originally envisioned; (2) recommend modifications justified by new information; (3) determine whether there are other or better uses for the resources committed to this activity and criteria; (4) assess whether success or failure could be determined by monitoring over the time period evaluated and (5) develop alternative activities and criteria in accordance with the Program Adaptive Management Plan. Evaluations will consider experience, new information, and the results of monitoring and/or research. Opinions of independent peer reviewers, if any, will also be compiled and summarized as part of the evaluation process. Changes to planned activities and their implementation schedule should be peer reviewed as appropriate under the Scientific Peer Review Guidelines (Attachment 3, Appendix A) prior to action by the Governance Committee.

3. Target Flows. During the First Increment, the FWS' species and annual pulse target flows serve as an initial reference point for determining periods of excess and shortage in the operation of Program reregulation

and water conservation/supply projects. The target flows are subject to Program peer review (during the First Increment or later) and review through the Adaptive Management Plan, and may be modified by FWS accordingly. If those target flows are modified, the Governance Committee will determine whether to revise use of those species and annual pulse target flows as a reference point and whether any such revisions also require revisions in the First Increment Milestones. Any changes to the target flows will not impact the ability of the Program to continue to provide ESA compliance during the First Increment as long as the Milestones, as found in Attachment 2, or as revised, are being met.

4. Program Peer Review. The Governance Committee may submit any Program activity or criteria, and the FWS's recommended flows for peer review. Such peer review shall be conducted pursuant to the Peer Review Guidelines (Attachment 3, Appendix A).

5. Day-to-Day Flexibility. Documents implementing the Program provide the flexibility for day-to-day management (e.g., decisions related to weed control or grazing on a particular parcel of land). This type of management will typically not require Governance Committee approval unless they implicate a change in Program policy, increase the budget, or impact the ability of the Program to provide the offsetting measures for ESA compliance purposes.

D. Land

The Governance Committee will meet Program objectives for habitat through land interest acquisition, restoration, management, and maintenance. Annual progress will be dependent upon market conditions and availability of willing participants. Habitat acquisition is to be on a willing seller/willing lessor basis. The land component of the Program is described in greater detail in the Land Plan (Attachment 4). The Organizational Structure Document (Attachment 6) and Land Advisory Committee (LAC) Charter (Attachment 6, Appendix F) describe the responsibilities for carrying out the land component of the Program assigned to the Governance Committee, Land Advisory Committee, a Land Interest Holding Entity, cooperators and contractors.

1. Acquisition of Interests in Land

   a. Program lands will be selected using the Land Plan (Attachment 4), subject to modification by the Governance Committee as appropriate per Section III.C.1 above. The initial focus will be on obtaining interests in and protecting wet meadow and channel habitat between Lexington and Chapman, Nebraska which are suitable for development into "habitat complexes" as described in the Land Plan, but acquisition of non-complex lands is also expected to occur to the extent permitted in the Land Plan (Attachment 4).

b. Acquisition may be in the form of purchase, lease, easement or other arrangement, as described in the Land Plan. The Governance Committee, with the advice of the Land Advisory Committee, shall determine the type of interest in land appropriate to particular situations, subject to any applicable limitations on ownership of land acquired with federal/state funds.

c. Because local support is essential to the success of the Land Plan, the Land Plan has been developed and will be modified as appropriate to assure that local opinions are heard, that land interest acquisition and development are coordinated with local landowners, and that information on acquisitions and on management plans will be available to all interested parties. Where applicable, the expertise of the University of Nebraska and other local organizations and individuals may be used. The Program will develop incentive programs as needed to encourage participation in the Program.

d. The Program is to avoid shifting tax burdens to adjacent landowners or communities. When land is acquired by the Program and held by the Land Interest Holding Entity or the acquired land is owned by another tax-exempt entity, the Program shall pay or provide for the payment of real property taxes or an equivalent amount. Such taxes or equivalent amount shall be determined each year using the assessments and levies in effect at the time such taxes are due or would be due if the property were owned by a tax paying entity.

e. A legal entity or entities will, on behalf of the Program, hold title or other interests in land acquired by or contributed to the Program as set forth in the Land Plan (Attachment 4). In the case of lands dedicated to the Program on behalf of a state, the entity dedicating such lands may continue to hold title or other interests in those lands, provided that sufficient access is granted to the Program's representatives to permit Program restoration and management of the lands, or the lands are otherwise protected for Program purposes.

2. Restoration and Protection. Restoration and protection of Program lands will be carried out consistent with the Land Plan (Attachment 4), subject to modification by the Governance Committee. Plans for managing each parcel of Program land will be prepared consistent with the Land Plan. Plans are initially expected to include identifying the habitat baseline for the parcel in question, adapting the appropriate recommendations of the Land Plan for the specific characteristics of the land, and developing site-specific monitoring and

maintenance requirements. Habitat management practices will be evaluated as part of the Program Adaptive Management Plan.

3. <u>Credit Toward Program Objectives</u>

a. Land protected and managed prior to July 1, 1997 for the benefit of endangered and threatened species by the Platte River Whooping Crane Critical Habitat Maintenance Trust, the National Audubon Society, and the Nature Conservancy within the associated habitats and the Central Nebraska Public Power and Irrigation District (CNPPID) (Jeffrey Island) will be credited to the Program's long-term objectives if such land meets criteria established by the Governance Committee, but not toward the objectives of the first Program increment without the prior approval of the Governance Committee and the managing entity. Lands acquired by these entities after July 1, 1997 may be contributed to the Program and counted toward First Increment objectives with the approval of the Governance Committee and the managing entity.

b. Land acquired by or on behalf of existing water related activities completing Section 7 consultation of the ESA prior to or during the term of the July 1997 Cooperative Agreement (as described in Section VII of that Agreement), including Nebraska Public Power District's (NPPD) Cottonwood Ranch Property habitat lands, tern and plover islands and sandpits, lands acquired by Wyoming and any lands acquired in the associated habitats using funds contributed prior to the Program as a result of ESA consultation, will be credited to both the Program's long-term objective of 29,000 acres and the First Increment objective of 10,000 acres.

E. <u>Water</u>

During the First Increment, progress toward Program water objectives will be measured against the water related milestones contained in the Milestones Document (Attachment 2). The benefits derived from Program projects implemented in the First Increment of the Program will be monitored and verified. Program objectives for addressing the impacts of existing water related activities by providing water capable of reducing shortages to target flows for the central Platte River will be met through a combination of three initial Program projects and other water conservation/supply projects (Section E.2. below). The impacts of new water related activities will be addressed by the states and the federal government in the manner and to the extent described in the states' depletions plans in the Program Water Plan (Attachment 5, Sections 7, 8, and 9), and the federal government's depletions plan (Attachment 5, Section 10) or a project proponent may proceed with an ESA Section 7(a)(2) consultation on its own.

The Organizational Structure Document (Attachment 6) and the Water Advisory Committee Charter (Attachment 6, Appendix H) describe the responsibilities for carrying out the Water Plan of the Program and how those responsibilities are assigned to the Signatories, the Governance Committee, the Water Advisory Committee, and Program Project Sponsors.

1. <u>The First Increment Program Water Objective, FWS Instream Flow Recommendations for Central Platte River, and Lower Platte River Flows</u>

FWS has developed instream flow recommendations for the central Platte River, which are described and quantified in the Program Water Plan (Attachment 5, Section 11). These FWS recommendations for the central Platte River include target flows, peak flows and other flows deemed important by the FWS. The FWS recommendations will be examined through the Adaptive Management Plan as described in Section III.C.1 above and may be modified by the FWS accordingly.

a. <u>Target Flow Recommendations</u>. The term "target flows" refers to FWS's recommended species and annual pulse flows for the central Platte River. The Program's First Increment water objective is to provide water capable of reducing shortages to FWS target flows by an average of 130,000-150,000 acre-feet per year. Except as described in paragraphs b. and c. below, Program water will be used to reduce those shortages. The states have not agreed that the target flows are biologically or hydrologically necessary to benefit or recover target species. However, the DOI and the states have agreed that the target flows can be used as a reference to determine progress towards meeting the Program's first increment water objectives, so long as the FWS's target flows are examined through the Adaptive Management Plan and peer review and may be modified by FWS accordingly.

b. <u>Peak and Other Flow Recommendations</u>. The FWS's instream flow recommendations for the central Platte River also include the periodic occurrence of peak flows at certain times of the year. Those peak flows are in excess of the target flows for the same time periods. During Program formulation, FWS also identified additional flows such as short-term channel management "pulses" that are lower than peak flows but are in excess of target flows and are deemed by the FWS to be important to the creation and/or maintenance of habitat for the target species in the central Platte associated habitats. Methods to evaluate the effectiveness of such flows in providing the benefits desired by FWS are described in the Adaptive Management Plan. The states have not agreed that the peak flows, "pulses" or such other FWS identified flows are biologically or hydrologically necessary to benefit or recover target species. The Program has a First Increment objective of improving the occurrence of Platte River flows in the central Platte associated habitats relative to the present occurrence of species and annual pulse target flows by an average of 130,000 to 150,000 acre-feet per year at Grand Island, through reregulation and water conservation/supply projects. Creation, protection or improvement of peak flows, pulse flows (other than annual pulse flows) and other FWS identified flows are not part of the first increment water objective. However, the Program will integrate the Program's land and water management activities consistent with the Program's Adaptive Management Plan and system constraints (storage capacity, water rights and the need to avoid property damage). Such integration will enable evaluation of, and FWS believes that such integration may enhance, the Program's ability to utilize flows to (1) avoid loss of existing associated habitats due to channel narrowing, incision, and vegetation encroachment and (2) maintain Program improvements in channel and wet meadow habitats. Consistent with such evaluations, the states agree that FWS may use Program water that is subject to release at its direction to reduce shortages to FWS's recommended peak, pulse, or other flows in the central Platte River as part of an attempt to achieve a more normalized flow regime (one closer to the former structure of the hydrograph) given system constraints. Any such use of Program water is subject to limitations described in the document "An Environmental Account for Storage Reservoirs on the Platte River System in Nebraska" (EA Document) in the Program Water Plan (Attachment 5, Section 5) to prevent such releases from causing or exacerbating floods. To enhance a peak, pulse, or other short duration high flows as described in Attachment 5, Section 1, Subsection 3, the Environmental Account (EA) Manager may request CNPPID and NPPD to reregulate water in their systems downstream of Lake McConaughy with or without also intentionally bypassing Program EA water that the Districts are allowed to divert at their diversion structures. In such an event, the Program will pay CNPPID and NPPD an amount equivalent to lost power production, increased power acquisition costs, and other associated costs in accordance with Attachment 5, Section 1, Subsection 3. To the extent that FWS uses Program water to produce or augment peak, pulse, or other flows, such use shall not decrease the target flow shortage reduction credited to the Program's initial three water projects or to any subsequently approved Program water project. In the case of the pallid sturgeon, peak flows are dealt with in the section on lower Platte River flows (Sec III. E. 1. c.).

c. Lower Platte River Flows. FWS believes that water related activities at times have reduced the quantity or rate of flow in the lower Platte River during the months of February through July. Consistent with the April 28, 2004 finding of the National Academy of Sciences (NAS), it is now agreed that current habitat conditions on the lower Platte River do not adversely affect the likelihood of survival and recovery of the pallid sturgeon because that reach of the river appears to retain several habitat characteristics apparently preferred by the species. However, NAS and FWS believe that further alterations of discharge patterns or channel features that modify those characteristics might irreparably alter this habitat for pallid sturgeon use, loss of Platte River habitat would probably result in a catastrophic reduction in the pallid sturgeon population, and any recovery effort for the pallid sturgeon will most likely include the lower Platte River. As stated by the NAS, the Governance Committee agrees that there are many questions about the biology of the pallid sturgeon and the role of the lower Platte River in the species recovery. While the states have not agreed with the NAS and FWS conclusions, the states and the FWS do agree that, during the first Program increment, impacts to the pallid sturgeon that are caused by Program activities or by new water related activities covered by the states or federal depletions plans will be assessed. The assessment will be conducted through the pallid sturgeon research and monitoring activities described in the Program's Integrated Monitoring and Research Plan (Attachment 3, Section V) and complimentary research conducted by others in the Missouri River and its tributaries. The assessment stage change study (Attachment 3, Section V) will be completed by the end of year 3 of the Program's First Increment. If such impacts are deemed to adversely affect the pallid sturgeon, the Governance Committee will develop and implement appropriate conservation measures that either negate or offset the occurrence of adverse impacts on the pallid sturgeon. The appropriate conservation measures will be funded through available Program funds or as otherwise determined by the Governance Committee. The expenditure of any funds proposed to be redirected is subject to approval by the Governance Committee.

d. <u>Impact of Program Activities on FWS Recommended Flows</u>. During Program formulation, FWS evaluated the three initial Program projects, the projects proposed in the Reconnaissance-Level Water Action Plan (Attachment 5, Section 6), the state and federal depletions plans relative to their projected impacts on the occurrence of target flows, peak flows and other flows in the central and lower Platte River deemed by the FWS to be important to the creation and/or maintenance of habitat for the target species. FWS recognizes that in order to achieve the Program's first increment water objectives, the operation of such projects and the implementation of such depletions plans will, at times, cause an unavoidable adverse impact on one or more of the recommended flows for the central Platte River or on flows in the lower Platte

River. FWS agrees that those adverse impacts are acceptable as long as such operation and implementation is in accordance with the Program Water Plan (Attachment 5), including the depletions plans, any Governance Committee approved operating rules and/or procedures, and other Program activities. This agreement by FWS is subject to NEPA and ESA analyses and review.

2. Program Water Operations to Meet First Increment Water Objectives

   a. Tamarack I, Pathfinder Modification and the Nebraska Environmental Account (Initial Program Projects). A portion of the Program's First Increment water objective will be met with three initial Program projects described in the Program Water Plan. They are: (1) the "Colorado's Initial Water Project (Tamarack I)" (Attachment 5, Section 3); (2) the "Wyoming's Pathfinder Modification Project" (Attachment 5, Section 4); and (3) "An Environmental Account for Storage Reservoirs on the Platte River System in Nebraska", which includes activities by Federal Energy Regulatory Commission ("FERC") Project No. 1417 and FERC Project No. 1835 in Nebraska (Attachment 5, Section 5). If implemented and operated as described, these three projects together will be credited for an average of 80,000 acre-feet per year toward the First Increment water objective of providing water capable of reducing shortages to target flows by an average of 130,000-150,000 acre-feet per year.

   b. Water Conservation/Supply Activities. The remaining portion of the Program's First Increment water objectives will be met through a program of incentive-based water conservation and water supply activities. The "Reconnaissance-Level Water Action Plan" included in the Program Water Plan (Attachment 5, Section 6) describes potential water conservation/supply projects that may be included in the Program with corresponding estimates of the reregulated or conserved water that can be credited toward Program objectives if the respective projects are implemented. The "Reconnaissance-Level Water Action Plan" also sets forth the process for including other water conservation/supply projects in the Program during the First Increment. The "Reconnaissance-Level Water Action Plan" describes the process for moving water projects through the feasibility study and implementation process. Governance Committee approval is required before any water conservation/supply project can be included in the Program. The Program will only include projects that yield a quantifiable net water benefit toward Program First Increment water objectives.

   If a proposed water conservation and supply project affects the Program's target flow shortage reduction benefits that are or will be achieved by an initial Program water project or by another approved Program water project, the proposed Program water project can be implemented if the result is a net increase in Program credit toward the First Increment water objective and if any adverse impacts to then-existing water related activities are addressed as provided later in this section. The sponsor(s) of any adversely affected initial or previously approved Program water project will not be held accountable to the Program or to the FWS for the reduction in Program benefits resulting from the new project.

A new project may be substituted for one or more projects identified in the original Program Water Plan or a project identified in the original Program Water Plan may be substantially modified, if the adverse impacts of that project on FWS recommended flows for the central Platte River are no greater in magnitude or frequency than the original project or projects. Otherwise, if a new or substantially modified project is considered for implementation in the Program Water Plan, FWS, through its membership on the Governance Committee, reserves the right to reject that project on the basis of adverse impacts to one or more of its recommended flows for the central Platte River or on lower Platte River flows.

It is the intent of the Program to implement Program water conservation and supply projects that do not adversely affect existing water related activities in the three states. Should Program water conservation and supply projects adversely impact an existing water related activity, the Governance Committee will evaluate those impacts and if it is not possible to avoid adverse impacts, take steps to offset, mitigate, or compensate the owner of that water related activity for such impacts.

c. Operation of Program Water Conservation/Supply Projects. The operations of the Program's three initial water projects and of all the other Program water conservation/supply projects will be coordinated as described in the "Program Water Management Process" included in the Program Water Plan (Attachment 5, Section 1). There are recognizable benefits to coordinating upstream Program activities so as to increase storage water as described in the EA Document (Attachment 5, Section 5). However, not all water regulated for Program purposes will be storable in that Environmental Account, and that water need not be stored to contribute toward Program objectives. The rules governing operation of a Program water conservation and supply project must be approved by the Governance Committee.

d. <u>Delivery of Program Water</u>.

i. The Program has agreed to secure defined benefits for the target avian species and their associated habitats. To do so, the Program seeks to deliver Program water at the appropriate time, place, and in the appropriate quantity. The Integrated Monitoring and Research Plan (Attachment 3, Section V) will study the geomorphological processes of the Platte River, including the feasibility of using Program water or other tools to provide defined benefits for the target avian species and their associated habitat. Undertaking these studies will not increase the habitat maintenance requirement of the Program (which is 10,000 acres for the First Increment), or the water requirement of the Program (which is providing water capable of reducing shortages to target flows by an average of 130,000 to 150,000 acre-feet of water per year for the First Increment). Ultimately the Program is anticipated to select and implement an effective suite of activities including the delivery of Program water that, in conjunction with other Program actions, will create sufficient species benefits to be ESA sufficient.

ii. The Governance Committee shall complete a study no later than the end of Year 2 of the First Increment to evaluate the feasibility of delivering by the end of Year 5 (1) 5000 cfs of Program water for three days to the upper end of the associated habitat (at Overton gage) for pulse flows when other demands on water are low (normally September 1 – May 31) and (2) quantities of Program water that are likely to yield 800 cfs at the habitat during the irrigation season.

The first phase of the study, to be completed by the end of Year 1 by an independent consultant retained by the Governance Committee, will identify alternative means to provide water in the quantities described above. The alternatives identified shall be limited to those that can be accomplished with water provided by the three initial Program projects and projects identified in Attachment 5, Section 6 of the Program Water Plan, using the National Weather Service flood stage for the North Platte River at North Platte, Nebraska, after taking into account the capital and maintenance measures described below in Section E.2.d.iii below. The monetary costs of each alternative will be estimated. In addition, the impacts of each alternative on the Program's capability to reduce shortages to target flows or to meet other Program objectives will be defined. Following completion of the first phase of the study, the Governance Committee will determine if the deliveries identified above are feasible, and if not, the Governance Committee will expand the study (second phase) to identify new water supply and conservation projects and/or other means to increase the ability to deliver water. However, any expanded studies must be limited to alternatives that can be accomplished consistent with the First Increment water objective, Section E of this document, and Program budget (Attachment 1).

Based on the results of the study and the adaptive management process, a plan would be developed and implemented. The plan shall include measures expected to deliver, by the end of Year 5 (1) 5,000 cfs of Program water for three days to the upper end of the associated habitat (at Overton gage) for pulse flows when other demands on water are low (normally September 1 – May 31) and (2) quantities of Program water that are likely to yield 800 cfs at the habitat during the irrigation season, unless the feasibility study and the adaptive management process find that these deliveries are infeasible or unnecessary and the Governance Committee concurs. If the evaluation finds these deliveries are infeasible, the Governance Committee commits to develop alternative means of providing similar benefits to the target avian species and their associated habitats.

iii. In Program Year 1, the Governance Committee will begin implementing the capital investment and maintenance measures that are described in Attachment 5, Section 2 and are designed to increase the channel capacity of the North Platte River upstream of Highway 83 to 3,000 cubic feet per second. The maintenance measures described in that attachment will continue as the Governance Committee deems appropriate until and during implementation of the plan described in Section E.2.d.ii. or until alternative means of providing similar benefits to the target avian species and their associated habitats have been developed.

3. <u>Depletions Plans to Mitigate the Impacts of New Water Related Activities</u>

The three states and the federal government have each prepared a depletions plan, all of which are consistent with the Program purpose described in Section I.A.4. These plans are intended to mitigate the impacts of new water related activities on the occurrence of target flows and on the effectiveness of the Program in reducing shortages to target flows, whether or not the new water related activities are subject to Section 7(a)(2) of the ESA or are intended to mitigate the impacts of other new water related activities. Each plan identifies the existing water related activities covered by the Program, and specifies the means by which new water related activities, both those subject to and those not subject to Section 7(a)(2) of the ESA, will be addressed under that plan. These plans are set forth in "Depletions Plan, Platte River, Wyoming" (Wyoming's Depletions Plan) (Attachment 5, Section 7); "Nebraska's New Depletions Plan" (Nebraska's Depletions Plan) (Attachment 5, Section 8); "Colorado's Plan for Future Depletions" (Colorado's Depletions Plan) (Attachments 5, Section 9); and the "Federal Depletions Plan for the Platte River Recovery Implementation Program" (Federal Depletions Plan) (Attachment 5, Section 10). The states and the federal government are responsible for the implementation of their respective depletions plans. Amendments to depletions plans must be reported to and approved by the Governance Committee. Any proposed amendment is to be approved by the Governance Committee only if the Governance Committee determines that the depletions plan, if so amended, would mitigate the following impacts of any new water related activities: (1) decreases in the occurrence of flows that contribute to target flows; and (2) decreases in target flow shortage reductions achieved or to be achieved by an approved Program water project. Also, if an amendment is proposed to a depletions plan that would result in greater adverse impacts on FWS recommended flows for the central Platte River or on lower Platte River flows than those associated with the original depletions plan, FWS reserves the right to reject the proposed amendment through its membership on the Governance Committee.

Each state and the federal government must also inform the Governance Committee of the specific new depletion mitigation measures it intends to implement consistent with its approved depletions plan. If a state or the federal government proposes use of mitigation measures not included within its approved plan, amendment of the plan shall be required. All mitigation measures for central Platte River impacts shall be implemented in the state where the depletion(s) being mitigated occur. The water yields provided for mitigation of new water related activities will not count toward the Program's First Increment water objectives, as those yields will be used to mitigate the impacts of new water related activities, not existing ones.

The depletions plans address the impacts of new water related activities, both those subject to and not subject to Section 7(a)(2) of the ESA. The plans explain how, with a Program in place, water related activities subject to Section 7(a)(2) consultation will proceed through the consultation process. The plans describe the process for determining whether a water related activity can rely on the Program for ESA compliance. Also, the plans only address the consultation process for the target species. To the extent a water related activity subject to Section 7(a)(2) consultation may effect other "non-target" listed species in any of the three states, impacts to those species must be addressed separately in that federal project's biological opinion required by ESA. For any new water related activity that is not covered by an approved depletions plan but is subject to Section 7(a)(2) consultation, the project proponent may proceed with consultation on its own and shall mitigate project impacts in accordance with the results of that consultation and without any reliance on Program activities for such mitigation. In the alternative the state can propose that the activity be covered by the Program by offering an amendment to the depletions plan that would address the impacts of that activity. If the Governance Committee approves an amendment allowing a new water related activity to be covered by a depletions plan, that activity will be covered by the Program. If the project proponent proceeds with consultation on its own, FWS agrees that it will recommend to the federal action agency that the project's mitigation measures address the following impacts of any new water related activities: (1) decreases in the occurrence of flows that contribute to target flows and (2) decreases in target flow shortage reductions achieved or to be achieved by an approved Program water project and that it also will recommend that water based mitigation measures for central Platte River impacts be implemented in the state where the depletion(s) being mitigated occur.

4. Institutional Protections

The responsibility for accounting, tracking, regulating, and protecting Program water rests with each state's water administration in the manner outlined in the Water Plan (Attachment 5) and approved by the Governance Committee. Any changes in state laws or procedures relating to the accounting, tracking, regulation, or protection of water will be reported to the Governance Committee.

Each state is expected to take whatever steps are necessary, as appropriate, to account for or provide institutional protection within that state for waters intended for environmental purposes, including without limitation: statutory and regulatory reform; granting of any necessary water rights; and water accounting systems. Accounting and tracking of Program water to and through the associated habitats will be implemented beginning Year 1 of the Program.

F. Evaluation of First Increment and Development of Subsequent Increments

1. Evaluation of Effectiveness of the First Increment and Review of Goals, Objectives, Activities and Criteria

At least three years before the end of the First Increment, the Governance Committee will develop a process and timeframe for evaluating the First Increment. The evaluation process will take into account the need for FWS to carry out independent ESA assessments, for NEPA compliance, and other statutory obligations for a second Program increment. These evaluations will include, but are not limited to the following: (1) consideration of information gained through the Integrated Monitoring and Research Plan and experience; (2) the judgment of habitat managers, field biologists, and independent experts; and (3) the results of any peer review. The purpose of these evaluations is to weigh whether Program goals, objectives, activities, and criteria should be modified or should continue unchanged. The Program evaluations performed by the Governance Committee will be coordinated with the FWS reviews undertaken as part of its statutory obligations under the ESA. The Federal Action that is the subject of programmatic ESA and NEPA review for a second Program increment will include continuation of existing water-related activities and new water-related activities that were consulted on as part of the programmatic biological opinion and project-specific biological opinions issued during the First Program Increment.

2. Definition of Second Increment Components and Term

Before expiration of the First Increment, the Governance Committee will identify goals, objectives, activities and criteria, and milestones or other measures for ESA compliance for a second Program increment. Independent peer review will be used as appropriate pursuant to the Scientific Peer Review Guidelines in the Program Adaptive Management Plan (Attachment 3, Appendix A) to review pertinent scientific data relating to the selection or implementation of specialized recovery tasks or the development of technical milestones. If the Governance Committee decides to recommend that the Department of the Interior and three states enter into an agreement for a second increment, the Governance Committee will develop proposed program documents.

One area of further research and analysis by the National Academy of Sciences, the Forest Service and others during the First Increment is the relationship between forest condition and water yield. The Forest Service has made certain commitments as further described in Attachment A to the Federal Depletions Plan (Attachment 5, Section 10). If the results of the analyses of the impacts of post-1997 changes in forest condition on water yield from forested lands located within the Platte River basin, as described in Attachment A to the Federal Depletions Plan, indicate a reduction in such water yield has occurred and may persist into the second increment, the Governance Committee shall discuss and fully consider such reductions, if any, during its deliberations on the second Program increment's goals, objectives, activities and criteria. The Governance Committee shall take any such reductions into account when it determines the responsibility for funding and implementing the second increment.

3. Decision to Enter Into a Second Increment

Any decision to enter into a second increment will be made by the signatories prior to the expiration of the First Increment.

IV. REGULATORY CERTAINTY

DOI and the states intend that this Program provide regulatory certainty for the target species under Sections 7 and 9 of the ESA for existing water related activities and for new water related activities that are covered by a state or federal depletions plan. Implementation of the First Increment milestones provides ESA compliance for the term of the First Increment, and the signatories anticipate that any future Program increments agreed to will provide such compliance during those increments. Additionally, implementation of the milestones is intended to provide ESA compliance for impacts from water related activities to the target species in the entire Platte River basin. Regulatory certainty is provided by the following mechanisms:

A. Existing Water Related Activities. The Program is to provide ESA compliance for the target species during its term for water related activities existing as of July 1, 1997. Certain existing water related activities underwent Section 7 consultation prior to the effective date of this Program (covered by the July 1997 Cooperative Agreement Sections VIII.A.1, 2 and 4). Under the Program, some of these activities may be covered through compliance with the terms of existing federal actions and others will be subject to revised consultations whereby the Program is to provide ESA compliance for the target species.

B. New Water-Related Activities. The Program is to provide ESA compliance for the target species during its term for certain specified new water related activities through the depletions plans of each state and the federal government as described in this Program. Certain new water related activities underwent Section 7 consultation prior to the effective date of this Program (covered by the July 1997 Cooperative Agreement Section VIII.A.3). Under the Program, some of these activities may be covered through the terms of existing federal actions and others will be subject to revised consultations whereby it will be determined if the new water related activities are covered by a depletions plan and this Program.

C. For water related activities covered in Sections IV.A and B above, FWS agrees to encourage other agencies to rely upon the Program when considering agency actions affecting the target species.

D. DOI and the states intend that the Program will provide ESA compliance during the First Increment for so long as the Program is attaining its First Increment Milestones (Attachment 2). Such ESA compliance will continue beyond the first 13-years of the Program provided a subsequent Program increment or First Increment Program extension is adopted pursuant to appropriate ESA and NEPA compliance procedures, and, for a subsequent increment, the effects of water-related activities are to be covered under a programmatic biological opinion for that subsequent increment.

E. If Milestones are not being met, and FWS makes a preliminary determination that the Program is not providing ESA compliance, FWS will notify the Governance Committee in writing and request assistance in resolving the situation. If the Governance Committee is unable to restore the ability of the Program to provide ESA compliance, the Governance Committee shall refer the matter to the Secretary of the Interior and the three Governors ("Oversight Committee") to resolve the situation. If such attempts at resolution are unsuccessful and the Program is terminated pursuant to the Program Agreement, FWS agrees that if it requests reinitiation of Section 7(a)(2) consultation for any water related activity which relied upon the Program as a component of its ESA compliance and which is subject to reinitiation pursuant to 50 C.F.R. § 402.16, it will request reinitiation for all such water related activities.

FWS further agrees that it will expeditiously pursue all available means to consult on all agency actions for which it requested reinitiation, and if it identifies new or additional measures that it will expeditiously pursue all available means to amend or modify the agency authorizations. If a state agrees to and continues to carry out the responsibilities it had under the Program, there is a presumption that such actions are sufficient to provide ESA compliance with respect to all water related activities in that state pending completion of any reinitiated consultations. When a state agrees to and continues to carry out the responsibilities it had under the Program, that state and any water related activities covered retain the ability to argue that the responsibilities undertaken are sufficient to constitute the long-term ESA compliance for the reinitiated consultations. FWS agrees to consider these undertakings in any reinitiated Section 7 consultations, including in the development of new reasonable and prudent alternatives or other measures.

F. In developing any new measures to meet the requirements of the ESA, FWS agrees to recognize any contributions made to this Program by the relevant state or the owner or operator of the water related activity under the July 1997 Cooperative Agreement and/or the Program and the degree to which the relevant state or owner or operator met its obligations under the July 1997 Cooperative Agreement or the Program.

G. No person or entity undertaking or proposing to undertake any water related activity will be required to accede to the provisions of this document or to rely on this Program. Reliance on the Program shall be voluntary. In the event such person or entity chooses not to so rely, or chooses to revoke reliance on the Program at any time, FWS will not consider this Program as ESA compliance for such water related activity. FWS believes that revoking reliance on the Program warrants a reopening of any federal action or authorization based thereon, and will reinitiate any ESA Section 7(a)(2) consultation for that water related activity which relied upon this Program.

H. Any time that FWS reinitiates Section 7(a)(2) consultation, it will issue a new biological opinion based on then current conditions. FWS believes that the new biological opinion and any subsequent amendment, restatement, or modification of a federal action based on the new biological opinion, would constitute a new federal action for purposes of administrative or judicial appeals. FWS further believes that no person or entity should be deemed to have waived or relinquished any right to challenge the legal, scientific, or technical validity of any aspect of the new biological opinion or agency action by virtue of its acceptance of or reliance on this Program, or by virtue of its support for this Program in other judicial or administrative proceedings.

V. PROGRAM COST SHARE AND EXIT STRATEGY

A. DOI and the states have determined that each has a responsibility to the success of the Program and that contributions for Program elements addressing existing water related activities should be made to the Program on an equitable basis. For purposes of the First Program Increment, DOI and the states agree that federal contribution and the collective state contributions should be as equal as possible. The Finance Document, Crediting and Exit Principles, and Program Budget (Attachment 1) provides the cash and cash equivalent contributions of the signatories.

B. The Program exit strategy is found in the Finance Document, Crediting and Exit Principles, and Program Budget (Attachment 1).

VI. CONFORMING FEDERAL FUNDING OR AUTHORIZATIONS

Any person or entity undertaking a water related activity that receives federal funding or a federal authorization and which relies on the Program as a component of its ESA compliance in Section 7 consultation must agree: (1) to the inclusion in its federal funding or authorization documents of reopening authority, including reopening authority to accommodate reinitiation upon the circumstances described in Section IV.E; and (2) to request appropriate amendments from the federal action agency as needed to conform its funding or authorization to any Program adjustments negotiated among the three states and DOI, including specifically new requirements, if any, at the end of the First Increment and any subsequent Program increments. FWS believes that the Program should not provide ESA compliance for any water related activity for which the funding or authorization document does not conform to any Program adjustments. Notwithstanding Section II.I of the Program Agreement, the states shall not be restrained from taking a position adverse to one another in administrative or judicial proceedings to compel the action agency to include reopening authority in any such federal funding or authorization. Nothing in this paragraph is intended to waive the right of any person or entity undertaking a water related activity to withdraw its reliance on the Program pursuant to Section IV.G.

VII. CONSISTENCY OF DOCUMENTS

The Governance Committee shall have the authority to resolve any inconsistencies between the Program Document and its attachments or referenced materials. The Program Document shall control, unless the Governance Committee decides otherwise.

PLATTE RIVER RECOVERY IMPLEMENATION PROGRAM

ATTACHMENT 1

FINANCE DOCUMENT
CREDITING AND EXIT PRINCIPLES
AND
PROGRAM BUDGET

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 1

Finance Document
Crediting and Exit Principles
And
Program Budget

December 7, 2005

Table of Contents

I. INTRODUCTION

A. Purposes

The purposes of this document are (1) to establish credits for certain cash, cash equivalent, water, and land contributions made by or on behalf of the parties to the Platte River Recovery Implementation Program Cooperative Agreement (the Program); (2) to provide guidance for use in determining other credits earned by or on behalf of the parties during the First Increment of the Program; (3) to establish principles for disposition, should the Program terminate, of assets acquired or contributed to accomplish the objectives of the Program; (4) to provide guidance on the ESA credits that might be available for use in consultation with the Fish and Wildlife Service should the Program terminate; and (5) detail the Program budget and the cash flow requirements for the First Increment of the Program.

B. Definitions of Terms

1. Cash Contributions - The respective amount of money that each signatory will contribute to the Program Budget during the First Increment. The records of the Financial Management Entity (FME) will be used to determine the amount and date of each signatory's actual cash contributions.

2. In-kind Contributions - During the First Increment of the Program, signatories may elect to be "Water Project Sponsors" or "Sponsors of Program Lands," as defined in Sections VIII.C and VIII.D of Attachment 6, respectively, in lieu of making their required Cash Contributions. In addition, a signatory may propose and the Governance Committee may approve agreements whereby signatories elect to provide technical or other services as in-kind contributions in lieu of making its Cash Contribution. The agreements between the signatory and the Governance Committee documenting these transactions will include the credit the signatory will receive toward its respective Cash Contribution. In addition, the agreements will address the disposition of the Program Assets provided by the in-kind contribution in the event of Program dissolution. (In-kind contributions do not include the costs associated with providing representatives on the Governance Committee, Oversight Committee or other committees established by the Governance Committee.)

3. Cash Equivalents - The states of Colorado, Nebraska, and Wyoming (the states) will be contributing water from the three initial Program water projects and the use of lands for Program purposes, herein defined as Cash Equivalents, in order to match, in part, the Cash Contributions of the Department of the Interior (DOI). During the Program, additional Cash Equivalent Contributions to the Program may be proposed. Such contributions will need to be approved by the Governance Committee before any crediting is authorized. The review and ultimate approval will have two elements: (1) whether the activity merits Cash Equivalent credit, and (2) if so, in what amount (potentially measured by value to the Program in meeting its First Increment objectives rather than by the level of expenditure).

4. Program Assets - Subject to the provisions in Section III, those assets acquired through the Cash Contributions of the signatories are considered Program Assets for purposes of this Attachment 1. Program Assets include, but are not limited to, land interests acquired through fee title, easements, or leases to the extent such easements and leases survive Program termination. Program Assets also include water interests and projects acquired through project construction or leases to the extent such leases survive Program termination. While the water from the three initial Program water projects and the use of Cottonwood Ranch and Deer Creek lands are considered Cash Equivalents for purposes noted in Section I.B.3 above, the projects and lands are not Cash Equivalents or Program Assets for purposes of determining a Signatory's Share of Program Assets as provided in Section I.B.5 below and those projects and lands are not subject to disposition by the Governance Committee. Neither Program dissolution nor withdrawal of a signatory party will have any impact on the ownership of any such projects or lands nor will it have any effect on the rights of the state where the project or land is located, or of entities within that state, to administer the project or land in accordance with applicable law.

5. Signatory's Share of Program Assets - Each signatory's respective share of the Program Assets will be equal to that signatory's total cash contributions at the time of Program dissolution compared against the total Cash Contributions made by all of the signatories at the time of Program dissolution For example, if Signatory A has made Cash Contributions totaling $3M to the Program and all of the signatories, including Signatory A, have made cash contributions totaling $100M to the Program at the time of dissolution, Signatory A would have an interest in 3% of the Program Assets.

II. CREDITING UNDER THE PROGRAM

The following table depicts the Cash Contributions and Cash Equivalent Contributions that will be provided by the DOI and the states during the First Increment of the Program:

Program Contributions
(values in millions of dollars)

Contributions	Total	DOI	States	Description
Cash	187.14	157.14	30.0	Colorado – 24.0; Wyoming 6.0
Cash Equivalents				
Land	10.0		10.0	Cottonwood Ranch/Deer Creek Lands
Water	120.19		120.19	Water from three initial projects
Total	**317.33**	**157.14**	**160.19**	

III. DISTRIBUTION OF PROGRAM ASSETS AND ESA CREDITS FOLLOWING PROGRAM TERMINATION OR SIGNATORY WITHDRAWAL

A. Principles Governing Dissolution of the Program

Consistent with section II.E. of the Program Agreement, if the Secretary of the Interior and the Governors of Colorado, Nebraska and Wyoming decide to dissolve the Program before the end of the First Increment or to not pursue a second increment of the Program, or if the Program is dissolved as the result of a signatory's withdrawal, the Program Governance Committee is dissolved and the signatories agree to form a signatory committee to satisfy the signatories' existing legal obligations under contracts and arrange for disposition of Program Assets. Other members of the Program Governance Committee may be invited to advise signatories in that regard. In the event that any signatory is unable or unwilling, following a decision to dissolve the Program, to continue to participate on such signatory committee, the remaining signatories shall be fully empowered to make such decisions and take such actions as are necessary to meet the signatories' legal obligations under the contracts with the Financial Management Entity (FME) and the Land Holding Entity (LHE) and properly dispose of Program Assets.

1. The signatory committee will remain functional until such time as the signatories' legal obligations under existing contracts and agreements are met and the disposition of Program Assets is resolved, including any outstanding payments due and payable to a "Water Project Sponsor" or "Sponsors of Program Lands." Until an asset is no longer the responsibility of the signatories, the signatories agree to ensure that FME will continue to pay property taxes and retain liability insurance. The signatories agree to manage the property in compliance with the "good neighbor" policy.

2. A signatory or a partnership of signatories may wish to purchase the shares in the Program Assets of any signatory or signatories wishing to sell, under the condition that the Program Assets will continue to be managed to provide habitat for the target species. If this occurs, the signatory committee will have the FME acquire the services of an independent appraiser to complete an appraisal of the Program Assets. The appraisal will be based on the continued use of the Program Asset to provide habitat to the target species. If the Program Governance Committee had previously established the appraised value or a method for determining the appraised value of a particular Program Asset in the event of Program dissolution, that value or method shall be used. The signatory or partnership of signatories may purchase the shares of the selling signatories at a price equal to the respective selling signatories' share of the Program Assets times the appraised value of the Program Assets. If the purchased Program Assets are land, those lands will be held by the Land Holding Entity or a successor selected by the purchaser and approved by the signatory committee as a condition of the sale. (A signatory state may offer to donate its interest in a Program Asset to another signatory or partnership of signatories and seek ESA credit from FWS in future reinitiated consultations in that state for the continuing benefits provided to the target species as a result of the donation.)

3. If none of the signatories are interested in acquiring Program Assets as described in Section III.A.2 above, the signatory committee will entertain offers from water user

and environmental entities to purchase the Program Assets under the condition that the Program Assets will continue to be managed to provide habitat for the target species. If the purchased Program Asset is land, that land will be held by the Land Holding Entity or a successor selected by the purchaser and approved by the signatory committee as a condition of the sale. The proceeds of the sale, after expenses, will be distributed to the signatories in accordance with their respective Signatory's Share of the Program Assets.

4. If the Program Assets are not purchased in accordance with Sections III.A.2 or 3 above, the signatory committee shall oversee the sale of such assets. Such sale may be made without the condition that the Program Asset must be managed to provide habitat for the target species. The proceeds of the sale, after expenses, will be distributed to the signatories in accordance with their respective Signatory's Share of the Program Assets.

B. ESA Credits

In the event of Program dissolution, if a state agrees to and continues to carry out the responsibilities it had under the Program, there is a presumption that such actions are sufficient to provide ESA compliance with respect to all water related activities in that state until any reinitiated consultations have been completed. When a state agrees to and continues to carry out the responsibilities it had under the Program, that state and any water related activities covered also retain the right to argue that the responsibilities undertaken are sufficient to constitute long term ESA compliance for the reinitiated consultations. FWS agrees to consider these undertakings in any reinitiated Section 7 consultations, including in the development of new reasonable and prudent alternatives or other measures.

In addition, to the extent the states respective contributions of cash, water (through the initial Program water projects), and land (Cottonwood Ranch and Deer Creek lands) will continue to benefit the target species beyond the dissolution of the Program, the states retain the right to argue that such future benefits resulting from their contributions should be considered in any reinitiated consultations. The FWS will give due consideration to these contributions and their resulting subsequent benefits to the target species and habitat in any reinitiated consultations.

IV. PROGRAM BUDGET AND CASH FLOW REQUIREMENTS

Activity	Estimated Cash Needs in 2005 Dollars (Millions)	Cash Equivalent Credit (Millions)
Water (130-150KAF)		
Three State Water Projects (80KAF)[1,] *		$120.19
Water Conservation/Supply (60KAF)[2]	$90.14	
Project Permitting[3]	$1.35	
Bypass	$3.08	
Channel Capacity Issues	$1.00	
Subtotal Water	$95.57	$120.19
Land (10K Acres)		
Cottonwood Ranch Acquisition (2,650 A, cash equivalent)[4,] *		$8.50
Wyoming's Deer Creek Property		$1.50
Acquisition (7,350A)[4]	$22.90	
0&M (Includes clearing)	$10.00	
Investigation/Leveling Act.[5]	$3.35	
Taxes	$1.53	
Project Perm. & LAC[3]	$1.35	
Subtotal Land	$39.13	$10.00
Program & Project Monitoring and Research[6]	$30.00	
Program & Project Administration (@ 1.49M/Yr)[7]	$19.37	
Third Party Direct Impact Mitigation Contingency and Liability	$0.67	
Peer Review and Independent Science Advice[8]	$2.35	
Program Legal Fees[9]	$0.05	
Totals	**$187.14**	**$130.19**
Estimated Total First Increment Cash and Cash Equivalent Costs		**$317.33**

* Indicates items for cash equivalent or in-kind contribution credit

[1]Three State Water Projects (80AF) from the Reconnaissance - Level Water Action Plan, Page 105, September 14, 2000 Reconnaissance - Level Water Action Plan, Page 108-109, September 14, 2000

[2]Estimate based on review of Reconnaissance-Level Water Action Plan.

[3]Project specific compliance with state and federal laws and regulations including NEPA requirement, and ESA requirements for protected species not covered by the Program.

[4]Cost for Cottonwood Ranch negotiated for in the Cooperative Agreement. Other purchase costs assume approximately $3,100/ac.

[5]Preliminary cost associated with moving 40 acres of land, 4 feet deep (per analysis in EIS) at cost of $1/yard.

[6]Monitoring and Research costs estimated by the Technical Committee, including Parsons/EIS Team estimate for Sediment/Vegetation and additional tasks identified by Governance Committee (e.g. water quality)

[7]Executive Director, staff, office space, travel, etc.

[8]Includes assistance for implementing the AMP and peer review of individual documents.

[9]Estimate includes assistance in developing Program, land, water entities, contracts, taxes, etc.

PLATTE RIVER RECOVERY IMPLEMENATION PROGRAM

ATTACHMENT 2

MILESTONES DOCUMENT

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 2

Milestones Document

December 7, 2005

Table of Contents

I. PURPOSE OF MILESTONES

During the First Increment of the Program, progress toward the Program objectives for Endangered Species Act (ESA) compliance purposes will be measured through the achievement of the Milestones. The Program will continue to serve as the ESA compliance for water related activities upstream of the confluence of the Loup River, Nebraska, so long as the Milestones are being met. The Governance Committee may change the Program's First Increment Milestones, provided such changes are consistent with accomplishing the First Increment Objectives.

II. MILESTONES

The Milestones are as follows:

1. **The Pathfinder Modification Project will be operational and physically and legally capable of providing water to the Program by no later than the end of Year 4 of the First Increment.**

2. **Colorado will complete construction of the Tamarack I and commence full operations by the end of Year 4 of the First Increment.**

3. **CNPPID and NPPD will implement an Environmental Account for Storage Reservoirs on the Platte System in Nebraska as provided in FERC licenses 1417 and 1835.**

4. **The Reconnaissance-Level Water Action Plan, as may be amended by the Governance Committee, will be implemented and capable of providing at least an average of 50,000 acre-feet per year of shortage reduction to target flows, or for other Program purposes, by no later than the end of the First Increment.**

5. **The Land Plan, as may be amended by the Governance Committee, will be implemented to protect and, where appropriate, restore 10,000 acres of habitat by no later than the end of the First Increment.**

6. **The Integrated Monitoring and Research Plan, as may be amended by the Governance Committee, will be implemented beginning Year 1 of the Program.**

7. **The Wyoming Depletions Plan, as may be amended with the approval of the Governance Committee, will be operated during the First Increment of the Program.**

8. **The Colorado Depletions Plan, as may be amended with the approval of the Governance Committee, will be operated during the First Increment of the Program.**

9. **The Nebraska Depletions Plan, as may be amended with the approval of the**

Governance Committee, will be operated during the First Increment of the Program.

10. The Federal Depletions Plan, as may be amended with the approval of the Governance Committee, will be operated during the First Increment of the Program.

III. EXPLANATORY MATERIAL AND SCHEDULES

Following are explanatory materials and estimated time frames for anticipated interim steps that will be taken toward meeting each Milestone. The explanatory information and related interim steps and schedules are to be considered as background information and are not to be considered as individual Milestones for purposes of ESA compliance. The scheduling, whether in relation to the Milestones themselves or the explanatory material, is referenced to the term of the First Increment, which is thirteen years.

The explanatory material illustrates progress that all parties expect to see and may form the basis to begin discussions within the Governance Committee concerning whether the Program should adjust or alter its current methods and administrative processes in order to achieve the Milestone using a revised approach.

1. The Pathfinder Modification Project will be operational and physically and legally capable of providing water to the Program by no later than the end of Year 4 of the First Increment.

Explanatory Information

A description of the Wyoming's Pathfinder Modification Project is found in the Program Water Plan (Attachment 5, Section 4). Funding the construction of this project is Wyoming's responsibility. Because Pathfinder Dam and Reservoir are federal facilities, however, the United States Bureau of Reclamation (USBR) is responsible for meeting federal construction specifications and oversight.

1.1. The appropriate party (Wyoming, USBR or Nebraska) is expected to apply for the necessary approvals and permits during Year 1 of the Program. It is expected that such approvals and permits will be obtained in Year 2. The approvals will include appropriate compliance pursuant to the National Environmental Policy Act (NEPA). It is expected that the following approvals and permits will be necessary:

1.1.1. The USBR, with assistance from Wyoming, will seek an amendment to the federal authorization for the Pathfinder Reservoir to allow the water that is stored in the Pathfinder Modification Project to be used for environmental and municipal purposes in a manner consistent with Wyoming law.

1.1.2. The USBR will seek a partial change of use for its water right for Pathfinder Reservoir from the Wyoming Board of Control to allow the water stored in the Pathfinder Modification Project to be used for environmental and municipal purposes.

1.1.3. Wyoming will seek approval from the Wyoming Legislature for the export of water for downstream environmental uses specific to the goals and duration of the Program.

1.1.4. Subject to the appropriate approvals and conveyance losses, Wyoming, in accordance with its law, will assure delivery of the storage water from the Pathfinder Modification Project designated for downstream environmental purposes to the Wyoming/Nebraska state line. A permit will be secured by Wyoming pursuant to Nebraska water law to conduct the designated environmental water to specified locations between the state line and Chapman, Nebraska. Beyond the state line, Nebraska will assure delivery of the water in accordance with the terms of any such permit granted and applicable Nebraska law.

1.2. Project construction will be initiated and completed by no later than the end of Year 3 of the Program. Final operational criteria will be developed by no later than the end of Year 3 of the Program. The Pathfinder Modification Project will be operational and capable of providing water to the Program by no later than the end of Year 4.

1.3. Environmental releases from the Pathfinder Modification Project will be provided in coordination with the FWS Environmental Account Manager in accordance with the stipulation entitled, "Amendment of the 1953 Order to Provide for the Modification of Pathfinder Reservoir."

1.4. Wyoming will develop an annual operations plan for the environmental account in the Pathfinder Modification Project and coordinate those plans with the FWS Environmental Account Manager.

2. Colorado will complete construction of Tamarack I and commence full operations by the end of Year 4 of the First Increment.

Explanatory Information

A description of Colorado's Tamarack I is found in the Program Water Plan (Attachment 5, Section 3). Funding the construction of this project is Colorado's responsibility. It is anticipated that the following tasks will be accomplished leading up to full operation of Tamarack Phase I for Program purposes:

2.1. Colorado will secure any necessary Colorado or federal authorizations and appropriate compliance under the National Environmental Policy Act (NEPA) prior to the end of Year 2 of the Program.

2.2. Colorado will construct and begin operation of 50% of the Tamarack I by the end of Year 2 of the Program.

2.3. Colorado will account for Tamarack I water passing to the Colorado-Nebraska state line. Nebraska initially will rely on accounting to track this water within Nebraska to the associated habitats. The effectiveness of this strategy to accomplish Program objectives will be assessed. In the event that permitting is deemed necessary to protect this water, Colorado will cooperate with Nebraska to enable acquisition of the needed permits.

2.4. Colorado will commence full Tamarack I operations by the end of Year 4, after consultation with the FWS's Environmental Account Manager to help Colorado maximize the benefit of its operations for Program purposes.

2.5. Colorado will develop an annual operations plan and coordinate that plan with the FWS's Environmental Account Manager.

3. CNPPID and NPPD will implement an Environmental Account for Storage Reservoirs on the Platte System in Nebraska as provided in FERC licenses 1417 and 1835.

Explanatory Information

"An Environmental Account for Storage Reservoirs on the Platte River System in Nebraska" (EA Document) is found in the Program Water Plan (Attachment 5, Section 5).

3.1. CNPPID will make contributions to the Environmental Account as set forth in its license, and will make releases from the Environmental Account as requested by the Environmental Account Manager in accordance with CNPPID's FERC-approved Administrative Plan.

3.2. Other water contributions may be provided to the Environmental Account as set forth in "An Environmental Account for Storage Reservoirs on the Platte River System in Nebraska" and as permitted and tracked by the Nebraska Department of Natural Resources (NDNR).

4. The Reconnaissance-Level Water Action Plan, as may be amended by the Governance Committee, will be implemented and capable of providing at least an average of 50,000 acre-feet per year of shortage reduction to target flows, or for other Program purposes, by no later than the end of the First Increment.

Explanatory Information

The terms "reduction in shortage", "target flows", and how water projects are evaluated to determine their contribution to reduction in shortage is described in the Platte River Recovery Implementation Program, Section III.E.

The combined three state water projects (Pathfinder Modification, Tamarack I, and the Nebraska Environmental Account) were evaluated and determined to provide an average reduction in shortage of 80,000 acre-feet per year. The combined effect of the original three projects and the Reconnaissance-Level Water Action Plan is intended to achieve the Program objective of "providing water capable of improving the occurrence of Platte River flows in the central Platte River associated habitats relative to the present occurrence of species and annual pulse target flows.... by an average of 130,000 to 150,000 acre-feet per year as measured at Grand Island....” (Platte River Recovery Implementation Program, Section III.A.3.b.(1)). Therefore, the Reconnaissance-Level Water Action Plan is intended to provide an average of at least 50,000 acre-feet per year reduction in shortage in addition to the three state water projects.

As Reconnaissance-Level Water Action Plan projects move forward from the reconnaissance level, to feasibility, to project implementation, the reduction in shortage credited to an individual project will remain as evaluated and agreed upon by the Governance Committee prior to project implementation, so long as the project is implemented in general and reasonable conformance with the project description. That amount of reduction in shortage for the Reconnaissance-Level Water Action Plan project will be credited towards the completion of Milestone 4, and is not dependent upon annual or day-to-day management decisions made by the Environmental Account Manager or future variations in hydrologic conditions during the First Increment**.**

The Program’s Reconnaissance-Level Water Action Plan is found in the Program Water Plan (Attachment 5, Section 6). The following steps are necessary to implement the Water Plan and are needed to successfully complete Milestone 4.

4.1. The Governance Committee is responsible for allocating funds necessary to implement the Reconnaissance-Level Water Action Plan in accordance with the Program budget, as approved by the signatories and may be revised by the Governance Committee.

4.2. The Governance Committee is responsible for acquiring the necessary permits for individual water related activities and for insuring compliance with all relevant local, state and federal laws and regulations.

4.3. The Governance Committee will determine which projects in the Reconnaissance-Level Water Action Plan are retained through the reconnaissance, feasibility, and implementation level. Water related activities implemented in accordance with the Water Plan will be credited to the Program’s long-term objective as set forth in the Platte River Recovery Implementation Program, Section III.A.3.a.(1) and the objective for the First Increment of the Program. As appropriate, the Governance Committee will develop and use protocols to determine what quantities of water are to be credited to the individual projects.

4.4. Recognizing that the initial Reconnaissance-Level Water Action Plan (Attachment 5, Section 6), is based on reconnaissance level project evaluations, the Governance Committee will complete feasibility studies on proposed projects and develop a Water Action Plan, if necessary, by the end of Year 3 of the First Increment.

4.5. This Water Action Plan, as may be amended by the Governance Committee, will be capable of providing at least an average of 25,000 acre-feet per year of shortage reduction to target flows, or for other Program purposes, by the end of Year 8 of the First Increment.

4.6. The Governance Committee will ensure that projects implemented under this Water Action Plan are operated in accordance with approved operating plans and that they are having the intended effects on Program purposes.

4.7. The Governance Committee will ensure that water produced by projects implemented under this Water Action Plan is included in approved tracking and accounting procedures and that these projects are coordinated with other Program activities including other water projects and with the management of the Environmental Account.

5. The Land Plan, as may be amended by the Governance Committee, will be implemented to protect and, where appropriate, restore 10,000 acres of habitat by no later than the end of the First Increment.

Explanatory Information

The Program's Land Plan is found in Attachment 4. The following steps are necessary to implement the Land Plan and are needed to successfully complete Milestone 5.

5.1. The Governance Committee is responsible for allocating the Land Plan funds in accordance with the Program budget, as approved by the signatories and may be revised by the Governance Committee.

5.2. The Governance Committee will insure the acquisition of necessary permits for individual land protection and habitat restoration activities and for insuring compliance with all relevant local, state and federal laws and regulations.

5.3. Land protected in accordance with the Land Plan and land acquired by or on behalf of existing water related activities completing ESA Section 7 consultation prior to the Program will be credited to the Program's long-term objective as set forth in Platte River Recovery Implementation Program, Section III.A.3.a.(2), and the objective for the First Increment of the Program.

5.4. NPPD is responsible for implementing the Cottonwood Ranch Development Plan as approved by FERC, in accordance with Article 407 of the license for Project 1835 and the settlement agreement. The Governance Committee will fund the habitat maintenance plan for the NPPD Cottonwood Ranch Property in accordance with the FERC License and the settlement agreement. The Governance Committee will reimburse NPPD for the Cottonwood Ranch development costs in accordance with the FERC License and the settlement agreement. The Program and this Milestone will be credited for 2,650 acres for the NPPD Cottonwood Ranch Property.

5.5. Management, restoration, and maintenance of Program lands will be accomplished according to the principles of adaptive management, including the identification of a habitat baseline for each parcel and the implementation of monitoring and research activities as described in the Program's Adaptive Management Plan found in Attachment 3.

5.6. A management and restoration plan specific to each parcel of land protected will be prepared within one year of acquisition and implemented as provided in the plan.

5.7. The Land Plan and management and restoration plan will be implemented with the advice of the Land Advisory Committee.

5.8. The Governance Committee will establish a land holding entity in accordance with the Program's Land Plan by the end of Year 1 of the Program.

5.9. Recognizing that restoration plans may require a number of years to complete, the Governance Committee will use its best efforts to protect 10,000 acres of habitat, including the 2,650 acres of habitat with the NPPD Cottonwood Ranch Property, by the end of Year 9 of the First Increment.

6. The Integrated Monitoring and Research Plan, as may be amended by the Governance Committee, will be implemented beginning Year 1 of the Program.

Explanatory Information

6.1. The Program's Integrated Monitoring and Research Plan (Attachment 3, Section 5) will be implemented to conduct biological response monitoring and research of all water and land actions as needed for adaptive management.

6.2. The Program is responsible for allocating the Integrated Monitoring and Research Plan (Attachment 3, Section 5) funds in accordance with the Program budget, as approved by the signatories and may be revised by the Governance Committee.

6.3. All aspects of the Program's Integrated Monitoring and Research Plan will be subject to independent peer review, as approved by the Governance Committee.

6.4. The results of the Program's Integrated Monitoring and Research Plan will be evaluated annually, to determine if the Program is operating as originally envisioned and to determine if management changes are warranted in accordance with the Adaptive Management Plan (Attachment 3).

6.5. Monitoring and research will be conducted to determine the impact of the Program's habitat development and maintenance activities and enable modifications to minimize impacts to the environment and adjoining landowners.

7. The Wyoming Depletions Plan, as may be amended with the approval of the Governance Committee, will be operated during the First Increment of the Program.

Explanatory Information

7.1. Operate Wyoming's Depletions Plan according to Section 7 of the Water Plan (Attachment 5)

8. The Colorado Depletions Plan, as may be amended with the approval of the Governance Committee, will be operated during the First Increment of the Program.

Explanatory Information

8.1. Operate Colorado's Depletions Plan according to Section 9 of the Water Plan (Attachment 5).

9. The Nebraska Depletions Plan, as may be amended with the approval of the Governance Committee, will be operated during the First Increment of the Program.

Explanatory Information

9.1. Operate Nebraska's Depletions Plan according to Section 8 of the Water Plan (Attachment 5).

10. The Federal Depletions Plan, as may be amended with the approval of the Governance Committee, will be operated during the First Increment of the Program.

Explanatory Information

10.1. Operate the Federal Depletions Plan according to Section 10 of the Water Plan (Attachment 5).

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM

ATTACHMENT 3

ADAPTIVE MANAGEMENT PLAN

PLATTE RIVER RECOVERY IMPLEMENATION PROGRAM
Attachment 3

Adaptive Management Plan
October 24, 2006

Table of Contents

List of Appendices

PREFACE - Purpose and Scope of Adaptive Management in the Program

Adaptive management in the Program is a systematic process administered by the Governance Committee for continually improving management by: 1) designing certain Program management activities to test alternative hypotheses, and 2) applying information learned from research and monitoring to improve Program management. The process also includes the flexibility to use information and experience from all sources.

The Governance Committee intends this Adaptive Management Plan (AMP) to describe the processes and procedures for implementing adaptive management. Terms within the AMP including, for example, objective or performance measure, have definitions specific to the AMP (see Sections III and IV). The Governance Committee does not intend the AMP to be used to determine Endangered Species Act (ESA) compliance or to automatically or implicitly establish Program requirements (e.g., to create obligations to achieve specific results).[1]

The AMP will be implemented within the existing Program defined contributions of money, land, and water unless amended in accordance with Section III.B.1 of the Program Document. The AMP, which will be amended as learning proceeds, includes those Program management activities and criteria that are subject to systematic investigation.

The Governance Committee recognizes the importance of implementing the AMP in attempting to achieve the following overall management objectives for whooping cranes, least terns, piping plovers, and pallid sturgeon:

1) Improve production of least tern and piping plover from the central Platte River.
2) Contribute to the survival of whooping cranes during migration.
3) Avoid adverse impacts from Program actions on pallid sturgeon populations.

The Governance Committee does not anticipate that these three overall management objectives will be modified, but the underlying management objectives related to the means of achieving these objectives, as described in Section IV.A and B. of this document, may be changed through the process described in 1), 2), and 3) below.

1) If information developed through the AMP, or other information, justifies changing a management objective, the Governance Committee may do so and will develop and implement new practices intended to achieve the changed management objective.
2) If information developed through the AMP, or other information, justifies abandoning a management objective the Governance Committee may do so.
3) If information developed through the AMP or other information, indicates a particular practice to achieve a management objective is not working and the management objective is neither modified nor abandoned, the Governance

[1] Adoption of the AMP does not constitute an admission by the states or water users of support or acceptance that any hypothesis or ecological model is valid, is based on the best science available or should be used as a measure of appropriate or reasonable accomplishments or success.

Committee will develop and implement alternative practices intended to achieve the same adaptive management objective.

For example, the AMP contains management objectives for creating channels with certain characteristics with specific practices. If it is determined that the these practices cannot achieve the desired channel characteristics then the practices may be modified, or abandoned for alternative practices for the purpose of achieving the same desired channel characteristics. Similarly, if it is determined that the desired outcome of management, in our example channel characteristics, should be modified, then these management objectives would be modified and management practices would be designed to meet the new management objectives. Likewise, if it is determined that the desired outcome of a particular channel characteristic be abandoned, the Governance Committee may do so. Throughout this, the overall management objectives of benefiting the target species would not change.

This plan is a strategic document that lays out the broad policies and guidelines for conducting adaptive management during the Program. More detail and specific operating plans will be prepared as additional information becomes available. These operating plans will identify specific management objectives for Program lands, specific management actions to be taken to achieve the management objectives, and specific monitoring and research activities that will be used in the evaluation of the management. The AMP is a flexible or "living" document and will be modified during the First Increment of the Program. At a minimum, the AMP will be revisited annually. Changes to the AMP may be recommended by the Executive Director or advisory committees, but the Governance Committee has the ultimate authority to make changes in the Plan. A process for modifying the AMP is described in more detail in Section I.G. below.

I. INTRODUCTION

Adaptive management as described in this Adaptive Management Plan (AMP) is a series of scientifically driven management actions (within policy and resource constraints) that use the monitoring and research results provided by the Integrated Monitoring and Research Plan (IMRP; Section V of this plan) to test priority hypotheses related to management decisions and actions, and apply the resulting information to improve management. Adaptive management works iteratively as illustrated in the "six steps" of adaptive management illustrated in Figure 1a (Nyberg 1999).

Science based adaptive management operates on the premise that:

1) Uncertainty exists in a managed system, and reduction of uncertainty can improve management;
2) Uncertainty can be reduced through adaptive management but can never be eliminated;
3) Management decisions must be made despite the uncertainty;
4) Monitoring and research programs are in place to evaluate management decisions and to continually improve the knowledge (e.g., underlying conceptual ecological models, computer models) on which these decisions should be based; and

5) Learning about the effects of management will hasten improvement of management decisions in the future resulting in more rapid and cost-effective attainment of management objectives.

Adaptive management experiments can be categorized into two types: “passive” and “active” (Walters and Holling 1990, Murray and Marmorek 2003). In passive adaptive management, alternatives are assessed in step 1 of Figure 1a, and the management action deemed *best* is designed and implemented in steps 2 and 3. Monitoring and evaluation (steps 4 and 5) then lead to appropriate adjustments (step 6). In active adaptive management, managers explicitly recognize in step 1 that they do not know which activities are best, and then select several alternative activities to design and implement in steps 2 and 3. Monitoring and evaluation of each alternative helps in deciding which was more effective in meeting objectives, and adjustments to the next round of management decisions can be made based on those lessons.

Passive adaptive management may initially be less expensive and require fewer people, because only one alternative management technique or strategy is implemented. However, if managers are incorrect in their assumptions, it can take longer to learn which activities are indeed most effective. The absence of a formal comparison of alternatives may mask weaknesses in the approach assumed to be best. As a result, it may prove necessary to go through several iterations of passive adaptive management experiments. Passive adaptive management is also more likely to confound natural environmental change and management effects, hampering managers’ ability to draw confident conclusions.

Active adaptive management may require a larger initial investment of time, labor, and funds, but since several alternatives are tested (usually including a no-action control), learning happens faster and fewer iterations may be needed to find the best alternative. In the Platte River, active adaptive management can only happen at the System and Program Scale through contrasts in actions over time (e.g. different flows in different years), as there are no control systems (see Section I.E. below, for definition of the various scales). At the System Scale, however, actions in one year may have a continuing effect in subsequent years for some ecosystem components, so the intended contrast is blurred. However, sharp spatial contrasts in actions can be created at the Project Scale (see Section V.B), which will likely provide the most promising opportunity for active adaptive management.

A major implication of adaptive management is that learning becomes one of the goals of management; therefore, the collection of useful data through monitoring and research should be an integral part of management decisions and actions. Monitoring and research should be designed to reduce management uncertainty. Typical sources of uncertainty include:

- Ecological (structural) uncertainty: population, community, or landscape dynamics are not completely known; important biological processes are at work; and, there are competing lines of thought as to how they work.
- Environmental variation: uncontrollable natural and anthropogenic changes that increase randomness in system dynamics.
- Partial controllability: management decisions are applied to the system in an unpredictable way and/or by parties not involved in the adaptive management

process, and are influenced by overriding forces (e.g., laws, regulations, and agreements).
- Partial observability: uncertainty about resource status, inability to see the system.

Program monitoring and research need to consider these sources of uncertainty and attempt to reduce, eliminate, or account for them in analyses and management decisions. However, the expected likelihood and costs of reducing uncertainty, and the expected benefit in terms of improved management decisions, will also be considerations when prioritizing monitoring and research projects. Of these major sources of uncertainty, partial controllability or implementation uncertainty is perhaps the largest issue in the Program (i.e. the land and water 'treatments' are uncertain at the Program and System scales). The AMP recognizes the contingent nature of various hypothesis tests and the importance of prioritizing monitoring and research activities based on these contingencies.

The following is the AMP for the Platte River Recovery Implementation Program (Program) and is a product of the Adaptive Management Working Group (AM Working Group) described in Section I.A. of this plan. This AMP is a strategic document that provides a framework for plans that will describe the adaptive management activities to occur. This AMP is dynamic and will change throughout the First Increment of the Program. The process for changing the AMP is also described in Section I.G. of this plan.

I.A. Program Goals and Program Objectives

The Program's long-term goals and First Increment goals and objectives are stated in the Program Document Section II and Section III.A.3.a.and b. The First Increment objectives include the protection, and where appropriate, restoration of 10,000 acres of habitat for the three avian target species and provide water capable of reducing shortages of U.S. Fish and Wildlife Service (FWS) target flows by an annual average of 130,000 to 150,000 acre-feet. The 10,000 acres of habitat identified as one of the First Increment objectives will initially include 9,200 acres that approximate or have the potential to approximate through restoration, habitat complex characteristics described in Table 1 of the Land Plan; and, up to 800 acres of habitat that have or have the potential to have the characteristics of non-complex habitat described in Table 2 of the Land Plan (Program Attachment 4).

Program goals and objectives will be achieved as a combination of individual land and water actions (e.g., individual water projects, individual land acquisitions) implemented over the First Increment. These actions are considered treatments applied to the associated habitats resulting in some desired response by target species and/or their habitats (Figure 2). The Program's approach to reducing shortages to target flow and the protection and restoration of land are described in the Water Plan (Attachment 5 of the Program) and Land Plan (Attachment 4 of the Program), respectively. These plans are subject to change by the Governance Committee based on learning through adaptive management.

I.B. General Concept of the Program's Adaptive Management

The Program objectives (see Section I.A. above) can only be modified through formal amendment of the Program and not as a part of the AMP. Individual land and water management actions (or treatments), where possible, will be developed and designed to gain the greatest feasible understanding of the response to management actions of the target species and components of their habitat through monitoring and research (Sit and Taylor 1998, Walters 1986). Program water will generally be managed to try to achieve flows as described in “Water Plan Reference Material” (Water Plan, Attachment 5, Section 11) and to produce effective adaptive management experiments. The guidelines for land acquisition, both complex and non-complex, are described in the Program’s Land Plan (Program Attachment 4, Tables 1 and 2). The Governance Committee may use analysis of information provided by the AMP during the First Increment to change these characteristics and/or guidelines contained in the Land and Water Plans.

I.C. Organizational Structure to Implement Platte River Adaptive Management

The Signatories (Colorado, Nebraska, Wyoming and the Department of the Interior (DOI)) have agreed to carry out financial and contracting responsibilities in coordination with the Governance Committee as described in the Organizational Structures Document (Program Attachment 6). Otherwise, Program decision-making lies with the Governance Committee, which is made up of Signatory and non-Signatory members. The organizational structure for making decisions and carrying out activities related to the Program is illustrated in the Organizational Structures Document (Attachment 6) and reproduced as Figure 3 in this plan. The following is a general description of the responsibilities and relationship of each component related to this plan.

I.C.1. Policy Functions

The Governance Committee will annually (or more often at their discretion) evaluate Program management activities, and the criteria that guide those Program activities, such as land and water acquisition and management criteria, and others, as described in the Program Document and its attachments (e.g., Milestones Document, Land Plan, and Water Plan). The Governance Committee evaluations will:

1) Assess whether the Program activities and criteria being examined are working as originally envisioned;
2) Except as noted in Section III.B.1 of the Program Document, modify the Program based on new information;
3) Determine whether there are other or better uses for the resources committed to the activity and criteria;
4) Considering available information including any reviews from advisory groups, assess whether success or failure could be determined by monitoring over the time period evaluated; and,
5) Develop alternative activities and criteria in accordance with adaptive management.

As part of the evaluation process, the Governance Committee will review information including, but not limited to, experimental results, costs, progress reports, and other AMP products. Opinions of an Independent Scientific Advisory Committee (ISAC), and peer reviewers if any, should be compiled and summarized as part of the evaluation process. The Governance Committee may approve changes to planned management activities and criteria and/or have its changes and implementation schedule peer reviewed under the Peer Review Guidelines (Appendix A) prior to implementation.

I.C.2. Roles and Responsibilities

I.C.2.a. Governance Committee

The Governance Committee makes policy decisions to implement the Program, and will make all decisions related to adaptive management, unless expressly delegated to the Program's Executive Director (ED), including changes to budgets and Program activities and criteria. As a part of its annual review of Program implementation and accomplishments, the Governance Committee will approve budgets and work schedules for staff necessary for implementation of the plan for the subsequent year or other defined budgetary cycles.

I.C.2.b. Executive Director

The ED carries out Program activities at the direction of the Governance Committee. The ED will provide staff support, coordinate activities with the Governance Committee's advisory committees, make recommendations on budget and schedule necessary to implement activities under this Plan, and provide a review of the implementation of the Plan. The ED will direct and supervise a staff capable of implementing the Program. The ED will also coordinate adaptive management activities with cooperators and provide oversight of contracts and contractors. The ED will provide the Governance Committee with a review and status of Program tasks and will make recommendations to the Governance Committee on adaptive management decisions.

The ED will be expected to work in close cooperation with the advisory committees and the Environmental Account (EA) Manager so that any recommendations being brought forward to the Governance Committee reflect the views of all those involved in the adaptive management program and that majority and all views are presented clearly and fairly. If necessary, and with Governance Committee approval, the ED may establish an ad hoc committee, including the ED, to work through Program activities that overlap between the advisory committees and the EA Manager.

To ensure that the scientific component of the AMP is effectively implemented, the ED's responsibilities include but are not limited to:

1) Synthesizing the scientific aspects of Program management through consultation and cooperation with the advisory committees, the EA Manager, and contractors,
2) Providing recommendations to the Governance Committee in consultation and cooperation with the ISAC, other advisory committees, and the EA Manager on matters including:
    a. Schedules and priorities for implementing projects to test existing and new hypotheses,
    b. Scopes of work for management, research and monitoring activities, including a recommendation on whether the work is done by staff, cooperators, and/or contractors,
    c. Technical review of proposals to do contract research and monitoring, and
    d. Modifying existing and developing new management plans for Program land and water necessary to implement the AMP.

3) Reporting on all land acquisition and management decisions with regard to how they relate to costs, the relative benefit to the target species, and contribution toward fulfilling the Program's objectives, including recommendations, if any, from the Land Advisory Committee (LAC), and
4) Conducting meetings and workshops with the advisory committees and the Governance Committee periodically to provide opportunities for detailed review of the implementation of the AMP.

The ED and staff will conduct a minimum of one workshop per year with the Governance Committee and advisory committees.

I.C.3. Advisory Functions
The ED will be providing information related to the AMP to, and assist in, communication between the Governance Committee, Land, Water, Technical Advisory Committees (LAC, WAC, and TAC, respectively) and the ISAC. The advisory committees will perform the duties described in committee charters contained in the Organizational Structures Document (Program Attachment 6).

The advisory committees will be formed by the Governance Committee in accordance with the processes included in their respective charters. The committees will provide advice on implementation of the Land Plan (LAC), Water Plan (WAC), and scientific aspects of the Program, including implementation of the AMP (TAC, WAC, LAC and ISAC).

I.C.3.a. Stakeholder Advisory Committees
The Land, Water, and Technical Advisory Committees are generally made up of representatives of stakeholder groups participating in the Program. These committees are expected to participate with the ED in the synthesis of the information and recommendations to be presented to the Governance Committee and ISAC.

I.C.3.b. Independent Scientific Advisory Committee
The purpose of the ISAC is to insure scientific integrity and quality in the Program by providing the Governance Committee with independent reviews of the Program's processes and products. The ISAC will provide independent scientific advice to the Governance Committee through the ED on scientific issues, including adaptive management, during the First Increment of the Program, according to their charter in Program Attachment 6, Appendix I. The ISAC will be composed of approximately five independent scientists knowledgeable in technical areas critical to the implementation of the AMP. The tasks to be completed by ISAC will be defined in a scope of work.

I.C.3.c. Environmental Account Manager
The FWS has been charged with the management of the Nebraska EA through an employee, the EA Manager. Each year an EA Annual Operating Plan (AOP) will be developed as described in the Water Plan (Attachment 5; Section 1). Most management actions and adaptive management experiments to test hypotheses will depend on the EA Manager being an integral part of the advisory process. Generally, water release decisions will be made within the overall management framework established by the AMP. Managers of other Program water will

coordinate their water projects through the ED and EA Manager, as appropriate, to facilitate monitoring and research.

I.D. National Academies of Science Review

At the request of the Cooperative Agreement Governance Committee, the DOI funded an 18-month review by the National Academies of Sciences (NAS) National Research Council (NRC) of the science related to the target species use of the Platte River, the FWS criteria for suitable habitat and target river flows, and the science related to the geomorphology of the river. The findings and recommendations of the NRC independent peer review (NRC 2005) were considered in the development of this plan and will be one of many sources of information considered in the implementation of adaptive management.

Overall, most recommendations related to monitoring and research contained in the NRC review were already in, or have been, incorporated into the Program's monitoring and research. For example, the NRC recommended that issues regarding other species of concern be considered in the Platte River area. The monitoring and research effort was modified to include additional effort for monitoring other species (i.e., species in addition to the target species). Additional funds and efforts have also been added to the monitoring and research budget to monitor water quality on Program lands.

While most items identified by the NRC are addressed, there remain a few items that the NRC identified as important considerations that have not been incorporated directly in to the AMP. These issues include:

1) Monitoring throughout geographic area of the target species' range using radio telemetry or banding,
2) Contribution of contaminants to current rate of least tern and piping plover mortality,
3) Monitoring of direct human influence (e.g., harvest of wild fish) for pallid sturgeon,
4) Determine the role of the Platte River in recovery of the pallid sturgeon, and
5) Impacts of long-term climatic influences.

While the Governance Committee and others may agree that these items are important aspects related to the target species, they have not been included in the Program because they were outside the scope of the Program, budgetary priorities, policy decisions, addressed by other groups, and other reasons. The Governance Committee may choose to participate with other groups on these issues in the future. Although, with respect to item 5, the Program will monitor year to year changes in weather, as these are important covariates in determining year-to-year fluctuations in monitoring and research results.

I.E. Scale of Platte River Adaptive Management

While the Program is designed to provide ESA compliance for existing and certain new water related activities throughout the Platte River basin upstream of the Loup River confluence, the land acquisition and management for the target bird species will occur in the central Platte River region (Lexington to Chapman, Nebraska), and Program water activities would be designed to provide benefits for the target bird species in the central Platte River region with subsequent benefits to the pallid sturgeon in the lower Platte River region (below the confluence with the

Elkhorn River). These areas are generally known as the "associated habitats" and comprise the study area for the AMP.

Adaptive management may occur at multiple scales during the Program:

- System Scale: System scale adaptive management evaluates the effects of Program management actions on the target species and associated habitats (as defined in the Program Document) throughout the entire study area. For example, the management of Program land may impact the way whooping cranes use both Program and non-Program lands.
- Program Lands: Program lands (or simply Program) scale adaptive management evaluates the effects of Program management actions on lands acquired by the Program (i.e., the entire parcel in which several management actions may be occurring), and management of non-Program lands as appropriate and when permitted by the landowner. For example, multiple management practices will occur on some Program lands designed to achieve a specific outcome for the entire parcel (e.g. the development of a habitat complex).
- Project Scale: Project scale adaptive management evaluates the effects of individual Program land management activities and water management projects. For example, the effect of a specific land management activity such as forest removal will be evaluated.

These scales will often be "nested" such that several individual project scale evaluations may be needed or combined into Program lands or System Scale evaluations, as appropriate. Additional detail will be provided for each of the scales through the development of management hypotheses.

I.F. Process for Modifying the Adaptive Management Plan

I.F.1 Process for Developing Work Plans

Annual and 5-year work plans will be developed for implementing the AMP. For Program Year 1, the following table identifies the road map to be followed in developing the first work plans.

Tasks	Responsible Party	Timeline	Comments
2007 Annual Work Plan - AMWG meeting to identify the components, identify scope of the annual work plan, define the products, better define what the work plan and experimental design will entail	AMWG	Nov-06	This will guide the 2007 work plan development
AMWG meeting to integrate the baseline monitoring with the IMRP	AMWG	Dec-06	This would guide interim baseline monitoring needs for early in the Program
Identify basic baseline monitoring needs for 2007	AMWG	2007	Examples of baseline monitoring needs include: Lidar, species use, and vegetation/geomorphology.

Tasks	Responsible Party	Timeline	Comments
Develop broad experimental design recommendations to GC from AMWG (what management actions are recommended to test priority hypotheses, what is timeline, where to implement management actions?)	AMWG, TAC, LAC, WAC, ED	Through December 2007	This will be one voice among many influencing which management actions the GC decides to implement
In parallel, work on 5-year workplan	AMWG	Through December 2008	Work plan tiers from the AMP
In parallel, conduct analysis and get outside expertise to help address work plan and experimental design feasibility issues	AMWG guides, others participate	Through December 2008	Potential need for outside expert assistance

I.F.2 Process for modifying the AMP during the First Increment of the Program

The AMP will be changed through a collaborative process led by the ED using an ad hoc committee of representatives of the LAC, WAC, and TAC. The process will also include review input from the ISAC and other peer reviewers as appropriate. The process will be based on the products resulting from the implementation of the Program's operating and implementation plans. The work plans will be developed by the ED, using the AMP as a strategic planning template. Budgets will be updated annually, reflecting the accumulating evidence for priority hypotheses, and making or modifying the plans for the subsequent year or years.

The steps involved in changing the AMP will likely include:

1. The ED will compile reports summarizing the previous field seasons of management, monitoring and research. This process will be completed on a different schedule for each project; although, it will typically occur in the fall and early winter of each year.
2. The ED will provide the AMP and reports summarizing the previous field seasons of management, monitoring and research to the LAC, WAC, TAC, and the ISAC for review in preparation of a workshop to be held annually. The workshop will typically be held mid-winter.
3. The ED will convene the workshop to facilitate changes in the AMP. The ad hoc committee attending the workshop will include representatives of the LAC, WAC, TAC, and the ISAC. The purposes of the workshops include:
   a. Developing modifications to CEMs based on new knowledge.
   b. Any member of the ad hoc committee or advisory committees may add to or modify the list of hypotheses expressing his or her scientific view.
   c. Reevaluate the remaining and new hypotheses to determine the priority hypotheses that will be recommended to the Governance Committee to be carried forward in the revised AMP.
   d. Reevaluate management objectives, management actions, indicators to address hypotheses related to management, and identify modifications that will be recommended to the Governance Committee.

   e. Reevaluate the monitoring and research identified in the IMRP portion of the AMP to determine if the proposed new or modified priority hypotheses are addressed by the existing protocols (Table 1).
   f. Reevaluate the sequencing of implementing tests of priority hypotheses.
   g. Develop recommended modifications of the list of protocols to insure that all priority hypotheses (including proposed changes) are addressed and eliminate unnecessary protocols and reallocate budgets.
4. Incorporate workshop products into the revised draft AMP and circulate to the Governance Committee at least two weeks in advance of an annual workshop to be held with the Governance Committee and advisory committees.
5. Based on the outcome of the workshop with the Governance Committee, the ED's office will revise and finalize the AMP for approval by the Governance Committee. Such approval would include budgets necessary to implement the AMP for the following 12 month period.
6. The ED will modify the Program AOP to reflect changes in the AMP
7. The Governance Committee will review the proposed AMP and AOP and will direct the ED to implement the work plans as approved for the upcoming field season. This approval will occur at the first regularly scheduled Governance Committee Meeting following the completion of the AMP and AOP.

II. POLICIES AND PRACTICAL CONSIDERATIONS

Adaptive management in the Program will be conducted within the limitations and constraints presented by policy, budget, federal and state laws and regulations, including state water law and interstate compacts and decrees, and the necessary elements of a scientific program.

II.A. Policy Considerations

In investigating any approach to maintaining and improving habitat for the target species, proposed actions must be feasible within the limitations of the resources available to the Program in the First Increment. This includes the quantity of water provided by the Environmental Account and other sources of Program water, 10,000 acres of habitat from those available under the willing seller/buyer concept, and budgets established for habitat restoration and monitoring, research and adaptive management activities. Thus, any decisions regarding tests of management activities must be conducted within the Program resources. In addition to these fundamental constraints on the Program, the following additional constraints have been identified from the Program Document, Program Attachments, and Governance Committee direction.

1. Care should be taken in considering management actions that preclude all other future management options.
2. All actions should be consistent with the Program's "Good Neighbor Policy".
3. All lands and water will be acquired from willing sellers or lessors.
4. Each approach will acknowledge system constraints, including storage capacity and water rights.

5. All land acquisition and management decisions will take into account the costs, the relative benefit to the target species, and contribution toward fulfilling the Program's objectives.
6. Program lands include Nebraska Public Power District's (NPPD) Cottonwood Ranch (2,650 acres), lands acquired by the State of Wyoming (470 acres), any lands acquired in the associated habitats by the National Fish and Wildlife Foundation using funds contributed prior to the Program as a result of ESA consultations, and other lands available to the Program as determined by the Governance Committee.
7. Management of Program water will not cause flows above the flood stage as defined by the National Weather Service.
8. The AMP does not preclude management or regulatory responsibilities of individual parties involved in the Program.

II.B. Considerations for and Elements of a Comprehensive Scientific Program

Successful application of adaptive management requires the best scientific foundation possible. Experiences from other restoration programs provide good lessons that can be applied in the context of the Program. A solid scientific foundation typically consists of a blend of monitoring (e.g., baseline data and long-term trend detection), experimental research (e.g., to determine cause-and-effect relationships), simulation modeling (e.g., to provide a tool to design experiments and test scientific understanding), and independent peer review.

With respect to monitoring and research, it is important to note that good experimental design generally includes 1) random allocation of treatments (including controls) to experimental units, and 2) replication of treatments across multiple experimental units. Ideally, all potential confounding variables are controlled directly through the design (e.g., held constant except the one under investigation), adjusted for in the statistical analysis, or removed through randomization. In general, scientific experiments can be conducted in the field, at a small scale in a model of field conditions (mesocosm), and in the laboratory (microcosm). All three approaches have inherent strengths and weaknesses which can be summarized as follows: field – most realism, but least experimental control; microcosm – least realism, but most experimental control; and mesocosm – intermediate to the other two. All three approaches may be used to test hypotheses during the Program as dictated by hypotheses and best available science.

The following should be considered when developing and implementing adaptive management actions and investigations:

1. Program treatments (land acquisitions and water deliveries) will not be applied in a random manner or with replication, so an experimental approach at the System and Program scale utilizing controls and replications will not be possible. Manipulative experiments at the project level (e.g., mesocosm and microcosm) that take advantage of experimental design features, such as randomization and controls within specific project areas, will be possible.
2. Because of the difficulties in applying an experimental approach at the system and Program scale, observational data collection for monitoring purposes may be the predominantly "field-scale" approach. However, opportunities will be sought to implement manipulative studies particularly with the management of Program lands

to test hypotheses. In addition, certain approaches to observational studies (e.g., use versus availability analysis of species habitat preference) may increase the utility of these observational data.

3. Relatively modest management treatments (water during certain periods) will reduce the power of field-scale experiments to detect an effect of the Program over the entire area of interest. Nevertheless, manipulative experiments at the field, meso, and microcosm scale may allow relatively powerful experiments that can detect treatment effects and patterns, and aid in the overall assessment of the Program's effects during and at the end of the First Increment. Also, the design of Program monitoring will take advantage of likely natural events such as large natural pulse flows and similar management of non-Program lands.
4. Large portions of the study area are currently under various types of physical management (e.g., tree clearing, disking, etc.). At the system level, this may provide more opportunity to learn species response and response of habitat features to different management measures, but it will also reduce the Program's ability to separate Program effects from other activities. At the project scale this form of system noise can be minimized and accounted for in the research design.
5. Study designs should allow a before/after analysis to determine biological response to Program management, yet limited quantitative pre-Program data exist. While there is a paucity of pre-Program data, there may be opportunity to develop pre-project data for small scale project studies. In addition, the combination of these smaller scale studies using optimum designs with the Program level correlation and trend analysis will allow a more powerful approach to determine the effect of the Program on target species and their habitat.
6. Because the river is a continuum, flows and management actions can not be confined to certain sections and management actions in one section may have effects on other sections. Such lack of independence between sites will need to be considered in experimental design and analysis.

These considerations and others (e.g., time lag) will be integrated as much as practical into experimental designs for testing hypotheses at various spatial scales, drawing together three elements: the CEMs and hypotheses in Section III below; the management objectives, indicators, and management actions in Section IV below; and the monitoring, research, analytical methods in the IMRP (Section V below).

III. CONCEPTUAL ECOLOGICAL MODELS AND HYPOTHESES

This section focuses on Conceptual Ecological Models (CEM) and hypotheses. These CEMs are broad general conjectures about how the Platte River system functions and are to be distinguished from the numerous other "models" associated with the Platte River, including computer models, statistical models, biological models, physical models, etc., which may be used as tools in evaluations under this plan and/or means to develop management predictions. These models will be tested and likely revised using information developed under this Plan. Brief descriptions of these other models are found in Appendix B. Hypotheses are outgrowths of the CEMs and are more specific and quantifiable conjectures about how the Platte River system functions and how the system may respond to Program management actions. A hypothesis may be tested by making predictions based on the hypothesis, designing a study, conducting the study and comparing the predictions against the resulting data and conclusions.

III.A. Conceptual Ecological Models

CEMs provide a visual framework or graphical representation for the current or hypothesized understanding of the central and lower Platte River associated habitats relative to target species, including the underlying hypotheses on how the driving forces, relationships, and processes impact the valued ecosystem components. CEMs are also used to identify competing hypotheses and research questions to be addressed by management, monitoring and research. During the First Increment, CEMs will be reviewed and evaluated, as information becomes available, and new questions, models and hypotheses will be formulated that may be used to modify management actions and monitoring and research.

By the very nature of adaptive management, CEMs will be reviewed on a regular basis and modified as warranted based upon findings within the adaptive management implementation. The Governance Committee will have final approval of the AMP, and thus the CEMs.

III.B. Hypotheses

For the Program, hypotheses deal with system processes (e.g., the role of sediment in channel morphology), system ecology (e.g., the way target species use the central Platte), and the response of target species and their habitat to Program management. CEMs were used by the AM Working Group to develop hypotheses and to identify areas of uncertainty and disagreement (i.e., competing hypotheses). The competing hypotheses regarding how the system “works” and what functions or effects various management practices are proposed to achieve are illustrated in the CEMs or they are easily derived from the CEMs as the alternate to the stated hypothesis.

During the July 1997 Cooperative Agreement, summary hypotheses were developed by the AM Working Group and are included in the tables below. Besides these hypotheses, the AM Working Group, Governance Committee, and other individuals have identified many other hypotheses that have not been prioritized or completely drafted and reviewed. This larger list of hypotheses is contained in Appendix C.

III.C. Conceptual Ecological Models and Broad Hypotheses

The AM Working Group created an overall conceptual model of the Platte River system (Figure 4). In developing the current system CEM, broad hypotheses were also developed and are included in the following table.

System Hypotheses
S-1: A combination of flow management, sediment management, and land management (i.e., Clear/Level/Pulse) will/will not generate detectable changes in the channel morphology of the Platte River on Program lands, and/or habitats for whooping crane, least tern, piping plover, pallid sturgeon and other species of concern.
S-2: A combination of non-managed flows, sediment management and land management (i.e., Clear/Level/Mechanical Maintenance) will/will not generate detectable changes in the channel morphology of the Platte River, and/or habitats for whooping crane, least tern, piping plover, pallid sturgeon and other species of concern.

System Hypotheses
S-3: Program management actions will/will not have a detectable effect on target species use of the associated habitats.
S-4: Program management actions will/will not be of sufficient scale and magnitude to cause detectable system wide changes in channel morphology and/or habitats for the target species.

The AM Working Group also developed CEM's for each of the target species (whooping crane, least tern and piping plover, and pallid sturgeon) and for the physical processes and wet meadows in the central Platte River. The following sections include each of the CEM's as well as the hypotheses, as developed at AM Working Group meetings, associated with various linkages in the CEM's as denoted by a numbered arrow.

III.C.1. Whooping Crane (WC) CEM

The draft CEM for whooping cranes (Figure 5) was developed using the process generally described above in Section III.A. Hypothesis corresponding to linkages in the CEM are found in the table below.

Whooping Crane Hypotheses
WC-1: Whooping cranes that use the central Platte River study area during migration seasons prefer habitat complexes and use will increase proportionately to an increase in habitat complexes. Characteristics of a Program habitat complex are defined in the Land Plan Table 1.
WC-2: Whooping cranes prefer palustrine wetlands to river channel, based on known migratory stopover habitats. Whooping crane use of the central Platte River study area during migration seasons will increase proportionately to an increase in palustine wetlands.
WC-3: Whooping cranes do forage in wet meadows and agriculture fields proportionate to their availability.
WC-4: In the central Platte River study area, whooping cranes prefer conditions created by species target flows and annual pulse flows.

III.C.2. Least Tern and Piping Plover (TP) CEM

The draft CEM for least terns and piping plovers (Figure 6) was developed using the process generally described above in Section III.A. Hypotheses corresponding to linkages in the CEM are found in the table below.

Least Tern and Piping Plover Hypotheses
TP-1: In the central Platte River study area, terns and plovers prefer/do not prefer riverine habitats as described in Land Plan Table 1 and use will/will not increase proportionately to an increase in habitat complexes.
TP-2: The maintenance of tern and plover populations in the central Platte requires/does not require that sandpits and river continue to function together to provide nesting and foraging habitat.
TP-3: Ephemeral nesting areas in the river are/are not needed for long-term nesting success of tern and plover.

Least Tern and Piping Plover Hypotheses
TP-4: Existing river flows influenced by drought, floods, hydrocycling, etc., do/do not provide a sufficient forage base (invertebrate/fish recruitment, survival, and correct composition) throughout the central Platte River study reach for populations of terns and plovers during the nesting season.

III.C.3. Pallid Sturgeon (PS) CEM

The draft CEM for pallid sturgeon (Figure 7) was developed using the process generally described above in Section III.A. Hypothesis corresponding to linkages in the CEM are found in the table below.

Pallid Sturgeon Hypotheses
PS-1: Current habitat in the lower Platte River is/is not suitable for adult and juvenile pallid sturgeon.
PS-2: Water related activities above the Loup River do/do not impact pallid sturgeon habitat.
PS-3: Non-Program actions (e.g., harvest, stocking, Missouri River conditions) determine the occurrence of pallid sturgeon the lower Platte River

III.C.4. Physical Process (PP) CEM

Draft CEMs and corresponding hypotheses regarding the overall physical processes of the Platte River, including wet meadows, are discussed in the following table and illustrated in Figures 8, 9, and 10. The CEMs were developed using the technical subgroup as described above in Section III.A.

Physical Processes Hypotheses Flow-Sediment-Mechanical Approach
PP-1: Flows of varying magnitude, duration, frequency and rate of change affect the morphology and habitat quality of the river, including: • Flows of 5,000 to 8,000 cfs magnitude in the habitat reach for a duration of three days at Overton on an annual or near-annual basis will build sand bars to an elevation suitable for least tern and piping plover habitat; • Flows of 5,000 to 8,000 cfs magnitude in the habitat reach for a duration of three days at Overston on an annual or near-annual basis will increase the average width of the vegetation-free channel; • Variations in flows of lesser magnitude will positively or negatively affect the sand bar habitat benefits for least terns and piping plovers.

Physical Processes Hypotheses Flow-Sediment-Mechanical Approach
PP-2: Between Lexington and Chapman, eliminating the sediment imbalance of approximately 400,000 tons annually in eroding reaches will: • Reduce net erosion of the river bed; • Increase the sustainability of a braided river; • Contribute to channel widening; • Shift the river over time to a relatively stable condition, in contrast to present conditions where reaches vary longitudinally between degrading, aggrading, and stable conditions; and • Reduce the potential for degradation in the north channel of Jeffrey Island resulting from headcuts.
PP-3: Designed mechanical alterations of the channel at select locations can accelerate changes towards braided channel conditions and desired river habitat using techniques including: • Mechanically cutting the banks and islands to widen the channel to a width sustainable by program flows at that site, and distributing the material in the channel; • At specific locations, narrowing the river corridor and increasing stream power by consolidating over 90 percent of river flow into one channel will accelerate the plan form change from anastomosed to braided, promoting wider channels and more sand bars. • Clearing vegetation from banks and islands will help to increase the width-to-depth ration of the river
PP-4: Higher water surface elevations resulting from raised river bed elevations can generate measurable increases in the elevation, extent, frequency and/or duration of growing-season high water tables in wet meadows within 3,000 feet of the river.

III.C.5. Priority Hypotheses and Looking Outward Matrix

An initial list of priority hypotheses to be tested was developed by the AM Working. Also, as the Program progresses, additional hypotheses are likely to be added or modifications made to the existing hypotheses using the process described in I.F.2 above.

Hypotheses are numerous and diverse and it is understood and agreed that not all hypotheses can or will be addressed or investigated due to time constraints (certain responses to management actions will take longer than the First Increment), physical limitations (only have so much water and land), cost constraints beyond the scope and/or available resources of the Program, or because they conflict with agreed upon policies. Therefore, hypotheses will be evaluated and prioritized with the following guidelines (the numbering system used in the guidelines does not reflect level of importance between different criteria).

Technical Guidelines (applied by ED, ISAC, and advisory committees):

1. Is there a scientific basis for the hypothesis based on existing data, information, and reviews?
2. Is there a critical interdependency with a high priority hypothesis?
3. Will testing the hypothesis limit the opportunities to test other high priority hypotheses?
4. Is the hypothesis on a critical path to achieve Program goals and objectives – nice to know versus need to know?

5. Is testing the hypothesis cost effective (dollars, other resources) and/or technically feasible?
6. Is the hypothesis on a critical path to assist in developing future Program goals and objectives?
7. Is the hypothesis critical to testing one of the two primary Strategies?
8. If the hypothesis is addressed, will it influence Program management?
9. Can Program actions be used to test the hypothesis or can research be conducted (can it be measured) to investigate the issue/action/hypothesis?
10. Does the hypothesis address areas of disagreement?

Policy Guidelines (applied by the Governance Committee):

1. Is the proposed hypothesis testing within Program constraints (Program goals and objectives, legal, compact, decrees, etc.)?
2. Is funding available and appropriate?
3. Are there other factors influencing hypothesis testing?

The AM Working Group initially discussed prioritizing all current hypotheses using the guidelines above and relating them to the CEMs, but decided that time constraints did not allow for this. Therefore, the group drafted broad hypotheses for the CEM's and included current links on the CEMs. As currently stated, many of the hypotheses are not testable, but they convey the general concepts and ideas regarding the topic(s). Further development, refinement, and prioritization will be needed for hypotheses and relationship clearly identified in the CEMs. This work will continue into the First Increment.

The AM Working Group took the initial step in the development of priority hypotheses by describing broad relationships among functional components of each CEM. These broad hypotheses were further refined by the development of specific hypotheses based on the relationship among functional components of the system as illustrated in x-y graphs (Appendix D). The x-y graphs illustrate the key relationships upon which hypotheses are based. For example, graphs S1 in Appendix D illustrates the three different hypothesized relationships between habitat for target bird species and competing approaches to channel management. In this example it is hypothesized that mechanical/sediment/flow management (i.e. clear/level/pulse) will result in improved habitat for the target bird species, that mechanical means combined with non-Program managed flows will have an equivalent habitat response, and that neither approach will have a measurable impact on habitat (the null hypothesis). The hypotheses illustrated in the x-y graphs were then placed into a matrix that illustrates the interaction of the major components of the physical environment, system inputs and valued ecosystem components. Hypotheses were placed into eight categories including system, pallid sturgeon, tern and plover, whooping crane, pallid sturgeon, flow, sediment, mechanical, and wet meadow (Appendix E). Each matrix contains detailed information the AM Working Group considered important for evaluating the relative need for testing of each hypothesis and the Working Group's recommended priority for each hypothesis. The rational for the recommended priority is also included. The high priority hypotheses identified through this effort are included in Table 2. It is notable that an important hypothesis may receive a lower priority because other hypotheses must be completed before a test is possible.

IV. MANAGEMENT OBJECTIVES, INDICATORS, AND PROPOSED MANAGEMENT ACTIONS FOR PROGRAM LANDS

This section provides initial management objectives, indicators (performance measures), and initially proposed management actions to be evaluated through adaptive management during the First Increment, which were derived from the priority hypotheses (Table 2). The AM Working Group recommends that the priority hypotheses, initial management objectives, and management actions be the basis for an initial work plan for the Program. These will be further developed and additional management objectives, indicators (performance measures), and proposed management actions will be added as necessary during the First Increment to test refined hypotheses and hypotheses yet to be proposed. Management actions will be implemented within the framework of the IMRP such that adequate study design and analysis methods (e.g. baseline) are incorporated. During Program First Increment, additional management objectives, indicators, and proposed management actions will likely be developed through the process of refining CEMs and identifying priority hypotheses.

The Program will initially attempt to achieve the following management strategies with the Governance Committee making a decision at the end of each step (Figure 11):

1. Begin with efforts at a sufficient scale to test concepts, to generate anticipated effects large enough to measure, but at a scale unlikely to cause undesirable impacts to third parties.

2. Monitor the effects of actions on key indicators of resource management objectives, and on indicators of undesirable consequences.

3. Determine if the same management action should be scaled up, or if the management action should be modified or abandoned.

4. Assuming management actions are resulting in desired outcomes, and as safety and efficacy of actions are established, increase scale to accomplish key management objectives (e.g., objectives included in Section IV.A.) by the end of the Program First Increment.

The following sections provide descriptions of initial proposed management objectives, indicators, and management actions, as proposed by one or more parties. Management objectives are broad descriptions of what the Program is trying to achieve. Additional site specific management actions, indicators and objectives will be created and refined through the CEM development process and included as a part of management plans for individual project or Program land parcels prior to the initiation of management on Program lands.

In this plan there are instances where management objectives, action, indicators, and hypotheses are implicitly accepted or explicitly stated as “true” or “false”. For example, some descriptions make use of terms or phrases that imply knowledge of changed conditions (e.g., such as rehabilitate or restore), knowledge of current conditions (e.g., sediment imbalance of a stated amount), or use of particular terminology. It is understood that the use of such terms or phrases does not imply acceptance by all parties of the underlying hypotheses or agreement on definitions of all technical terminology.

IV.A. Management Objectives and Indicators

Management objectives are a means to evaluate effectiveness of different Program actions within an adaptive management framework. Management objectives represent the desired outcome of one or a combination of management actions expressed in quantitative and measurable terms. Management objectives are not synonymous with Program Objectives (see Section I.B above). Management objectives relate to management actions and provide the linkage between the purpose of management and the Program Goals and Objectives. Indicators are measurable parameters within the objectives that will be used to gauge the ability of the management actions to meet the management objectives, and ultimately the Program Goals and Objectives. More work is required on the specific management objectives and indicators in Section IV, which will be accomplished through the process described in Section I.F. above.

The following is a preliminary list of overall management objectives for the First Increment of the Program. These objectives were develoloped by the AM Work Group.

1) Improve production of Least Tern and Piping Plover from the central Platte River

- a) Increase number of fledged tern and plover chicks
    - i) Increase nesting pairs (indicator is nesting pairs)
    - ii) Increase fledge ratios (indicator is chicks successfully produced per unit adult, nest or pair) and reduce chick mortality from causes such as flooding, predation, weather, inadequate forage.
- b) Reduce adult mortality
    - i) Reduce predation (indicator is nesting pairs)

2) Contribute to the survival of Whooping Cranes during migration

- a) Increase availability of whooping crane migration habitat along the central Platte River (indicators are the area of suitable roosting habitat, area of suitable foraging habitat, proportion of population, crane use days, etc.).

3) Avoid adverse impacts from Program actions on Pallid Sturgeon populations

- a) Indicators have not been identified as more research is needed to determine what potential indicators the Program may affect.

4) Within overall objectives 1-3, provide benefits to non-target listed species and non-listed species of concern and reduce the likelihood of future listing

- a) Increase availability of habitats for these species (Land Plan “other species of concern”) along the central Platte River. Indicators are species occurrence, Land Plan Table 1 and 2 characteristics).

IV.B. Proposed Management Actions

The purpose of management actions is to achieve management objectives. There are two different "strategies" (a logical package of management actions) proposed to achieve management objectives. One strategy attempts to rehabilitate the Platte River towards a braided channel morphology as the underpinnings of restoring habitat for key management species (commonly referred to as "Clear/Level/Pulse"). The other strategy attempts to achieve similar management objectives by mechanical creation and maintenance of habitat for target species, which may or may not depend on the Platte River (although all actions will occur within the Platte River associated habitats). This strategy has commonly been referred to as the "clear/level/mechanical maintenance" or "clear/level/plow", although a better term may simply be "mechanical creation and maintenance" such that the clear/level portion is not hard-wired into the strategy. The Governance Committee has also committed to implementing management actions that are part of this strategy, and other groups outside of the Program will also be implementing management actions that could be considered part of this approach.

It is the intent of the Governance Committee to implement and test the management actions of these two strategies in parallel using the "stair-step" approach described in Figure 11. This parallel implementation is also consistent with the preferred means of implementing adaptive management experiments (i.e., active adaptive management).

The Governance Committee and others recognize the difficulties and potentially confounding responses from implementing both of these strategies simultaneously and the needed time to recognize changes on the various scales. Careful thought and planning in the management implementation and measurements for monitoring and research will be needed to eliminate these problems as much as possible and/or account for them in monitoring and research. The hypotheses referenced in this section are the CEM hypotheses included in the tables above.

IV.B.1. Flow-Sediment-Mechanical Approach

The Governance Committee agrees to pursue and test the concept of "clear-level-pulse" (Flow-Sediment-Mechanical Approach), with additional details related to the specific hypotheses to be tested and field tests to be developed. The following describes the objectives of the flow-sediment-mechanical pulse approach:

1. Create and maintain where possible a wide braided channel with a high width/depth ratio. The main channel width would be sized for sustainability, based on available bankfull flows (as augmented by the Program), and considering habitat and landscape characteristics. The desired braided plan form may require consolidation of the flow and river channels to maximize stream power and aided by removal of wooded banks and islands and addition of sediment.

2. Offset the existing sediment imbalance by increasing sediment inputs to the habitat area from one or more of the following sources:
    a. sand augmentation through mechanical actions- island and bank clearing and leveling,

b. sand augmentation from bank and island actions not directly related to bank cutting and island leveling (an example could be excavation associated with wetland development), or

c. reducing the imbalance through channel plan form changes, tributary delivery improvements, or flow routing changes.

3. Use the EA and other Program water to create annual peaks as large as can be sustained over many years, likely through the creation of annual, short-duration high flows within existing banks. Try to ensure that the spring peak flow is higher than any subsequent summer flow.

The focus of this concept is on several overall management objectives for Program lands including: 1) improvement of river channel areas on Program lands toward habitat complex characteristics described in Table 1 of the Land Plan (increased availability of areas of wide, shallow channel with unobstructed view and sandbars suitable for roosting and nesting); 2) maintain those improvements; and, 3) minimize or offset current river processes that tend to diminish channel areas on Program lands approximating Land Plan Table 1 characteristics. This approach would prioritize Program land acquisition upstream of Minden, Nebraska, with an objective of acquiring roughly 6,400 acres upstream of this location, and the remaining 2,800 acres downstream. By prioritizing upstream sites, overall Program habitat benefits could be maximized.

The over-arching hypothesis associated with the Flow-Sediment-Mechanical approach, as indicated by the physical processes CEMs in Section III, is that a combination of flow management, sediment management, and land management implemented concurrently will generate detectable changes in the channel morphology of the Platte River, and habitats for whooping crane, least tern, piping plover, pallid sturgeon and other species of concern. In turn, creating the habitat conditions described in Land Plan Table 1 will increase least tern and piping plover production from riverine habitats, and increase survival of migrating whooping cranes.

Species benefits may be gained by implementing one or two of the individual management actions of the Flow-Sediment-Mechanical approach, however more substantial benefits can be realized by applying these actions in tandem (e.g., when sediment is added to the river without mechanical actions, the habitat benefits may not be detectible within the First Increment of the Program; flow increases without sediment augmentation could result in negative effects). Meaningful tests of the Flow-Sediment-Mechanical approach will be compromised without implementing all three actions in concert. Following is a discussion of each of the three actions.

IV.B.1.a. Mechanical

Management Action: To increase the acreage of channel area greater than 750 feet wide by 30 percent over the 1998 baseline conditions for the study area, and restore channel habitat toward Land Plan Table 1 characteristics. The following methods and others where appropriate and effective will be used:

i. consolidate the flow and river channels to maximize stream power and help induce braided channel characteristics;

ii. mechanically cut banks and lower islands to a level that will be inundated by anticipated annual peak flows; and

iii. mechanically clear vegetation from islands and banks in the single channel as needed to aid the widening process and make sediment available for recruitment to the river.

Consolidating flows and widening the river at select locations by cutting banks and leveling islands can begin in Year 1 of the Program prior to increases in annual high flow, provided acceptable Program lands or Cooperator lands are available. Clearing vegetation and widening the river independent of consolidating flow should be concurrent with implementation of increases in annual high flows. Mechanical flow consolidating and river widening actions can occur independent of sediment augmentation, but greater increases in river width are expected at sites downstream of sand augmentation. The design and location of mechanical actions should be guided by available data, science, numerical modeling, and the availability of Program lands or cooperator lands. Where favorable conditions exist, mechanical actions may also be used to modify the topography, soils, and/or connectivity with the Platte channel on Program lands to support wet meadow conditions at these sites.

Potential Effects: The mechanical action of consolidating flows will help shift the river to a braided condition, which widens the river and creates more sand bars (CEM Physical Processes (PP) Hypothesis 3). Cutting banks and leveling islands in conjunction with pulse flows will widen the river (PP-3). Pulse flows are needed with both mechanical actions of consolidating flow and river widening to raise sand bars to an elevation suitable for least tern and piping plover nesting habitat (PP-1). Sediment augmentation is required in conjunction with increases in flows and contributes to wider sustainable channels, contributes to increases in occurrence of sand bars, restores stream bed elevation, and over time will promote the occurrence of a braided plan form in currently anastomosed reaches of the river (PP-2).

Creation of ephemeral sand bars (braided condition) with Land Plan Table 1 characteristics will increase least tern and piping plover production on riverine habitats and will reduce predation by shifting nesting locations from one year to the next and/or maintaining separation between nests and river banks (CEM Tern and Plover (TP) Hypotheses 1 and 3). Creating a wider, braided channel will reduce channel depths, and increase forage opportunities for least tern and piping plover chicks (TP-4) leading to improved growth and survival (TP-1). Increasing channel width, sand bars, and shallow water depths (braided condition) will increase roosting habitat for whooping cranes (CEM Whooping Crane (WC) Hypothesis 1), thereby increasing migration survival of whooping cranes.

Restoring stream bed elevation will increase water stage for a given flow, which will increase growing-season groundwater elevations in adjacent meadows, increasing the area/extent of wet meadow habitat. Increasing wet meadows during migrational times will increase migration survival of whooping crane.

IV.B.1.b. Sediment augmentation

Management Action: Sediment is mechanically placed into the river from banks, islands and out-of-bank areas at a rate that will eliminate the sediment deficiency and restore a balanced sediment budget within the expected future flow regime. Starting in Year 1 of the Program, choose one location on Program lands, or Cooperator lands above Overton, as this would focus sand augmentation in upstream locations which may also provide benefits for later restoration efforts downstream. River sand will be moved from approximately 20 acres and be pushed to locations and elevations where it can be mobilized by the river flow. Leveled areas would need to be lowered to the elevation that can be overtopped and scoured by a flow to prevent seedling survival. At the time of or prior to full implementation of the annual high flows in the water plan, sediment augmentation at one or more additional sites would be implemented with volumes of sand augmentation based on the estimated sediment deficiency. The rate of augmentation at each site should be guided by sediment transport rates and flows, and by monitoring at, upstream and downstream of the augmentation site. The location for these sites should be guided by the location of sediment deficiencies as determined by available data, and numerical modeling, and guided by the availability of Program lands or Cooperator lands. In addition to sand augmentation, alternative methods above will be investigated, such as channel plan form changes, improvement to tributary delivery or flow routing changes and then develop a master plan for sustaining a sediment balance over the long-term.

Potential Effects: Sand augmentation, combined with flows and mechanical actions, will have the same effects as described in Section IV.B.1.a.

IV.B.1.c. Flows

Management Action: Using the Environmental Account in Lake McConaughy and the Program's ability to deliver 5,000 cfs of Program water at Overton, as well as the flexibility in the CNPPID and NPPD canal and reservoir system operations (assuming mutually acceptable arrangement can be made for the use of that flexibility), short-duration near-bankfull flows will be generated in the habitat reach in the springtime or at other times outside of the main irrigation season. The intent is to achieve these flows, if possible, on an annual or near-annual basis.

Testing will begin in the first year of the Program with a pulse flow target of up to 5,000 cfs for three days at Overton. An "operational plan" for achieving this objective will be developed by the EA Committee or other committee, with close coordination with the ED, and implemented within the first year of the Program. This pulse flow will be monitored to test the logistics of coordinating pulse flow creation, to evaluate the effects on infrastructure, and to assess the fate and effect of the pulse as it moves to and through the habitat reach. Biologic and geomorphic monitoring and research efforts will be developed through coordination with the TAC. As the Program develops an increased ability to safely deliver pulse flow water over time, including the recovery of some lost conveyance capacity in the North Platte River at North Platte, flows of larger magnitude and/or modified durations will be generated, with increasing emphasis on achieving measurable improvements in channel morphology and habitat conditions, including increased sand bar height and reduced vegetation in the active channel.

Potential Effects: Flow modification, combined with sediment augmentation and mechanical actions, will have the same effects as described in Section IV.B.1.a. In addition, increasing flows in the central Platte River during the February-July time frame may improve habitat conditions for forage fish used by least terns (TP-4) and improve habitat conditions and help provide spawning cues for the pallid sturgeon in the lower Platte River, increasing their survival and reproduction (PS-2).

IV.B.2. Mechanical Creation and Maintenance Approach
The Governance Committee agrees to pursue and test the concept of using mechanical creation and maintenance ("clear-level-plow"), with additional details related to the specific hypotheses to be tested and field tests to be developed

The objectives of the mechanical creation and maintenance approach are:

1) Improve least tern and piping plover production by management of sandpits and riverine islands developed and maintained by mechanical and other means (e.g., herbicides, grazing, burning) without the need for pulse flows described in IV.B.1.c (TP-2 and TP-4).

2) Improve survival of whooping cranes by providing non-riverine wetlands, upland habitats, and open channel habitats similar to those described in IV.A.1 maintained with mechanical and other means without the need for pulse flows described in IV.B.1.c (WC-2).

IV.B.2.a. Sandpit Management
Management Action: To increase the amount of nesting habitat available to least terns and piping plovers the Program will acquire 200 acres of sandpits that will include at least 40 acres of bare sand. Each individual pit will have a water to bare sand ratio of 1:1 to 3:1 and bare sand areas will be islands or peninsulas with a base with half or less of the maximum width. The areas with nesting birds at time of acquisition will receive predator management that includes fencing and predator removal. Areas within these sandpits that are not being utilized by birds will be returned to bare sand peninsulas or islands, shoreline length will be maximize and predator management techniques applied.

An additional 200 acres of abandoned sandpit or habitat created by the Program which is similar in nature to sandpits will be acquired that will include at least 40 acres of bare sand. Each individual pit will have a water to bare sand ratio of 1:1 to 3:1 and bare sand areas will be islands or peninsulas with a base with half or less of the maximum width. Areas will be returned to bare sand to maximum shoreline length and predator management techniques applied.

Potential Effects: Predator management will increase least tern and piping plover fledge ratios (fledglings per adult, nest or pair). Sandpit land management will increase barren sand at suitable slope, elevation, shape, etc. to increase usable nesting area. If numbers of nesting pairs is currently limited by nesting substrate this will increase nesting pairs. Maximizing wetted area will increase plover foraging area. Diversified water depths in ponds will allow for a diverse fish assemblage to provide tern forage. Both activities would increase the number of nesting pairs if foraging habitat is limiting nesting pairs.

IV.B.2.b. Restore, Create and Maintain Bare Sand Riverine Islands and Channel Width
Management Action: Islands will be created using the same methods as in "clear-level-pulse" except for the EA augment pulses described in IV.B.1. Maintenance will require a mechanical maintenance emphasis on nesting island and surrounding channel area during low flow years.

Channels of 750 feet wide will be created and maintained using mechanical means similar to methods in the “clear-level-pulse” except for released pulses.

Predator management at known least tern and piping plover nesting colonies at constructed riverine islands will begin Year 1 of the Program.

Potential Effects: These management actions will increase barren sand on riverine islands for nesting area. If numbers of nesting pairs are currently limited by nesting substrate this will increase nesting pairs. If least terns and piping plovers prefer riverine islands for nesting over sandpits, there should be a shift in nesting off of sandpits to islands. If least terns and piping plover are more successful at reproduction on river islands, there should be greater fledge ratios over sandpits.

These management actions will also increase whooping crane roost habitat. Therefore increasing survival, based on the assumption that habitat along the Platte River limits whooping cranes survival.

IV.B.2.c. Create and Maintain Inundated Wetlands and Upland Areas

Management Action: Each 0.5 miles of linear wetland (sloughs, backwater) constructed on Program lands will include at least one area that has a shallow water area with a minimum water surface area of 500 feet by 500 feet. These areas will be designed such that they can be drained for vegetation management purposes. Where possible these wetlands will be filled by surface flow or pumping during whooping crane migration periods. These will not be necessary within the high banks when channel width already exceeds 750 feet.

The Cooperative Agreement whooping crane monitoring has resulted in many more hours of whooping crane use in corn fields compared to grasslands. Therefore, Program acquired agricultural fields not previously wetlands should be planted to corn. In addition the Program will explore enhancing the foraging value of these fields by flooding them utilizing existing irrigation equipment. One area 10 to 20 acres at least 200 yards from a road will be flooded during a spring and fall migration period to determine feasibility and cost.

All acquired properties will be evaluated for the presence of non-riverine wetlands that have been altered or filled and they will be restored to their original size.

The Program will utilize the remaining 400 acres of non-complex land to create 300 acres of palustrine wetland. These should have at least 25% of the area with a shallow water depth (approximately less than 10 inches) during whooping crane migration periods. Any upland areas acquired in the process of acquiring the desired wetland areas should have an easement attached limiting access during whooping crane migration time and the construction of permanent dwellings and animal confinement facilities and be resold or leased for other purposes such as farming, hunting or grazing at a rate that will repay the Program by the end of the first increment.

Potential Effects: Restored or created and maintained wetland areas will provide roosting and foraging areas for whooping cranes increasing survival, if habitat along the Platte River limits whooping cranes survival.

V. INTEGRATED MONITORING AND RESEARCH PLAN (IMRP)

To implement the 6-step process described in Figure 1b, the hypotheses developed in the assessment stage must be harmonized with the design of actions and associated monitoring in the design stage. The CEMs and priority hypotheses determine what is accomplished in the IMRP.

Ultimately, for each priority hypothesis, the AMP will articulate in the work plan (developed according to Section I.F1):

- what monitoring protocols will be used (Table 1);
- what management actions will be applied where and when to create spatial and temporal contrasts;
- what measurement precision of key indicators is attainable with the proposed protocols;
- what specific methods of data analysis will be used, and
- based on all of the above, what size of effects are desirable and detectable over what time period, with what levels of Type 1 and Type 2 error (e.g. concluding that a habitat feature benefits a species when in fact it does not, or concluding that a habitat feature doesn't benefit a species when in fact it does).

V.A. Introduction

As discussed above, effective adaptive management requires a thorough monitoring and research effort to collect vital knowledge for decision making. This section, Integrated Monitoring and Research Plan (IMRP) is designed to determine the biological response of the target species and their habitats to the actions throughout the entire study area, on Program lands, and in specific project management areas, during the First Increment of the Program through scientifically designed monitoring and research. The monitoring and research measures for the First Increment of the Program are composed of compliance monitoring and biological response monitoring and research (Figure 12). This section of the AMP focuses on the biological response monitoring and research for the Program. Information derived using the IMRP along with information from the FWS, state agencies, and others regarding the species biology, status, and recovery in the region, will be used to evaluate the Program's First Increment and overall species recovery assuming comparable methods and metrics are used in all areas. The Governance Committee will also use this information in the adaptive management of Program lands, Program activities, and the overall Program when developing Second Increment milestones.

Monitoring and research will be used to determine impacts on valued ecosystem components. Adaptive management decisions will be improved if statistically valid and meaningful monitoring and research data are gathered at the System, Program lands, and Project Scales during the First Increment. Monitoring activities will document trends in changes of parameters of interest in relation to measured variables (covariates) that have the potential to impact those trends. Research will necessarily be more limited in scope and scale but will provide an estimate of cause and effect relationships between management actions and outcomes. Monitoring and research information will be integrated to provide a weight of evidence supporting changes in management. It will not only support changes, it will help identify what changes are needed and provide information on the best means of modifying management actions. Information will be gathered throughout the First Increment and will be used to improve management during the First Increment and in decisions made at the end of the First Increment (e.g., increase or decrease in land or water).

V.B. Monitoring Versus Research, and How They Must be Integrated

Following development of the CEM's and hypotheses, monitoring and research approaches may be refined and changes may be made to protocol descriptions. Monitoring and research will be linked to CEM's and hypotheses. The current list of hypotheses and protocols are cross referenced in Table 1.

V.B.1. Monitoring

Program monitoring is designed to provide unbiased estimates of population and habitat parameters over space and time with high precision. Monitoring data will be used to estimate status (e.g. mean, median, minimum, and maximum) and trend in the entire study area, and in specific areas of interest within the study area (e.g., Program lands). In addition, both individual (gross) and net trends are of interest. A statistical survey design has been employed to meet these objectives. The design includes the establishment of survey panels, the revisit design (plan for the timing of survey of panels), the membership design (rule for sample units' membership in a panel), the definition of sample unit, and the enumeration of the sampling frame.

All monitoring and research will be conducted by following detailed and scientifically accepted protocols. Program staff, or contractors under the supervision of Program staff, will develop additional monitoring and research protocols as needed. All protocols will be subject to review by the Program's Technical Advisory Committee and approval by the Governance Committee. Monitoring studies are designed to address hypotheses by documenting trends in selected performance measures related to biological response with statistical inference possible to the appropriate study areas.

Monitoring is defined as the collection and analysis of repeated observations or measurements over a long period of time to document the status or trend in the parameters of interest. These data will be used to test hypotheses by assessing such relationships as whether there is a non-zero trend through time, or assessing whether or not there are spatial differences in indicators along gradients of flow/habitat conditions. The Program's monitoring is focused on estimating trends in species and habitat and therefore measures factors that directly relate to the condition/status of the species or its habitat. The monitoring portion of the IMRP is designed to detect statistically significant changes in measured parameters over time and document correlations between management activities, other random variables, and those changes.

The IMRP is designed to provide monitoring data that are unbiased for the region of interest (system, Program lands, or project specific area). Each portion of the monitoring program (e.g., species use, channel dynamics) will involve protocols and Standard Operating Procedures (SOP) detailing the methods of data collection. Protocols and SOPs should not be changed during the monitoring period unless the new approach to monitoring is clearly superior, can overlap with existing monitoring for a period of time, and the two methods are highly correlated.

The development of monitoring protocols will consider existing (i.e., pre-treatment) data and data collection methods to evaluate the costs and benefits of collecting data with the same methods and in the same locations during the Program. Where appropriate, existing protocols will be used or modified for use in the Program. Quantitative data that have been collected with similar methods and in the same study area will be analyzed with data collected under the IMRP when appropriate. The combined data could be used to conduct before-after-control-impact (BACI) studies when controls are available, before-after comparison when control areas are unavailable, to calculate an estimate of trend, or conduct resource selection function (RSF) analyses (see Section V.I).

The methods used for Program monitoring have been chosen to provide status and trend estimates of indicators of biological response. The monitoring is designed to collect data quickly and in a repeatable fashion (i.e., two people taking the measurement should get the same value). Monitoring data for documenting trends will be most useful after many years of consistent data collection. At a minimum, the monitoring portion of the plan must continue for the entire First Increment. The value of continuous monitoring data will only be realized if the IMRP has sustained political and financial support.

V.B.2. Research

Program research is designed to evaluate the merit of specific hypothesized cause and effect relationships (i.e., as developed through CEMs) among species and habitat associations and species and habitat response to Program management. Each research project will be hypothesis driven and will follow a specific protocol with defined objectives, a statistical survey design, and anticipated analysis methods to meet the objectives. When appropriate, monitoring data and management models will be used to predict the outcome of a specific management measure and the observed response will be evaluated against the predicted species and habitat response.

Research will include detailed studies (short-term, 3-5 years) of specific management actions, studies taking advantage of the limited opportunity for manipulative experiments, and studies that utilize habitat and species response to natural events combined with Program activities. Research projects typically use the latest technology and methods and have specific study objectives. Examples of these objectives include the tests of hypotheses, tests of habitat suitability models, and modeling of physical processes. Research objectives will typically be designed to resolve issues related to the potential impact of Program management activities on the indicators of biological response, assist in the understanding of the biology of the target species, fill knowledge gaps required to induce measurable improvements to the recovery of the target species and their habitats, assist in the validation and improvement of management methods, and/or allow the testing and improvement of existing species habitat models.

Models will be used for both monitoring and research projects. Statistically based models will use monitoring data to estimate trends in the indicators of biological response and predict future direction of trends. Other statistical models may be used in the data analysis to estimate effect sizes and correlations. Research data will also be used in the development of process models (e.g., models describing the process of sediment transport, island building, vegetation encroachment, etc), and calibration and verification of these models will use both research and monitoring data.

It is important that linkages are established between the different models, research studies and monitoring components. The linkage between monitoring and research is to some extent established by the basic study design. For example, Figure 13 illustrates the Cottonwood Ranch research related to management of a portion of the channel conducted by NPPD. The figure illustrates the anchor points used to locate monitoring activities and how they were incorporated into the research protocol. This kind of co-location of monitoring and research data collection will be a primary means of linking monitoring and research activities on all Program lands.

A more theoretical linkage between different activities related to monitoring, research and model building will be illustrated through the development of a 'Looking Outward Matrix' (template provided in Figure 14). A Looking Outward Matrix shows the information to be passed from one model/sub model/monitoring/research activity to another (i.e. specific variables, units, spatial and temporal scales. This is a useful tool for improving the integration of both modeling and monitoring activities. The Looking Outward Matrix will be developed during the First Increment.

Monitoring and research conducted under the IMRP will be integrated such that they will collect similar data where possible (e.g., "channel width" for monitoring projects will be measures the same as "channel width" for research projects). The spatial scale for monitoring will generally be broader with effort spread throughout the study area as opposed to research in specific areas such as Program lands, although, monitoring intensity can be increased on any area of interest.

Conducting both monitoring and research will hasten management improvement opportunities. Conducting only monitoring would result in a long time period requirement to collect enough data to justify modification of management actions. Only conducting research could result in not knowing whether actions are having system-wide improvements on variables that have a long response time. Therefore, it is essential to conduct both monitoring and research efforts.

V.C. Discussion of Scale Issues Related to Monitoring and Research

The general study area for monitoring and research for the three bird species consists of an area 3.5-miles either side of the Platte River centerline beginning at the junction of U.S. Highway 283 and Interstate 80 near Lexington, Nebraska, and extending eastward to Chapman, Nebraska. When side channels of the Platte River extend beyond the 3.5-mile area, a 2-mile area is included around these channels. For pallid sturgeon, the study area consists of the lower Platte River between its confluence with the Elkhorn River and its confluence with the Missouri River. This geographic limitation was established for primary data collection by the Governance Committee and is thought to include the area most likely used by the three bird target species when they are also using the Platte River. The selection of the lower Platte River for the pallid sturgeon is based on historical data contained in the Baseline Document. Obviously all four species occur outside this geographic area and the Program will incorporate information from other contemporary studies of these species from areas outside the general study area.

The design of the monitoring and research includes three spatial scales: System, Program Lands, and Project Scale (see also Section I.E.).

- System scale monitoring investigates the entire study area. The objective of this level of monitoring is to evaluate the effects of the Program on the target species' and their habitats throughout the associated habitats (see Program Document, Section I.A, for description). This will be done through analysis of correlations of species use, species abundance, use site characteristics and other variables (e.g., resource availability, changes in land use, river stage, etc.). Examples of system level monitoring include tracking trends in sediment budget, the abundance of sand bars and islands, the abundance of wet meadows, the abundance of whooping crane roosting sites and their physical and biotic characteristics throughout the study area, whooping crane monitoring, and least tern and piping plover monitoring. System scale monitoring allows the estimation of habitat selection (Manley et al. 2002) by target species, which is useful in the evaluating the effectiveness of the First Increment of the Program in meeting goals and objectives in the Program and evaluation of hypotheses related to species habitat needs. Little or no research can effectively be conducted at the system scale due to long time-lags, diversity of the overall system, etc. However, multiple smaller scale research experiments (Program lands scale or project scale) could be nested to research issues on the system scale.

- Program lands scale monitoring and research will investigate specific actions taken to implement the Land and Water Plans. The objective of Program lands scale research and monitoring is to evaluate the effectiveness of the entire suite of management practices implemented on each parcel of Program land, including documenting beginning conditions prior to Program management. Coordination will be needed between those implementing the IMRP and those implementing the Land and Water Plans to insure that proper data are collected before management begins and to learn the nature and extent of the proposed management actions. Examples of Program lands scale monitoring and research include determining plant species composition and abundance and more detailed measurements of sediment budget, channel widths, and abundance of sandbars and islands on parcels of Program lands.

- The objective of project scale monitoring and research is to evaluate processes (e.g., the relation of flow to channel maintenance) and management methods (e.g., a specific timber clearing activity, wet meadow development, island creation). Several research areas and topics for the evaluation of processes and methods are identified in Table 1. For example, the IMRP contains research items related to channel geomorphic processes (e.g., sediment transport, island building, flows) and management methods to influence channel geomorphology (e.g., sediment augmentation, island lowering) (see Tasks 1-4 in Table 1). Specific monitoring and research studies will be adopted for each type of project. However, it is important that research be conducted as soon as practical for use in adaptive management. This research will 1) provide knowledge related to processes to be used in other projects, 2) identify successful methods that can be implemented in other areas, as they are deemed appropriate, and 3) identify needed time to allow meaningful research data to be collected during the First Increment. It is also important to consider monitoring and research needs when evaluating land protection options through the Land Plan (Attachment 4).

The Program's biological response monitoring and research is designed to: 1) provide data to evaluate the effectiveness of the Program to meet goals and objectives for the habitat and population response of the target species, 2) provide data to evaluate the relative importance of Program habitat protection and restoration measures to the target species, 3) provide data to support adaptive management decisions regarding activities periodically during the First Increment of the Program, and 4) provide scientifically defensible data to facilitate development of milestones for future Program increments. Analysis of information from all three levels of monitoring and research will be used to learn which management actions are most likely to achieve stated goals and objectives and to make adaptive management decisions during the First Increment. Near the end of the First Increment this information will be used to evaluate the Program and develop Second Increment milestones.

V.D. Timing and Schedule

System scale monitoring will begin as soon as a Program is implemented and continue with the same protocols through the First Increment. In doing so, it will be possible to view the system as various flows occur, both natural and Environmental Account induced, and as new Program lands are protected and managed. Program lands scale monitoring should begin as each parcel of land is protected. Necessary baseline data should be collected through Program lands level monitoring prior to land management activities. This will allow each parcel to be evaluated as a unit through implementation of various restoration and management activities.

Research protocols will be implemented as topics arise and lands become available. Several specific research areas are currently identified and timelines established. These include research related to pallid sturgeon and research related to geomorphic process and restoration methods. For pallid sturgeon, several research items are included in Table 1. Implementation of some of these items (as described in Section V.K.) will begin after work is completed by the University of Nebraska-Lincoln, and summary of existing pallid sturgeon information. The Program anticipates regular review of all monitoring and research, but the Governance Committee has agreed that specific attention will be paid to review of pallid sturgeon research activities at the end of Year 4 and Year 7. During these reviews the Governance Committee will determine how the Program will proceed with future pallid sturgeon research.

In-channel geomorphic process and restoration activities are identified as Tasks 1-4 in Table 1. Most of these activities are planned for implementation over the first three years of the Program, with some work continuing throughout the Program. Actual implementation will be contingent on availability of appropriate Program lands or other lands available to the Program (e.g., The Nature Conservancy, Audubon, Platte River Trust, etc.) and personnel to conduct the research. These research activities were developed through a joint effort of the EIS Team and Parsons Engineering (Parsons 2002).

V.E. Experimental Design Strategy Across Multiple Scales

The study design for each monitoring and research component of the IMRP has been integrated into one overarching statistical survey design. Through the use of a common design, the monitoring and research activities will collectively determine the biological response to Program management actions. This integrated survey design is intended to maximize the use of monitoring and research resources by enabling the shared use of data for multiple studies, and ensure unbiased estimates with inference to the intended resource.

The cornerstone of the IMRP is a systematic sample of survey units throughout the length of the Platte River reach. This systematic sample will allow unbiased estimation of monitoring and research parameters at the system, Program, or project level scale. Utilizing an equal probability based sample of units will enable post-stratification and will provide pre-treatment data for all areas in the system (specifically useful for Program land purchases at locations unknown at the start of the Program). For any given stratification scheme, the sample for each stratum will contain population units in proportion to their presence in the landscape. Monitoring activities are intended for trend estimation and the examination of the influence of other variables on the estimated trend. Hypotheses developed from monitoring (i.e. factor A was the cause of a trend) will be evaluated with experimental research. Research will investigate the hypothesized cause and effect relationship and may involve the application of treatments such as habitat manipulation.

V.E.1. Monitoring Design

Monitoring revisit design - Survey designs for environmental monitoring are greatly enhanced by the use of panels to identify which sample units are surveyed on each visit through time. A panel is a collection of sample units that are always sampled at the same time (Fuller 1999). The frequency and pattern at which panels are visited through time is the revisit design (McDonald 2003).

The revisit design of a monitoring program reflects the relative importance of each monitoring objective. Visiting a set of sample units every year (pure panel) ensures low variance for trend estimates but the sites tend to wear out and obtain biases through conditioning, particularly when destructive sampling is used (Fuller 1999, McDonald 2003). Visiting a set of sites in alternating years (rotating panel) allows for the inclusion of more sites in the sample (increasing the chance of observing rare elements) and results in low variance for the estimation of mean levels (status) within a year (Fuller 1999, McDonald 2003). Urquhart and Kincaid (1999) found the pure panel to be the best for detecting linear trends through time and revisiting new sample units each time to be the best for estimating status. The revisit design for biological monitoring under the IMRP will balance the objectives for status and trend estimation equally as suggested by McDonald (2003), Fuller (1999), Breidt and Fuller (1999), and Urquhart et al. (1998).

The IMRP revisit design involves a split panel; a panel (group of sample units) that is visited every year and several panels that are visited in rotating years. Using the notation specified by McDonald (2003), the revisit design for biological monitoring will be [1-0, 1-3]; one panel will be surveyed each visit (the 1 pure panel visited each time is indicated by the 1-0) and four panels will be surveyed once every fourth visit (the 4 rotating panels each surveyed 1 time and then not surveyed 3 times are indicated by the 1-3). This split panel design has been shown to provide the most power for estimating status and trend (Urquhart and Kincaid 1999, Breidt and Fuller 1999). The total number of panels is 5, the sum of the numbers in the string of the McDonald (2003) notation. Since most biological monitoring is conducted on an annual basis, this translates to one pure panel visited every year and four rotating panels each visited once every four years. The revisit design of the rotating panel was planned so that every panel will be visited three times during the First Increment of the Program.

Monitoring membership design - The membership design specifies the selection of sample units for each panel (McDonald 2003). The terminology commonly associated with probability-based statistical sampling is appropriate at this level of the design. Common probability-based membership designs include simple random sampling, stratified sampling, and systematic sampling. The importance of using probability-based sampling in a long term monitoring study can not be overemphasized (Edwards 1998). The probability-based sample will enable unbiased estimation of ecological parameters and variances with well defined inferences (Thompson 1992, Peterson et al. 1992).

A probability-based sample can include units in the sample with equal or unequal probability. The use of an equal probability sample for collecting natural resource monitoring data will give the widest range of statistical analysis options (McDonald 2003). The sample of units to be included in a panel for the biological response monitoring under the IMRP will be based on a systematic sample in space. Systematic placement of sample units within the study area will ensure that the estimates will be representative of the entire study area (Thompson 1992, Peterson et al. 1992).

This survey design has defined a sample unit to be any point along the centerline of the widest channel of the central Platte River as it traverses through the study area (see anchor points as shown in Figure 13). The river can be viewed as a one-dimensional feature in two-dimensional space. The number of points in the population of points along the centerline of the river is infinite. An equal probability sample of points from this infinite population will provide “anchors” for data collection. These anchor points will serve as the sample units for a broad range of sampling activities. For example, some studies may sample along a transect crossing through the anchor point and perpendicular to the flow of the river while another study may sample a plot of land adjacent to the river on the nearest exposed land north of the anchor point. This sample unit was selected to encompass all surveys for a river-focused Program into one survey design.

One sample of anchor points will be used to co-locate all research and monitoring studies. This systematically placed set of anchor points will facilitate correlations between the monitoring components. The spatial intensity of sampling for each study can be increased or decreased within the framework of the sample points (e.g. 1 point every ¼ mile, 1 point every 8 miles). Any point along the centerline had an equal probability of inclusion in the sample of population units.

A set of anchor points was systematically placed (i.e. equally spaced based on a random starting point) along a defined centerline of the river during the July 1997 Cooperative Agreement. The U.S. Army Corps of Engineers (COE) navigational maps and 1998 color infrared photographs were used to determine the widest channel. The centerline was documented in a line theme called (baseline.shp). Anchor points were established every 400 meters along the centerline and documented in a point theme called (400m_pts.shp). This file was updated with the river miles

(400ma_pts.shp) using the "River Miles for the Central Platte River" dataset published by the U.S. Bureau of Reclamation, Great Plains Region, Platte River EIS Office.

For First Increment data to be most useful, monitoring activities will need to survey the exact same sites. For this reason, the centerline will not be changed if the river thalweg moves during the First Increment. For example, there will be geomorphic monitoring designed to evaluate cross sections of the river at an anchor point. The cross sections will be oriented perpendicular to flow and the endpoints will be marked on the banks. Throughout the First Increment, the direction of flow of the river may shift at an anchor point, but for comparison purposes, the orientation of the cross section should not be shifted. Keeping the centerline and the sample activities in the same location will increase precision for trend detection.

The monitoring design has intentionally avoided stratification in the membership design. Since attributes of long term monitoring locations evolve through time, a stratified design will tend to lose efficiency as monitoring data accumulate. For example, it is common for a sample unit that has been assigned to one stratum at the beginning of the study to be more similar to another stratum after a number of years (e.g., grassland in Year 1 has developed into a shrubland by Year 10). In this case the stratum of the sample unit at analysis time is unclear. The sample unit could be analyzed with the initial stratum (grassland) resulting in high within strata variance since the units attributes have changed. Alternatively, the sample unit could be moved to the ecologically appropriate stratum (shrubland) for the analysis, though the probability of inclusion of this sample unit in the new stratum is un-defined. A systematic placement of points throughout the study area will ensure coverage of each stratum in proportion to the relative abundance of the stratum each year.

Monitoring data analysis - Analyses conducted with monitoring data will include the estimation of linear trend and status (mean levels). Trends can be estimated at one individual sample unit (gross trend) and across all sample units (net trend; Duncan and Kalton 1987). The average of gross trends across each sample unit will be used to estimate net trend (Urquhart et al. 1998). Ecologically structured variance components (identifiable by the revisit design) of net trend can be incorporated into a standard linear statistical model resulting in powerful estimates of the trend of interest (Urquhart et al. 1998).

Statistical analysis methods such as post-stratification (Thompson 1992) will be used to estimate the status and trend of certain groups of monitoring locations. Locations can be grouped into geomorphological or bridge segments for analyses that are consistent with historic analyses. Alternatively, locations can be grouped into areas with significant influence by human structures (bridges, diversions, etc.) and locations not directly influenced by human structures. Sampling units will be classified into strata before each analysis so that the within strata variance is minimized.

In concert with systematic sampling of habitat parameters over the entire study area, systematic monitoring of species use will also occur throughout the entire study area. The monitoring protocols pertaining to species use do not involve definitions of habitat types ("suitable habitat") within which sampling is concentrated or restricted. Protocols for monitoring use locations of the target species are designed to allocate known search effort throughout a defined study area, regardless of habitat suitability. Thus, habitat characteristics at use locations documented by the monitoring will be contrasted to habitat characteristics throughout the study area. In some protocols, the study area has been defined through the use of habitat (fish monitoring will only occur in water) but this has only occurred when the habitat can be defined by the Program. It is recognized that the species monitoring protocols collect data only on individuals using the central Platte River (the lower Platte River for pallid sturgeon), not on the entire whooping crane, least tern, and piping plover populations. Therefore, these results are only applicable to the populations' use of this area and are biased for inference to the entire population.

V.E.2. Research Design

The hypothesized relationships among species and habitat associations and species and habitat response to Program land and water management (treatments) will be evaluated with research. Proper research designs will produce accurate and precise results with an efficient use of resources. Research designs will include both experimental and observational studies. Inferences to the cause and effect relationship will be possible with experimental research while inferences with observational studies will be limited to associations (Keuhl 1994).

There are many components of the statistical design of experimental research. Each IMRP research project will be designed for a specific research question and will ideally contain the following components: controls, randomization, and replication. The use of control areas will enable efficient estimation of treatment effects (Keuhl 1994). Without controls, there will be no benchmark estimate of changes that would have occurred in the treatment areas regardless of the treatment (Keuhl 1994). Randomization is a critical component of experimental design. Randomization applies to the selection of experimental units from the population and forms the basis of the applicability of research results to the population. Randomization also applies to the application of the treatments to experimental units enabling the experiment to account for confounding factors (Neter et al. 1996). Replication refers to the duplication of the study design to multiple experimental units. Replication provides an estimate of experimental error and increases the precision for tests of treatment effects (Neter et al. 1996). Analyses of experimental research with controls, randomization, and replication are described in many statistical texts (Box et al. 1978, Keuhl 1992, Neter et al. 1996).

In the cases where IMRP research project designs are not able to incorporate controls, randomization, and replication, constrained study designs will be developed (Skalski and Robson 1992). It is anticipated that system wide Program effectiveness research will not always be able to incorporate each of the statistical design components because of the lack of replication at the treatment level (the Platte River) and lack of control areas (water treatments effecting the entire reach). Instead, small scale manipulative studies will be conducted on Program lands and inferences will be restricted to the project area with system wide conclusions left to professional judgment.

Smaller scale studies at the project level will use the optimum design available. Experimental design features such as control areas, randomization, and replication, will be possible within specific project areas. Several analysis techniques have been designed for use with this type of data (e.g., before-after control-impact designs, control-impact designs, before-after designs, and gradient response analyses; Skalski and Robson 1992). Final judgments about management effectiveness will be based on independent manipulative research studies supported by correlations observed among sites and with the monitoring data.

An example of IMRP experimental research could be the study designed to evaluate the effectiveness of clear, level, and pulse activities. Models (see Appendix B) could be used to predict the channel topography expected to result from the management implementation. Study reaches will be randomly selected and the 3 treatments (uncleared and unleveled, cleared and unleveled, cleared and leveled) will be randomly assigned to reaches. Channel and sandbar topography, grain size distribution, and vegetation characteristics will be measured in and downstream of each reach, both before and after the pulse flows are implemented. Parameter values derived from the post-treatment topography will be compared to predicted values to judge the management effectiveness. These conclusions combined with system wide trends of topographical parameters, slope, sediment supply, etc. will provide the information necessary to determine if further implementation of the management activity is warranted.

An example of IMRP observational research could be the study designed to evaluate the effectiveness of whooping crane habitat restoration activities. Aerial and ground surveys will be implemented; ideally radio telemetry would be used, to document areas used by whooping crane individuals. The relative use of the restoration areas by whooping crane will be used to judge the management effectiveness. Characteristics of used areas will also be contrasted to characteristics of available areas (from monitoring data or collected simultaneously) in resource selection function analyses (Manly et al. 2002).

V.H. Monitoring and Research Protocols

Specific and detailed protocols will be written for each study related to management designed to achieve habitat characteristics listed in Land Plan Tables 1 and 2 and for other research and monitoring projects developed during the Program. Research into cause and effect processes will usually take place on Program lands. The research site may receive intensive study over a few years with data collection methods designed for analysis through process models. Research and monitoring will be most complementary if the research methods are the same as monitoring methods, but they may require some differences.

Peer review of monitoring and research protocols is an important component of IMRP protocol development. Peer review will be conducted following the Scientific Peer Review Guidelines (Appendix A). Peer review was conducted for the whooping crane monitoring protocol developed during the July 1997 Cooperative Agreement and the comments were considered by the TAC. Other monitoring protocols will be subject to peer review before full implementation. Peer reviewed monitoring protocols will be accepted as final and contractors implementing a protocol will be expected to follow the protocol methods as closely as possible. Research protocols developed during the Program will also be subject to peer review before implementation. Research protocols will detail the research objectives and expected research plan without full details of the specific study methods. Contractors hired to implement a research protocol will have flexibility in the study methods but will be expected to employ the most scientifically acceptable methods to accomplish the research objectives.

V.I. Monitoring and Research Data Analysis

The Governance Committee, with recommendations and analysis from the advisory committees, ISAC, and ED, will consider and evaluate the information collected from the monitoring and research studies. This evaluation may involve scientific advisors, peer review of data and reports, and statistical and trend analysis of data collected over the length of the Program. The evaluation will also involve a comparison with data contained in the Baseline Document when appropriate (see "Use of Baseline" below). In addition, existing models, updated models, and new models will be available for use in analyzing data. For example, the response of Program lands to management will initially be evaluated against predicted habitat needs defined by the FWS whooping crane model. As new data on whooping crane habitat use is acquired the model will be evaluated and modified as appropriate or a new model developed. The model was recently reviewed and updated once by the USGS, but further updates may be warranted after further data collection (Farmer et al. 2005). Thus, management for whooping cranes may initially be evaluated based on the existing whooping crane model while future predictions and evaluations would be made using an updated or new model.

In the scientific method for determining the effect of a management action, traditionally a null hypothesis will be adopted as the model that must be rejected in order to infer that an indicator has changed or that a cause-and-effect relationship exists. Normally, the null hypothesis would be the hypothesis that there is no difference in the value of an indicator between reference areas and assessment areas or that there is a zero correlation between two indicators along their gradients. Scientists often are concerned with the statistical power of an experiment, that is, the probability of rejecting a null hypothesis when it is false. In the case of Program monitoring, the null hypothesis will usually be that there is no impact to parameters such as sandbar elevation, channel width, or species use. Accepting a "no impact" results when an experiment has low statistical power may give Program administrators and the public a false sense of concern that the Program is ineffective. The power of the test to detect an effect is a function of the sample size, the chosen α value, estimates of variance, and the magnitude of the effect. The α level of the experiment is usually set by convention, if not by regulation, and the magnitude of the effect in an observational study is certainly not controllable. Thus, sample size and estimates of variance usually determine the power of observational studies and give weight to the evidence of an effect.

Observational studies in natural ecosystems typically have low statistical power to detect impacts of a treatment. When observational studies are designed properly, the ultimate determination of statistical power is sample size. The lack of sufficient sample size necessary to have reasonable power to detect significant differences and the large and uncontrollable environmental variation are common problems in field studies, such as those discussed in this document. Estimates of habitat availability or use can be made in a given year through sample surveys, but tests of other parameters for any given year (e.g., reproductive success, species abundance) may have relatively little power to detect an effect of flow or habitat on the species of concern. The anticipated lack of power is a concern and should be addressed by increasing sample size when practical, through the use of efficient study design, and by minimizing measurement error (e.g., the use of the proper study methods, properly trained personnel, etc.). However, most field studies in natural ecosystems will result in data that must be analyzed with an emphasis on detection of biological significance when statistical significance is marginal.

Trends detected during the First Increment for several important variables may suggest effects, even when tests of statistical significance on individual variables have marginal confidence. This deductive, model-based approach is illustrated by the following discussion. The evaluation of Program management actions might include an assessment of the effects from flow modifications on individual birds (e.g., size of use area) and population effects such as reproduction (e.g., fledged young). Several outcomes are possible from the bird studies. For example, an increase in apparent habitat in the assessment area implies a benefit to birds. An increase in bird use in the assessment area without an increase on similar “reference area(s)” may be interpreted as evidence of an effect of flows on individual birds. The presence of a greater number of nests in the assessment area as compared to reference areas increases the weight of evidence that an effect can be attributed to the flow modifications. However, an increase in use of both the reference and assessment area may be interpreted as a response unrelated to the Program. It is important to consider survey effort and methods in all areas when comparing these types of data. For example, more birds may be found in the assessment area simply because a vigorous survey protocol is being implemented to look for them there and not in other areas. Data on covariates (e.g., prey, weather) for the assessment and reference area(s) could be used to further clarify this interpretation.

Integration of monitoring and research is essential in understanding the effects of management actions in a long-term adaptive management program. Monitoring data may suggest correlations between trends in the variable of interest with management actions. For example, the amount of in channel reproductive habitat for least terns and piping plovers may appear correlated to river stage. However, the connection between river stage and management activities may be unclear. Manipulative studies of the effect of Water Plan activities may provide information that assists in the subjective assessment of the relative importance of Program management actions to species and habitat trends. Multiple indicators of correlation among target species and their habitat and Program actions, combined with research indicating cause and effect relationships between management actions and habitat or species responses will result in a subjective “weight of evidence” determination of impact of management actions on species and their habitat.

The biologically significant level of changes in variables associated with the target species is subjective and will depend on the species involved. Thus, the Program will need to consider this point and the weight of evidence when evaluating the monitoring and research data. Adaptive management decisions could be applied to management actions (land and water allocations/plans), indicators of biological response, and/or monitoring and research activities to better serve the needs of the Program. During the annual evaluation, the Governance Committee, based on recommendations from the ISAC, ED, and advisory committees, will decide if any adaptive management changes will be made (Figures 1 and 2). Changes to monitoring and research objectives, protocols, and budgets as a result of the annual reviews should only be implemented when sufficient data warrant such a change to avoid reducing the value of the monitoring and research data.

Analysis of research and monitoring data will be conducted in accordance with the analysis procedures outlined in each protocol. Analysis methods will necessarily vary and no attempt is made here to prescribe specific methods. It is assumed that both statistical and theoretical models will be used in these analyses. However, it is the philosophy of this plan that analyses will be conducted using generally accepted statistical procedures that allow a straightforward interpretation of the results.

***Use of the Baseline* -** A Baseline Document was developed for completion of Milestone R1-1 of the July 1997 Cooperative Agreement. The Baseline Document reviews the existing information related to the target species in the associated habitats (e.g., species occurrence, habitat use) as well as landscape/physical habitat data collected in the central Platte River (e.g., GIS information, sediment transport information). The document also identifies which data may be used in an analysis of Program effectiveness (e.g., before-after analysis). In general, there are very limited amounts of quantitative data that were collected according to a written or reproducible protocol.

***Trend Analysis Methods* -** There are many statistical analysis methods used to evaluate the significance of a trend in data, including parametric and nonparametric techniques. Certain techniques have been favored and used more often in certain disciplines. A description of four techniques expected to be used with the Program monitoring data follows. Use of one technique over another will depend on the distribution and independence properties of the data. Additional data analysis techniques may become available as result of current research into statistics and computer intensive methods (e.g., Manly et al. 2002).

Simple linear regression (Sokal and Rohlf 1995) will often be used to estimate the linear relationship between the response variable and the time variable. The regression model provides an estimate of slope while incorporating the effects of covariates. The null hypothesis will be that the slope is not different from zero. This analysis technique assumes the response variable is normally distributed.

Mixed models for longitudinal data (Verbeke and Molenberghs 2000) may be more appropriate in many situations, particularly since computer programming has improved the estimation procedures. The model provides an estimate of slope while incorporating the effects of covariates and multiple sources of random variability (individual, spatial correlation, measurement). Null hypothesis will be that the slope of the trend coefficient is not different from zero.

Non-parametric methods (e.g., Mann-Kendall Test described in Helsel and Hirsch 1992) will be used when the lack of distributional assumptions about the response variable is necessary (e.g., not normally distributed). The model provides a nonparametric estimation of trend. The null hypothesis will be that the response does not tend to increase or decrease over time.

Difference metrics will be calculated as basic summary measures for changes in a response variable at a site. These metrics will normally be calculated in a pairwise manner and will not incorporate multiple years. The differences will be used in univariate analysis procedures to estimate overall changes in the study area.

***Habitat Selection Analysis* -** Scientists identify resources used by animals (e.g. vegetation type, food, etc.) and document their availability (usually expressed as abundance or presence/absence).

These studies are carried out to identify the long-term requirements for the management or conservation of an animal population. In the case of the Program, habitat selection by target species is of interest for the evaluation of biological response to management activities and existing models and hypothesis regarding habitat suitability. Manly et al. (2002) provide a unified statistical theory for the analysis of selection studies. In habitat selection studies, the availability of a habitat resource is the quantity accessible to the animal (or population of animals) and the use of a habitat resource is that quantity utilized during the time period of interest (Manly et al. 2002). When use of a habitat resource is disproportionate to availability then the use is considered selective (i.e. the animal is showing a preference for the habitat resource).

Habitat selection studies can be used with marked or unmarked individuals. In most of the observational studies conducted by the Program, it will be impossible to identify unique animals. It is expected that the data will contain more than one habitat selection made by the same individual. Pseudoreplication occurs when an analysis of this type of data does not reflect the number of individuals sampled and does not account for the influence of individuals that are present in the data multiple times (Hurlbert 1994). These individuals can overly influence the analysis and the results are not applicable to the population. However, in the absence of a marked population of animals, we can use observations of animals seen from randomly or systematically based surveys in time and space to reduce field observation biases.

When conducting resource selection analyses the issue of scale is very important as it relates to the definition of available habitat. For example, when determining the scale of the "available" dataset in analysis of whooping crane habitat use, the results may vary if the available set of data is based on the entire study area, within bridge segments, or within 1-mile of use locations. To deal with this issue data analysis will likely be conducted at multiple scales.

Meta-analysis - Meta-analysis is useful in the analysis of ecological field studies. This analysis involves the combination of statistical results from several independent studies that all deal with the same issue (Hedges and Olkin 1985). It may be extremely important for use when historical and baseline data exist on species and habitat response. The simplest form of meta-analysis is illustrated by the following discussion. If several independent statistical comparisons are made on the same response indicator but with relatively low sampling intensity, then it is possible that none are significant at the traditional level of $P < 0.05$. However, all or most significance levels may be "small" (e.g., all Ps are < 0.15) and suggestive of the same type of response. The probability that, for example, three or more independent tests would, by chance, indicate the same response direction suggesting a positive or negative response from the management action, is itself an unlikely event. The combined results may establish response due to the management action with overall significance level $P < 0.05$. This type of analysis may also be useful in interpreting the results of several separate cause-effect research project as to how the entire system works.

V.J. Reporting

Generally, all Program research and monitoring will be coordinated by the ED and staff, reviewed by the appropriate advisory committee(s) and ISAC, and approved by the Governance

Committee. These reports will be used to produce annual/biannual work plans or operating plans by taking a retrospective look at each of following questions:

1) Have the intended actions been implemented?
2) Have the intended processes occurred?
3) Has the intended amount of habitat been created?
4) Have the intended species responses occurred?

These questions are listed in cause-effect and sequential order. Early in the Program, the focus at the System and Program Scales will be primarily on implementation of actions, with baseline measurements of processes, habitat and responses. However, project level monitoring and research may be able to tackle hypothesis tests early in the period of the First Increment. These work plans would then plan out the steps for the next year (or two) given what has occurred to date.

All contractors and participants in Program monitoring and research will prepare annual reports and a final report. Besides the traditional introduction, methods, results, and discussion/ summary sections found in scientific reports, monitoring and research reports for the Program will included, at a minimum:

1) Summary of management actions taken at the site(s) to help ensure that unexpected treatments can be accurately considered in the evaluation of results,
2) Elaboration on any unexpected treatments or management and the impacts that they had or may have had on the results,
3) A link back to how the results address or answer questions and priority hypotheses from the CEMs.

These reports will be compiled by the ED and staff, then supplied to the Governance Committee and the proper advisory committee(s) (e.g., TAC and LAC for island clearing activities, WAC for tracking/accounting activities, ISAC) for review. The advisory committees will annually review these reports and provide advice and recommendations regarding the activity, the report, and adaptive management to the Governance Committee through the process described in I.F.2. The Governance Committee will make final adaptive management decisions. The Governance Committee, and ED, with advice from the committees will ensure that management decisions are properly implemented. Investigators will be encouraged to publish the results of their final approved research and monitoring projects in appropriate peer-reviewed journals.

V.K. Species Specific Monitoring and Research Protocols

Using a collaborative process to develop CEMs and hypotheses, and knowledge of each species and their habitats, a list of proposed monitoring and research activities was developed (Table 1). These monitoring and research activities will be cross referenced to hypotheses presented in Section III of this plan and in Table 1.

The monitoring and research activities were designed to address specific questions regarding hypotheses and models regarding the relationship of target species to their habitat. The identified monitoring and research activities were used during the July 1997 Cooperative Agreement period to begin developing monitoring protocols and will be used in the future to identify new hypotheses, models, and protocols that are needed for their evaluation by the Program. Most monitoring protocols were developed during the July 1997 Cooperative Agreement related to species use of the area and habitat variables associated with use locations. However, very few research protocols were developed, as these will be site specific. Monitoring and research protocols developed to date are attached in Appendix F and are on file with the Program's ED. Additional protocols will be identified and developed as needed during the Program.

As described above, the general philosophy of the IMRP is that monitoring will provide an estimate of trend in habitat conditions and habitat use by target species with statistical inference possible to the entire area of interest, or to specific subdivisions of the entire area. Analysis of trend data will also allow an evaluation of the relative selection for habitats by target species, and the effect of various environmental variables to that selection. Research will provide an estimate of cause and effect among variables of interest, which will be used to interpret apparent trends of habitat conditions and use. These data will be used to make adaptive management decisions regarding which habitats to protect, which methods to use to enhance or restore protected habitats, and how best to achieve species benefits desired by the Program. The following is a general discussion of the monitoring and research planned for the First Increment. More detailed information will be contained in the work plans.

V.K.1. Whooping Crane

Monitoring of whooping cranes is designed to annually gather information on whooping crane stopovers and habitat use in the central Platte River valley. Monitoring will be conducted using systematic aerial and ground sample surveys that will result in an annual index of crane use. The objectives for whooping crane monitoring include:

1) Detect whooping crane stopovers in the study area;
2) Identify the locations of use and crane group movements in the study area;
3) Document crane group activities at use sites;
4) Document the physical and/or biological characteristics of use sites; and,
5) Collect landscape data associated with use sites.

The monitoring is designed to allow evaluation of changes in the frequency and the distribution of stopovers within the study area over time. Opportunistic locates will also be used to detect whooping crane stopovers in the study area. Crane group movements will be documented to identify use sites and to describe the patterns of movement of each crane group. Observers will also document each activity displayed by the crane groups. Habitat parameters will be described and measured for the purpose of comparative habitat analyses (e.g., habitat suitability or preference analyses). Habitat parameters will be measured at transects established at use sites and at random sites throughout the study area. Random sites for transects will occur on Program and non-Program lands (where access is available) so that habitat availability can be estimated system wide and for specific Program lands. These landscape data will be used in use/availability analyses using aerial photography and GIS information. The Program has available a complete land use/cover GIS layer based on 1998 color infrared photography. The Program will continue regular collection of landscape data for the study area through other protocols, such as the "Protocol for Aerial Photography in the Central Platte River Valley". Information will also be collected from the FWS and state agencies throughout the whooping crane's migrational corridor. Monitoring whooping crane use of the study area following this protocol began in 2001.

Research related to the whooping crane will primarily occur through the detailed analysis of monitoring data to evaluate the relative importance of different feeding habitats (e.g., wet meadow and cropland) and roosting sites (e.g., various channel widths) and to determine the relative importance of environmental factors (e.g., roads) in influencing selection of roosting, loafing and feeding sites. These data will ultimately be used for adaptive management decisions related to the whooping crane and to evaluate hypotheses and models that initially are guiding habitat protection activities for the whooping crane. Research activities indirectly related to the whooping crane and its habitat are described in more detail under in-channel habitat investigations.

V.K.2. Interior Least Tern and Piping Plover

The monitoring protocol for least terns and piping plovers has three main objectives:

1. Determination of nest site characteristics by locating tern and plover nests within the study area,
2. Determine the relationship of environmental parameters to nesting colonies of least terns and plovers by documenting reproductive habitat parameters at least tern and piping plover nesting colonies in the study area, and
3. Document numbers of least tern and piping plover adults in the study are through a simple count during each survey period.

Monitoring will consist of two components: 1) effort-based census of the Platte River between Lexington and Chapman, Nebraska, and 2) census of sandpits and historic (pre-Program) constructed nesting areas. Habitat parameters will be measured at all located colonies. Surveys for use will be conducted at least three times during each year by airboat within the river and by foot at sandpits. Pre-Program data exist for some of the study area and data resulting from surveys of these areas during the First Increment of the Program will allow a “before-after” analysis of use. However, most of the analysis will look for trends in habitat and use during the Program. The timing of Program habitat protection and management activities will provide some opportunity for a “before-after” analysis of the effect of Program activities. For example, least tern and piping plover surveys began during the July 1997 Cooperative Agreement; this information will provide use data from the river and on other accessible areas from before Program implementation. If the Program acquires in-channel or sandpit habitats managed for terns and plovers where pre-Program data exist, then direct comparisons of the protected lands before and after protection and comparisons between in-channel and sandpit habitats will be possible. Information from all components will be used to make informed judgments regarding the changes in least tern and piping plover reproductive parameters associated with Program activities. Monitoring of least tern and piping plover reproduction following this protocol began in 2001.

A detailed analysis of monitoring data will be used to evaluate the relative importance of different nesting habitats (e.g., sandbars and sandpits) and to determine the relative importance of environmental factors (e.g., human activity) in influencing selection of nesting sites and their success. Research into the effectiveness of surveying for least terns and piping plovers using the monitoring protocol is also planned. This will entail a double-sampling, current airboat and intensive ground survey, when terns and plovers are found nesting within the river channel. Research and monitoring related to prey for terns (fish) and plovers (invertebrates) are also planned. If a prey base is found to be inadequate, in quality and quantity, to support nesting and rearing terns or plovers, further research and monitoring will be added to identify potential means for alleviating factors limiting prey populations, considering factors such as temperature, drought, flow variations, hydrocycling and others. All data will ultimately be used for adaptive management decisions related to the least terns and piping plovers and to evaluate hypotheses and models that initially are guiding habitat protection activities for the terns and plovers. Research activities indirectly related to least terns and piping plovers and their habitat are described in more detail under in-channel habitat investigations.

V.K.3. Pallid Sturgeon

Pallid sturgeon monitoring and research will initially focus on the following five protocols/ activities. Under each activity are the objectives, generally stated.

1. A summary of existing information on the pallid sturgeon;
   - Objective is to understand the existing knowledge on pallid sturgeon biology range wide, but with particular emphasis on the Platte River.
2. Micro- and macro-habitat use/selection by adult and juvenile sturgeon, relative to conditions;
   - Objectives are to 1) determine what habitats pallid sturgeon use (and select for) in the Platte River, and what are the similarities and differences with habitat use and selection in other parts of the species range, 2) Does use and selection change with changes in river conditions, and if so how?
3. Identify the physical effects of subtly different rates of flow (stage and associated elements) over time on connection, construction, maintenance, and evolution of pallid sturgeon habitat components. Data need is pursuant to developing appropriate offsets for flow reductions stemming from implementation of the Program and New Depletions Plans;
   - Objective is to quantify and identify how the distribution of existing macro and meso habitats change over time and flow conditions.
4. Characterization of selected water quality parameters in the lower Platte and tributary contributions;
   - Objective is to determine what the range and variation, both spatially and temporally, of selected water quality parameters (particularly temperature, turbidity, dissolved oxygen, and specific conductivity) are in the lower Platte River under a range of flow conditions, as well as the relative contributions of the individual sub-basins.
5. Periodic evaluation and peer review of information.

Additional monitoring and research will be conducted if warranted. A decision to conduct additional monitoring and research will be made during the First Increment of the Program based on the evaluation of data from the above tasks. The first decision node for identification of monitoring and research items will occur upon completion of the research and finalization of the report conducted by the University of Nebraska-Lincoln. The University of Nebraska-Lincoln study conducted research on the pallid sturgeon in the lower Platte River. When the report is completed, the results of this work and the products of the existing information review will be evaluated. Similar reevaluations will occur throughout the Program. The Governance

Committee, after receiving advice from the TAC will reconsider the entire research and monitoring package for the pallid sturgeon after each review. Monitoring and research will be based on the existence of important data gaps and a determination by the Governance Committee that additional research and/or monitoring activities related to the pallid sturgeon are needed during the Program's First Increment. The monitoring and research tasks may include tasks as outlined in Table 1 (additional description of these tasks can be found in the FWS's Pallid Sturgeon Monitoring and Research Plan, February 10, 2005) some other mix of tasks, or new tasks that are defined based on the available information at that time. It is anticipated that the initial review and revision of the pallid sturgeon portion of the Integrated Monitoring and Research Plan will occur during the First Year of the Program. All work done on the pallid sturgeon during the Program's First Increment will be coordinated with contemporary work being conducted on the species by others in the Missouri River and its tributaries.

If species specific habitat management is conducted by the Program, the existing monitoring and research protocols will be reviewed to make sure they are adequate to evaluate the management activities. If needed, additional monitoring and research protocols will be developed to evaluate the specific management actions.

V.K.4. Other Listed and Non-Listed Species of Concern

The Program will monitor for selected other species of concern on Program lands. For example, sandhill crane use will be documented on Program lands during whooping crane monitoring, or the Program may monitor neotropical migrants on Program lands to evaluate the impacts of forest clearing. Specific protocols will be written prior to Program implementation.

The Program will also monitor and evaluate the status of other listed and non-listed species and other habitats using existing information. While the Program will not actively collect field data on all species throughout the central Platte region, it will consider the information collected by others (e.g., FWS, States) as part of the overall Program monitoring effort. The list of species that the Program will monitor and evaluate is found in the Baseline Document (Section V.I., Use of the Baseline). This list contains the species identified in the Land Plan (Attachment 4), as well as other listed and non-listed species. The "species of concern" identified in the Land Plan are those species that the Program will consider, where practical, when developing land management plans and is a significantly smaller list than the other listed and non-listed species that will be monitored using existing information as part of the IMRP.

V.K.5. In-channel Characteristics

In-channel characteristics (e.g., sandbars, vegetation encroachment, etc.) were identified during the July 1997 Cooperative Agreement as a high priority for monitoring and research. Monitoring of in-channel characteristics will be conducted through implementation of the protocols "Monitoring the vegetation of the central Platte River valley" and "Monitoring the channel geomorphology of the central Platte River valley". These protocols include monitoring of vegetation and geomorphology, respectively, along transects systematically placed throughout the study area (system level) and more intensively on Program lands (Program level). Vegetation monitoring will provide estimates of species composition, diversity, and density in all habitats according to their availability. Geomorphology monitoring will provide channel width, depth profiles, and sediment grain size information.

Significant and detailed research into channel geomorphology and processes was identified through a joint effort between the EIS Team and Parsons Engineering, working for the Governance Committee, during the July 1997 Cooperative Agreement period. The general objectives (focus) of the research identified are:

1) Investigate the erosion, transport, and deposition processes in the central Platte River including as feasible and appropriate, factors including flow variability, drought, high flow events and hydrocycling.
2) Investigate the in-channel vegetation dynamics in the central Platte River, including investigating the processes of vegetation removal and how to prevent vegetation establishment.
3) Conduct a comprehensive geomorphic assessment of the central Platte River from Lexington to Chapman, Nebraska; including distribution/number/size and persistence of sandbars, how management impacts the river, and what width can be supported with various flows.
4) Investigate proposed in-channel restoration activities; including island lowering, sand augmentation, and pulse flows.

The Parsons-EIS Team group developed a detailed list of reconnaissance-level descriptions of investigations that will be implemented to resolve questions identified by numerous interests regarding Platte River channel trends, processes, and restoration treatments. Research is to begin year one of the Program, and most work would be conducted within the first three years of the First Increment, however, actual implementation will depend on availability of lands, development of management plans, and personnel. These items are described in detail in the final report and tables provided by Parsons Engineering on January 16, 2001 (Parsons 2002) and generally described in the first four tasks of Table 1. Research protocols to investigate Platte River channel trends, processes, and restoration activities will be developed during the Program.

V.K.6. Habitat Comparisons

The overall monitoring and research design and protocols/activities planned for implementation during the Program, will allow the Governance Committee, with recommendations from the TAC and LAC, to make comparisons of species use of different areas with differing habitat characteristics. Examples of comparisons that might be of interest to the Governance Committee include complex and non-complex areas, areas managed using different techniques, and areas managed for different physical parameters, such as 1,000-foot channel widths and 700-foot channel widths.

The objectives for habitat comparisons are 1) a determination of the extent and characteristics of habitats preferred by the target bird species, and 2) the degree to which various environmental variables influence this preference.

Following is an illustration of how data collected at whooping crane use sites, Program lands, and system wide will allow these comparisons. The whooping crane monitoring protocol directs measurements of three transects at all river use sites. These transects are measured perpendicular to the general flow of the channel using survey equipment and will provide a description of habitat used by whooping cranes. The geomorphology protocol directs in-channel measurement of transects, perpendicular to the general flow of the channel, systematically throughout the study area and more intensively at Program lands using survey equipment. Using the description of whooping crane use sites, the Governance Committee can evaluate whether or not habitat complexes as currently described (Program Attachment 4, Table 1), complex habitat areas under varying management, non-complex habitat areas, or non-Program lands provide these same characteristics using direct comparisons and whether whooping cranes show differential preference for one more of these habitat areas through resource selection function analysis. The number of whooping cranes detected through this monitoring plan may be insufficient to allow population or species level determinations. However, the Program has not identified surrogate measurements in the case that this concern is realized.

V.K.7. Channel Capacity

The Water Plan (Attachment 5, Section 2) contains a discussion of management action anticipated to address channel capacity issues along the North Platte River below Lake McConaughy. Once management actions are decided upon, appropriate monitoring and research will be designed and conducted to evaluate the management actions.

VI. MONITORING AND RESEARCH DATA STORAGE

This section describes the conceptual design and implementation methods for a database management system for all administrative information and data and reports created under the biological monitoring and research component of the Program.

VI.A. Design Considerations and Specifications

VI.A.1. Area of Interest

A large number of biological monitoring and research activities described under the Program. The collection of such large amounts of data during the Program's first thirteen year increment by potentially numerous contractors, cooperators, agencies, and staff necessitates a centralized database management system that will permanently store, organize, and distribute Program data and information. A database management system (DBMS) is a collection of computer programs that enables users to store, modify, and extract information from a database. This information can be in the form of raw or summary data, metadata, and texts such as reports, protocols and address lists. Central storage of data and text allow all users to access the data quickly, ensures that all users are looking at the same and most up-to-date information that has been subjected to rigorous QA/QC procedures, and forces standardized data collection and reporting over the life of the Program. These characteristics of a DBMS have many implications for data analysis and interpretation.

A database management system will provide a safe, long-term storage warehouse of data and reports which will be less volatile and more accessible than information stored on individual computers or in filing cabinets distributed across different locations. Warehousing all data in one database will facilitate consistency in data collection and reporting over time and within individual projects and will ensure that data from different projects will be linked by date and location, allowing investigators to search for relationships between events in time and space. Consistent and efficient data collection requires creating standardized raw data collection forms that ensure the necessary information is recorded in the proper format. If study results will be compared between years or the data will be analyzed for trend to determine if resource parameters are changing over time, then it is critical that the format for the collected data remain constant across years and principal investigators.

Secondary to standardized data collection and reporting, and data storage and retrieval is the use of a DBMS to keep the public notified of current events within the Program and provide an avenue of contact for public questions and input. A DBMS with a web-based component will allow easy access for all Program participants and provide a venue for public outreach and participation.

VI.A.2. Database Design

The database management system will be a web-based system supported by common and tested database management software such Oracle™ or IBM's DB2™. Data will be viewed using Microsoft Access™ and texts will be 'pdf' documents that can be viewed with Adobe Acrobat Reader™. Different levels of security will ensure that only principal investigators can submit data and reports, only the DBMS manager can alter data and reports, and that all other users have read-only access to data and text. A third level of security will allow the public and non-Program groups to view Program news, reports and data that are reported in a format appropriate for public viewing.

A web-based DBMS will allow real-time updates to the database and ensure that all Program participants have access to the database (at their assigned level of security) from any location through the Internet. Another benefit of the web-based system is the accessibility of the Program information. The only hardware and software that will be necessary to submit, access, and retrieve information from the database is a computer with an internet connection and the correct version of web-browser, which historically can be downloaded free of charge (e.g., Netscape Navigator 4.0).

The database management system will be developed and managed by an independent contractor (private or government) for the Program. The contractor will work with the Governance Committee, ED and Program staff and proper advisory committees to develop the DBMS. The Program staff will periodically evaluate the system to ensure it is performing to expectations and operating within budget. Periodic evaluations will also allow the contractor to further develop and enhance the system to keep the DBMS efficient, "user-friendly" and up-to-date with the current technology (i.e. software enhancements).

The database will be created and managed using database management software such as Oracle™ or IBM's DB2™. The database software will be chosen based on cost, flexibility and the perceived life of the software. The design of the database management system is described below, with examples of how each component will be used by Program participants or the general public.

Web Page - The database point of entry (i.e. access for all users other than the database manager) will be the Program's home page on the world-wide-web. This web page will feature a description of the Program, contact names and addresses of primary participants, links to web pages that contain hydrologic information for the Platte River, weather information and web-pages of Program participants. There could also be links to other relevant sources of information such as web pages for the Nebraska Geospatial Data Clearinghouse and cooperators like the Nebraska Department of Natural Resources. The web page will be the portal for the database and a database directory will direct users to information and applications available inside the DBMS.

Access to information inside the database will depend on the type of user, and participants with security clearance will use login names and passwords to access Program participant-only information. For example, the general public could enter the database through the web page, requiring no login name or password, but access will be limited to completed work products ready for distribution to the public. A program participant could enter any portion of the database (i.e. protocols, raw data, administrative information, etc.) with read-only access. This type of security would permit users to view text and data and query and retrieve data for analysis while preventing anyone from purposefully or accidentally altering the content or format of data tables and texts. The third level of security would be assigned to primary investigators. These users would have the same level of access as regular Program participants but they would also have the ability to submit data and text to be entered into the database. Only the database manager will have the ability to alter existing data tables and texts by adding or deleting information or changing formats. Alteration of data tables will follow a very specific protocol and all record changes will be documented in a log within the DBMS.

An important component of the database management system is the ability to track and record uses of the database at all security levels. Software will be used to calculate and record the number of visits, the average time for each visit, types of data queries submitted and information relative to the submission of data and text to the database.

***Directory* -** The directory found on the Program's web page will direct users to information and applications within the database management system. For illustration, the web page could categorize components of the DBMS as "Information" or "Applications" and further categorize information as "Administrative" or "Project-Based". Administrative information contained in the DBMS will consist of information such as directories of projects and participants, permit application forms, committee meeting minutes and budgets. Project-based information contained in the DBMS will consist of information such as individual project descriptions, protocols, raw data, metadata and reports. Applications available within the DBMS will consist of (1) viewing aerial photos and GIS thematic layers or maps, (2) data query and retrieval and (3) data/text submission.

***Administrative Information* -** The database management system will contain administrative information for the Program. A portion of this information will only be available to Program participants and access will be gained by use of a login name and password. A complete list of all Program participants will be stored in the database along with telephone numbers, email addresses and street addresses. Currently, the ED has a database of over 550 individuals interested in receiving news and information on the July 1997 Cooperative Agreement, with a majority of the list being private individuals who reside in the central Platte River valley, and the names and addresses of Program participants. Users can use this list for contacting other Program members and for in-house mailings and memos, as well as public mailings.

Other information that will be stored in the Administrative Information component of the database will be minutes from committee meetings, scheduled agendas, budget information and template forms for required permits and Program paper work. Budget information and template forms will likely only be used by Program staff however, minutes and agendas are of interest to a wider audience and thus would be accessible at all security levels. Examples of forms that would be accessible in the database are ESA permit applications, expense forms and memos. Completed forms will also be stored in the database so that users can reference past material to complete or update necessary permit applications, memos, and other various administrative documentation. For example, if an ESA permit needs to be renewed, the principal investigator can download the appropriate form from the database and view completed ESA permit applications for the same or other projects that were successful in the past.

***Project-Based Information* -** Within the database will be a directory list of current and past Program research and monitoring projects. Most of this information will be available to all users, including the general public. The directory for Project-based information will contain project names, current and past principal investigators along with contact phone numbers and addresses. From the directory users can choose to view the project's description (duration, goals, personnel, etc.), protocol(s) for data collection, metadata, raw data and reports. Investigators or Program participants can view past protocols, data and reports to become more informed about project goals and results.

Users can access data from other projects to include information and covariates in their analyses and reports. Metadata and project protocols will explain the data and allow others to perform their own statistical analyses or link information collected from other projects to their own data. Storing project information and data in electronic form in the database will not only provide safeguards for keeping information that the Program has invested many resources into collecting, but it fosters sharing of information and promotes users to become well informed of other projects. Sharing data also promotes investigations into relationships between projects and project data that were not initially targeted. The Program's philosophy of employing an adaptive management strategy to the Platte River basin relies on the ability to easily access past and current information to compare results between years and among projects.

***Land and Water Management Plan Implementation Information* -** The database management system will contain information about the Program land and water management actions. Information such as actual EA releases, land purchases, and all land management activities will be documented in the database. Storing information about management actions will facilitate the use of the information in the analysis of Program monitoring and research data.

***Applications* -** The database management system will not only store data and information but it will house applications that allow users to perform tasks relating to database use and management. The first and probably most important task a user will perform is submitting data or text to be included in the database management system. All submitted data will be in the form of a comma delimited text file. This will allow participants to make their own choices as to what software they use to house the data on their personal computer, and it will remove the requirement that all users purchase necessary software updates and use the identical versions of the same software. Once the data is submitted to the database, the database manager will run a Quality Assurance/Quality Control (QA/QC) (refer to Section VI.C. below) routine to make sure that the submitted file contains the correct data fields and all data follow the required formats (e.g. correct units of measurement, missing values correctly indicated), and that data is not replacing existing data within the database. It will still be the responsibility of the principal investigator to perform rigorous QA/QC on their data and text prior to submission.   Once the data has been added to the database the database manager will notify the submitter via email when the data has been appended to the database and can be viewed on the web page.

All text will be submitted in the form of a Microsoft Word ™ document. Users will not be required to use a specific version of Microsoft Word ™. The database manager will convert the Word documents to 'pdf' format so that all users can access and view the document from the database. The database manager will notify the submitter once the document(s) have been added to the database and are viewable on the web page. Text documents will be easily downloaded to a local computer in 'pdf' format with the click of a button.

Another important application of the database system is the data query and filter application. If called by the user, a window will appear that allows the user to define data that he/she would like to view. Data can be called to the screen by project name, season and year or data queries can be more complex, calling data by location and or time of observation as well as by any other available field. An investigator may want to extract and view all observations from all projects linked to three specific anchor points along the river corridor or the investigator may want to view all data collected during a specific hydrologic flow event, say flow of the main river channel greater than 5000 cfs. This easy to use and built-in application with capabilities to query, filter and display data will prove to be a valuable asset to the Program.

Data will be downloaded in a comma delimited text format with the click of a button, which will allow the user to view and analyze filtered data on a local computer using their available software. Information regarding all data submissions, extractions, and query events will be recorded and stored by the database manager to accompany other database administration records and documents. These records will be viewed during periodic evaluations of the DBMS.

A GIS and aerial photograph interface will be integrated into this DBMS. This interface will contain a link to the catalog of aerial photographs and videographs that are available from the FWS, U.S. Geological Survey, Bureau of Reclamation, Program, and other sources as available. Depending on propriety concerns, the photographs could be stored in the Program's database or the Program's web page could contain a link to another web site containing the photographs. The GIS and aerial photograph interface will include orthophotos, digital elevation models and GIS thematic layers and maps created by individual projects.

The GIS and aerial photograph interface will contain links to Project data and metadata. This will allow users to retrieve information relative to specific regions or sample points visible in a thematic layer with a point and click of the mouse. For instance, when viewing a thematic layer illustrating the locations of least tern and piping plover islands the user could point and click on an island or group of islands to view all least tern and piping plover data associated with those locations. Anchor points along the main river channel will also be geo-referenced, allowing users to view data associated with each anchor point or sets of points when viewing their locations through the GIS Interface. This application is similar to the data query and filter application only the user can call data linked to locations in space while viewing the locations on a mapped section of the Platte River corridor.

VI.B. Timing

The development of the DBMS will be implemented through three phases, as described below.

- **Phase I.** The first step in developing the DBMS will involve taking a look at current data, developing a list of possible data sources, and prioritizing the incoming data according to levels of importance. The characteristics of the most important data sources will be used to design the technical specifications of the data storage components of the database. The list of future data sources will allow some flexibility to be built into the system from the beginning.

  The contractor responsible for building the database will work with principal investigators, ED and staff, advisory committees, and the Governance Committee to standardize raw data entry forms, spreadsheet formats, and reporting forms that will be mandatory throughout the life of the individual monitoring or research project. This will ensure that collected data will stay consistent in format and quality across years and principal investigators. It will also ensure that the data can be accurately and efficiently uploaded into the database.

  Phase I will involve developing the web-based component of the system. Phase I will be completed early in the Program, and the resulting DBMS will be called the "pilot system". This pilot DBMS will be ready to store project data in Year 2 and the web page that allows access to the system will also be functional by this time. Applications and administrative information may not yet be available on the database.

- **Phase II.** Following Phase I there will be a period of ongoing evaluation of the DBMS by Program participants and the database manager. This period will allow users to provide input and suggestions for further development of the system. Until data is actually uploaded to the database and users get a chance to access the data through the "pilot system" the full potential for the DBMS will not be realized. Principle investigators and Program participants will be able to use the pilot system during this time and provide input and comments into the DBMS structure. During Phase II, links between different data sources and levels of information will be made. This will allow the applications of the DBMS to become operational. Thus, Phase II will involve creating the aerial photograph and GIS interface and the data query and filter applications.

  Phase II can be considered the period in which the DBMS grows in sophistication, not only improving efficiency and ease of use, but linking data and texts and allowing users to connect and query multiple layers of data. Phase II will last for a period of 2 to 3 years.

- **Phase III.** Phase III will begin once the Program has decided that the DBMS satisfies all reasonable objectives set by the Program and the database manager, and the DBMS is at a stage where no major improvements or modifications need to be made to the system. This phase will consist primarily of updating the system with current data and information as it is collected and reported by the users, tracking uses and changes made to the database by users, and monitoring of the system's performance and integrity. Phase III will begin at the end of Phase II and last through the duration of the First Increment of the Program. As new projects develop, the database contractor will work with principal investigators and Program staff during the creation of the study's protocol to develop the necessary forms and spreadsheets for data collection. This will ensure that the information collected from the project has a proper place in the database and can be linked to data collected by other projects according to a location in space and time.

VI.C. Database Quality Assurance/Quality Control (QA/QC)

QA/QC measures will be implemented for all database system components by the ED and staff. Observers will be responsible for inspecting his or her data forms for completeness, accuracy, and legibility. The study team leader will review data forms to insure completeness and legibility, and any problems detected will be corrected. Once the data has been submitted to the database manager for inclusion in the database, the manager will review the submitted data for general quality, ensuring the proper fields have been included, units of measure are consistent with past data and missing values are appropriately labeled. Once data have been appended to the database, the manager will check the updated database for completeness and accuracy.

The database manager will check applications for data querying and retrieval periodically, ensuring that all components are functioning properly.

VI.D. Report Format

The DMBS manager will annually prepare a draft and final report describing the current state of the database management system including additions or modifications, troubles encountered, a record of uses in the past year, and suggestions for improvement of the database. The report will contain a summary table that displays the number of data/document submissions, average time from submission until the information is viewable on the web, number of users (i.e. general public, program participants), number of data queries and number of data downloads.

VI.E. Administration

Administration of DBMS will be delegated to the ED by the Governance Committee. Administration of the DBMS may or may not be further delegated to a contract manager depending on decisions to be made after initiation of the Program.

VI.F. Existing Data Evaluation

The database management system manager will review existing data for all projects to evaluate consistency and become familiar with current data collection protocol and recording formats. The developer will work with principal investigators to develop standardized raw data collection forms and formats for storing data electronically. Current protocol and raw data entry forms may not need revisions.

VI.G. Data Sheets

Principal investigators of existing projects will meet with the database manager to confirm that existing raw data entry sheets provide the necessary framework for good, consistent data collection. Data sheets will be developed for future projects after the project's goals and data collection protocol have been defined.

VII. ESTIMATED BUDGET

The current estimated budget for monitoring and research activities is contained in Table 1 and totals $30,006,275. Budget for implementing other aspects of the AMP, such as paid experts to serve on the ISAC, management actions, etc. are included in the overall Program budget (Program Attachment 1)

IX. LITERATURE CITED

Box, G.E.P., W.G. Hunter, and J.S. Hunter. 1978. Statistics for experimenters. John Wiley and Sons, New York. Pp. 653.

Breidt, F.J. and W.A. Fuller. 1999. Design of supplemented panel surveys with application to the natural resources inventory. Journal of Agricultural, Biological, and Environmental Statistics 4(4): 331-345.

Duncan, G.J. and G. Kalton. 1987. Issues of design and analysis of surveys across time. International Statistical Review 55: 97-117.

Edwards, D. 1998. Issues and themes for natural resources trend detection. Ecological Applications 8(2) 323-325.

Fuller, W.A. 1999. Environmental surveys over time. Journal of Agricultural, Biological, and Environmental Statistics 4(4): 331-345.

Farmer, A.H., J.W. Terrell, J.H. Henriksen, and J.T. Runge. 2005. Evaluation of models and data for assessing whooping crane habitat in the central Platte River, Nebraska: U.S. Gelogical Survey, Biological Resources Discipline, Scientific Investigations Report 2005-5123, 64 p.

Hedges, L.V. and I. Olkin. 1985. Statistical methods for Meta-analysis. Academic Press, New York. pp. 369.

Helsel, D.R. and R.M. Hirsch. 1992. Statistical methods in water resources. Elsevier. New York. pp. 522.

Hurlbert, S. H. 1984. Pseudoreplication and the design of ecological field experiments. Ecol. Monogr. 54:187-211.

Keuhl, R.O. 1992. Statistical principles of research design and analysis. Duxbury Press, Belmont, California. Pp. 686.

Manly, B. F. J., L.L. McDonald, D. Thomas, T.L. McDonald, and W.P. Erickson. 2002. Resource Selection by Animals: Statistical Design and Analysis for Field Studies, Second Edition. Kluwer Academic Publishers, Boston. pp. 221

McDonald, T.L. 2003. Review of environmental monitoring methods: survey designs. Environmental Monitoring and Assessment 85: 277-292.

Murray, C. and Marmorek, D.R. 2003. Adaptive Management and Ecological Restoration. *In* Ecological Restoration of Southwestern Ponderosa Pine Forests. P. Friederici, ed. Ecological Restoration Institute, Flagstaff, AZ. p. 417-428.

National Research Council (NRC) of the National Academies. 2005. Endangered and threatened species of the Platte River. The National Academies Press, Washington, D.C., 299 p.

Neter, J., M.H. Kutner, C.J. Nachtsheim, and W. Wasserman. 1996. Applied linear statistical models, Ed 4. McGraw-Hill. New York. Pp. 1408.

Nyberg, B. 1999. Implementing Adaptive Management of British Columbia's Forests - Where Have We Gone Wrong and Right? In: McDonald, G.B., J. Fraser and P. Gray (Eds.). Adaptive Management Forum: Linking Management and Science to Achieve Ecological Sustainability. OMNR, Peterborough, ON, Canada. pp. 17-20 p.

Peterson, S.A., N.S. Urquhart, E.B. Welch. 1999. Sample representativeness: A must for reliable regional lake condition estimates. Environmental Science and Technology 33(10): 1559-1565.

Skalski, J.R. and D.S. Robson. 1992. Techniques for wildlife investigations: Design and analysis of capture data. Academic Press, San Diego. Pp. 237.

Parsons Engineering (Parsons). 2002. Final Report, Parsons/EIS Joint Team River Process Investigations Analysis. Contract completion letter and spreadsheets from Douglas L. Meurer, Parsons, to Dale Strickland, CA Executive Director.

Sit, V., and B. Taylor (eds.). 1998. Statistical Methods for Adaptive Management Studies. B. C. Ministry of Forests, Victoria, British Columbia, Canada. http://www.for.gov.bc.ca/hfd/pubs/docs/lmh/Lmh42.pdf

Sokal, R.R. and F.J. Rohlf. 1995. Biometry, Third Edition. Freeman. New York. pp. 887.

Thompson, S.K. 1992. Sampling. John Wiley and Sons, New York. pp. 347.

Urquhart, N.S. and T.M. Kincaid. 1999. Designs for detecting trends from repeated surveys of ecological resources. Journal of Agricultural, Biological, and Environmental Statistics 4(4): 404-414.

Urquhart, N.S., S.G. Paulsen, and D.P. Larsen. 1988. Monitoring for policy-relevant regional trends over time. Ecological Applications 8(2):246-257

Verbeke, G. and G. Molenberghs. 2000. Linear mixed models for longitudinal data. Springer. New York. pp. 568.

Walters, C. 1986. Adaptive management of renewable resources. Macmillan, New York.

Walters, C.J. and C.S. Holling. 1990. Large-scale management experiments and learning by doing. Ecology 71:2060-2068.

Table 1. Identified protocols/activities and draft estimated budget for monitoring and research

Ref. No.	Protocol/Activity	Description, Responsible Party, and Schedule	13 year Budget	CEM Hypotheses
		Geomorphology and Vegetation		
1	Monitoring the **channel geomorphology** of the Central Platte River valley	**Description:** Annual geomorpholocal (including flows) monitoring throughout the study area (system level monitoring) and more intensely on Program lands (Program level monitoring). **Responsible Party**: Program. **Schedule:** Monitoring will be conducted annual once the Program begins.	$877,500	PP-1, PP-2, PP-3
2	Monitoring the **vegetation** of the central Platte River Valley	**Description:** Annual vegetation monitoring throughout the study area (system level monitoring) and more intensely on Program lands (Program level monitoring), focusing on out-of channel areas. **Responsible Party:** Program. **Schedule:** Monitoring will be conducted annual once the Program begins.	$877,500	PP-1, PP-2, PP-3
3	Evaluate sediment erosion, transport, and deposition processes	**Description:** This study will obtain data on the hydraulic and sediment transport processes, especially the deposition and erosion along the river bed and banks, and the formation of bedforms, bars, and islands within the overall channel. The data will be analyzed using physical principals to develop an understanding of the sediment deposition and erosion processes acting on the river, with special emphasis on the habitat characteristics of open-view width and sandbar dimensions. **Responsible Party:** Program. **Schedule:** Research will begin once necessary lands are available and specific protocols can be written.	$2,302,344	PP-1, PP-2, PP-3

Ref. No.	Protocol/Activity	Description, Responsible Party, and Schedule	13 year Budget	CEM Hypotheses
4	Evaluate in-channel vegetation dynamics	**Description:** The vegetation dynamics study focuses primarily on developing an understanding of the processes of interaction between flow, sediment transport, and vegetation. To develop this understanding, an extension of existing vegetation demography investigation is included, along with investigations of the specific interaction between flow, sediment transport, and vegetation at locations where vegetation plots on the river would be established. Because of the inherent uncertainties and non-idealized conditions that exist when collecting data in the field, a laboratory component of data collection has been included. Further description provided in the Parsons/EIS Team report. **Responsible Party:** Program. **Schedule:** Research will begin once necessary lands are available and specific protocols are written.	$2,235,600	PP-1, PP-2, PP-3
5	Comprehensive geomorphic assessment from Lexington to Chapman, Nebraska	**Description:** This investigation will provide a qualitative and quantitative geomorphic assessment of the Platte River. Existing data will be compiled and a substantial amount of new data on the current and historical form of the river will be collected, focusing primarily on the reach from Lexington to Chapman with possible extensions upstream and downstream. Development of a comprehensive assessment of the river's form and processes controlling the form are necessary precursors to implementation of any treatments intended to modify the river's form. The comprehensive geomorphologic assessment will also provide a forum for interaction among the various investigation components to allow development of an appropriate interpretation of the results of the various investigations regarding meeting of habitat objectives from a sediment, vegetation, and geomorphic perspective. Further description provided in the Parsons/EIS Team report. **Responsible Party:** Program. **Schedule:** Research will begin once necessary lands are available and specific protocols are written.	$3,570,905	PP-1, PP-2, PP-3

Ref. No.	Protocol/Activity	Description, Responsible Party, and Schedule	13 year Budget	CEM Hypotheses
6	Investigation of river restoration activities	**Description:** This study will test the performance and effects of pulse flows, measures to remove vegetated islands, and measures to create sand bars. The pulse flow would be tested in three phases: The first, initial phase would be to gather information on discharge wave travel times and wave attenuation and on river stage at locations where there is concern about potential flooding problems. Selected vegetated river islands would be cleared and lowered from each of four study reaches prior to the second pulse flow test. The second and third pulse flow tests would be conducted to study the removal of new vegetation on the river bed and sandbars, the building of new sandbars (with and without woody debris), and other sediment transport processes. Further description provided in the Parsons/EIS Team report. **Responsible Party**: Program. **Schedule:** Research will begin once necessary lands are available and specific protocols are written.	$1,607,526	PP-1, PP-2, PP-3
		Aerial Photography and GIS		
7	Protocol for Aerial Photography in the Central Platte Valley	**Description:** Provide aerial photographs at regular intervals throughout the Program for analysis in other protocols. Black and white photographs will be taken in even years and cover the 1 mile area on either side of the centerline of the river. CIR photographs will be taken in odd years and cover the 3.5 mile area on either side of the centerline of the river. **Responsible Party:** Program. **Schedule:** Aerial photography began in 2000 and will continue annually as described in the Protocol	$378,000	PP-1
8	Protocol for GIS Analysis of Ortho-rectified CIR Photography - with minimum land cover types as those included in 1998 analysis	**Description:** Create a land use/cover GIS layer with CIR photos taken at the end of the first increment. This protocol will use the CIR photos from reference no. 3 and includes ground truthing of cover and use types. This study will replicate the 1998 land use/cover procedure to facilitate a before-after study of land use. **Responsible Party:** Program. **Schedule:** GIS Analysis will occur near the end of the first increment using ortho-rectified photos.	$270,000	PP-1

Ref. No.	Protocol/Activity	Description, Responsible Party, and Schedule	13 year Budget	CEM Hypotheses
		Least Terns and Piping Plovers		
9	Monitor potential and known nesting habitat, distribution and number of breeding pairs, and reproductive success of **least terns and piping plovers** in the central Platte valley	**Description:** Monitor annual presence of least terns and piping plovers in the study area (in-channel and pits), nesting attempts/success, fledge success, and habitat parameters at reproductive sites. **Responsible Party:** Program. **Schedule:** Monitoring using this protocol began in 2001 and will continue annually as described in the protocol.	$1,053,000	TP-1, TP-2, TP-3
10	Protocol for measuring channel habitat characteristics at **least tern and piping plover** nest/colony locations	**Description:** Monitoring colony characteristics to complement reference no. #9. The geomorphology monitoring transect methods (ref no. 1) will be used at each in-channel colony site. **Responsible Party:** Program. **Schedule:** Monitoring will begin when least terns and/or piping plovers are found nesting on natural islands within the river channel.	$202,500	TP-1, TP-2, TP-3
11	Monitor riverine prey base (fish) for **least terns**	**Description:** Collection of prey base information (e.g. species composition, distribution, habitat utilization). Data will be used in other protocol to determine relationship of flows on hab, pred, etc of prey base for tern and plover. **Responsible Party:** Program. **Schedule:** Monitoring to begin with Program implementation.	$526,500	TP-4
12	Determine relationship of flows on creation/maintenance of habitat, predation, nest inundation, and distribution, abundance and composition of prey base for **least terns and piping plovers.**	**Description:** Analysis of information from ref no. 1-6 on creation and maintenance of sandbar habitat; ref. no. 9 on predation, nest inundation; and from ref. no. 11 and 20 on abundance and composition of prey base to determine relationship with flow data from USGS/NEDNR. **Responsible Party:** Program. **Schedule:** Analysis will occur near the end of the first increment when sufficient information has been collected through implementation of above referenced protocols.	$540,000	PP-1, PP-2, PP-3, TP-1, TP-2, TP-3, TP-4

Ref. No.	Protocol/Activity	Description, Responsible Party, and Schedule	13 year Budget	CEM Hypotheses
13	Determine reproductive habitat requirements for **least terns and piping plovers** and if reproductive habitat is limiting in the central Platte valley (Considered very important, likely to be done later in Program)	**Description:** Reproductive habitat parameters will be collected as part of reference nos. 9 and 10 and can be used to define tern and plover habitat requirements. GIS could be used to determine the amount of this type of habitat to evaluate if it is limiting. **Responsible party:** Program. **Schedule:** analysis will occur near the end of the first increment when sufficient information has been collected through implementation of above referenced protocols.	$67,500	TP-1, TP-2, TP-3
14	Determine impacts limiting reproductive success of **least terns and piping plovers** in central Platte (Determined through analysis of monitoring data)	**Description:** Analysis of reproductive data and habitat data collected as part of reference numbers 9 and 10. **Responsible Party:** Program. **Schedule:** analysis will occur near the end of the first increment when sufficient information has been collected through implementation of above referenced protocols.	$81,000	TP-1, TP-2, TP-3
15	Determine the importance of riverine and non-riverine habitat to **piping plovers and least terns** (Determined through analysis of monitoring data)	**Description:** An analysis of nest numbers, fledge success, etc collected as part of ref. no. 9 and 10 to the amount of riverine and non-riverine habitat available. Amounts of habitat from aerial photos (GIS) and/or airboat surveys to be conducted as part of reference no. 3-6. **Responsible Party:** Program. **Schedule:** analysis will occur near the end of the first increment when sufficient information has been collected through implementation of above referenced protocols.	$105,300	TP-1, TP-2
16	Identify limiting factors to prey bases for **least terns and piping plovers**	**Description:** Analysis of data collected through ref. No. 11, 17, 18, 19, 20 and protocols collecting physical habitat data within the channel. **Responsible Party:** Program. **Schedule:** analysis will occur near the end of the first increment when sufficient information has been collected through implementation of above referenced protocols.	$175,500	TP-4
17	Determine effects of temperature on **least tern** prey base (fish) (Secondary consideration to The Effect of Flow on Temp which is covered by another protocol)	**Description:** Research study will be a combined field and laboratory (if published information not available for correct species) exercise. Will need to follow studies to determine prey species, abundance, composition, and effects of flow on temperature. **Responsible Party:** Program. **Schedule:** analysis will occur near the end of the first increment when sufficient information has been collected through implementation of above referenced protocols.	$405,000	TP-4

Ref. No.	Protocol/Activity	Description, Responsible Party, and Schedule	13 year Budget	CEM Hypotheses
18	Determine effects of temperature on **piping plover** prey base (insects)	**Description:** Research study will be a combined field and laboratory (if published information not available for correct species) exercise. Will need to follow studies to determine prey species, abundance, composition, etc. **Responsible Party:** Program. **Schedule:** analysis will occur near the end of the first increment when sufficient information has been collected through implementation of above referenced protocols.	$405,000	TP-4
19	Determine availability of prey base in non-riverine reproductive habitats for **least terns**	**Description:** Study will research the abundance and composition of fish found in sandpits and other non-riverine areas available to terns. Study should include correct sampling methods to look at availability in the water column. **Responsible Party:** Program. **Schedule:** Protocol will be developed and implemented after necessary sandpits are selected and access gained.	$236,250	TP-4
20	Determine availability of prey base in non-riverine reproductive habitats for **piping plovers**	**Description:** Study will research the abundance and composition of prey (insects) for piping plovers found in sandpits and other non-riverine areas available to plovers. **Responsible Party:** Program. **Schedule:** Protocol will be developed and implemented after necessary sandpits are selected and access gained.	$236,250	TP-4
21	Determine if prey base availability limit **least tern and piping plover** populations	**Description:** Analysis of field information gathered under reference no. 11, 17, 18, 19, 20 and flow information. Also includes a study to watch foraging terns and plovers to determine foraging rates/distances. **Responsible Party:** Program. **Schedule:** analysis will occur near the end of the first increment when sufficient information has been collected through implementation of above referenced protocols and a protocol has been written to collect data on foraging terns and plovers.	$175,500	TP-4
		Whooping Cranes		
22	Monitor changes in quantity, quality, and distribution of **whooping crane** migrational habitat over time. Parameters will be defined using GIS protocols (covered by GIS)	**Description:** Analysis of information from whooping crane habitat use (ref no. 23) and the post-first increment land cover/use GIS layers (ref no. 8) to determine the spatial distribution of migrational habitat. **Responsible Party.** Program. **Schedule:** GIS Analysis will occur near the end of the first increment using ortho-rectified photos.	$0	WC-1, WC-2, WC-3, PP-1, WC-4

Ref. No.	Protocol/Activity	Description, Responsible Party, and Schedule	13 year Budget	CEM Hypotheses
23	Monitor **whooping crane migrational habitat use.**	**Description:** Document characteristics of use habitat, monitor activity at use sites and estimate an index of the amount of use. **Responsible Party:** Program. **Schedule:** Monitoring using this protocol begin in 2001. Monitoring will continue annual during the Program.	$2,632,500	WC-1, WC-2, WC-3, PP-1, WC-4
24	Monitor physical and structural characteristics of loafing, foraging, and roosting **whooping crane** migrational habitat (Covered by habitat use protocol)	**Description:** All whooping crane use areas are covered as part of Whooping Crane Use Monitoring Protocol, ref. No. 23. **Responsible Party:** Program. **Schedule:** Monitoring using this protocol begin in 2001. Monitoring will continue annual during the Program.	$0	WC-1, WC-2, WC-3,
25	Conduct thorough analyses of existing databases to update current understanding of **whooping crane** habitat use and behavior during migration (Currently being conducted by NGPC)	**Description:** Review of existing data related to whooping crane habitat used during migration. **Responsible Party:** NGPC **Schedule:** Complete. Report done by Jane Austin and Amy Richert (2001).	$0	WC-1, WC-2, WC-3, WC-4
26	Determine **whooping crane/tern/plover** habitat response to site-specific restoration activities. Species will be targeted by specific protocols.	**Description:** This study will analyze data collected from species use protocols to determine the relationship between the use of restored/managed areas (including management and restoration techniques) with flow data, land use/cover data (program land use), population data, and other data. **Responsible Party:** Program. **Schedule:** Monitoring and research activities will begin after Program restoration activities have been implemented.	$405,000	WC-1, WC-2, WC-3, WC-4, TP-1, TP-2, TP-3

Ref. No.	Protocol/Activity	Description, Responsible Party, and Schedule	13 year Budget	CEM Hypotheses
27	Determine factors affecting **whooping crane** distribution and habitat use in the central Platte River valley (Determined using monitoring data)	**Description:** This study will analyze data collected from whooping crane migrational use protocol (ref. no. 23) and other whooping crane use information to determine the relationship in spatial use patterns with flow data, Land use/cover data (program land use), and population data. **Responsible Party:** Program. **Schedule:** Analysis will occur near the end of the first increment after sufficient data have been collected through whooping crane use monitoring protocol, other studies, and as part of the GIS analysis.	$0	WC-1, WC-2, WC-3, WC-4
28	Determine relationships between river stage and wet meadow hydrology for **whooping crane** habitat	**Description:** This will be a more refined and site specific investigation on wet meadow hydrology based on information from the COHYST/other studies of wet meadows at various distances from the river. **Responsible Party:** Program. **Schedule:** Research will be conducted when suitable wet meadow sites are protected or restored on Program lands.	$135,000	WC-1, WC-2, WC-3, PP-4
29	Determine relationships between wet meadow hydrology and the physical, biological, and chemical composition of wet meadows for **whooping crane** habitat (i.e., wet meadow quality)	**Description:** Research was conducted on existing wet meadows within the central Platte region by the USGS. This research will augment the existing information on wet meadow quality issues in the Platte River associated habitat in combination with protocol 28. **Responsible Party.** Program **Schedule:** Research will be conducted when suitable wet meadow sites are protected or restored on Program lands	$1,000,000	PP-4, WC-1, WC-4
30	Determine relative importance, quality, quantity, and distribution of wet meadows and other semi-aquatic habitats to migrating **whooping cranes** in the central Platte valley.	**Description:** This study will analyze data collected from whooping crane migrational use protocol (ref. No. 23) to look at use (i.e., importance) of all habitat types. **Responsible Party.** Program. **Schedule:** Analysis will be conducted during the Program (e.g., near the end of the first increment) when sufficient data have been collected on whooping crane use.	$0	WC-1, WC-3
31	Determine the importance of **whooping crane** habitat along the central Platte River to the recovery of the species	**Description:** Program needs feedback on the relative importance of the Platte River when considered with all sites along the migrational corridor. **Responsible Party:** USFWS **Schedule:** On-going. Part of NAS review.	$0	WC-1, WC-4

Ref. No.	Protocol/Activity	Description, Responsible Party, and Schedule	13 year Budget	CEM Hypotheses
Pallid Sturgeon				
32	Quantification of **pallid sturgeon** habitats available in the lower Platte	**Description:** Identify the physical effects of subtly different rates of flow (stage and associated elements) over time on connection, construction, maintenance, and evolution of pallid sturgeon habitat components. Data need is pursuant to developing appropriate offsets for flow reductions stemming from implementation of the Program and New Depletion Plans. **Responsible Party:** Program. **Schedule:** Mapping will begin within the first few years of the Program.	$810,000	PS-1
33	Characterization of selected water quality parameters in the **lower Platte** and tributary contributions	**Description:** This study builds on current monitoring. Monitor the variation, both spatially and temporally of selected water quality parameters (e.g. temperature, turbidity, dissolved oxygen, and specific conductivity) in the lower Platte River as well as the relative contributions of the individual sub-basins to lower Platte water quality parameters using established methodologies. **Responsible Party:** Program. **Schedule:** Annual Monitoring beginning with Program implementation.	$491,400	PS-1, PS-2
34*	Quantification/modeling of **pallid sturgeon** habitats available in the lower Platte	**Description:** Identify and quantify the distribution of micro-habitat types available in the lower Platte River. **Responsible Party:** Program. **Schedule:** This effort is expected to be based on information gained in item 36 and review of other information.	$337,500	PS-1, PS-2
35	**Pallid sturgeon** existing information summary	**Description:** Assemble and summarize, where appropriate, the existing information on pallid sturgeon biology. This effort should encompass information gathered throughout the specie's range, but particular emphasis should be placed on information from the Platte River. **Responsible Party:** Program. **Schedule:** Review will be conducted within the first year of the Program.	$32,400	PS-1, PS-2, PS-3

Ref. No.	Protocol/Activity	Description, Responsible Party, and Schedule	13 year Budget	CEM Hypotheses
36	Micro- and macro-habitat use/selection by adult and juvenile **pallid sturgeon**, relative to conditions	**Description:** This study builds on current research to capture wild pallid sturgeon, implant transmitters, and track their movements upon release. This will allow the identification of micro- and macro-habitats, and habitat setting (e.g. position in relation to other channel features) used by wild pallid sturgeon in the lower Platte River and confluence area, as well as identify changes in habitat use relative to conditions. Established protocols may be incorporated and data transfer/sharing with Missouri River research will be facilitated. **Responsible Party:** Program. **Schedule:** Research will begin in first year of Program.	$2,623,050	PS-1
37*	**Pallid sturgeon** food habits	**Description:** This study builds on current research. Analyze stomach contents using non-lethal techniques. **Responsible Party:** Program. **Schedule:** This effort is expected to be based on information gained in item 36 and review of other information.	$24,300	PS-1
38*	Characterize the relationship of flow regime and sediment transport to habitat creation/ maintenance in the **lower Platte River**	**Description:** Investigate the relationship between flow regime and sediment transport to creation and maintenance of habitat in the lower Platte River. This effort should adapt and build on methodologies used by USGS and NGPC for efforts in the Platte River. **Responsible Party:** Program. **Schedule:** This effort is expected to be based on information gained in item 36 and review of other information.	$432,000	PS-1, PS-2
39*	**Pallid sturgeon** larval collection & identification of spawning habitat	**Description:** This study builds on current research. Larval pallid sturgeon should be collected using established protocols. Sampling will be targeted in areas of pallid sturgeon use as identified in item 36. Samples should be preserved in ethanol or other fixative that does not preclude DNA analysis, and sturgeon will be separated for DNA analysis. **Responsible Party:** Program. **Schedule:** This effort is expected to be based on information gained in item 36 and review of other information.	$1,048,950	PS-1

Ref. No.	Protocol/Activity	Description, Responsible Party, and Schedule	13 year Budget	CEM Hypotheses
40*	Characterize relationship between **central Platte and lower Platte** flows	**Description:** This item is listed here because it is part of the broader pallid sturgeon research plan, but the associated tasks will be addressed by the Water Management Committee. This is a refinement of the "Testing the Assumption" analysis. Refine the current analysis to be usable in real time and improve accuracy for use with refined habitat use knowledge gained through items 36, 37, 38 and 42. Refinements are expected within the first increment. **Responsible party:** Program. **Schedule:** This effort is expected to be based on information gained protocols idenified above and review of other information.	$0	PS-2
Other Species of Concern				
41	Monitor and evaluate the status of **other listed and non-listed species and other habitats** using existing information for throughout the region and through measurement on Program lands	**Description:** Protocol for proceedure to contact various agencies/groups and reporting on information on "other species of concern" in the study area to evaluate Program management and other activities. For Program lands protocols will be written to monitor the impact of Program management on other species of concern (e.g., neotropical migrants) **Responsible party:** Program. **Schedule:** Annual during the Program	$1,475,500	Other Species CEM's and Hypotheses not drafted
Database				
42	Design, implement, and maintain a **database** for long-term storage and retrieval of data and reports generated through monitoring and research activities	**Description:** Database design, requirements for implementation, and maintenance needs for a spatially referenced, internet accessable, quality assured and quality controled warehouse for datas collected during research and monitoring. **Responsible Party:** Program. **Schedule:** Ongoing during the Program.	$1,755,000	All

Ref. No.	Protocol/Activity	Description, Responsible Party, and Schedule	13 year Budget	CEM Hypotheses
Water Quality				
43	Design and implement a water quality monitoring program	**Description:** Design and implement a water quality monitoring program to augment existing local, State, and Federal water quality monitoring efforts in the region. Focus will be related to Program lands **Responsible Party:** Program. **Schedule:** Ongoing during the Program.	$475,000	All
	Grand Total		$30,006,275	

Table 2. List of Priority Hypotheses.

X-Y Graph number	Link to CEM Hypotheses	Description of hypothesis	Description of alternative/competing hypotheses	Rationale based on Prioritization Criteria
System				
S1	S-1, S-2	The Platte River form can be modified by either mechanical/sediment/flow management (i.e., clear/level/ pulse) or mechanical means along with non-Program managed flows (i.e., clear/level/mechanical).		Influence Program management, goals, and objectives
S1a	S-1, S-2, S-4	Program channel habitat restoration actions will result in detectable change to Platte River form and function	Can not detect a significant effect on indicators	Influence Program management, goals, and objectives
S1b	S-3	Program land management actions (i.e., restoration into habitat complexes) will have a detectable effect on target birds species use of the associated habitats	Can not detect a significant effect on indicators	Influence Program management, goals, and objectives
S1c	S-1, S-2	Program actions will increase functional wet meadows in habitat complexes during the first increment		Influence Program management, goals, and objectives
S2	S-1, S-2	Implementing Program land and water management actions (i.e., habitat complexes and clear/level/pulse) will have a detectable effect on other species use of the associated habitats	Within the overall management objectives for whooping crane, terns and plovers, and pallid sturgeon, benefits can be provided to non-target listed species and non-listed species of concern thereby reducing the likelihood of future listing and improve overall ecosystem diversity.	Influence Program management, goals, and objectives

X-Y Graph number	Link to CEM Hypotheses	Description of hypothesis	Description of alternative/competing hypotheses	Rationale based on Prioritization Criteria
Terns and Plover				
T1	TP-1, TP-2, TP-3	Additional bare sand habitat will increase the number of adult least terns.	bare sand is not currently limiting number of adults	Critical path for Program goals and objectives
T2	TP-4	Tern productivity is related to the number of prey fish (<3 inches) and fish numbers limit tern production below 800 cfs from May-Sept.	prey fish do not limit tern production at 799 cfs or tern production is limited by summer flows of < 50 cfs	On critical path for Program, will influence future water management
T2a	TP-4	Flow rates influence the number and species diversity in tern prey base (fish).	tern productivity not affected by fish community species diversity	On critical path for Program, will influence future water management
P1	TP-1, TP-2, TP-3	Additional bare sand habitat will increase the number of adult piping plover.	bare sand is not currently limiting number of adults	Critical path for Program goals and objectives
P2	TP-4	Plover productivity is related to the number of suitable macroinverts and macroinverts limit plover production below 800 cfs from May-Sept.	macroinverts do not limit plover production at 799 cfs or plover production is limited by summer flows of < 50 cfs	On critical path for Program, will influence future water management
TP 1	TP-2	Interaction of river and sandpit habitat.	LT and PP show no preference for the river over sandpits	Address areas of disagreement
TP 2	TP-1, TP-2, TP-3	The central Platte River may act as a source or sink for terns and plovers.	currently not a sink	Will be addressed through current monitoring effort
TP 4d	TP-1, TP-2	Correlation between river island habitat and flow.		Address areas of disagreement, potential impacts to Program management
TP 5	TP-1	Use of riverine islands by least terns and piping plovers will increase with active channel width.	use will not increase with channel width	Will influence Program management
Whooping Cranes				
WC 1	WC-1, WC-2, WC-3	Whooping Crane use will increase as function of Program land and water management activities.	Whooping Crane use will not increase as function of Program land and management activities.	Influences Program management

X-Y Graph number	Link to CEM Hypotheses	Description of hypothesis	Description of alternative/competing hypotheses	Rationale based on Prioritization Criteria
WC 3	WC-1, WC-2, WC-3	Whooping crane use is related to habitat suitability.The prediction of habitat suitability for whooping crane in channel habitat as a function of water depth (preferred depth?) and channel width (define as wetted width, open width other?)	WC use of areas is not directly linked to FWS habitat suitability values	Influences Program management and Program goals and objectives
WC 4	WC-3	Whooping crane use of the central Platte River study area will increase proportionally to an increase in wet meadows	WC do not use wet meadows currently and are unlikely to respond to increases in wet meadow area	Influence Program goals and objectives
WC 5	WC 4	Whooping cranes are adversely affected by nocturnal disturbances that lead to flushing (walking or flying) which could lead to potential mortality.	WC are not negatively impacted by nocturnal disturbances	High degree of disagreement
Pallid Sturgeon				
PS-1	PS-1, PS-2	Program flow/sediment management will result in a positive species response by the pallid sturgeon in the lower Platte River.	Program flow/sediment management will result in no increase in species use/occurrence by the pallid sturgeon in the lower Platte River.	Influences Program management and Program goals and objectives
PS-2	PS-2	Program water management will result in measurable changes on flow in the lower Platte River.	Program water management will result in statistically insignificant changes on flow in the lower Platte River	Influences Program management and Program goals and objectives
PS-4	PS-1, PS-2	Flows in the lower Platte will affect pallid sturgeon habitat suitability.	Flows in the lower Platte River will have no effect on pallid sturgeon habitat suitability	Influences Program management and Program goals and objectives
PS-5	PS-1	Pallid sturgeon habitat suitability is maximized between water temperatures of X and Y in the lower Platte River.	pallid sturgeon use is independent of river water temperature	Influences Program management and Program goals and objectives

X-Y Graph number	Link to CEM Hypotheses	Description of hypothesis	Description of alternative/competing hypotheses	Rationale based on Prioritization Criteria
PS-6	PS-1, PS-2	Increasing flow in the lower Platte will affect pallid sturgeon habitat availability.	increasing flow in the lower Platte River will have no effect on pallid sturgeon habitat availability	Influences Program management and Program goals and objectives
PS-7	PS-1	Increasing habitat availability in the lower Platte will increase pallid sturgeon use.	pallid sturgeon use is independent of lower Platte River habitat availability	Influences Program management and Program goals and objectives
PS-9	PS-2	Increasing Program flow releases will decrease water temperatures in the lower Platte River.	River water temperature is independent of flow rate in the lower Platte River Increases in program flow releases will increase water temperatures on the lower Platte River	Influences Program management and Program goals and objectives
PS-11	PS-3	Non-Program actions (e.g., harvest, stocking, Missouri River conditions) determine the occurrence of pallid sturgeon in the lower Platte River	Program actions will affect the rate of occurrence of pallid sturgeon in the lower Platte River such that use is disproportionate to external factors (e.g., stocking, harvest, local conditions) relative to local population.	Influences Program management and Program goals and objectives
Physical Processes - Flow				
Flow #1	PP-1	Increasing the variation between river stage at peak (indexed by Q1.5 flow at Overton) and average flows (1,200 cfs index flow), by increasing the stage of the peak (1.5-yr) flow through Program flows, will increase the height of sand bars between Overton and Chapman by 30% to 50% from existing conditions.	Flow magnitudes and channel compilations are insufficient to generate bars high enough to provide habitat for LT and PP. Bars may quickly vegetate making them poor habitat for target species. Bars can be created/maintained by mechanical/other means.	Fundamental to testing the Flow, sediment, mechanical strategy

X-Y Graph number	Link to CEM Hypotheses	Description of hypothesis	Description of alternative/competing hypotheses	Rationale based on Prioritization Criteria
Flow #3	PP-1	Increasing 1.5-yr Q with Program flows will increase local boundary shear stress and frequency of inundation at existing green line (elevation at which riparian vegetation can establish). These changes will increase riparian plant mortality along margins of channel, raising elevation of green line. Raised green line = more exposed sandbar area and wider unvegetated main channel.	Insufficient Program flows to adequately increase shear stress on banks. Plant mortality can be achieved by other means.	Fundamental to testing the Flow, sediment, mechanical strategy
Flow #4	PP-1	Annual riparian seedling mortality greater than 90% is required to prevent riparian encroachment on exposed bars, thereby increasing (maintaining at least 10 acres/mile) exposed bars between Overton and Grand Island that are usable as LT and PP habitat.	Riparian seedling mortality greater than 90% is needed to increase exposed bar area. Other factors drive exposed bar area instead of seedling mortality. Plant mortality can be achieved by other means.	Fundamental to testing the Flow, sediment, mechanical strategy
Flow #5	PP-1	Increasing magnitude and duration of a 1.5-yr flow will increase riparian plant mortality along the margins of the river. There will be different relations (graphs) for different species.	Insufficient Program flows to maintain required flow durations. Plant mortality can be achieved by other means.	Fundamental to testing the Flow, sediment, mechanical strategy

X-Y Graph number	Link to CEM Hypotheses	Description of hypothesis	Description of alternative/competing hypotheses	Rationale based on Prioritization Criteria
Physical Processes - Sediment				
Sediment #1	PP-2	Average sediment augmentation nr Overton of 185,000 tons/yr under existing flow regime and 225,000 tons/yr under Governance Committee proposed flow regime achieves a sediment balance to Kearney.	Augmentation greater than or less than 225,000 tons/year is needed to balance the sediment budget and increase exposed bar area. There is no sediment imbalance. Exposed bar area or occurrence of braiding will not be affected by increased sediment. Sediment balance is insignificant except in local instances. Satisfactory bar areas can be created and maintained through strictly mechanical actions.	Fundamental to testing the Flow, sediment, mechanical strategy
Sediment #2	PP-2	A balanced sediment budget (sediment augmentation of 225,000 tons/year near Overton under proposed Governance Committee flows) when implemented with mechanical actions (channel consolidation & widening) in anastomosed reaches will promote braided channel morphology with an average braiding index in the main channel of greater than 3.	Flows and sediment augmentation are insufficient to achieve desired braiding index.	Fundamental to testing the Flow, sediment, mechanical strategy
Sediment #3	PP-2	Increasing the average braiding index of the main channel by achieving a balanced sediment budget, increases the active unvegetated width of the main channel at an index flow of 2,000 cfs(at Overton).	Width will not change with increasing braiding index	Fundamental to testing the Flow, sediment, mechanical strategy

X-Y Graph number	Link to CEM Hypotheses	Description of hypothesis	Description of alternative/competing hypotheses	Rationale based on Prioritization Criteria
Sediment #4	PP-2	Increasing the average braiding index to greater than 3 for the main channel in the sediment deficient reach near Overton will increase and maintain exposed bar area greater than 1.5 acres in the reach between Overton and Kearney at an index flow of 1,200 cfs (at Overton).	There is no relationship between braiding index and area of exposed bars. Exposed bars may be created (maintained) through mechanical means without need to change braiding index.	Fundamental to testing the Flow, sediment, mechanical strategy
Physical Processes - Mechanical				
Mechanical #2	PP-3	Increasing the Q1.5 in the main channel by consolidating 85% of the flow, and aided by Program flow and a sediment balance, flows will exceed stream power thresholds that will convert main channel from meander morphology in anastomosed reaches, to braided morphology with an average braiding index > 3.	Higher stream power (higher 1.5 yr Q and/or more consolidation of side channels) needed to convert channel to braided morphology. Lower stream power will convert channel to braided morphology	Fundamental to testing the Flow, sediment, mechanical strategy
Mechanical #3	PP-3	Reducing the number of channels in a transect to 3 or less <u>under balanced sediment budget</u> will convert anastomosed reaches of the Platte River between Overton and Chapman to a braided channel morphology. With proposed flow regime, should occur with greater number of channels	Reducing the number of channels in a transect to 1 or 2 is necessary to achieve an average braiding index in the main channel of greater than 3.	Fundamental to testing the Flow, sediment, mechanical strategy

X-Y Graph number	Link to CEM Hypotheses	Description of hypothesis	Description of alternative/competing hypotheses	Rationale based on Prioritization Criteria
Mechanical #4	PP-3	Increasing the average braiding index to greater than 3 in the main channel by channel manipulation will promote in the Platte River at the mechanically changed sites a total main channel wetted width exceeding 500 to 750 ft at an index flow of 1,700 cfs (at Overton).	A braiding index greater then 4 is needed to achieve a width greater than 500 ft There is no relation between braiding index and channel width	Fundamental to testing the Flow, sediment, mechanical strategy
Mechanical #5	PP-3	Increasing the average braiding index to greater than 3 for the main channel by mechanical channel manipulation, will increase and maintain exposed bar area greater than 1.5 acres at mechanical changed sites at an index flow of 1,200 cfs (at Overton).	Mechanically consolidating flows will have no effect on areal extent of bars.	Fundamental to testing the Flow, sediment, mechanical strategy
Wet Meadows				
WM-2	PP-4	Wet meadows producing the optimum productivity and diversity of macro-invertebrates potentially consumed by WC exhibit certain characteristic combinations of soils, hydrology, size and location. Mormon Island and adjacent to Rowe Sanctuary have some of best existing combinations	There are too many possible combinations of site characteristics to allow for a meaningful characterization of “desirable” conditions.	Basic information need to evaluate what conditions in wet meadows are important for productivity that is meaningful to WC use, Help inform what sites to acquire and/or protect/restore.
WM-3	PP-4	Shallow surface water and groundwater in March and April support high productivity and diversity of macroinvertebrates as potential food sources to WC in wet meadows.		Basic information need to evaluate what conditions in wet meadows are important for productivity that is meaningful to WC use, Help inform what sites to aquire and/or protect/restore.

X-Y Graph number	Link to CEM Hypotheses	Description of hypothesis	Description of alternative/competing hypotheses	Rationale based on Prioritization Criteria
WM-4	PP-4	A predominance of organic-rich soils supports the productivity and diversity of macro-invertebrates as potential WC food sources in bottomland grasslands.	Wet meadows and their soils are too complex and variable to allow this individual factor to be effectively assessed.	Basic information need to evaluate what conditions in wet meadows are important for productivity that is meaningful to WC use, Help inform what sites to acquire and/or protect/restore.
WM-8a	PP-4	As the spring depth to groundwater increases, surface soils stay frozen longer. Where groundwater is closer to the surface soils thaw sooner.		Each site will respond to river channel stage uniquely, this hypothesis is a prerequisite to many of the other hypotheses (if there is no response from program actions, it becomes less important)

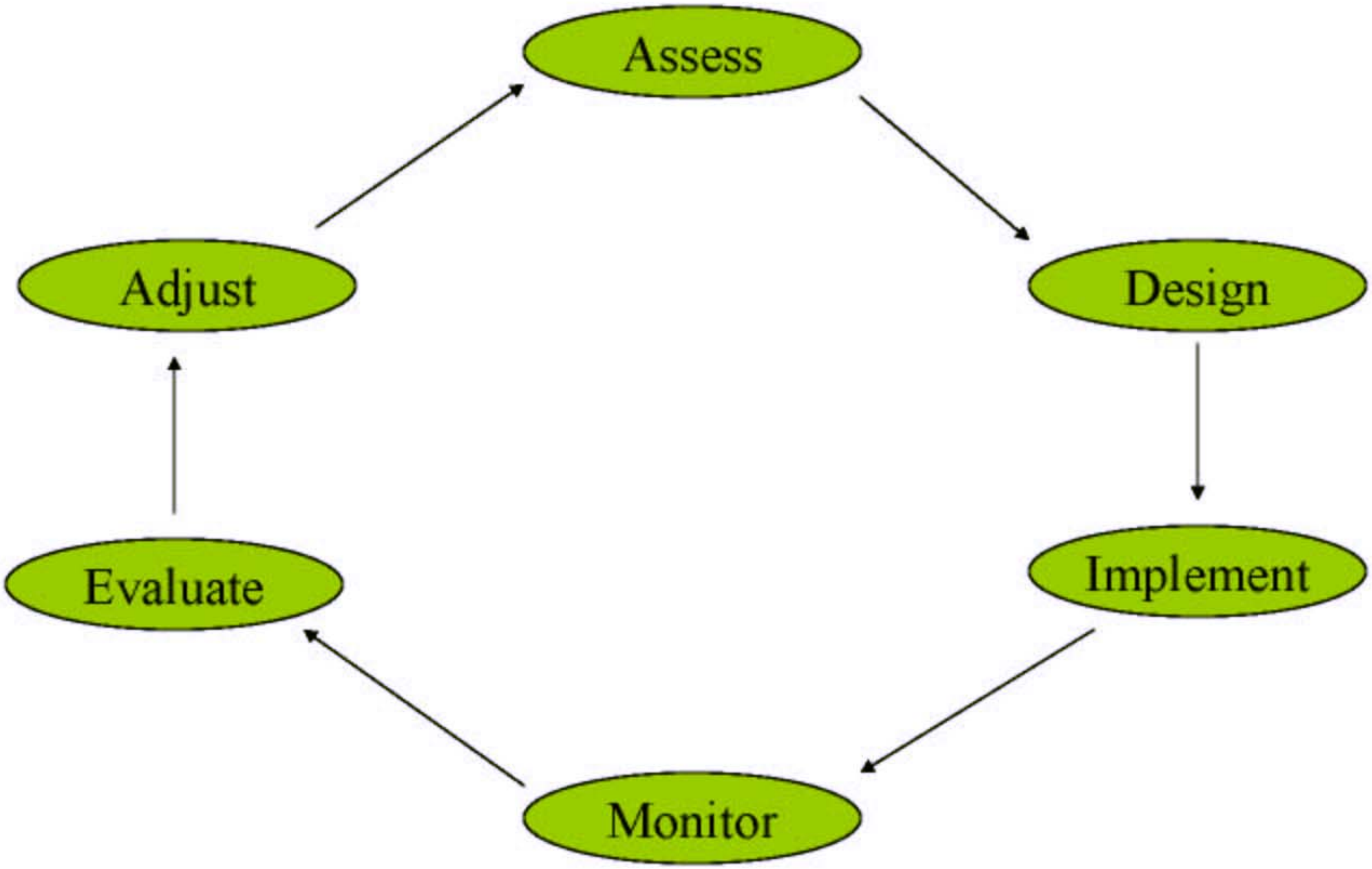


Figure 1a. Six steps of adaptive management (Nyberg 1999).

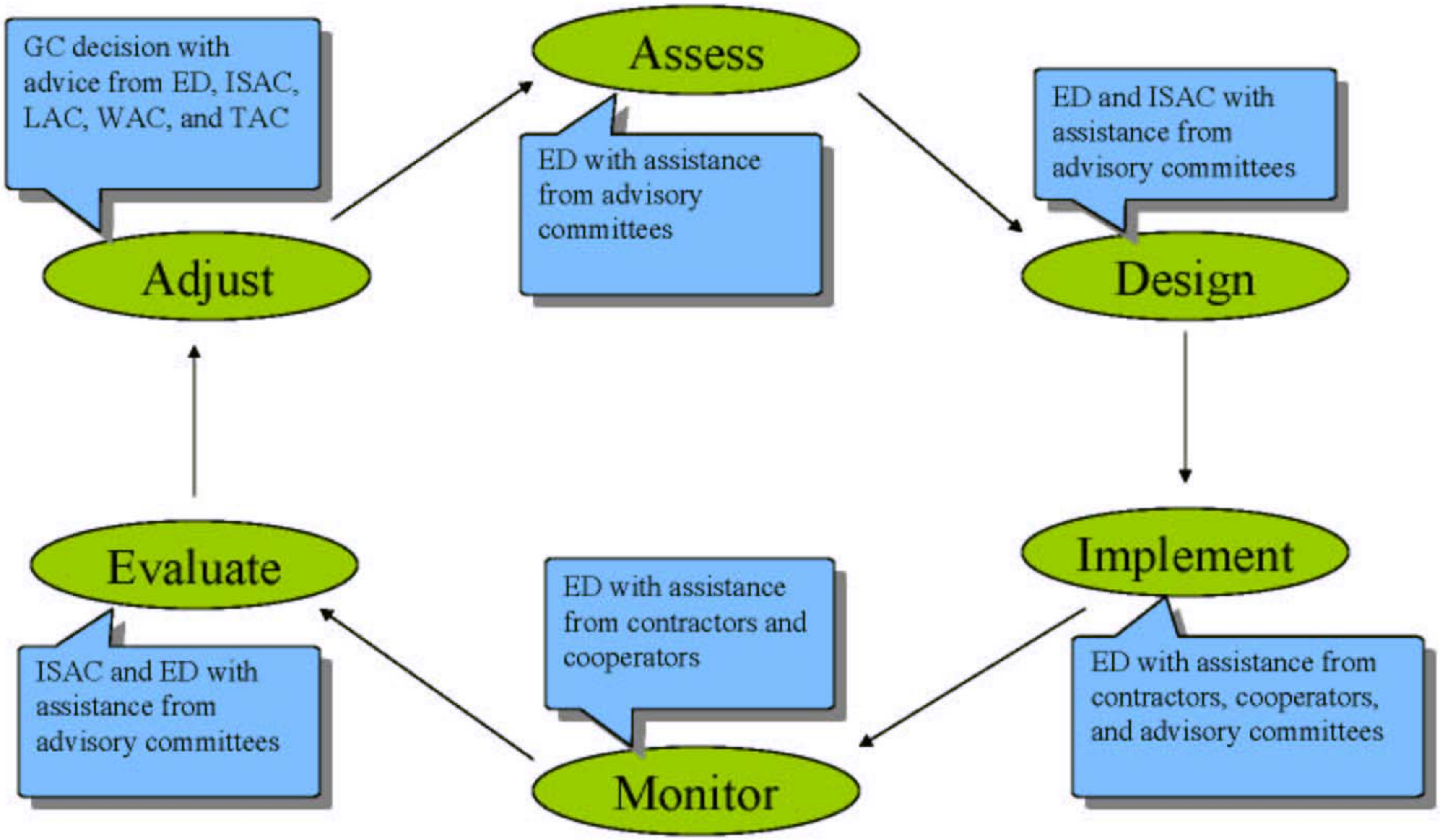


Figure 1b. Six steps of adaptive management and task assignments for the Program (modified from Nyberg 1999)

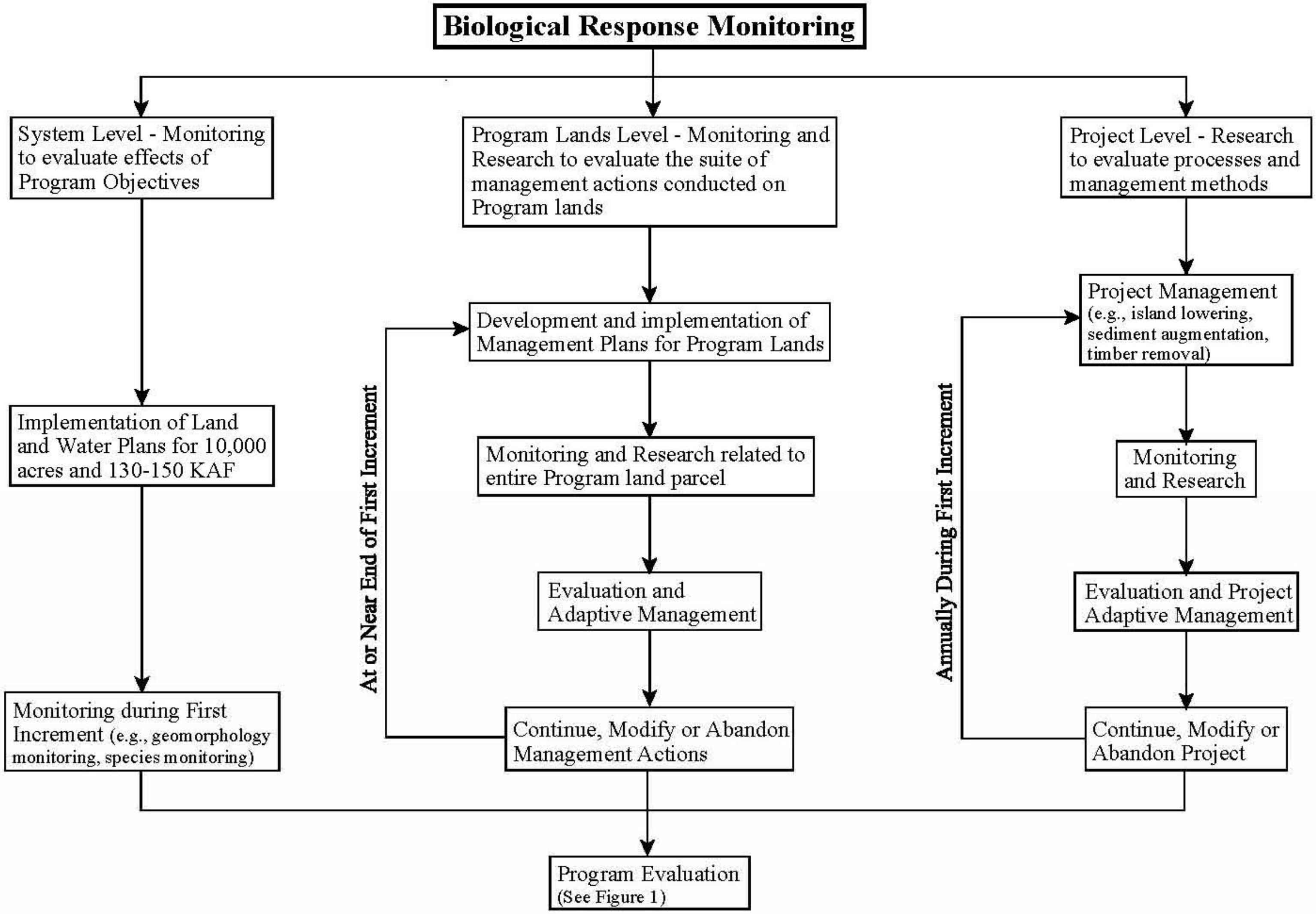


Figure 2. Biological response monitoring and adaptive management during Program

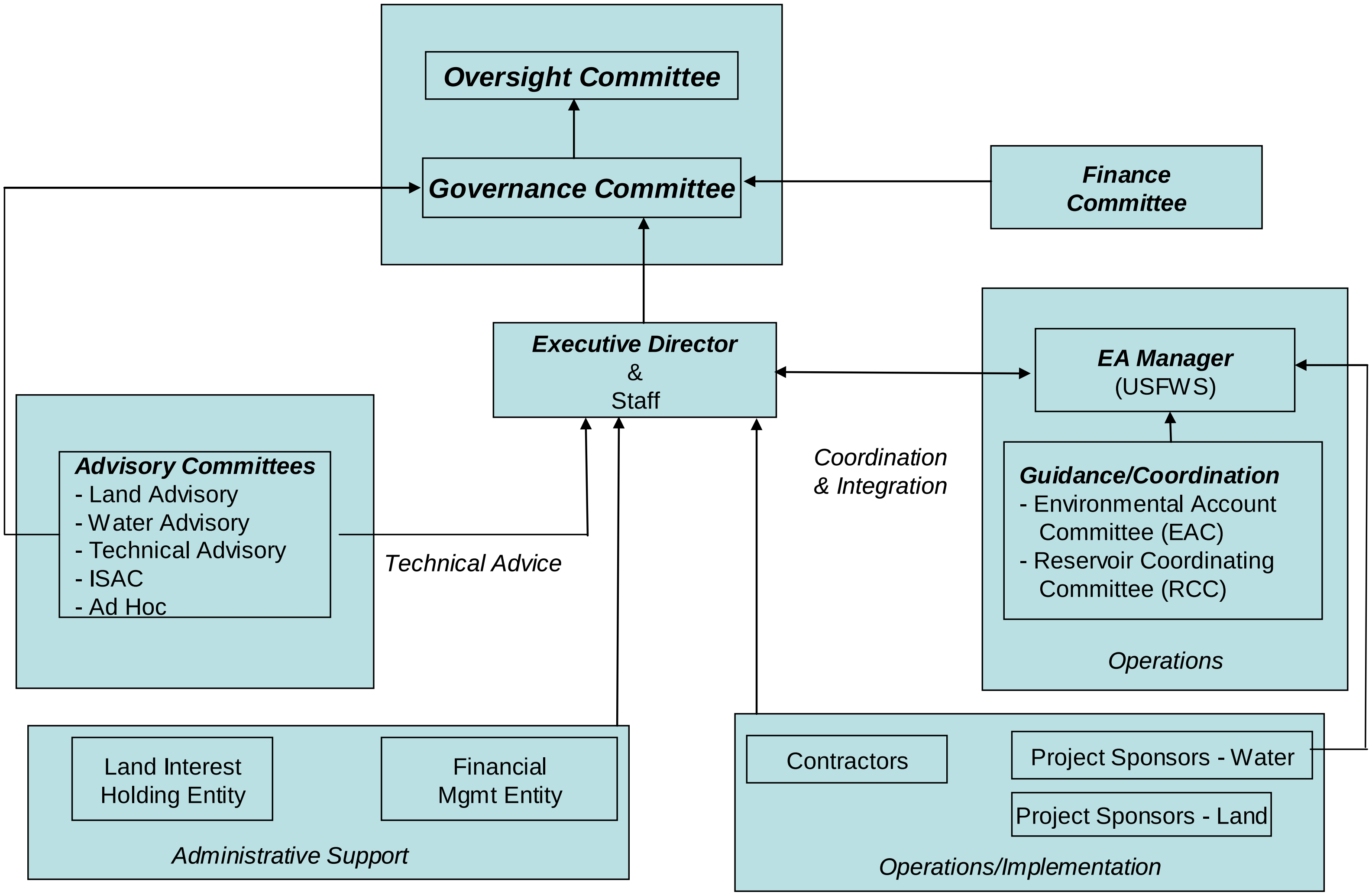


Figure 3. Figure from Organizational Structure Document.

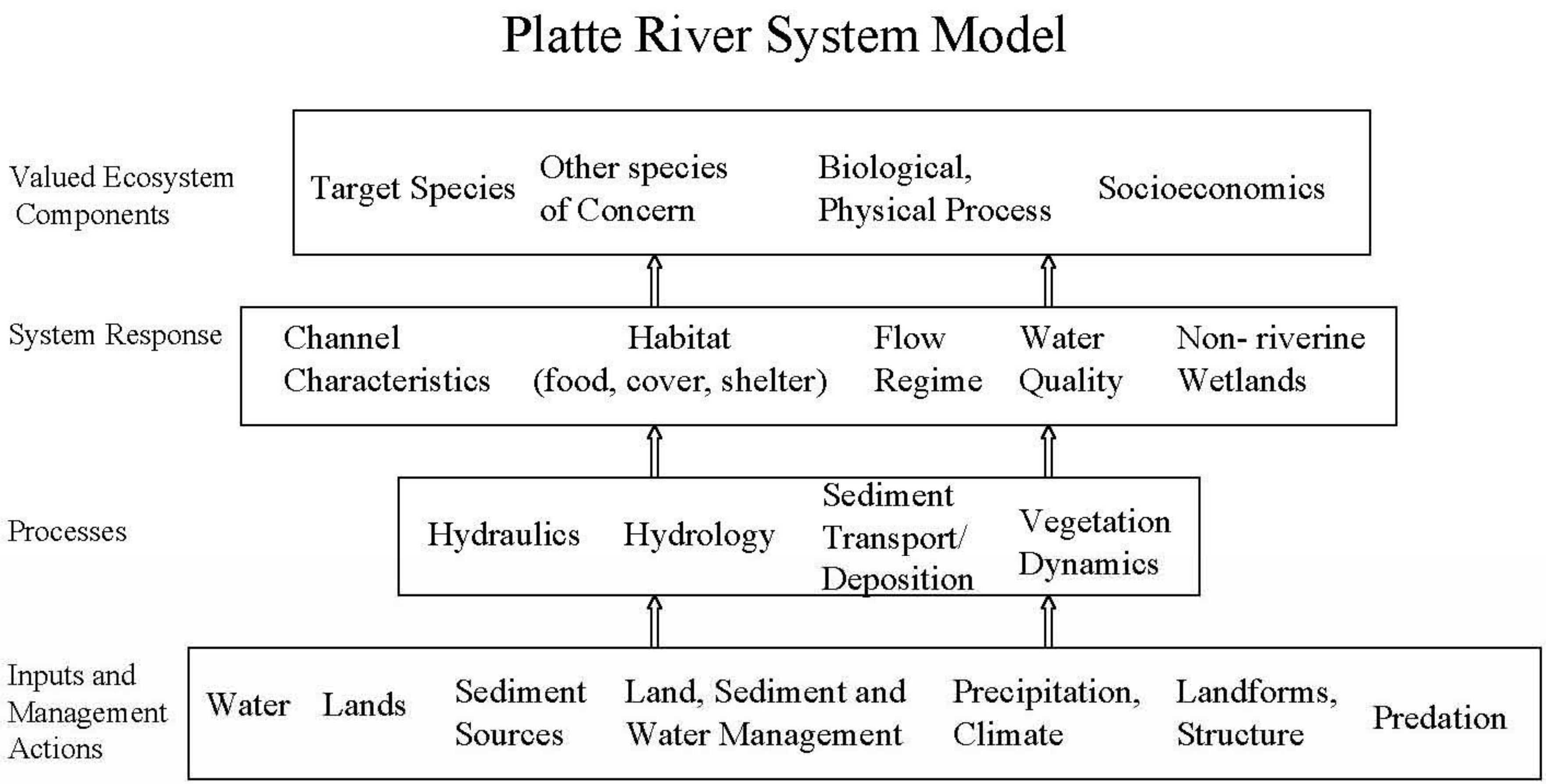


Figure 4. Platte River system conceptual ecological model.

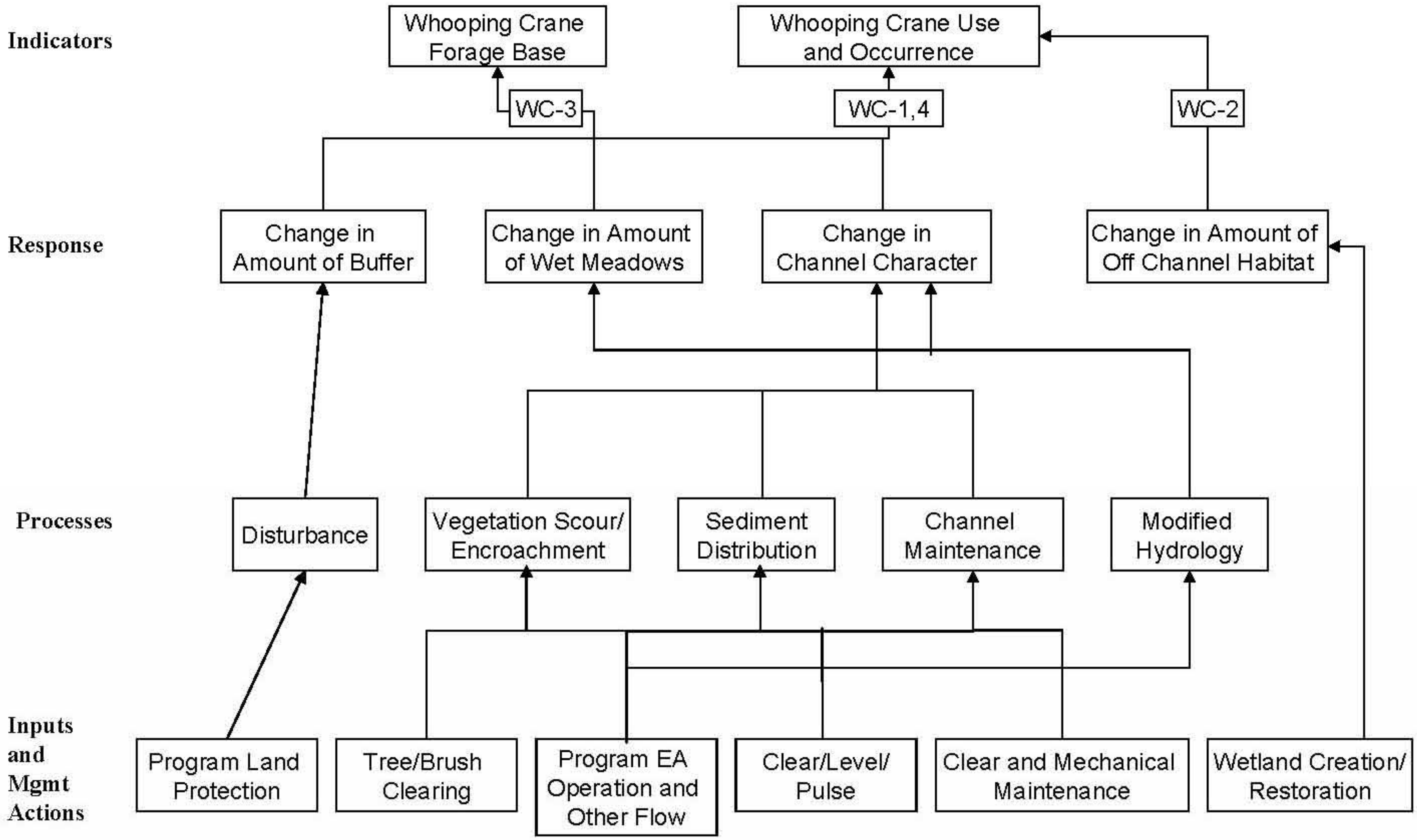


Figure 5. Whooping crane conceptual ecological model (including example locations for current hypotheses).

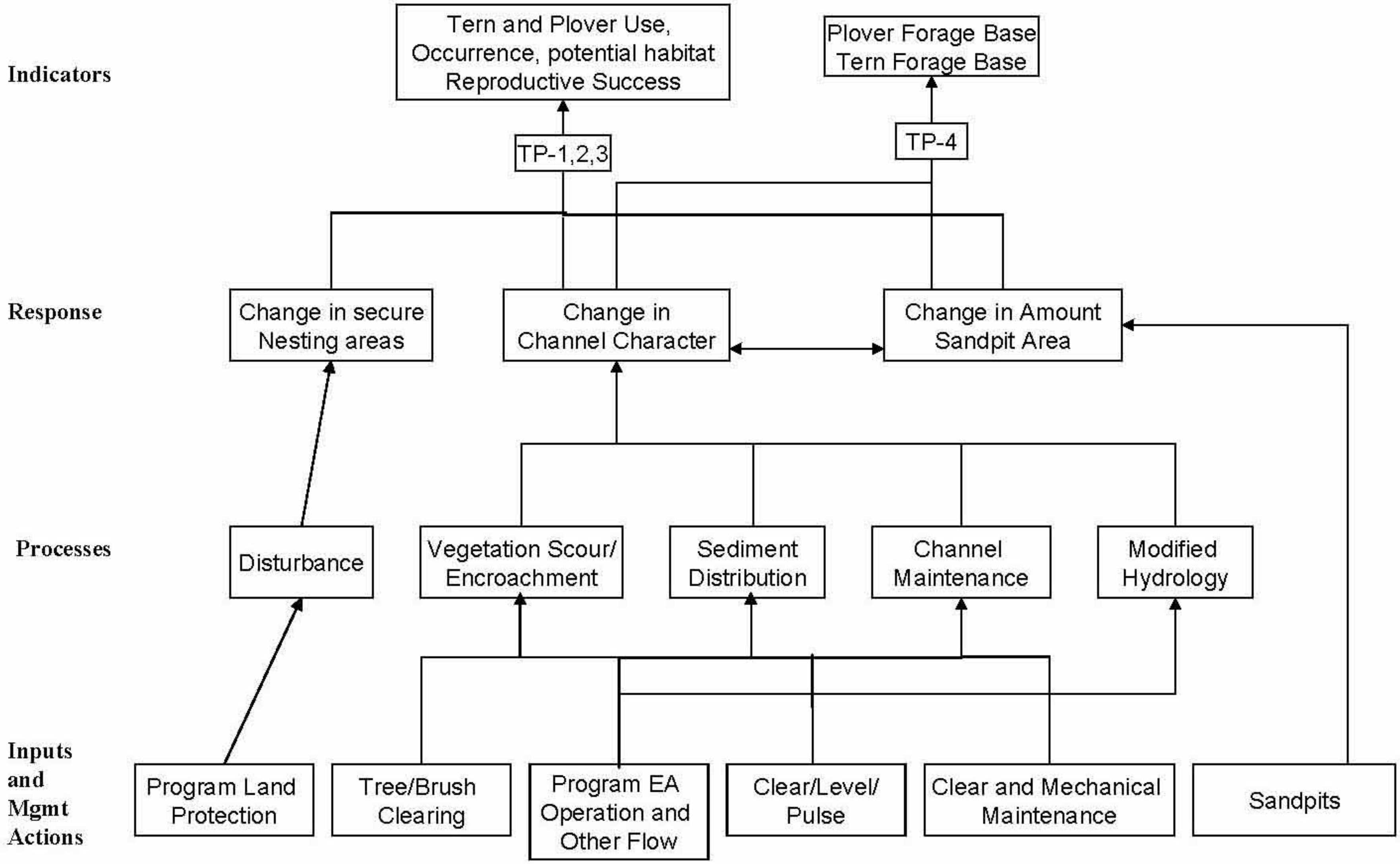


Figure 6. Least tern and piping plover conceptual ecological model (including example locations for current hypotheses).

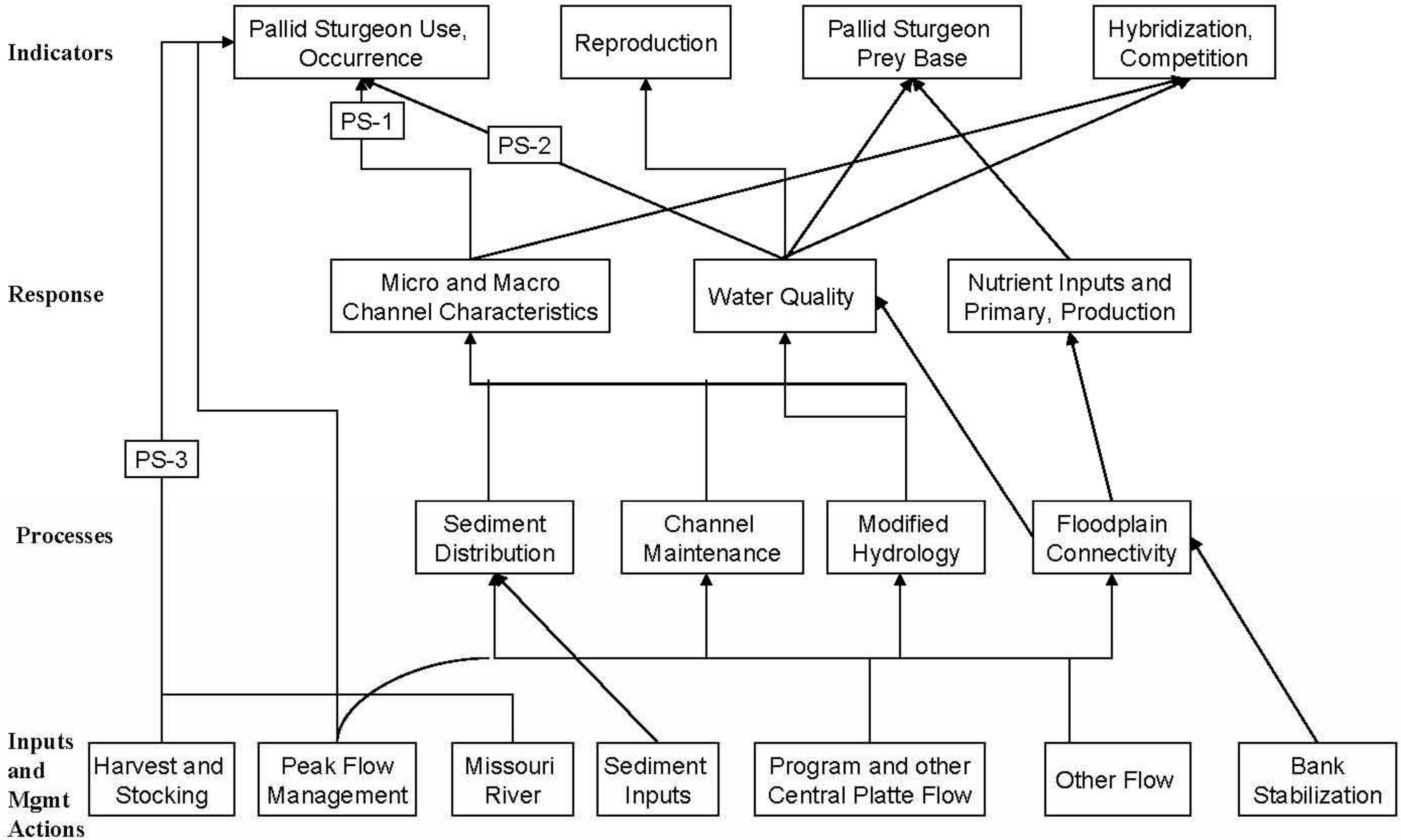
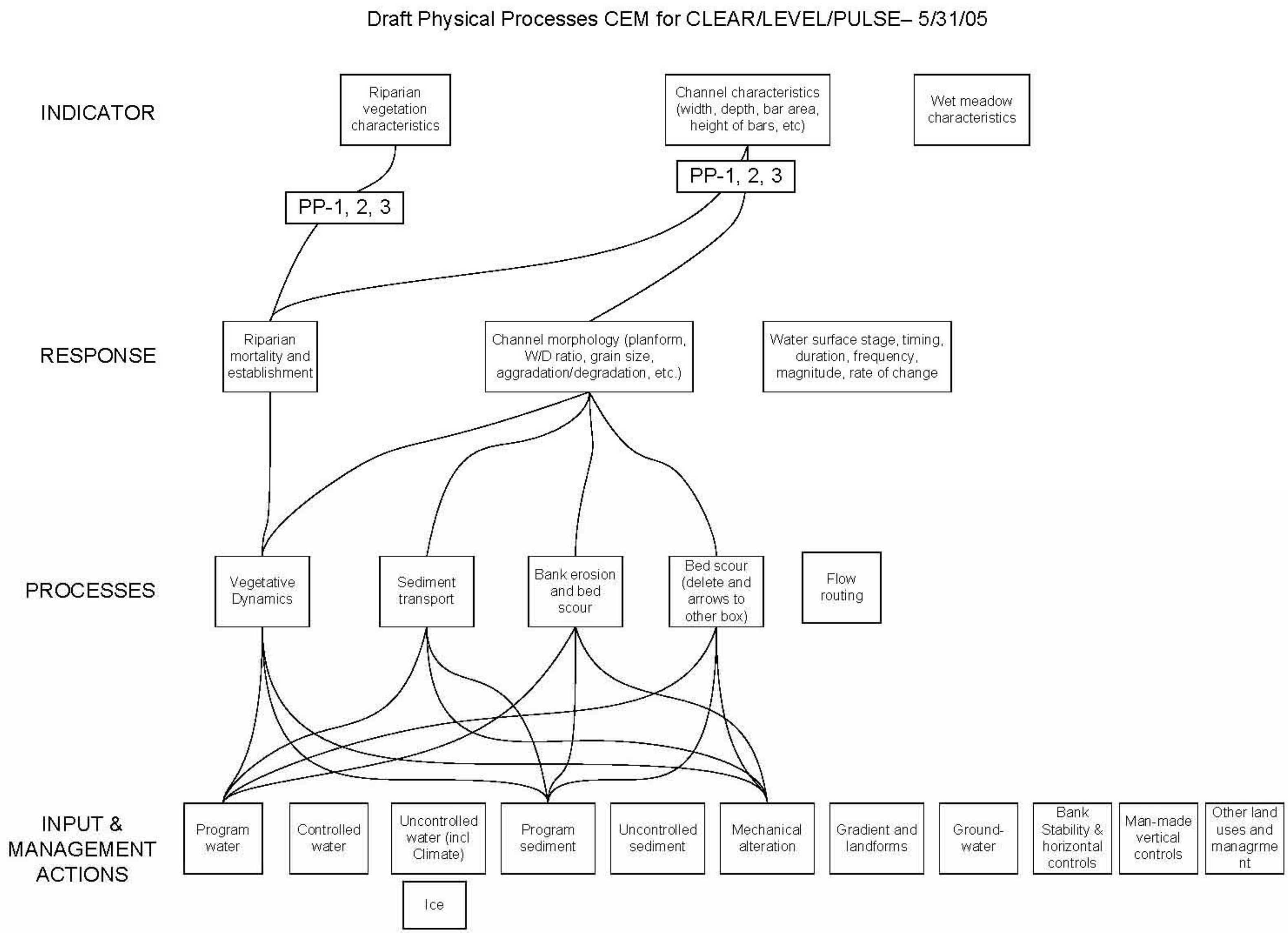


Figure 7. Pallid sturgeon conceptual ecological model (including example locations for current hypotheses).



NOTE: The lines illustrate priority hypothesized linkages; however, a complete set of hypothesized interactions is too complex to illustrate here.

Figure 8. Flow-sediment-mechanical CEM

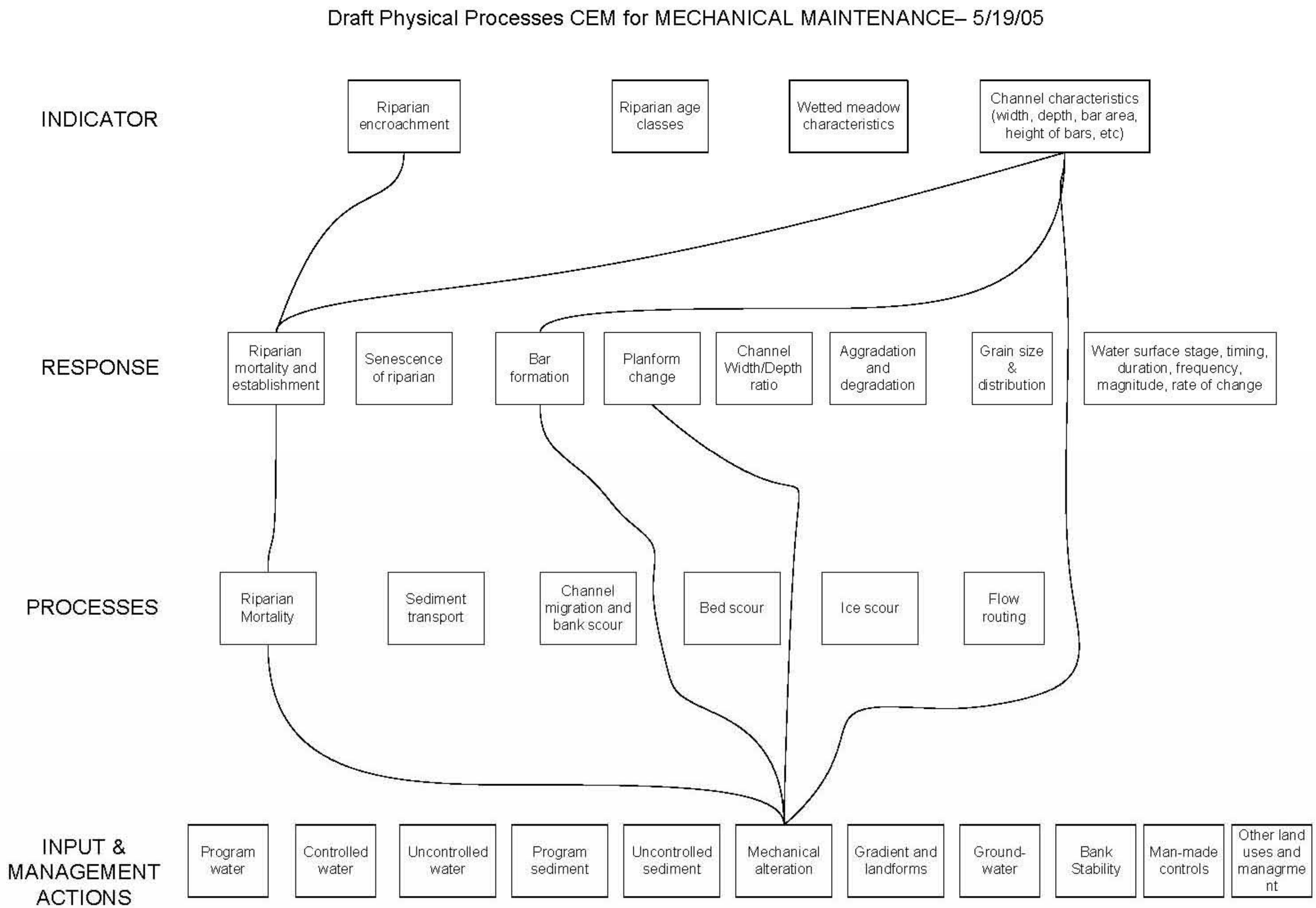


Figure 9. Mechanical creation and maintenance CEM

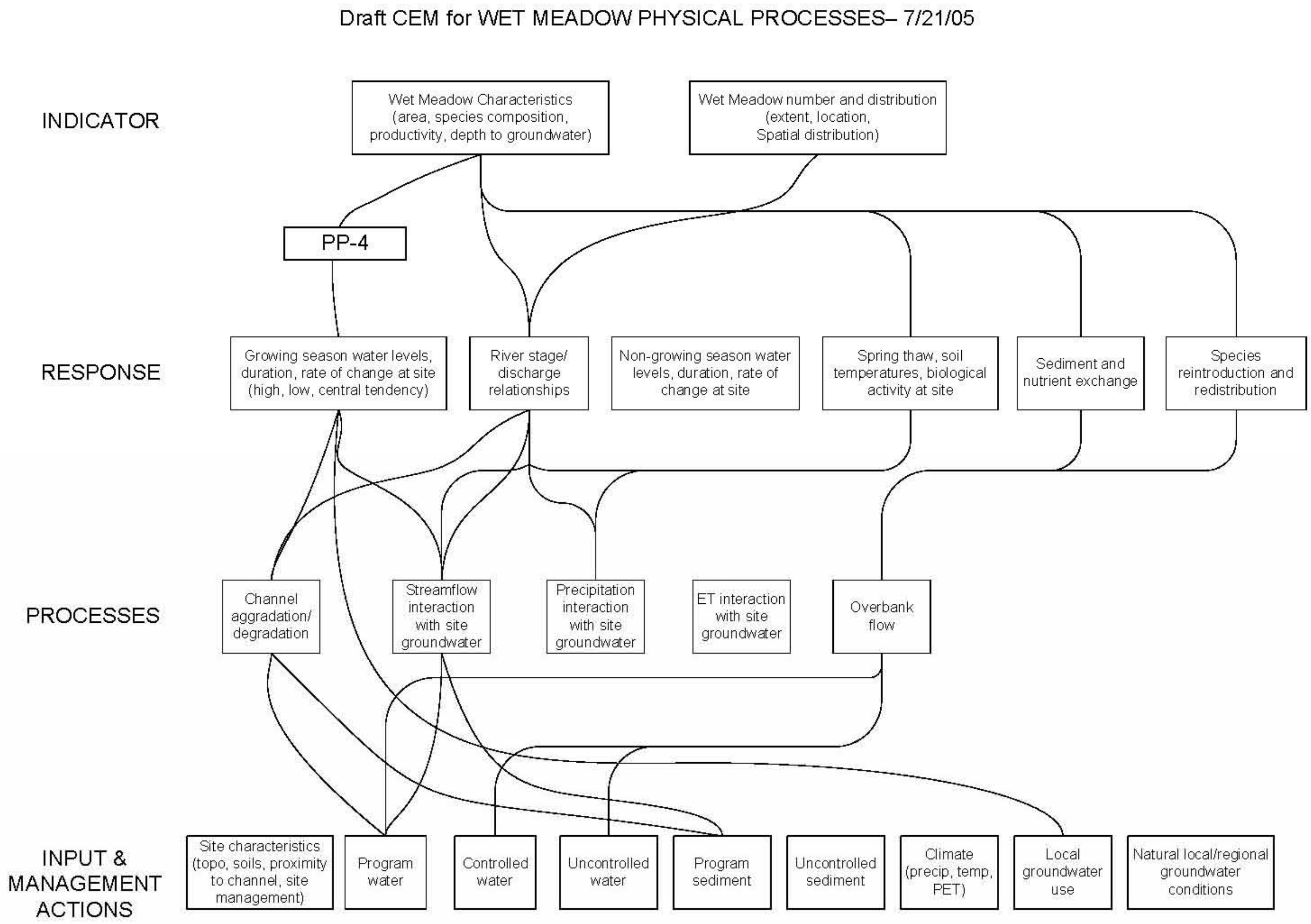


Figure 10. Wet meadow CEM

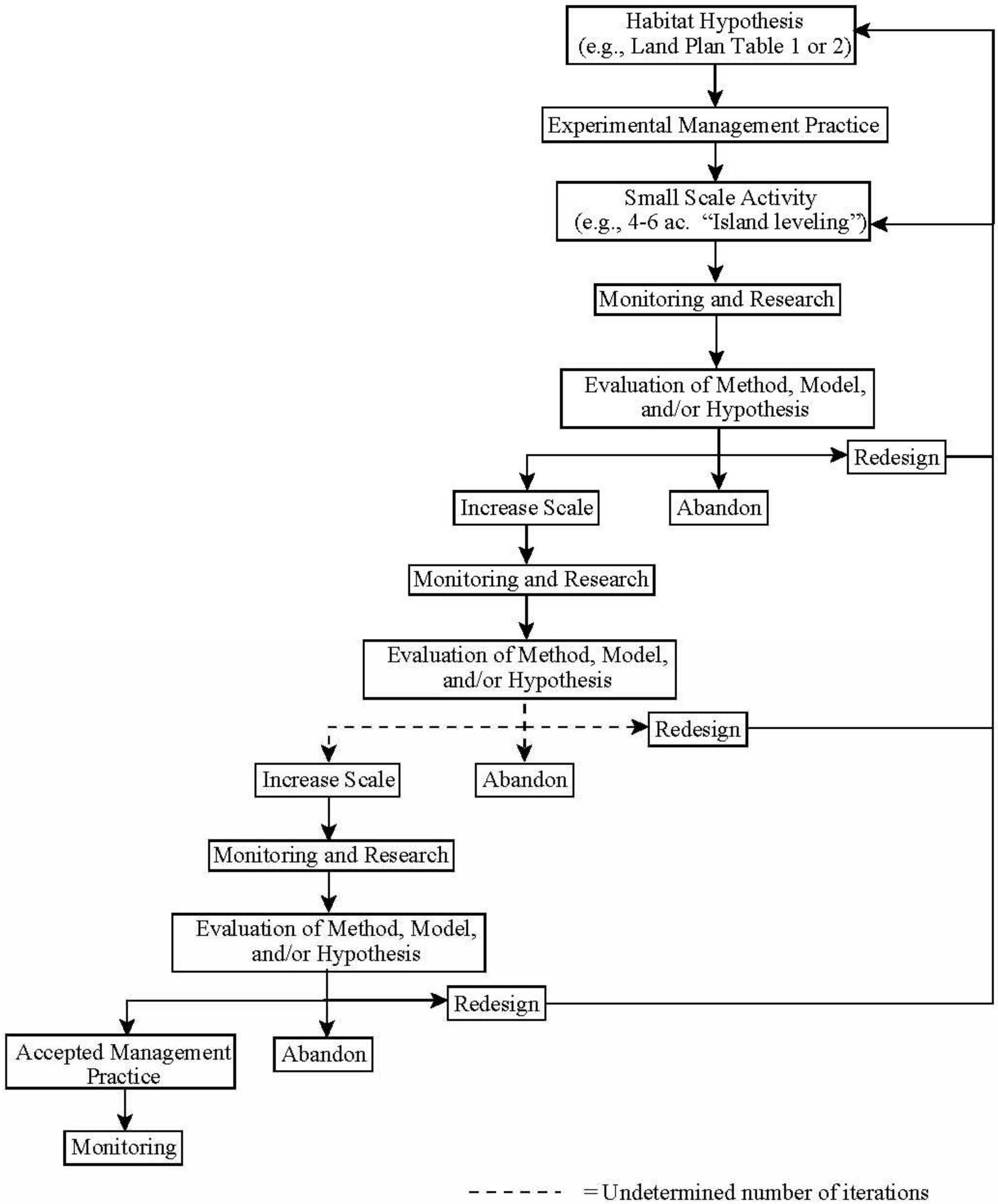


Figure 11. Example adaptive management process with stair step approach

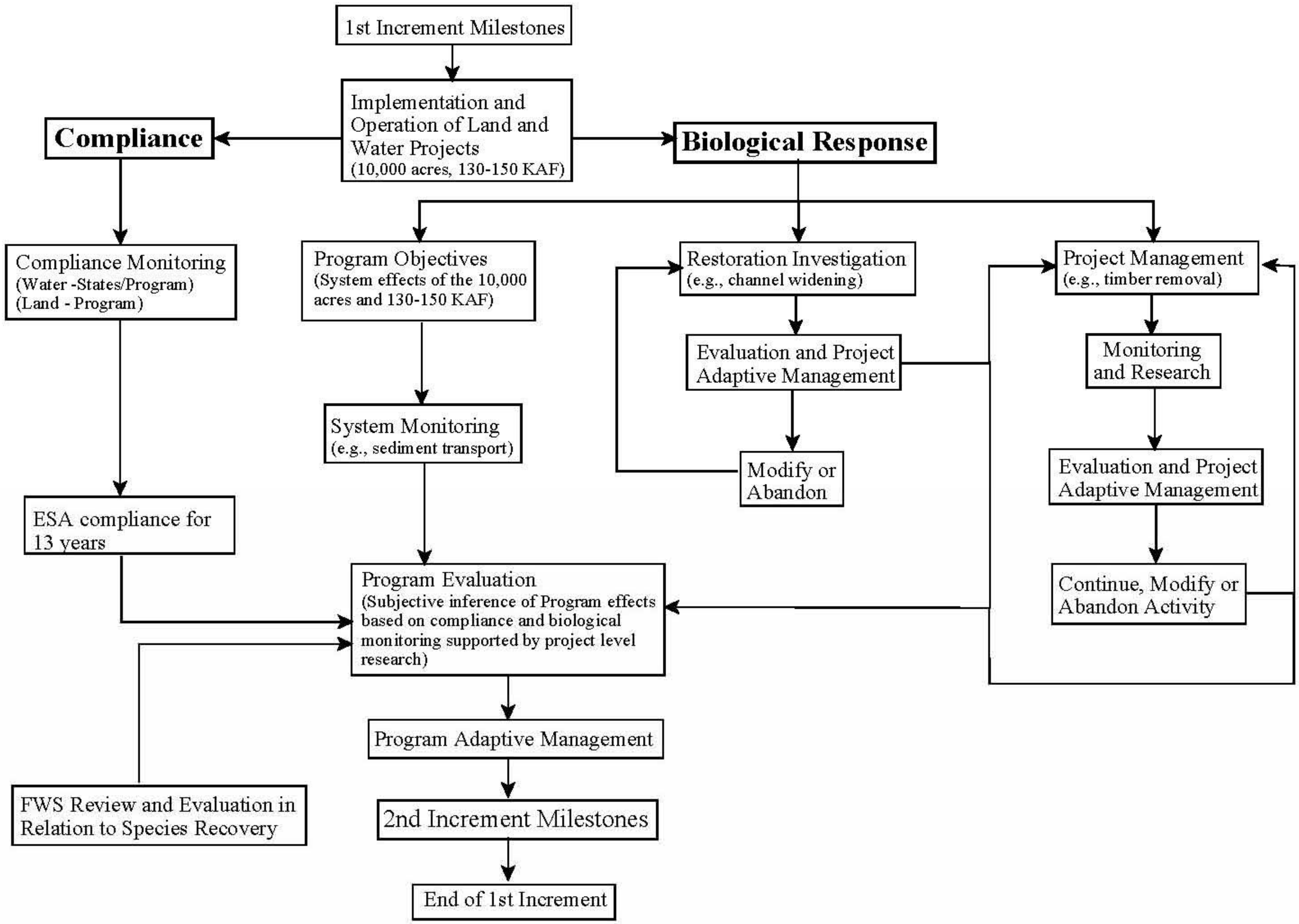


Figure 12. Compliance monitoring and biological response monitoring for the Program

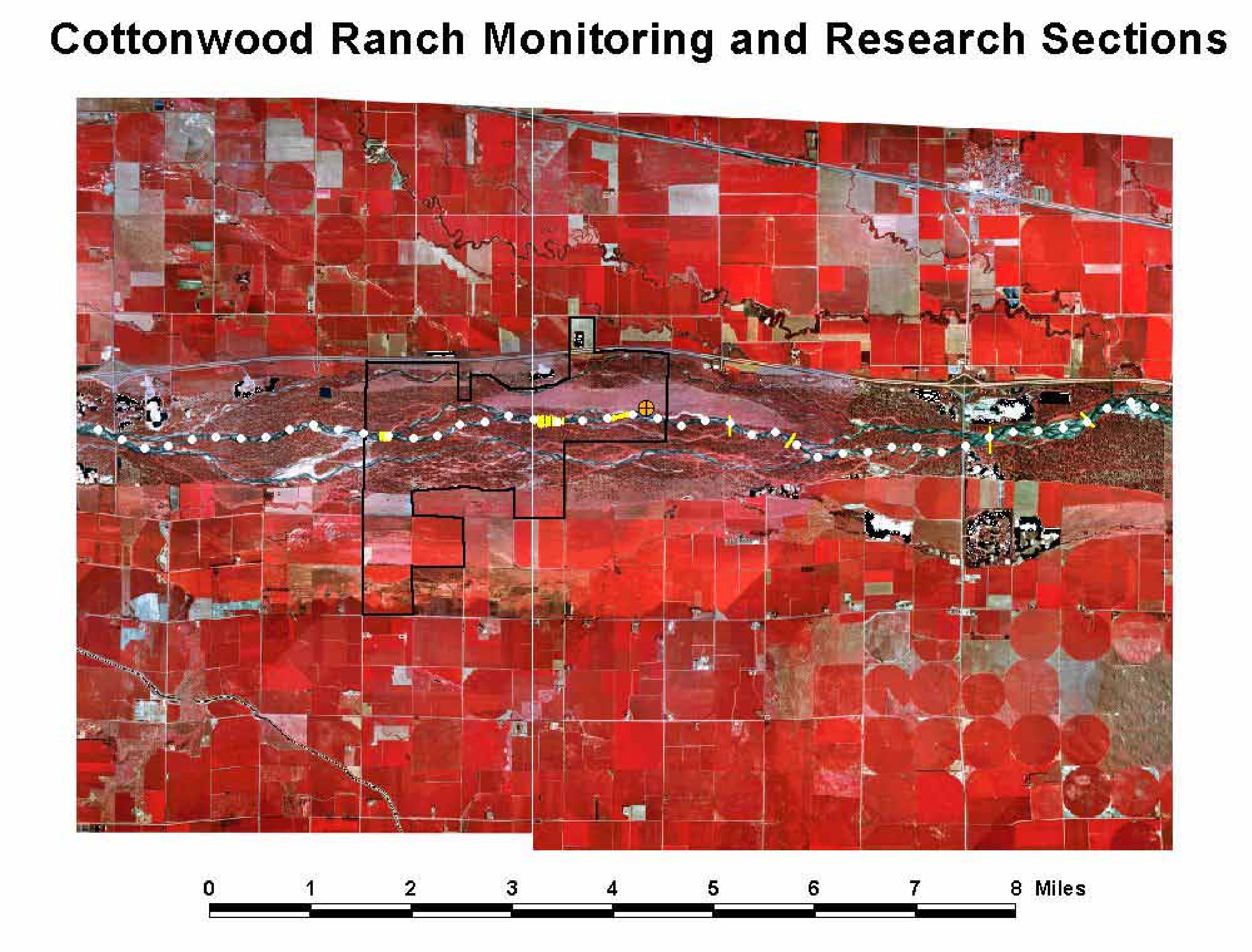


Figure 13. Monitoring and research transects (dashes) at Cottonwood Ranch and example of the series of anchor points (dots) to locate the monitoring transects.

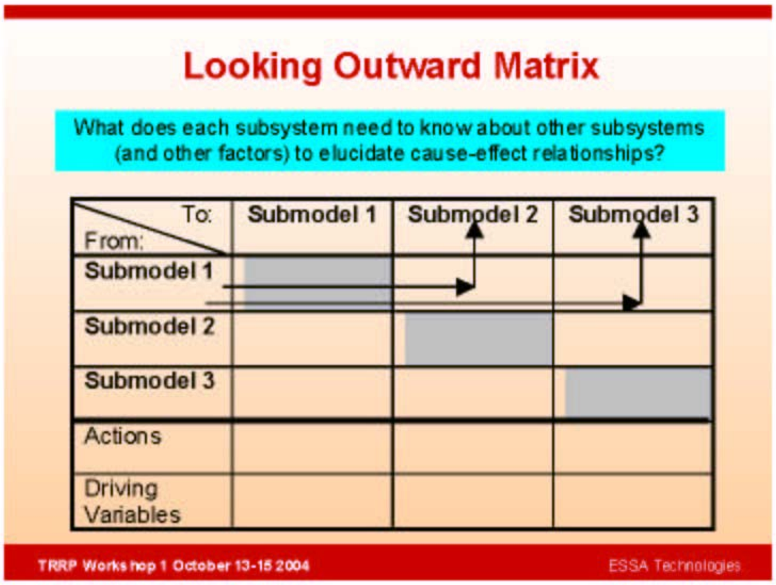


Figure 14. Looking outward matrix (example used from Dave Marmorek, ESSA Technologies)

Appendix A – Peer Review Guidelines

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM

SCIENTIFIC PEER-REVIEW GUIDELINES

These guidelines have been developed to provide a general process for peer-review of scientific documents during the Platte River Recovery Implementation Program (Program). Peer-reviews conducted during the Program will be conducted in accordance with "INSTRUCTIONS TO PEER-REVIEWERS" (Attachment A).

WHAT IS PEER-REVIEW? Scientific peer-review is a process by which technical experts provide unbiased comments, suggestions, and evaluation of the science and technology of proposals, study plans, reports of data analyses, and other documents. Peer-review provides evaluation of the technical quality and relevancy of a document in meeting objectives or in addressing hypotheses. Peer-review usually involves obtaining comments from appropriate technical experts ("peers") who have no financial, supervisory, or familial relationship to the authors of the work. Peer-review is not an administrative review, nor does peer-review address political or other non-scientific features of a project or document.

Peer-review typically involves review by several technical experts in the appropriate subject area. By obtaining multiple, independent technical opinions, the peer-review process provides a means of evaluating the scientific soundness of a product, further minimizing introduction of bias or conflict of interest. The process of peer-review ultimately cannot insure that a document or product is without fault.

Peer-review should be an efficient process so that monitoring, research, publications, and other work can proceed in a timely manner. This process should be streamlined and not create a bottleneck of bureaucracy, delaying appropriate publications, fieldwork, data analyses, or modeling.

WHY IS PEER-REVIEW NECESSARY? Peer-review serves to strengthen a document, whether it is a study plan, proposal, or report, in several ways. A review can provide suggestions for improvements of the work. Experts typically suggest better approaches, more efficient methods, innovative approaches to analysis, and supporting data or literature. A document or plan that has been viewed as being sound, through peer-review, achieves improved credibility in the eyes of the scientific community. Peer-review enhances the reliability of a document, having been examined by peer-scientists. Where proposals or study plans are developed to address specific needs, peer-review can insure that the project serves the specific objectives of the program.

WHEN WILL PEER-REVIEW BE USED? The process described in this document may be used for products (proposals, plans, models, data, reports, protocols, etc.) funded by the Program or for other products essential to meeting Program milestones, but lacking adequate review. All products relied upon by the Program that influence management decision may be subjected to the following peer review process at the discretion of the Governance Committee with advice from the Technical Advisory Committee or other advisory committees. For some products, however, a high level of scientific quality may be maintained by existing quality control and administrative review procedures, and peer review will be unnecessary.

WHAT ARE THE PRIORITIES FOR PEER REVIEW? The first priority for peer review are items identified for peer review in the 1997 Cooperative Agreement Milestones, which include all water depletion/accretion impact analyses, and all habitat and species monitoring and research activities. Proposals and protocols for new research and monitoring activities necessary for meeting Program milestones will receive the second priority for peer review. Third priority will be given to recent reports of completed studies considered essential to meeting Program milestones. Already peer-reviewed products will receive the lowest priority for peer review. Priorities may change depending on issues.

PEER-REVIEW PROTOCOL

1. The Executive Director will administer the peer-review process for the Governance Committee. The duties of the Executive Director are as follows:

    a) Assemble Master List of potential reviewers with assistance from the standing advisory committees (Technical, Land, Water).
    b) Select reviewers for each work product to be reviewed, and obtain approval of selected reviewers by the Governance Committee.
    c) Handle all correspondence with reviewers.
    d) Compile and transmit all relevant materials from reviews to Panel members for decision-making.
    e) Coordinate revision of work product if needed.
    f) Prepare, obtain approval from the Governance Committee, and administer budget for reviews.
    g) Ensure the review process works in a timely and efficient manner.

2. The Governance Committee and its recognized advisory committees (Technical, Land, Water) identify the need for peer-review as requirements for proposals, studies, or reports arise. The requesting committee identifies each need for peer-review to the Executive Director (see figure below).

3. The Executive Director will determine priorities for peer review in keeping with the guidelines noted above, and develop budgets for peer review for approval by the Governance Committee. A Peer Review Working Group consisting of one member of the Governance Committee and one member from each of the Governance Committee's standing advisory committees (Technical, Land, Water) or other group as identified will assist the Executive Director in this effort. Budgets and priorities will be subject to the approval by the Governance Committee and may change as the Program evolves.

4. Reviewers meeting the standards outlined in these guidelines will conduct the peer-review.

5. When peer review is appropriate the Executive Director, in consultation with the Peer Review Working Group, will select three peer-reviewers from scientific areas appropriate to the subject or discipline of each request. The reviewers will conduct independent peer-reviews and send reviews to the Executive Director. According to the specific needs of each peer-review task, the reviewers could complete review of a single or group of related proposals, plans, or reports. A statistician will participate as a fourth reviewer when the subject or discipline includes experimental design and/or statistical analyses.

6. A list of qualified and willing experts will be assembled in a number of technical topic areas; reviewers will be carefully selected from this list to ensure reviewers are the most appropriate based on the subject matter being reviewed. The Executive Director will maintain a file with the resume and credentials of each peer-reviewer.

7. Criteria for peer-reviewers include:

    a) No conflict of interest for or against the project document or its authors based on financial interest in the product or author(s), familial relationship with the author(s), personal bias for or against the institution or author(s), professional connection to the institution or author(s), organizational affiliation, or potential to be influenced by lobbying or other political pressure to produce a certain result or more work in the area of this product.

    b) Expertise appropriate for the theme of the project or document(s).

    c) The ability to complete a technical review in a reasonable time, as determined by the requesting committee.

    d) Individuals will be selected from a diversity of institutions, including state, federal, local government, and non-governmental organizations for each project, while avoiding members from the same institution or agency as the author(s).

8. The committee requesting review, in conjunction with the Peer Review Working Group, will approve the Peer-review Panel. Objections regarding individuals must relate to the criteria outlined in number 7. The Governance Committee will resolve all conflicts.

9. An attempt will be made to obtain voluntary participation on Peer-review Panels without cost to the Governance Committee. A stipend or honorarium will be offered for review when necessary. The Governance Committee will approve an annual budget for peer-reviews.

10. The requesting advisory committee will prepare specific guidance for each review task. Suggested guidance includes an outline of the specific need for peer-review, the milestones or objectives to be addressed by the work, and other specific criteria for the document.

11. Reviewers shall provide written comment on the document(s) under review. Reviews will be conducted similar to the system and methods used by the National Science Foundation and major scientific journals and in accordance with the Proposal, Protocol and Study Plan Review Guidelines and Report Review Guidelines (see Attachment A).

12. Upon completion of the reviews, the Executive Director will:
    a) Prepare a package of material including all reviews and any relevant material,
    b) Distribute all material to requesting committee for a determination of action,
    c) If appropriate work with the requesting committee and author to make any needed revisions,
    d) Maintain a file of peer-reviews for each document, and
    e) Provide a summary of items a-c to the Governance Committee for approval.

13. The peer-review process does not determine the approval or disapproval of the activity associated with the request (funding a study, use of data or analytical results, publication of a report, etc.). Peer reviews may not be definitive (i.e., there may be disagreement among reviewers). The Committee seeking the review may or may not have the authority to approve the review; however, at a minimum, it is responsible for transferring the review summary and document(s) to the Governance Committee, who will have final authority to approve the review.

DOCUMENTATION OF PEER-REVIEW CONDUCTED OUTSIDE THE PROGRAM

There will likely be cases where the Program will benefit from models, data, analyses, or conclusions drawn by projects developed in the past or ongoing, but supported by institutions outside the oversight of the Program. The committee requiring the information will determine the need for peer-review of these products.

There is no intent to duplicate the peer-review conducted by others. Scientific journals typically conduct their own peer-review. Most major journals have high-quality peer-review that is universally accepted. Scientists are encouraged to publish their findings in the peer-reviewed scientific literature whenever possible and appropriate. In most instances this level of peer review is considered adequate for the purposes of the Program.

Institutions and agencies may administer their own peer-review process for study plans and reports. In using the models, data, or conclusions (reports) from studies not funded by the Program, the appropriate advisory committee is responsible for determining if additional peer-review is necessary. In making the decision regarding the need for peer-review it may be helpful to document an institution’s peer-review process for the project or report. With the assistance of the appropriate advisory committee, it may be useful to consider the following information on alternative peer-review processes when available:

I. Title of Study / Project / Report:
II. Type of Work: __report __study plan/proposal __model __ other (specify)
III. Principal Investigators: name, address, phone number, and e-mail
IV. Source of financial support for project / report:

V. Peer-Review Documentation

A. Names / Institutions of peer-reviewers (may have been anonymous)

B. Brief Description of the peer-review process:

C. Were revisions made to the project/report in response to reviewers' comments?

ATTACHMENT A

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM

INSTRUCTIONS TO PEER-REVIEWERS

Thank you for agreeing to review this product. The following is a summary of expectations for peer-review and the topics that we wish each peer-reviewer to address.

A. INDEPENDENCE OF A PEER-REVIEW

Peer-review must provide an unbiased opinion of the scientific quality of a product (proposal, report, data, map, etc.) by individuals who are independent from the authors and external to them and their institution. A review must be independent of various types of conflicts of interest with the author(s) and with the product under review. The Platte River Recovery Implementation Program (Program) places considerable reliance on the objectivity, integrity, and professionalism of each peer-reviewer to provide technical opinion of each product without bias or conflict of interest.

Please review each question about your bias or independence. Your peer-review will be anonymous to the author unless you choose to share it. Your review will be held in the file for the Program as documentation of the peer-review process for this product.

YOUR CONSIDERATIONS SHOULD INCLUDE THE FOLLOWING FACTORS THAT COULD LEAD TO BIAS OR CONFLICT OF INTEREST:

- financial interest in the product or the author(s);
- familial relationship with the author(s);
- bias, for personal reasons, for or against the author(s) or institutions of this product;
- professional connection (current or former: student or advisor, supervisor or supervised, employer, etc.) to the author(s) or the institution of this product;
- organizational affiliation (same agency, department, organization, business, etc.);
- impacts of lobbying or political pressure exerted by persons looking for a particular result or more work in the area of this product;

IF YOU FEEL THAT YOU CANNOT PROVIDE AN UNBIASED REVIEW, PLEASE DO NOT REVIEW THIS PRODUCT AND IMMEDIATELY RETURN THE DOCUMENT TO THE PROGRAM’S EXECUTIVE DIRECTOR.

B. PROPOSAL, PROTOCOL, AND STUDY PLAN REVIEW GUIDELINES

CONFIDENTIALITY - The enclosed product is a privileged communication. Please do not show it to anyone or discuss it, except to solicit assistance with a technical point. Your review and your recommendation should also be considered confidential.

TIMELINESS - In fairness to the author(s) and the needs of the Program, please return your review within ___ days. If it seems likely that you will be unable to meet this deadline, please return the product immediately or contact the Executive Director.

CONFLICTS OF INTEREST - Please review the "Independence of a Peer-review". If you feel that you might have difficulty writing an objective review, please return this material immediately, without reviewing it. If your previous or present connection with the author(s) or their institution(s) might be construed as creating a conflict of interest, but no actual conflict exists, please discuss this issue in the cover letter that accompanies your review.

YOUR REVIEW SHOULD ADDRESS THE FOLLOWING:

Please provide comments on separate sheets of paper. Support your comments with specific evidence from the text.

Do the objectives/hypotheses appropriately address the needs that have been identified for the Program? Are they scientifically sound, testable, and appropriate given the type or precision of the data available?

Is the design of the study scientifically sound? Is it technically and statistically appropriate for addressing the goals and objectives of the project? Is the reasoning behind the design based on generally accepted scientific principles?

Are the methods and experimental design appropriate in scale, timing, geographic scope, and precision for addressing the objectives? Are the measurements appropriate for addressing objectives?

Are plans for data analysis sound and likely to address the objectives?

Are the authors and their institutions well qualified, with appropriate facilities, to conduct the work?

Are the proposed time frame, personnel, and budget appropriate for conducting the work?

Will the products meet the needs identified?

C. REPORT REVIEW GUIDELINES

CONFIDENTIALITY - The enclosed manuscript is a privileged communication. Please do not show it to anyone or discuss it, except to solicit assistance with a technical point. Your review and your recommendation should also be considered confidential.

TIMELINESS - In fairness to the author(s) and to the needs of the Program, please return your review within __ days. If it seems likely that you will be unable to meet this deadline, please return the manuscript immediately or contact the Executive Director.

CONFLICTS OF INTEREST - Please review the "Independence of a Peer-Review" above. If you feel you might have any difficulty writing an objective review, please return the manuscript immediately, un-reviewed. If your previous or present connection with the author(s) or an author's institution might be construed as creating a conflict of interest, but no actual conflict exists, please discuss this issue in the cover letter that accompanies your review.

YOUR REVIEW SHOULD ADDRESS THE FOLLOWING:
What is the major contribution of this document? What are its major strengths and weaknesses, and its suitability for publication and/or use by the Program? Are conclusions based on sound scientific methods and reasoning? Please include both general and specific comments bearing on these questions and emphasize your most significant points.

General Comments:
1. Scientific soundness
2. Organization and clarity
3. Conciseness
4. Degree to which conclusions are supported by the data
5. Cohesiveness of conclusions

Specific Comments:
Please support your general comments with specific evidence and literature. You may write directly on the manuscript, but please summarize your handwritten remarks separately. Comment on any of the following matters that significantly affected your opinion of the manuscript:

1. Presentation: Is a tightly reasoned argument evident throughout? Does the manuscript wander from the central purpose?

2. Methods: Are they appropriate? Current? Described clearly and with sufficient detail so that someone else could repeat the work?

3. Data presentation: When results are stated in the text of the manuscript, can you easily verify them by examining tables and figures? Are any of the results counterintuitive? Are all tables and figures clearly labeled? Well planned? Too complex? Necessary?

4. Statistical design and analyses: Are they appropriate and correct? Can the reader readily discern which measurements or observations are independent of which other measurements or observations? Are replicates correctly identified? Are significance statements justified?

5. Conclusions: Has the author(s) drawn conclusions from insufficient evidence? Are the interpretations of the data logical, reasonable, and based on the application of relevant and generally accepted scientific principles? Has the author(s) overlooked alternative hypotheses?

6. Errors: Point out any errors in technique, fact, calculation, interpretation, or style.

7. Citations: Are all (and only) pertinent references cited? Are they provided for all assertions of fact not supported by the data in the manuscript?

D. FAIRNESS AND OBJECTIVITY

If the research reported in this paper is flawed, criticize the science, not the scientist. Harsh words in a review will cause the reader to doubt your objectivity; as a result, your criticisms will be rejected, even if they are correct!

Comments should show that:
1. You have read the entire manuscript carefully,
2. Your criticisms are objective and correct, and are not merely differences of opinion, and are intended to assist the author in improving the manuscript, and
3. You are qualified to provide an expert opinion about the research reported in this manuscript.

E. ANONYMITY

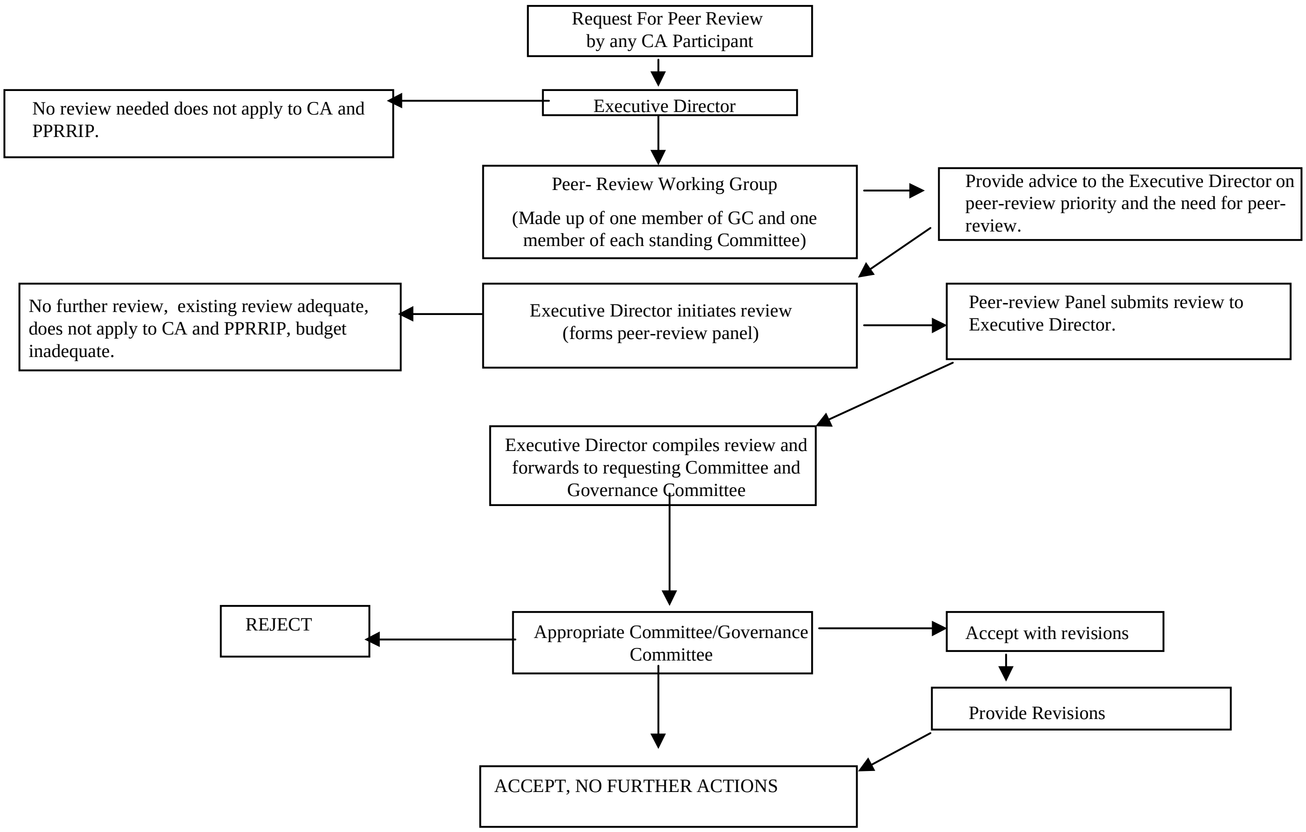
You may sign your review if you wish. If you choose to remain anonymous, avoid comments to the authors that may serve as clues to your identity, and do not use paper that bears the watermark of your institution.

RATING:
Please score each aspect of this manuscript using the following rating system: 1=excellent, 2=very good, 3=good, 4=fair, 5=poor.

	Rating
Scientific soundness	___
Degree to which conclusions are supported by the data	___
Organization and clarity	___
Cohesiveness of conclusions	___
Conciseness	___
Importance to objectives of the Program (For use by internal review panel only)	___

RECOMMENDATION	(check one)
Accept	___
Accept after revision	___
Unacceptable	___

Peer-Review Sequence Platte River Cooperative Agreement (CA) and Proposed Platte River Recovery Implementation Program (PPRRIP)



Appendix B - Models

Analytical and Computer Models
There has been considerable disagreement over the assumptions, data used, accuracy and appropriateness of almost all these models and they are not necessarily viewed as acceptable analytical tools by all parties during the adaptive management process. However, some or all of these models may be used to make predictions in regards to certain management actions or to analyze data collected through the monitoring and research efforts. Results of adaptive management may be used to update models as applicable.

Integrated Models

1. Habitat Complexes – Habitat complexes are assemblages of relevant habitat types important to the target species, and consist of channel areas, wet meadows, and buffers (see Land Plan Table 1).

2. Non-Complex Habitat – The states and water users suggested habitat criteria that included ranges for certain variables contained within a "Habitat Complex" and additional land cover types that are used by the target species. Through the process of negotiation the ranges were dropped and the non-riverine land cover types have become the "Non-Complex Habitat" (see Land Plan Table 2).

Physical Models

1. Sediment/Vegetation Model – The Sed/Veg Model predicts how changes in river flow and sediment transport into the central Platte River will affect the geometry of the river channel, channel vegetation, and important habitat characteristics for the target species.

2. FWS Mountain Prairie Region Instream Flow Recommendations and Proposed Usage for the Platte River Recovery Implementation Program – The FWS has developed Instream Flow Recommendations for the central Platte River (Platte River Recovery Implementation Program, Attachment 5, Section 11), which they believe are necessary to "achieve the flow-dependent goal of 'rehabilitation and maintaining the structure and function, patterns and processes, and habitat of the central Platte River Valley ecosystem'" for the purpose of creating and maintaining habitat for the three target avian species. The instream flow recommendations include species and annual pulse flows, and periodic annual peak flows.

3. Central Platte River OPSTUDY Model – "The Central Platte River OPSTUDY Model" (CPR Model) was developed by the U.S. Bureau of Reclamation and the FWS as a tool for evaluating management alternatives affecting flows in the central Platte River in Nebraska (Attachment-91 (F) of the DEIS). The CPR Model is a water accounting model for tracking gains, losses, diversions from and accretions to the central Platte River system.

4. Cooperative Hydrologic Study (COHYST) - The COHYST is a study designed to improve the understanding of hydrologic and geologic conditions in the Platte River Basin above Columbus, Nebraska. COHYST was developed by several Nebraska entities including natural resources districts, public power districts, state agencies, water user organizations, and environmental and agricultural organizations. When completed, COHYST will assist with understanding the interrelationship and interaction between surface water and groundwater and provide a tool in evaluating management and regulation options relating to groundwater and surface water.

Biological Models

1. Instream Flow Models – Two physical habitat simulation models developed for the Platte River have been used by the FWS to develop two biological models, one for whooping crane roosting habitat and one for forage fish habitat. These two models are based on applications of Physical Habitat Simulations Methodology (PHABSIM). Each model has two primary components: habitat suitability index models for the species (described below); and channel hydraulics models of the study area.

a. **Whooping Crane Model –** The Whooping Crane Model was developed by the Platte River Management Joint Study (PRMJS) Biology Workgroup (with a recent review and modification by the USGS (Farmer et al. 2005)). The purpose of the Whooping Crane Model is to predict the quality and spatial distribution of whooping crane roosting habitat.

b. **Forage Fish Model –** Several entities have contributed to the development of habitat suitability index models for Platte River forage fish. Suitability indices for microhabitat variables (i.e., depth, velocity, substrate, and cover) have been developed for 24 species or species life stages.

2. Tern and Plover Nesting Model – The U.S. Fish and Wildlife Service developed a Tern and Plover Nesting Model for use in the analysis of the Program for the Biological Opinion (B.O.). The purpose of the model is to predict the relative impacts of the annual and seasonal hydrology cycle on the formation of sandbars hypothesized to be suitable as nesting sites. This is not a computer simulation model, but a set of analytic procedures.

Appendix C. Additional Hypotheses Identified

Whooping Crane

Hypothesis
Whooping cranes prefer wetlands during migration that are at least 1 acre in size, have at least 400 feet of unobstructed visibility from an open water area with depths less than 0.7 feet are with in 0.5 miles of a feeding area (cropland during migration) and are at least 1,600 feet from the nearest disturbance (such as road or house).
Whooping cranes select for flows of 2,400 cfs at Grand Island
Probability of whooping crane use increases as channel widths increase
Whooping crane use is related to amount of channel inundation.
Whooping crane use will increase with an increase in suitable wet meadows near the channel.
Whooping crane use will increase with more wet meadow acreage.
Whooping crane use of wet meadows will increase with increased biomoass of macroinvertebrates
Repeated stage changes on a daily or sub-daily basis adversely impact whooping crane use of the Platte River for roosting
WC will remain on the roost if water depths do not fluctuate outside of 7-30 cm depth.
Species target flows and annual pulse flows are needed to create and maintain suitable habitat characteristics for whooping cranes in the following ways: -**<u>Provide roosting habitat</u>** (prevent a major break in wetted width in whooping crane roosting habitat; provide roosting habitat; provide migration habitat) -**<u>Sustain wet meadows and backwaters</u>** (sustain hydrologic and biologic processes which sustain wet meadows; inundate wet meadows; inundate backwaters; drive ecosystem processes in backwaters and wet meadows such as thawing and stimulation of biological activity that ultimately produces food for animals and favorable habitat for both animals and plants; feeding sites in wet meadows; influence groundwater levels, and composition and structure of biological communities in grasslands; maintain and enhance the occurrence of soil moisture and pooled water for the lower trophic levels of the food chain in low grasslands; bring the groundwater levels in grasslands up near to soil surface in areas of grassland and above soil surface in some lowest areas of grasslands) -**<u>Maintain channel characteristics and riverine community</u>** (form sandbars, trigger the response of the aquatic community; restore certain annual effects characteristic of the historic natural hydrograph; sediment transport; for redistribution and deposition of sediment; shaping channel morphology into wide, shallow channels; form and move ice, which scours vegetation and shapes the channel; maintain and enhance the physical structure of wide, open unvegetated and braided channel characteristics for resting, feeding and roosting; redistribute sediment in the active channel and maintain the geomorphology of the channel; in years with little or no ice formation, saturate soil in meadows) -**<u>Scour vegetation</u>** (scour seedlings off sandbars and prevent seed germination; scour vegetation of different size and age classes and prevent reestablishment of

vegetation; management of the recruitment of cottonwoods; seedling removal; cause and/or contribute to break up of ice and move ice for the effect of scouring vegetation off sandbars in the active channel) -**Maintain predator barrier** -**Maintain nutritional and physiologic conditions** (contribute important nutritional and physiological conditions for birds preparing to breed; support primary production of invertebrates which are needed by cranes for protein) -**Help disperse birds** (helps disperse birds and reduce losses due to disease [avian cholera, botulism, etc.])

Least tern and Piping Plover

Hypothesis
Sandpits do provide sufficient foraging habitat for terns and plovers.
Platte River is needed to provide sufficient foraging habitat for terns and plovers.
The tern and plover populations in the central Platte can be provided by the river only.
Predators learn where maintained nesting locations are and reduce the nesting success.
Minimal secure areas are needed for success nesting a. 0.25 mile not needed for buffer
For piping plovers and least terns to successfully nest and rear chicks in and along the central Platte River, a certain quantity and quality of forage items are required throughout the nesting season. River flow variability at different time scales (e.g., sub-daily, seasonal, annual) due to controlled (e.g., hydrocycling) and uncontrolled (e.g., floods) factors impact the ability of the central Platte River to produce and sustain the necessary forage base.
Repeated stage changes on a daily or sub-daily basis (e.g., caused by hydrocycling) adversely impacts the availability, abundance, and diversity of the aquatic invertebrate communities that forms the food base for piping plovers.
Repeated stage changes on a daily or sub-daily basis (e.g., caused by hydrocycling) adversely impact the distribution, abundance and composition of the aquatic fish community that forms the food base for the least tern by: a. Forcing daily lateral shifts in microhabitat availability, reducing the suitability of the central Plate River to support fish species. b. Decreasing recruitment of many central Platte River fish species that form the food base for the least tern due to desiccation of eggs. c. Increasing the frequency, magnitude and duration of localized high water temperature events.
A fledge ratio of 1.13 or 1.17 fledging/pair is needed to prevent the central Platte River from being a population sink for piping plover.
A fledge ratio of 0.7 fledging/pair is needed to prevent the central Platte River from being a population sink for least terns.
Tern and plover will select for specific elevations above current water levels compared to available elevations for nest initiation
Increased vegetation cover decreases tern and plover use.
Bare sand suitability increases with size
Least tern and piping plover use will be maximized at 50-65% water to sand combination.

Increased flow rates increase the amount of water area compared to sand area
Daily stage change impacts on tern and plover prey base
Target flows influence least terns and piping plovers in the following ways: -**<u>Sustain backwaters and side channels</u>** (inundate backwaters; drive ecosystem processes in backwaters that ultimately produce food for animals and favorable habitat; influence fish reproductive behavior and the availability and quality of spawning, nursery, and rearing habitat, including backwater habitat of fishes; maintain and rehabilitate backwaters and side channels as spawning and nursery habitats) -**<u>Maintain channel characteristics and riverine community</u>** (form sandbars, trigger the response of the aquatic community; restore certain annual effects characteristic of the historic natural hydrograph; sediment transport; for redistribution and deposition of sediment; shaping channel morphology into wide, shallow channels; form and move ice, which scours vegetation and shapes the channel; maintain and enhance the physical structure of wide, open unvegetated and braided channel characteristics; redistribute sediment in the active channel and maintain the geomorphology of the channel in years with little or no ice formation; provide channel habitat for water-dependent organisms, including spawning fish, shorebirds) -**<u>Maintain biological diversity</u>** (Maintain the components of biological diversity, e.g., invertebrates, fishes) -**<u>Scour vegetation</u>** (scour seedlings off sandbars and prevent seed germination; scour vegetation of different size and age classes and prevent reestablishment of vegetation; management of the recruitment of cottonwoods; seedling removal; cause and/or contribute to break up of ice and move ice for the effect of scouring vegetation off sandbars in the active channel) -**<u>Support fish/aquatic community</u>** (prevent loss of richness of aquatic species, especially fish and mollusks; support biological processes, which sustain fish and aquatic organisms dependent on certain flows; support spawning fish and other responses of the aquatic community; influence fish reproductive behavior and the availability and quality of spawning, nursery, and rearing habitat, including backwater habitat of fishes; maintain and prevent loss of the native fish community and will promote survival of fish young-of-the-year; promote critical stages in the life cycles of fishes and other aquatic organisms) -**<u>Fish distribution and movement</u>** (promote movement and (re)distribution of fishes and other aquatic organisms) -**<u>Prevent low elevation nesting</u>** (prevent nesting by shore birds at low elevations on sandbars; prevent shore birds from nesting at such low elevations in the channel that their nests would be subject to flooding during subsequent intervals of higher flows caused by local rainfall and/or flow regulation practices) **-<u>Control water temperature</u>** (relationship between flow and water temperature is considered important; prevents losses from the native fish community by curtailing rises in water temperatures to levels that otherwise would be detrimental or lethal to a variety of

life history stages of aquatic organisms, including fishes; prevent or reduce future harmful episodes to the aquatic community)

-**<u>Maintain predator barrier</u>**

(Provides a degree of barrier to terrestrial predators, which would otherwise more easily prey on shore bird nests)

-**<u>Maintain nutritional and physiologic conditions</u>**

(contribute important nutritional and physiological conditions for birds preparing to breed; facilitate nutrient cycling in the floodplain)

Pallid Sturgeon

Hypothesis
Water quality changes as a result of Program water management result in a measurable change in pallid sturgeon reproduction in the lower Platte River.
The net result of retiming due to depletions plans in the upper basin will/will not result in measurable changes in the lower Platte River.
The net result of retiming due to depletions plans in the upper basin will/will not result in measurable changes in channel characteristics in the lower Platte River associated habitat.
The net result of retiming due to depletions plans in the upper basin will/will not result in measurable changes in floodplain connectivity in the lower Platte River associated habitat
The net result of retiming due to depletions plans in the upper basin will/will not result in measurable changes in spring (March-June) peak flows in the lower Platte River associated habitat.
Incidental harvest of pallid sturgeon negate recovery efforts and benefits gained in the lower Platte River.
Pallid stocking efforts will impact ability to investigate other hypotheses.
Competition with non-native species could affect the recovery of the pallid sturgeon.
Changes in flow rate and/or channel characteristics will/will not result in detectable change in patterns/levels of pallid sturgeon use in the lower Platte River.
Program water management and retiming due to depletions plans will/will not result in detectable change in water quality in the lower Platte River.
Pallid sturgeon occurrence in the Platte River is incidental and not because of selection.
Pallid sturgeon do/do not spawn in the Platte River.
Pallid sturgeon use on the lower Platte River is dependant on conditions in the middle Missouri River basin.
Changes in water quality (temp, turbidity, etc) will result in detectable change in patterns/levels of pallid sturgeon use in the lower Platte River.
Program water management and retiming due to depletions plans will/will not result in measurable changes in pallid sturgeon use of the lower Platte River.
The lower Platte River does not provide essential habitat for the pallid sturgeon; rather it receives incidental usage.
The hydrological changes caused by the Program and new depletions plans will not provide measurable changes in the lower Platte River hydrologically, and/or stage changes.
Program flows and sediment management will result in measurable changes on sediment load in the lower Platte River

Increasing pallid sturgeon use in the lower Platte River will increase pallid sturgeon populations.
Different rates of flow in the lower Platte affect pallid sturgeon prey base.
Non-Program actions (e.g., harvest, stocking, Missouri River conditions) determine the occurrence of pallid sturgeon in the lower Platte River

Physical Processes (including wet meadow)

Hypothesis
Reclamation's unsteady-flow model for the Kingsley-to-North Platte reach of the North Platte River can be used to predict the two-day peak pulse flow magnitude in the river at North Platte, Nebraska resulting from a specified Kingsley EA release pattern to within 20% of the actual magnitude and with 75% certainty (3 out of 4 cases).
Reclamation's unsteady-flow model for the Central Diversion-to-Overton reach of the Platte River can be used to predict the two-day peak pulse flow magnitude in the river near Overton, Nebraska resulting from a specified amount and timing of EA water passing Central's diversion to within 25% of the actual magnitude and with 75% certainty.
Higher-magnitude peak flows will result in higher sand bars and a wider channel, and will accomplish more geomorphic work per unit of water released.
A flow magnitude of 5,000-8,000 cfs for a duration of 18 hours at Grand Island is needed to build sand bars to an elevation suitable for Least Tern and Piping Plover habitat.
A flow magnitude of 5,000-8,000 cfs for a duration of 18 hours at Grand Island is needed in two out of three years to prevent riparian seedlings from encroaching, and to maintain the width-to-depth ratio of the channel.
Managed flow releases in September will be more effective at removing seedlings than managed flow releases in March to May time frame.
The increased occurrence of peak flow events between 5,000-8,000 cfs for a duration of 18 hours at Grand Island in two out of three years will increase the average width of the seedling-free channel over time.
Most vegetation on banks can be removed at a shear force exceeding 0.5 to 1 lbs/sqft with a flow duration of 18 hours at Grand Island.
A flow magnitude of 5,000-8,000 cfs for a duration 18 hours at Grand Island is needed to initiate bank erosion.
A flow of 5,000-8,000 cfs will not build a sand bar that will remain emerged at typical summer flow peaks due to local rainfall events (i.e. 2,740 cfs, the median summer peak at Kearney from 1985 to 2004) and thus is the bars formed will not be habitat suitable for long-term propagation of least terns and piping plovers.
Sand bars which are not inundated within the growing season of when they are formed will vegetate beyond the 25% suitable for least tern and piping plover nesting in one growing season and this vegetation will not be susceptible to erosion in subsequent years with flows of the same magnitude that created the initial sandbar.
It is not possible to deliver a flow of 5,000 to 8,000 cfs for a duration of 18 hours at Grand Island within the current channel and infrastructure conveyance capacity.
There is an existing sediment imbalance creating a net loss of approximately 400,000 tons annually in the Platte River between Lexington and Grand Island, NE.

After a bar has been created by whatever means, ongoing stage fluctuations will decrease the bar area that could potentially be used by terns and plovers. Erosion will be less with a balanced sediment budget. Rate, magnitude, and frequency of stage fluctuation needs to be considered
Under current conditions of no sediment augmentation, the major sources of sediment are: the bed and banks of the river between Lexington and Jeffrey Island (est. 45%); the bed and banks of the river between Jeffrey Island and Kearney (est. 35%); and the tributaries (est. 20%).
The sediment loss within the stretch identified is not as great as stated and not as extensive.
Clearing bank vegetation will reduce bank stability and make the cleared location more susceptible to erosion under peak flows, force less than $0.5 lb/ft^2$.
Reducing the stability of the river banks through removal of vegetation, will increase the width to depth ratio of the channel.
Mechanically cutting the banks to widen the channel to a width sustainable by program flows at that site and distributing the material in the channel, is a sustainable means of channel widening and provides a source of sediment augmentation.
Mechanically lowering the islands to elevations inundated by flows of 500 cfs, mechanically lowering islands and distributing the material in the channel is a sustainable means of channel widening and provides a source of sediment augmentation.
Indirectly narrowing the width of the hydraulic corridor (preferred width less than 3,000 ft) by consolidating channels under proposed flow regime and balanced sediment budget will convert anastomosed reaches of the Platte River between Overton and Grand Island to a braided channel morphology.
The consolidation of flow from multiple channels into a single channel will achieve an active channel width that provides more acres of Table 1 habitat than the sum of acres available from individual channel widths.
Channel bank erosion and widening will occur when there is at least a 50% increase in flow when consolidating flow to a single channel.
10,000 acres of land can be developed into habitat as defined by current usage data for whooping cranes, least terns, and piping plovers. Lands with a wide range of physical characteristics including channels of various widths, palustrine wetlands sandpits, cropland and grasslands that contain a wetland component for roosting, foraging sites for least terns and piping plovers.
Suitable habitat for least terns and piping plovers include sandpits and riverine channels with shoreline habitats that can be developed and maintained by mechanical and other means in combination with existing river flows that will provide benefits to the species.
Suitable habitat for whooping cranes can be developed and maintained with mechanical and other means to provide channel habitat and palustrine wetlands in addition to the existing river flows that will provide benefits to the species.
Management of lands below the J-2 return provides sufficient habitat to offset any hypothesized channel degradation. The sediment transport measurements and questions addressed in the EIS/Parsons report need to be completed to determine a management plan, if any, for this reach.
Suitable habitat for whooping cranes can be developed and maintained with mechanical and other means to provide channel habitat and palustrine wetlands in addition to the existing river flows that will provide benefits to the species.

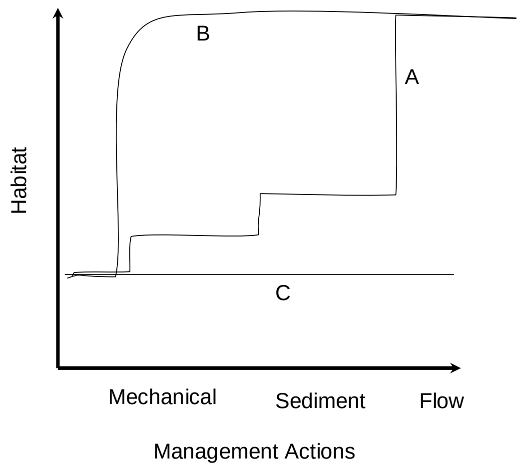
Management of lands below the J-2 return provides sufficient habitat to offset any hypothesized channel degradation. The sediment transport measurements and questions addressed in the EIS/Parsons report need to be completed to determine a management plan, if any, for this reach.
Throughout a majority of the central Platte River the unvegetated active channel is in dynamic equilibrium. Temporary narrowing occurs only during severe drought and can be corrected by mechanical means.
Flow regimes significantly less than USFWS target flows will provide adequate flows to support least tern and piping plover foraging habitat as well as whooping crane roosting habitat. The USFWS target flows are not biologically or hydrologically necessary to benefit or recover species.
Use of EA water for wetlands, and habitat enhancements other than target and pulse flows will provide benefits to the species.
The FWS recommendations related to habitat complexes and habitat characteristics are too narrow and exclude a broader range of habitat characteristics that are and can be successfully used by the species.
Channel incision due to clean water returns is limited to the upper most sections of the habitat along the south channel.
Currently Platte River characteristics including associated sandpit habitats are not limiting the recovery of whooping cranes, least terns or piping plovers.
The Clear-level-pulse concept must be tested in a stepwise manner, collecting appropriate data to answer the questions and hypothesis questions included in the EIS/Parson team report.
The EIS/Parsons Joint River Process Investigations Analysis list a number of questions associated with Tasks 1-4. It is assumed that all the questions are based on hypotheses that need to be investigated during the Clear/Level/Pulse investigations.
The Parson report sets forth alternative views related to incisive channel degradation and sediment transport. It is assumed that these views will be integrated into the sub-hypotheses and alternative sub-hypotheses being tested as part of the Clear/Level/Pulse investigations. The DWU note that the current placeholder statement needs some work if it stays to integrate testing these alternative scientific views
The Clear-level-pulse concept will not create or provide safe tern and plover nesting habitat.
The highest sandbars created with pulse flow attempts will be vegetated by the end of the first growing season and will not erode in subsequent pulses.
Fluctuations in river stage alter the cross-sectional profiles and dimensions of channel sand bars and islands. The specific effect of stage change on the morphology of these features is determined by the frequency, rate, direction and magnitude of the change, and by sediment supply conditions (balanced or not balanced relative to river transport capacity).
Repeated stage changes in excess of 1.0 feet on a daily or sub-daily basis (e.g., as caused by hydrocycling) will measurably reduce the dimensions of and/or greatly steepen the beach profile associated with channel sand bars and islands when compared to similar sites where such daily or sub-daily stage changes are not occurring.
Over the long term, uncontrolled variability in river stage (e.g., as caused by annual peaks and floods) has a substantially greater measurable effect on the profiles and dimensions of channel sand bars and islands in any given river reach than do more frequent but smaller-magnitude stage variations at sub-daily time scales (e.g., as caused by hydrocycling).

On average in any given year, Program-implemented pulse flows will have a substantially greater measurable effect on the profiles and dimensions of sand bars and islands in any given river reach than will more frequent but smaller-magnitude stage variations at sub-daily time scales.
The effect of sub-daily variations in stage on the profiles and dimensions of channel islands and sand bars is determined more by the available sediment supply in that reach of the river (sediment balance and sediment size distribution) than by the frequency, rate, or magnitude of stage changes.
Wet meadows
Water levels for wet meadows are primarily a function of regional groundwater levels and/or climatic events.
Regional groundwater levels and/or climatic events are more dominant than streamflow in influencing wet meadows.
When wet meadow water levels and streamflow show correlation, that is because they are both influenced by a third factor (i.e. regional groundwater table or climatic conditions), not because one is caused by the other.
Water levels in wet meadows can not be significantly influenced by a managed release of water down the river.
River stage is an important influence on the hydrology (water tables and soil moisture) of wet meadows adjacent to the river channel through its effect on groundwater gradients. The two preferred metrics for assessing wet meadow hydrologic conditions in terms of their potential to support habitat conditions described in Table 1 of the Land Action Plan are (a) the 10% cumulative frequency growing-season water levels, and (b) the 7-day moving average growing-season high water levels (see Henzey et al., 2004).
River stage does not have a significant influence on groundwater more than 3,000 feet from a flowing channel (BOR May 2001).
Releases of project water to elevate river stage concurrent with local precipitation and/or snowmelt events will generate more measurable improvements to wet meadow hydrology than will equivalent releases made at other times, as measured by one or both of the above metrics.
A water table rise during the early stages of spring thaw hastens soil thaw and promotes biological activity and/or productivity in wet meadow areas by bringing warmer water closer to the soil surface.
Platte River flows overtopping areas cleared of trees and brush deposit silt. Silt deposition from overtopping flows helps create organic surface soils capable of retaining more moisture and nutrients, and thereby helps develop desirable wet meadow conditions.
Establishment of a self-sustaining grassland component of a wet meadow can not be established on the bare mineral soils of areas cleared of trees and brush.
Overbank flooding from the river to wet meadow areas on at least rare occasions (*e.g.*, once every 5 to 20 years) improves the connectivity between wet meadows and river, repopulates wet meadows with whooping crane prey/forage species, modifies wet meadow swales, and enhances nutrient conditions (These prey and forage need to be identified so that the hypotheses can address whether or not this actually happens and whether or not whooping cranes actually utilize any of the prey and forage identified).
A high productivity and diversity of macro-invertebrates in areas used by whooping cranes along the Platte River will improve WC conservation and recovery

High water tables in wet meadows provide greater benefits to WC if they occur in the Feb-Jun period versus other times of year
Periodic inundation of wet meadow areas due to overbank flow increases their suitability as WC habitat and reduces risk of new species listings
Areas where surface soils thaw earlier allow for increased macro
As depth to groundwater increases during the Mar15-Apr15 period, the number of macroinvertebrates available as WC prey decreases.

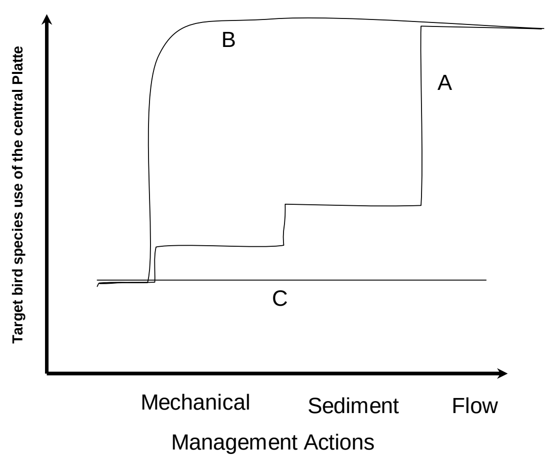
Appendix D. X-Y Graphs

S1. The Platte River form can be modified by either mechanical/sediment/flow management (i.e., clear/level/pulse) or mechanical means along with non-Program managed flows.



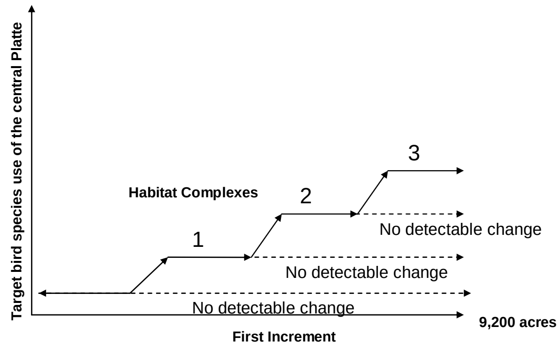
A) Mechanical modification of channel combined with sediment and flow management will affect channel morphology which will result in species use
B) Mechanical efforts alone can have the same affect as clear level pulse
C) Management actions will not be of sufficient scale and magnitude to cause detectable system wide changes

S1a. Program channel habitat restoration actions will result in detectable change to Platte River form and function.



a) Mechanical modification of channel combined with sediment and flow management will affect channel morphology which will result in species use (See figure S2),
B) Mechanical efforts alone can have the same affect as clear level pulse
C) It will not be possible to detect changes in channel form on a system wide level.

S1b Program land management actions (i.e., restoration into habitat complexes) will have a detectable effect on target birds species use of the associated habitats



Achieving habitat features on Program lands with characteristic approximating the guidelines in Table of the Land Plan (Habitat Complexes) and the Mgt. Joint Study will be an efficient and biologically effective long-term land conservation and management strategy on the Platte River for the target bird species. Overall habitat complex approach

Distribution – 3 complexes distributed throughout study reach

Location – 6,400 ac above Minden; 2,800 ac below Minden

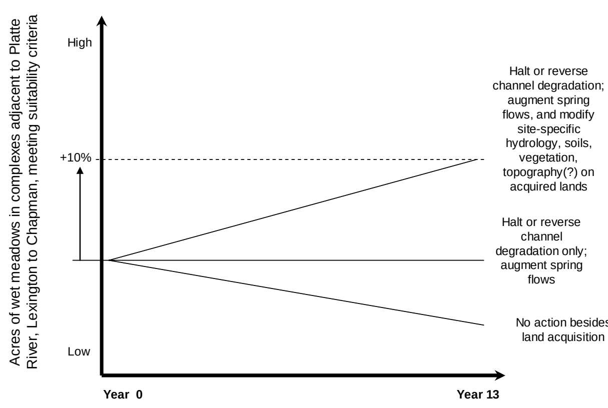
Channel – 2 miles long; 1,150 ft channels (overall 30% increase in channels >750 ft); maintained by clear/level/pulse approach

Wet Meadows – 640 ac per complex (10% increase in central Platte region)

Buffers – Up to 0.5 miles wide but may be variable

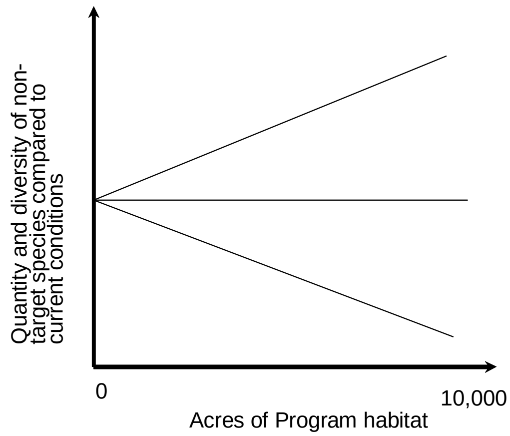
Restoration – At least 50% of land would undergo restoration

S1c: Program actions will increase functional wet meadows in habitat complexes during the first increment



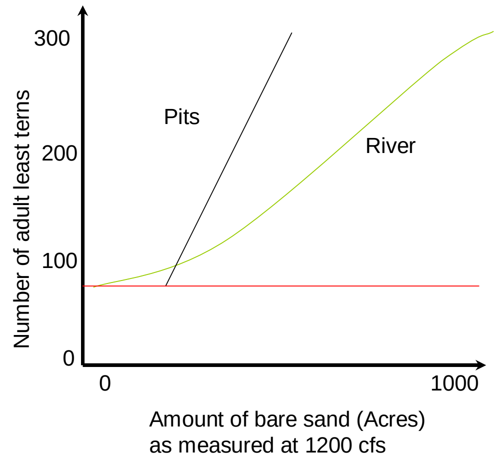
Proposed Program actions (land acquisition and management, halting or reversing channel degradation, augmenting spring flows, minimizing further reductions of peak flows) will increase the total acreage of wet meadows in habitat complexes by the end of the first increment. Absent these Program actions, total suitable wet meadow area is likely to decline.

S2 Implementing Program land and water management actions (i.e., habitat complexes and clear/level/pulse) will have a detectable effect on other species use of the associated habitats



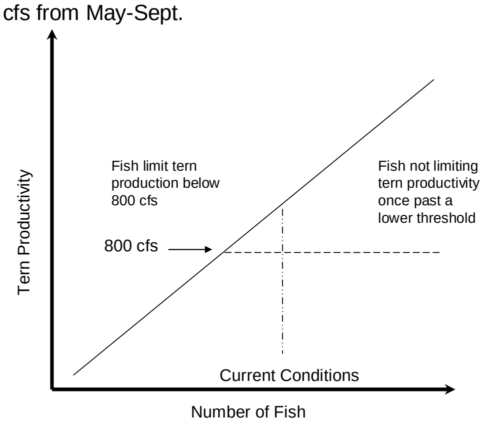
Management Objective #4 Within the overall management objectives for whooping crane, terns and plovers, and pallid sturgeon, benefits can be provided to non-target listed species and non-listed species of concern thereby reducing the likelihood of future listing and improve overall ecosystem diversity.

T1: Additional bare sand habitat will increase the number of adult least terns.



Green line is island densities from central Platte constructed islands using only years when birds were present on islands densities would be approximately half this if we use all years islands were present.
Black line using estimated acres and 96 bird average on 81 acres of sandpits last 4 years
Red line is bare sand not currently limiting so additional acres has no effect.

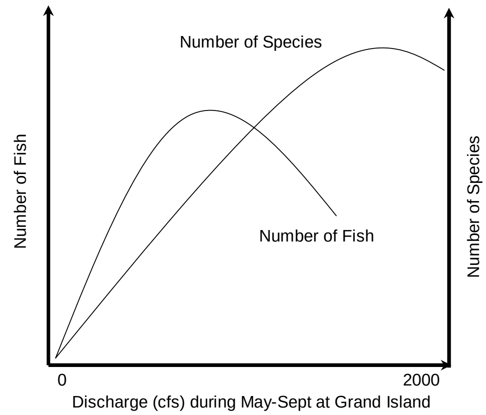
T2. Tern productivity is related to the number of prey fish (<3 inches) and fish numbers limit tern production below 800 cfs from May-Sept.



One of the USFWS target flows is related to fish populations for tern prey base. If the prey base is limiting terns, and flows are released to increase the prey base, tern numbers should increase. If fish numbers are not limiting the tern population, increased numbers of fish will not increase tern numbers.

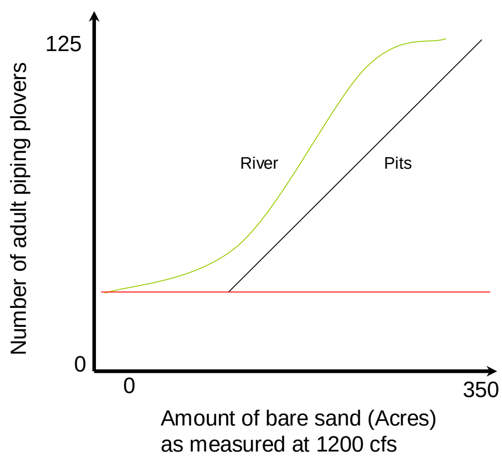
Factors that may limit fish populations include: temperature, nutrients, ambient air temperature, solar energy, fish movement, species composition, etc.

T2a. Flow rates influence the number and species diversity if tern prey base (fish).



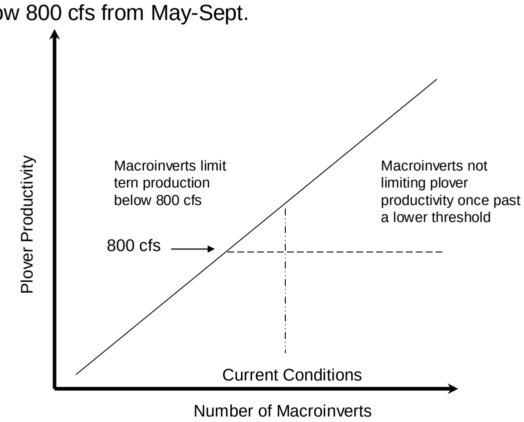
As flows increase there is a corresponding increase in both the number of species and number of individual fish. At some flow the numbers of fish decline due to the fact that some species with large numbers of individuals (e.g., killifish) due better at lower flows. The numbers of overall species increases because some of the individuals remain as well as other species "move in".

P1. Additional bare sand habitat will increase the number of adult piping plover.



Green line is island densities from central Platte constructed islands using only years when birds were present on islands densities are approximately half this is we use all years islands were present.
Black line using estimated acres and 30 bird average on 81 acres sandpits last 4 years
Red line bare sand not limiting so additional acres no effect

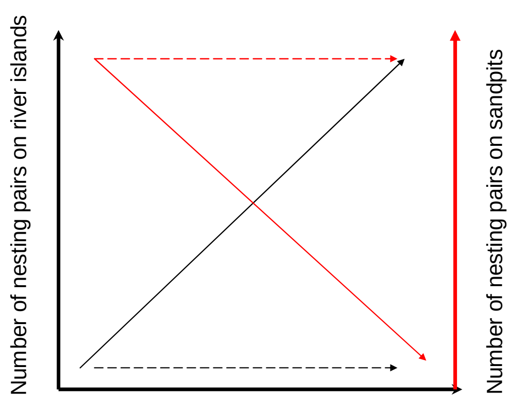
P2. Plover productivity is related to the number of suitable macroinverts and macroinverts limit plover production below 800 cfs from May-Sept.



If the prey base is limiting plovers, and flows are released to increase the prey base, plover numbers should increase. If macroinvert numbers are not limiting the plover population, increased numbers of macroinverts will not increase plover numbers.

Factors that may limit macroinvert populations include: temperature, nutrients, ambient air temperature, solar energy, species composition, etc.

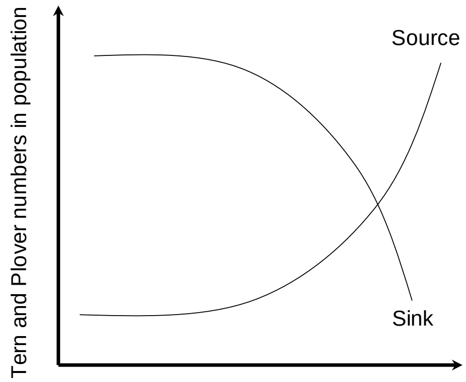
TP 1. There is an Interaction of river and sandpit habitat.



As river habitat increases, additional birds will 1) move into the region, and birds will continue to use the sandpits at current number or 2) move from sandpits to the river.

The relationship between use and location (river, sandpit) may indicate a relative preference for nesting location.

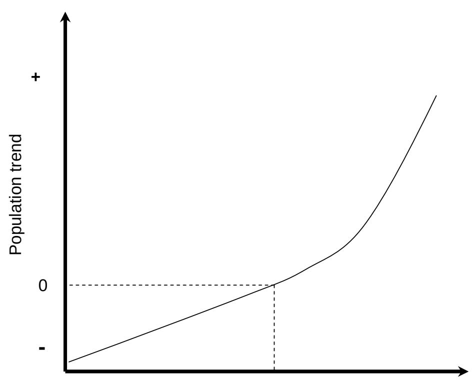
TP 2. The central Platte River may act as a source or sink for terns and plovers.



Unknown if birds that are fledge on the central Platte (pits or otherwise) breed elsewhere, die on winter grounds, other. Full investigation would require a banding study.

This is a good hypothesis, but it would be difficult to implement at a Program level because the scope of the test would be far outside of the Program scales. Production of a subpopulation is not always proportional to subpopulation trends because of interconnectedness to other subpopulations.

TP 2a. A fledge ratio of 1.13 or 1.17 fledging/pair is needed to prevent the central Platte River from being a population sink for piping plover.

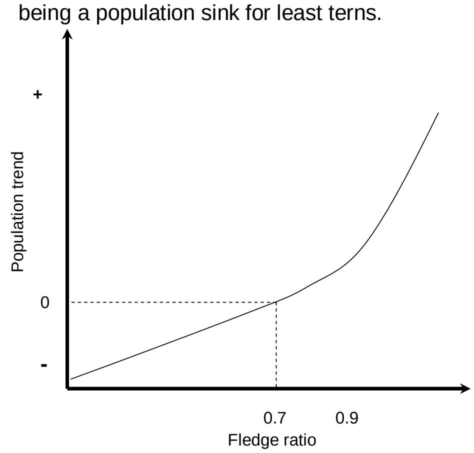


A long-term piping plover fledge ratio less than 1.13 or 1.7 will result in the area being a population "sink".

Different areas (pits vs. river) and different nest management practices will influence the fledge ratio.

The fledge rates are based on studies of productivity for the entire metapopulation. Production of a subpopulation is not always proportional to subpopulation trends because of interconnectedness to other subpopulations (e.g., annual immigration/emigration and productivity of other subpopulations).

TP 2b. A fledge ratio of 0.7 fledging/pair is needed to prevent the central Platte River from being a population sink for least terns.

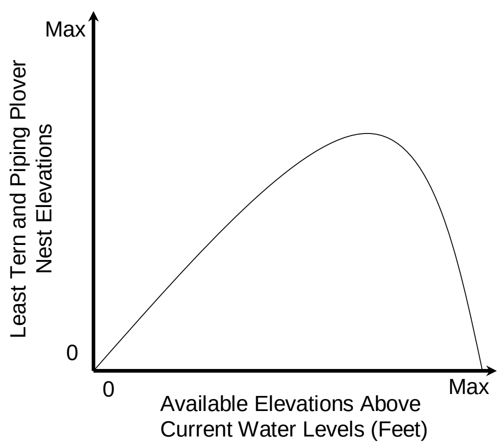


A long-term least tern fledge ratio less than 0.7 will result in the area being a population "sink".

Different areas (pits vs. river) and different nest management practices will influence the fledge ratio.

The fledge rates are based on studies of productivity for the entire metapopulation. Production of a subpopulation is not always proportional to subpopulation trends because of interconnectedness to other subpopulations (e.g., annual immigration/emigration and productivity of other subpopulations).

TP 3. Tern and plover will select for specific elevations above current water levels compared to available elevations for nest initiation

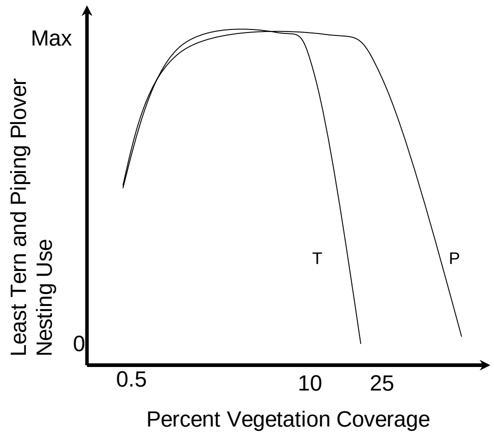


Hypothesis: Tern and Plovers select for specific elevations above current water levels compared to the available sandbar elevations for nest initiation

Alternate Hypothesis: Tern and Plovers randomly select sandbar elevations when initiating nests

This hypothesis will evaluate elevations at 1,200 cfs as well as elevations associated with all other flows.

TP 4. Increased vegetation cover decreases tern and plover use.

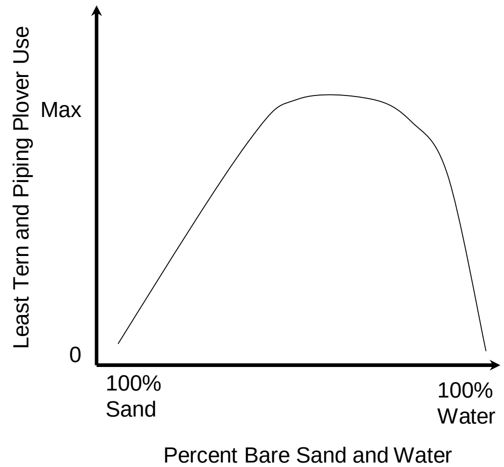


Least tern use within an area will decrease at 10% vegetative cover and piping plover use will decrease at 25% cover.

TP 4a. Bare sand suitability increases with size

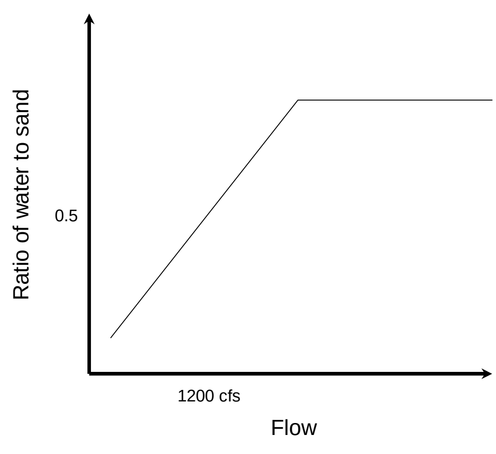
1.5 acres is the minimum size of bare sand area to be considered habitat by terns and plover. One hypothesis is that once a maximum bare sand area is reached additional area will not increase use. Other hypothesis is that more bare sand area will result in more use with no maximum.

TP 4b. Least tern and piping plover use will be maximized at 50-65% water to sand combination.



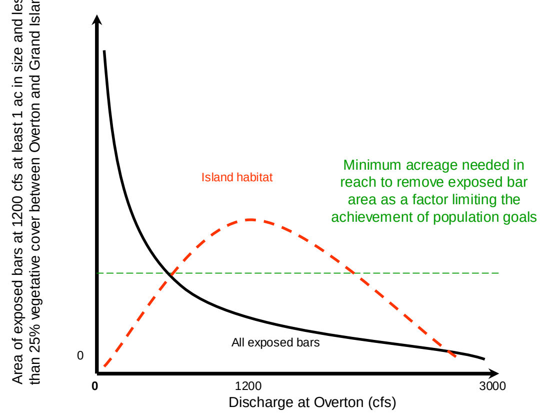
Tern and plover use of an area requires a combination of bare sand and water. If an area is comprised completed of either use will be zero. Optimal ratios may be different for the two species.

TP 4c. Increased flow rates increase the amount of water area compared to sand area



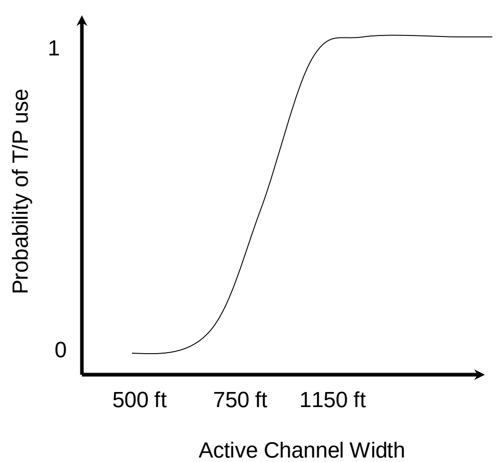
A flow rate of 1200 cfs results in the optimum water to sand ratio.

TP 4d. Correlation between river island habitat and flow.



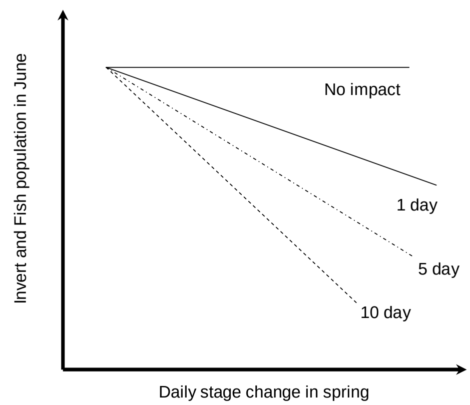
Once islands are created by peak flows or mechanical manipulation, flows at Overton of 1,200 cfs maximizes area of exposed island bars between Overton and Grand Island that is usable for LT and PP habitat. At lower flows, island areas are low due to connection with bank. At higher flows, island areas are low due to inundation.

TP 5: Use of riverine islands by least terns and piping plovers will increase with active channel width.



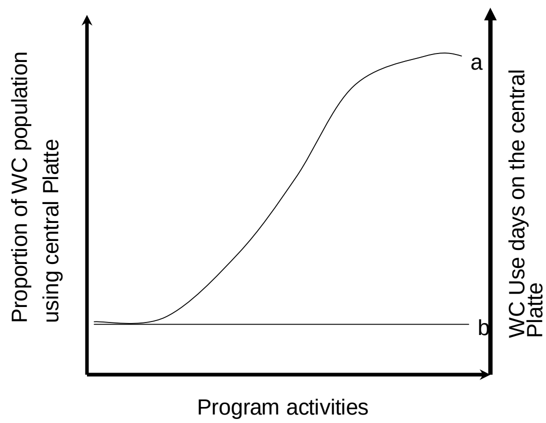
Tern and plover use of an area will be maximized when active channel widths are between 750 and 1150 feet wide.

TP 6. Daily stage change impacts on tern and plover prey base



Repeated stage changes on a daily or sub-daily basis adversely impacts the abundance and diversity of the aquatic invertebrate and fish communities that forms the food base for piping plovers and least terns, respectively. For plovers and terns to successfully nest and rear chicks in and along the central Platte River, a certain quantity and quality of prey items are required throughout the nesting season. Curves are likely different for different species of fish and invertebrates.

WC 1. Whooping Crane use will increase as function of Program land and management activities.

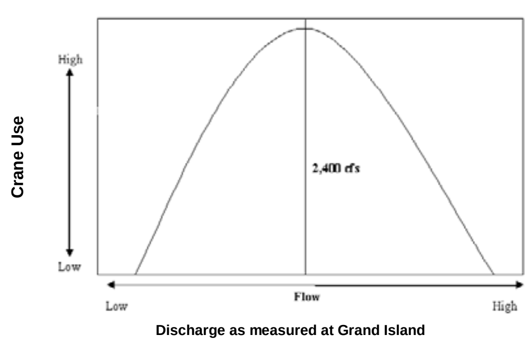


a. The amount of whooping crane use days will increase as Program activities increase.

b. Whooping crane use days will not increase with Program activities.

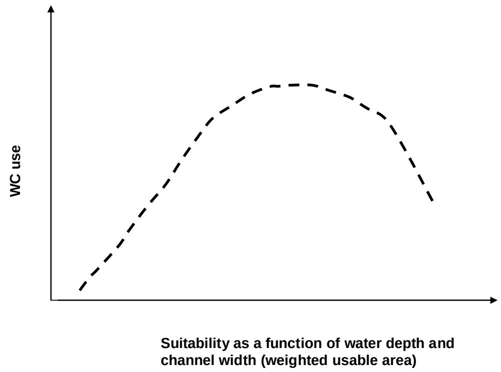
Analysis and consideration will be needed to investigate Program activities and non Program activities (e.g., Trust land management). Analysis could also be done on a bridge segment basis as well as a system basis.

WC 2. Whooping cranes select for flows of 2,400 cfs at Grand Island



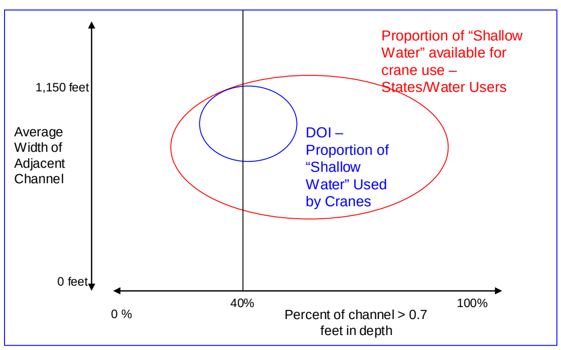
Whooping crane use is maximized at 2400 cfs

WC 3. Whooping crane use is related to habitat suitability

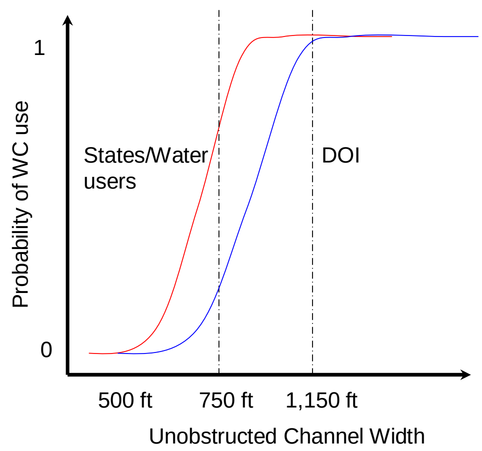


The prediction of habitat suitability for whooping crane in channel habitat as a function of water depth and unobstructed channel width. FWS Instream flow recommendation for fall and spring whooping crane migration season is 2,400 cfs. Farmer et al. estimates that peak suitability is achieved at 1700 cfs.

WC 3a. Whooping crane use is related to unobstructed channel width and channel depth



WC 3b: Probability of whooping crane use increases as channel widths increase



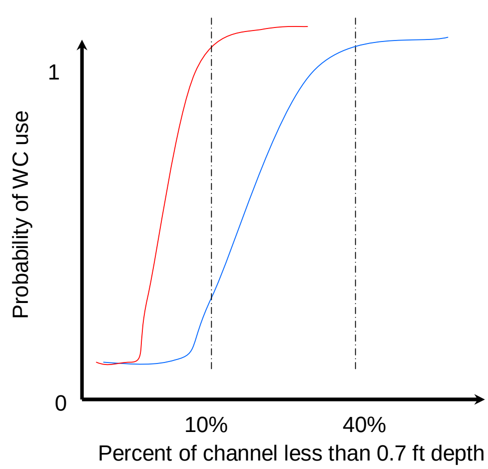
Whooping crane prefer wider, shallower channels w/open views; includes a. depth, b. width, c. distance to disturbance, d. proximity to wet meadow, e. size , f. length, g. water velocity, h. flight hazard, I. distribution.

a. Whooping crane use is proportional to unobstructed channel width.

b. Whooping crane use is not proportional to unobstructed channel width.

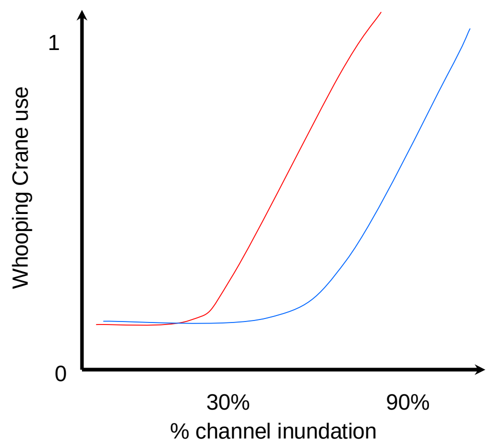
An evaluation should also be conducted that looks at probability of use in respect to varying, contiguous lengths of wide channel (e.g., 1.5 miles “wide” channel has greater frequency of use than 0.5 miles).

WC 3c. Whooping crane use is related to channel depth



For a given stretch of river 2-miles long and 1,150 feet wide, whooping crane use is proportional to percent of channel less than 0.7 ft.

WC 3d. Whooping crane use is related to amount of channel inundation.



For a given stretch of river 2-miles long and 1,150 feet wide, 90-100% of channel inundation during migration (wetted width) is needed to maximize whooping crane use.

WC 4 Whooping crane use of the central Platte River study area will increase proportionally to an increase in wet meadows

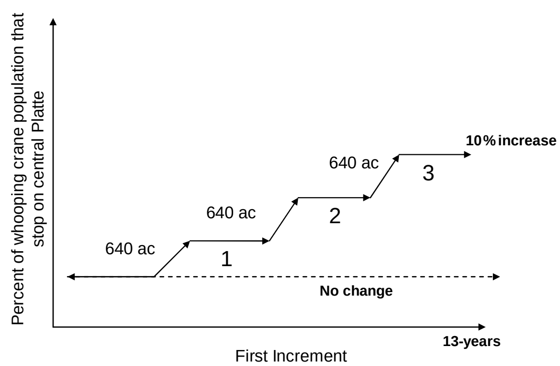
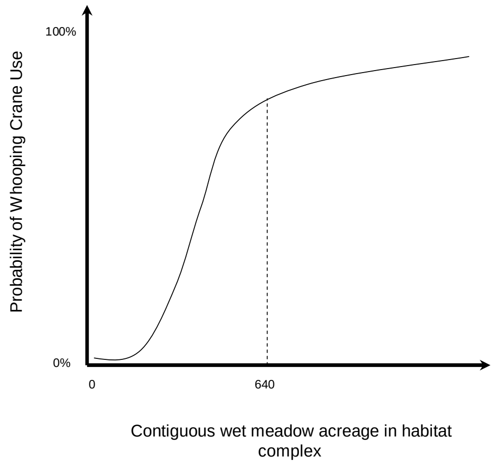


Table 1 wet meadow characteristics:

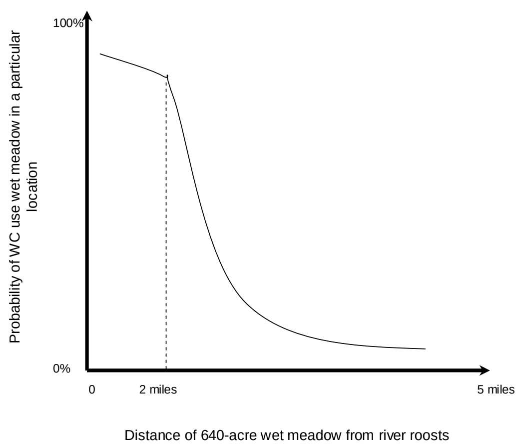
- Within of channel habitat whose length is two miles
- 640 contiguous acres
- Not less than 0.5-mile distant or appropriately screened from disturbance
- Appropriate mix of vegetation, hydrology, topography and soils, and food sources (see set meadow hypotheses

WC 4a: Whooping crane use will increase with suitable wet meadow size



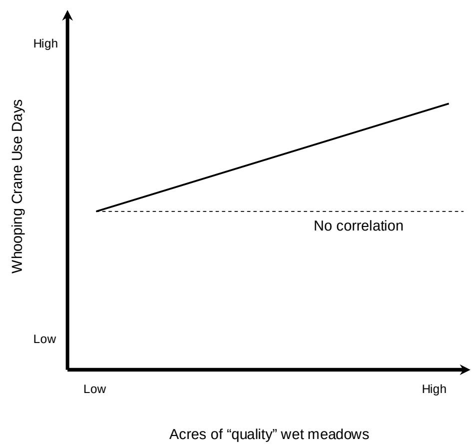
The probability that Whooping Cranes use wet meadow areas within a habitat complexes increases as the contiguous area of wet meadow in the complex increases. (This assumes these wet meadows have suitable hydrology and soils, and are within 2 miles of Platte channels with suitable roosting depths and unobstructed widths). A threshold of 640 acres per habitat complex is hypothesized to achieve desired Program benefits.

WC 4b. Whooping crane use will increase with an increase in suitable wet meadows near the channel.



The probability that Whooping Cranes use wet meadows in any particular location decreases as their distance from river roosts increases. (Assumes these wet meadows have suitable hydrology and soils). A distance of two miles for an individual complex is hypothesized to be the maximum acceptable to achieve desired Program benefits.

WC 4c. Whooping crane use will increase with more wet meadow acreage.

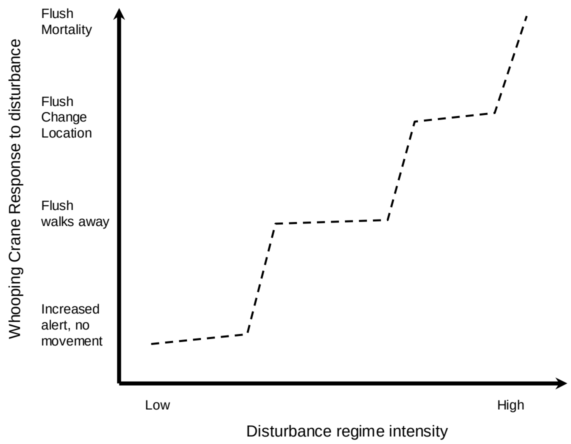


Increase in acres of quality wet meadows will increase use days of whooping cranes on the central Platte.

WC 4d: Whooping crane use of wet meadows will increase with increased biomoass of macroinvertebrates

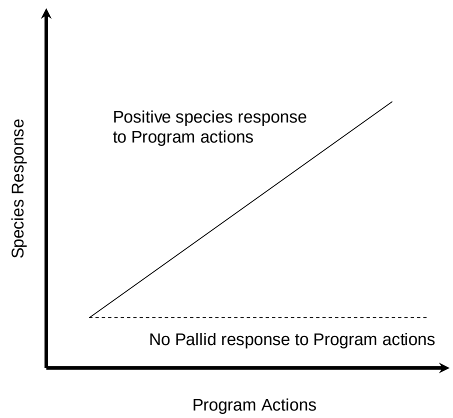
Increased macroinverts near soil surface or less than one-foot of water will increase whooping crane use days

WC 5 Whooping cranes are adversely affected by nocturnal disturbances that lead to flushing (walking or flying) which could potentially lead to mortality.



Roosting Whooping Cranes can be disturbed by many factors (animals, humans, vehicles, water flow and level changes). Level of disturbance can range from increased alert behavior through displacement from a roost, which can lead to increased probability of mortality. Mortality, if it occurs, is most likely a secondary effect of flying from a roost and colliding with power lines or other structures.

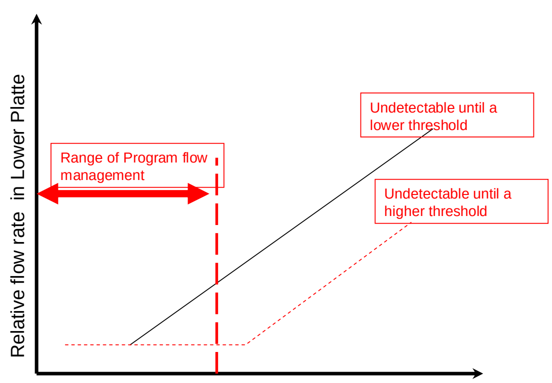
PS- 1: Program flow/sediment management will result in a positive species response by the pallid sturgeon in the lower Platte River.



Changes in flow rate and/or channel characteristics will not result in detectable change in patterns/levels of pallid sturgeon use in the lower Platte River.

Species use could be used as the indicator of species response?

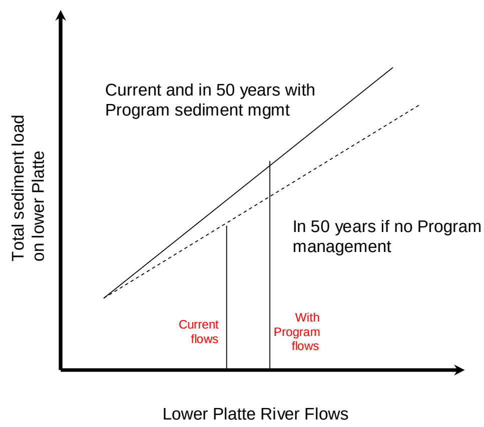
PS 2: Program water management will result in measurable changes on flow in the lower Platte River.



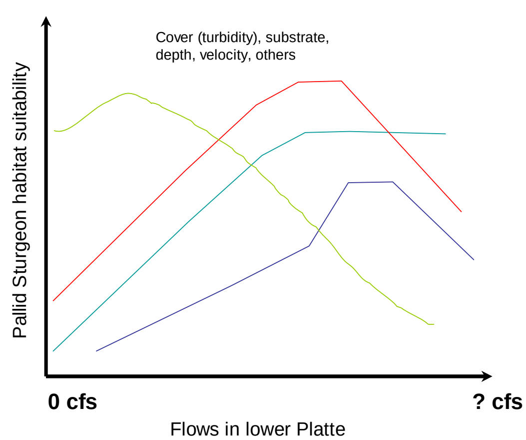
Program flow management results in measurable change in the lower Platte flows. The probability of detecting flow changes in the lower Platte as a result of Program water management activities (e.g., new depletions plans, summer flow augmentation) is improbable.

Program pulse flow management will have the greatest chance of resulting in measurable changes in the lower Platte.

PS 3: Program flows and sediment management will result in measurable changes on sediment load in the lower Platte River

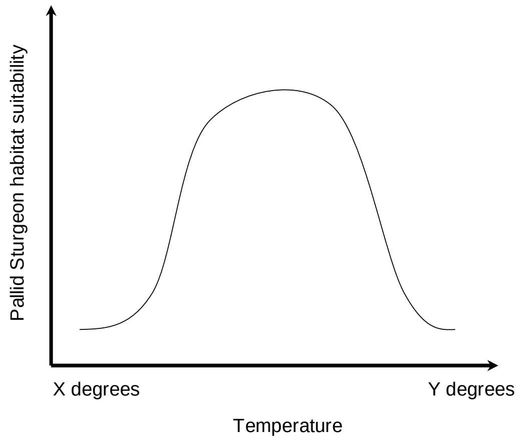


PS- 4: Flow in the lower Platte will affect pallid sturgeon habitat suitability.



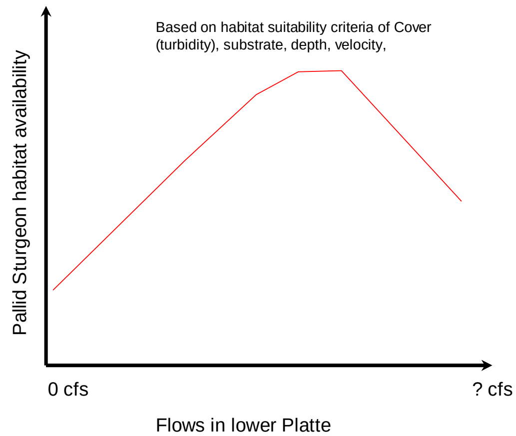
Flows on the lower Platte river affects habitat suitability for Pallid Sturgeon. Some habitat suitability is known, some requires more research.)

PS- 5: Pallid sturgeon habitat suitability is maximized between water temperatures of X and Y in the lower Platte River.



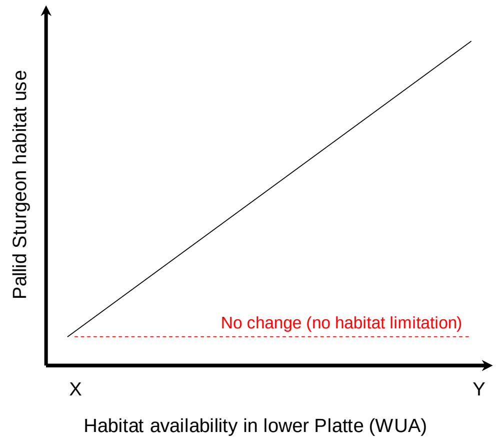
See text above

PS-6: Increasing flow in the lower Platte will affect pallid sturgeon habitat availability.



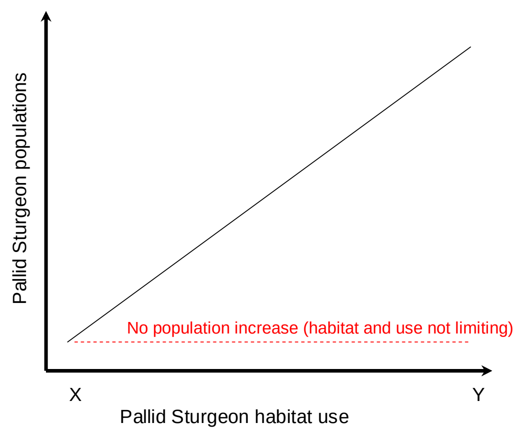
Increase flows on the lower Platte river will affect habitat availability for Pallid Sturgeon.

PS-7: Increasing habitat availability in the lower Platte will increase pallid sturgeon use.



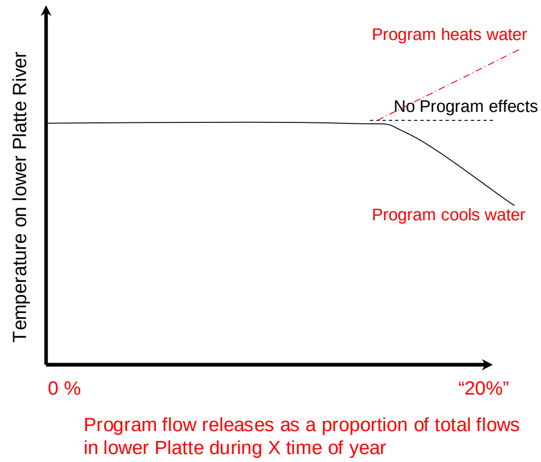
See text above

PS-8: Increasing Pallid sturgeon use in the lower Platte River will increase pallid sturgeon populations.



See text above

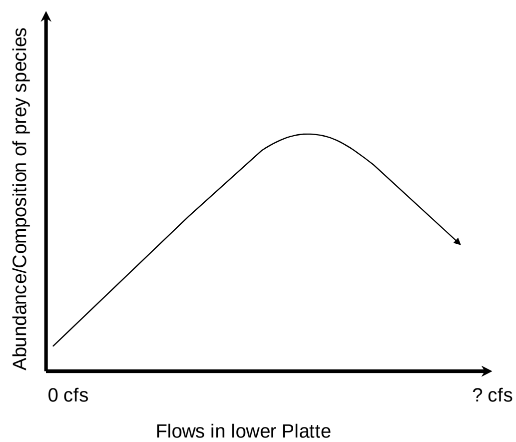
PS-9: Increasing Program flow releases will decrease water temperatures in the lower Platte River.



Increased program flow releases will decrease summer water temperatures on the lower Platte River

Increased program flow releases will have no effect on summer water temperatures on the lower Platte River (equilibrium conditions reached before the lower Platte River)

PS-10: Different rates of flow in the lower Platte affect pallid sturgeon prey base.

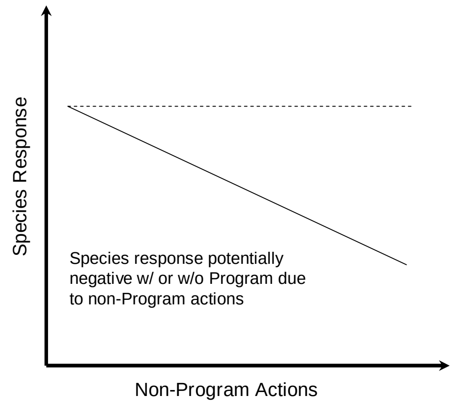


Numerous other parameters should be hypothesized including:

PS1b: Changes water quality (temp, turbidity, etc) will result in detectable change in patterns/levels of pallid sturgeon use in the lower Platte River.

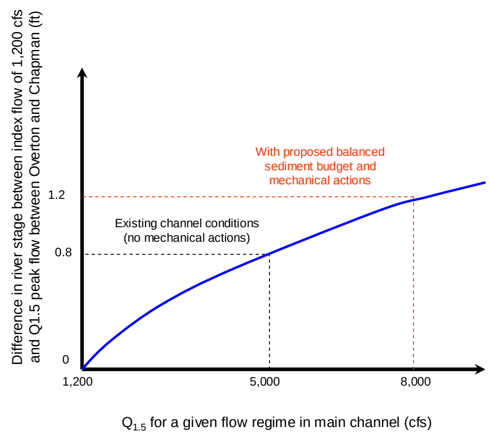
PS1c: Floodplain connectivity

PS-11: Non-Program actions (e.g., harvest, stocking, Missouri River conditions) determine the occurrence of pallid sturgeon the lower Platte River



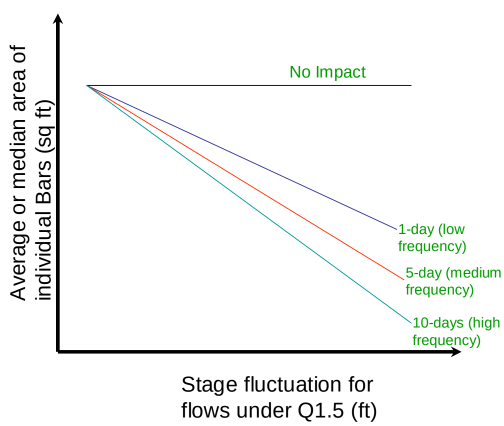
Non-Program actions: Incidental harvest, stocking, Missouri River conditions, Competition with non-native species, local water quality, disease, hybridization.

Flow 1: Increasing river stage variation will increase sand bar height



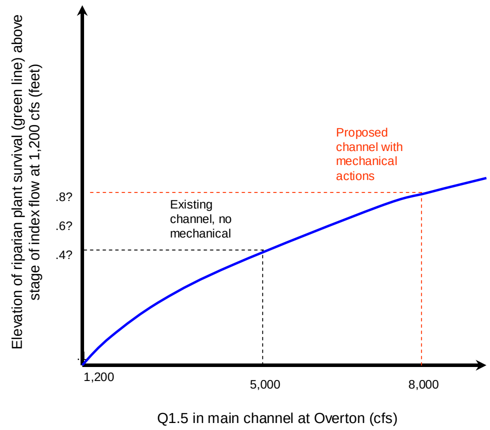
Increasing the variation between river stage at peak flow (indexed by $Q_{1.5}$ flow at Overton) and average flows (1,200 cfs index flow), by increasing the stage of the peak (1.5-yr) flow through Program flows, will increase the height of sand bars between Overton and Chapman by 30% to 50% from existing conditions, assuming balanced sediment budget.

Flow 2. Stage fluctuation will decrease bar area



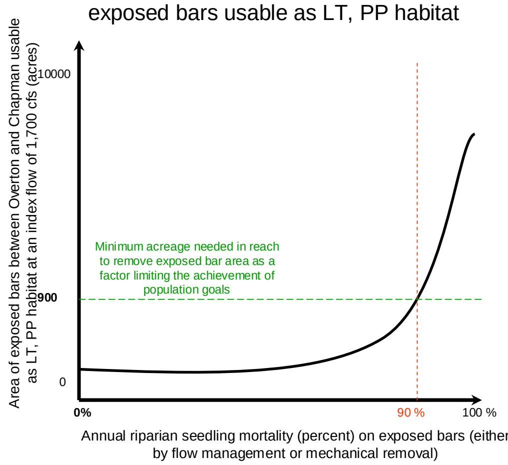
After a bar has been created by whatever means, ongoing stage fluctuations will decrease the bar area that could potentially be used by terns and plovers. Erosion will be less with a balanced sediment budget. Rate, magnitude, and frequency of stage fluctuation needs to be considered

Flow 3: Increased peak (1.5 yr) flow = raised green line (the lowest elevation at which vegetation can establish on river banks and sand bars) = more exposed sand bar area and wider unvegetated main channel.



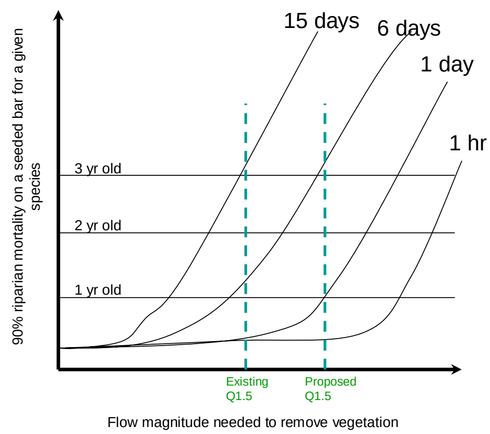
Increasing the 1.5-yr peak flow regime (indexed by $Q_{1.5}$ flow at Overton) with Program flows will increase the local boundary shear stress and frequency of inundation at the existing green line (elevation at which riparian vegetation can establish). These changes will increase plant mortality along the margins of the channel, raising the elevation of the green line. A raised green line results in more exposed sand bar area and wider unvegetated main channel.

Flow 4: Increased riparian plant mortality = more exposed bars usable as LT, PP habitat



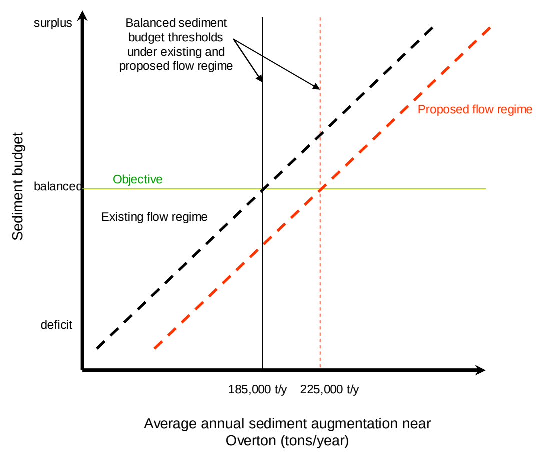
Annual riparian seedling mortality greater than 90% is required to prevent riparian encroachment on exposed bars, thereby maintaining at least 900 acres of exposed bars between Overton and Chapman that are usable as LT and PP habitat.

Flow #5: Increased magnitude and duration of flow increases riparian plant mortality



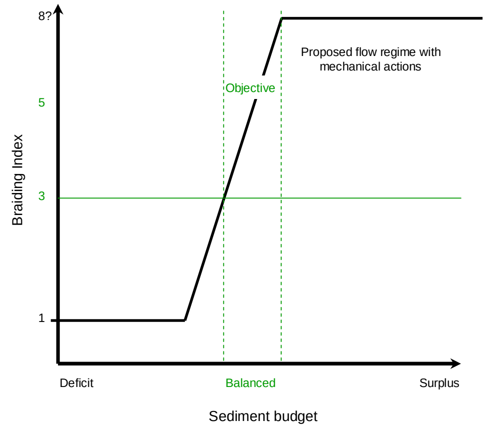
Increasing magnitude and duration will increase riparian plant mortality along the margins of the river. There will be different relations (graphs) for different species.

Sediment 1: Sediment augmentation balances the sediment budget.



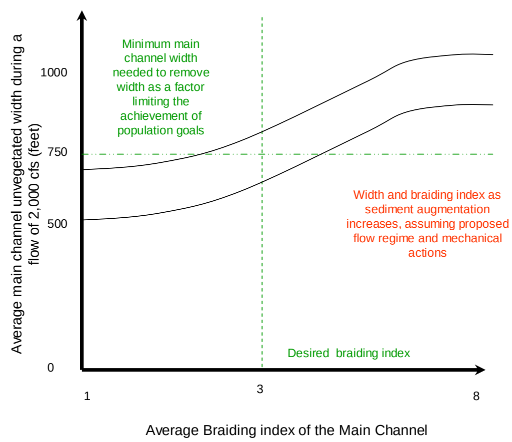
Sediment augmentation near Overton to 185,000 tons/yr under existing flow regime and 225,000 tons/year under the Governance Committee proposed flow regime achieves a sediment balance to Kearney.

Sediment 2: Balanced sediment budget promotes braiding and an increased braiding index



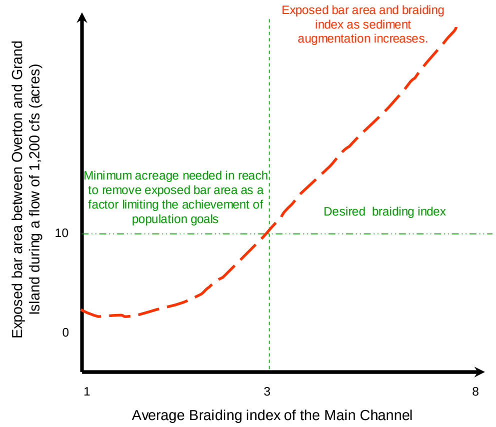
A balanced sediment budget (sediment augmentation of 225,000 tons/yr near Overton under proposed Governance Committee flows) when implemented with mechanical actions (channel consolidation & widening) in anastomosed reaches will promote braided channel morphology with an average braiding index in the main channel of greater than 3.

Sediment 3: Increasing the braiding index by achieving a sediment balance increases main channel width



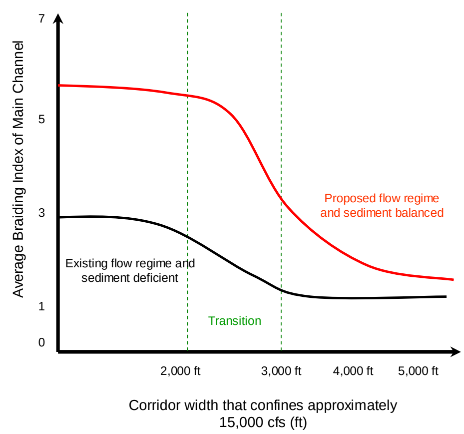
Increasing the average braiding index of the main channel by achieving a balanced sediment budget, increases the active width of the main channel at an index flow of 2,000 cfs (at Overton).

Sediment 4: Increasing the braiding index by achieving a sediment balance increases bar area



Increasing the average braiding index to greater than 3 for the main channel by achieving a sediment balance, will increase and maintain exposed bar area greater than 1.5 acres in the reach between Overton and Kearney at an index flow of 1,200 cfs (at Overton).

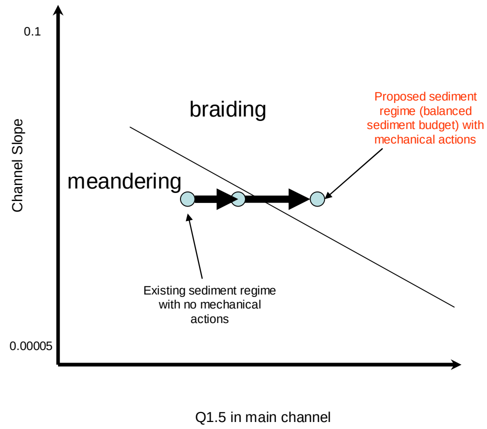
Mechanical (Channel manipulation) 1: Decreased “hydraulic corridor width” encourages braiding



Indirectly narrowing the width of the hydraulic corridor (preferred width less than 3,000 ft) by cosolidating channels <u>under proposed flow regime and balanced sediment budget</u> will convert anastomosed reaches of the Platte River between Overton and Chapman to a braided channel morphology.

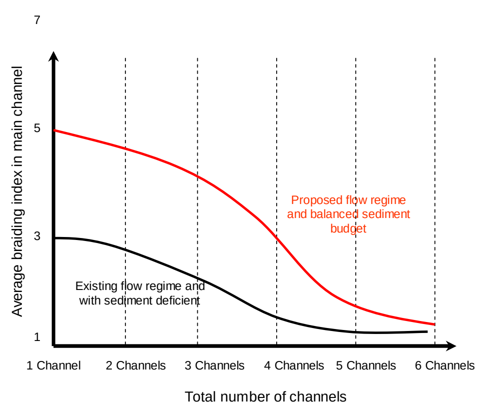
“Hydraulic corridor width” is defined as the width from furthest wetted left bank to furthest wetted right bank, as measured at an index flow of 15,000 cfs.

Mechanical (channel manipulation) 2: Stream power determines braided channel morphology (this focuses on channel consolidation rather than increased releases)



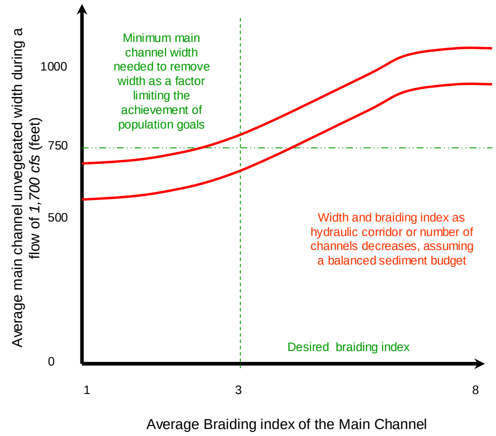
Increasing the Q1.5 in the main channel by consolidating 85% of the flow, and aided by Program flow and a sediment balance, flows will exceed stream power thresholds that will convert the main channel from a meander morphology in anastomosed reaches to a braided morphology with an average braiding index greater than 3.

Mechanical (Channel manipulation) 3: Reducing number of channels increases unit stream power, which encourages braiding



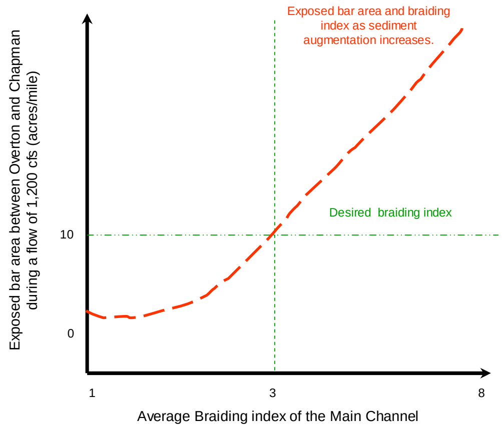
Reducing the number of channels in a reach of river to 3 or less <u>under proposed flow regime and balanced sediment budget</u> will convert anastomosed reaches of the Platte River between Overton and Chapman to braided channel morphology.

Mechanical (Channel Manipulation) 4:
Increasing braiding by channel manipulation, increases main channel width



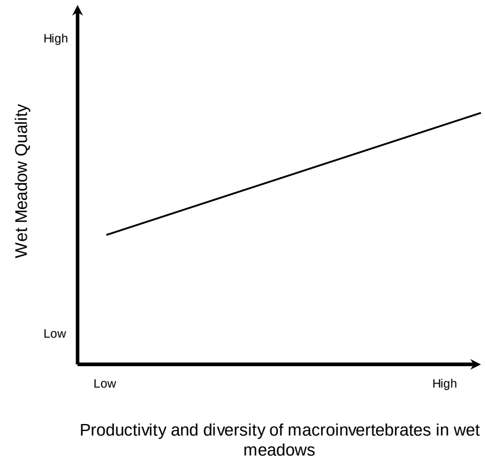
Increasing the average braiding index to greater than 3 in the main channel by channel manipulation will promote in the Platte River at the mechanically changed sites a total main channel wetted width exceeding 500 to 750 feet at an index flow of 1,700 cfs (at Overton).

Mechanical (Channel Manipulation) 5:
Increasing the braiding index by channel manipulation increases bar area



Increasing the average braiding index to greater than 3 for the main channel by mechanical channel manipulation, will increase and maintain exposed bar area at 10 acres per mile at an index flow of 1,200 cfs (at Overton).

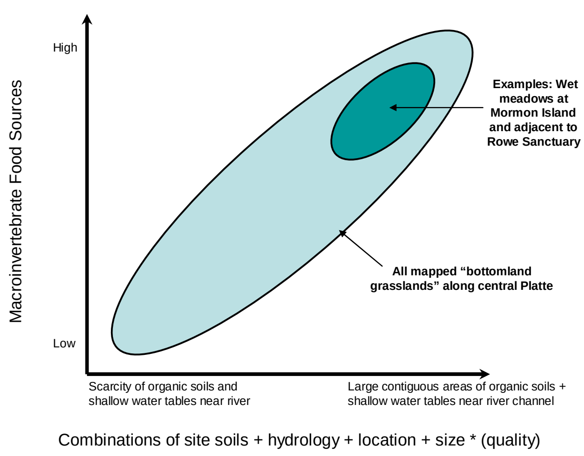
Wet Meadow 1: An increase in macroinvertebrate diversity and productivity increases the quality of a wet meadow as whooping crane foraging habitat.



A high productivity and diversity of macro- invertebrates* in areas used by whooping cranes along the Platte River corridor will improve WC conservation and recovery.

(*Note: FWS posits similar relationships to other food sources: e.g., amphibians, reptiles, fish, freshwater shellfish)

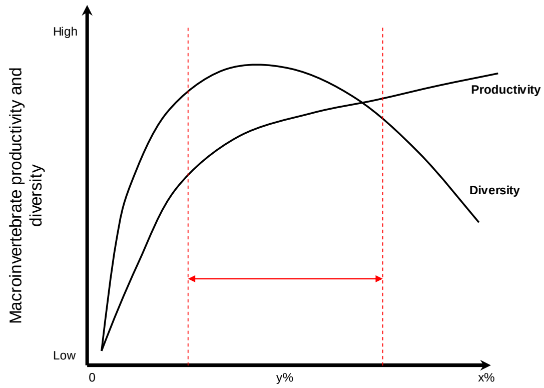
Wet Meadow 2: Quality wet meadows provide potential macroinvertebrate food sources for WC



Wet meadows producing the optimum productivity (biomass) and diversity of macroinvertebrates potentially consumed by whooping cranes exhibit certain characteristic combinations of soils, hydrology, size, and location. The ideal combinations are not yet fully understood, however along the central Platte habitat reach good existing examples are believed to be found at wet meadows at Mormon Island and adjacent to Rowe Sanctuary.

*NOTE: It is hypothesized that vegatation can be a good indicator of desired wet meadow conditions, but is not generally a primary determinant of those conditions

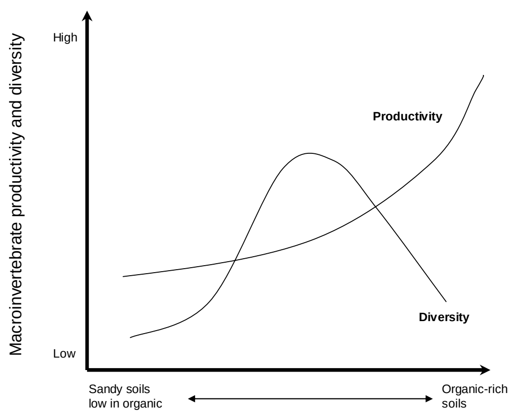
Wet Meadow 3: Suitable wet meadow hydrology
(March-April)



Percent of area with water table surface +0.5 feet above
to -0.5 feet below ground surface in March and April

Shallow surface water and groundwater less than 0.5 feet deep in March and April support high productivity and diversity of macroinvertebrates as potential food sources to Whooping Cranes in wet meadows, provided site soils are satisfactory.

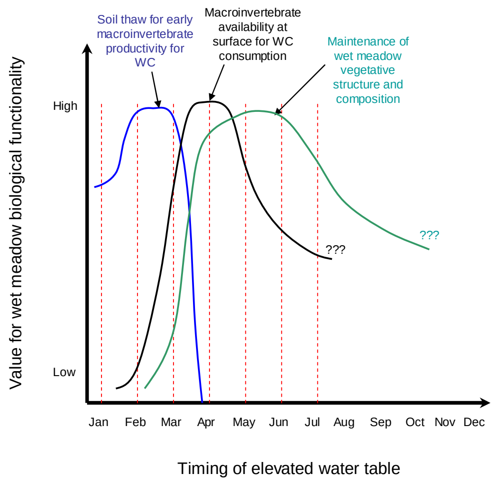
Wet Meadow 4: Suitable wet meadow soil conditions



Dominant soil type

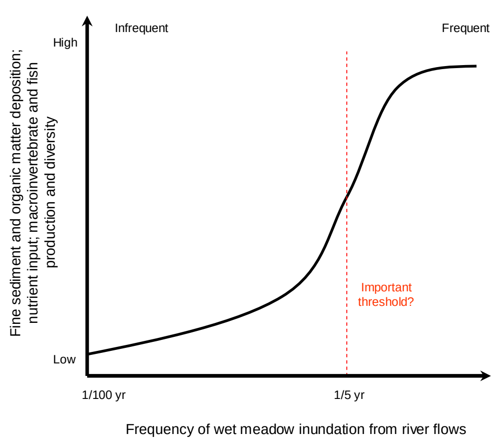
A predominance of organic-rich soils supports the productivity and diversity of macroinvertebrates as potential Whooping Crane food sources in wet meadows, provided site hydrology is satisfactory.

Wet Meadow 5: The timing of elevated water tables in wet meadows influences benefits for WC



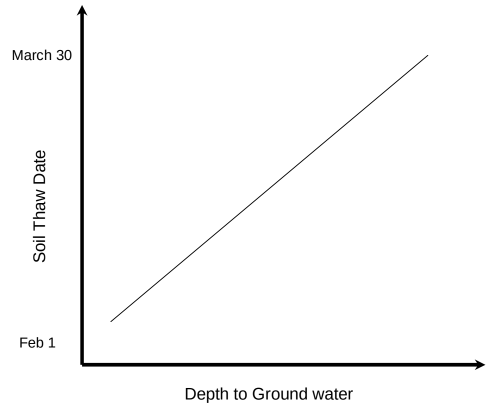
High water tables in wet meadows provide greater benefits to whooping cranes if they occur in the Feb-Jun period versus other times of the year, for multiple reasons. (See related charts 8a-d)

Wet Meadow 6: Periodic inundation of wet meadow areas increases their suitability as WC habitat



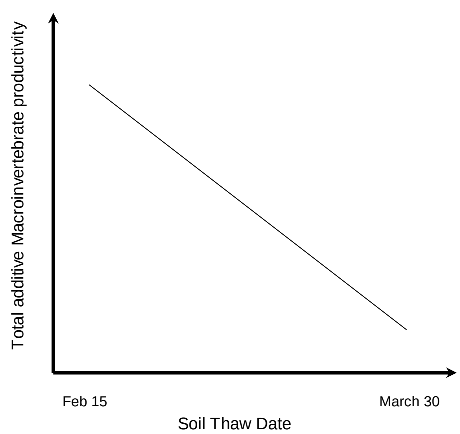
Periodic inundation of wet meadows between Overton and Grand Island increases fine-sediment and organic matter deposition, increases nutrient input, and increases the production and diversity of macroinvertebrates and fish available for Whooping Cranes. *[NOTE: Program actions are not expected to increase the frequency of wet meadow inundation by peak flows, however one intent of the Program is to minimize future reductions in the frequency of these events].*

Wet Meadow 6a: Soil thaw dates are related to ground water elevation.



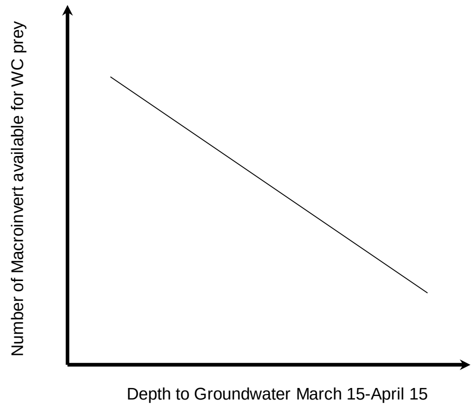
As the depth to ground water increases (i.e., higher elevation) the ground will stay frozen longer. Those areas where ground water is closer to the surface thaw sooner.

Wet Meadow 6b: Marcroinvertebrate production is higher in wet meadows where the soil thaws earlier.



Areas where the soils thaw earlier allow for increased macroinvert productivity.

Wet Meadow 6c: The availability of macroinverts for whooping crane prey decreases with greater depths to ground water.



As distance to ground water increases the number of macroinverts available as whooping crane prey decreases.

Appendix E. Matrices

System Matrix

Graph number	Description of hypothesis	Link to CEM Hypotheses	Source of information, if any	Detectability/ sensitivity (feasibility)	Time needed for measuring a response	Dependent Variable (Indicator)	Corresponding quantitative management objective	Description of alternative/competing hypotheses	Priority Hypotheses?	Rationale based on Prioritization Criteria
S1	The Platte River form can be modified by either mechanical/sediment/flow management (i.e., clear/level/ pulse) or mechanical means along with non-Program managed flows.	S-1, S-2	SedVeg Gen3	High	First Increment	Braiding index, channel width, sandbar area			Yes	Influence Program management, goals, and objectives
S1a	Program channel habitat restoration actions will result in detectable change to Platte River form and function	S-1, S-2, S-4	Joint Study	High.	1-10 years	Species use	Channel width increase, decreased depths with improve river habitat for species	Can not detect a significant effect on indicators	Yes	Influence Program management, goals, and objectives
S1b	Program land management actions (i.e., restoration into habitat complexes) will have a detectable effect on target birds species use of the associated habitats	S-3	Joint Study	Low	First Increment	Whooping crane use days/proportion of population, Least tern piping plover number of adults/nests/fecundity	Improve Production LT & PP, Impove Survival Whooping	Can not detect a significant effect on indicators	Yes	Influence Program management, goals, and objectives
S1c	Program actions will increase functional wet meadows in habitat complexes during the first increment	S-1, S-2		High. Requires good sampling/mapping of wet meadow areas at being and end of Program	First Increment	Wet meadows along habitat reach incomlexes at beginning and end of Program	10% increase in wet meadow acreage over the 1998 baseline trhough habitat acquisition and restoration (Note: meadow quality, not just quantity, will also be an important metric)		Yes	Influence Program management, goals, and objectives
S2	Implementing Program land and water management actions (i.e., habitat complexes and clear/level/pulse) will have a detectable effect on other species use of the associated habitats	S-1, S-2	Joint Study	Medium-High	1-5 years	Species occurrence; Land Plan Table 1 and 2 characteristics	Use by other species of concern. Prevent need to list additional species	Within the overall management objectives for whooping crane, terns and plovers, and pallid sturgeon, benefits can be provided to non-target listed species and non-listed species of concern thereby reducing the likelihood of future listing and improve overall ecosystem diversity.	Yes	Influence Program management, goals, and objectives

Tern and Plover Matrix

Graph number	Description of hypothesis	Link to CEM Hypothesis	Source of information, if any	Detectability/ sensitivity (feasibility)	Time needed for measuring a response	Dependent Variable (Indicator)	Corresponding quantitative management objective	Description of alternative/competing hypotheses	Priority Hypotheses?	Rationale based on Prioritization Criteria
T1	Additional bare sand habitat will increase the number of adult least terns.	TP-1, TP-2, TP-3		high	1-3 years after sand created	number of nesting adult lt	75 nesting pairs lt	bare sand is not currently limiting number of adults	Yes	Critical path for Program goals and objectives
T2	Tern productivity is related to the number of prey fish (<3 inches) and fish numbers limit tern production below 800 cfs from May-Sept.	TP-4	FWS Target flows	medium	x years above 800 cfs and x years below 800 cfs	number of fish between 0.5 and 3 inches long	x fish per meter of water, least tern fledglings per adult?	prey fish do not limit tern production at 799 cfs or tern production is limited by summer flows of < 50 cfs	Yes	On critical path for Program, will influence future water management
T2a	Flow rates influence the number and species diversity in tern prey base (fish).	TP-4	FWS Target flows	medium	period that covers multiple flow levels	species diversity index	Diversity Index of x,least tern fledglings per adult	tern productivity not affected by fish community species diversity	Yes	On critical path for Program, will influence future water management
P1	Additional bare sand habitat will increase the number of adult piping plover.	TP-1, TP-2, TP-3		high	1-3 years after sand created	number of adult pp	64 pp	bare sand is not currently limiting number of adults	Yes	Critical path for Program goals and objectives
P2	Plover productivity is related to the number of suitable macroinverts and macroinverts limit plover production below 800 cfs from May-Sept.	TP-4	FWS Target flows	medium	x years above 800 cfs and x years below 800 cfs	number of macroinverts	x macroinverts per meter of wet sand results in Y plover fledglings per adult?	macroinverts do not limit plover production at 799 cfs or plover production is limited by summer flows of < 50 cfs	Yes	On critical path for Program, will influence future water management
TP 1	There is an interaction of river and sandpit habitat.	TP-2	Sidle andKirsch 1992, Jenniges 2004, BO, EIS	high	1-3 years after sand created	proportion of nests/adults/fledglings relative to available habitat river and sandpits	Fledge rate of 0.7 lt, 1.13pp, 126 adult lt, 64 pp (nesting pairs)	LT and PP show no preference for the river over sandpits	Yes	Address areas of disagreement
TP 2	The central Platte River may act as a source or sink for terns and plovers.	TP-1, TP-2, TP-3	NAS	medium	10 years	Fledge ratio	Fledge rate of 0.7 lt, 1.7 pp	currently not a sink?	Yes	Will be addressed through current monitoring effort
TP 2a	A fledge ratio of 1.13 or 1.17 fledging/pair is needed to prevent the central Platte River from being a population sink for piping plover.	TP-1, TP-2, TP-3	NAS, Lutey 2003	high	3 year running average	Fledge ratio	fledge ratio of 1.13 or 1.7	some other number correct?	No	Will be addressed through current monitoring effort
TP 2b	A fledge ratio of 0.7 fledging/pair is needed to prevent the central Platte River from being a population sink for least terns.	TP-1, TP-2, TP-3	NAS, Lutey 2003	high	3 year running average	Fledge ratio	fledge ration of 0.7	some other number correct?	No	Will be addressed through current monitoring effort
TP 3	Tern and plover will select for specific elevations above current water levels compared to available elevations for nest initiation	TP-1, TP-2	Zweitz et al 1992	high	1 year of nesting	nest height	all nest established at elevation x corrected to Kearney	Terns and plovers do not select specific nest elevations	No	Higher priority when birds start nesting on river, low for on sandpits
TP 4	Increased vegetation cover decreases tern and plover use.	TP-1, TP-2	Numerous papers	low	multiple	tern use	vegetation less than 25%	general agreement	No	Identified in literature, will collect information using current protocol
TP 4a	Bare sand suitability increases with size	TP-1, TP-2	personal observation jj	dependent on availbility of different sizes	10 year of nesting	density	1 pair tern per acre and 1 plover per 6 acres	There is a maximum limit of bare sand area that is suitable for terns and plovers	No	May increase in priority for second increment
TP 4b	Least tern and piping plover use will be maximized at 50-65% water to sand combination.	TP-1, TP-2	personal observation jj	dependent on availbility of different ratios	20 nesting sites	number of nests		different ratio or not important at all	No	Will be investigated through current monitoring effort
TP 4c	Increased flow rates increase the amount of water area compared to sand area	TP-1, TP-2	physics	high				general agreement	No	
TP 4d	Correlation between river island habitat and flow.	TP-1, TP-2	Zweitz et al 1992, Target Flows	need use first to define habitat	?	Islands of x size, x height	10 acres per mile at 1200 cfs		Yes	Address areas of disagreement, potential impacts to Program management
TP 5	Use of riverine islands by least terns and piping plovers will increase with active channel width.	TP-1	Zweitz et al 1992	high	1-3 years with suitable islands in channels	number of nesting pairs	75 nesting pairs lt, 32 pair nesting pp	use will not increase with channel width	Yes	Will influence Program management
TP 6	Daily stage change impacts on tern and plover prey base	TP-4	Professional opinion	high	3 years	number of fish between 0.5 and 3 inches long, number of bugs	x fish per unit of water, bugs per unit of sand	hydrocycling does not affect forage to a limiting degree	No	Depends on determination of T2 and T2a. Has high level of disagreement.

Whooping Crane Matrix

Graph number	Description of hypothesis	Link to CEM Hypothesis	Source of information, if any	Detectability/ sensitivity (feasibility)	Time needed for measuring a response	Dependent Variable (Indicator)	Corresponding quantitative management objective	Description of alternative/competing hypotheses	Priority Hypotheses?	Rationale based on Prioritization Criteria
WC 1	Whooping Crane use will increase as function of Program land and water management activities.	WC-1, WC-2, WC-3	Land Plan Table 1. Joint Study.	Medium	After land and water activities are implemented. Could review annually	Proportion of population using Central Platte	amount of land/habitat available; Duration and magnitude of pulse flows and flow augmentation. Crane use variable (proportion of population, number, use days etc)	Whooping Crane use will not increase as function of Program land and management activities.	Yes	Influences Program management
WC 2	Whooping cranes select for flows of 2,400 cfs at Grand Island	WC-4	WS flow target (C4R)	Medium	Depends number of crane observations and site evaluations; likely 10 plus years	WC use	FWS flow target. Crane use variable (proportion of population, number, use days etc)	WC select river at flows lower than FWS target flows	No	Cannot measure cranes that do not use the Platte River. Could be done with radio tracked birds and then becomes high
WC 3	Whooping crane use is related to habitat suitability. The prediction of habitat suitability for whooping crane in channel habitat as a function of water depth (preferred depth?) and channel width (define as wetted width, open width other?)	WC-1, WC-2, WC-3	C4R. Farmer et al. 2006	Low, dependent on WC use at numerous flow rates	Depends number of crane observations and site evaluations; likely 10 plus years	WC use	Attaining Unobstructed channel widths of 1150 ft and water depths of 0.7. Achieving target flows. Estimate of WUA. Crane use variable (proportion of population, number, use days etc)	WC use of areas is not directly linked to FWS habitat suitability values	Yes	Influences Program management and Program goals and objectives
WC 3a	Whooping crane use is related to unobstructed channel width and channel depth	WC-1	Land Plan Table 1. Citations	Low, dependent on WC use at variable conditions	Depends number of crane observations and site evaluations; likely 10 plus years	WC Use	Objecitves for habitat complexes from Land Plan Table 1. Wider, braided river. Crane use variable (proportion of population, number, use days etc)	Bird use on central Platte is not limited by channel depth or widths as there is adequate range of depths and widths.	No	Will be captured in Program monitoring
WC 3b	Probability of whooping crane use increases as channel widths increase	WC-1	Professional opinion, Land Plan Table 1. Citations	Low, dependent on WC use at variable conditions	Depends number of crane observations and site evaluations; likely 10 plus years	WC use	Objectives for habitat complexes, wider river. Crane use variable (proportion of population, number, use days etc)	The proportion of WC use will not increase with increases in channel widths because range of river widths available is sufficient to fulfill crane use	No	Will be captured in Program monitoring
WC 3c	Whooping crane use is related to channel depth	WC-1	Professional opinion, Land Plan Table 1. Citations	Low, dependent on WC use at variable conditions	Depends number of crane observations and site evaluations; likely 10 plus years	WC use	Objectives for habitat complexes, wider river. Crane use variable (proportion of population, number, use days etc)	WC use of river will not increase by completing habitat complex characteristics as there is sufficient areas with adequate water depth	No	Will be captured in Program monitoring
WC 3d	Whooping crane use is related to amount of channel inundation.	WC-1	Land plan, models,	Low, dependent on WC use at variable conditions	Depends number of crane observations and site evaluations; likely 10 plus years	WC use	flow targets, habitat complexes. Crane use variable (proportion of population, number, use days etc)	Additional flows will not increase available for roosting on the river	No	Will be captured in Program monitoring

WC 4	Whooping crane use of the central Platte River study area will increase proportionally to an increase in wet meadows	WC-3	professional opinion	Low, dependent on available wet meadow and wc use	Depends number of crane observations and site evaluations; likely 10 plus years	WC use	habitat complex, meadow restoration. Crane use variable (proportion of population, number, use days etc)	WC do not use wet meadows currently and are unlikely to respond to increases in wet meadow area	Yes	Influence Program goals and objectives
WC 4a	Whooping crane use will increase with suitable wet meadow size	WC-3	professional opinion	Low, dependent on available wet meadow and wc use	Depends number of crane observations and site evaluations; likely 10 plus years	WC use	habitat complex, meadow restoration. Crane use variable (proportion of population, number, use days etc)	WC do not use wet meadows currently and are unlikely to respond to increases in wet meadow area	No	Address after WC 4
WC 4b	Whooping crane use will increase with an increase in suitable wet meadows near the channel.	WC-3	professional opinion	Low, dependent on available wet meadow and wc use	Depends number of crane observations and site evaluations; likely 10 plus years	WC use	habitat complex, meadow restoration. Crane use variable (proportion of population, number, use days etc)	WC do not use wet meadows currently and are unlikely to respond to increases in wet meadow area near or far from channel	No	Address after WC 4
WC 4c	Whooping crane use will increase with more wet meadow acreage.	WC-3	professional opinion	Low, dependent on available wet meadow and wc use	Depends number of crane observations and site evaluations; likely 10 plus years	WC use	habitat complex, meadow restoration. Crane use variable (proportion of population, number, use days etc)	WC do not use wet meadows currently and are unlikely to respond to increases in wet meadow area near or far from channel	No	Address after WC 4
WC 4d	Whooping crane use of wet meadows will increase with increased biomoass of macroinvertebrates	WC-3	professional opinion	Low, dependent on available wet meadow and wc use	Depends number of crane observations and site evaluations; likely 10 plus years	WC use	habitat complex, meadow restoration. Crane use variable (proportion of population, number, use days etc)	WC do not use wet meadows currently and are unlikely to respond to increases in wet meadow area near or far from channel	No	Address after WC 4
WC 5	Whooping cranes are adversely affected by nocturnal disturbances that lead to flushing (walking or flying) which could lead to potential mortality.	WC 4	Citations, data from other parts of range, professional opinions	Medium	Dependant on crane monitoring events	WC flushing events	WC roost monitoring,	WC are not negatively impacted by nocturnal disturbances	Yes	High degree of disagreement

Pallid Sturgeon Matrix

Graph number	Description of hypothesis	Link to CEM Hypothesis	Source of information, if any	Detectability/ sensitivity (feasibility)	Time needed for measuring a response	Dependent Variable (Indicator)	Corresponding quantitative management objective	Description of alternative/competing hypotheses	Priority Hypotheses?	Rationale based on Prioritization Criteria
PS-1	Program flow/sediment management will result in a positive species response by the pallid sturgeon in the lower Platte River.	PS-1, PS-2	professional judgement	low, due to low population numbers, difficulty in capture	8-10 years	pallid sturgeon use/occurrence	increase in use of Platte River by pallid sturgeon relative to rest of RPMA 4	Program flow/sediment management will result in no increase in species use/occurence by the pallid sturgeon in the lower Platte River.	Yes	Influences Program management and Program goals and objectives
PS-2	Program water management will result in measurable changes on flow in the lower Platte River.	PS-2	opstudy, testing the assumption analysis (aka flow transmission analysis - Anderson et al.)	Medium (5% gaging accuracy for "excellent" USGS measurements)	2-5 years	lower Platte River flow rate	increase in spring (Feb-Jul) lower Platte River flow rates	Program water management will result in statistically insignificant changes on flow in the lower Platte River	Yes	Influences Program management and Program goals and objectives
PS-3	Program flows and sediment management will result in measurable changes on sediment load in the lower Platte River	PS-2	professional judgement	Low (difficult to detect change due to flow and sedimentmanagement	5-10 years	Sediment load on the lower Platte	increase in sediment load in lower Platte River	Program flow and sediment management will have no effect on measureable changes in sediment load in the lower Platte River	No	Investigate with or after review of Program flows impacts on flows in lower Platte
PS-4	Flows in the lower Platte will affect pallid sturgeon habitat suitability.	PS-1, PS-2	Peters/Parham 2006	medium (high but for scope of effort)	3-8 years	pallid sturgeon use/occurrence	increase in connectivity and prevalence of habitat as defined in Peters/Parham 2006	Flows in the lower Platte River will have no effect on pallid sturgeon habitat suitability	Yes	Influences Program management and Program goals and objectives
PS-5	Pallid sturgeon habitat suitability is maximized between water temperatures of X and Y in the lower Platte River.	PS-1	PS propagation plan	low, due to low population numbers, difficulty in capture	8-10 years	pallid sturgeon use/occurrence	correlation between pallid sturgeon use of lower Platte River and specific temperature ranges	pallid sturgeon use is independent of river water temperature	Yes	Influences Program management and Program goals and objectives
PS-6	Increasing flow in the lower Platte will affect pallid sturgeon habitat availability.	PS-1, PS-2	Peters/Parham 2006	medium (high but for scope of effort)	3-8 years	micro and macro channel characteristics	increase in connectivity and prevalence of habitat as defined in Peters/Parham 2005	increasing flow in the lower Platte River will have no effect on pallid sturgeon habitat availability	Yes	Influences Program management and Program goals and objectives
PS-7	Increasing habitat availability in the lower Platte will increase pallid sturgeon use.	PS-1	Peters/Parham 2006	low, due to low population numbers, difficulty in capture	8-10 years	pallid sturgeon use/occurrence	increase in use of Platte River by pallid sturgeon relative to rest of RPMA 4	pallid sturgeon use is independent of lower Platte River habitat availability	Yes	Influences Program management and Program goals and objectives
PS-8	Increasing pallid sturgeon use in the lower Platte River will increase pallid sturgeon populations.	PS-1	professional judgement	low, due to low population numbers, difficulty in capture	10-13 years	pallid sturgeon reproduction and populations	local (RPMA 4) pallid sturgeon population size	pallid sturgeon population size is independent of use of the lower Platte River	No	
PS-9	Increasing Program flow releases will decrease water temperatures in the lower Platte River.	PS-2	Dinan 1992, Zander 1995, Zander 1996, Sinokrot et al. 1996, Miller 199X, King 199X	low, due to small relative contrib. of Program to LP flows	4-6 years	lower Platte River temperature	correlation between streamflow and river water temperature as per Dinan 1992	River water temperature is independent of flow rate in the lower Platte River Increases in program flow releases will increase water temperatures on the lower Platte River	Yes	Influences Program management and Program goals and objectives
PS-10	Different rates of flow in the lower Platte affect pallid sturgeon prey base.		Peters and Holland 1994, Peters/Parham 2006	medium (high but for natural interannual variation)	4-8 years	pallid sturgeon prey base	Increase abundance and diversity of small fish and drifting invertebrates	availability of pallid sturgeon prey items is independent of flow rate to the degree that it can be affected by the Program	No	
PS-11	Non-Program actions (e.g., harvest, stocking, Missouri River conditions) determine the occurrence of pallid sturgeon in the lower Platte River	PS-3	professional judgement	low, due to low population numbers, difficulty in capture	8-10 years	pallid sturgeon use/occurrence	Improve stocking, harvest management, Missouri River populations	Program actions will affect the rate of occurrence of pallid sturgeon in the lower Platte River such that use is disproportionate to external factors (e.g., stocking, harvest, local conditions) relative to local population.	Yes	Influences Program management and Program goals and objectives

Flow Matrix

Graph number	Description of hypothesis	Link to CEM Hypothesis	Source of information, if any	Scientific basis of hypothesis	Detectability/ sensitivity (feasibility)	Time needed for measuring a response	Dependent Variable (Indicator)	Corresponding quantitative management objective	Description of alternative/competing hypotheses	Priority Hypotheses?	Rationale based on Prioritization Criteria	Phasing	Notes
Flow #1	Increasing the variation between river stage at peak (indexed by Q1.5 flow at Overton) and average flows (1,200 cfs index flow), by increasing the stage of the peak (1.5-yr) flow through Program flows, will increase the height of sand bars between Overton and Chapman by 30% to 50% from existing conditions.	PP-1	Smith 1971,... EIS 2006, SedVeg model runs	Medium, model computations done, some central Platte data to be analyzed from naturally occurring events, but no planned peak flow field tests done yet.	Topographic documentation is easy	1-5 years (can assess the effect of a single flow)	height of island bars above a 1,200 cfs index flow	Hieght of island bars greater than 1.5 acres that are 1 ft above 1,200 cfs water elevation	Flow magnitudes and channel compilations are insufficient to generate bars high enough to provide habitat for LT and PP. Bars may quickly vegetate making them poor habitat for target species. Bars can be created/maintained by mechanical/other means.	Yes	Fundamental to testing the Flow, sediment, mechanical strategy	Could be a 1-3 year delay due to addressing infrastructure limitation at North Platte	Include the mechancial strategy in testing this hypothesis. Could do this in year 1-3(?) as we get the infrastructure and pulse flow issues worked out
Flow #2	After a bar has been created by whatever means, ongoing stage fluctuations will decrease the bar area that could potentially be used by terns and plovers. Erosion will be less with a balanced sediment budget. Rate, magnitude, and frequency of stage fluctuation needs to be considered	PP-1	Colorado River papers, Field observations	Medium, observed in field, but linkage back to rampdown rates and frequency not established	Detectable with area and cross section surveys, relate to gaging station data.	months to 1-year (can be assessed by small number of flows)	Sand bar area at 1,200 cfs	Minimum bar area needed by Terns and Plovers.	Different drawdown rates and frequencies then X and Y. Sand bar area is not dependent on drawdown magnitudes, rates and frequencies, or are overwhelmingly influenced by other factors and frequency of drawdown is a neglible variable. Fast drawdown rates benefit sand bar area.	No	Medium because we need bars to form first, and the USFWS-Central agreement requires a finding of bars being limiting to tern and plover production before this is tested	Dependent on a finding that bars are insufficient (limiting factor to tern and plover production), also dependent on the time lag for bars to form	
Flow #3	Increasing 1.5-yr Q with Program flows will increase local boundary shear stress and frequency of inundation at existing green line (elevation at which riparian vegetation can establish). These changes will increase riparian plant mortality along margins of channel, raising elevation of green line. Raised green line = more exposed sandbar area and wider unvegetated main channel.	PP-1	Parsons, 1960, Porter and Silberger, 1960, Parsons, 1963, Chen and Cotton, 1988, Theissen 1992, Smith 1976, Modeled with SedVeg, some field verifcation by Simons and Associates.	High for young grasses, willow and cottonwood plants, supported by literature and modeling, less certainty for other plant species.	Easily computed, and easily measured in field with multiple vegetation plots/cross section surveys.	1- 5 years	Computed local shear stress, elevation green line on banks & bars, bar area at 1,200 cfs, unvegetated width of main channel.	Produce increase in unvegetated main channel width for WC, and unvegetated sand bar area for LT and PP from Overton to Chapman.	Insufficient Program flows to adequately increase shear stress on banks. Plant mortality can be achieved by other means.	Yes	Fundamental to testing the Flow, sediment, mechanical strategy		Include the mechancial strategy in testing this hypothesis. Could do this in year 1-3(?) as we get the infrastructure and pulse flow issues worked out
Flow #4	Annual riparian seedling mortality greater than 90% is required to prevent riparian encroachment on exposed bars, thereby increasing (maintaining at least 10 acres/mile) exposed bars between Overton and Grand Island that are usable as LT and PP habitat.	PP-1	Professional judgement, no data collected yet?	Low because there is no basis that 90% is sufficient for preventing encroachment and preserving line of sight	Easily detectable for local monitoring, long-term by air photos	5-10 years	Planform surface area of exposed bars at a flow of 1,200 cfs	Increase exposed bar area at an index flow of 1,200 cfs from X acres/mile to 10 acres/mile between Overton and Grand Island	Riparian seedling mortality greater than 90% is needed to increase exposed bar area. Other factors drive exposed bar area instead of seedling mortality. Plant mortality can be achieved by other means.	Yes	Fundamental to testing the Flow, sediment, mechanical strategy		Include the mechancial strategy in testing this hypothesis. Could do this in year 1-3(?) as we get the infrastructure and pulse flow issues worked out
Flow #5	Increasing magnitude and duration of a 1.5-yr flow will increase riparian plant mortality along the margins of the river. There will be different relations (graphs) for different species.	PP-1	For magnitudes see Flow #3. For duration less info available, see Colorado River papers.	High to Medium for magnitude (see Flow #3). Medium to Low for duration.	Easily computed, and easily measured in field with multiple vegetation plots/cross section surveys.	1- 5 years depending on occurrence of pulse and natural peak flows	Computed local shear stress, plant mortality and of elevation green line on banks & bars	Channel shear stress exceeds 1.0 lbs/sqft (dependent on plant species, age) for a a 1.5 year recurrence. 90% plant mortality of various ages of plants on bars	Insufficient Program flows to maintain required flow durations. Plant mortality can be achieved by other means.	Yes	Fundamental to testing the Flow, sediment, mechanical strategy		Include the mechancial strategy in testing this hypothesis. Could do this in year 1-3(?) as we get the infrastructure and pulse flow issues worked out

Definition of braiding index for main channel (as used here) is: Average number of anabranches/flow paths in the main channel based on bisecting wetted main channel perpendicular to flow direction. The braiding index value of "greater
ve force acting perpendicular to (scrapping) the bank, lbs/sqft.

Sediment Matrix

Graph number	Description of hypothesis	Link to CEM Hypothesis	Source of information, if any	Scientific basis of hypothesis	Detectability/ sensitivity (feasibility)	Time needed for measuring a response	Dependent Variable (Indicator)	Corresponding quantitative management objective	Description of alternative/competing hypotheses	Priority Hypotheses?	Rationale based on Prioritization Criteria	Phasing	Notes
Sediment #1	Average sediment augmentation nr Overton of 185,000 tons/yr under existing flow regime and 225,000 tons/yr under Governance Committee proposed flow regime achieves a sediment balance to Kearney.	PP-2	Sed Veg, topographic differencing	High because this estimate is based on a combination of sediment transport capacity estimates as well as estimates of tributary sediment contribution	Difficult to estimate sediment contribution from tribs, Sediment budget is difficult to measure	5-10 years	channel bed elevation (storage) in different reaches	Maintain balanced sediment budget in all reaches, Prevent future systematic channel bed lowering between Overton and Grand Island, Prevent future systematic channel bed raising in downstream reaches	Augmentation greater than or less than 225,000 tons/year is needed to balance the sediment budget and increase exposed bar area. There is no sediment imbalance. Exposed bar area or occurence of braiding will not be affected by increased sediment. Sediment balance is insignificant except in local instances. Satisfactory bar areas can be created and maintained through strictly mechanical actions.	Yes	Fundamental to testing the Flow, sediment, mechanical strategy	Dependent on land acquisition or access to lease properties for sediment supply, Yearly input would vary with wetter/drier years, could be done in year 1 at Cottonwood (not ideal, but doable), One management action will test all four hypotheses	"Existing flow regime" assumes no drought conditions
Sediment #2	A balanced sediment budget (sediment augmentation of 225,000 tons/year near Overton under proposed Governance Committee flows) when implemented with mechanical actions (channel consolidation & widening) in anastomosed reaches will promote braided channel morphology with an average braiding index in the main channel of greater than 3.	PP-2	Empirical observations on the Central Platte	Medium because based on empirical observations on central/lower Platte River	Braiding index easily computed once it is defined for the central Platte Rvier	5-10 years	Braiding index of main channel	Convert average braiding index for main channel in the reach between Overton and Kearney to greater than 3.	Flows and sediment augmentation are insufficient to achieve desired braiding index.	Yes	Fundamental to testing the Flow, sediment, mechanical strategy	Would require some higher flows (either natural flows or pulse flows) to make this happen, mechanical would accelerate response, ideally do both at the same time	
Sediment #3	Increasing the average braiding index of the main channel by achieving a balanced sediment budget, increases the active unvegetated width of the main channel at an index flow of 2,000 cfs(at Overton).	PP-2	Empirical observations on the Central Platte	Medium based on empirical observations on central Platte River	Air photos for large differences, cross-section surveys for smaller differences.	5-10 years	Braiding index and unvegetated width of main channel at index flow	Widen the main channel between Overton and Kearney to greater than 750 feet, or to greater than 500 feet where channel remains divided in more than 3 channels.	Width will not change with increasing braiding index	Yes	Fundamental to testing the Flow, sediment, mechanical strategy	Would require some higher flows (either natural flows or pulse flows) to make this happen, mechanical would accelerate response, ideally do both at the same time	Include the mechancial strategy in testing this hypothesis. Could do this in year 1-3(?) as we get the infrastructure and pulse flow issues worked out
Sediment #4	Increasing the average braiding index to greater than 3 for the main channel in the sediment deficient reach near Overton will increase and maintain exposed bar area greater than 1.5 acres in the reach between Overton and Kearney at an index flow of 1,200 cfs (at Overton).	PP-2	None yet, need to develop this relationship from observations downstream of Kearney	Low because there is no basis for these numbers yet	Need existing conditions flown at index flow. Easily detectable with air photos if flown at index flow.	5-10 years	Planform surface area of exposed bars at a flow of 1,200 cfs	Increase exposed bar area (greater than 1.5 acres) at an index flow of 1,200 cfs from X acres/mile to 10 acres/mile between Overton and Grand Island	There is no relationship between braiding index and area of exposed bars. Exposed bars may be created (maintained) through mechanical means without need to change braiding index.	Yes	Fundamental to testing the Flow, sediment, mechanical strategy	Would require some higher flows (either natural flows or pulse flows) to make this happen, mechanical would accelerate response, ideally do both at the same time	Include the mechancial strategy in testing this hypothesis. Could do this in year 1-3(?) as we get the infrastructure and pulse flow issues worked out

Definition of braiding index for main channel (as used here) is: Average number of anabranches/flow paths in the main channel based on bisecting wetted main channel perpendicular to flow direction. The braiding index value of "greater than 3" is based on limited measurements from 1998 infra-red air photos.

Mechanical Matrix

Graph number	Description of hypothesis	Link to CEM Hypothesis	Source of information, if any	Scientific basis of hypothesis	Detectability/ sensitivity (feasibility)	Time needed for measuring a response	Dependent Variable (Indicator)	Corresponding quantitative management objective	Description of alternative/competing hypotheses	Priority Hypotheses?	Rationale based on Prioritization Criteria	Phasing	Notes
Mechanical #1	Indirectly narrowing the width of the hydraulic corridor (preferred width less than 3,000 ft) by consolidating channels under proposed flow regime and balanced sediment budget will convert anastomosed reaches of the Platte River between Overton and Grand Island to a braided channel morphology.	PP-3	Empirical observations on the Central Platte	High because based on empirical observations on Central Platte River. Feasibility: medium, due to difficulties consolidating flow.	Easily detectable, braiding index easily computed	<5 years, as long as there is at least a flow greater than Q5 during that period	braiding index, width to depth ratio and width of main channel	Increase average braiding Index in the main reach between Overton and Grand Island to greater than 3.	Narrowing floodway to a width lower than 2,000 ft is needed to achieve an average braiding index in the main channel greater than 3.	No		Do channels in Mech 3 first, look at other approaches later if Mech 3 doesn't work	
Mechanical #2	Increasing the Q1.5 in the main channel by consolidatining 85% of the flow, and aided by Program flow and a sediment balance, flows will exceed stream power thresholds that will convert main channel from meander morphology in anastomosed reaches, to braided morphology with an average braiding index > 3.	PP-3	Van den Berg, 1995; Leopold and Wolman 1957	High because based on empirical observations on Central Platte River. But is site dependent on percent distribution of flow among channels in consolidated transect.	Discharge can be easily measured, discharge at flow splits need to be measured, braiding Index can be easily measured	5-10 years	braiding index, main channel width, width to depth ratio of main channel at reference flow	Convert channel morphology from anastomosed to braided, or increase average braiding index to greater than 3 in main channel.	Higher stream power (higher 1.5 yr Q and/or more consolidation of side channels) needed to convert channel to braided morphology. Lower stream power will convert channel to braided morphology	Yes	Fundamental to testing the Flow, sediment, mechanical strategy	Do this ASAP, we don't have pulse flows, but the natural flows may also be able to test this, dependent on land acquisition and sediment input	
Mechanical #3	Reducing the number of channels in a transect to 3 or less under balanced sediment budget will convert anastomosed reaches of the Platte River between Overton and Chapman to a braided channel morphology. With prposed flow regime, should occur with greater number of channels	PP-3	Empirical observations on the Central Platte	High because based on empirical observations on Central Platte River. Assumes certain percent distribution of flow among channels.	Easily detectable, braiding index easily computed	<5 years, as long as there is at least a flow greater than Q5 during that period	braiding index, width to depth ratio and width of main channel	Convert average braiding index of the main channel in the reach between Overton and Grand Island to greater than 3.	Reducing the number of channels in a transect to 1 or 2 is necessary to achieve an average braiding index in the main channel of greater than 3.	Yes	Fundamental to testing the Flow, sediment, mechanical strategy	Do this ASAP, we don't have pulse flows, but the natural flows may also be able to test this, dependent on land acquisition and sediment input	
Mechanical #4	Increasing the average braiding index to greater than 3 in the main channel by channel manipulation will promote in the Platte River at the mechanically changed sites a total main channel wetted width exceeding 500 to 750 ft at an index flow of 1,700 cfs (at Overton).	PP-3	Based on empirical observations from central Platte River	Low because preliminary numbers	Easily detectable with air photos	5-10 yrs	Total channel width at an index flow of 1,700 cfs	Increase channel width in the reach between Overton and Grand Island to at least 750 ft	A braiding index greater then 4 is needed to achieve a width greater than 500 ft There is no relation between braiding index and channel width	Yes	Fundamental to testing the Flow, sediment, mechanical strategy	Do this ASAP, we don't have pulse flows, but the natural flows may also be able to test this, dependent on land acquisition and sediment input	Include the mechancial strategy in testing this hypothesis. Could do this in year 1-3(?) as we get the infrastructure and pulse flow issues worked out
Mechanical #5	Increasing the average braiding index to greater than 3 for the main channel by mechanical channel manipulation, will increase and maintain exposed bar area greater than 1.5 acres at mechanical changed sites at an index flow of 1,200 cfs (at Overton).	PP-3	None yet	Low because there is no basis for these numbers yet	Easily detectable for individual flow by ground survey and air photos at index flow.	5-10 yrs	Area of inchannel bars at index flow of 1,200 cfs.	Flow of 6,000 cfs for 3 days will cause an increase in bar area	Mechanically consolidating flows will have no effect on areal extent of bars.	Yes	Fundamental to testing the Flow, sediment, mechanical strategy	Do this ASAP, we don't have pulse flows, but the natural flows may also be able to test this, dependent on land acquisition and sediment input	Include the mechancial strategy in testing this hypothesis. Could do this in year 1-3(?) as we get the infrastructure and pulse flow issues worked out

Definition of braiding index for main channel (as used here) is: Average number of anabranches/flow paths in the main channel based on bisecting wetted main channel perpendicular to flow direction. The braiding index value of "greater than 3" is based on limited
ned as the width from furthest wetted left bank to furthest wetted right bank, as measured at an index flow of 15,000 cfs

Wet Meadow Matrix

Graph number	Description of hypothesis	Link to CEM Hypothesis	Source of information, if any	Detectability/ sensitivity (feasibility)	Time needed for measuring a response	Dependent Variable (Indicator)	Corresponding quantitative management objective	Description of alternative/competing hypotheses	Priority Hypotheses?	Rationale based on Prioritization Criteria	Phasing	Notes
WM-1	A high productivity and diversity of macro-invertebrates in areas used by whooping cranes along the Platte River will improve WC conservation and recovery	PP-4	Walkinshaw, 1973; FWS, 1994; Johnsgaard, 1996; NRC, 2005: "Few data are available for testing [this] hypothesis"	Difficult to detect because so many variables influence conservation and recovery	> 10 years?	Possible surrogate: Frequency and duration of WC use of Platte sites with abundant and diverse macro-invertebrates		Other factors unrelated to Platte River and/or macro-invertebrates have a far greater impact on whooping crane survival and reproduction; this hypothesis, if true, cannot be detected during the first increment.	No			
WM-2	Wet meadows producing the optimum productivity and diversity of macro-invertebrates potentially consumed by WC exhibit certain characteristic combinations of soils, hydrology, size and location. Mormon Island and adjacent to Rowe Sanctuary have some of best existing combinations	PP-4, WC-3	Siebert, 1994	Medium. Study of multiple sites will allow multivariate analysis of conditions supporting aquatic and semi-aquatic invertebrates.	5-10 years	Site-specific macro-invertebrate production and diversity during March-April	Need criteria to prioritize sites suitable for acquisition, maintenance, protection, or improvement by the Program for habitat complexes. Need standards to measure the success of meadow restoration efforts.	There are too many possible combinations of site characteristics to allow for a meaningful characterization of "desirable" conditions.	Yes	Basic information need to evaluate what conditions in wet meadows are important for productivity that is meaningful to WC use, Help inform what sites to acquire and/or protect/restore.	Not dependent on pulse flows or mechanical actions, dependent on land acquisition or access agreements or lease lands	Need to document current and historic wet meadow extent and location (baseline conditions) in System hypothesis 1-c. Other biota may also be important (e.g. amphibians, fish, reptiles).
WM-3	Shallow surface water and groundwater in March and April support high productivity and diversity of macroinvertebrates as potential food sources to WC in wet meadows.	PP-4	Siebert, 1994; Wesche et al., 1994; Craig Davis' papers of the early '90s; Nagel and others	High	2-5 years	Site-specific aquatic and semi-aquatic invertebrate production and diversity during March-April	Same as above.		Yes	Basic information need to evaluate what conditions in wet meadows are important for productivity that is meaningful to WC use, Help inform what sites to aquire and/or protect/restore.	Not dependent on pulse flows or mechanical actions, dependent on land acquisition or access agreements or lease lands. This logically could be "packaged" with WM-2.	Need to document current and historic wet meadow extent and location (baseline conditions) in System hypothesis 1-c
WM-4	A predominance of organic-rich soils supports the productivity and diversity of macro-invertebrates as potential WC food sources in bottomland grasslands.	PP-4	Nagel	Moderate-High	2-5 years	Site-specific aquatic invertebrate production and diversity	Same as above.	Wet meadows and their soils are too complex and variable to allow this individual factor to be effectively assessed.	Yes	Basic information need to evaluate what conditions in wet meadows are important for productivity that is meaningful to WC use, Help inform what sites to aquire and/or protect/restore.	Not dependent on pulse flows or mechanical actions, dependent on land acquisition or access agreements or lease lands. This logically could be "packaged" with WM-2.	Need to document current and historic wet meadow extent and location (baseline conditions) in System hypothesis 1-c
WM-8	High water tables in wet meadows provide greater benefits to WC if they occur in the Feb-Jun period versus other times of year	PP-4	Wesche et al., 1994; Henszey and Wesche, 1993	Low-Med. Requires consideration of flow variability, climate variability, site variability, and multiple potential WC benefits.	5-10 years	Soil thaw at various depths. Invertebrate activity at various times. Vegetative structure and composition.	Inform habitat complex management, including management of site drainage, site irrigation, local groundwater use, management of adjacent river channel.	Potential for Program to augment or alter the magnitude and timing of water tables is too limited to have measurable wet meadow effects.	No			Could be done at the same time as testing WM 2-4 for small incremental cost
WM-9	Periodic inundation of wet meadow areas due to overbank flow increases their suitability as WC habitat and reduces risk of new species listings	PP-4	Siebert, 1994; Currier (year?)	Low because of infrequency of inundating events.	>10 years?	Diversity and productivity of WC forage species, and other meadow-dependent species	Assess the effects of changes in the frequency of overbank flows in the Central Platte, whether due to Program actions or other factors.	Frequency of wet meadow inundation is too rare and too unrelated to Program actions for this hypothesis to be meaningfully assessed.	No	Program flows would not be large enough to affect this, however the Program is proceding on the basis of certain assumptions about "acceptable" reductions in peak flows and corresponding habitat effects; these assumptions merit additional scrutiny.		Passive investigation (be prepared for random natural events, as pulse flows would not be large enough to inundate wet meadows.)
WM-8a	As the spring depth to groundwater increases, surface soils stay frozen longer. Where groundwater is closer to the surface soils thaw sooner.	PP-4	Wesche et al., 1994	High	1-2 years	Soil and groundwater temps at various depths, Feb-Apr.	See WM#8		Yes	Each site will respond to river channel stage uniquely, this hypothesis is a prerequiste to many of the other hypotheses (if there is no response from program actions, it becomes less important)	Sequentially, this should be the first WM-8 subhypothesis to evaluate.	Could be done very economically with the other research activities above
WM-8b	Areas where surface soils thaw earlier allow for increased macro-invertebrate productivity.	PP-4	Wesche et al., 1994	Moderate	> 3 years?	Invertebrate productivity.	See WM#8		No			Could be done economically with WM-2
WM-8c	As depth to groundwater increases during the Mar15-Apr15 period, the number of macroinvertebrates available as WC prey decreases.	PP-4	Wesche et al., 1994	Moderate	> 3 years?	Invertebrate availability near ground surface during WC feeding hours.	See WM#8		No			Could be done economically with WM-2

Appendix F – Protocols

Attachment 1
Draft
Monitoring whooping crane migrational habitat use in the central Platte River valley

September 16, 2005

I. INTRODUCTION

The States of Colorado, Nebraska and Wyoming and the Department of the Interior (DOI) agreed to participate in a basin-wide cooperative program relating to four target species (interior least tern, piping plover, whooping crane and pallid sturgeon) and their associated habitats in the Cooperative Agreement for Implementing a Platte River Recovery Implementation Program (Program). One of the primary purposes of the Program is to "implement certain aspects of the Fish and Wildlife Service's (FWS') recovery plans for the target species that relate to their associated habitats by providing for the following: 1) securing defined benefits for the target species and their associated habitats to assist in their conservation and recovery through a basin-wide cooperative approach that can be agreed to by the three states and DOI…". The Program builds upon the July 1, 1997 Cooperative Agreement for Platte River Research and Other Efforts Relating to Endangered Species Habitats Along the Central Platte River, Nebraska (July 1997 Cooperative Agreement).

Program implementation will follow a process of adaptive management to address areas of scientific uncertainty. Monitoring is an integral part of the adaptive management process. The adaptive management approach will allow for efficient modification of management actions in response to new and changing environmental conditions. The Program, with assistance from the Technical Advisory Committee will monitor and document, relative to the habitat and species conditions that existed as of the effective date of the Cooperative Agreement, habitat and species responses to habitat improvement activities. With scientific advisory assistance, the Technical Advisory Committee will review monitoring results and make recommendations to the Program's Governance Committee regarding the effects of Program activities on whooping crane habitat use in the study area. The Governance Committee, using the Technical Advisory Committee's input, will evaluate projects and the overall Program to determine what, if any, changes are needed in the management.

This monitoring protocol will be used by the Program to gather information on whooping crane habitat use and to provide an index of abundance in the study area. It is understood that regardless of survey method not all cranes are certain of being detected during migration and therefore full implementation of this or any other protocol will not represent complete use of the central Platte River valley. Information from this protocol will be used to help evaluate the biological response of whooping cranes and habitat to the land and water management activities of the Program.

This monitoring protocol addresses several July 1997 Cooperative Agreement milestones:

<u>R2-1</u> A technical committee appointed by the Governance Committee will develop protocols for and initiate habitat and species monitoring and research

R3-1 the FWS and Technical Committee will identify data needed to ascertain biological response and the time frame required to evaluate those data (R3-1 milestone as revised at the August 2, 2000 Technical Committee/Governance Committee workshop)

R5-1 The Nebraska Districts (Nebraska Public Power District and Central Nebraska Public Power and Irrigation District) will implement any research and monitoring measures required by new Federal Energy Regulatory Commission (FERC) license articles for FERC Projects Nos. 1417 and 1835.

R1-2 and R1-3 A technical committee will continue monitoring to document, relative to the habitat and species conditions that existed as of the effective date of the Cooperative Agreement, habitat and species responses to activities undertaken pursuant to the Cooperative Agreement.

R3-2 and R3-3 The Nebraska Districts will continue to implement any research and monitoring measures required by FERC license articles for FERC Projects Nos. 1417 and 1835.

II. PURPOSE

The purpose of this monitoring protocol is to describe the conceptual design, study methods, and procedures that will be used annually to gather repeatable information on whooping crane stopovers in the central Platte River valley, Nebraska. Detailed Standard Operating Procedures (SOP) will be written for each task when the protocol is finalized. This is a sample survey protocol that will result in an annual index of crane use. This protocol describes the procedures to be used for these specific objectives:

1) Detect whooping crane stopovers in the study area – systematic aerial surveys of the study area will be conducted and the data will be used to comparatively evaluate changes in the frequency and the distribution of stopovers within the study area over time. Opportunistic locates will also be used to detect whooping crane stopovers in the study area.

2) Identify the locations of use and crane group movements in the study area – crane group movements will be documented in order to identify use-sites, and to describe the patterns of movement of each crane group.

3) Qualitatively document crane group activities at use-sites – observers will qualitatively document activities displayed by the crane groups. Observed activities may help identify factors that influence how cranes use the area and aid in the interpretation of crane behavior.

4) Document the physical and/or biological characteristics of use-sites – habitat parameters will be described and measured for those whooping cranes observed stopping in the central Platte River valley for comparative habitat analyses (e.g., as in determining habitat suitability or preference analyses).

5) Landscape Data Collection – Basic landscape source data of whooping crane use-sites in the study area (e.g., central Platte River valley) will be collected through this protocol. This information will be used in future use/availability analyses using aerial photography and Geographic Information System (GIS) information and appropriate landscape data collected from other protocols. Currently the Program has available a complete land use/land cover GIS analysis of 1998 color infrared photography. Continued regular collection of landscape data sources of the study area through other protocols, such as aerial photographs, geomorphology monitoring protocol and GIS data, will enable future habitat use/availability research.

The protocol also outlines what information Program personnel will collect from the FWS and state agencies throughout the whooping crane's migrational corridor.

The Technical Committee implemented the February 23, 2001 version of this protocol during the spring 2001 season, the September 12, 2001 version during the fall 2001 season, the December 20, 2001 version during the spring and fall 2002 season, and the August 21, 2003 version during the fall 2003 season. The Technical Committee did not implement a survey in spring 2003. This version of the protocol incorporates changes as a result of the previous implementation periods, independent peer review, and other comments.

III. DESIGN CONSIDERATIONS AND SPECIFICATIONS

III.A. Area of Interest

The area of interest for monitoring whooping crane migrational habitat use consists of an area 3.5-miles either side of the Platte River beginning at the junction of U.S. Highway 283 and Interstate 80 near Lexington, Nebraska, and extending eastward to Chapman, Nebraska. When side channels of the Platte River extend beyond the 3.5-mile area, a 2-mile area is included around these channels (see attached map). If crane groups being monitored move outside this study area the field crews will make a professional judgment on whether or not the cranes are migrating from the Platte River area. If the crane group is judged to be migrating from the area, ground crews will stop observations. If the crane group is judged to be just temporarily using habitat outside the primary study area the ground crew will continue to make observations.

III.B. Project Design

This protocol collects information on whooping cranes using the central Platte River, not necessarily on the entire whooping crane population. This may bias the sample for making inference to the entire whooping crane population. In addition, the results from this protocol may not be representative of the population, or subgroup of the population using the central Platte, because of the use of multiple observations per crane group and/or the lack of use by unique crane groups in the analysis (i.e., pseudo-replication). Options for addressing pseudo-replication are discussed in Section IV.D. Analysis Methods.

III.B.1. Detecting/Locating Whooping Crane Stopovers

Whooping crane stopovers will be documented using both systematic surveys and opportunistic sighting reports. Crane groups detected with systematic surveys will have known probabilities of inclusion in the sample, while crane groups detected opportunistically will compromise a non-probability based sample. Since the systematic sample covers the study area from East to West with equal effort, and from North to South with known frequency, biases in sample effort can be accounted for. The opportunistic sample will contain biases associated with the unequal sampling effort that cannot be accounted for, and therefore may not represent actual crane use of the study area.

The relative efficiency of sighting whooping crane groups using systematic aerial surveys is not known, but will become known through protocol implementation over the years (e.g., use of decoys and known birds in the area, etc). Public reports and reports from other survey efforts in the valley (e.g., Nebraska Game and Parks Commission (NGPC), Platte River Trust, FWS surveys) will also be used to identify occurrences of whooping crane stopovers in the study area. These sighting reports may increase the opportunity to gather crane movement and habitat use information. Data on movement and habitat use for birds detected through the systematic aerial survey will be analyzed separated and in conjunction with all other observations of crane movement and habitat use in the analysis of species habitat relationships.

Aerial Survey

Aerial surveys will be used to detect whooping crane stopovers in the study area. Systematic surveys are necessary to develop information on the spatial and temporal distribution of crane stopovers in the Platte River for comparative evaluations. The design of these systematic surveys is intended to provide a known chance for observing crane use throughout the study area. Daily flights will be conducted in early morning during the period when whooping cranes are most likely to be in route between the wintering and breeding grounds. Flights will take place over the main river channel (river transects) and upland regions of the study area (return transects). The "main river channel" is defined as the widest channel when all channels have flowing water. It is recognized that this protocol over-samples the river (river transects are flown daily) compared to return transects that include upland areas and the river (seven return transects are flown in a rotating order). River transects systematically survey the main channel east to west. Return transects systematically sample the entire study area north to south.

Opportunistic Locates

Birdwatchers, outdoor enthusiasts, farmers, and other survey efforts might make initial observations of whooping crane groups in the study area. Sighting reports from these and other groups (labeled "opportunistic locates") may provide additional information on crane stopover occurrences, but the conclusions are only applicable to the areas searched by the people that would report a sighting. An analysis of habitat use by cranes sighted opportunistically is outlined in this protocol. But locations of whooping cranes obtained through this method are biased and quantifying the bias due to the location and amount of effort expended to obtain these observations is not planned.

Survey Detection Rates

Whooping crane decoys will be used to estimate the accuracy of whooping crane detection from the aerial survey. Crane decoys will be placed randomly throughout the study area and the detection by the aerial survey crew will be recorded. Surveyors will not know the location of decoys while conducting the survey. Searcher efficiency will be calculated as the percentage of cranes observed. Decoys will be placed at randomly selected points in the path of the riverine and return transects. Estimates of searcher efficiency will be made for each transect strata separately (riverine and return). Individuals placing decoys will accurately map or record the

UTM of the decoy and the transect on which it was placed. If the vegetation/landscape at the decoy location is different in the field than on the mapped data provided, the individual placing the decoy will move the decoy to the closest point corresponding to the mapped vegetation/ landscape type.

III.B.2 Movement Tracking

After a crane group has been located in the study area, either through aerial surveys or opportunistically, a ground crew will be notified to confirm the sighting and begin immediate monitoring to document habitat use. The ground crew(s) will locate the cranes with directions from the sighting party and will document crane movements, document crane use-site activities, and describe the physical and biological attributes of use-sites. Each crane group will be tracked continuously until they are observed leaving the study site or are lost by the tracking crew. Cranes will be observed at a distance from vehicles to document movements. Monitoring crews will be trained to be aware of crane sensitivity to human presence, to identify behavioral responses to disturbance, and to view cranes using methods that reduce the likelihood of disturbance. Crews will strictly adhere to guidelines regarding minimization or elimination of crane disturbance, to be provided by the FWS, while conducting the monitoring.

Locations of crane groups under observation will be recorded in two categories. Instantaneous points will identify the exact location of the group every 15 minutes. Location points will identify the general location of the group during the observation period. Whenever a crane group moves from the area of one contiguous habitat type to another, a new location ID will be assigned. In the event that a crane group is observed in the same location from 2 observers (e.g., from the ground and from the air), the same location ID will be recorded by each observer.

III.B.3. Activity Monitoring

While monitoring crane movements, ground crews will collect information on crane activities. The field crew will record the activity being conducted by a whooping crane at each of the 15 minute instantaneous point mapped for the movement tracking into one of the following categories: courtship, preening, resting, feeding, alert, agonistic, or other as described. If the crane group is comprised of more than one individual, the observer will select a “focus” crane that will be used to record activity information. The observer will also video tape the crane group using a digital video camera for the entire time it is at a use site.

III.B.4. Use-Site Characteristics

Tracking crews will collect information on the physical and biological characteristics of the riverine and non-riverine whooping crane use-sites. Characteristics of crane use locations will be described and measured as soon as practical after the crane group leaves the study area. Habitat parameters will be described and measured for the purpose of comparative habitat analyses.

Use-site characteristics will also be measured at randomly selected riverine locations each year. These will typically be the same as the decoy locations used for survey detection rates. Measurements will be made using the same methods as outlined for crane use sites. The measurement of these sites will be spaced throughout the aerial survey period. Data from measurements at randomly selected locations (e.g., decoy locations) will be used as an available dataset.

III.C. Timing

Aerial surveys of the study area will be conducted in the spring from March 21 to April 29 and in the fall from October 9 to November 10 (the 5^{th} and 95^{th} percentile of initial observation dates of whooping cranes in Nebraska between 1975-1999). Opportunistic observations will be collected during all times of the year. Measurements of habitat characteristics at whooping crane use sights will occur immediately following each observation regardless of how the birds were found (aerial or opportunistic). Crane movements will be monitored until the crane group leaves the study area or is no longer observable. Measurements of habitat characteristics will be taken after the group departs the study area.

IV. METHODS

IV.A. Definitions

Crane activity- Qualitative definitions

Feeding- any behavior suggesting the bird is in the act of feeding, such as a crane flipping over objects and/or probing for food or slow locomotion interrupted by these activities
Loafing- crane standing still in one place
Preening- crane preening feathers
Agonistic - defensive or offensive display with other birds. Can be with other whooping cranes, sandhill cranes, etc.
Courtship- crane performing unison call and/or dancing
Alert- crane alert and scanning horizon

Crane group – one or more cranes in a migrating unit. The group may consist of an individual crane, a family unit, or small flock.

Sighting – observation of a crane group in the study area.

Confirmed Sighting - Observation made by a State or Federal biologist or officer or by other known qualified observer (trained ornithologist or birder with experience in identification of whooping cranes). A photograph may also be used to confirm sightings. Aerial survey crew with previous aerial whooping crane observations may confirm a crane group during the survey.

Probable Sighting - No confirmation made by State or Federal biologist or officer or by other known qualified observer, yet details of the sighting seem to identify the birds as whooping cranes. To be classified as a probable sighting each of the following factors must be met: (1) location of sighting is within normal migration corridor and is an appropriate site for whooping cranes, (2) date of sighting is within period of migration, (3) accurate physical description, (4) number of birds is reasonable, (5) behavior of the birds does not eliminate whooping cranes, and (6) good probability that the observer would provide a reliable report.

Unconfirmed Sighting - Details of the sighting meet some, but not all of the six factors listed for a probable sighting.

Stopover – Use of the study area during spring or fall migration.

Use-site - A location of a crane group in the study area. A single crane group may have (and likely will have) more than one use-site per day.

Obstruction - objects (e.g., vegetation, bank, etc.) >1.5m above water line

Unobstructed width – The unobstructed width is defined as the area between obstructions less than 1.5m above water line and includes all water and island/sandbars <1.5m. A line will be drawn across the channel, through the use-site and will be oriented perpendicular to the general flow within the channel.

Water/Wetted Width - The water/wetted width is defined as the area covered by water between obstructions less than 1.5m. This measurement does not include sandbars and islands above the water surface but less than 1.5m. A line will be drawn across the channel, through the use-site and will be oriented perpendicular to the general flow within the channel.

IV.B. Field Techniques

IV.B.1. Detecting/Locating Whooping Crane Stopovers

Two methods will be used to locate migrating whooping crane stopovers along the central Platte River during spring and fall migration: aerial surveys and opportunistic locates. The Program's Technical Committee may choose to implement each protocol component as necessary to obtain needed information, for example changing the survey effort based on results of past surveys.

Aerial Survey

Daily aerial surveys, weather permitting, will be conducted along the central Platte River valley between Lexington and Chapman, Nebraska to locate spring and fall migrating whooping crane groups. The aerial surveys will take place from March 21 to April 29 in the spring and October 9 to November 10 in the fall. These dates are based on the 5th and 95th percentile of initial sighting dates for all recorded sightings of whooping crane groups in Nebraska from 1975 to 1999 (Jane Austin, USGS Northern Prairie Wildlife Research Center, pers. comm.). This protocol intends to collect a sample during possible migration time and does not intend to survey the entire time-period it would be possible for a crane group to migrate through the study area. Therefore, the survey dates will not be extended during times of delayed migration. However, if the survey period extends past the migration time in a given season, the surveys will be stopped using the following rules. For the spring survey, flights will be discontinued 5 days after the last normally migrating whooping cranes have departed Aransas, if no whooping cranes have been sighted in the central Platte valley for 5 days, and there are no recent (5 days) reports of whooping cranes in the Central Flyway south of the Platte River. For the fall survey, flights will be discontinued if no whooping cranes have been sighted in the central Platte valley for 5 days, and there are no recent (5 days) reports of whooping cranes in the Central Flyway north of the Platte River. The Program Manager or Biologist responsible for managing these surveys will be in contact with Tom Stehn (or other Aransas official) at (361) 286-3533 to obtain information related to bird departure/arrival from Aransas.

A Cessna 172 or similar aircraft will fly at a speed of 100 mph, as safety allows. One plane will fly the area between Chapman and the Nebraska Highway 10 (Minden) Bridge (the east leg). The second plane will fly the area between the Minden Bridge and the Lexington Bridge (the west leg). Two observers in addition to the pilot will be in each plane.   Surveys will begin between ½ hour before sunrise to sunrise, unless weather during this time period precludes beginning the survey. All attempts should be made to begin the survey at ½-hour before sunrise. If the survey cannot begin during this time period, due to weather/visibility requirements, the survey start time can be extended up to 2 hours after sunrise. Surveys may be canceled due to unsafe weather conditions (e.g., rain, snow, fog, high winds) or if there is significant snow cover on the ground that greatly impedes the surveyors chances of locating a whooping crane group.

All aerial surveys will be flown such that the flight direction when flying the river transect will be away from the rising sun. To help address the concern that one end of the river transect will always be flown early and the other late, there will be two start locations for each leg (east side and west side) of the study area. Using the eastern section as an example: on day one the flight will begin at Chapman, fly the river west to Minden, fly a predetermined return transect (upland) back to Chapman. On day two the flight will begin at the Wood River bridge, fly the river transect west to Minden, fly a predetermined return transect back to Chapman, and then fly the rest of the river transect from Chapman to Wood River. This pattern will continue through the survey period. The start points for the west leg will be the Minden Bridge and Odessa Bridge. During the river transect, observers will be situated such that the main channel(s) can be clearly viewed by both observers looking out the passenger side of the plane. This will necessitate that the plane fly just south of the main channel.

There are seven return transects: one, two or three miles either north or south of the centerline of the river and one directly down the centerline of the river (Figure 1). On the return transect, observers will look out different sides of the plane so that they can survey the half-mile to the north of the transect as well as the half-mile to the south of the transect. The return transect surveyed each day will be set based on a predetermined, systematically rotating schedule. This design will provide a systematic aerial survey to locate whooping crane groups in areas outside of the channel as well as within the channel. Again, it is recognized that this sampling scheme over-samples the river compared to those areas surveyed with the return transects.

All transects will be flown at 750’ altitude unless FAA regulation dictate a higher altitude (e.g., a minimum of 1000’ altitude when flying over towns and cities). The 750’ altitude for transects is selected for safety reasons. Extremely large numbers of migratory waterfowl are present in the central Platte River valley each spring. The 750’ altitude allows pilots to fly over most of the airborne waterfowl and to decrease the chance of flushing additional waterfowl into the air as the plane approaches. If a suspected whooping crane is seen, the plane is encouraged to circle to an altitude of 500’ (when safety allows) to provide a better viewing opportunity of the suspected whooping crane.

Each plane will have aerial photos, maps, and a global position system (GPS) unit to aid in the documentation of crane locations. When a whooping crane group is located, an air to ground radio will be used to immediately contact ground personnel that are geographically closest to the sighting. UTM coordinates taken either from the plane’s GPS system or hand held unit will be recorded on the data sheet and relayed to the ground crew. The aerial survey crew will photograph the whooping crane group and the general location using a 35mm or digital camera. All observations will be recorded on the aerial observation datasheet. If the ground crew has not located the whooping crane group by the time the aerial survey is complete, the plane will return to the crane group’s original coordinates and attempt to relocate the group. If the crane group is relocated from the air, the plane will maintain visual contact with the crane group and direct the ground crew to the location. The procedures to be followed by the ground crew once the crane group is located are in Section IV.B.2.

During the aerial flights, a ground crew will be stationed at four points in the study area. When the aerial survey crew radios a possible crane group sighting to the ground crew, the nearest two ground personnel will immediately attempt to locate the group. The ground crew will search for a minimum of two hours in the suspected area (or until dark) in an attempt to locate the sightings of crane groups made by the aerial flight crew. All effort expended by the ground crew to locate possible whooping crane groups will be documented on the datasheets and in the database.

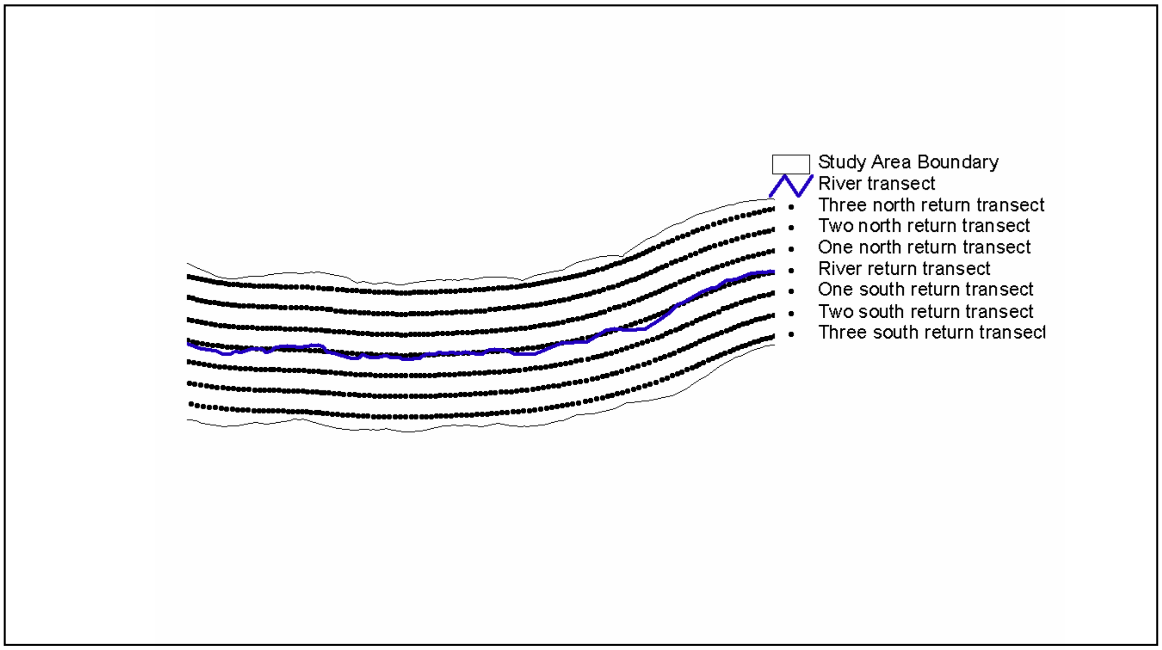


Figure 1. River flight transects and 7 return flight transects flown during the aerial surveys. Only a potion of the study area from East to West is shown.

Opportunistic Locates

The quality and timing of public sighting reports are highly variable. For example, several reports of a single group may be made by different individuals; sightings may be reported after the group has left the area; geese, white sandhill cranes, pelicans, or egrets may be reported as whooping cranes; etc. In an effort to document the validity of a sighting in a timely manner, a toll free number will be used to relay reports of possible whooping crane sightings to the ground crew. This number should be publicized at local areas frequented by birders, FWS offices, NGPC offices, and possibly in newspapers, to mail carries, bus drivers, etc. The ground monitoring crew will attempt to confirm all crane sighting reports that are in the study area and not yet confirmed. As a prioritization after confirmed sightings, the crew will check “probable” sightings, and then check “unconfirmed” sightings. The ground monitoring crew will conduct ground monitoring on all confirmed whooping cranes in the study area as described in Section IV.B.2.

All sightings relayed to the ground crew will be searched for by the ground crew for at least two hours. Incidental observations reported to the ground crew from outside the study area will be immediately forwarded to the FWS Nebraska field office, Whooping Crane Migration Information Coordinator. Information on all confirmed and probable sightings made by the ground crew will be forwarded to the FWS Nebraska field office.

The crew will fill out ground monitoring observation forms for all effort expended to locate confirmed and probable sightings of crane groups in the study area. In addition, the crew will collect use-site characteristics and fill out a use-site characteristics form for all crane sightings classified by the FWS as “confirmed”.

Survey Detection Rates
Whooping crane decoys will be placed at randomly selected locations during the aerial survey. Aerial crews will not be aware of the presence of the decoys during the flight. When the aerial crew observes a decoy, the location of the sighting should be relayed to the ground crew for confirmation of the decoy location. Decoy observations will be recorded on the aerial observation datasheet.

IV.B.2 Movement Tracking
Each crane group will be continuously tracked from the roost in early morning until arriving back at roost in the evening, until the crane group leaves the study area, or until the ground crew loses the group. If a crane group is lost, observers will spend a minimum of two hours attempting to relocate the group in the suspected area or until dark. All observations of crane groups by the ground crew will take place at a distance identified in the FWS guidelines and from vehicles.

All observations of cranes will be recorded on the Instantaneous and Continuous Use-site Monitoring data sheet. Both instantaneous and continuous movement data will be collected during the movement tracking monitoring and recorded on this datasheet. Continuous locations will be recorded and documented with a sketch map on the back of the datasheet or aerial photograph. A unique location ID will be assigned to each contiguous habitat type used by the crane group during the movement tracking monitoring.

Instantaneous locations will be recorded at fifteen-minute intervals. The specific location of the crane group will be marked on the map. A unique instant point ID will be assigned during the movement tracking monitoring.

The following information will also be recorded for the observation period: crane group composition (single bird, family group, or flock); group size; age estimation if possible (adult/juvenile); weather conditions; leg band color if present; and the association of the crane group with other avian species (sandhill cranes, waterfowl, etc).

IV.B.3 Crane Group Numbering
Any time a crane group is observed in the study area by the survey crew, a *Crane Group ID* will be assigned to the group. The *Crane Group ID* will consist of the following information: year; “SP” for the spring monitoring period or an “FA” for the fall; sequential number (e.g. 2002FA01,

2002FA02, 2002FA03,… etc). Any time a crane group is observed in the study area by the survey crew, a new *Crane Group ID* will be assigned unless the surveyors note on the data sheets the reasons why they believe this is a previously recorded group (using their professional judgment). In this case, the same crane group ID will be used. FWS crane group numbers for confirmed sightings will be included in the Program database and linked to the Program crane group numbers. This will assist in future cross-referencing between FWS and Program databases.

Each field or location used by a crane group will get a new *Location ID*. *Location ID* will be a sequential alphabetical letter (A, B, etc.). The variables *Crane Group ID* and *Location ID* and *Time* will be used to connect information about sightings in a field through all the datasheets and associated data tables. Specifically, this identifier will document when the crane group used a location on the ground.

For example, if a crane group is observed in the Fall 2002 survey from the air and relayed to the ground crew, the first location observed will be assigned *Location ID* A (Crane Group ID=2002FA01) and the *Time* will be recorded. In the event that a crane group is observed by two people (e.g. from air and from the ground) in the same location and at the same time, the two observations should have the same *Crane Group ID* (Crane Group ID=2002FA01), the same *Location ID* (A), and the same *Time*. If the ground observer observes the crane group moving to another field, the location would be assigned *Location ID* B (Crane Group ID=2002FA01) and the *Time* recorded. If the ground observer observes the crane group returning to a previously used field, say A, the location would be assigned *Location ID* A (Crane Group ID=2002FA01) and the *Time* recorded. If the crane group goes out of sight, the next time a crane group is observed in the area, the crane group ID will be assigned 2 (Crane Group ID=2002FA02) (unless the observers think it is the same group as 01 and the supporting justification is documented); and the first location observed by this group will be assigned *Location ID* A. The project leader will need to continually review the datasheets to ensure the crane group ID and Location ID are correct, since field crew members may not know what the next sequential crane group ID should be.

Instantaneous data will be taken every 15 minutes at each crane group location. Each point will get a new *Instant Point ID*. The variables *Crane Group ID* and *Instant Point ID* will be used to connect information about sightings at instant points through all the datasheets and associated data tables.

IV.B.4. Activity Monitoring

Crane activity will be monitored during the course of movement tracking. As the observer watches the crane group, he/she will record the activity being conducted by the whooping crane at each of the 15 minute instantaneous points documented during the movement tracking as one of the following categories: courtship, preening, resting, feeding, alert, agonistic or other activity as defined by the observer. If the crane group is comprised of more than one individual, the observer will select a "focus" crane that will be used to record activity information from. This information will be recorded on a datasheet. The observer will also video tape the crane group using a digital video camera for the entire time it is at a use site. Each tape/disk will be numbered and this number will be recorded on the datasheet for later cross-referencing. During the taping the observer will also verbally identify the date, time, location, and whooping crane group number that is being videoed.

IV.B.5. Use-Site Characteristics

The National Vegetation Classification Standard (NVCS) vegetation type will be documented for each continuous and instantaneous use-site using the Instantaneous and Continuous Use-site Monitoring datasheet. The time in, time out, and UTM location will also be recorded at the continuous use-sites. The time, distance to potential disturbance, and the type of disturbance will also be recorded at the instantaneous use-sites.

Additional physical and geomorphological characteristics of crane use locations will be measured for locations with standing or flowing water. These measurements will be made as soon as practical after the cranes leave the study area using the Use Site Characteristics datasheets. In all instances, proper landowner permission will be secured before Program personnel enter private property to conduct the measurements. FWS and/or NGPC personnel that have previously conducted site use evaluations will help train Program staff and contractors for future site evaluations.

Photographs taken of crane use-sites observed from the air will be used to locate the use area on the ground. A general sketch of the area and/or photograph will be taken for each use-site. The following characteristics will be recorded for each site with standing or flowing water.

The *Use Site ID* variable connects each location used by a crane group to the use characteristics measured on the ground. The *Use Site ID* is a sequential number assigned when the measurements are made (beginning with 1). The project manager will record the *Use Site ID* on the datasheets with the corresponding *Crane Grup ID*, *Location ID* and *Time*. In cases where a crane group has used the same location multiple times, there will be multiple *Location ID's* linked to one *Use Site ID* (assuming here the use characteristics were measured only once).

IV.B.5.a. Land cover class

The National Vegetation Classification Standard (NVCS) vegetation type will be documented for each continuous and instantaneous use-site.

IV.B.5.b. Distances to visual obstruction >1.5m

Distances from the crane group location to the nearest obstructions >1.5m in each of four quadrats oriented perpendicular/parallel to the channel for riverine use-sites and in the four cardinal directions for standing water will be made using a laser range finder. An obstruction is defined as objects (e.g., vegetation, bank, etc.) >1.5m above water line and encompassing more than 30 degrees of the horizontal field of view.

IV.B.5.c. Flow

The nearest upstream and downstream gage will be used to document provisional instantaneous flows during the period of crane use, and when the habitat measures are made. These data will be available from USGS gaging stations.

IV.B.5.d. Substrate

The percentage of each substrate type at a crane use-site will be documented for the four classes: less than 1mm, 1-4.9mm, 5-14.9mm, greater than 15mm.

IV.B.5.e. Unobstructed width

Channel width information will be gained by direct measurement and calculated from the water depth profile data. The distance between obstructions >1.5m along a line perpendicular to the channel and passing through the crane observation will be measured.

IV.B.5.f. Water/Wetted Width

Water or wetted width (defined the same for this protocol) will be measured directly in the field and calculated from the water depth profile data. The distance covered by water and between obstructions >1.5m along a line perpendicular to the channel and passing through the crane observation will be measured.

IV.B.5.g. Water depth profiles and sandbar location/elevation

When a crane group utilizes an area containing standing or flowing water, three parallel transects 25m apart will be established such that the middle transect crosses through the most recent crane group location. This procedure will allow the calculation of a mean and variance for each roost characteristic in the area a crane group used while acknowledging the difficulty in determining the exact crane group location when viewed from a distance.

Transects will be situated perpendicular to the general flow for river locations and perpendicular to the long axis of non-flowing water bodies. Elevation measurements will be taken along each transect using a stadia transit and rod. One measurement will be taken at approximately every 3m, when changes in topography are encountered, and at water lines. Each transect will begin and end where the transect line reaches an obstruction greater than 1.5m that a crane could not be seen through. UTMs at the bank of each transect will be documented using a GPS unit. When a sandbar is encountered along the profile transect, the distance at which the sandbar begins and ends (width) and height will be measured and the length estimated.

The channel morphology profile measurements will be interpolated during the analysis stage to produce a continuous profile of relative water surface elevation across the channel. Linear interpolation between each adjacent point along the transect will be used to sample from the profile at equally spaced increments. Water depth will be calculated as the average of equally spaced measurements of the relative water surface elevation profile that are at and below zero (water surface elevation). Sandbar elevation will be calculated as the average of equally spaced measurements of the relative water surface elevation profile that are at and above zero.

IV.B.5.h. Distances to potential disturbance features

Distance to potential disturbance will be documented in the lab using the most recent aerial photographs. Potential disturbance is defined as power lines, houses, etc.

IV.C. Data Collection from State and Federal Agencies

The report will contain a summary of all whooping crane migrational sightings within Nebraska and specifically the central Platte River corridor as obtained from the FWS, Grand Island. FWS crane group identification numbers will be recorded in the database.

IV.D. Analysis Methods

The information collected through this protocol will be used to define the habitat characteristics of whooping crane use-sites in the study area. The protocol is designed to provide information on crane groups with known probability of inclusion in the sample regardless of the crane group location in the study area. Since the aerial survey data provides this information but the opportunistically located cranes have an unknown probability of inclusion in the sample, analyses will be conducted separately for cranes located through the aerial surveys and for cranes located opportunistically.

Habitat Use

Since the whooping crane is a rare species and identifying individual cranes is usually not possible, all analyses with this data will need to balance small sample sizes with pseudo-replication. There are two options for the analysis of habitat use, one analysis will use every observation taken on each crane group, and will contain multiple observations per group. The second analysis will retain the sample size as the number of whooping cranes and average multiple observations of a crane as the first step of the analysis.

There are several analysis methods available for summarizing the habitat characteristics of whooping crane use-sites. The methods range from calculating means and variances, to modeling habitat use, to documenting changes through time, to methods that are not currently developed. With each analysis the probability sample of whooping crane use-sites collected under this protocol will provide data adequate for inferences to all cranes stopping along the Platte River in the study area.

Index of Use

An annual index of crane use will be developed using the information obtained by this protocol. The index of use will document the number of crane groups observed per survey effort (flights). The change in this index through time will estimate a change in the frequency of use throughout the first increment, if the protocol is implemented in a consistent manner.

Activity Monitoring Data

Annual analysis of activity monitoring data will only include the instantaneous data collected every 15 minutes. Videography collected will be archived for later analysis.

V. QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

QA/QC measures will be implemented at all stages of the study, including field data collection, data entry, data analysis, and report preparation. Observers will be trained and tested in the methods used and on their ability to identify whooping cranes. Data forms will be completed on a daily basis. At the end of each survey day, each observer will be responsible for inspecting his or her data forms for completeness, accuracy, and legibility. The study team leader will review data forms to insure completeness and legibility, and correct the forms as needed. Any changes made to the data forms will be initialized by the person making the change.

To help train observers that will be conducting the aerial surveys, each individual will be required to fly practice transects, or portion of transect. During this flight there will be whooping crane decoys placed in the river channel to allow observers the opportunity to see a “whooping crane” from the air at the speed and altitude of the surveys.

Data will be entered into the Program's Microsoft Access 2000 database by qualified technicians. These files will be compared to the raw data forms and checked for errors. Any irregular codes detected, or any unclear or ambiguous data will be discussed with the observer and study team leader. All changes made to the raw data will be documented.

After the data have been keyed and verified, the study team leader or QA/QC technician will check a five percent sample of data forms against the final computer file. Any problems identified will be traced back to the raw data forms, and corrections will be documented.

VI. DATA COMPILATION AND STORAGE

The Program's Microsoft Access 2000 database will be used to store, retrieve and organize field observations. The data for each survey will be incorporated within the larger Program database. All field data forms, field notebooks, and electronic data files will be retained for ready reference.

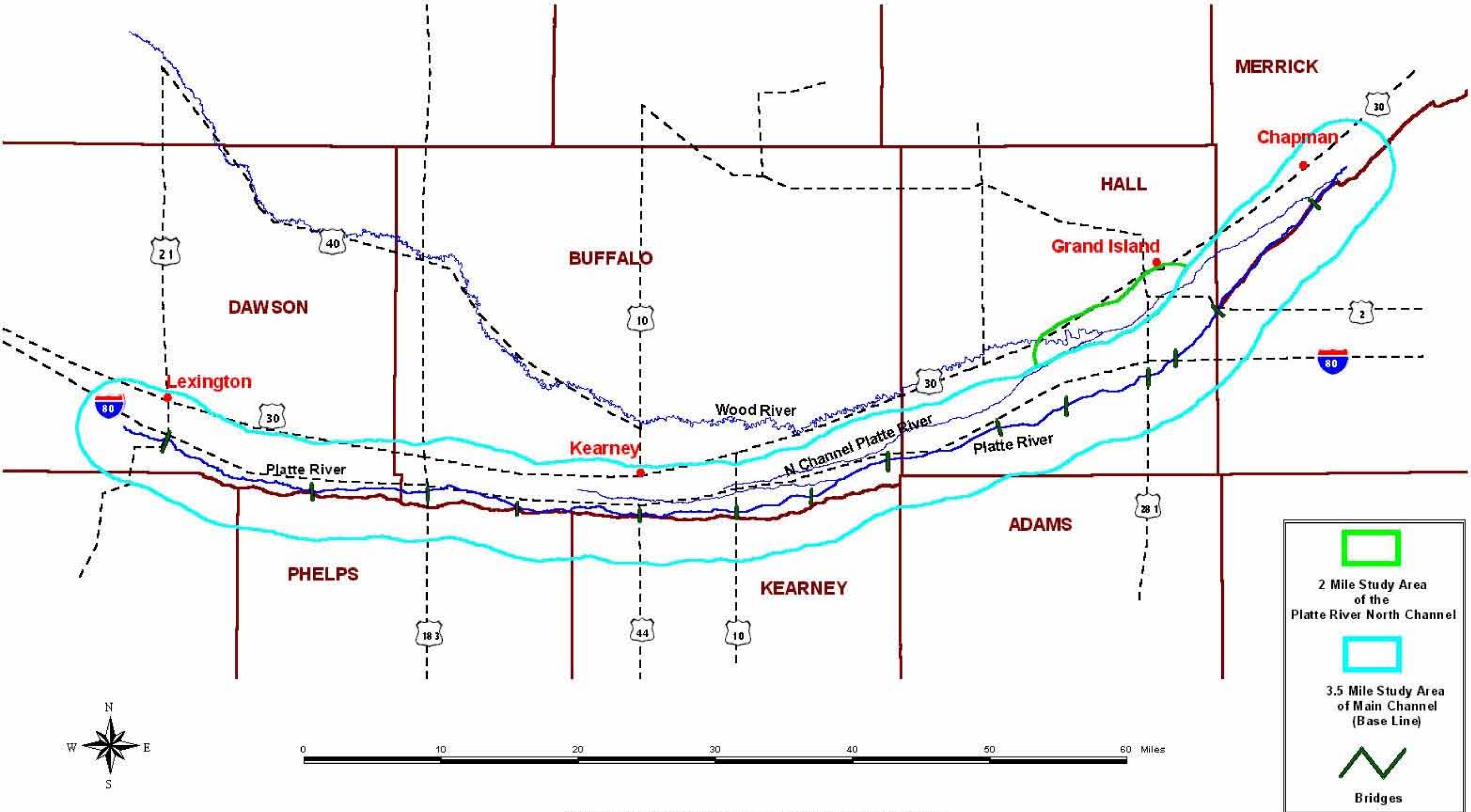
VII. REPORT FORMAT

Data on whooping crane habitat use will be compiled and summarized annually, and incorporated within the larger Program database. A draft and final report will be produced each year describing the methods employed, results, and any conclusions that can be drawn. The report will have both written and graphical components. The report will also contain maps and/or aerial photos showing crane use-sites. Descriptive statistics of whooping crane use will be prepared. Reports will be provided to both the Technical Committee and Governance Committee.

VIII. DATA SHEETS – *To be provided prior to survey implementation*

Aerial Survey
Aerial Observation
Ground Monitoring
Instantaneous and Continuous Use Site Monitoring
Use-site Characteristics Summary
Use-site Characteristics Profile

Cooperative Agreement Platte River Study Area



Maps and Analysis Prepared by Lynx Spatial Technologies Inc.

DRAFT
Protocol for
Monitoring reproductive success and reproductive habitat parameters of least terns and piping plovers in the central Platte River

May 1, 2002

I. INTRODUCTION

The States of Colorado, Nebraska and Wyoming and the Department of the Interior (DOI) agreed to participate in a basin-wide cooperative program relating to four target species (interior least tern, piping plover, whooping crane and pallid sturgeon) and their associated habitats in the Cooperative Agreement for Implementing a Platte River Recovery Implementation Program (Program). One of the primary purposes of the Program is to “implement certain aspects of the FWS’ recovery plans for the target species that relate to their associated habitats by providing for the following: 1) securing defined benefits for the target species and their associated habitats to assist in their conservation and recovery through a basin-wide cooperative approach that can be agreed to by the three states and DOI…”. The Program builds upon the July 1, 1997 Cooperative Agreement for Platte River Research and Other Efforts Relating to Endangered Species Habitats Along the Central Platte River, Nebraska (July 1997 Cooperative Agreement).

Program implementation will follow a process of adaptive management to address areas of scientific uncertainty. Monitoring is an integral part of the adaptive management process. The adaptive management approach will allow for efficient modification of management actions in response to new and changing environmental conditions. The Program’s Technical Advisory Committee will monitor and document, relative to the habitat and species conditions that existed as of the effective date of the Cooperative Agreement, habitat and species responses to habitat improvement activities. The Technical Advisory Committee will review monitoring results and make recommendations to the Program’s Governance Committee regarding the effects of Program activities on whooping crane habitat use in the study area. The Governance Committee, using the Technical Advisory Committee’s input, will evaluate projects and the overall Program to determine what, if any, changes are needed in the management.

This monitoring protocol will be used by the Technical Advisory Committee to gather information on least tern and piping plover reproductive success and reproductive habitat parameters in the study area. It is understood that regardless of survey method not all terns and plovers are certain of being detected and therefore full implementation of this or any other protocol will not represent complete use of the central Platte River valley. Information from this protocol will be used to help evaluate the biological response of terns and plovers and habitat to the land and water management activities of the Program.

This monitoring protocol addresses several July 1997 Cooperative Agreement milestones:

R2-1 A technical advisory committee appointed by the Governance Committee will develop protocols for and initiate habitat and species monitoring and research

R3-1 the FWS and TC will identify data needed to ascertain biological response and the time frame required to evaluate those data (R3-1 milestone as revised at the August 2, 2000 TC/GC workshop)

R5-1 The Nebraska Districts will implement any research and monitoring measures required by new FERC license articles for FERC Projects Nos. 1417 and 1835.

R1-2 and R1-3 A technical advisory committee will continue monitoring to document, relative to the habitat and species conditions that existed as of the effective date of the Cooperative Agreement, habitat and species responses to activities undertaken pursuant to the Cooperative Agreement.

R3-2 and R3-3 The Nebraska Districts will continue to implement any research and monitoring measures required by FERC license articles for FERC Projects Nos. 1417 and 1835.

II. PURPOSE

This document describes the conceptual design and study methods for locating tern and plover nests and monitoring the reproductive success and reproductive habitat parameters at least tern and piping plover colonies in the central Platte River valley, Nebraska. The monitoring is designed to document long term trends in reproductive and habitat parameters throughout the time the protocol is implemented.

This protocol will also be used by Nebraska Public Power District (NPPD) and Central Nebraska Public Power and Irrigation District (Central), collectively “the Districts”, as part of their compliance with Federal Energy Regulatory Commission (FERC) licensing.

III. DESIGN CONSIDERATIONS AND SPECIFICATIONS

III.A. Area of Interest

The area of interest for monitoring the reproductive success and reproductive habitat of least terns and piping plovers consists of the Platte River beginning at the junction of U.S. Highway 283 and Interstate 80 near Lexington, Nebraska, and extending eastward to Chapman, Nebraska. This includes approximately 90 miles of the Platte River and sandpits within 3.5 miles of the main channel or 2 miles of a side channel if the side channel extends beyond 3.5 miles of the main channel.

III.B. Statistical Design

The design consists of two main components: 1) effort-based census of the Platte River between Lexington and Chapman, and 2) census of historic (pre-Program) nesting areas and potential nesting areas on sandpits and constructed islands. These two monitoring components were designed along with a research component that was designed to evaluate the efficiency of each survey. Data will exist both prior to and after Program initiation for some of the 2rd component, with data collected only after Program implementation for the 1st component and the research component. Information from all components will be used to make informed judgments regarding the trends in tern and plover reproductive parameters associated with Program activities. Habitat parameters will be measured at all located nests.

III.B.1. Component 1, Effort-based Census of River (Extensive Survey)
To make statistical inferences to the entire study area, an effort-based survey will be conducted along the entire river corridor. The survey will involve locating nests from an airboat. Every channel with an active width (bare sand and/or water) greater than 75m on the Platte River between Lexington and Chapman, Nebraska will be surveyed. The boat will be directed through the channels in such a manner that observers can view all sand areas, making the total survey time dependant on the amount of sand present (i.e., more sand visible at low flows will require longer survey periods).

The entire river will be searched three times per breeding season (mid May, mid June, and mid July). Windows are provided as guidelines to determine when to survey (10 May-25 May, 10 June-25 June, and 10 July-25 July), but exact timing of the surveys will be dependent on flow and safety conditions. Before each survey an aerial flight will be conducted over the study area to determine the availability of bare sand, if its presence is in doubt. If there is no bare sand visible at the end of the airboat survey window, an airboat survey will not be conducted and the number of nests will be recorded as 0. If any bare sand is visible, regardless of size or condition, the airboat survey will be conducted when it is determined that flows have been at or below flight-day flows for three consecutive days.

III.B.2. Component 2, Census of Sandpits and Constructed Riverine Islands
All sandpits that have areas of bare sand (<20% vegetative cover) greater than one acre, and for which access can be gained, will be surveyed 3 times for active tern and plover colonies. Also, any nesting area constructed and maintained by the Program will be visited weekly between May 15 and July 15 for active tern and plover colonies. Reproductive areas (colonies) that were located and monitored prior to Program initiation will be monitored under this component. Since every accessible sandpit will be monitored we will have a census of colonies and a sample of nests at each colony. The nest is the sample unit for calculation of reproductive parameters, and inference will be to accessible sandpits with areas of bare sand greater than one acre.

Each of these areas will be searched three times per breeding season (mid May, mid June, and mid July) for tern and plover adults and nests. These surveys will be conducted regardless of the survey activity on the river. Nests located during these surveys will be monitored as described below. Monitoring all sandpits and constructed islands will allow unbiased estimation of trends in reproductive parameters at these areas. Only the areas that were monitored prior to Program initiation will be used in analytical comparisons of data collected before and after Program implementation. Areas that were not monitored prior to Program initiation will not be used in the before-after analysis but will be used in the trend analysis. Continuing surveys of these areas using the same methods to locate and monitor nests will facilitate detecting trends in reproduction during the Program.

III.C. Timing
Surveys of the river and sandpits to document nest presence will be conducted three times annually (mid May, mid June, and mid July). Least tern or piping plover nests found in any survey will be visited every three days to evaluate the nest status. Information to be collected during each site visit is described below.

IV. METHODS
IV.A. Biological, Reproductive, and Habitat Definitions

- Biological parameters

Brood – An active nest or clutch of chicks.

Nesting colony – The area encompassed by multiple nests within which disturbance to one nest results in a disturbance reaction by adults of other nests. In cases where only a single nest is present, the nest will serve as the "colony" for habitat measurements.

Nest Initiation – A nest is initiated when it is constructed and at least one egg is laid.

Nest success – A nest is successful when at least one egg hatches.

Fledge – A least tern chick has fledged when it is covered in unsheathed feathers, has a black eyestripe, and has a short tail, or flight is observed, or nestling is 15 days old. A piping plover chick is fledged when it is covered in unsheathed feathers and has a short tail, or flight is observed, or nestling is 15 days old.

- Reproductive Parameters

Total Nests Initiated – The total number of nests initiated whether successful or not. This total includes first nesting attempts as well as re-nesting attempts.

Nest-based Hatching success – The total number of hatched eggs (chicks) divided by the total number of nests initiated (i.e., if there were 60 chicks and 75 nests, the hatching rate would be 0.80 or 80%). Using the number of nests in the denominator of this statistic recognizes the greater independence of fate between nests than between eggs.

Nesting loss – The total number of unsuccessful nests divided by the total number of nests initiated (i.e., if there were 125 nests initiated and 25 nests were unsuccessful, nest loss would be 0.20 or 20%).

Nesting success – The total number of successful nests divided by the total number of nests initiated (i.e., if there were 125 nests initiated and 100 nests were successful, nest success would be 0.80 or 80%).

Number of Pairs – The number of pairs will be estimated one of two ways; 1) the maximum number of nests and number of broods at any one survey, or 2) half of the maximum number of adults counted at any one survey. Data collection will allow the estimation of the number of pairs using either method.

Nest-based Fledging success – the number of fledged birds per initiated nest (i.e., if 60 chicks were fledged from 50 nests, the fledging success would be 1.2 fledged birds per nest).

Pair-based Fledgling success – the number of fledged birds per bird pair (i.e., if 60 chicks were fledged from 50 pairs, the fledging success would be 1.2 fledged birds per pair).

- Nest-level Habitat Parameters

Nearest bank – Distance to the nearest bank across water estimated from a distance (riverine only).

Nest elevation – The elevation of each nest above the water surface estimated from a distance.

Nest management – Management activities applied specifically to nests (i.e. exclosures).

Vegetation composition – Percentage of vegetation cover in grass, forb, and woody vegetation types in a $1m^2$ and $5m^2$ area around the nest.

Vegetation density – The number of stems of grass, forb, and woody vegetation types in a $1m^2$ and $5m^2$ area around the nest divided by the area.

Vegetation height – Average height of all vegetation in a $1m^2$ and $5m^2$ area around the nest.

- Colony-level Habitat Parameters

Colony management – Management activities applied to the colony (i.e. predator fencing, predator trapping, herbicide, mowing).

Adjacent land use – The general description of land uses immediately next to as well as in close proximity to the colony.

Bare sand area – The total area with <20% vegetative cover at the colony site.

Pond size – Size of pond adjacent to the colony's nesting substrate (sandpits only). This parameter can be measured using aerial photographs or GIS.

Distance from colony to river – Distance between centroid of the colony and closest active river channel. An active river channel is defined as a channel carrying water when the entire river has a minimum flow of 1200 cfs. This parameter can be measured using aerial photographs or GIS.

Sandbar/Island height – The elevation of the sandbar/island recorded three transects perpendicular to the flow of the water and centered on the centroid of the river colony. The survey will be conducted after all terns and plovers leave the colony and with the use of a transit or survey grade GPS unit.

Channel width – Width of entire open-channel, including land, measured at the colony. This measurement will be derived from the elevation transect.

IV.B. Field Techniques

Standard field practices will be followed during each visit to a nesting area. The following information will be recorded: date, time of day, weather conditions (both for previous day and observation day), length of visit, number of adults and chicks, other species of wildlife present in area, and other information as needed. No more than a total of eight visits will be made within any one colony site and activity within the colony areas will be limited to less than 20 minutes in duration. Within colony visits will be conducted no more than once during a seven day period. All observations will be conducted when the temperature is less than 90°F (32°C) to reduce stress and mortality to eggs and chicks. If daily temperatures remain below 75°F, nests may be checked either in the morning or afternoon. If temperatures go above 75°F, nest will only be checked in the morning. If predatory animals (e.g., hawks, raccoons) are visible or fresh sign of predatory animals is observed (e.g., fresh tracks) nests will not be approached.

IV.B.1. Nest location

Component 1, Effort-based Census of River (Extensive Survey)

Effort-based census of the river to determine nest initiation will be conducted three times during each breeding season on the central Platte River between Lexington and Chapman, Nebraska. Surveys will be conducted in mid May, mid June, and mid July. An airboat will be used to access the river habitat within each bridge segment. The operator of the boat and a minimum of one observer will cover each active channel greater than 75m (as described above) searching for least tern and piping plover nests. The airboat will be operated such that observations of all bare sand areas can be made. Names of observers and time spent conducted the survey will be recorded on datasheets. GPS units will be used to accurately record which channels are surveyed.

If an adult piping plover(s) or least tern(s) is observed, the boat will be driven upstream of the location and the motor turned off. As the boat drifts by the location of the bird observation, both observers will attempt to locate the nesting bird. This method will enable the nests to be located without entering land before permission is granted. If the nest is located, or if the observers can not confirm the absence of a nest, the point will be mapped on an aerial photograph or 7.5-minute quadrangle map and a hand drawn map. The hand drawn map will include vegetative cover, distinguishing features of the area, estimated channel widths, and approximate topography. A GPS unit will be used to determine the UTM coordinates. Subsequent relocation of the nest will use the UTMs for the general location within the river and site maps or photos will be used to locate specific nest sites. After the nest is located the survey will begin from where the bird was first observed. As soon as possible after completion of the survey, the landowner will be contacted in an attempt to gain access to the property for monitoring of the nest. If landowner permission is not obtained, the area will be excluded from estimates of nesting success if monitoring cannot occur from a distance but will be included in estimates of total nests.

The number of terns and plovers detected during each airboat survey will be recorded and their likely association (reproductively) with a river, sandpit, or constructed island nesting colony will be noted. The surveyors will attempt to keep individual birds separated and only counted once.

Component 2, Census of Sandpits and Constructed Riverine Islands

Surveys for tern and plover nests at sandpits will be conducted in mid May, mid June, and mid July. Observations will be made using binoculars and/or spotting scope at a distance great enough to not cause disturbance of nesting birds (usually > 50 m, but closer or further as terrain dictates) and of duration of at least 1/2 hour. The observations will be done from multiple locations to provide complete coverage of the colony. In addition to recording the nests found during the survey, the monthly survey will be used to collect information on the number of adults, active nests, chicks, broods, and fledglings.

Once nests are located locations will be mapped on aerial photographs and hand drawn maps. Nests will not be marked with visible markers. Relocation of nests for monitoring purposes will be based on hand drawn maps and written descriptions. On the visit on which a nest is located, the number of eggs will be counted if viewable from a distance and habitat parameters will be estimated. Subsequent monitoring for hatching success and fledging success is described below. Each colony location will be recorded using a GPS unit and the UTM coordinates recorded.

If a sandpit or constructed island has active nests that are monitored every three days, it will not be necessary to do an additional survey of the area on June 15 or July 15. The information obtained on the visit to the colony nearest the June or July survey date will be used for the monthly survey data. The surveyor will mark the nearest survey date on the datasheet and spend duration of at least 1/2 hour to record the number of adults, active nests, chicks, broods, and fledglings at the site.

IV.B.2. Nest monitoring

Monitoring active nests will begin immediately after the first nests are initiated and will be conducted for nests located in components 1 and 2 described above. When permission is obtained to enter a nest location, the nest will be approached only to determine cause of predation. The number of eggs in each nest will be recorded if viewed using binoculars or spotting scope or if the colony is entered to investigate predation. Active nests will be viewed from a distance great enough not to disturb the birds and at least every third day to confirm nest status. Monitoring will continue until the nest becomes inactive either through nest success or nest failure. Colonies will not be entered more than eight times in any one year and not more than one time in a seven-day period.

When a nest is no longer active (as observed by using binoculars or spotting scope from a distance), the observer will determine if the nest hatched, was abandoned, or was predated. If the observer suspects nest failure, he/she will enter the colony to check the nest for evidence of the outcome. Indications that the nest was abandoned include no disturbance to the nest, and eggs intact in the nest, intact eggs not at incubation temperature. Evidence that the nest was depredated includes broken eggs, disturbed nest site, and predator tracks. All evidence (type of tracks, condition of egg fragments, scat, and any other sign) relating to potential nest predators will be recorded on data sheets. If the nest was successful, there may be small eggshell fragments in the bottom of the nest but the adult will have removed the larger pieces from the nest. Another indication that the nest was successful is that there will be a chick(s) in the area with the adults, and fecal material in the immediate vicinity of the nest. The outcome of each nest, including an estimate of the number of hatched eggs, will be documented on data sheets.

Timing of visits to determine fledging success will depend on obtaining the date of hatching from nest success monitoring (see above). Because tern and plover chicks require approximately 18-20 days to fledge (Murphy 1999), visits will be timed to begin before chicks leave the natal areas.

Fledging status of least terns and piping plovers will be determined by observation of the natal area from a distance great enough to minimize disturbance to adults or chicks (usually > 50 m). The entire natal area will be watched for fledglings and a complete, or nearly complete, count of chicks and adults will be made at each site. The observer will spend a minimum of 0.5 hour at each colony location and will scan the area using binoculars and/or spotting scope a minimum of 5 passes over the area. During each pass of the area the observer will count all adults and chicks and estimate the age of chicks.

Number of adults, nests, chicks, broods, and fledglings, estimated time until fledging for each chick, and any other pertinent information for each site will be recorded on data sheets (attached). An estimate of the number of successfully fledged chicks will be based on age and the date chicks were last observed or directly counted if chicks are observed flying from natal areas. Each site will be monitored every 3 days until all chicks are no longer observed at the natal area.

IV.B.3. Habitat Measurements

The colony will not be entered to conduct habitat measurements until after all of the chicks have fledged and all the birds have left the area. Nest-level habitat measurements will be estimated/recorded from outside the colony using binoculars or a spotting scope. Colony-level habitat measurements will be measured after all birds have left the nesting area.

For each nest in the study area, five habitat parameters will be estimated from outside the colony at the time the nest is located: 1) the distance between the nest and the nearest water, including the type of water, 2) the elevation of the nest above the water level, 3) nest specific management activities, 3) estimates of the percentage of grass, forb, or woody vegetation types within $1m^2$ and within $5m^2$ of the nest, 4) number of stems (to get density) within $1m^2$ and within $5m^2$ of the nest, and 5) vegetation height within $1m^2$ and within $5m^2$ of the nest.

For each colony (one or more nests) located in the study area, colony-level management activities will be recorded along with the adjacent land use. The bare sand area, size of adjacent pond, and distance from the colony to the river will be measured in a GIS for each colony. The location of each nest in the colony will be drawn on a copy of an aerial photograph to estimate the centroid of the colony.

For each colony located on the river, three parallel cross-sectional transects will be used to measure a depth profile perpendicular to the flow. The middle transect will pass through the centroid of the colony, the upstream and downstream two transects will pass through the remaining thirds of the colony. For areas with only one nest, the middle transect will pass through the nest location, one transect 25 m upstream and one transect 25 m downstream. A survey grade GPS unit or transit/rod will be used to record distance and elevation at 3 m intervals, slope breaks, and water lines from permanent bank to permanent bank or permanent obstruction (e.g., woody vegetation, bank) greater than 1.5m. The colony location will be noted on the data sheet or on the computer used to capture the cross sectional data. Estimates of active channel width will be obtained from the elevation transect data.

IV.C. Analysis Methods

Estimates of reproductive parameters will be summarized separately for the river survey (component 1) and for the sandpit and constructed island surveys (component 2) because the different methods used to locate nests will most likely result in different probabilities of inclusion of a nest in each sample. In both cases, the nest will be the sample unit for the calculation of reproductive parameters by colony, river segment, bridge segment or the entire river. Associations between reproductive parameters and habitat variables will use the nest or the colony as the experimental unit depending on the habitat variable. Inference for these analyses will be to the sandpits within the study area or colonies on the Platte River within the study area. For the trend analysis on sandpits and constructed islands, the experimental unit will be the colonies because the location of the colony will be the same every year. For the trend analysis on the river, the experimental unit will be the river segment because colonies will not be in the same location of the river every year.

The total number of nests initiated will be calculated for each site (riverine, sandpit or constructed island). The variance will be calculated using the variance of a total from a simple random sample (Thompson 1992).

Hatching success
The total number of hatched eggs will be calculated for each site. The variance will be calculated using the variance of a total from a simple random sample (Thompson 1992). The nest-based hatching success will be calculated as the ratio of the total number of hatched eggs to the total number of nests initiated.

Nesting loss
The total number of unsuccessful nests will be calculated for each site. The variance will be calculated using the variance of a total from a simple random sample (Thompson 1992). The estimate of nesting loss will be calculated as the ratio of the total number of unsuccessful nests to the total number of nests initiated. The variance will be calculated by the variance of the ratio of totals (Cochran 1977).

Nesting success
The total number of successful nests will be calculated for each site. The variance will be calculated using the variance of a total from a simple random sample (Thompson 1992). The estimate of nesting success will be calculated as the ratio of the total number of successful nests to the total number of nests initiated. The variance will be calculated by the variance of the ratio of totals (Cochran 1977).

Fledging success
The total number of fledglings will be calculated for each site. The variance will be calculated using the variance of a total from a simple random sample (Thompson 1992). The estimate of fledging success will be calculated two ways. Nest-based fledgling success will be calculated as the ratio of the total number of fledglings to the total number of nests initiated. Pair-based fledgling success will be calculated as the ratio of the total number of fledglings to the total number of breeding pairs. The variance of each estimate will be calculated by the variance of the ratio of totals (Cochran 1977).

Mayfield Estimators
The Mayfield estimate of daily mortality rate will be calculated as the ratio of total number of unsuccessful nests to the total number of exposure days. The variance of the daily mortality rate will be calculated as the variance of a maximum likelihood estimator (Johnson 1979). Daily

survival rate will be calculated as one minus the daily mortality rate, and hatching success will be calculated as the daily survival rate raised to the power of the length of the incubation period.

Associations with reproductive parameters
Physical habitat measurements made at the colony level can be used in regression equations to predict reproductive parameters (hatching success, nesting success, fledgling success). One scale of this analysis will be a regression of the habitat covariates measured on each site to the mean parameters calculated by site. The sample unit for this analysis will be the site (riverine, sandpit, or constructed islands). Possible covariates include the size of the site (water) and the distance to the river. This analysis will be conducted within each year and across years (using site averages).

A second scale of analysis would be to use regression to relate habitat covariates measured at a nest to the reproductive parameters for the corresponding nest. The sample unit for this analysis would be the nest. We can determine the association of changes in habitat variables with changes in response variables. These regressions will include a site indicator variable to detect site influences on the reproductive parameters. The number of chicks from a nest can be related to habitat using normal linear regression, while success of a nest (yes or no) can be related to habitat using logistic regression. Again, this analysis will be conducted within each year and across years.

Trend Detection
Using both the historic data from monitoring these colonies and data collected under this protocol, the slope of the least squares regression line against time will be estimated for each colony. The average and standard error of the slope statistic across colonies will provide an estimate and confidence interval of average trend.

Note that without a reference area there will be a tendency for the effects of the increased flows and habitat management to be confounded with trends in the reproductive parameters due to other factors not measured. For example, the reproductive success may increase immediately after Program initiation because the weather was more conducive to the birds successfully fledging young for those years. With data collected over time, the effects of other factors will diminish and the inferences regarding the effects of the Program will get stronger.

Before-After Analyses
Data from sites (colonies) that were monitored before Program initiation can be compared to data collected under this protocol in the same areas. Since the Program influences all colonies in the study area, cause and effect relationships can not be established by this analysis. Reproductive parameters will be calculated without adjustments for comparison with pre-Program survey data.

Before-after analyses will be conducted by averaging the values of the reproductive parameters before Program implementation and after implementation for each sandpit. The slope between these two numbers will be calculated and the average slope (over sandpits) will be an estimate of the before to after change in the parameter. Inferences are to the sandpits involved in this analysis.

Nest Habitat Characteristics
Habitat measurements made at the nests will be summarized using means across nests and normal based confidence intervals (Zar 1984).

Colony level habitat measurements will be summarized using means across colonies and normal based confidence intervals (Zar 1984).

V. RESEARCH ASSOCIATED WITH THIS MONITORING PROTOCOL

An intensive nest survey of portions of the river will be conducted to augment the monitoring activities *(CITE RESEARCH PROTOCOL)*. This research is intended to determine the effectiveness of the riverine survey by documenting habitat characteristics associated with nests located under component 1 of this protocol and nests not located (double sampling). The data will enable the development of an adjustment factor for river survey data to accurately estimate the number of nests on the river. This research will be conducted during the implementation of the monitoring protocol for a duration necessary to adequately model the sampling effectiveness. The intensive survey will be most useful if it is implemented after the river survey has detected nests on the river.

VI. QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

QA/QC measures will be implemented at all stages of the study, including field data collection, data entry, data analysis, and report preparation. Observers will be trained in the methods used and tested on their ability to locate and identify nests. At the end of each survey day, each observer will be responsible for inspecting his or her data forms for completeness, accuracy, and legibility. The study team leader will review data forms to insure completeness and legibility, and any problems detected will be corrected. Any changes made to the data forms will be initialized by the person making the change.

Data will be entered into electronic files at a centralized database by qualified technicians. These files will be compared to the raw data forms and any errors detected will be corrected. Any irregular codes detected, or any unclear or ambiguous data will be discussed with the observer and study team leader. All changes made to the raw data must be documented for future reference.

After the data have been keyed and verified, the study team leader or QA/QC technician will check a five percent sample of data forms against the final computer file. Any problems identified in later stages of analysis will be traced back to the raw data forms, and appropriate changes in all steps will be made.

VII. DATA COMPILATION AND STORAGE

A centralized database will be established to store, retrieve and organize field observations. Data from field forms will be keyed into electronic data files using a pre-defined format that will make subsequent data analysis straightforward. All field data forms, field notebooks, and electronic data files will be retained for ready reference.

VIII. REPORT FORMAT

A draft and final report will be produced each year describing the methods employed, results, and any conclusions that can be drawn. The report will have both written and graphical components. Graphs will show trends from year to year in such things as number of nests initiated, nesting success, and fledging success. The report will also contain maps showing areas searched for nests and areas that contained nests.

IX. ADMINISTRATION

The Program will be responsible for implementation of the protocol and obtaining the necessary permits.

X. EXISTING DATA EVALUATION

Nebraska Public Power District (NPPD) collected least tern and piping plover reproduction data on 3 islands (Elm Creek, Lexington, Overton) and 3 sandpits (Johnson's, Lexington, and Blue Hole) from 1991 to 2000. This data is located in a Microsoft excel file *t&p tables00.xls* house in the Kearney office. The file contains the number of initiated nests, number of hatched nests, number of hatched chicks, and the number of fledged chicks at each of the 6 sites for each year. Various forms of reproductive success statistics can be created from this data.

As a check on the existing data, trends through time were estimated for hatching success defined as the ratio of the number of hatched chicks to the number of nests, and for fledging success defined as the ratio of the number of fledglings to the number of nests. The slope of the regression of success parameters on year (estimate of trend) were graphed and averaged by species to get an average trend. 95% confidence intervals on both of these averages included zero.

XI. DATA SHEETS

(Attached)

XI. BIBLIOGRAPHY

Cochran, W.G. 1977. Sampling techniques, 3rd edition. John Wiley and Sons, New York, NY.

Johnson, D.H. 1979. Estimating nest success: The Mayfield method and an alternative. The Auk 94:651-661.

Manly, B.F., L.L.McDonald, and G.W.Garner. 1996. Maximum likelihood estimation for the double-count method with independent observers. 1: 170-189.

McDonald, L.L., H.B.Harvey, F.J.Mauer, and A.W.Brackney. 1990. Design of aerial surveys for Dall Sheep in the Arctic National Wildlife Refuge, Alaska. Biennial symposium of the Northern Wild Sheep and Goat Council. 7: 176-193.

Murphy, R.K., B.G.Root, P.M.Mayer, J.P.Goossen, K.A.Smith. 1999. A draft protocol for assessing piping plover reproductive success on Great Plains alkali lakes. Pages 90-107 in K.F.Higgins, M.R. Brashier, and C.D. Kruse (eds.), Proceedings, piping plovers and least terns of the Great Plains and nearby. South Dakota State University, Brookings.

Samuel, M.D., E.O.Garton, M.W.Schlegel, R.G.Carson. 1987. Visibility bias during aerial surveys of elk in Northcentral Idaho. Journal of Wildlife Management. 51(3): 622-630.

Thompson, S.K. 1992. Sampling. John Wiley and Sons, New York. pp. 347.

Zar, J. H. 1984. Biostatistical Analysis. 2nd edition. Prentice-Hall, Inc, Englewood Cliffs, N.J. pp. 718.

Draft
Monitoring the vegetation of the central Platte River valley

September 19, 2006

System-Level Monitoring

I. PURPOSE
The purpose of system-level vegetation monitoring is to document the vegetation community in the Program study area.

I.A. Land Cover/Use Survey
The purpose of the land cover/use survey is to document system-wide status in large-scale areal coverage of land cover/use. This monitoring is designed to detect land use changes during the First Increment.

I.B. In-channel Seedling Survey
The purpose of the in-channel seedling survey is to provide system-wide status in areal coverage of seedlings in the main channel. This information is designed for use in the annual management plan of the Environmental Account.

II. DESIGN CONSIDERATIONS AND SPECIFICATIONS
II.A. Area of Interest
The area of interest for system-level vegetation monitoring consists of the area 3.5-miles on either side of the Platte River centerline beginning at the junction of U.S. Highway 283 near Lexington, Nebraska, and extending eastward to Chapman, Nebraska (approximately 90 miles). When side channels of the Platte River extend beyond the 3.5-mile area, an additional 2-mile area is included around these channels.

II.B. Parameters of Interest
The monitoring will collect data appropriate to estimate land cover class acreage, and frequency distribution of elevation (above a base flow) for seedlings in the channel.

II.C. Sampling Design
II.C.1. Land Cover/Use
The system-level land cover/use monitoring is designed to document status by repeating the development of a land cover/use GIS layer at the end of the first increment. The same methods used in the development of the pre-Program land cover/use layer with the 1998 ortho-rectified color infra-red photographs will be employed. The pre-Program land cover/use GIS layer was developed by the Bureau of Reclamation, Great Plains Region, Platte River EIS Office (USDI BOR 2000). The same cover types, with updates as possible, will be used during the Program.

Trends in land cover class acreage can be assessed by comparing the post-first increment GIS layer to the layer created from the 1998 photographs. An estimate of net change in the areal extent of each cover class will be made with the study area-wide estimates of land cover/use area (e.g. the hectares of wetted channel increased by 10). Evaluating a sample of points in the study area will allow estimates of gross change (e.g. 20 hectares changed from forest to wetted channel, 10 hectares changed from wetted channel to lowland grasses) (Duncan and Kalton 1987).

In addition, estimates of the areal extent of each cover class will be made during the First Increment using non-rectified aerial photographs. These estimates will be made every three years and will be used to interpret the trends detected with the land cover/use GIS layer at the beginning and ending of the First Increment. Transects spaced evenly throughout the study area and positioned at the anchor points will be used to estimate the areal extent of each cover class. The distance of each cover class along each transect will be measured on the aerial photographs and the areal extent of each land cover/use class will be inferred from this data.

II.C.2. In-channel Seedling Survey

The system-level seedling survey is designed to document the areal extent of the study area main channel with willow and cottonwood seedlings less than 3 years old or purple loosestrife or false indigo. The monitoring will locate areas with seedlings (willows, cottonwoods, purple loosestrife, and false indigo less than 1 meter in height) and without other well-established woody vegetation (greater than 1 meter in height). An estimate of the seedling area will be made annually and will include the elevations associated with seedling areas. The main channel in the study area forms the population (area) of interest for this monitoring.

The system-wide anchor points will be used to locate the data collection in order to obtain estimates that are representative of the entire study area. The survey will utilize the topography survey conducted as part of the annual geomorphology monitoring. Since the objective of this monitoring is to estimate status, the in-channel seedling monitoring design will be conducted at the sites in the rotating panel of the geomorphology survey.

One fixed width (belt) transect at each anchor point will be used to estimate the area of the channel with seedlings present. The transect will be centered on an anchor point and be oriented perpendicular to the flow. The length of each transect will be the width of the channel. The width of each transect will be 300 meters, extending for 150 meters up and downstream of the anchor point.

All areas within the belt transect that contain seedlings, and do not contain permanent woody vegetation greater than 1 meter in height will be recorded. The size and elevation of each area and the presence of each of the four species of seedlings (willow, cottonwood, purple loosestrife, and false indigo) will be documented.

III. METHODS

III.A. Definitions

Seedling- Willow tree less than 1 meter high, cottonwood tree less than 1 meter high, purple loosestrife plant, or false indigo plant.

III.B. Field Techniques

III.B.1. Land Cover/Use

Field techniques for the land cover/use GIS will follow those used in the development of the pre-Program land cover/use GIS layer from the 1998 ortho-rectified color infra-red photographs. Field work will be required to develop vegetation classification signatures for the photographs, field check the preliminary classification, and to perform an accuracy assessment of the classification.

III.B.2. In-channel Seedling Survey

Three hundred meter wide belt transects (150 meters on either side of the topography transect) will be visited once a year during the time frame specified in Section III.C.2. to document the areas without permanent woody vegetation containing seedlings. There will be one transect at each anchor point in the rotating panel of the topography survey.

Within the belt transect, specific areas with seedlings will be delineated. The presence or absence of each type of seedling will be documented for each area. In each area, the topography will be measured along two axes with a survey-grade global positioning system (GPS). The longest axis of the polygon will be the first axis surveyed. The longest axis that is perpendicular to the first axis will also be surveyed. The survey data will be used to estimate the size of the area and the elevation of the area. One GPS reading will be taken at the ends of each transect and every 3 meters along each transect. One GPS point will be captured at the highest point in the area, and if neither axis of the area meets water level, one reading of the water level nearest the area will be taken.

III.C. Timing

III.C.1. Land Cover/Use

The development of a land cover/use GIS layer will take place during the last years of the First Increment. Color infra-red photographs will be taken according to the Aerial Photography Protocol.

III.C.2. In-channel Seedling Survey

The in-channel seedling survey will take place annually between July 1 and August 31 and at the same time as the annual topography survey. The elevation information will come from the topography survey as outlined in the geomorphology protocol. The information gained from this monitoring will be summarized for inclusion in the Draft Environmental Account annual operating plan in November.

IV. Analysis Methods

IV.1. Land Cover/Use

A before-after comparison analysis of the net change and gross change in the areal coverage of each land cover/use class will be conducted. This analysis will attempt to incorporate the accuracy of the pre and post-First Increment land cover/use classifications. The areal extent of each land cover/use class will be the sum of each polygon in the coverage. The net change will be calculated as the difference of the area of each land cover/use class in the pre-Program and post- First Increment GIS coverages.

Estimates of gross change will be estimated using a set of points randomly placed throughout the study area. Each point will be classified according to the land cover/use in the pre-Program and post- First Increment GIS coverages. A matrix of pre to post land cover/use classes will be used to indicate the extent of land cover/use class conversions that occurred over the course of the First Increment.

IV.2. In-channel Seedling Survey

The average elevation and areal extent of seedlings will be estimated with the in-channel seedling survey. The GPS survey information will be transformed to provide the distance from the transect end and elevation for each point along each of the two transects at each seedling area. The areal extent of the seedling area will be estimated by the formula for the area of an ellipse using the length of the two transects. The elevation of the seedling area will be calculated as the average of the elevation readings along the two transects and converted to the elevation above water at a base flow.

The elevation and areal estimates will be combined across the seedling areas delineated at each anchor point. The area will be summed and the elevations averaged (weighted by area) for an anchor point estimate. The proportion of area covered by seedlings will be calculated for each transect by dividing the area covered by an estimate of the area surveyed. The area surveyed will be 300 meters by the width of the channel at the anchor point (calculated from topography data collected for the geomorphology monitoring).

The proportion of area covered will be estimated for the entire main channel of the system by summing the area covered across anchor points and dividing by the sum of the area surveyed across anchor points. The variance of this estimate will be calculated using the variance of a ratio of totals (Cochran 1965; page 158).

The average and highest elevation of seedling areas at each anchor point will be converted to the elevation above water level at a base flow using nearby gaging information. To combine across areas at an anchor point, the elevations for all the areas with seedlings will be averaged using the areas as the weight. The area covered (in hectares) and average elevation above water at a base flow at each anchor point will be combined across anchor points to obtain a frequency distribution of elevation for seedlings in the study area channel. This distribution will be created using hectares as the basic unit and will be used to determine the proportion of seedlings present in the main channel at each elevation above the base flow water level.

Program-Level Monitoring

I. PURPOSE

The purpose of Program-level vegetation monitoring is to document the vegetation community on Program lands. The land cover survey in conjunction with the vegetation community survey will provide the coverage area and a species list for each land cover type. The emergent wetland quality survey will provide a complete species list including rare species. When the land cover survey is repeated on a Program land, changes in the amount of each land cover class will be estimated for the Program land. When the vegetation community or emergent wetland quality survey is repeated on a Program land, the similarity of species composition will be estimated for the Program land. These comparisons may take place after a land or water management plan has been implemented, or near the end of the First Increment. The same design and field methods will be implemented each time the lands are surveyed.

I.A. Land Cover Survey

The purpose of the land cover survey is to document the areal extent of each land cover class.

I.B. Vegetation Community Survey

The purpose of the vegetation community survey is to document species composition in each land cover class.

I.C. Emergent Wetland Quality Survey

The purpose of the emergent wetland quality survey is to document the total species composition in the emergent wetland cover type for an assessment of emergent wetland vegetation quality.

II. DESIGN CONSIDERATIONS AND SPECIFICATIONS

II.A. Area of Interest

The study areas for the Program-level monitoring are the blocks of land managed by the Program. It is expected that Program lands will be near one of the channels of the central Platte River between the junction of U.S. Highway 283 near Lexington, Nebraska, and Chapman, Nebraska. Each contiguous block of Program land will be sampled in a separate survey.

II.B. Parameters of Interest

The monitoring will collect data appropriate to estimate land cover class acreage, plant species composition, tree density, shrub/sapling density, percent plant cover (by species), percent non-plant cover, relative percent plant cover (by species), emergent wetland plant species composition and emergent wetland plant diversity.

II.C. Sampling Design

The Program-level monitoring is designed to collect vegetation data that is representative of each Program land. The monitoring will take place systematically throughout the Program land and will focus on estimating the above parameters. The system-wide anchor points will be used to locate the data collection.

II.C.1. Land Cover Survey

Transects will be surveyed to document the amount of land in each land cover class. The land cover transects will begin and end at property boundaries and will be oriented in the north to south direction. Each transect will be centered on a systematically placed anchor point along the centerline of the river.

Each Program land will contain 20 systematically placed transects. Transects will be surveyed using line-intercept methods (Bonham 1989). The linear distance of each land cover class along the transect will be recorded by marking the boundary with a GPS. The land cover classes used for this survey will be agriculture field, exposed sand beach/bar, emergent wetland, forest, grassland, open water (pit, pond or lake), open water canal, and wetted channel.

For the exposed sand beach/bar, emergent wetland, open water canal, and wetted channel cover types, the linear distance along the transect must be at least 5 meters to be discerned as a separate land cover type. For the agriculture field, forest, and grassland cover types, the linear distance along the transect must be at least 10 meters to be discerned as a separate land cover type. For example, a grassland four meters wide within the forest cover type would not be designated as a separate cover type.

II.C.2. Vegetation Community Survey

The land cover transect will be surveyed to document the species composition in each vegetated land cover class. The land cover classes will be identified using the methods in III.A.1. Step-point sampling will be used to determine the percent plant cover, percent non-plant cover, and relative percent plant cover in exposed sand beach/bar, emergent wetland, forest, and grassland cover types. Point-centered-quarter sampling will be used to estimate tree density and shrub/sapling density for the forest cover type.

Agriculture

The agriculture cover type is defined as areas under cultivation during the time of the vegetation survey. This cover type may also include irrigation ditches, access lanes, and haystacks. When the land cover transect crosses through an actively planted monoculture, the crop type will be recorded. When the land cover transect crosses through a fallow agriculture field, a step-point sample will be taken every 10 meters along the land cover transect.

Exposed sand beach/bar

The exposed sand beach/bar cover type is defined as an area with exposed sandy soils and low vegetative cover (typically less than 50%). This may include inactive channels, islands, point bars, and areas adjacent to some active channels. When the land cover transect crosses through the exposed beach/bar cover type, a step-point sample will be taken every 2 meters.

Emergent wetland

The emergent wetland cover type is defined by saturated and inundated soils where water depths do not exceed one meter (e.g. on/near seeps, springs, drainages, pond margins, swales, riverbanks, and in ditches). When the land cover transect crosses through the emergent wetland cover type, step point samples will be taken every 2 meters.

Forest

The forest cover type is defined as the area on river terraces and large and small islands within the floodplain that have sufficient substrate over ground water to allow root development and sufficient aeration. Where the land cover transect crosses through the forest cover type, a point-centered-quarter plot will be established every 200 meters (Laycock and Batcheler, 1973). The first plot will be established a minimum of 50 meters in from the edge of the forest cover type to avoid edge effect and there will be no plots when the forest does not cross the land cover transect for a length longer than 100 meters. In addition, two forest step-point transects will cross at right angles to each other, centered on the point-centered-quarter plot, and extending in the four cardinal directions. Each forest transect will be 50 meters in length and a step-point sample will be taken every 2 meters for a total of 25 hits per transect and a total of 50 hits per plot.

Grassland
The grassland cover type is defined by herbaceous vegetation with native tall grasses and introduced grass species. This definition encompasses both upland and lowland grasslands. Upland grasslands are defined by drier and often elevated soils that are not subirrigated; lowland grasslands occur on subirrigated soils within the floodplain. Where the land cover transect crosses through the grassland cover type, a step-point sample will be taken every 10m.

II.C.3. Emergent Wetland Quality Survey
The emergent wetland will be surveyed to document rare species presence, species diversity, and the percent plant cover in the emergent wetland cover type. The emergent wetland areas will be identified using the methods in III.A.1. Emergent wetland quadrat sampling will take place in 2x2 meter quadrats established along the land cover transect. Quadrats will be spaced 10 meters apart along the transect within the emergent wetland section(s). The distance between the quadrat locations will be accumulated over all the sections of emergent wetland along a land cover transect. Every species observed in the quadrat will be recorded along with ocular estimates of the coverage area.

III. METHODS
III.A. Field Techniques
III.A.1. Land Cover Survey
Before the survey begins, the anchor point corresponding to each land cover transect will be identified using a geographic information system (GIS). The 20 transects will be systematically spaced along the centerline of the river as it runs through or adjacent to the property. The location of the junction of the land cover transect with every property boundary (north and south ends) will be identified for use in locating the endpoints in the field. Surveyors will begin at one end of the land cover transect and walk to the other end. The line-intercept survey method will identify the location of the beginning/end of each land cover class boundary along the transect with GPS (using the above definitions).

For the exposed sand beach/bar, emergent wetland, open water canal, and wetted channel cover types, the linear distance along the transect must be at least 5 meters to be discerned as a separate land cover type. For the agriculture field, forest, and grassland cover types, the linear distance along the transect must be at least 10 meters to be discerned as a separate land cover type.

III.A.2. Vegetation Community Survey

All species information will be recorded using *Flora of the Great Plains* (Great Plains Flora Association 1986) as the authority for plant species identification. Plant species that are unknown to the surveyors will be collected and numbered for later identification and rectification on the datasheets or in the database.

III.A.2.a. Step-point Sampling

Step-point sampling will be used to define the species composition and percent cover within each land cover/use cover type (Bonham 1989). Step point samples will be taken along the land cover transects in the exposed sand beach/bar, emergent wetland, and grassland cover types. Step point samples will also be taken along specifically defined transects in the forest cover types.

The step point samples will be taken using an apparatus described in Evans and Love (1957) and modified by Owensby (1973). At each location a step-point sample is to be taken, the surveyor will place the hind legs of the step-pointer on the ground, and then bring the front leg down and record the species of the first piece of vegetation touched by the pointer. One species will be recorded at each step-point location.

If the pointer touches a non-vegetated item (bare ground, building, debris pile, downed woody debris, leaf litter, or open water), this non-vegetated item will be recorded. There will not be any additional vegetated hit information recorded when the first hit is non-vegetated. (Note: this differs from the method described in Evans and Love, but will facilitate the calculation of more precise estimates of percent plant cover).

Step-point data will be composed of a list of vegetation species and non-vegetated items and the number of hits for each. The step-point lists will be recorded separately for each section of the land cover transect. For example, if there are two sections of grassland cover type along the same land cover transect, the step-point data will be recorded separately for the two sections of grassland cover type. These sections will be identified using the UTMs of the endpoints of the cover types. Step point data will also be recorded separately for the emergent wetland transect and the land cover transect through the same emergent wetland. Likewise, step point data will also be recorded separately for the forest transect and the land cover transect through the same forest.

III.A.2.b. Point-centered-quarter Sampling

Point-centered-quarter sampling will be used to define the species composition and density in the forest community. Point-centered-quarter plots will be established every 200 meters along the land cover transect in the forest cover type and at least 50 meters from the edge of the forest. The location of each point-centered quarter plot will be captured with a GPS at the time of sampling.

The area around each point-centered-quarter plot will be divided into four imaginary quarters, with the transect line as the north-south bisector. In each quarter, the distance from the center point to the nearest live tree greater than 5-cm dbh (diameter at breast height) will be recorded, along with its dbh and species. In addition, the distance to the nearest live shrub/sapling (dbh less than 5 cm) and the species will be recorded in each quadrat. Each quarter of the plot will extend as far as needed to locate the nearest tree and a laser rangefinder will be used to record all distances.

III.A.3. Emergent Wetland Quality Survey

All species information will be recorded using *Flora of the Great Plains* (Great Plains Flora Association 1986) as the authority for plant species identification. Plant species that are unknown to the surveyors will be collected and numbered for later identification and rectification on the datasheets or in the database.

Quadrat sampling will be used to quantify the species composition in the emergent wetland cover type. Quadrat sampling locations will occur every 10 meters along the emergent wetland sections of the land cover transect. A running tally of length of emergent wetland thus far traversed along the land cover transect will be kept by the field surveyors. When the 10m point is reached, a $2m^2$ quadrat frame will be placed with one edge at the 10m point and the frame extending to the 12m point, with 1 meter of the frame falling on either side of the transect. When the 20m point is reached, another quadrat sampling location will be established. The sampling will continue in this manner (30m, 40m, etc.) until the end of the transect. For each land cover transect, the tally of the length of the emergent wetland cover type will begin at 0.

A $2m^2$ quadrat frame will be used to delineate the survey area. The centerpoint of each quadrat sampling location will be recorded with a GPS. Ocular estimation will be used to quantify the cover of each species present in the quadrat. All vegetation species should be recorded and assigned a minimum of 1% cover. The sum of the cover of all vegetation species can add to more than 100% if the vegetation is layered in the vertical dimension.

III.B. Timing

The land cover survey, the vegetation community survey, and the wetland quality survey will take place at the same time, between June 1 and July 31. The land cover survey and vegetation community survey will be conducted on each Program land when they are acquired and will be conducted again for a comparison of the vegetation community at a later time. The emergent wetland quality survey will take place annually between June 1 and July 31.

IV. Analysis Methods

IV.A. Data Summarization Methods

IV.A.1. Land Cover Survey

The percentage and areal extent of each land cover type will be estimated with the land cover survey. The length of each land cover section along the transect will be calculated using the UTMs of the endpoints. The percentage of each land cover type will be calculated as the length covered by each land cover type divided by the total length of all cover types. The cover estimates can be calculated for each land cover transect, the property, or for all properties combined. The areal extent of each land cover type on the property will be calculated by multiplying each proportion by the number of hectares of the property. The variance of these estimates will be calculated using the variance of a ratio of totals (Cochran 1965; page 158).

IV.A.2. Vegetation Community Survey

IV.A.2.a. Step-point Sampling

Percent plant cover by species, relative percent plant cover by species, and total cover will be estimated with the step-point data. Percent plant cover by species will be calculated as the number of hits of each species divided by the total number of hits. Percent non-plant cover by category type will be calculated as the number of hits of each non-plant type (bare ground, leaf litter, downed woody material, or open water) divided by the total number of hits. The relative percent plant cover by species will be calculated as the number of hits of each species divided by the total number of vegetative hits. The frequency of a species estimated as the percentage of points from point data gives an absolute frequency that can be reported as a frequency or cover (Bonham 1989).

The cover estimates can be calculated for each land cover transect, the property, or for all properties combined. In each case the estimates of the population proportions are calculated by summing the hits of a particular species and dividing by the total number of hits. The variance of these estimates will be calculated using the variance of a proportion (Thompson 1992; page 36).

IV.A.2.b. Point-centered-quarter Sampling

Tree density and shrub/sapling density will be estimated with the point-centered-quarter data. Total tree density estimates will be the inverse of the squared average distance to the trees across all quarters (Laycock and Batcheler, 1973) or using the unbiased estimator of Pollard (1971). Density for each tree species will be calculated by multiplying total tree density by the relative abundance of each species detected during the point-centered-quarter sampling. The variance of these estimates will be obtained by averaging the density estimates across transects and using the variance of a mean (Thompson 1992; page 15).

IV.A.3. Emergent Wetland Quality Survey

Species diversity, percent plant cover by species, relative percent plant cover by species, and total cover will be estimated with the quadrat data. Species diversity will be calculated and averaged across all quadrats on the transect. Percent plant cover by species will be calculated as the average of the cover of each species across all quadrats on the transect. The quadrat-level relative percent plant cover by species will be calculated as the ratio of the cover of the species divided by the total vegetative cover observed in the quadrat. The relative percent plant cover by species will be calculated as the average of the relative cover of each species across all quadrats on the transect.

The diversity and cover estimates can be calculated for each land cover transect, the property, or for all properties combined. In each case the estimates of the population proportions are calculated by summing the hits of a particular species and dividing by the total number of hits. The variance of these estimates will be calculated using the variance of a proportion (Thompson 1992; page 36).

IV.B. Statistical Analysis Methods

This vegetation monitoring plan is designed to document the vegetation community on a Program land at a point in time. For each metric estimated with this monitoring data, the value and associated confidence interval will be calculated each year the sampling is conducted. After an area has been sampled over multiple years, trend analyses can be conducted to determine if a change in the values of these metrics has occurred. Inferences developed as part of this monitoring will be to each Program land sampled, and for Program-lands combined.

Management-Level Monitoring and Research

I. PURPOSE
The purpose of the management-level monitoring and research is to evaluate the effectiveness of land and water management actions on the vegetation community. Examples of land management actions that might be implemented include clearing a forest to an open channel, clearing a forest to a grassland, or creating an emergent wetland. An example of a water management action that might be implemented is the removal of seedlings with the Environmental Account (EA).

II. DESIGN CONSIDERATIONS AND SPECIFICATIONS
II.A. Area of Interest
The area of interest for the land management monitoring and research consists of specific study areas that have been managed by the Program. These areas will generally be delineated prior to the management activity. The area of interest for the water management monitoring and research consists of the Program study area.

II.B. Sampling Design
The management-level monitoring and research is designed to provide information for making adaptive management decisions related to the impact of land and water management actions on the vegetation community. Ideally, there will be vegetation sampling both before and after the management action is implemented. In addition, sampling both managed and control areas will facilitate the analysis of vegetation data for determining the influence of management on the vegetation community. It is not expected that every area receiving management actions will require vegetation sampling.

II.B.1. Land Management Monitoring and Research
In general, the land management monitoring will involve vegetation sampling at locations throughout the management area. Each management action will have a different vegetation sampling plan depending on the vegetation community before the management and the desired vegetation community after management. Control areas (similar sized areas that do not undergo management actions) will be measured for comparison purposes when there is high annual variation in the vegetation community. Measurements in control areas will be used to evaluate the effectiveness of treatments while accounting for changes that occurred in the study area regardless of the management actions.

II.B.2. Water Management Monitoring and Research
In general, the water management monitoring will involve vegetation sampling at locations throughout the Program study area. The sampling plan for evaluation of each management action will depend on the vegetation community before the management and the desired vegetation community after management. It will not be possible to establish control areas to evaluate the effectiveness of water actions, since water management will be applied to the entire study area.

To evaluate the effectiveness of a pulse flow or an ice scour to remove seedlings from the main channel, the seedling areas located in the system-level seedling survey will be revisited after the management event of interest occurs. This monitoring will be designed to evaluate the effectiveness of the pulse flow whether the event is produced by the environmental account or other flow management. Since the system-level seedling survey will be conducted annually between July 1 and August 31, the most recently delineated seedling areas will be used to evaluate the management.

III. METHODS

III.A. Definitions

Exposed sand beach/bar- The exposed sand beach/bar cover type is defined as an area with exposed sandy soils and low vegetative cover (typically less than 50%). This may include inactive channels, islands, point bars, and areas adjacent to some active channels.

Emergent wetland- The emergent wetland cover type is defined by saturated and inundated soils where water depths do not exceed one meter (e.g. on/near seeps, springs, drainages, pond margins, swales, riverbanks, and in ditches).

Forest- The forest cover type is defined as the area on river terraces and large and small islands within the floodplain that have sufficient substrate over ground water to allow root development and sufficient aeration.

Grassland- The grassland cover type is defined by herbaceous vegetation with native tall grasses and introduced grass species.

III.B. Field Techniques

III.B.1. Land Management Monitoring and Research

Each managed area will require different sampling methodology depending on the goal of the management action. Step-point sampling will be used to determine the percent plant cover, percent non-plant cover, and relative percent plant cover in areas with low growing vegetation. Point-centered-quarter sampling will be used to estimate tree density and shrub/sapling density in forested areas. Quadrat sampling will be used to estimate plant species composition and diversity. The following sampling strategies will be used to evaluate the vegetation community in the desired cover type.

Exposed sand beach/bar

When a management action is implemented to obtain an exposed beach/bar, step-point sampling will be used to document the vegetation community. A systematic grid will be placed in the management area with spacing of one point per 15 acres. At each point, step-point samples will be taken every 2 meters along four 25m transects radiating out in each cardinal direction. Each point in the grid will have a total of 50 step-point samples.

Emergent wetland

When a management action is implemented to obtain an emergent wetland, step-point sampling will be used to document the vegetation community. Emergent wetland sampling transects will be established along the dominant direction of the wetland and extend for 100 meters. A step-point sample will be taken every 2 meters along each emergent wetland transect for a total of 50 hits. Emergent wetland quadrats will be placed every 10 meters for a total of 10 quadrats. Ideally several emergent wetland transects will be placed throughout the management area.

Grassland
When a management action is implemented to obtain a grassland, step-point sampling will be used to document the vegetation community. A systematic grid will be placed in the management area with spacing of one point per 15 acres. At each point, step-point samples will be taken every 2 meters along two 50 meter transects crossing on the point and extending in the four cardinal directions. Each point will have a total of 50 step-point samples.

III.B.2. Water Management Monitoring and Research
Each seedling area identified during the system-level seedling survey will be visited after the event of interest occurs to document the presence or absence of willow or cottonwood seedlings. If all the anchor points can not be visited during the survey, a random sample of anchor points will be selected for sampling.

Within each seedling area, the presence or absence of seedlings will be recorded and the topography will be re-measured along the same two axes measured before the management activity of interest using a survey-grade global positioning system (GPS). The UTM locations of the ends of each transect will be used to re-locate the transect. One GPS reading will be taken at the ends of each transect and every 3 meters along each transect. One GPS point will be captured at the highest point in the area, and if neither axis through the seedling area meets water level, one reading of the water level nearest the area will be taken.

III.C. Timing
The timing of vegetation surveys for land management actions will depend on the type and chronology of management actions. In general, vegetation sampling will take place from June 15 to August 15.

The timing of vegetation surveys for water management actions will depend on the event of interest. To facilitate inferences, the vegetation sampling should occur as soon as possible after the event of interest occurs.

IV. Analysis Methods
IV.A. Data Summarization Methods
Calculation of plant cover estimates by species using the step-point sampling data will follow the procedures outlined in the Program-land section of this protocol. In the management-level analysis, summation of the numerator and denominator will be over the sample points instead of transects. Variance estimates will be the same.

Calculation of density estimates by species using the point-centered-quarter sampling data will follow the procedures outlined in the Program-land section of this protocol.

Calculation of the average elevation of each seedling area will follow the procedures outlined in the system-level section of this protocol. The success of the management will be summarized across all seedling areas at the anchor point with the calculation of the proportion of area with seedlings present before the management on which seedlings were absent after the management. A summary over the anchor points will involve the ratio of the two areas and the variance of the ratio of totals (Cochran 1965; page 158).

IV.B. Statistical Analysis Methods

When the vegetation is sampled before and after management, before-after analyses will be used to document the change in a vegetation community response variable (i.e. presence of seedlings, number of species, tree density). When a control area has also been sampled, before-after control-impact analyses will be used to determine the association of a management action (impact) with a vegetation community response variable (i.e. presence of seedlings, number of species, tree density). In both these analyses, associations will be based on correlations. Since the land and water management actions will not be applied in random locations throughout the study area, the inferences can only be made to the areas managed. Applying the conclusions in an adaptive management decision making context for the entire study area will require professional judgment of applicability.

We will use the proportion of the seedling area defined during the first survey (before the management) that did not have seedlings present after the management to evaluate the effectiveness of seedling removal. The area at each anchor point still covered in seedlings and average elevation above water at a base flow will be combined across anchor points to obtain a frequency distribution of elevation for seedlings in the study area channel after the event of interest. The contrast of the frequency distributions before and after the event of interest will summarize the effectiveness of the water management. The conclusions from this analysis will be based on the seedling data collected at two sequential time periods, and will be associated with all the water management actions that occurred between the two times of the vegetation sampling. Applying the conclusions to one specific event that occurred between the two sampling periods will require professional judgment.

REFERENCES

Bonham, C.D. 1989. Measurements for Terrestrial Vegetation. John Wiley and Sons, New York. pp. 338.

Cochran, W.G. 1965. Sampling Techniques, 2nd Edition. John Wiley and Sons, New York. pp. 413.

Duncan, G.J. and G. Kalton. 1987. Issues of design and analysis of surveys across time. International Statistical Review 55: 97-117.

Evans, R.A. and R.M. Love. 1957. The step-point method of sampling – a practical tool in range research. Journal of Range Management. 10:208-212.

Great Plains Flora Association. 1986. Flora of the Great Plains. University of Kansas Press, Lawrence, KS. 1402pp.

Laycock, W.A., and C.L. Batcheler. 1973. Comparison of distance-measurement techniques for sampling tussock grassland species in New Zealand. Journal of Range Management 28(3). P 235 – 239.

Owensby, C.E. 1973. Modified step-point system for botanical composition and basal cover estimates. Journal of Range Management. 26:302-303.

Pollard, J.H. 1971. On distance estimators of density in randomly distributed forests. Biometrics 27: 991-1002.

Thompson, S.K. 1992. Sampling. John Wiley and Sons, New York. pp. 347.

U.S. Department of the Interior (USDI) Bureau of Reclamation. 2000. Central Platte River 1998 Land Cover/Use Mapping Project Nebraska. Prepared by the Remote Sensing and Geographic Information Group (RSGIG) of the Bureau of Reclamation's Technical Service Center as Technical Memorandum No. 8260-00-08. Prepared for the Platte River EIS Team. October 20.

Draft
Monitoring the channel geomorphology of the Central Platte River valley

March 12, 2003

The States of Colorado, Nebraska and Wyoming and the Department of the Interior (DOI) agreed to participate in a basin-wide cooperative program relating to four target species (interior least tern, piping plover, whooping crane and pallid sturgeon) and their associated habitats in the Cooperative Agreement for Implementing a Platte River Recovery Implementation Program (Program). One of the primary purposes of the Program is to "implement certain aspects of the FWS's recovery plans for the target species that relate to their associated habitats by providing for the following: 1) securing defined benefits for the target species and their associated habitats to assist in their conservation and recovery through a basin-wide cooperative approach that can be agreed to by the three states and DOI…". The Program builds upon the July 1, 1997 Cooperative Agreement for Platte River Research and Other Efforts Relating to Endangered Species Habitats Along the Central Platte River, Nebraska (July 1997 Cooperative Agreement).

Program implementation will follow a process of adaptive management to address areas of scientific uncertainty. Monitoring is an integral part of the adaptive management process. The adaptive management approach will allow for efficient modification of management actions in response to new and changing environmental conditions. The Program will monitor and document, relative to the habitat and species conditions that existed as of the effective date of the Cooperative Agreement, habitat and species responses to habitat improvement activities. The Program's Technical Advisory Committee will review monitoring results and make recommendations to the Program's Governance Committee regarding the effects of Program activities on whooping crane, least tern, and piping plover habitat use in the study area. The Governance Committee, using the Technical Advisory Committee's input, will evaluate projects and the overall Program to determine what, if any, changes are needed in the management. This evaluation will occur during the First Increment of the Program to support adaptive management and at the end of the First Increment to assist in the development of milestones for the Second Increment.

This monitoring protocol describes the study design and field methods for monitoring channel geomorphology in the central Platte River valley. The protocol is designed to enable Program participants to document changes in the Platte River system associated with the Program at three spatial scales: system-level, Program-level, and the management-specific level.

This monitoring protocol addresses several July 1997 Cooperative Agreement milestones:

<u>R2-1</u> A technical committee appointed by the Governance Committee will develop protocols for and initiate habitat and species monitoring and research

<u>R3-1</u> FWS will develop procedures to determine the means of ascertaining biological response of species and habitat to mitigation measures, and the time frame required to measure such biological response. The GC interpreted the milestone as

meaning, FWS and TC will identify data needed to ascertain biological response and the time frame required to evaluate those data (August 2, 2000 TC/GC workshop)

<u>R5-1</u> The Nebraska Districts will implement any research and monitoring measures required by new FERC license articles for FERC Projects Nos. 1417 and 1835.

<u>R1-2 and R1-3</u> A technical committee will continue monitoring to document, relative to the habitat and species conditions that existed as of the effective date of the Cooperative Agreement, habitat and species responses to activities undertaken pursuant to the Cooperative Agreement.

<u>R3-2 and R3-3</u> The Nebraska Districts will continue to implement any research and monitoring measures required by FERC license articles for FERC Projects Nos. 1417 and 1835.

System-Level Monitoring

I. PURPOSE

The purpose of the system-level monitoring is to document trends in channel geomorphology parameters in the Cooperative Agreement study area during the First Increment of the Program, including documenting channel width, channel degradation or aggradation, grain sizes and suspended sediment loads.

II. DESIGN CONSIDERATIONS AND SPECIFICATIONS

II.A. Area of Interest

The area of interest for system-level channel geomorphology monitoring consists of channels within an area 3.5-miles either side of the centerline of the Platte River beginning at the junction of U.S. Highway 283 and Interstate 80 near Lexington, Nebraska, and extending eastward to Chapman, Nebraska (approximately 90 miles). When side channels of the Platte River extend beyond the 3.5-mile area, an additional 2-mile area is included around these channels.

II.B. Monitoring Design

The system-level geomorphology monitoring is designed to document trends in the channel within the entire study area throughout the First Increment. In addition, the data will provide information on trends at specific sites or groups of sites within the entire river. Monitoring will focus on measuring and tracking changes in bed elevation, grain size distribution, channel width, stage, suspended sediment concentration, and suspended sediment load using raw data. The monitoring data will be collected through a topographic survey, bed material survey, aerial and ground photography, gaging stations, and staff gages.

A probability based systematic sample of points along the river will be “anchors” for data collection. These anchor points were systematically placed along the centerline of the main channel of the river as described in the IMRP. The anchor points are spaced at 400 m intervals along the centerline, and each point has been labeled with a UTM location and a Corps of Engineers river mile (using COE river mile shape file obtained from BOR/EIS office). The geomorphology monitoring outlined in this protocol will use a sample of these points as the basic sampling unit for data collection and analyses.

The anchor points sampled in any year under this protocol will be components of a pure panel and a rotating panel of sites. A panel is made of a group of sampling sites that are always visited at the same time. The pure panel will consist of a group of sites that are visited at each sampling time. The rotating panel will consist of 4 groups of sites, with only one group visited at each sampling time and each group revisited once every 4 sampling times.

When a sampling point is established near a pre-existing geomorphology transect with historic data; a decision rule will be used to determine if the historic locations will be included in the survey during first-increment monitoring instead of the systematically selected location. The decision rule will be based on an analysis of previously measured cross sections (e.g., BOR transects and Cottonwood Ranch Monitoring and Research transects). The analysis will attempt to define a set of easily measured characteristics, including distance between transects, that indicate the similarity of the sampling locations. If the sites are similar the historic location will be used and if the sites are not similar the systematically selected site will be retained in the sample. All historical sampling locations will be sampled during the first increment (as a separate “historic” panel) and the historical sites not serving as permanent transects will be phased out by year 4 of the First Increment. Historic transects that were surveyed in the study area are listed in the Baseline section of the Program document.

II.B.1. Topographic Survey

An annual low flow (ideally between 250 and 500 cubic feet per second (cfs)) topographic survey will be made between July 1 and August 31 to track changes in measures of bed elevation and depth. Changes in this measurement over time will indicate aggradation or degradation at a point in the river. A group of 10 cross sections (transects) will be measured at each anchor point selected for sampling. Each transect will continue across all channels and islands of the Platte River in the accretion zone and will be oriented perpendicular to the general alignment of all channels. Actual measurements will only be taken along the transects in the potential bank erosion zone. Out of channel areas will be documented using conventional aerial photography or potentially a light detection and ranging (LIDAR) system.

There will be 15 sample points in the pure panel and 20 sample points in the rotating panel (5 visited each year) for a total of 20 locations visited in a year and 35 locations visited during the First Increment. The sample points in the pure panel will be visited each year while the sample points in the rotating panel will be visited every four years. Each point in the rotating panel will be surveyed three times in the First Increment.

There will be 10 topographic survey transects spaced 50 meters apart at each sampling point. This nest of transects will extend for 250m on either side of the sampling point. The topographic surveys on each transect will cross the entire accretion zone through measurements will only be recorded within the potential bank-erosion zone. When the transect is re-visited in the First Increment, the repeated measurements will be taken along the same orientation as the original transect and include the channels, banks, and small islands within the accretion zone but will not include the upland portions of the transect beyond the potential bank-erosion zone.

The use of multiple transects at an anchor point will create a mapped area of topography at the point. This data will provide a surface of topography, which when viewed in contrast to a surface at another time can result in the calculation of a change in the volume of sediment. These estimates will be used to indicate aggradation or degradation within the sampled area. Estimates across all anchor points will be used to obtain a system-level estimate.

II.B.2. Bed and Bank Material Survey

Bed and bank material samples will be taken at the topographic survey points to track changes in measures of bed material grain size distribution. Changes in grain size distribution over time will indicate coarsening or fining of the sediment at the system level. Each sample will be sent to a lab when the collection process is complete to estimate the grain size distribution.

Thirty samples of bed material (verticals) will be taken per sampling point. There will be 3 samples taken per transect in the main channel at each sampling point. Five additional samples will be taken from the bed of the other channels for multi-channel locations, one from every other transect. The 30 samples for each point should be sufficient to represent the bed material population. Previous sampling in the central Platte River indicates that there is a great deal of variability in the grain sizes of bed material sampled along a cross section. The number of samples needed to characterize the mean grain size of the bed was chosen as a compromise between sampling practicality and statistical confidence.

Bank material will be documented using stratigraphy and grain size distribution of the bank material. One drawing will be created for each bank in the main channel at each sample point. There will be one sediment sample taken from each layer in the stratigraphy.

II.B.3. Photography

Aerial photographs will be used to document changes in the channel width. This protocol requires no additional aerial photography than what has been outlined by the Program's aerial photography protocol. The April 24, 2001 draft aerial photography protocol calls for CIR photography to be taken at 1:24,000 scale in alternative years with black and white photography taken at 1:12,000 scale. The procedures for measurement of channel width from aerial photographs will follow recommendations made by the Parsons EIS team and included in the IMRP for research into the correct and relevant definitions of width and the accuracy and reliability of width measurements. Measurements of width on the photographs will occur at each anchor point in the Cooperative Agreement study area to obtain a system-level estimate.

Channel widths measured from aerial photographs will enable repeatable estimates that are obtained using the same techniques through time. Widths can also be obtained from the topography survey data though this data may not facilitate documentation of trends of the desired width measurement. Since the topography survey transects will not change orientation as the channel changes, a measurement of width from this data may not be exactly perpendicular to the flow of the river. Though this width measurement will be an index of width and will be measured at a higher resolution that the aerial photograph measurements.

Ground photography and ground measurements taken during the topographic survey (Section II.B.1) will be used to document and describe bank condition, vegetation type and structure, and the location of the main channel. Three photographs will be taken on each bank of the main channel from the survey point. These photographs will be archived by the Program for use in clarifying changes detected by the topography survey. The vegetation measurements will also be documented by the photographs for use in the interpretation of aerial photographs.

II.B.4. Gaging Stations

Discharge and stage will be monitored using real-time gaging station data from existing gages at Cozad, Overton, Cottonwood Ranch (main channel only), Odessa, Kearney, and Grand Island. River stage is measured approximately hourly at these gaging stations, and discharge is estimated using rating curves. The rating curves will be maintained by periodic measurements of depth and flow rate and by shifting the rating curves as needed. The uncorrected hourly discharge and stage values, along with corrected daily summaries will be stored in either the Nebraska Department of Natural Resources or the U.S. Geological Survey database (depending on the entity overseeing the operation of the gaging station). The rating curves used for predicting discharge will be documented and stored with the data to detect changes in channel morphology (Wahl and Weiss 1995).

Suspended sediment will be monitored at gaging stations at Lexington, Overton, Kearney, and Grand Island throughout the year. Suspended sediment samples will be collected with a computer controlled pumping sampler. Selection at list time (SALT) sampling procedures will be programmed into the sampler to obtain unbiased estimates of annual suspended sediment load with known variance at each point (Thomas and Lewis 1993). This selection procedure uses an auxiliary variable (stage) to select sample times with probability proportional to sediment transport (more samples during high flow). Changes in the concentration of suspended sediment and annual suspended sediment load will be documented through time. Since the gaging stations are not placed randomly throughout the study area, inferences about suspended sediment load in the entire study area will be up to the judgment of professionals.

Real-time water temperature measurements will be made continuously at the Cozad, Overton, Cottonwood Ranch (main channel only), Odessa, Kearney, and Grand Island gages. This data will be displayed with the gaging data on the USGS website, if possible, and will provide information to assist in management of the Environmental Account.

II.B.5. Staff gages

Water surface elevation will be monitored to determine if significant changes have occurred in the channel bottom elevation at each topography survey point in the pure panel. If a change of more than 0.15 meters (0.5 feet) is detected with the staff gage data at any point, a topography survey will be conducted as soon as possible. If a change in channel bottom elevation is confirmed by the topography survey, topography surveys will be conducted at each monitoring point in the adjacent 5 miles.

Data from the staff gage at each sample point in the pure panel will be combined with the estimated discharge at the adjacent transects using the nearest real-time stream gage to develop a rating curve for each of the points. The relationship will be developed using measurements taken 10 times a year for the first 3 years of the First Increment. After that time, there will be four measurements of stage taken a year at each staff gage to monitor changes in the channel bottom elevation.

II.C. Timing

II.C.1. Topographic Survey

Annual low flow topographic surveys will be made between July 1 and August 31 while the flow is between 250 and 500 cfs. The sample points in the pure panel and one of the rotating panels will be surveyed each year.

II.C.2. Bed and Bank Material Survey

Bed and bank material surveys will be collected with each topographic survey.

II.C.3. Photography

Aerial photographs will be taken as part of the Program's aerial photography protocol. The April 24, 2001 draft protocol calls for CIR photography to be taken every other year in odd number years in late-May and July with flows around 1200 cfs. The protocol also calls for black and white photography to be taken every other year in even number years between November (even year) and April with flows around 1000 cfs. Interpretation of aerial photographs for a trend analysis of width will take place after all the photographs involved in the analysis have been taken.

II.C.4. Gaging Stations

The stream gages in the area will be operated continuously to record stage. Discharge measurements will be made periodically to update the rating curve according to the gage operating plan. Suspended sediment will be measured periodically throughout the year according to SALT sampling procedures.

II.C.5. Staff gages

Stage readings at staff gages will take place throughout the year during the first three years of the First Increment to establish a rating curve, and then four times a year during the remainder of the First Increment.

III. METHODS

III.A. Definitions

Accretion zone- area encompassed by the former channels of the river.

Active channel- portion of the channel where inundation by water and movement of bed sediment occurs sufficiently often to maintain the area devoid of vegetation.

Geomorphology- the study of the earth’s landforms and the land shaping processes operating upon the surface of the earth. Specifically, fluvial geomorphology is the study of landforms and processes associated with rivers and other water.

Rating curve- the relationship between stage and discharge at one location in the river.

Stratigraphy- the arrangement of strata as related to origin, composition, distribution, and succession.

III.B. Field Techniques

III.B.1. Topographic Survey

The topography of river cross-sections will be surveyed using a survey-grade global positioning system (GPS) to document the location and elevation of features within the accretion zone of the floodplain, including the elevation and location of beds, banks, bars, and islands. The GPS will compute the position of a rover unit relative to a known horizontal and vertical datum or base station using a satellite network and real time radio communication between the base and rover. Positions will be precise to within 2 centimeters in the vertical direction and 1 centimeter in the horizontal direction. The GPS requires a coordinate seed (known initial point) from which to begin making measurements, such as a reference marker set by the National Geodetic Service (NGS). Horizontal reference for the GPS will be related to NAD 1983 and vertical reference will be to NGVD 1988.

Each cross-section will be oriented perpendicular to the principal flow direction and will pass through all channels and the anchor point. The location of the cross-section will be delineated on both banks with a permanent marker (pin) set above the flood elevation and far enough from the active channel to avoid all but the most severe erosion effects. The goal of the survey is to adequately define the cross section of the channel and delineate geomorphic features. The surveyor will take GPS readings and appropriately identify in the data recorder the top of bank, toe of bank, left and right edge of water, water surface at exposed bars and islands, bed elevation, and any other significant geomorphic feature in the cross section. In order to adequately define the channel bed, GPS readings will be taken at any break in slope. If the channel bed or portion of the channel bed is flat with no breaks in slope, a GPS reading will be taken every 2 meters.

III.B.2. Bed and Bank Material Survey
Bed sediment will be surveyed along the topography survey transects using procedures from Edwards and Glysson (1999) and Vanoni (1977). Each of the ten transects will be divided into equally spaced increments to locate 3 verticals for sampling, for a total of 30 samples per sample point. Sediment samples will be collected using a steel cylinder sampler 7 centimeters in diameter and 20 centimeters in length welded to a steel pipe 155 centimeters long. At each increment, the sampler is plunged into the bed of the river until the can portion of the sampler is filled with sediment. The sampled depth will be the top 7 cm of the surface of the bed in order to provide similar data to the BM54 sampler used at bridge sections (Edwards and Glysson 1999) and to sample bed material that is most readily available for transport. The sample is then transferred to a sample bag that is labeled with the sampled section, sample number, and the date and time the sample was taken.

Bank sediment will be surveyed from the left and right banks on the main channel at each topography survey point. At each bank, the sediment stratigraphy will be described in a notebook and the steel cylinder sampler will be used to take one sample in each layer. The stratigraphy will document the color, texture and length of each layer along the vertical axis of the bank.

III.B.3. Photography
Aerial photographs will be taken according to the Program's protocol. The April 24, 2001 draft protocol calls for CIR photography at 1:24,000 scale to be taken every other year in odd number years in late-May and July with flows around 1200 cfs. The protocol also calls for black and white photography at 1:12,000 scale to be taken every other year in even number years between November (even years) and April with flows around 1000 cfs.

Ground photography stations on each bank adjacent to the topography survey point will be taken with a 35mm film camera and a 28mm lens. Photographs will be taken from the transect pin looking upstream (with bank in center of the frame), downstream (with bank in center of the frame), and across stream (with the pin of the other bank in the center of the frame). Additional photographs will document the other banks of multi-channel sections. Transect and point identification, date, time, film type, lens, and azimuth will be recorded for each photograph. Photographs will be developed, examined and cataloged immediately after field work is completed.

III.B.4. Gaging Stations
The stream gages in the area will be operated according to USGS guidelines (Buchanan and Somers 1968, Buchanan and Somers 1969, Carter and Davidian 1968). Discharge and stage will be measured at each gaging station to estimate a standard USGS rating curve (Kennedy 1984).

Suspended sediment and sediment load will be measured using procedures from Edwards and Glysson (1999) and Thomas and Lewis (1993).

III.B.5. Staff gages

Staff gages will be installed and operated according to USGS guidelines (Buchanan and Somers 1968). Discharge will be estimated using data from the nearest, appropriate, real-time stream gage (Carter and Davidian 1968).

IV. Analysis Methods

IV.A. Laboratory Analysis Methods

The sediment samples will be analyzed by dry sieving to determine their mechanical composition. Each sample will be dried and weighed to determine total weight. The sample will be placed in a sieve stack with ½ phi gradations and agitated for 25 minutes using a Rotap. The weight of material retained on each sieve will be recorded after transferring the material to a tared dish. The process will be repeated for every sieve in the stacks to yield the grain-size distribution for a sample (Guy 1969).

Bank samples in each strata will be mathematically combined to get one estimate of grain-size distribution for each bank. The length of each layer in the bank stratigraphy will be used as the weight when combining across strata.

Aerial photographs will be analyzed after several years of data collection. The use of photographs for measuring channel width parameters has not been standardized. The IMRP research component that investigates this issue will be conducted prior to the analysis of the monitoring data. This investigation will include determining the most accurate and reliable way to measure the following parameters on aerial photographs: active channel width, unvegetated channel width, and unobstructed channel width.

IV.B. Data Summarization Methods

All raw data will be retained in the Program database, though summaries of raw data will be calculated for each sample point. Below is a list of the summarization metrics that will be calculated with this data, though it is expected there will be other metrics calculated. In addition, difference metrics will be calculated for each sample unit as the difference of any metric between two time periods.

IV.B.1. Topographic Survey

Mean channel bed elevation- the average of equally spaced measures of elevation throughout the surveyed channel. A linear interpolation between actual data points will be used to estimate elevation at any point.

Mean depth- the average of equally spaced measures of depth below water line throughout the surveyed channel. A linear interpolation between actual data points will be used to estimate depth at a standardized flow and at any point.

IV.B.2. Bed and Bank Material Survey

Median particle size (d_{50})- the particle size for which 50 percent of the sample is finer.

Cumulative frequency distribution of particle size- the percent of the sample with particles finer than each sediment size. Percentages used to represent the variability in particle size are $d_{16,}$ the particle size for which 16 percent of the sample is finer, and $d_{84,}$ the particle size for which 84 percent of the sample is finer.

Geometric mean particle size- the square root of the product of $d_{84.1}$ and $d_{15.9}$.

Geometric standard deviation of particle size - the square root of the ratio of $d_{84.1}$ to $d_{15.9}$.

IV.B.3. Photography

Active channel width- the distance across the channel from bank to bank.

Bank vegetation- the presence or absence of vegetation documented by ground photographs taken on the bank of each transect.

Bank stability- the change in bank position documented by ground photographs taken on the bank of each transect.

Mean open-view width- the total area of open (unvegetated) channels divided by the channel length. This metric will be calculated by river section.

IV.B.4. Gaging Stations

Daily mean discharge- the average discharge documented at a gaging station in a 24 hour period.

Daily peak flow- the maximum discharge documented at a gaging station in a 24 hour period.

Hourly uncorrected discharge- predicted discharge from a stage-discharge relationship that has not been finalized by the gage operator.

Hourly uncorrected stage- measured water surface elevation that has not been finalized by the gage operator.

Stage-discharge relationship- a relationship created by sampling stage and discharge throughout the range of observed values. This rating curve is developed using standard USGS methods.

Suspended sediment concentration- the number of sediment particles per cubic foot of water.

Total annual suspended sediment load- the integral (sum) of the product of suspended sediment concentration and discharge over a year.

IV.B.5. Staff gages

Water surface elevation- the height of the water surface as measured at the staff gage.

IV.C. Statistical Analysis Methods

The monitoring transects described in this protocol are designed as an observational study through time. There is no comparison of control and treatment. This monitoring plan is designed to detect trends in physical habitat and geomorphology measures. Data will be summarized for each anchor point and statistics such as the mean and standard deviation will be compiled using anchor points as the sample unit. In system-level monitoring, inferences will be made to the entire study area (or a river reach of interest) since each point will be placed systematically along the length of the river.

Analysis of trends for each parameter will follow the recommendations in the IMRP. Difference metrics will be calculated between survey times for each sampling unit. Trend analyses will be conducted using non-parametric techniques, least squares regression, or mixed models for longitudinal data (Chen et al. 1999, Helsel and Hirsch 1992). The selection of the method used to determine if trends are statistically significant will depend on the amount of missing data, the distribution of the data, and historical use of methods for each parameter.

Post-stratification of the river by classifying points into strata will enable analyses of the data within each stratum (Thompson 1992). Points can be grouped into geomorphological or bridge segments for analyses that are consistent with analyses that were conducted previously. Alternatively, points can be grouped into areas with high influence of human structures (bridges, diversions, etc.) and points not directly influenced by human structures. Points will be classified into strata before each analysis so that points that have changed strata affiliation will be in the correct stratum for analysis.

Program-Level Monitoring

I. PURPOSE

The purpose of Program-level monitoring is to estimate trends in the physical conditions on Program lands. The monitoring will involve the same general survey procedures used in system-level monitoring with a greater intensity of sampling effort on Program lands.

II. DESIGN CONSIDERATIONS AND SPECIFICATIONS

II.A. Area of Interest

The study areas for the Program-level monitoring are the discrete blocks of land protected by the Program.

II.B. Monitoring Design

The Program-level monitoring is designed to collect data that is representative of each Program land. Program-level monitoring will take place systematically throughout each area. Monitoring will focus on tracking changes in bed elevation, grain size distribution, channel width, and stage at a more spatially intensive scale. Suspended sediment concentration monitoring will not be intensified for Program-level monitoring.

The system of anchor points will be used for anchors of data collection at the Program-level of monitoring. The anchor points chosen for inclusion in the sample will be comprised of a pure panel and a rotating panel in any one year. Half the survey effort will go into each panel. The pure panel will consist of a group of sites that are visited each year. The rotating panel consists of 4 groups of sites, only one of which is visited in a year with each group revisited every 4 years. The number of sample points in each group will be determined through analyses of pilot data and an evaluation of monetary and logistical constraints.

II.B.1. Topographic Survey

The design for the Program-level annual low flow topographic survey will follow the system-level design above. There will be a pure panel and a rotating panel established for the First Increment. The number of transects in each panel will depend on the size of the Program land.

II.B.2. Bed and Bank Material Survey

The design for the Program-level bed material sampling will follow the system-level design above. There will be verticals sampled throughout the channels in proportion to the amount of flow in each channel (with at least 2 verticals in each channel).

II.B.3. Photography

Ground photography at each Program-level monitoring transect will follow the system-level design above.

II.C. Timing

The timing for surveys conducted for Program-level monitoring will follow the system-level design.

III. METHODS

III.A. Field Techniques

III.A.1. Topographic Survey

The topography of river cross-sections will be surveyed using the methods outlined in the system-level monitoring.

III.A.2. Bed and Bank Material Survey

Bed sediment will be surveyed using the methods outlined in the system-level monitoring.

III.A.3. Photography

Ground photography will be collected at each transect using the methods outlined in the system-level monitoring.

IV. ANALYSIS METHODS

IV.A. Laboratory Analysis Methods

The sediment samples will be analyzed according the system-level monitoring methods.

IV.B. Data Summarization Methods

All raw data will be retained in the program database, though estimates across raw data will be calculated for each sample unit. In addition, metrics involving the difference between two time periods will be calculated for each sample unit. Program-level metrics for the topographic survey will be the same as mentioned above for the system-level surveys.

IV.C. Statistical Analysis Methods

The monitoring transects described in this protocol are designed as an observational study through time. There is no comparison of control and treatment. This monitoring plan is designed to detect trends in physical habitat and geomorphology measures. Data will be summarized for each anchor point and statistics such as the mean and standard deviation will be compiled using anchor points as the sample unit. In Program-level monitoring, inferences will be made to each Program land and for Program-lands combined.

Analysis of trends for each parameter will follow the recommendations in the IMRP. Difference metrics will be calculated between survey times for each sampling unit. Trend analyses will be conducted using non-parametric techniques (Kendall's Tau), least squares regression, or mixed models for longitudinal data. The selection of the method used to determine if trends are statistically significant will depend on the amount of missing data, the distribution of the data, and historical use of methods for each parameter.

Post-stratification of the river by classifying transects into strata will enable analyses of the data within each stratum (Thompson 1992). Transects can be grouped into geomorphological or bridge segments for analyses that are consistent with analyses that were conducted previously. Alternatively, transects can be grouped into areas with high influence of human structures (bridges, diversions, etc.) and transects are not directly influenced by human structures. Transects will be classified into strata before each analysis so that transects that have changed will be in the correct stratum for analysis.

Project-Level Monitoring and Research

The management-level monitoring and research will be designed to document the changes in the geomorphologic conditions in managed areas on Program lands. The monitoring will document changes associated with management activities. It is anticipated that some management activities will be adequately covered by the Program level monitoring, while some activities may require more intensive monitoring. In addition, intensive short term research may be implemented to investigate specific effects of management activities (changes in water surface elevation after a short term stochastic event). If the Program identifies the need to conduct further geomorphologic monitoring or research related to specific management actions, further protocols will be written (e.g., Technical Committees Research Protocol for Nebraska Public Power District's Cottonwood Ranch Property, dated August 1, 2000.)

REFERENCES

Buchanan, T. J. and W. P. Somers. 1968. ”Stage Measurements at Gaging Stations,” *Techniques of Water-Resources Investigations*, Book 3, Chapter A7, U.S. Geological Survey, Reston, Virginia, 28 pp.

Buchanan, T. J. and W. P. Somers. 1969. ”Discharge Measurements at Gaging Stations,” *Techniques of Water-Resources Investigations*, Book 3, Chapter A8, U.S. Geological Survey, Reston, Virginia, 65 pp.

Carter, R. W. and L. Davidian. 1968. “General Procedure for Gaging Stations,” *Techniques of Water-Resources Investigations*, Book 3, Chapter A6, U.S. Geological Survey, Reston, Virginia, 13 pp.

Chen, A. H., Rus, D. L. and C. P. Stanton. 1999. “Trends in Channel Gradation in Nebraska Streams, 1913-95,” *Water Resources Investigations Report 99-4103*, U.S. Geological Survey, Reston, Virginia, 29 pp. + Appendices

Edwards, T.K., and G. D. Glysson. 1999. Field methods for measurement of fluvial sediment: US Geological Survey Techniques Water Resources Investigations, Book 3, Chapter C2, 89 p.

Guy, H.P., 1969. Laboratory theory and methods for sediment analysis: US Geological Survey Techniques Water Resources Investigations, Book 5, Chap C1, 58 p.

Helsel, D. R. and R. M. Hirsch. 1992. *Statistical Methods in Water Resources*, Elsevier, Amsterdam, 522 pp.

Kennedy, E. J. 1984. “Discharge Ratings at Gaging Stations,” *Techniques of Water-Resources Investigations*, Book 3, Chapter A10, U.S. Geological Survey, Reston, Virginia, 59 pp.

Thomas, R. B., and J. Lewis. 1993. A comparison of selection at list time and time-stratified sampling for estimating suspended sediment loads. Water Resources Research, 29(4): 1247-1256.

Thompson, S. K. 1992. Sampling. John Wiley and Sons, New York. pp. 347.

Vanoni, V. A., ed., *Sedimentation Engineering*, ASCE Manuals and Reports on Engineering Practice #54, American Society of Civil Engineers, New York, 745 pp, 1977.

Wahl, K. L. and L. S. Weiss. 1995. Channel degradation in southeastern Nebraska Rivers, in Symposium on Watershed Management Planning for the 21st Century, San Antonio, Texas, 1995, Proceedings: New York, American Society of Civil Engineers, p.250-259.

Draft
Protocol for Aerial Photography in the Central Platte River Valley

I. INTRODUCTION

The States of Colorado, Nebraska and Wyoming and the Department of the Interior (DOI) agreed to participate in a basin-wide cooperative program relating to four target species (interior least tern, piping plover, whooping crane and pallid sturgeon) and their associated habitats in the Cooperative Agreement for Implementing a Platte River Recovery Implementation Program (Program). One of the primary purposes of the Program is to "implement certain aspects of the FWS' recovery plans for the target species that relate to their associated habitats by providing for the following: 1) securing defined benefits for the target species and their associated habitats to assist in their conservation and recovery through a basin-wide cooperative approach that can be agreed to by the three states and DOI…". The Program builds upon the July 1, 1997 Cooperative Agreement for Platte River Research and Other Efforts Relating to Endangered Species Habitats Along the Central Platte River, Nebraska (July 1997 Cooperative Agreement).

Program implementation will follow a process of adaptive management to address areas of scientific uncertainty. Monitoring is an integral part of the adaptive management process. The adaptive management approach will allow for efficient modification of management actions in response to new and changing environmental conditions. The Program's Technical Committee will monitor and document, relative to the habitat and species conditions that existed as of the effective date of the Cooperative Agreement, habitat and species responses to habitat improvement activities. With scientific advisory assistance, the Technical Committee will review monitoring results and make recommendations to the Program's Governance Committee regarding the effects of Program activities on habitat conditions in the study area. The Governance Committee, using the Technical Committee's input, will evaluate projects and the overall Program to determine what, if any, changes are needed in the management.

The Technical Committee (TC) has identified monitoring and research needs of the proposed Program in the Integrated Management and Research Plan (IMRP). Many of the identified activities will require up-to-date and standardized aerial photos. In addition, the TC has initiated a demonstration research and monitoring project on Nebraska Public Power Districts Cottonwood Ranch that requires photography.

Aerial photography is available along the central Platte River at differing intervals from 1938 to present. To date, these photographs have not been taken at consistent intervals using standard guidelines. Because of this inconsistency, comparison of these photos is difficult and may lead to differing interpretations of basic habitat conditions on the River. In 1998 Color Infrared (CIR) photography was used to document existing conditions in the area of concern for the proposed Program. These photos were photo-rectified and converted to orthophotographs that can be used for spatial analysis with a Geographic Information System (GIS).

This monitoring protocol addresses several July 1997 Cooperative Agreement milestones:

<u>R2-1</u> A technical committee appointed by the Governance Committee will develop protocols for and initiate habitat and species monitoring and research

<u>R3-1</u> The FWS and TC will identify data needed to ascertain biological response and the time frame required to evaluate those data (R3-1 milestone as revised at the August 2, 2000 TC/GC workshop)

<u>R5-1</u> The Nebraska Districts will implement any research and monitoring measures required by new FERC license articles for FERC Projects Nos. 1417 and 1835.

<u>R1-2 and R1-3</u> A technical committee will continue monitoring to document, relative to the habitat and species conditions that existed as of the effective date of the Cooperative Agreement, habitat and species responses to activities undertaken pursuant to the Cooperative Agreement.

<u>R3-2 and R3-3</u> The Nebraska Districts will continue to implement any research and monitoring measures required by FERC license articles for FERC Projects Nos. 1417 and 1835.

II. PURPOSE

The purpose of this protocol is to describe the conceptual design, methods, and procedures that will be used to document vegetative and geomorphologic conditions of the central Platte River valley, Nebraska using aerial photography. The photography as outlined in this protocol is sufficient to fulfill the purposes as currently defined in Technical Committee protocols; however, this does not preclude the possible need for additional remote sensing in the future (e.g., LIDAR, videography, etc). Currently the Cooperative Agreement and proposed Program has available a complete land use/land cover GIS analysis of 1998 color infrared photography. Long-term, consistent collection of landscape data for the study area through aerial photographs will enable future habitat use/availability research. This protocol describes the procedures to be used as follows:

1. CIR orthophotographs for comparison of conditions at the end of the First Increment with the existing conditions photography of 1998.

2. CIR photography taken at regular intervals during full vegetative cover in late May-July.
    a. Photos will be used for evaluating vegetation and channel conditions during least tern and piping plover nesting seasons
    b. Photos will be used for sampling land use/land cover classes in the system level portion of the General Monitoring Protocol and documenting vegetation characteristics on Program lands and within managed areas.
    c. Photos will be used to estimated the amount of grassland areas for whooping crane habitat

3. Black and white photos taken at regular intervals during low flow periods and when vegetative matter is dormant (i.e., leaf-off) (November-April) for channel morphology comparisons.
    a. Photos will be used to document the physical and/or biological characteristics of use sites and these habitat parameters will be described and measured for the purpose of comparative habitat analyses (e.g., as in comparing used sites from available sites selected randomly on photographs). This information is required in the Cottonwood Ranch Monitoring and Research Project and will likely be needed in similar research projects in the future.
    b. Photos will result in landscape data collection. for whooping crane use sites in the study area. This information will be used in future use/availability analyses using aerial photography and GIS information.

III. DESIGN CONSIDERATIONS AND SPECIFICATIONS

III.A. Area of Interest

The area of interest for aerial photography includes the entire 90-mile length defined in the proposed Program and includes an area 3.5-miles either side of the centerline of the Platte River. When side channels of the Platte River extend beyond the 3.5-mile area, a 2-mile area is included around these channels.

III.B. Project Design

III.B.1. CIR Orthophotography

Aerial CIR orthophotography will be conducted to replicate the 1998 CIR orthophotography at the end of the First Increment. This photography will be obtained in time to finalize geospatial analyses by the end of the First Increment for use in the analysis of all data for the establishment of milestones for the Second Increment. It is difficult to predict all the data needs at this point, but at a minimum the land cover, land use, and species use layers of the 1998 GIS analysis will be repeated. Conditions of photography should closely match the 1998 existing condition photography (i.e., late summer with flows at or below 1,000 cfs) and methods for creation of the data layers will be repeated for optimal comparison with the 1998 data (e.g., insure same criteria are used for establishing various land cover types). The EIS Team is documenting these methods.

III.B.2 CIR Photography

Summertime CIR photos will be used to document habitat conditions for least terns and piping plovers, amount of grassland areas for whooping crane habitat, and summertime vegetation characteristics throughout the system, on Program lands, and within managed areas. For example, bare sand substrates will be identified that may be potential least tern and piping plover nesting habitat. The Technical Committee anticipates that changes in available nesting habitat will be tracked throughout the First Increment. Information gained from aerial photography will also be used in conjunction with measurements taken at specific sites on the ground that relate to vegetation establishment on the bars, height of bars, etc. CIR photos will be used to estimate by line transect methods the land use/land cover types present as described in the General Monitoring Protocol (e.g., amount of grassland, forest, etc). Use and analysis of the aerial photography will be described in protocols that are written for the specific activities outlined in the IMRP. Photos will be taken on a bi-annual basis between late-May and July with flows at or near 1200 cfs (i.e., target flow levels during this time of year).

III.B.3 Black and White Photography
Black and white photos will be used for channel morphology measurements. These photos will be taken during times when riparian vegetation is dormant and flows are as low as possible to facilitate measurement of channel morphological characteristics. The photos will be used to help measure parameters such as channel width, bank position, island position and stability, hydraulic geometry characteristics of width and track changes associated with management techniques. This is consistent with the use of black and white aerial photographs in the Cottonwood Ranch Property Monitoring and Research Protocol to be implemented in 2000. Black and white photography will be taken on a bi-annual basis between November and April as dictated by vegetative conditions. If possible, flows will be at or below 1000 cfs when photographs are taken.

III.C. Timing
CIR orthophotography should be taken 2 years before the end of the First Increment in late summer (e.g., August) when flows are approximately 1000 cfs.

CIR photography will be obtained between late-May and July. Photography should be obtained at flows as close to 1200 cfs as possible. CIR photography will be flown in odd number years (i.e. 2001, 2003). CIR Photography will start in 2001.

Black and White photography should be obtained between November and April with flows ideally at or below 1000 cfs. Black and white photography should be flown in even number years (i.e. 2000, 2002) and will begin in winter 2000-2001.

IV. METHODS
IV.A. Definitions

IV.B. Field Techniques
Three types of aerial photography will be used to document and monitor habitat conditions along the central Platte River: CIR orthophotographs, CIR photography and black and white photos. The Program's Technical Committee may choose to implement each protocol component as necessary to obtain needed information, for example changing the number of aerial surveys based on results of past surveys. Exact survey dates will be adjusted as more data is collected. The flight schedule will be dependent on suitable conditions for operating a small plane (weather and mechanical), snow cover, and other environmental conditions.

IV.B.1 CIR Orthophotography
CIR orthophotography planned for the end of the First Increment will use methods comparable to the CIR photography conducted for GIS analysis in 1998 (U.S. Department of the Interior 2000).

IV.B.2. CIR Photography
CIR photos will be taken at a scale of 1:24,000 and converted to 1:12,000 and will include the entire 90-mile length defined in the proposed Program, plus 3.5 miles either side of the centerline of the river. This scale and area will require approximately 332 exposures. These photos will not be rectified.

IV.B.3. Black and White Photography
Black and white photos will be taken at a scale of 1:12,000 and converted to 1:6,000 and will include the entire 90-mile length defined in the proposed Program plus one mile either side of the centerline of the river. Neither the CIR or black and white photography identified will be rectified. Past studies on the Platte River have used control points (in this instance the rectified images in the 1998 will be used) to match photos and adjust scale (Johnson 1994, Randy Parker pers. Comm. 2000). This will require approximately 465 exposures.

IV.D. Analysis Methods
This protocol describes the collection of aerial photographs and is not meant to detail how the photographs will be used or analyzed. The use and analysis of aerial photography information is described in the individual species and habitat research/monitoring protocols developed in the IMRP.

V. QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)
QA/QC measures will be implemented at all stages of the study, including field data collection, data entry, and report preparation.

VI. DATA COMPILATION AND STORAGE
- To be completed when Program staff and structure is defined.

VII. REPORT FORMAT
A draft and final report will be produced each year describing the methods employed, results of taking aerial photos, and types of photos taken. Information derived from aerial photographs by other protocols (e.g., Least Tern and Piping Plover Monitoring, Vegetation Monitoring) will be compiled and summarized annually in those reports, and incorporated within the larger Program database. All report will have both written and graphical components. Reports will be provided to both the Technical Committee and Governance Committee.

VIII. ADMINSTRATION
- To be completed when Program staff and structure is defined.

IX. EXISTING DATA EVALUATION
- To be completed when revised R1-1 Baseline information available

X. DATA SHEETS
No Program data sheets will be utilized in implementation of this protocol. Qualified contractors will supply all aircraft, personnel, and other necessary equipment.

XI. BIBLIOGRAPHY
U.S. Department of the Interior. 2000. Central Platte River 1998 Land Cover/Use Mapping Project, Nebraska. Technical Report of the Platte River EIS Team.

XII. ESTIMATED BUDGET

Cost estimates to capture the different photographs are presented below and are based on 2000 dollars. Inflation and other factors may increase these costs during the Program. Costs associated with analyzing the different types of photographs will be included in the protocols that use these photos (e.g., General Monitoring Protocols use for geomorphology measurements). Costs of interpreting the Orthophotography CIR near the end of the first increment are also not included in this protocol.

Black and white photography will include the entire 90-mile length defined in the proposed Program and include a width of 1 mile either side of the centerline of the river. This will require 465 exposures and cost $13,000.

CIR Photos may be taken at a scale of 1:24,000 and converted to 1:12,000. Photography will include the entire 90-mile length defined in the proposed Program and include 3.5 miles either side of the centerline of the river. This will require 332 exposures and cost $18,000.

Orthophotography CIR should be taken 2 years before the end of the first increment of the Program. Cost is $80,000.

Annual Cost [a]

2000 – Black and White	$13,000
2001 – CIR	$18,000
2002 – BW	$13,000
2003 – CIR	$18,000
2004 - BW	$13,000
2005 – CIR	$18,000
2006 – BW	$13,000
2007 – CIR	$18,000
2008 – BW	$13,000
2009 – CIR	$18,000
2010 – BW	$13,000
2011 - Ortho CIR	$80,000
2012 – BW	$13,000
2013 – CIR	$18,000

[a] Cost estimates are based on the current dollar value for services and supplies and are subject to change due to inflation, cost increases etc.

Draft Protocol for
Monitoring Riverine Prey Base for Least Terns: Fish Species Composition, Spatial Distribution, and Habitat Utilization in the central Platte River

September 25, 2006

I. PURPOSE

The purpose of this protocol is to monitor the riverine prey base (forage fish) for least terns during the nesting season in the Platte River Recovery Implementation study area (Lexington to Chapman, Nebraska). Fish sampling will be conducted and the data will be summarized as forage fish abundance parameters, community structure parameters, and population structure parameters. Spatial and temporal changes in the forage fish parameters will be documented with annual monitoring. Habitat utilization will be quantified by sampling the range of channel habitats and comparing physical attributes with the observed abundance. Physical attributes of the sampled areas will be collected.

II. DESIGN CONSIDERATIONS AND SPECIFICATIONS

II.A. Area of Interest

Water areas that are within 3.5-miles either side of the Platte River beginning at the junction of U.S. Highway 283 and Interstate 80 near Lexington, Nebraska, and extending eastward to Chapman, Nebraska. When side channels of the Platte River extend beyond the 3.5-mile area, a 2-mile area is included around these channels (cite map). Water areas of interest include all areas that have a stage change due to flow manipulation. Chadwick et al. (1997) define this area as "closely associated off-channel habitats within the floodplain with some degree of hydraulic connection to the mainstem, such as ponds, sloughs, and side-channels." Water areas of interest do not include manmade features such as dredged sandpits, drains or canals. The Chadwick definition also excludes tributary streams or other bodies of water.

II.B. Parameters of Interest

II.B.1. Fish Parameters

The monitoring program will collect data appropriate to estimate forage fish abundance parameters such as absolute abundance, density, and relative abundance. Community structure parameters such as the relative abundance of each species, richness, and diversity will be estimated. Population structure parameters such as age and size distribution will be estimated. The data will be appropriate to estimate spatial distributions such as the range of the study area where the forage fish occur. The data will be appropriate to estimate habitat utilization to document the type of water area in which the forage fish occur.

II.B.1. Physical Attribute Parameters

The monitoring program will collect data to estimate these physical attribute parameters: water width, water depth, water velocity, water temperature, water dissolved oxygen content, water pH, water transparency/turbidity, water conductivity, and substrate size. Flow characteristics such as the magnitude of a pulse flow, daily discharge and stage will be summarized from gage data as estimates of physical attribute parameters.

II.C. Sampling Design

Sampling will take place at system-wide anchor points and at historic locations previously sampled by Chadwicks & Associates Inc. (Chadwick & Associates, Inc. 1990). The fish survey will target the forage fish of least terns and is timed to occur during the nesting season. Water areas of interest that are crossed by the anchor transect will be sampled within a set distance from the transect, depending on the water habitat type. Fish and physical attribute sampling will be collocated in each water area crossed by the anchor transect.

Habitat specific fish sampling will be conducted at each of these water habitat types: open channel, open channel bank, open channel snag, side channel, side channel bank, backwater, isolated backwater, pond, and slough. Fish sampling will be conducted using seining nets and electrofishing. Seining is known to favor the inclusion of small fish in the sample (Hayes et al. 1996, Gutreuter et al. 1995, Bayley and Herendeen 2000) and will be implemented to gather size distribution data of forage fish (Reynolds 1996). Electrofishing is known to favor the inclusion of large fish in the sample (Reynolds 1996, Wiley and Tsai 1983) and will be implemented in habitats where seining is not practical. The use of both methods will maximize the probability of capture of fish given the selectivity of each method.

The sampling methods will be standardized to enable comparisons over time (Hayes et al. 1996) and the sampling effort will be quantified enabling comparisons on a per unit of effort basis (Reynolds 1996). Electrofishing effort will be quantified with the number of minutes and seining effort will be quantified with the area encompassed by the seining grid. Electrofishing power will be standardized to facilitate consistency in fish collection effort (Reynolds 2000).

Two nationally known long-term monitoring programs: the EPA's Environmental Monitoring and Assessment Program (EMAP) (McCormick and Hughes 1998) and the USGS's National Water Quality Assessment (NAWQA) (Moulton et al. 2002) provided general guidance on fish monitoring in wadeable streams. However, the uniqueness of the central Platte River, specifically the shallow depths, fluctuating sand substrate, lack of riffle–pool complexes (Chadwicks & Associates Inc. 1993) and the scarcity of pools (Morris 1960 in Chadwick & Associates Inc. 1994) mandate a protocol unique for this study area.

The forage fish monitoring study conducted by Chadwicks & Associates Inc., Littleton, Colorado, from 1989 to 1993 provided specific guidance for forage fish sampling methods within the study area (Chadwick & Associates, Inc. 1990, Chadwick & Associates, Inc. 1991, Chadwick & Associates, Inc. 1992, Chadwick & Associates, Inc. 1993). Chadwick defined three habitat types in 1989 (main channel, river banks/island edges, and low velocity pools) with sampling methods specific to each. The study delineating the main channel into 4 habitat types in 1990 (open channel, bank, snag, and backwater) and added bridges, sloughs, side channels, and ponds as habitat types to be sampled (Chadwick & Associates, Inc. 1990, Chadwick & Associates, Inc. 1991). The study further delineated isolated backwaters from backwaters in 1991 (Chadwick & Associates, Inc. 1992). Sampling in 1992 was limited to the five main channel habitat types (open channel, bank, snag, backwater and isolated backwater) since sampling in the off-channel habitat types (sloughs, side channels, and ponds) reveal numerous non-forage species and the species composition of bridge habitats resembled the main channel

(Chadwick & Associates, Inc. 1993). [Extension of this paragraph to the 1995 survey effort will be included when the reports are obtained.]

The specific fish sampling methods also changed throughout the span of Chadwick's forage fish monitoring study from 1989 to 1993. Most notably, electrofishing of the open channel habitat type was dropped in favor of seining (Chadwick & Associates, Inc. 1992) based on comparisons of data collected. Also, the original 23 sites were reduced to 6 main channel sites (Chadwick & Associates, Inc. 1993). Their final study design was effective in sampling the fish community as evidenced by the inclusion of only one new species to the cumulative species list in the 4th year of sampling (Chadwick & Associates, Inc. 1992). [Extension of this paragraph to the 1995 survey effort will be included when the reports are obtained.]

III. METHODS

III.A. Definitions

Anchor transect- North to south oriented line centered on a sample point (anchor point or historic location) and extending through the area of interest.

Backwater- Aquatic habitat type characterized by a naturally or artificially formed arm or area of standing or slow moving water partially isolated from the main flow of the channel but directly connected to the a channel at either the upstream or downstream end (Armantrout 1998).

Isolated backwater- Aquatic habitat type characterized by standing or slow moving flow isolated from the main flow of the channel but not directly connected to the a channel at either the upstream or downstream end.

Open channel- Aquatic habitat type characterized by unobstructed moving flow wider than 75 feet.

Open channel Bank- Aquatic habitat type characterized by bank structure with permanent vegetation or rip-rap.

Open channel Snag- Aquatic habitat type characterized by the presence of woody debris (log, stumps, branches, etc.) in the open channel.

Pond- Aquatic habitat type characterized by standing water out of the main channel.

Side channel- Aquatic habitat type characterized by unobstructed moving flow with width less than 75 feet.

Side channel bank- Aquatic habitat type characterized by a side channel with a bank structure with permanent vegetation or rip-rap.

Slough- Aquatic habitat type characterized by standing or slow moving water out of the main channel. Low swamp or swamp-like area in a marshy or reedy backwater with marsh characteristics such as abundant vegetation (Armantrout 1998).

III.B. Field Techniques
III.B.1. Fish Survey
Fish sampling methods will be specific to each water type traversed by the anchor transect. When a water area of interest is encountered along the anchor transect, is will be classified into one of the aquatic habitat types and sampled according to the methods below.

Open channel – Open channels will be sampled within 90 meters on either side of the anchor point (a 180 meter (590.5 feet) section of channel) (Chadwick 1997, Matthews 1990). Six seining grids will be placed within the reach. The six grids will be located 15m, 45m, and 75m upstream and downstream of the anchor point. Two grids will be in the center of the channel, two will be in the northern quarter of the channel (one-quarter of the wetted width from the northern bank), and two will be in the southern quarter of the channel (one-quarter of the wetted width from the southern bank).

Open channel snag – Backpack electrofishing around snags within 90 meters of the anchor transect where it crosses an open channel. A random sample of 3 snags will be made after all snags are identified. The area sampled around each snag will be estimated by the surveyors.

Open channel bank or side channel bank - Backpack electrofishing for 15 meters along bank where the anchor transect enters the channel from land. Both banks will be sampled resulting in two locations sampled each time a channel is crossed by the anchor transect.

Backwater, isolated backwater, slough, or pond – Backpack electroshocking within 15 meters (either side) along the anchor transect where it crosses through the aquatic habitat. The width of the water area will be measured at the anchor transect and the area surveyed will be estimated.

Side channel- Backpack electrofishing for 25 meters upstream and downstream of the anchor transect. The width of each side channel will be measured at the anchor transect and the area surveyed will be estimated.

Electrofishing
Electrofishing will start at the downstream end and proceed upstream (Hendricks et al. 1980, Reynolds 1996, McCormick and Hughes 1998). The backpack electrofishing units will contain an electrofishing device mounted on a backpack frame. The power source will be either a 24-volt deep cycle battery or a 115-volt gasoline-powered generator. Direct current (DC) with an appropriate pulse rate range (e.g., 30 to 60 pps) will be used to minimize damage to fish and maximize collection effectiveness (Moulton et al. 2002). The voltage and minutes of electrofishing (start and end times) will be recorded.

Exact electrofishing voltage and amperage (current) settings will be dictated by water conditions at the time of sampling. Power output in the form of wattage will be standardized at 3000 watts. Current water temperature and conductivity will be measured prior to sampling and the applicable power settings will be taken from charts in Burkhardt and Gutreuter (1995) or Gutreuter et al. (1995).

Fish handling and electrofishing safety protocols will be written including details as in McCormick and Hughes (1998), Moulton et al. (2002), and USFWS (1992).

Seining
Seining grids will be deployed in the manner used by Chadwick & Associates, Inc. A 25 ft. x 50 ft. rectangular enclosure will be formed by two 50 ft. and two 30 ft. fine mesh (1/8") seines. The 50 ft. side of the enclosure will run parallel to the direction of flow and the 25 ft side of the enclosure (with 5 feet of sag) will be moved downstream through the enclosure to trap fish at the end. The six seining grids within a reach will be sampled in a downstream to upstream direction.

When seining grid lands in an unsuitable location, the grid will be moved to the nearest suitable locations. Reasons for moving a grid include deep water, uneven bottom, or snags.

Fish Handling
All affected fish will be collected and placed in buckets filled with ambient water, taxonomically identified to species, weighed and measured for length, checked for external abnormalities, and released downstream. Fish collection information will be recorded separately for each habitat type. The most recent American Fisheries Society taxonomic names will be used (Robins et al. 1991). Collections will be made for fish that can not be identified to species. Maximum total length is the greatest possible length of the fish with mouth closed and caudal rays squeezed together to give the maximum overall measurement (Anderson and Neumann 1996).

III.B.2. Physical Attribute Survey

Physical attribute sampling methods will be specific to each parameter.

- Width (meters)- meter tape
- Depth (meters)- meter stick
- Velocity (meter/second)- water velocity meter 20 cm below water surface
- Temperature (Centigrade degree)- thermometer
- Dissolved oxygen (mg/l)- dissolved oxygen meter
- pH- pH meter
- Turbidity (NTU)- Nephelometric turbidity unit
- Conductivity (S/cm)- Temperature-level-conductivity meter for temperature compensated conductivity
- Substrate size- (estimate in classes)

The location of physical attribute sampling will be specific to each water type traversed by the anchor transect:

Open channel – Width, depth, and velocity will be measured at the six seining locations. Temperature, dissolved oxygen content, pH, transparency/turbidity, conductivity, and substrate size will be measured mid-point of the channel at the anchor point.

Backwater, isolated backwater, slough, or pond - Width will be measured along the anchor transect as it crosses the water area. Depth, velocity, temperature, dissolved oxygen content, pH, transparency/turbidity, conductivity, and substrate size will be measured at the center of the width of water area along the anchor transect.

Side channel- Width will be measured along the anchor transect as it crosses the water area. Depth, velocity, temperature, dissolved oxygen content, pH, transparency/turbidity, conductivity, and substrate size will be measured at the center of the width of water area along the anchor transect.

III.C. Annual Timing

Annual sampling will take place once between July 1 to August 31, to cover the time period when chicks and juvenile least terns are present in the study area. This time frame coincides with low flows and stability in the fish community (Meador et al. 1993). All fish sampling will take place when the nearest gage reports flows below 500 cfs.

IV. Analysis Methods

Estimates of each forage fish abundance parameters, community structure parameters, and population structure parameters and associated confidence intervals will be calculated each year the sampling is conducted. Data from multiple samples in a water habitat type will be averaged to form one estimate per anchor transect. Data will be averaged across the anchor transects to obtain annual status estimates with associated confidence intervals. The spatial distribution of forage fish species and taxonomic groups will be graphically displayed from the annual status estimates. Habitat utilization for forage fish species will be quantified through analyses of the presence/absence data with the water habitat type and physical attribute information.

After several years of data collection, trend analyses will be conducted to determine if a change in the values of the forage fish parameters has occurred. Inferences developed as part of this monitoring will be to the study area.

REFERENCES

Anderson, R.O., and R.M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-482 in B.R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Armantrout, N.B., compiler. 1998. Glossary of aquatic habitat inventory terminology. American Fisheries Society, Bethesda, Maryland.

Bayley, P.B., and R.A. Herendeen. 2000. The efficiency of a seine net. Transactions of the American Fisheries Society 129: 901–923.

Burkhardt, R.W., and S. Gutreuter. 1995. Improving electrofishing catch consistency by standardizing power. North American Journal of Fisheries Management 15: 375-381

Chadwick & Associates, Inc. 1990. Platte River forage fish monitoring study, 1989. Report prepared for Nebraska Public Power District and the Central Nebraska Public Power and Irrigation District.

Chadwick & Associates, Inc. 1991. Preliminary report, Forage fish monitoring study, central Platte River, Nebraska. Report prepared for Nebraska Public Power District and the Central Nebraska Public Power and Irrigation District.

Chadwick & Associates, Inc. 1992. Forage fish monitoring study, central Platte River, Nebraska, 1990-1991. Report prepared for Nebraska Public Power District and the Central Nebraska Public Power and Irrigation District.

Chadwick & Associates, Inc. 1993. Forage fish monitoring study, central Platte River, Nebraska, 1992. Report prepared for Nebraska Public Power District and the Central Nebraska Public Power and Irrigation District.

Chadwick & Associates, Inc. 1994. Ecology of plains river fishes with emphasis on the central Platte River, Nebraska; Annotated bibliography. Report prepared for Nebraska Public Power District and the Central Nebraska Public Power and Irrigation District.

Chadwick, J.W., S.P. Canton, D.J. Conklin, Jr., and P.L. Winkle. 1997. Fish species composition in the central Platte River, Nebraska. Southwestern Naturalist 42(3): 279-289.

Gutreuter, S., R. Burkhardt, and K. Lubinski. 1995. Long Term Resource Monitoring Program Procedures: Fish Monitoring. National Biological Service, Environmental Management Technical Center, Onalaska, Wisconsin, July 1995. LTRMP 95-P002-1. 42 pp. + Appendixes A-J.

Hayes, D.B., C.P. Ferreri, and W.W. Taylor. 1996. Active fish capture methods. Pages 193-220 in B.R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Hendricks, M.L., Hocutt, C.H., and Stauffer, J.R., Jr. 1980. Monitoring of fish in lotic habitats, in Hocutt, C.H., and Stauffer, J.R., Jr., eds., Biological monitoring of fish. Lexington, Mass., Lexington Books, p. 205–231.

Matthews, W.J. 1990. Fish community structure and stability in warmwater midwestern streams. In Bain, M.B., ed., Ecology and assessment of warmwater streams. Workshop synopsis, U.S. Fish and Wildlife Service, Biological Report 90(5): 16 -17.

McCormick, F.H. and R.M. Hughes. 1998. Aquatic vertebrates. Section 12 in J.M. Lazorchuk, D.J. Klemm and D.V.Peck (Eds.). Environmental Monitoring and Assessment Program-Surface Waters: Field Operations and Methods for Measuring the Ecological Condition of Wadebable Streams. EPA/620/R-94/004F. U.S. Environmental Protection Agency, Washington, D.C.

Meador, MR; Cuffney, TF; and M.E. Gurtz. 1993. Methods for Sampling Fish Communities as Part of the National Water-Quality Assessment Program. USGS Open-File Report 93-104. USGS, Raleigh N.C. 40 pp.

Morris, L.A. 1960. The distribution of fish in the Platte River, Nebraska. MS Thesis, University of Missouri, Columbia.

Moulton II, S.R, J.G. Kennen, R.M. Goldstein, and J.A. Hambrook. 2002. Revised Protocols for Sampling Algal, Invertebrate, and Fish Communities as Part of the National Water-Quality Assessment Program. USGS Open-File Report 02- 150, USGS Reston, VA. 75 pp.

Reynolds, J.B. 1996. Electrofishing. Pages 221-253 in B.R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Reynolds, J.B. 2000. Electrofishing theory. Chapter 1 in Allen-Gil, S.M. (Ed.). New Perspectives in Electrofishing. EPA/600/R-99/108. U.S. Environmental Protection Agency, Washington, D.C.

Robins, C.R., Bailey, R.M., Bond, C.E., Brooker, J.R., Lachner, E.A., Lea, R.N., and W.B. Scott. 1991. Common and scientific names of fishes from the United States and Canada. American Fisheries Society, Bethesda, Md. Special Publication 20, 183 p.

USFWS (U.S. Fish and Wildlife Service). 1992. Electrofishing. Chapter 6, part 241. Safety operations, occupational safety and health. USFWS, Washington DC.

Wiley, M.L., and C. Tsai. 1983. The relative efficiencies of electrofishing vs. seines in piedmont streams of Maryland. North American Journal of Fisheries Management 3: 243-253.

Research Protocol for Nebraska Public Power District's Cottonwood Ranch Property

Approved by the Platte River Cooperative Agreement
Technical Committee on
August 1, 2000

Introduction

The Platte River Endangered Species Partnership (PRESP) is developing a proposed Program that will undertake a number of management activities to modify both land and water to increase or improve habitat for least terns, piping plovers, and whooping cranes. As directed under the Federal Energy Regulatory Commission (FERC) License for Project 1835, Article 407, Nebraska Public Power District (NPPD) will provide to PRESP approximately 2,650 contiguous acres of land on the central Platte River between the J-2 Return and Elm Creek, known as the Cottonwood Ranch Property. This property will count towards the Program's first increment goal of 10,000 acres. A conceptual plan for development and enhancement of the Cottonwood Ranch Property was developed by NPPD in consultation with the Nebraska Game and Parks Commission (NGPC), the Governance Committee and their representatives, Central Nebraska Public Power and Irrigation District (Central) and the U. S. Fish and Wildlife Service (FWS). Development and enhancement of NPPD's Cottonwood Ranch Property is anticipated to begin in September or October 2000.

NPPD's implementation of the Cottonwood Ranch Development and Enhancement Plan will help fulfill milestones L3-1, L1-2 and L1-3 of the Cooperative Agreement. The Development and Enhancement Plan is also consistent with the direction given in Section III.C.2 of the Proposed Program (e.g., restoration initially based on recommendations in the Platte River Management Joint Study). The major components of the Development and Enhancement Plan are to modify existing channel structure to improve nesting conditions for least terns and piping plovers and roosting habitat for whooping cranes. At this time the conceptual basis of the plan is to convert approximately 220 total acres of bottomland to produce active channel and nesting habitat as well as backwaters and sloughs. Purposes of the woodland removal are to improve unobstructed views within the channels and to promote channel widening. In addition, NPPD will excavate 7000 linear feet of 'pilot' channels in abandoned channels of accretion land. Pilot channels are intended to convey river flows and promote channel expansion by increasing the amount of bankline exposed to river erosion.

The removal of channel bank vegetation on Cottonwood Ranch is intended to effect bank erosion and channel widening. Bank-stored sediment is, thus, expected to be reintroduced into the channel. Deposition of this material may occur downstream. The mechanics of river sediment transport processes need to be examined to determine the effects of channel management actions on bank erosion and sediment transport, and to detect and evaluate possible impacts of deposition.

This proposal implements monitoring and research on NPPD's Cottonwood Ranch property. The overall goal of this monitoring and research is to provide data necessary to evaluate channel rehabilitation practices. Specific questions focus on whether management actions cause the channel to widen, whether measurable changes in the channel structure occur downstream, whether these changes can be linked to the management action, and whether widened channels can be sustained by river processes.

This protocol outlines how the research and system-level monitoring programs will combine to provide information about the effects of the demonstration project on the mechanics of river processes. Study design and data collection for the research program are described below. Also, components of General Monitoring within and immediately downstream of the Cottonwood Ranch are outlined and described in further detail in the Platte River General Monitoring Protocol. Specific methods or standard operating procedures (SOPs) will be documented so that field and laboratory practices are repeatable.

Management Action

NPPD and the Management Oversight Committee for the Cottonwood Ranch Property have designed management methods to remove woody vegetation from islands and banks within the Cottonwood Ranch property. In addition to the vegetation removal, some abandoned channels will be excavated as pilot channels to convey river flows. The management activity is scheduled to begin in September or October 2000 after one visit to the research and monitoring transects has been completed under this protocol.

Goals and Objectives for Monitoring and Research

The monitoring and research program is designed to link the detection of geomorphologic response with a mechanism to investigate its cause. Two components of data collection allow the necessary temporal and spatial resolution: 1) A general monitoring component that focuses on the integrated effects of management within the Cottonwood Ranch property and associated impacts downstream and provides initial information to the long term monitoring program devised for adaptive management, and 2) an intensive research component that examines the combined management activity in order to understand direct affects on the local channel system.

The general monitoring component focuses on collecting information from cross sections of the river and examining serial aerial photography. Measurements at these cross sections include channel topography, vegetation, bed and bank material grain size, and ground photography. These measurements will provide a baseline of information regarding the natural variability present in this reach of the river, the need for additional parameters, and specifically in the management reach, the potential for trend detection throughout the first increment of the Program.

The intensive research component will focus on collecting data sets with fine spatial resolution on three reaches of the middle channel undergoing riparian vegetation modification of the Platte River within the Cottonwood Ranch. Data collection will consist of detailed topographic surveying, bed and bank sediment sampling, observations of in-channel and bank vegetation, and ground photography. The three reaches were selected to represent the conditions of the river above the management area, in the management area, and below the management area. Results of the intensive research component will be used to separate normal variability in the channel from changes that are specifically produced by the management activities.

Specific objectives are as follows:

Objective 1) General river monitoring within Cottonwood Ranch that will become part of the overall adaptive management program along the central Platte River

A) To document physical characteristics of the Platte River channels both within the Cottonwood Ranch and immediately downstream.

B) To integrate the general monitoring program within Cottonwood Ranch Property into the monitoring scheme devised for adaptive management within the PRESP's area of interest.

Objective 2) Intensive research aimed at estimating channel changes and sediment movement resulting from integrated management practices

A) To evaluate channel changes (e.g. changes in channel width, distribution of depths within cross sections, and bank stability) resulting from specific vegetation clearing activities along islands and river banks

B) To determine the sediment budget and sediment movement of mobilized bed and bank material to downstream areas from the managed channel before and after vegetation removal in the management channel.

C) To evaluate the effects of natural river processes (eg. seasonal distribution of flow depths and erosion potential on banks) to maintain or augment the management activities.

The monitoring and research in this protocol does not evaluate species response to habitat development and enhancement but does evaluate the response of the existing environment to management actions. The Cottonwood Ranch Property Development and Enhancement Plan was developed based upon current knowledge of habitat needs by the target species with the assumption that ultimately this Plan will result in benefits to the target species. This approach is consistent with adaptive management. While species response to habitat management will take multiple years to evaluate it is imperative to the success of the proposed Program that this initial management action be evaluated to guide future land management and improve understanding of river processes that create and maintain channel habitat. The Districts have and will continue to monitor wildlife use of the site including fish abundance and diversity, breeding and migratory bird use and bald eagle use of an adjacent roost site.

General Monitoring Protocol

Data Collection

Transects across the middle channel of the Platte River will be surveyed at low flow following the Cottonwood Ranch research protocol outlined below. Low flows are needed to provide easier working conditions and for safety. Stream discharge of the Platte River at Overton, NE, gage will be used to identify appropriate working conditions and these flows will be recorded in the SOP. General Monitoring transects to be surveyed include eight research cross sections spaced one mile apart. Three of these transects are on the Cottonwood Ranch property and five are located downstream of Cottonwood Ranch and upstream of the Kearney Canal Diversion. Five of these eight monitoring transects are to be located at the anchor points of the probability based sample taken for the General Monitoring. The Universal Transversal Mercator (UTM) locations of these 5 points are the intersection of the main channel of the Platte and eastings 461003.49, 462593.20, 464146.15, 468659.43, and 470167.71. General Monitoring cross sections are shown in Figure 1. The channel variables for these eight General Monitoring cross sections will be collected through the research project. The Platte River General Monitoring Program will maintain data collection at some or all of these cross sections after the completion of this research project.

The data collection in year 2000 will serve as the pilot year for purposes of refining the Platte River General Monitoring Protocol. Data collected at these initial General Monitoring cross sections will: 1) Provide first year data for long term monitoring, 2) refine estimates of costs for collecting data at these widely spaced monitoring cross sections, and 3) identify statistical characteristics of variables including variance and dependence estimates and the sensitivity of trend detection. Data collected at each transect will include topographic survey, bed sediment sampling, and ground photography.

Data Analysis

Data will be summarized at the transect level and statistics such as the mean and standard deviation will be compiled using transects as the sample size. These data will be included in an annual data report. Post-stratification of the transects into managed, unmanaged, and downstream strata will enable pilot analyses of the data for each strata, although the sample sizes are insufficient for making changes across a broad spatial scale. Trend detection will involve computing the least squares regression line through all the data points in a regression of any summary measure against year. Statistically significant increases or decreases in trend will be defined as a nonzero regression line.

Research Protocol

Data Collection

Transect types are outlined in Table 1 and locations of these transects are shown in Figure 1. There are two types of transects identified: 1) Temporal intensive cross sections that are surveyed four to six times a year (including before and after high flow season and a survey in the Fall) along with ancillary data (i.e. bed and bank material sampling and ground photography), and provide information on intra-annual variability; and 2) spatial intensive cross sections that are surveyed and ancillary data collected once a year on a series of tightly spaced cross section to provide information on changes within specific channel reaches. The spatially intensive cross sections are placed upstream of the managed area, within the managed area, and downstream of the managed area. The temporally intensive cross sections are a subset of the spatially intensive cross sections.

Streamflow will be collected at a stream gage to be placed on the middle channel of the Cottonwood Ranch property below the management activities. The gage will provide streamflow discharge for that specific channel and total river flow comparisons with the gage, Platte River at Overton, NE. Suspended-sediment concentration is collected at the streamflow gage on the middle channel. Suspended-sediment concentration and the size distribution of the suspended material provide information on changes in fine-grained sediment movement and changes from the managed section upstream. To provide a continuous record of fine-grained sediment transport, an Optical Backscatter sensor will be used.

Methods

1) Topographic survey - The procedure for surveying river cross-sections employs a survey-grade global positioning system (GPS) to measure the location of bed, bank, and bar locations relative to a fixed horizontal and vertical datum. The cross-section will be oriented orthogonal to the principal flow direction in the reach considered, with the extents of the section delineated on either bank with a permanent marker.

Cross section will be measured from either river left or river right depending on the surveyor’s field and office data reduction preferences. The surveyor will begin at a marker on one bank and proceeds in a straight line toward the corresponding marker on the opposite bank. Rather than making equally spaced measurements of position along the section the practice is to instead define the ‘slope breaks’ encountered. An example of a slope break could be the top of a bank and the corresponding toe of the bank. The point at which the water surface intersects an island or bank will also delineated. An important aspect of measuring these cross sections requires an ability of the surveyor to recognize and delineate geomorphic features such as banks, bars, high water marks, and water edge.

The GPS used in the topographic survey computes the position of a rover unit relative to a known horizontal and vertical datum or base station using a satellite network and real time radio communication between the base and rover. Positions will be precise to within 2 centimeters in the vertical direction and 1 centimeter in the horizontal direction. The GPS requires a ‘coordinate seed’ or a known initial point from which to begin making measurements. An arbitrary position could be selected but the best practice is to relate a survey to a reference marker set by the National Geodetic Service (NGS). A listing of NGS benchmarks near the Cottonwood Ranch property and the quality of the horizontal and vertical values are compiled in Table 2. In addition, a number of UGSG elevation benchmarks are located in the vicinity. To relate the research cross sections to a common reference, NPPD will set a series of bench marks near the research activity.

2) Bed /Bank Sediment Sampling- The procedures for measuring bed sediment are taken from Edwards and Glysson, 1999. The type of bed material sediment sampler selected for use is a function of the size of the bed sediment measured and the depth and velocity of the river considered. The Platte River can be safely waded during most months of a typical water year. Previous experience has shown it is practical to do wading bed material sampling in the Platte River. The sampler used consists of a steel cylinder 7 centimeters in diameter and 20 centimeters in length welded to a steel pipe 155 centimeters long.

The general procedure for sampling with this sampler involves dividing the cross section into a series of equally spaced increments or verticals. A sufficient number of verticals should be sampled as to provide a representative statistical population. Previous sampling in this reach of the Platte River indicates that there is a great deal of variability in the sizes of bed material sampled along a section. We have calculated the number of samples (n) needed to characterize the mean grain size given the standard deviation of a sample from this population. Based on this data set we have computed that between 10 and 15 samples should provide a compromise between sampling practicality and statistical confidence. Given the bank material is generally more homogeneous than the bed material fewer of these samples are needed. Two samples taken from each bank, above bankfull stage, along the section should provide a representative population.

The cross-section will be divided into equally spaced increments to encompass the 15 samples. At each increment the sampler is plunged into the bed of the river until the can portion of the sampler is filled with sediment. Sample depths are 2 inches in order to provide similar data to the BM54 sampler used at bridge sections and to sample bed material that is most readily available for transport. The sample is then transferred to a sample bag that is labeled with the sampled section, sample number, as well as the date and time the sample was taken. Care must be taken to transfer the entire sample to the sample bag with special attention not to lose any of the fine material. The procedure is identical for bank sampling.

The samples are analyzed by dry sieving to determine their mechanical composition. Each sample is dried and weighed to determine total weight. The sample is placed in a sieve stack with ½ phi gradations and agitated for 25 minutes using a Rotap. The weight of material retained on each sieve is recorded after transferring the material to a tared dish. The process is repeated for every sieve in the stacks to ultimately yield the grain-size distribution for that sample (Guy, 1969).

3) Ground photography - Photo stations are identified as metal USGS bench marks set in 18 inches of concrete. Photo stations are located on each bank of cross sections. Photographs are taken upstream, downstream, and cross-stream to document the cross section and the condition of the banks upstream and downstream of the cross section. Photographs are taken with 4x5 or 35mm film cameras or digital cameras with a minimum resolution of 1712 X 1368 pixels. Each photo requires the following information: bench mark identification, date, time, film type, lens, azimuth, and any remarks needed.

4) Gaging streamflow - Gaging station procedures are found in Buchanan and Somers (1969), Buchanan and Somers (1968), and Carter and Davidian (1968). These procedures will be followed.

5) Suspended sediment concentration - Fine-grained sediment will be monitored using Optical Backscatter (OBS) sensors connected to a CR21 data collection platform.

Calibration – a correlation between OBS readings and suspended-sediment concentration needs to be defined. Suspended sediment concentrations are obtained for various streamflows along with an OBS value. Suspended sediment concentration is obtained using the equal width methods as defined in Edwards and Glysson (1999, p.48).

Sensor maintenance – sensor must be cleaned once a month to prevent and reduce biological fouling. Readings shall be collected before and after cleaning to establish changes from fouling

Data Analysis

Data from the topographic survey will be exported from the surveying software (Trimble Survey Office) and summarized as the distance from the bank and the elevation at every transect. Graphs can be made using a plotting software package (Microsoft Excel) of the distance versus elevation to reveal the outline of the bottom of each cross section. From the bed sediment sampling, each transect will have 15 samples analyzed and lab statistics will be returned for each. Statistics include d_{16}, d_{50}, and d_{84}. Information gathered from the stream gaging stations will result in discharge data that can be summarized to the daily measures.

Statistical models will be used to summarize sediment and channel measurements for each of the three reaches.

Research Budget Summary for the First Year Activities
(All figures in gross dollars)

Data Collection / Analysis

1. **Cross sections, bed material sampling, and ground photography**
   - a. **Spatial sections (50 sections, one time)**
     - **Field/analysis……………………………………15,400**
     - **Laboratory……………………………………... 9,060**
     - **Subtotal………………………………………….…24,460**
   - b. **Temporal (8 sections, 2 times)**
     - **Field/analysis…………………………………15,400**
     - **Laboratory…………………………………… 5,750**
     - **Subtotal ………………………………………21,150**
   - c. **General sections (5 sections, 1 time)***
     - **Field/analysis……………………………………6,165**
     - **Laboratory………………………………………1,460**
     - **Subtotal………………………………………….7,625**
2. **Stream gage (1 gage on middle channel)**
   - a. **Installation………………………………………………………….6,480**
   - b. **Operation/record published….…………………………………..17,000**
   - c. **OBS Operation/data reduction…………………………………..11,600**
   - d. **Subtotal…………………..…………………………………………35,080**
3. **Equipment……………………………………………………………………8,487**

Data Report (1st year data on CDROM, 1,200 copies)……………………………..…3,000

First year total………………………………………………………………….....99,802

Second year total (approx.)…………………………………………..………....100,000
Third year total (approx.).……………………………………………………….....100,000

*** Totals assume easy access to sections with transport assistance using airboat from NPPD.**

Table 1. Data to be collected at each transect type and the gaging station. Temporal intensive cross sections are surveyed four to six times a year, spatial intensive cross sections are surveyed once a year. Both types of transects will be placed upstream of the managed area, within the managed area, and downstream of the managed area.

TEMPORAL INTENSIVE MONITORING			
FIELD ACTIVITY	**FREQUENCY**	**VARIABLE QUANTIFIED / QUALIFIED**	**WHAT YOU LEARN FROM THE DATA**
TOPOGRAPHIC SURVEY	4-6 TIMES / YR @	BED ELEVATION	HOW MUCH HAS THE BED AGGRADED/DEGRADED BETWEEN FIELD VISITS
	8 SECTIONS	BANK POSITION	HOW MUCH HAVE THE BANKS INCISED BETWEEN FIELD VISITS
		WETTED WIDTH	HOW WIDE IS THE CHANNEL AT THAT FLOW
		BAR/ ISLAND POSITION / ELEVATION	BARS/ISLANDS MOVED, AGGRADED OR DEGRADED BETWEEN FIELD VISITS
BED/BANK SEDIMENT SAMPLING	4-6 TIMES / YR @	GRAIN SIZE	HOW MUCH DO THESE VALUES CHANGE BETWEEN FIELD VISITS
	8 SECTIONS	GRADATION	WHAT ARE THE STATISTICS
		PERCENT SILT AND CLAY	WHAT TRENDS ARE SIGNIFICANT
GROUND PHOTOGRAPHY	4-6 TIMES / YR @	BANK STABILITY	ARE THE BANKS STABLE/UNSTABLE FROM ONE FIELD VISIT TO THE NEXT
	8 SECTIONS	VEGETATION	VEGETATION CHANGE FROM ONE FIELD VISIT TO THE NEXT

SPATIAL INTENSIVE MONITORING / GENERAL MONITORING			
FIELD ACTIVITY	**FREQUENCY**	**VARIABLE QUANTIFIED / QUALIFIED**	**WHAT YOU LEARN FROM THE DATA**
TOPOGRAPHIC SURVEY	1 TIME / YR @	BED/BANK ELEVATION/POSITION	THE INTEGRATED YEARLY CHANGE IN THESE VARIABLES IN EACH REACH
	50 / 8 SECTIONS	WETTED WIDTH	
		BAR/ISLAND POSITION/ELEVATION	
BED/BANK SEDIMENT SAMPLING	1 TIME / YR @	GRAIN SIZE	WHAT TRENDS ARE PRESENT ALONG EACH REACH
	25 / 8 SECTIONS	GRADATION	WHAT ARE THE STATISTICS
		PERCENT SILT AND CLAY	WHAT TRENDS ARE SIGNIFICANT
GROUND PHOTOGRAPHY	1 TIME / YR @	BANK STABILITY	THE INTEGRATED CHANGE IN APPEARANCE OF EACH REACH
	50 / 8 SECTIONS	VEGETATION	WITH RESPECT TO THESE VARIABLES

Table 1 cont.

STREAMFLOW / SUSPENDED-SEDIMENT CONCENTRATION			
FIELD ACTIVITY	**FREQUENCY**	**VARIABLE QUANTIFIED / QUALIFIED**	**WHAT YOU LEARN FROM THE DATA**
STREAM GAGING	12 TIMES / YR @	STAGE / DISCHARGE RELATIONSHIP	HOW MUCH WATER IS MOVING THROUGH THE MAIN CHANNEL
	1 GAGE		WHAT ARE THE STATISTICS OF FLOW
			CAN RELATE UPSTREAM GAGE AT OVERTON TO THE GAGE
			TRACK THE TIMING AND MAGNITUDE OF HIGH FLOW EVENTS
GAGE HEIGHT	CONTINUOUS REC.	STAGE	CONTINUOUS FLOW INFORMATION
OBS MONITOR	CONTINUOUS REC.	OBS VALUES	OBS IS A SURRAGATE FOR FINE-GRAINED SUSPENDED SEDIMENT CONC.

Table 2. Horizontal and vertical control near Cottonwood Ranch.

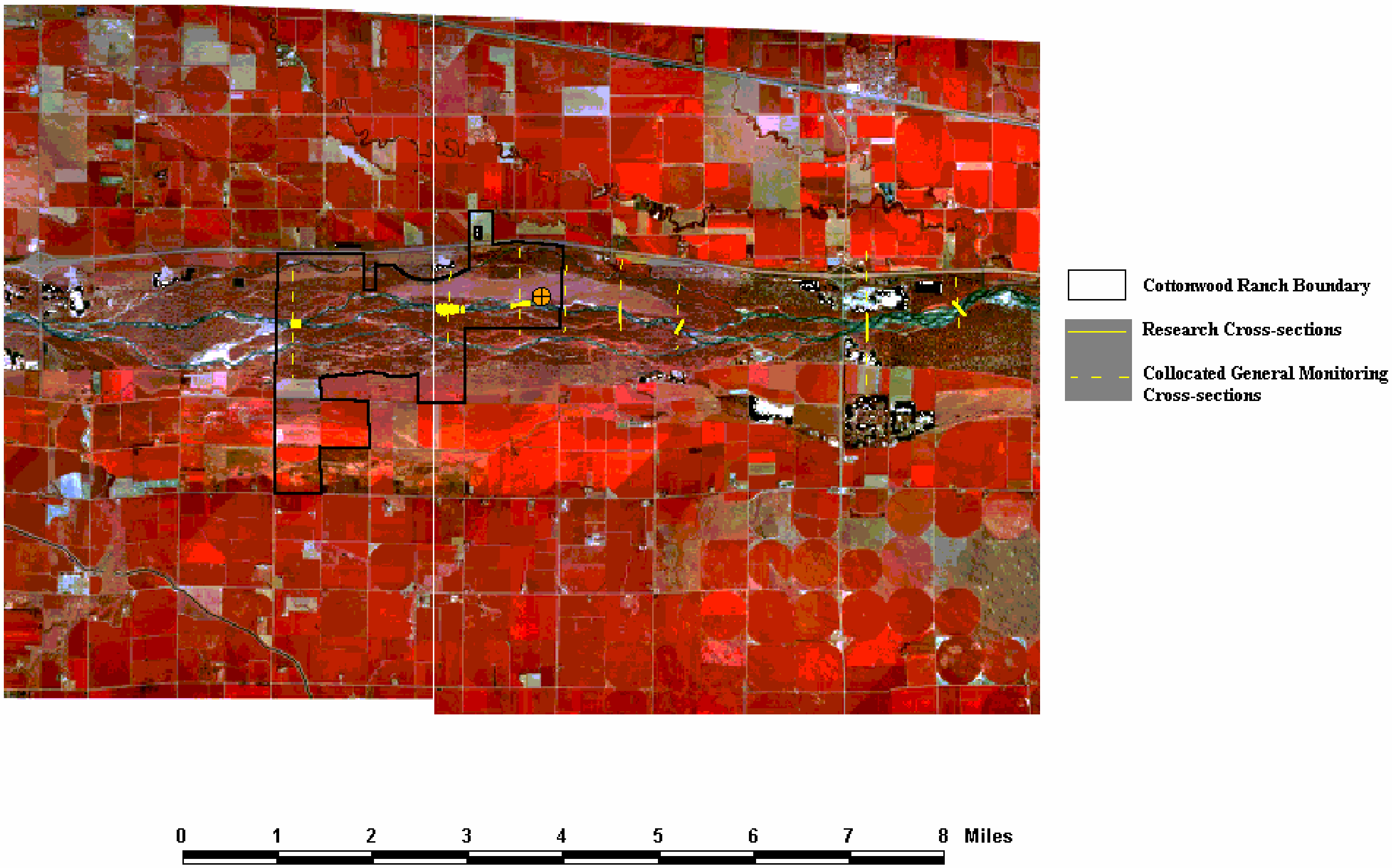
NGS VERTICAL AND HORIZONTAL CONTROL

DESIGNATION	PID	QUAD	LATITUDE	LONGITUDE	NAVD 88 (FEET)	HORZ ORDER	VERT ORDER
WESTSIDE	LH1050	OVERTON	403945.5202	993727.323	2445.7	THIRD	THIRD
80 11	LH1052	OVERTON	404138.8115	993226.301	2305.3	SECOND	THIRD
80 10A	LH1329	ELM CREEK W.	404153.4278	992715.891	2279	SECOND	NA
80 10	LH 1330	ELM CREEK W.	404140.5509	992246.67	2253	SECOND	NA
80 10 A AZ MK	LH 1331	ELM CREEK W.		992716.642	2279	SECOND	NA
Z 434	LH1435	ELM CREEK W.	404343	992752	2304.56	SCALED	FIRST
A 435	LH1436	ELM CREEK W.	404136.7199 404334	992643	2287.07	SCALED	FIRST

USGS VERTICAL CONTROL

DESIGNATION	QUAD	ELEVATION (FASL)
8RLW 1960	OVERTON	2347
80-11-1959	OVERTON	2311
80-11-1959	OVERTON	2304
13 RLW 1960	OVERTON	2296
12 RLW 1960	OVERTON	2305
3 RGW 1960	ELM CREEK W.	2247
80-9-1959	ELM CREEK E.	2209

Figure 1. Cottonwood Ranch Monitoring and Research Sections



REFERENCES USED IN PROTOCOL DEVELOPMENT:

Buchanan, T.J., and Somers, W.P., 1969, Discharge measurements at gaging stations: US Geological Survey Techniques Water Resources Investigations, Book 3, Chap A8, 65 p.

Buchanan, T.J., and Somers, W.P., 1968, Stage measurement at gaging stations: US Geological Survey Techniques Water Resources Investigations, Book 3, Chap A7, 28 p.

Carter, R.W., and Davidian, J., 1968, General Procedure for gaging streams: US Geological Survey Techniques Water Resources Investigations, Book 3, Chap A6, 13 p.

Edwards, T.K., and Glysson, G.D., 1999, Field methods for measurement of fluvial sediment: US Geological Survey Techniques Water Resources Investigations, Book 3, Chapter C2, 89 p.

Guy, H.P., 1969, Laboratory theory and methods for sediment analysis: US Geological Survey Techniques Water Resources Investigations, Book 5, Chap C1, 58 p.

Guy, H.P., and Norman, V.W., 1970, Field methods for measurement of fluvial sediment: US Geological Survey Techniques Water Resources Investigations, Book 3, Chap C2, 59 p

Kennedy, E.J., 1984,Levels at streamflow gaging stations: US Geological Survey Techniques Water Resources Investigations, Book 3, Chap A19, 31 p.

Kennedy, E.J., 1984, Discharge ratings at gaging stations: US Geological Survey Techniques Water Resources Investigations, Book 3, Chap A13, 53 p.

Kennedy, E.J., 1983, Computation of continuous records of streamflow: US Geological Survey Techniques Water Resources Investigations, Book 3, Chap A10, 59 p.

Rantz, S.E., and others, 1982, Measurement and computation of streamflow: US Geological Survey Water Supply Paper 2175, volume 1 and 2.

Porterfield, George, 1972, Computation of fluvial-sediment discharge: US Geological Survey Techniques Water Resources Investigations, Book 3, ChapC3, 66 p.

Wagner, C.R., 1995, Stream-gaging cableways: US Geological Survey Techniques Water Resources Investigations, Book 3, Chap A21, 56 p.

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM

ATTACHMENT 4

LAND PLAN

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 4

Land Plan

December 7, 2005

Table of Contents

List of Appendices and Tabs

TAB 1 - PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM EXCERPT
TAB 2 - PLATTE RIVER IMPLEMENTATION PROGRAM EXCERPT, LAND COMPONENT
TAB 3 - PLATTE RIVER IMPLEMENTATION PROGRAM EXCERPT, PROGRAM ADAPTIVE MANAGEMENT
TAB 4 - ORGANIZATIONAL STRUCTURE FOR PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM EXCERPT, DRAFT LAND ADVISORY COMMITTEE CHARTER

I. PURPOSE

The purpose of the Land Plan is to provide guidance in implementing the land component of the First Increment of the Platte River Recovery Implementation Program (Program). To aid in the understanding of the Land Plan, excerpts from other relevant Program documents are included as Tabs. The "initial focus" of the Program is to acquire interests in lands[1] between Lexington and Chapman, Nebraska, to restore them where appropriate, to maintain them, and otherwise to manage them so that they provide benefits to the target species based on the individual features of the land while using some or all of the characteristics of "habitat complexes" as discussed in Section II.B.1 below. The initial focus on habitat complexes is subject to change during the First Increment through investigations in the Adaptive Management Plan (Attachment 3 and Section III.B of the Program Document). This Plan also allows the Governance Committee to consider non-complex lands that provide demonstrable benefits to the species and have or could potentially have the characteristics described in Section II.B.2 below. The Governance Committee may also agree to undertake, fund or give credit for activities outside the Lexington to Chapman reach to provide biological benefit to the target species. Habitat acquisition is to be on a willing seller/willing lessor basis. All land acquisition and management decisions will take into account the costs, the relative benefit to the target species, and contribution toward fulfilling the Program's objectives. The Program will manage its lands in accordance with a "good neighbor policy" as described in Section IV below.

Responsibility for implementing the Land Plan lies ultimately with the Governance Committee, but a number of activities will be carried out by the Land Advisory Committee, the Program's Executive Director, or both working collaboratively. Activities assigned to the Executive Director in the Land Plan may be carried out by the Executive Director personally or, under his or her supervision, by Program staff, contractors or other Program participants. The relationships among the Governance Committee, Land Advisory Committee, Executive Director and other Program participants are described in the Program's Organizational Structure document (Program Attachment 6). Land Advisory Committee membership and responsibilities are described in the Land Advisory Committee Charter (TAB 4; Organizational Structure, Program Attachment 6). The Land Advisory Committee provides advice and recommendations to the Governance Committee related to land acquisition, management and other land-related issues. A Land Interest Holding Entity will hold the Program's real property interests, and in some circumstances sponsorship arrangements will allow Program use of lands without transfer of the property rights.

II. LAND ACQUISITION

A. Process for Identifying and Evaluating Potential Program Lands

Particular parcels of land to be considered for Program acquisition will generally be identified in one of two ways. First, the Program will identify potential parcels for acquisition based on location, existing habitat, land uses, and/or potential for restoration and may approach owners of such land parcels, either through "open house" public meetings or on a one-to-one basis.

[1] "Acquire" includes purchase, lease, easement or other arrangements (Appendix E).

Second, landowners who are seeking to market or to dedicate their property to the Program may contact representatives of the Program. The Executive Director will be responsible for approaching landowners, coordinating activities to approach landowners, responding to landowner inquiries and cataloguing all potential offers received.

The Executive Director, working with the Land Advisory Committee, will evaluate all parcels of property that have been identified for possible acquisition. The evaluation process will provide the information necessary for the Governance Committee to decide which lands to acquire. The Executive Director will have a process or processes to work with the Land Advisory Committee to evaluate a parcel of property, and to provide information to the Governance Committee when quick action is needed to secure that parcel of property.

The Executive Director, working with the Land Advisory Committee, will complete the Land Evaluation Worksheet (Appendix A), which requires the evaluators to answer a series of questions about each potential parcel of land and its nearby land and water features. As part of that process, the Executive Director will obtain or develop maps showing the proposed property boundaries, habitat types, and the location of nearby "conservation lands" owned by the National Audubon Society, the Platte River Whooping Crane Critical Habitat Maintenance Trust, The Nature Conservancy or others. Initial maps identifying some of these features available to the Program are found in Appendix F. If warranted, the Land Advisory Committee will conduct a site visit. To ensure consistent landowner contact, the Executive Director will accompany the Land Advisory Committee on any visits to the proposed parcel of property. While informal and preliminary discussions will likely take place between the landowner and the Executive Director or Program Staff and/or Land Advisory Committee representatives during the initial evaluation of a parcel of property, formal negotiations and commitments must be carried out by or under the direction of the Executive Director, and require Governance Committee approval.

The Executive Director will compile all information related to the parcel of land under consideration (i.e., Land Evaluation Worksheet, maps, and results of the site visit) in a report for review by the Land Advisory Committee. The report will describe how each parcel of land fits with the Program's goals and objectives.[2] The Land Advisory Committee will develop recommendations on whether the Program should or should not pursue acquiring a particular parcel of property, and any recommended acquisition terms. If the Land Advisory Committee is not able to reach agreement on whether to recommend pursuing the acquisition of a parcel, it will identify all viewpoints raised by Land Advisory Committee representatives without identifying majority or minority views. The Executive Director will transmit each evaluation report, along with the Land Advisory Committee's recommendations or viewpoints to the Governance Committee.

After receipt of the evaluation report and Land Advisory Committee's recommendations or concerns regarding a particular parcel of property, the Governance Committee has several options to pursue. For instance, the Governance Committee may reject the parcel, defer any

[2] Specifically, the completed worksheet will describe how the parcel under consideration fits with Section II.B Table 1 or 2 target characteristics, the preferences listed in Sections II.B.1 and II.B.2 below and with any habitat complex being formed. The worksheet also calls for non-complex lands to be identified in the evaluation process so it is clear if they are being counted against any acreage cap.

decision until a later time, approve initiating formal negotiations and provide instructions regarding acceptable terms, or approve bidding on the parcel up to a pre-determined maximum purchase price. If the Governance Committee decides to pursue acquiring an interest in a property, it will assign the negotiations or bidding to the Executive Director (who may work with Program Staff, a contractor negotiating agent, Land Advisory Committee representatives or other Program participants) to negotiate or bid on the Program's behalf consistent with the Governance Committee's instructions. If negotiation or bidding is successful, the Governance Committee will act a second time to approve the final acquisition agreement or arrangements.

B. Land Acquisition Decision Process for the Program

The Governance Committee retains the authority to decide whether to acquire an interest in any particular parcel of land. Unless changed through the Adaptive Management Plan (Program Attachment 3), the Governance Committee will be guided by the considerations described below.

1. Habitat Complexes

The "initial focus" of the acquisition process is on habitat complexes.[3] A "habitat complex" consists of wet meadows, channel areas, and buffers. "Channel area" is the portion of the river that conducts flow and is bounded on either side by stable banks or permanent islands with vegetation that obstructs view. At low flows it includes interconnected small channels and exposed sand or gravel bars and non-permanent islands. "Wet meadows" are areas with a generally level or low-lying undulating surface consisting of a mosaic of swales with wetland soils and vegetation and ridges with upland native or restored grasslands. "Buffer" is used to shield wet meadow or channel habitat areas from potential disturbances.

The Program will use its best efforts to acquire lands that approximate or have the potential to approximate through restoration the target habitat complex characteristics in Table 1, Target Habitat Complex Guidelines.[4] Among other things, the realities of budget, geography and the Program's willing seller/lessor policy mean that it may be difficult to acquire contiguous lands meeting the size and physical characteristics described in Table 1. For these and other reasons, the dimensions and proportions of the target habitat complex are not required for land acquisitions to be considered habitat complexes for the Program. The Governance Committee has the flexibility to acquire complex lands that do not have all of the types of habitat and habitat characteristics described in Table 1[5], at the end of the Land Plan.

[3] The duration of the "initial focus" on habitat complexes is not fixed. Based on the information available at Program inception, the parties expected that "initial" would refer to the entire First Increment. The Governance Committee may modify this focus early, based on investigations in the Adaptive Management Plan.

[4] The parties have agreed to use these habitat complex characteristics as an initial acquisition, restoration and maintenance target. The states and July 1997 Cooperative Agreement Land Committee continue to disagree that these characteristics represent the "best" habitat or necessary habitat for the target species, or that the Program will be able to sustain the characteristics solely with flow management. The states and July 1997 Cooperative Agreement Land Committee believe that an approach based on acquiring and developing habitat with a range of characteristics is justified.

[5] For example, after considering the available lands, the Governance Committee may decide that the greatest biological benefit would be from acquiring a habitat complex with a wide channel area but little or no nearby wet meadow habitat, or a wet meadow area near a narrow channel area. Generally, riverine habitat will be considered habitat complex land.

The target habitat complex characteristics in Table 1 will be examined through the Adaptive Management Plan during the First Increment. The Adaptive Management Plan (Program Attachment 3) includes activities that will be used to assess species use and habitat as related to the Table 1 characteristics and other management options.

While the "best case" acquisition is a single parcel of land of the size and with the characteristics described in Table 1, land ownership patterns in the central Platte River area suggest that habitat complexes will generally be formed from lands acquired through multiple transactions over a period of time. The Program may acquire land for one or more complexes or partial complexes during the First Increment that it intends to add to during subsequent increments. The Governance Committee has the flexibility and responsibility to exercise its judgment in choosing among the parcels actually available to best implement the First Increment of the Program within practical constraints.

The Governance Committee will consider many factors when deciding whether to acquire a particular parcel of land, including but not limited to the following:

- The relative potential benefits to the target species from individual parcels of property alone and/or in combination with nearby parcels of property.
- The type of interest in land, including fee simple ownership, leases, easements or other arrangements agreed to by the Governance Committee. It is anticipated that a mix of interests will be acquired during the First Increment. The length of the interest should be long enough to provide a good return of benefits given the costs of acquisition, restoration and management. In furtherance of the long-term objective of perpetual protection of land, the interests acquired during the First Increment should be for as long a term as feasible.
- The location of the parcel of property. It is preferred to space habitat complexes with no more than one per "bridge segment" (river reach between two bridges) in ten bridge segments between Lexington and Chapman, Nebraska. Preferred bridge segments for the First Increment are:
    - those bridge segments located near the upstream end of the associated habitats,
    - those with habitat that can be most reasonably improved and that is not already being protected for target species purposes by another entity,
    - those bridge segments with existing habitat that is not already being protected for target species purposes by another entity and that appears likely to be lost or degraded without Program protections, and
    - those bridge segments that do not currently have any protected habitat.
- Generally a larger parcel of property is preferred over a smaller one to provide greater unobstructed view and protection from disturbance. A smaller parcel (even less than 40 acres) may be of interest, however, if it adjoins or is near already protected lands or has habitat characteristics that would allow the already-protected lands to more closely approximate Table 1 characteristics, would improve the habitat value of the land already under protection for the target species, or has a recent history of species use.
- The potential for combining an individual parcel of property with other adjoining or nearby parcels of properties to function, or potentially function, as a habitat complex. Parcels that can function as a habitat complex with adjoining or nearby lands that are

already protected are preferred over those that could function as a habitat complex when considered with adjoining or nearby lands that are unprotected.

- Wet meadows that are contiguous with or close by channel areas are preferred over wet meadows further away.
- The potential to form a habitat complex managing both sides of the river.
- The potential success of restoration efforts.
- The relative costs of acquisition, restoration and maintenance activities, and other cost considerations.

2. Non-Complex Habitat Lands

While the "initial focus" of the First Increment is on the "habitat complex" approach, focus does not mean entirety. The Governance Committee will consider non-complex habitat lands that provide demonstrable benefits to the target species such as sandpits and existing or restorable non-riparian wetlands and wet meadows within the Program's area of interest consistent with Table 2. It is foreseen that some of the Land Component's resources will be used for such habitat, but no more than 800 acres of the 10,000 acres to be acquired during the First Increment will be non-complex habitat unless it is determined through the Adaptive Management Plan that additional non-complex habitat lands should be acquired.

Non-complex habitat with demonstrable benefits includes sandpits for tern and plover nesting and non-riparian wetlands and wet meadows for whooping crane roosting and foraging that currently or potentially have the characteristics described in Table 2, Non-Complex Habitat Guidelines. In addition to acquiring interests in existing sandpits, the Governance Committee has the flexibility to enter into arrangements with sand and gravel operators so that habitat areas with suitable characteristics become available to the Program in the future. Implementation of the Adaptive Management Plan may lead the Governance Committee later to identify additional types of non-complex habitat with demonstrable benefits for the species, but at Program inception, wetland, wet meadow and sandpit "non-complex" habitat will be sought. The Adaptive Management Plan identifies a process that will be used to assess species uses and habitat as related to non-complex types of habitat.

The Governance Committee will consider many factors when deciding whether to acquire a particular parcel of non-complex habitat land, including, but not limited to, the following:

- The relative potential benefits to the target species from individual parcels of property alone and/or in combination with nearby parcels of property.
- The type of interest in land, including fee simple ownership, leases, easements or other arrangements agreed to by the Governance Committee. It is anticipated that a mix of interests will be acquired during the First Increment. The length of the interest should be long enough to provide a good return of benefits given the costs of acquisition, restoration and management. In furtherance of the long-term objective of perpetual protection of land, the interests acquired during the First Increment should be for as long a term as feasible.
- The location of the parcel of property relative to other types of habitat or habitat complexes. The scarcity of habitat serving similar species needs in an area may increase the desirability of a particular parcel of property.

- Generally a larger parcel of property is preferred over a smaller one to provide greater unobstructed view and protection from disturbance.
- The recent use by the target species of a particular parcel of property. For those sandpits that possess the characteristics described in Table 2, recent nesting activity (within the last 5 years) is generally preferred over those that do not have such use. This preference does not apply when evaluating opportunities to work with sand and gravel operators to provide areas with the characteristics described in Table 2 in the future.
- The potential success of restoration efforts. Functioning wetlands and those requiring minimal restoration efforts are preferred.
- The likelihood that used or useful habitat will be lost if not protected by the Program.
- The potential for obtaining useful data regarding land management options under the Adaptive Management Plan.
- The relative costs of acquisition, restoration and maintenance activities, and other cost considerations.

C. Process for Acquiring, Holding and Disposing of Interests in Program Lands

The Governance Committee may approve acquiring property interests in land through lease, easement, purchase or any other arrangement that it chooses. Any property interest or other arrangement must provide sufficient interest or control for lands to become part of the Program. The Governance Committee may approve disposing of some or all of the Program's interest in lands if not needed for Program purposes.

1. Holding Interests in Program Lands

a. Land Interest Holding Entity

Because the Governance Committee and Program are not legal entities that can enter into contracts or hold property, the Program will use a Land Interest Holding Entity to hold title to Program lands, or to enter into leases, easements, and other contractual arrangements for Program lands. All purchases, leases, easements, and other land-holding transactions will be made at the direction of the Governance Committee, working through contractual arrangements with the Land Interest Holding Entity (see Organizational Structures document, Program Attachment 6, Section VIII.B). The Land Interest Holding Entity will be a non-government entity, and will be identified through a search or bid process. To avoid any potential conflicts of interest, the Land Interest Holding Entity will be prohibited from managing Program lands.

b. Sponsors of Program Lands

Sponsors of Program lands are entities or individuals who dedicate the use of such lands to the Program, but retain ownership of the property rights that allow Program use of the lands. Sponsored lands must be protected by other federal, state or local programs, managed under regulatory oversight as habitat, or protected by non-profit conservation groups or government agencies.

A Signatory (Colorado, Nebraska, Wyoming or the federal government) may sponsor Program lands. To do so, it must identify a responsible agency and provide plans for land management, Program access and/or Program coordination to provide appropriate assurances of management consistent with the Program's goals and objectives. A non-Signatory may also sponsor Program lands. To do so, it must enter into arrangements such as management and/or access agreements with the Land Interest Holding Entity, a Program Signatory or Signatories or a conservation organization, or must have a management plan in place that is required by a regulatory agency. Any agreements, management plans or other arrangements must be satisfactory to the Governance Committee and assure Program access and management consistent with the Program's goals and objectives.

Program lands owned by Sponsors include the Nebraska Public Power District's (NPPD's) Cottonwood Ranch Property (2650 acres), lands acquired by Wyoming (470 acres), and any lands acquired in the associated habitat by the National Fish and Wildlife Foundation using funds contributed prior to the Program as a result of ESA consultations. NPPD's tern and plover islands and sandpits may also be sponsored. Examples of lands which might be considered for inclusion in the Program in future sponsorship arrangements include those owned, leased or under easements held by the Nebraska Game and Parks Commission, the Platte River Whooping Crane Maintenance Trust, Inc., the National Audubon Society, The Nature Conservancy, and The Central Nebraska Public Power and Irrigation District (CNPPID). Lands managed by these entities prior to July 1, 1997 for the benefit of endangered and threatened species, and CNPPID's Jeffrey Island Habitat Area may be credited to the Program's long-term objective, but not toward the First Increment objectives of the Program without prior approval of the Governance Committee and the Sponsor. Other lands acquired by these entities after July 1, 1997 could contribute toward First Increment objectives, and are more likely to come into the Program under sponsorship arrangements during the First Increment. See Appendix B for a partial list of federal, state, and local programs that could also provide lands to the extent consistent with the law and policy governing such programs.

A parcel of sponsored land may be included in the Program only if approved by the Governance Committee consistent with the Land Plan. All sponsorship arrangements will be developed on a case-by-case basis considering the Program's investment in the project. Section II.C.2 below describes provisions to be addressed in sponsorship arrangements.

2. Controlling Program Lands

All Program lands will be managed and controlled pursuant to management plans as described in Section III below. If the Program acquires less than a fee simple interest in a parcel of property, other individuals or entities will hold property interests in that parcel. For each such parcel, the Governance Committee must have assurances at the time of acquisition that the Program will have adequate control of activities on the land to implement a management plan. These assurances may be provided through the terms of leases, easement agreements or other written agreements with such individuals or entities. For Sponsored Program lands, these assurances may be provided through the management plans that are required by a regulatory agency (such as the Federal Energy Regulatory Commission-approved plan in place for NPPD's Cottonwood Ranch Property) or prepared by a Signatory Project Sponsor's designated responsible agency. The same agreement or plan will also make clear the rights retained by the landowner and any assurances given to the landowner by the Program about how Program activities will be carried out or coordinated with the landowner. When the Governance Committee acquires less than a fee simple interest in land, agreements or plans must include at least the following information:

- A description of the access to be allowed to Program participants for the purpose of habitat restoration, management, maintenance, monitoring and research, to the extent such activities are necessary on the property.
- A description of land uses and management to assure that non-Program and Program uses of the land are compatible. Appendix C contains broad descriptions of the types of provisions that the Program might negotiate to assure compatible use of Program land. Not all types of provisions will be needed on all parcels. Due to variability in land uses, physical characteristics of a parcel of property, and interests of the landowner, provisions that address compatible use of that property will be negotiated on a case-by-case basis when the agreement or plan is drafted. When parcel-specific provisions are negotiated, they will explicitly identify land uses that are allowed, allowed with prior coordination, restricted in time or place, or prohibited so that both the landowner and the Program have clear expectations.
- The right for the Program and/or Project Sponsor to carry out agreed-upon management plans for that property. Management plans and agreements providing details and defining management flexibility may be included in a lease, easement or other written agreement.
- A requirement that the agreement provide sufficient notice of expiration/termination, if applicable, so that Program lands can likely be replaced while the protections are still in place on those lands that will be taken out of the Program.
- A description of how any property interest in land held by the Program will be dealt with if the Program ends.
- A description of any conditions that limit Program activities on the parcel.
- A description of the rights that are retained by the landowner (e.g., hunting rights, mineral rights).
- A description of the conditions of public access, if any.
- A description of the required communications between the Program and landowner.

3. Leasing or Selling Interests in Program Lands[6]

If the Program acquires lands through fee simple purchase, the Governance Committee may decide to minimize Program costs by establishing conservation easements on the lands, and then reselling that property. Such conservation easements would subject the purchaser to conditions and limitations as described in Section II.C.2 above to assure that the use of the land remains compatible with Program objectives. Similarly, Program lands may be leased for uses that are compatible with Program objectives.

The Governance Committee may also choose to acquire a parcel of land only part of which would serve Program purposes, as described in Section II.C.4 below. The Governance Committee subsequently may request that the Land Interest Holding Entity lease or sell the property interest in those acres that do not count toward the Program objectives. The Governance Committee may determine the best means to dispose of some or all of its interests in such lands.

[6] Leasing or selling interests in Program lands must comply with any applicable federal and state law.

Finally, through the Adaptive Management Plan (Program Attachment 3) the Governance Committee may find that lands previously counted toward habitat objectives have become of limited benefit to the Program, and decide to sell or lease interests in such lands. In such an event, the Governance Committee has an obligation to acquire replacement lands, if needed, to meet Program objectives.

4. Crediting Lands Acquired Toward Program Objectives

If the Program acquires an interest in a parcel of land for a habitat complex or non-complex habitat, it will count toward the 10,000 acre First Increment objective. Lands that are part of a habitat complex or are non-complex habitat, and that are used to evaluate management options, will count toward the 10,000-acre objective. The Governance Committee may choose to acquire a parcel of land only part of which would serve Program purposes. Before acquisition, the Governance Committee will identify those acres that will not be counted toward the Program objectives.

The Governance Committee will also determine prior to acquisition whether a parcel of land will count against the 800-acre cap on non-complex habitat. The Governance Committee may acquire certain non-riverine wetlands or sandpits within a reasonable distance from a habitat complex that function with that complex, and may, on a case-by-case basis, consider those lands as habitat complex lands. Non-complex lands may be reclassified as complex lands if a habitat complex is later developed in the area.

5. Disposition of Land Upon Ending the Program

Each lease, easement or written agreement for Program lands not held in fee title will address disposition of the Program's interest in those lands if the Program is terminated. The Program's Finance Document (Program Attachment 1) addresses the disposition of Program lands held in fee, and crediting for land benefits among Program participants.

III. HABITAT RESTORATION, MAINTENANCE AND OTHER MANAGEMENT

The Governance Committee, working through the Executive Director, will assure that habitat restoration, maintenance and management efforts are coordinated among the parcels of land. The Governance Committee may elect to use Program staff or a land management contractor under the direction of Program Staff for this purpose.

A. Process for Addressing Habitat Restoration, Maintenance and Management

The Program will use management plans to describe the appropriate restoration, maintenance, and other management activities for each parcel of land acquired for the Program. The Executive Director will draft the management plans for review and approval. The Executive Director will coordinate with the Land Advisory Committee during the drafting process to provide for early exploration of any recommendations or concerns. The Executive Director will also coordinate with the Program's Technical Advisory Committee and those carrying out aspects of the Adaptive Management Plan to explore any research or data collection needs that might be accommodated as part of the management plan. Any draft management plan submitted to the Governance Committee for approval will be accompanied by a recommendation and/or comments by the Land Advisory Committee, and any comments by the Technical Advisory Committee. Management plans must be approved by the Governance Committee.

A management and restoration plan specific to each parcel of land protected will be prepared within one year of acquisition and implemented as provided in the plan.

B. Guidance for Developing Management Plans

The parcel-specific management plans will describe the following:

- the existing habitats, including maps/aerial photographs;
- the amounts of each type of existing habitat and the types of habitat to be created or restored;
- management goals and objectives;
- methods for restoration, maintenance and management, including noxious weed and pest control measures;
- parcel-specific monitoring and research;
- the land management contractor or Sponsor's flexibility in day-to-day implementation of the management plan, contrasted with plan modifications needing Governance Committee approval;
- integration of the parcel into an existing or planned habitat complex (if appropriate);
- access to carry out restoration, maintenance, research and monitoring where the Program does not own a parcel of Program land in fee;
- coordination and communication with the landowner or Sponsor (if any);
- an assessment of pre-existing conditions to use in evaluating potential adverse impacts on neighbors as a result of the management plan;
- public access for recreation and education;
- schedule for restoration and maintenance activities;
- budget; and
- future communications with neighboring landowners.

Unless changed through the Adaptive Management Plan, the following guidance will be used in developing parcel-specific management plans.

1. Restoration and Maintenance

Habitat complex lands will be restored if appropriate, and maintained to benefit the target species pursuant to parcel-specific management plans developed based on individual features rather than strict adherence to Table 1. To the extent practical, however, the characteristics described in Table 1 will guide development of the restoration component of a parcel's management plan. Management plans for non-complex habitat lands will be developed with the purpose of achieving at least the characteristics described in Table 2. Management plans will take into account the availability of Program resources to accomplish restoration measures and to maintain conditions after restoration.

Management plans will generally select methodologies from “Habitat Management Methods for Least Terns, Piping Plovers, and Whooping Cranes” developed by the July 1997 Cooperative Agreement’s Habitat Criteria Subcommittee (available from the Program’s Executive Director). The Adaptive Management Plan includes investigations of additional experimental management practices, including but not limited to those related to the channel. As the Governance Committee determines that any such practice is effective through the Adaptive Management Plan’s phased investigations, it will identify that practice as being available, in addition to those described in Management Methods document, to select as a restoration or maintenance measure in a management plan.

2. Public Access

The Program will provide public access to fee title Program lands for recreation and educational purposes, when and where it is consistent with Program objectives and land use. On Program lands where other property interests continue to be privately held, landowners may be requested, but not required, to provide similar public access. The Program may encourage agencies and organizations to provide non-Program incentives to landowners for providing such public access to Program lands that are acquired through leases or easements.

Specific guidelines for allowing public access will be established in the management plans for each parcel to describe appropriate conditions, times of the year, and uses that are consistent with the goals of the Program. Any public access to Program lands that are privately owned will be closely coordinated with and only permitted with the landowner’s prior permission.

3. Benefits to “Other Species of Concern”

In developing parcel-specific management plans, the Program will where practical select restoration, maintenance and other management measures for the target species that do not harm or may benefit other “species of concern,” when such activities are consistent with the needs of the target species and are within the Program budget. An initial list of “species of concern” as related to land management is found in Appendix D. The Governance Committee may delete species from that list, or add species if they are (1) known to occur or have the potential to occur naturally in the associated habitats within the central Platte River valley; and (2) are listed by the state or federal government as endangered, threatened or candidate species; were delisted and are in an initial five-year monitoring period; are ranked as G1, G2, or G3 by Nebraska Natural Heritage Program; or use habitat within the associated habitats in the central Platte River valley that is essential to species survival.

4. Monitoring and Research on Program Lands

All Program monitoring and research will be conducted under the Program’s Integrated Monitoring and Research Plan (Program Attachment 3, Section V). The Integrated Monitoring and Research Plan’s biological response (habitat and species) monitoring and research program provides: 1) integrated monitoring and research data to evaluate the effectiveness of the Program in providing habitat for target species, 2) data supporting Adaptive Management Plan decisions regarding management activities during the First Increment of the Program, and 3) scientifically defensible data that allow the determination of future milestones for the Program. The integration of monitoring and research will provide information for the Adaptive Management Plan, which may lead to adjustments in how Program lands are evaluated or managed under this Land Plan.

The Program's Integrated Monitoring and Research Plan includes monitoring of species use and conditions at the Program's managed complex and non-complex habitat areas, and in areas not managed for the Program, looking for species use preferences. The management plans for each parcel of Program land will accommodate access for data collection as appropriate under the Integrated Monitoring and Research Plan to observe the response of the target bird species and environment and other species of concern to Program activities and to track the conditions of habitats.

As part of the research effort, it is foreseen that some land and resources will be managed for research purposes, including a portion of the lands within habitat complexes and non-complex habitat lands. Non-Program lands may also be used. As parcels are acquired and/or as management plans are developed, the Executive Director, coordinating with the Land Advisory Committee and other committees advising the Governance Committee, will identify what research under the Integrated Monitoring and Research Plan might be appropriate on that parcel. Such research measures might include (1) testing Table 1 characteristics and alternative management options to those characteristics; (2) testing Table 2 characteristics; and (3) carrying out investigations of experimental management practices related to the channel. These and other monitoring and research measures are included in the Adaptive Management Plan. The Executive Director's evaluation of a parcel will take into account various factors, including the amount of time remaining in the Program increment, growing knowledge of the real estate available, and the physical characteristics of the parcel. In evaluating potential research sites on habitat complex lands, the Executive Director will identify whether it is possible to schedule the research without introducing a deliberate delay in overall completion. For example, the Executive Director might consider whether a portion of the land could be managed in a "test" configuration, allowing data to be acquired over a fixed term while restoration work is carried out on the remaining portion, with restoration then completed in the test area.

When the Executive Director identifies potential research activities on a parcel of Program land, they will be addressed in the draft management plan, reviewed by the Land Advisory Committee and other committees as assigned by the Governance Committee, and ultimately will be implemented only with Governance Committee approval. Any approved research will be carried out under the Integrated Monitoring and Research Plan as part of the Adaptive Management Plan, but must also be accommodated in the management plans adopted for the affected parcel of Program land.

Research results will be used in the Adaptive Management Plan, and may lead to adjustments in the management practices described in the Program's "Habitat Management Methods for Least Terns, Piping Plovers, and Whooping Cranes."

C. Implementation of Management Plans

Under the direction of the Executive Director, Program staff and/or Program contractors (or Sponsors on sponsored Program lands) will carry out restoration, maintenance and management tasks as called for in the management plans, and participate in monitoring and research. Sponsors managing Program lands pursuant to a required management plan, such as the Cottonwood Ranch Property management plan, may implement their management plans directly, in accordance with their approved plans. Any land management contracts or Sponsorship arrangements will require periodic progress and status reports by the contractor or Sponsor. These reports will be provided to the Executive Director. The Executive Director will provide these status reports to the Land Advisory Committee for review, and then submit them to the Governance Committee accompanied by any recommendations and/or comments agreed upon by the Land Advisory Committee or made by individual Land Advisory Committee representatives. Copies will also be provided to those implementing the Adaptive Management Plan.

D. Land Acquisition and Restoration Tracking

Program staff will use GIS, maps, and aerial photographs to track lands acquired by the Program. When a new parcel is acquired, Program staff will log the land into the GIS database and record the change on hard copy maps and/or aerial photographs. The tracking will include not only the total number of acres acquired and their location, but will summarize each major vegetation type (e.g., forest, grassland, etc) in the GIS and on maps or photographs. These materials will be available to the Land Advisory Committee and Governance Committee when considering progress and status reports from land management contractors.

IV. ADDRESSING POTENTIAL ADVERSE IMPACTS OF THE LAND COMPONENT

The Program is to avoid shifting tax burdens to adjacent landowners or communities. When land is acquired by the Program and held by the Land Interest Holding Entity, regardless of whether the landowner thereafter is a tax exempt entity, the Program shall pay or provide for the payment of real property taxes or an equivalent amount. Such taxes or equivalent amount shall be determined each year using the assessments and levies in effect at the time such taxes are due or would be due if the property were owned by a tax paying entity

The Governance Committee intends to conduct Program activities in accordance with the following good neighbor policy.

> All activities of the Governance Committee, its committees and subcommittees and other persons implementing, operating, and maintaining the Program shall be carried out in such a way that the Program will be viewed as a "good neighbor" by the residents of central Nebraska and any others who might be affected by Program activities. The Program will comply with applicable local, state, and federal laws and to the extent permitted by such laws, will be responsible for its actions to the same extent as a private individual under like circumstances. The following principles shall guide the Program to be a good neighbor.

- The Program will emphasize the prevention, as opposed to the correction, of actions that cause adverse effects on adjacent landowners or others. Program representatives will talk with neighboring landowners and tenants and others as appropriate, and attempt to document pre-existing conditions and carefully monitor the effects of Program activities.

- If, notwithstanding all efforts to avoid causing adverse effects, concerns are raised that such effects are nevertheless occurring, the Program will have local representatives readily accessible so that the nature and cause of any problem can be quickly determined and needed corrective actions can be taken in a timely manner.

- The Program will require its contractors to carry appropriate insurance to cover documented damage claims resulting from their actions. The Program will make provisions to cover on a case-by case basis other documented damages resulting from unintended consequences of the Program.

V. FIRST INCREMENT LAND COMPONENT BUDGET

A First Increment land budget of $39,131,000 (not including cash equivalent credits) in 2005 dollars is set forth in the Program budget (Program Attachment 1). Budget estimates are an approximation of the funding necessary for the acquisition of property rights, restoration and maintenance of Program lands during the first Program increment. The costs will also include tax payments and potential mitigation of adverse impacts. Budget estimates do not include calculations of inflation over the Program First Increment.

The Program will seek out federal, state, and local programs that may provide cost sharing for restoration or management activities on Program lands.

The following considerations were used in the development of the budget:

1. A First Increment length of 13 years;
2. Taxes (or an equivalent amount) will be paid on lands acquired for the Program[7];
3. All monitoring and research activities on Program lands are included in other budgets; and
4. No cost sharing.

[7] Taxes or their equivalent cannot be paid by the federal government directly to the counties but will be paid by the Program through a financial management entity (see Organizational Structure, Program Attachment 6).

Table 1. Target Habitat Complex Guidelines[8]

1. Riverine Habitat	Characteristics
Location	Between Lexington and Chapman, NE
Channel area	Approximately 2 miles long, 1,150 feet wide and includes both sides of the river. "Channel area" represents the portion of the river that conducts flow and is bounded either by stable banks or permanent islands that obstruct view. At low flows, the channel area includes interconnected small channels and exposed sand or gravel bars and non-permanent islands.
Water depth	A range of depths with approximately 40 percent of the channel area less than 0.7-foot deep during whooping crane migration periods.
Wetted width	90 - 100 percent of channel area inundated during migration periods.
Water velocity	Velocity is variable with depth. During whooping crane migration and least tern and piping plover nesting seasons, velocity should be less than 4 mph in shallow areas.
Sandbars and Channel Morphology	Non-permanent sandbars and low, non-permanent islands throughout the channel area, high enough to provide dry sand during the tern/plover nesting season and free of vegetation that inhibits nesting or creates visual obstructions to whooping cranes. Diverse channel morphology providing a variety of submerged sand bars and other macrohabitats, including backwater areas and side channels inundated by discharge.
Proximity to wet meadow forage habitat	Within 2 miles, but contiguous is preferred.
Distance from disturbance	For whooping cranes: In general, not less than 0.5-mile distant or appropriately screened from potential disturbances. Potential disturbances may include roads, railroads, occupied dwellings, bridges or other activities that would disturb whooping cranes from using a site. For least tern/piping plover: Potential disturbances should be evaluated case-by-case. In general, not less than 0.25 mile distant, or appropriately protected from human disturbances.
Unobstructed View	Good visibility upstream, downstream, and across the channel.
Flight Hazards	Overhead lines should be avoided, if possible. Overhead lines within 0.5 mile of complex boundaries should be evaluated during the screening process to determine whether marking would be appropriate.
Security	Sufficient control to avoid human disturbance to target species.

[9]The Parties have agreed to use these habitat complex characteristics as an initial acquisition, restoration and maintenance target. The states and July 1997 Cooperative Agreement Land Committee continue to disagree that these characteristics represent the "best" habitat or necessary habitat for the target species, or that the Program will be able to sustain the characteristics solely with flow management. The states and July 1997 Cooperative Agreement Land Advisory Committee believe that an approach based on acquiring and developing habitat with a range of characteristics is justified.

2. Wet Meadow Habitat	Characteristics
Location	Within 2 miles of the above-described channel area.
Size	Approximately 640 contiguous acres or more.
Distance from Disturbance	In general, not less than 0.5-mile distant or appropriately screened from potential disturbance. Potential disturbances may include roads, railroads, occupied dwellings, bridges or other activities that would disturb target species from using a site.
Vegetation Composition	Native prairie grasses and herbaceous vegetation, lacking or mostly lacking sizable trees and shrubs, occurring in a mosaic of wetland (hydrophytic) and upland (non-hydrophytic) plants.
Hydrology	Swales subirrigated by ground water seasonally near the soil surface and by precipitation and surface water, with the root zone of the soil continuously saturated for at least 5 - 12.5% of the growing season. Except immediately following precipitation events, higher areas may remain dry throughout the year.
Topography and Soils	The topography is generally level or low undulating surface, dissected by swales and depressions. Mosaic of wetland soils with low salinity in swales and non-wetland soils occurring in uplands.
Food Sources	Capable of supporting aquatic, semi-aquatic, and terrestrial fauna and flora characteristic of wet meadows; especially aquatic invertebrates, beetles, insect larvae, and amphibians.
3. Buffer	**Characteristics**
	That portion of a complex used to isolate channel areas and wet meadows from potential disturbances. In general, it is up to 0.5 miles wide, but is variable depending on topography, screening, and other factors. Buffer areas may include an extended wet meadow or channel area, upland grassland, pasture, hay land, cropland, palustrine wetland, woodland, managed sandpits, or a combination of these and other compatible land features.

Table 2. Non-Complex Habitat Guidelines

Sandpit Habitat for Terns and Plovers	**Characteristics**
Location	Within 2 miles of a river channel, between Lexington and Chapman, Nebraska.
Size	Approximately 3 acres or greater of nesting substrate, that may be extended to include a management zone surrounding the nesting area.
Topography and soils	Open expanse of bare or sparsely vegetated (<25%) homogeneous sandy or sand and gravel substrate that provides dry substrate during the nesting season. Scattered small stones, twigs, pieces of wood and other debris may be present.
Security	Sufficient control to avoid human disturbance to terns and plovers.
Non-riparian Habitat for Whooping Cranes	**Characteristics**
Location	Off-channel but within 3.5 miles of the centerline of the channel area, between Lexington and Chapman, Nebraska.
Type of habitat	Wetland area, wet meadow area or both.
Wetlands	Depressional wetlands with semi-permanent, permanent or seasonal shallow body(ies) of water (palustrine wetlands) that are typically wet during the crane migration season and consist of heavy, depressional soils, such as Fillmore, Massie, Scott, and Marsh soils. Water depths should be primarily less than 18 inches and banks should be low. Generally the wetted portion of the habitat area should be greater than approximately 5 acres in size. The habitat area also includes the surrounding areas that protect or enhance the functioning of the ecosystem and/or habitat area. The habitat areas should be lacking trees or tall shrubs. During the migration season, emergent vegetation should either be absent, loosely scattered, or low enough to not restrict whooping crane use.
Wet Meadows	A generally level or low and undulating surface, dissected by swales and depressions. The area consists of a mosaic of wetland soils with low salinity in swales and non-wetland soils occurring in uplands. The area has native prairie grasses and herbaceous vegetation, occurring in a mosaic of wetland (hydrophytic) and upland (non-hydrophytic) plants, and is lacking or mostly lacking sizable trees and shrubs. The area is capable of supporting aquatic, semi-aquatic, and terrestrial fauna and flora characteristic of wet meadows; especially aquatic invertebrates, beetles, insect larvae, and amphibians. Swales wetted by groundwater, surface water or precipitation with the root zone of the soil saturated for at least 7 days during the growing season.

Distance from disturbance	In general, not less than 0.25-mile distant or appropriately screened from potential disturbance. Potential disturbances include paved roads, railroads, occupied dwellings, bridges or other activities that would disturb target species from using a site.
Unobstructed View	Good visibility in all directions.
Security	Sufficient control to avoid human disturbance to target species.

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 4
Appendix A

Platte River Program Land Evaluation Worksheet

December 7, 2005

Sections II-III should be completed as much as possible prior to a site visit for use in determining if a site visit is warranted.

I. Evaluation Team and Schedule

1) Evaluation Team Members

____
____
____

2) Date of Evaluation _________________

II. Geographic Considerations

1) Does the tract lie within the Lexington to Chapman, NE reach of the Platte River and within 3.5 miles of the main channel or 2 miles of a side channel? If no, the tract is not eligible for inclusion in the Program, unless otherwise specified by the Governance Committee.

2) In what bridge segment does the tract lie?

3) Is the tract contiguous to or near to existing lands protected for conservation purposes that are compatible with Program objectives?

4) How many acres are in the tract? ______ acres

5) Is the tract to be considered as "non-complex habitat"?

6) Legal description (SEC, TNP, RNG), Attach map showing property boundaries.

III. Land Use Considerations

1) What are the current land cover types on the property? (if available, attach 1998 aerial CIR photographs, land use overlay, NWI maps, Farm Service Agency maps and annual aerial survey, most recent aerial photographs, soil maps, and a report from the Program database providing a list of land uses and acreages from within the property boundary).

2) If the tract currently includes land uses that are incompatible with target species habitat, can these land uses be modified or changed? If yes, describe the modifications and estimate costs.

3) If existing land uses are modified or changed to make the tract suitable habitat for the target species, will there likely be quantifiable direct positive or negative impacts on neighbors? If yes, describe the impacts and estimate the cost of mitigating or avoiding negative impacts pursuant to the Program's good neighbor policy (Land Plan Section IV)?

4) Are there land uses on neighboring properties that are incompatible with target species habitat? If so, is it feasible to provide buffer area to protect or enhance habitat on the subject tract? If yes, describe the modifications and estimate costs. Do adjacent land uses limit management options on the land? If yes, list and indicate the significance of the limitations to future management.

5) Is there present or past documented use of the property by the target species or any other federally or state listed threatened or endangered species or species of concern? If yes, indicate the source of the information, the species using the property, the date observations were made, and indicate how current land cover conditions compare to those at the time of use?

6) Is there present or past use of the property that raises potential environmental concerns?

IV. Target Species Habitat Considerations (To be completed on a site visit if further investigation is warranted)

1) What types of habitat currently exist on the property (include photographs)?

A) Estimate the acres of non-riverine surface water and describe (e.g., depth, permanency, source of water, flow).

B) Average width, median width and range of widths of active channel(s) measured at ¼-mile intervals; include all channels, measured using Technical Advisory Committee protocols for use with aerial photography.

C) Length of river frontage.

D) Acres of contiguous sand substrates with less than 25% vegetative cover (potential reproductive habitat for least terns and piping plovers) at time of visit (estimate separately for each barren bar).

E) Estimated height of island and river channel banks relative to the water surface at the time of the visit and provide the contemporaneous data from the nearest USGS gauge.

F) Are there power/transmission lines on the property? If yes, describe and record on the property map.

G) Estimate depth to groundwater based on plants, soils, etc. If groundwater information from the site is available include with evaluation. Use information from existing groundwater wells and other data available (e.g., records from the NRD).

H) Is there evidence of temporary surface inundation in non-wetland areas? If yes, describe the boundary of the inundation and potential source.

I) Describe any man-made groundwater drains, reuse pits, or other features effecting groundwater on the property or within 0.5-mile of property boundary.

2) How many acres of the parcel under consideration can contribute to a habitat complex? Delineate these areas on the attached aerial photo.

A. Total acres of land contributing to habitat complex
   a. Active channel width ______
   b. Wet meadow acres ________
   c. Backwater acres __________
   d. Grassland acres ___________
   e. In-channel bare sand acres _______
   f. Sloughs, number and acres _______
   g. Buffer ________

B. How many acres can be considered non-complex habitat?
   a. Wetland acres
   b. Wet meadow acres
   c. Acres of sand or gravel substrate with <25% vegetation
   d. Management area acres

C. Number of excess acres (land not contributing to a habitat complex or non-complex habitat area) _______________

D. What type of habitat restoration is needed for the parcel (e.g., tree clearing), and at what estimated cost?

E. What buffer is available?

V. Property Management Considerations

1) Are there existing liens, leases, easements, outstanding judgments or other encumbrances on the property? If so, specify.

2) Determine if an environmental audit has been completed. If so, attach the audit to the worksheet.

3) What protection options will the landowner consider?
   A) Sale
   B) Perpetual easement
   C) Lease
   D) Other (specify)
   E) Offered Price ____________
   F) Market Appraisal ____________

Total Acres in Tract _________

Current Land Use Modification or Cessation Costs _______
Third Party Impact Mitigation Costs _______
Adjacent Incompatible Land Use Mitigation Costs _______
Total Extraneous Costs _______

Known Encumbrances to Property Management

Estimated operations and maintenance costs, annual and for the First Increment.

Other Considerations

Recommendation of Evaluation Team

Recommendation of LAC

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 4
Appendix B

Examples of Federal, State, and Local Programs that may Contribute Protected Land or Funds toward Habitat Restoration during the Program
December 7, 2005

Federal Programs (source: *Catalog of Federal Funding Sources for Watershed Protection*, USEPA 1999.)

Bring Back the Natives Grant Program (FWS) - provides funds to restore damaged or degraded riverine habitats and their associated native aquatic species. (Restoration option)

Conservation Reserve Program (USDA) - provides annual payments to landowners who set aside existing cropland for a minimum of ten years for wildlife habitat. (Protection option)

Environmental Quality Incentives Program (USDA) - provides “cost-share” assistance to landowners who implement certain land and water management practices that help conserve natural resources. (Restoration option)

Land and Water Conservation Fund Grants to States (NPS) - provides funds to support acquisition and development of state and local recreation areas that guarantee perpetual public access. (Protection and Restoration option)

North American Wetlands Conservation Act Grants Program (FWS, NAWWO) - provides matching grants to carry out wetlands conservation projects that benefit waterfowl and other migratory birds. (Restoration option)

Partners for Wildlife (FWS) - provides incentive payments to landowners to implement land and water management practices that provide wildlife habitat benefits. (Restoration option)

Pesticide Environmental Stewardship Grants (USEPA) - provides seed money for pesticide users to develop voluntary programs that reduce pollution and safety risks associated with agricultural pesticide use. (Restoration option)

Rainwater Basin Joint Venture (FWS, others) - a cooperative partnership established to facilitate protection and restoration of wetlands for migratory waterfowl in the Rainwater Basin wetlands of south-central Nebraska. This organization may be able to provide technical assistance or partner contacts for wetland restoration activities in the Platte valley. (Restoration option)

Wetland Reserve Program (USDA) - provides annual or lump-sum payments to landowners who set aside farmed wetlands. Land can be set aside with permanent or 30-year easements, or funds can be provided for restoration. (Restoration and Protection option)

State and Local Programs:

Natural Resources Districts - local government agencies that are responsible for preserving and enhancing wildlife habitat on private lands in Nebraska. Programs and technical assistance capabilities vary from district to district. (Restoration and Protection option)

NE Buffer Strip Program (NDA) - provides annual payments for up to ten years to landowners who plant grass strips adjacent to streams. (Protection option)

Nebraska *WILD* (NGPC) - provides assistance for a variety of wildlife habitat improvement and restoration practices. This program will also provide transition payments to landowners who convert cropland to wildlife habitat. (Restoration and Protection option)

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 4
Appendix C

Compatible Use of Program Lands

December 7, 2005

The following are examples of land use activities that may be allowed, prohibited, restricted, or required on Program lands that the Program does not hold in fee simple. Due to variability in land uses, physical characteristics of a property, and interests of the landowner, these are broad descriptions of the types of provisions that the Program might negotiate to assure compatible use of Program land. Not all types of provisions will be needed on all parcels. Actual provisions of the agreement or other arrangements with the landowner will explicitly describe activities that are allowed, allowed with prior coordination, restricted in time or place, or prohibited, so that both the landowner and the Program have clear expectations. Compatible use activities will be negotiated on a case-by-case basis at the time the agreement or other arrangement is developed.

I. Compatible Land Use Activities

The following land use activities may be compatible with Program land use on all or part of a parcel of Program land. Restrictions may be needed on a case-by-case basis depending on the characteristics and Program use of the parcel of property.

A. Grazing, haying, and prescribed burns on grassland areas, and normal agricultural practices on cropland areas, are generally compatible with Program land use. To assure compatible land use, on a case-by-case basis the Program may need limits on the place, time, or extent that these activities occur, or may ask for prior notice.

B. Recreational use of the property (e.g., boating, fishing, hunting, trapping, hiking, horseback riding, wildlife viewing, mushroom picking) is generally compatible with Program land use. However, some types of recreational activities may be restricted when federally listed species are present during nesting and migration periods. Recreational use of motorized vehicles (e.g., ATVs, motorcycles, snowmobiles, etc.) is generally incompatible with Program land use during nesting or migration periods, when federally listed threatened and endangered species may be present.

C. Harvesting of firewood for personal use is generally compatible with Program land use.

II. Incompatible Land Use Activities

The following land use activities may be considered incompatible with Program land use on all or part of a parcel of Program land. Depending on the characteristics and Program use of the parcel of property, they may be prohibited altogether or allowed to occur subject to certain restrictions.

A. Filling, ditching, or draining of wetlands (jurisdictional or non-jurisdictional) on the property is generally incompatible with Program land use.

B. Drilling and use of any new irrigation wells on the property is incompatible with Program land use if such activity results in the loss and/or degradation of wetland functions and values due to depletion of the alluvial aquifer.

C. Depending on the characteristics and Program use of the parcel of property, the use of chemicals and the application of pesticides on the property may be incompatible with Program land use. Some chemicals and pesticides may be prohibited, or they may be subject to case-by-case restrictions on place, time, or extent of use, or they may require notice or approval by the Program before use. Consistent with the Program's good neighbor policy and Nebraska law, any restrictions sought by the Program will also consider needs for noxious weed control and insect-borne disease.

D. Construction of stream/river bank stabilization structures (e.g., armoring, jetties, hard points, revetments, bendable weirs, etc.) is generally incompatible with Program land use except to prevent damage to existing houses, building structures, wells, bridges, and other such facilities.

E. Construction of new permanent structures, facilities, or other such features on the property (e.g., industrial/commercial facilities, bridges, irrigation wells, residential buildings, utility lines, roads, etc) is incompatible with Program land use if the structure would create a visual intrusion or cause some disturbance to federally listed species and thus inhibit or preclude such species use of habitat areas.

F. Depending on the characteristics and Program use of the parcel of property, construction of flood or water control structures (e.g., levees, dikes, ditches, etc.) on the property may be incompatible with Program land use. As indicated above, such structures are generally incompatible with Program land use in areas that impact wetlands, the streambed, the riverbanks, or the stream/river flow.

G. Depending on the characteristics and Program use of the parcel of property, public access to the property may be incompatible with Program land use. To assure compatible land use, the Program may need restrictions on the place, time, or extent of access offered, or may ask for prior notice or approval.

H. A change in land use from that described in the landowner’s agreement with the Program or the Project Sponsor’s plan may be incompatible with Program land use and will require prior notice or approval by the Program.

I. Destruction or removal of any state or federally listed threatened or endangered plants from the property is prohibited.

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 4
Appendix D

Species of Concern - Initial List
December 7, 2005

SPECIES	**CRITERIA (PRIORITY)**	**HABITAT**
Bald eagle	Federal Threatened State Threatened	Riparian woodlands
Sandhill cranes	Area essential to species survival	In-channel, meadows, agricultural lands
River otter	State Threatened	Riparian/river channels
American burying beetle	Federal Endangered State Endangered	Grasslands Open woodlands
Platte River stonefly	Endemic to Central Platte River	Sloughs
Regal fritillary	G3 rank	Wet meadows, grasslands
Western prairie fringed orchid	Federal Threatened State Threatened	Wet meadows
Saltwort	State Endangered	Saline wetlands
Mussels[1]	FWS Concern	River channels

[1] Species known to be in the central Platte River: *Anodota imbecilis* (paper floater), *Anodota g. grandis* (giant floater), *Lasmigona c. complanata* (white heel-splitter), *Potamilus ohiensis* (pink paper shell), *Quadrula quadrula* (maple leaf), *Quadrula pustules* (pimple back), *Strophitus u. undulates* (squaw foot), *Leptodea fragilis* (fragile paper shell), *Anodontoides ferussacianus* (cylindrical paper shell), *Uniomerus tetralasmus* (pond horn), *Corbicula fluminea* (Asiatic clam), *Toxolasma parvus* (lilliput), *Lampsilis ventricosa* (pocketbook)

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 4
Appendix E

Land Plan Glossary

December 7, 2005

Acquire includes purchase, lease, easement or other arrangements.

Adaptive Management Plan is Attachment 3 of the Program Document and describes a systematic process administered by the Governance Committee for continually improving Program management by: 1) designing certain Program management activities to test alternative hypotheses and 2) applying information learned from research and monitoring of Program management. The process also includes the flexibility to use information and experience from all sources. The Adaptive Management Plan describes experiments that have uncertain outcomes. Changes in adaptive management activities and the Adaptive Management Plan are expected.

Associated Habitats are, with respect to the interior least tern, whooping crane, and piping plover, the Platte River Valley beginning at the junction of U.S. Highway 283 and Interstate 80 near Lexington, Nebraska, and extending eastward to Chapman, Nebraska, including designated critical habitat for the whooping crane and that portion of designated critical habitat for piping plover within that Lexington to Chapman reach. With respect to the pallid sturgeon, the term "associated habitat" means the Lower Platte River between its confluence with the Elkhorn River and its confluence with the Missouri River. "Associated habitats" may, to the extent approved by the Governance Committee, include any critical habitat in the Lexington to Chapman reach of the Platte River Basin which is subsequently designated by the U.S. Fish and Wildlife Service for the target species.

Buffer may be one component of a "habitat complex." Buffer is used to shield wet meadow or channel habitat areas from potential disturbances.

Channel (see River Channel Area below).

Easements, as the Program seeks them, are voluntary restrictions in perpetuity or for a term of years that limit development or use of a parcel of land to protect conservation values. The easement is a recorded restriction in the property deed and therefore applies to all subsequent owners and to lessors. The non-profit or other entity that is granted the easement can monitor and enforce its terms.

Executive Director is the head of the Program's paid staff and reports to the Program's Governance Committee. See Organizational Structure document, Attachment 6 of the Program Document, for responsibilities.

Fee Simple means ownership of all rights in a piece of real estate.

First Increment. The Program will be implemented in increments. The First Increment of the Program begins with the signing of the Program Agreement by DOI and the three states, and shall continue for thirteen years from that date or until any later date agreed upon by the Governance Committee in approval of an extension, subject to appropriations.

GIS is Geographic Information System, which typically refers to a database integrated with an electronic mapping system.

Governance Committee is the group of Signatory and non-Signatory members that makes Program decisions and policy. See Organizational Structure document, Attachment 6, for membership and responsibilities.

Habitat Complexes consist of wet meadows, channel areas, and buffers. See *Land Plan* Section II.B.1.

Integrated Monitoring and Research Plan is a section in the Adaptive Management Plan (Attachment 3, Section V**)** that provides for the Program's biological response (habitat and species) monitoring and research to provide: 1) integrated monitoring and research data to evaluate the effectiveness of the Program in providing habitat for target species, 2) data supporting adaptive management decisions regarding management activities during the First Increment of the Program, and 3) scientifically defensible data that allow the determination of future milestones for the Program.

Land Advisory Committee is a standing Advisory Committee established by the Governance Committee to provide advice on land-related Program activities. Committee membership and responsibilities are described in its charter (Attachment 6, Appendix F).

Land Component is the portion of the Program that relates to the acquisition and management of land as habitat for the target species.

Land Interest Holding Entity is a non-government entity that holds title to Program lands, or enters into leases, easements, and other contractual arrangements for Program Lands. The Land Interest Holding Entity is retained through contracts with the Signatories, and works at the direction of the Governance Committee.

Lease is a short or long-term rental of land for specific purposes. A lease gives the lessee use or access rights to a property for a set period of time.

Maintenance is the physical effort made throughout the term of the Program to sustain vegetation or topography of a parcel of Program land in the condition described in the Program's management plan for that parcel of land, after any initial restoration has taken place. Examples include burning vegetation, repairing fences and reshaping bank areas.

Management of a parcel of Program land includes all Program activities related to that parcel. Examples include restoration, maintenance, research and monitoring, controlling access and coordination with neighbors.

Management Plan is the parcel-specific plan for all Program activities on or related to that parcel of Program land. Management plans are discussed in the *Land Plan,* Section III.

Monitoring is the collection and analysis of repeated observations or measurements over a long period of time to document the status or trend in the items of interest. The Program's monitoring is focused on estimating trends in species and habitat and therefore measures factors that directly relate to the condition/status of the species or its habitat according to protocols in the Integrated Monitoring and Research Plan section of the Adaptive Management Plan that takes place on Program lands and non-Program lands.

Non-Complex Habitats are lands that provide demonstrable benefits to the target species such as sandpits and existing or restorable non-riparian wetlands and wet meadows within 3.5 miles of the centerline of the main channel area, or 2 miles of the banks of a side channel, in the area from Lexington to Chapman, Nebraska.

Noxious Weed Control is the measures necessary to contain and/or eradicate plants identified as noxious weeds by the State of Nebraska, consistent with Nebraska law.

Program is the Platte River Recovery and Implementation Program.

Program Goals. The Program's long-term goal is to improve and maintain the associated habitats. This goal and its components are in the Program Document.

Program or First Increment Objective The Program has long-term and First Increment objectives in the Program Document.

Research is designed to establish cause and effect relationships among variables and management actions by manipulating variables thought to be influential in these relationships in combination with randomization, replication, and experimental controls. Research will generally be short term with most studies lasting on the order of 3 to 5 years. Research projects typically use the latest technology and methods and have specific study objectives.

Restoration is the initial effort after acquisition to alter vegetation or topography of a parcel of Program land to the condition described in the Program's management plan for that parcel of land.

River Channel Area is the portion of the river which conducts flow and is bounded on either side by stable banks or permanent islands with vegetation that obstructs view. At low flows it includes interconnected small channels and exposed sand or gravel bars and non-permanent islands.

Signatory is Colorado, Nebraska, Wyoming or the Department of the Interior (DOI), each of which signs the agreement creating the Program. See Organizational Structure document, Attachment 6, for responsibilities.

Sponsors of Program lands are entities or individuals who dedicate the use of such lands to the Program, but retain ownership of the property rights that allow Program use of the lands. Sponsored lands must be protected by other federal, state or local programs, managed under regulatory oversight as habitat, or protected by non-profit conservation groups or government agencies.

Target Characteristics are those described in the target habitat complex guidelines in Table 1 or the non-complex habitat guidelines in Table 2 of the Land Plan. They are used to evaluate potential acquisitions and plan for restoration and maintenance of Program lands along with other considerations in the manner described in the Land Plan, Section II.B.1 and Section III.B.

Target Species are the interior least tern, whooping crane, piping plover and pallid sturgeon.

Wet Meadows are areas with a generally level or low-lying undulating surface consisting of a mosaic of swales with wetland soils and vegetation and ridges with upland native or restored grasslands.

Wetlands are depressional areas with semi-permanent, permanent or seasonal shallow body(ies) of water (palustrine wetlands) that are typically wet during the whooping crane migration and consist of heavy, depressional soils, such as Fillmore, Massie, Scott, and Marsh soils.

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 4
Appendix F

Map List and Source
December 7, 2005

The following is a list of maps that have been prepared on land use/land cover and general land ownership type in the area prior to a Program.

1998 Land Cover/Use by Bridge Segment in the Central Platte River. Bureau of Reclamation, Platte River EIS Team.

1998 Land Ownership, Central Platte River, Nebraska. Bureau of Reclamation, Platte River EIS Team.

Land Plan

TAB 1

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM EXCERPT
PROGRAMS GOALS AND OBJECTIVES

Platte River Recovery Implementation Program Excerpt –
Programs Goals and Objectives

The following are excerpts from the draft Platte River Recovery Implementation Program dated December 7, 2005, describing the Program's goals and the objectives of the Program's land component.

Section II. (Program Goals)

PROGRAM GOALS

The Program's long-term goal is to improve and maintain the associated habitats. This goal includes: (1) improving and maintaining migrational habitat for whooping cranes, and reproductive habitat for least terns and piping plovers; (2) reducing the likelihood of future listings of other species found in this area; and (3) testing the assumption that managing flow in the central Platte River also improves the pallid sturgeon's lower Platte River habitat.[5]

---

[5] The Integrated Monitoring and Research Plan (Attachment 3, Section V) addresses how the assumption is to be tested, including steps that will be taken to determine habitat needs of the pallid sturgeon.

Section III. (Program Elements), Subsection A. (General Description), 3. (Objectives)

a. Long term Objectives. The long-term objectives for the Program are:

(2) to perpetually protect, restore where appropriate, and maintain approximately 29,000 acres of suitable habitat primarily in habitat complexes in the central Platte River area located between Lexington and Chapman, Nebraska.[6]

b. First Increment Objectives. DOI and the states commit to achieving the following objectives by the end of the First Increment of the Program:

(2) protecting, restoring where appropriate, and maintaining at least 10,000 acres of habitat in the central Platte River area between Lexington and Chapman, Nebraska. The Governance Committee may agree to undertake, fund or give credit for land activities outside this area to provide biological benefits to the target species.

---

[6] Non-complex habitat approved for acquisition by the Governance Committee will count toward the 29,000 acre objective because it will provide demonstrable benefits to target species. The definitions of complex and non-complex habitat may be changed by the Governance Committee but are initially set forth in the Land Plan (Attachment 4).

Land Plan

TAB 2

PLATTE RIVER IMPLEMENTATION PROGRAM EXCERPT
LAND COMPONENT

Platte River Implementation Program Excerpt - Land Component

The following is an excerpt from the draft Platte River Recovery Implementation Program dated December 7, 2005, Section III. (Program Elements) describing the Program's land component.

Section III. D. (Land)

D. Land

The Governance Committee will meet Program objectives for habitat through land interest acquisition, restoration, management, and maintenance. Annual progress will be dependent upon market conditions and availability of willing participants. Habitat acquisition is to be on a willing seller/willing lessor basis. The land component of the Program is described in greater detail in the Land Plan (Attachment 4). The Organizational Structure Document (Attachment 6) and Land Advisory Committee (LAC) Charter (Attachment 6, Appendix F) describe the responsibilities for carrying out the land component of the Program assigned to the Governance Committee, Land Advisory Committee, a Land Interest Holding Entity, cooperators and contractors.

1. Acquisition of Interests in Land

a. Program lands will be selected using the Land Plan (Attachment 4), subject to modification by the Governance Committee as appropriate per Section III.C.1 above. The initial focus will be on obtaining interests in and protecting wet meadow and channel habitat between Lexington and Chapman, Nebraska which are suitable for development into "habitat complexes" as described in the Land Plan, but acquisition of non-complex lands is also expected to occur to the extent permitted in the Land Plan (Attachment 4).

b. Acquisition may be in the form of purchase, lease, easement or other arrangement, as described in the Land Plan. The Governance Committee, with the advice of the Land Advisory Committee, shall determine the type of interest in land appropriate to particular situations, subject to any applicable limitations on ownership of land acquired with federal/state funds.

c. Because local support is essential to the success of the Land Plan, the Land Plan has been developed and will be modified as appropriate to assure that local opinions are heard, that land interest acquisition and development are coordinated with local landowners, and that information on acquisitions and on management plans will be available to all interested parties. Where applicable, the expertise of the University of Nebraska and other local organizations and individuals may be used. The Program will develop incentive programs as needed to encourage participation in the Program.

d. The Program is to avoid shifting tax burdens to adjacent landowners or communities. When land is acquired by the Program and held by the Land Interest Holding Entity or the acquired land is owned by another tax-exempt entity, the Program shall pay or provide for the payment of real property taxes or an equivalent amount. Such taxes or equivalent amount shall be determined each year using the assessments and levies in effect at the time such taxes are due or would be due if the property were owned by a tax paying entity.

e. A legal entity or entities will, on behalf of the Program, hold title or other interests in land acquired by or contributed to the Program as set forth in the Land Plan (Attachment 4). In the case of lands dedicated to the Program on behalf of a state, the entity dedicating such lands may continue to hold title or other interests in those lands, provided that sufficient access is granted to the Program's representatives to permit Program restoration and management of the lands, or the lands are otherwise protected for Program purposes.

2. Restoration and Protection. Restoration and protection of Program lands will be carried out consistent with the Land Plan (Attachment 4), subject to modification by the Governance Committee. Plans for managing each parcel of Program land will be prepared consistent with the Land Plan. Plans are initially expected to include identifying the habitat baseline for the parcel in question, adapting the appropriate recommendations of the Land Plan for the specific characteristics of the land, and developing site-specific monitoring and maintenance requirements. Habitat management practices will be evaluated as part of the Program Adaptive Management Plan.

3. Credit Toward Program Objectives

a. Land protected and managed prior to July 1, 1997 for the benefit of endangered and threatened species by the Platte River Whooping Crane Critical Habitat Maintenance Trust, the National Audubon Society, and the Nature Conservancy within the associated habitats and the Central Nebraska Public Power and Irrigation District (CNPPID) (Jeffrey Island) will be credited to the Program’s long-term objectives if such land meets criteria established by the Governance Committee, but not toward the objectives of the first Program increment without the prior approval of the Governance Committee and the managing entity. Lands acquired by these entities after July 1, 1997 may be contributed to the Program and counted toward First Increment objectives with the approval of the Governance Committee and the managing entity.

b. Land acquired by or on behalf of existing water related activities completing Section 7 consultation of the ESA prior to or during the term of the July 1997 Cooperative Agreement (as described in Section VII of that Agreement), including Nebraska Public Power District’s (NPPD) Cottonwood Ranch Property habitat lands, tern and plover islands and sandpits, lands acquired by Wyoming and any lands acquired in the associated habitats using funds contributed prior to the Program as a result of ESA consultation, will be credited to both the Program’s long-term objective of 29,000 acres and the First Increment objective of 10,000 acres.

Land Plan

TAB 3

PLATTE RIVER IMPLEMENTATION PROGRAM EXCERPT
PROGRAM ADAPTIVE MANAGEMENT

Platte River Implementation Program Excerpt – Program Adaptive Management

The following are the land-related excerpts from the draft Platte River Recovery Implementation Program dated December 7, 2005, Section III (Program Elements) describing aspects of the Program that can only be changed by the Secretary of the Interior and the Governors, and describing how all other aspects of the Program can be changed through Program Adaptive Management.

Section B (Modification of the Program) and Section C (Flexibility and Change During the First Increment Through Program Adaptive Management).

B. Modification of the Program

1. Amendments by the Secretary of the Interior and Governors of Colorado, Nebraska, and Wyoming during the First Increment.

   The following changes to the Program will require unanimous consent of the Secretary of the Interior and the Governors of Colorado, Nebraska and Wyoming, and will require a formal amendment of the Program Agreement and this Program Document:

   a. Change of the First Increment objectives of providing water capable of reducing the shortage to target flows by an average of 130,000 to 150,000 acre feet per year and of protecting, restoring where appropriate, and maintaining 10,000 acres of habitat for the target species;

   b. Change to Section IV of the Program Document regarding regulatory certainty afforded under the Program;

   c. Change to underlying principles of the Program that limit it to acquiring interest in land only from willing participants (Section III.D), that provide that the Program will pay taxes or their equivalent (per Section III.D.1.c), and that define July 1, 1997 as the date for new and existing water-related activities;

   d. Increase of signatories' funding responsibilities under the Program; or

   e. Establishment of a subsequent increment of the Program.

2. Modifications by the Governance Committee. Changes to the Program not reserved to the signatories above may be made by the Governance Committee.

C. Flexibility and Change During the First Increment.

The Governance Committee will administer the Program during the First Increment using a flexible and incremental approach. To further the First Increment objectives, the Program Document and its attachments describe certain activities and criteria such as Milestones, Adaptive Management Plan, Land Plan, and Water Plan, land and water acquisition and management criteria, management actions, and others. These activities and criteria were based on the information available at the time the Program was established. Changes to Program activities and criteria may be justified by new information. This includes: 1) information learned as the result of implementation of the Land, Water, and Adaptive Management Plans; 2) information from other sources including relevant data from non-Program sources on target species and habitats; and, 3) practical considerations such as land availability, economics, budgetary and time constraints, and the ability or inability, notwithstanding good faith efforts of the participants, to achieve predicted outcomes of Program management hypotheses. Accordingly, except as noted in Section III.B.1 above, the Governance Committee may change the Program's First Increment Milestones and other activities and criteria, provided such changes are consistent with accomplishing the First Increment Objectives. These changes may be made and the Program will continue to provide ESA compliance during the First Increment, so long as the First Increment Milestones, as may be amended, are being met.

1. <u>Adaptive Management Plan.</u> The Adaptive Management Plan, set forth in Attachment 3, describes a systematic process administered by the Governance Committee for continually improving Program management by: 1) designing certain Program management activities to test alternative hypotheses and 2) applying information learned from research and monitoring of Program management. The process also includes the flexibility to use information and experience from all sources.

   The Adaptive Management Plan describes experiments that have uncertain outcomes. Changes in adaptive management activities and the Adaptive Management Plan are expected. Achieving particular results through implementation of the Adaptive Management Plan is not the basis for determining ESA compliance during the First Increment.

   The Adaptive Management Plan will be implemented within the existing Program defined contributions of money, land, and water unless amended in accordance with Section III.B.1 above. The Governance Committee recognizes the importance of the Adaptive Management Plan.

   a. <u>Habitat and Species Baseline</u>. The Program uses a 1997 starting point, where possible, to assess its effects. This baseline (Baseline Document for Fulfillment of Platte River Cooperative Agreement Milestone R1-1, (Baseline Document)) provides a summary of information available prior to the Program about the target species and their habitat. Where data are sufficient and methodologies are replicable, this information may be used to assess First Increment activities and criteria. The information available at Program inception did not provide a complete summary of the condition of the species or a comprehensive summary of the habitat available for the target species. Where data were not sufficient or replicable or disagreement exists as to then-current hypotheses regarding the species and their habitats, the Integrated Monitoring and Research Plan (Attachment 3, Section V) includes measures to fill data gaps and assess trends in species and habitat conditions. Historic information, models, and conceptions of the species and their habitat will be rigorously evaluated and modified as data and information become available.

b. Integrated Monitoring and Research Plan and Protocols. Adaptive management requires systematic observation and evaluation of the target species and the associated habitats to observe their response to the different Program activities. The Governance Committee will use the Integrated Monitoring and Research Plan (Attachment 3, Section V) to monitor and evaluate the impacts of the activities implemented in the First Increment of the Program on Program lands and the associated habitats and the response of the target species to those impacts. The monitoring and research protocols may be modified by the Governance Committee per Section III.B.2 above.

2. Assessments of Activities and Criteria During the First Increment. Program activities and criteria that guide such Program activities shall be periodically evaluated by the Governance Committee. The Governance Committee evaluations will: (1) assess whether the Program activity and criteria being examined is working as originally envisioned; (2) recommend modifications justified by new information; (3) determine whether there are other or better uses for the resources committed to this activity and criteria; (4) assess whether success or failure could be determined by monitoring over the time period evaluated and (5) develop alternative activities and criteria in accordance with the Program Adaptive Management Plan. Evaluations will consider experience, new information, and the results of monitoring and/or research. Opinions of independent peer reviewers, if any, will also be compiled and summarized as part of the evaluation process. Changes to planned activities and their implementation schedule should be peer reviewed as appropriate under the Scientific Peer Review Guidelines (Attachment 3, Appendix A) prior to action by the Governance Committee.

3. Target Flows. During the First Increment, the FWS' species and annual pulse target flows serve as an initial reference point for determining periods of excess and shortage in the operation of Program reregulation and water conservation/supply projects. The target flows are subject to Program peer review (during the First Increment or later) and review through the Adaptive Management Plan, and may be modified by FWS accordingly. If those target flows are modified, the Governance Committee will determine whether to revise use of those species and annual pulse target flows as a reference point and whether any such revisions also require revisions in the First Increment Milestones. Any changes to the target flows will not impact the ability of the Program to

continue to provide ESA compliance during the First Increment as long as the Milestones, as found in Attachment 2, or as revised, are being met.

4. Program Peer Review. The Governance Committee may submit any Program activity or criteria, and the FWS's recommended flows for peer review. Such peer review shall be conducted pursuant to the Peer Review Guidelines (Attachment 3, Appendix A).

5. Day-to-Day Flexibility. Documents implementing the Program provide the flexibility for day-to-day management (e.g., decisions related to weed control or grazing on a particular parcel of land). This type of management will typically not require Governance Committee approval unless they implicate a change in Program policy, increase the budget, or impact the ability of the Program to provide the offsetting measures for ESA compliance purposes.

Land Plan

TAB 4

ORGANIZATIONAL STRUCTURE FOR PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM EXCERPT

DRAFT LAND ADVISORY COMMITTEE CHARTER

Organizational Structure for Platte River Recovery Implementation Program Excerpt - Draft Land Advisory Committee Charter

The following Land Advisory Committee Charter is Appendix F of Draft Organizational Structure for the Platte River Recovery Implementation Program (Attachment 6) dated December 7, 2005.

Land Advisory Committee Charter
December 7, 2005

I. PURPOSE

Section VII.A of the Organizational Structure for the Platte River Recovery Implementation Program (Program) calls for the Governance Committee to establish a standing Land Advisory Committee (LAC) to provide advice on Program activities to accomplish the purposes specified in this charter, as it may be amended by the Governance Committee.

Ultimate responsibility for implementing the Program's Land Plan lies with the Governance Committee, including approval of all acquisitions, management plans, budgets and expenditures. A number of activities will be carried out by the LAC to assist in the Land Plan's implementation (as described in Section IV below), generally coordinated or in collaboration with the Program's Executive Director (as described in Section III below). The LAC will also provide meaningful local input into decisions about operations of the land component, including making recommendations to the Governance Committee about how the Program can both be a "good neighbor" and effectively further the purposes of the Program.

II. COMMITTEE STRUCTURE

A. The representation to the LAC is as follows:

1. One (1) representative of the State of Colorado
2. One (1) representative of the State of Nebraska
3. One (1) representative of the State of Wyoming
4. One (1) representative of the U.S. Bureau of Reclamation
5. One (1) representative of the U.S. Fish and Wildlife Service
6. One (1) representative of the environmental Governance Committee representatives.
7. One (1) representative of the Central Nebraska Public Power and Irrigation District and the Nebraska Public Power District (the Districts).
8. Three (3) representatives of local Nebraskans.

B. For the representatives identified in items 1-6 above, Governance Committee representatives will appoint their respective representatives to the LAC and alternates to serve in the representative's absence (e.g., State of Colorado Governance Committee member will appoint Colorado's LAC member and alternate). At any time after the initial representatives are selected, the Governance Committee representatives may appoint replacement representatives or alternates.

C. For the representative identified in item 7 above, both Districts together will choose one representative and alternate, and may subsequently appoint a replacement representative or alternate at any time.

D. For the representatives identified in item 8 above, the three local Nebraska representatives, and alternates to serve in each respective representative's absence, will be selected by the local Natural Resource Districts (NRDs) with one representative and alternate chosen by the Central Platte NRD, one representative and alternate chosen by the Tri-Basin NRD, and one representative and alternate chosen by both NRD's to represent an area not already represented. Local Nebraska representatives will serve three-year terms that rotate so only one member is either renewed or replaced each year. Initial appointments will be for one, two, or three years to insure proper rotation, with the initial terms of appointment to be worked out by the two NRDs. The appropriate NRD or NRDs may appoint a replacement or alternate as needed to complete the term of a local representative or alternate who is unable or unwilling to do so.

E. The LAC shall select a Chairperson, Vice Chairperson, and Recording Secretary during the first meeting following the creation of the committee and each year thereafter.

F. The Program's Executive Director shall maintain an official membership list and record the Chairperson, Vice Chairperson, and Recording Secretary designations.

G. Non-committee members may be requested by the LAC to serve on subgroups, workgroups, etc. However, non-committee members will not be included in final determination of consensus.

III. COORDINATION WITH THE GOVERNANCE COMMITTEE AND EXECUTIVE DIRECTOR

In addition to carrying out assigned tasks, the LAC can raise an issue to the Governance Committee for its consideration and for potential action.

The Governance Committee will assign a Governance Committee representative to sponsor the LAC. This sponsorship will serve to provide the coordination, advice, and input from the LAC to the Governance Committee in an efficient and effective manner.

As described in the Organizational Structure document, the LAC is not supervised or directed by the Program's Executive Director, nor does the LAC supervise or give direction to the Executive Director. As a practical matter, the two entities must closely cooperate and coordinate their activities because the Program's Executive Director will implement many aspects of the Land Plan that the LAC is to review to offer comments and advice. In carrying out its responsibilities, the LAC may work with the Executive Director as follows:

A. The LAC may request the Executive Director to arrange facilities, maintain documentation of LAC meetings and agendas, and provide other administrative assistance.

B. The LAC may work directly with the Executive Director to provide advice on land evaluations or draft plans or budgets early in the development process, to assure meaningful and timely opportunities for the Executive Director to make adjustments. This cooperation is in addition to the LAC's recommendations and/or comments to the Governance Committee at a later stage.

C. Because the Executive Director also provides administrative support to the Governance Committee, when the LAC prepares advice, recommendations and comments for the Governance Committee, the LAC will work with the Executive Director on meeting the Governance Committee's schedule, coordinating with other committees, scheduling time on the agenda, arranging for distribution of materials, etc.

D. The LAC may request the Executive Director to facilitate the development of consensus.

E. The LAC may request Program staff assistance for specific tasks from the Executive Director, who may provide such assistance or refer the request to the Governance Committee.

F. When the Governance Committee assigns a task to the LAC, the LAC should anticipate that the Executive Director will provide information about the task and schedule to the LAC. This may include providing LAC assistance in a task assigned to the Executive Director.

IV. COMMITTEE RESPONSIBILITIES

Specific LAC functions and responsibilities are:

A. Working through the Executive Director using the evaluation process and Worksheet in the Land Plan, evaluating potential acquisitions and providing recommendations and advice to the Governance Committee regarding whether to pursue an acquisition;

B. If approached by landowners regarding a potential acquisition, passing the information on to the Executive Director for evaluation, and, if requested by the Executive Director, working with the Executive Director in any further discussions with the landowner;

C. If requested by the Governance Committee and/or Executive Director, working with the Executive Director in approaching a landowner and/or assisting in negotiating a potential acquisition the Governance Committee has decided to pursue;

D. Reviewing negotiated potential acquisitions and recommending acquisition actions to the Governance Committee for approval;

E. Reviewing and providing advice to the Executive Director during the Executive Director's development of parcel-specific land management plans and identification of monitoring, research and data collection needs related to those parcels of land;

F. Providing comments and/or recommendations to the Governance Committee regarding adoption of each parcel-specific management plan, including management plans provided by Program sponsors;

G. If requested by the Governance Committee, providing advice to the Executive Director regarding any issues arising during implementation of the Program's land management plans;

H. Reviewing and providing comments and/or recommendations on periodic progress and status reports by land management contractors or Sponsors for consideration by the Governance Committee along with the progress and status reports;

I. Reviewing the results of management and monitoring of Program lands, peer review and other activities related to the Land Plan, and, if warranted, providing comments and/or recommendations (potentially in coordination with the Technical Advisory Committee, U.S. Fish and Wildlife Service, or other committees as appropriate) regarding Governance Committee revisions to management plans consistent with the Adaptive Management Plan;

J. Providing advice to the Executive Director in the development of budgets for Land Plan activities, and subsequently providing comments and/or recommendations to the Governance Committee regarding the adoption of proposed land-related budgets;

K. Reviewing and providing comments to the Executive Director and/or the Governance Committee on the Executive Director's records and status reports regarding land-related Program milestones;

L. Participating in Program outreach efforts to neighbors, stakeholders and the community regarding the Program's plans and practices on Program lands;

M. Providing an opportunity for local input and questions as recommendations are being formulated, as approved plans are implemented, or as local concerns arise, and raising issues to the Governance Committee as appropriate;

N. If the Program is terminated in a way that the Governance Committee and LAC remain active, monitoring implementation of Governance Committee approved "exit" activities if requested to do so by the Governance Committee.

V. COMMITTEE PROCEDURES

A. The LAC will meet as needed to accomplish the responsibilities outlined in Section IV of this charter and the Program.

B. LAC meetings will be open to the public except when discussing confidential matters, as the LAC deems necessary. Meetings attended by interested members of the public will include an open comment period.

C. Agendas, meeting minutes, reports, and other information will be furnished to LAC members prior to scheduled meetings and to participating nonmembers and the public upon request. Agendas, meeting minutes, reports, and other information related to confidential land acquisition or personnel or contract matters will be made available to only LAC representatives and their designated alternates.

D. A quorum shall be required for the LAC to conduct business. A quorum shall be present if the meeting is attended by the representatives of each of the three states, a representative of the U.S. Fish and Wildlife Service, and by three other members or alternates, at least one of which shall be a local Nebraska representative.

E. The decisions of the committee, including those regarding recommendations to the Governance Committee, must be by consensus during a meeting in which a quorum is present. Any issue that cannot be resolved with consensus agreement shall be elevated to the Governance Committee. The LAC will present all viewpoints on such unresolved issues to the Governance Committee without identifying majority or minority views.

F. The LAC may elect to use subcommittees to carry out some of its tasks under the Land Plan.

G. LAC may rotate the location of meetings among the three states and may use teleconferencing or other alternatives to attending meetings.

H. Local Nebraska representatives to the LAC who do not have a duty to participate in LAC activities as part of their employment or under a contract with an NRD may request reimbursement of actual expenses and per diem associated with attending LAC meetings or other activities as directed by the LAC or Governance Committee. The Finance Committee will develop the procedure for payment of reimbursement requests.

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM

ATTACHMENT 5

WATER PLAN

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 5

Water Plan

October 24, 2006

The Program Water Plan consists of the following Sections:

1. Program Water Management Process
2. Channel Capacity of the North Platte River Upstream of Highway 83
3. Colorado’s Initial Water Project (Tamarack I)
4. Wyoming’s Pathfinder Modification Project
5. An Environmental Account for Storage Reservoirs on the Platte River System in Nebraska
6. Reconnaissance-Level Water Action Plan
7. Depletions Plan, Platte River Basin, Wyoming
8. Nebraska New Depletion Plan
9. Colorado’s Plan for Future Depletions
10. Federal Depletions Plan for the Platte River Recovery Implementation Program
11. Water Plan Reference Materials

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 5
Section 1

Program Water Management Process

August 8, 2006

Described below is the Program's water management process and the relationship of the FWS's Environmental Account (EA) Manager and the Program to that process. The relationship is also shown in Figure 1 of the Organizational Structure Document (Attachment 6).

1. Background

a. Water projects throughout the Platte River basin are operated by various entities in accordance with each state's water laws. The responsibility for accounting**,** tracking, regulating, and protecting water rests with each state's water administration.

b. Pursuant to FERC relicensing requirements, an Environmental Account (EA) was established in Lake McConaughy. A contract between Central Nebraska Public Power and Irrigation District (CNPPID) and the FWS authorized the FWS's representative, the EA Manager, to request releases of EA water pursuant to the terms of the contract. The EA Manager is an employee of the FWS and has the responsibility to manage, request releases from, and coordinate operations of the EA. The EA Manager also develops the EA Annual Operating Plan (AOP), including the demands for the EA water.

c. Pursuant to FERC relicensing requirements, the document entitled, *An Environmental Account for Storage Reservoirs on the Platte River System in Nebraska* (Attachment 5, Section 5) establishes an Environmental Account Committee (EAC) and Reservoir Coordinating Committee (RCC). The EAC is chaired by the EA Manager and provides guidance/input to the EA Manager for the development of the EA AOP. The RCC provides a forum to coordinate the annual operating plans of other projects and to discuss projected water supply conditions in the basin. The RCC is for coordination purposes only.

d. The EA Manager, EAC, and RCC, created to meet FERC relicensing requirements, will continue to exist with or without the Program.

e. Relative to Program water management, Project Sponsors include the states in their tracking, accounting, regulating, and protecting Program water; the federal government and the states in the management of their respective depletions plans; CNPPID for the EA in Lake McConaughy; the State of Colorado for Tamarack I; and the State of Wyoming for the Pathfinder Modification Project. In addition, the Program Water Plan provides opportunity for parties outside the Program to enter into cooperative arrangements with the Signatories for meeting Program water goals.

2. Program Water Operation Process. The following proposed Program water operation process builds on the existing structure that is in place for the Lake McConaughy EA and integrates that structure into the Program.

a. The role of the FWS's EA Manager as the Lake McConaughy EA operator will be expanded. The EA Manager will prepare an annual AOP for the Program water (Program AOP) in the manner described below. The right to request water from individual projects may be accomplished through contracts, letter agreements, or whatever means is acceptable to the Project Sponsor, EA Manager, and Governance Committee. Project Sponsors retain the authority, unless delegated to the Governance Committee or EA Manager, to develop and implement individual operating plans for Program water, provided such operations are consistent with applicable state laws, compacts, decrees, and the Program first increment water objectives.

b. The responsibility for accounting, tracking, regulating, and protecting Program water rests with each state's water administration. Any changes in state laws or procedures relating to the accounting, tracking, regulating, and protecting water will be reported to the Governance Committee.

c. In October, the Project Sponsors will report to the EA Manager on the status of the water supply conditions projected in their respective written AOP's. The projected water supply conditions will initially be based on average inflow conditions.

d. The EA Manager, in consultation with the Executive Director, will use the information provided by the Project Sponsors, EAC, and RCC to develop a draft Program AOP. The Program AOP will match the projected water supply conditions to the EA Manager's stated goals and priorities.

e. In November, the EA Manager and the Executive Director will meet with the Project Sponsors, EAC, and RCC to discuss and receive input on the draft Program AOP. After consideration of the information received, the EA Manager will make any appropriate revisions in the Program AOP and distribute it to the Executive Director and the Project Sponsors. The Program AOP will include a description of the goals and purposes for which releases of Program water will be requested by the EA Manager.

f. The Executive Director will report to the Governance Committee on the status of the Program AOP. If needed, the Governance Committee will seek additional review/guidance on the Program AOP from the Water and Technical Advisory Committees. The Governance Committee or its individual members may recommend changes to the Program AOP.

g. At least once a month, the Project Sponsors may update their projected water supplies conditions and include the estimated snowmelt run off and actual inflow/demand data.

h. The EA Manager may use the updated water supply information provided by the Project Sponsors to update the Program AOP at least once a month.

i. The Executive Director will report monthly to the Governance Committee on the status of the Program AOP. If needed, the Governance Committee will seek additional review/guidance on the updated Program AOP from the Water and Technical Advisory Committees. The Governance Committee or its individual members may recommend changes to the Program AOP at any time.

j. The EA Manager will request the release of Program water in accordance with the Program AOP and the contracts and agreements with the Program Sponsors. However, it is understood that the EA Manager will need to react and adapt to the actual hydrologic events that may impact the planned deliveries to the habitat. To the extent possible, the EA Manager will keep the Executive Director informed of the day-to-day operations for the Program water.

k. At the end of each water year, the EA Manager will prepare a report comparing the actual Program water operations during the water year with the operations outlined in the Program AOP, identifying and explaining any differences in actual operations from the operations proposed in the previous year's Program AOP, and providing other information requested by the Governance Committee. The year-end report will also describe whether the EA releases met the goals and purposes for which the water was used. This year-end report and any Governance Committee comments on that report will be used by the EA Manager as input to the subsequent year's Program AOP.

3. Program Water Operations for Enhancing Peak, or Pulse, or Other Flows by Reregulating Water in the CNPPID and/or NPPD Systems and Intentionally Bypassing Program EA Water

a. Consistent with Program section II.E.1.b, the EA Manager may request CNPPID and/or the Nebraska Public Power District (NPPD) to reregulate flows in their respective systems, downstream of Lake McConaughy, and in conjunction with such reregulation may also request the Districts intentionally to bypass EA water. EA Bypass Flows are created when CNPPID or NPPD (Districts), at the request of the EA Manager, waives the discretion provided by their licenses and the Environmental Account Document (Attachment 5, Section 5) to divert Environmental Account (EA) water that could have been routed through their systems, and instead routes the EA water via the North Platte and/or Platte River. The reregulation of water in District facilities with or without intentional EA bypass will only be requested to enhance peak, pulse or other short-duration high flows.

The EA Manager will consider the following factors when determining whether reregulation with or without intentional EA bypass is necessary, and in developing the annual plan for such operations:

(1) Feasibility/likelihood of generating satisfactory flows without reregulation and intentional EA bypass.

To the extent that a short-duration high flow or other flows of the desired magnitude and duration can be achieved without reregulation and intentional bypass, or with reregulation but without making an intentional EA bypass, reregulation and bypass may not be needed or requested. This is most likely to occur under wetter-than-normal basin conditions when CNPPID is already making full or nearly-full diversions at the CNPPID Supply Canal headgate.

(2) Anticipated benefits

In cases where reregulation with intentional bypass of EA water would not be expected to provide improvements in the magnitude and duration of the high flows or other flows, nor contribute to the effectiveness of achieving other habitat objectives such as channel sediment mobilization, the FWS is unlikely to call for an intentional bypass or reregulation.

(3) Magnitude, duration, and effectiveness of peak flow events occurring over the previous 12 months.

If a pulse flow of unusually high magnitude (*e.g.*, approaching or exceeding 8,000 cfs) occurred across the habitat reach over the previous year, and these flows were effective at scouring in-channel vegetation, reworking sediment, improving habitat for the target species, or achieving similar Program management objectives, the FWS may determine that it is a low priority to use EA water to generate a short-duration high flow in the current year, and thus may not request a bypass or reregulation for pulse flow purposes.

(4) Other circumstances

Additional considerations may be important. For example, a reregulation and EA bypass request may be needed to test the effectiveness of alternative flow routing strategies, particularly during earlier, experimental EA releases.

b. In the event that the EA Manager calls for reregulation with or without intentional EA bypasses to enhance peak, pulse or other short-duration high flows, the Districts will not unreasonably decline to provide the requested reregulation and intentional EA bypass flows. Reasonable causes for declining to provide requested reregulation with or without intentional bypass include prior nonpayment by the Program under paragraphs c.(1) and (2) below, the Program not providing EA water for system refill per subparagraph c.(3) below, and disagreement by the State of Nebraska's Department of Natural Resources with water accounting to implement subparagraph c.(3) below to avoid impacts on either Districts' water supply. Regulation and intentional bypass will be available as follows:

(1) To assist in creating or enhancing peak, pulse or short duration high flows below the J-2 Return, at the Environmental Account (EA) Manager's request CNPPID will regulate up to 12,000 acre-feet annually of water diverted at CNPPID's diversion dam under CNPPID's power use appropriations, and retime the return of that water to coincide with releases made from the EA in Lake McConaughy. The amount of regulation available may be limited by CNPPID to less than 12,000 acre-feet in some years or some times of the year depending on anticipated impacts on project facilities, anticipated impacts on others (e.g., downstream flooding, damage to other river facilities), conflicting operational or licensing requirements such as implementation of the Flow Attenuation Plan, and compliance with other agreements. (The initial test will be 4,000 acre-feet in February, March, or April after which, and prior to planning for the subsequent

water year, CNPPID will determine based on physical and operational impacts if regulation beyond 4,000 acre-feet will be available to the Program).

(2) In planning for flow enhancement and requesting regulation and bypass, the EA Manager will seek to limit the EA water intentionally bypassed at CNPPID's diversion dam to the minimum amount necessary to achieve the intended flow magnitude and duration downstream of the J-2 return and will rely to the extent feasible on the regulation of flow in CNPPID's system to enhance flows. Planning and requests for regulation and bypass will also include reasonable ramping rates to attempt to avoid damage to CNPPID's system. Throughout the peak, pulse or other short duration high flow event being enhanced, CNPPID will continue to release water as necessary to meet or exceed the minimum flow requirements at its diversion dam called for in section III of the EA document, in accordance with the compliance measures in section III.G which measure flows for compliance purposes excluding EA releases. .

(3) To assist in creating or enhancing peak, pulse or short duration high flows, NPPD will coordinate the operations of the Sutherland Project with the EA Manager and CNPPID, and, if requested, will intentionally bypass EA water and/or reregulate EA water or other water in its system to the extent feasible without impacting NPPD's ability to meet other downstream demands and to operate the system in a manner that is consistent with safe business operations.

c. When reregulation is provided with or without intentional EA bypass, the Program will provide payment to the Districts in an amount equivalent to resultant lost power production, increased power acquisition costs and other associated costs, and will provide water from the EA as needed to refill the Districts' systems ("borrow and payback"). The EA Manager will not call for reregulation with or without intentional EA bypass resulting in total payments that exceed $ 3,081,000 for the following activities during the first increment of the Program, unless approved by the GC.

(1) Lost power production and increased power acquisition costs include:

a. Power generation forgone by CNPPID, valued at rates consistent with CNPPID's then-applicable power sales agreement(s);

b. For so long as CNPPID sells the power it produces at its canal hydropower facilities to NPPD, the net additional cost, if any, to NPPD of obtaining replacement power for the generation foregone by CNPPID. The cost of the increase in power, if any, would be based on the delivered market price of power at the time of by-pass as compared to the contract price from CNPPID;

c. If CNPPID sells the power it produces at its canal hydros to another party, the net additional cost, if any, to the other party of obtaining replacement power for the generation foregone by CNPPID; and

d. The net increase in cost to NPPD, if any, from replacing power foregone by NPPD facilities during times of EA by-pass. The cost of the replacement power, if any, would be based on the delivered market price of power.

(2) Other associated costs to be paid for by the Program beyond direct lost power production and increased power acquisition costs may occur if equipment or facilities are operated outside the normal range to accommodate reregulation and/or EA bypass. They may include bank sloughing in canals and reservoirs,

wind and wave erosion in Johnson Lake, additional lost hydro generation due to lower head, costs of avoiding recreational impacts, and, with discharges above the normal full canal flow, turbine cavitation damage, tailrace damage, and damage to other components.

(3) Upon completion of activities to aid the creation or enhancement of peak, pulse or short-duration high flows, sufficient water will be released from the EA to refill the supply canal/reservoir systems to levels existing prior to the initiation of reregulation and/or bypass activities, and to avoid refilling using the Districts' storage water. Replacement water, including any EA water which is part of the replacement water, will be available for use by the affected District or Districts for power and/or irrigation. Timely replacement of water (as determined by the affected District or Districts) will be arranged between the affected District or Districts and the EA Manager.

(4) Similar to the Program's good neighbor policy regarding addressing adverse impacts of the land component of the Program, the Program will address damages to third parties impacted by regulation in the Districts' systems and/or intentional EA bypass, such as fisheries, concessionaires, cabin owner's docks, boats, and shore stations, sand dams, private river facilities and equipment, without regard to any liability limitations that the Districts may otherwise have in place under other agreements. The Program shall, prior to implementing operations under this agreement in any water year, take appropriate measures to have in place a liability insurance policy naming the Districts as co-insured to cover at least $1 million in documented claims resulting from reregulation and/or EA bypass activities or shall provide other means of addressing third party impacts that hold the Districts harmless and are acceptable to the Districts. Payments of damages to third parties and cost of the insurance policy or alternatives will be counted toward the $3.081 million budgeted for reregulation and intentional EA bypass.

d. The GC will be kept informed of plans for reregulation with or without intentional EA bypass and estimated costs, and will be provided the opportunity for comment through the annual Program AOP process described in section 2 above as follows:

(1) As part of the development of the Program AOP described in Attachment 5, Section 1, Subsection 2, the Districts will work cooperatively with the FWS to explore potential water routing and delivery strategies. The EA Manager will annually document the intent to implement reregulation with or without intentional EA bypasss in the draft Program AOP, including the estimated amount of EA water to be intentionally bypassed, the Districts facilities/diversion to be used for reregulation or to be bypassed, and flow conditions anticipated when bypasses would be requested.

(2) The Districts will independently provide estimates of their respective lost power production and increased power acquisition costs and any other anticipated costs associated with the proposed reregulation with or without EA bypass within 30 days of receipt of the draft Program AOP for use by the EA Manager in preparation of any revision to the Program AOP.

(3) When reporting to the GC on the status of the revised Program AOP per Attachment 5, Section 1, Subsection 2.f, the Executive Director will particularly note any costs associated with reregulation and/or bypass flows. The GC may

seek additional review/guidance or recommend changes relating to reregulation and bypass flows.

(4) Based on updated water supply estimates provided per Attachment 5, Section 1, Subsection 2.g, the reregulation and bypass cost estimates from the Districts and/or other information, the EA Manager may amend the draft Program AOP proposed reregulation or EA bypasses. The EA Manager and Executive Director will include any such amendment in the monthly status report on implementation of the Program AOP required in Attachment 5, Section 1, Subsection 2.i..

(5) Prior to December 31 each year, each District will separately invoice the Program's Executive Director with a copy to the EA Manager based on the cost factors in paragraph 3.c above together with suitable documentation of the basis for the amount billed. The amount of EA water by-passing the District's diversion dams will be determined based on the Nebraska Department of Natural Resources water accounting program.

(6) Prior to 60 days following receipt of the invoices from the Districts, the Executive Director, in consultation with the EA Manager, will review and provide payment through the financial management entity for the bills from the Program budget item specifically established for this purpose.

(7) In the event that the Program disagrees with the amount of any invoice, it shall nonetheless pay the full amount of the disputed invoice and shall advise the District in question, within 30 days of the receipt of the invoice, of the amount in dispute together with its reasons in writing for disputing that portion of the bill. Such payment shall be placed in escrow pending resolution of the dispute. In the event the parties are unable to agree upon a resolution of the dispute within 60 days of the date of the invoice (or such later date as the parties may mutually agree), the dispute shall be submitted to an arbitration under the rules and procedures of the American Arbitration Association.

e. After the start of Program implementation, a formal agreement will be entered into between the Program and CNPPID and NPPD that will implement the provisions outlined in this Attachment 5, Section 1, Subsection 3. There will be no reregulation or EA bypass under the Program until such agreement is in effect.

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 5
Section 2

Channel Capacity of the North Platte River Upstream of Highway 83

December 7, 2005

I. Purpose

The purpose of this section of the Water Plan is to describe the capital investment and maintenance measures addressed in Section III.E.2.d.iii of the Program Document.

II. Description

The descriptions of the capital investment and maintenance measures are provided in Exhibit A to this attachment. Exhibit A consists of the report entitled "North Platte Channel Capacity Study," prepared by J.F. Sato and Associates, Inc, absent the appendices. This report was prepared for the Water Management Committee during the term of the Cooperative Agreement. The Governance Committee, based on input from the Water Management Committee, concluded the Base Case, Alternative 1 and Alternative 2, outlined in the report should be implemented to increase the capacity of the channel of the North Platte River upstream of Highway 83 to 3,000 cubic feet per second (cfs). The report refers to the Base Case, Alternative 1 and Alternative 2 as short-term solutions as J.F. Sato and Associates, Inc. proposed additional studies to identify long-term solutions. The Governance Committee did not approve the proposal for additional studies.

III. Schedule

It is the intent of the Governance Committee to complete the Base Case, Alternative 1 and Alternative 2, described in Exhibit A, as one project in accordance with the following preliminary schedule:

	Tasks	Completion Date
1.	Permitting (federal, state, local)	October 1, 2007
2.	Final design; acquisition of easements; preparation of bid packages, as needed.	July 1, 2008
3.	Solicit and review bids. Prepare contracts. Issue the construction notice to proceed.	October 1, 2008
4.	Completion of the project.	October 1, 2009

It is understood that the proposed project must undergo a review under the National Environmental Policy Act (NEPA) in order to secure the necessary federal permits. The NEPA review could alter the configuration of some of the components of the project and impact the above preliminary schedule. However, it is the intent of the Governance Committee to complete as much of the project as possible by October 1, 2009. It may be necessary to phase the work to ensure as much work as possible can be completed by this date.

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 5
Section 2
Exhibit A

Final Report
North Platte Channel Capacity Study
For the
Water Management Committee
North Platte Cooperative Agreement

J. F. SATO AND ASSOCIATES
Engineering, Environmental,
and Program Management Services
5898 South Rapp Street • Littleton, CO 80120
Phone 303.797.1200 • Fax 303.797.1187
www.jfsato.com

Final Report
North Platte Channel Capacity Study
For the
Water Management Committee
North Platte Cooperative Agreement

December 1, 2005

Prepared by

J.F. Sato and Associates, Inc.
5898 South Rapp Street
Littleton, Colorado 80120
(303) 797-1200
Contact: Steve Lowry

J. F. SATO AND ASSOCIATES
Engineering, Environmental,
and Program Management Services
5898 South Rapp Street • Littleton, CO 80120
Phone 303.797.1200 • Fax 303.797.1187
www.jfsato.com

North Platte Channel Study
Final Report

Table of Contents

JFS&A
J. F. SATO AND ASSOCIATES
Engineering, Environmental,
and Program Management Services
5898 South Rapp Street • Littleton, CO 80120
Phone 303.797.1200 • Fax 303.797.1187
www.jfsato.com

North Platte Channel Capacity Study –Final Report

Purpose: This Final Report is submitted in accordance with Section 3.6 of the Scope of Services in the contract between J.F. Sato and Associates (JFSA) and the Nebraska Community Foundation. Based on the Preliminary Review Technical Memo dated August 31 that was first presented to the Water Management Committee (WMC) on September 7, 2005, and then to the Governance Committee (GC) on September 12, 2005, JFSA was directed to consider the following three alternatives for conceptual design:

- Base Case: construction of channels to intercept and drain the area near Washboard Road
- Alternative 1: Includes the Base Case, plus two additional channels for additional drainage
- Alternative 2: Includes Alternative 1, plus removes a sand bar in one of the critical upper channels

Background: The objective of this study is to investigate methods to increase and maintain a channel capacity in the North Platte River at North Platte, Nebraska of 3,000 cubic feet per second (cfs). In July 2001 flows of this magnitude caused nuisance flooding of properties approximately 1,500 feet upstream of Highway 83 (Hwy 83). In July 2002 more serious flooding occurred in several homes, hay meadows, and parts of both Washboard Road and North River Road. The National Weather Service (NWS) visited the site in response to concerns from local residents. Based on daily stream gauge and water level measurements and the corresponding degree of flooding, the NWS issued a letter on September 9, 2002, that lowered the flood stage from El 6.0 to El 5.7. The stream gauge is located just downstream of Hwy 83. This stage equated to a flow of about 1,980 cfs, less than the desired amount. This water level impacts the Platte River Recovery Implementation Program's (Program) ability to pass Environmental Account (EA) water and the Central Nebraska Public Power and Irrigation District's (Central) ability to pass flows needed for irrigation demands without exceeding the flood stage.

The activities leading up to this final report are listed on the timeline in Table 1.

Engineering, Environmental,
and Program Management Services
5898 South Rapp Street • Littleton, CO 80120
Phone 303.797.1200 • Fax 303.797.1187
www.jfsato.com

Table 1. Timeline of Activities.

Date	Activity
May 23 2005	RFP Issued
June 15 2005	Proposals Received
July 5 2005	Contract Award
July 6-7 2005	Field Visit
July 13 2005	Scoping Session, Cheyenne
July 25-27	Additional data collection
August 1 2005	Initial Technical Memorandum
August 31 2005	Preliminary Results Technical Memorandum
September 7 2005	Teleconference with the Water Management Committee
September 12 2005	Presentation to the Governance Committee in Denver
November 1 2005	Draft Final Report
December 1 2005	Final Report

Further background information can be found in the Technical Memoranda included as appendices.

Problem Identification and Solutions: In our earlier reports we described the flooding problem as having two parts - the "local" and the "big-picture" parts. The local problem is the flooding upstream of Hwy 83 in the area south of North River Road. The big-picture problem is the change over time in the conveyance in the reach extending from Central's Main Supply Canal diversion to several miles upstream of Hwy 83. The alternatives selected for conceptual design provide a solution to the local problem. The solution will be effective as long as the main channel capacity in the reach near the Hwy 83 bridge continues to maintain the ability to convey 3000 cfs without causing direct flooding of the impacted area. Many factors impact the longevity of the solution. These include continued invasive vegetation growth in the main channels, continued deposition of sediments, and floods that may temporarily restore part of the channel capacity.

As part of our initial investigation, we had looked at a Base Case and seven alternatives as described below:

Base Case. The following elements are included:

1. Open State Channel
2. Extend State Channel north to existing ponds/North River Road
3. Construct road ditch along west side of Washboard Road
4. Open southern channel from road ditch to abandoned detour road
5. Remove abandoned detour road and construct ditch to main channel of the North Platte
6. Remove phragmites along opened drainages

Alternative 1. The following additional elements are **added** to the Base Case:

1. Improve and open the channel to connect existing culverts in Washboard Road to the existing concrete box culvert under Hwy 83.

2. Improve conveyance through the ponds to the main channel and provide overflow structure.

Alternative 2. The following additional element is **added** to Alternative 1:

1. Remove sand bar that is blocking the northern channel about 1,500 feet above Hwy 83 and improve the channel downstream of this point.

Alternative 3. Construct dikes to protect properties.

Alternative 4. Purchase or remove properties.

Alternative 5. Dredge channel through the reach and place berms.

Alternative 6. Revise diversion operation.

Alternative 7. Interconnect NPPD's Sutherland Canal and Central's Main Supply Canal (aka Tri-County Canal).

Section 3.3 of the contract scope requested JFSA to look at several factors in evaluating alternatives. These are:

- An opinion of capital cost
- An estimate of annual O&M costs
- A description of logistics, including permitting
- Comments on the potential for channel aggradation
- Channel capacity expected
- Probability of success

This information was summarized in a decision matrix to decide on the scenarios to be carried into conceptual design. The three highest ranking scenarios, in order, were Alternative 2, Alternative 1, and the Base Case.

Cost Estimates: The cost estimates have been reviewed and updated as part of this phase. The updated cost estimates are included in Appendix A. Quantities were developed from the drawings. Unit prices were estimated from construction cost guides, such as R.S. Means, as well as input from local contractors. Standard unit prices were increased to allow for small work areas and access. Land values were estimated from records of the County Assessor's office and increased about 20 percent. Phragmite's removal costs were estimated from literature sources. At this level of study a contingency of 25 percent is standard practice. Engineering costs at 15 percent include surveying, final design, plans and specifications, and limited construction administration. Legal and administrative costs are included to cover city, county, and project sponsor costs. Permitting costs and costs for an Environmental Assessment (EA) are our estimates after we discussed the scope with the United States Army Corps of Engineers (USACE) in Kearney, NE. Wetlands may be present in all locations. The costs for wetland delineation include field time, preparation of exhibits and coordination with regulators. The costs noted for the EA for each alternative are inclusive, for example the EA cost for Alternative 2 includes the costs of the EA for Alternative 1 and the Base Case.

J. F. SATO AND ASSOCIATES
Engineering, Environmental,
and Program Management Services
5898 South Rapp Street • Littleton, CO 80120
Phone 303.797.1200 • Fax 303.797.1187
www.jfsato.com

Easements: The proposed work is on both public and private property. Where work extends outside of the public right-of-way, additional easements would be needed. We have indicated on the drawings the proposed easements. Temporary easements would be needed during construction. Permanent easements would be needed where maintenance is required. Temporary easements were taken as 3 percent of the land value; permanent easements were taken as 10 percent of the land value. Because the work generally occurs in the undeveloped portion of private parcels, the land value was reduced 50 percent when calculating easement costs.

Permitting: An overview of permit requirements follows.

Federal**.** The US Army Corps of Engineers (USACE) will require Section 404 permitting for all work accomplished in wetlands and other waters of the United States, such as the North Platte River. The permitting process will begin with accurate delineation of jurisdictional wetlands within the project area. The USACE office in Kearney, Nebraska, will verify these delineations and provide guidance on permit application. Initial discussion with the USACE concerning this project has resulted in their opinion that an Individual Section 404 Permit will be required. This permit type would require a diversity of data collection, including threatened and endangered species (T&E) clearances, wetland delineation, and cultural resource clearances. Other federal agencies, such as the US Fish and Wildlife Services, would be involved. A public comment period is involved. The timeframe for preparing and processing this type of permit is no less than three months.

Mr. Dwight Tillotson of the Kearney office of the USACE has indicated that an Environmental Assessment will be needed as part of the decision making process for the 404 permit. The applicant normally assists in the preparation and analysis of alternatives for a project of this complexity.

Any alternative that would permanently impact the jurisdictional floodplain would also require the submittal of a Conditional Letter of Map Revision (CLOMR) to Federal Emergency Management Agency (FEMA) in accordance with the National Flood Insurance Program. Currently, there is an update (Flood Hazard Mitigation Study (FHMS)) to the floodplain boundaries being prepared by the City of North Platte. The scenario studies in the Conceptual Design are not expected to require a CLOMR because they have not significantly changed the cross section of the main channels.

State. At this point, no state permits have been identified. The North Platte Game Refuge is located in the project area. The Refuge area is off limits to hunting. The boundaries are based on the delineated riverbank, but none of the proposed work is expected to impact the riverbank delineation. The limits of the Refuge are shown on the drawings.

Local. Because Washboard Road is a county road, a county road permit is anticipated. Haul permits may be needed if large amounts of material are moved on public roads. The City regulates the floodplain in this area. Any construction in the floodplain would require a Floodplain Development Permit. Obtaining a permit requires performing studies similar to the studies needed for a CLOMR, as noted above.

Description of Alternatives. A description of each scenario follows. Drawings are provided in Appendix A.

Scenario: Base Case

Description: The Base Case is a short-term solution that represents the minimum work required to reduce the flooding of properties and allow passage of 3,000 cfs through the Hwy 83 Bridge. The following features are included and shown on the drawings in Appendix A:

Open the State Channel. The State Channel is approximately 2,360 feet long and was built in the late 1960s as part of the Hwy 83 bridge reconstruction project. The purpose of the channel was to drain water from the upper floodplain, or , to keep the bridge construction area dry. After the bridge construction, this channel was allowed to fill in with vegetation and sediment. Vegetation consists of trees, grasses, and phragmites. Opening this channel would intercept flows in the overbank and convey them to the main channel. The proposed work would clear and grub the channel and excavate about 1.5 feet from the channel bottom. The channel width would be restored to 20 feet. To ensure that flows reach this channel, the natural channel (North Channel) to which it connects would also be cleared of vegetation and regraded at a width of 80 feet for a distance of about 800 feet.

Extend the State Channel. To intercept water that flows near the North River Road, a new channel with a 20-foot base width would be extended to the North River Road. To minimize excavation and disruption, the existing ponds would be incorporated.

Construct Road Ditch along Washboard Road. Any flow that passes around or under the State Channel will continue to Washboard Road. A road ditch approximately 1,150 feet long with a bottom width of 8 feet would be constructed along the west side of Washboard Road to convey flows south to the South Channel, a natural channel. Culverts with headwalls would be installed under the existing drives. The ditch would be re-vegetated and the landscaping restored. The bottom of the ditch would be lined with 2-inch rock to reduce erosion and facilitate maintenance.

Open South Channel. At the end of the proposed road ditch along Washboard Road, the flows would enter an existing channel (South Channel) that used to convey significant flows before being blocked with vegetation and sediment. The Base Case would open about 800 feet of channel by removing vegetation and regrading the invert. The end of this channel would connect to the next ditch that is proposed.

Remove Abandoned Road, Construct Ditch. The 24-foot wide asphalt road constructed as part of the detour for the Hwy 83 bridge construction was never totally removed. A section about 800 feet long remains in place. The road embankment interferes with flow in the floodplain. The Base Case would remove the road and construct a ditch that connects the South Channel to the main channel of the river. Where the South Channel meets the proposed ditch, an existing temporary culvert would be removed and the earthwork reshaped to provide smooth flow. A private duck blind has been constructed next to the road and would have to be relocated.

Removal of *Phragmites australis* (common reed). Besides the clearing and grubbing work in the channels that would mechanically remove *Phragmites australis*, the Base Case proposes to use chemical methods to kill *Phragmites* for at least 50 feet on each side of the reopened channels. Part of this treatment is proposed to be done with aerial methods using the glyphosate compound Rodeo®. In areas where adjacent vegetation may be damaged by drift, the use of backpack sprayers is proposed. One application of chemical at the correct time of year has been reported to be effective in killing the standing growth. Subsequent annual applications are needed to keep the plant from returning.

Capital Cost: Estimated quantities and unit prices were developed for the work as described above. The opinion of cost is attached. The estimated cost is $398,610. The estimated cost for the EA has been shown separately.

O&M Cost: Annual costs will be incurred to keep the channels free of vegetation and sediment. An allowance has also been provided for maintenance of the road ditch and culverts.

Logistics, including permitting: This scenario will impact the waters of the US and therefore require an Individual 404 Permit. The USACE has indicated that an EA will need to be prepared as part of the review process for the Permit.

Potential for additional channel aggradation: This alternative will not have any significant impact on the mechanisms causing aggradation in the main channel.

Probability of success: Based on our understanding of the causes for the flooding during 2002, this proposed action has a high probability of success to eliminate flooding at a flow of 3,000 cfs as long as the channels that are noted are kept open.

Channel capacity expected: For the short term, the main channel should be able to convey 3,000 cfs through the reach without resulting in flooding. If aggradation and encroachment of vegetation in the main river channel continues, the effectiveness of this scenario may diminish over time.

JFSA

EXHIBIT BC-1

NORTH PLATTE CHANNEL CAPACITY STUDY
CONCEPTUAL DESIGN
ENGINEER'S OPINION OF PROBABLE COST

ALTERNATIVE: **BASE CASE**

CAPITAL COST:

No.	Item	Quantity	Unit	Unit Price	Total
1	Mobilization	1	LS	$12,500.00	$12,500.00
Open & Extend State Channel, North Channel					
2	Clear and grub	5.6	Ac	$1,250.00	$7,000.00
3	Excavate and haul	4,600	CY	$7.00	$32,200.00
				subtotal:	$39,200.00
Construct Road Ditch along Washboard Rd					
4	Clear and grub	0.6	Ac	$1,250.00	$750.00
5	Excavate and haul	1,550	CY	$7.00	$10,850.00
6	Culverts, 36-inch CMP, 50 ft long	6	EA	$5,000.00	$30,000.00
7	Headwalls	6	EA	$2,500.00	$15,000.00
8	Restore drives, landscaping	3	EA	$7,500.00	$22,500.00
9	Channel lining, 2-inch rock	260	CY	$25.00	$6,500.00
10	Geotextile fabric	2,550	SY	$3.00	$7,650.00
				subtotal:	$93,250.00
Remove Detour Road, Open South Channel, Build Ditch					
11	Clear and grub South Channel	1	Ac	$1,250.00	$1,250.00
12	Remove 3-inch asphalt road	2,150	SY	$5.00	$10,750.00
13	Remove embankment, haul	8,900	CY	$7.00	$62,300.00
14	Excavate ditch	2,075	CY	$5.00	$10,375.00
				subtotal:	$84,675.00
Phragmites					
15	Treat phragmites, aerial spray	5	Ac	$225.00	$1,125.00
16	Treat phragmites, backpack sprayer	2	Ac	$1,100.00	$2,200.00
				subtotal:	$3,325.00
Investigations, Permits					
17	Wetland Delineation/Verification	96	Hr	$85.00	$8,160.00
18	USACE Section 404 Individual Permit	120	Hr	$85.00	$10,200.00
19	Easements, Permanent	9	Ac	$200.00	$1,800.00
20	Geotechnical Report	1	LS	$2,000.00	$2,000.00
				subtotal:	$22,160.00

Sub-total:		$255,110.00
Contingency:	25%	$63,780.00
Sub-total:		$318,890.00
Engineering:	15%	$47,830.00
Legal and Admin:	10%	$31,889.00
Total:		$398,610.00
Environmental Assessment (if required):		$80,000.00

JFSA **EXHIBIT BC-1**

NORTH PLATTE CHANNEL CAPACITY STUDY

CONCEPTUAL DESIGN

ENGINEER'S OPINION OF PROBABLE COST

ALTERNATIVE: **BASE CASE**

ANNUAL O&M COST:

No.	Item	Quantity	Unit	Unit Price	Total
1	Clear vegetation	5	Ac	$500.00	$2,500.00
2	Treat Phragmites	6.6	Ac	$750.00	$4,950.00
3	Clear culverts	1	LS	$500.00	$500.00
4	Road ditch maintenance	1	LS	$1,000.00	$1,000.00
5	Remove sediment from opened channels	1	LS	$3,500.00	$3,500.00
6	Mitigation monitoring for 404 Permit	24	HR	$85.00	$2,040.00
				Sub-total:	$14,490.00
			Contingency:	25%	$3,620.00
				Sub-total:	$18,110.00
			Legal and Admin:	10%	$1,811.00
				Total:	$19,921.00

Scenario: Alternative 1 – Base Case and Drainage Improvements

Description: Alternative 1 is a short-term solution that **includes** the elements of the Base Case and **adds** two elements to improve drainage. The first element is restoring the drainage way from the culverts that cross under the north end of Washboard Road to the concrete box culvert (CBC) under Hwy 83. The second element is improving the flow from the eastern lake to the southern lake and on to the main channel of the North Platte River (NPR). The features are shown on the drawings in Appendix A.

The improvements to the drainage way begin at two 24-inch-diameter corrugated metal pipe (CMP) culverts under Washboard Road. The upstream ends of these culverts have been damaged, restricting flow. The culverts will be repaired and headwalls provided to protect the upstream ends. The downstream channel will be cleared of vegetation and brush for a length of approximately 800 linear feet and a width of about 50 feet and reshaped to improve its ability to convey flows. This reach of the channel discharges into the northern lake (former sand pit).

Water that enters the northern lake now exits either through two 12-inch-diameter CMPs to the east or through one 18-inch diameter culverts and a swale to the south. The lake discharges over a low spot in the south berm where it overflows to the main channel of the NPR.

The improvements to the east would include replacing the two 12-inch-diameter culverts with two 36-inch-diameter culverts with upstream and downstream headwalls. These will discharge into a natural channel that needs to be cleared of vegetation and widened for a distance of about 400 feet to reach the CBC. The CBC consists of two cells, each 4 feet wide and 2.5 feet high. Downstream of the CBC, an additional 600 feet of channel needs to be cleared and regraded to allow flow to continue into the lake on the east side of Hwy 83. A controlled overflow section will be constructed to reduce damage should the lake level rise to the point of overtopping.

The improvements to the south include replacing the culvert between the lakes with two 30-inch-diameter CMPs with headwalls and constructing an overflow section in the berm of the south lake at an elevation to provide for adequate drainage. The overflow section would consist of a concrete cutoff wall with a 10-foot-long overflow section. A riprap blanket would be placed downstream to minimize erosion or the embankment.

There are few, if any, phragmites in this area. Treatment of vegetation would be limited to mechanical removal of trees and brush.

Capital Cost: Estimated quantities were developed for the work as described above. The Opinion of Probable Construction Cost for Alternative 1 has been estimated at $530,145. The estimate is attached.

The estimated cost for the EA, $90,000, includes the work for the Base Case, and has been shown separately.

O&M Cost: Annual costs will be incurred to keep the channels free of vegetation and sediment and to maintain the culverts.

Logistics, including permitting: There will be minimal impact to the channels. No additional permitting other than needed for the Base Case is expected to cover this work.

Potential for additional channel aggradation: The additional channels that would be improved as part of this alternative are not subject to significant aggradation. See the Base Case for comments on the river channels.

Probability of success: Because these drainage improvements are not impacted by either uncontrolled vegetation or aggradation, they are expected to function well and result in a high probability of success.

Channel capacity expected: The same as for the Base Case, that is, for the short term, the channel should be able to convey 3,000 cfs through the reach without resulting in flooding. If aggradation and encroachment of vegetation in the main river channel continues, the effectiveness of this scenario may diminish over time.

JFSA **EXHIBIT ALT1-1**

NORTH PLATTE CHANNEL CAPACITY STUDY

CONCEPTUAL DESIGN

ENGINEER'S OPINION OF PROBABLE COST

ALTERNATIVE: **ALTERNATIVE 1** (Base plus connection to the CBC)

CAPITAL COST:

Item No.	ITEM	Quantity	Unit	Unit Price	Total
1	Base Case (includes mobilization)	1	LS	$255,110.00	$255,110.00
2	Clear and grub	2.5	Ac	$1,250.00	$3,125.00
3	CMP 30-inch repair upstream ends (2)	1	LS	$1,000.00	$1,000.00
4	Culverts, 30-inch CMP, 150 ft long	2	EA	$10,000.00	$20,000.00
5	Headwalls, 30-inch CMP	8	EA	$2,500.00	$20,000.00
6	Culverts, 36-inch CMP, 100 ft long	2	EA	$9,000.00	$18,000.00
7	Headwall, 36-inch CMP	4	EA	$2,500.00	$10,000.00
8	Concrete cutoff wall, including excavation	3.3	CY	$600.00	$1,980.00
9	Revegetate	2	Ac	$500.00	$1,000.00
10	Bank protection	42	CY	$40.00	$1,680.00
11	Additional geotechnical	1	LS	$1,500.00	$1,500.00
12	Additional permitting	24	Hr	$85.00	$2,040.00
13	Additional Easements, permanent	2.3	Ac	$200.00	$460.00
14	Additional Wetland Delineation	40	Hr	$85.00	$3,400.00
				Sub-total:	$339,295.00
			Contingency:	25%	$84,820.00
				Sub-total:	$424,115.00
			Engineering:	15%	$63,620.00
			Legal and Admin:	10%	$42,410.00
				Total:	$530,145.00
			Environmental Assessment (if required):		$90,000.00

ANNUAL O&M COST:

No.	Item	Quantity	Unit	Unit Price	Total
1	Base Case	1	LS	$14,490.00	$14,490.00
2	Clear vegetation, additional	2	Ac	$500.00	$1,000.00
3	Treat Phragmites, additional	0	Ac	$750.00	$0.00
4	Clear culverts, additonal	1	LS	$500.00	$500.00
5	Road ditch maintenance	0	LS	$1,000.00	$0.00
6	Remove sediment from opened channels	1	LS	$1,500.00	$1,500.00
7	Mitigation monitoring for 404 Permit	24	HR	$85.00	$2,040.00
				Sub-total:	$19,530.00
			Contingency:	25%	$4,880.00
				Sub-total:	$24,410.00
			Legal and Admin:	10%	$2,441.00
				Total:	$26,851.00

Scenario: Alternative 2 – Base Case plus Alternative 1 plus Removal of Sand Bar

Description: Alternative 2 is a short-term solution that **includes** the elements of both the Base Case and Alternative 1 and **adds** the removal of the sand bar located about 1.5 miles above Hwy 83 where the main channel splits into two. See the drawings in Appendix A. Information from local residents and officials indicates that this channel used to convey significant flows. During the low flow period of the mid-1980s to late 1990s, a sand bar built up at the upper end of this channel. Aerial photographs reviewed during this period confirm this statement. This sand bar was observed in 2002 by the USACE representatives and also during our June 2005 field visit. By comparing the photographs from the 2002 visit with our observations, it is clear that this sand bar has continued to grow and that vegetation, primarily phragmites, has become established. The effect contributes to flow being restricted upstream of this point so that water flows out of the main channel, into the overbank and along the area just south of North River Road. By removing this sand bar more flow is expected to pass down the north channel of the river, thereby lowering water levels upstream and reducing the flow in the overbank.

From a review of recent aerial photographs, the sand bar is estimated to contain approximately 3,750 cubic yards (cy) of material, assuming maximum dimensions of 250 feet long by 120 feet wide and 4 feet deep. To encourage flow through this channel, approximately 500 feet of the natural channel would be cleared and regraded for a width of approximately 80 feet. An access road on private property will have to be cut through the buildup of phragmites to reach this area.

Capital Cost: Estimated quantities were developed for the work as described above. The Opinion of Probable Construction Cost for Alternative 2 (includes Base Case and Alternative 1) has been estimated at $629,010. The cost estimate is attached.

The estimated cost for the EA, $100,000, also covers the work needed for the Base Case and Alternative 1, and is shown separately.

O&M Cost: The nature of the stream in this area is likely to result in additional sand deposits in the reopened channel. Annual maintenance to remove the accumulated material will be required. Likewise, due to the prevalence of *Phragmites australis* adjacent to the channel, control methods (spraying) will be needed annually. These costs are included in the cost estimate.

Logistics, including permitting: Permit requirements would be similar to those described under the Base Case.

Potential for additional channel aggradation: As noted above, this area is subject to continued aggradation as long as the overall characteristics of the river channel are not changed in this reach.

Probability of success: As long as the channel is kept open, this alternative is expected to have a high probability of success.

Channel capacity expected: Similar to Alternative 1, this activity should reduce flooding in the affected area. The river channel will be able to pass 3,000 cfs through the Hwy 83 Bridge under current conditions. Continued aggradation or encroachment by vegetation will diminish the conveyance.

JFSA **EXHIBIT ALT2-1**

NORTH PLATTE CHANNEL CAPACITY STUDY

CONCEPTUAL DESIGN

ENGINEER'S OPINION OF PROBABLE COST

ALTERNATIVE: **ALTERNATIVE 2**: (Base + Alt 1 + remove sand bar)

CAPITAL COST:

Item No.	Item	Quantity	Unit	Unit Price	Total
1	Base Case + Alternative 1	1	LS	$339,295.00	$339,295.00
2	Access road	1	LS	$2,500.00	$2,500.00
3	Clear and grub	2.0	Ac	$1,500.00	$3,000.00
4	Excavate and haul	7100	CY	$7.00	$49,700.00
5	Revegetate	1	Ac	$500.00	$500.00
6	Additional permitting	40	Hr	$85.00	$3,400.00
7	Excavate and haul	2.55	Ac	$200.00	$510.00
8	Additional Wetland Delineation	40	Hr	$85.00	$3,400.00
9	Easements, temporary	1.85	Ac	$60.00	$111.00
10	Easements, permanent	0.75	Ac	$200.00	$150.00
				Sub-total:	$402,566.00
			Contingency:	25%	$100,640.00
				Sub-total:	$503,206.00
			Engineering:	15%	$75,480.00
			Legal and Admin:	10%	$50,320.00
				Total:	$629,010.00
			Environmental Assessment (if required):		$100,000.00

ANNUAL O&M COST:

No.	Item	Quantity	Unit	Unit Price	Total
1	Alternative 1, includes Base Case	1	LS	$19,530.00	$19,530.00
2	Clear vegetation, additional	2	Ac	$500.00	$1,000.00
3	Treat Phragmites, additional	1	Ac	$750.00	$750.00
4	Clear culverts	0	LS	$500.00	$0.00
5	Road ditch maintenance	0	LS	$1,000.00	$0.00
6	Remove sediment from opened channels	1	LS	$2,000.00	$2,000.00
7	Add'l mitigation monitoring for 404 Permit	24	HR	$85.00	$2,040.00
				Sub-total:	$25,320.00
			Contingency:	25%	$6,330.00
				Sub-total:	$31,650.00
			Legal and Admin:	10%	$3,165.00
				Total:	$34,815.00

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 5
Section 3

Colorado's Initial Water Project (Tamarack I)

December 7, 2005

I. PROJECT DESIGN

Colorado's initial water project (Tamarack I) involves the use of participating existing and future wells and other water facilities in Colorado to re-regulate flows that are in excess of legal rights to and physical demands for water in Colorado in a manner that is consistent with the flow-related goals of the Platte River Recovery Implementation Program (Program). As a result of the geographic location of Tamarack I near the state line, re-timing of stream flow that results from Tamarack I is estimated to develop an average annual yield of at least 10,000 acre-feet during times of target flow shortages and after any canal interception has occurred. As stated in the Program description, all signatories have agreed that the combined operations of Tamarack I and the other two initial Program water projects in the Program shall score and be credited with reducing flow shortages by 80,000 acre-feet. Water rights for the operation of the components of Tamarack I will be obtained and exercised under Colorado law for beneficial uses in Colorado.

Participating wells, ditches or other facilities, and associated water rights, may also be operated for purposes other than those associated with the Program, for example but not by way of limitation, augmentation purposes and protection and enhancement of native species and wildlife. Such operations are not part of Tamarack I, and references to Tamarack I do not include such operations.

The components of Tamarack I will be developed within the 40 miles above the state line beginning at about the Tamarack Ranch State Wildlife Area owned by the Colorado Division of Wildlife near Crook, Colorado. The goal for the development of Tamarack I facilities will focus on private and public lands nearest the state line so interception of accretions by Colorado ditches will be minimized. These facilities will include wells located adjacent to the South Platte River that divert groundwater from the alluvial aquifer, canals that divert water from the South Platte River, and off-channel reservoirs.

When operating recharge facilities, water that percolates into the groundwater alluvium from these facilities will return to the South Platte River at a later time. Inflows to canals and recharge basins will be identified as Tamarack I water, new depletions plan water, or water for state wildlife area purposes. All such inflows will be measured and recharge or seepage will be computed as inflows minus evaporation. Evaporation in acre-feet will be determined by using available weather station data and the surface areas of the recharge sites. Recharge basins are typically located in sandy upland areas with high infiltration rates such that free water surface areas are minimal, resulting in low evaporation amounts. The evaporation computed for existing recharge projects in the lower South Platte River basin in Colorado is typically less than one percent of gross flows. Colorado will identify and account for contributions from off-channel reservoirs in the same manner as recharge accounting.

Any Tamarack I accretions intercepted by Colorado canals will be accounted for, reported to other parties to the Program and will not count towards satisfying Colorado's obligations.

By selecting the optimal location of recharge basins, the return flows are less likely to be intercepted by Colorado's senior ditches. Observation wells will be located between the recharge basins and the river so that groundwater gradients and return flows to the river from the recharge basins' seepage can be monitored. The accounting methods used by Colorado to estimate return flows to the river from the operation of Tamarack I shall be approved by the Governance Committee.

II. HISTORICAL ANALYSIS

Colorado has analyzed how Tamarack I would have operated during the period 1947-1994. For the purpose of this historical analysis, periods and amounts of excess flows for diversion by the Tamarack I to recharge facilities in Colorado were assumed to occur when the following two conditions were satisfied: (1) South Platte River Compact requirements were satisfied and (2) flows exceeded the U.S. Fish and Wildlife Service ("FWS") year round target flows at the Grand Island gage on the Platte River in Nebraska. Existing target flows for every month were used in this analysis and the monthly target values varied with hydrologic conditions of wet, average, and dry.

This analysis assumed that pumping of new groundwater wells located next to the river to recharge basins could occur during the winter because wells can operate during freezing periods due to warmer groundwater temperatures. Colorado plans to install up to forty recharge wells and/or canal lift stations in conjunction with pipelines, recharge basins, and related monitoring features. For the 1947-1994 study period, the average annual diversion to recharge in the Tamarack I would have been 29,640-acre feet. Recharge from canal systems is accomplished during periods when there is unused canal capacity. These periods occur in the fall and winter after the irrigation season until freeze-up, typically through the month of November and during spring runoff when there are excess river flows.

Tables 1 and 2 list the reregulation results of Tamarack I operations for this historical analysis of the 1947-1994 period. Table 1 lists the monthly additions or increases that would have occurred to the historic Julesburg gage flows as a result of the accretions or return flows to the river caused by the groundwater recharge of Tamarack I. As the header to Table 1 indicates, shrink during the summer months due to canal interception is included in the table values. These are net values and occurred for months when river accretions exceeded the diversions to the recharge basins. Table 2 lists the monthly net depletions that would have occurred for months when the diversion to the recharge basins exceeded the accretions in that month. From Table 1, the average annual net addition or accretion is 12.3 thousand acre-feet ("kaf") after canal interception. There was actually 15.2 kaf total of accretions but 2.9 kaf is intercepted by downstream canals resulting in the 12.3 kaf after canal interception. From Table 2, the average annual net depletion is 19.4 kaf. The difference between the total average annual accretion of 15.2 kaf and the average annual depletion of 19.4 kaf is due to evaporation and some of the accretions to the river not being accounted for because they would have occurred after 1994, which is the last year of the modeled period.

III. CRITERIA FOR OPERATION OF TAMARACK I

A. In operating Tamarack I, Colorado will make a good faith effort to minimize canal interception. All such facilities will be operated by Colorado and its water users in compliance with the requirements of the South Platte River Compact and for Program purposes during times of excesses to target flows.

1. Operations of Tamarack I recharge facilities during the First Increment of the Program will focus on periods for diversions that result in accretions back to the river during times of shortages in February through June when downstream canal interceptions are the least. The months of greatest diversion by Tamarack I facilities will be December and January when greatest target flow excesses exist. Operations to the extent practical will minimize accretions back to the river during July and August. These months have the greatest canal interception and losing river reaches. Diversions for Tamarack I during the First Increment of the Program will be limited to a ten-year running annual diversions average of 30,000 acre feet, with simultaneous diversions limited to 225 cfs.

2. For the purposes of these criteria, times of target flow shortages are measured against the flow conditions that exist as of July 1997. The Grand Island gage will be compared to routed amounts of water that would be diverted by Tamarack I. This routed diversion will utilize the lag and loss factors approved by the Governance Committee. The routed amount reduced by the loss factors will be subtracted from the expected (i.e., based on trends and scheduled operational releases from Lake McConaughy) Grand Island gage flow occurring for the number of days of lag in the future and if this computed Grand Island gage flow is still above a desired target then diversions for Tamarack I will take place to the extent that Grand Island gage flows do not drop below targets.

B. Each year the Environmental Account (EA) Manager, in consultation with project sponsors, EA Committee (EAC), and Reservoir Coordinating Committee (RCC), will develop a Program Annual Operating Plan (AOP) based on AOP's provided by project sponsors. Colorado will develop an AOP for Tamarack I and coordinate Tamarack I operations with the EA Manager.

Colorado will operate Tamarack I so not to increase shortages to target flows at the associated habitat unless requested otherwise by the EA Manager. Tamarack I facilities may also be operated for purposes other than the Program, subject to requirements of state law and the South Platte River Compact, so long as (1) such operation does not interfere with the use of those facilities for the purposes described in this plan or Colorado's new depletions plan and (2) any associated new depletions are mitigated in accordance with Colorado’s Plan for Future Depletions.

C. Consistent with Section E.2.a. of the Program Document, as long as Tamarack I is constructed and operated as described herein, the target flow shortage reduction credited to Tamarack I individually or to the three initial water projects collectively will not be reduced even if the real time frequency and magnitude of flows in excess to targets at Grand Island causes Tamarack I to produce an average annual yield that is less than that projected under historic flow conditions, regardless of the reasons for the change.

TABLE 1

Additions to Historic Julesburg Gage Flows from TAM 1 Scenario of Reregulation

Units = kAF SUMMER SHRINK INCLUDED

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	April-Sept Total
1947	0	0	0.9	0.7	0.5	0	0	0.9	1.1	1.1	0	0	5.2	3.2
1948	0	0	0	2.5	2.5	2.2	1.9	0	0	1.3	1.1	0	11.6	9.2
1949	0	3.1	0	0	2.2	0	0	0	0	1.6	0	0	6.8	2.2
1950	0	0	3.9	3.3	3.0	0	2.3	2.0	1.8	1.7	1.5	0	19.4	12.4
1951	0	3.4	2.8	2.2	1.9	0.1	0	1.6	0	0	0	0	11.8	5.6
1952	0	0	0	0	3.7	3.5	0	0	0	0	2.1	0	9.2	7.2
1953	0	3.8	3.2	2.5	2.2	0	1.7	0	0	0	1.2	0	14.7	6.5
1954	0	3.2	2.7	2.1	0	0	0	0	0	0	1.0	0	8.9	2.1
1955	0	1.9	1.6	1.3	0	1.0	0	0	0	0	0.7	0	6.5	2.3
1956	0	1.4	1.2	0.9	0	0	0	0	0	0.6	0.5	0	4.6	0.9
1957	0.6	0.5	0.6	0.5	0.5	0	0	0.9	1.0	1.0	0.9	0	6.6	3.0
1958	0	2.9	2.4	1.2	0	0.3	0	0	0	1.7	1.5	0	10.0	1.5
1959	0	3.3	2.8	2.1	1.8	1.5	0	0	0	1.0	0.9	0	13.4	5.4
1960	0	2.9	0	1.9	1.9	1.7	0	0	0	1.1	1.0	0	10.6	5.5
1961	0	2.5	2.0	1.5	1.3	1.1	0	0	0.8	0.8	0.7	0	10.7	4.7
1962	0	2.8	0	1.9	1.9	0	0.9	1.8	1.6	1.5	1.3	0	13.7	8.0
1963	0	0	2.0	1.9	0	0	0	0	1.1	1.1	1.0	0	7.0	3.0
1964	0	3.1	2.4	1.8	1.6	0	1.2	0	0	0	0.8	0	10.9	4.6
1965	0	2.0	1.7	1.3	0	0	0	1.4	0	0	0	0	6.3	2.7
1966	0	0.9	3.9	3.2	2.8	2.3	2.1	0	1.7	1.6	1.4	1.3	21.2	12.1
1967	0	2.6	2.1	1.6	1.4	0	0	0	0	1.8	1.6	0	11.3	3.1
1968	0	3.5	2.8	2.1	1.8	1.6	1.4	1.3	1.2	1.1	0	1.1	17.8	9.4
1969	0	2.6	0	1.8	1.8	1.6	0	0	0	1.6	0	0	9.5	5.3
1970	0	0	3.4	0	2.7	2.4	0	0	2.2	2.1	1.9	0	14.7	7.3
1971	0	3.7	3.1	2.4	2.1	0	1.8	0	1.8	1.7	0	0	16.5	8.1
1972	0.1	0	2.7	2.5	2.3	2.0	1.9	1.7	1.5	1.4	1.3	0	17.4	11.9
1973	0	0	2.9	0	0	0	2.9	2.9	2.6	0	0	0	11.3	8.4
1974	0	0	0	0	3.9	3.7	0	0	2.7	2.5	0	0.5	13.3	10.3
1975	0	3.7	3.2	2.6	2.3	2.0	1.9	0	1.6	1.5	1.4	0	20.1	10.3
1976	0	3.5	2.8	2.2	1.9	0	0	1.4	1.3	1.2	1.1	1.1	16.5	6.8
1977	0	2.5	2.0	1.5	1.3	1.2	0	0	0	0.9	0.8	0	10.2	4.0
1978	1.5	1.4	0	1.3	0	1.4	0	0	1.1	1.1	1.0	0.9	9.7	3.9
1979	0.9	0.8	0.8	0.7	0.7	0	0	1.3	1.5	1.5	1.1	0	9.3	4.3
1980	0	0	0	2.6	0	0	2.8	0	2.5	2.3	2.0	0.6	12.9	7.9

1981	0	3.1	2.6	2.1	1.8	1.6	0	0	0	1.2	1.1	0	13.5	5.5
1982	0	3.1	2.6	2.0	1.7	1.4	1.3	0	1.1	1.0	0.9	0	15.2	7.5
1983	0	0	2.6	0	0	0	0	0		0	0	0	2.6	0.0
1984	0	0	0	0	0	0	0	4.6		0	0	0	4.6	4.6
1985	0	0	0	2.2	4.9	4.4	4.1	3.7	0	3.3	3.2	0	25.7	19.3
1986	0	0	4.3	0	0	0	0	0	0	0	0	0	4.3	0.0
1987	0	0	0	0	0	0	0	5.0	0	4.2	0	0	9.1	5.0
1988	0	0	5.5	4.8	4.4	3.8	0	0		2.8	2.6	0	26.9	16.0
1989	0	4.3	3.8	3.1	0	2.4	0	0	0	2.1	2.2	2.2	20.1	5.5
1990	0	3.3	2.9	2.3	2.1	1.9	0	0	0	1.5	1.4	1.4	18.4	7.9
1991	0	2.0	1.8	1.5	1.4	1.3	0	0	0 2.9	1.1	1.0	0	11.3	5.3
1992	0.8	1.9	1.7	1.5	1.4	1.2	1.2	1.1	1.0	1.0	0.9	0.9	14.6	7.4
1993	0	2.0	0	1.5	1.6	1.5	0	0	1.5	1.3	1.5	0	9.5	4.6
1994	0	3.3	2.8	2.1	1.8	1.6	0	0	1.1	1.2			13.9	6.7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	0 Sep	Oct	Nov	Dec		
avg	0.1	1.8	1.9	1.6	1.5	1.1	0.6	0.7	1.2 0.8	1.2	0.9	0.2	$\boxed{12.3}$	6.2
max	1.5	4.3	5.5	4.8	4.9	4.4	4.1	5.0	2.9	4.2	3.2	2.2	26.9	19.3
min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0
std	0.3	1.5	1.4	1.1	1.3	1.2	1.0	1.2	0.9	0.9	0.8	0.5	5.4	3.8

TABLE 2
Depletions to Historic Julesburg Gage Flows from TAM 1 Scenario of Reregulation
These are Net Depletions which equal diversions to recharge sites reduced by return flows resulting from the COL2A Scenario recharge.
Units = kAF

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1947	-6.1	-1.8	0	0	0	-7.5	-7.7	0	0	0	-7.0	-7.2	-37.3
1948	-5.9	-4.0	-5.4	0	0	0	0	0	0	0	0	-7.1	-22.5
1949	-6.1	0	-5.7	-5.9	0	-5.8	-6.0	0	-3.8	0	-5.6	-5.8	-44.7
1950	-4.6	-3.1	0	0	0	0	0	0	0	0	0	-6.8	-14.5
1951	-5.8	0	0	0	0	0	-6.8	0	-6.3	-6.4	-5.9	-5.7	-36.9
1952	-4.5	-2.8	-4.2	-4.4	0	0	0	0	0	0	0	-6.3	-22.1
1953	-5.3	0	0	0	0	0	0	0	0	0	0	-7.0	-12.3
1954	-6.0	0	0	0	0	0	0	0	0	0	0	-3.4	-9.4
1955	-2.3	0	0	0	0	0	0	0	0	0	0	-0.7	-3.0
1956	-2.5	0	0	0	0	0	0	0	0	0	0	-0.6	-3.1
1957	0	0	0	0	0	-7.5	-2.2	0	0	0	0	-7.4	-17.0
1958	-6.3	0	0	0	-6.8	0	-6.6	0	0	0	0	-6.8	-26.5
1959	-5.8	0	0	0	0	0	0	0	0	0	0	-7.3	-13.1
1960	-5.6	0	-5.9	0	0	0	0	0	0	0	0	-1.3	-12.8
1961	-6.7	0	0	0	0	0	0	0	0	0	0	-7.5	-14.2
1962	-6.4	0	-5.9	0	0	-6.3	0	0	0	0	0	-4.6	-23.3
1963	-1.2	-5.4	0	0	0	0	0	0	0	0	0	-7.3	-13.8
1964	-6.2	0	0	0	0	0	0	0	0	0	0	-3.4	-9.6
1965	-3.8	0	0	0	0	-7.0	-7.2	0	-6.4	-6.5	-6.0	-5.8	-42.5
1966	-4.6	0	0	0	0	0	0	0	0	0	0	0	-4.6
1967	-6.5	0	0	0	0	-6.7	-6.9	0	0	0	0	-5.7	-25.8
1968	-5.8	0	0	0	0	0	0	0	0	0	-3.5	0	-9.3
1969	-6.6	0	-6.0	0	0	0	-6.7	0	0	0	-6.5	-6.6	-32.4
1970	-5.4	-3.7	0	-1.7	0	0	-6.0	0	0	0	0	-6.4	-23.2
1971	-5.5	0	0	0	0	-6.2	0	0	0	0	-6.5	-6.6	-24.7
1972	0	-4.6	0	0	0	0	0	0	0	0	0	-6.9	-11.5
1973	-5.9	-4.1	0	-5.5	-5.8	-5.4	0	0	0	-5.8	-5.6	-5.6	-43.7
1974	-4.3	-2.8	-4.0	-4.2	0	0	0	0	0	0	-3.5	0	-18.8
1975	-5.4	0	0	0	0	0	0	0	0	0	0	-6.9	-12.2
1976	-5.8	0	0	0	0	0	0	0	0	0	0	0	-5.8
1977	-6.8	0	0	0	0	0	0	0	0	0	0	-7.0	-13.7
1978	0	0	-6.9	0	0	0	0	0	0	0	0	0	-6.9

1979	0	0	0	0	0	-7.3	-7.4	0	0	0	0	-6.9	-21.5
1980	-5.9	-4.0	-5.4	0	-5.6	-5.5	0	0	0	0	0	0	-26.3
1981	-5.9	0	0	0	0	0	0	0	0	0	0	-7.1	-13.1
1982	-6.1	0	0	0	0	0	0	0	0	0	0	-7.3	-13.4
1983	-6.2	-4.4	0	-5.7	-6.0	-5.6	-5.6	-5.3	-4.9	-4.8	-4.5	-4.4	-57.4
1984	-3.4	-1.8	-3.3	-3.6	-3.8	-3.6	-3.7	0	-3.6	-3.9	-3.8	-3.7	-38.2
1985	-2.7	-1.4	-2.7	0	0	0	0	0	-4.7	0	0	-5.1	-16.6
1986	-4.2	-2.7	0	-4.2	-4.6	-4.3	0	0	-4.4	-4.7	-4.4	-4.3	-37.8
1987	-3.2	-1.8	-3.0	-3.3	-3.4	-3.3	-3.3	0	-3.3	0	-3.6	-3.8	-31.9
1988	-2.8	-1.3	0	0	0	0	0	0	0	0	0	-5.7	-9.8
1989	-4.7	0	0	0	0	0	0	0	-6.0	0	0	0	-10.7
1990	-5.7	0	0	0	0	0	0	0	0	0	0	0	-5.7
1991	-3.0	0	0	0	0	0	0	0	0	0	0	-7.2	-10.2
1992	0	0	0	0	0	0	0	0	0	0	0	0	0.0
1993	-5.3	0	-6.5	0	0	0	0	0	-6.8	0	0	-4.8	-23.4
1994	-5.9	0	0	0	0	0	0	0	0	0	0	0	-5.9
avg	-4.6	-1.0	-1.4	-0.8	-0.7	-1.7	-1.6	-0.1	-1.0	-0.7	-1.4	-4.5	-19.4
max	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
min	-6.8	-5.4	-6.9	-5.9	-6.8	-7.5	-7.7	-5.3	-6.8	-6.5	-7.0	-7.5	-57.4
std	2.0	1.6	2.3	1.7	1.9	2.8	2.7	0.8	2.1	1.8	2.4	2.8	12.9

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 5
Section 4

Wyoming's Pathfinder Modification Project

December 7, 2005

The following description of the Pathfinder Modification Project is an excerpt from the Pathfinder Modification Stipulation (Appendix F- "Amendment of the 1953 Order to Provide for the Modification of Pathfinder Reservoir" to the Final Settlement Stipulation) that was approved by the States of Nebraska, Wyoming, and Colorado and the United States on March 13, 2001 as part of the settlement of the Nebraska v. Wyoming lawsuit. The following Final Settlement Stipulation was approved by the U.S. Supreme Court on November 13, 2001.

1. The Pathfinder Modification Project would increase the capacity of the existing Pathfinder Reservoir by approximately 54,000 acre feet to recapture storage space lost to sediment. The modification would be accomplished by raising the elevation of the existing spillway by approximately 2.39 feet with the installation of an inflatable dam or some other means. The recaptured storage space would store water under the existing 1904 storage right for Pathfinder Reservoir and would enjoy the same entitlements as other uses in the reservoir with the exception that the recaptured storage space could not place regulatory calls on existing water rights upstream of Pathfinder Reservoir other than the rights pertaining to Seminoe Reservoir.

2. Approximately 34,000 acre feet of the proposed 54,000 acre foot modification would be accounted for in an environmental account and operated for the benefit of endangered target species and their habitat in Central Nebraska.

   a. Water would accrue to the environmental account as an equal priority partner to other reservoir uses. The 34,000 acre-foot account is approximately 3.18% (34,000/1,070,000) of the capacity of Pathfinder Reservoir. Therefore, the account would accrue 3.18% of the inflow that is storable under the 1904 storage right.

   b. The environmental account could not contain more than 34,000 acre feet at any one time and will be administered under Wyoming water law. For example, if at the end of a water year, which is defined as October 1 to September 30, 10,000 acre feet of water was in the account, the account could only accrue 24,000 acre feet under its priority fill during the forthcoming water year.

   c. The account would be assessed its proportionate share of evaporation losses based on the storage water in the account.

d. If there is a Platte River Recovery Implementation Program (Program), the environmental account could be operated, under contract with the Bureau of Reclamation, by the same manager that would manage the environmental account in Lake McConaughy. If the Program does not exist, the account would be operated by the Bureau of Reclamation, in accordance with subsequent contracts and ESA consultations and in a manner consistent with Wyoming water law and the North Platte Decree.

e. The storage and delivery of water from the environmental account to the Wyoming/Nebraska stateline would serve as Wyoming's proposed reasonable and prudent alternative for the Pathfinder Modification Project. If there is a Platte River Recovery Implementation Program (Program) that serves as the reasonable and prudent alternative for water related activities in the Platte River basin, the storage and deliveries from the environmental account would serve as a Wyoming contribution to the water component of that Program on behalf of Wyoming's existing water users, including the federal storage water contractors located in Wyoming and Nebraska to the extent the activities of such contractors are related to the delivery of storage water from the federal reservoirs in Wyoming. If no Program exists, such storage and deliveries would serve as a proposed reasonable and prudent alternative for the ongoing section 7 consultation on the operation of Bureau of Reclamation reservoirs serving Wyoming and Nebraska. Further, if a separate program is sought by Wyoming and the federal storage contractors in Wyoming and Nebraska, they may seek credit for such deliveries for purposes of ESA evaluations.

3. The State of Wyoming would have the exclusive right to contract with the Bureau of Reclamation for the use of the remaining 20,000 acre feet of the modification capacity in a "Wyoming account" to provide municipal water to North Platte communities in Wyoming, replacement water to satisfy any obligations under the modified North Platte Decree or any stipulation in this case, or water for endangered species as described in Paragraph 3.e.

a. Water would accrue to the Wyoming account as an equal priority partner to other reservoir uses. The 20,000 account is 1.87% (20,000/1,070,000) of the capacity of Pathfinder Reservoir. Therefore, the account would accrue 1.87% of the inflow that is storable under the 1904 storage right.

b. The Wyoming account could not contain more than 20,000 acre feet at any one time and will be administered under Wyoming water law. For example, if at the end of a water year, which is defined as October 1 to September 30, 5,000 acre feet of water was in the account, the account could only accrue 15,000 acre feet under its priority fill during the forthcoming water year.

c. The Wyoming account would be assessed its proportionate share of evaporation losses based on the storage water in the account.

d. The storage water would be used to supplement Wyoming municipalities' water rights or to satisfy any obligation under the modified North Platte Decree or any stipulation in this case. If released to meet an obligation under the Decree or stipulation in this case, the storage water will be administered under procedures adopted by stipulation in this case as such procedures may be modified from time to time by the North Platte Decree Committee. Storage water used to supplement municipal water rights will be administered as follows: When the municipal surface or hydrologically connected ground water rights, or a portion thereof, are regulated due to a priority call, the municipality whose rights are regulated, subject to state law, could continue to divert to meet its municipal demands and its depletions would be replaced from its contracted portion of the Wyoming account subject to the following conditions:

    i. The municipality must have the capability to measure its diversions and its return flows in a manner approved by the Wyoming State Engineer in order to accurately measure the resulting depletions. If the return flows cannot be measured in a manner acceptable to the Wyoming State Engineer, the entire amount diverted will be considered a depletion and will be debited from the respective municipalities' account.

    ii. Contracts for water from the Pathfinder Modification Project with the State of Wyoming will stipulate that the contracting municipality can only serve new individual demands less than 100 acre feet of water per year.

    iii. If the City of Casper contracts for water in the Wyoming account, water in its portion of the account must be depleted before it can exercise its entitlements in Seminoe Reservoir. This condition serves to alleviate project impacts on Seminoe Reservoir.

e. The Bureau of Reclamation, under contract with the State of Wyoming, will operate the 20,000 acre feet Wyoming storage account to insure an annual estimated firm yield of 9,600 acre feet.

> In any year that the demand for municipal use is less than 9,600 acre feet, the remaining balance of the annual firm yield may be used by Wyoming for depletion replacement or release for endangered species in Central Nebraska. Such uses are secondary to the purpose of providing water for municipal use for North Platte communities in Wyoming. Any water used for endangered species purposes must be released from storage before the end of the water year and does not constitute a permanent water right.

4. In order for the project to be implemented, [1] the federal authorization of Pathfinder Reservoir will be amended if necessary to include municipal and environmental purposes, [2] the water right for Pathfinder Reservoir must undergo a partial change of use under Wyoming water law to allow the uses of the Wyoming and environmental accounts contemplated by this Stipulation, and [3] the Wyoming Legislature must approve the export of water for downstream environmental purposes. Further, any decision of the Bureau to proceed with the project in this Stipulation will not be made until after completion of any appropriate analysis under NEPA or consultation under the ESA.

5. In order to address the effects the Pathfinder Modification Project may have on contractors for water from Glendo, Pathfinder and Seminoe Reservoirs in Wyoming, upon completion of the Pathfinder Modification Project, Wyoming will pay the Wyoming and Nebraska federal storage water contractors' share of the Safety of Dams Modifications to the federal reservoirs to be implemented by the Bureau of Reclamation in the near future.

6. In order to address the effects the Pathfinder Modification Project may have on the Kendrick Project, upon completion of the Pathfinder Modification Project, Wyoming will assist the Casper Alcova Irrigation District with the resolution of existing selenium issues that are impacting its existing operation.

7. Existing Wyoming and Nebraska federal storage water contractors will not be held responsible for any costs assigned to the Pathfinder Modification Project.

8. Subject to the appropriate approvals and conveyance losses, Wyoming, in accordance with its water law, will assure delivery of the storage water from the Pathfinder Modification Project herein designated for downstream environmental purposes to the Wyoming/Nebraska state line. A permit will be secured under Nebraska water law by the contractor for the environmental account to conduct the quantities of water thus delivered at the state line, subject to appropriate conveyance losses, to specified locations between the state line and Chapman, Nebraska. The environmental releases will begin subsequent to completion of the project and issuance of the permits by Nebraska. Beyond the state line, Nebraska will assure delivery of the water in accordance with the terms of any such permit granted and with other applicable Nebraska law.

9. As long as the project is implemented in the manner outlined herein, the State of Nebraska hereby stipulates that it will support the project in this litigation and in any other proceeding necessary to implement and operate the project.

10. Upon completion of the Pathfinder Modification Project, Wyoming will release the 404 permit and the water rights for the Deer Creek Project, a proposed and permitted reservoir with a capacity of approximately 66,000 acre feet and provide fee simple title to the 470 acres of habitat it owns in the critical habitat area in Central Nebraska to the FWS or other entities as deemed appropriate by the FWS. Nebraska will move to dismiss Jess v. West, No. 88-1-308 (D. Neb.).

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 5
Section 5

An Environmental Account for Storage Reservoirs on the Platte River System in Nebraska As included in the Project 1417 FERC License

December 7, 2005

This document was made part of the FERC license of The Central Nebraska Public Power and Irrigation District in 1998 and has not been modified for inclusion in the Program Document. Some terminology differences have occurred in the intervening years so this document's internal definitions may correspond to different terms in other parts of the Program Document. In addition, a successor agency has assumed the responsibilities of the State of Nebraska identified in this document.

I. INTRODUCTION

A. Definitions

1. "MOA" means the Memorandum of Agreement among the states of Colorado, Nebraska, Wyoming and the Department of the Interior dated June 1994, the Cooperative Agreement for Platte River Research and Other Efforts Relating to Endangered Species Habitats Along the Central Platte River, Nebraska (Cooperative Agreement) developed pursuant to that Memorandum of Agreement, and any Platte River Recovery Implementation Program (Program) implemented following that Cooperative Agreement.

2. "Governance Committee" means the committee designated in the Cooperative Agreement, or its successor governance body as it may be structured under the Program.

3. "Central" means the Central Nebraska Public Power and Irrigation District.

4. "NPPD" means the Nebraska Public Power District.

5. "Districts" means Central and NPPD.

6. "FERC" means the Federal Energy Regulatory Commission.

7. "Projects" means FERC Project 1417 and FERC Project 1835.

8. "NEDWR" means the Nebraska Department of Water Resources.

9. "Approved Storage Facilities" means a District facility or facilities proposed for EA storage in Nebraska by the Districts and approved by the Governance Committee and NDNR.

10. “EA” means Environmental Account, an annual account of water in Lake McConaughy, or other Approved Storage Facilities, available for release for environmental purposes during the October 1 to September 30 water year.

11. “Current Regime of the River” means the flow characteristics of the North Platte, South Platte and Platte River drainage which are available under existing conditions, as defined by the Governance Committee, determined in accordance with procedures to be adopted pursuant to the MOA. The principal purpose will be to serve as a reference point for determining whether and how relevant flow characteristics are changed by the MOA or future developments.

12. “EA Manager” means an individual designated by the Regional Director of the U.S. Fish and Wildlife Service (“FWS”) to manage and coordinate operations of the EA and to be responsible for calling for releases from the EA pursuant to such contracts as may be executed to meet the objectives of the MOA.

13. “New Water” means water which is not included in the Current Regime of the River, but which is the result of the management and operation of the MOA and is available for storage in the EA.

B. The EA makes storage in, and water from, Lake McConaughy or other Approved Storage Facilities available for instream flow releases and allows the manager of the EA the flexibility to make releases that are most efficient for accomplishing the goals set by the Governance Committee.

C. This document describes how water contributed becomes part of the EA. Contributions to the EA, defined in Paragraph II.B, may be from Colorado, Wyoming, Nebraska and/or from water conservation/supply activities carried out under the MOA, or from other sources approved by the Governance Committee.

D. Nothing in this document shall preclude any entity from exercising its state water rights to ensure those water rights are not reduced, relinquished or extinguished by failure to use.

E. Consistent with the guidelines below, and to the extent possible, water released from the EA should be used for as many beneficial uses as possible.

II. ENVIRONMENTAL ACCOUNT

A. <u>General Description</u>

1. Water contributed to the EA, regardless of its source, loses any separate identity upon entering Lake McConaughy or other Approved Storage Facility, and simply becomes part of the EA.

2. Water remaining in the EA after September 30 of each year may be carried over and added to the following year’s contributions to the EA, subject to the limitations of Paragraphs II.A.3 through II.A.6 below.

3. The total quantity of water in the EA in Lake McConaughy may never exceed 200,000 acre-feet (af) at any time during the water year.

4. Whenever Lake McConaughy fills to regulatory capacity as defined by FERC's dam safety requirements for Project No. 1417 and the EA is less than 100,000 af, the Districts shall contribute additional water to increase the EA to 100,000 af regardless of the quantity of EA water already released during that water year.

5. At any time that Lake McConaughy reaches regulatory capacity as defined by FERC's dam safety requirements for Project No. 1417 and the EA exceeds 100,000 af, the EA shall be reduced to 100,000 af regardless of the sum of the contributions from the states and from Conservation Activities, or the quantity of carryover from a prior year.

6. Storage losses for Lake McConaughy and other Approved Storage Facilities shall be calculated by the NEDWR and assigned monthly to the EA using the following formula: ((average monthly storage in the EA) divided by the (average monthly storage in total)) times the total losses for the storage facility for that month, or by another mutually agreed upon formula.

7. Transportation losses for EA water shall be calculated by the NEDWR in the same manner as the NEDWR calculates such losses for other water in the North Platte and Platte Rivers.

8. Contributions to the EA shall be protected by the NEDWR from groundwater or surface water depletion from the state line or the source of contribution from within Nebraska to Lake McConaughy or other Approved Storage Facilities.

B. <u>EA Contributions</u>

1. <u>Nebraska's Contributions</u>

a. <u>Central and NPPD</u>

(1) The EA contribution by the Districts, and the water users served by them, is based upon the understanding that the flows available at Lewellen on the North Platte River and at the Korty Diversion on the South Platte River remain representative of the Current Regime of the River except for changes to the Current Regime of the River which are compensated, mitigated, or offset at Lewellen or the Korty Diversion pursuant to the MOA. A system will also be established to resolve disputes on detrimental impacts and appropriate compensation, mitigation or offsetting measures, including disputes arising after the Program has been implemented.

(2) Storable Natural Inflows are those North Platte River waters entering Lake McConaughy that are measured at the Lewellen gauge and that may be stored consistent with legal, regulatory or public safety restrictions. Flows which are not considered to be

Storable Natural Inflows include: a) environmental contributions from Wyoming, Colorado, MOA Conservation Activities or other entities; b) transfers of storage water from upstream facilities; and c) demands based upon senior non-hydropower natural flow water rights.

(3) At the end of each month from October through April, the EA shall be credited with an amount equal to 10% of the Storable Natural Inflows to Lake McConaughy for that month, as determined by the NEDWR based upon the real-time gauge data available from the NEDWR for the Lewellen gauge, up to an annual limit of 100,000 af. The 100,000 af limit shall not be construed to affect the adjustment of the contents of the EA to 100,000 af when the reservoir fills, as described in Paragraphs II.A.4 and II.A.5.

b. Other Nebraska Contributions

Other Nebraska water contributions may be provided to the EA by the state or other water users through plans or programs that are approved by the Governance Committee provided that: (1) the Districts are assured that as a result of a contribution, inflows into Lake McConaughy and flows at the Korty Diversion remain representative of the Current Regime of the River, except for changes to the Current Regime of the River impacting the Districts' operations which are compensated, mitigated, or offset pursuant to the MOA; and (2) these new contributions may be characterized by the NEDWR as New Water; and (3) those contributions may be stored in Lake McConaughy or other Approved Storage Facilities.

2. Wyoming's Contributions

a. New Water attributable to the State of Wyoming may be contributed to the EA through its "Pathfinder Modification Project" or other plans or programs that are approved by the Governance Committee.

b. It is anticipated that the Governance Committee in cooperation with the Wyoming State Engineer and the NEDWR will develop an accounting system for the purpose of defining and determining the amount of New Water at the state line attributable to the State of Wyoming under its Pathfinder Modification Plan or under any other plan which may be approved by the Governance Committee. The accounting system to be developed will include a system for resolving any disputes that may arise relative to the determination of the amount of New Water provided by the State of Wyoming to the EA.

c. Wyoming's contribution to the EA shall be the quantity delivered at the state line for MOA purposes, as defined in Paragraph II.B.2.b, less losses to the Lewellen gauge on the North Platte River as determined by the NEDWR.

3. Colorado's Contributions

a. New Water attributable to the State of Colorado may be stored in the EA under procedures developed by the Districts and Colorado and approved by the Governance Committee.

b. It is anticipated that the Governance Committee in cooperation with the Colorado State Engineer and the NEDWR will develop an accounting system for New Water attributable to the State of Colorado and delivered to the state line which, under the procedures developed pursuant to Paragraph II.B.3.a above, is available to be stored in the EA under the Program. The accounting system to be developed will include a system for resolving any disputes that may arise relative to storage of New Water in the EA attributable to the State of Colorado.

4. Conservation Water

a. Activities carried out under the Program Water Conservation/Supply Component may contribute to the EA any quantifiable net conserved water, as defined and accounted for in the Water Conservation/Supply Action Plan, which can be controlled and credited to storage in Lake McConaughy or other Approved Storage Facilities.

b. The Governance Committee in consultation with the appropriate state water entity will develop an accounting system for the EA contributions developed by water conservation/supply activities, to include operational agreements with owners of the facilities in which these contributions will be stored. The accounting system developed will include a system for resolving any disputes that arise relative to the accounting process.

C. EA Operations

1. EA Committee and EA Manager

a. The EA Manager shall possess the authority to request releases from the EA pursuant to the terms of a contract with Central in the case of Lake McConaughy or with the appropriate District in connection with releases from other Approved Storage Facilities.

b. An EA Committee ("EAC") shall be organized by the EA Manager to work with and provide guidance to the EA Manager. The EA Manager shall invite representatives from Central, NPPD, U.S. Bureau of Reclamation ("BOR"), FWS, NEDWR, the Nebraska Game and Parks Commission, Colorado, Wyoming, the Audubon Society and the Platte River Whooping Crane Critical Habitat Maintenance Trust to participate in the EAC. The EA Manager shall meet with the EAC at least twice a year, in October and March, and more frequently at the discretion of the EA Manager.

c. Central shall release EA water from Lake McConaughy as requested by the EA Manager as it would for any other customer, and will coordinate with NPPD and the NEDWR regarding such releases. Procedures and protocol will be developed as necessary to facilitate coordination of operations with EA releases.

d. In October of each year, in consultation with the EAC, the EA Manager shall establish flow targets and an annual operating plan for the EA based on predicted water supplies, the status of the species of concern and the goals set by the Governance Committee. Consistent with the FWS priority recommendations described in “Instream Flow Recommendations for the Central Platte River, Nebraska” and attached to “The Department of the Interior's Amended Comments under Section 10j of the Federal Power Act” dated August 11, 1994, a priority will be given to the use of EA water to maintain flows throughout the summer. Adjustments throughout the year to the operating plan would be expected to reflect prevailing conditions and increased knowledge of species needs.

e. To protect the EA water stored in and released from Lake McConaughy to and through the habitat area, and for Central to have the authority to contract with the EA Manager to make releases as directed, Central will use best efforts to seek and, if granted, to maintain storage use permits and other regulatory authorities as necessary. For other Approved Storage Facilities, the appropriate District shall likewise seek and, if granted, maintain storage use permits and other regulatory authorities as necessary. The Districts will not abandon or take any action which will reduce, relinquish or extinguish the storage use permit for the EA.

f. The EA Manager shall coordinate with the NEDWR and the Districts as necessary for NEDWR to perform accounting functions related to the storage and release of the EA.

2. General Rules for EA Operations

a. EA releases may be temporarily reduced or suspended if events occur which limit or prevent the Districts’ ability to provide them. The types of events which would limit or prevent EA releases include but are not limited to inspections of facilities, maintenance or repair of structures, failure of a structure, or existence of an emergency condition which is not otherwise predicted. Weather related events such as icing conditions, regional or localized rain or snowstorms, flooding events and high wind conditions may also require the alteration or suspension of EA releases. No alteration or suspension of releases for these or similar types of occurrences will be deemed to be a lack of compliance. The Districts will coordinate all planned safety and maintenance activities with the EA Manager, and will notify the EA Manager of all events which lead to reduction or suspension of releases. The Districts will maintain appropriate records of such events.

b. If an emergency situation occurs such that water must be evacuated (in whole or part) from Lake McConaughy, the EA shall be reduced in proportion to the ratio of the total quantity of water evacuated and total storage prior to the evacuation.

c. The EA Manager may not request releases from the EA when the Platte or North Platte River at Keystone, North Platte, Brady, Cozad, Kearney or Grand Island is at or above flood stage as defined for those locations by the National Weather Service ("NWS"). If the EA Manager requests a release of EA water that the Districts believe would cause the Platte or North Platte River to rise above flood stage, the request for release may be denied. However, the EA Manager may appeal the denial by requesting the NWS to make a determination as to whether or not the requested release would cause either of the rivers to rise above flood stage at any of the previously listed sites. If the NWS determines the requested release would cause either of the rivers to rise above flood stage, the denial would stand. If the NWS determines the requested release would not cause either of the rivers to rise above flood stage, the requested releases will be made.

III. OPERATING RULES FOR PROJECT NO. 1417 AND PROJECT NO. 1835

A. <u>General Rules for Project Operations</u>

1. The operating rules for the Projects are based upon the understanding that flows available to the Districts in the North Platte and South Platte Rivers remain representative of the Current Regime of the River except for changes to the Current Regime of the River impacting the Districts' operations which are compensated, mitigated, or offset pursuant to the MOA. Procedures and processes developed in consultation with NEDWR and adopted by the Governance Committee shall be used to verify that such flows are not altered in a manner which causes impacts to either of the Districts' operations which are not compensated, mitigated, or offset pursuant to the MOA. Under the MOA, notwithstanding the foregoing, the obligations of Colorado and Wyoming are fully set forth in the Cooperative Agreement and the Proposed Program, and nothing in this EA document is intended to impose any additional or independent obligations, requirements, or restrictions of any sort on Colorado or Wyoming. For as long as there is a Program, if Colorado and Wyoming reregulate flows in accordance with their proposed Tamarack Plan (Attachment 5, Section 3) and Pathfinder Modification Plan (Attachment 5, Section 4) and their respective new depletions proposals (Attachment 5, Sections 7 and 9), existing and new water-

related activities in Colorado and Wyoming will be included in the Current Regime of the River.

2. Operations plans for the Projects which include monthly release and storage goals shall be developed annually in October and modified as necessary by the Districts through the water year after communicating with the EA as described in Paragraph IV.D.

3. Neither release requirements, nor allocation of water to the EA, nor any other provision in this document is intended to relieve the Districts or their successors or assigns from complying with the terms of the May 21, 1954 Water Storage Agreement between Central and the Platte Valley Public Power and Irrigation District (NPPD's predecessor), and amendments thereto, except to the extent that this document is in direct conflict with the terms of the agreement. Additionally, the provisions of this document are not intended to prevent the Districts or their successors or assigns from further amending such agreement, provided such amendments are not inconsistent with this document. These operating rules are not intended to favor one District or the other.

4. The Districts shall have responsibility for determining predicted Storable Natural Inflows as referenced in Paragraphs III.B.1, III.C.1, III.D.1, and III.E.1 for the purposes of determining whether very wet, wet, transitional, or dry conditions exist. Predicted Storable Natural Inflows, and the category of conditions anticipated, should be determined by October 15 of each water year and may be adjusted and refined by the Districts.

5. The Districts will use South Platte flows to the extent possible.

6. Whenever the use of surface water for irrigation in the Platte River valley ends before September 30, operational flows for Central and NPPD for the remainder of the water year shall be in the range specified for the preceding November 16 to February 14 time period.

7. Operational rules may be temporarily suspended if events occur which prevent operations in the manner prescribed. The types of events which would require suspension of the operating rules include, but are not limited to, inspections of facilities, maintenance or repair of structures, failure of a structure, hydraulic limitations of facilities or existence of an emergency condition which is not otherwise predicted. Weather related events such as icing conditions, regional or localized rain or snowstorms, flooding events and high wind conditions may also require suspension of the operating rules. No alteration or suspension of the operating rules for these or similar types of occurrences will be deemed to be a lack of compliance. The Districts will coordinate all planned safety and maintenance activities with the EA Manager, and will notify the EA Manager of all events which lead to reduction or suspension of the operational rules. The Districts will maintain appropriate records of such events.

8. Releases from Lake McConaughy may be made as needed to supplement flows and river gains to meet irrigation requirements.

9. All EA water or other water made available to the Program for environmental purposes which must be released from or passed through Lake McConaughy or other Approved Storage Facilities may be diverted by the Districts, at their discretion, into Project facilities. The diverting District shall return the diverted environmental water to the river and shall replace any losses of water in excess of those which the NEDWR determined otherwise would occur if that water had been transported via the Platte River system. Although such water released or passed through may be used for as many beneficial uses as possible, neither EA releases nor pass through of environmental water are restricted by canal capacity or hydropower generation constraints.

10. Notwithstanding Paragraph III.A.9, if the total flow in the Platte River at Brady (currently measured by USGS gauge number 06766000) at any time in March or April of a very wet, wet or transitional year as defined below is less than 200 cubic feet per second (cfs), the EA Manager may request Central to route enough EA water through its Jeffrey Return such that the quantity released from the Jeffrey return plus the Platte River at Brady totals up to 200 cfs. The total volume of EA water released in this manner shall not exceed 3000 af in any one water year unless agreed to by Central.

11. The Districts shall pass through or release waters from Lake McConaughy as needed to supplement river flows and river gains to provide at least the lowest operational flows described in Paragraphs III.B through III.F, without taking into account and in addition to any releases being made from the EA. Such operational flows may be diverted by the Districts, at their discretion, into Project facilities.

12. Throughout the water year, the combined flow from the Keystone Diversion and the Korty Diversion shall provide an average of at least 400 cfs inflow to the Sutherland Reservoir and maintain an elevation of at least 3,045 feet in Sutherland Reservoir.

13. Diversions at the Korty Diversion Dam may be up to canal capacity.

14. The rules for the Projects' operations require the Districts to accept constraints on the use of a portion of their respective water rights. These rules were specifically based upon current upstream project operations and river conditions, and the Districts' contribution to the EA. The Districts shall have no obligation to accept further constraints on the use of their respective water rights for these operational rules if the reservoir contents of Lake McConaughy are subject to greater or more frequent fluctuations as a result of, or to accommodate, contributions to the EA from others. The Districts may take any dispute regarding additional constraints to the Governance Committee for resolution.

B. Very Wet Conditions

1. Very Wet conditions are defined as those circumstances when the total Lake McConaughy contents as of October 1, including the EA, plus the predicted Storable Natural Inflows from October 1 to March 31, exceed 2.1 million acre feet (maf).

2. Releases from Lake McConaughy in the non-irrigation season for diversion at the Keystone Diversion Dam should be at least 700 cfs and average at least 875 cfs.

3. Non-irrigation season releases from Lake McConaughy shall supplement river flows and river gains to provide for a minimum diversion at the Central Diversion Dam of 1000 cfs and an average diversion of at least 1600 cfs from October 1 through November 15, a minimum diversion of 800 cfs and an average diversion of at least 1000 cfs from November 16 through February 14, and a minimum diversion of 1100 cfs and an average diversion of at least 1400 cfs from February 15 through the beginning of irrigation season (use of surface water for irrigation below Lake McConaughy or Korty Diversion).

4. Requirements in Paragraphs III.B.2 and 3 are independent of each other and each must be met.

5. There shall be no upper limit on outflows from Lake McConaughy other than meeting the standards of safety and beneficial use.

C. Wet Conditions

1. Wet conditions are defined as those circumstances when the total Lake McConaughy contents, including the EA, equal or exceed 1.50 maf as of October 1, or the total Lake McConaughy contents level as of October 1 plus the predicted Storable Natural Inflows from October 1 to March 31 is between 1.85 maf and 2.1 maf.

2. Releases from Lake McConaughy in the non-irrigation season for diversion at the Keystone Diversion Dam should be at least 700 cfs. If the October 1 lake level is less than 1.25 maf, diversions at the Keystone diversion in October may be at a reduced rate, but not less than 450 cfs.

3. Non-irrigation season releases from Lake McConaughy shall supplement river flows and river gains to provide for a minimum diversion at the Central Diversion Dam of 900 cfs and an average diversion of at least 1200 cfs from October 1 through November 15, and a minimum diversion of 800 cfs and an average diversion of at least 1000 cfs from November 16 through February 14, and a minimum diversion of at least 1000 cfs and an average diversion of at least 1240 cfs from February 15 through the beginning of irrigation season.

4. Requirements in Paragraphs III.C.2 and 3 are independent of each other and each must be met.

5. There shall be no upper limit on outflows from Lake McConaughy other than meeting the standards of safety and beneficial use.

6. Releases should be managed to allow Lake McConaughy to fill to approximately 1.5 maf by March 31 and to fill to licensed or authorized capacity thereafter. Filling to less than 1.5 maf by March 31 will be permitted if inflows expected after that date would cause reservoir spills or flooding downstream. After consultation with the EA Manager by the Districts as described in Paragraph IV.4, releases for diversion at the Central Diversion Dam may be reduced to the rates required in transitional conditions (Paragraph III.D.3) if necessary to allow Lake McConaughy to fill as provided in this paragraph.

D. Transitional Conditions

1. Transitional conditions are defined as those circumstances that exist between wet and dry conditions as they are defined in this document.

2. Non-irrigation season releases from Lake McConaughy for diversion at the Keystone Diversion Dam should be at least 450 cfs and average no more than 900 cfs (exclusive of EA releases) except as otherwise permitted herein.

3. Non-irrigation season releases from Lake McConaughy shall supplement river flows and river gains to provide for a minimum diversion at the Central Diversion Dam of 900 cfs and an average diversion of at least 1000 cfs from October 1 through November 15, and a minimum diversion of 800 cfs and an average diversion of at least 950 cfs from November 16 February 14, and a minimum of diversion of at least 850 cfs and an average diversion of at least 1100 cfs from February 15 through the beginning of irrigation season.

4. Requirements in Paragraphs III.D.2 and 3 are independent of each other and each must be met.

5. There shall be no upper limit on outflows from Lake McConaughy other than meeting the standards of safety and beneficial use.

6. Releases should be managed to allow Lake McConaughy to fill to between 1.27 and 1.5 maf by March 31 with the goal to optimize reservoir storage taking into account whether the transition is from wet to dry or from dry to wet. After consultation with the EA Manager by the Districts as described in Paragraph IV.D, releases for diversion at the Central Diversion Dam may be reduced to the rates required in dry conditions (Paragraph III.E.3) if necessary to allow Lake McConaughy to fill as provided in this paragraph.

E. <u>Dry Conditions</u>

1. Dry conditions are defined as those circumstances when either the total Lake McConaughy contents, including the EA, as of October 1 plus the predicted Storable Natural Inflows from October 1 to March 31 is less than 1.55 maf, or the October 1 total Lake McConaughy content is less than 800 thousand acre-feet (kaf), but excluding those conditions defined as very dry in Paragraph III.F.1.

2. Non-irrigation season releases from Lake McConaughy for diversion at the Keystone Diversion Dam should average between 250 cfs and 700 cfs (exclusive of EA releases).

3. Non-irrigation season releases from Lake McConaughy shall supplement river flows and river gains to provide a minimum diversion at the Central Diversion Dam of 700 cfs and an average diversion of at least 900 cfs from October 1 through November 15, and a minimum diversion of 700 cfs and an average diversion of at least 850 cfs from November 16 through February 14, and a minimum diversion of at least 800 cfs and an average diversion of at least 960 cfs from February 15 through the beginning of irrigation season.

4. Requirements in Paragraphs III.E.2 and 3 are independent of each other and each must be met.

5. There shall be no upper limit on outflows from Lake McConaughy other than meeting the standards of safety and beneficial use.

6. Releases should be managed to impound between 250 kaf and 550 kaf during the non-irrigation season with a goal to optimize reservoir storage. After consultation with the EA Manager by the Districts, releases for diversion at the Central Diversion Dam may be at rates less than the average but not below the minimums specified in Paragraph III.E.3 if necessary to allow Lake McConaughy to fill as provided in this paragraph.

F. <u>Very Dry Conditions</u>

1. Very dry conditions are defined as those circumstances when the total Lake McConaughy content, including the EA, as of October 1 is less than 650 kaf.

2. Non-irrigation season releases from Lake McConaughy for diversion at the Keystone Diversion Dam should average between 250 cfs and 700 cfs (exclusive of EA releases).

3. Non-irrigation season releases beyond those required in Paragraph III.F.2 above shall be planned in consultation with the EA Manager and other customers to maximize multiple use of water and to share the effects of shortages. It is anticipated that irrigation season releases will be adjusted by the Districts and their customers consistent with existing policies and contracts to reduce water use to preserve future drought protection.

G. <u>Compliance Measurement</u>

1. Compliance with release requirements for diversion at the Keystone Diversion Dam shall be accomplished if the real-time mean daily average or non-irrigation season average gauge readings meet or exceed the requirements.

2. Central shall plan its operations to target mean daily flows at its diversion which meet or exceed minimum diversion requirements. In recognition of the distance involved and potential intervening factors affecting flows, compliance with release for minimum diversion requirements at the Central Diversion Dam shall be accomplished if either: 1) the real-time mean daily gauge reading less EA flows at that location meets or exceeds the required minimum minus 5 percent; or 2) the seven-day running average of the real-time mean daily gauge readings less EA flows meets or exceeds the required minimum. Compliance with releases for average diversion requirements at the Central Diversion Dam shall be accomplished within each period provided the average for the period of real-time mean daily gauge readings less EA flows conforms with the required average. Neither the seven-day running average nor the period average shall be calculated including any day during which the operational rules were suspended pursuant to Paragraph III.A.7.

3. Details of measurement and accounting protocols to verify compliance will be developed by the Districts, the EAC and NDWR.

IV. COORDINATING RESERVOIR MANAGEMENT

A. A Reservoir Coordination Committee ("RCC") shall be established to provide a forum to coordinate annual operation plans. This committee shall consist of one representative each from Central, NPPD, the EA Manager, BOR, Colorado, Wyoming and NEDWR. The RCC will coordinate operations plans and review reservoir accounting, inflow projections, storage and release goals and river monitoring methodologies.

B. The RCC shall meet at least annually and as often thereafter during the water year as is necessary to coordinate Central's and NPPD's water operations with the EA Manager's operation of the EA.

C. The RCC is for coordination purposes only. The Districts and the EA Manager retain the authority to develop their individual operations plans.

D. Central, as the operator of Lake McConaughy, and NPPD as the operator of the Sutherland project, shall communicate with the EA Manager in the manner the Districts communicate with other water users to facilitate effective day to day coordination. Central, NPPD and the EA Manager shall communicate as necessary to effectively coordinate their respective plans as they are implemented. The EA Manager shall be informed and provided background data if the Districts conclude it is appropriate to change the designation of the type of year before the plan is changed and related changes are made in required releases for diversion. The EA Manager also shall be informed as expeditiously as possible under the circumstances, should contingencies arise such as those described in Paragraphs II.C.2.a and b and Paragraph III.A.7. Increases or decreases in releases of operational flows or the EA shall be coordinated to ensure impacts to the hydraulic systems are minimized and beneficial uses maximized.

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM

Attachment 5
Section 6

Reconnaissance-Level Water Action Plan

Platte River Research Cooperative Agreement

Reconnaisance - Level Water Action Plan

Prepared for

GOVERNANCE COMMITTEE OF THE COOPERATIVE AGREEMENT FOR PLATTE RIVER RESEARCH

September 14, 2000

BOYLE
ENGINEERING CORPORATION

in association with
BBC Research & Consulting
Anderson Consulting Engineers

Table of Contents

Page No.

Table of Contents (cont.)

Page No.

Table of Contents (cont.)

Page No.

Table of Contents

List of Tables

Page No.

Table of Contents (cont.)

List of Tables

Page No.

List of Figures

I. Background Information

A. Purpose of the Proposed Program

The states of Nebraska, Wyoming and Colorado and the U.S. Department of the Interior (DOI) entered into a partnership to address endangered species issues affecting water use in the Platte River Basin. This partnership is guided by the Cooperative Agreement for Platte River Research (June 1997). The Proposed Platte River Recovery Implementation Program (Program) builds upon the Cooperative Agreement and lays out several activities and contributions from the three states and federal government that are to be conducted in specified increments. A primary goal of the Program is to assist in the recovery of the target species and their associated habitats through a basin-wide cooperative approach. One of the objectives of the first phase of the Program is to develop a Water Action Plan that identifies various projects in each state that can be applied to the overall water goals of the Program.

The U.S. Fish and Wildlife Service (FWS) developed recommendations for flows that it believes are needed at different times of the year for endangered species and other wildlife. The water goals of the Program are to reduce shortages to the FWS target flows by an average of 130,000 to 150,000 acre-feet per year (ac-ft/yr) over the next 10 to 13 years. A portion of the instream flow objectives will be met through an Environmental Account (EA) in Lake McConaughy, the Pathfinder Modification Project, and the Tamarack Plan. The remaining instream flow improvements will be met through a program of incentive-based water conservation and water supply activities. The Water Action Plan is intended to address the water conservation/supply component of the Program. The primary purpose of the Water Action Plan with respect to the Program is to identify ways of reducing shortages to target flows by 130,000 to 150,000 ac-ft/yr on average including the three specific projects mentioned above.

B. Need for the Proposed Program

The driving force behind the Cooperative Agreement and the Program is that many water projects in the Platte River Basin are subject to reviews of federal government permits. Under the Endangered Species Act (ESA), federal agencies must ensure that the water projects they authorize, fund, or carry out do not jeopardize the continued existence of endangered and threatened species or result in the destruction or modification of habitat that has been determined to be critical. The Cooperative Agreement is a comprehensive approach to address ESA requirements that will eliminate the need for each individual water project to undergo a separate review of its impacts on endangered and threatened species.

DOI and the states have proposed the Program to serve as the reasonable and prudent alternative for existing and certain new water related activities. If implemented, the Program will provide regulatory certainty under the ESA to existing water related activities and to certain new water related activities that are subject to review under section seven of the ESA.

II. Process

A. Development of the Water Action Plan

Boyle Engineering Corporation (Boyle) was retained to complete a Water Conservation/Supply Reconnaissance Study (Study) to identify and evaluate water supply and conservation alternatives within the three states that could contribute toward achieving the proposed program's objectives for reducing shortages to target flows. Boyle's services were performed under the direction of the Water Committee (WC). The Final Report for the Study, which was submitted to the WC on December 13, 1999, provides information on local net hydrologic effects, reductions to target flow shortages at the critical habitat, and costs at a reconnaissance level for each project evaluated. A preliminary assessment of legal and institutional requirements, social issues and environmental issues was also included.

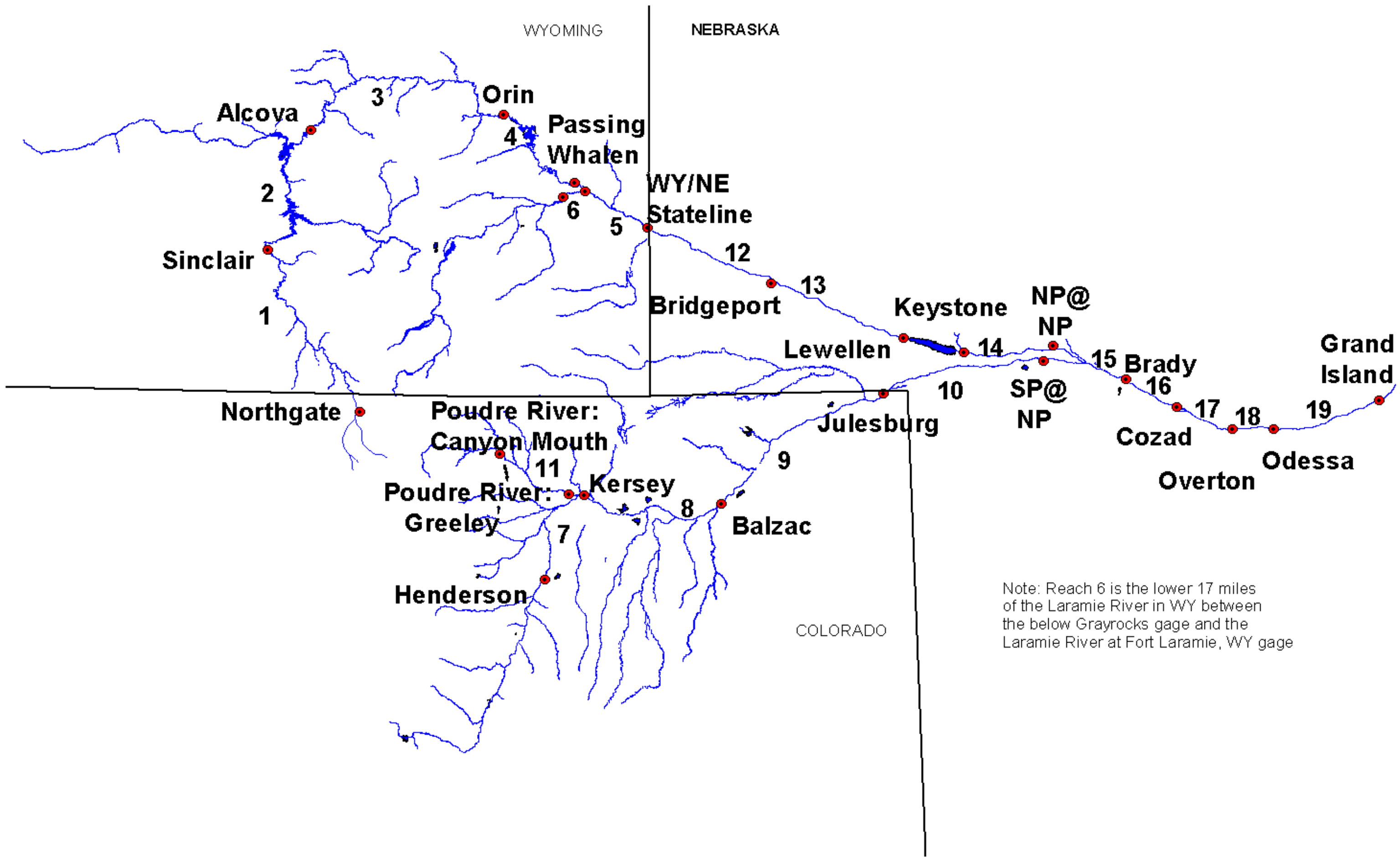
The Final Report was used by the Water Action Plan Committee in identifying and selecting the projects included in this Water Action Plan. However, the Water Action Plan includes some projects that were not analyzed by Boyle in the original study. Boyle relied on information provided by the three states and data presented in the Final Report to evaluate the projects included in this Water Action Plan. Representatives from the three states were contacted to acquire an understanding of how the states envision implementing the proposed projects. If the operating concept for a given project differed from that presented in the Final Report, information provided by the states was relied on. Likewise, if a more detailed analysis of a project has recently been completed and more information is now available regarding the yield and cost, that information has been taken into account.

The three states identified 13 potential projects for inclusion in the Water Action Plan. These projects are located throughout the Platte River Basin (Figure 1). Yield evaluations were made by the Platte River EIS/ESA team to refine the individual and cumulative yields of the projects and address the interactive effects of the projects. In developing the proposed program, each state identified a water reregulation project and agreed to the performance of the study and the development of a Water Action Plan. The combined effect of the original three projects and the Water Action Plan is intended to achieve the Program goal of reducing shortages to target flows by 130,000 to 150,000 ac-ft/yr in the first increment. A list of the projects included in the Water Action Plan is provided in the table below.

Table II-1
Water Action Plan Projects

State	Project
Nebraska	CNPPID Re-regulating Reservoir
Nebraska	Water Leasing
Nebraska	Water Management Incentives
Nebraska	North Dry Creek/Ft. Kearny Cutoffs
Nebraska	Dawson/Gothenburg Canal GW Recharge
Nebraska	Net Controllable Conserved Water
Nebraska	Groundwater Management
Nebraska	Power Interference
Wyoming	Pathfinder Municipal Account
Wyoming	Glendo Storage
Wyoming	Temporary Water Leasing
Wyoming	La Prele Reservoir
Colorado	Groundwater Management

Figure 1 – Platte River Basin and Study Reaches



The Water Action Plan Committee recognized that U. S. Forest Service (USFS) vegetation management may affect flows in the North, South, and Central Platte basins. The WAPC agreed that further study is required to determine these impacts and the USFS's responsibility to address these impacts. In addition, in the review of existing USFS management plans and future amendments to such plans, the FWS will establish a review criterion that vegetation management shall not lead to new depletions or a reduction in runoff from forest lands that adversely affect target flows or Program Projects for Threatened and Endangered Species. Whatever the outcome of these studies and reviews, the signatories will not be released from first increment commitments to reducing shortages to the FWS target flows by an average of 130,000 – 150,000 acre-feet per year.

All projects included in the Water Action Plan are voluntary and participation is incentive based. Inclusion of these projects in the Program is subject to reaching an agreement with the involved parties.

B. Additional Information Needs

The information presented for the projects included in the Water Action Plan is at a reconnaissance level of detail. Feasibility studies, final designs, and environmental permitting will be required before specific projects can be constructed. Where no construction is needed, implementation plans will be needed along with any necessary legislation.

Feasibility level studies will be required to address information requirements that are common to most projects. Those information needs are described in part C. of this Process.

Feasibility studies also may include the use of demonstration projects as discussed in Chapter 10 of the Study. Demonstration projects include small-scale projects that are constructed to test both the feasibility of larger scale projects and the assumptions used in their evaluation; projects that are not physically constructed, but provide further data through field investigations and measurements; and projects that focus on refining assumptions and methodologies used to analyze an alternative by developing more sophisticated analytic tools.

Additional project specific information needs are identified below.

<u>CNPPID Re-regulating Reservoir:</u> Information will be needed on reservoir seepage losses and the associated effects on surrounding landowners. The willingness of local landowners to sell their land will also need to be evaluated because specific parcels of land are required to construct the reservoirs evaluated.

<u>Water Leasing in Nebraska and Wyoming:</u> The willingness of irrigators to participate in this project must be evaluated before yields and costs can be further defined. This could be accomplished by regional or local questionnaires, public meetings, or many other methods.

<u>Water Management Incentives:</u> Baseline conditions will need to be established from which changes can be measured. The willingness of irrigators to participate in this project must be evaluated before yields and costs can be further defined.

<u>Groundwater Management:</u> Further investigation and monitoring is required prior to and during implementation of groundwater management programs to ensure the sustainability of these projects. A more in-depth hydrogeologic analysis is needed to address the dynamic response of the groundwater mound in Central Nebraska and the possible firm yield that can be attained without mining the mound. Any project designed to take water from the mound will need to be phased-in so that hydrologic impacts can be monitored and evaluated.

<u>Dawson/Gothenburg Canal Recharge Projects:</u> Information is needed on high groundwater levels in the area and the associated effects on surrounding landowners.

Power Interference: This project has several operational and contractual considerations that will need to be addressed, including how saved water is released, and how existing and new contractual arrangements with power generators can be executed.

La Prele Reservoir: Further analysis of the seepage from La Prele Reservoir is needed to determine whether a temporary storage contract in a downstream reservoir such as Glendo Reservoir is necessary to fully realize the yield associated with this project.

C. Process for Advancing Water Conservation/Water Supply Projects

The potential projects identified in Table II-1 have been evaluated at a reconnaissance level and will be funded for advancement to the feasibility level unless the Governance Committee decides otherwise. As more in-depth analyses of project yields and costs are completed, the Governance Committee may choose to replace projects in the Water Action Plan with alternative projects. Each state has expressed its desire to reserve the right to add or remove projects from consideration in the future if an issue arises that cannot be resolved. Circumstances that might result in projects being added to the Water Action Plan include insufficient yield to meet the water goals of the Program. A project can be removed from the Water Action Plan if the project is not implementable within the first increment (13 years), generates significantly less yield than was anticipated, is too expensive, is unacceptable to the Governance Committee for other reasons, or if an agreement cannot be negotiated with the project sponsor. New projects may or may not require a supplement to the Programmatic EIS. Elements of the Water Action Plan will be subject to site specific National Environmental Policy Act (NEPA) and ESA review as appropriate.

The following process will be used to add new projects for consideration and to advance projects, including those identified in the initial list, from conception of an idea, through reconnaissance study, through identification for feasibility study, through feasibility evaluation, to acceptance or rejection for implementation, and through implementation.

1. ADDING PROJECTS TO THOSE IDENTIFIED FOR FEASIBILITY STUDIES.

a. Anyone can propose to the Governance Committee an additional water conservation/supply project to be considered.

b. Any proposal to consider an additional project must be accompanied by a reconnaissance study by the project sponsor or a concept for a reconnaissance level study by the Program for that project. The Governance Committee will address funding by the Program if reconnaissance studies were not funded by the project sponsor or others.

c. The reconnaissance study shall include, at a minimum:

   i. preliminary estimates of shortage reduction;
   ii. preliminary estimates of cost, including any financial or other incentives necessary to implement the project;
   iii. preliminary identification of legal, socioeconomic and institutional impediments, compatibility with existing law, and any changes in law necessary to implement the project;
   iv. preliminary identification of beneficial and adverse environmental impacts, including impacts on surface water, groundwater, water quality, vegetation, wildlife, and on-site threatened and endangered species;
   v. preliminary identification of water availability based on historical flows and program projects;
   vi. preliminary assessment of relation of project yield to other program projects;

vii. preliminary analysis of potential beneficial and adverse direct and third party impacts, including hydrologic, economic, and social impacts on surface water and groundwater users, and preliminary identification of measures and estimate of costs to avoid, offset, or mitigate adverse impacts, if appropriate; and

viii. preliminary identification of federal, state, county, and other permits necessary to implement the project and process for obtaining such permits.

The Governance Committee will decide how to handle the proposal, which could include: (1) requesting additional information from the project proponent; (2) referring the proposal to a committee for consideration and a recommendation; (3) adding the project to the list of those advancing to the feasibility level of study and discussing with any project sponsor other than a state whether such study will be funded and/or contracted for by the Program or the project sponsor; or (4) rejecting the proposal.

2. FEASIBILITY STUDIES AND APPROVAL OR REJECTION BY G.C.

a. A proposal, budget and schedule for carrying out feasibility studies will be provided to the Governance Committee by the Water Committee or other Governance Committee designee. Anyone can carry out feasibility studies at their own expense and provide them to the Governance Committee for consideration.

b. Feasibility studies will include complete and refined information about each issue identified in items 1.c.i through 1.c.viii above. Feasibility studies will also include the following information:

   i. A reasonable implementation schedule for the project;
   ii. The process(es) for obtaining any necessary water rights for the project, any necessary agreements with water rights holders, and/or any necessary changes of water law;.
   iii. A process for obtaining public input and reporting thereon;
   iv. A proposed monitoring program for the project;
   v. Proposed operating rules for the project;
   vi. Any other necessary project construction requirements, methods, procedures, and schedules.

c. The Governance Committee will consider the feasibility level study for each project and decide whether to: (1) request additional information; (2) refer the proposal to a committee for consideration and a recommendation; (3) accept the proposed water conservation/water supply project for implementation; or (4) reject the project. At that time DOI will advise what activities, if any, are necessary to comply with NEPA.

d. Associated issues, such as property acquisition (if appropriate), "buy back" rights, avoidance or mitigation of direct and third party impacts, and equity and crediting if the program terminates must be resolved before a project is accepted for implementation.

3. IMPLEMENTATION OF PROJECTS ACCEPTED BY THE GC AFTER FEASIBILITY STUDIES

a. The Governance Committee must approve funding for the project for the project to be implemented.

b. The project may be implemented by the Governance Committee, by one or more states, or by another project sponsor or sponsors, in accordance with the plan and schedule included in the feasibility study and approved by the Governance Committee. If the project sponsor oversees implementation, the project sponsor will coordinate with a designated representative of the Governance Committee who would receive advice from the Water Committee.

c. Implementation tasks, which will be subject to Governance Committee oversight and approval as appropriate, may include: (1) complying with state and federal laws and regulations; (2) hiring contractors; (3) completing final project design; and (4) building and operating the project. The executive director, a contractor, a state or a project sponsor as appropriate may implement some or all of these tasks.

d. The executive director, contractor, state or project sponsor will provide appropriate information to the Governance Committee to ensure that the project is operating according to design and to determine if its performance can be improved to increase water yield, cut costs, or achieve other benefits. If the Governance Committee considers proposals to increase yield or performance of a project not operated by the executive director, another program contractor, or a state, discussions will include the project sponsor. Such changes shall not be implemented without the agreement of the project sponsor. If unanticipated changes occur during implementation, the issues shall be brought to the Governance Committee for resolution.

e. After implementation, monitoring and research will occur as directed by the Governance Committee in accordance with the Program's Integrated Monitoring and Research Plan. Monitoring shall also occur as needed to evaluate direct and third party impacts and any mitigation process instituted.

f. Tracking and accounting will be accomplished per Program procedures.

III. Projects

A. Introduction

The information presented in this Water Action Plan is intended to meet both the needs of the Governance Committee and the EIS/ESA Team. The proposed projects must be described in sufficient detail so the EIS/ESA Team can evaluate the benefits of the proposed Program for the target species and the general impacts of the Program on the Platte River Basin water resources and dependent economies.

The following information is provided for each project included in the Water Action Plan per the December 1, 1999 memo by Curt Brown, Platte River EIS Study Manager.

1. *Location of the Project:* Location of project facilities or associated actions.
2. *Basic Description:* The plan of operation that produces the intended benefit.
3. *On-site Yield and Timing:* A typical schedule of diversions, storage, or releases producing the local yield to the river. This corresponds with on-site hydrologic effects.
4. *Legal and Institutional Requirements for Implementation:* Issues critical to the successful implementation of the element. This may include issues related to permitting, water rights, contracts, state laws and regulations, interstate compacts, etc.
5. *Schedule for Implementation:* The likely schedule for full implementation of the project.
6. *Expected Project Life:* The projected life of the element, based on the estimated investment and operating costs.
7. *Capital and Operational Costs:* The initial and annual costs for the project.

In addition to these seven EIS team information requirements, the WAPC requested information be included on third-party impacts. Third party impacts may include hydrologic, economic, social, and environmental impacts associated with each project. A hydrologic analysis considers impacts on existing surface and groundwater users resulting from changes in the timing and quantity of water in the river while taking into account terms and conditions of interstate compacts, decrees and the Program. A socioeconomic analysis considers impacts on the local and regional economy, taxes, hydropower generation, and recreation. An environmental impact analysis considers changes in water quality and habitat areas.

A qualitative identification of potential third-party impacts associated with each project is provided, however, a more in-depth quantification of negative and positive costs, benefits, and specific impacts has not been completed. For example, third party costs may include power interference charges or compensation for adverse impacts to existing water right holders and groundwater users. Costs/benefits associated with third party impacts will need to be assessed prior to implementation. Costs associated with third party impacts could be relatively high for certain projects, resulting in higher costs than presented in this report. Likewise, positive third party impacts should be credited to the Program when possible, which could reduce the cost of a project. Information on third party impacts developed by the EIS team will be included when made available.

Two other types of information are mentioned in the WC's Scope of Services under Water Action Plan requirements, which include: 1) monitoring and accounting methods; and 2) recommendations concerning how Program water moves through the system to maximize benefits to the habitat. These two topics are addressed in Chapters IV and V, respectively.

B. Nebraska Projects

1. CNPPID Re-regulating Reservoir

◊ Location:

Several re-regulating reservoir options were evaluated by HDR Engineering Inc. (HDR) for Central Nebraska Public Power and Irrigation District (CNPPID). The HDR report, titled *Depletion Mitigation Study Phase I*, was made available to Boyle Engineering on April 13, 2000. The HDR report has been relied on for information on potential re-regulating reservoirs within CNPPID's system.

Nebraska indicated they are willing to consider a re-regulating reservoir(s) capable of yielding an annual average of up to 8,000 ac-ft of target flow reductions at the critical habitat, of which 4,000 to 5,500 ac-ft would be made available to the Program (Jim Cook, Nebraska Natural Resource's Commission, June 28, 2000 memo). The remaining portion of the yield will be retained by Nebraska to potentially offset future depletions. An average of up to 8,000 ac-ft/yr of target flow reductions could be attained through a single re-regulating reservoir or a combination of reservoirs. As such, the six most promising re-regulating reservoir options evaluated in the HDR report are presented below.

The site locations of the six re-regulating reservoirs listed in order by location from west to east are described as follows:

Option 1: Jeffrey Canyon Reservoir. This site is located south of Brady in Lincoln County on the south side of the Central District Supply (Canal). This reservoir would be fed from Jeffrey Reservoir. The reservoir capacity is estimated to be 10,390 ac-ft.

Option 2: Smith Canyon Reservoir. This site is located southwest of Gothenburg in Dawson County on the south side of the Canal. This reservoir would be fed by water pumped from the Canal. The reservoir capacity is estimated to be 12,895 ac-ft.

Options 3&4: Midway Lakes Reservoirs No. 2 and No. 5. These sites are located south of Willow Island in Dawson County on the south side of the Canal. These reservoirs would be fed by water pumped from the Canal. The capacities of Midway Lakes Reservoirs No. 2 and No. 5 are is estimated to be 6,433 ac-ft and 11,429 ac-ft, respectively.

Option 5: North Plum Creek Reservoir. This site is located southeast of Cozad in Dawson County on the north side of the Canal. This reservoir would be fed by water from the Canal. The reservoir capacity is estimated to be 2,320 ac-ft.

Option 6: J-2 Forebay Reservoir. This site is located southeast of Lexington in Gosper County in the Plum Creek basin, south of the J-2 Forebay on the south side of the Canal. This reservoir would be gravity fed from the Canal. The reservoir capacity is estimated to be 3,436 ac-ft.

◊ **Basic Description:**

Re-regulating reservoirs capture Platte River water beyond that required for irrigation deliveries and mainstem instream flows during periods of excess flow at the critical habitat. In general, water would be diverted from the Central District Supply Canal during periods of excess and released during periods of shortage at the critical habitat. In the case of the Jeffrey Canyon and the J-2 Forebay Reservoirs, water would be supplied from Jeffrey Reservoir and the J-2 Forebay, respectively, as opposed to the Canal. CNPPID is proposing to re-regulate flows in their system, in which case diversions will not be increased or decreased, only return flows will change.

◊ **On-Site Hydrologic Effects:**

The HDR Report was relied on for yield estimates. The on-site yields presented have not been discounted, therefore, the EIS team will need to consider the reservation of water for Nebraska's future depletions in determining the scores associated with these reservoirs.

HDR developed a spreadsheet to analyze the flow regime of each potential reservoir. Reservoir operations were modeled on a daily basis. Daily operation is possible due to the close proximity of the reservoirs to the habitat. Days of excess can occur in months that the monthly flow does not exceed monthly target flows, in which case, the reservoirs could be operated to store on *days* of excess and release on *days* of shortage. These reservoirs can take advantage of short-term excesses and shortages in a more efficient manner than other alternatives that are further upstream.

The following assumptions and operating rules were used by HDR to determine the yield and timing associated with these reservoirs.

- No dead pool was accounted for. All reservoirs were allowed to drop until they were dry.

- Type of year for purposes of defining target flows (wet, average, or dry) is known.

- Travel time from Overton to Grand Island is two days. Historic flows at Overton were used to determine the amount of water that should be stored or released from the reservoirs to meet the target flows at Grand Island.

- Buffers were used to incorporate a factor of safety in the decision to store or release. If the flow at Overton was more than 200 cfs above the target flow, then water was diverted to storage. If the flow at Overton was more than 500 cfs below the target flow, then water was released from storage. Changes to these buffers will affect yield results.

- Incremental changes in gains and losses between Overton and Grand Island are negligible.

- Rainfall falling on water surfaces was assumed to be added to the reservoir volume in full. Historical daily precipitation data was obtained from the Holdrege weather station.

- Runoff contributed from rainfall falling on the drainage basin surrounding the reservoirs was subject to SCS losses. Antecedent moisture conditions were used.

- Seepage through the dams was estimated using Darcy's Law and the geometry of the dam along with soil characteristics. Daily seepage rates were based on the water surface elevation at the beginning of the day.

- Evaporation was based on available climate data for the North Platte weather station. A constant water surface area associated with one-half the reservoir depth was used for each reservoir for the purpose of determining evaporative losses and direct rainfall.

- The reservoirs began the study period empty.

- Inflow and outflow capacities were preliminarily set by conversations with CNPPID. Fill capacities ranged from 100 to 400 cfs, while release capacities were set at 50 cfs for all reservoirs. Changes to these capacities will affect yield results.

- No freeboard was used in the hydraulic and hydrologic analyses. Water was considered to be spilled in full beyond the normal volume of the reservoir.

- Water was available in the Canal up to the amount of the historic J-2 Return during periods when diversions into the reservoirs were made. The water diverted from the Canal to be stored in the reservoir could not exceed the flow in the J-2 Return.

Daily reservoir operations data, including diversions to storage and releases, have not yet been made available by HDR and CNPPID.

◊ Legal And Institutional Requirements for Implementation:

There may be several legal and institutional requirements necessary to implement any of these reservoirs. As noted by NPPD in comments received May 3, 2000, the operational rules must insure that all senior water right demands are met before storage is considered or credited to a CNPPID re-regulating reservoir. This condition should be met if water is only available for storage on days that flows downstream of the J-2 Return exceed the needs of existing water rights.

Nebraska will also explore several institutional alternatives for capturing, releasing, and protecting water generated from a re-regulating reservoir if it moves forward (Nebraska's Comments on Boyle January 17, 2000 Memo). Potential institutional alternatives presented by CNPPID, which address legal requirements, are as follows. If the reservoir is filled by re-timing water already diverted under an existing water right when river flows below the J-2 Return exceed target flows, there will be no additional diversions from the Platte River. Therefore, one alternative may be to modify the existing water rights to permit additional regulation provided no other water right is harmed. Another alternative may be to specify the Central District Supply Canal, rather than the Platte River, as the source of water for the reservoir. In this case, the argument could be made that water is available for storage on days that flows downstream of the J-2 Return exceed the needs of existing water rights and target flows. Another option may be to file for a new storage permit to divert water from the Platte River. A new storage permit with a junior priority date may not be a significant problem given CNPPID's intentions not to harm other water rights or target flows (CNPPID's comments, February 16, 2000).

If CNPPID is able to acquire a permit to divert under their existing water rights then water could be protected from diversion under the new storage right. However, even if releases are not protected, there is little opportunity for downstream users to divert additional water associated with this project given the proximity to the critical habitat.

Based on conversations with CNPPID personnel, it is possible that CNPPID may need an amendment to the current Federal Energy Regulatory Commission (FERC) license to construct this reservoir since it could affect operations of its current FERC licensed projects. However, there is no FERC requirement that CNNPID build this reservoir to improve their system. NEPA/ESA compliance would also have to be completed on the construction of the reservoir to address any on-site issues.

Other federal and state agency permit requirements investigated and identified in the HDR report include the following. A U.S. Army Corps of Engineers 404 permit would be required in addition to a 401 Water Quality Certification, which would be addressed via the 404 permitting process. Coordination with the Nebraska State Historic Preservation Officer would be required before construction. An NPDES Permit to Discharge Storm Water Associated with Construction Activity and associated Storm Water Pollution Prevention Plan for construction activity would be required. Construction activity would require review from the State of Nebraska DEQ-Air Quality Division. Permits may be required for the construction of structures within the affected counties in Nebraska.

◊ **Schedule For Implementation:**

Comments were received from Nebraska regarding draft implementation schedules for all Nebraska projects included in the Water Action Plan. The implementation schedules provided are estimated times to implementation from the start of the Program, or if action to implement that alternative does not commence until sometime after the first year of Program implementation, the estimated time to complete implementation once it has begun. Implementation times assume that principle efforts are directed at that alternative. To the extent that efforts are being made to implement multiple alternatives, the implementation times may be longer. All of the implementation times are subject to obtaining any necessary supporting water rights and/or changes to existing water rights used to support the Program.

As noted in comments received from Nebraska, a re-regulating reservoir within CNPPID's system is estimated to take five to seven years to implement. A final design study and several state and federal permits would be required prior to construction.

◊ **Expected Project Life:**

The project life of a re-regulating reservoir would most likely extend well beyond the first increment of the Program. If properly maintained and operated, reservoir lives can exceed 75 to 100 years. Existing seepage problems associated with some of these sites could impact the project life depending on whether seepage problems can be avoided or mitigated.

◊ **Capital And Operational Costs:**

The HDR report was relied on for cost estimates with the exception of hydropower impacts. The capital and annual costs for this project include costs associated with land acquisition, access, pump intake system, outlet structure and system, spillway, construction of the earthen dam, annual operations and maintenance costs, and lost hydropower revenue.

Most of the capital construction costs were determined by estimating the quantities of the components and multiplying by a unit cost for each. Some of the assumptions used by HDR for unit costs are as follows:

- $5 per cubic yard for embankment material complete in place.
- $35 per square yard for riprap with a sand filter.
- $340 per acre for mulching on the face of the dam.
- $8,000 per drop structure on spillway channels.
- Intake and outlet system costs are variable based on site conditions.
- $1000 per acre for land acquisition.
- Pump system costs were based on the power required to operate pumps at given flowrates and heads.
- Annual operations and maintenance costs were estimated to be 5 percent of pump capital costs.
- Mean annual lost hydropower costs were estimated to be $3 per acre-foot per hydropower plant bypassed. (Per personal communication with Mike Drain of CNPPID, May 16, 2000, this figure is in error and should have been $4 per acre-foot, therefore, the $4 figure has been used in this Water Action Plan. Furthermore, this figure represents loss of hydropower revenue to CNPPID but does not reflect loss in revenue to NPPD.)[1]
- $125,000 per mile for construction of access roadway.

The total capital costs and annual operations and maintenance costs are summarized in the table below. Nebraska is reserving 31 to 50 percent of the estimated 8,000 ac-ft/yr yield (or 2,500 to 4,000 ac-ft/yr of reserved yield) to offset future depletions, in which

[1] For some reservoirs there will be annual costs associated with lost hydropower generation because releases bypass a plant. Water diverted to storage will be taken out above the hydropower plant and released below the generator.

case only a proportionate share of the cost of this project would be attributable to the Program. Fifty (50) percent of the total capital costs and annual costs attributable to the Program were estimated to range from approximately $2.45 million to $4.61 million and $78,000 to $255,000, respectively. Sixty nine (69) percent of the total capital costs and annual costs range from approximately $3.39 million to $6.37 million and $108,000 to $352,000, respectively.

Table III-1
Re-regulating Reservoir Costs

	Jeffrey	Smith	Midway No. 2	Midway No. 5	N. Plum	J-2
CAPITAL COSTS						
Land Acquisition	524,000	715,000	276,000	421,000	221,000	206,000
Access Roadway	450,000	925,000	137,500	1,215,000	165,720	75,000
Pump Intake System	2,075,055	1,567,580	2,088,517	1,856,685	1,893,841	4,301,481
Outlet Structure	200,000	200,000	240,000	240,000	200,000	240,000
Spillway	315,833	226,983	218,000	194,517	280,500	242,083
Earth Dam	4,662,515	4,756,115	3,155,000	3,361,574	2,033,944	1,892,599
Outlet System	1,001,775	94,612	157,254	83,179	111,308	231,328
Total Capital Cost	**9,229,178**	**8,485,290**	**6,272,271**	**7,371,955**	**4,906,313**	**7,188,491**
50% of the Capital Cost	**4,614,589**	**4,242,645**	**3,136,136**	**3,685,978**	**2,453,157**	**3,594,246**
69% of the Capital Cost	**6,368,133**	**5,854,850**	**4,327,867**	**5,086,649**	**3,385,356**	**4,960,059**
ANNUAL COSTS						
Hydropower Lost	63,796	36,612	20,648	23,908	28,288	33,880
O&M and Power Costs	315,946	408,301	485,389	485,931	128,113	209,002
Total Annual Cost	**379,742**	**444,913**	**506,037**	**509,839**	**156,401**	**242,882**
50% of the Annual Cost	**189,871**	**222,457**	**253,019**	**254,920**	**78,201**	**121,441**
69% of the Capital Cost	**262,022**	**306,990**	**349,166**	**351,789**	**107,917**	**167,589**

Potential costs associated with third party impacts have not been evaluated. The project costs presented above may be higher if there are third party impact costs.

◊ Third-Party Impact Considerations:

Potential third party impacts include positive and negative effects on the following:

1. Hydrologic conditions: Includes changes in streamflows, canal flows, and return flows both in terms of timing and quantity.
2. Economic and fiscal conditions: Includes changes in income, employment, sales or expenditure patterns, tax revenues, related industries, and economic development.
3. Environmental conditions: Includes changes in water quality and habitat areas.
4. Social Conditions: Includes changes in recreational areas, visitations, and expenditures.

There are potential negative economic and hydrologic third party impacts associated with this project due to changes in the quantity and timing of streamflows. If the reservoir is filled by re-timing water already diverted under an existing water right there will be no additional diversions from the Platte River. Diversions to storage will decrease return flows at the J-2 Return and reduce available flows for new downstream water users in the future or potentially existing downstream users if they are not protected through the water rights administration process. Storage releases and return flows from reservoir seepage will also alter the quantity and timing of water available to downstream users. Reservoir seepage is a particular concern due to existing seepage problems in the Plum Creek drainage for example. Additional seepage may increase groundwater levels in the vicinity, which could have both positive and negative third party impacts. Increased groundwater levels could reduce pumping costs for nearby groundwater irrigators. Alternatively, increased groundwater levels could result in waterlogging of nearby irrigated lands causing decreased productivity and yields.

A re-regulating reservoir could generate employment opportunities on a short-term basis during construction, which is a third party economic benefit. A re-regulating reservoir should not impact crop patterns or crop production, in which case regional changes in income, sales, or tax revenues are not likely.

A CNPPID re-regulating reservoir could provide an increase in recreational opportunities, which is a third party benefit. Recreational opportunities may include swimming, picnicking, fishing, nature study, sightseeing, hiking, and boating. The extent to which recreational opportunities are enhanced depends on how the reservoir is operated and whether the other reservoirs in the vicinity, including Johnson Lake and Elwood Reservoir, already provide similar recreational opportunities.

Third party environmental impacts associated with this project can be both positive and negative. There could be negative impacts to wetlands from reservoir impoundment and positive impacts resulting from the creation of additional wildlife habitat. Reservoir projects could also have both negative and positive impacts on water quality and downstream aquatic habitat. Water quality could improve during the summer months when additional flows are added to the river. However, water quality could be degraded and fish and aquatic habitat negatively impacted during the winter months when river flows are reduced. This possibility might be minimized if water is only pumped when target flows are being met.

2. *WATER LEASING IN NEBRASKA*

◊ Location:

Nebraska has not yet identified specific irrigation districts or individual farmers that are willing to participate in a leasing program in conjunction with the Program. The willingness to participate is also unknown at this time. Due to these conditions, a leasing program was evaluated for Reaches 10 (Julesburg, CO gage to South Platte at North Platte, NE gage) and 14 through 19 (Keystone Diversion gage to Grand Island, NE gage). ***It was assumed that representative leasing projects are located at the mid-point of each reach because specific irrigation districts and lands willing to participate in the Program are not yet known.*** The reaches are defined as follows:

Reach 10: Julesburg, CO gage to South Platte at North Platte, NE gage
Reach 14: Keystone Diversion gage to North Platte at North Platte, NE gage
Reach 15: North Platte at North Platte, NE, gage to Brady, NE gage
Reach 16: Brady, NE gage to Cozad, NE gage
Reach 17: Cozad, NE gage to Overton, NE gage
Reach 18: Overton, NE gage to Odessa, NE gage

Reach 19: Odessa, NE gage to Grand Island, NE gage

The principal canals or irrigation districts that have irrigated lands in reaches 10, and 14 through 19 are listed below. These irrigation districts and/or canals could potentially be involved in a leasing program.

Reach 14: Keith-Lincoln Canal, Paxton-Hershey Canal, North Platte Canal, Suburban Canal and Cody-Dillon Canal
Reach15: CNPPID
Reach 16: CNPPID, Six Mile Canal, Thirty Mile Canal, Orchard-Alfalfa Canal, Cozad and Gothenburg Canals
Reach 17: CNPPID and Dawson County
Reach 18: CNPPID and Kearney Canal
Reach 19: CNPPID

◊ **Basic Description:**

A voluntary temporary leasing program would provide incentives to farmers to annually lease water supplies that would otherwise have been used for irrigation. The amount of water available to the Program consists of the reduction in consumptive use. The project evaluated assumes that leased water rights are dependent on storage rights in Lake McConaughy. In general, water will be leased from an irrigation district or farmer with storage rights in Lake McConaughy. The reduction in consumptive use will likely be added to the EA when storage space is available and released during times of shortage at the critical habitat. The EA may not always be available to re-regulate downstream reductions in consumptive use, however, the opportunity for an exchange is greater if leasing is associated with a water right dependent on storage. For example, irrigation releases from Lake McConaughy for CNPPID and Nebraska Public Power District (NPPD) could be reduced, which would result in corresponding increases in the EA. Although it may be feasible to lease natural flow water rights, it will be more difficult to insure protection.

Under a temporary lease, irrigation districts or farmers would not relinquish ownership of their water rights. Pending approval of new legislation, water supplies could be leased for five years with an option to renew at the conclusion of the contract for another five years. To provide maximum flexibility the mix of farms participating in the program would be allowed to change over time. The leasing program that has been analyzed considers leasing approximately 25,500 ac-ft annually, which corresponds to a reduction of about 17,000 ac-ft/yr delivered on farm and a reduction in consumptive use of about 8,400 ac-ft/yr.

◊ **On-Site Hydrologic Effects:**

Estimates of on-site yield and timing presented below were based on the Final Report.

The number of acres that were assumed to be included in a leasing program are summarized in the following table. The acreage is based on the assumption that the full water supply and associated reductions in consumptive use consist of storage water. Many acres below Lake McConaughy receive storage water primarily as a supplement to natural flow supplies. To the extent that storage is used to supplement natural flow supplies, the acreage included in a leasing program and the yield it can produce may need to be adjusted.

Table III-2
Leasing Program

Reach	Program Acres (ac)
10	460
14	560
15	610
16	770
17	1,610
18	2,080
19	1,750
Total	7,840

The amount of water leased in each reach was based on the distribution of acres irrigated with surface supplies. Although a significant portion of the acreage included in this program is in reaches 18 and 19, which are within or near the end of the critical habitat, the savings in consumptive use may be stored in the EA as space is available. Releases from the Lake McConaughy EA will flow through the entire critical habitat, therefore, the yields of these programs have not been discounted. As mentioned earlier, the project assumes that leased water rights are associated with storage rights.

The tables below show the proposed average monthly reductions in diversions and the reductions in on-farm deliveries for each reach. Although the reductions in diversions were assigned to a reach based on the distribution of irrigated acres, in some cases the reductions would occur further upstream depending on the location of the mainstem headgate. The amount delivered on-farm was based on the average conveyance loss for each reach. Data on conveyance losses was based on county-level information obtained from the USGS Water Use Data for 1995.

Table III-3
Reductions in Diversions from the North Platte, South Platte and Platte Rivers (ac-ft)

Month	Reach 10	Reach 14	Reach 15	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0	0	0	0
November	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0
January	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0
April	16	19	14	19	34	23	9
May	34	41	31	41	80	55	21
June	288	279	293	458	905	983	819
July	683	639	696	1128	2622	2946	2347
August	613	575	625	1036	2115	2386	2023
September	50	59	45	80	147	134	83
Annual	1683	1611	1705	2762	5904	6528	5302

Table III-4
Reductions in the Amount Delivered On-Farm (ac-ft)

Month	Reach 10	Reach 14	Reach 15	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0	0	0	0
November	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0
January	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0
April	10	15	11	11	20	16	6
May	20	32	24	24	48	38	14
June	173	218	232	272	535	665	566
July	410	501	549	670	1551	1994	1620
August	368	450	494	616	1251	1615	1397
September	30	46	36	48	87	91	57
Annual	1010	1262	1346	1641	3492	4418	3661

A representative leasing program could reduce on-farm deliveries and consumptive use by about 17,000 ac-ft per year and 8,500 ac-ft per year, respectively. On-farm reductions in consumptive use were based on an on-farm efficiency of 50 percent.

The following table shows the average monthly reductions in consumptive use for the 1975-94 period.

Table III-5
Reductions in Consumptive Use (ac-ft)

Month	Reach 10	Reach 14	Reach 15	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0	0	0	0
November	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0
January	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0
April	5	8	6	6	10	8	3
May	10	16	12	12	24	19	7
June	87	109	116	136	268	333	283
July	205	251	275	335	776	997	810
August	184	225	247	308	626	808	699
September	15	23	18	24	44	46	29
Annual	505	631	673	821	1746	2210	1830

Based on the water budget spreadsheet, a reduction in consumptive use of about 8,400 ac-ft resulted in a yield of 7,000 ac-ft of shortage reductions at the critical habitat without diversion losses. In this case, it is important to note that flows in the critical habitat will only be increased by reductions in consumptive use. Therefore, the amount of leased water is considerably higher to account for historic return flows. The modeling being performed by the EIS team may indicate that the yield associated with 8,400 ac-ft of consumptive use savings is higher or lower than 7,000 ac-ft of reductions to target flow shortages. If the EIS modeling indicates a yield that differs from 7,000 ac-ft at the critical habitat, the size of the leasing program may require adjustment.

◊ **Legal And Institutional Requirements for Implementation:**

There are several legal and institutional requirements necessary to implement this project. New legislation would be required to establish the conditions under which a water rights leasing program could be implemented in Nebraska. Two legislative bills, 671 and 672, which address water rights leasing, have been indefinitely postponed and will need to be reintroduced in a subsequent legislative session. These bills would need to be ratified before leasing could be implemented in Nebraska.

The Nebraska Department of Natural Resources would manage agricultural leases. Based on the conditions proposed in LBs 671 and 672, a leasing application must be approved by the DWR. For some leases, water not used for irrigation could be stored in the Lake McConaughy EA. Water released from the EA would be protected from diversion under water right A-17695. If an individual farmer within an irrigation district desires to lease water to the Program, the irrigation district must consent to the lease.

The terms and conditions under which the EA could be used to re-regulate reductions in irrigation water use downstream of Lake McConaughy would need to be agreed upon.

◊ **Schedule For Implementation:**

This project does not require any new construction or infrastructure, therefore, the implementation schedule is based primarily on the resolution of legal and institutional issues.

As noted in comments received from Nebraska, the draft schedule for implementing this project is as follows:

Year 1: Introduction of proposed legislation.

Year 2: Enactment of legislation and adoption of rules and regulations to implement leasing law.

Year 3: Governance Committee establishes an incentive based leasing program compatible with Nebraska water rights leasing law.

Year 4 to Year ? (will depend on cash flow to the Program and participant willingness): Water right leases are secured from individual water right holders and the Department of Natural Resources (DNR) reviews each lease for approval/disapproval. This assumes such approval would be required by the legislation.

◊ **Expected Project Life:**

The expected project life is dependent on the length of the leasing contracts. Proposed legislation provides for 5-year leases with an option to renew for another 5-year period at the conclusion of the lease. A leasing program could extend through the first increment of the Program and beyond if multiple lease renewals are allowed and farmers come in and out of the program.

◊ **Capital And Operational Costs:**

The Final Report was relied on for leasing cost estimates. The annual costs of a representative water leasing program were estimated based on the following components:

- Annual economic value of irrigation on lands in Reaches 10, and 14 through 19. The annual value of irrigation supplies was estimated at between $45 and $55 per ac-ft of consumptive use based on farm net income and land rental differentials between irrigated and non-irrigated lands. Farm net income estimates were based on average cropping patterns, yields, prices, and costs for the years 1992, 1994, and 1996 provided in an agricultural database compiled by Natural Resources Consulting Engineers, Inc. (NRCE). Information on land rental differentials was based on the information from the United States Department of Agriculture, Nation Agricultural Statistics Services (NASS) published in July 1999.

- An incentive premium of 25 percent to induce participation in the program.

- Transaction and administrative costs representing approximately 30 percent of total program costs.

On an annual basis, a leasing program was estimated to cost an average of about $80 per acre-foot of consumptive use saved on-farm. This cost includes an incentive premium and administrative costs. A separate leasing cost analysis was completed by Vernon Nelson, co-chairman of the Land Committee. Vernon Nelson estimated that leasing water in South Central Nebraska would cost about $123 per acre per year not including an incentive premium or administrative costs. More information is needed on the assumptions used by Vernon Nelson's study group to fully assess the reasons for the difference in costs. One potential difference could be the source of data used to determine yields, prices and costs. Vernon Nelson's estimate also assumed that taxes paid would be for irrigated land even if land involved in a lease was converted to dryland, whereas Boyle's estimate considered land rental differentials between irrigated and non-irrigated lands. Per CNPPID, (fax from Don Kraus, May 16, 2000) Mr. Nelson's approach reflects the provisions of proposed leasing bills. For comparison purposes a similar incentive premium of 25 percent and administration cost of 30 percent were added to Vernon Nelson's estimate, for a total of about $190 per acre. It was assumed that the administration cost includes CNPPID's lost irrigation delivery fee of $24.49 per contract acre. Both cost estimates have been provided in the table below to provide a range of potential costs associated with leasing. The total annual cost of a leasing program could range from about $660,000 to $1.5 million.

Table III-6
Leasing Program – Annual Costs

Reach	Program Acres (ac)	CU Saved (ac-ft)	Annual Cost based on Average of about $80/ac-ft of CU saved($)	Annual Cost based on $190/acre ($)
10	460	505	39,000	87,400
14	560	630	47,000	106,400
15	610	675	53,000	115,900
16	770	820	61,000	146,300
17	1,610	1,745	123,000	305,900
18	2,080	2,210	166,000	395,200
19	1,750	1,830	172,000	332,500
Total	7,840	8,415	661,000	1,489,600

Potential costs associated with third party impacts have not been evaluated. The costs presented above may be higher if there are third party impact costs. In addition, leasing contracts need to be renewed on a periodic basis, in which case there may be additional costs associated with permitting or re-negotiating leases.

◊ **Third-Party Impact Considerations:**

A leasing program can alter the timing and quantity of water in the river, in which case, there are potential hydrologic and corresponding economic third party impacts on downstream users. If water conserved is not protected from downstream diversion, there would be third party hydrologic benefits. Additional flows under this scenario may allow downstream junior water rights holders to make greater use of their water rights. However, changing the timing and quantity of water could also result in negative hydrologic impacts on downstream irrigators. Negative third party hydrologic impacts from these alternatives are most likely to occur to nearby farmers who have traditionally relied on tailwater runoff or groundwater recharge from participating farms for a portion of their water supply.

Apart from the potential third party hydrologic impacts identified above, there could also be third party economic impacts on agricultural equipment suppliers, farm workers, processing industries and local communities that depend on agriculture. The economy in the study area is dependent on agriculture to a large degree in which case economic and fiscal conditions could be negatively impacted by changes in crop patterns and crop production. If water deliveries are significantly reduced within an individual canal company or irrigation district's service area, company or district revenues may be negatively impacted. Depending on the conditions of the lease, if land is reclassified as dryland it will have reduced value for tax purposes. A reduction in tax revenues would be a negative fiscal impact.

Third party environmental impacts associated with leasing can be both positive and negative. Water quality could improve during the summer months when additional flows are added to the river. However, water quality could be degraded and fish and aquatic habitat negatively impacted during the winter months when river flows are reduced due to reductions in return flows. It is unlikely that a leasing program will have any third party impacts on recreational activities.

3. *WATER MANAGEMENT INCENTIVES (CONSERVATION CROPPING, DEFICIT IRRIGATION, FALLOWING, AND ON-FARM IRRIGATION CHANGES)*

◊ Location:

Nebraska has not yet identified specific irrigation districts or individual farmers that are willing to participate in a water management program in conjunction with the Program. The willingness to participate is also unknown at this time. Due to these conditions, the following options have been analyzed.

Option 1: Conservation cropping in Reaches 16 through 19.
Option 2: Deficit irrigation in Reaches 16 through 19.
Option 3: Land fallowing in Reaches 10, and 14 through 19.
Option 4: On-farm changes in irrigation techniques in Reaches 17 through 19.

Ideally these programs would be located in downstream locations close to the critical habitat to minimize difficulties associated with “protecting” the water. ***However, because specific irrigation districts and lands willing to participate in the Program are not yet known, it was assumed that representative water management projects are located at the mid-point of each reach.*** The reaches are defined under water leasing in Nebraska.

The principal irrigation districts and/or canals that have irrigated lands in Reaches 10, and 14 through 19 are described under water leasing in Nebraska. These irrigation districts and/or canals could potentially be involved in a water management program.

The yield and cost analyses of these programs has been limited to surface water irrigation, however, if additional water generated from these options is not protected it may be institutionally easier to apply these programs close to the critical habitat. In order to achieve the proposed yields below Kearney, Nebraska these types of projects would also have to be applied to lands irrigated with groundwater because there is not a sufficient amount of surface water irrigation below Kearney to realize the proposed yield. Analysis of the yields and costs of these options as they apply to groundwater irrigated lands could be completed once more information is obtained regarding specific groundwater irrigators willing to participate in the Program.

◊ **Basic Description:**

Water management alternatives consist primarily of programs resulting in reductions in consumptive use, or in the case of on-farm changes in irrigation techniques, reductions in return flows that do not return to the Platte River above the critical habitat. The programs evaluated assume the water rights involved are dependent on storage rights in Lake McConaughy. In general, an irrigation district or farmer with storage rights in Lake McConaughy will be paid to reduce their diversions through conservation cropping, deficit irrigation, land fallowing, or changes in irrigation techniques. The reduction in consumptive use will likely be added to the EA when storage space is available and released during times of shortage at the critical habitat. Although these programs could include reductions in natural flow diversions, it will be more difficult to insure protection. The EA may not always be available to re-regulate downstream reductions in consumptive use, however, the opportunity for an exchange is greater if the project is associated with a water right dependent on storage.

Option 1: Conservation cropping. Consists of a voluntary program to encourage the conversion of a portion of commonly irrigated, water intensive crops to production of less water intensive crops or crop rotations also found in the local area. Based upon local cropping pattern information, the conversion from continuous corn cropping to an alternating rotation of corn and soybeans was evaluated in Reaches 16 through 19.

Option 2: Deficit irrigation. Consists of a voluntary program to reduce irrigation water use. This analysis focuses on reducing irrigation on corn acres by six inches per acre in exchange for incentive payments.

Option 3: Land fallowing. Consists of a voluntary program under which farmers agree not to irrigate certain lands in exchange for payment. To effectively reduce consumptive use, this fallowed acreage must be over and above historical fallowing practices for purposes of land conservation.

Option 4: On-farm changes in irrigation techniques. Consists of a voluntary program aimed at improving irrigation efficiency. These measures focus on reducing return flows from farms rather than reducing consumptive use. In Reaches 17, 18, and 19 a large proportion of return flows do not return to the river above the critical habitat. These flows either accrete to the groundwater mound in the area, travel into the Republican Basin, or return to the Platte River below the critical habitat. This circumstance, along with the proximity of these reaches to the critical habitat, makes this area the most economically and hydrologically favorable for the implementation of on-farm improvements to irrigation techniques.

For Options 1 through 3 the amount of water available to the Program consists of the reduction in consumptive use, whereas, the amount available under option 4 consists of the reduction in return flows that do not return to the Platte River above the critical habitat.

◊ **On-Site Hydrologic Effects:**

Programs capable of reducing average annual target flow shortages by 7,000 ac-ft/yr have been evaluated for each water management alternative: conservation cropping, deficit irrigation, land fallowing, and on-farm changes in irrigation techniques. Each of these projects has been analyzed ***independently*** of each other. Ultimately, only one of these projects or a combination of these projects would be implemented for a total yield of 7,000 ac-ft/yr in accordance with Nebraska's estimate of the maximum yield attributable to water management that could be available to the Program.

Estimates of on-site yield and timing were based on the Final Report. Each water management alternative is described in more detail below.

Option 1: Conservation Cropping

The representative conservation cropping program evaluated focuses on a conversion from continuous corn cropping to an alternating rotation of corn and soybeans. The distribution of land involved in conservation cropping in each reach was based on the distribution of acres irrigated with surface supplies. The number of acres that were assumed to be included in a conservation cropping program are summarized in the following table. The acreage is based on the assumption that the full water supply and associated reductions in consumptive use consist of storage water. Many acres below Lake McConaughy receive storage water primarily as a supplement to natural flow supplies. To the extent that storage is used to supplement natural flow supplies, the acreage included in a conservation cropping program and the yield it can produce may need to be adjusted. This applies to all water management options.

Table III-7
Conservation Cropping Program

Reach	Acres Included in Program (ac)
16	3,200
17	7,200
18	9,300
19	11,000
Total	30,700

Although a significant portion of the acreage included in this program is in reaches 18 and 19, which are within or near the end of the critical habitat, the savings in consumptive use may be stored in the EA as space is available. Releases from the Lake McConaughy EA will flow through the entire critical habitat, therefore, the yields have not been discounted. This applies to all water management programs.

On-farm consumptive use savings from implementing an alternating corn and soybean rotation are estimated to be three inches per acre per year. The tables below show the proposed average monthly reductions in diversions and the reductions in on-farm deliveries for each reach. Although the reductions in diversions were assigned to a reach based on the distribution of irrigated acres, in some cases the reductions would occur further upstream depending on the location of the mainstem headgate. The amount delivered on-farm was based on the average conveyance loss for each reach. Data on conveyance losses was based on county-level information obtained from USGS Water Use Data for 1995.

Table III-8
Conservation Cropping - Reductions in Diversions from the Platte River (ac-ft)

Month	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0
November	0	0	0	0
December	0	0	0	0
January	0	0	0	0
February	0	0	0	0
March	0	0	0	0
April	19	35	25	13
May	40	83	58	31
June	446	935	1037	1234
July	1098	2709	3107	3536
August	1010	2185	2517	3048
September	78	152	141	125
Annual	2691	6100	6887	7988

Table III-9
Conservation Cropping - Reductions in the Amount Delivered On-Farm (ac-ft)

Month	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0
November	0	0	0	0
December	0	0	0	0
January	0	0	0	0
February	0	0	0	0
March	0	0	0	0
April	11	21	17	9
May	24	49	40	22
June	265	553	702	852
July	652	1603	2103	2441
August	600	1292	1704	2105
September	46	90	96	86
Annual	1598	3608	4661	5515

A representative conservation cropping program could reduce on-farm deliveries and consumptive use by about 15,400 ac-ft per year and 7,700 ac-ft per year, respectively. On-farm reductions in consumptive use were based on an on-farm efficiency of 50 percent.

The following table shows the average monthly reductions in consumptive use for the 1975-94 period.

Table III-10
Conservation Cropping – Reductions in Consumptive Use (ac-ft)

Month	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0
November	0	0	0	0
December	0	0	0	0
January	0	0	0	0
February	0	0	0	0
March	0	0	0	0
April	6	10	8	5
May	12	25	20	11
June	133	277	351	426
July	326	801	1052	1221
August	300	646	852	1052
September	23	45	48	43
Annual	799	1804	2330	2758

Based on the water budget spreadsheet, a reduction in consumptive use of 7,700 ac-ft resulted in a yield of 7,000 ac-ft of shortage reductions at the critical habitat without diversion losses. In this case, it is important to note that flows in the critical habitat will only be increased by reductions in consumptive use. Therefore, the reduction in diversions is considerably higher to account for historic return flows. The modeling being performed by the EIS team may indicate that the yield associated with 7,700 ac-ft of consumptive use savings is higher or lower than 7,000 ac-ft of reductions to target flow shortages. If the EIS modeling indicates a yield that differs from 7,000 ac-ft at the critical habitat, the size of the water management program may require adjustment. This applies to all water management options evaluated.

<u>Option 2: Deficit Irrigation Practices</u>

A deficit irrigation program would focus on reducing water use in irrigated corn production. The representative deficit irrigation program would reduce irrigation on corn acres by six inches per year. The distribution of land involved in deficit irrigation in each reach was based on the distribution of acres irrigated with surface supplies. The number of acres that were assumed to be included in a deficit irrigation program are summarized in the following table.

Table III-11
Deficit Irrigation Program

Reach	Acres Included in Program (ac)
16	2,000
17	4,300
18	5,500
19	4,700
Total	16,500

The tables below show the proposed average monthly reductions in diversions and the reductions in on-farm deliveries for each reach. Although the reductions in diversions were assigned to a reach based on the distribution of irrigated acres, in some cases the reductions would occur further upstream depending on the location of the mainstem headgate. The amount delivered on-farm was based on the average conveyance loss for each reach. Data on conveyance losses was based on county-level information obtained from USGS Water Use Data for 1995.

Table III-12
Deficit Irrigation - Reductions in Diversions from the Platte River (ac-ft)

Month	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0
November	0	0	0	0
December	0	0	0	0
January	0	0	0	0
February	0	0	0	0
March	0	0	0	0
April	23	42	29	11
May	49	98	69	27
June	545	1107	1219	1063
July	1342	3207	3653	3045
August	1233	2586	2959	2625
September	95	180	166	107
Annual	3287	7220	8095	6879

Table III-13
Deficit Irrigation - Reductions in the Amount Delivered On-Farm (ac-ft)

Month	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0
November	0	0	0	0
December	0	0	0	0
January	0	0	0	0
February	0	0	0	0
March	0	0	0	0
April	14	25	20	8
May	29	58	47	19
June	324	655	825	734
July	797	1897	2472	2103
August	733	1530	2003	1813
September	57	107	112	74
Annual	1953	4271	5478	4750

A representative deficit irrigation program could reduce on-farm deliveries and consumptive use by about 16,500 ac-ft per year and 8,200 ac-ft per year, respectively. On-farm reductions in consumptive use were based on an on-farm efficiency of 50 percent. The following table shows the average monthly reductions in consumptive use for the 1975-94 period.

Table III-14
Deficit Irrigation – Reductions in Consumptive Use (ac-ft)

Month	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0
November	0	0	0	0
December	0	0	0	0
January	0	0	0	0
February	0	0	0	0
March	0	0	0	0
April	7	12	10	4
May	14	29	23	9
June	162	327	413	367
July	399	948	1236	1051
August	366	765	1001	906
September	28	53	56	37
Annual	976	2135	2739	2375

Option 3: Land Fallowing

It was assumed that 7,800 acres would be included in a land fallowing program in Nebraska, as summarized in the following table.

Table III-15
Land Fallowing Program

Reach	Acres Fallowed
Reach 10	500
Reach 14	500
Reach 15	600
Reach 16	800
Reach 17	1,600
Reach 18	2,000
Reach 19	1,800
Annual Total	7,800

The amount of land fallowed in each reach was based on the distribution of acres irrigated with surface supplies. The tables below show the proposed average monthly reductions in diversions and the reductions in on-farm deliveries for each reach. Although the reductions in diversions were assigned to a reach based on the distribution of irrigated acres, in some cases the reductions would occur further upstream depending on the location of the mainstem headgate. The amount delivered on-farm was based on the average conveyance loss for each reach. Data on conveyance losses was based on county-level information obtained from USGS Water Use Data for 1995.

Table III-16
Land Fallowing - Reductions in Diversions from the North, South and Platte Rivers (ac-ft)

Month	Reach 10	Reach 14	Reach 15	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0	0	0	0
November	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0
January	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0
April	16	19	15	20	34	23	9
May	35	40	32	42	80	54	21
June	295	274	301	468	904	963	826
July	700	627	713	1153	2620	2886	2368
August	628	564	641	1060	2113	2338	2041
September	51	58	46	82	147	131	83
Annual	1725	1581	1747	2824	5898	6395	5348

Table III-17
Land Fallowing - Reductions in the Amount Delivered On-Farm (ac-ft)

Month	Reach 10	Reach 14	Reach 15	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0	0	0	0
November	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0
January	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0
April	10	15	12	12	20	16	6
May	21	31	25	25	47	37	14
June	177	214	237	278	535	652	571
July	420	491	563	685	1550	1953	1635
August	377	442	506	630	1250	1582	1409
September	31	45	37	49	87	89	58
Annual	1035	1239	1380	1678	3489	4328	3693

A representative land fallowing program could reduce on-farm deliveries and consumptive use by about 16,800 ac-ft per year and 8,400 ac-ft per year, respectively. On-farm reductions in consumptive use were based on an on-farm efficiency of 50 percent. The following table shows the average monthly reductions in consumptive use for the 1975-94 period.

Table III-18
Land Fallowing – Reductions in Consumptive Use (ac-ft)

Month	Reach 10	Reach 14	Reach 15	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0	0	0	0
November	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0
January	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0
April	5	7	6	6	10	8	3
May	10	16	13	12	24	18	7
June	89	107	119	139	267	326	285
July	210	246	282	342	775	976	817
August	188	221	253	315	625	791	705
September	15	23	18	24	44	44	29
Annual	517	619	690	839	1744	2164	1846

Option 4: Changes in Irrigation Techniques

In Reaches 17, 18, and 19 a large portion of return flows return to the Republican River Basin, accrete to the groundwater mound or return to the Platte River below the critical habitat. It was assumed that 50 percent of the return flows do not return to the Platte River above the critical habitat. A 1993 survey conducted by CNPPID indicated that about 50 percent of the surface supplied irrigated acreage within their district is irrigated with techniques that have substantial potential for increases in efficiency. The distribution of land involved in each reach was based on the distribution of acres irrigated with surface supplies. The number of acres that were assumed to be included in this program are summarized in the following table.

Table III-19
Changes in Irrigation Techniques

Reach	Acres Included in Program (ac)
17	6,800
18	8,700
19	7,400
Total	22,900

The tables below show the proposed average monthly reductions in diversions and the reductions in on-farm deliveries for each reach due to efficiency improvements. Although the reductions in diversions were assigned to a reach based on the distribution of irrigated acres, in some cases the reductions would occur further upstream depending on the location of the mainstem headgate. The amount delivered on-farm was based on the average conveyance loss for each reach. Data on conveyance losses was based on county-level information obtained from the USGS Water Use Data for 1995.

Table III-20
Changes in Irrigation Techniques - Reductions in Diversions from the Platte River (ac-ft)

Month	Reach 17	Reach 18	Reach 19
October	0	0	0
November	0	0	0
December	0	0	0
January	0	0	0
February	0	0	0
March	0	0	0
April	33	23	9
May	78	55	21
June	881	969	822
July	2553	2902	2354
August	2059	2351	2030
September	144	132	83
Annual	5748	6431	5318

Table III-21
Changes in Irrigation Techniques - Reductions in the Amount Delivered On-Farm (ac-ft)

Month	Reach 17	Reach 18	Reach 19
October	0	0	0
November	0	0	0
December	0	0	0
January	0	0	0
February	0	0	0
March	0	0	0
April	20	16	6
May	46	37	14
June	521	655	567
July	1510	1964	1626
August	1218	1591	1401
September	85	89	57
Annual	3400	4352	3672

A representative program to improve irrigation efficiency could reduce on-farm deliveries by about 11,400 ac-ft/yr. These reductions represent gross savings. The yield of this project may be lower to the extent that return flows would have returned to the Platte River.

◊ Legal and Institutional Requirements for Implementation:

There is currently no existing legislation or new legislation being considered which addresses the water management options described above, in which case, permits are not required to implement these projects. However, it is not clear how water saved under these programs would be protected. Technically it will be difficult to define how much additional water is added to the river on any given day, which will complicate efforts to protect this water. While it remains untested, it may be that Section 46-252 could be used to protect water saved under the water management options outlined above (Nebraska's

Comments on Boyle January 17, 2000 Memo). A permit would be required if water generated by these projects is to be protected by Section 46-252. Due to the uncertainty regarding protection it would be beneficial to locate water management projects in locations as close to the critical habitat as possible to minimize diversion losses. In order to achieve the proposed yields below Kearney, Nebraska, these types of projects would also need to be applied to lands irrigated with groundwater because there is not a sufficient amount of surface water irrigation below Kearney to realize the proposed yields.

Agreements, which establish the conditions under which water management projects would be operated, need to be negotiated with irrigation districts or individual farmers.

◊ **Schedule For Implementation:**

These projects do not require new construction or infrastructure, therefore, the implementation schedule is based primarily on the resolution of legal and institutional issues.

As noted in comments received from Nebraska, the draft schedule for implementing this project is as follows:

Year 1 or Year 2: Governance Committee establishes an incentive based program for implementing one or more of the options for reducing shortages through water management incentives.

Year 3 to Year ? (will depend on cash flow to the Program and participant willingness): Individual irrigators come to agreement with the Governance Committee to implement one or more of the water management incentive options selected by the Governance Committee. Applications are made and processed by the Nebraska DNR to determine how much, if any, protection can be given under Section 46-252 to "new water" produced by such implementation. Processing Section 46-252 applications could take up to one year.

◊ **Expected Project Life:**

These projects could be implemented indefinitely depending on the willingness of irrigation districts and/or individual farmers to participate in these voluntary programs.

◊ **Capital and Operational Costs:**

The Final Report was relied upon to develop cost estimates for the water management projects. Potential costs associated with third party impacts have not been evaluated. The costs presented below may be higher if there are third party impact costs. In addition, contracts with irrigators or districts need to be renewed on a periodic basis, in which case there may be additional costs associated with permitting or re-negotiating contracts. The annual costs of the representative water management projects are summarized below.

Option 1: Conservation cropping

At this time, it has been assumed that participating farmers would be compensated with payments per ac-ft conserved on-site comparable to estimates for short-term leasing arrangements. On an annual basis, the cost of a leasing program was estimated to range from about \$80 to \$190 per acre-foot of consumptive use saved on-farm. Therefore, the total annual cost for conservation cropping is estimated to range from \$620,000 to \$1.5 million based on an average annual reduction in consumptive use of about 7,700 ac-ft.

Option 2: Deficit Irrigation

Based on NRCE data regarding corn production, the estimated annual impact on farm revenues from the representative deficit irrigation program would be \$90 to \$100 per participating acre planted in corn. An incentive premium of 40 percent has been added to induce farmers to participate in the program. In addition, an annual administrative cost of \$20 per participating acre has been included. The total average annual cost per participating acre is estimate to be about \$150. Based on an estimated total of about 16,500 acres participating in the program, the annual cost would be about \$2.5 million.

Option 3: Land Fallowing

The annual cost of a representative land fallowing program was estimated based on the following components:

- Annual value of irrigated lands. This value for the region as a whole is estimated to be between \$100 and \$110 per acre based on annual net income to farmers and irrigated land rental rates.
- An incentive premium of 25 percent to induce participation.
- Administrative costs, which average \$20 per acre fallowed.

On an annual basis, a land fallowing program was estimated to cost an average of about \$150 per acre. Based on an estimated total of 7,800 acres participating in the Program, the annual cost was estimated to be approximately \$1.2 million.

Option 4: Changes in Irrigation Techniques

During the past seven years, CNPPID has calculated the average annual cost of these measures based on its program to implement on-farm conservation improvements at \$217 per acre foot reduced on-farm deliveries. There is uncertainty regarding the use of this cost for the following reasons: 1) This cost may not apply to this analysis because it includes some items which are not incremental changes over the pre-improvement system (such as water delivery costs) and excludes some incremental costs to the landowner (such as production reduction in pivot corners), and 2) The validity of the method used to estimate the quantity of water saved by on-farm improvements is continuously being evaluated by CNPPID's Conservation Task Force.

Although there is uncertainty regarding the use of $217 per acre foot reduced on-farm deliveries, it is the best available information at this time. Based on an average annual reduction of 11,400 ac-ft of on-farm deliveries in Reaches 17 through 19, the total annual cost of this project would be about $2.5 million.

◊ **Third-Party Impact Considerations:**

A water management program can alter the timing and quantity of water in the river, in which case, there are potential hydrologic and corresponding economic third party impacts on downstream users. If water conserved through these alternatives is not protected from downstream diversion, there may be positive and negative third party hydrologic impacts. Additional flows under this scenario may allow downstream junior water rights holders to make greater use of their water rights. Additional hydrologic benefits related to changes in irrigation techniques exist for areas prone to high water tables because groundwater recharge will be reduced. Negative third party hydrologic impacts from these alternatives are most likely to occur to nearby farmers who have traditionally relied on tailwater runoff or groundwater recharge from participating farms for a portion of their water supply. Positive and negative third party hydrologic benefits may be minimal depending on how close to the critical habitat these programs are implemented.

Apart from the potential third party hydrologic impacts identified above, there could also be third party economic impacts on agricultural equipment suppliers, farm workers, processing industries and local communities that depend on agriculture. The economy in the study area is dependent on agriculture to a large degree, in which case economic and fiscal conditions are impacted by changes in crop patterns and crop production. For all programs, changes in the farm product can have negative impacts on processors, shippers, purchasers of farm products as well as local livestock growers, and local communities that depend on agriculture.

For conservation cropping there may be third party economic impacts on farm workers and input suppliers because of differing requirements between traditional crops and alternative crops grown as a result of the program. Deficit irrigation will likely result in reduced yield, potentially impacting processors, shippers, livestock growers and others relying on this production. If land is reclassified as dryland under a land fallowing program it will have reduced value for tax purposes. A reduction in tax revenues would be a negative fiscal impact. For all water management options considered, if water deliveries are significantly reduced within an individual canal company or irrigation district’s service area, company or district revenues may be negatively impacted. Negative third party economic impacts can be reduced to a degree if participating properties are geographically dispersed because it is unlikely that regional crop patterns and the value of crop production would change significantly.

Third party environmental impacts associated with water management programs can be both positive and negative. Water quality could improve during the summer months when additional flows are added to the river. However, water quality could be degraded and fish and aquatic habitat negatively impacted during the winter months when river flows are reduced due to reductions in return flows. It is unlikely that a water management program will have any third party impacts on recreational activities.

4. GROUNDWATER MANAGEMENT

◊ Location:

Based on the principles submitted by Nebraska, groundwater management has been limited to a total yield of no more than 6,000 ac-ft/yr until it can be successfully demonstrated through a phased-in project that groundwater mining will not occur at this level. Nebraska has indicated they will not consider expanding groundwater management unless further investigation and study reveals that higher yields can be sustained. Nebraska also intends to reserve as much of the yield of this project as Nebraska believes is necessary to offset new depletions in that state. However, Nebraska currently estimates that 1,400 ac-ft/yr of the yield of this project would be in addition to that needed for new depletion offset and therefore could be made available to the Program. That is the yield used for purposes of the analysis in this plan.

A 13,000-acre area located under the Phelps Canal system is a potential groundwater management area due to high groundwater tables. The area is bounded by the Phelps Canal to the south and east, by the Township 6 line to the north, and by the Funk Odessa Road to the west. Another groundwater management area being considered by Tri-Basin Natural Resources District (TBNRD) is the Reynold's and Robb Wetland, which is located in Section 10, Township 8 North, Range 21 West. This area is approximately 60 acres in size and is currently managed for wildlife under an agreement with the Rainwater Basin Joint Venture. Other potential groundwater management areas in Phelps and Kearney Counties include approximately 22,000 acres in Township 7 North, Ranges 18 and 19 West, and 23,000 acres in Townships 6 and 7 North and Ranges 15, 16, and 17 West.

◊ Basic Description:

Groundwater management can be accomplished in a number of ways. Several options that could be implemented to manage the groundwater mound are described below.

Option 1: Active Groundwater Pumping from High Groundwater Areas. This would involve pumping from areas of high groundwater and returning water back to the Platte River.

If this option is implemented under the Phelps Canal system, wells capable of pumping 1,000 gpm for up to 100 days a year (mostly during the summer months) could be installed and tied into a collection system(s) that discharges water into Lost Creek and/or North Dry Creek for return to the Platte River. Approximately four wells would be required to pump 1,400 ac-ft/yr (roughly 30 percent additional capacity was added for redundancy).

Option 2: Passive Lowering of the Groundwater Table. This would involve paying farmers to dry-land farm every other year. The associated reduction in surface water use could either be returned to the Platte River or stored in the Lake McConaughy EA when storage space is available. This project could be implemented effectively under the Phelps Canal system. Irrigators would make beneficial use of their water every other year in which case it would not be subject to forfeiture under the "use-it-or-lose-it" condition.

Option 3: Groundwater Irrigation. Farmers would be paid to put in wells and use groundwater as opposed to surface water to irrigate. Reductions in storage water diversions could be stored in the Lake McConaughy EA when storage is available and released as needed for the Program.

Option 4: Conjunctive Use. A conjunctive use project under CNPPID's system would consist of shallow wells that discharge directly into CNPPID's distribution system and a recharge system of wells, pits, or drains located in the same area. Each year, in late fall and winter, flows at the Johnson #2 Power Plant that exceed target flows would be diverted through CNPPID's distribution system for recharge to the local groundwater aquifer. The groundwater aquifer would be recharged to a pre-determined level. Each spring and summer, an equivalent amount of water would be pumped for irrigation. Pumping during the irrigation season would replace irrigation releases from Lake McConaughy.

◊ On-Site Hydrologic Effects:

The options described above could be implemented to yield a total of 1,400 ac-ft/yr for the Program. Each of these projects has been analyzed ***independently*** of each other. Ultimately, only one of these projects or a combination of these projects will be implemented for a total yield of 1,400 ac-ft/yr.

The following table summarizes how any one of these projects could be implemented in the areas described above to yield 1,400 ac-ft/yr. It was assumed that implementation of any one of these options will reduce the water supply for the others. However, it is possible that one option or a combination of these options could be implemented to yield a total of 1,400 ac-ft/yr. For active groundwater pumping from high groundwater areas it was assumed that 280 ac-ft would be pumped each month from May through September during periods of target flow shortage, for an annual total of 1,400 ac-ft. For passive lowering of the groundwater table and groundwater irrigation the monthly distribution of reductions in surface water consumptive use was based on the monthly distribution of diversions into the Phelps County Canal. For a conjunctive use project, 1,400 ac-ft will be diverted to recharge in November, and 280 ac-ft would be pumped each month from May through September to replace irrigation storage releases. For options 2 through 4, the yield to the Platte River represents storage increases in the Lake McConaughy EA which can be released to meet target flow shortages.

Table III-22
Groundwater Management – Yield to the Platte River

Month	Option 1 (ac-ft)	Options 2 (ac-ft)	Option 3 (ac-ft)	Option 4 (ac-ft)
October	0	0	0	0
November	0	0	0	-1,400
December	0	0	0	0
January	0	0	0	0
February	0	0	0	0
March	0	0	0	0
April	0	14	14	0
May	280	140	140	280
June	280	257	257	280
July	280	504	504	280
August	280	425	425	280
September	280	60	60	280
Annual	1400	1400	1400	0

Consideration will need to be given to whether the yields associated with some of these groundwater management options should be discounted because those yields would be provided through only a portion of the full habitat or whether there are other aspects of the benefits provided by those projects which would justify giving them full credit. Water returned to the Platte River via North Dry Creek or Lost Creek is introduced partway into the critical habitat. Additional water returned to the Platte River via the North Dry Creek cutoff or the Lost Creek/Ft. Kearny cutoff flows through roughly 60 percent of the critical habitat.

Impacts on return flows or Platte River flows should be minimal if the implementation of a groundwater management program yielding 1,400 ac-ft/yr results in maintaining the water table at a level that does not create problems for residents and farmers.

◊ **Legal and Institutional Requirements for Implementation:**

Certain groundwater management options can be accomplished under current Nebraska water law. For example, no permit would be required to convert to dry-land farming and a permit would only be required for conversion to groundwater irrigation if the well used for that purpose has not yet been constructed. For dry-land farming, CNPPID would seek a modification from the Nebraska DWR to increase the EA by the same amount of reduced storage use. For a conjunctive use project, an intentional recharge permit would most likely be required to recharge the aquifer. Although legislation exists regarding intentional recharge permits it is untested. If this project targets storage water for recharge then the use of the storage right would need to be changed to include recharge. A permit would also be required to pump back into the CNPPID's distribution system if the well used for that purpose has not yet been constructed.

Actively pumping from high groundwater areas could face several legal obstacles. Although current Nebraska water law would not require a permit from the Nebraska DWR to actively pump groundwater into North Dry Creek or Lost Creek, there is currently no statutory authority to transfer groundwater off overlying land for environmental purposes. It is likely that new legislation would be required to implement this type of project. There is some ambiguity regarding whether this could be accomplished without new legislation, however, new legislation would be preferable if this type of project is included in the Program. According to Nebraska representatives on the WAPC, new legislation could be prepared for the legislative session next year.

Water added to the Lake McConaughy EA and released during periods of shortage would be protected downstream under water right A-17695. Protection would not be needed for water that is returned to the Platte River via North Dry Creek or Lost Creek because that water is added within the critical habitat reach and there are no significant diversions below that point which could remove water associated with these projects from the Platte River.

NEPA compliance and site-specific environmental permits may be required for the construction of infrastructure related to groundwater management depending on the severity of on-site impacts. A 404 permit from the U.S. Army Corps of Engineers would be required to construct a cutoff between Lost Creek and the Fort Kearny IPA.

◊ **Schedule For Implementation:**

As noted in comments received from Nebraska, a groundwater management project could be implemented in two years, however, it would need to be phased in over several years. Infrastructure including wells, pumps, pipeline, etc. would need to be installed. A water rights permit may need to be secured from the Nebraska DWR depending on which option is implemented. NEPA compliance and site-specific environmental permits may also be required prior to implementation.

◊ **Expected Project Life:**

The expected project life varies depending on the groundwater management plan implemented. Active pumping from the groundwater mound, groundwater irrigation, and conjunctive use projects could extend beyond the first increment of the Program. A constraint on the project life could be the wells and pumping hardware, which would most likely need to be replaced within 10 to 20 years. In addition, drawdown limits could be set by either TBNRD or CNPPID, in which case the project would be terminated if these limits are exceeded.

The project life of dry-land farming depends on the willingness of farmers to dry-land farm every other year. Some farmers may be willing to dry-land farm on a rotating cycle indefinitely, whereas, others may only be interested on an infrequent basis. However, in general, groundwater management projects have the capability of being extended through the first increment.

◊ Capital and Operational Costs:

Costs for the groundwater management projects summarized above include up-front infrastructure costs, consisting primarily of wells, pumps, and collection/distribution systems, and annual operations and maintenance costs. Potential costs associated with third party impacts have not been evaluated. The costs presented below may be higher if there are third party impact costs.

Several of the groundwater management options are the subject of the HDR report, *Depletion Mitigation Study Phase I*, which was recently made available to Boyle. Cost information provided in the HDR report was used to supplement this cost analysis. Costs for these projects are outlined below.

<u>Option 1: Active Pumping from High Groundwater Areas.</u> The cost to install a shallow well and pump capable of pumping up to 1000 gpm was estimated to be $15,000 based on recent cost estimates obtained from TBNRD in connection with the Plum Creek demonstration project. This cost may be higher depending on site specific conditions and the depth of the well. Assuming four wells are required to pump a total of 1,400 ac-ft/yr, the total cost for wells and pumps is estimated to be $60,000. The cost of the collection system could vary significantly depending on where this type of project is applied and the length of pipeline required to convey water back to a tributary, such as Lost Creek, or the Platte River. It was assumed that the project would be implemented under the Phelps Canal system and only one collection system would be required to deliver water to either Lost Creek or North Dry Creek. The cost of the collection system was estimated to be $530,000. The costs to improve the cutoffs are included under the Dry Creek/Ft. Kearny Cutoff projects. The total capital cost of this project is estimated to be about $590,000. Annual operations and maintenance costs were estimated to be $14,000.

<u>Option 2: Passive Lowering of the Groundwater Table.</u> It was assumed that the cost to induce farmers to dry land farm is comparable to the estimated cost to lease water. On an annual basis, the cost of a leasing program was estimated to range from about $80 to $190 per acre-foot of consumptive use saved. It was assumed that the upper range of these costs includes CNPPID's revenue losses of $24.49 per contract acre associated with reduced deliveries. The total cost could range from about $112,000 to $266,000 based on a reduction in consumptive use of 1,400 ac-ft/yr.

<u>Option 3: Groundwater Irrigation.</u> The cost associated with this project consists primarily of well construction and pump costs. Assuming four wells are required to pump up to 1,400 ac-ft/yr, the total cost for wells and pumps is estimated to be $60,000. This does not include annual operations and maintenance costs and other associated costs to improve irrigation equipment if necessary. The conversion from surface water irrigation to groundwater irrigation may require irrigation system improvements such as the installation of center pivots.

<u>Option 4: Conjunctive use.</u> The costs associated with this project consist primarily of well construction and pump costs and the cost of a recharge collection/distribution system. Assuming four wells are required to pump up to 1,400 ac-ft/yr, the total cost for wells and pumps is estimated to be $60,000. Depending on the configuration of the recharge system needed for a conjunctive use project, additional costs would be incurred

for recharge basins or pipe drains. The construction cost associated with recharge basins or pipe drains will vary based on the size and location of the basin or length of the drain. There will also be annual operations and maintenance costs. The cost of the recharge collection/distribution system and annual operations and maintenance costs were based on data provided by the EIS team. The total cost of the wells and recharge system and annual operations and maintenance costs were estimated to be about $161,000 and $5,900, respectively.

◊ **Third-Party Impact Considerations:**

A groundwater management program can alter the timing and quantity of water in the river, in which case, there are potential hydrologic and corresponding economic third party impacts on downstream users. Third party impacts associated with dry-land farming are similar to land fallowing as discussed under water management programs. Third party impacts associated with the remaining groundwater management programs are discussed below.

In general, groundwater programs result in positive hydrologic impacts. Actively pumping from high groundwater areas, conversion to groundwater irrigation, and conjunctive use projects all typically increase flows in the river. Additional flows under this scenario may allow downstream junior water rights holders to make greater use of their water rights. A conjunctive use project would reduce available flows for junior downstream water users during the winter months when water would typically be diverted for recharge.

Pumping from high groundwater areas may lower regional groundwater levels, which could have both positive and negative impacts. Negative impacts include increased pumping costs for nearby groundwater irrigators due to lower groundwater levels. Alternatively, lower groundwater levels would decrease waterlogging of nearby irrigated lands and alleviate problems with flooded basements, both of which are positive impacts. Conjunctive use projects will lower and raise groundwater levels at different times of the year, which could have both positive and negative impacts. There could be negative third party impacts on landowners adjacent to creeks or drains used to return groundwater to the Platte River if waterlogging problems are increased.

In general, these projects will have minimal direct or indirect impacts on business sales, employment, wages, and wealth. Any third party economic impacts will likely be related to impacts on agricultural production in the affected area. For example, lowering groundwater levels could decrease waterlogging problems and increase agricultural productivity. Diversions to recharge through existing canals will reduce the opportunity for the owner to use that conveyance capacity, however, it may increase revenues from delivery fees.

There could be numerous environmental impacts associated with groundwater management projects. Similar to the Tamarack Recharge Plan, conjunctive use projects can generate wetlands and wildlife habitat if recharge basins are incorporated. Impacts on water quality can be both positive and negative. Recharge projects could improve water quality on-site due to the creation of wetlands. Water quality could also improve during the summer months when additional flows resulting from these projects return to the river. However, water quality could be degraded and fish and aquatic habitat negatively impacted during the winter months if river flows are reduced. Pumping and recharge in certain areas could result in the dissolution and mobilization of salts that are either native to the geologic material or a byproduct of fertilizers, which could have negative impacts on water quality.

The groundwater management programs described above would likely have minimal impact on recreational opportunities. If recharge basins are used for a conjunctive use project there could be some recreational benefits associated with the creation of additional wildlife habitat areas.

5. DRY CREEK/FORT KEARNY CUTOFFS

◊ Location:

The Dry Creek/Ft. Kearny Cutoffs consist of two projects within TBNRD, as shown in Figure 2. The first project involves a cutoff from Lost Creek to North Dry Creek located south of Kearney in Sections 9 and 16, Township 7 North, Range 16 West. The second project involves a cutoff from Lost Creek to the Fort Kearny Improvement Project Area (IPA) located south of Kearney in Sections 1 and 12 of Township 7 North, Range 16 West. Both of these projects are located within the area influenced by the groundwater mound. Further evaluation and study is required to define the relationship between the groundwater mound and these projects.

◊ Basic Description:

TBNRD has completed some preliminary investigations of the Lost-Creek cutoff projects. The two projects presented below would be operated to return existing flows in Lost Creek or releases from the Funk Lagoon to the Platte River. These cutoffs could also be operated similar to active pumping from the groundwater mound, described under groundwater management. The potential yields from active pumping were not included for these two cutoff projects since the yields were included under the groundwater management option. If active pumping were included with the cutoff projects, well(s) could be installed in high groundwater areas to pump water into Lost Creek during periods of target flow shortage.

Option 1: Lost Creek/North Dry Creek Cutoff. Through an agreement with the North Dry Creek Drainage Board, TBNRD installed a 20-cfs cutoff from Lost Creek in May 1998 to divert discharges from Funk Lagoon into North Dry Creek. North Dry Creek enters the Platte River about 1-1/2 miles west of the Kearney Bridge on Highway 44. A water management plan for Funk Lagoon is currently being developed among FWS, TBNRD, and CNPPID that will set target elevations for the lagoon's pools throughout the year for the benefit of migratory waterfowl. Opportunities within the FWS's mandate for management of the Funk Lagoon Wildlife Protection Area (WPA) may exist for the lagoon to be drawn down at times of the year when the discharged water will benefit the critical habitat along the Platte River. The water released from the lagoon would be routed to the Platte River via the existing connection between Lost Creek and North Dry Creek. Lowering lagoon levels in the summer could reduce shortages in the critical habitat and reduce flooding damage to surrounding cropland from high groundwater levels. Replacement water for Funk Lagoon would be provided by CNPPID at the end of the irrigation season. Improvements to CNPPID's Phelps Canal may be needed to make deliveries to Funk Lagoon.

Option 2: Lost Creek/Ft. Kearny Cutoff. Lost Creek is a tributary to the Platte River. The creek flows approximately parallel and south of the river and converges with the Platte near the end of the critical habitat reach. The Fort Kearny IPA is a drainage ditch, maintained by TBNRD, which empties into the Platte River about one mile east of the Kearney Bridge on Highway 44.

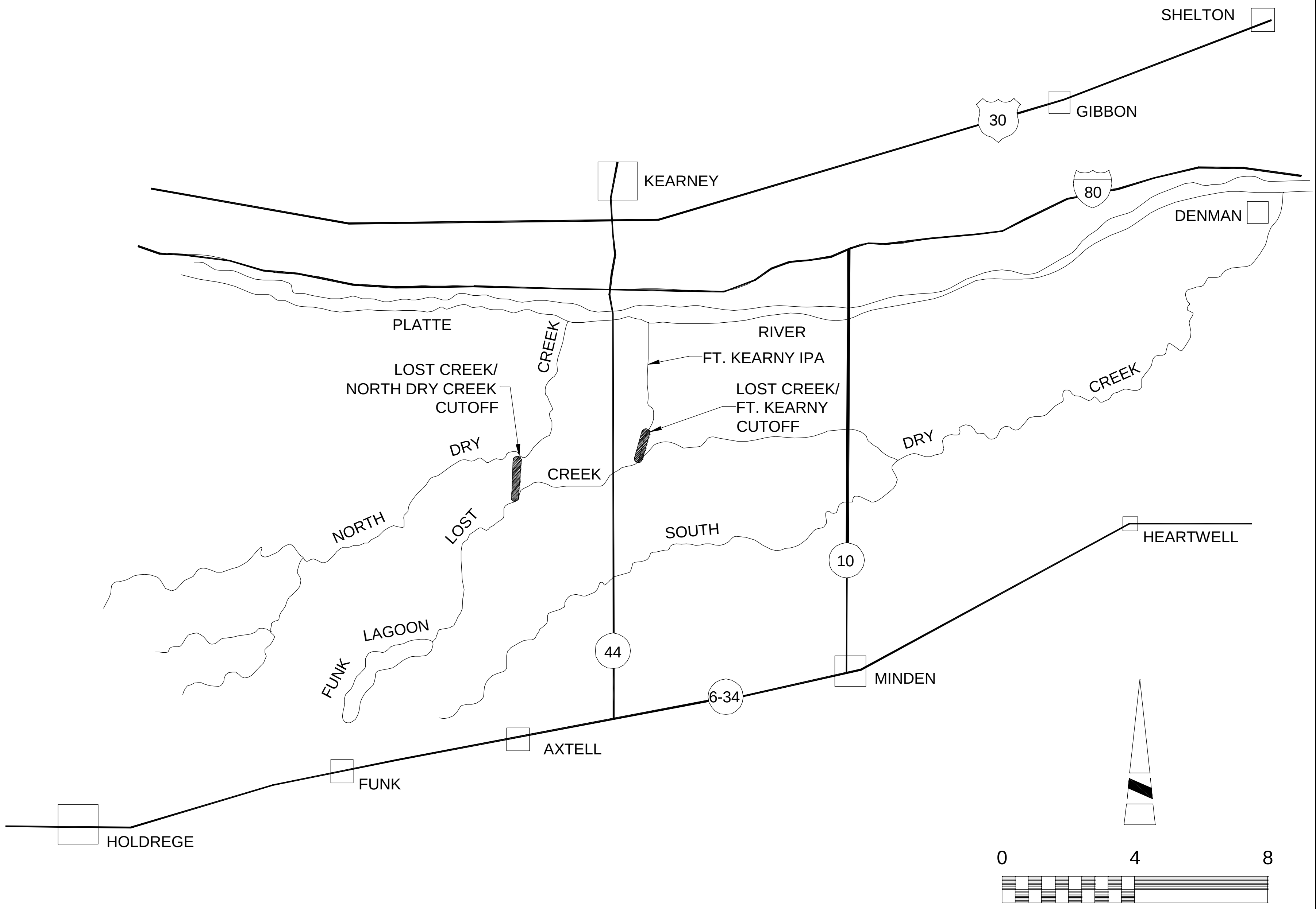
This project would consist of the construction of a ditch about ¾ mile in length to connect Lost Creek to the Fort Kearny IPA, allowing increased flow through approximately 20 miles of the critical habitat. A pump station may be necessary to expand this project in the vicinity of Lost Creek. The pump station would likely be located along Crooked Creek, which intersects the IPA approximately one mile from the river.

◊ **On-Site Hydrologic Effects:**

Per discussions with TBNRD personnel (Rich Holloway, May 19, 2000), Lost Creek is often dry at the North Dry Creek Cutoff and is a gaining reach downstream of this point to the Ft. Kearny Cutoff. Typical flows at the downstream cutoff may be up to 15 cfs in May decreasing to about 6 cfs in September. Therefore, the yield of the upstream cutoff was assumed to be dependent on Funk Lagoon releases whereas flows available to the downstream Ft. Kearny Cutoff might take advantage of gaining flows. The total yield associated with these projects is estimated to be 4,400 ac-ft/yr, or the equivalent of a steady year-round flow of 6 cfs that is timed such that the diversions are effective in reducing shortages to target flows. As shown below, it is assumed that this yield would be most effectively delivered in relation to target flows in the May to September period.

Per the discussion of Water Management Committee members, both of these projects would require consideration of whether the yields should be discounted because those yields would be provided through only a portion of the full habitat or whether there are other aspects of the benefits provided by those projects which would justify giving them full credit. Additional water returned to the Platte River via the North Dry Creek cutoff returns to the river approximately 1.5 miles west of Highway 44 near Kearney. The Lost Creek/Ft. Kearny cutoff returns to the river approximately one mile east of Highway 44 near Kearney. Water that is returned to the Platte River via these cutoffs flows through roughly 60 percent of the critical habitat.

<u>Option 1: Lost Creek/North Dry Creek Cutoff.</u> The diversion of Funk Lagoon discharges to North Dry Creek was carried out twice from 1998 to 1999, however, there is little data on the volume of water discharged and the resulting increases in flow in North Dry Creek.



SOURCE : CNPPID

BOYLE ENGINEERING CORPORATION

NORTH DRY CREEK/
FORT KEARNY CUTOFFS

FIGURE 2

The yield of this project is dependent on the management plan developed by the FWS. CNPPID excess flows that fill Funk Lagoon have been approximately 300 ac-ft/yr. The FWS currently has a contract for approximately 700 ac-ft/yr from CNPPID. Return flows from upstream irrigated lands are estimated to be in the range of 1,500 ac-ft to 2,500 ac-ft per year. Thus the potential releases from Funk Lagoon for the Lost Creek-North Dry Creek cutoff could be in the range of 2,500 ac-ft to 3,500 ac-ft per year.

It was assumed that 2,200 ac-ft would be available to make releases from Funk Lagoon during periods of shortage at the critical habitat from May through September. The replacement water would come from CNPPID's system or return flows at the end of the irrigation season. The average monthly net yield to the Platte River is provided in the table below. More data and analysis is required to determine release and filling sequences for the 1975-94 period and evaluate conveyance losses en route to the Platte River.

Table III-23
Lost Creek/North Dry Creek Cutoff – Net Yield to the Platte River

Month	Funk Lagoon Releases (ac-ft)	CNPPID Deliveries to Funk Lagoon (ac-ft)	Net Yield (ac-ft)
October	0	-1100	-1100
November	0	-1100	-1100
December	0	0	0
January	0	0	0
February	0	0	0
March	0	0	0
April	0	0	0
May	440	0	440
June	440	0	440
July	440	0	440
August	440	0	440
September	440	0	440
Annual	2,200	-2200	0

Option 2: Lost Creek/Ft. Kearny Cutoff. This yield analysis considers diverting existing flows in Lost Creek back to the Platte River during times of shortage at the critical habitat. Routing water pumped from high groundwater areas back to the river via the Ft. Kearny IPA cutoff is evaluated under groundwater management.

It was assumed that an average of 2,200 ac-ft/yr would be available for diversion back to Platte River via the cutoff as shown in the table below.

Table III-24
Lost Creek/Ft. Kearny IPA Cutoff – Net Yield to the Platte River (ac-ft)

Month	Net Yield (ac-ft)
October	60
November	60
December	50
January	50
February	60
March	60
April	60
May	360
June	360
July	360
August	360
September	360
Annual	2,200

◊ **Legal and Institutional Requirements for Implementation:**

A water rights permit would be required from the Nebraska DWR to divert water into Lost Creek. CNPPID's water rights will also need to be changed to include environmental uses to make deliveries to Funk Lagoon. Once permits are obtained water could be protected under Section 46-252, which provides for the protection of water for the purposes of instream beneficial uses. Under Section 46-252 the DWR is responsible for assuring that water conducted into or along natural channels for the purposes of instream beneficial uses is not subsequently diverted or withdrawn.

The Lost Creek/Ft. Kearny project involves the construction of a cutoff between Lost Creek and the Fort Kearny IPA, which requires a 404 permit from the U.S. Army Corps of Engineers. NEPA compliance and site-specific environmental permits may also be required for the construction of infrastructure related to this project depending on the severity of on-site impacts.

A FWS permit would be required under the Refuge Administration Act. Agreements would need to be negotiated with TBNRD, CNPPID, and FWS, which establish the conditions under which these projects would be operated if included in the Program.

Compliance with the City of Kearney Wellhead Protection Permit program would also be required.

◊ **Schedule For Implementation:**

As noted in comments received from Nebraska, the draft schedules for implementing these projects are as follows:

Option 1: Lost Creek/North Dry Creek Cutoff. The cutoff involved in this project is already constructed, therefore, the implementation schedule is based primarily on the resolution of legal and institutional issues. It may take one to two years to obtain a water rights permit and change of use from the DWR and negotiate a contract with TBNRD, FWS, and CNPPID, after which this project could be implemented.

Option 2: Lost Creek/Ft. Kearny Cutoff. The schedule for implementation is dependent on the time required to construct a cutoff between Lost Creek and the Fort Kearny IPA, obtain a permit from the Nebraska DWR, secure a 404 permit and NEPA compliance, and negotiate a contract with TBNRD. This project may take one to two years to implement.

◊ **Expected Project Life:**

The expected project lives are dependent on the agreements with TBNRD, CNPPID, and FWS. These contracts may need to be renewed on a year-to-year basis. In addition, these projects will likely be phased in and their continuation dependent on the results of monitoring impacts on local groundwater levels and Funk Lagoon. TBNRD could set drawdown limits to establish an upper bound on pumping from the Lost Creek watershed. If these limits are exceeded the project may be shutdown depending on the conditions set by TBNRD.

◊ **Capital and Operational Costs:**

The costs for these projects include up-front infrastructure costs, consisting primarily of wells, pumps, and improvements to ditches, culverts, and outlets, and annual operations and maintenance costs. Potential costs associated with third party impacts have not been evaluated. The costs presented below may be higher if there are third party impact costs.

Option 1: Lost Creek/North Dry Creek Cutoff. The Final Report was relied on for costs associated with this project. Costs to date are approximately $300,000. This includes installation of an underdrain at the upstream end of Funk Lagoon, maintenance of seven miles of creek channel, installation of the cutoff between Lost Creek and North Dry Creek, and concrete and road culverts associated with a mile connecting ditch. Improving the system to allow available water to be discharged in the spring and summer without affecting downstream agricultural activities would require rebuilding the North Dry Creek outlet and constructing pivot bridge crossings for center pivots. Estimated costs for these improvements are about $30,000. The total up-front capital cost associated with the entire project is $330,000. The annual operations and maintenance costs are estimated to be about $4,000. In addition, CNPPID would assess an annual water delivery fee. The current irrigation delivery fee is $24.49 per contract acre for a 15-inch contract (1.25 ac-ft), therefore, the cost per ac-ft is about $19.59. CNPPID could adjust this fee based upon changes in their irrigation delivery rates. The annual delivery fee would be $86,200 assuming CNPPID delivers an average of 4,400 ac-ft per year to Funk Lagoon. CNPPID deliveries may be less depending on the amount of return flows from upstream irrigated lands.

Option 2: Lost Creek/Ft. Kearny Cutoff. Assuming this project is operated to return existing flows in Lost Creek to the Platte River, the costs include up-front capital costs associated with the Lost Creek – Ft. Kearny IPA cutoff and annual operations and maintenance costs. Up-front costs associated with this project consist primarily of improvements to the Ft. Kearny Ditch, installation of the cutoff, diversion structures and gates, and pivot bridges along Lost Creek. If this project is operated to pump from high groundwater areas additional costs would be incurred for wells, pumps, and pipeline. These costs are addressed under groundwater management. Preliminary estimates of the costs associated with this project were provided by TBNRD.

The total up-front capital costs and annual operations and maintenance costs associated with this entire project were estimated to be about $333,000 and $6,000, respectively, as summarized in the following table.

Table III-25
Cost of Lost-Creek/Fort Kearny IPA Cutoff Project

DESCRIPTION	**COST ($)**
Diversion structure on Lost Creek	30,000
RTU and Measuring Device at Inlet	15,000
Excavate connecting ditch	60,000
Gated culvert on Crooked Ck Ditch	2,000
Bore under Highway 50A, Install Culvert	17,500
RTU and Measuring Device at Outlet	15,000
Flap Gate at Outlet	7,500
Clean Ft. Kearney Ditch, Install Culverts	65,000
Observation Wells	13,000
Pivot Crossings	20,000
Berm at Outlet	10,000
Clearing and grubbing trees along Lost Creek	42,500
Surveys	2,500
Secure 404 Permit, DWR Water Right	3,000
CNPPID Capitalized Costs	11,770
CNPPID Estimated Costs - Year 2000	9,500
TBNRD Capitalized Costs	4,815
TBNRD Estimated Costs - Year 2000	4,000
Total Capital Cost	**333,085**
Annual Operations and Maintenance Cost	**6,000**

◊ **Third-Party Impact Considerations:**

There are potential positive and negative hydrologic and economic third party impacts on downstream users due to changes in the quantity and timing of water in the river as a result of these projects. There could be third party benefits to homeowners and landowners in areas where groundwater levels are lowered due to pumping. Waterlogging in several areas throughout the Central Platte has resulted in decreased agricultural productivity and yield. Lowering the groundwater table could improve productivity, and in some cases bring waterlogged land back into production. Conversely, lowering groundwater levels may have negative third party economic impacts if pumping costs are increased. There are also potential negative hydrologic impacts associated with potential increases in groundwater levels adjacent to diversion ditches, cutoffs and creeks that are used to return water to the Platte River.

There are potential third party hydrologic benefits associated with the Funk Lagoon project to downstream homeowners and landowners. The channel capacity of Lost Creek is currently not sufficient to handle irrigation return flows and storm events, therefore, diversions from Lost Creek via the cutoff would free up additional channel capacity.

These projects would likely have minimal impact on recreational opportunities. There are potential third party environmental impacts related to removing water from Lost Creek. Water quality could be degraded and fish and aquatic habitat negatively impacted when flows in the creek are reduced.

6. DAWSON AND GOTHENBURG CANAL GROUNDWATER RECHARGE

◊ **Location:**

The Dawson and Gothenburg Canals are both located on the north side of the Platte River primarily in Dawson County. The Gothenburg Canal headgate is located approximately eight miles upstream of Gothenburg, Nebraska. The Dawson Canal headgate is located near Cozad, Nebraska.

◊ **Basic Description:**

Recharge projects under the Dawson and Gothenburg Canals would involve diverting surface water directly from the Platte River into these canals during the non-irrigation season. Canal seepage would percolate into the alluvium and recharge the groundwater aquifer. Excess water that is not recharged would be returned to the river via spillways within the same month. Return flows that result from canal seepage would accrue to the river for some duration after the recharge event. Diversions should be possible throughout the non-irrigation season if there is enough hydraulic head in the canals to produce flow velocities high enough to prevent freezing.

It may be possible to check up the canals to enhance recharge. This would in effect create a recharge basin along the canal, which may help achieve the same recharge with less diversion. The use of check dams should not impact the yield analysis significantly because the same amount of recharge would be achieved. Wells and/or drains could also be used to enhance recharge by lowering areas of high groundwater in the vicinity of the canal. Lower groundwater tables would increase the potential for recharge. Yields could also be realized sooner if these projects are operated as conjunctive use projects. During late fall and winter, flows that exceed target flows could be diverted into the Gothenburg and Dawson Canals for recharge to the local aquifer. During spring and summer months, an equivalent amount of water could be pumped for irrigation. Pumping during the irrigation season would replace irrigation releases from Lake McConaughy.

◊ **On-Site Hydrologic Effects:**

The total potential yield associated with these projects is estimated to be 2,600 ac-ft/yr. Nebraska is reserving 800 ac-ft of that yield to offset future depletions, therefore, approximately 1,800 ac-ft/yr is available to the Program (Jim Cook, Nebraska Natural Resources Commission, June 28, 2000 memo). Yield estimates and timing were based on the Final Report. Diversions from the Platte River and monthly accretions to the river provided in the Final Report were prorated to reflect only 69 percent of the yield as available to the Program. Underlying canals, such as the Cozad Canal, could potentially intercept recharge water returning to the river, in which case the yields of these projects may be less. Further monitoring and investigation is required to determine the extent to which underlying canals and irrigated lands intercept recharge water returning to the Platte River.

Monthly diversions are limited based on the amount of flow that can seep from the canals without generating a significant amount of tailwater. Information was provided by NPPD regarding the maximum rates that can be diverted when no one is taking water for irrigation and the spillways back to the river are running at maximum capacity. Based on this information, monthly diversions to the Gothenburg and Dawson Canals were limited to 150 cfs and 200 cfs, respectively. The ditch loss is about 20 percent according to information provided by NPPD, therefore, the maximum ditch loss that would be lagged back to the river is 30 cfs and 40 cfs for the Gothenburg and Dawson Canals, respectively. Monthly diversions to recharge could also potentially be limited by climatic cycles. During wet years, it may not be possible to recharge the aquifer when groundwater levels are excessively high.

The available flow to the Gothenburg Canal during the non-irrigation season was assumed to be the flow at the North Platte River gage at Brady, which is just upstream of the headgate. The available flow to the Dawson Canal during the non-irrigation season was assumed to be the flow at the North Platte River gage at Cozad, which is just downstream of the headgate. The Gothenburg Canal and Dawson Canal recharge projects rely on the same water supply to a degree, in which case, the yield of these projects together may not be as great as the sum of the individual yields.

Diversions to recharge were limited to months of target flow excesses at the critical habitat. The amount diverted into the Gothenburg Canal is equal to the available flow or 150 cfs, whichever is less. The amount diverted into the Dawson Canal is equal to the available flow or 200 cfs, whichever is less. The distance from the canal to the river varies along the length of the canal. An average SDF factor of 3250 days was used to lag seepage from the canals back to the river. The following tables show the total depletion from the Platte River and the net yield to the Platte River for the 1975-1994 period for the Dawson and Gothenburg Canals, respectively. Negative numbers indicate months when diversions to recharge exceed the accretion to the river whereas positive numbers indicate months when river accretions exceed diversions to recharge.

Table III-26
Gothenburg Canal – Diversions from the Platte River (ac-ft)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	0	0	0	6140	0	0	0	0	0	0	0	0	6140
1976	0	0	5810	6120	0	0	0	0	0	0	0	0	11930
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	6380	0	0	0	0	0	0	6380
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	6380	6380	6380	6380	6380	0	0	0	0	0	31900
1981	0	0	4680	5130	0	0	0	0	0	0	0	0	9810
1982	0	0	6350	4730	0	0	0	0	0	0	0	0	11080
1983	0	0	6380	6380	6380	6380	6380	0	0	0	0	0	31900
1984	6380	0	6380	6380	6380	6380	6380	0	0	0	0	0	38280
1985	6380	6380	6380	6380	6380	6380	0	0	0	0	0	0	38280
1986	0	0	6380	6380	6380	6380	6380	0	0	0	0	0	31900
1987	6380	6380	6380	6380	6380	6380	6380	0	0	0	0	0	44660
1988	0	6380	6380	6380	6380	0	0	0	0	0	0	0	25520
1989	0	0	5870	6380	0	0	0	0	0	0	0	0	12250
1990	0	0	0	5450	0	0	0	0	0	0	0	0	5450
1991	0	0	5760	6220	0	0	0	0	0	0	0	0	11980
1992	0	0	6080	6330	0	6380	0	0	0	0	0	0	18790
1993	0	0	5840	6380	0	6380	0	0	0	0	0	0	18600
1994	5440	6380	6380	6380	0	0	0	0	0	0	0	0	24580
Average	1229	1276	4572	5196	2233	2871	1595	0	0	0	0	0	18972

Table III-27
Gothenburg Canal – Unlagged Seepage (ac-ft)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	0	0	0	1228	0	0	0	0	0	0	0	0	1228
1976	0	0	1163	1225	0	0	0	0	0	0	0	0	2387
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	1276	0	0	0	0	0	0	1276
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	1276	1276	1276	1276	1276	0	0	0	0	0	6381
1981	0	0	936	1027	0	0	0	0	0	0	0	0	1963
1982	0	0	1269	947	0	0	0	0	0	0	0	0	2216
1983	0	0	1276	1276	1276	1276	1276	0	0	0	0	0	6381
1984	1276	0	1276	1276	1276	1276	1276	0	0	0	0	0	7657
1985	1276	1276	1276	1276	1276	1276	0	0	0	0	0	0	7657
1986	0	0	1276	1276	1276	1276	1276	0	0	0	0	0	6381
1987	1276	1276	1276	1276	1276	1276	1276	0	0	0	0	0	8933
1988	0	1276	1276	1276	1276	0	0	0	0	0	0	0	5105
1989	0	0	1174	1276	0	0	0	0	0	0	0	0	2450
1990	0	0	0	1091	0	0	0	0	0	0	0	0	1091
1991	0	0	1153	1244	0	0	0	0	0	0	0	0	2397
1992	0	0	1215	1266	0	1276	0	0	0	0	0	0	3758
1993	0	0	1168	1276	0	1276	0	0	0	0	0	0	3720
1994	1088	1276	1276	1276	0	0	0	0	0	0	0	0	4916
Average	246	255	914	1039	447	574	319	0	0	0	0	0	3795

Table III-28
Gothenburg Canal – Net Yield to the Platte River (ac-ft)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	0	0	0	-1228	0	0	0	1	2	3	4	5	-1213
1976	7	7	-1154	-1216	9	10	11	12	14	17	20	22	-2242
1977	24	26	27	28	28	29	29	29	29	29	29	28	335
1978	28	27	27	27	26	-1251	25	25	24	24	25	26	-967
1979	27	28	28	29	29	30	30	30	29	29	29	29	346
1980	28	28	-1249	-1249	-1250	-1250	-1250	27	30	34	39	45	-6015
1981	51	57	-874	-961	69	71	73	75	78	80	82	83	-1116
1982	84	85	-1184	-861	85	84	84	84	85	87	88	89	-1191
1983	89	89	-1187	-1187	-1188	-1189	-1189	88	90	93	97	102	-5290
1984	-1169	112	-1160	-1157	-1155	-1152	-1150	130	134	139	144	150	-6135
1985	-1120	-1115	-1112	-1109	-1106	-1104	175	179	184	189	195	200	-5544
1986	205	208	-1066	-1065	-1065	-1065	-1066	210	211	213	215	219	-3848
1987	-1054	-1051	-1049	-1048	-1047	-1046	-1044	234	238	243	248	253	-6123
1988	258	-1015	-1012	-1010	-1010	266	267	267	269	271	274	275	-1899
1989	276	276	-899	-1003	271	269	266	264	263	262	260	259	765
1990	257	255	252	-841	246	243	240	236	234	231	229	226	1808
1991	223	221	-935	-1029	212	209	206	205	204	203	203	202	123
1992	201	200	-1016	-1069	195	-1083	191	191	191	191	192	194	-1422
1993	195	196	-972	-1081	195	-1082	193	193	193	194	195	197	-1385
1994	-889	-1077	-1077	-1077	199	199	201	203	206	209	212	214	-2479
Average	-114	-122	-781	-905	-313	-441	-185	134	135	137	139	141	-2175

Table III-29
Dawson Canal – Diversions from the Platte River (ac-ft)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	0	0	0	8510	0	0	0	0	0	0	0	0	8510
1976	0	0	8510	8510	0	0	0	0	0	0	0	0	17020
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	8510	0	0	0	0	0	0	8510
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	8510	8510	8510	8510	8510	0	0	0	0	0	42550
1981	0	0	7590	8200	0	0	0	0	0	0	0	0	15790
1982	0	0	8510	8170	0	0	0	0	0	0	0	0	16680
1983	0	0	8510	8510	8510	8510	8510	0	0	0	0	0	42550
1984	8510	0	8510	8510	8510	8510	8510	0	0	0	0	0	51060
1985	8510	8510	8510	8510	8510	8510	0	0	0	0	0	0	51060
1986	0	0	8510	8510	8510	8510	8510	0	0	0	0	0	42550
1987	8510	8510	8510	8510	8510	8510	8510	0	0	0	0	0	59570
1988	0	8510	8510	8510	8510	0	0	0	0	0	0	0	34040
1989	0	0	8510	8510	0	0	0	0	0	0	0	0	17020
1990	0	0	0	8510	0	0	0	0	0	0	0	0	8510
1991	0	0	8510	8380	0	0	0	0	0	0	0	0	16890
1992	0	0	8510	8510	0	8510	0	0	0	0	0	0	25530
1993	0	0	8510	8510	0	8510	0	0	0	0	0	0	25530
1994	8510	8510	8510	8510	0	0	0	0	0	0	0	0	34040
Average	1700	1700	6340	7190	2980	3830	2130	0	0	0	0	0	25870

Table III-30
Dawson Canal – Unlagged Seepage (ac-ft)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	0	0	0	1702	0	0	0	0	0	0	0	0	1702
1976	0	0	1702	1702	0	0	0	0	0	0	0	0	3403
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	1702	0	0	0	0	0	0	1702
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	1702	1702	1702	1702	1702	0	0	0	0	0	8508
1981	0	0	1518	1640	0	0	0	0	0	0	0	0	3158
1982	0	0	1702	1633	0	0	0	0	0	0	0	0	3335
1983	0	0	1702	1702	1702	1702	1702	0	0	0	0	0	8508
1984	1702	0	1702	1702	1702	1702	1702	0	0	0	0	0	10209
1985	1702	1702	1702	1702	1702	1702	0	0	0	0	0	0	10209
1986	0	0	1702	1702	1702	1702	1702	0	0	0	0	0	8508
1987	1702	1702	1702	1702	1702	1702	1702	0	0	0	0	0	11911
1988	0	1702	1702	1702	1702	0	0	0	0	0	0	0	6806
1989	0	0	1702	1702	0	0	0	0	0	0	0	0	3403
1990	0	0	0	1702	0	0	0	0	0	0	0	0	1702
1991	0	0	1702	1676	0	0	0	0	0	0	0	0	3378
1992	0	0	1702	1702	0	1702	0	0	0	0	0	0	5105
1993	0	0	1702	1702	0	1702	0	0	0	0	0	0	5105
1994	1702	1702	1702	1702	0	0	0	0	0	0	0	0	6806
Average	340	340	1267	1439	596	766	425	0	0	0	0	0	5173

Table III-31
Dawson Canal – Net Yield to the Platte River (ac-ft)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	0	0	0	-1702	0	0	0	1	2	4	6	7	-1682
1976	9	10	-1690	-1689	13	14	15	17	20	24	28	31	-3199
1977	34	36	38	39	40	41	41	41	41	41	40	40	473
1978	39	39	38	38	37	-1665	35	35	34	34	35	36	-1265
1979	37	38	40	40	41	41	41	41	41	40	40	40	480
1980	39	38	-1664	-1664	-1665	-1665	-1665	38	41	47	54	62	-8005
1981	70	77	-1435	-1552	93	96	99	102	105	109	112	115	-2009
1982	117	118	-1583	-1515	118	118	117	118	120	122	124	125	-1901
1983	126	127	-1575	-1575	-1576	-1577	-1577	125	127	131	137	144	-6961
1984	-1551	157	-1540	-1536	-1533	-1530	-1526	179	184	191	198	206	-8100
1985	-1488	-1482	-1476	-1473	-1470	-1467	239	244	250	257	265	272	-7328
1986	277	282	-1417	-1416	-1416	-1416	-1417	284	285	287	291	296	-5079
1987	-1401	-1397	-1395	-1393	-1392	-1391	-1389	316	321	327	333	341	-8122
1988	347	-1350	-1346	-1344	-1344	358	358	360	362	365	368	370	-2497
1989	371	371	-1332	-1334	364	361	358	355	353	352	350	348	917
1990	346	343	340	-1366	332	327	323	319	315	312	309	306	2206
1991	302	299	-1406	-1385	287	284	280	278	277	276	276	275	44
1992	274	273	-1431	-1433	266	-1438	261	260	260	261	263	265	-1918
1993	266	267	-1434	-1435	266	-1437	263	263	263	265	267	269	-1919
1994	-1431	-1430	-1429	-1430	272	272	274	277	282	286	290	292	-3475
Average	-161	-159	-1085	-1256	-413	-584	-244	183	184	187	189	192	-2967

Based on an SDF factor of 3,250 days, 28 percent of the amount recharged will have returned to the river within 3,250 days, or approximately nine years. As currently modeled, the majority of the benefits from this program would accrue after the first increment. Benefits could be realized sooner if recharge basins are constructed along the canal or the canals are checked up in locations that are close to the river corresponding with much smaller SDF factors. This would allow seepage to return to the river faster and provide a more immediate benefit to the species. Alternatively, benefits could be realized sooner if these projects are operated as conjunctive use projects.

◊ **Legal and Institutional Requirements for Implementation:**

It is unlikely that new legislation would be required to implement this project. An intentional recharge permit to divert water into these canals for recharge must be obtained from the Nebraska DWR. The intent of these recharge projects would be to designate augmentation of stream flow to the Platte River as their major purpose, in which case seepage is intentional rather than incidental.

Although legislation regarding intentional recharge exists, it is untested. There are questions regarding the issue of protection and whether additional water generated from recharge projects would become natural flow or protected water. Recharge water may be protectable from diversion under Section 46-252, however, the use of Section 46-252 to protect return flows is untested. One obstacle could be that under current Nebraska law return flows from canal seepage are considered to be natural flow, which is available to the next senior water right holder. In addition, an accounting procedure would be needed to distinguish return flows associated with irrigation operations from return flows due to intentional off-season recharge. The accounting system could be similar to that which is used in Colorado, where numerous recharge projects are conducted using irrigation canals to offset the stream depletion caused by pumping of irrigation wells.

A contract would need to be negotiated, which establishes the conditions under which the Gothenburg and Dawson Canals are used for recharge during the non-irrigation season.

◊ **Schedule For Implementation:**

These projects require limited, if any, new construction or infrastructure, therefore, the implementation schedule is based primarily on the resolution of legal and institutional issues. As noted in comments received from Nebraska, it may take 2 to 4 years to implement these projects.

◊ **Expected Project Life:**

The expected project life of a Gothenburg/Dawson recharge project is dependent on the length of the contract and the conditions for contract renewal. This project could potentially extend well beyond the first increment of the Program.

◊ **Capital and Operating Costs:**

The costs of these projects include the construction of diversion and storage facilities and annual delivery fees. The costs were based on data provided by the Northern Colorado Water Conservancy District for the Tamarack Plan.

Up-front costs consider capital costs of subsurface investigations, a diversion structure and recharge basin if necessary, and measuring devices. A cost of $3,500 was included for subsurface investigations. The cost for a diversion structure off the main canal (to a recharge basin) and recharge basin was estimated to be about $9,000. A cost of $4,000 was included for regulation and measurement, which includes the cost of flumes, stilling wells, and stage recorders. Engineering costs were assumed to be 10 percent of the total construction cost of the project. The total capital cost associated with each of these recharge projects is $20,000. These costs may be incurred if the canal is checked up to simulate a recharge basin or if this project is operated as a conjunctive user project. If this project is operated as a conjunctive use project, these costs could be applied to wells or drains. Assuming Nebraska reserves 31 percent of the potential yield of these projects for offset purposes, the total capital cost attributable to the Program is $13,800.

A fee of $10 per ac-ft recharged per year is included as an annual operating cost. The annual operating cost or delivery fee was applied to the amount recharged as opposed to the amount diverted because it may be possible to check up the canals and achieve the same amount of recharge with significantly less diversion. The annual costs associated with the Gothenburg and Dawson Canal recharge projects are about $38,000 and $51,800, respectively.

Potential costs associated with third party impacts have not been evaluated. The costs presented above may be higher if there are third party impact costs.

◊ **Third-Party Impact Considerations:**

Third party impacts associated with these groundwater recharge projects are similar to those discussed for groundwater management. The primary hydrologic and economic third party impacts are due to changes in the quantity and timing of water in the river. Unlike projects that involve active pumping from high groundwater areas, however, these projects will likely result in higher groundwater levels due to increased recharge return flows. This could present a problem for lands underlying the Dawson and Gothenburg Canals as groundwater levels in these areas have risen in recent years. Raising groundwater levels could have the opposite positive and negative third party impacts as lowering groundwater levels.

7. CENTRAL PLATTE POWER INTERFERENCE

◊ **Location:**

A power interference project would operate primarily at CNPPID’s Kingsley Dam Hydro, the two Johnson Hydros and Jeffrey Hydro in conjunction with the Lake McConaughy EA. NPPD’s Sutherland System and North Platte Hydro facility would also be involved as NPPD and CNPPID power generation operations are closely related.

◊ **Basic Description:**

Nebraska intends to reserve as much of the yield of this project as Nebraska believes is necessary to offset new depletions in that state. However, Nebraska currently estimates that 1,400 ac-ft/yr of the yield of this project would be in addition to that needed for new depletion offset and therefore could be made available to the Program. That is the yield used for purposes of the analysis in this plan. A power interference project entails a monetary payment to a hydroelectric generator sufficient to induce that generator to modify the release of water through the hydropower turbines. The modification might include a change in the timing of such generation or perhaps a bypass of the turbines in order to reduce target flow shortages at the critical habitat. The two Johnson units and Jeffrey are owned by CNPPID, which has expressed an interest in a power interference compensation program. Although CNPPID owns these facilities, it should be noted that any change to their operation affects NPPD's operations.

In general, Lake McConaughy releases would be scaled back during times of excess at the critical habitat. The "excess" flow could be stored in the EA to be released at a later time when planned releases and downstream river gains do not meet instream flow recommendations. When the water is subsequently released, it may or may not be available for diversion and routing through the district's hydro facilities depending on river conditions in effect. The monetary compensation must at least equal the market value of the hydropower that is forsaken on behalf of the target flows.

◊ **On-Site Yield and Timing:**

Yield estimates and timing were based on the Final Report. The following constraints reflect certain operational constraints and physical system relationships that define the maximum amount of water available for hydropower interference.

- An ac-ft loss to Jeffrey amounts to an ac-ft loss at Johnson No. 1 (J-1) and Johnson No. 2 (J-2) because the same water passes through all three plants and also the North Platte Hydro.

- Storage at Jeffrey or the two Johnson units is insufficient to effectively operate a power interference program. It is assumed that this alternative will rely upon Lake McConaughy storage without affecting total annual Kingsley generation.

- Following its authority, CNPPID has confirmed the priority of water releases for its irrigation customers. CNPPID believes that this priority can be accommodated with power interference.

- Minimum stream flow requirements under the new FERC license include a range of releases from Lake McConaughy, which will limit hydropower interference. These minimum flows change according to very wet to very dry conditions and are measured at the Keystone Diversion Dam and the CNPPID Diversion Dam in Nebraska. This constraint is reflected in this analysis.

- Since the benefit of power interference lies not with increases in average annual flows but with timing of releases, the "yield" of this alternative is in balancing periodic excesses at Grand Island with periodic shortages. This consideration has been accounted for in the yield analysis.

Modeling of power interference and Lake McConaughy storage contents was provided by CNPPID. The following steps offer additional detail regarding the calculation of yields and timing.

- The maximum theoretical water available for power interference is the minimum of the J-2 return flows and the maximum Kingsley Release, provided in Tables 8.H.20 and 8.H.21, respectively, in the Final Report. By considering the J-2 returns, this avoids a negative impact on CNPPID's irrigation customers since that water is not removed from the system. Although Kingsley may not experience diminished annual generation, this retiming could result in lost power generation at the North Platte, Jeffrey, and Johnson Nos.1 and 2 Hydros.

- The minimum stream flow requirements represent another constraint on power interference yield. Table 8.H.22 in the Final Report indicates the minimum release requirements below Keystone at the Sutherland Supply Canal. Because of minimum flow requirements at Keystone, minimum flow requirements at CNPPID's North Platte Diversion are likely to be met so any changes would not have substantive effects upon yield. The difference between historical McConaughy releases and minimum flow release requirements is presented in Table 8.H.23 of the Final Report. This represents potential storage without regard to Grand Island excesses, shortages or McConaughy storage restrictions.

- Potentially retimed hydropower interference volume, or the total available water, is equal to the minimum of: (1) J-2 return flows; (2) historical McConaughy releases less McConaughy minimum release requirements; and (3) Grand Island excesses, as shown in Table 8.H.24 of the Final Report. These amounts exceed McConaughy storage restrictions in some months.

- Excess flows at Grand Island are considered to be the source of potential storage. This storage cannot exceed available McConaughy storage, nor can it carry over to the following month without available storage during that month. Releases from Lake McConaughy were scaled back from the power interference project presented in the Final Report based on the ratio of the yield proposed by Nebraska to target flow reductions without diversion losses presented in Table 8.H.18 of the Final Report.

Based on the assumptions and criteria outlined above and the yield target provided by Nebraska, the re-timed releases from Lake McConaughy due to power interference are shown in the following table.

Table III-32
Re-timed Releases from Lake McConaughy

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	2843	0	0	0	0	0	0	0	2843
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	2176	0	2176
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	1070	1070
1982	0	0	0	0	296	0	0	0	0	0	0	0	296
1983	0	0	0	0	1567	0	0	0	0	0	0	0	1567
1984	1475	0	0	0	4372	0	0	0	5643	0	0	0	11491
1985	0	0	0	0	3312	677	416	157	0	0	0	0	4561
1986	479	0	0	0	379	0	0	0	2580	0	0	0	3437
1987	1088	2015	1580	0	3996	0	0	0	0	0	3252	0	11932
1988	4299	0	0	0	1224	2757	1153	0	0	0	0	0	9433
1989	0	0	0	0	1668	0	0	0	0	0	30	0	1698
1990	748	0	0	0	492	0	0	0	0	0	0	0	1239
1991	0	0	0	0	870	462	0	0	0	2549	0	0	3880
1992	0	0	0	0	542	0	195	0	0	0	0	0	737
1993	0	0	0	0	0	0	0	0	0	0	36	0	36
1994	0	0	0	0	5082	140	3850	0	0	0	661	0	9734
Average	404	101	79	0	1332	202	281	8	411	127	308	53	3306

NPPD noted in comments received May 3, 2000 that the analysis of water availability for hydropower interference must consider the existence of additional senior natural flow rights held by NPPD and others and cannot be based solely on Lake McConaughy storage and releases as related to target flows. This condition will have to be evaluated before implementing this project.

Based on the water budget spreadsheet, an average annual release of approximately 3,300 ac-ft will generate approximately 1,400 ac-ft of target flow reductions at the critical habitat without diversion losses. The losses appear relatively high for this project because some releases were made, particularly in February, when storage space was unavailable. As a result, releases were made during several months that shortages do not exist at the critical habitat due to storage capacity constraints. This project could be operated differently to reduce the amount of water that is retimed in an effort to minimize releases during periods of excess at the critical habitat.

◊ **Legal and Institutional Requirements for Implementation:**

A permit to increase contributions to the Lake McConaughy EA resulting from power interference must be obtained from the Nebraska DWR. Once a permit is obtained water released from the EA would be protected from downstream diversion losses under water right A-17695.

An agreement will need to be negotiated between CNPPID and NPPD, which establishes the conditions under which power interference would be implemented.

◊ **Schedule For Implementation:**

This project does not require any new construction or infrastructure, therefore, the implementation schedule is based on the resolution of legal and institutional issues. As noted in comments received from Nebraska, a power interference project could potentially be implemented in two to four years depending on how long it takes to negotiate an agreement between CNPPID and NPPD. This agreement or contract would probably need to be renewed on an annual basis. This project would most likely be phased in to ensure that it is working as planned, there are no unanticipated effects, and it is acceptable to NPPD and CNPPID.

◊ **Expected Project Life:**

The project life of power interference is primarily dependent on the agreement between CNPPID and NPPD. This project could potentially be implemented on a year-to-year basis through the first increment of the Program.

◊ **Capital and Operating Costs:**

There are two elements of cost to consider for power interference charges: payments to CNPPID for the lost revenue (since less energy will be sold to NPPD) and the net cost NPPD will incur to replace the energy it would have received from CNPPID, plus the value of associated capacity loss encompassed by generation and replacement costs. The latter is not simply a third party impact because NPPD has a multi-year contract with CNPPID to obtain energy under specified terms. NPPD and CNPPID also signed an operating agreement in 1954 that recognizes responsibilities of both parties with regard to Lake McConaughy operations. NPPD might experience other losses associated with generation and capacity reductions at its North Platte Hydro if Lake McConaughy is storing for power interference when the North Platte Hydro is below capacity. Compensation for damages or losses to NPPD are likely to be required.

The first cost element can be derived by relating CNPPID's power revenues to net energy delivered and then to water released from the district's three hydrogenerating facilities. For the 1994 through 1998 period, this amounted to an average of $12 per ac-ft released by the three plants.

It is noted that power generation could still occur with power interference, but it will be at different times or later in the year. Except for the Kingsley hydro, power generation could only occur with power interference if water is released from the EA when canal capacity is available. A loss in value may result if power generation is re-timed. The loss/revenue associated with re-timed power generation requires further analysis.

The second cost component, NPPD's losses, is more uncertain. NPPD has indicated that it does, in fact, need this power and would have to replace it. Since NPPD relies on power generated by CNPPID, it would need to purchase outside power resources that would have the components of capacity charges, energy charges, transmission costs, and transmission losses. These costs would vary by peak, off-peak and season. The costs need to be projected in an electric industry marketplace that faces tightening supplies and is moving to market-based rates. These accumulated costs, less the payments to CNPPID, represent the avoided costs that NPPD faces and would seek to recover. As noted by NPPD in comments received May 3, 2000, lost hydropower revenue costs must also include additional hydropower generation replacement costs.

Avoided costs must be derived on a utility-specific and specific resource replacement basis. The value lost to NPPD in this circumstance depends on the nature of NPPD's system load over time, other generation capabilities within their system, and other opportunities to acquire power resources from other generators. A quantification of these costs is complicated by considering electric industry restructuring and other uncertainties. A study of NPPD power system requirements and sources by cost over time will be needed to confirm present power values to NPPD. Information provided by NPPD included formulas to convert acre-feet of water retimed to the amount of power that could be generated at the North Platte, Jeffrey, Johnson, and Kingsley hydroelectric plants. NPPD also provided a forecast of the future market value of power generation from the New York Mercantile Exchange's "Entergy" forecast. The forecast projects monthly power values 18 months into the future. NPPD suggested that prices beyond the 18-month forecast period be escalated to a Consumer Price Index projection ranging from 2.7 to 3.4 percent annually over the next fifteen years. These escalation rates are generally consistent with the uniform 3.0 percent rate used to compute present value costs in chapter VI.

The following approach was used to prepare a conservative estimate of NPPD’s costs (without transmission, operations, or maintenance costs, which are dependent on the source of replacement power). It was assumed that no power could be generated from re-timed releases from Lake McConaughy due to potential system constraints. In other words, NPPD would incur the additional cost to replace lost power associated with all re-timed releases.

It was assumed that water stored for hydropower interference would have been “historically” released and run through the generating plants. The costs associated with the “historical” releases represents NPPD’s avoided costs. The following table shows water stored for hydropower interference. This water is then re-timed and released during periods of target flow shortages as shown previously in Table III-32.

Table III-33
Hydropower Interference Storage at End-of-Month
(ac-ft)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	1907	937	0	0	0	0	0	0	0	0	2843
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	2176	0	0	2176
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	1070	0	1070
1982	0	0	210	85	0	0	0	0	0	0	0	0	296
1983	0	0	899	668	0	0	0	0	0	0	480	995	3042
1984	0	0	0	4372	0	1927	532	3184	0	0	0	0	10015
1985	0	0	113	4448	0	0	0	0	0	0	0	479	5040
1986	0	0	68	310	0	0	0	2580	0	0	4010	2600	9568
1987	0	0	0	2069	0	508	2071	1179	1136	612	0	2045	9620
1988	0	1231	2662	1241	0	0	0	0	0	0	0	0	5134
1989	0	0	972	696	0	0	0	0	0	30	0	748	2445
1990	0	0	0	492	0	0	0	0	0	0	0	0	492
1991	0	0	541	791	0	0	0	1014	1535	0	0	0	3880
1992	0	0	342	395	0	0	0	0	0	0	0	0	737
1993	0	0	0	0	0	0	0	0	0	2884	0	1037	3921
1994	234	1878	1927	1150	0	0	0	0	0	661	0	0	5849
Average	12	155	482	883	0	122	130	398	134	318	278	395	3306

The average monthly volumes of water stored for hydropower were used to determine NPPD's avoided costs. Monthly averages were used to be consistent with all other alternatives. For all other alternatives the average annual net hydrologic effect was multiplied by a present day annual cost. In this case, it is not sufficient to use an annual cost because power values change on a monthly basis.

The average monthly volumes of water stored for hydropower interference were converted to MWH of power generation assuming a linear relationship exists between the flow through the turbines and power generation. The previously mentioned formulas for computing power generation at each of the four plants were reviewed with NPPD personnel on August 2, 2000. NPPD's more detailed spreadsheet model indicated that 3,300 af of flow would result in 2,100 MWH of energy production. Therefore, monthly flow volumes were multiplied by 2,100 MWH/3,100 ac-ft to convert to MWH. The projected monthly power values for the year 2001 were multiplied by the monthly hydropower generated to determine the monthly costs to NPPD to replace lost power. As shown in the following tables, the maximum total annual cost to NPPD would be about $123,100/year without ancillary transmission, operation, and maintenance costs.

Table III-34
Hydropower Generation (MWH)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Average	7	99	306	561	0	77	83	253	85	202	177	251	2100

Table III-35
Entergy Prices for Energy ($/MWH)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	51.75	48.25	44.00	44.00	49.75	79.00	147.50	127.50	45.00	40.50	40.50	40.50

Table III-36
Hydropower Costs ($)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Average	384	4764	13472	24671	0	6110	12195	32222	3817	8185	7153	10165	123137

The total cost to CNPPID would amount to about $12 per ac-ft or approximately $39,600 per year to redistribute 3,300 ac-ft. Therefore, the total annual cost would be about $162,700 plus ancillary costs. Potential costs associated with third party impacts have also not been evaluated. The costs presented above may be higher if there are third party impact costs. In addition, an agreement or contract between CNPPID and NPPD to implement power interference would need to be renewed on a periodic basis, in which case there may be additional costs associated with permitting or re-negotiating contracts.

◊ **Third-Party Impact Considerations:**

Power interference will likely produce third party hydrologic, economic and environmental effects. Water release schedules from Lake McConaughy will differ from the historical pattern, primarily in non-irrigation months. There will also be changes in the timing and quantity of water available downstream of the J-2 return. Changes in release schedules and J-2 returns could have potential positive and negative economic and hydrologic third party impacts on downstream water users that rely on these flows.

Economic effects might stem from modified stream flows, but more likely from the diverse impacts associated with securing replacement power. NPPD will experience direct impacts associated with acquiring power resources from other generators. NPPD may also experience an increased need for reactive volt-ampere (VAR) support and need to replace voltage control supplied by the hydros. NPPD customers could likely experience higher electricity costs because of more expensive non-hydro power or, worse, experience a reduction in power availability that could produce economic constraints. The loss of system generating capacity will be evident for the Mid-America Power Pool.

Third party environmental consequences are likely as hydro generation, usually very low in environmental impacts, is potentially replaced by fossil fuel generation, which often affects air quality and other environmental resources.

Third party impacts on recreational opportunities relate primarily to fluctuations in reservoir pools due to changes in storage and release schedules. Fluctuating reservoir levels can be a detriment to recreation activities such as boating and fishing if they occur.

8. NET CONTROLLABLE CONSERVED WATER

◊ **Location:**

This project consists of conservation activities implemented by CNPPID within their system.

◊ **Basic Description:**

Net controllable conserved water has resulted from actions taken by CNPPID to comply with the agreement with the National Wildlife Federation to provide reductions in average annual diversions of surface water. The net controllable conserved water resulting from a grant from the Bureau of Reclamation will be added to the EA at no cost to the Program. The net controllable conserved water not attributed to a grant from the Bureau of Reclamation will be made available to the Program at the average cost of the conservation activities.

The three main categories of water conservation measures that have been implemented address: 1) reservoirs, 2) canal distribution and delivery system, and 3) on-farm irrigation. Reservoir improvements include a water conservation alternative developed for Elwood Reservoir that revised the fill/release operations to minimize seepage. Canal distribution and delivery system improvements include installation of pipelines, earth compaction, membrane lining, canal structures, structure automation and turnout relocation. These improvements are aimed at reducing losses in the system. On-farm irrigation changes include system improvements, such as installation of center pivots, gated pipe, flow meters, and surge valves, or management improvements, such as irrigation scheduling, adjustments to irrigation set times, and alternate furrow irrigation. On-farm irrigation changes are intended to improve irrigation efficiencies.

◊ **On-Site Yield and Timing:**

The amount of net controllable conserved water associated with conservation measures is currently being evaluated but has not yet been finalized. Nebraska has indicated that 5,000 ac-ft/yr of net controlled conserved water is available to the Program, however, there is uncertainty regarding this estimate as the yield analysis of CNPPID's conservation activities has not yet been completed. This amount is subject to change pending the results of an on-going study.

Conserved water will be added to the Lake McConaughy EA on October 1 of each year as specified in the license agreement. This water can then be released during times of shortage at the critical habitat.

◊ **Legal and Institutional Requirements for Implementation:**

Net controllable conserved water will be stored in the EA and released during periods of target flow shortages. Approval from the Nebraska DWR will be required to add additional conserved water to the EA. There should be no other legal and institutional requirements as these conservation activities have already been implemented.

◊ **Schedule For Implementation:**

The yield associated with this alternative is the result of conservation activities that have already been implemented. As noted in comments received from Nebraska, this project could be implemented in zero to two years.

◊ **Expected Project Life:**

The expected life of this project extends well beyond the first increment of the Program. Under the FERC license agreement, CNPPID is obligated to perform conservation activities for 40 years.

◊ **Capital and Operating Costs:**

The net controllable conserved water resulting from a grant from the Bureau of Reclamation will be added to the EA at no cost to the Program. It is assumed that 500 ac-ft/yr is available at no cost to the Program (Jim Cook, Nebraska Natural Resources Commission, June 28, 2000 memo). The 4,500 ac-ft/yr of net controllable conserved water, which is not attributed to the grant from the Bureau of Reclamation, will be made available to the Program at the cost of the conservation activities.

The Central Nebraska Regional Water Conservation Task Force (Task Force) developed a cost-effectiveness analysis to evaluate the feasibility of conservation improvements. There is uncertainty regarding the use of these costs because certain assumptions regarding project lifetimes and interest rates may differ from those used to evaluate other Program projects. As such, further evaluation of these costs is required. Based on information developed by the Task Force, the total cost for gross water savings associated with net controllable conserved water is estimated to be about $3.2 million. Of this amount, CNPPID received a $500,000 grant from the Bureau of Reclamation. The total cost to the Program excluding the Bureau of Reclamation funds is estimated to be about $2.7 million. Using a discount rate of 6 percent and a term of 13 years, the annual cost is $305,000.

The amount of conserved water available to the Program could change pending the results of an on-going study.

◊ **Third-Party Impact Considerations:**

Conservation activities associated with net controllable conserved water have already been implemented in which case there are no additional third party impacts associated with allocating this water to the Program.

C. Wyoming Projects

1. *PATHFINDER MODIFICATION MUNICIPAL ACCOUNT*

◊ **Location:**

Pathfinder Dam is located on the North Platte River about three miles below the confluence with the Sweetwater River and about 47 miles southwest of Casper, Wyoming.

◊ **Basic Description:**

The Pathfinder Modification Stipulation, agreed to by the parties to the Nebraska v. Wyoming lawsuit (NE, WY, CO, US) in September 1997, provides for the Pathfinder Modification Project, which would increase the capacity of the existing Pathfinder Reservoir by approximately 54,000 ac-ft. The increased capacity is proposed to be filled with water stored under the existing 1904 storage right for Pathfinder Reservoir with the exception that regulatory calls can not be placed on existing water rights upstream of Pathfinder Reservoir other than the storage rights pertaining to Seminoe Reservoir.

The Pathfinder Modification Project will serve both environmental and municipal uses. An environmental account of 34,000 acre-feet will be operated for the endangered species and habitat in Central Nebraska in accordance with certain conditions. A municipal account of 20,000 acre-feet will provide municipal water to North Platte communities in Wyoming through contracts between the municipalities and the State of Wyoming in accordance with certain conditions.

As noted in Wyoming comments received on April 5, 2000, the Bureau of Reclamation will operate the 20,000 acre-foot municipal storage account to provide an annual estimated firm yield of 9,600 ac-ft. The Pathfinder Modification Stipulation restricts municipal carry-over storage to 20,000 ac-ft. In any year the municipal demand is less than 9,600 ac-ft, the remaining balance is available to Wyoming to be released for the benefit of the endangered species in the critical habitat at Wyoming's discretion. The delivery of water contributed from the municipal account would be considered in addition to the storage and delivery of water from the Pathfinder environmental account.

As summarized in Wyoming's proposal, storage water in the Pathfinder municipal account would be made available to the Program each year as follows:

- Storage water that is not used to supplement the water rights of municipalities in the North Platte River basin in Wyoming and mitigate future depletions as defined in Wyoming's "Depletion Mitigation Program, Platte River Basin, Wyoming" could be leased to the Program.

- To determine the amount of water available to the Program, Wyoming would review the status of water availability within the North Platte River basin. Wyoming will not know in advance exactly how much water they will need to meet all anticipated uses, therefore, prior to June 1 of each year, state officials will make a conservative judgement as to the amount of water that may be required for Wyoming's purposes.

- Wyoming would advise the Governance Committee in June as to how much water the EA manager could move from Pathfinder municipal account to the EA in Lake McConaughy from July 1st through September 30th of the same year.

- After September 30th, Wyoming would quantify its depletions for the previous year (October 1 through September 30). If the quantification indicates that Wyoming exceeded it's "existing water related activity baseline", Wyoming will quantify the excess depletion at the Wyoming/Nebraska state line. Using the tracking and accounting procedures and providing for replacement water from its other sources, the amount of storage released from the Pathfinder municipal account needed to offset the excess depletions at the state line will be determined. This amount of storage would be subtracted from the amount of water provided to the Program to determine the amount of credit Wyoming would get from the Program. Wyoming would expect lease payments for the difference between the volume of water provided to the Program from July through September and any amount in excess of Wyoming's "existing water related activity baseline".

◊ **On-Site Hydrologic Effects:**

The total capacity of the municipal storage account is 20,000 ac-ft. As noted in Wyoming comments received on April 5, 2000, the firm yield of this account is 9,600 ac-ft. It is appropriate to consider the firm yield as opposed to average yield for this project because the municipal account will be operated to provide a firm yield. The amount of water available to the Program is dependent on the amount needed to supplement municipal water rights and/or mitigate excess depletions and cannot exceed the firm yield in any year. Wyoming anticipates that 4,800 ac-ft of storage water from the municipal account could be available for lease to the Program on an average annual basis (Wyoming's December 16, 1999 proposal). The amount available to the Program will vary on a year to year basis depending on Wyoming's needs. In some years no water from this account will be available to the Program, whereas, in other years, up to 9,600 ac-ft could be available to the Program.

Because the average annual amount that would be released from the Pathfinder Reservoir municipal account and delivered to the Lake McConaughy EA is relatively small, the EA manager may choose to move all of the water downstream during the month of September to minimize conveyance losses.

Two potential schedules are provided in the table below for releases from the Pathfinder Reservoir municipal account. Accumulations to storage are not required by the EIS/ESA team because they are already incorporated in the North Platte River Water Utilization Model (NPRWUM). The NPRWUM model stores water in Pathfinder Reservoir when the water rights are in priority.

Table III-37
Pathfinder Municipal Account – Yield to the North Platte River

Month	Option #1 : Releases from Pathfinder Municipal Account (ac-ft)	Option #2 : Releases from Pathfinder Municipal Account (ac-ft)
October	0	0
November	0	0
December	0	0
January	0	0
February	0	0
March	0	0
April	0	0
May	0	0
June	0	0
July	1,600	0
August	1,600	0
September	1,600	4,800
Annual	4,800	4,800

◊ **Legal and Institutional Requirements for Implementation:**

Although the 1997 Pathfinder Modification Stipulation was agreed to by the parties to the Nebraska v. Wyoming lawsuit, it has not yet been ratified by the Supreme Court. For this analysis, it was assumed that the Pathfinder Modification Stipulation will be ratified and approved by the U.S. Supreme Court. As the Pathfinder Modification Project will be funded by the Wyoming Water Development Program, the Wyoming Legislature must approve the project and its funding.

There are several other legal changes and requirements necessary to implement this project. The federal authorization of Pathfinder Reservoir will be amended, if necessary, to include municipal and environmental purposes. The 1904 Wyoming water right for Pathfinder Reservoir would have to undergo a partial change of use for Pathfinder storage water to be stored for municipal and downstream environmental purposes in the critical habitat. In addition, a secondary supply water right would be needed to ensure the protection of storage water downstream to the Wyoming/Nebraska state line. The change of use and the secondary supply water right would be contingent upon the existence of the Program and Wyoming's participation in that Program. The secondary supply water right would need to be secured from the Wyoming State Engineer and the change of use would need to be secured from the Wyoming Board of Control.

In order to obtain regulatory certainty for the delivery of Pathfinder storage releases to the Wyoming/Nebraska state line, the Wyoming State Engineer and Legislature must approve the export. In addition, a permit under Nebraska water law is needed to protect project environmental releases delivered to the Wyoming/Nebraska state line to specified locations between the state line and Chapman, Nebraska.

NEPA/ESA compliance and a federal 404 permit are also required to implement this project. It is anticipated that the NEPA/ESA review of the proposed Program will include the necessary NEPA/ESA review for this project in sufficient detail to secure the federal approvals required for implementation.

◊ **Schedule For Implementation:**

As noted in Wyoming comments received on April 5, 2000, the schedule for the implementation of this alternative is as follows. In year 1, the following activities will be completed by the State of Wyoming:

- Seek and obtain project authorization and funding from the Wyoming Legislature,
- Conduct environmental assessments required by NEPA,
- Seek an amendment to the federal authorization of Pathfinder Reservoir from Congress if necessary,
- Seek a partial change of use through the Wyoming Board of Control for the water right for Pathfinder Reservoir under Wyoming water law,

- Seek the statutory review by the Wyoming State Engineer on the potential export of storage water for downstream environmental uses.

In year 2, pending the outcome of year 1 activities, the State of Wyoming will:

- Seek approval from the Wyoming Legislature for the export of water for downstream environmental uses,

- Seek a secondary supply water right, issued to the Wyoming Water Development Commission, from the Wyoming State Engineer to protect the deliveries of Pathfinder storage water to the Wyoming/Nebraska state line,

- Seek a permit under Nebraska water law to protect project environmental releases delivered to the Wyoming/Nebraska state line to specified locations between the state line and Chapman, Nebraska.

In year 3, pending the outcome of year 2 activities, project construction will be initiated and completed. The storage and release of project water will be available upon completion of the project.

◊ **Expected Project Life:**

The inclusion of this project in the Program is contingent on the existence of the Program and Wyoming's participation in that Program. The expected project life is dependent on the length of the contract with the State of Wyoming. For purposes of this plan, it is assumed that the first increment of the program will be 13 years and Wyoming will participate in the Program for the duration of the first increment. Subject to these terms, it is likely Wyoming would agree to a contract length through year 13 year with an option to renew at the end of the first increment, depending on the terms of the second increment and Wyoming's participation in that second increment as noted in Wyoming's comments received on April 5, 2000.

◊ **Capital And Operational Costs:**

The amount of water available to the Program, for which Wyoming would expect lease payments, is the difference between the volume of water provided to the Program from July through September and any amount that Wyoming uses to replace depletions in excess of Wyoming's "existing water related activity baseline" during the water year.

Based on Wyoming's comments received on April 5, 2000, Wyoming has noted that the cost should be based on the projected costs of acquiring other Program water. Alternatively, the cost to lease this water could be based on recovering the capital cost attributable to the Pathfinder municipal account, including construction costs and costs of mitigating third party impacts, plus annual operating, maintenance and replacement costs. Wyoming has estimated that construction and third party mitigation costs for the Pathfinder Modification Project will total approximately $10 million. Of this amount, the total third party impact costs to irrigators are estimated to be $7.9 million as presented in the 3-Brick Proposal (Bureau of Reclamation, May 1996). Third party impact costs include 1) an estimated cost of about $3.8 million for repayment of the Safety of Dams Corrective Action Study (SOD CAS) modifications that will be incurred by irrigators that benefit from the North Platte and Kendrick Projects and the Glendo Unit, and 2) an estimated cost of about $4.1 million for selenium remediation that will be incurred by the Kendrick Project irrigators. The total cost of this project is not comparable to other total costs presented in this report as third party impact costs are included.

Of the total cost of $10 million, approximately 37 percent (20,000/54,000) or $3.7 million can be attributed to the municipal account. Using a discount rate of 6 percent and a term of 13 years, the annual cost for the construction and mitigation of third party impacts is $418,000. Thus, the estimated cost per acre-foot of yield would be $418,000/9,600 ac-ft or $43.50 per ac-ft per year. The operation and maintenance costs that would be paid annually to the Bureau of Reclamation are estimated to be $20,000 per year. According to the 3-Brick Proposal the inflatable dam has a design life of 35 years. Based on an estimated cost of $1.9 million for the inflatable dam, which was prepared by the EIS team, the annual amount needed to replace the inflatable dam at the end of 35 years would be approximately $17,000. Therefore, the annual costs per acre-foot of yield would be $37,000/9,600 ac-ft or $4 per ac-ft per year. Under these assumptions, the annual breakeven cost to Wyoming would be $47.50 per acre-foot of yield. Assuming that Wyoming would lease water to the Program at this price, the average annual cost to the Program for 4,800 ac-ft is $47.50 times 4,800 ac-ft or $228,000 per year from year 4 through year 13 of the Program. However, Wyoming has noted it may reserve the right to recover the actual cost and loss in potential revenue earnings associated with third-party impacts when computing the lease price on an acre foot basis.

◊ **Third-Party Impact Considerations:**

Third party impacts that have been identified include costs to irrigators that benefit from the North Platte and Kendrick Projects and the Glendo Unit for repayment of the SOD CAS modification and costs incurred by Kendrick Project irrigators for selenium remediation.

Third party impacts on other Wyoming appropriators associated with the Pathfinder Modification Project will be evaluated by the Wyoming Board of Control during its consideration of the partial change of use for the water right for Pathfinder Reservoir and as part of the State Engineer's and legislators' review and approval of the export of water. Wyoming has attempted to address these impacts in its project implementation plan, however, the Wyoming Board of Control will make the final decision regarding impacts to other appropriators. Originally, the water in the municipal account would have only been released to meet the needs of the municipalities during times of water rights regulation or to mitigate excess depletions in Wyoming. Both of these events are expected to occur sporadically. Leasing water to the Program will result in a more constant demand on the municipal account. Water that is leased to the Program under this project will be protected downstream to Lake McConaughy in which case it must not be available to downstream diverters. Although leased water will not be available to users in Wyoming, it is anticipated that only water in excess of the amount required to meet all anticipated uses will be leased to the Program.

There is a possibility that fluctuating reservoir levels due to releases from the municipal account could have an impact on recreational activities within Wyoming. Leasing water from the municipal account of the Pathfinder Modification Project should not significantly increase the overall environmental impacts associated with this project.

2. GLENDO STORAGE

◊ **Location:**

Glendo Dam is located on the North Platte River about four and one half miles southeast of the town of Glendo, Wyoming upstream of Guernsey Reservoir.

◊ **Basic Description:**

The 1953 Order Modifying and Supplementing the North Platte Decree (1953 Order) provides for the storage of 40,000 ac-ft in Glendo Reservoir during any water year for the irrigation of lands in western Nebraska and in southeastern Wyoming below Guernsey Reservoir. Of the 40,000 ac-ft available for irrigation, the 1953 Order allocates 25,000 ac-ft for the irrigation of lands in western Nebraska and 15,000 ac-ft of storage for the irrigation of lands in southeastern Wyoming.

A recent stipulation entitled "Amendment of the 1953 Order to Provide for Use of Glendo Storage Water" (Glendo Stipulation) was agreed to by the parties to the Nebraska v. Wyoming lawsuit (WY, NE, CO, US) in September 1997. Although the parties have agreed to the stipulation, the Supreme Court has not yet ratified it. For this analysis, it has been assumed that the Glendo Stipulation will be ratified and become an amendment to the 1953 Order prior to the storage and release of water for the Program.

The Glendo Stipulation provides for several changes to the 1953 Order that relax the conditions under which Glendo storage water can be used. Significant changes include the following:

- The potential use of Glendo storage water was expanded to municipal, industrial, and other uses and the service area expanded from the North Platte River basin to the Platte River basin.
- Glendo storage may be used for fish and wildlife purposes downstream of Glendo Reservoir. Any releases made for such purposes shall be administered and protected as storage water in accordance with Wyoming and Nebraska law.

These changes facilitate the use of Glendo storage water as a component of the Program. Of the 15,000 ac-ft of Glendo storage water allocated to Wyoming, there are currently permanent contracts for 4,400 ac-ft. The remaining 10,600 ac-ft is leased by the Bureau of Reclamation under temporary water service contracts for up to one year. Wyoming is considering negotiating a permanent contract with the Bureau of Reclamation for all of the remaining 10,600 ac-ft of storage (Wyoming December 16, 1999 proposal).

Water in excess of that needed to meet Wyoming's contracted demands and replace Wyoming's potential excess depletions would be available to the Program. Wyoming estimates that 2,650 ac-ft of Glendo storage water could be available to the Program on an average annual basis (Wyoming's December 16, 1999 proposal).

Wyoming would make Glendo storage water available to the Program each year in the following manner.

- Any storage water that is not used for municipal, industrial, or agricultural purposes within Wyoming or to mitigate future depletions as defined in Wyoming's "Depletion Mitigation Program, Platte River Basin, Wyoming", could be leased to the Program.

- To determine the amount of water available to the Program, Wyoming would review the status of water availability within the North Platte River basin. Wyoming will not know in advance exactly how much water they will need to meet all anticipated uses, therefore, prior to June 1 of each year, state officials will make a conservative judgement as to the amount of water that may be required for Wyoming's purposes.

- Wyoming would advise the Governance Committee in June as to how much water the EA manager could move from Glendo Reservoir to the EA in Lake McConaughy from July 1st through September 30th of the same year.

- After September 30th, Wyoming would quantify its depletions for the previous year (October 1 through September 30). If the quantification indicates that Wyoming exceeded it's "existing water related activity baseline", Wyoming will quantify the excess depletion at the Wyoming/Nebraska state line. Using tracking and accounting procedures and providing for replacement water from its other sources, the amount of storage water released from Wyoming's contracted storage in Glendo Reservoir needed to offset the excess depletions at the state line will be determined. This amount of storage would be subtracted from the amount of water provided to the Program to determine the amount of credit Wyoming would get from the Program. Wyoming would expect lease payments for the difference between the volume of water provided to the Program from July through September and any amount in excess of Wyoming's "existing water related activity baseline".

◊ **On-Site Hydrologic Effects:**

The amount of water available to the Program is dependent on the yield of the uncontracted storage, which is presently 10,600 ac-ft and the amount needed by Wyoming to meet municipal, industrial, or agricultural uses within Wyoming or to mitigate future depletions. This amount will vary on a year to year basis, however, Wyoming anticipates that 2,650 ac-ft could be available for lease to the Program on an average annual basis. Because the average annual amount that would be moved from Glendo Reservoir to the Lake McConaughy EA is relatively small, the EA manager may choose to move all of the water downstream during the month of September to minimize conveyance losses.

Two potential schedules are provided in the table below for releases from Glendo Reservoir to the Lake McConaughy EA. Accumulations to storage are not included because they are already incorporated in the NPRWUM model. The NPRWUM model stores water in Glendo Reservoir when the water rights are in priority.

Table III-38
Glendo Reservoir – Yield to the North Platte River

Month	Option #1 : Releases from Glendo Reservoir (ac-ft)	Option #2 : Releases from Glendo Reservoir (ac-ft)
October	0	0
November	0	0
December	0	0
January	0	0
February	0	0
March	0	0
April	0	0
May	0	0
June	0	0
July	883	0
August	883	0
September	883	2,650
Annual	2,650	2,650

◊ **Legal and Institutional Requirements for Implementation:**

Although the recent Glendo Stipulation was agreed to by the parties to the Nebraska v. Wyoming lawsuit, it has not yet been ratified by the Supreme Court. For this analysis, it has been assumed that the Glendo Stipulation will be ratified and become an amendment to the 1953 Order.

A contract would need to be negotiated between the Bureau of Reclamation and the State of Wyoming. NEPA compliance will also be required on this contract. As Wyoming's obligations under the contract will be funded by the Wyoming Water Development Program, the Wyoming Legislature must review the proposal and approve the needed funding.

There are several other legal and institutional requirements necessary for implementation of this project. The Glendo Stipulation provides federal authorization to use Glendo storage water for fish and wildlife purposes, however, the state water right for Glendo Reservoir will need to be modified to provide for the use of Glendo storage water for environmental and related purposes. A secondary supply water right is also necessary to ensure the protection of Glendo storage water downstream to the Wyoming/Nebraska state line. The change of use and the secondary supply water right would be contingent upon the existence of the Program and Wyoming's participation in that Program. The secondary supply water right would need to be secured from the Wyoming State Engineer and the change of use would need to be secured from the Wyoming Board of Control.

In order to obtain regulatory certainty for the delivery of Glendo storage releases to the Wyoming/Nebraska state line, the approval of the Wyoming State Engineer and Legislature will be required under Wyoming's export law.

◊ **Schedule For Implementation:**

This project does not require any new construction or infrastructure, therefore the implementation schedule is based primarily on the resolution of legal and institutional issues.

As noted in Wyoming comments received on April 5, 2000, the schedule for the implementation of this alternative is as follows. In year 1, the following activities will be completed by the State of Wyoming:

- Conduct environmental assessments required by NEPA,
- Finalize the contract for Glendo storage between the Bureau of Reclamation and the State of Wyoming,
- Seek and obtain a modification to the 1945 Decree, as amended in 1953, in accordance with the 1997 stipulation,
- Seek authorization and funding from the Wyoming Legislature,
- Seek a partial change of use through the Wyoming Board of Control for the water right for Glendo Reservoir under Wyoming water law,
- Seek the statutory review by the Wyoming State Engineer on the potential export of storage water for downstream environmental uses.

In year 2, Wyoming will:

- Seek approval from the Wyoming Legislature for the export of water for downstream environmental uses,
- Seek a secondary supply water right, issued to the Wyoming Water Development Commission, from the Wyoming State Engineer to protect the deliveries of Glendo storage water to the Wyoming/Nebraska state line to the critical habitat,
- Seek a permit under Nebraska water law to protect project environmental releases delivered to the Wyoming/Nebraska state line to specified locations between the state line and Chapman, Nebraska.

In year 3, pending the outcome of year 2 activities, the storage and release of Glendo water will be available.

◊ **Expected Project Life:**

The inclusion of this project in the Program is contingent on the existence of the Program and Wyoming's participation in that Program. The expected project life is dependent on the length of the contract. For purposes of this plan, it is assumed that the first increment of the Program will be 13 years and Wyoming will participate in the Program for the duration of the first increment. Subject to these terms, it is likely Wyoming would agree to a contract length through year 13 with an option to renew at the end of the first increment, depending on the terms of the second increment and Wyoming's participation in that second increment as noted in Wyoming's comments received on April 5, 2000.

◊ **Capital and Operational Costs:**

The cost of this project consists of lease payments for the difference between the water provided to the Program from July through September and any amount that Wyoming is required to use to offset excess depletions during the water year. Wyoming has noted that the cost should be based on the project costs of acquiring other Program water. Alternatively, costs to lease Glendo storage water could be based on the costs of Bureau of Reclamation temporary water service contracts, which currently range from $5/ac-ft/yr for irrigation uses to $75/ac-ft/yr for municipal and industrial purposes. If the Program leases an average of 2,650 acre-feet annually, the total annual cost could range from $13,250 to $198,750 beginning in year 3 through year 13 of the Program.

Potential costs associated with third party impacts have not been evaluated. The costs presented above may be higher if there are third party impact costs.

◊ **Third-Party Impact Considerations:**

Glendo Reservoir is already constructed and the storage water considered under this alternative has been used for other purposes under short term contracts, therefore, third party impacts associated with leasing uncontracted for water will likely be minimal but will require further evaluation.

Water that is leased to the Program under this project will be protected downstream to Lake McConaughy in which case it must not be available to downstream diverters. Although leased water will not be available to users in Wyoming, it is anticipated that only water in excess of the amount required to meet all anticipated uses will be leased to the Program. Environmental impacts associated with this alternative are expected to be minimal.

3. *TEMPORARY WATER LEASING*

◊ **Location:**

Specific irrigation districts or individual farmers that are willing to participate in a temporary water leasing program are not yet known. At this time a temporary water leasing program has been evaluated for Reaches 1 through 4 (Northgate, CO gage to Whalen Diversion Dam gage) and Reach 6 (Laramie River below Grayrocks Reservoir gage to Fort Laramie, WY gage). ***It is assumed for this analysis that leasing projects are located at the mid-point of each reach because specific irrigation districts and landowners willing to participate in the Program are not yet known***. The reaches are defined as follows:

Reach 1: Northgate, CO gage to Sinclair, WY gage
Reach 2: Sinclair, WY gage to Alcova, WY gage
Reach 3: Alcova, WY gage to Orin, WY gage
Reach 4: Orin, WY gage to Passing Whalen Diversion Dam gage
Reach 6: Laramie River below Grayrocks Reservoir gage to Fort Laramie, WY gage

◊ **Basic Description:**

A voluntary temporary water leasing program would provide incentives to farmers to annually lease water supplies that would otherwise have been used in irrigation. The amount of water available to the Program consists of the reduction in consumptive use, which is reviewed and approved by the State Engineer or Board of Control, as provided by Wyoming law. The program evaluated assumes that leased water rights are dependent on storage rights. Although it may be feasible to lease natural flow water rights, it will be more difficult to insure protection from downstream water users.

Under a temporary water lease the irrigation districts or farmers would not relinquish ownership of their water rights. To provide maximum flexibility the mix of farms participating in the leasing program would be allowed to change over time and the length of the temporary lease allowed to vary based on the needs of the irrigation district or farmer. Individual farm owners could choose to lease a portion of their water supplies on a temporary basis, likely subject to a minimum lease volume to manage practical administrative and program management costs.

The leasing program that has been analyzed considers leasing approximately 22,700 ac-ft of water supplies annually, which corresponds to about 16,400 ac-ft delivered on farm and 8,200 ac-ft of historic consumptive use.

◊ **On-Site Hydrologic Effects:**

The Final Report was relied on for estimates of yield and on-farm timing. The estimated amount of water leased in each reach was based on the distribution of acres irrigated with surface supplies. The number of acres that were assumed to be included in a leasing program are summarized in the following table.

Table III-39
Leasing Program

Reach	Acres Included in Leasing Program (ac)
1	680
2	1,520
3	600
4	590
6	1,610
Total	5,000

The tables below show the proposed average monthly reductions in diversions and the reductions in on-farm deliveries for each reach. Although the reductions in diversions were assigned to a reach based on the distribution of irrigated acres, in some cases the reductions would occur further upstream depending on the location of the mainstem headgate. The amount delivered on-farm was based on the average conveyance loss for each reach. Data on conveyance losses was obtained from county-level information obtained from USGS Water Use Data for 1995.

Table III-40
Reductions in Diversions from the North Platte River (ac-ft)

Month	Reach 1	Reach 2	Reach 3	Reach 4	Reach 6
October	106	289	136	150	252
November	0	0	0	0	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	0	0	0	0	0
April	49	71	32	35	56
May	311	689	305	259	533
June	619	1572	698	522	1159
July	811	2205	1001	828	1528
August	660	1949	911	754	1347
September	350	932	436	391	721
Annual	2905	7707	3518	2939	5597

Table III-41
Reductions in the Amount Delivered On-Farm (ac-ft)

Month	Reach 1	Reach 2	Reach 3	Reach 4	Reach 6
October	80	210	84	108	194
November	0	0	0	0	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	0	0	0	0	0
April	38	52	20	24	44
May	236	500	190	184	410
June	468	1142	436	374	890
July	614	1602	626	592	1174
August	500	1416	570	538	1036
September	264	678	272	280	554
Annual	2200	5600	2198	2100	4302

A representative leasing program could potentially reduce on-farm deliveries and consumptive use by about 16,400 ac-ft per year and 8,200 ac-ft per year, respectively. On-farm reductions in consumptive use were based on an on-farm efficiency of 50 percent. The following table shows the average monthly reductions in consumptive use for the 1975-94 period.

Table III-42
Reductions in Consumptive Use (ac-ft)

Month	Reach 1	Reach 2	Reach 3	Reach 4	Reach 6
October	40	105	42	54	97
November	0	0	0	0	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	0	0	0	0	0
April	19	26	10	12	22
May	118	250	95	92	205
June	234	571	218	187	445
July	307	801	313	296	587
August	250	708	285	269	518
September	132	339	136	140	277
Annual	1100	2800	1100	1050	2150

Based on the water budget spreadsheet, a reduction in consumptive use of 8,200 ac-ft resulted in a yield of 3,900 ac-ft of shortage reductions at the critical habitat without diversion losses. In this case, it is important to note that flows in the critical habitat will only be increased by reductions in consumptive use. Therefore, the amount of leased water is considerably higher to account for historic return flows. The modeling being performed by the EIS team may indicate that the yield associated with 8,200 ac-ft of consumptive use savings is higher or lower than 3,900 ac-ft of reductions to target flow shortages. If the EIS modeling indicates a yield that differs from 3,900 ac-ft at the critical habitat, the size of the leasing program may require adjustment.

◊ **Legal and Institutional Requirements for Implementation:**

There are several legal changes and requirements necessary to implement this project. There is an existing statute, 41-3-110, that provides for leasing on a temporary basis but it was originally intended for the acquisition of temporary water rights for highway or railroad roadbed construction or repair. This statute provides for temporary leases not to exceed two years. The Wyoming State Engineer is investigating whether this statute is broad enough to cover temporary agricultural leases for longer periods and for a broader set of users.

A temporary change of use would be required for the lease of irrigation water to be used for downstream environmental purposes in the critical habitat. The change of use would need to be secured from the Wyoming Board of Control. If the leased water is storage water or is converted to storage water, secondary supply water rights would have to be secured from the Wyoming State Engineer. The change of use and secondary supply water right would be contingent upon the existence of the Program and Wyoming's participation in that Program.

In order to obtain regulatory certainty for the delivery of leased water to the Wyoming/Nebraska state line, the approval of the Wyoming State Engineer and Legislature will be required under Wyoming's export law. The approval of the Bureau of Reclamation may also be required if storage water is leased from irrigation districts with federal contracts for storage water.

◊ **Schedule For Implementation:**

As noted in Wyoming comments received on April 5, 2000, the schedule for implementation of this alternative is as follows. In year 1, the following activities must be completed:

- The Governance Committee must develop procedures for seeking temporary water leases including the prices it is willing to offer and the terms needed for Program purposes. In addition, the determination must be make as to the NEPA compliance required for each transaction.

In year 2, the State of Wyoming will address the following activities:

- It is likely that statutory changes will be needed to implement intermediate and long-term temporary water leasing. The Wyoming State Engineer is discussing this issue with state legislators and other affected parties. Therefore, it is difficult to predict what the final decision of the Wyoming Legislature will be. For purposes of this analysis, it is assumed that the Wyoming Legislature will approve the needed statutory changes in year 2 of the Program. Further, it is assumed that, as the lease of water is a temporary change of use, the state's approval process will be similar to that of a permanent change of use.

In year 3, the following activities may occur:

- The Governance Committee must seek temporary water leases,
- Potential lessees will need to develop technical information regarding such issues as the historical consumptive use of the water they may be willing to lease,
- It is likely that agreements must also be negotiated with reservoir owners for the temporary storage of the leased water.

In year 4, the following activities may occur:

- The lessees must seek and obtain temporary changes of use through the Wyoming Board of Control,
- The lessees must seek and obtain the statutory reviews by the Wyoming State Engineer on the potential export of leased water for downstream environmental uses.

In year 5, the following activities may occur:

- The lessees must seek and obtain approval from the Wyoming Legislature for the export of water for downstream environmental uses,
- If the leased water is storage water, the lessees must seek and obtain a secondary water right, issued to the Wyoming Water Development Commission, from the Wyoming State Engineer to protect the deliveries of water to the Wyoming/Nebraska state line,
- A party, perhaps the State of Wyoming, must seek and obtain a permit under Nebraska water law to protect leased water for environmental purposes, delivered to the Wyoming/Nebraska state line to specified locations between the state line and Chapman, Nebraska.

In year 6, the storage and release of leased water could be available.

◊ Expected Project Life:

The inclusion of temporary water leasing in the Program is contingent on the existence of the Program and Wyoming's participation in that Program. The expected project life is dependent on the length of the temporary leasing contracts. The length of the temporary leasing contracts will depend of the requirements of the Program, the willingness of potential lessees to participate under those requirements, and the conditions placed in the proposed leasing statutes by the Wyoming Legislature.

◊ **Capital and Operational Costs:**

In order for this alternative to be feasible, Wyoming has noted that the price must be attractive to potential lessees. Potential lessees may expect lease payments commensurate with prices being paid by the Program for other water supplies providing the same benefits at the critical habitat. Prices have not been established for water supplies to be included in the Program, therefore, leasing cost estimates were based on the Final Report. The annual cost of a representative temporary water leasing program was estimated based on the following components:

- Annual economic value of irrigation on lands in Reaches 1, 2, 3, 4, and 6. The annual value of irrigation supplies was estimated at between $22 and $38 per ac-ft of consumptive use based on farm net income and land rental differentials between irrigated and non-irrigated lands. Farm net income estimates were based on average cropping patterns, yields, prices, and costs in the NRCE database for the years 1992, 1994, and 1996. Information on land rental differentials was based on the information from the United States Department of Agriculture, National Agricultural Statistics Services (NASS) published in July 1999.

- An incentive premium of 25 percent to induce participation in the program.

- Transaction and administrative costs representing approximately 30 percent of total program costs.

On an annual basis, the study team estimates that a temporary water leasing program would cost an average of $35 per acre foot of consumptive use saved on-farm in Reaches 1, 2, 3, 4, and 6. The cost to lease water on a temporary basis increases from upstream to downstream reaches. The total annual cost for water leasing in Reaches 1, 2, 3, 4, and 6 is estimated to be $279,000, as shown in the following table.

Table III-43
Temporary Water Leasing Program – Annual Costs

Month	CU Saved (ac-ft)	Estimated Annual Cost ($)
Reach 1	1,100	32,000
Reach 2	2,800	85,000
Reach 3	1,100	38,000
Reach 4	1,050	42,000
Reach 6	2,150	82,000
Total	8,200	279,000

Potential costs associated with third party impacts have not been evaluated. The costs presented above may be higher if there are third party impact costs. In addition, contracts with irrigators or districts need to be renewed on a periodic basis, in which case there may be additional costs associated with permitting or re-negotiating contracts.

◊ **Third-Party Impact Considerations:**

Third party impacts on other Wyoming appropriators associated with this alternative will be evaluated by the Wyoming Board of Control during its consideration of the temporary change of use for the various water rights offered for lease and as part of the State Engineer's and legislator's review and approval of the export of water. The Wyoming Board of Control will only allow a change of use of historic consumptive use. This will serve to reduce or eliminate third-party impacts to other Wyoming appropriators.

4. LA PRELE RESERVOIR

◊ **Location:**

La Prele Reservoir is an existing irrigation and industrial supply reservoir in Wyoming located on La Prele Creek approximately 13 miles upstream of the confluence with the North Platte River. The confluence of La Prele Creek and the North Platte River is approximately 115 miles downstream of the Alcova gage.

◊ **Basic Description:**

La Prele Reservoir was constructed between 1905 and 1909. The current capacity of the reservoir is approximately 20,000 ac-ft and it is permitted for irrigation, domestic and industrial uses. In 1974 an agreement was made between the Douglas Water Users Association (Association) and the Panhandle Eastern Pipeline Company (PEPL) to rehabilitate the reservoir. The terms of the agreement provided that PEPL buy 5,000 ac-ft of storage space at the price equivalent to the principal and interest of a loan which was used to rehabilitate the reservoir and associated ditches.

This analysis assumes that PEPL's storage right in La Prele Reservoir is available for lease by the Program. PEPL's 5,000 ac-ft share of space in La Prele Reservoir is limited by the yield of its share and the conditions under which it may be put to beneficial use in the context of the Program.

◊ **On-Site Yield And Timing:**

The Final Report was relied on to estimate yields and timing. To evaluate the yield of PEPL's portion of La Prele Reservoir, a simplified operations study was conducted for the study period from 1975 through 1994. The study is based on a similar investigation done by Banner and Associates in 1981. Further discussions with representatives with the La Prele Irrigation District and the local Hydrographer/Water Commissioner indicate that further evaluation is needed to accurately represent operations of the La Prele Reservoir as it relates to seepage, potential winter time releases and current irrigated acreages. Based on conversations with the La Prele Irrigation District, the Banner and Associates 1981 report does not accurately reflect *current* operations of the reservoir. The assumptions used to model La Prele Reservoir are outlined below:

- Inflow to La Prele Reservoir: The USGS maintained a streamflow gage on La Prele Creek a short distance above the reservoir. The Bureau of Reclamation (Bureau) estimated reservoir inflow as 105.5 percent of gage flow in a 1969 feasibility report on La Prele Reservoir. The extra 5.5 percent accounts for inflow between the gage and the dam. Where USGS data does not exist (October through February 1975-92, and all of 1993 and 1994) averages were used.

- Senior Downstream Rights: The reservoir must bypass water to downstream senior, direct-flow diverters that have no storage in La Prele Reservoir. The bypass requirement is based on 1,469 irrigated acres and the statutory diversion allowance of 1 cfs per 70 irrigated acres. In addition, the bypass requirement is reduced by 800 ac-ft distributed uniformly over the irrigation season based on the Bureau's estimate of average annual return flows that are used for irrigation.

- La Prele Irrigation District (District) Demand: The reservoir must bypass water to project lands after the senior direct flow users have been satisfied. Project lands consist of 11,454 irrigated acres, of which, 10,305 acres are District lands, and about 1,150 acres are associated with "carrier rights". The bypass requirement is based on the Bureau's estimate of annual water requirements and its monthly distribution. Information provided by the La Prele Irrigation District indicates that District lands have increased to 11,472 irrigated areas since the 1981 Banner and Associates report. Further evaluation should consider any changes in irrigated acreage.

- Seepage: The current stage-seepage relationship as reported by the Hydrographer-Water Commissioner is that seepage varies linearly with stage, from 0 cfs at the dead pool elevation to 7 cfs at the spillway height. Seepage calculations were simplified to be 3.5 cfs throughout the study period. Further evaluations should consider any additional data compiled on seepage rates and stage relationships.

- Evaporation: Evaporation is based on the reservoir surface area and appropriate monthly evaporation rates. Evaporation calculations were simplified using an average surface area of approximately 450 acres throughout the study period, which corresponds with a storage volume of approximately 10,000 ac-ft, or half of the current capacity. Evaporation was prorated 25 percent to PEPL's storage account and 75 percent to the remaining storage, respectively, based on the maximum storage capacities of each account.

The District is currently using PEPL's storage water in La Prele Reservoir for irrigation purposes, therefore, diversions to storage under PEPL's account were not treated as negative flows. If water was available in PEPL's account it was released whenever there was a shortage at the critical habitat. The amount released is equal to the shortage at the critical habitat or the total storage attributable to PEPL's account, whichever amount is less. The table below shows monthly reservoir releases and seepage from PEPL's storage account in La Prele Reservoir for the 1975-94 period.

Table III-44
La Prele Reservoir – Net Yield to the North Platte River (ac-ft)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	549	537	513	211	672	0	0	786	0	0	0	0	3268
1976	549	537	211	211	965	0	0	1485	0	0	0	0	3958
1977	549	537	513	475	426	0	0	560	0	0	0	0	3060
1978	549	537	513	475	426	0	0	2500	0	0	0	0	5000
1979	549	537	513	475	426	0	0	143	0	0	0	0	2643
1980	549	537	211	211	211	211	211	211	211	2177	0	0	4740
1981	549	537	211	211	965	0	0	0	0	0	0	0	2473
1982	549	537	211	211	965	0	0	950	0	0	0	0	3423
1983	549	537	211	211	211	211	211	211	211	211	211	211	3195
1984	211	2257	211	211	211	211	211	211	211	211	471	0	4627
1985	211	211	211	211	211	211	1107	0	0	0	0	0	2373
1986	549	537	211	211	211	211	211	211	211	211	211	211	3195
1987	211	211	211	211	211	211	211	211	211	211	577	0	2687
1988	549	211	211	211	211	1045	0	2500	0	0	0	0	4938
1989	549	537	211	211	965	0	0	0	0	0	0	0	2473
1990	549	537	513	211	672	0	0	0	0	0	0	0	2482
1991	549	537	211	211	965	0	0	211	211	1897	0	0	4791
1992	549	537	211	211	965	0	0	0	0	0	0	0	2473
1993	549	537	211	211	965	0	0	2500	0	0	0	0	4973
1994	211	211	211	211	1581	0	0	2500	0	0	0	0	4925
Average	481	558	287	251	622	116	108	760	63	246	73	21	3585

Water released from La Prele Reservoir could be re-stored in the Lake McConaughy EA and re-regulated. One negative aspect of this project is that seepage from La Prele Reservoir is not controllable. A temporary storage contract in Glendo Reservoir would most likely be needed to store seepage losses attributable to PEPL's account, particularly during the non-irrigation season.

◊ **Legal and Institutional Requirements for Implementation:**

There are several legal changes and requirements necessary to implement this project. There is an existing statute, 41-3-110, that provides for leasing on a temporary basis but it was originally intended for the acquisition of temporary water rights for highway or railroad roadbed construction or repair. This statute provides for temporary leases not to exceed two years. The Wyoming State Engineer is investigating whether this statute is broad enough to cover leases with other entities for longer periods and for a broader set of uses.

La Prele Reservoir is currently permitted for irrigation, domestic, and industrial uses. A change of use of storage water rights would be required for this water to be used for downstream environmental purposes in the critical habitat. In addition, a secondary supply water right would be needed to ensure the protection of releases downstream to the Wyoming/Nebraska state line. The change of use and the secondary supply water right would be contingent upon the existence of the Program and Wyoming's participation in that Program. The secondary supply water right would need to be secured from the Wyoming State Engineer and the change of use would need to be secured from the Wyoming Board of Control.

In order to obtain regulatory certainty for the delivery of water to the Wyoming/Nebraska state line, the approval of the Wyoming State Engineer and Legislature will be required under Wyoming's export law.

Any agreement with PEPL to lease storage water would require the approval of the La Prele Irrigation District. The District may object to the lease of PEPL's water or to changing the use of this water right. It is possible that obtaining the approval of the District could impact the yield and cost of PEPL's storage water.

◊ **Schedule For Implementation:**

As this alternative is basically a water lease, its schedule for implementation would be the same as that depicted under the heading of "Water Leasing" in Wyoming, with the exception that prior to year 3 an agreement must be reached with PEPL. Any such agreement will need to address the impacts to the operations of the La Prele Irrigation District. The schedule for implementation will be negatively impacted if the District objects to the lease of PEPL's water or to changing the use of this water right.

◊ **Expected Project Life:**

The inclusion of this project in the Program is contingent on the existence of the Program and Wyoming's participation in that Program. PEPL's agreement with the Association/District began in October 1986 and is in effect for 25 years. At PEPL's option, the agreement can be extended for up to 15 years. Therefore, 12 years remain on PEPL's original agreement, with the option to renew the agreement for another 15 years. Accordingly this project could be sustainable well beyond the first increment of the Program. The expected project life is dependent on the length of the lease contract with PEPL. The lease could be short-term (two to five years) or could extend 13 years or longer through the first increment. An option to renew the lease at the end of the contract could also be provided depending on the terms of the second increment and Wyoming's participation in that second increment.

◊ **Capital and Operational Costs:**

PEPL's position in La Prele Reservoir was obtained, in effect, by PEPL agreeing to indemnify the full repayment of the rehabilitation loan that was made by the State of Wyoming Farm Loan Board to the District. The total loan by the Farm Loan Board to the District was $4,975,000 and bears interest at an annual rate of four percent on the declining balance. The annual debt service payment is a constant amount of about $318,460. The remaining principal payment on the note is approximately $1,156,000. The terms of the agreement between PEPL and the District indicate that PEPL is also responsible for a portion of the annual operation and maintenance costs associated with the reservoir, however, this cost is minimal.

The cost to lease PEPL's storage water would likely consist of the annual debt service payment of about $318,460, an incentive premium to induce participation in the Program, some transaction and administrative costs, and annual operation and maintenance costs associated with PEPL's share of the reservoir beginning in year 6 of the first increment. Any transaction involving the lease of PEPL's water right would require the approval of the Board of Directors of the District. Obtaining the approval of the District could further impact the cost of leasing PEPL's water and storage.

Potential costs associated with third party impacts have not been evaluated. The costs presented above may be higher if there are third party impact costs. In addition, a leasing contract with PEPL would need to be renewed on a periodic basis, in which case there may be additional costs associated with permitting or re-negotiating the contract.

◊ **Third-Party Impact Considerations:**

Potential third party economic impacts associated with La Prele Reservoir are related primarily to impacts on the District. The District is currently using water stored under PEPL's right for irrigation. If this water is purchased or leased for the Program it will no longer be available for use by the District, which is a potential negative third party economic impact depending on how reliant the District is on PEPL's storage right. As the District is already water short, any additional reductions in supply could potentially have a significant impact on the local agricultural economy and crop production.

Third party impacts on Wyoming appropriators associated with this alternative will be evaluated by the Wyoming Board of Control during its consideration of the temporary change of use for the water right offered for lease and as part of the State Engineer's and legislator's review and approval of the export of water. The Wyoming Board of Control will only allow a change of use of historic consumptive use. This will serve to reduce third-party impacts to other appropriators.

D. Colorado Projects

1. GROUNDWATER MANAGEMENT — TAMARACK III

◊ **Location:**

An expanded Tamarack project (Tamarack Phase III) will likely be located along the south side of the South Platte River in the Tamarack Ranch State Wildlife Area (SWA) and the Pony Express SWA, which is 40 miles upstream from the Colorado/Nebraska state line. Expanded recharge is also being considered for the Peterson and South Reservation Ditches, which divert from the South Platte River just downstream of Sedgwick, Colorado.

◊ **Basic Description:**

Colorado has proposed Tamarack Phase III in order to provide water to the Program. Per Colorado's comments and the direction of the WAPC Chair, the Beebe Draw project has been removed from further consideration and analysis. As a replacement, the yield associated with the Beebe Draw project will be provided by further expansion of Tamarack Phase III.

An expanded Tamarack project involves diverting surface water directly from the South Platte River via canals or wells located adjacent to the river. Water that is diverted or pumped is conveyed to recharge sites at various distances from the river where it is allowed to percolate into the alluvium for recharge of the groundwater aquifer. Return flows that result from such recharge accrue to the river for some duration after the recharge event depending on the hydrogeologic conditions and the distance from the site to the river.

Recharge sites must overlie the alluvial aquifer and be hydraulically connected to the river. In general, Colorado is considering sites with SDF factors ranging from 60 days to 300 days. For this analysis it was assumed that representative recharge sites are located at an SDF factor of 270 days.

◊ **On-Site Hydrologic Effects:**

Estimates of yields and timing were based on the Final Report. The expanded Tamarack project that has been evaluated is expected to reduce target flow shortages by an average of approximately 17,000 ac-ft/yr. The facilities required for an expanded Tamarack Project include wells located adjacent to the South Platte River and existing canals that divert water from the South Platte River, including the Peterson and South Reservation Canals. Excess accretion credits associated with current ditch recharge programs that are not needed for well augmentation will also be targeted for Tamarack Phase I and Phase III.

The amount of water available for diversion was determined based on the following conditions:

- All existing legal rights and physical demands and GASP augmentation requirements are satisfied above the State Compact requirements. According to the Division 1 Office of the Colorado Department of Water Resources this condition occurs when the flows at the Colorado/Nebraska state line exceed 180 cfs between April 1 and October 15.

- The amounts needed for operation of Colorado's proposed Tamarack Plan (Phase I) are met. State line flows have been adjusted to account for depletions/additions to historic Julesburg gage flows from Phase 1.

- Water is only available when monthly target flow shortages do not exist at the critical habitat.

While the above conditions were used to determine the yield of Tamarack Phase III, the three states have initiated discussions about other potential criteria for use in determining when such recharge projects can withdraw from the river. The final yields will be dependent upon the conclusions reached in those discussions.

The following tables show the diversions to recharge, recharge accretions to the South Platte River, and the net yield to the South Platte River for the 1975-94 period. Diversions or depletions from the South Platte River were treated as negative numbers, whereas positive numbers indicate months when recharge back to the river exceeded diversions.

Table III-45
Enlarged Tamarack Project : Diversions from the South Platte River to Recharge(ac-ft)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	0	0	0	12791	0	0	0	0	0	0	0	0	12791
1976	0	0	14355	14355	0	0	0	0	0	0	0	0	28710
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	14355	0	0	0	0	0	0	14355
1979	0	0	0	0	0	0	0	0	0	11038	0	0	11038
1980	0	0	14355	14355	14355	14355	14355	14355	14355	0	0	0	100485
1981	0	0	14355	14355	0	0	0	0	0	0	0	0	28710
1982	0	0	14355	7842	0	0	0	0	0	0	0	0	22197
1983	0	0	14355	14355	14355	14355	14355	14355	14355	14355	14355	14355	143550
1984	14355	0	14355	14355	14355	14355	14355	14355	14355	0	0	14355	129195
1985	14355	14355	14355	14355	14355	14355	0	0	0	0	0	14355	100485
1986	0	0	14355	14355	14355	7014	14355	14355	14355	0	0	14355	107499
1987	14355	14355	14355	14355	3543	14355	14355	14355	14355	0	0	14355	132738
1988	0	14355	14355	14355	14355	0	0	0	0	0	0	0	57420
1989	0	0	13879	14355	0	0	0	0	0	0	0	14355	42589
1990	0	0	0	14355	0	0	0	0	0	0	0	0	14355
1991	0	0	6640	11440	0	0	0	0	14355	0	0	0	32435
1992	0	0	14355	14355	0	14355	0	0	0	0	0	0	43065
1993	0	0	11829	14355	0	14355	0	0	0	0	0	14355	54894
1994	2871	14355	14355	14355	0	0	0	0	0	0	0	0	45936
Average	2297	2871	10230	11652	4484	6093	3589	3589	4307	1270	718	5024	56122

Table III-46
Enlarged Tamarack Project : Recharge Accretions to the South Platte River (ac-ft)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	0	0	0	16	1079	1235	1011	767	631	514	418	366	6036
1976	307	277	297	1325	2844	2657	2179	1690	1422	1185	980	874	16036
1977	744	680	608	500	502	445	422	377	361	336	304	294	5573
1978	268	260	246	211	221	242	1431	1561	1307	1050	842	734	8372
1979	614	556	494	405	407	361	343	309	297	318	1150	1336	6590
1980	1066	897	801	1724	3262	4173	5166	5616	6364	6755	5725	4814	46363
1981	3867	3364	2939	3338	4890	4442	3834	3142	2789	2438	2100	1946	39087
1982	1710	1612	1534	2274	3374	3025	2631	2180	1959	1735	1514	1421	24970
1983	1265	1207	1175	1990	3687	4607	5612	6040	6793	7226	7326	7914	54840
1984	7917	8395	7417	6920	7931	8065	8672	8626	9146	9267	7944	6969	97269
1985	6952	7867	8391	7897	9161	9114	9575	8254	7230	6216	5287	4906	90850
1986	5405	5395	4815	4899	6543	7080	7324	7419	8207	8573	7446	6593	79697
1987	6688	7677	8267	7829	9089	8238	8591	8689	9344	9556	8281	7358	99607
1988	7316	7069	7421	7549	8702	8792	8189	6822	6123	5414	4718	4427	82542
1989	3939	3760	3548	3975	5686	5285	4758	4069	3767	3427	3060	2990	48263
1990	3831	4008	3569	2934	4144	4006	3653	3152	2941	2695	2422	2339	39694
1991	2134	2087	2007	2202	3445	3307	2994	2571	2447	3433	3344	3028	33000
1992	2595	2410	2253	3033	4556	4263	4949	4490	3957	3417	2926	2711	41560
1993	2394	2275	2156	2653	4261	4054	4782	4360	3846	3323	2847	2692	39640
1994	3506	3934	4756	5096	6494	5735	4979	4126	3710	3290	2876	2707	51208
Average	3126	3186	3135	3338	4514	4456	4555	4213	4132	4008	3575	3321	45560

Table III-47
Enlarged Tamarack Project : Net Yield to the South Platte River (ac-ft)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	0	0	0	-12775	1079	1235	1011	767	631	514	418	366	-6754
1976	307	277	-14058	-13030	2844	2657	2179	1690	1422	1185	980	874	-12674
1977	744	680	608	500	502	445	422	377	361	336	304	294	5573
1978	268	260	246	211	221	-14113	1431	1561	1307	1050	842	734	-5983
1979	614	556	494	405	407	361	343	309	297	-10720	1150	1336	-4448
1980	1066	897	-13554	-12631	-11093	-10182	-9189	-8740	-7991	6755	5725	4814	-54122
1981	3867	3364	-11416	-11017	4890	4442	3834	3142	2789	2438	2100	1946	10377
1982	1710	1612	-12821	-5568	3374	3025	2631	2180	1959	1735	1514	1421	2773
1983	1265	1207	-13180	-12365	-10669	-9748	-8743	-8315	-7562	-7129	-7030	-6441	-88710
1984	-6438	8395	-6938	-7435	-6424	-6290	-5683	-5729	-5209	9267	7944	-7386	-31926
1985	-7403	-6488	-5964	-6458	-5195	-5241	9575	8254	7230	6216	5287	-9449	-9635
1986	5405	5395	-9540	-9456	-7812	66	-7031	-6936	-6148	8573	7446	-7763	-27802
1987	-7667	-6678	-6088	-6526	5546	-6117	-5764	-5666	-5011	9556	8281	-6997	-33131
1988	7316	-7286	-6934	-6806	-5653	8792	8189	6822	6123	5414	4718	4427	25122
1989	3939	3760	-10331	-10380	5686	5285	4758	4069	3767	3427	3060	-11365	5674
1990	3831	4008	3569	-11421	4144	4006	3653	3152	2941	2695	2422	2339	25339
1991	2134	2087	-4633	-9239	3445	3307	2994	2571	-11908	3433	3344	3028	564
1992	2595	2410	-12102	-11322	4556	-10092	4949	4490	3957	3417	2926	2711	-1505
1993	2394	2275	-9673	-11702	4261	-10302	4782	4360	3846	3323	2847	-11663	-15253
1994	635	-10421	-9599	-9260	6494	5735	4979	4126	3710	3290	2876	2707	5272
Average	829	315	-7096	-8314	30	-1636	966	624	-174	2739	2858	-1703	-10562

Colorado has noted that Tamarack will be operated consistent with the operations of the Lake McConaughy EA. Comments received from Colorado imply that the same rules, which apply to the EA regarding diversions during periods of shortage at the critical habitat, should also apply to Tamarack. In other words, Colorado believes Tamarack should receive credit for bypassing water if the EA is storing water during times of shortage at the critical habitat.

◊ Legal and Institutional Requirements for Implementation:

Phase I of the Tamarack Plan fell under the auspices of NEPA because federal dollars are used to partially fund the state wildlife areas. To satisfy NEPA compliance an Environmental Assessment (EA) was completed for Phase I of the Tamarack Plan. The EA was approved for a total diversion of about 30,000 ac-ft from the South Platte River, of which approximately 20,000 ac-ft could be pumped from wells and 10,000 ac-ft could be diverted into existing canals. For an enlarged Tamarack project the existing EA would need to be amended to provide for increased diversions from the South Platte River.

A new water right filing is required for increased diversions under an enlarged Tamarack project. In Colorado, an in-state beneficial use, such as fishery or wildlife use, must be decreed for water generated from recharge projects to be protected within the State. Similar to Phase I of the Tamarack Plan, in-state wildlife enhancement benefits associated with the recharge sites could constitute an in-state beneficial use. The water rights filing should take less than one year. The necessary hardware could be installed and the project operated under a temporary substitute supply plan in the interim while the water rights filing is being approved.

◊ Schedule For Implementation:

The schedule for implementation is dependent on the time required to install the necessary hardware, i.e. wells, pumps, pipeline, recharge basins, etc., and the time needed to resolve legal and institutional requirements including the water rights filing, EA amendment, and approval of a temporary substitute supply plan if necessary.

Wells and credits from recharge in existing canals are the basis of Colorado's Tamarack Phase III. As noted in comments received from Colorado, agreements with existing canals would be developed by year 2. Wells for recharge on public SWA lands and private lands would be developed at a rate of about 10 wells per year or 5 years to develop up to 50 wells. An enlarged Tamarack project would be fully implemented after 5 years.

◊ Expected Project Life:

The expected project life of an expanded Tamarack project would extend beyond the first increment of the Program. A constraint on the project life could be the wells and pumping hardware, which would most likely need to be replaced within 10 to 20 years.

◊ Capital and Operational Costs:

The direct costs were estimated based on the capital costs associated with the construction of diversion and storage facilities and annual operating costs. The costs for these types of projects were based on data provided by Northern Colorado Water Conservancy District. Costs estimated for an expanded Tamarack project consider the following items.

- Subsurface investigations
- Construction of wells
- Pumps and related facilities
- Diversion facilities
- Construction of recharge ponds
- Regulation and measurement
- Conveyance facilities
- Engineering costs associated with the design of facilities and analysis of operations
- Compensation provided to the canal company
- Operations and maintenance

Up-front capital costs for an expanded Tamarack project were estimated as follows. A cost of $3,500 was included for subsurface investigations. A total cost of $30,000 per well was included for the well drilling, casing material, pump, pump column and shaft, discharge head assembly, and electric motor. It was assumed that electrical power would not be available at all well sites, therefore, an additional cost of $4,000 was included to provide power to the well. A pipeline cost of $20,000 per well was included for conveyance facilities and $7,000 was included for pipeline installation. A cost of $6,000 was included for recharge basin construction. Engineering costs associated with the design of facilities and analysis of operations were assumed to be 10 percent of the total construction cost of the project.

There are some additional capital costs associated with recharge diversions to existing canals. Costs for diversion structures from an existing canal are typically about $3,000. A cost of $4,000 was included for regulation and measurement, which includes the cost of flumes, stilling wells, and stage recorders.

Annual costs consist of operations and maintenance costs and delivery fees. Pump operation costs, which consist primarily of electricity costs, are typically about $8 per ac-ft pumped. Annual maintenance costs are minimal and typically less than $300 per well. For diversions to existing canals, canal companies typically charge the owner of the recharge basin a delivery fee per ac-ft delivered. The delivery fee was assumed to be $5 per ac-ft per year.

An expanded Tamarack project will consist of a combination of wells and diversions to existing canals. The maximum monthly amount diverted from the river is approximately 14,500 ac-ft. About 50 wells would be required to pump up to 14,500 ac-ft per month based on an average pumping rate of 2,200 gpm per well. The average annual diversion from the South Platte River is approximately 56,000 ac-ft. It was assumed that on average about one-third of the annual amount or 20,000 ac-ft/yr would be diverted into existing canals and about two-thirds or 36,000 ac-ft/yr would be diverted via pumps located adjacent to the river. It was assumed that 20 recharge sites would be needed for canal diversions to recharge, and about 50 sites would be needed for pumping to recharge (one site per well).

The total capital cost and annual cost for an expanded Tamarack project is estimated to be about $4.2 million, and $403,000, as shown in the table below.

Table III-48
Cost of an Enlarged Tamarack Project

DESCRIPTION	Cost for Existing Canals ($)	Cost for Wells ($)	Total Cost ($)
Subsurface Investigations	3,500	3,500	
Diversion Structures	3,000		
Recharge Basins	6,000	6,000	
Measuring Devices	4,000		
Well Construction & Pumps		30,000	
Conveyance Conduit		7,000	
Power Hook-up		4,000	
4000' 12" dia pipe @ $5/ft		20,000	
Total Cost per Structure or Well	**16,500**	**70,500**	
No. of structures or wells	20	50	
Total Construction Cost	330,000	3,525,000	
Engineering Fees (10%)	33,000	353,000	
Total Capital Cost	**363,000**	**3,878,000**	**4,241,000**
ANNUAL COSTS			
Amt. Diverted	20,000	36,000	
Delivery Cost	100,000		
Pump operation cost ($8/af)		288,000	
Annual Maintenance Costs ($300/well)		15,000	
Total Annual Cost	**100,000**	**303,000**	**403,000**

Potential costs associated with third party impacts have not been evaluated. Costs may be higher if there are third party impact costs.

◊ **Third-Party Impact Considerations:**

Third party impacts associated with an expanded Tamarack project are similar to those described for groundwater management programs and recharge projects in Nebraska. However, there are potential additional third party hydrologic and economic impacts associated with an expanded Tamarack project as it relates to downstream users. Third party hydrologic effects may include potential impacts on downstream users including CNPPID, NPPD, irrigated lands served by Lake McConaughy, the EA in Lake McConaughy, and hydropower production. These impacts may be minimal or significant depending on how the recharge project is operated. There could be potential negative economic and hydrologic impacts to downstream users if water that is diverted from the river for recharge was historically diverted by downstream irrigators and hydropower generators. Colorado representatives indicated that they have been working with water users in Nebraska to evaluate potential impacts on downstream users, including CNPPID and NPPD, due to an expansion of Tamarack. Preliminary work suggests that potential negative impacts may be minimal. At times an expansion of Tamarack may produce positive impacts.

The three states have initiated discussions about potential criteria, such as effects on downstream senior water rights that can be used in determining when such projects can withdraw from the river. The conditions of the interstate compact and the terms of the Program will impact how Tamarack is operated with regard to river withdrawals. Each state has the right to manage and use water within its boundaries consistent with interstate compacts and decrees and the terms of the Cooperative Agreement and Program.

E. Yield at the Critical Habitat:

The Platte River EIS team modeled the three states' projects (Pathfinder Modification Project, Lake McConaughy EA, and Tamarack Phase I) and the projects included in the Water Action Plan (Revision No. 3 dated April 18, 2000) to determine a total yield score. This score coincides with the average annual reduction to target flow shortages at the critical habitat. Based on the model results, the total score of the combined North Platte, South Platte, and Central Platte projects is approximately 144,000 ac-ft. The EIS team recommends the WAPC consider the "true score" to be in the range of approximately 135,000 to 137,000 ac-ft/yr to account for additional losses not captured in the current models. This score meets the water goals of the Program, which are to reduce shortages to the FWS target flows by 130,000 to 150,000 ac-ft/yr.

There are significant differences between the EIS team models and the water budget spreadsheet, which was used by Boyle to determine reductions in target flow shortages. As a result, the EIS team made adjustments to either the net hydrologic effects provided in the Water Action Plan or to the EIS models to simulate certain projects. Boyle was directed by the WAPC to meet with the EIS team to assist with interpretations of Boyle's methods and findings to minimize the possibility of changes to the proposed operations of the Water Action Plan projects. The primary assumptions or changes indicated by the EIS team are summarized below.

- **Study Period:** For all projects, the study period used by Boyle (1975-1994) is different than the study period being used for the Programmatic EIS (1947-1994). As such, the EIS team extended the net hydrologic effects data presented in the Water Action Plan to be consistent with the period of record used for the Programmatic EIS.

- **La Prele Reservoir:** La Prele Reservoir was modeling independently of the Boyle analysis. Most of the assumptions used by the EIS team were consistent with the Boyle analysis, however, the following additional assumptions were used by the EIS team: 1) any available storage is released each year from May through September, 2) the Program does not get credit for reservoir seepage, and 3) La Prele deliveries are charged a 10 percent loss between La Prele Reservoir and Glendo Reservoir.

- **Wyoming Water Leasing:** The consumptive use savings associated with leasing in Wyoming were assumed to be 8,200 ac-ft, which is consistent with Boyle's analysis. However, the EIS team determined the reduction in deliveries based on the assumption that 50 percent of any diversion returns to the river. The Boyle analysis takes into account both canal losses and farm losses, which average about 65 percent in reaches 1, 2, 3, 4, and 6. The difference in losses assumed by the EIS team and Boyle should not affect the yield score because the total reduction in consumptive use is the same for both analyses.

- **CNPPID Re-regulation Reservoir:** There are six potential re-regulating reservoirs presented in the Water Action Plan. To simplify the modeling of this project, the J-2 Forebay re-regulating reservoir was chosen as a representative project. OPstudy, which is a monthly model, was used by the EIS team to determine the score associated with the J-2 Forebay reservoir. Because daily operation of the reservoir is possible due to the close proximity of the reservoir to the habitat, the EIS team adjusted the score of this project by multiplying by a factor of 2.0 to account for the benefits of daily operation.

- **Nebraska Water Leasing and Water Management Incentives:** These projects were simulated together by the EIS team because the models do not distinguish between reductions in consumptive use due to water leasing versus water management incentives. Based on comments received from Nebraska during the April 26, 2000 WAPC meeting, the total yield associated with water management incentives was increased from 3,500 ac-ft/yr, presented in Revision #3 of the Water Action Plan, to 7,000 ac-ft/yr. There are four potential water management options presented in the Water Action Plan. To simplify the modeling of this project, conservation cropping was chosen as a representative project. All reductions in consumptive use were assumed to be tied to storage in Lake McConaughy except reductions associated with Reach 10, which coincides with the Western Canal. Water leasing in that reach is related to reductions in natural flow diversions and consumptive use. The reaches used in the Boyle analysis were translated into corresponding reaches used in the OPstudy model.

- **Groundwater Management:** There are four potential groundwater management options presented in the Water Action Plan. To simplify the modeling of groundwater management, a conjunctive use project was chosen as a representative project. The option chosen should not impact the yield score significantly because the intended yields of all four options are the same. The average annual volume diverted to recharge was 2,800 ac-ft, which is slightly lower than the 3,000 ac-ft/yr proposed in the Water Action Plan. The difference is due to the fact that the EIS team limited diversions to the J-2 return flow during the non-irrigation season when excesses occurred.

- **Lost Creek/North Dry Creek Cutoffs:** There are two potential cutoff options presented in the Water Action Plan. To simplify the modeling of these projects, the Lost Creek/Ft. Kearny cutoff was modeled assuming existing flows in Lost Creek are diverted back to the Platte River via the cutoff. The maximum monthly flow back to the river was assumed to be 500 ac-ft, which is slightly higher than the 440 ac-ft assumed by Boyle. This change was necessary to achieve a yield close to the 2,200 ac-ft/yr identified in the Water Action Plan. The EIS team reduced the final score of this project by 50 percent because water enters the river midway through the critical habitat.

- **Net Controllable Conserved Water:** Based on comments received from Nebraska during the April 26, 2000 WAPC meeting, the total yield available to the Program was increased from 2,000 ac-ft/yr, presented in Revision #3 of the Water Action Plan, to 5,000 ac-ft/yr.

- **Dawson/Gothenburg Canal:** Due to time constraints, the EIS team did not model this project.

The remainder of this Section E consists of a memo prepared by the EIS team and transmitted to Boyle on May 4, 2000. The memo discusses the results of the EIS team modeling effort and summarizes how each proposed component of the plan was incorporated into the North Platte and Central Platte EIS models.

The Platte River EIS team modeled the Draft Water Action Plan (Revision No. 3 dated April 18, 2000) after further guidance and clarification from Boyle Engineering. In many instances, the exact target yield or score of each separate project could not be "fixed" or held to the desired target due to interaction between the different projects. This effect is not deemed critical as the modeling demonstrates that the combined range of yield and/or score for the individual projects is available to the Water Action Plan. We are also not able to "score" each project individually in terms of its specific contribution to the total reduction in instream flow shortage. However, we do list either the yield of a project on site, the amount contributed to the Environmental Account (EA) if applicable, or an actual "score" for each project.

Although the total combined score is approximately 144,000 acre-feet in average shortage reduction, we recommend that the Water Action Plan Committee consider this value as an over-estimate because we have not been able to address Environmental Account losses to the extent we believe is necessary to fully support that "score". At this time, we recommend that the Committee consider the "true" score to be in the range of approximately 135,000 to 137,000 acre-feet in order to account for additional losses not captured in the current models. However, it is our assessment that the proposed mix of projects, if implemented to the scale outlined in the draft plan, is followed then the target result in re-regulating flows to reduce shortages will be achieved.

We also did not consider any competition between the Water Action Plan and the ability of the State's Future Depletion Plans to also provide water at the scale envisioned over the first proposed increment (13-15 years). This is mentioned not as a perceived problem, only to clarify the analysis that was done.

Following is a summary of how each proposed component of the plan was incorporated into the North Platte and Central Platte EIS OPstudy models.

NORTH PLATTE RIVER EIS MODEL

<u>La Prele Reservoir</u>
(Average yield = 2,225 acre-feet per year at the reservoir)
Because the study period used by Boyle Engineering to prepare the Water Action Plan is less than the study period being used for the Programmatic EIS, it was necessary to independently model La Prele Reservoir. To do so, the following assumptions were made.

1. Inflows to La Prele Reservoir are based on a USGS gage that was maintained on La Prele Creek a short distance above La Prele Reservoir. The inflow is assumed to be 105.5% of the gaged flow. This assumption was adopted from the DWAP prepared by Boyle. Where USGS data does not exist (November-February 1972, October-February 1973-1992, and all of 1993 and 1994) averages are used.

2. System bypass demands and the distribution of those demands are from the 1981 report titled "Preliminary Technical Data report, WyCoalGas Project Water System" prepared by Banner and Associates for Panhandle Eastern Pipe Line. These are also the demands that were utilized by Boyle for the DWAP and include senior downstream rights and La Prele Irrigation District demands.

3. Storable flows are the difference between the inflows and system bypass demands, storable flows are split 25% to PEPL and 75% to the district, and PEPL's storable flows are limited to 5000 acre-feet in any water year.

4. Seepage is 3.5 cfs throughout the study period. This assumption was adopted from the DWAP prepared by Boyle. All seepage is charged against the PEPL storage account to the extent that storable flows plus storage are greater than the seepage amount. In simple words, the PEPL account is not allowed to accrue negative amounts when seepage is greater than 25% of the inflows plus storage in PEPL's account.

5. Evaporation calculations are simplified using an average surface area of approximately 450 acres and evaporation is prorated 25% to Panhandle Eastern Pipe Line's account and 75% to the remaining storage. This assumption was adopted from the DWAP prepared by Boyle. Similar to seepage, evaporation is not allowed to cause PEPL storage to drop below zero. Evaporation rates for each month are from the 1981 report titled "Preliminary Technical Data report, WyCoalGas Project Water System" prepared by Banner and Associates for Panhandle Eastern Pipe Line.

6. Demand on the PEPL account for the Program was structured such that any available storage would be released each water year and releases occur in May-Sept.

7. The storage in the PEPL account equals the storage from the previous month plus the storable flow minus seepage minus 25% of the evaporation minus the demand, not to be less than zero. Therefore, demand is limited to the available storage adjusted for seepage and evaporation.

8. The Program does not get credit for seepage amounts because seepage is part of the current regime of the river and does not constitute "new" water.

9. La Prele deliveries are charged a 10% loss between La Prele Reservoir and Glendo Reservoir. This was adapted from the 1981 report titled "Preliminary Technical Data report, WyCoalGas Project Water System" prepared by Banner and Associates for Panhandle Eastern Pipe Line.

Using these assumptions the average annual delivery from the La Prele project for 1947-1994 is 2,225 acre-feet per year at the reservoir.

<u>Pathfinder Municipal Account</u>
(Average yield = 4,800 acre-feet per year at the reservoir)
The input to the North Platte River EIS model was modified such that the municipal demand is 4,800 acre-feet per year. The demand is 9,600 in dry years, 0 in wet years and 5,664 in the remaining years. The annual flows into Seminoe Reservoir for 1941-1994 were ranked from lowest (1954) to highest (1984) and the top 33% were considered wet and the bottom 25% were considered dry. After determining the Pathfinder Municipal demand, the remaining delivery (9,600 minus the municipal demand) was made available to the program and delivered in September.

Glendo Storage
(Average yield = 2,650 acre-feet per year at the reservoir)
The North Platte EIS model has a demand for the 10,600 acre-feet of Glendo conservation storage. In order to provide water for the Program, an additional demand had to be put on the system. The Program would not receive any storage during dry years as described above. In the remaining years, the Program could take up to the difference between the existing demand and the maximum 10,600 acre-feet delivery. In order to achieve a yield of 2,650 acre-feet at the reservoir, approximately 50% of the difference was delivered to the Program.

Water Leasing
(Average yield is approximately 8,200 acre-feet per year at the reservoir)
Given the declaration by the Water Committee that water leasing should be tied to storage, water leasing in reaches 1, 2, 3, and 4 was concentrated in the Kendrick Project. In order to achieve the reduction in consumptive use of approximately 6,100 acre-feet, the deliveries to the Kendrick Project were reduced by 17% or around 12,200 acre-feet per year. This incorporates the assumption that approximately 50% of any diversion returns to the North Platte River, which is different from Boyle's analysis. Boyle's analysis includes conveyance losses which are considered to be 100% consumptive use. The EIS analysis uses the assumptions that are included in the North Platte River EIS model, which are that 50% of any diversion returns to the river. Water leasing in reach 6 is assumed to be tied to the storage associated with the Wheatland Irrigation District and the consumptive use portion of the leasing is added as an inflow to the North Platte River EIS model at the Laramie River.

CENTRAL PLATTE RIVER EIS OPSTUDY MODEL

CNPPID Re-Regulating Reservoir
("Score" = 6.2 kaf)
Following receipt of Central's Depletion Mitigation Study Phase I (HDR Engineering, April 7, 2000), Boyle advised using the J-2 Forebay project as an example project with a capacity of 3,436 acre-feet. The project included an inflow rate (when instream flow excess existed at Overton, Grand Island, and the J2 return) of 100 cfs to the reservoir, and an outflow rate of 50 cfs whenever shortages were occurring. In the monthly OPstudy model, the average annual release was approximately 3,100 acre-feet. Based on EIS team comparisons of monthly and daily flow data for a reregulating project in the vicinity of the J2-Forebay area (and the size of the inlet & outlet), the EIS team scored this project by multiplying by a factor of 2.0. This resulted in a "score" of 6,200 acre-feet for this example project.

Water Leasing and Water Management Incentives
(Yield to EA = 15.9 kaf + Western Canal reduction of 0.947 kaf)
Projects of these types basically involve reductions in consumptive use and depending upon the location, the "saved" water may or may not be directly available to the McConaughy Environmental Account. For example, the Western Canal (Boyle reach 10) does not receive storage water from Lake McConaughy. Therefore, Water Leasing and Management Incentives in that reach are related to reductions in natural flow diversions combined with recognition of the saved volume and protection from diversion for consumptive use. The Western Canal volume associated with Leasing/Incentives averaged 947 acre-feet per year.

The other reaches in the Boyle report were translated into the corresponding OPstudy reaches and the reduction in consumptive use assumed to be from reduced storage deliveries:

Keystone - Sutherland Canals (North Platte River)	898 acre-feet
Sutherland - North Platte Canals (North Platte River)	268 acre-feet
Brady - Cozad Canals (Platte River)	1,558 acre-feet
Central District (Platte River)	12,217 acre-feet
Kearney Canal (Platte River)	221 acre-feet

The sum of the savings in consumptive use (except for the Western Canal) is 15,160 acre-feet. This volume was allocated annually to the EA in each October. The Boyle report recognizes that to achieve a certain volume of consumptive use reduction, a larger reduction in on-farm deliveries is needed in order to provide previous levels of return flow to the system. By modeling the reduction in Consumptive Use, the OPstudy model is consistent with Boyle's analysis.

Ground Water Management
(Amount stored below J2 area = 2.8 kaf, amount credited to EA = 4.5 kaf)
Option 4 in the Boyle report (conjunctive use project in CNPP&ID area) was used as a representative project. An annual target storage volume of 3,500 acre-feet was used in the OPstudy model, and diversion from the J2-return flow available was allowed during the non-irrigation season when excess occurred. The average annual volume stored over the study period from excess was approximately 2,800 acre-feet and it was assumed that this volume was subsequently pumped during the irrigation season to meet demands. Accounting for losses in the NPPD and Central District systems resulted in an average of 4,500 acre-feet being credited to the Environmental Account.

Lost Creek/North Dry Creek Cutoff
(2.2 acre-feet contributed to river, "score" = 1.1 kaf)
This project was simulated by introducing water into the OPstudy model above Kearney (in the Overton - Odessa reach of the model). A maximum inflow rate of 500 acre-feet was allowed whenever instream flow excess was occurring during May thru September. This is somewhat higher than the 440 acre-feet volume identified by Boyle in Table III-26 in order to achieve a yield closer to that identified in the draft plan (2,200 acre-feet). Because the water enters in the mid-section of the habitat, the final score was 50% of the volume introduced.

Power Interference
(Yield to EA of 5.5 kaf)
The OPstudy model was modified to make the operation of the Power Interference Scenario compatible with the analysis done by Boyle. Specifically, excess to FERC requirements is considered during the non-irrigation season, and excess to "system needs" (irrigation, minimum canal flow, etc.) is considered during the irrigation season. Nebraska identified a target yield from this component of 4,000 acre-feet. The potential yield of this component is greater than 4,000 acre-feet, and in order to achieve results closer to the target level only a portion of the available power interference volume was reregulated and credited to the Environmental Account. The total amount credited was 5,500 acre-feet and this is assumed to be close to 4,000 acre-feet in "score".

Net Controllable Conserved Water
Based on discussions with Boyle and direction from the Water Action Plan Committee, an annual volume of 5,000 acre-feet was contributed to the Environmental Account from Lake McConaughy storage in each October.

Dawson/Gothenburg Canal GW Recharge
Due to time constraints and the need for additional modifications to model this component, the EIS team did not model this recharge project. It is noted that the projected yield is approximately 1,300 acre-feet. It is assumed that the project is feasible (i.e. enough "excess" remains to reregulate), and that the yield of 1,300 acre-feet is somewhat included in the other projects over/under-estimate of the total yield.

Tamarack Phase III
(Yield of 27.8 kaf exchanged into EA)
This was modeled by increasing the pumping capacity of Wells 1, 2, 3, & 4 such that the reregulated volume exchanged into the McConaughy EA approximated the target level of 27,000 acre-feet.

Total Score
The total score of the combined North Platte, South Platte, and Central Platte projects is approximately 144 kaf

Source: EIS team.

IV. Monitoring and Accounting

A. Monitoring

Per the WC's Scope of Services, monitoring methods will be necessary to assess the effectiveness of projects as they are implemented. These methods must be compatible with the tracking and accounting methods being developed separately by the WC in concert with each state's water administration. To a certain extent there may be overlap between monitoring and tracking and accounting methods. This section provides information on the types of information needed to support assessments of project effectiveness.

The extent to which monitoring is necessary will depend to a large degree on how much information is currently available for each of the projects included in the Water Action Plan. Monitoring requirements will be similar for certain types of projects, therefore, they have been described for four general types of projects.

- **Reservoir Projects**

Reservoir projects include the CNPPID Re-regulating Reservoir, La Prele Reservoir, Glendo storage and the Pathfinder municipal account. For all these projects monitoring will be required to account for diversions to storage and releases. In the case of Pathfinder Reservoir and Glendo Reservoir, diversions to the municipal account, and the 40,000 ac-ft pool, respectively, are of primary interest. In the case of the CNPPID Re-regulating Reservoir and La Prele Reservoir, additional monitoring of seepage may be required to assess impacts on downstream landowners and track seepage gains to the river.

- **Agricultural Conservation**

These projects include water leasing and water management programs. For agricultural conservation projects it will be necessary to define baseline conditions prior to implementing the project. Baseline conditions are necessary to ensure the programs are implemented as designed. Monitoring will be required to assess the acreage involved in the program, crop mixes, consumptive irrigation requirements, natural flow and storage water deliveries, and surface and groundwater return flows. Baseline conditions can be determined primarily through surveys and diversion records, however, observation wells may need to be installed and hydrogeologic investigations conducted to measure return flows. On-farm efficiency tests may also be necessary to quantify surface and groundwater return flows.

Once baseline conditions are defined it will be possible to determine the incremental hydrologic effects of water leasing, land fallowing, deficit irrigation, conservation cropping, or changes in irrigation techniques, and monitor whether programs are being implemented as designed.

- **Groundwater Management**

These projects include groundwater management, groundwater recharge, and the North Dry Creek/Fort Kearny cutoff projects. There is a significant amount of monitoring required for groundwater management and recharge projects to confirm projects generate the proposed yields. The estimated yields of recharge projects were calculated using the Steam Depletion Factor (SDF) method. These estimates do not account for site-specific variations in geologic conditions. Therefore, observation wells would need to be installed and hydrogeologic investigations and modeling conducted to more accurately measure recharge water returning to the river.

With respect to groundwater management projects in Nebraska there is uncertainty regarding the dynamic response of the groundwater mound in Central Nebraska and the extent to which water from the mound can be used to supplement streamflows. Further investigation and monitoring is required prior to implementing groundwater management programs in Central Nebraska to ensure the sustainability of these projects. Observation wells and hydrogeologic investigations will be needed to monitor and assess the impacts of the proposed projects. Any project designed to take water from the mound will need to be phased-in so that hydrologic impacts can be monitored and evaluated.

- **Power Interference**

The modeling tool that was appropriately used in the study for basin-wide comparisons of projects must be supplemented with a detailed reservoir operations model to more accurately predict the yield of the power interference project. Current uncertainties associated with this alternative are primarily the amount of water available for power interference, and the operation of Lake McConaughy as it relates to power interference.

In addition to the yield analysis, there are also needs for accurate monitoring and accounting tools. Monitoring and accounting methods for power interference must use reservoir operations data consistent with other day-to-day management activities. Accounting will be required to track how much water is available for power interference, power interference releases, and changes in storage.

B. Tracking and Accounting

Pursuant to Milestone W14-1 of the Cooperative Agreement, the three states have developed tracking and accounting procedures for tracking water contributions to the Program. To the extent possible, existing laws and water administration will be used, however, in some instances laws and/or water administration procedures may need to be changed. Presented below are tracking and accounting procedures provided by the three states.

1. NEBRASKA'S TRACKING AND ACCOUNTING

Under existing water law in Nebraska there are two types of water that can be tracked and protected from diversion: storage water and water conducted down a stream under statute 46-252. Essentially, the tracking and accounting program keeps track of the amount of storage water introduced and/or diverted in a given river reach. Pre-set conveyance losses are assessed in each reach. Losses to storage water are assessed in proportion to the relative amounts of storage water and natural flow in the reach. The residual water in the reach is considered to be natural flow. River reaches are established based on the distance water can travel within one day.

Storage water is water that has been permitted to be stored in a reservoir. In Nebraska before storage water released into a stream can be protected for specific uses, the water must also have a storage use permit. This permit indicates the use of the water, point of release and the point of use or diversion. For instream uses, the water is protected from diversions from its point of release to the permitted end point of the beneficial use. Once storage water has passed the last point of diversion or the "end point" of the instream use indicated on the permit, any remaining water is considered to be natural flow.

Traditionally Nebraska statute 46-252 has allowed the state to protect from diversion water that is put into a natural stream simply to convey that water to a downstream point of diversion. This statute could also be used to protect water for instream uses from the point of introduction to the end point of the instream use. A key provision of this law is that the protected water is water that otherwise would not have been available in the stream.

There are several projects in the proposed Water Action Plan that rely on the release of water from a storage reservoir. The CNPPID Re-regulating Reservoir, Power Interference, Pathfinder Municipal Account, Glendo Storage, and La Prele Reservoir options would all involve the use of storage water. Under existing Nebraska law these projects could obtain a storage use permit allowing the state to protect the water for instream environmental uses.

As stated above, Nebraska statute 46-252 has traditionally been used to allow a natural stream to be used as a conduit to move water from release into the stream downstream to another point of diversion. The statute did contemplate allowing the state to protect from diversion water introduced into the stream for instream purposes. There is no reason to believe that this statute could not be used to protect water derived from the other projects listed in the proposed Water Action Plan. However, to date there are no legal precedents to indicate precisely how this law would work in any given situation. Until an actual application has been duly heard and granted, it is impossible to know whether such permits would be granted.

If permits are granted under statute 46-252, one key premise would be that the protected water would not otherwise have been available for use. In each case, the applicant would have to show that the water to be protected would not otherwise have been available. For example, return flows from a project that were historically available for other water rights would presumably have to remain available for use by these rights. However, if the applicant could show that water from water leasing, ground water management or a recharge project would not have been otherwise available in the stream, the Director could grant a permit to protect this water for beneficial instream uses.

2. WYOMING'S TRACKING AND ACCOUNTING

1. Wyoming has agreed to contribute water from the Environmental Account of the Pathfinder Modification Project to the proposed Program. The release from this account will be tracked by adding the necessary lines to the existing daily accounting program. Conveyance losses will be charged proportionally to the Program water in the same manner that losses will be charged to other storage deliveries, according to the North Platte Decree (Decree) and its stipulations.

2. Wyoming has suggested that water may be leased from the Municipal Account of the Pathfinder Modification Project and/or its allocation from Glendo Reservoir, subject to certain specified conditions. Again, the releases from these accounts will be tracked by adding the necessary lines to the existing daily accounting program. Conveyance losses will be charged proportionally to the Program water in the same manner that losses will be charged to other federal storage deliveries, according to the Decree.

3. Wyoming has also suggested that water may be leased to the proposed Program, subject to certain specified conditions. At a minimum, such a lease would require a temporary change of use and must meet the requirements of Wyoming water law. The lease would be subject to the review and approval of the Wyoming Board of Control. The Board of Control would place conditions on the transaction to ensure the protection of other appropriators. These restrictions will address the amount of water that can be leased and conveyance losses to be charged, as well as address other issues specific to the individual transactions. The existing daily accounting program can be revised to accommodate any of the four following categories of lease transaction:

    a. If the leased water comes from **federal storage**, it will be tracked and accounted as explained in item 2. above.
    b. If the leased water comes from **non-federal storage**, it will be assessed a conveyance loss by the Board of Control for the distance to the state line.
    c. If the leased water comes from **natural flow and is not stored**, the Board of Control will determine the appropriate conveyance loss from the point of historic use to the state line. It is likely that this category will be difficult, if not impossible, to achieve and implement.
    d. If leased **natural flow is to be stored** in a reservoir, the Board of Control will assess conveyance losses from the point of historic use to the reservoir. The release of such water from the reservoir will be assessed conveyance losses in accordance with a. or b. above depending on the ownership and location of the reservoir.

4. Future depletions will be computed and reported in accordance with Wyoming's Depletion Mitigation Program. Wyoming will calculate the impacts of any excess depletions to flows at the state line. Wyoming will determine the cause of the excess depletion and determine the amount of water that would have arrived at the state line had the excess not occurred. In order to make this determination, conveyance losses must be considered. The losses specified in the Decree and past Board of Control orders will be used to the extent possible. After the impact from the excess depletions has been determined, Wyoming will calculate the amount of water that would have to be released from the Municipal Account of the Pathfinder Modification Project or its contract storage in Glendo Reservoir to offset the impact, giving full consideration to the conveyance losses specified in the Decree. The resulting calculated release would be subtracted from releases made of leased water (see item 2 above). Wyoming would not expect lease payments for any water which served to offset the impact of excess depletions.

3. COLORADO'S TRACKING AND ACCOUNTING

In Colorado, water rights are property rights, which can be freely changed, subject to a non-injury standard. The Water Right Determination and Administration Act of 1969, § 37-92-101 et seq., C.R.S. (1990 & 1996 Supp.), requires the holder of a water right who wants an enforceable priority date to adjudicate the water right in water court. § 37-92-302 (1) (a). The Act allows the holder of a junior water right to adjudicate a water right so long as no injury occurs to other existing water rights.

The state engineer and division engineers are responsible for administering and distributing the waters of the state based on priorities. § 37-92-301 (1) and (3). This includes protecting water to a water right's decreed point of diversion and, in the case of storage releases or recharge projects, delivering it to a beneficial use within Colorado. Examples of this could be the Tamarack Ranch and Pony Express State wildlife recharge projects. The division engineer has authority to protect the return flows from the recharge projects, which have a first beneficial use of wildlife and augmentation on the State Lands and then subsequently route water for beneficial uses close to the state line. Depending on the actual location of any project in the Lower South Platte River, diversion structures may have to be modified and measuring devices installed to assure that water can be delivered to the downstream point of beneficial use in Colorado. Transit losses would be assessed based upon river conditions at the time of delivery.

Existing Colorado law provides several possible mechanisms for protecting water to the state line. First, the Colorado Water Conservation Board would appropriate or acquire instream flows in Colorado to the state line. Colorado's instream flow statute, § 37-92-102 (3) & (4), C.R.S. (1990 & 1996 Supp.), vests the CWCB with the exclusive authority to obtain a decree adjudicating a water right for instream flows in a stream channel between specific points. The Board is empowered to appropriate such water or to acquire such water, water rights, or interests in water as it determines may be required for minimum stream flows to preserve the natural environment to a reasonable degree. Id. Under section 102 (3) (c), the Board must find, specifically,

> that the natural environment will be preserved to a reasonable degree by the water available for the appropriation to be made; that there is a natural environment that can be preserved to a reasonable degree with the board's water right, if granted; and that such environment can exist without material injury to water rights.

Section 102 (3) also provides that the Board is not authorized "to deprive the people of the State of Colorado of the beneficial use of those waters available by law and interstate compact."

Thus, to protect flows to the state line, the Board would have to determine that the amount and timing of flows was necessary to preserve the natural environment to a reasonable degree in Colorado and that doing so would not deprive the people of Colorado of the beneficial use of water available under the South Platte River Compact.

Another possible way to deliver additional water to Nebraska for the endangered species would be for some entity to appropriate or acquire water, water rights, or interests in water to be transported to and used in Nebraska. However, it is unlawful to divert, carry or transport any surface or ground water out of the state without complying with Colorado's export statute, § 37-81-101 et seq., C.R.S. (1990), which established standards for approving exports. The statute applies to the transportation of water from the state by any means, including natural streams or watercourses. § 37-81-101 (2). Depending on the source of water, the would-be exporter must file an application with and receive approval from the State Engineer, Ground Water Commission or water court. Id. Since the export statute has never been used, this would be a case of first impression.

A third option would be for Colorado to enact new legislation expressly authorizing the protection of water to the state line to benefit endangered species in Nebraska. If this alternative is selected by the Governance Committee and the water is proposed to be protected, the existing statutes would have to be changed. Any proposed change to the Export Statute would face stiff opposition in the State since it affects other Compacts throughout Colorado. Colorado would only consider changing the law if no other alternative is available to meet Colorado's obligation.

It is important to recognize that even water that is not legally protected to the state line may still reach it anyway depending on the location and timing. If a proposed project is located close to the state line, where no Colorado water user will have the opportunity to divert the water, this water will unavoidably result in changes in the timing of flows at the state line, for which Colorado may receive credit in a Platte Basin Endangered Species Recovery Program. Tracking and accounting of the recharge rates and subsequent return flow rates would have to be done by someone other than the State Engineer's Office. Depending on the actual location of any project in the lower river, diversion structures may have to be modified and measuring devices installed. If the water is not protected then Colorado would keep track of any water that is not diverted by vested water users. It should be noted that we are considering the possibility of tracking the use of any water that is diverted by any irrigation system. This tracking of the irrigation diversions would be done by someone other than the State Engineer's Office and is envisioned to happen if only a few diverters are involved. It is Colorado's position that if the water is new retimed water that any return flows that can be quantified should be credited towards the program. The tracking of any return flows to the river from the original recharge efforts and including subsequent return from any irrigation diversions would be reported to the State Engineer's Office.

The existing accounting of the State Engineer's Office would need to be revised to track the Tamarack Plan Water that moves through the lower reaches of the river. This would require making minor additions to our existing tracking system to specifically track this water.

V. Water Movement through the Hydrologic System

Water movement through the hydrologic system refers to effects on conserved or additional water as it flows downstream to the critical habitat. Depending on how a project is operated there are options for management, storage, and delivery that could maximize benefits for the critical habitat.

Conserved water or retimed water suffers losses en route to the critical habitat. Additional water flowing through the system as a result of an alternative is subject primarily to evaporation, seepage, and diversion losses. Depending on the water rights status associated with a project, diversion losses may or may not apply. If the additional water generated by a project can be protected there are no downstream diversion losses. However, if a project cannot be protected additional water will suffer diversion losses as is moves downstream through the system.

The primary method to increase a project's reductions to target flow shortages is to re-regulate additional water through the Lake McConaughy EA. As indicated in Section D of Attachment II of the Cooperative Agreement, "It is an operational goal to coordinate upstream conservation activities so as to increase storage in the Environmental Account." For projects that are upstream of Lake McConaughy, the EA could be used to re-regulate additional or retimed water provided storage space is available. Projects in Wyoming that are located on the North Platte River above Lake McConaughy can be easily re-regulated through the EA. The EA could also be used to re-regulate additional program water downstream of Lake McConaughy through exchanges, however, the EA may not always be available to re-regulate downstream projects. Users downstream of Lake McConaughy such as CNPPID and/or NPPD could divert the additional water generated by an alternative in exchange for reduced releases, which would result in corresponding increases in the EA. South Platte and Platte River exchanges for projects downstream of Lake McConaughy are less certain because of minimum flow requirements and the requirement that water be of use to CNPPID and NPPD. The opportunity for such exchanges is greater if a project, such as water leasing, is already associated with Lake McConaughy storage.

It may be possible to use storage accounts in other reservoirs to re-regulate Program water to enhance benefits at the critical habitat. For example, a temporary storage contract in Glendo Reservoir would most likely be needed to store seepage losses attributable to PEPL's storage account in La Prele Reservoir so that water can be released during periods of shortage. Likewise, temporary water leasing in Wyoming is more effective if it is tied to storage water. For example, there may be opportunities to lease water from the Kendrick Project and potentially store that water in an environmental account in Seminoe Reservoir.

VI. Summary

The Program is based on an incremental approach to achieve the goal of providing 130,000 to 150,000 ac-ft per year over the next 10 to 13 years. A portion of the instream flow objectives will be met through the Lake McConaughy EA, the Pathfinder Modification Project, and the Tamarack Plan. The primary purpose of the Water Action Plan with respect to the Program is to identify ways of reducing the remaining target flow shortages. The three states have identified 13 projects for inclusion in the Water Action Plan. These projects consist primarily of reservoir, groundwater management and recharge, agricultural leasing and conservation, and power interference projects.

A. Estimated Yields

The estimated yields at the critical habitat associated with the 13 projects are summarized in Table VI-1. These yields are based on model runs using the water budget. The EIS team has modeled the combined effects of the three state's projects and the 13 projects included in the Water Action Plan. Recent EIS team modeling of the three states' projects, which include the Lake McConaughy EA, Pathfinder Modification Project, and the Tamarack Plan indicate a score of about 80,000 ac-ft per year of average reductions to target flow shortages. The total score associated with the three state's projects and all 13 projects included in the Water Action Plan is 144,000 ac-ft/yr (EIS team memo, May 4, 2000). As stated in their May 4, 2000 memo, the EIS team recommends the WAPC consider the "true score" to be in the range of approximately 135,000 to 137,000 ac-ft/yr to account for additional losses not captured in the current models.

B. Cost Estimates

The initial and annual costs associated with each project are summarized in Table VI-1. The total up-front capital costs associated with the 13 projects range from 8.0 to 11.9 million. A financial analysis of the total funding requirements through the first increment has also been completed. To determine the total funding requirements through the first increment the annual operations and maintenance costs for 13 years of use were estimated and an equivalent present value cost was computed using a six-percent discount rate. The up-front capital costs were added to the present value of annual costs to obtain a total capitalized cost. The estimated total capitalized cost of the 13 projects ranges from $36.9 to $68.8 million, as summarized in Table VI-1. To provide distinction for projects that have an infrastructure value beyond the first increment, the total cost and unit cost of each project in year 14, which is the first year of the second increment, is included in Table VI-1. For example, the costs of a reservoir project in year 14 consist only of operations, maintenance, and replacement costs because the initial capital costs are included in their entirety in the first increment. However, the cost of an agricultural leasing project in year 14 is assumed to be the same as it is in year 1 because there are no large capital construction costs associated with this type of project.

Table VI-1
Water Action Plan
Summary Table[8]

Project	State	Initial Cost ($)	Annual Cost ($)	Present Value of Annual Cost through the First Increment[5] ($)	Present Value of Total Cost through the First Increment ($)	Estimated Yield at Critical Habitat (ac-ft)	First Increment Unit Cost ($/ac-ft)[6]	Year 14 Total Cost ($)	Year 14 Unit Cost ($/ac-ft)
1. CNPPID Reregulating Reservoir (min. yield	Nebraska	$2,450,000 - $4,610,000	$78,000 - $255,000	$690,000 - $2,258,000	$3,140,000 - $6,868,000	4,000	$790 - $1,720	$78,000 - $255,000	$20 - $60
CNPPID Reregulating Reservoir (max. yield	Nebraska	$3,390,000 - $6,370,000	$108,000 - $352,000	$956,000 - $3,120,000	$4,350,000 - $9,490,000	5,500	$790 - $1720	$108,000 - $352,000	$20 - $60
2. Water Leasing	Nebraska		$661,000 - $1,489,000	$5,852,000 - $13,182,000	$5,852,000 - $13,182,000	7,000	$840 - $1,880	$661,000 - $1,489,000	$90 - $210
3. Water Management Incentives[3]	Nebraska		$620,000 - $2,500,000	$5,489,000 - $22,132,000	$5,489,000 - $22,132,000	7,000	$780 - $3,160	$620,000 - $2,500,000	$90 - $360
4. GW Management [1]	Nebraska								
Active Pumping		$590,000	$14,000	$124,000	$714,000	1,400	$510	$14,000	$10
5. North Dry Creek/Fort Kearny Cutoffs	Nebraska								
Lost Ck/North Dry Ck Cutoff		$330,000	$86,200	$763,000	$1,093,000				
Lost Ck/Ft. Kearny IPA Cutoff		$333,000	$6,000	$53,000	$386,000				
Subtotal		$663,000	$92,200	$816,000	$1,479,000	4,400	$340	$92,200	$20
6. Dawson/Gothenburg Canal GW Recharge	Nebraska								
Gothenburg Canal GW Recharge		$13,800	$38,000	$336,000	$349,800				
Dawson Canal GW Recharge		$13,800	$51,700	$458,000	$471,800				
Subtotal		$27,600	$89,700	$794,000	$821,600	1,800	$460	$89,800	$50
7. Power Interference[2]	Nebraska		$162,700	$1,440,000	$1,440,000	1,400	$1,030 [2]	$162,700	$120
8a. Net Controllable Conserved Water	Nebraska		$0	$0	$0	500	$0	$0	$0
8b. Net Controllable Conserved Water	Nebraska		$305,000	$2,700,000	$2,700,000	4,500	$600	$305,000	$70
9. Pathfinder Municipal Account	Wyoming		$228,000	$2,018,000	$2,018,000	4,800	$420	$228,000	$50
10. Glendo Storage[4]	Wyoming		$13,250 - $198,750	$117,000 - $1,759,000	$117,000 - $1,759,000	2,650	$40 - $660	$13,250 - $198,750	$5 - $75
11. Water Leasing	Wyoming		$279,000	$2,470,000	$2,470,000	3,900	$630	$279,000	$70
12. LaPrele Reservoir	Wyoming		$318,500	$2,820,000	$2,820,000	2,200	$1,280	***	***
13. GW Management (Tamarack III)	Colorado	$4,241,000	$403,000	$3,568,000	$7,809,000	17,000	$460	$403,000	$20
Total/Average		**$8.0 - 11.9 million**			**$36.9 - $68.8 million**	**62,550 - 64,050**	**$580 - $1070**	**$2.9 - $6.1 million**	**$47 - $95**

Notes:

1: Potential groundwater management projects include active pumping, dry-land farming, conversion to groundwater irrigation and conjunctive use.
Only one of these projects is necessary to yield 1,400 ac-ft, therefore, only the costs associated with active pumping have been included in the total.
The estimated annual cost associated with passive lowering of the groundwater table with dry-land farming ranges from $112,000 to $266,000.
The estimated capital cost associated with conversion to groundwater irrigation is $60,000. This does not include costs to improve irrigation equipment if necessary.
The estimated capital cost associated with a conjunctive use project is $161,000, with an annual operations and maintenance cost of $5,900.

2: The annual costs associated with power interference include NPPD's generation costs but not transmission, operation and maintenance costs for replacement power.

3: Water management programs consist of conservation cropping, deficit irrigation, land fallowing, and on-farm irrigation changes. The costs presented provide the range for these projects.

4: The cost for Glendo storage is based on costs to lease Glendo storage water under temporary water service contracts, which range from $5/ac-ft/yr for irrigation uses to $75/ac-ft/yr for municipal and industrial purposes.

5: The present value of annual costs is based on a period of 13 years, which corresponds with the First Increment, and a discount rate of 6 percent. These costs may need to be adjusted once implementation schedules are better defined. Replacement costs were not included.

6: The unit cost equals the present value of total cost divided by the yield.

7: The minimum and maximum costs are based on the North Plum Creek and Jeffrey Canyon Reservoirs, respectively.

8: Costs to mitigate potential third party impacts are not included.

*** PEPL will no longer have an annual debt service payment after the remaining principal payment on the loan is paid off. After the remaining pricipal is paid off the annual cost per ac-ft may change.

It is important to note that the annual costs may not be incurred for the entire 13 years of the first increment. As discussed below, some projects will likely be phased in and other projects will take several years to implement. The present value of annual costs during the first increment will depend upon the time and level of implementation. There is considerable uncertainty regarding the implementation schedules, therefore, the present value of annual costs was based on the entire first increment, or 13 years. The total capitalized costs presented in Table VI-1 may be less depending on when projects are implemented and how many years annual costs are incurred. The funds for the Program are scheduled to be provided throughout all of the first increment. When potential schedules and costs are better defined, schedules will need to be reassessed and possibly modified strictly for cash flow reasons. This is further discussed in section E.

C. Legal and Institutional Issues

There are specific legal and institutional requirements related to each individual project, however, some generalizations can be made regarding the legal requirements in each state. In Nebraska for example, Section 46-252 provides for the protection of water for the purposes of instream beneficial uses. It is possible that additional water generated by several Nebraska projects included in the Water Action Plan will be protected under Section 46-252. In the case of agricultural conservation and leasing projects in Nebraska there is currently no existing legislation that addresses these programs. New legislation would be required to implement a leasing program in Nebraska. In general, permits would be required from the Nebraska DWR to implement any project in Nebraska. In Wyoming, secondary supply water rights would be required from the Wyoming State Engineer to ensure the protection of additional water downstream to the Wyoming/Nebraska state line. In addition, the Wyoming State Engineer and Legislature must approve any exports. Any partial change of use needed for water to be used for downstream environmental purposes in the critical habitat would need to be secured from the Wyoming Board of Control. It is likely that an amendment to existing legislation would be required to lease agricultural water rights or La Prele Reservoir water as the existing statute, 41-3-110, only provides for leases up to two years. In Colorado, in-state wildlife enhancement benefits must be decreed for water generated from recharge projects to be protected within Colorado. Such water may then reach Nebraska, where it can be delivered to the associated habitats. For all three states NEPA compliance and site-specific environmental permits may be required for the construction of any infrastructure depending on site impacts.

D. Third Party Impacts

Third party impacts were identified and discussed qualitatively. Third party effects that have been considered include hydrologic, economic, environmental and socioeconomic impacts. Third party hydrologic impacts on existing surface and groundwater users are due primarily to changes in the timing and quantity of water in the river. Diversions, storage releases, and return flows alter the quantity and timing of water available to downstream users. Third party economic impacts related to agricultural conservation and leasing programs are related primarily to effects on agricultural equipment suppliers, farm workers, processing industries and local communities that depend on agriculture. The economy in the study area is dependent on agriculture to a large degree in which case economic and fiscal conditions are impacted by changes in crop patterns and crop production. Some projects, including reservoir and recharge projects, provide an increase in recreational opportunities. Third party environmental impacts for most projects can be both positive and negative as they relate to water quality. Water quality could improve during the summer months when additional flows are added to the river, and degrade during the winter months when river flows are reduced.

E. Implementation Schedule

The states were requested by the WAPC to develop implementation schedules for their projects as shown in the second column of Table VI-2 below. These schedules are estimated times to implementation from the start of the Program, or if action to implement the alternative does not commence until sometime after the first year of Program implementation, the estimated time to complete implementation once it has begun. The third column of Table VI-2 provides the estimated times used in the analysis of funding requirements presented below.

Table VI-2
Implementation Schedule

Project	Years to Implement	Assumed Time Required
CNPPID Re-regulating Reservoir	5-7	7
Water Leasing in Nebraska	4-?.	4
Water Management Incentives	3-?	3
Groundwater Management (Nebraska)	2	2
North Dry Creek/Ft. Kearny Cutoffs	1-2	2
Dawson/Gothenburg Canal GW Recharge	2-4	4
Power Interference	2-4	4
Net Controllable Conserved Water	0-2	2
Pathfinder Municipal Account	3	3
Glendo Storage	2	2
Temporary Water Leasing in Wyoming	5	5
La Prele Reservoir	5	5
Groundwater Management (Tamarack III)	5	5

Note: Groundwater management in Nebraska will be phased in over several years.
Tamarack III will be phased in and fully implemented after 5 years.

All projects included in the Water Action Plan are capable of extending through the first increment. There are some projects that could potentially extend well beyond the first increment because of the infrastructure in place, while other projects, such as water leasing are subject to annual or periodic extensions.

Two of the basic ways to evaluate funding requirements for the program are: 1) Escalate the initial and annual costs to the year in which the costs are estimated to occur to account for inflation and compute the total cost that might be incurred in each year of the first increment of the Program; and 2) Compute the discounted funding required assuming that funds are set aside in the first year of the Program. Both analyses assume that funds are required in accordance with the implementation schedule shown in Table VI-2 above. The analyses also assume a three (3) percent compound annual rate of inflation. Since Table VI-1 presents a range of initial and annual costs for several projects, two figures are shown below to present the low and high range of costs. Under the first approach, the total funding required, including inflation, would range from approximately $50 million to $90 million for the low and high ranges, respectively.

Figure 3: Low Range Costs with Inflation

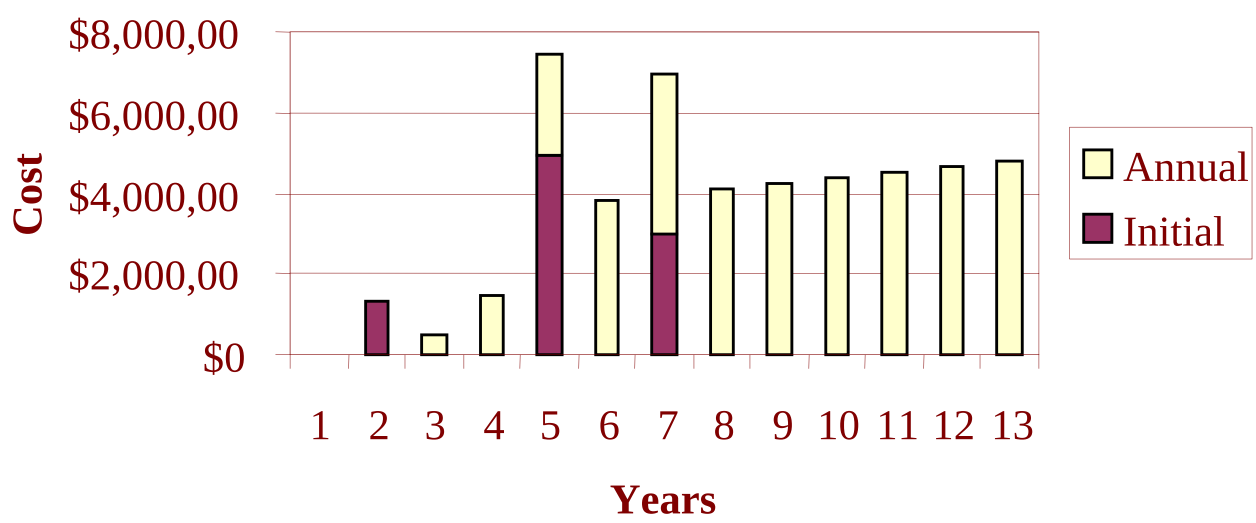
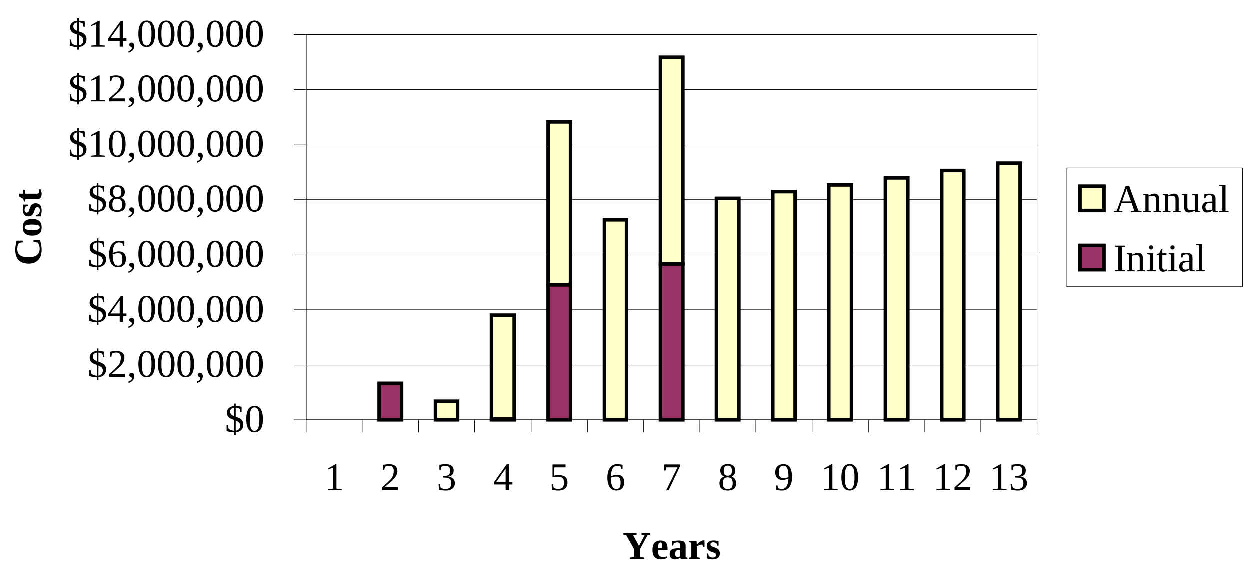


Figure 4: High Range Costs with Inflation



The second approach to evaluating funding requirements is to discount the costs expected to be incurred each year of the thirteen-year first increment to the same base year. Using a six percent discount rate, the Program's up-front funding requirement would be approximately $30 million for the low range costs and $55 million for the high range costs.

The information presented above is based on reconnaissance-level cost estimates and very general assumptions regarding when specific projects and programs would be implemented. Feasibility studies, final design, permitting, and the resolution of legal and institutional requirements will be necessary before the implementation of any project can proceed.

ATTACHMENT 5
SECTION 7

Depletions Plan, Platte River Basin, Wyoming
(Wyoming's Depletions Plan)
October 24, 2006

Revised August 11, 2009

Template Biological Assessment & Biological Opinion Updated December 3, 2019

Outline

CHAPTER 1-GENERAL INFORMATION

I. Purposes

Wyoming's Depletions Plan serves the following purposes of the Platte River Recovery Implementation Program (PRRIP) as described in subsection I.A.4 of the Program Document:

"Mitigating the adverse impacts of new water related activities on (a) the occurrence of FWS target flows (as described in Section E.1.a) and (b) the effectiveness of the Program in reducing shortages to those flows, such mitigation to occur in the manner and to the extent described in Section E.3 and in the approved depletions plans;"

This depletions plan serves these Program purposes by:

I.A. Specifying the existing water related activities in Wyoming that are covered by the PRRIP;

I.B. Identifying the means by which new water related activities, both those subject to and those not subject to Section 7(a)(2) of the Endangered Species Act (ESA) will be addressed; and

I.C. Describing depletion mitigation measures Wyoming intends to implement.

II. Description of Principles

II.A. Cooperative Agreement-On July 1, 1997, the "Cooperative Agreement for Platte River Research and other Efforts relating to Endangered Species Habitats along the Central Platte River, Nebraska" (Cooperative Agreement) was executed by the Governors of Colorado, Nebraska and Wyoming and the Secretary of the Department of Interior (collectively referred to as the "Signatories").

II.B. Platte River Recovery Implementation Program (PRRIP) – The PRRIP describes the basin-wide cooperative program envisioned in the Cooperative Agreement. The PRRIP will provide Endangered Species Act (ESA) compliance relative to the four federally listed target species (whooping crane, piping plover, least tern and pallid sturgeon) and their associated habitats for existing and new water related activities in the Platte River Basin. The term of the PRRIP is thirteen (13) years after its approval by the Governors of the three states and the Secretary of the DOI.

II.C. ESA compliance-"ESA compliance" means: (1) serving as the reasonable and prudent alternative to offset the effects of water-related activities that the U.S Fish and Wildlife Service (FWS) found were likely to cause jeopardy to one or more of the target species or to adversely modify critical habitat before the Program was in place; (2) providing offsetting measures to avoid the likelihood of jeopardy to one or more of the target species or adverse modification of the critical habitat for new or existing water-related activities evaluated under the ESA after the Program was in place; and (3) avoiding any prohibited take of target species.

II.D. Associated habitats-With respect to the interior least tern, whooping crane, and piping plover, “associated habitat” means the Platte River Valley beginning at the junction of U.S. Highway 283 and Interstate 80 near Lexington, Nebraska, and extending eastward to Chapman, Nebraska, including designated critical habitat for the whooping crane and that portion of any designated critical habitat for piping plover within that Lexington to Chapman reach. With respect to the pallid sturgeon, the term “associated habitat” means the lower Platte River between its confluence with the Elkhorn River and its confluence with the Missouri River.

II.E. Water related activities-“Water related activities” means activities and aspects of activities which (1) occur in the Platte River Basin upstream of the confluence of the Loup River with the Platte River; and (2) may affect Platte River flow quantity or timing, including, but not limited to, water diversion, storage and use activities, and land use activities. Changes in temperature and sediment transport will be considered impacts of a "water related activity" to the extent that such changes are caused by activities affecting flow quantity or timing. Impacts of "water related activities" do not include those components of land use activities or discharges of pollutants that do not affect flow quantity or timing.

II.F. Existing water related activities-“Existing water related activities” include surface water or hydrologically connected groundwater activities implemented on or before July 1, 1997. The PRRIP will provide ESA compliance for the following existing water related activities in Wyoming:

II.F.1. The existing operations of federal and other reservoirs in Wyoming.

II.F.2. Wyoming’s allocation of Glendo storage water in accordance with Appendix C of the Final Settlement Stipulation and the Modified North Platte Decree entered in Nebraska v. Wyoming, No. 108 Original (hereafter referred to as the Final Settlement Stipulation and the Modified North Platte Decree).

II.F.3. Pathfinder Modification Project as described in Appendix F of the Final Settlement Stipulation and Modified North Platte Decree.

II.F.4. Transfers approved by the Wyoming Board of Control as long as only the historic consumptive use is transferred, thereby preventing approved transfers from causing increases in depletions.

II.F.5. Water conservation projects to the extent they do not increase depletions or consumptive use. Any increases in consumptive use resulting from irrigation conservation projects will be considered in periodic updates of unit consumptive use rates.

II.F.6. Existing water related activities as defined by the baselines set forth below and further described in this depletions plan.

II.F.6.a. North Platte River Basin (NPRB) Existing Water Related Activities Baseline No. 1-The baseline for irrigation water related activities above Guernsey Reservoir includes some water related activities allowed by the Final Settlement Stipulation and Modified North Platte Decree.

II.F.6.b. NPRB Existing Water Related Activities Baseline No. 2-This baseline covers water use categories and geographic areas not covered by Baseline No. 1. The water use categories under this baseline are: (1) irrigation, (2) municipal, (3) industrial, and (4) "other" water uses as defined in this depletions plan. If a water use under this baseline becomes obsolete and there is evidence that the use occurred in 1992 through 1996, a new use may be substituted for that obsolete use and that new use will be considered an existing water related activity covered by the PRRIP. The standards for implementing these substitutions are set forth in this depletions plan.

II.F.6.c. South Platte River Basin (SPRB) Existing Water Related Activities Baseline-This baseline is discussed in Chapter 3 of this depletions plan.

II.G. New water related activities-"New water related activities" include new surface water or hydrologically connected groundwater activities including both new projects and expansion of existing projects, both those subject to and not subject to section 7(a)(2) of the ESA, which may affect the quantity or timing of water reaching the associated habitats and which are implemented after July 1, 1997.

II.H. Timing of depletions and mitigation-Depletions in excess of existing water related activities baselines and new water related activities will be quantified for the irrigation season (May 1 through September 30) and the non-irrigation season (October 1 through April 30). Mitigation for these depletions will be provided to ensure that the benefits of that mitigation will occur at the state line in the same season as the impacts of the corresponding excess or new depletions, with one possible exception. It may be necessary to time replacement water during September for excess or new depletions that impact flows at the state line in the non-irrigation season because Guernsey Dam on the North Platte River, the Wheatland Irrigation District's dams on the Laramie River, and the Hawk Springs Dam on Horse Creek are basically closed in the non-irrigation season.

II.I. Hydrologically connected groundwater well-A well so located and constructed that if water were withdrawn by the well continuously for 40 years, the cumulative stream depletion would be greater than or equal to 28% of the total volume of groundwater withdrawn from that well. Use from groundwater wells in Wyoming that are not hydrologically connected does not effect the purposes of the PRRIP, is not a new water related activity, and requires no mitigation.

II.J. FWS target flows-These target flows are species and annual pulse flow recommendations for the Platte River at Grand Island, Nebraska developed by U.S. Fish and Wildlife Service as described in Attachment 5, Section 11. Wyoming has not agreed that these target flows are biologically or hydrologically necessary to benefit or recover the target species. These target flows will be under review during the PRRIP.

II.K. Governance Committee-The Committee is established to oversee implementation of the PRRIP. The approval of this depletions plan by the Governance Committee warrants that it meets the goals, objectives and purposes of the PRRIP and the requirements of subsection III.E.3 of the Program Document. During the term of the PRRIP, the Governance Committee will review implementation of this depletions plan. Amendments to this depletions plan must be reported to and approved by the Governance Committee.

II.L. Scheduled Reports:

December 31, 2007-Complete the Interim Depletions Mitigation Plan described in subsection II.B of Chapter 2. The plan will address any new depletions that commenced between the beginning of the 1997 water year (October 1, 1996) and the end of the 2007 water year (September 30, 2007).

March 15, 2009-Complete the first annual report describing the implementation of this depletions plan addressing water year 2008 (October 1, 2007 through September 30, 2008)

March 15, 20XX-Complete subsequent annual reports for the preceding water year.

III. FWS and State of Wyoming Coordination

This section of Wyoming's Depletion Plan explains the coordination that will occur between the U.S. Fish and Wildlife Service (FWS) and its consultations and the State of Wyoming (state) and its evaluations of water related activities during the PRRIP under this depletions plan. If the FWS, project proponent and State of Wyoming do not concur on a particular issue, the parties will work together to resolve the disagreement and may refer the matter to the Governance Committee for guidance.

III.A. Definitions

The following subsection describes the coordination process with a narrative and schematic. The following definitions are offered to clarify the terms used in the description:

III.A.1. "New water related activities" are defined in subsection II.G of Chapter 1.

III.A.2. New water related activities subject to a consultation with the FWS under section 7(a)(2) of the ESA have a "federal nexus."

III.A.3. The "State Coordinator" is the state employee within the Wyoming State Engineer's Office responsible for administering this depletions plan.

III.A.4. A "project proponent" is the party seeking approval of a water related activity. A federal agency may be a project proponent under this depletions plan.

III.A.5. "Federal Action Agency" is the agency responsible for providing the necessary federal clearances or approvals for a project proponent's proposed action. The Federal Action Agency must assure that a project proponent complies with the ESA through consultation with the FWS.

III.B. Description

The following narrative corresponds with the brief descriptions displayed in the schematic provided after page 9 of this plan.

Box 1. Platte River Basin Water-Related Activities

The FWS Representative will become aware of water related activities through communications with project proponents or Federal Action Agencies. The State Coordinator will become aware of water related activities through the permitting process for new water rights or through the Wyoming Water Development Office. Go to Box 2. (Is there a federal nexus?)

Box 2. Is there a federal-nexus?

The Federal Action Agency, FWS Representative and State Coordinator will determine if the water related activities have a federal nexus.

If no, go to Box 3. (Use Wyoming's Depletions Plan.)
If yes, go to Box 4. (Initiate ESA consultation.)

Box 3. Use Wyoming's Depletions Plan.

Does the water related activity conform to the definition of an existing water related activity provided in subsection II.F of Chapter 1 of this depletions plan? If yes, document the activity and stop.

Does the water related activity conform to the definition of a new water related activity provided in subsection II.G of Chapter 1 of this depletions plan? If yes, go to section II of Chapter 2 or section II of Chapter 3 of this depletions plan depending on whether the new water related activity is located in the North Platte River basin or South Platte River basin, respectively.

Box 4. Initiate ESA consultation

All proposed water related activities with a federal nexus are subject to ESA consultation with the FWS. Go to Box 5. (Existing or new water related activity?)

Box 5. Existing or new water related activity?

Does the water related activity with the federal nexus conform to the definition of an existing water related activity provided in subsection II.F of Chapter 1 of this depletions plan? If yes, the activity is covered by the PRRIP. Go to Box 6. (Existing Water Related Activity-Streamlined ESA consultation)

Does the water related activity with the federal nexus conform to the definition of a new water related activity provided in subsection II.G of Chapter 1 of this depletions plan? If yes, go to Box 7. (Depletions analyses)

Box 6. Existing water related activity-Streamlined ESA consultation.

The activity is covered by the PRRIP. A streamlined ESA consultation will be completed. Attachment No. III to this depletions plan provides a description of the streamlined ESA consultation and provides template documents that will be used. Stop.

Box 7. Depletions analyses

The Federal Action Agency, consulting with the water user, is responsible for providing a project description of the proposed federal action, including a monthly estimate of the annual depletions at the location of the proposed action resulting from the new water related activity. The Federal Action Agency will provide the State Coordinator with a copy of the depletions analyses and other information pertinent to the new water related activity. Go to Box 8. (Proponent desire State assistance?)

Box 8. Proponent desire state assistance?

Because the PRRIP is voluntary, the applicant or project proponent must request that the new water related activity with a federal nexus be addressed by this depletions plan and the PRRIP.

If yes, go to Box 9. (State proposal for coverage?)
If no, go to Box 13. (Independent ESA Section 7 consultation)

Box 9. State proposal for coverage?

The State Coordinator will review and comment on the depletions analyses. In addition, the State Coordinator, in consultation with the Director of the Wyoming Water Development Office (Director), may recommend to the Federal Action Agency and FWS Representative that the new water related activity be covered by the state's mitigation process described in subsection II.D of Chapter 2 of this plan. Working with the project proponent and the Director, the State Coordinator will provide a proposal outlining the terms of that coverage using the parameters of subsection II.D of Chapter 2 of this plan.

The proposal will be developed using Template No. 1-Wyoming Platte River Recovery Agreement, provided in Attachment III.

If yes, go to Box 10. (Federal concurrence with state proposal?)

If no, go to Box 13. (Independent ESA Section 7 consultation)

Box 10. Federal concurrence with state proposal?

The Federal Action Agency and FWS Representative will determine if the state's proposal meets the requirements of section III.E.3 of the Program Document and the programmatic biological opinion (PBO) issued by the FWS on June 16, 2006. The Federal Action Agency and FWS Representative may work with the State Coordinator to develop a mutually acceptable proposal.

The FWS Representative and State Coordinator may elevate the discussions to the Regional Director of the FWS, the Wyoming State Engineer, and Director of the Wyoming Water Development Office.

If yes, go to Box 11. (New water related activity-Streamlined ESA consultation)

If no, go to Box 12. (G.C. approved amendment?)

Box 11. New water related activity-Streamlined ESA consultation

If a mutually acceptable proposal (Wyoming Platte River Recovery Agreement) is reached, a streamlined ESA consultation will be completed. Attachment No. III to this depletions plan provides a description of the streamlined ESA consultation and provides template documents that will be used. Stop. Annual reporting of all streamlined ESA consultations will be provided to the Governance Committee.

Box 12. G.C. approved amendment?

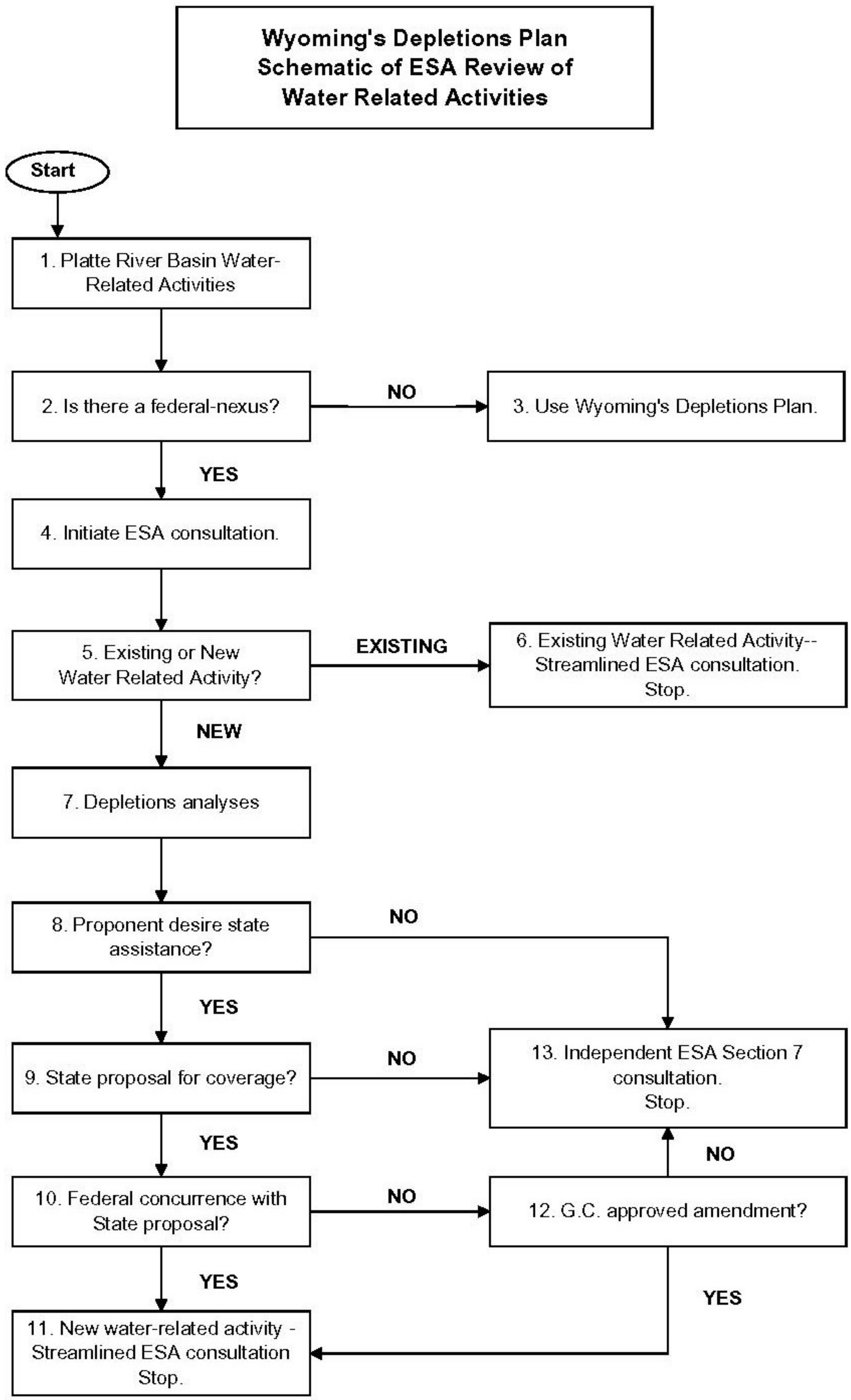
If a mutually acceptable proposal within the parameters of subsection II.D of Chapter 2 of this plan cannot be developed, the FWS Representative and State Coordinator may offer amendments to this plan to the Governance Committee for approval. The amendments would include changes to this plan needed to address specific new water related activities with a federal nexus.

If yes, go to Box 11. (New water related activity-Streamlined ESA consultation)

If no, go to Box 13. (Independent ESA Section 7 consultation)

Box 13. Independent ESA Section 7 consultation

The new water related activity will be subject to a ESA Section 7 consultation conducted "outside of the PRRIP" by the FWS. Upon completion of the FWS consultation, the project proponent will be required to independently provide mitigation as required by that consultation. Stop.


Wyoming's Depletions Plan
Schematic of ESA Review of
Water Related Activities
Start
1. Platte River Basin Water-Related Activities
2. Is there a federal-nexus?
NO
3. Use Wyoming's Depletions Plan.
YES
4. Initiate ESA consultation.
5. Existing or New Water Related Activity?
EXISTING
6. Existing Water Related Activity-- Streamlined ESA consultation. Stop.
NEW
7. Depletions analyses
8. Proponent desire state assistance?
NO
YES
9. State proposal for coverage?
NO
13. Independent ESA Section 7 consultation. Stop.
YES
NO
10. Federal concurrence with State proposal?
NO
12. G.C. approved amendment?
YES
YES
11. New water-related activity - Streamlined ESA consultation Stop.

CHAPTER 2-NORTH PLATTE RIVER BASIN, WYOMING

I. Existing Water Related Activities

I.A. Description

The existing water related activities covered by Wyoming's Depletions Plan and the PRRIP are defined in subsection II.F of Chapter 1. Wyoming's Depletion Plan contains two (2) independent existing water related activities baselines for the North Platte River basin (NPRB) in Wyoming. That means that any "overruns" in one baseline cannot be offset by "under-runs" in the other baseline.

I.B. NPRB Existing Water Related Activities Baseline No. 1

I.B.1. Description

The only water use category under Baseline No. 1 is irrigation water use in the NPRB above Guernsey Reservoir. Wyoming's compliance with the Final Settlement Stipulation and Modified North Platte Decree will provide confirmation that Wyoming has not exceeded this baseline for purposes of the PRRIP. The activities that are required as part of Wyoming's reporting obligations under the Final Settlement Stipulation and Modified North Platte Decree will serve as Wyoming's monitoring for Baseline No. 1.

The following is a summary of those provisions of the Final Settlement Stipulation and Modified Decree that define Baseline No. 1:

I.B.1.a. Wyoming is enjoined from diverting or permitting the diversion of water from the North Platte River and its tributaries, including water from hydrologically connected groundwater wells, upstream of Guernsey Reservoir for the intentional irrigation of more than a total of 226,000 acres of land in Wyoming during any one irrigation season, exclusive of the Kendrick Project. In the year 2012, this injunction will be replaced with two injunctions, one that limits the number of acres that can be irrigated above Pathfinder Dam and one that limits the number of acres that can be irrigated between Pathfinder Dam and Guernsey Reservoir; the two injunctions will total 226,000 acres. (See Modified North Platte Decree, ¶ II(c) and Exhibit 4 to the Final Settlement Stipulation.)

I.B.1.b. Wyoming is enjoined from diverting or permitting the diversion of water for irrigation from the North Platte River and its tributaries, including water from hydrologically connected groundwater wells, upstream of Pathfinder Dam for the consumption in any period of ten consecutive years of more than 1,280,000 acre feet. Wyoming is enjoined from diverting or permitting the diversion of water for irrigation from the North Platte River and its tributaries, including water from hydrologically connected groundwater wells, between Pathfinder Dam and Guernsey Reservoir for the consumption in any period of ten consecutive years of more than 890,000 acre feet exclusive of the Kendrick Project. (See Modified North Platte Decree, ¶ II(a) and (b) and Exhibit 6 of the Final Settlement Stipulation.).

I.B.1.c. No more than 35,000 acres of land in the First Unit of the Kendrick Project may be irrigated. (See ¶ VII of the Final Settlement Stipulation.) The Wyoming water rights held by the Casper Alcova Irrigation District, the contractor for storage water from the Kendrick Project, restricts its irrigated acreage to 24,248.23 acres. The acreage limitation in the water rights will serve as the existing water related baseline for monitoring the operations of the Casper Alcova Irrigation District.

I.B.2. Reporting of Existing Water Related Activities-Baseline No. 1

The Modified North Platte Decree requires Wyoming to annually report acreage irrigated by surface water and hydrologically connected groundwater wells in the area above Guernsey Reservoir, excluding those lands irrigated within the Kendrick Project. In addition, Wyoming is required to annually report the consumptive use resulting from the irrigation of these lands within the area covered by the acreage limitation. These reports are provided to the North Platte Decree Committee (NPDC). The purpose of these reports is to monitor compliance with the provisions in the Modified Decree, described in subsections I.B.1.a. and I.B.1.b. above.

Wyoming's compliance with the Final Settlement Stipulation and Modified North Platte Decree will provide confirmation that Wyoming has not exceeded this baseline for purposes of the PRRIP, with the exception of the irrigated acreage limitation for the Kendrick Project that is specific to this depletions plan. If Wyoming's reports to the NPDC indicate that the acreage and consumptive use limitations were not exceeded, the annual report to the Governance Committee will simply note that Wyoming complied with the Modified Decree.

If Wyoming exceeds the acreage or consumptive use limitations for the areas above Guernsey Reservoir as defined in the Modified Decree, Wyoming will have exceeded Baseline No. 1, independent of the acreage limitation for the Kendrick Project. The annual report to the Governance Committee will include the excess depletions resulting from the overruns to the limitations in the Modified Decree. The effects of overruns will be translated to the Wyoming/Nebraska state line using the methodology described in Attachment I.

The annual report to the Governance Committee will also indicate whether the Kendrick Project exceeded the acreage limitation described above in B.1.c. Kendrick irrigated acreage will be monitored by the Wyoming State Engineer's Office and through reports available through the Bureau of Reclamation.

If the acreage limitation (24,248.23 acres) for the Kendrick Project is exceeded, the annual report to the Governance Committee will quantify the excess acreage and calculate the excess depletions. The effects of excess depletions will be translated to the Wyoming/Nebraska state line using the methodology described in Attachment I to this depletions plan.

Under-runs to the acreage and consumptive use limitations in the Modified Decree or under-runs to the acreage limitation for the Kendrick Project will not be used to offset overruns to Baseline No. 2, described in section I.C of this plan. However, if revisions to the Modified Decree or Kendrick operations result in permanent reductions in depletions, Wyoming reserves the right to seek credit for such reductions through the Governance Committee.

I.B.3. Mitigation of Excess Water Related Activities-Baseline No. 1

If the acreage limitations or consumptive use limitations, described respectively in subsections I.B.1.a.and I.B.1.b, are exceeded, it will mean that Wyoming did not meet the limits of the Modified Decree. The North Platte Decree Committee (NPDC) will need to address the situation. The deliberations of NPDC will be independent of the PRRIP and this depletions plan. The NPDC resolution of the matter may or may not meet the program purposes described in subsection I.A.4 of the Program Document. If resolution by the NPDC is not satisfactory for program purposes, Wyoming will remain obligated to mitigate the effects of the excess depletions at the state line.

If the acreage limitation for the Kendrick Project, described in subsection B.1.c., is exceeded, it will mean that the Casper Alcova Irrigation District did not comply with its water rights. The Wyoming State Engineer's Office (WSEO) will need to address this situation. The deliberations by the WSEO will be independent of the PRRIP and this depletions plan. The WSEO resolution of the matter may or may not meet the program purposes described in subsection I.A.4 of the Program Document. If resolution by the WSEO is not satisfactory for program purposes, Wyoming will remain obligated to mitigate the effects of the excess depletions at the state line.

Mitigation for the depletions in excess of Baseline No. 1 will be provided in the same manner as depletions in excess of Baseline No. 2, described in subsection I.C.3. However, if Baseline No. 1 is exceeded in a water year in which there is a spill routed over or through Guernsey Dam or Kingsley Dam, Wyoming reserves the right to present evidence to the Governance Committee that exceeding the baseline or acreage limitation did not adversely affect the program purposes identified in subsection I.A.4 of the Program Document. A finding by the Governance Committee that the replacement of excess depletions is not necessary or could be reduced will have precedence over any mitigation described in this depletions plan.

I.C. NPRB Existing Water Related Activities Baseline No. 2

I.C.1. Description

For purposes of this depletions plan, the NPRB is broken down into the following sub-basins. (See Figure No. 1)

Sub-basin	Description
1.	NPRB from the CO/WY state line to Pathfinder Dam
2.	NPRB from Pathfinder Dam to Guernsey Dam.
3.	NPRB from the Guernsey Dam to the WY/NE state line, the southern boundary being the Gering/Ft. Laramie Canal, with the exception that lands above the canal, but irrigated from that canal, will be included.
4.	Upper Laramie River Basin, upstream of Wheatland Irrigation District's tunnel no. 2
5.	Lower Laramie River Basin, downstream of Wheatland Irrigation District's tunnel no. 2 and upstream of the Gering/Fort Laramie Canal, including those lands between the Horse Creek and Laramie River drainages, and excluding lands above the Gering/Ft. Laramie Canal, but irrigated from that canal.
6.	Horse Creek Drainage, following its topographic boundary until it intersects with the Gering/Fort Laramie Canal, then the canal becomes the drainage boundary for purposes of this plan.

Baseline No. 2 covers water use categories not covered by Baseline No. 1. The following are the water use categories under Baseline No. 2:

Water Use Categories

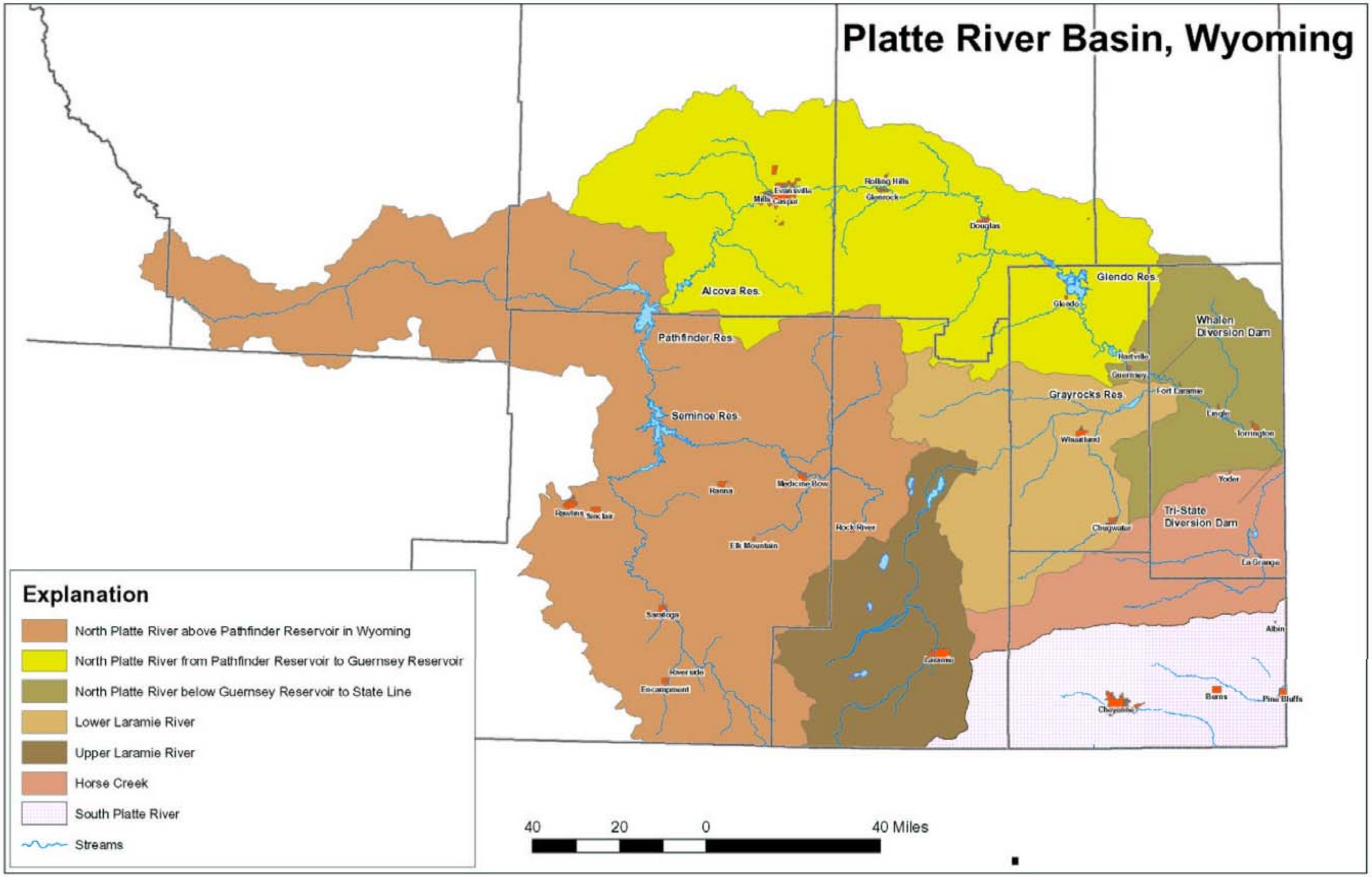
1. Irrigation use in sub-basins 3 through 6. Irrigation use in sub-basins 1 and 2 is covered by Baseline No. 1.

2. Municipal use in sub-basins 1 through 6.

3. Industrial use in sub-basins 1 through 6.

4. Other uses in sub-basins 1 through 6.

The following describes the water use categories and Benchmarks that are included under the existing water related activities Baseline No. 2.



Platte River Basin, Wyoming
Alcova Res.
Pathfinder Res.
Seminoe Res.
Glendo Res.
Grayrocks Res.
Whalen Diversion Dam
Tri-State Diversion Dam
Explanation
North Platte River above Pathfinder Reservoir in Wyoming
North Platte River from Pathfinder Reservoir to Guernsey Reservoir
North Platte River below Guernsey Reservoir to State Line
Lower Laramie River
Upper Laramie River
Horse Creek
South Platte River
Streams
40
20
0
40 Miles

I.C.1.a. Irrigation Water Use

The Benchmark Acreages for sub-basins 3 through 6 are based on field inspections completed by State Engineer Office personnel in 1995 through 1997. The field inspectors were provided 7.5 minute quadrangles that depicted irrigated acreage obtained from infrared photography purchased by the Wyoming Water Development Commission (WWDC). The WWDC obtained this photography in the summers of 1983 and 1984. The field inspectors added and deleted lands depicted on the quadrangles to accurately represent lands irrigated from 1995 to 1997 by surface water and groundwater. The following table depicts the results of the field inspections:

Sub-basins (as defined above)	Benchmark Acreage
NPRB-Guernsey Dam to the WY/NE state line	106,221
Upper Laramie River Basin	91,255
Lower Laramie River Basin	85,711
Horse Creek Basin	41,179

Wyoming will annually complete field inspections of irrigated acreage for each sub-basin and compare the results to the Benchmark Acreages listed above. By the end of year 7 of the PRRIP, a comprehensive inspection will be completed using aerial photography or satellite imagery and field verifications.

The total annual depletions resulting from the irrigation of the Benchmark Acreages listed above will not be calculated. However, the unit consumptive use rates (acre feet/acre) for each sub-basin will be used in this plan in order to calculate the volumetric effects of "overruns" and "under-runs" to the Benchmark Acreages. Unit consumptive use rates have been developed using methods similar to those agreed upon for assessment of compliance with the consumptive use provisions of the settlement of Nebraska v. Wyoming. That methodology was applied to local climatic data and surveys of crop yields and cropping patterns published by the National Agricultural Statistics Service. To capture average climate conditions, unit consumptive use rates for individual crops were averaged over a baseline period, i.e. the most recent 20-30 years, depending upon data availability. These average unit values for each crop were then applied to the actual crop mix (i.e. the proportions of corn, beets, alfalfa, etc.) for a 20-year baseline period (1982-2001). The result is average unit annual consumptive use values for each sub-basin which reflect the application of the long-term, average climate to the most recent 20-year cropping patterns. The following table provides these average unit values which were developed by TriHydro Corporation for the Wyoming Water Development Commission's "Platte River Basin Plan" and will be used for purposes of this plan:

Unit Consumptive Use Rates

Sub-basin (as defined above)	acre feet/acre
NPRB-Guernsey Dam to the WY/NE state line	1.32
Upper Laramie River Basin	0.79
Lower Laramie River Basin	1.31
Horse Creek Basin	1.16

Cropping patterns; irrigation practices, such as increases in supplemental supplies; and other factors that may affect the average unit consumptive uses in each sub-basin will be reviewed every five years. The average annual unit consumptive use rates will be revised if the review indicates that changes are warranted.

As explained in the discussion related to Baseline No. 1, the Final Settlement Stipulation and Modified North Platte Decree place consumptive use limitations on Wyoming in the areas above Pathfinder Dam and between Pathfinder Dam and Guernsey Reservoir. As the administration of these limitations evolves, information may become available which will warrant changes to the methods used to calculate the average unit consumptive use rates listed above.

I.C.1.b. Municipal Water Use

A Benchmark has been developed for municipal water use for each of the six (6) sub-basins defined in Chapter 2, Section I.C.1. The Benchmarks are based on water use information for each municipality within the respective sub-basins. The water use information was used to determine each of the 26 municipality's maximum annual depletions from 1992 through 1996. The majority of the water use calculations were based on actual diversion records. In the event that records were not available, diversions were estimated using populations and estimated per capita use. Some municipalities have expanded their service areas beyond their corporate limits to serve adjacent rural domestic water users. Some industries obtain water from municipal water systems. These factors were included in the water use for the municipalities, rather than the Benchmarks for rural domestic and industrial water use. Return flow factors were used to convert diversions to depletions. The depletions were calculated using effluent records or other available information. The following table depicts the Benchmarks for each of the six (6) sub-basins:

Municipal Water Use-Benchmarks

Sub-basin	Benchmark (Annual Depletions in acre feet)	
	Irrigation Season	Non-irrigation season
1. Above Pathfinder Dam	2,290	1,040
2. Pathfinder Dam to Guernsey Dam	8,265	1,555
3. Guernsey Dam to the WY/NE state line	2,405	860
4. Upper Laramie River Basin	2,990	670
5. Lower Laramie River Basin	935	325
6. Horse Creek Drainage	95	55

Additional baseline information will be used to monitor future water related activities. This additional baseline information for each municipal system addresses the status of the water supply as of July 1, 1997 and includes information relating to the water system, water rights, population, water use, and the wastewater system. The information will be used to estimate the depletive or accretive impacts of changes in operations. For example, a municipality may convert from a surface water supply to non-hydrologically connected groundwater wells. A municipality may convert from a zero discharge wastewater system to a flow-through system, thereby reducing depletions. These types of changes may allow municipalities to accommodate additional growth without increasing depletions. This baseline information will also be used to determine if increased population or a particular change in operations will cause a municipality to permanently exceed its 1992-1996 water use and, therefore, should be considered a new water related activity.

I.C.1.c. Industrial Water Use

The major industrial water user in the NPRB in Wyoming is the Basin Electric Power Cooperative (BEPC), who owns and operates the Laramie River Station near Wheatland, Wyoming. On December 4, 1978, an Agreement of Settlement and Compromise (Agreement) was executed by the BEPC, the State of Nebraska, the Rural Electricification Administration (REA), the U.S. Army Corps of Engineers (USCOE) and several environmental groups to resolve disputes regarding the issuance of loan guarantees by the REA and the issuance of the dredge and fill permit by the USCOE for BEPC's Grayrocks Dam and Reservoir. The Agreement contains annual consumptive use limitations on the Laramie River Station, places operating conditions on the water supplies for the power plant, and established the "Platte River Whooping Crane Habitat Maintenance Trust." The parties agreed that compliance with the Agreement satisfies the requirements of the Endangered Species Act. The Benchmark for this existing water related activity, the various water supplies for the Laramie River Station, is to comply with the 1978 Agreement of Settlement and Compromise. Wyoming will monitor any amendments to the Agreement or issues related to non-compliance resolved by the parties to ensure conformance with the purposes of the PRRIP. If BEPC seeks to amend its water rights or operations in a manner that would permanently reduce depletions, Wyoming reserves the right to seek credit for the reduced depletions under this plan through the Governance Committee.

There are six (6) other significant industrial water users in the NPRB in Wyoming: the Sinclair Refinery, the former Amoco Refinery, the former Texaco Refinery, the Little America Refinery, the Dave Johnson Power Plant, and a sugar beet processing plant in Torrington. Each of these six industrial water supply systems has a Benchmark. The Benchmarks are based on each system's maximum depletions during the 1992-1996 water years. The following table depicts the Benchmarks for the six industrial water supply systems:

Industrial Water Use-Benchmarks for Major Industries

Sub-basin	Benchmark (Annual Depletions in acre feet)	
	Irrigation Season	Non-irrigation season
1. Above Pathfinder Dam		
Sinclair Refinery	1,110	1,340
2. Pathfinder Dam to Guernsey Dam		
Amoco Refinery	2,050	1,015
Texaco Refinery	320	140
Little America Refinery	505	700
Dave Johnson Power Plant	4,640	5,520
3. Guernsey Dam to the WY/NE state line		
Sugar beet processing plant	40	1,140

Additional baseline information will be used to monitor future water related activities. This additional baseline information for each of the above systems will address the status of their water supply as of July 1, 1997 and will include information relating to the water system, water rights, water use, and the wastewater system. The information will be used to estimate the depletive or accretive impacts of proposed changes in operations to determine if those changes can be accommodated under the existing Benchmark or if they should be considered new water related activities.

Lack of specific data on the annual water use of the other industries within the basin makes it difficult to establish a meaningful history of their industrial water use. However, each of the industries has a portfolio of water rights under which they operate. These portfolios would have to be revised if the industries were to replace or modify their water supplies. The Benchmark for these other industries is based on their water rights. A tabulation of the industrial water rights issued on or before July 1, 1997 has been developed. If one of these industrial water users wants to replace or modify their water supplies, the depletions resulting from those projects would be considered existing water related activities if they do not increase the depletions beyond those that occurred from 1992 through 1996. If the projects result in depletions beyond this threshold, the excess depletions would be considered new water related activities.

I.C.1.d. Other Water Uses

This water use category includes those uses that do not fit under the irrigation, municipal or industrial permitting processes. The following is a description of other uses that will be considered by this depletions plan.

I.C.1.d.i. Rural Domestic Water Use

This category addresses the water use by the population in each sub-basin outside the service areas of the municipal water supply systems, which are served by individual wells or centralized systems for rural subdivisions. A Benchmark has been developed for the rural domestic water use in each of the sub-basins within the NPRB.

The Wyoming Department of Administration and Information provided estimates of the population in each of the sub-basins. The populations served by municipal water systems were subtracted from the estimates to determine the rural population in each sub-basin from 1992 through 1996. It is estimated that depletions resulting from personal use, including irrigation of lawns and gardens, equates to 100 gallons per capita per day or 0.11 acre feet per year. For purposes for this depletions plan, this use is reduced to 0.10 acre feet per person per year to account for the fact that approximately 10% of the rural population is served by non-hydrologically connected groundwater wells. The following Benchmarks were established using the rural population estimates and a depletion factor of 0.1 acre feet per person per year:

Rural Domestic Water Use-Benchmarks

Sub-basin	Benchmark (Annual Depletions in acre feet) Irrigation Season	Non-irrigation season
1. Above Pathfinder Dam	160	80
2. Pathfinder Dam to Guernsey Dam	360	180
3. Guernsey Dam to the WY/NE state line	270	130
4. Upper Laramie River Basin	270	130
5. Lower Laramie River Basin	200	100
6. Horse Creek Drainage	80	40

I.C.1.d.ii. Livestock Use

In Wyoming, there is a simplified water right permitting process for stock wells as long as the proposed capacity of the well does not exceed 25 gallons per minute. This depletions plan considers the use of stock wells permitted under this process to be non-depletive. If the proposed capacity of a well exceeds 25 gallons per minute, the water user must undergo a more detailed water rights permitting process and seek a permit for a miscellaneous use well.

There is also a simplified water right process for stock watering reservoirs as long as the proposed storage capacity of the reservoir does not exceed 20 acre feet in capacity and 20 feet in dam height. If the proposed stock water reservoir exceeds these limitations, the water user must undergo a more detailed water right permitting process for the reservoir. Both categories of stock watering reservoirs will be administered under this plan in the same manner as miscellaneous uses.

Water supplies for feed lots and hog farms are permitted as miscellaneous wells or miscellaneous surface water diversions. Miscellaneous uses will be addressed by this plan as described below.

I.C.1.d.iii. Miscellaneous Uses

* Miscellaneous Use Wells-This designation for ground water rights is used for the following: 1) domestic wells, 2) stock/domestic and 3) stock wells with a permitted capacity greater than 25 gallons per minute. This use designation is also used for rural commercial establishments, cemeteries, golf courses, dewatering, and uses that do not fit other defined water right categories.

* Miscellaneous Surface Water Diversions-There is no formal "miscellaneous" permit category for surface water diversions within the WSEO. However, permits for surface water diversions are issued for recreational, commercial, and other uses that do not fit under the irrigation, municipal or industrial permitting categories.

* Fish and Recreation Reservoirs-This designation is used for impoundments that serve fish propagation, wetlands development, golf courses, and aesthetic purposes. Small reservoirs in this category are treated like stock reservoirs in that there is a

simplified water right permitting process if the proposed storage capacity does not exceed 20 acre feet or the proposed dam height does not exceed 20 feet. If the proposed project exceeds these limitations, the water user must undergo a more detailed permitting process.

There is no annual water use information available on stock watering reservoirs or the miscellaneous uses described above. The Benchmark for these water uses is based on their water rights. Tabulations of the water rights issued on or before July 1, 1997 for these uses have been developed. If one of these water users wants to replace or modify their water supplies, the depletions resulting from those projects would be considered existing water related activities if they do not increase the depletions beyond those that occurred from 1992 through 1996. If the projects result in depletions beyond this threshold, the excess depletions would be considered new water related activities.

I.C.2. Reporting of Existing Water Related Activities-Baseline No. 2

Wyoming will generate an annual report to describe its water use during the previous water year. The depletions from the annual water use will be compared against the Benchmarks. Overruns and under-runs to these Benchmarks will be quantified. The effects of the overruns and under-runs will be translated to the state line using the tracking factors described in Attachment I. If it cannot be demonstrated that there were sufficient under-runs to offset the overruns, Wyoming will be responsible for mitigating the effects of the net overruns at the state line in the manner described in subsection I.C.3 of this chapter.

In circumstances where water related activities shift among various categories, but depletions remain within baseline quantities, it may be necessary to modify the Benchmarks under Baseline No. 2. For example:

I.C.2.a. Changes in water use may occur formally, as water right transfers. Under Wyoming law, the consumptive use from the use of existing water rights can be transferred to new or different beneficial uses. These changes of use are reviewed and approved by the Wyoming Board of Control (WBOC). These transactions do not increase depletions and are not new water related activities subject to mitigation. However, these changes of use may result in modified Benchmarks under Baseline No. 2.

I.C.2.b. Similarly, but without an explicit water right transfer, if an existing water use becomes obsolete and there is evidence that the use occurred in the 1992-1996, an alternative use may be substituted and thus be covered by Wyoming's Depletions Plan and the PRRIP. These substitutions may be made between Benchmarks in those categories under Baseline No. 2. For example, a municipality may increase its service area and, as a result, use of individual domestic wells may decline. The Benchmark for the municipality should increase, while the Benchmark for rural domestic water use would decrease. The standard for such substitutions will be to ensure that reassigning the use between Categories and Benchmarks will not increase overall depletions.

Data and information used to develop the benchmarks under Baseline No. 2 will be provided for inclusion in PRRIP files. Wyoming's annual reports will advise the Governance Committee of any changes to the Benchmarks.

I.C.3. Mitigation of Excess Depletions-Baseline No. 2

There are differences between excess existing water related activities and new water related activities. In general, if an existing water related activity baseline is exceeded, it will typically be a one-time event or a limited number of sporadic events caused by above-average water supply conditions. New water related activities result in the depletion of additional water on a regular basis. Section II of Chapter Two of this plan describes how new water related activities will be reported and mitigated.
The following describes how Wyoming would mitigate excesses to the existing water related activities Baseline No. 2.

Wyoming will annually monitor and report water uses covered by Existing Water Related Baseline No. 2 in the manner described in Section I.C of Chapter 2 of the depletions plan. The depletions from annual water use will be compared against the Benchmarks included under this baseline. Overruns and under-runs to these Benchmarks will be quantified. The effects of overruns and under-runs will be translated to the state line using the methods described in Attachment I for irrigation season and non-irrigation season overruns and under-runs. If the overruns are not offset by under-runs, Wyoming will provide a mitigation plan for the review and approval of the Governance Committee. The mitigation plan will:

I.C.3.1. Identify the net overruns at the state line that occurred in the irrigation season and offer a means to replace those overruns in the irrigation season of the year following the year the overruns occurred.

I.C.3.2. Identify the net overruns at the state line that occurred in the non-irrigation season and offer a means to replace those overruns in the non-irrigation season of the year following the year the overruns occurred. It may be necessary to time replacement water during September for excess or new depletions that impact flows at the state line in the non-irrigation season because Guernsey Dam on the North Platte River, the Wheatland Irrigation District's dams on the Laramie River, and the Hawk Springs Dam on Horse Creek are basically closed in the non-irrigation season.

If there is a system spill routed over or through Guernsey Dam or Kingsley Dam, Wyoming reserves the right to present evidence to the Governance Committee that Wyoming's excess depletions did not adversely affect the program purposes identified in subsection I.A.4 of the Program Document and that replacement water is not required or could be reduced. A finding by the Governance Committee that the replacement of excess depletions is not necessary or could be reduced will have precedence over any mitigation described in this depletions plan.

II. New Water Related Activities

II.A. Description

"New water related activities" are defined in subsection II.G of Chapter 1.

II.B. Interim Depletions Mitigation Plan

Wyoming has provided annual reports to the Governance Committee relating to water right permitting activities that have occurred since July 1, 1997. The WSEO has advised anyone seeking new water rights of the proposed PRRIP and that mitigation may be required for new depletions occurring after July 1, 1997.

Wyoming will review the permitting activities and pertinent water use information to quantify any new depletions that commenced between the beginning of the 1997 water year (October 1, 1996) and the end of the 2007 water year (September 30, 2007). Wyoming will also determine if the existing water related baselines are being exceeded by existing water related activities in the year the PRRIP is implemented. An "Interim Depletions Mitigation Plan" (IDMP) will be provided to the Governance Committee. The IDMP will quantify new and excess depletions and propose a mitigation plan for those depletions. The Governance Committee must approve the IDMP before any required mitigation is implemented.

II.C. State Evaluations of New Water Related Activities

New water related activities that are not subject to a consultation with the FWS under section 7(a)(2) of the ESA will undergo state evaluations. Wyoming will use the following process to define, quantify, and mitigate new water related activities:

II.C.1. The Wyoming State Engineer's Office (SEO) is responsible for the following activities related to water rights: 1) appropriation (permitting); 2) adjudication (confirmation of beneficial use by the Wyoming Board of Control (WBOC) and issuance of certificates); 3) amendments (changes to water rights as approved by the WBOC); and 4) administration (regulation under the prior appropriation doctrine). The SEO and WBOC will decide whether permits for new water rights should be approved. These decisions will consider compliance with Wyoming law and the Modified North Platte Decree, as well as impacts to other appropriators. The determination as to whether approval of permits for new water right related activities should be granted is independent of this depletions plan.

II.C.2. If the Surface Water or Groundwater Divisions of the SEO concludes that a permit for a new water right related activity should be approved, the State Coordinator will be provided a copy of the permit application and any other pertinent information. The Administrator will complete the following initial review:

II.C.2.a. If it is evident that the new water related activity will not increase depletions, the State Coordinator will document that there are no new depletions associated with the activity for potential future reporting related to the depletions plan. Examples of such activities are changes of use approved by the Wyoming Board of Control (WBOC) or Wyoming State Engineer (WSE) or replacement of an existing water supply that was active in 1992 through 1996. The documentation could be in the form of a copy of the order by the WBOC or WSE, a copy of a permit condition, an affidavit or other evidence documenting that the project is a replacement for an existing water related activity that has been or will be abandoned.

II.C.2.b. If it is apparent that the new water right activity will result in increased depletions, the State Coordinator will estimate the associated increase in depletions that would occur in the irrigation season and non-irrigation season using information on the application for the water right and, if necessary, additional information provided by the proponent. As an alternative, the SEO may require the proponent to complete a form that would accompany the applications for new water rights that would provide the State Coordinator information from which to determine the increased depletions and other information that would be helpful in the deliberations relating to this depletions plan.

II.C.3. The State Coordinator will contact the proponent of the new water right activity to determine if that proponent has existing uses in the same sub-basin as the new depletion that could be transferred or retired to offset anticipated new depletions that would occur during the irrigation season and non-irrigation season, respectively. If the proponent cannot offset new depletions in this manner, they will be advised that mitigation will be required. The mitigation may be achieved through the following processes:

II.C.3.a. The proponent may be allowed to participate in the Wyoming Water Bank, described below.

II.C.3.b. If the new depletions cannot be covered by the Wyoming Water Bank, the proponent will be required to submit a mitigation plan to the Administrator. The plan must document the means by which the increased depletions would be mitigated. The State Coordinator will receive and review the plans and submit the plan to the Surface Water or Groundwater Divisions to determine what, if any, permitting actions are required to implement the plan.

II.C.4. If the increased depletions can be mitigated as described above, a Recovery Agreement will be developed and executed by the project proponent and the State Coordinator. The State Coordinator will notify the appropriate permitting division within the SEO. The division may condition authorization for the new water right to ensure compliance with the approved means of mitigation.

II.D. Mitigation for New Water Related Activities

The following mitigation process will be used for the following: 1) new water related activities undergoing state evaluations, or 2) new water related activities with a federal nexus in which the FWS has approved the use of this process in the manner described in Section III of Chapter 1 of this plan. In either event, the mitigation responsibilities under the PRRIP are described in subsection I.A.4 of the Program Document. The mitigation must occur in the manner and to the extent described in subsection III.E.3 of the Program Document and this depletion plan.

Wyoming will meet its obligations to the PRRIP by translating the net depletions from new water related activities and the benefits from the corresponding point of mitigation to the Wyoming/Nebraska state line using the tables in Attachment I with one notable exception. If the delivery of replacement water is protected by state water law, the conveyance losses established by the SEO will be used to translate the benefits of the replacement water at the state line. The impacts of new water related activities occurring at the state line in the irrigation season must be mitigated during the same irrigation season and the impacts of new water related activities occurring in the non-irrigation season must be mitigated in the same non-irrigation season. However, it may be necessary to time replacement water during September for excess or new depletions that impact flows at the state line in the non-irrigation season because Guernsey Dam on the North Platte River, the Wheatland Irrigation District's dams on the Laramie River, and the Hawk Springs Dam on Horse Creek are basically closed in the non-irrigation season.

If there is a system spill routed over or through Guernsey Dam or Kingsley Dam, Wyoming reserves the right to present evidence to the Governance Committee that depletions from Wyoming's new water related activities did not adversely affect the program purposes identified in subsection I.A.4 of the Program Document and that mitigation is not required or could be reduced. A finding by the Governance Committee that mitigation of new depletions is not necessary or could be reduced will have precedence over any mitigation described in this depletions plan.

Mitigation for depletions from new water related activities will be provided in the following manner:

II.D.1. Wyoming Water Bank

The State of Wyoming will administer a Wyoming Water Bank (WWB). Project proponents, including federal agencies, may be allowed to participate in the WWB if it is determined that the WWB has sufficient assets to accept the responsibility for mitigating the depletions for the term of the PRRIP and potential future increments of the PRRIP. Federal agencies' participation in the WMDP will be limited to a total of 350 acre feet per year, unless increased participation is approved by the State Coordinator, in consultation with the Director of the Wyoming Water Development Office (Director). WWB assets may include the following:

II.D.1.a. The State Coordinator will maintain a tabulation of abandoned, obsolete or reduced depletions that were considered under existing water related activities baselines. Reduced depletions may result from water right abandonment actions or the simple retirement of an existing water use. Examples of activities that may result in decreased depletions include a reduction in irrigated acreage due to revised operations, the down-sizing of an industrial facility or the conversion of irrigated lands for subdivisions or other less depletive activities. If the tabulation of obsolete or reduced depletions indicates there have been sufficient reductions under the existing water related baselines to offset the depletions from the new projects, the new projects may be covered by the WWB. If the State Administrator concludes that there are not sufficient reductions under the existing water related baselines to offset the depletions from new projects, the Director will be consulted to determine if there is sufficient replacement water available to offset the depletions as per subsection II.D.1.b.

II.D.1.b. The Wyoming Water Development Office (WWDO) will maintain an inventory of replacement water supplies. Storage water available through an existing water related activity, such as existing reservoirs in Wyoming, or the delivery of new water to the system, such as imported water or non-hydrologically connected groundwater, could be used as a replacement supply. Water available from the Wyoming Account in the Pathfinder Modification Project and Wyoming's allocation of Glendo storage water will not be considered a replacement water option for new water related activities as it is needed for other purposes.

Prior to the beginning of each water year, the State Coordinator and the Director will make a determination of the obligations the WWB could accept for the following water year. Initially, the WWB may only be able to serve projects with very small depletions like domestic wells or stock watering reservoirs. If the WWDO is successful in securing replacement water or there are considerable reductions in depletions covered by the existing water related baselines, the WWB may be capable of serving projects with larger depletions in the future.

II.D.2. Activities outside the WWB

Wyoming will require proponents of projects not covered by the WWB to provide project specific mitigation. A mitigation plan identifying the proposed replacement supply must be provided for review and approval. The following describes the alternate means in which mitigation may be provided by a project proponent:

II.D.2.a. An existing water related activity covered under the existing water related activity baseline in the same river reach as the new depletion could be transferred or retired. For example, if a project proponent wants to implement a new project, the proponent could retire an existing water use that depletes water in the same quantity as the new project if the timing of the retired depletions at the state line would have occurred in the same irrigation or non-irrigation season as the depletions from the new project. As previously noted in II.C.3, project proponents will be encouraged to pursue this alternate if possible.

II.D.2.b. An activity covered under the existing water related activity baseline but within a different river reach as the new depletion could be retired. Both the effects of the new depletion and the benefits of the retired water related activity would be translated to the WY/NE state-line to ensure the depletion is effectively replaced. Replacement water achieved from simply retiring an existing use cannot be protected under state water law, so the depletions and benefits will be translated to the state line using the tables in Attachment I.

(Note: Under II.D.2.a.or II.D.2.b above, project proponents cannot seek involuntary abandonments of water rights and propose that, if successful, the resulting reductions in depletions can be used as mitigation for their projects.)

II.D.2.c. The project proponent could elect to provide replacement water by acquiring storage water available under the existing water related baseline, such as existing reservoirs in Wyoming, or the delivery of new water to the system, such as imported water or non-hydrologically connected groundwater. The project proponent would have the following options:

II.D.2.c.i Simply release and measure the water entering a stream or river under the assumption that it will not be protected under Wyoming water administration. Under this option, the effects of the new depletions and the benefits of the replacement supply must balance at the WY/NE state line using the tables in Attachment I.

II.D.2.c.ii. Seek protection of the delivery of the replacement water to the WY/NE state line. Under this option, the effects of the new depletion at the state line would be calculated using the tables in Attachment I. However, the replacement supply would be assessed losses (conveyance and other) imposed by the Wyoming State Engineer's Office from the point of delivery to the stream or river to the WY/NE state line.

II.D.2.c.iii. Seek protection of the delivery of the replacement water from the state line to the Lewellen gage upstream of Lake McConaughy in Nebraska from the State of Nebraska.

II.D.3. Groundwater Wells

The definition of non-hydrologically connected groundwater wells is provided in Chapter 1, subsection II.I. Attachment No. II to this depletions plan includes maps of areas in which wells are classified as not hydrologically connected and provides a description of the methodology used to develop them. Groundwater wells within these areas are categorically excluded as new water related activities and are exempt under this plan due to lack of hydrological connection. If wells fall outside the areas depicted on the map, the project proponents or State Coordinator may complete analyses of hydrological connection to determine if the wells meet the criteria for non-hydrologically connected wells. Proponents of new groundwater projects, in which the wells are determined to be hydrologically connected, may elect to assume the water pumped has the same effects as a surface water diversion or may complete groundwater modeling to determine actual effects on surface water. The annual report to the Governance Committee will include a map depicting those new wells with a permitted capacity of 500 gpm, or greater, that are considered non-hydrologically connected during the reporting period.

II.D.4. Reporting

Wyoming will annually report to the Governance Committee the new water related activities and the manner in which the depletions were addressed. The report will address the new depletions in each sub-basin and water use category. The Governance Committee may review the annual report and seek clarifications and modifications if it is deemed that Wyoming is not complying with sub-section III.E.3 of the Program Document.

CHAPTER 3-SOUTH PLATTE RIVER BASIN, WYOMING

I. Existing Water Related Activities

I.A. Description

The major streams in Wyoming's South Platte River Basin (SPRB) are Crow Creek, which flows into Colorado, and Lodgepole Creek, which flows into Nebraska. Both of these streams are dry at the respective state lines, except during periods of peak flows, which occur during the spring runoff or flash floods.

The City of Cheyenne receives a portion of its water supply from direct flow diversions and storage reservoirs in the upper Crow Creek drainage. When surface water could no longer meet its demands, the city turned to groundwater and, ultimately, developed the Cheyenne Stage I and Stage II projects.

The Cheyenne Stage I and Stage II Projects consist of a collection and transmission system in the Little Snake River Drainage within the Upper Colorado River Basin. The system collects stream flows in the Little Snake River Drainage and delivers them to a tunnel that transports the water under the continental divide to Hog Park Reservoir in the North Platte River Basin. Storage in Hog Park Reservoir is released to replace water stored in Rob Roy Reservoir or diverted by other supply components of the Stage I and Stage II projects located in the Douglas Creek Drainage in the NPRB. The water released from the Rob Roy supply system is delivered by gravity to Cheyenne's reservoirs in the Upper Crow Creek drainage in the SPRB.

From 1970 to 1997, Cheyenne's use of the Stage I and Stage II projects supplemented the flows of Crow Creek through return flows from the use of trans-basin water by an average of approximately 3,000 acre feet per year. None of this return flow arrives at the Colorado state line due to intervening agricultural water use. As Cheyenne continues to grow, there will be more demands placed on the Stage I and Stage II projects, which will result in increased return flows to Crow Creek. Whether this increased return flow will arrive at the state line is irrelevant. If the return flow arrived at the state line, it would be considered an accretion rather than a depletion. It would take extraordinary efforts to protect any such accretions to serve the PRRIP.

In Wyoming, importers of water, such as the City of Cheyenne, have the right to fully deplete their imported water subject to the development of a monitoring plan approved by the WSEO. Therefore, the City may find a use for the water that returns to Crow Creek. However, this future activity will not affect the existing water related baseline, because none of the return flow left Wyoming prior to July 1, 1997.

I.B. Existing Water Related Activities Baseline

Under Wyoming's Depletion Plan, the existing water related activities Baseline for water leaving the SPRB in Wyoming for most of the water use categories is zero. For several years prior to July 1, 1997, water passed the state lines only during some spring runoffs or large rainfall events. The only water use category that could impact these events would be the construction or enlargement of reservoirs to store what little natural flow is passing the state lines. Therefore, the Benchmark for the SPRB will be the existing reservoir capacity as of July 1, 1997, as evidenced by water rights and field inspections.

II. New Water Related Activities

Due to the limited availability of storable natural flow and cost of construction of storage facilities, it is unlikely that reservoirs proposing to store natural flow in the SPRB will be constructed in Wyoming. If reservoirs were proposed, they would likely fall under the federal nexus and a consultation with the FWS would be required. In the unlikely event that a reservoir is proposed that falls outside the federal nexus, Wyoming will complete a state evaluation in the manner described in subsection II.C of Chapter 2 of this depletions plan. If the project undergoes a separate state evaluation, the standard for mitigation is described in subsection I.A.4 of the Program Document. The mitigation must occur in the manner and to the extent described in subsection III.E.3 of the Program Document and this depletions plan.

Attachment No. I
Wyoming's Depletions Plan
Tracking of Depletions and Accretions

Wyoming is committed to comply with Section III.E.3 of the Program Document through the implementation of Wyoming's Depletions Plan. However, Wyoming has long contended that new depletions in Wyoming will have very little effect on the occurrence or magnitude of FWS target flows at the critical habitat or the effectiveness of the Program in reducing shortages to those target flows. Further, Wyoming has consistently requested that the Governance Committee prepare an "analytical tool" that could be used to track the impacts of depletions on the program purposes identified in Section I.A.4 of the Program Document.

The following presentation is offered as an "interim tool" with the understanding that time constraints will not allow the development of the "analytical tool" before the Program must be approved for implementation and the understanding that the Governance Committee will develop and approve such an "analytical tool" as soon as possible during the first increment of the Program.

The interim tool would be used in the Wyoming Depletions Plan for the following purposes:

1. Calculating the effects of overruns and the benefits of under-runs relating to the various Benchmarks under Existing Water Related Baseline No. 2 at the Wyoming/Nebraska state line.

2. Determining the amount of retired water use that would be necessary to offset new water related activities to allow those new water related activities to be covered by an existing water related baseline.

3. Calculating the amount of unprotected replacement water that would be necessary to offset new water related activities that cannot be covered by an existing water related baseline.

This "interim tool" is based on the assumption that balancing the effects of depletions and the benefits of accretions at the Wyoming/Nebraska state line mitigates the impacts of excess depletions and new water related activities in Wyoming on FWS target flows and maintains the effectiveness of the Program in reducing shortages to those target flows. Balancing the effects and benefits at the Wyoming/Nebraska state line suggests that, in Nebraska, if the depletions had not occurred, flows would have incurred the same losses from the state line to the habitat as unprotected replacement water supplies and, therefore, the program purposes are met. However, if there is a system spill routed over or through Guernsey Dam or Kingsley Dam, Wyoming reserves the right to present evidence to the Governance Committee that any excess depletions or new water related activities in Wyoming did not adversely affect the program purposes that mitigation is not required or could be reduced in the year the spill occurred.

In order to balance the effects and benefits at the Wyoming/Nebraska state line, it must be recognized that the storage water delivered to the Guernsey-State Line reach from the federal reservoirs approximates 75% to Nebraska and 25% to Wyoming. In addition, the Modified North Platte Decree (Decree) apportions the natural flow in the irrigation season (May 1 through

September 30) in the reach 75% to Nebraska and 25% to Wyoming. Nebraska's share of water is diverted at the Whalen Diversion Dam into the Interstate or Gering-Fort Laramie Canals; at a diversion just upstream of the state line into the Mitchell Canal; or at the Tri-State Diversion Dam, just downstream of the state line. The system is operated to ensure that no water passes the Tri-State Diversion Dam with the exceptions of system spills and some minor storage deliveries. Therefore, the only way to balance the effects or benefits at the Wyoming/Nebraska state line of the three activities described above is to make the balance point the Guernsey-State Line reach as flows arriving in this reach will automatically divided 75% to Nebraska and 25% to Wyoming.

Tables I and II serve to track the effects of depletions and the benefits of accretions in the sub-basins within the North Platte River Basin (NPRB) in Wyoming to the Guernsey- State Line reach during the irrigation season (May 1 through September 30) and the non-irrigation season (October 1 through April 30), respectively.

The tables were developed to estimate the amount of water that would arrive at the Guernsey to State Line reach if the depletions had not occurred and the amount of water that would arrive at the reach if there were under-runs to baselines, retirement of existing water uses, or replacement water was provided but not specifically protected by Wyoming water administration.

The tables recognize that Guernsey Dam on the North Platte River, the Wheatland Irrigation District's dams on the Laramie River, and the Hawk Springs Dam on Horse Creek are basically closed in the non-irrigation season. Therefore, the tables assume that depletions that occur in the non-irrigation season above these dams do not show up at the Guernsey-State Line reach until the dams begin releasing water in the irrigation season.

A. Overruns/Under-runs to Existing Water Related Baseline No. 2

Wyoming will annually monitor and report water uses covered by Existing Water Related Baseline No. 2 in the manner described in Section I.C of Chapter 2 of the depletions plan.

The depletions from annual water use will be compared against the Benchmarks included under this baseline. Overruns and under-runs to these Benchmarks will be quantified. The effects of overruns and under-runs will be translated to the state line using the tracking factors in Tables I and II for irrigation season and non-irrigation season. If the overruns are not offset by under-runs, Wyoming will provide a mitigation plan for the review and approval of the Governance Committee. The mitigation plan will:

1. Identify the net overruns at the state line that occurred in the irrigation season and offer a means to replace those overruns in the irrigation season of the year following the year the overruns occurred.

2. Identify the net overruns at the state line that occurred in the non-irrigation season and offer a means to replace those overruns in the non-irrigation season of the year following the year the overruns occurred.

The mitigation plans will be specific to each occurrence of excess depletions to Existing Water Related Baseline No. 2. If the mitigation plan proposes to mitigate the excess depletions with natural flow, Tables I and II may be an appropriate tool to quantify the benefits in the Guernsey-State Line reach. If the mitigation plan proposes to mitigate the excess depletions with storage water, it may be protected by Wyoming water administration and administered to arrive at the Wyoming/Nebraska state line rather than just the Guernsey-State Line reach and Tables I and II would not be applicable. In either event, the mitigation plans would be subject to review and approval by the Governance Committee.

B. Retirement of Existing Water Uses to Offset New Water Related Activities

Section II.D of Chapter 2 of Wyoming's Depletions Plan explains that new water related activities can be mitigated by retiring an existing water related activity covered by a baseline. The following examples are offered to explain how the tables could be applied to alternative retirement plans for the development of a hypothetical new subdivision in the Upper Laramie River sub-basin that will deplete 100 acre feet of water per year (60 acre feet in the irrigation season and 40 acre feet in the non-irrigation season).

1. The developer could acquire and permanently retire irrigated lands in the Upper Laramie River sub-basin that are included under the existing water related baseline. However, the benefits of retiring irrigated land occur in the irrigation season. Review of Tables I.E and II.C indicate that the effect of depletions in the non-irrigation season have twice the effect at the Guernsey-State Line reach as depletions in the irrigation season.

The following calculations quantify the amount of water needed at the Guernsey-State Line reach to offset the effects of the new subdivision in the Upper Laramie River sub-basin.

Irrigation season effects = 60 acre feet x 0.25 (Table I.E)	=	15.0 acre feet
Non-irrigation season effects = 40 acre feet x 0.50 (Table II.C)	=	<u>20.0 acre feet</u>
Effects at the Guernsey-State Line reach		35.0 acre feet

Due to the intervening reservoirs, the effects of the depletions resulting from the subdivision in the Upper Laramie River basin in both the irrigation and non-irrigation seasons arrive at the Guernsey-State Line reach during the irrigation season. Therefore, retiring irrigated lands, an irrigation season depletion, serves to mitigate the total effects of the subdivision at the reach in terms of quantity and timing under this particular example. The following calculation quantifies the amount of water needed in the Upper Laramie River basin to provide 35 acre feet at the Guernsey-State Line reach in the irrigation season.

Replacement needed = 35 acre feet/0.25 (Table I.E) = 140.00 acre feet

Therefore, the developer could acquire and permanently retire irrigated lands that consumed 140 acre feet of water per year. At a consumptive use rate of 0.79 acre feet/acre, 177 acres would have to be retired in the Upper Laramie River sub-basin.

2. The developer will be encouraged to mitigate new water related activities in the river reach in which the resulting depletions will occur. However, if there are no implications to intervening water rights or those implications are mitigated, the developer may propose to retire water use in another river reach. For example, assume the developer proposes to acquire and permanently retire irrigated land in the Guernsey to State Line sub-basin that is included under the existing water related baseline.

The following calculations quantify the amount of water needed at the Guernsey-State Line reach to offset the effects of the new subdivision in the Upper Laramie River sub-basin.

Irrigation season effects = 60 acre feet x 0.25 (Table I.E)	=	15.0 acre feet
Non-irrigation season effects = 40 acre feet x 0.50 (Table II.C)	=	20.0 acre feet
Effects at the Guernsey-State Line reach		35.0 acre feet

Due to the intervening reservoirs, the effects of the depletions resulting from the subdivision in the Upper Laramie River basin in both the irrigation and non-irrigation seasons arrive at the Guernsey-State Line reach during the irrigation season. Therefore, retiring irrigated lands, an irrigation-season depletion, serves to mitigate the total effects of the subdivision at the reach in terms of quantity and timing under this particular example. The following calculation quantifies the amount of water needed in the Guernsey to State Line sub-basin to provide 35 acre feet in the irrigation season.

Replacement needed = 35.0 acre feet/1.00 (Table I.D)	=	35.0 acre feet

Therefore, the developer could acquire and permanently retire irrigated lands in the Guernsey to State Line sub-basin that consumed 35 acre feet of water per year. At a consumptive use rate of 1.31 acre feet/acre, 27 acres would have to be retired.

C. Unprotected Replacement Water to Offset New Water Related Activities

The developer, discussed in the examples in B. above, could purchase 100 acre feet of storage water per year from a reservoir in the Upper Laramie River sub-basin that is an existing water related activity and release 60 acre feet of the water in the irrigation season and 40 acre feet of water in the non-irrigation season into the river system without the benefit of protection under water administration. As the released replacement water is in the same sub-basin as the new water related activity, the effects of the depletions and the benefits of the replacement will be the same at the Guernsey-State Line reach and the loss factors in the tables do not have to be considered.

The developer will be encouraged to mitigate new water related activities in the river reach in which the resulting depletions will occur. However, if there are no implications to intervening water rights or those implications are mitigated, the developer may propose to provide unprotected replacement water in a different water reach. The tables would be used as part of the evaluation of such proposals. The term "unprotected" is used to suggest that the water would not be protected under Wyoming water administration but would be considered natural flow that could be used by intervening appropriators. Unprotected replacement water could be achieved by simply releasing and measuring water into a stream or river under the assumption that it will not be protected under Wyoming water administration.

If replacement water is protected by Wyoming water administration, the tables are not applicable, as losses assessed by the Wyoming State Engineer's Office for each specific project would prevail. For the replacement water to be protected, it will need to be storage water. If the replacement/storage water is to be protected, it may be administered to arrive at the Wyoming/Nebraska state line rather than just the Guernsey-State Line reach.

Table I-Tracking One (1) Acre Foot of Depletion or Accretion Irrigation Season

A. Above Pathfinder Reservoir (Main Stem)-Irrigation season

Reach	Use/Reach	Remaining Flow	Comments
Above Pathfinder	5%	0.95	Conveyance loss (12% for total reach)
Pathfinder to Guernsey	5%	0.90	Conveyance loss
Effects @ Guernsey-State Line		**0.9**	Irrigation season

B. Pathfinder to Guernsey Reservoir (Main Stem)-Irrigation season

Pathfinder to Guernsey	2.5%	0.975	Conveyance loss (5% for total reach)
Effects @ Guernsey-State Line		**0.975**	Irrigation season

C. Above Guernsey Reservoir (Tributaries)-Irrigation Season

Above Guernsey	50%	0.50	Use and conveyance loss within reach
Effects @ Guernsey-State Line		**0.50**	Irrigation season

D. Guernsey Reservoir to State Line-Irrigation season

Effects @ Guernsey-State Line		**1.00**	Irrigation season

E. Upper Laramie-Irrigation season

Above Wheatland Res.	50%	0.50	Use and conveyance loss within reach
Wheatland ID (WID)	50%	0.25	Use and conveyance loss within reach
Grayrocks Reservoir	0%	0.25	Assumes direct bypasses
Effects @ Guernsey-State Line		**0.25**	Irrigation season

F. Lower Laramie-Irrigation season

Above Grayrocks	50%	0.50	Use and conveyance loss within reach
Grayrocks Reservoir	0%	0.50	Assumes direct bypasses
Effects @ Guernsey-State Line		**0.50**	Irrigation season

G. Horse Creek-Irrigation season

Horse Creek	100%	0.00	There is no flow from HC during the irrig. season.
Effects @ Guernsey-State Line		**0.00**	Irrigation season

Table II-Tracking One (1) Acre Foot of Depletion or Accretion
Non-Irrigation Season

A. Above Pathfinder Reservoir-Non-irrigation season

Reach	Use/Reach	Remaining Flow	Comments
1. Pathfinder in priority			
Above Pathfinder	2.5%	0.975	Conveyance loss (5% for total reach)
Pathfinder-Guernsey	5%	0.93	Conveyance loss-Water released in irrigation season
Effects @ Guernsey-State Line		**0.93**	Irrigation season*
2. Seminoe in priority			
CAID/Casper Canal	50%	0.50	Water released/used in irrigation season
Effects @ Guernsey-State Line		**0.50**	Irrigation season*

B. Pathfinder to Guernsey Reservoir-Non-irrigation season

Stored in Guernsey		1.00	
Effects @ Guernsey-State Line		**1.00**	Irrigation season*

C. Upper Laramie-Non-irrigation season

Stored in Whtld. Res.		1.00	
Wheatland I.D. (WID)	50%	0.50	Water released/used in irrigation season
Grayrocks Reservoir	0%	0.50	Assumes direct bypasses
Effects @ Guernsey-State Line		**0.50**	Irrigation season*

D. Lower Laramie-Above Grayrocks

Stored in Grayrocks		1.00	
Grayrocks Reservoir	0%	1.00	Assumes direct bypasses
Effects @ Guernsey-State Line		**1.00**	Non-irrigation season

E. Horse Creek-Above Hawk Springs Reservoir-Non-irrigation season

Stored in Hawk Springs		1.00	
Below Hawk Springs Res.	100%	0.00	Water released/used in irrigation season
Effects @ Guernsey-State Line		**0.00**	Irrigation season*

F. Below Guernsey, Grayrocks, and Hawk Springs Reservoirs-Non-irrigation season

Effects @ Guernsey-State Line		**1.00**	Non-irrigation season

* Depletions and accretion in the non-irrigation season translate to effects at the Guernsey-State Line during the irrigation season due to the intervening reservoirs.

Attachment II
Wyoming's Depletions Plan
Groundwater Areas Not Considered to be Hydrologically Connected

Introduction

Attachment 5, Section 7 to the Platte River Recovery Implementation Program is the "Depletions Plan, Platte River Basin, Wyoming", known as "Wyoming's Depletion Plan". Chapter 1, Sec.II.I. provides criteria for the designation, "hydrologically connected", and exempts groundwater development that does not meet these criteria from the provisions of the Depletion Plan:

> Hydrologically connected groundwater well - A well so located and constructed that if water were withdrawn by the well continuously for 40 years, the cumulative stream depletion would be greater than or equal to 28% of the total volume of groundwater withdrawn from that well. Use from groundwater wells in Wyoming that are not hydrologically connected does not effect the purposes of the PRRIP, is not a new water related activity, and requires no mitigation.

Chapter 2, Sec. II.D.3. of Wyoming's Depletion Plan references maps of areas determined to be not "hydrologically connected" with respect to groundwater development, and explains the use of those maps in the categorization and accounting of groundwater wells:

> The definition of non-hydrologically connected groundwater wells is provided in Chapter 1, subsection II.I. Attachment No. II to this depletions plan includes maps of areas in which wells are classified as not hydrologically connected and provides a description of the methodology used to develop them. Groundwater wells within these areas are categorically excluded as new water related activities and are exempt under this plan due to lack of hydrological connection. If wells fall outside the areas depicted on the map, the project proponents or State Coordinator may complete analyses of hydrological connection to determine if the wells meet the criteria for non-hydrologically connected wells. Proponents of new groundwater projects, in which the wells are determined to be hydrologically connected, may elect to assume the water pumped has the same effects as a surface water diversion or may complete groundwater modeling to determine actual effects on surface water. The annual report to the Governance Committee will include a map depicting those new wells with a permitted capacity of 500 gpm, or greater, that are considered non-hydrologically connected during the reporting period.

The definition of "hydrological connection" in Wyoming's Depletion Plan was adopted from criteria included in the Modified North Platte Decree to govern the accounting of irrigated acreage. Acreage irrigated from wells determined to be not hydrologically connected was excluded from the Decree limitations on irrigation in the lower-Laramie River Basin and in the North Platte River Basin above Guernsey Dam. As a screening tool to assist the Wyoming State Engineer's Office in the consideration of future irrigation well applications, the North Platte Decree Committee (NPDC) agreed to the preparation of maps of those areas for which additional analysis of hydrological connection would not be necessary. In these areas – called "exclusion area”, “area determined to not be hydrologically connected”, and, informally, “green area” – any future wells are presumed to not be hydrologically connected under the “28/40" criteria. Outside of the mapped areas, wells may or may not be hydrologically connected, but more detailed, site-specific investigations are required to adequately assess this issue.

The development of maps of exclusion areas in those portions of the North Platte River Basin subject to Modified North Platte Decree limitations is detailed in a series of technical memoranda developed by Wyoming in cooperation with the NPDC Groundwater Wells Subcommittee and subsequently approved by the NPDC for use in Modified Decree compliance reporting. Those memoranda are included with the minutes of the relevant NPDC meetings. They are cited below, in reference to their specific sub-basins, but are not repeated here. The following general discussion of the methodology, however, is drawn from those memoranda. The methodology, data sources, calculations, etc. approved by the NPDC have been extended to the rest of the North Platte Basin in Wyoming to complete Wyoming’s Depletion Plan.

Figure 1 provides a general location map for the North Platte River Basin and the individual sub-basins discussed below. Figures 2 through 5 present calculation details for those sub-basins (and portions of sub-basins) not previously examined by the NPDC. An appendix to this memo compiles the six individual sub-basin maps produced from the NPDC work and the present discussion.

Procedure

The basic approach to the definition of areas in which groundwater wells are presumed not to meet the Depletion Plan criteria for hydrological connection comes from the evaluation of stream depletion by the U.S. Geological Survey (USGS) as laid out in papers by Jenkins (1968). This technique uses a term called “stream depletion factor” (sdf):

$$sdf = d^2S/T$$

where (all parameters expressed in consistent units):

d = distance from well to stream
S = aquifer storativity (dimensionless)
T = aquifer transmissivity

The “sdf” parameter has units of days. It’s functional relationship with stream depletion is defined in equation and graphical form by Jenkins (1968).

The conceptual model behind this formulation is that of a linear stream with a well at the specified perpendicular distance from the stream, in an infinite, homogeneous, and isotropic aquifer, with both the well and the stream fully penetrating the aquifer. Drawdown in the system is assumed to be insignificant in relation to aquifer thickness, and the stream is assumed to have an unlimited water supply and no streambed resistance to groundwater flow.

Generally, to define exclusion areas, aquifer parameters are entered into the above equation and the distance parameter is calculated to define the "setback distance" where an sdf value corresponding with 28% depletion in 40 years is achieved. Areas beyond the setback distance are exclusion areas. Where area-wide groundwater modeling has been developed (e.g the lower-Laramie River Basin), and provides an integration of spatial variations in aquifer and stream parameters, such modeling is used in preference over the above, simplified approach. However, such models are rare in the North Platte Basin of Wyoming.

Obviously, this is a highly-generalized, screening-level approach to hydrogeologic conditions that can be quite complex in detail. The objective is to define areas for which additional analysis is not necessary to reasonably conclude that the depletive impact of a groundwater well would fall below the threshold of 28% in 40 years. Areas not so defined may or may not meet the "28/40" criteria, but more detailed study is deemed necessary to make that determination.

The conceptual model behind this method is inherently conservative, in the sense of over-predicting rather than under-predicting stream depletion (i.e. smaller rather than larger exclusion zones), and has generally been applied so as to enhance rather than compromise that conservatism. For example, where streams are accompanied by a high-permeability alluvial aquifer, setbacks have generally been calculated from the edge of the alluvial aquifer rather than from the stream channel, with the effect of increasing the setback distance by the width of the alluvial aquifer (i.e. as though the alluvial aquifer were infinitely permeable). Where pump test data provide a range of transmissivity or permeability values for a formation, the larger values generally have been used for setback calculation. Similarly, in the absence of specific data, a value of 0.1 is used as the default for the storage parameter, increasing setback distances over what would be calculated using the higher values typical of site-specific studies (e.g. 0.15, 0.23, 0.25). As a final step in the delineation of exclusion areas, setback distances are manually smoothed (either increasing the distance or leaving it unchanged in all cases) to provide qualitative compensation for multiple-stream effects.

In some cases, the boundaries of exclusion areas are defined stratigraphically rather than by setback distance calculations. For example, the large setback distances associated with high-permeability formations may be truncated where the lower contact of the formation outcrops if the underlying formation is of significantly lower permeability (i.e. rather than the large setback being extended on into the area of known low-permeability material). Such boundaries are indicated as "stratigraphic boundary" on the attached figures.

Portions of some sub-basins have not been evaluated for hydrological connection due to the character of the hydrogeology and stream system. This generally applies to areas in which aquifer materials have little primary permeability, so groundwater movement is dominated by fracture-producing structural features that may be ill-suited to the simplified analysis as homogeneous porous media. The primary example is the mountainous areas underlain by granites and other crystalline rocks. There, the perennial stream network is commonly sufficiently dense that the fracture systems necessary to provide useful groundwater production may also provide ready connection to nearby surface water. Areas for which evaluations have not been made are subject to the same qualification as cited above for all other locations not identified as in exclusion areas, i.e. groundwater wells in these areas may or may not meet the hydrologically-connected criteria, but more detailed, site-specific investigations are required to adequately assess this issue.

Following the procedures developed for the NPDC, the standard, USGS 1:100,000-scale map coverage is used to identify “perennial” streams. With exceptions as noted in the sub-basin by sub-basin discussions, setback distances are only considered for perennial streams that flow into the North Platte River or one of its tributaries. Streams in topographically closed basins or streams which lose their flow to evaporation/infiltration well before reaching the North Platte system are not considered avenues for North Platte River depletion. (The flow in intermittent streams is commonly a function of storm events rather than a connection with groundwater. The logic of generally excluding intermittent streams from consideration here is that if the groundwater table is significantly below the stream, stream losses are a function of streambed permeability, and are insensitive to changes in groundwater levels as would be caused by well development.)

Unless otherwise noted, all geologic contacts come from the statewide geologic mapping of Love and Christiansen (1985).

North Platte River Basin above Alcova Dam

This area falls within that portion of the North Platte River Basin subject to the irrigated acreage restrictions of the Modified North Platte Decree. Areas presumed not to meet the “28/40" hydrological connection criteria have been developed and approved by the NPDC for purposes of irrigated acreage accounting under the Decree. The details of that development are provided in the October 12, 2006 memo attached to the minutes of the October 17, 2006 NPDC meeting. The exclusion areas approved by the NPDC are adopted without modification for the PRRIP Wyoming Depletion Plan. These areas are presented on the attached map entitled, “Above Alcova Dam - North Platte River Basin Areas Not Hydrologically Connected” dated October 17, 2006.

North Platte River Basin between Alcova and Guernsey Dams

This area falls within that portion of the North Platte River Basin subject to the irrigated acreage restrictions of the Modified North Platte Decree. Areas presumed not to meet the “28/40" hydrological connection criteria have been developed and approved by the NPDC for purposes of irrigated acreage accounting under the Decree. The details of that development are provided in the April 13, 2004 memo attached to the minutes of the April 13, 2004 NPDC meeting. The exclusion areas approved by the NPDC are adopted without modification for the PRRIP Wyoming Depletion Plan. These areas are presented on the attached map entitled, “Alcova Dam to Guernsey Dam - North Platte River Basin Areas Not Hydrologically Connected” dated April 13, 2004.

Laramie River Basin above Wheatland Irrigation District Tunnel

This area falls outside that portion of the North Platte River Basin subject to the irrigated acreage restrictions of the Modified North Platte Decree. Thus, the methodology developed for the

NPDC for the areas outlined above has been applied to this area specifically for Wyoming's Depletion Plan. Setback distances, stratigraphic boundaries, and the assignment of exclusion areas so defined are presented on Figure 2. The exclusion areas are also presented on the attached map entitled, "Upper Laramie Basin Areas Not Hydrologically Connected" dated July 10, 2006. The following discussion provides the details of development.

Those portions of the upper Laramie River basin underlain by crystalline rocks (all rocks of Precambrian age) are excluded from the present analysis due to the high density of perennial streams, the fracture-dominated character of the permeability, and the unlikelihood of substantial groundwater development, as discussed in the "Procedure" section. (See "no analysis" designation on Figure 2.)

In areas adjacent to perennial streams, e.g. the downstream end of this basin, this same "no analysis" approach is taken to the Casper Fm. and underlying strata. (Due to the potential similarities in fracture conditions within the Forelle Limestone and the underlying Casper Fm., and to provide an additional margin of conservatism, the "top" of the Casper aquifer is here considered as the Forelle / Chugwater Fm. contact. This approach leaves the 250 ft. of strata in the Forelle and Satanka Shale (between the Forelle Lms. and the Casper Fm.) as a buffer against Casper Fm. depletions being transmitted to overlying strata.)

Upstream of the crystalline rocks of the Laramie Range (T22, R73), where the river runs across younger, sedimentary rocks, generalized transmissivities, storage coefficients, and the resultant sdf-calculated exclusion-zone setback distances are adopted for groups of hydrologically similar formations as developed by the NPDC analysis of adjacent North Platte sub-basins. Figure 2 presents the setback values (in ft.). (No applicable large-area groundwater modeling has been identified for the upper-Laramie basin.)

The following list presents the generalized setback values adopted from NPDC (2004) and NPDC (in preparation) for the various formations through which the Laramie River and its tributaries flow in this basin:

Formation(s)	Setback distance
Chugwater Fm.	2800 ft.
Sundance, Thermopolis, Mowry, Frontier	8300 ft.
Niobrara and Steele Shales	2800 ft.
Mesaverde	8300 ft.
Lewis Shale	2800 ft.
Hanna Fm.	13700 ft

Quaternary deposits in this basin vary from extremely-low permeability glacial moraine to well-sorted stream alluvium. However, the occurrence of thick deposits of high-permeability alluvium in the upper Laramie basin is relatively rare. Most of the extensive mapped Quaternary deposits (e.g. Love and Christiansen, 1985; 1:500,000-scale) form a relatively thin veneer over the bedrock which controls groundwater flow. Lowry et al. (1973) describe the Quaternary aquifer: "most of the deposits are thin and often occur in elevated positions, there is little or no saturation of most deposits shown on the map. Deposits near stream level generally contain some water ...". (Their map is quite similar to that of Love and Christiansen with respect to these deposits.) The sporadic geologic mapping available for the upper Laramie River basin at 1:25,000 scale (e.g. McAndrews, 1966) commonly shows the situation of bedrock units exposed in scattered outcrops where the thin Quaternary veneer has been stripped away.

To further investigate this issue, Statements of Completion filed with the Wyoming State Engineer's Office were reviewed for 41 individual wells located in the areas of Quaternary deposits mapped by Love and Christiansen (1985). These wells were selected to investigate the thickness of Quaternary deposits in areas for which there are no nearby bedrock outcrops, i.e. in those areas most likely to provide relatively thick unconsolidated deposits. This examination provided site-specific confirmation of the generalizations presented above. There is rarely more than 20 ft. of material above bedrock, and unless the well is beside a stream, that material is most commonly unsaturated. Many of the wells completed in the shallow sand and gravel deposits alongside the Laramie or Little Laramie River, however, are reported to be quite productive.

In addition, records for all water wells permitted for yields of 100 gpm or more that are not at locations obviously meeting the "hydrologic connection" criteria were individually examined. (The generally poor groundwater conditions in the upper Laramie Basin are indicated by there only being 12 wells with reported yields of 100 gpm or more that fall in the exclusion areas defined herein.) In all areas except one (discussed below), these wells are completed in locally productive bedrock strata rather than in unconsolidated surficial materials. For example, wells P295G and P371C, located in T15, R73W, Sec. 17 are on an exclusion area boundary line[1]. The lithologic log for the former describes "earth and clay" for the first 10 ft., then "rock" to the total depth of 85 ft. The latter well is 1629 ft. deep. In both cases, it is clear that the mapped surface deposit of Quaternary alluvium is not controlling groundwater production or hydrologic connections.

The exception cited in the previous paragraph is a group of "wells" (some are simply open pits) along the Pioneer Canal and the associated string of lakes in topographic depressions between T14, R76, Sec. 15 and T14, R75, Sec. 1. It is concluded that these wells are largely pumping irrigation seepage and return flows which would not otherwise return to the Laramie River.

Thus, to delineate areas of potentially hydrologically connected alluvial material in the upper Laramie River basin, larger-scale mapping (1:100,000) by the Wyoming Geological Survey has been consulted. From Hallberg and Case (2005) and VerPloeg and Boyd (2000) the "Alluvium" and "Alluvial deposits", respectively, have been extracted for identification of exclusion area setbacks. Mapped setbacks are the greater (further from the stream) of 1) the extent of the mapped deposits of alluvium; or 2) the setback calculated based on the underlying bedrock as listed above.

Checking this approach against individual well data indicated that well P394G (T16, R75, Sec. 8) had been inappropriately classified. The lithologic log for this well reports 30 ft. of gravel,

---

[1]Well locations are based on Wyoming State Engineer's Office Statements of Completion. These documents list only the permitee-supplied 1/4, 1/4 Section, the center of which is assumed as the well location for the present analysis.

from which a yield of 300 gpm is obtained. Thus, in the area west of the Steele Shale ridge in the northwest portion of the Township, the "Qal"/"Qt" contact of Love and Christiansen (1985) is used to define a somewhat smaller exclusion area than provided by the above approach. (East of this ridge, well permits report small yields, and well depths up to 100 ft.. Even close to the river (e.g. T17, R74. Sec. 19), lithologic logs report "shale"and "clay" at around 10 ft.

In T19, R74, the Laramie River skirts an area of Wind River Formation outcrop (west of the river), mostly located in the topographically closed Dutton Creek Basin. This formation has been found to be locally quite permeable in the Shirley Basin, further west ("above Alcova" sub-basin). In recognition of the possibility of high-permeability Wind River Fm. strata being in contact with the river through this reach, the setback distance of 21,000 ft. from the Shirley Basin area is adopted for the west side of the river here. This approach reaches beyond the topographic boundary of the Laramie River Basin, into the topographically closed basin of Dutton Creek. It is assumed that the groundwater divide is, or could be modified through groundwater extraction to be, west of the topographic divide in this case. Because the Wind River Fm. lies on top of the adjacent formations exposed upstream and downstream (as opposed to extending its influence beyond its surface outcrop as an underlying formation), its associated setback distance is applied only to the area of Wind River Fm. outcrop. This creates a truncation of the 21,000-ft setback at the lower contact of the formation.

On the east side of the Laramie River through this reach, groundwater communication with the river is controlled by the Lewis Shale and a 2800-ft. setback is applied. In recognition of the small area in which the Wind River Fm. extends to the east side of the river (T19, R74), the Lewis-Shale setback is applied from the edge of the Wind River Fm. rather than from the river channel[2].

The only perennial tributary of the Laramie River from the downstream end of the upper-Laramie sub-basin to where the river flows out of the mountains southwest of Laramie city, is the Little Laramie River. The drainage of the Little Laramie River is addressed as above, i.e. setbacks applied as a function of underlying formations. Upstream of the junction of Mill Creek and the Little Laramie River (T16, R76, Sec.3) setbacks are larger than the inter-stream distances, so the exclusion area boundary is defined by the relatively large, Hanna-Fm.-based setback north from the North Fork of Mill Creek and the Mesaverde-based setback south from the Little Laramie River. Thus, the areas of more complex structural conditions along the mountain face (e.g. T17, R77, Sec. 31) are not indicated for exclusion and the analysis need not consider separate setbacks for individual formations.

Detailed studies of the Casper Fm. associated with the City of Laramie municipal supply wells (e.g. Western Water, 1993) have identified a regional permeability of 20 ft/day for the active portion of this formation around the Laramie wells (i.e. the largely saturated portion of the aquifer adjacent to its contact with the overlying Satanka Shale). Applied to the formation thickness of 700 ft., a transmissivity of 14,000 ft^2/day (105,000 gpd/ft) is indicated. Entry of this value into the sdf calculation produces a "28/40" setback distance of 8.6 miles (45,000 ft.). This

[2]The setback from this contact instead of from the river channel is indicated by a short red line marking the contact on Figure 2.

distance is applied to the Casper Formation north and south of the natural springs feeding Spring Creek, a tributary of the Laramie River[3]. It is this radius of potential influence centered on the head of Spring Creek, and truncated at the Forelle / Chugwater contact, that creates the semicircle, "windshield wiper", shape in the lower right portion of Figure 2.

Laramie River Basin below Wheatland Irrigation District Tunnel

With the exception of the Wheatland Irrigation District, this area falls within that portion of the North Platte River Basin subject to the irrigated acreage restrictions of the Modified North Platte Decree. Areas presumed not to meet the "28/40" hydrological connection criteria have been developed and approved by the NPDC for purposes of irrigated acreage accounting under the Decree. The details of that development are provided in the March 27, 2003 memo attached to the minutes of the April 3, 2003 NPDC meeting (for the main part of the basin) and the April 11, 2006 memo attached to the minutes of the April 11, 2006 NPDC meeting (for the southern basin and other peripheral areas). The exclusion areas approved by the NPDC are adopted without modification for the PRRIP Wyoming Depletion Plan.

Because the area within the Wheatland Irrigation District (WID) is outside the irrigated acreage restrictions of the Decree, exclusion areas are developed here. Aquifer transmissivities and storage characteristics for WID are taken from groundwater modeling prepared by Nebraska experts for the Nebraska v. Wyoming lawsuit (Hydroscience Associates, 2000a) – the same modeling that was used in the NPDC analysis for the surrounding areas subject to Decree restrictions. Similarly, exclusion area setbacks are calculated using the same simplified, "sdf", method. Setback distances, stratigraphic boundaries, and the assignment of exclusion areas so defined for the Wheatland Irrigation District area are presented on Figure 3. These exclusion areas are combined with those adopted by the NPDC and presented on the attached map entitled, "Lower Laramie Basin Areas Not Hydrologically Connected" dated July 10, 2006.

A setback of 13,514[4] ft. is applied to the reach of Wheatland Creek downstream of the town of Wheatland, where the groundwater model produced a transmissivity of 1500 ft^2/day and a storage coefficient of 0.12. Given the proximity of these setbacks (in some cases overlapping) to those along Sybille Creek (west) and Chugwater Creek (east) and the presence of a second, shallower and more permeable aquifer layer across much of this area, no exclusion zone is proposed west of Wheatland.

Upstream of Wheatland, to a point on the eastern of the two perennial forks of Wheatland Creek (also known as Ayers Draw) the groundwater model transmissivity of 1000 ft^2/day generates a setback of 11,034 ft. for the lower aquifer layer (the Arikaree Fm.). Along both this and the west

---

[3]Although this stream is not identified as perennial on the 1:100,000-scale USGS mapping, it is known to carry Casper-Formation water westward to the Laramie River, and thus provides a stream-depletion connection to the river as long as it is flowing. Groundwater production beyond the point of complete depletion of this small stream no longer has a ready mechanism for transmission of depletion to the Laramie River / North Platte system and may qualify as "not hydrologically connected".

[4]Although the five significant digits listed here are well beyond the accuracy of the input and analysis, they are retained for conformity with the NPDC-approved values in the surrounding lower-Laramie River basin.

fork (also known as Rock Creek), the shallow aquifer layer (Quaternary terrace deposits) is present and appears to be sufficiently permeable that wells penetrating significant saturated thickness cannot be categorically excluded under the "hydrological connection" criteria. Thus, no extensions of the previously-defined exclusion zones into the area of terrace deposits ("Qt" or "Qs" on Love and Christiansen, 1985) are indicated. (This contact defines the "stratigraphic boundary" on Figure 3 at the south end of WID.)

In the headwaters of the east fork of upper Wheatland Creek, the groundwater model transmissivity of 70 ft^2/day generates a setback of 2,919 ft., although this setback is mostly subsumed by the larger setback from downstream segments.

The exclusion area established previously for the area south of Wheatland Irrigation District is extended northward based on the above setbacks and boundaries and the same process of manual smoothing as was applied in the surrounding NPDC-approved areas.

North Platte River Basin below Guernsey Dam (excluding Laramie River and Horse Creek drainages)

This area falls outside that portion of the North Platte River Basin subject to the irrigated acreage restrictions of the Modified North Platte Decree. Thus, the methodology developed with the NPDC for the areas outlined above has been applied to this area specifically for Wyoming's Depletion Plan. Setback distances, stratigraphic boundaries, and the assignment of exclusion areas so defined are presented on Figure 4. The exclusion areas are also presented on the attached map entitled, "Guernsey to State Line Basin Areas Not Hydrologically Connected" dated July 10, 2006. The following discussion provides the details of development.

This sub-basin provides the most widespread, productive aquifer of the North Platte River basin in Wyoming. The alluvial sands and gravels along the river create what has been termed the "valley-fill aquifer" (Crist, 1975), which has been extensively developed for irrigation. It is basically coincident with the "alluvium" mapped by Love and Christiansen (1985), with the addition of areas mapped as "dune sand" northeast of Torrington.

Due to its well-demonstrated production potential and location within the "pivotal reach" of the North Platte River with respect to the North Platte Decree, the alluvial aquifer along the North Platte River below Guernsey Dam has been the subject of several modeling studies (e.g. Crist, 1975, Hydroscience, 2000b). This aquifer extends from approximately the Interstate Canal on the north, to the geologic contact with Brule and Chadron Formation outcrops approximately 2 miles south of the river. Transmissivities in the 100s of thousands of gpd/ft provide groundwater connections well within the 40-year time frame of the "hydrological connection" criteria. No exclusion zones are proposed for this aquifer. Furthermore, to maintain a conservative approach for the underlying deposits, setbacks are applied from the edge of the valley-fill aquifer as though it were the stream.

Beneath the valley-fill aquifer, groundwater modeling in this area has consistently considered materials to be essentially impermeable. These are largely the siltstone and mudstone-dominated strata of the White River Fm. (Brule and Chadron Fms.) that appear at the surface to the north and south of the valley-fill aquifer.

At the upstream end of this reach of the North Platte River, and beyond the valley-fill aquifer, hydrological connection with the river is controlled by the Arikaree Fm. Along the south side of the North Platte in this reach, exclusion zones have been developed previously, for the lower-Laramie River Basin and for the Alcova-to-Guernsey Basin. In the former, an effective transmissivity of 400 ft^2/day and a calculated setback distance of 7,000 ft. (6,979 ft.; NPDC, 2003) were developed from groundwater modeling work centered in the Wheatland area. In the latter, an effective transmissivity of 250 ft^2/day and a calculated setback distance of 5,500 ft. (NPDC, 2004) were developed from groundwater modeling work along Horseshoe Creek. The larger of the two setback values – 7,000 ft. – is adopted here, and is applied to the north side of the North Platte River as well. (West of the “valley-fill aquifer” modeled by Crist (1975), i.e. in Platte Co., the “Qa” unit of Love and Christiansen (1985) is used for the boundary from which the setback distance is applied.)

Nearly coincident with the hydrologic boundary between the above-Guernsey and below-Guernsey reaches of the North Platte River is the axis of the Hartville Uplift. Outcrops of Paleozoic formations to the west (“North Platte Basin between Alcova and Guernsey Dams” reach) are afforded a large setback (16,000 ft.) to reflect the potential for widespread, fracture-enhanced permeability. East of the lower contacts of these aquifers are granitic rocks and thin, overlying deposits of Arikaree Fm. The Arikaree Fm. thickens eastward to provide a useful aquifer in northern Goshen Co. Thus, at the extreme upstream end of the Guernsey to State Line reach of the North Platte River, a large setback is applied to the area of Paleozoic-rock outcrop on the north side of the North Platte, and the Arikaree Fm. setback (7,000 ft.) is applied eastward from those outcrops.

Downstream of the Arikaree Fm., hydrological connections beyond the valley-fill aquifer are controlled by the lower-permeability strata of the Brule, Chadron, and Lance Fms. The Brule Fm. was evaluated for the NPDC in the adjacent lower-Laramie River Basin (NPDC, 2003; NPDC, 2006), where a transmissivity of 120 ft^2/day and a setback of 4200 ft. were applied. HRS (2000; p. 4-5) evaluated groundwater flow between the Horse Creek and lower North Platte River basins (i.e. the southwest portion of the below-Guernsey reach of the river being considered here, primarily in the Chadron and Lance Fms.), for which they applied an effective transmissivity of 267 ft^2/day. Application of the larger of these values – 267 ft^2/day – generates a setback distance of 6,200 ft., which is applied from the edge of the valley-fill aquifer on the north and south sides of the North Platte River.

Although not recognized as perennial on the USGS 1:100,000-scale stream coverage, agricultural drains in the area south of the North Platte River and north of the Ft. Laramie Canal are known to flow year-round due to irrigation return flows. To reflect the potential for North Platte depletions via groundwater development adjacent to these drain systems, a 6,200-ft buffer is applied to these features (Cherry Creek Drain, Katzer Main Drain) as well.

Rawhide Creek is the only significant tributary to the North Platte River in this reach that is not confined to the area discussed above (excluding the Laramie River, which is considered in other sections of this report). Rawhide Creek is an intermittent stream for 4.4 miles above the Interstate Canal, but is perennial through a large area in northern Goshen County underlain by the Arikaree Fm.. The aquifer in this area is adequate to support irrigation-well development (see Crist, 1977), but it is separated from the valley-fill aquifer along the North Platte by several miles of intervening Brule Fm. (Crist (1975) and the refined "Crist" model developed by Nebraska for the Nebraska v. Wyoming lawsuit (Hydroscience, 2000b) modeled the Brule as creating an effectively impermeable boundary to the "valley fill" aquifer. Thus, groundwater-development caused depletion of Rawhide Creek is primarily transmitted through to the North Platte River via the narrow alluvial aquifer along the intermittent stretch of Rawhide Creek.

Crist (1975) provides a transmissivity estimate for the alluvium along Rawhide Creek north of the Interstate canal of 4,300 ft^2/day. Calculation of a setback distance based on this transmissivity produces a value of 4.75 miles. Since this setback calculation assumes a widespread aquifer rather than a narrow band of alluvium, it is concluded that the Rawhide connection to the Arikaree aquifer in northern Goshen Co. does not meet the "hydrological connection" criteria of this report.

Horse Creek Basin

This area falls outside that portion of the North Platte River Basin subject to the irrigated acreage restrictions of the Modified North Platte Decree. Thus, the methodology developed with the NPDC for the areas outlined above has been applied to this area specifically for Wyoming's Depletion Plan. Setback distances, stratigraphic boundaries, and the assignment of exclusion areas ("Area Determined to be Not Hydrologically Connected") so defined are presented on Figure 5. The exclusion areas are presented on the attached map entitled, "Horse Creek Basin Areas Not Hydrologically Connected" dated July 10, 2006. The following discussion provides the details of development.

The lower Horse Creek basin in Wyoming (i.e. downstream of T20, R61, Sec. 4) is underlain by the Lance and Chadron Fms. HRS (2000) evaluated groundwater flow northward through these deposits from the Horse Creek basin south of this area, concluding that such flow was minimal due to the relatively low permeability. The effective transmissivity of 267 ft^2/day from that report generates a setback distance of 6,200 ft., which is applied throughout the areas of Chadron and Lance outcrop. (The same approach was applied above, for the adjacent portions of the Guernsey-to-stateline basin.)

Upstream of this area, and downstream of T19, R63, Sec.4 on Bear Creek and T18, R63, Sec. 3 on Horse Creek, the basin is underlain by the Brule Formation. This formation consists primarily of fine-grained materials (clay, silt, ash), commonly produces springs along its upper contact as downward-moving groundwater encounters its low permeability, and produces lab-sample permeabilities of 0.1 and 0.2 gpd/ft^2 (Rapp et al., 1957). However, the uppermost Brule includes abundant fractures and sand and gravel lenses and stringers in local areas of the Horse Creek basin, which can produce highly favorable local conditions for groundwater production. Examples of such extraordinary areas include the Pine Bluffs lowland (Lowry and Crist, 1967), 25 miles south of Horse Creek, and the LaGrange area in the eastern Horse Creek Basin.

Borchert (1976) presents the results of two Brule Fm. pump tests in T19, R61, Secs. 9 and 11, where transmissivities of 70,000 - 100,000 ft^2/day were found. However, he also reports a pump test of the overlying alluvial aquifer only ½ mile to the north of the first of the Brule wells (T19, R61, Sec. 4) in which a negative boundary was observed corresponding to the alluvium / Brule contact. Borchert explains this: "Because the Brule in this area has a low permeability, it acts as a hydrologic barrier ...", seemingly strongly at odds with the Brule pump tests cited above. Borchert (1985) later developed a groundwater model for a 10–mile X 10-mile are in the central Horse Creek basin around Hawk Springs Reservoir (T20, R61), combining the Brule with the overlying alluvial deposits to define the "LaGrange Aquifer". Model-calibrated hydraulic conductivities ranged from 0.01 to 950 ft/day. (A map of the distribution of hydraulic conductivity used in this model has not been located.)

To address this evidence of localized high Brule-Fm. transmissivities, Statements of Completion filed with the Wyoming State Engineer's Office have been reviewed for 21 Brule Fm. water wells in the Horse Creek Basin to supplement the published research (e.g. Rapp et al., 1957; Borchert, 1976; Borchert, 1985; Libra et al., 1981). Although interpretation of driller-reported production tests (often run by bailer) is somewhat speculative, a picture of highly-variable conditions again emerges. Apparently credible drawdown data from this sample set range from 6 gpm with 134 ft. of drawdown for a well east of Hawk Springs Reservoir (T20, R60, Sec. 18; U.W.154754), to 10 gpm with no measurable drawdown from a well at the southern end of the area of Brule outcrop (T18, R62, Sec. 13; U.W.110562).

Thus, the present level of investigation is insufficient to identify the stream depletion relationships of the Brule Fm. in the Horse Creek basin. No exclusion areas are mapped for the area underlain by this formation, including the overlying Quaternary alluvial and terrace deposits in the east-central Horse Creek Basin. Given the generally low permeabilities of the Brule Fm., however, this area is a likely candidate for additional, site-specific studies demonstrating a relatively low level of hydrological connection. The northwest-southeast trending Brule outcrop in the northeast Horse Creek basin has been evaluated in conformance with the adjacent Guernsey-to-stateline and lower-Laramie River basins, i.e. assumed to be of relatively low permeability. The boundary between these two approaches ("no analysis" vs. low-permeability Brule) is drawn as a straight line defined by the upper Brule contacts in the topographic low spots in T20, R64, Sec. 13 and T21, R63, Sec. 32. Brule outcrops northeast of this line are more than 5 miles from the nearest point on Fox Creek (northern tributary of Bear Creek), a distance through which the persistence of high Brule transmissivity is considered quite unlikely.

Upstream of the "Goshen Hole" area, Horse Creek and its only perennial tributary, Bear Creek, flow across the Arikaree Fm. and , in Laramie County, the Ogallala Fm. Lowry and Crist (1967) present an average specific capacity for the Arikaree of 0.016 gpm/ft/ft of saturated thickness, and map a saturated thickness of approximately 200 ft. for most of the Arikaree reach of Horse Creek. Estimation of an effective transmissivity based on a specific capacity of 3.2 gpm/ft (i.e. 0.016 * 200) suggests a value of approximately 4,800 gpd/ft (640 ft^2/day)[5]. (Borchert (1976) presents Arikaree Formation transmissivities of 1,240 to 3,300 gpd/ft from pump tests near Albin

---

[5]Transmissivity (in gpd/ft) can be approximated as 1500 * specific capacity (in gpm/ft) based on the empirical equation of Driscoll (1986, p. 1021).

(T17, R62), south of Horse Creek.) Use of the 4,800 gpd/ft value generates an exclusion area setback distance of 9,700 ft. which is applied to Horse Creek and its tributaries through the Arikaree Fm.[6] In consideration of the potentially high permeabilities locally present in the underlying Brule Fm. (discussed above), the effective eastern boundary of the Arikaree-Fm. exclusion zone is mapped by drawing a straight line that connects the Arikaree / Brule contact in each of the stream-valley bottoms rather than following the upland contact of Love and Christiansen, 1985. (This approach treats the areas where relatively thin, upland Arikaree deposits overly the Brule as effectively part of the Brule "outcrop".)

Kellehan Creek is a south-bank tributary of Horse Creek which the USGS 1:100,000-scale mapping identifies as perennial only downstream to (T18, R61, Sec.28), several miles short of its confluence with Horse Creek. Recognizing the possibility that communication between Kellehan and Horse Creeks may be locally enhanced due to Brule permeabilities, setback distances are applied to upper Kellehan Creek (in the Arikaree Fm.) as though it were a through-flowing tributary.

Upstream of the Arikaree, Horse Creek flows across the Ogallala Fm. Lowry and Crist (1967) cite Ogallala transmissivities from 5,000 to 38,000 gpd/ft from the much-studied area of the Cheyenne municipal wells (20 miles south of Horse Creek). Setback calculation using the high end of this range produces a value of 27,000 ft. This setback is not extended into the area of Brule-Fm. outcrop because the Arikaree lies on top of the Brule, i.e. the higher Arikaree-Fm. permeabilities clearly terminate at its contact with the underlying Brule.

Upstream of the Ogallala outcrop, setbacks are adopted from the geologically similar conditions on upper Chugwater Creek, 5 - 10 miles to the north (NPDC, 2006). In both areas a Brule-Fm. based setback of 4200 ft. is applied to that formation and to the underlying, less-permeable strata of the Pierre Shale. Exclusion-area analysis is terminated where uppermost Horse Creek flows across crystalline rocks (and across the short interval of steeply eastward-dipping sedimentary strata on the mountain flank).

References Cited

Borchert, William B.; 1976; Geohydrology of the Albin and LaGrange Areas, Southeastern Wyoming; U.S. Geological Survey Water-Resources Investigations 76-118.

Borchert, William B.; 1985; The Ground-Water System in the LaGrange Aquifer Near LaGrange, Southeastern Wyoming; U.S. Geological Survey Water-Resources Investigation Report 83-4024.

Crist, M.A.; 1975; Hydrologic Analysis of the Valley-Fill Aquifer, North Platte River Valley, Goshen County, Wyoming; U.S. Geological Survey Water-Resources Investigations 3-75.

[6] Along Fox Creek, e.g. T20N, R64W, Love and Christiansen (1985) map a deposit of Quaternary sand. As elsewhere, this is largely a veneer over groundwater-controlling bedrock, as evidenced by Rapp et. al (1957) ignoring it entirely in their geologic mapping of the area.

Crist, Marvin A.; 1977; Hydrologic evaluation of the Arikaree formation near Lusk, Niobrara, and Goshen Counties, Wyoming; U.S. Geological Survey Water-Resources Investigation 77-111, Open-File Report.

Driscoll, Fletcher G.; 1986; Groundwater and Wells; Johnson Division, St. Paul.

Hallberg, Laura L. and James C. Case; 2005; Preliminary Surficial Geologic Map of the Rock River 30' X 60' Quadrangle, Albany, Platte, and Laramie Counties, Wyoming; Wyoming State Geological Survey, Open File Report 05-3.

HRS Water Consultants; 2000; "Hydrolgeologic Review" - Chapter 4 in Water Rights, Streamflow, and Hydrogeology of the Horse Creek Basin, Wyoming, Bern Hinckley - editor; expert witness report submitted by Wyoming in Nebraska v. Wyoming, No. 108 Original.

Hydroscience Associates, Inc.; 2000a; Depletions to the Lower Laramie River System Resulting from Ground-Water Withdrawals and the Laramie River Power Station; expert witness report submitted by Nebraska in Nebraska v. Wyoming, No. 108 Original.

Hydroscience Associates, Inc.; 2000b; Depletions to the North Platte River Resulting from Ground-Water Withdrawals for Irrigation from Whalen Dam to the Nebraska-Wyoming State Line; expert witness report submitted by Nebraska in Nebraska v. Wyoming, No. 108 Original.

Jenkins, C.T.; 1968; Computation of Rate and Volume of Stream Depletion by Wells, Techniques of Water-Resources Investigations of the United States Geological Survey, Chapter D1, Book 4 (Hydrologic Analysis and Interpretation).

Jenkins, C.T.; 1968; Techniques for Computing Rate and Volume of Stream Depletion Near Wells; Groundwater, 6, no. 2, pp. 37-46.

Libra, Robert D., Michael Collentine, and Kenneth Feathers; Occurrence and Characteristics of Ground Water in the Denver-Julesberg Basin, Wyoming; University of Wyoming Water Resources Research Institute (U.S. EPA Contract G-008269-79).

Love, J. D. and Ann Coe Christiansen; 1985; Geologic Map of Wyoming; U.S. Geological Survey; 1:500,000-scale.

Lowry, Marlin E., Samuel J. Rucker, IV, and Kenneth L. Wahl; 1973; Water Resources of the Laramie, Shirley, Hanna Basins and Adjacent Areas, Southeastern Wyoming; U.S. Geological Survey Hydrologic Investigations Atlas HA-471.

Lowry, Marlin E. and Marvin A. Crist; 1967; Geology and Ground-Water Resources of Laramie County, Wyoming; U.S. Geological Survey Water-Supply Paper 1834.

McAndrews, Harry; 1966; Geologic Map of the Lake Ione Quadrangle, Albany County, Wyoming; U.S. Geological Survey Map GQ-508.

North Platte Decree Committee; April 3, 2003; “Hydrological Connection Determinations – Lower Laramie Basin”; memorandum from Bern Hinckley to NPDC Groundwater Wells Subcommittee dated March 27, 2003.

North Platte Decree Committee; April 13, 2004; “Hydrological Connection Determinations – Alcova Dam to Guernsey Reservoir”; Groundwater Wells Subcommittee memorandum from Phil Stump / Bern Hinckley to Jennifer Schellpeper and Lyle Myler dated April 13, 2004.

North Platte Decree Committee; April 11, 2006; “Hydrological Connection Determinations – Lower-Laramie River Basin extensions”; Groundwater Wells Subcommittee memorandum from Bern Hinckley, Lisa Lindemann to NPDC Groundwater Wells Subcommittee dated January 4, 2006.

North Platte Decree Committee; in preparation; “Hydrological Connection Determinations - Above Alcova Dam”; [As of 7/06 a technical memo and exclusion-area maps are under review by the Groundwater Wells Subcommittee of the NPDC for potential recommendation to the NPDC in October, 2006.]

Rapp, J.R., F. N. Visher, and R.T. Littleton; 1957; Geology and Ground-Water Resources of Goshen County Wyoming; U.S. Geological Survey Water Supply Paper 1377.

VerPloeg, Alan J. And Cynthia S. Boyd; 2000; Preliminary Digital Geologic Map of the Laramie 30' X 60' Quadrangle, Albany and Laramie Counties, Southeastern Wyoming; Wyoming State Geological Survey, Geologic Hazards Section Digital Map 00-1.

Western Water Consultants; 1993; Wellhead Protection Area Delineation for Turner Well Field, Pope Well Field, Soldier Spring, and Simpson Springs; consultant report to the City of Laramie, Nov. 19, 1993.

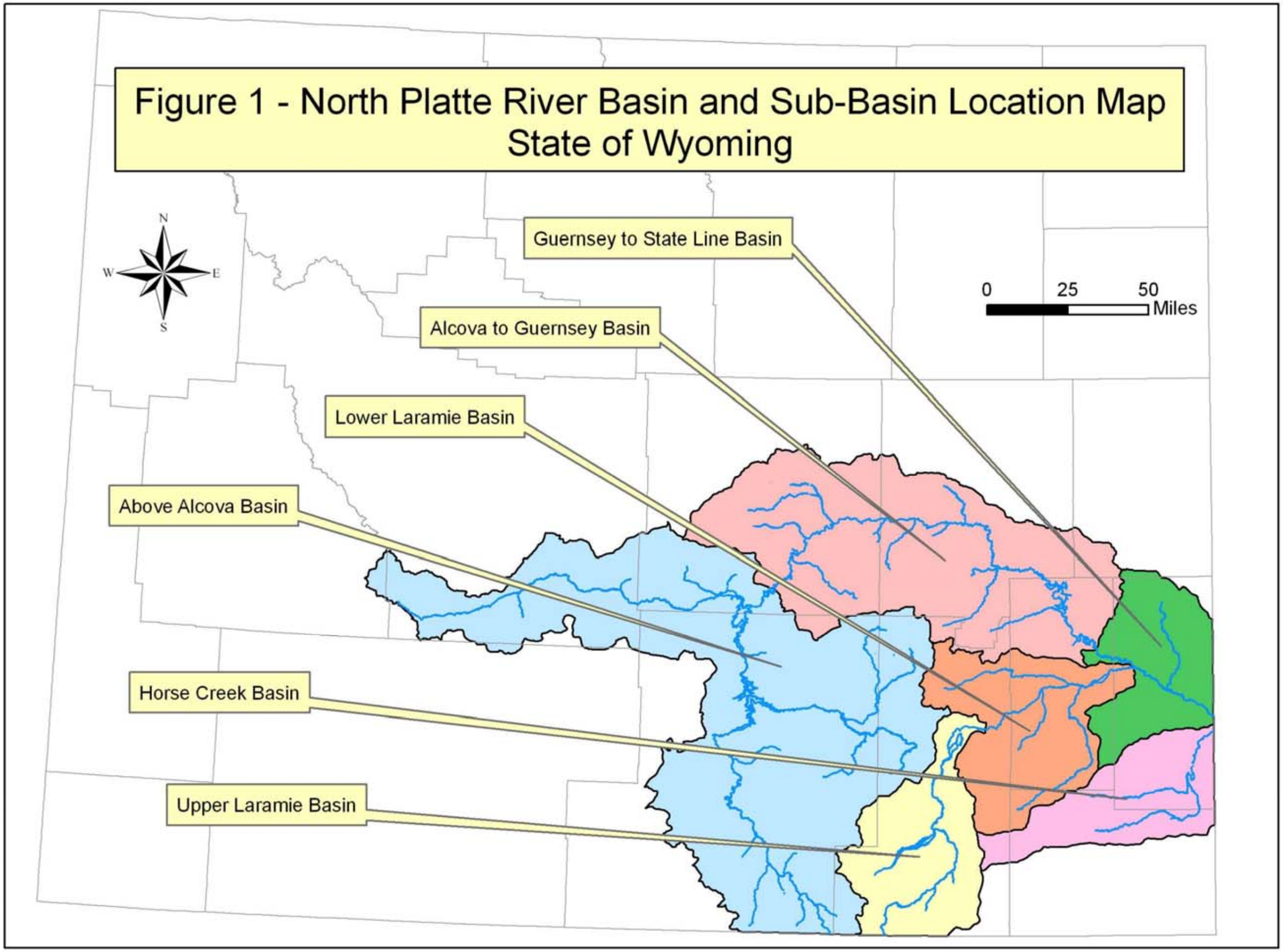


Figure 1 - North Platte River Basin and Sub-Basin Location Map
State of Wyoming
N
W
E
S
Guernsey to State Line Basin
Alcova to Guernsey Basin
Lower Laramie Basin
Above Alcova Basin
Horse Creek Basin
Upper Laramie Basin
0
25
50
Miles

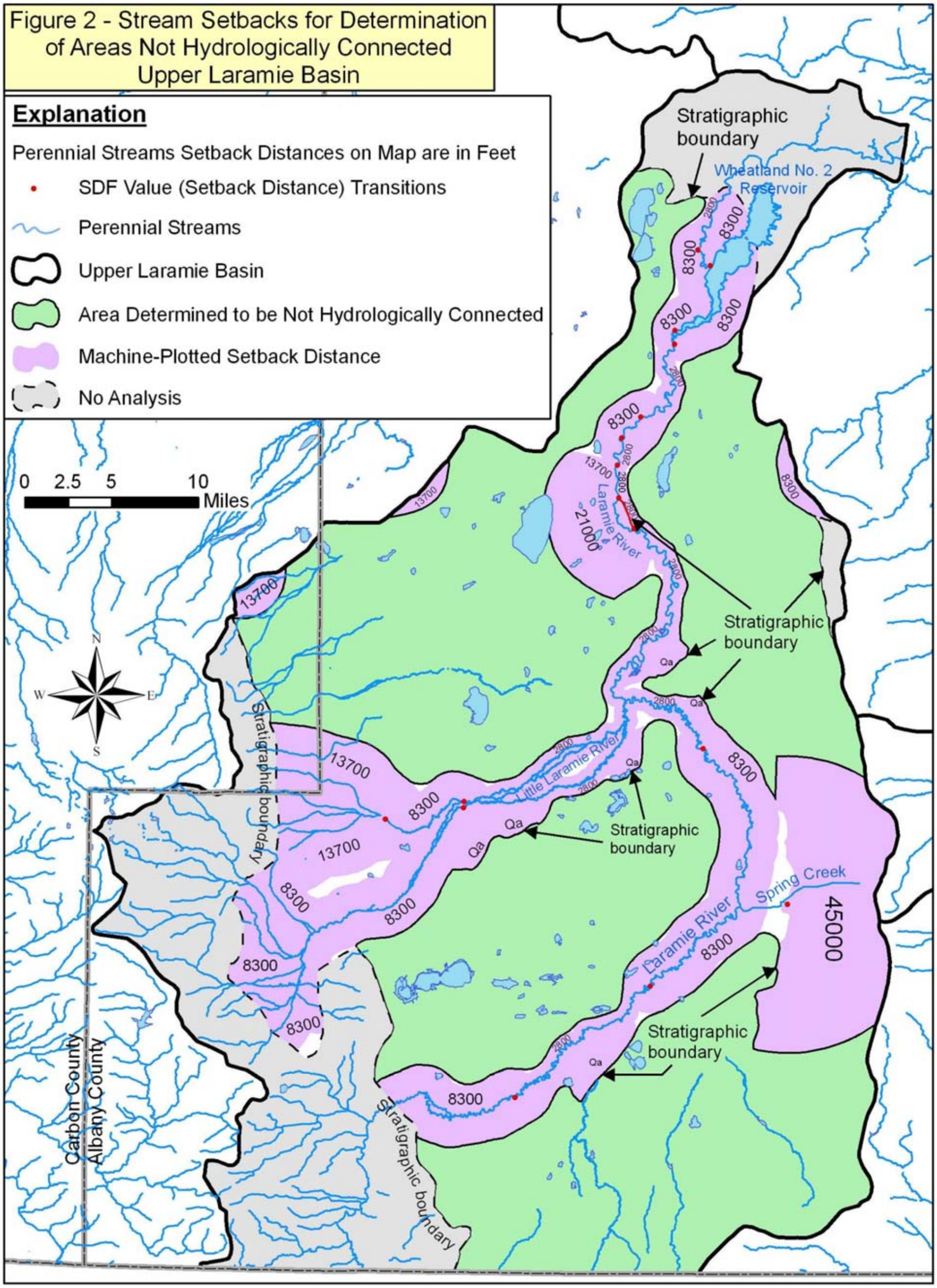


Figure 2 - Stream Setbacks for Determination of Areas Not Hydrologically Connected Upper Laramie Basin
Explanation
Perennial Streams Setback Distances on Map are in Feet
SDF Value (Setback Distance) Transitions
Perennial Streams
Upper Laramie Basin
Area Determined to be Not Hydrologically Connected
Machine-Plotted Setback Distance
No Analysis
0 2.5 5 10 Miles
Stratigraphic boundary
Wheatland No. 2 Reservoir
Laramie River
Little Laramie River
Spring Creek
Carbon County
Albany County
8300
13700
21000
45000
2800
Qa

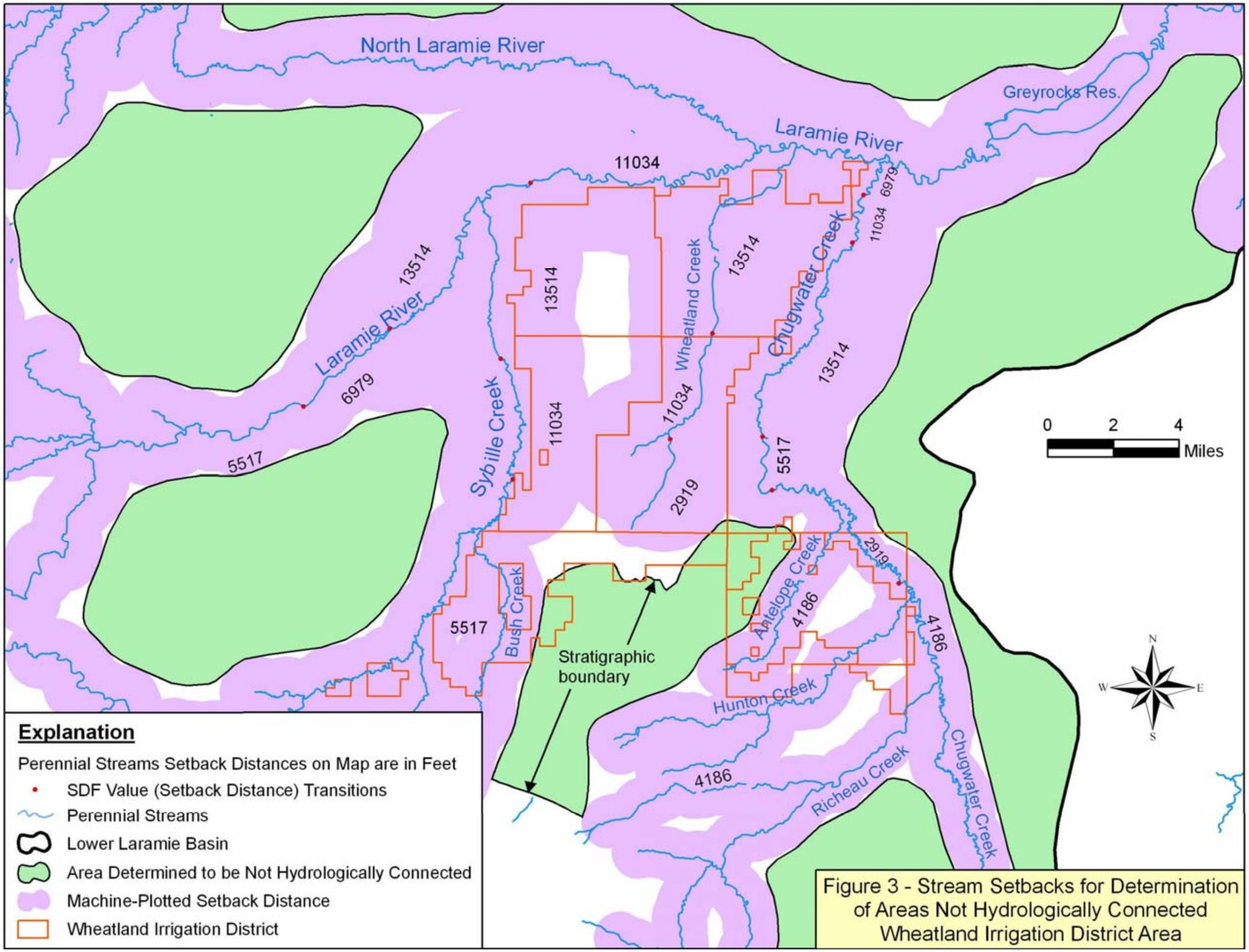


Figure 3 - Stream Setbacks for Determination of Areas Not Hydrologically Connected Wheatland Irrigation District Area

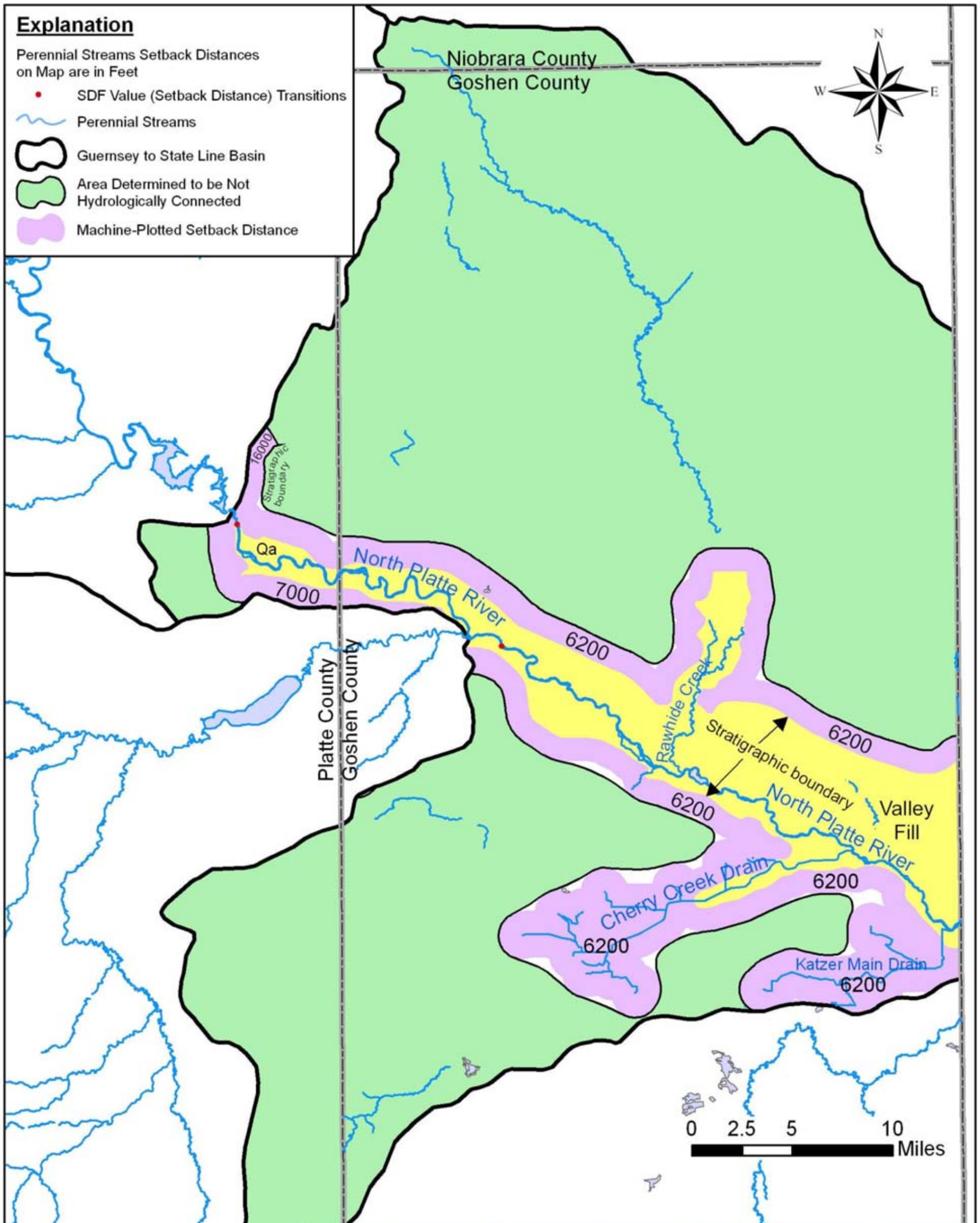


Figure 4 - Stream Setbacks for Determination of Areas Not Hydrologically Connected Guernsey to State Line Basin

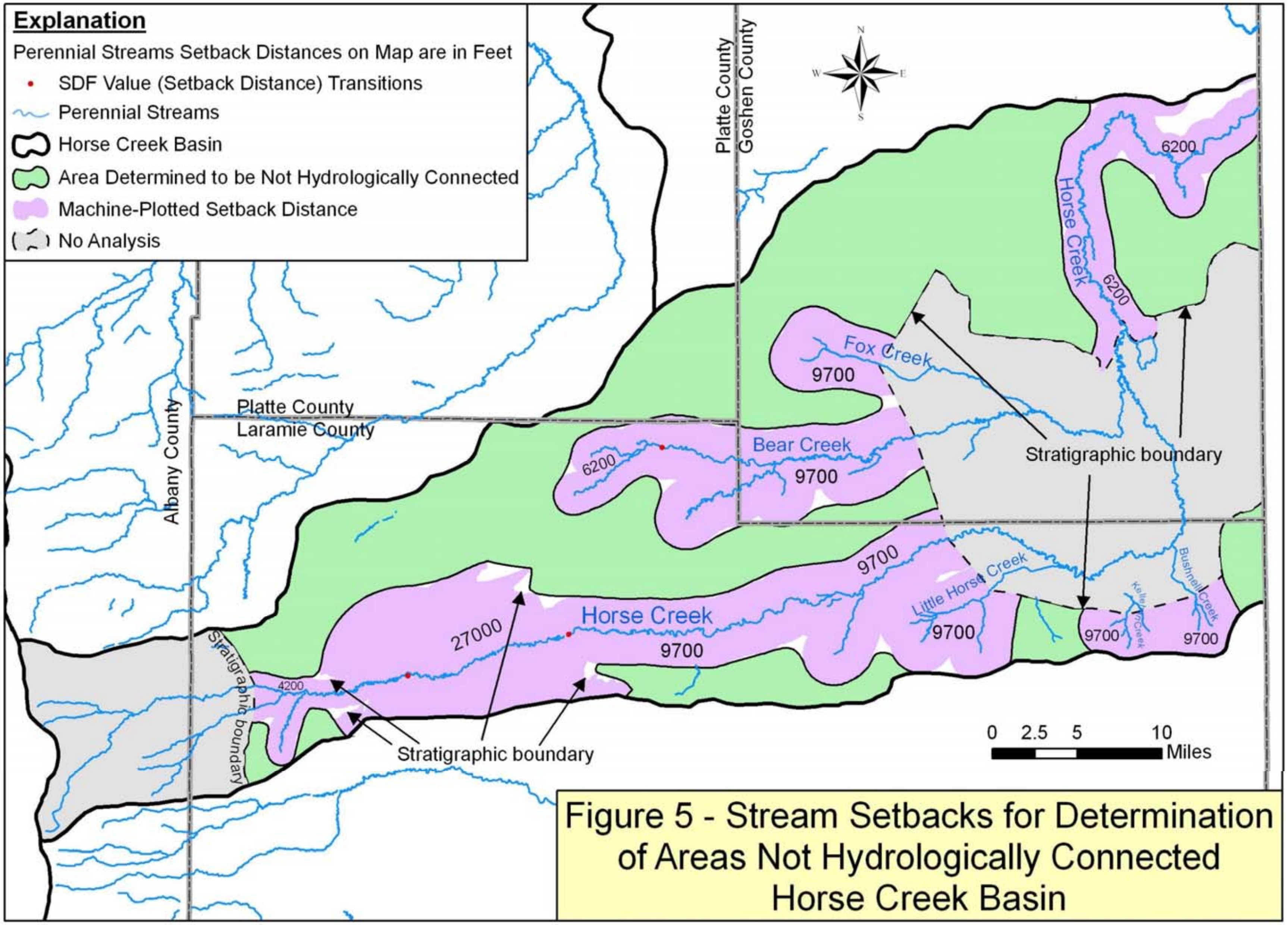
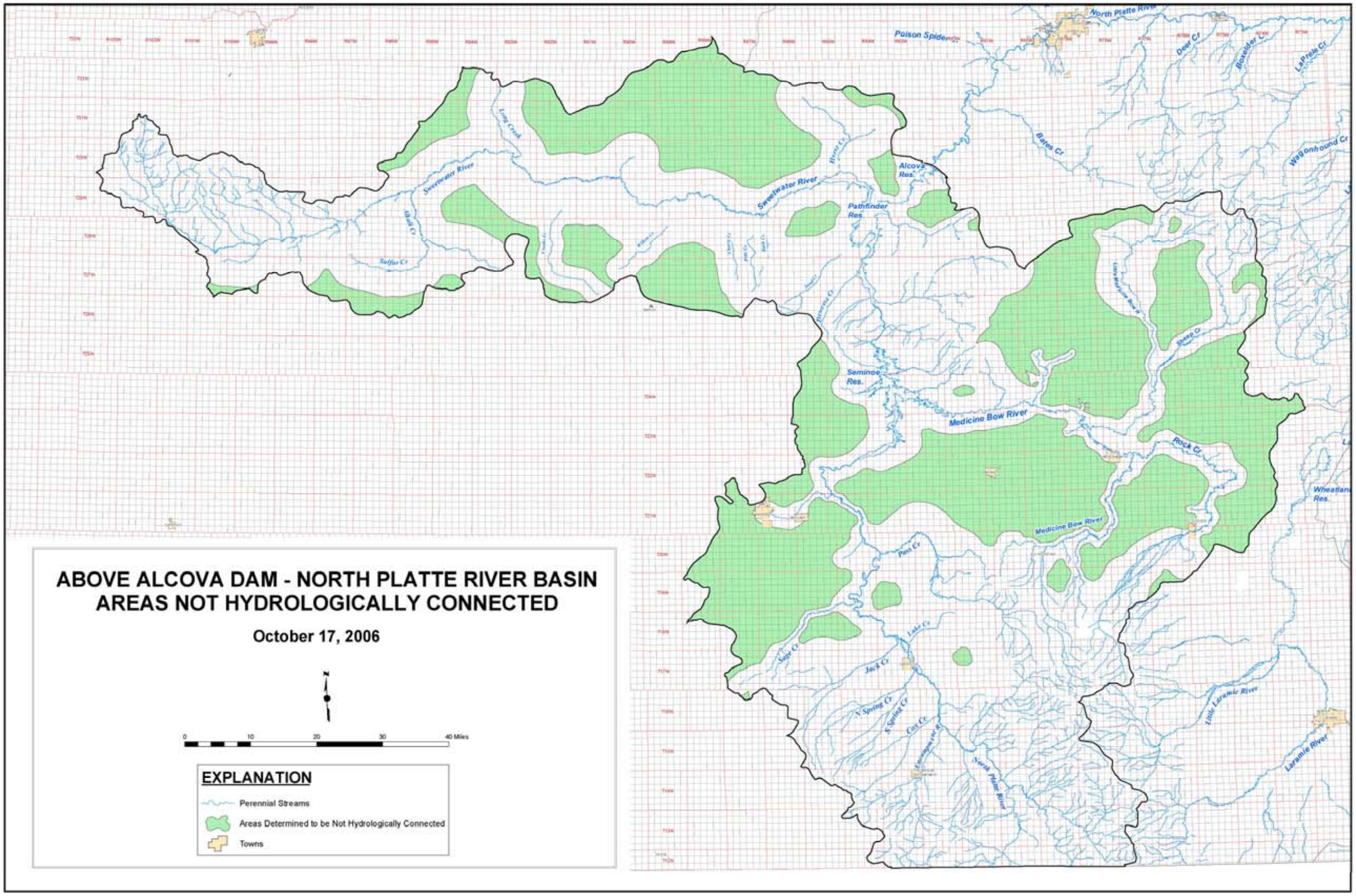
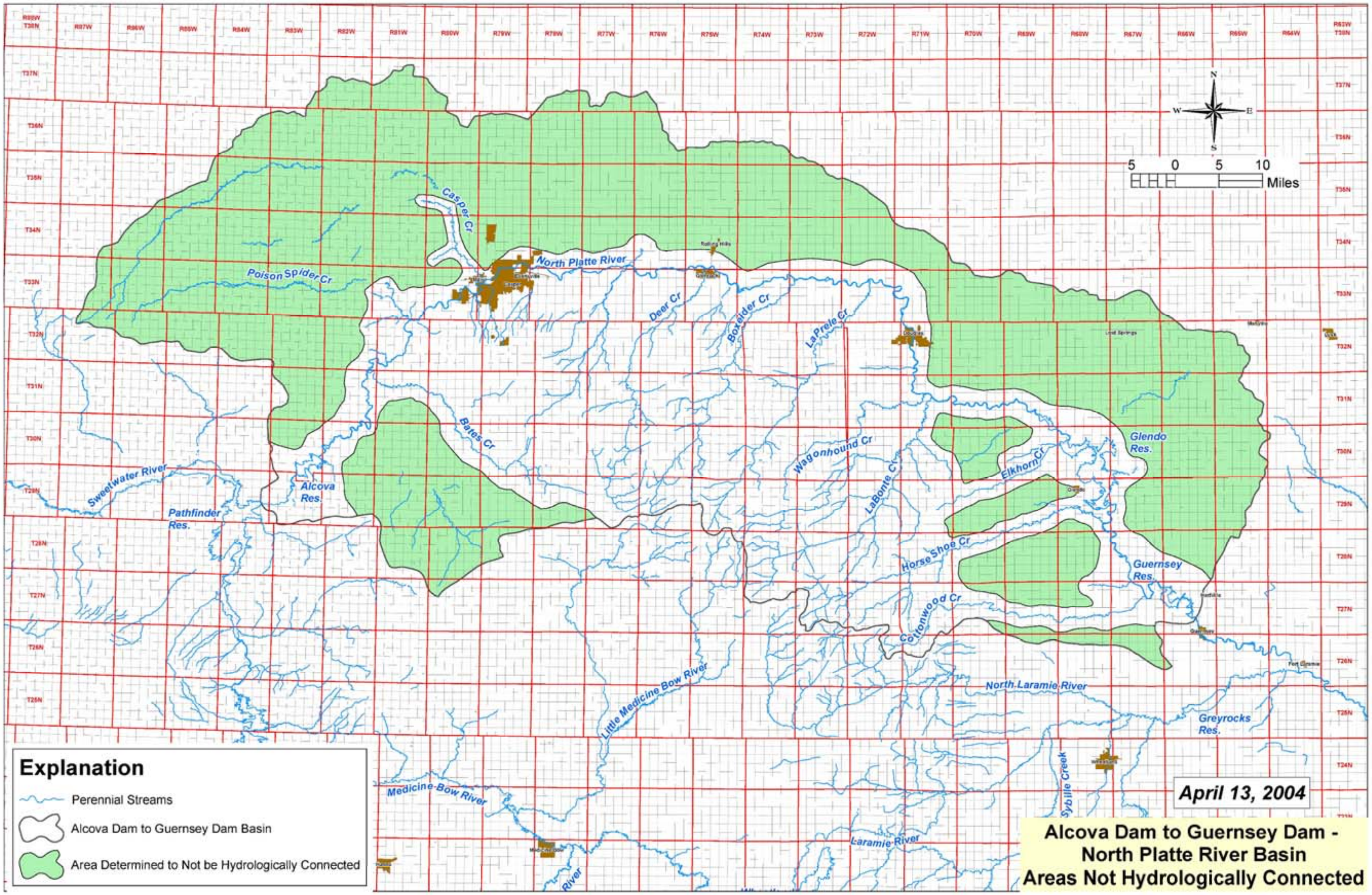
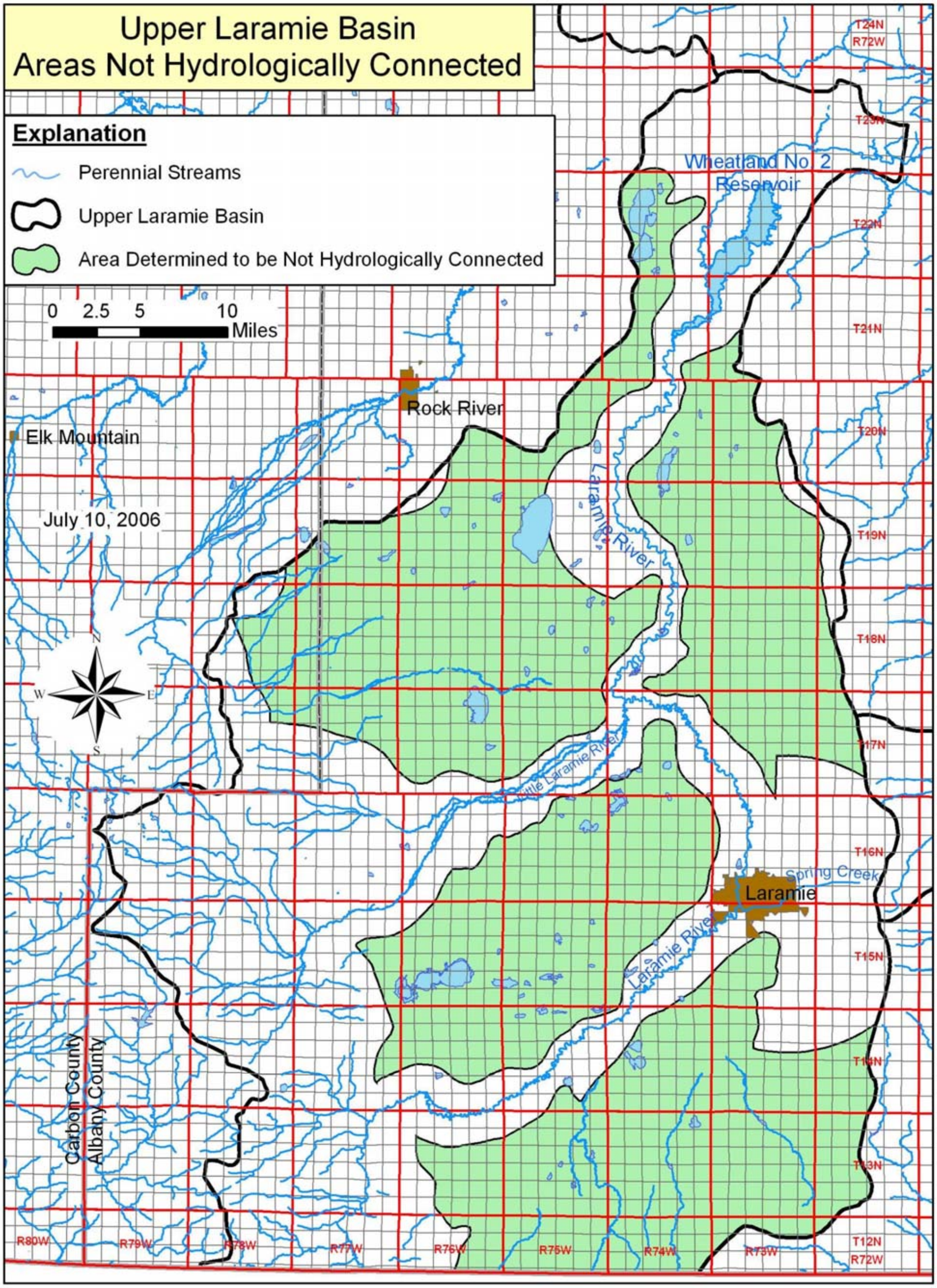
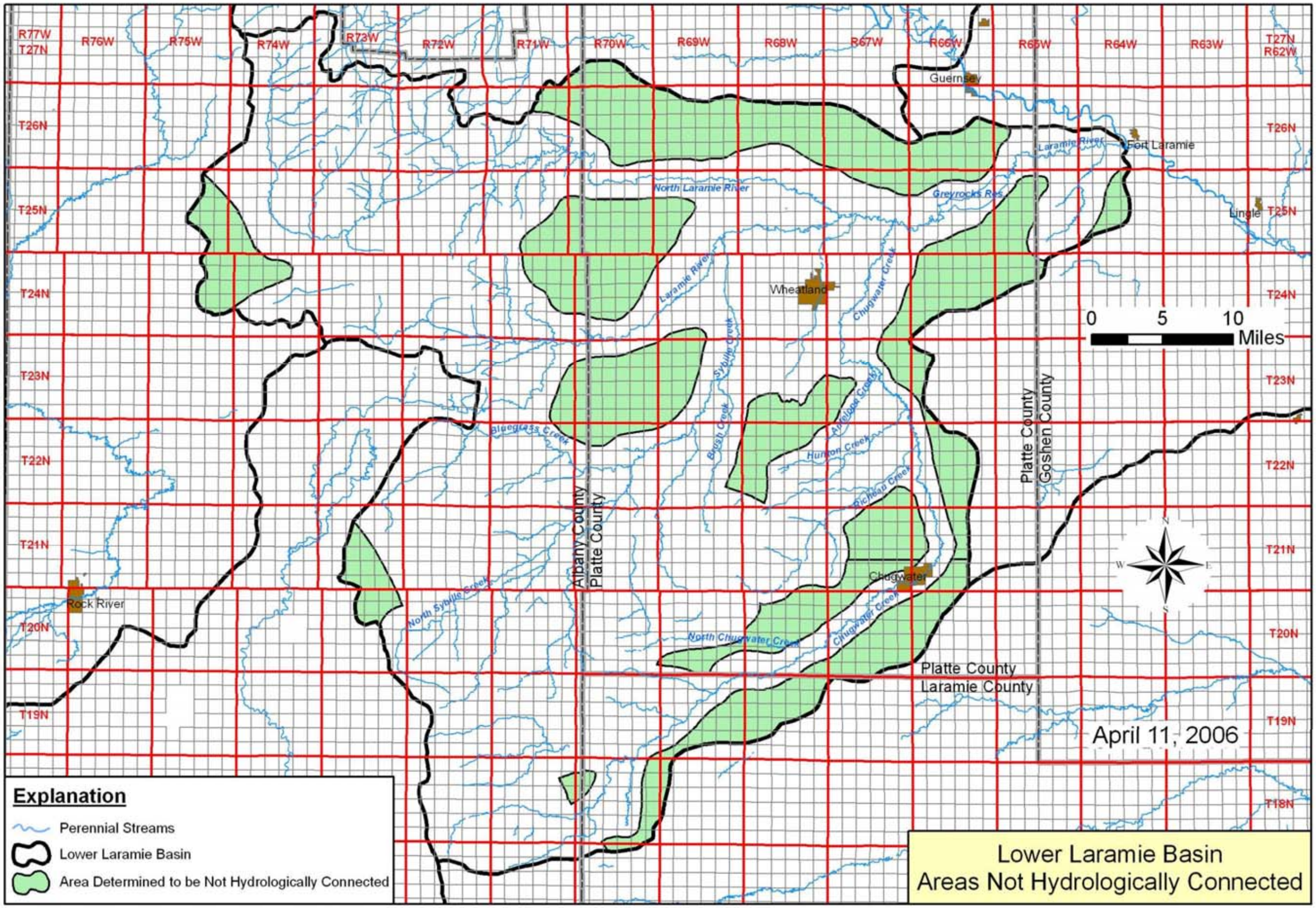


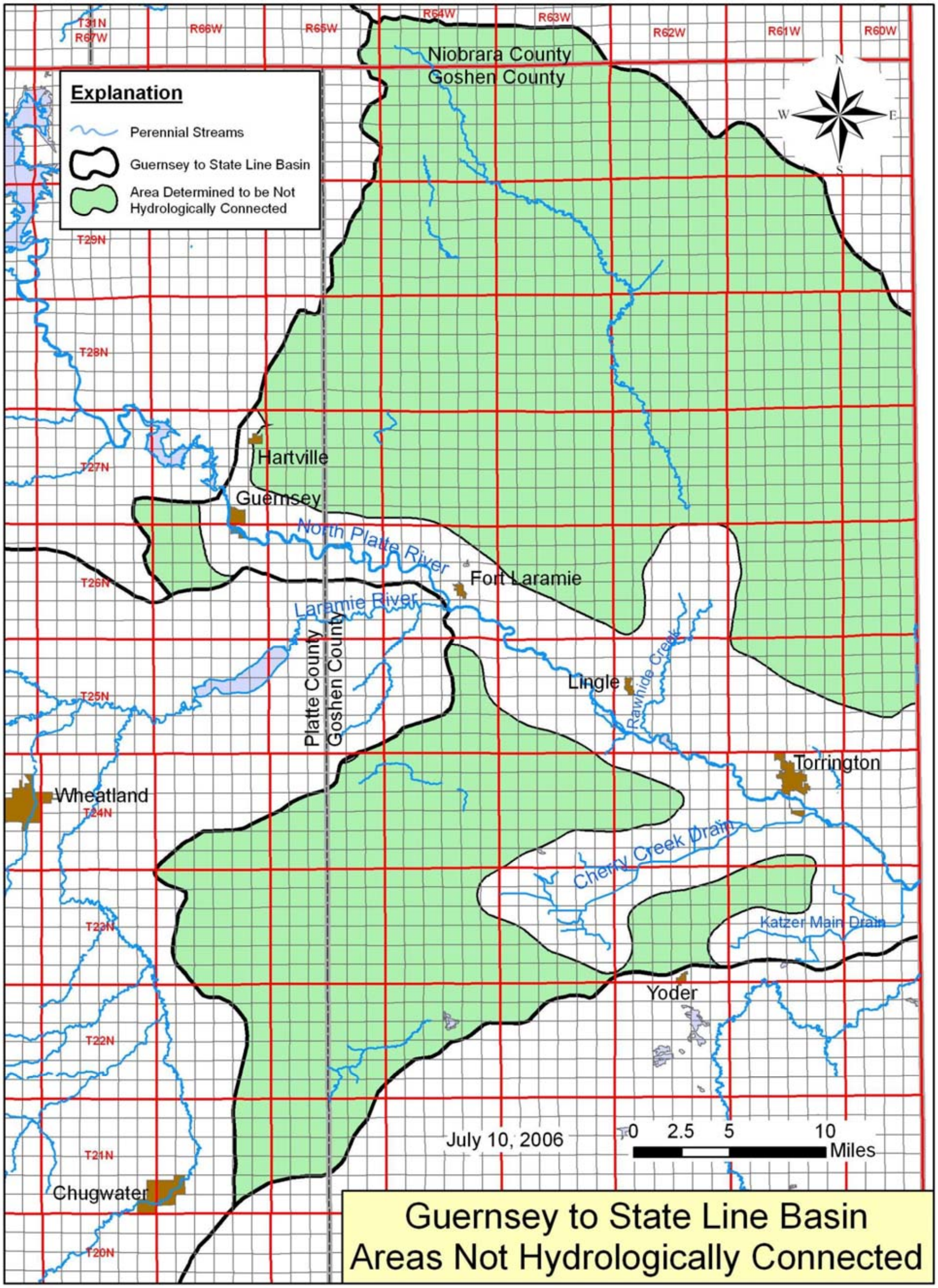
Figure 5 - Stream Setbacks for Determination of Areas Not Hydrologically Connected Horse Creek Basin


ABOVE ALCOVA DAM - NORTH PLATTE RIVER BASIN
AREAS NOT HYDROLOGICALLY CONNECTED
October 17, 2006
0
10
20
30
40 Miles
EXPLANATION
Perennial Streams
Areas Determined to be Not Hydrologically Connected
Towns
Sweetwater River
Medicine Bow River
Rock Cr
Sheep Cr
Alcova Res.
Pathfinder Res.
Seminoe Res.
North Platte River
Poison Spider
Bates Cr
Deer Cr
Boxelder Cr
LaPrele Cr
Wagonhound Cr
Wheatland Res.
Little Laramie River
Laramie River
Lake Cr
Jack Cr
Sage Cr
Pass Cr

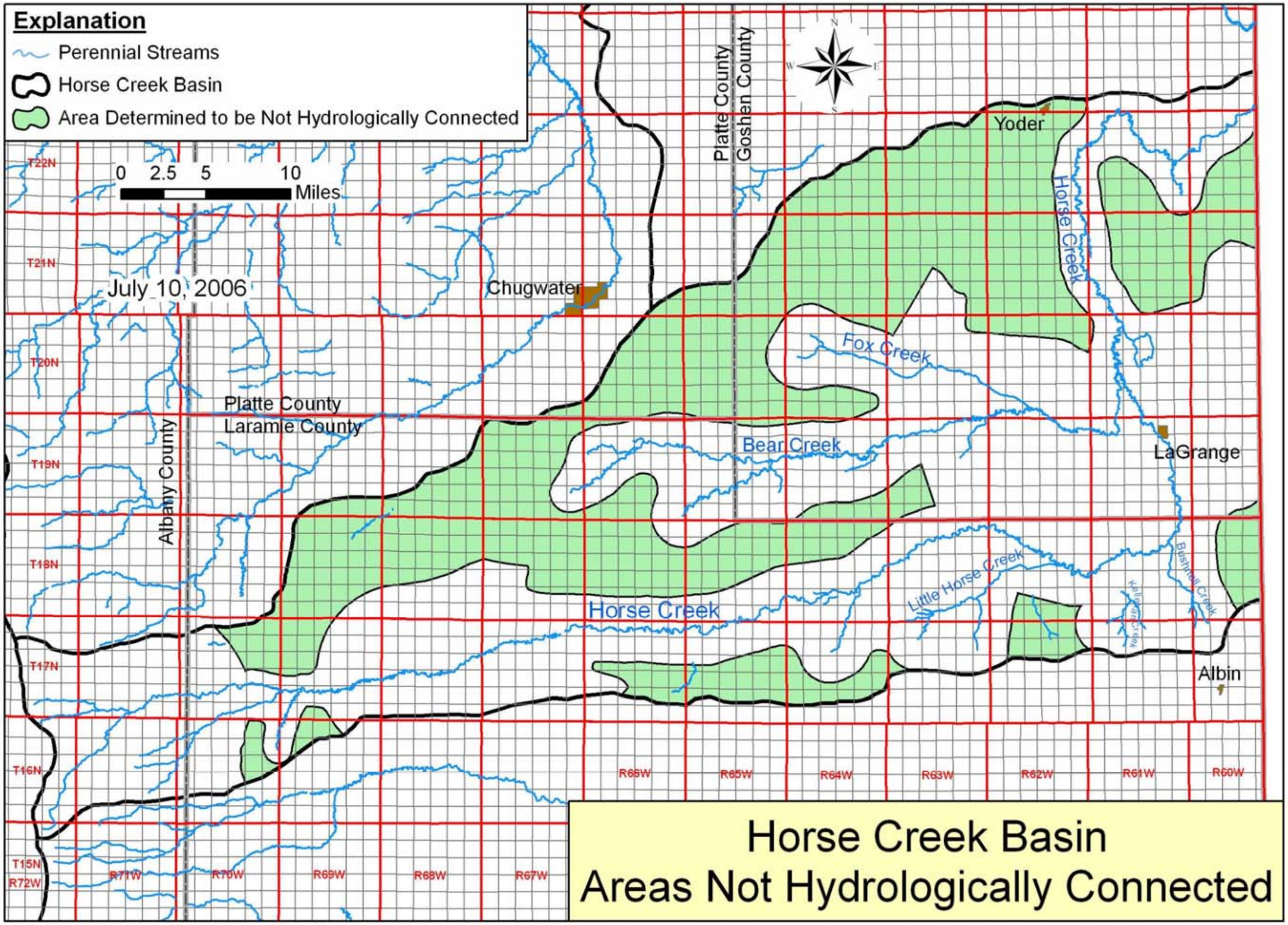

Explanation
Perennial Streams
Alcova Dam to Guernsey Dam Basin
Area Determined to Not be Hydrologically Connected
April 13, 2004
Alcova Dam to Guernsey Dam -
North Platte River Basin
Areas Not Hydrologically Connected
5 0 5 10
Miles
N
S
W
E
North Platte River
Casper Cr
Poison Spider Cr
Deer Cr
Boxelder Cr
LaPrele Cr
Bates Cr
Wagonhound Cr
LaBonte Cr
Elkhorn Cr
Glendo Res.
Alcova Res.
Pathfinder Res.
Sweetwater River
Horse Shoe Cr
Cottonwood Cr
Guernsey Res.
North Laramie River
Greyrocks Res.
Little Medicine Bow River
Medicine Bow River
Sybille Creek
Laramie River
River


Upper Laramie Basin
Areas Not Hydrologically Connected
Explanation
Perennial Streams
Upper Laramie Basin
Area Determined to be Not Hydrologically Connected
0 2.5 5 10
Miles
July 10, 2006
Rock River
Elk Mountain
Wheatland No 2 Reservoir
Laramie River
Little Laramie River
Spring Creek
Laramie
Laramie River
Carbon County
Albany County
T24N
R72W
T23N
T22N
T21N
T20N
T19N
T18N
T17N
T16N
T15N
T14N
T13N
T12N
R72W
R80W
R79W
R78W
R77W
R76W
R75W
R74W
R73W


Lower Laramie Basin
Areas Not Hydrologically Connected
April 11, 2006
Explanation
Perennial Streams
Lower Laramie Basin
Area Determined to be Not Hydrologically Connected
0 5 10
Miles
Guernsey
Fort Laramie
Lingle
Wheatland
Chugwater
Rock River
North Laramie River
Laramie River
Greyrocks Res
Albany County
Platte County
Platte County
Goshen County
Platte County
Laramie County
R77W
T27N
R76W
R75W
R74W
R73W
R72W
R71W
R70W
R69W
R68W
R67W
R66W
R65W
R64W
R63W
T27N
R62W
T26N
T25N
T24N
T23N
T22N
T21N
T20N
T19N
T18N



T31N
R67W
R66W
R65W
R64W
R63W
R62W
R61W
R60W
Niobrara County
Goshen County
Explanation
Perennial Streams
Guernsey to State Line Basin
Area Determined to be Not Hydrologically Connected
T29N
T28N
T27N
T26N
T25N
T24N
T23N
T22N
T21N
T20N
Hartville
Guernsey
North Platte River
Fort Laramie
Laramie River
Platte County
Goshen County
Lingle
Rawhide Creek
Torrington
Wheatland
Cherry Creek Drain
Katzer Main Drain
Yoder
July 10, 2006
0 2.5 5 10
Miles
Chugwater
Guernsey to State Line Basin
Areas Not Hydrologically Connected


Explanation
Perennial Streams
Horse Creek Basin
Area Determined to be Not Hydrologically Connected
0 2.5 5 10
Miles
July 10, 2006
Chugwater
Platte County
Goshen County
Platte County
Laramie County
Albany County
Yoder
Horse Creek
Fox Creek
Bear Creek
LaGrange
Little Horse Creek
Horse Creek
Bushnell Creek
Albin
T22N
T21N
T20N
T19N
T18N
T17N
T16N
T15N
R72W
R71W
R70W
R69W
R68W
R67W
R66W
R65W
R64W
R63W
R62W
R61W
R60W
Horse Creek Basin
Areas Not Hydrologically Connected

Attachment No. III
Wyoming's Depletions Plan
Streamlined ESA Consultation Process

On June 16, 2006, the U.S. Fish and Wildlife Service (FWS) issued a programmatic biological opinion (PBO) for the Platte River Recovery Implementation Program. The PBO established a two-tiered consultation process for future federal actions on existing and new water related activities subject to section 7(a)(2) of the ESA. The PBO, dated June 16, 2006, is the Tier 1 BO and it evaluated the effects of the PRRIP, which includes Wyoming's Depletions Plan.
The Tier 2 BO will determine if the flow related effects of future federal actions are consistent with the scope and determination of effects addressed in the Tier 1 BO. The federal review will determine if: 1) the proposed activities comply with the definition of existing water related activities and/or 2) proposed new water related activities are covered by Wyoming's Depletions Plan.

The Tier 2 BO will be completed under the streamlined ESA consultation process discussed in this attachment and the template documents provided herein. Please note that this streamlined ESA consultation process will only be necessary for future federal actions on water related activities. Water related activities that are not federal actions will be addressed by the State Coordinator in the manner outlined in Wyoming's Depletions Plan.

The following is a summary addressing the template documents included in this attachment that would be used to develop the Tier 2 BO.

<u>Template No. 1-Wyoming Platte River Recovery Agreement</u>
This agreement between the State of Wyoming and the water user would be used to document any action required of the water user to comply with Wyoming's Depletions Plan. If the water users proposed water related activity complies with the depletions plan without additional actions by the water user, the State Coordinator would simply advise the Federal Action Agency and FWS of this fact through correspondence and this agreement would not be necessary. However, if applicable, this agreement would be drafted by the State Coordinator in consultation with the water user. The draft agreement would be offered to the Federal Action Agency and the FWS for review and comment. Upon concurrence of the federal agencies, the Wyoming Platte River Recovery Agreement will be finalized.

<u>Template No. 2-Platte River Recovery Agreement</u>
This agreement is between the water user and the FWS. The agreement will be drafted by the Federal Action Agency using this template and may include the Wyoming Platte River Recovery Agreement as an attachment. The Platte River Recovery Agreement will be initially executed by the water user. The FWS will execute the agreement upon completion of the Tier 2 Biological Opinion.

<u>Template No. 3-Biological Assessment & Request for Formal Section 7 Consultation</u>
The Federal Action Agency will complete the biological assessment using this template. Please note that the biological assessment will address site specific effects on listed species within

Wyoming not covered by the PRRIP and the PBO. The biological assessment, along with the Platte River Recovery Agreement executed by the water user, will be submitted to the FWS.

<u>Template No. 4-Platte River Tier 2 Biological Opinion</u>
The streamlined consultation process will be completed when the FWS issues the Tier 2 Biological Opinion and executes the Platte River Recovery Agreement.

TEMPLATE NO. 1
WYOMING PLATTE RIVER RECOVERY AGREEMENT

This RECOVERY AGREEMENT is entered into this ____ day of _____________, [Year], by and between the Wyoming State Engineer (State Engineer), acting on behalf of the State of Wyoming and name of Water User ("Water User").

WHEREAS, in 2006, the Secretary of the Interior and the Governors of Wyoming, Nebraska and Colorado signed a Cooperative Agreement to implement the Platte River Recovery Implementation Program ("Program"); and

WHEREAS, the Program implements certain aspects of the Service's recovery plans for four species (interior least tern, whooping crane, piping plover and pallid sturgeon) (collectively the "target species") listed as threatened or endangered pursuant to the Endangered Species Act ("ESA"). The Program is intended to provide defined benefits for the target species and their associated habitats while providing for water development in the Platte River Basin to proceed in compliance with state law, interstate compacts and decrees, and the ESA; and

WHEREAS, on June 16, 2006, the Service issued a programmatic biological opinion (PBO) concluding that implementation of the Program, along with existing and a specified amount of new depletions, are not likely to jeopardize the continued existence of the target species or destroy or adversely modify their designated critical habitat in Nebraska. The Service also concluded that implementation is not likely to jeopardize the threatened bald eagle or western prairie fringed orchid in Nebraska; and

WHEREAS, Water User is the choose one: owner/operator/contractor of name of water project or projects (Water Project), which causes or will cause depletions to the Platte River system within Wyoming; and

WHEREAS, the State of Wyoming has prepared and the Governance Committee of the Program has approved the Depletions Plan, Platte River, Wyoming (Wyoming's Depletions Plan), which defines the existing water related activities and certain specific new water related activities that are covered
by the Program and the PBO;

WHEREAS, Water User's Water Project is covered by the PBO; and

WHEREAS, Water User desires certainty that its depletions can occur consistent with Section 7 and Section 9 of the ESA and therefore its Biological Opinion through participation in the Program; and

WHEREAS, the existing water related activity will be operated on behalf of Wyoming water users.

NOW THEREFORE, Water User and the State Engineer agree as follows:

(Example Situations)

If the State Coordinator has determined that the activity will qualify as an existing water related activity without terms and conditions, **this agreement may not be necessary**. For example, if the water user is rehabilitating an existing water supply system that will not increase depletions or the water user is proposing a project that will rely on a change of use approved by the Wyoming Board of Control, then the State Engineer would simply document such findings in a letter to the Federal Action Agency.

OR

If the State Coordinator has determined that the activity will qualify as an existing water related activity subject to certain terms and conditions, this agreement can be used to document those terms and conditions. For example, a water user seeking a replacement well may be required to cement
the old well and/or voluntarily abandon an existing water right. (Note: This could also be documented with conditions on the permit for the replacement well.) Another example, the water user could acquire and retire depletions from an existing water related activities as defined in Wyoming's Depletions Plan and thereby ensure the activity can be completed without exceeding an existing water related activity benchmark or baseline.

OR

If the water user is proposing a new water related activity, the agreement would be used to document the terms and conditions for coverage by Wyoming's Depletions Plan and the Program. For example, the water user could acquire replacement water to offset the new depletions. Another example, the water user could seek and receive replacement water from the Wyoming Water Bank through the Director of the Wyoming Water Development Office. (Any agreements for water from the water bank should be attached to this agreement.)

OR

If the water user is proposing a project that includes both existing and new water related activities, the agreement could be used to document the quantification of the two activities, and perhaps, place conditions on each to ensure there is proper mitigation.

The following general conditions will apply to this agreement:

1. The Wyoming State Engineer, his employees, and the State of Wyoming do not waive their sovereign immunity by entering into this agreement and specifically retain immunity and all defenses available to them as sovereigns pursuant to W.S. 1-39-104(a) and all other laws.

2. The construction, interpretation and enforcement of this agreement shall be governed by the laws of the State of Wyoming. Venue for any court action shall be in the First Judicial District, Laramie County, Wyoming.

3. Water user shall indemnify, defend and hold harmless the State of Wyoming, the State Engineer, and its officers, agents, employees, successors and assignees from any and all claims, lawsuits, losses and liability arising out of the Water User's failure to perform any of Water User's
duties and obligations hereunder or in connection with the negligent performance of Water User's duties or obligations or participation in the Program.

___________________________________ ________________________

Water User Representative Date

___________________________________ ________________________

Wyoming State Engineer Date

Approved by: ____________________________ ________________________

Wyoming Attorney General's Office Date

WYOMING

TEMPLATE BIOLOGICAL ASSESSMENT & REQUEST FOR FORMAL SECTION 7 CONSULTATION

Text shown in blue should be provided by the applicant

[DATE]

[FROM FEDERAL ACTION AGENCY
TO U.S. FISH & WILDLIFE SERVICE]

This letter contains the Biological Assessment addressing potential impacts from operation of the [Project] on federally-listed species and designated critical habitats. With this submission, we are requesting initiation of Formal Consultation under Section 7(a) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.)("ESA"), concerning the whooping crane (*Grus americana*), interior least tern (*Sternula antillarum*), northern Great Plains population of the piping plover (*Charadrius melodus*), pallid sturgeon (*Scaphirhynchus albus*) (collectively referred to as the "target species"), and designated critical habitat of the whooping crane. We further request initiation of Formal Consultation for the western prairie fringed orchid (*Platanthera praeclara*), [include other non-target listed species or critical habitats, as needed]. We have determined that the Project is not likely to adversely affect the American burying beetle (*Nicrophorus americanus*) and will have no effect on the Eskimo curlew (*Numenius borealis*).

[Briefly describe: (1) Project; (2) Applicant; (3) Project location; and (4) Federal action (e.g., permit or authorization) associated with the Project.]

For an Existing Water-Related Activity

Based on a determination by the Wyoming State Engineer's Office (SEO), this project is an existing water-related activity which will not increase depletions to the Platte River system and is covered by the Program's Wyoming Depletions Plan. A copy of the determination received from the SEO is attached to this biological assessment.

Description of water use should include:

- Location of Use (e.g., the service district, the county, the irrigation district, the industrial facility)
- Source of Water (e.g., water from X wells located in Y county providing up to Z acre-feet of supply annually; X acre-feet of storage rights from Y reservoir)
- Use of Water (e.g., approximately X domestic water taps, X acres of irrigated cropland, operation of an X-megawatt power-generation plant, up to X miles of pipeline hydrostatic testing, etc.)

Note: Depletions to Platte River flows (if any) associated with existing water-related activities covered by the Wyoming Depletion Plan do not need to be estimated.

For a New Water-Related Activity

Based on a determination by the Wyoming State Engineer's Office (SEO), this project is a new water-related activity which [will not result in new depletions] [*or*] [will result in new depletions to the Platte River Basin requiring mitigation in order to be covered by the Program's Wyoming Depletions Plan]. A copy of the determination received from the SEO is attached to this biological assessment.

Description of water use should include:

- Location of Use (e.g., the service district, the county, the irrigation district, the industrial facility)
- Source of Water (e.g., water from X wells located in Y county providing up to Z acre-feet of supply annually; X acre-feet of storage rights from Y reservoir)
- Use of Water (e.g., approximately X domestic water taps, X acres of irrigated cropland, operation of an X-megawatt power-generation plant, up to X miles of pipeline hydrostatic testing, etc.)

Description of water replacement (mitigation) should include:

- A description of the mitigation measures agreed upon to comply with Wyoming's Plan (or with the Federal Depletion Plan). A copy of the corresponding Platte River Recovery Agreement between the project proponent and the State of Wyoming may be provided to meet this information need.

The Platte River Recovery Implementation Program (PRRIP or Program), established in 2006, is implementing actions designed to assist in the conservation and recovery of the target species and their associated habitats along the central and lower Platte River in Nebraska through a basin-wide cooperative approach agreed to by the States of Wyoming, Nebraska, and Colorado and the U.S. Department of the Interior [Program, 2006; Section I.A.1.]. The Program addresses the adverse impacts of existing and certain new water related activities on the Platte River target species and associated habitats, and provides ESA compliance[1] for effects to the target species and whooping crane critical habitat from such activities including avoidance of any prohibited take of such species. [Program, 2006; Section I.A.2 & footnote 2.]. The State of Wyoming is in compliance with its obligations under the Program.

For Federal actions and projects participating in the Program, the Platte River Recovery Implementation Program Final Environmental Impact Statement (U.S Department of Interior, 2006) and supplemental Environmental Assessment and Finding of No Significant Impact (2018), as well as the June 16, 2006 programmatic biological opinion (PBO) and the August 27, 2018 Supplemental biological opinion (collectively referred to as the PBOs) serve as the description of the environmental baseline and environmental consequences for the effects of the Federal actions on the listed target species, whooping crane critical habitat, and other listed species in the central and lower Platte River addressed in the PBOs. These documents are hereby incorporated into this Biological Assessment by this reference.

Table II-1 of the Supplemental biological opinion (pages 6-8) contains a list of species and critical habitat in the action area, their status, and the Service's determination of the effects of the Federal action analyzed in the PBOs, including the continued operation of existing and certain new water-related activities. The Service determined in the PBOs that the continued operation of existing and certain new water-related activities may adversely affect but would not likely jeopardize the continued existence of the endangered whooping crane, interior least tern, and pallid sturgeon, or the threatened northern Great Plains population of the piping plover.

[1] "ESA Compliance" means: (1) serving as the reasonable and prudent alternative to offset the effects of water-related activities that FWS found were likely to cause jeopardy to one or more of the target species or to adversely modify critical habitat before the Program was in place; (2) providing offsetting measures to avoid the likelihood of jeopardy to one or more of the target species or adverse modification of critical habitat in the Platte River basin for new or existing water-related activities evaluated under the ESA after the Program was in place; and (3) avoiding any prohibited take of target species in the Platte River basin.

Further, the Service found that the continued operation of existing and certain new water-related activities may adversely affect but would not likely jeopardize the threatened bald eagle and western prairie fringed orchid associated with the central and lower reaches of the Platte River in Nebraska, and was not likely to destroy or adversely modify designated critical habitat for the whooping crane. The bald eagle was subsequently removed from the federal endangered species list on August 8, 2007.

The Service also determined that the PBOs Federal Action, including the continued operation of existing and certain new water-related activities, would have no effect to the endangered Eskimo curlew. There has not been a confirmed sighting since 1926 and this species is believed to be extirpated in Nebraska. Lastly, the Service determined that the PBOs Federal Action, including the continued operation of existing and certain new water-related activities, was not likely to adversely affect the endangered American burying beetle.

[Insert applicable BA text describing potential affects to non-target listed species, their critical habitats, if any, and/or site-specific affects to any listed species/critical habitat]

INSERT APPLICABLE LANGUAGE BELOW:

The above-described Project operations qualify as an "existing water related activity" because they are surface water or hydrologically connected groundwater activities implemented on or before July 1, 1997, within the intent and coverage of the Program. [Program, 2006; Section I.A. footnote 3]. The existing water related activity conforms to the criteria in Section III of Chapters 2 or 3 of the Depletions Plan, Platte River Basin, Wyoming (Wyoming's Depletions Plan [Program, Attachment 5, Section 7]) and:

1. The existing water related activity is operated on behalf of Wyoming water users;

2. The State Coordinator has determined that the activity qualifies as an existing water related activity; and

3. If required by the State Coordinator, the Applicant has signed a Wyoming Recovery Agreement to document any mitigation requirements need to qualify as an existing water activity.

-AND/OR-

The above-described Project operations qualify as a "new water related activity" because such operations constitute new surface water or hydrologically connected groundwater activities which may affect the quantity or timing of water reaching the associated habitats of the target species implemented after July 1, 1997. [Program, 2006; Section I.A. footnote 3]. The new water related activity conforms to the criteria in Section II of Chapters 2 or 3 of Wyoming's Depletions Plan and:

1. The new water related activity is operated on behalf of Wyoming water users;

2. The new water related activity can be completed without exceeding an existing water related baseline or benchmark as described in Wyoming's Depletions Plan or the Applicant has requested, and the State of Wyoming has agreed, that the depletions resulting from the new water related activity will be mitigated with water from the Wyoming Water Bank; and

3. The Applicant has signed a Wyoming Recovery Agreement with the Wyoming State Coordinator to document the requirements to qualify for the status described in 2. above.

[Note: It is understood that a Project may include existing and new water related activities. In these situations, the activities within the Project must be categorized as “existing” or “new” and biological assessment will address both categories.]

Accordingly, the impacts of this activity to the target species, whooping crane critical habitat, and other listed species in the central and lower Platte River addressed in the PBOs are covered and offset by operation of Wyoming’s Depletions Plan as part of the PRRIP.

The Applicant intends to rely on the provisions of the Program to provide ESA compliance for potential impacts to the target species and whooping crane critical habitat. Insert the [Federal Agency] intends to require, as a condition of any approval, that the Applicant fulfill the responsibilities required of Program participants in Wyoming. The [Federal Agency] also intends to retain discretionary Federal authority for the Project, consistent with applicable regulations and Program provisions, in case reinitiation of Section 7 consultation is required.

This letter addresses consultation on all listed species and designated critical habitat in Nebraska, including the referenced Platte River target species and whooping crane critical habitat. Potential impacts from construction and operation of the Project to any other federally-listed threatened or endangered species and designated critical habitats will be addressed within the applicable biological opinion prepared by the Service, in accordance with the ESA.

References:

Platte River Recovery Implementation Program Document. 2006.

U.S. Department of the Interior. 2006. Platte River Recovery Implementation Program Final Environmental Impact Statement.

U.S. Fish and Wildlife Service. 2006. Biological Opinion on the Platte River Recovery Implementation Program.

U.S. Department of the Interior. 2018. Platte River Recovery Implementation Program First Increment Extension Final Environmental Assessment.

U.S. Fish and Wildlife Service. 2018. Supplemental Biological Opinion on the Platte River Recovery Implementation Program First Increment Extension.

/FROM FEDERAL ACTION AGENCY/

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
[State] Field Office
[Address]
[City, State, Zip Code]

[Date]

[FWS tracking number]

[Name]
[Agency]
[Address]
[City, State Zip]

RE: [Project Name] Project, [County Location] County, [State]

Dear [Mr./Mrs.] :

This biological opinion is provided in response to your [Date] request to initiate formal consultation pursuant to section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA). Your biological assessment describes the potential effects of the [Project Name] on federally listed species and designated critical habitat.

The Federal Action reviewed in this biological opinion is the [Project Name] Project, located at [location description], [county name] County, [state]. The Project is [project description and purpose].

I. Background

On June 16, 2006, the U.S. Fish and Wildlife Service (Service) issued a programmatic biological opinion (PBO) for the 13-year first increment of the Platte River Recovery Implementation Program (PRRIP) and water-related activities[1] affecting flow volume and timing in the central and lower reaches of the Platte River in Nebraska. On August 27, 2018, the Service issued a supplemental programmatic biological opinion (Supplement) for an extension of the PRRIP through 2032. These two biological opinions are hereinafter referred to collectively as the PBOs. The action area for the PBOs includes the Platte River basin upstream of the confluence with the Loup River in Nebraska, and the mainstem of the

[1] The term "water-related activities" means activities and aspects of activities which (1) occur in the Platte River basin upstream of the confluence of the Loup River with the Platte River; and (2) may affect Platte River flow quantity or timing, including, but not limited to, water diversion, storage and use activities, and land use activities. Changes in temperature and sediment transport will be considered impacts of a "water related activity" to the extent that such changes are caused by activities affecting flow quantity or timing. Impacts of "water related activities" do not include those components of land use activities or discharges of pollutants that do not affect flow quantity or timing.

Platte River downstream of the Loup River confluence.

The Federal Action addressed by the PBOs includes the following:

1) funding and implementation of the PRRIP through 2032, the anticipated first increment of the PRRIP, as extended; and

2) continued operation of existing and certain new water-related activities[2] including, but not limited to, Reclamation and Service projects that are (or may become) dependent on the PRRIP for ESA compliance during the first increment of the PRRIP, as extended, for their effects on the target species[3], whooping crane critical habitat, and other federally listed species[4] that rely on central and lower Platte River habitats.

The PBOs establish a two-tiered consultation process for future federal actions on existing and new water-related activities subject to section 7(a)(2) of the ESA, with issuance of the PBOs being Tier 1 and all subsequent site-specific project analyses constituting Tier 2 consultations covered by the PBOs. Under this tiered consultation process, the Service will produce tiered biological opinions when it is determined that future federal actions are "likely to adversely affect" federally listed species and/or designated critical habitat in the PRRIP action area and the project is covered by the PBOs.

Although the water depletive effects of this Federal Action to central and lower Platte River species have been addressed in the PBOs, when "no effect" or may affect but not likely to adversely affect determinations are made on a site-specific basis, the Service will review these determinations and provide written concurrence where appropriate. Upon receipt of written concurrence, section 7(a)(2) consultation will be considered completed for those federal actions.

Water-related activities requiring federal approval will be reviewed by the Service to determine if: (1) those activities comply with the definition of existing water-related activities; and/or (2) proposed new water-related activities are covered by the applicable states or the federal depletions plan. The Service has determined that the [Project Name] Project meets the above criteria; therefore, this Tier 2 biological opinion regarding the effects of the [Project Name] Project on the target species, whooping crane critical habitat, and western prairie fringed orchid in the central and lower Platte River can tier from the PBOs. This Tier 2 biological opinion does not address potential effects from construction and operation of the Project on any other federally-listed threatened or endangered species and designated critical habitats outside of the PRRIP action area. Those effects will be addressed by the appropriate Field Office of the Service, in accordance with the ESA.

---

[2] "Existing water related activities" include surface water or hydrologically connected groundwater activities implemented on or before July 1, 1997. "New water-related activities" include new surface water or hydrologically connected groundwater activities including both new projects and expansion of existing projects, both those subject to and not subject to section 7(a)(2) of the ESA, which may affect the quantity or timing of water reaching the associated habitats and which are implemented after July 1, 1997.

[3] The "target species" are the endangered whooping crane (*Grus americana*), the interior least tern (*Sternula antillarum*), the pallid sturgeon (*Scaphirynchus albus*), and the threatened northern Great Plains population of the piping plover (*Charadrius melodus*).

[4] Other listed species present in the central and lower Platte River include western prairie fringed orchid (*Platanthera praeclara*), American burying beetle (*Nicrophorus americanus*) and Eskimo curlew (*Numenius borealis*).

II. Consultation History

Table II-1 of the Supplement (pages 6-8) contains a list of species and critical habitat in the action area, their status, and the Service's determination of the effects of the Federal Action analyzed in the PBOs.

The Service determined in the Tier 1 PBOs that the Federal Action, including the continued operation of existing and certain new water-related activities, may adversely affect but would not likely jeopardize the continued existence of the federally endangered whooping crane, interior least tern, and pallid sturgeon, or the federally threatened piping plover (herein after referred to as piping plover), and western prairie fringed orchid in the central and lower Platte River. Further, the Service determined that the Federal Action, including the continued operation of existing and certain new water-related activities, was not likely to destroy or adversely modify designated critical habitat for the whooping crane. The bald eagle was subsequently removed from the Federal endangered species list on August 8, 2007. Bald eagles continue to be protected by the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. For more information on bald eagles, see the Service's webpage at: http://www.fws.gov/migratorybirds/BaldEagle.htm

The Service also determined in the Tier 1 PBOs that the Federal Action would have no effect to the endangered Eskimo curlew. There has not been a confirmed sighting since 1926 and this species is believed to be extirpated in Nebraska. Lastly, the Service determined that the Federal Action, including the continued operation of existing and certain new water-related activities, was not likely to adversely affect the endangered American burying beetle.

The effects of the continued operation of existing and certain new water-related activities on the remaining species and critical habitats listed in Table II-1 of the Supplement were beyond the scope of the PBOs and were not considered.

The Service has reviewed the information contained in the biological assessment submitted by your office on [Date]. We concur with your determinations of "may affect, and likely to adversely affect" for the endangered whooping crane, interior least tern, pallid sturgeon, and the threatened piping plover, and the western prairie fringed orchid in the central and lower Platte River. We also concur with your determination of may affect, and likely to adversely affect, for designated whooping crane critical habitat.

We also concur with your determinations of "may affect, but not likely to adversely affect" for [species, and "no adverse modification of critical habitat" for species]. You have also made the determination of no effect for the [species]. We acknowledge those no effect determinations.

III. Scope of the Tier 2 Biological Opinion

The [Project Name] Project is a component of "the continued operation of existing and certain new water-related activities" requiring a federal action to be evaluated in the Tier 1 PBOs, and flow-related effects of the Federal Action are consistent with the scope and the determination of effects in the PBOs. Because [Project Proponent] has elected to participate in the PRRIP, ESA compliance for flow-related effects to federally listed endangered and threatened species and designated critical habitat from [Project Name] Project is provided to the extent described in the Tier 1 PBOs.

This biological opinion applies to the [Project Name] Project effects to listed endangered and threatened species and designated critical habitat as described in the PBOs for the period of the first 26 years of the PRRIP (i.e., the anticipated duration of the PRRIP first increment and extension).

IV. Description of the Federal Action

[Describe the Federal Action and any Interdependent and Interrelated Actions – use text from the Biological Assessment]

V. Status of the Species/Critical Habitat

Species descriptions, life histories, population dynamics, status and distributions are fully described in the PBO on pages 76-156 and on pages 17-53 in the Supplement for the whooping crane, interior least tern, piping plover, pallid sturgeon, and western prairie fringed orchid, and whooping crane critical habitat, and are hereby incorporated by reference.

Climate change was evaluated as a potential threat to the species and whooping crane critical habitat in the Supplement. The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). "Climate" refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007, p. 78). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8-14, 18-19).

Changes in temperature and/or precipitation patterns will influence the status of the Platte River system. These changes may contribute to threats that have already been identified and discussed for interior least tern, piping plover, pallid sturgeon and western prairie fringed orchid in the Tier 1 PBOs.

[Discuss changes in status of target species/critical habitat since the Tier 1 PBOs were issued, or include a statement saying "Since issuance of the Service's PBO and the Supplement, there have been no substantial changes in status."]

VI. Environmental Baseline

The Environmental Baseline sections for the Platte River and for the whooping crane, interior least tern, piping plover, pallid sturgeon, and western prairie fringed orchid, and whooping crane critical habitat are described on pages 157 to 219 of the Tier 1 PBO and pages 54 to 81 of the Supplement, and are hereby incorporated by reference.

[Discuss changes in status of target species/critical habitat in the action area since the Tier 1 PBOs were issued, or include a statement saying "Since issuance of the Service's PBO and the Supplement, there have been no substantial changes in status of target species/critical habitat in the action area."]

VII. Effects of the Action

Since issuance of the Tier 1 PBO, our analyses under the ESA include consideration of ongoing and projected changes in climate. The Supplement considered these impacts. In our analyses, we used our best professional judgement to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change. Actions that are undertaken to improve the river ecology and habitats for listed species not only address human activities, but also contribute to listed species and whooping crane critical habitat resiliency to climate change.

Based on our analysis of the information provided in your biological assessment for the [Project Name], the Service concludes that the proposed Federal Action will result in a [a/an existing depletion, new depletion, or a combination of existing and new depletions]. These depletions are associated with [briefly describe here, or by reference, the specific water supply sources, water uses, amount information, etc. (e.g. in Colorado, use the *Supplemental Worksheet for PRRIP BA*)].

[Include as needed:] As an existing water-related activity, we have determined that the flow-related adverse effects of the [Project Name] are consistent with those evaluated in the Tier 1 PBOs for the whooping crane, interior least tern, piping plover, pallid sturgeon, western prairie fringed orchid, and whooping crane critical habitat.

[Include as needed:] As a new water-related activity, we have determined that the flow-related adverse effects of the [Project Name] are consistent with those evaluated in the Tier 1 PBOs for the whooping crane, interior least tern, piping plover, pallid sturgeon, western prairie fringed orchid, and whooping crane critical habitat, and these effects on flows are being addressed in conformance with the [Select the applicable depletion plan: Wyoming

Depletion Plan, Nebraska New Depletion Plan, Colorado Plan for Future Depletions, Federal Depletions Plan] of the PRRIP.

[If the site-specific project/activity may affect listed species/critical habitat addressed in the PBOs, include those site-specific effects here. In that instance, the Incidental Take Statement section below may need additional text.]

VIII. Cumulative Effects

Cumulative effects include the effects of future State, local, or private (non-federal) actions that are reasonably certain to occur in the action area considered in this biological opinion. A non-federal action is "reasonably certain" to occur if the action requires the approval of a State or local resource or land-control agency, such agencies have approved the action, and the project is ready to proceed. Other indicators which may also support such a "reasonably certain to occur" determination include whether: a) the project sponsors provide assurance that the action will proceed; b) contracting has been initiated; c) State or local planning agencies indicate that grant of authority for the action is imminent; or d) where historic data have demonstrated an established trend, that trend may be forecast into the future as reasonably certain to occur. These indicators must show more than the possibility that the non-federal project will occur; they must demonstrate with reasonable certainty that it will occur. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act and would be consulted on at a later time.

Cumulative effects are described on pages 194 to 300 of the Tier 1 PBO and pages 102 to 104 of the Supplement, and are hereby incorporated by reference. [Discuss any changes in cumulative effects, if any, since the Tier 1 PBOs was issued, or include a statement saying "Since issuance of the Service's PBO and the Supplement, there have been no substantial changes in cumulative effects to the species."]

IX. Conclusions

The Service concludes that the proposed [Project Name] Project is consistent with the Tier 1 PBOs for effects to listed species and critical habitat addressed in the Tier 1 PBOs. After reviewing site specific information, including: 1) the scope of the Federal Action; 2) the environmental baseline; 3) the status of the whooping crane, interior least tern, piping plover, pallid sturgeon, and western prairie fringed orchid in the central and lower Platte River and their potential occurrence within the project area, as well as whooping crane critical habitat; 4) the effects of the [Project Name] Project; and 5) any cumulative effects, it is the Service's biological opinion that the [Project Name] Project, as described, is not likely to jeopardize the continued existence of the federally endangered whooping crane, interior least tern, and pallid sturgeon, or the federally threatened piping plover, or western prairie fringed orchid in the central and lower Platte River. The [Project Name] Project is also not likely to destroy or adversely modify designated critical habitat for the whooping crane.

This Tier 2 biological opinion does not address potential effects from construction and operation of the Project on any other federally-listed threatened or endangered species and designated critical habitats outside of the PRRIP action area. Those effects will be addressed by the appropriate Field Office of the Service, in accordance with the ESA.

X. Incidental Take Statement

Section 9 of ESA and federal regulations pursuant to section 4(d) of ESA prohibit the take of endangered and threatened species without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct, and applies to individual members of a listed species. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

Sections 7(b)(4) and 7(o)(2) of ESA do not apply to the incidental take of federally listed plant species (e.g., Ute ladies' tresses orchid, and western prairie fringed orchid). However, limited protection of listed plants from take is provided to the extent that ESA prohibits the removal and reduction to possession of federally listed endangered plants or the malicious damage of such plants on non-federal areas in violation of state law or regulation or in the course of any violation of a state criminal trespass law. Such laws vary from state to state.

The Department of the Interior, acting through the Service and Bureau of Reclamation, is implementing all pertinent Reasonable and Prudent Measures and implementing Terms and Conditions stipulated in the Tier 1 PBOs' Incidental Take Statements (pages 309-326 of the PBO and 111-115 of the Supplement) which will minimize the anticipated incidental take of federally listed species. In instances where the amount or extent of incidental take outlined in the Tier 1 PBOs is exceeded, or the amount or extent of incidental take for other listed species is exceeded, the specific PRRIP action(s) causing such take shall be subject to reinitiation expeditiously.

[If the site-specific project/activity may affect listed species/critical habitat addressed in the PBOs, include any site-specific Reasonable and Prudent Measures and Terms and Conditions here. See the format in the PBOs Incidental Take sections]

XI. Closing Statement

Any person or entity undertaking a water-related activity that receives federal funding or a federal authorization and which relies on the PRRIP as a component of its ESA compliance in section 7 consultation must agree: (1) to the inclusion in its federal funding or authorization documents of reopening authority, including reopening authority to accommodate reinitiation upon the circumstances described in Section IV.E. of the Program document; and (2) to request appropriate amendments from the federal action agency as needed to conform its funding or authorization to any PRRIP adjustments negotiated among the three states and the Department of the Interior, including specifically new requirements, if any, at the end of the first PRRIP increment and any subsequent PRRIP increments. The Service believes that the PRRIP should not provide ESA compliance for any water-related activity for which the funding or authorization document does not conform to any PRRIP adjustments (Program Document, section VI). Reinitiation of consultation over [Project Name] Project will not be required at the end of the first increment including the extension (a period covering the first 26 years of the PRRIP) provided a subsequent Program increment or additional first increment Program extension is adopted pursuant to appropriate ESA and NEPA compliance procedures, and, for a subsequent increment, the effects of the [Project Name] Project are covered under a Tier 1 PBO for that increment addressing continued operation of previously consulted-on water-related activities.

This concludes formal consultation on the actions outlined in the [Date] request from [federal action agency]. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; 3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, the specific action(s) causing such take shall be subject to reinitiation expeditiously.

Requests for reinitiation, or questions regarding reinitiation should be directed to the appropriate Field Office at the address below.

[For Colorado and Nebraska Projects, select the Nebraska field office; for Wyoming, select Wyoming field office below and delete the other one]

Field Supervisor
Nebraska Ecological Services Field Office
U.S. Fish and Wildlife Service
9325 S Alda Road
Wood River, NE 68883

Field Supervisor
Wyoming Ecological Services Field Office
U.S. Fish and Wildlife Service

334 N Parsley Boulevard
Cheyenne, WY 82007

XII. Conservation Recommendations

Section 7(a)(1) of ESA directs Federal agencies to utilize their authorities to further the purposes of ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of an action on listed species or critical habitat, to help implement recovery plans, or to develop information. Conservation recommendations are provided in the PBO (pages 328-329) and Supplement (page 117) and are hereby incorporated by reference.

XIII. Literature Cited

Platte River Recovery Implementation Program Document. 2006.

U.S. Department of the Interior. 2006. Platte River Recovery Implementation Program Final Environmental Impact Statement.

U.S. Fish and Wildlife Service. 2006. Biological Opinion on the Platte River Recovery Implementation Program.

U.S. Department of the Interior. 2018. Platte River Recovery Implementation Program First Increment Extension Final Environmental Assessment.

U.S. Fish and Wildlife Service. 2018. Supplemental Biological Opinion on the Platte River Recovery Implementation Program First Increment Extension.

We appreciate the opportunity to review and comment on this proposed project. Should you have questions, please contact [FWS lead biologist] within our office at [email address] or [phone number].

PLATTE RIVER RECOVERY IMPLEMENATION PROGRAM
Attachment 5
Section 8

Nebraska New Depletion Plan
For the Platte River Recovery Implementation Program

December 7, 2005

Updated June 2, 2009

I. Extent of Obligation Relative to New and Expanded Uses of Water

This draft plan describes the actions Nebraska proposes to take to prevent or mitigate for new depletions to United States Fish and Wildlife Service (USFWS) target flows (target flows) to the extent those new depletions are caused by new and expanded uses of water, i.e. those begun or expanded on or after July 1, 1997. Implementation of this plan would serve the following purposes of the Platte River Recovery Implementation Program as described in subsection I.A.4 of the Program Document:

> "mitigating the adverse impacts of new water related activities on (1) the occurrence of FWS target flows (as described in Section III.E.1.a) and (2) the effectiveness of the Program in reducing shortages to those flows, such mitigation to occur in the manner and to the extent described in Section III.E.3 and in the approved depletions plans."

Water related activities that were begun prior to July 1, 1997 and are not expanded after that date are not subject to this plan, but will have Endangered Species Act (ESA) coverage under the Platte River Recovery Implementation Program as long as such a Program continues to exist.

Implementation of this plan will occur primarily through actions taken by the Nebraska Department of Natural Resources (NDNR) and by the up to seven natural resources districts (NRDs) that have land area subject to this plan. The dates in this plan are based on an assumption that either (1) decisions to implement a Platte River Recovery Implementation Program will be made by the Department of the Interior and by the Governors of Nebraska, Colorado and Wyoming by January 1, 2006 or (2) all of the geographic area for which new surface water and ground water uses would be subject to this plan after December 31, 2005 will be under a stay or moratorium on new uses by January 10, 2006. If neither assumption proves to be correct, changes may be needed in the implementation dates for this plan. Such changes will be subject to Governance Committee approval. Implementation is also subject to the authorities granted by and limitations of Nebraska statutory and case law and to sufficient funds being appropriated by the Nebraska legislature and/or raised by the natural resources districts involved.

The details of how this plan will be implemented depend on the time of initiation of a new use that causes a depletion to the Platte River or tributary thereof. Depletions to USFWS "target flows" and to "state-protected flows" (both terms are defined later in this document) because of groundwater and surface water uses begun or expanded between July 1, 1997 and December 31, 2005, regardless of where located, will be estimated and will be offset in quantity, time and location according to the schedule set forth in Part IV of this plan. The responsibility for implementing such offsets will rest with the state except to the extent such offsets are required because (a) the new use causing the depletion is subject to the Federal Depletions Plan or (b) a person or entity other than the state has assumed responsibility for offset for specific new depletions.

Beginning on January 1, 2006, the responsibility for implementing this plan will be shared between the state and the NRDs involved. To the extent that new uses of groundwater require permits from NRDs (presently includes all new wells with pumping capacities greater than 50 gpm), the following new and expanded groundwater uses begun on or after January 1, 2006 (including any for which the purpose is to increase the water supply in a river basin other than the Platte River Basin) will not be allowed **unless** the adverse effects of those uses on state-protected flows and on target flows will be offset: uses that (a) are located within the North Platte, South Platte or the Platte River watershed in Nebraska and (b) are so located and constructed that if water were intentionally withdrawn for 40 years, the cumulative stream depletion to the North Platte, the South Platte, the Platte River or a base flow tributary thereto upstream of Chapman, NE would be greater than or equal to 28% of the total groundwater consumed as a result of the withdrawals from those wells. The relative responsibilities for providing offsets for uses that are initiated will vary depending on the nature of the use and the extent to which it causes new depletions to state-protected flows and/or to target flows. For new or expanded uses of groundwater that are not subject to the Federal Depletions Plan, are within the geographic area described in (a) and (b) above, but do not require permits from NRDs (e.g. less than 50 gpm wells), the cumulative impact of all such uses and of any offsetting decreases in uses of the same type will be estimated and the adverse net effects on state-protected flows and on target flows will be offset by the state.

To the extent that the Department of Natural Resources (DNR) has jurisdiction over new uses of surface water (presently includes all diversions from natural streams except those for instream livestock watering and all on-stream storage reservoirs greater than 15AF), new uses to be begun on or after January 1, 2006 (including any for which the purpose is to increase the water supply in any river basin other than the Platte River Basin) will not be allowed by the department unless any adverse effects on state-protected flows and target flows are either prevented or are offset. The extent to which the new surface water appropriator or the state is responsible for the offset will depend on the nature of the use and the extent to which it causes new depletions to state-protected flows and/or to target flows. For new or expanded sandpits and other surface water bodies that do not require permits from DNR (e.g. some new reservoirs with less than 15AF storage capacity), the cumulative impact of all such uses will be estimated and adverse effects on state-protected flows and on target flows will be estimated and will be offset by the state. Nebraska has not permitted any new surface water storage reservoirs in the Platte River Basin upstream of the confluence of the Platte River with the Loup River since July 1, 1997 and currently has a moratorium on the issuance of any new surface water appropriations in that area. If that moratorium were to be lifted or modified during the term of the Program, the ESA compliance coverage provided for new surface water storage reservoirs through implementation of the Program (including this depletions plan) will include compliance coverage for (1) the depletions to target flows that are caused by all such Nebraska reservoirs constructed after that date, regardless of storage capacity; (2) the impacts to FWS peak flows that are caused by Program-approved reservoirs, regardless of storage capacity, that are implemented after that date in accordance with the Water Action Plan; and (3) as long as the storage capacities of all other Nebraska reservoirs constructed or permitted for construction in that part of the basin after Program initiation do not collectively exceed 10,000 acre feet, the impacts to FWS peak flows that are caused by any such other reservoir. Any need to mitigate separately for adverse peak flow impacts caused by a new Nebraska reservoir that is subject to ESA Section 7 consultation (other than a reservoir that is to be implemented in accordance with the Water Action Plan) after that collective storage capacity has been exceeded shall be determined during that Section 7 consultation.

Nebraska's Cooperative Hydrology Study models and other tools will be used by the state and the NRDs to determine the amount, timing and location of depletions to state-protected flows and target flows and also to evaluate the effectiveness of proposed offset projects. In all cases, the offset objective will be to replace the water depleted in the amounts needed and at the times and locations needed to prevent harm to the water uses and/or the target flows for which such flow protection is required. All offset measures shall be constructed and operated or implemented so that they do not cause additional shortages to either target flows or state-protected flows.

II. Definitions

A. **Base Flow Tributary—**Any stream or drain that, for purposes of Nebraska's Cooperative Hydrology Study (COHYST)models, is considered to have contributed base flow to the Platte River under 1997 development conditions. A map showing the streams, stream reaches and drains that are considered to be base flow tributaries is attached as Attachment 1.

B. **State-Protected Flows—**The rates of flow in specified reaches of the North Platte, South Platte, and Platte Rivers and their base flow tributaries at or above Chapman, NE that would be available under July 1, 1997 surface water and groundwater development conditions and that are needed to: (1) satisfy Nebraska natural flow and storage appropriations above Chapman and in effect when a new use is proposed; (2) satisfy Nebraska instream flow appropriations above Chapman and in effect when a new use is proposed; (3) recharge aquifers above Chapman, but only to the extent needed to prevent loss of available water supply, as opposed to reductions in water levels, for then existing Nebraska groundwater users; and (4) implement the Platte River Recovery Implementation Program's Water Action Plan, the objective of which is to reduce target flow shortages.

C. **Target Flows—**The following flows, unless and until modified by the Program's Governance Committee, are the target flows for the reach of the Platte River from Lexington to Chapman, NE, that will be used to determine when and to what extent depletions caused by uses subject to this plan must be offset.

	Target Flow (cfs)	
Time Period	***Wet and Normal Periods***	***Dry Periods***
Jan. 1 to Jan. 31	1,000	600
Feb. 1 to Feb. 14	1,800	1,200
Feb. 15 to March 15	3,350	2,250
March 16 to March 22	1,800	1,200
March 23 to May 10	2,400	1,700
May 11 to May 19	1,200	800
May 20 to June 20	3,700(wet) 3,400(normal)	800
June 21 to July 31	1,200	800
August 1 to Sept. 15	1,200	800
Sept. 16 to Sept. 30	1,000	600
Oct. 1 to Nov. 15	2,400(wet) 1,800(normal)	1,300
Nov. 16 to Dec. 31	1,000	600

For the purpose of determining whether a specific time period is wet, normal or dry, the methodologies approved by the Governance Committee for the Platte River Recovery Implementation Program will be utilized (Attachment 5, Section 4, III B-F).

III. Sources of Offset Water

The following water sources may be used to offset depletions for which mitigation is required by this plan:

- The portions of the yields from the following Reconnaissance-Level Water Action Plan projects reserved by Nebraska for offset purposes: the CNPPID reregulating reservoir, groundwater mound management, the Dawson/Gothenburg Canal recharge project, and power interference.
- Water leasing and water right transfers
- Water management incentives including but not limited to: irrigation system conversions, changes in tillage practices, changes in cropping mix, and deficit irrigation
- Retirement of or reduction in consumption by existing surface water and groundwater uses
- Other groundwater recharge/retiming projects
- Construction of new surface water storage projects
- Purchase of storage water from existing surface water storage projects
- Pumping groundwater directly into a stream
- Converting from surface water to groundwater to eliminate a portion of the depletion or to change the timing of the depletion

- Relocating the point of groundwater withdrawal so that the depletion is reduced and/or the timing is changed
- New controlled drainage projects
- Other offset projects as feasible and appropriate

Specific offset projects will not be selected for implementation until the amount, timing and location of depletions that must be offset has been determined.

IV. Schedule and Reporting

- By January 1, 2007, the state will report the amount of new and expanded water use in the COHYST modeled area begun between July 1, 1997 and December 31, 2005 and the amount, timing, and location of any depletions to target flows because of such new uses.

- By December 31, 2010, the state (or other responsible person or entity when applicable) will (a) put into place the measures necessary to offset in amount, timing and location then existing depletions to target flows and to state-protected flows caused by new water uses that are not subject to the Federal Depletions Plan and are begun between July 1, 1997 and December 31, 2005 and/or (b) will indicate the extent to which it intends to rely on water from one or more Program water projects that have not yet been completed but for which yields are reserved by Nebraska for the purpose of providing such offsets. To the extent that option (b) is utilized, the state shall at the same time demonstrate its preparedness to assume its proportionate share of the responsibility to complete that Program project. In the event that it is determined by the Governance Committee that a Program water project relied upon by Nebraska under option (b) either will not be implemented at all or that the operational date for such project will be delayed by more than two years past the operational date projected by the Governance Committee at the end of Year 3 of the First Increment, Nebraska will, no later than two years after such originally projected operational date, implement such other interim or permanent offset measures as are necessary to fulfill its extant offset obligation. Offset measures for depletions that are caused by such new (7-1-97 to 12-31-05) water uses but that do not occur until after December 31, 2008 will be put into place as necessary to offset such new depletions in amount, timing and location by the time they occur, or the state will indicate the extent to which it intends to utilize option (b) above for that purpose. Reliance on option (b) as the means for achieving such offsets will be subject to the same conditions as described above.

- Each year, commencing in 2007 and continuing as long as the First Increment of the Program remains in effect, the state will provide the Governance Committee with a report containing the following information for the preceding year: (1) any permitted new and expanded uses of surface water subject to this plan; (2) any permitted new and expanded uses of groundwater subject to this plan; (3) the collective amount, timing, and locations of the depletions to target flows because of those new and expanded uses; (4) the collective amount, timing, and locations of all mitigation required by the NRDs or otherwise documented (e.g. reductions in other water uses) or to be provided; and (5) the collective amount, timing, and locations of any additional measures to be implemented by the state to satisfy all mitigation elements required because of new depletions to target flows. To the extent that the NRD required offsets, i.e. those needed because of depletions to state-protected flows, collectively fail to provide sufficient offset of depletions to target flows to cover the mitigation required because of new and expanded uses begun on or after January 1, 2006, additional offset measures will be implemented within two years after the date those new and expanded uses are initiated or will be implemented by the time the depletions to the flows actually occur, whichever is later.

- Starting in 2010 and every five years thereafter, the state also will begin to conduct a new land use inventory and will collect such other information as is necessary to assess the sufficiency of the combined NRD required and state offset measures implemented because of new and expanded uses of surface water and groundwater subject to this plan. Such assessment shall be completed by December 31 of the year following the year the assessment was begun. If that assessment indicates that more offset measures have been put in place than this plan requires to fully mitigate for the new depletions to target flows since the last such assessment, the amount of the excess shall be available to offset future new depletions. If the assessment indicates that additional offset measures need to be put in place, the state will identify the amount, timing, and location of the offset water to be provided by such additional measures. Within two years after the completion of the assessment, the state will put in place any such required additional offset measures. All such offset measures shall be constructed and operated or implemented so that they do not cause additional shortages to either target flows or state-protected flows.

While new and expanded uses of groundwater that are begun on or after January 1, 2006 and are outside the watershed boundaries of the North Platte, South Platte and Platte Rivers and/or the 28% in 40 year lines are not subject to this plan and therefore do not require mitigation for any adverse effects on state-protected flows or target flows, the state, as part of its assessment every five years, will use well registration records and other available information to determine the extent and distribution of such new groundwater uses. Following such assessments, the state will report the following additional information to the Governance Committee:

- By January 1, 2012 and every five years thereafter through the end of the First Increment of the Program, the state will report on the results of its most recent assessment as outlined above.

- By December 31, 2013 and every five years thereafter through the end of the First Increment of the Program, the state will report, as applicable, the amount, timing and location of any excess offsets that are available to offset future new depletions or the amount, timing, and locations of water being provided because of any additional offset measures taken to make up for any offset shortages identified in the previous assessment and which result from new and expanded uses subject to this plan.

If it is determined prior to the end of a Program increment that the aggregate new depletions to target flows associated with all Nebraska uses that are initiated or expanded after January 1, 2006 and are outside the watershed boundaries of the North Platte, South Platte and Platte Rivers and/or outside the 28% in 40 year lines will exceed an average of 2,000 AF per year by the end of the next Program increment, Nebraska understands that, for such subsequent increment, the depletion plan exemption for any such additional new or expanded uses may not be acceptable to the Governance Committee.

V. Tasks Remaining to be Completed as Implementation Occurs

For this plan to be fully implemented, the following additional tasks need to be completed:

a. Refine the COHYST models as needed following the completion of peer review;

b. Determine the extent of any increase in irrigated acreage in the COHYST modeled area between 1997 and 2005;

c. Determine the extent of any increase in average annual consumptive water use by municipalities, industries, rural domestic and other new water related activities in the COHYST modeled area between 1997 and 2005;

d. Determine the amount, timing and location of any depletions to the Platte River or a base flow tributary because of any increase described in b. or c. above;

e. Determine by stream reach and time period the flows that will serve as state-protected flows for purposes of this plan;

f. Develop a tracking system to route depletions described in d. above downstream to locations where those depletions adversely affect state-protected flows and/or target flows;

g. Quantify by stream reach and time period the extent to which the increases described in b. and c. above cause depletions to state-protected flows and/or target flows;

h. Determine what measures will be utilized to offset, in amount, timing and location, the depletions quantified as per g. above;

i. Secure funding for and implement the measures identified in h. above.

j. Establish 12-31-05 baselines for irrigated acreage within the Platte River Basin and inside the 28% in 40 year lines;

k. Establish 12-31-05 baselines for municipal, industrial, rural domestic and other water related activities within the Platte River Basin and inside the 28% in 40 year lines and determine methods to be used to measure increases and decreases in consumptive water use thereafter;

l. Determine methods to be used to measure post 2005 changes in water consumption for municipal, industrial and other water related activities inside the COHYST modeled area but outside the Platte River Basin and/or the 28% in 40 year lines; and

m. Adopt and implement, in at least six natural resources districts, integrated management plans governing the initiation of new water related activities and the expansion of water related activities that have been initiated through 2005; such plans will encompass at least the geographic area that is within the Platte River Basin and inside the 28% in 40 year lines for the Platte and base flow tributaries.

Nebraska will brief the Governance Committee as these tasks are completed. Any resulting work products may be reviewed by the Governance Committee and any such products that are comparable to Governance Committee approved elements of the other states' depletion plans will be subject to Governance Committee approval. The work products that are subject to approval will include, but are not necessarily limited to: use of the COHYST models in the implementation of the new depletion plan (including establishment of the 28% in 40 years lines);

the tracking system used to route depletions; and the baselines for irrigated acreage and for municipal, industrial, rural domestic and other water related activities.

VI. Section 7 ESA Consultations for New Water Related Activities with a Federal Nexus

This section, including the flow chart that follows, is intended to explain and illustrate: (1) how consultations between FWS and federal action agencies will proceed when Section 7 ESA consultations are required on proposed new water related activities in Nebraska; (2) the function of this plan relative to such consultations; and (3) how the role of the State and any other party with responsibility for implementing any depletion offsets or other required reasonable and prudent alternatives will be formalized when such consultations are required. The term "new water related activity" is defined in footnote 3 to item I.A.2 of the Program Document, but for purposes of this section of the Nebraska plan, it applies only to new water related activities for which consultation occurs after the initiation of the PRRIP.

The following narrative corresponds with the box numbers and brief descriptions displayed in the flow chart which follows:

Box 1: Platte River Basin New Water Related Activity (NWRA)
Is the proposed activity a new water related activity as defined above? If no, the remainder of the flow chart does not apply. If yes, go to Box 2.

Box 2: Is there a federal nexus?
Is this new water related activity one for which Section 7 ESA consultation between the federal action agency and FWS is required? If no, go to Box 3. If yes, go to Box 4.

Box 3: Use Nebraska's Depletion Plan, if applicable.
Whether or not offset or other mitigation for the activity will be required will be governed by this plan. No further agency action is needed and no recovery agreement needs to be signed.

Box 4: Federal Consultation Initiated.
The federal action agency and the FWS begin consultation and the proponent of the new water related activity is asked to provide such information as is required by FWS to do the consultation.

Box 5: Depletion Analysis.
The federal action agency, consulting with the FWS and using information obtained from the proponent of the new water related activity, provides a project description of the proposed federal action, including an estimate of the amount, timing and location of the depletions to the Platte River that will be caused by the proposed activity.

Box 6: Is the NWRA one for which DNR or an NRD requires permits?
The Nebraska Department of Natural Resources will keep FWS informed as to what kinds of new surface water and ground water activities require DNR permits and, for each NRD with land area subject to this plan, what kind of new ground water related activities require permits from that NRD. FWS will coordinate with DNR in the event of questions about answers to this

question for particular types of new water related activities. If the answer to the question is yes, go to Box 8. If the answer is no, go to Box 7.

Box 7: Is the NWRA of another type for which offsets are provided by the NE Depletion Plan?
This depletion plan provides for state offset of some new water related activities for which permits are not required from either DNR or an NRD. If the answer to the question is yes, go to Box 8. If the answer is no, go to Box 9.

Box 8: FWS and federal action agency have streamlined consultation regarding depletions covered by the NE Depletions Plan; NDP to serve as RPA for NWRA to that extent.
This depletion plan provides ESA coverage for all depletions caused by new ground water activities and such coverage for most depletions caused by new surface water activities (see other portions of the plan for details). Except for any depletions that are caused by a new surface water activity but are not covered by this plan, the measures required by this plan will serve as the reasonable and prudent alternative for depletions caused by a proposed new water related activity.

Box 9: NE Depletion Plan modified to provide offsets (GC approval required).
If the answer to the question in Box 7 is no, the Program Document allows for GC approval of changes in any state's depletion plan for the purpose of broadening ESA coverage under that plan. FWS and state concurrence on any such proposed amendment to this plan will be required before GC action is requested. If this plan is not modified to allow ESA coverage of the new water related activity involved, go to Box 10. If such modification is approved by the GC, go to Box 8.

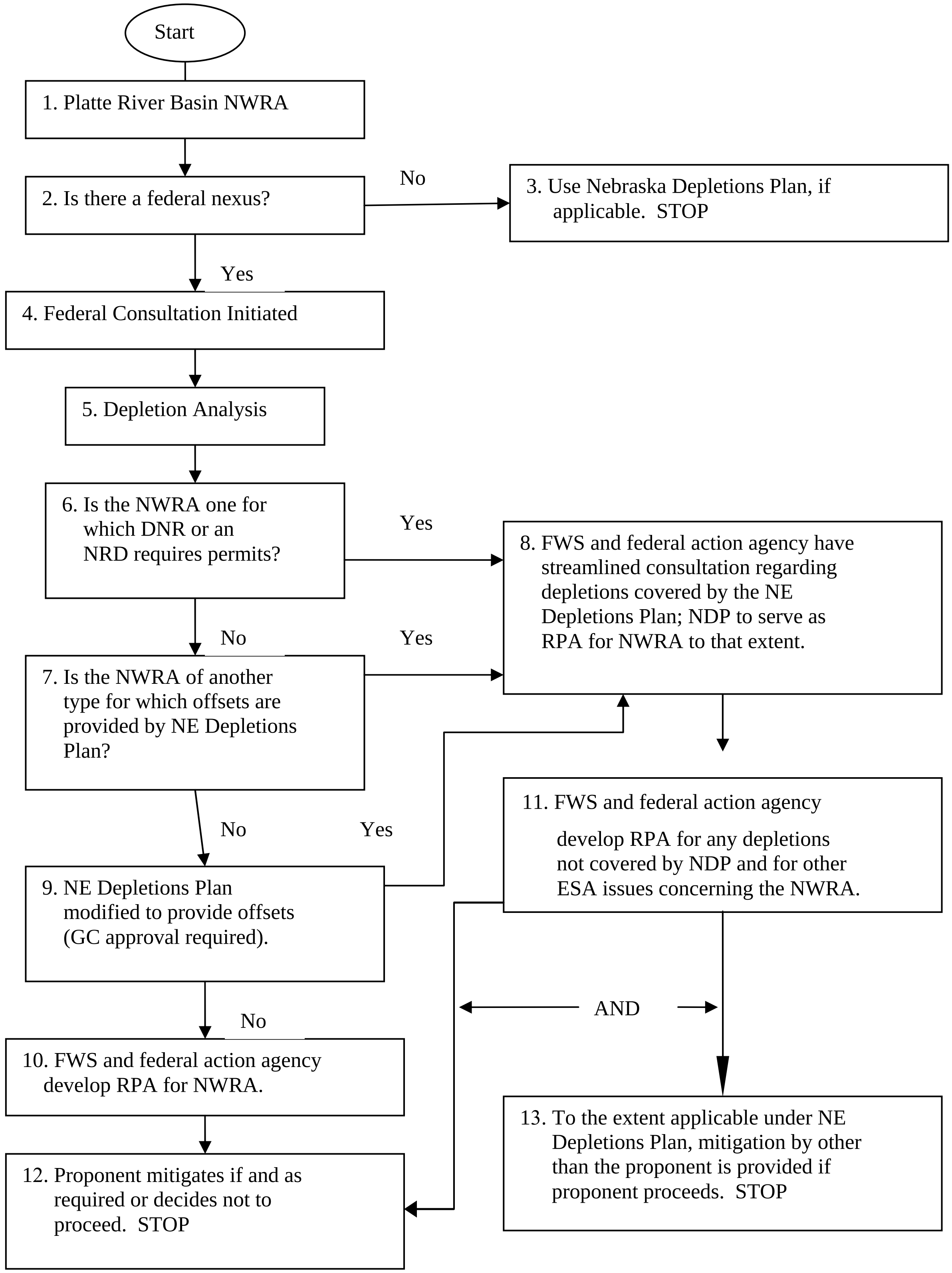
Box 10: FWS and federal action agency develop RPA for NWRA.
This box will apply only when the Nebraska new depletion plan will play no role in the development of reasonable and prudent alternatives for the proposed new water related activity. When the RPA has been developed in that situation, go to Box 13.

Box 11: FWS and federal action agency develop RPA for any depletions not covered by the NDP and for other ESA issues concerning the NWRA.
If there are water depletion issues that are not covered by this plan, those issues will be addressed separately by the FWS and the federal action agency. The same is true concerning ESA issues related to the proposed activity, but not involving water depletions. When any issues addressed at this stage have been resolved, go to Box 12 and when applicable Box 13.

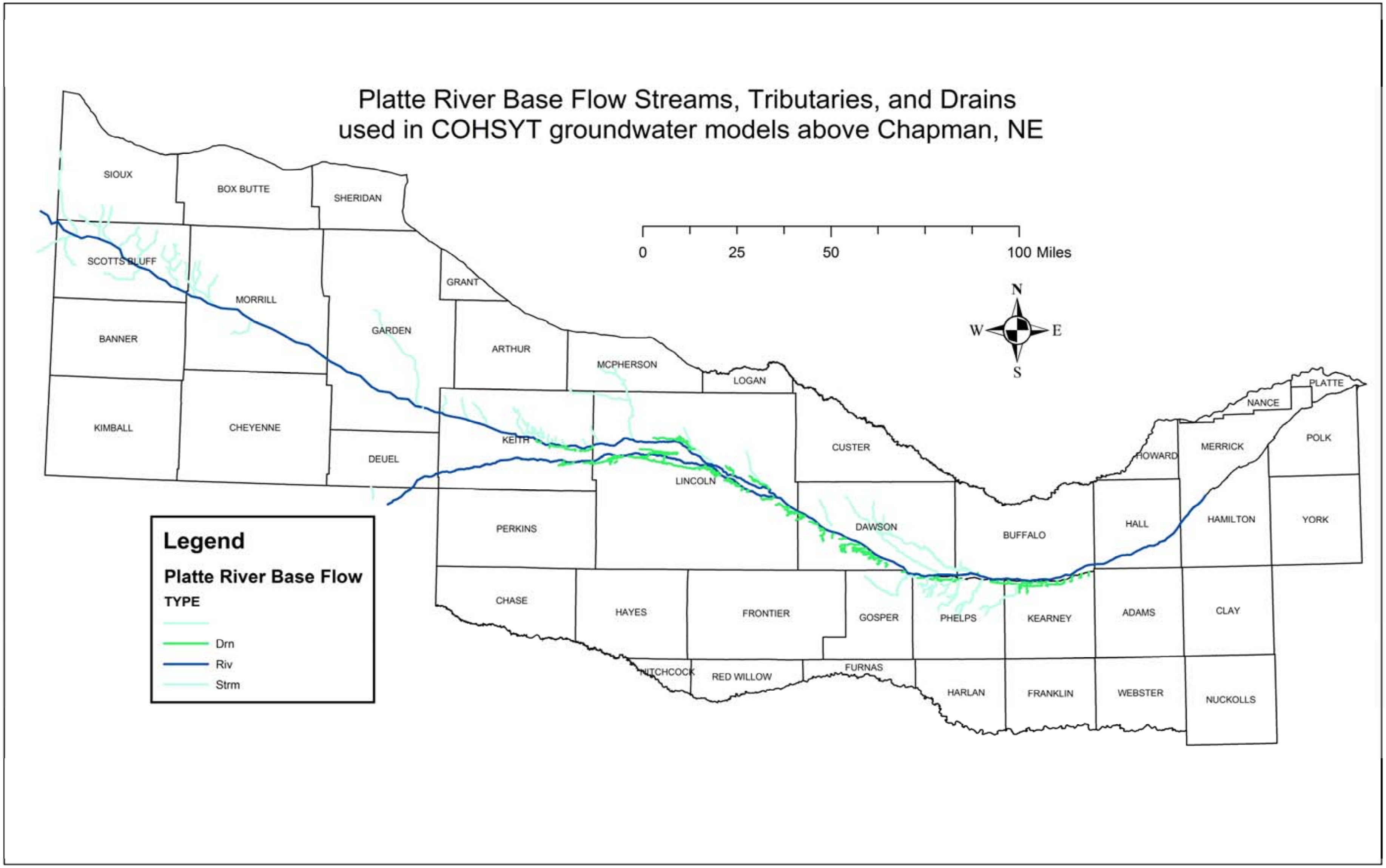
Box 12: Proponent mitigates if and as required or decides not to proceed.
Obviously, the proponent of the new water related activity may decide not to proceed. If the decision is to proceed, any mitigation required of the proponent as a result of actions taken under Box 10 or under Boxes 8, 9, 11 and 12 will be provided in the amounts and at the times and locations required.

Box 13: To the extent applicable under NE Depletion Plan, mitigation by other than the proponent is provided if proponent proceeds.
Under this depletion plan, the state is responsible for offsetting depletions to FWS target flows that are not otherwise offset by the project proponent or some other party on behalf of the project proponent. The state alone is also responsible for depletion offsets for some new water related activities (see Box 7). Depending upon how offsets are to be actually developed and implemented, other parties, such as NRDs who plan to own and operate offset projects, might also be responsible for some or all of the depletion mitigation required for a given new water related activity.

Nebraska New Depletion Plan—Flow Chart for Section 7 Consultations



Attachment 1



PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 5
Section 9

COLORADO'S PLAN FOR FUTURE DEPLETIONS[1]

October 24, 2006
Text Last Updated December 1, 2015

Exhibit B & C Updated December 3, 2019

Colorado will be responsible for mitigating the impacts of new water related activities in Colorado on the associated habitats, in the manner described below.[2] As part of the proposed Program, the mitigation described below shall constitute the means for mitigating new water related activities in Colorado, except for water related activities pursued by entities electing not to participate in the Program. Subject to the planned NEPA and ESA reviews, the Department of the Interior ("DOI") agrees that Colorado's Future Depletions Proposal is a sufficient contribution by Colorado to offset the impacts of new water related activities in the South Platte River Basin in Colorado. If Colorado implements the mitigation program described below, new water related activities in Colorado will not adversely affect the "Current Regime of the River," as that term is used in the document entitled "An Environmental Account for Storage Reservoirs in the Platte River System in Nebraska," (Program Attachment 5, Section 5). For purposes of this document, "new water related activities" shall be used as that term is defined in the Platte River Recovery Implementation Program (Program Document), footnote 3. New water related activities shall not include augmentation for wells existing pre-June 30 1997, provided the augmented wells do not increase irrigated acreage beyond that irrigated on June 30, 1997.[3]

---

[1] In the Cooperative Agreement and the Program Draft EIS, the Colorado Plan for Future Depletions was referred to as Tamarack II.

[2] Colorado offers this agreement as part of its efforts to resolve endangered species conflicts through a negotiated and mutually agreed upon basin-wide cooperative agreement and recovery program. Nothing in this agreement constitutes an admission by Colorado that any depletion to the North or South Platte Rivers or their tributaries in Colorado that have occurred or may in the future occur adversely affect or reduce state line flows. Similarly, Colorado does not admit that any changes in the amount or timing of flows at the Colorado-Nebraska or Colorado-Wyoming state lines that have occurred or may in the future occur reach or adversely affect endangered species habitat in Nebraska. This agreement is not intended, and should not be construed, to amend or modify the South Platte River Compact or any interstate decree, or to waive any rights thereunder.

[3] Prior to 2003, ground water users in the South Platte River Basin augmented their out-of-priority depletions with administratively approved annual substitute water supply plans. In 2003, the Colorado General Assembly required these ground water users to transition to a system of court-approved plans for augmentation. The applications for approval of the court-approved plans for augmentation must be filed with the water court no later than December 31, 2005. The courts may need a number of years to approve the proposed plans, during the interim the ground water users will continue to operate pursuant to administratively approved substitute water supply plans. Because the court-approved plans are permanent , the replacement obligations contained in those plans may be more stringent than those included in the administratively approved plans. In order to resolve a potential controversy concerning whether the use of ground water under more stringent terms constitutes an expansion of an existing project, the parties to the Cooperative Agreement, based on the assumption that the court approved augmentation plans will not result in increased consumptive use in Colorado, have agreed that wells in existence prior to June 30, 1997 and the augmentation sources for those wells included in any court-approved plans for augmentation will be deemed

I. SOUTH PLATTE RIVER BASIN
A. Population Estimates.

The 1997 "Population Baseline" for Colorado's Future Depletions Plan is:

1. Northern Region -- Boulder, Weld, Larimer, Washington, Morgan, Sedgewick, Logan, Phillips (701,470)

2. Central Region -- Denver, Jefferson, Adams, Clear Creek, Gilpin, Park (1,766,207)

3. Southern Region -- Arapahoe, Douglas, Elbert (194,602)

Within 90 days after the inception of the Program, the Colorado State Demographer shall report the amount by which the population of each region is expected to increase over the Population Baseline by the end of the initial reporting period ("projected Population Increase"). At the end of each reporting period, Colorado will provide the Governance Committee an estimate by the Colorado State Demographer of the actual population in each region (which shall be the Population Baseline for the next succeeding reporting period), and an estimate of the projected Population Increase for the next succeeding reporting period.

As of 2001, 55% of the new Broomfield County will be in the Northern Region and 45% will be in the Southern Region.

B. Water Use and Effect Assumptions.

Assumptions concerning per capita water use, supply source mix by region, and accretive/depletive effects of each supply source (including monthly distributions of said effects), set forth in this paragraph and the table below, represent reasonable estimates at the outset of the program, and may be modified by the Governance Committee based on information made available to that Committee by Colorado or others. The gross per capita water requirement in the South Platte River Basin in Colorado will be assumed to be 0.27[4] af/yr, with 35% consumptive use assumed for all municipal purposes, and 45% consumptive use assumed for agricultural irrigation purposes. It is anticipated that new water related activities within the three regions will be from six sources of supply to serve the Population Increase, each with a different depletive or accretive effect on flows in the South Platte River. The three regions will develop the six sources of supply in different combinations. It will be initially assumed that the sources of supply for new water related activities will be developed in the combinations and will have the accretive or depletive effect shown below[5]:

---

existing uses of water and not new water-related activities as long as the augmented wells do not increase irrigated acreage beyond that irrigated on June 30, 1997.

[4] A value of 0.2504 af/yr gross per capita will be used for the first 2-year reporting period of 2007-2008 and for the 5-year reporting period of 2009-2013 for the South Platte Basin.

[5] Colorado will use a revised % mix of water sources, as indicated in the August 6, 2009 memo to the Water Advisory Committee for the initial reporting period of 2007-2008 and for the 5-year reporting period of 2009-2013.

Source	Northern Region	Central Region	Southern Region	Accretive (or Depletive) Effect
New Transbasin Imports	40%	30%	20%	64%
Nontributary Groundwater	0%	10%	50%	68%
Ag. to Urban Conversion	35%	5%	0%	10%
Conservation	5%	15%	10%	0%
Wastewater Exchange/Reuse	10%	25%	10%	(41%)
Native South Platte Flows	10%	15%	10%	(27%)

The Governance Committee has adopted assumptions concerning the monthly distribution of the accretive/depletive effect of the development of each source of supply, taking into consideration the accretive/depletive effect shown above, the weighted contribution to meeting total water demand, and the anticipated monthly return flow pattern based on municipal water use patterns. The assumptions shown herein or as may be modified by the Governance Committee shall be as measured at or near the point of use.

C. <u>Transit Loss Assumptions</u>.

Colorado's commitment to offset the cumulative accretive/depletive effect of new water related activities in the three regions (hereinafter referred to as "Cumulative Effect") will be as measured at or reasonably near the Colorado-Nebraska state line. The Cumulative Effect will be influenced by natural river gains and losses, and water uses and return flows downstream from the points of use. The three states have studied transit losses in a study entitled "Tracking/Accounting Procedure for Determining Depletion/Accretion Impacts for the Three Program Water Projects and New Water Related Activities, Including Water Conservation/Supply Projects." This study considered the routing of both accretions and depletions from the Kersey gauge to a point at or reasonably near the Colorado-Nebraska state line. This study indicated much higher transit losses than those set forth in the table below, but until the three states are able to more fully study transit loss issues as they exist in all states for both protected and unprotected flows, Colorado will temporarily use the monthly transit loss per-mile factors set forth in the table below. The transit loss assumptions will be updated when the final study and negotiations are concluded.

Jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
.02%	.02%	.05%	.1%	.3%	.45%	.5%	.5%	.5%	.4%	.1%	.02%

D. <u>Reporting Periods</u>.

The Initial Reporting Period will be two years from the initiation of a Program. Subsequent Reporting Periods will be each five years thereafter, for so long as the Program is in effect. At the close of each reporting period, Colorado will report:

1. an estimate of the actual population in each region (which shall be the Population Baseline for the next succeeding reporting period);

2. any new information relevant to the continued use or modification of assumptions set forth herein for:

a) gross per capita water requirements, including assumptions regarding the relationship among municipal, industrial and agricultural use of water,

b) the accretive/depletive effect of each source of supply, and

c) the cumulative effect at the state line;

3. the operations and effects of projects to mitigate new depletive effects;

4. an estimate of the projected Population Increase for the next succeeding reporting period;

5. estimates of the net accretive/depletive effects and Cumulative Effect for the next reporting period; and

6. net changes in irrigated agricultural acreage, using readily available data.

Colorado will also submit annual information reports to the Governance Committee estimating population increase in each of the three regions, and describing water sources used to supply new water related activities including type of water source, works used and water quantities supplied. Colorado will promptly report to the Governance Committee any new information that significantly affects assumptions relied upon in this Program.

E. <u>Determination of Cumulative Effect -- Initial Reporting Period</u>.

Within 90 days after the inception of the Program, Colorado will provide to the Governance Committee a calculation of the average monthly distribution of the Cumulative Effect for anticipated water related activities in the South Platte River Basin in Colorado for the Initial Reporting Period. The calculation will be based on the projected Population Increase for that period, and the water use and transit loss assumptions described above or as may be modified by the Governance Committee. The Cumulative Effect as approved by the Governance Committee will determine the mitigation measures that will be undertaken by Colorado during the Initial Reporting Period.

F. <u>Determination of Cumulative Effect -- Subsequent Reporting Periods</u>.

Colorado will monitor actual water use and development in the South Platte River Basin in Colorado beginning July 1, 1997. At the end of the Initial Reporting Period, and at the end of each Subsequent Reporting Period, Colorado will report to the Governance Committee for its review and approval any adjustments in the Population Increase and in the Cumulative Effect for that period. Such adjustments will serve as the basis for calculations for the next succeeding Reporting Period. Any resulting increase or decrease in Cumulative Effect will be added to or subtracted from the Cumulative Effect to be mitigated in the next succeeding Reporting Period.

G. Mitigation of Cumulative Effect.

The signatories assume that the Cumulative Effect for any annual period is expected to be a mix of net accretions during the fall, winter and spring period, and net depletions in the late-spring to mid-summer period, resulting in an estimated total seasonal net depletive effect on an order of magnitude of less than 1,800 af/yr for each 100,000 additional people in the South Platte River Basin in Colorado. Based on these assumptions, Colorado will, in each Reporting Period, undertake such re-regulation projects within Colorado as are necessary to shift water flows at a point upstream from the Colorado-Nebraska state line and downstream from the last diversion in Colorado, from periods of net accretion to periods of net depletion. The re-regulation projects divert water in priority through existing ditch head gates or wells downstream of Colorado's Washington County line. After diversion, this water recharges the alluvial aquifer of the South Platte River. Colorado will locate the recharge areas the distance necessary from the South Platte or its tributaries to result in accretions at locations downstream of the last river diversion in Colorado in periods of net depletion Colorado's commitment to re-regulate flows in any Reporting Period shall equal the total depletive effect by month for those months in which a net depletive effect will occur. To the extent that Colorado constructs projects or obtains the ability to re-regulate water in excess of the total depletive effect for those months in which a net depletive effect will occur, such capacity will be available for use in the next succeeding Reporting Period. Should total annual net depletive effects exceed the assumptions set forth above, Colorado reserves the option of reconsidering different measures to mitigate those effects under the Program.

H. ESA Compliance.

ESA compliance for South Platte Basin future depletions in Colorado will conform to the Program document. Except as described below, qualifying new water related activities that are in the South Platte Basin and are operated on behalf of Colorado water users are covered by the Colorado plan for future depletions. Exhibit A to this plan for future depletions is a draft schematic and explanation of how Colorado water users may qualify to use this plan in any ESA Section 7 consultation process for water projects in Colorado. Exhibit B is the template Biological Assessment and request for formal section 7 consultation that program participants may use to address potential impacts from operation of their new water activity on federally-listed species in Nebraska. Exhibit C is the template biological opinion the United States Fish and Wildlife Service will issue in response to the template Biological Assessment and request for formal section 7 consultation.

> 1. New water related activities would not be covered by this plan after the average annual water supply to serve Colorado's population increase from "Wastewater Exchange/Reuse" and "Native South Platte Flows" exceeds 98,010 acre feet during the February-July period described below. The 98,010 acre-foot figure represents gross water deliveries (supplies) to meet new demands for an average hydrologic year, and is not a consumptive use or diversion limitation. In analyzing proposed new water related activities that have supplies derived from the storage of native South Platte flows, only those supplies resulting from diversions to storage or wastewater exchange and reuse during the period from February through July will be counted toward the 98,010 acre-feet. In the event that a new water related activity is not covered by Colorado's plan pursuant to this Section I.H.1, Colorado and the activity's proponent can propose, as

provided in Section E of the Program document, amendments that will allow Colorado's Plan to provide ESA compliance for that new water related activity.

2. The Colorado plan for future depletions does not cover the construction of a major on-stream reservoir located on the main stem of the South Platte River anywhere downstream of Denver, Colorado. In addition, the Colorado plan for future depletions does not cover hydropower diversion/return projects that divert water including sediments from the main stem of the South Platte River anywhere downstream of Denver, Colorado and return clear water to the South Platte River.

3. Colorado's plan for future depletions will provide ESA coverage for new water related activities related to existing U.S. Bureau of Reclamation water supply projects that currently provide water for Colorado water users. At Colorado's discretion, new federal water related activities in Colorado that provide water to Colorado water users may be provided ESA coverage by the Colorado plan for future depletions. Nothing in the Colorado plan for future depletions shall be construed as changing the water rights, or ownership, of any federal water project.

The ESA compliance covered by this plan only concerns consultation on the target species. To the extent that a federal nexus activity has potential impact on "non-target" listed species, then impacts to those species must be addressed in that federal project's Biological Opinion (BO) required by ESA.

For the purposes of this section H. the following definitions apply:

Covered means in compliance with the Endangered Species Act with regard to potential impacts to the least tern, piping plover, whooping crane and pallid sturgeon in and along the central and lower Platte River in Nebraska, for the duration of the First Increment.

Average means the average estimated or modeled effect over a multi-decadal period of time including a mix of wet, normal and dry hydrologic conditions. Initially, this will be the 1947-1994 period used in the current version of the Central Platte Op Study Model and the Platte Programmatic EIS. However, this time period may be adjusted if the Governance Committee concurs.

Major On-Stream Reservoir means a reservoir of more than 2,000 acre-feet. It does not include new diversion facilities that may impound a small amount of water. Reservoirs, including gravel pit reservoirs, adjacent to the main stem of the South Platte River and reservoirs on tributaries to the South Platte River are not considered to be located on the "mainstem" for purposes of this paragraph.

I. No Power to Limit Colorado Water Rights.

Prior to the inception of this Program there was not legal authority to deny the appropriation of un-appropriated water of the State or prevent the diversion and re-diversion of legally re-usable water. Nothing in this Plan for Future Depletions shall be construed to authorize the Program to deny the appropriation of unappropriated water or prevent the diversion and re-diversion of legally re-usable water to achieve Program goals, objectives or Milestones.

J. <u>Commitment to Revise</u>.

This Plan for Future Depletions is premised on the assumptions contained herein. In the event that the assumptions underlying this plan are not realized, the State of Colorado commits to revise its Plan for Future Depletions accordingly.

II. NORTH PLATTE RIVER BASIN

A. <u>Background Information.</u>

This document sets forth Colorado's Plan to address new water related activities in the North Platte River Basin, Jackson County, Colorado. Subject to ongoing NEPA and ESA reviews, and verification of certain assumptions, the parties to the Program Cooperative Agreement have agreed that Colorado's Depletions Plan is a sufficient contribution to offset alleged effects on endangered species habitats in Nebraska of new water related activities in the North and South Platte River Basin in Colorado. Colorado's Depletions Plan for the South Platte is also summarized in this subsection of the Program Water Plan.

Colorado proposes to include new water related activities in the North Platte River Basin in the Platte River Recovery Implementation Program (Program) and to offset alleged effects on endangered species habitats in Nebraska in accordance with this agreement. The following summary provides an outline of the procedures and methods Colorado will use to monitor existing and new water related activities for the North Platte Basin and how mitigation measures for endangered species issues might be implemented.

B. <u>North Platte Decree.</u>

The decree in *Nebraska v. Wyoming*, 325 U.S. 589 (1945), *modified*, 345 U.S. 981 (1953) (the Decree), and modified by the Final Settlement Stipulation, March 13, 2001 enjoins Colorado from diverting water from the North Platte River and its tributaries for the irrigation of more than a total of 145,000 acres in Jackson county during any one irrigation season. The Decree also enjoins Colorado from storing more than 17,000 acre-feet of water for irrigation purposes from the North Platte River and it tributaries in Jackson County between October 1 of any year and September 30 of the following year. Finally, the Decree enjoins Colorado from exporting out of the basin of the North Platte River and its tributaries in Jackson County more than 60,000 acre-feet of water in any period of ten consecutive years. The Decree requires Colorado to prepare and maintain complete and accurate records of the total area of land irrigated and the storage and exportation of water and to make such records available for inspection.

C. <u>Existing Water Related Activities.</u>

In its 1945 opinion, the U.S. Supreme Court found that 131,800 acres were presently under irrigation in Jackson County in Colorado. Since then the number of acres being irrigated in any one year has been as high as 134,467. The Decree allows Colorado to irrigate up to 145,000 acres. For purposes of this Program, the parties to the Cooperative Agreement agree that depletion associated with the irrigation of up to 134,467 acres constitute existing uses and that depletions associated with the irrigation of between 134,468 and 145,000 acres in Jackson County constitute new water related activities. The irrigation storage and export limits in the Decree also represent existing uses as of 1945, and reflect the Supreme Court's recognition that transbasin diversions in some years exceeded 6,000 acre-feet. Since the limitations in the Decree represent historical uses in Jackson County, any depletions within those limits constitute existing water uses. Storing more than 17,000 acre-feet of water for irrigation purposes between October 1 of any year and September 30 of the following year and exporting more than 60,000 acre-feet of water in any period of ten consecutive years are not permitted under the Decree, and, therefore, no new water related activities of these types are contemplated.

In addition to existing uses in accordance with the Decree, Jackson County's small population and limited industry consume a small quantity of water under prior existing rights. Colorado does not anticipate significant population growth in Jackson County during the term of the Cooperative Agreement or the First Increment of the program. The population baseline for Jackson County is 2022 people. Colorado estimates that the 2004 population for Jackson County is 1,554 people. The State demographer does not predict the Jackson County population to exceed 2022 people by the end of the First Increment.

Piscatorial, wildlife, and other environmental uses implemented on or before July 1, 1997 will constitute existing uses. Any water diverted for new uses for these purposes implemented after July 1, 1997 will constitute new water related activities.

D. New Water Related Activities.

For purposes of the Program Cooperative Agreement, the parties agree to the following:

1. *Agricultural Water Use:* Irrigation of more than 134,467 acres in any year will constitute new water related activities. The parties agree that net depletions (diversions less return flows) associated with irrigating additional acres as measured at the Colorado - Wyoming state line equal .83 acre-feet per acre during the irrigation season.

2. *Municipal and industrial use (M&I):* Colorado does not expect the Jackson County population to exceed 2022 in the First Increment. Similar to the methodology adopted for the South Platte new depletion plan, new municipal and industrial water uses are assumed to be .27[6] acre- feet per capita per year. Consumptive use is 35% of gross water use, unless otherwise reported to the Governance Committee by the State of Colorado. The parties agree that the monthly distribution of the depletive effect of this municipal and industrial water use is the same as that defined for the South Platte Basin, unless otherwise reported to the Governance Committee by the State of Colorado.

3. *Piscatorial, wildlife, and other environmental uses:* To the extent that these uses are not incidental to agricultural use, such uses implemented after July 1, 1997 will constitute new water related activities. Net depletions associated with such uses will be determined from

[6] A value of 0.2504 af/yr gross per capita will be used for the first increment based on South Platte Basin M&I assumptions for July 2007.

Colorado Division of Water Resources information on actual annual net depletions. It is expected that all piscatorial, wildlife, and other environmental uses will have a federal nexus, but Colorado will monitor these uses through the Division of Water Resources and the water court resumes for Water Division No. 6. If there are significant piscatorial, wildlife, and other environmental (PWE) uses implemented after July 1, 1997, are not incidental to agricultural uses, and that do or do not have a federal nexus, then the depletions associated with these new PWE's will have to be approved for coverage under the North Platte Baseline described in Section E. below.

E. North Platte Baseline.

The overall consumptive use associated with the total covered levels of existing water related activities in the North Platte River Basin, identified above in Section D, is an appropriate overall baseline measure. The North Platte Baseline is the total depletion amount associated with the irrigation of up to 134,467 acres and a county population of 2,022, and the implemented uses, as of July 1, 1997 for industrial uses, and piscatorial, wildlife, and environmental uses that are not incidental to agricultural uses. Consumptive depletions associated with the difference between total measured irrigated acreage and the current Jackson County population in any one year, and the upper level of depletions associated with irrigation of 134,467 acres and the population of 2,022, may provide a positive balance of available consumptive depletion that can be allocated to other new water related activities. The available consumptive depletion that could potentially be available will be calculated using the agreed upon values of 0.83 acre-feet per acre during the irrigation season and 35% of 0.27[7] acre-feet per capita per year. For example, if there were 100 acre-feet of consumptive depletions associated with proposed new piscatorial, wildlife, and other environmental uses that were not incidental to agricultural use, with approval, this amount of consumptive depletion could be covered by reducing the baseline allowance of 134,467 acres of irrigated acreage by 120 acres to a new allowance of 134,347 acres. This method of dealing with consumptive depletions associated with new water related activities in the North Platte Basin will allow Colorado to vary between the types of uses as long as the overall consumptive depletions do not exceed the North Platte Baseline, as described above. Data and information related to changes in the type of use, without exceeding the overall depletions associated with the North Platte Baseline will be provided through the attached accounting form that is also approved and agreed to by the Governance Committee. Colorado's annual reports will advise the Governance Committee of any changes in the different types of uses, as provided on the accounting form.

If a non-federal water user is going to exceed the baseline for a particular type of use but the North Platte Baseline for the entire North Platte River Basin within Colorado will not be exceeded, that water user shall file a request to the Jackson County Water Conservancy District for approval of this exceedence. The Jackson County Water Conservancy District will review the request in order to assure that the total North Platte Baseline will not be exceeded and will make an official determination of whether to approve or not approve the request to be covered under the North Platte Baseline. The Jackson County Water Conservancy District will report to the State of Colorado and SPWRAP all approved requests for depletion coverage from the North Platte Baseline, as well as denied requests and the basis for each denial, and the state will keep

[7] A value of 0.2504 af/yr gross per capita will be used for the first increment based on South Platte Basin M&I assumptions for July 2007.

an accounting of all approved decreed water rights that vary from the original uses under the North Platte Baseline and Colorado will report these to the Governance Committee in the annual reporting. In addition, membership in SPWRAP must be demonstrated.

New water related activities are defined as: 1) industrial uses that occur beyond the 1997 level; 2) population increases that exceed the population baseline of 2022 people; 3) post-1997 piscatorial, wildlife, or environmental uses that are not incidental to agricultural uses; or, 4) irrigation of acres greater than 134,467 acres. All consumptive depletions associated with these new water related activities must be replaced on a one-to-one basis in the North Platte Basin unless those consumptive depletions are approved for coverage under the North Platte Baseline and said baseline of the entire North Platte Basin within Colorado has not been exceeded. New water related activities that exceed the entire North Platte Baseline (over-runs) will be mitigated in a manner described in the accounting form, attached.

The State of Colorado, as a signatory to the Program Agreement, will provide its independent authority regarding administration of water-related activities in Jackson County for consistency with Colorado water law, and the objectives of the Program.

F. Monitoring and Reporting.

During the first increment, Colorado does not foresee any: projected increases in: 1) irrigated acreage in Jackson County over 134,467 acres; 2) population over the 2022 person "population baseline"; or 3) significant non-nexus piscatorial, wildlife, or other environmental uses (which are not incidental to agricultural uses). Similar projections will be made at the beginning of each subsequent reporting period. At the end of the first reporting period, and at the end of each subsequent reporting period, Colorado will report to the Governance Committee: the irrigated acreage, irrigation storage, transbasin diversions, and population in Jackson County. Colorado will also report on any non-nexus piscatorial, wildlife, and other environmental uses (which are not incidental to irrigation uses) and any new industrial uses occurring since 1997.

These South Platte River Basin derived assumptions probably significantly overstate actual M&I water use in Jackson County. The gross per capita M&I water requirement of 0.27[8] acre-feet per year is probably high because lawn irrigation is less prevalent in Jackson County than in the South Platte River Basin. The actual monthly distribution of the depletive effects associated with M&I use in Jackson County is probably different than that of the South Platte Basin, since Jackson County's higher elevation and shorter, cooler summers limit lawn irrigation to a shorter time period than occurs in the South Platte Basin. Thus, M&I uses in Jackson County are likely to produce fewer depletions during the months of shortage to target flows at Grand Island in comparison with M&I uses in the South Platte Basin. However, in the absence of specific data, Colorado agrees to apply South Platte Basin assumptions[9] to M&I use in Jackson County as of July of the year that begins the increment (e.g., July 2003, July 2008 etc.).

[8] A value of 0.2504 af/yr gross per capita will be used for the first increment based on South Platte Basin M&I assumptions for July 2007.
[9] A value of 0.2504 af/yr gross per capita will be used for the first increment based on South Platte Basin M&I assumptions for July 2007.

F. ESA Compliance.

Colorado commits to offset the net cumulative effects of depletions associated with new water related activities in the manner described within this depletion plan. It is the intent of Colorado that new depletions will be offset in accordance with Section I.A.4 and Section III.E.3 of the Program Document and this depletion plan. ESA compliance for North Platte Basin future depletions in Colorado will conform to the Program Document.

Exhibit A
12-05-05

Platte River Recovery Implementation Program

Schematic and Explanation of Endangered Species Act Section 7 Consultation Process in Colorado

This document illustrates how, with a Program in place, water related activities subject to Section 7(a)(2) consultation of the Endangered Species Act (ESA) will proceed through the consultation process and how Colorado's Future Depletions Plan relates to that process. Projects involving both "new" and "existing" water related activities will proceed on dual procedural pathways during the streamlined consultation process.

The bold text for each box as explained below corresponds to the wording in the schematic for that box. If nothing other than the wording in the schematic appears in this document, the wording in the schematic is considered to be self-explanatory. The various steps, or boxes, have been numbered to aid the discussion. However, the numeric order does not imply any sequence of steps. The steps in the schematic are:

Box 1) **Platte River Basin Water-Related Activity**. A Platte River basin water-related activity upstream of Chapman, NE.

Box 2) **Is there a federal-nexus**? If so, Section 7 consultation is required.

Box 3) **Activity is covered by the Program**.

Box 4) **Colorado and FWS notify each other of Federal Action subject to Section 7 consultation**. Colorado is under no affirmative duty to search for projects in the state that may be subject to Section 7 consultation, but if it becomes aware of one, this box highlights Colorado's agreement that it will pass the information along to the FWS. FWS agrees to notify Colorado after FWS is notified by a project proponent or a federal agency of an action subject to Section 7 consultation within the State.

Box 5) **Is it a New or Existing water related activity**? Colorado's Plan for Future Depletions specifies the means by which new water related activities, both those subject to and those not subject to Section 7(a)(2) of the ESA, will be addressed under the plan.

Box 6) **Existing water related activity covered by Program**. Federal action agency consults with FWS. Federal Action Agency to use Template Biological Assessment~~.~~

Box 7) **Federal Agency, applicant & State notified that Program covers the project**. **Platte River Section 7 obligations are known. If Colorado requirements for Program participation are met and confirmed by the South Platte Water Related Activities**

Program, Inc. (SPWRAP), streamlined consultation completed pursuant to Template Biological Opinion.

Box 8) **Is it a "Federal" New water related activity**? Is the new water related activity addressed by the federal depletions plan (and not covered by the State plan)? Most of the time the answer to this question would be obvious, but if there were any question as to its status, Colorado and the FWS would decide on a case-by-case basis before proceeding. If it were a “federal” depletion then the Federal Depletions Plan would be used to address the depletion (Box 9). If that were not possible, the activity would be subject to a separate consultation “outside” of the Program (Box 11).

Box 9) **Use Federal Depletions Plan if possible**. (e.g., the federal agency is the “applicant”).

Box 10) **Do Applicant & Colorado desire the Project to be covered by the State's Depletions Plan**? Because the Program is voluntary, the applicant and Colorado must elect for the project depletion to be addressed by the State’s depletions plan. If the applicant or Colorado elects for the project not to participate in the Program then the project would be subject to a separate consultation “outside” of the Program (Box 11).

Box 11) **Section 7 Consultation conducted “outside of the Program**”.

Box 12) **Federal Agency provides depletion analysis to FWS and Colorado**. The federal agency consulting with the Service is responsible for providing a project description of the proposed federal action, including information describing the proposed depletions. The necessary information is identified in the Template Biological Assessment. Meetings and discussions to define the project depletions will generally include the federal agency, applicant, Service, and the State. For new water related activities, the Service will consider the latest updates provided by the state pursuant to the terms of its depletions plan.

Box 13) **Colorado reviews the depletion analysis and makes a determination**: **Is the Project addressed by the State Depletions Plan**? Upon request of the FWS, Colorado will certify whether a federal nexus project has met State requirements for Program participation and is covered by the State’s depletions plan.

Box 14) **Can State Depletions Plan be modified to include project depletion**? If the State does not certify a project as being within its plan, the State, subject to the amendment process set forth in the Program Document, Section E, may amend its plan.

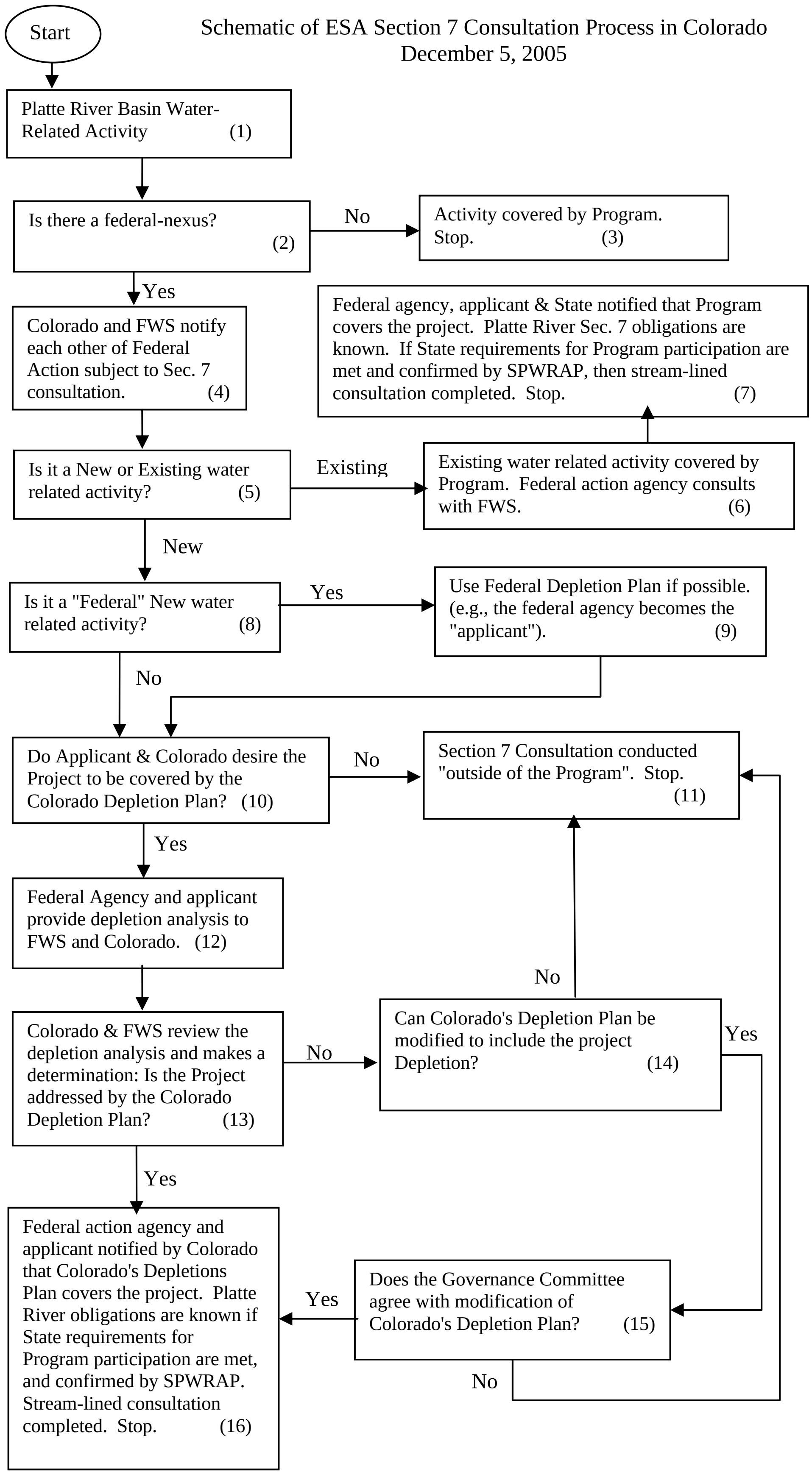
Box 15) **Does the Governance Committee agree with modification of State Depletions Plan**? If amendment of the State depletions plan is proposed, the State will follow the amendment process set forth in the Water Section (Program Document, Section E).

Box 16) **Federal Action Agency and applicant are notified by Colorado that Program / State Depletions Plan covers the project**. Platte River obligations are known. If State requirements for Program participation are met and confirmed by theSouth Platte Water Related Activities Program, Inc. (SPWRAP), streamlined consultation completed pursuant to Template

Biological Opinion. If the proposed project depletions are covered by a State's depletions plan and if State requirements for Program participation are met, then the consulting federal agency, the applicant and the State would be notified by the FWS that the proposed project's effects to the target species are "covered" by the State's depletions plan. Annual reporting of all section 7 formal consultations will be provided to the Governance Committee.

Attachments: Template Biological Assessment
Template Biological Opinion

Schematic of ESA Section 7 Consultation Process in Colorado
December 5, 2005



**TEMPLATE BIOLOGICAL ASSESSMENT &
REQUEST FOR FORMAL SECTION 7 CONSULTATION**

[DATE]

[FROM FEDERAL ACTION AGENCY
TO U.S. FISH & WILDLIFE SERVICE]

This letter comprises the Biological Assessment addressing potential impacts from operation of the [Project] on federally-listed species in Nebraska. With this submission, we are requesting initiation of Formal Consultation under Section 7(a) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.) (ESA), concerning the whooping crane (*Grus americana*), interior least tern (*Sternula antillarum*), northern Great Plains population of the piping plover (*Charadrius melodus*), pallid sturgeon (*Scaphirhynchus albus*) (collectively referred to as the "target species"), and designated critical habitat of the whooping crane. We further request initiation of Formal Consultation for the western prairie fringed orchid (*Platanthera praeclara*) [include other non-target listed species or critical habitats, as needed]. We have determined that the Project is not likely to adversely affect the American burying beetle (*Nicrophorus americanus*) and will have no effect on the Eskimo curlew (*Numenius borealis*).

[Using the "**Supplemental Worksheet for PRRIP BA Template" (Worksheet)** (link to Worksheet), insert the information from items 1. (Applicant Name), 2. (Federal Agency Involved), 3. (Project Name/Description of Project or Proposed Action), and 4. (Project Location)]

[***Note:*** *the completed Supplemental Worksheet should be attached to this Biological Assessment when submitting to the Service.*]

Operation of this Project will result in some amount of continuing historic and/or new depletions to the South Platte River associated with the [from the **Worksheet**, insert information from items 5. (General Description of Water Source) and 7. (Annual Volumetric Water Use)].

The Platte River Recovery Implementation Program (PRRIP or Program), established in 2006, is implementing actions designed to assist in the conservation and recovery of the target species and their associated habitats along the central and lower Platte River in Nebraska through a basin-wide cooperative approach agreed to by the States of Colorado, Nebraska, and Wyoming and the U.S. Department of the Interior [Program, 2006; Section I.A.1.]. The Program addresses the adverse impacts of existing and certain new water related activities on the Platte target species and associated habitats, and provides ESA compliance[1] for effects to the target species and whooping crane critical habitat from such activities including avoidance of any prohibited

[1] "ESA Compliance" means: (1) serving as the reasonable and prudent alternative to offset the effects of water-related activities that FWS found were likely to cause jeopardy to one or more of the target species or to adversely modify critical habitat before the Program was in place; (2) providing offsetting measures to avoid the likelihood of jeopardy to one or more of the target species or adverse modification of critical habitat in the Platte River basin for new or existing water-related activities evaluated under the ESA after the Program was in place; and (3) avoiding any prohibited take of target species in the Platte River basin.

take of such species. [Program, 2006; Section I.A.2 & footnote 2.]. The State of Colorado is in compliance with its obligations under the Program.

For Federal actions and projects participating in the Program, the Platte River Recovery Implementation Program Final Environmental Impact Statement (U.S. Department of Interior, 2006) and supplemental Environmental Assessment and Finding of No Significant Impact (2018), as well as the June 16, 2006 programmatic biological opinion (PBO) and the August 27, 2018 Supplemental biological opinion (collectively referred to as the PBOs) serve as the description of the environmental baseline and environmental consequences for the effects of the Federal actions on the listed target species, whooping crane critical habitat, and other listed species in the central and lower Platte River addressed in the PBOs. These documents are hereby incorporated into this Biological Assessment by this reference.

Table II-1 of the Supplemental biological opinion (pages 6-8) contains a list of species and critical habitat in the action area, their status, and the Service's determination of the effects of the Federal action analyzed in the PBOs, including the continued operation of existing and certain new water-related activities. The Service determined in the PBOs that the continued operation of existing and certain new water-related activities may adversely affect but would not likely jeopardize the continued existence of the endangered whooping crane, interior least tern, and pallid sturgeon, or the threatened northern Great Plains population of the piping plover. Further, the Service found that the continued operation of existing and certain new water-related activities may adversely affect but would not likely jeopardize the threatened bald eagle and western prairie fringed orchid associated with the central and lower reaches of the Platte River in Nebraska, and was not likely to destroy or adversely modify designated critical habitat for the whooping crane. The bald eagle was subsequently removed from the federal endangered species list on August 8, 2007.

The Service also determined that the PBOs Federal Action, including the continued operation of existing and certain new water-related activities, would have no effect to the endangered Eskimo curlew. There has not been a confirmed sighting since 1926 and this species is believed to be extirpated in Nebraska. Lastly, the Service determined that the PBOs Federal Action, including the continued operation of existing and certain new water-related activities, was not likely to adversely affect the endangered American burying beetle.

CHOOSE APPLICABLE LANGUAGE BELOW:

[Based on the **Worksheet** information from item 6. (Water Use Classification)]

The above-described Project operations qualify as an "existing water related activity" because they reflect the effects of a surface water or hydrologically connected groundwater activity implemented on or before July 1, 1997, within the intent and coverage of the Program. [Program, 2006; Section I.A. footnote 3].

-OR-

The above-described Project operations qualify as a "new water related activity" because such operations constitute a new surface water or hydrologically connected groundwater activity which may affect the quantity or timing of water reaching the associated habitats of the target species implemented after July 1, 1997. [Program, 2006; Section I.A. footnote 3]. The Project conforms to the following criteria in Section H of Colorado's Plan for Future Depletions [Program, Attachment 5, Section 9]:

1. The Project is operated on behalf of Colorado water users;

2. The Project does not involve construction of a major on-stream reservoir located on the mainstem of the South Platte River anywhere downstream of Denver, Colorado;

3. The Project is not a hydropower diversion/return project diverting water including sediments from the mainstem of the South Platte River anywhere downstream of Denver and returning clear water to the South Platte River.

4. The Project does not cause the average annual water supply to serve Colorado's population increase from "Wastewater Exchange/Reuse" and "Native South Platte Flows" to exceed 98,010 acre feet during the February-July period.

   Accordingly, the impacts of this activity to the target species, whooping crane critical habitat, and other listed species in the central and lower Platte River addressed in the PBO are covered and offset by operation of Colorado's Future Depletions Plan as part of the PRRIP.

The Applicant intends to rely on the provisions of the Program to provide ESA compliance for potential impacts to the target species, whooping crane critical habitat, and other listed species in the central and lower Platte River addressed in the PBOs. The [Federal Agency] intends to require, as a condition of any approval, that the Applicant fulfill the responsibilities required of Program participants in Colorado, which includes participation in the South Platte Water Related Activities Program, Inc. (SPWRAP). The [Federal Agency] also intends to retain discretionary Federal authority for the Project, consistent with applicable regulations and Program provisions, in case reinitiation of Section 7 consultation is required.

This letter addresses consultation on all listed species and designated critical habitat in Nebraska, including the referenced Platte River target species and whooping crane critical habitat. Potential impacts from construction and operation of the Project to any other federally-listed threatened or endangered species and designated critical habitats will be addressed within the applicable biological opinion prepared by the Service, in accordance with the ESA.

References:

Platte River Recovery Implementation Program Document. 2006.

U.S. Department of the Interior. 2006. Platte River Recovery Implementation Program Final Environmental Impact Statement.

U.S. Fish and Wildlife Service. 2006. Biological Opinion on the Platte River Recovery Implementation Program.

U.S. Department of the Interior. 2018. Platte River Recovery Implementation Program First Increment Extension Final Environmental Assessment.

U.S. Fish and Wildlife Service. 2018. Supplemental Biological Opinion on the Platte River Recovery Implementation Program First Increment Extension.

/FROM FEDERAL ACTION AGENCY/

Supplemental Worksheet for PRRIP BA Template

The information below is needed for the U.S. Fish & Wildlife Service (Service) to complete a formal ESA Section 7 consultation in a streamlined manner under the Platte River Recovery Implementation Program (PRRIP), the June 16, 2006 programmatic biological opinion and the August 27, 2018 supplemental biologic opinion. The worksheet can also help the Service determine if consultation is required (see link for exceptions to the consultation requirements).

1. **Applicant Name:** ______________________________
2. **Federal Agency Involved (if applicable):** ______________________________
3. **Project Name/Description of Project or Proposed Action:**

____
____
____
____
____
____
____
____

4. **Project Location (include street address, or comparable, specific location information and County):**

____
____
____

5. **General Description of Water Source(s) (no need to identify specific/associated water rights):**
   - **a.** % Transbasin Imports ______%
   - **b.** % Native South Platte Water ______%
   - **c.** % Nontributary Groundwater ______%
   - **d.** % Other (please specify; e.g., in-basin agricultural conversion, reuse, etc.)
     ______________________________ ______%

6. **Water Use Classification (check one or both boxes, as applicable):**
   - **a. Water use qualifies as an "existing water related activity"** ☐
     (Water use is surface water or hydrologically connected groundwater that has historically been used prior to July 1, 1997)
   - **b. Water use qualifies as a "new water related activity" (includes new and expanded existing projects)** ☐
     (Water use constitutes a new surface water or hydrologically connected groundwater that will occur after July 1, 1997)

7. **Annual Volumetric (acre-feet) water use (existing; new; and future buildout, if applicable) associated with the Project:**

____
____

Exhibit C

Platte River Tier 2 Biological Opinion Template
For
Water-Related Activities and Central/Lower Platte Species Addressed by the Platte River Recovery Implementation Program's Programmatic Biological Opinion

December 3, 2019

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
[State] Field Office
[Address]
[City, State, Zip Code]

[Date]

[FWS tracking number]

[Name]
[Agency]
[Address]
[City, State Zip]

RE: [Project Name] Project, [County Location] County, [State]

Dear [Mr./Mrs.] :

This biological opinion is provided in response to your [Date] request to initiate formal consultation pursuant to section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA). Your biological assessment describes the potential effects of the [Project Name] on federally listed species and designated critical habitat.

The Federal Action reviewed in this biological opinion is the [Project Name] Project, located at [location description], [county name] County, [state]. The Project is [project description and purpose].

I. Background

On June 16, 2006, the U.S. Fish and Wildlife Service (Service) issued a programmatic biological opinion (PBO) for the 13-year first increment of the Platte River Recovery Implementation Program (PRRIP) and water-related activities[1] affecting flow volume and timing in the central and lower reaches of the Platte River in Nebraska. On August 27, 2018, the Service issued a supplemental programmatic biological opinion (Supplement) for an extension of the PRRIP through 2032. These two biological opinions are hereinafter referred to collectively as the PBOs. The action area for the PBOs includes the Platte River basin upstream of the confluence with the Loup River in Nebraska, and the mainstem of the

[1] The term "water-related activities" means activities and aspects of activities which (1) occur in the Platte River basin upstream of the confluence of the Loup River with the Platte River; and (2) may affect Platte River flow quantity or timing, including, but not limited to, water diversion, storage and use activities, and land use activities. Changes in temperature and sediment transport will be considered impacts of a "water related activity" to the extent that such changes are caused by activities affecting flow quantity or timing. Impacts of "water related activities" do not include those components of land use activities or discharges of pollutants that do not affect flow quantity or timing.

Platte River downstream of the Loup River confluence.

The Federal Action addressed by the PBOs includes the following:

1) funding and implementation of the PRRIP through 2032, the anticipated first increment of the PRRIP, as extended; and

2) continued operation of existing and certain new water-related activities[2] including, but not limited to, Reclamation and Service projects that are (or may become) dependent on the PRRIP for ESA compliance during the first increment of the PRRIP, as extended, for their effects on the target species[3], whooping crane critical habitat, and other federally listed species[4] that rely on central and lower Platte River habitats.

The PBOs establish a two-tiered consultation process for future federal actions on existing and new water-related activities subject to section 7(a)(2) of the ESA, with issuance of the PBOs being Tier 1 and all subsequent site-specific project analyses constituting Tier 2 consultations covered by the PBOs. Under this tiered consultation process, the Service will produce tiered biological opinions when it is determined that future federal actions are "likely to adversely affect" federally listed species and/or designated critical habitat in the PRRIP action area and the project is covered by the PBOs.

Although the water depletive effects of this Federal Action to central and lower Platte River species have been addressed in the PBOs, when "no effect" or may affect but not likely to adversely affect determinations are made on a site-specific basis, the Service will review these determinations and provide written concurrence where appropriate. Upon receipt of written concurrence, section 7(a)(2) consultation will be considered completed for those federal actions.

Water-related activities requiring federal approval will be reviewed by the Service to determine if: (1) those activities comply with the definition of existing water-related activities; and/or (2) proposed new water-related activities are covered by the applicable states or the federal depletions plan. The Service has determined that the [Project Name] Project meets the above criteria; therefore, this Tier 2 biological opinion regarding the effects of the [Project Name] Project on the target species, whooping crane critical habitat, and western prairie fringed orchid in the central and lower Platte River can tier from the PBOs. This Tier 2 biological opinion does not address potential effects from construction and operation of the Project on any other federally-listed threatened or endangered species and designated critical habitats outside of the PRRIP action area. Those effects will be addressed by the appropriate Field Office of the Service, in accordance with the ESA.

---

[2] "Existing water related activities" include surface water or hydrologically connected groundwater activities implemented on or before July 1, 1997. "New water-related activities" include new surface water or hydrologically connected groundwater activities including both new projects and expansion of existing projects, both those subject to and not subject to section 7(a)(2) of the ESA, which may affect the quantity or timing of water reaching the associated habitats and which are implemented after July 1, 1997.

[3] The "target species" are the endangered whooping crane (*Grus americana*), the interior least tern (*Sternula antillarum*), the pallid sturgeon (*Scaphirynchus albus*), and the threatened northern Great Plains population of the piping plover (*Charadrius melodus*).

[4] Other listed species present in the central and lower Platte River include western prairie fringed orchid (*Platanthera praeclara*), American burying beetle (*Nicrophorus americanus*) and Eskimo curlew (*Numenius borealis*).

II. Consultation History

Table II-1 of the Supplement (pages 6-8) contains a list of species and critical habitat in the action area, their status, and the Service's determination of the effects of the Federal Action analyzed in the PBOs.

The Service determined in the Tier 1 PBOs that the Federal Action, including the continued operation of existing and certain new water-related activities, may adversely affect but would not likely jeopardize the continued existence of the federally endangered whooping crane, interior least tern, and pallid sturgeon, or the federally threatened piping plover (herein after referred to as piping plover), and western prairie fringed orchid in the central and lower Platte River. Further, the Service determined that the Federal Action, including the continued operation of existing and certain new water-related activities, was not likely to destroy or adversely modify designated critical habitat for the whooping crane. The bald eagle was subsequently removed from the Federal endangered species list on August 8, 2007. Bald eagles continue to be protected by the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. For more information on bald eagles, see the Service's webpage at: http://www.fws.gov/migratorybirds/BaldEagle.htm

The Service also determined in the Tier 1 PBOs that the Federal Action would have no effect to the endangered Eskimo curlew. There has not been a confirmed sighting since 1926 and this species is believed to be extirpated in Nebraska. Lastly, the Service determined that the Federal Action, including the continued operation of existing and certain new water-related activities, was not likely to adversely affect the endangered American burying beetle.

The effects of the continued operation of existing and certain new water-related activities on the remaining species and critical habitats listed in Table II-1 of the Supplement were beyond the scope of the PBOs and were not considered.

The Service has reviewed the information contained in the biological assessment submitted by your office on [Date]. We concur with your determinations of "may affect, and likely to adversely affect" for the endangered whooping crane, interior least tern, pallid sturgeon, and the threatened piping plover, and the western prairie fringed orchid in the central and lower Platte River. We also concur with your determination of may affect, and likely to adversely affect, for designated whooping crane critical habitat.

We also concur with your determinations of "may affect, but not likely to adversely affect" for [species, and "no adverse modification of critical habitat" for species]. You have also made the determination of no effect for the [species]. We acknowledge those no effect determinations.

III. Scope of the Tier 2 Biological Opinion

The [Project Name] Project is a component of "the continued operation of existing and certain new water-related activities" requiring a federal action to be evaluated in the Tier 1 PBOs, and flow-related effects of the Federal Action are consistent with the scope and the determination of effects in the PBOs. Because [Project Proponent] has elected to participate in the PRRIP, ESA compliance for flow-related effects to federally listed endangered and threatened species and designated critical habitat from [Project Name] Project is provided to the extent described in the Tier 1 PBOs.

This biological opinion applies to the [Project Name] Project effects to listed endangered and threatened species and designated critical habitat as described in the PBOs for the period of the first 26 years of the PRRIP (i.e., the anticipated duration of the PRRIP first increment and extension).

IV. Description of the Federal Action

[Describe the Federal Action and any Interdependent and Interrelated Actions – use text from the Biological Assessment]

V. Status of the Species/Critical Habitat

Species descriptions, life histories, population dynamics, status and distributions are fully described in the PBO on pages 76-156 and on pages 17-53 in the Supplement for the whooping crane, interior least tern, piping plover, pallid sturgeon, and western prairie fringed orchid, and whooping crane critical habitat, and are hereby incorporated by reference.

Climate change was evaluated as a potential threat to the species and whooping crane critical habitat in the Supplement. The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). "Climate" refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007, p. 78). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8-14, 18-19).

Changes in temperature and/or precipitation patterns will influence the status of the Platte River system. These changes may contribute to threats that have already been identified and discussed for interior least tern, piping plover, pallid sturgeon and western prairie fringed orchid in the Tier 1 PBOs.

[Discuss changes in status of target species/critical habitat since the Tier 1 PBOs were issued, or include a statement saying "Since issuance of the Service's PBO and the Supplement, there have been no substantial changes in status."]

VI. Environmental Baseline

The Environmental Baseline sections for the Platte River and for the whooping crane, interior least tern, piping plover, pallid sturgeon, and western prairie fringed orchid, and whooping crane critical habitat are described on pages 157 to 219 of the Tier 1 PBO and pages 54 to 81 of the Supplement, and are hereby incorporated by reference.

[Discuss changes in status of target species/critical habitat in the action area since the Tier 1 PBOs were issued, or include a statement saying "Since issuance of the Service's PBO and the Supplement, there have been no substantial changes in status of target species/critical habitat in the action area."]

VII. Effects of the Action

Since issuance of the Tier 1 PBO, our analyses under the ESA include consideration of ongoing and projected changes in climate. The Supplement considered these impacts. In our analyses, we used our best professional judgement to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change. Actions that are undertaken to improve the river ecology and habitats for listed species not only address human activities, but also contribute to listed species and whooping crane critical habitat resiliency to climate change.

Based on our analysis of the information provided in your biological assessment for the [Project Name], the Service concludes that the proposed Federal Action will result in a [a/an existing depletion, new depletion, or a combination of existing and new depletions]. These depletions are associated with [briefly describe here, or by reference, the specific water supply sources, water uses, amount information, etc. (e.g. in Colorado, use the *Supplemental Worksheet for PRRIP BA*)].

[Include as needed:] As an existing water-related activity, we have determined that the flow-related adverse effects of the [Project Name] are consistent with those evaluated in the Tier 1 PBOs for the whooping crane, interior least tern, piping plover, pallid sturgeon, western prairie fringed orchid, and whooping crane critical habitat.

[Include as needed:] As a new water-related activity, we have determined that the flow-related adverse effects of the [Project Name] are consistent with those evaluated in the Tier 1 PBOs for the whooping crane, interior least tern, piping plover, pallid sturgeon, western prairie fringed orchid, and whooping crane critical habitat, and these effects on flows are being addressed in conformance with the [Select the applicable depletion plan: Wyoming

Depletion Plan, Nebraska New Depletion Plan, Colorado Plan for Future Depletions, Federal Depletions Plan] of the PRRIP.

[If the site-specific project/activity may affect listed species/critical habitat addressed in the PBOs, include those site-specific effects here. In that instance, the Incidental Take Statement section below may need additional text.]

VIII. Cumulative Effects

Cumulative effects include the effects of future State, local, or private (non-federal) actions that are reasonably certain to occur in the action area considered in this biological opinion. A non-federal action is "reasonably certain" to occur if the action requires the approval of a State or local resource or land-control agency, such agencies have approved the action, and the project is ready to proceed. Other indicators which may also support such a "reasonably certain to occur" determination include whether: a) the project sponsors provide assurance that the action will proceed; b) contracting has been initiated; c) State or local planning agencies indicate that grant of authority for the action is imminent; or d) where historic data have demonstrated an established trend, that trend may be forecast into the future as reasonably certain to occur. These indicators must show more than the possibility that the non-federal project will occur; they must demonstrate with reasonable certainty that it will occur. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act and would be consulted on at a later time.

Cumulative effects are described on pages 194 to 300 of the Tier 1 PBO and pages 102 to 104 of the Supplement, and are hereby incorporated by reference. [Discuss any changes in cumulative effects, if any, since the Tier 1 PBOs was issued, or include a statement saying "Since issuance of the Service's PBO and the Supplement, there have been no substantial changes in cumulative effects to the species."]

IX. Conclusions

The Service concludes that the proposed [Project Name] Project is consistent with the Tier 1 PBOs for effects to listed species and critical habitat addressed in the Tier 1 PBOs. After reviewing site specific information, including: 1) the scope of the Federal Action; 2) the environmental baseline; 3) the status of the whooping crane, interior least tern, piping plover, pallid sturgeon, and western prairie fringed orchid in the central and lower Platte River and their potential occurrence within the project area, as well as whooping crane critical habitat; 4) the effects of the [Project Name] Project; and 5) any cumulative effects, it is the Service's biological opinion that the [Project Name] Project, as described, is not likely to jeopardize the continued existence of the federally endangered whooping crane, interior least tern, and pallid sturgeon, or the federally threatened piping plover, or western prairie fringed orchid in the central and lower Platte River. The [Project Name] Project is also not likely to destroy or adversely modify designated critical habitat for the whooping crane.

This Tier 2 biological opinion does not address potential effects from construction and operation of the Project on any other federally-listed threatened or endangered species and designated critical habitats outside of the PRRIP action area. Those effects will be addressed by the appropriate Field Office of the Service, in accordance with the ESA.

X. Incidental Take Statement

Section 9 of ESA and federal regulations pursuant to section 4(d) of ESA prohibit the take of endangered and threatened species without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct, and applies to individual members of a listed species. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

Sections 7(b)(4) and 7(o)(2) of ESA do not apply to the incidental take of federally listed plant species (e.g., Ute ladies' tresses orchid, and western prairie fringed orchid). However, limited protection of listed plants from take is provided to the extent that ESA prohibits the removal and reduction to possession of federally listed endangered plants or the malicious damage of such plants on non-federal areas in violation of state law or regulation or in the course of any violation of a state criminal trespass law. Such laws vary from state to state.

The Department of the Interior, acting through the Service and Bureau of Reclamation, is implementing all pertinent Reasonable and Prudent Measures and implementing Terms and Conditions stipulated in the Tier 1 PBOs' Incidental Take Statements (pages 309-326 of the PBO and 111-115 of the Supplement) which will minimize the anticipated incidental take of federally listed species. In instances where the amount or extent of incidental take outlined in the Tier 1 PBOs is exceeded, or the amount or extent of incidental take for other listed species is exceeded, the specific PRRIP action(s) causing such take shall be subject to reinitiation expeditiously.

[If the site-specific project/activity may affect listed species/critical habitat addressed in the PBOs, include any site-specific Reasonable and Prudent Measures and Terms and Conditions here. See the format in the PBOs Incidental Take sections]

XI. Closing Statement

Any person or entity undertaking a water-related activity that receives federal funding or a federal authorization and which relies on the PRRIP as a component of its ESA compliance in section 7 consultation must agree: (1) to the inclusion in its federal funding or authorization documents of reopening authority, including reopening authority to accommodate reinitiation upon the circumstances described in Section IV.E. of the Program document; and (2) to request appropriate amendments from the federal action agency as needed to conform its funding or authorization to any PRRIP adjustments negotiated among the three states and the Department of the Interior, including specifically new requirements, if any, at the end of the first PRRIP increment and any subsequent PRRIP increments. The Service believes that the PRRIP should not provide ESA compliance for any water-related activity for which the funding or authorization document does not conform to any PRRIP adjustments (Program Document, section VI). Reinitiation of consultation over [Project Name] Project will not be required at the end of the first increment including the extension (a period covering the first 26 years of the PRRIP) provided a subsequent Program increment or additional first increment Program extension is adopted pursuant to appropriate ESA and NEPA compliance procedures, and, for a subsequent increment, the effects of the [Project Name] Project are covered under a Tier 1 PBO for that increment addressing continued operation of previously consulted-on water-related activities.

This concludes formal consultation on the actions outlined in the [Date] request from [federal action agency]. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; 3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, the specific action(s) causing such take shall be subject to reinitiation expeditiously.

Requests for reinitiation, or questions regarding reinitiation should be directed to the appropriate Field Office at the address below.

[For Colorado and Nebraska Projects, select the Nebraska field office; for Wyoming, select Wyoming field office below and delete the other one]

Field Supervisor
Nebraska Ecological Services Field Office
U.S. Fish and Wildlife Service
9325 S Alda Road
Wood River, NE 68883

Field Supervisor
Wyoming Ecological Services Field Office
U.S. Fish and Wildlife Service

334 N Parsley Boulevard
Cheyenne, WY 82007

XII. Conservation Recommendations

Section 7(a)(1) of ESA directs Federal agencies to utilize their authorities to further the purposes of ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of an action on listed species or critical habitat, to help implement recovery plans, or to develop information. Conservation recommendations are provided in the PBO (pages 328-329) and Supplement (page 117) and are hereby incorporated by reference.

XIII. Literature Cited

Platte River Recovery Implementation Program Document. 2006.

U.S. Department of the Interior. 2006. Platte River Recovery Implementation Program Final Environmental Impact Statement.

U.S. Fish and Wildlife Service. 2006. Biological Opinion on the Platte River Recovery Implementation Program.

U.S. Department of the Interior. 2018. Platte River Recovery Implementation Program First Increment Extension Final Environmental Assessment.

U.S. Fish and Wildlife Service. 2018. Supplemental Biological Opinion on the Platte River Recovery Implementation Program First Increment Extension.

We appreciate the opportunity to review and comment on this proposed project. Should you have questions, please contact [FWS lead biologist] within our office at [email address] or [phone number].

PLATTE RIVER RECOVERY IMPLEMENATION PROGRAM
Attachment 5
Section 10

Federal Depletions Plan for the Platte River Recovery Implementation Program

December 7, 2005

1. Purpose

The purpose of the Federal Depletions Plan is to describe the approach for offsetting or preventing the impacts of new water related activities on the occurrence of target flows and on the effectiveness of the Program in reducing shortages to target flows for certain new water related activities which are a federal agency responsibility to offset.

2. Background

Key elements of the Program include depletion plans to ensure that new depletions to target flows (species and annual pulse flows) in the central Platte River (i.e., those resulting from new or expanded uses begun on or after July 1, 1997) will be offset, replaced, or prevented. Plans intended to help achieve this objective have been developed by the states of Nebraska, Wyoming, and Colorado. However, for certain types of federal activities the states' depletion plans do not provide water to replace the new depletion. This means that some new federal projects, specifically, those providing primarily a "national benefit" as opposed to benefits accruing primarily to local water users within a state, will not be covered in full or in part by the states' new depletion plans. Therefore, this Federal Depletions Plan will address some of the new depletions that will be deemed a federal agency responsibility.

The Federal Depletions Plan was developed by the DOI in coordination with other federal agencies involved in land and water management activities in the Platte River basin. Discussions with a number of these agencies and solicitation of relevant information was initiated on October 17, 2001, in a meeting at the FWS regional office in Lakewood, Colorado. In January 2004, a draft of this Plan was distributed to the federal agencies listed in Table 1, and their comments on this Plan were requested and are reflected in the table.

3. Definitions

Federal Depletion

An existing or new water related activity (as defined in the Program Document) implemented by federal agencies that primarily provide a "national benefit" to the general public as opposed to benefits accruing primarily to local water users within a state. In cases where an environmental project of "national benefit" is implemented by a state agency with some federal participation (e.g., federal cost-sharing), any new depletions resulting from that project will be a federal responsibility in proportion to the extent to which the cost of establishing and maintaining that project is provided by federal funds and personnel.

New Depletion
A depletion to target flows (FWS species and annual pulse flows) in the Platte River caused by new water related activities (as defined in the Program Document) begun after July 1, 1997.

New Federal Depletion
A new depletion which is partially or solely a federal agency responsibility to address. Typically, these are water-related activities for which the associated water rights are held by a federal government agency for a national benefit.

4. Categories of Known or Anticipated New Federal Depletions

General categories of known or anticipated New Federal Depletions likely to be provided ESA compliance under this plan have been identified to the extent possible (Table 1). Examples of new water related activities that would be considered primarily a national benefit in scope include, but are not necessarily limited to, the following:

- New water storage facilities, impoundments, and consumptive water uses at National Wildlife Refuges, Waterfowl Production Areas, and National Fish Hatcheries;
- New consumptive water uses at National Forests, Parks, Monuments, and Historic Sites, including recreational, habitat improvement, administrative, and emergency uses; and
- New depletions associated with activities at federal facilities which provide benefits that are primarily national in scope, such as national defense, national security, or national research and development activities (e.g., Rocky Mountain Arsenal; National Renewable Energy Laboratory; Rocky Flats).

There may be other future projects where the classification of the new depletion ("federal" or "non-federal" responsibility) is not obvious. In such cases, final classification of the project will be made by the FWS in coordination with the Platte River Governance Committee. However, each state retains the right to determine whether the activity may be covered by that state's plan.

5. Scope of the Federal Depletions Plan

The scope of the Federal Depletions Plan is to cover relatively small new federal depletions associated with the operation, management, and improvement of federal lands and federal facilities providing primarily national benefits to the general public.

6. Water Related Activities Outside the Scope of the Federal Depletions Plan

This Plan does not address "the impacts, including channel stability, of past and future vegetation management" by the U.S. Forest Service (USFS) in the Platte River basin.[1] Such impacts will be

[1] It is the position of the Forest Service that changes to water yield from forested landscapes resulting from the natural variability of the forest condition are not federal actions and do not constitute depletions that require

the subject of further research and analysis during the First Increment of the Program as described in Attachment B of this plan (December 2, 2005 letter from Rick D. Cables, Regional Forester to Dale Strickland, Executive Director, Platte River Endangered Species Partnership).

This Plan is not intended to cover large new federal depletions (e.g., federal depletions measured in thousands of acre-feet per year) that could be associated with new or enlarged reservoirs, large well fields, large surface water diversions, or other large-scale activities. Those will be covered through measures developed under separate ESA Section 7 consultation.

This Plan is not intended to address water conservation activities implemented on privately-owned agricultural lands in the Platte River basin that may result in new depletions. It will remain the responsibility of federal agencies to initiate Section 7 ESA consultation with FWS for such federal actions that are likely to result in new depletions to the Platte River, including water and land conservation activities.

7. Procedure for Addressing New Federal Depletions

7.1 ESA Section 7 Consultation Requirements

Section 7 (a)(2) of the ESA requires federal agencies to consult with the Secretary of the Interior to ensure their actions are not likely to jeopardize federally-listed (threatened or endangered) species or adversely modify or destroy designated critical habitat. Consultation is required if a federal action may affect federally listed species or designated critical habitat. Adoption of a Platte River Recovery Implementation Program does not change this legal requirement.

New federal depletions may be covered by the Program's Federal Depletions Plan when the federal agency consults under Section 7 of the ESA, quantifies the new federal depletion, and agrees to participate in the Program. Attachment A of this plan describes the consultation process for water related activities and Federal Depletions.

If a federal agency chooses to not participate in the Program/Federal Depletions Plan then the FWS will request the agency to replace the new federal depletion to the extent necessary to (1) be consistent with the Program Agreement, and (2) mitigate the impacts of the new federal depletion on the occurrence of target flows and on the effectiveness of the Program in reducing shortages to target flows, consistent with Section III.E.3 of the Program Document. Such replacements shall occur in the same state in which the new federal depletion occurs, or the responsible agency shall use other acceptable methods as agreed to by the FWS and the Governance Committee.

---

consultation under Section 7(a)(2) or any other provisions of the Endangered Species Act. Several entities represented on the Governance Committee do not agree with this position taken by the Forest Service.

7.2 Extent of New Federal Depletions Addressed by the Federal Depletion Plan

This Plan may serve as a mechanism for providing ESA coverage for a maximum 1,050 acre-foot/year of new federal depletions after July 1, 1997 and the end of the First Increment, measured in terms of average annual reductions in target flows. These reductions will be quantified at the Colorado-Nebraska state line (if the project is in the South Platte basin above this line), at the Colorado-Wyoming state line (if the project is in the North Platte basin above this line), at the Wyoming-Nebraska state line (if the project is in the North Platte Basin in Wyoming above this line), or at the uppermost point in the South Platte, North Platte, or mainstem Platte River above Chapman where the project's aggregate impact on flows can be quantified (if the project is in Nebraska). For purposes of quantifying flow reductions, water tracking and accounting procedures adopted for the corresponding state plans will be applied.

Each state has agreed to work with the DOI and cooperating federal agencies in the process of securing up to 350 acre-feet of water annually, if needed, to offset new federal depletions within the state in a manner consistent with the respective state's Depletion Plan. Such assistance could include making water that is available for offset purposes to non federal parties under that state’s Depletion Plan also available to federal agencies that are responsible for new federal depletions. If such water is made available and if the federal agency initiating the new federal depletion decides to offset its new federal depletion in that manner, the federal agency is to reimburse the appropriate parties the proportionate cost of the project providing the offset water or is to do whatever else is required of other parties using water from the same offset source. Replacement timing and location will be consistent with state plans, and the replacement responsibility is to be commensurate with the new federal depletion occurring.

At such time that a proposed activity is determined to result in new federal depletions that cumulatively exceed the 1,050 acre-foot/year threshold, this Plan will not be available for purposes of ESA compliance for new federal depletions in excess of this total. In such an instance FWS and the activity's proponent can consider amendments that will allow this Plan to provide ESA compliance for the activity, as provided in Section III.E of the Program Document. The development of any such amendments will include an evaluation of impacts (if any) to peak flows in the central and lower Platte River.

7.3 Method of Determining Responsibilities for Offsetting, Replacing, or Preventing New Federal Depletions

Requirements for the replacement of new federal depletions using the Federal Depletions Plan are as follows:

1. New federal depletions will be replaced in the same state in which they occur, or use other acceptable replacement locations as agreed to by the Governance Committee.

2. New federal depletions will be quantified as follows:

a) In general, the same tools, methods, and procedures used to determine new depletions and the required offsets according to the states' plans, including timing of replacements, will apply in determining and replacing new federal depletions.

b) The extent to which the proposed activity creates or increases shortages to the occurrence of target flows and on the effectiveness of the Program in reducing shortages to target flows relative to pre-July 1,1997 conditions will be determined and the quantity, timing, and location of the new federal depletion to target flows will be offset.

c) Lag times and conveyance loss between the site of the new depletion and the state line (if in Colorado or Wyoming) or the Platte River at Grand Island, Nebraska (if in Nebraska) will be estimated using the same tools and methods adopted for the corresponding state's depletions plan.

For example, for new federal depletions associated with activities in **Colorado**, the transit loss factors utilized in Colorado's New Depletions Plan would be applied to estimate the effects at the Colorado-Nebraska state line. For activities in **Nebraska**, the Cooperative Hydrology Study (COHYST) models and other tools used to implement Nebraska's New Depletions Plan will be used to estimate depletive impacts and to determine the required offsets. For activities in **Wyoming**, depletions will be routed to the Wyoming-Nebraska state line using the methods identified in Wyoming's Depletions Plan.

7.4 Options for Mitigating, Offsetting or Preventing New Federal Depletions

If the federal agency elects to participate in the Program and rely of the Federal Depletions Plan, they will have several options for addressing the new federal depletions for which the agency is responsible, as listed below.

1. **Replace the new federal depletion by permanently retiring an equivalent federal depletive activity**.
   For example, if the creation or expansion of ponds on a national wildlife refuge in the Platte basin results in new federal depletions, FWS would have the option of ceasing activities at the same or a different site to partially or fully fulfill its obligation to offset the federal depletive impacts. Documentation sufficient to demonstrate the quantity, timing, and location of the proposed offsetting activity would be an essential requirement.

2. **Provide funding to the appropriate parties to ensure that offsetting measures will be implemented consistent with the applicable state depletion plan, as necessary to offset the new federal depletion**.
   Provided there is concurrence on the part of the state in which the new federal depletion will occur, the federal agency would have the option of providing annual funding in the amount necessary to ensure replacement of this water or offsetting of its depletive effects consistent with the corresponding state's new depletion plan. Federal agency reimbursements would be proportionate to their share of offsetting water from the corresponding state project. For example, should Wyoming choose to establish a "water

bank" as part of its program for offsetting Platte depletions, the federal agency may be given the option, at Wyoming's discretion, of paying Wyoming or the Program to offset the new federal depletion by means of this water bank strategy.

3. **Replace the new federal depletion through other means**.
If the federal agency is unable or elects not to replace the depletion through cessation of another consumptive water use or through coordination with a state depletion plan, other means of replacing the depletion may be acceptable. For example, a commitment to lease the requisite quantity of augmentation water from a private entity in the same state may be an acceptable alternative, provided that (1) this activity is determined to satisfactorily offset new depletions to Program target flows in quantity, timing, and location, (2) it is determined to satisfactorily offset new depletions in accordance with Section III.E.3 of the Program Document.

7.5 Monitoring of Section 7 Consultations and Federal-Nexus Depletions

The accurate and timely identification, accounting, and tracking of new federal-nexus projects that cause depletions is an integral component of the Program. This includes identifying and accounting for new federal depletions. The FWS will develop a system to monitor the status of federal-nexus depletions throughout the Platte River basin as Section 7 consultation is conducted. For each federal-nexus depletion, this system will include information on:

- The responsible federal agency (*i.e*., the agency consulting with FWS);
- The project name, operator, and cooperators if applicable;
- The date of the action;
- The amount of the depletion at the project site;
- The offsetting obligation (*i.e*., lagged depletion at the replacement site after transit losses are taken into account);
- The category of depletion (new, existing, federal, state, private non-Program, etc.)
- The location and starting date of the depletion;
- The method used to offset the new depletion, and the status of the action taken (for example, if a "fair share" payment is being made under the state depletion plan, when was the requisite fee last paid?).

A summary report will be derived from this project tracking and accounting system and provided to the Governance Committee on an annual basis.

8. Impacts to Peak Flows

The Program requires full offset of any anticipated increases in shortages to Program target flows, as Program target flows are defined in Attachment 5, Section 11 of the Program Document. With regard to the larger and less frequent peak flows identified by the FWS as desirable for maintenance of habitat conditions in the central and lower Platte River (see also Attachment 5, Section 11), it is the position of the FWS to minimize reductions in the magnitude and frequency of these flows due to new activities in the basin, while recognizing that some reductions may be necessary in order to implement the re-regulation or other activities necessary to achieve Program goals.

It is assumed that new projects having the potential to significantly affect peak flows in the central and lower Platte River will necessarily include a storage component, and it is reasonable to assume that such projects therefore will have a federal nexus (*e.g.*, require a Section 404 permit). Thus, future ESA section 7 consultation with the FWS is highly probable in cases where significant impacts to peak flows may occur, whether they result in a new federal depletion or a new non-federal depletion.

No major new storage facilities (*e.g.*, with storage capacities measured in hundreds of acre-feet or more) to serve national benefit/federal uses are anticipated in the Platte River basin during the First Increment. However, federal facilities storing relatively modest quantities of water (for example, new ponds on national wildlife refuges) are likely during the First Increment.

9. Known and Anticipated New Federal Depletions Occurring After July 1, 1997

Table 1 identifies known and anticipated New Federal Depletions occurring since July 1, 1997. This matrix was developed by the Department of the Interior by soliciting information about known and anticipated water-use activities in the Platte River basin from the identified federal agencies.

While an attempt has been made to identify all possible new federal depletions of significance, this summary is necessarily limited by currently available information and by imperfect knowledge of future activities. Moreover, it is possible that federal agencies not included in Table 1 (for example, the Department of Defense) may create depletions that would be a federal responsibility to address. Nevertheless, the information gathered to date and summarized in Table 1 suggests that the anticipated magnitude of cumulative new federal depletions in the Platte River basin from July 1, 1997 through the end of the First Increment of the Program will likely be in the range of a few hundred acre-feet or less.

Table 1. Estimated New Federal Depletions

Agency	**Example Activities of "Federal Scope"**	**Example Activities Not Considered to be of "Federal Scope"**	**Estimated New Federal Depletions Since 1997**	**Planned/Reasonably Foreseeable Additional New Federal Depletions**	**Background/Baseline Information Provided by/ Available from Agency**
U.S. Army Corps of Engineers	None identified.	- Flood control & water supply - Environmental restoration - Section 404 permitting	None.	None anticipated. "We do not believe we have any planned or foreseeable activities that could be defined as Federal depletions for strictly Federal needs."	- Booklet describing Corps assistance activities: *Civil Works: Technical Assistance, Project Implementation, and Emergency Management Programs* - Omaha District Home Page: *www.nwo.usace.army.mil/html/pdp/CivWeb.htm* - Contact: Bob Nebel, (402) 221-4621.
U.S. Bureau of Land Management	Spring developments, Wells, and Small reservoirs/ ponds, including stock ponds and tanks, to the extent that the above activities involve water rights held by BLM. - Creating new wetlands or enhancing existing wetlands	Externally-initiated authorized user activities. For example, oil and gas development (drilling and related land reclamation activity) - Restoring historic wetlands	In Colorado: **31.6 AF/yr** associated with new reservoirs at the Hebron Slough Wildlife Area. **6.0 AF/yr** associated with 9 spring developments and 15 wells. In Wyoming: **5.6 AF/yr** associated with stock watering ponds and 1 well (estimated; this number not yet confirmed)	In Colorado: **15 to 100 AF/yr** by the end of 13 years related to livestock and wildlife water development activities, primarily in the North Platte basin. In Wyoming: 107 AF total **(8.2 AF/yr**) by the end of 13 years associated with "strictly federal" spring developments, wells, and small reservoirs and ponds. 2.3 AF total (**0.2 AF/yr**) by the end of 13 years associated with resolution of a trespass violation. 13 AF total (**1.0 AF/yr**) by the end of 13 years associated with oil and gas well drilling and land reclamation.	In Colorado: 1997, 1998, 1999, and 2000 Depletion Reports. Contact: Jay Thompson, (303) 239-3724. In Wyoming: May 2002 memorandum from Wyoming Deputy State Director. Contact: Mark Gorges, (307) 775-6100.
U.S. Bureau of Reclamation	Some environmental restoration activities.	- Water service contracts - Water conservation activities - Most environmental restoration activities (e.g., establishment	None.	None. "We have not identified any specific future Federal depletions associated with Reclamation activities in the Platte River basin that are strictly Federal in scope".	Contact: Gary Davis, (406) 247-7717.

		and restoration of wetland & riparian habitats).			
U.S. Department of Veteran's Affairs	Operation of National Cemeteries, including lawn irrigation, ponds, etc.		None identified.	None identified to date.	John Reiker, National Cemetery Administration, (303) 914-5711.
USDA Natural Resources Conservation Service	None identified.	- Farm impoundments - Grade stabilization - On-farm conservation programs	None identified.	"The NRCS does not anticipate any Federal projects that will have a significant impact on flows in the Platte River" ... "we will consult with USFWS on any individual planned projects that may result in depletions of greater than 25 acre feet. However ... [we] are not aware of any planned NRCS-assisted projects that would exceed 25 acre-feet depletion per year." [FWS note: all applicable activities resulting in new depletions, whether less than or greater than 25 AF/year, will be subject to ESA consultation]	Contact: Richard Van Klaveren, Regional Conservationist, Lincoln, Nebraska. (402) 437-5315.
U.S. Department of Energy	Decommissioning & closure of Rocky Flats Environmental Technology site.	None identified.	None identified.	To be determined for Rocky Flats using the Site-wide Water Balance (SWWB) Model. Anticipated to be **less than 25 AF/yr** by the end of 13 years, and possibly zero. [FWS note: all applicable activities resulting in new depletions, whether less than or greater than 25 AF/year, will be subject to ESA consultation]	- SWWB *Model Report for the Rocky Flats Environmental Technology Site*, May 2002 - Contact: John Stover, (303)966-9735
U.S. Environmental Protection Agency	None identified.	None identified.	None identified.	"We … have made the determination that the Environmental Protection Agency Region 8 does not have any water-related depletion activities in our programs."	Contact: Carol Campbell, (303) 312-6340.
U.S. Fish & Wildlife Service	- Water storage and use at national wildlife refuges, waterfowl	- Federal Aid programs which primarily benefit local	**10.2 AF/year**	To be determined as they occur. Total federal new depletions during the First Increment are anticipated to total **less**	"Inventory of USFWS Water-Related Operations in the Platte River Basin and Documentation of

	production areas, and fish hatcheries	communities (e.g., ponds at city parks) - Partners for Fish & Wildlife-funded activities or other similar activities implemented on private lands (e.g., stream rehabilitation and wetland restoration on private lands)	associated with new wells at the Funk Waterfowl Production Area (Nebraska), at the Saratoga Fish Hatchery (Wyoming), and at the Black-Footed Ferret Facility (Colorado) **5.0 AF/year** associated with new ponds at the Arapaho National Wildlife Refuge (Colorado).	**than 200 AF/yr**, including the following locations and activities: - **Arapaho National Wildlife Refuge (NWR)**, Colorado: new ponds with approximately 12 acre-feet of storage capacity and approximately 14 AF/yr of net new depletions are anticipated. - **Rainwater Basin Waterfowl Production Area (WPA)**, Nebraska: Additional well drilling and/or water impoundments for wetland maintenance may occur in the next 13 years. - **Rocky Mountain Arsenal NWR**, Colorado: New supply wells, ponds or wetland impoundments may be established on this site. - **Wetland Habitat Improvement Program Projects**: No new major depletions (>25 AF/yr) are anticipated. Since July 1997, minor new depletions associated with these projects have accrued at a rate of about 10 AF/year. *No* new water-depleting activities are anticipated at the following facilities: - **Bamforth NWR** (Wyoming) - **Black-Footed Ferret Facility** (Colorado) - **Cresent Lake NWR** (Nebraska) - **Hutton Lake NWR** (Wyoming) - **Mortenson Lake NWR** (Wyoming) - **North Platte NWR** (Nebraska) - **Pathfinder NWR** (Wyoming) - **Saratoga National Fish Hatchery** (Wyoming) - **Two Ponds NWR** (Colorado)	Pre-1997 Conditions", October 2001. (This document identifies the pre-1997 "baseline" information available for each wildlife refuge and WPA, against which future water consumption comparisons may be made). Contact: Don Anderson, (303) 236-4484.
U.S. Forest Service	Forest-Service-initiated water uses, including: -	Externally-initiated authorized user activities. For	In process of tabulating. Estimated **less than**	To be determined as they occur. Because the rate of new depletions associated with the identified "federal	Pre-1995 "historic" federal-scope USFS minor depletions documented in the *Programmatic*

	Recreation/campground uses - Species habitat improvement projects - Administrative sites - Emergency actions (wildfire, etc.)	example: - Permitted pipelines - Permitted reservoirs and ditches - Permitted recreational activities	**1 AF/yr** total since 1997.	scope" activities in recent decades have occurred at the rate of less than 0.2 AF/yr annually, total federal new depletions during the First Increment of the Program are likely to be **less than 3 AF/yr** at the end of 13 years. Presumes that there will be no new Forest Service-initiated reservoirs established during this period.	*Biological Assessment for Minor Water Depletions* (9/25/95) and supplement document. Since that date, individual forests have been documenting new depletions, and the USFWS has been tracking totals. Contact: Director Physical Resources or Director, Renewable Resources (303) 275-5350.
U.S. National Park Service	- Water use at National Parks, National Monuments, and National Historic Sites.	None identified.	None.	To be determined as they occur. Total federal new depletions during the First Increment are anticipated to total **less than 10 AF/yr**, including the following locations and activities: **Fort Laramie National Historic Site** (Wyoming): Up to **6 AF/yr** associated with construction of a new maintenance facility and new well. **Rocky Mountain National Park** (Colorado): No new depletions anticipated. There are no plans to modify existing dams nor construct new campgrounds or other facilities requiring new depletions. **Scotts Bluff National Monument** (Nebraska): No new depletions anticipated.	Letters provided by: • Valery Naylor (Superintendent, Scotts Bluff National Monument) • George Helfrich (Superintendent, Fort Laramie National Site), and • Anthony Schetzsle (Acting Superintendent, Rocky Mountain National Park). Contact: Karl Cordova, 970-586-1258.

NOTE: The above summary represents USFWS interpretation of information provided by these federal agencies. These agencies may or may not concur with the summary information as presented here. The nature and quantity of new depletions and potential coverage under this Plan ultimately will be determined at the time that ESA Section 7 consultations occur.

Attachment A
General Schematic of ESA Section 7 Consultation Process
for Water Related Activities and Federal Depletions

This document illustrates how, with a Program in place, water related activities subject to Section 7(a)(2) consultation will proceed through the consultation process and how the Federal Depletions Plan relates to that process. Projects involving both “new” and “existing” water related activities will proceed on dual pathways during the consultation process. The streamlined process outlined in the schematic may be used to address effects to the target species if the applicant elects to participate in the Program. Effects to other (non-target) listed species also will be separately addressed, as needed, during consultation on that activity.

The bold text for each box as explained below corresponds to the wording in the schematic for that box. If nothing other than the wording in the schematic appears in this document, the wording in the schematic is considered to be self-explanatory. The various steps, or boxes, have been numbered to aid the discussion. However, the numeric order does not imply any sequence of steps. The steps in the schematic are:

Box 1) **Platte River Basin Water-Related Activity**. A Platte River basin water-related activity. Proceed to box 2.

Box 2) **Is Section 7 Consultation Required?** If so, proceed to box 4. Otherwise, proceed to box 3 (stop).

Box 3) **Stop.** Section 7 consultation is not required.

Box 4) **FWS notifies applicable State of Federal Action subject to Section 7 consultation**. FWS will notify each State as federal agencies initiate actions subject to Section 7 consultation within a State, and provide annual reports to the Governance Committee on completed consultations. (See section 7.5 Monitoring of Section 7 Consultations and Federal-Nexus Depletions in the Federal Depletions Plan.) Proceed to box 5.

Box 5) **Is it a New or Existing water related activity**? If it is an existing activity, proceed to box 6. If it is a new activity, proceed to box 8.

Box 6) **If applicant elects to participate in the Program, the existing water related activity can be covered by the Program. Otherwise, consultation is completed without relying on the Program.** Once section 7 consultation for an activity’s effects to listed species is initiated with the FWS, effects to the target species by existing activities can be offset by participating in the Program. Effects to other (non-target) listed species are also addressed, as needed, during consultation on that activity. Proceed to box 7 (participate in Program), otherwise, proceed to box 13 (complete consultation outside of Program).

Box 7) **Federal agency and Governance Committee notified that Program covers the project**. **FWS completes a streamlined consultation for effects to target species. Stop.** A "streamlined" consultation is one where: a) the federal action agency determines a project may affect listed species and initiates ESA consultation with the Service, b) the effects to the target species and their critical habitats had been analyzed in the programmatic EIS and programmatic biological opinion, and c) the Program's actions or Depletion Plans can be used as ESA compliance measures for that project's effects to the target species in the Platte River basin and their critical habitats in Nebraska. Other listed species, if any, must also be addressed during consultation.

Box 8) **Is a State Depletion Plan Applicable**? If so, see the applicable schematic for the applicable State Depletion Plan. Otherwise, proceed to box 9.

Box 9) **Can the Federal Depletions Plan be used?** The depletions covered by the Federal Depletions Plan are those associated with new water related activities (as defined in the Program Document) implemented by federal agencies that primarily provide a "national benefit" to the general public as opposed to benefits accruing primarily to local water users within a state. The Federal Depletions Plan can be used to address some or all of the new depletions that will be deemed a federal agency responsibility to offset. The scope of the Federal Depletion Plan is to cover relatively small new federal depletions associated with the operation, management, and improvement of federal lands and federal facilities providing primarily national benefits to the general public. The scope of the programmatic biological opinion includes approximately 350 acre-feet of federal depletions within each of the three states. If the Federal plan can be used, proceed to box 10. If the project is beyond the scope of the Federal Plan, then determine whether an amendment of the plan to include ;the new water related activity can be done, which would be subject to Governance Committee approval of the modified plan (box 11).

Box 10) **Federal Agency provides depletion analysis to FWS and State**. The federal agency consulting with the Service is responsible for providing a project description of the proposed federal action, including information describing the proposed depletions to waters (surface and ground) that supply flow to the Platte River. The necessary information is identified in a Biological Assessment. Meetings and discussions to define the project depletions will generally include the federal agency, Service, and the State. Proceed to box 12.

Box 11) **Can the Federal Depletions Plan be amended to cover the Federal Depletion, including concurrence by the Governance Committee?** If yes, proceed to box 10 (Depletion Analysis), otherwise, section 7 consultation is conducted outside of the Program (box 13). Stop.

Box 12) **Can replacement water for the Federal Depletion be obtained with State's assistance?** Each state has agreed to work with the DOI and cooperating federal agencies in the process of securing up to 350 acre-feet of water annually, if needed, to offset new federal depletions within the state in a manner consistent with the respective state's Depletion Plan. See section 7.2 Extent of New Federal Depletions Addressed by the Federal Depletion Plan. If State assistance is possible, proceed to box 14. Otherwise, the federal agency may still participate in the Program by finding replacement water on its own (box 15)

Box 13) **Section 7 consultation completed outside of the Program. Stop.** If the Federal Depletion is outside of the scope of the Federal Depletions Plan (box 9), and the Federal plan cannot be amended to address the depletion (box 11), then consultation is completed outside of the Program. Stop.

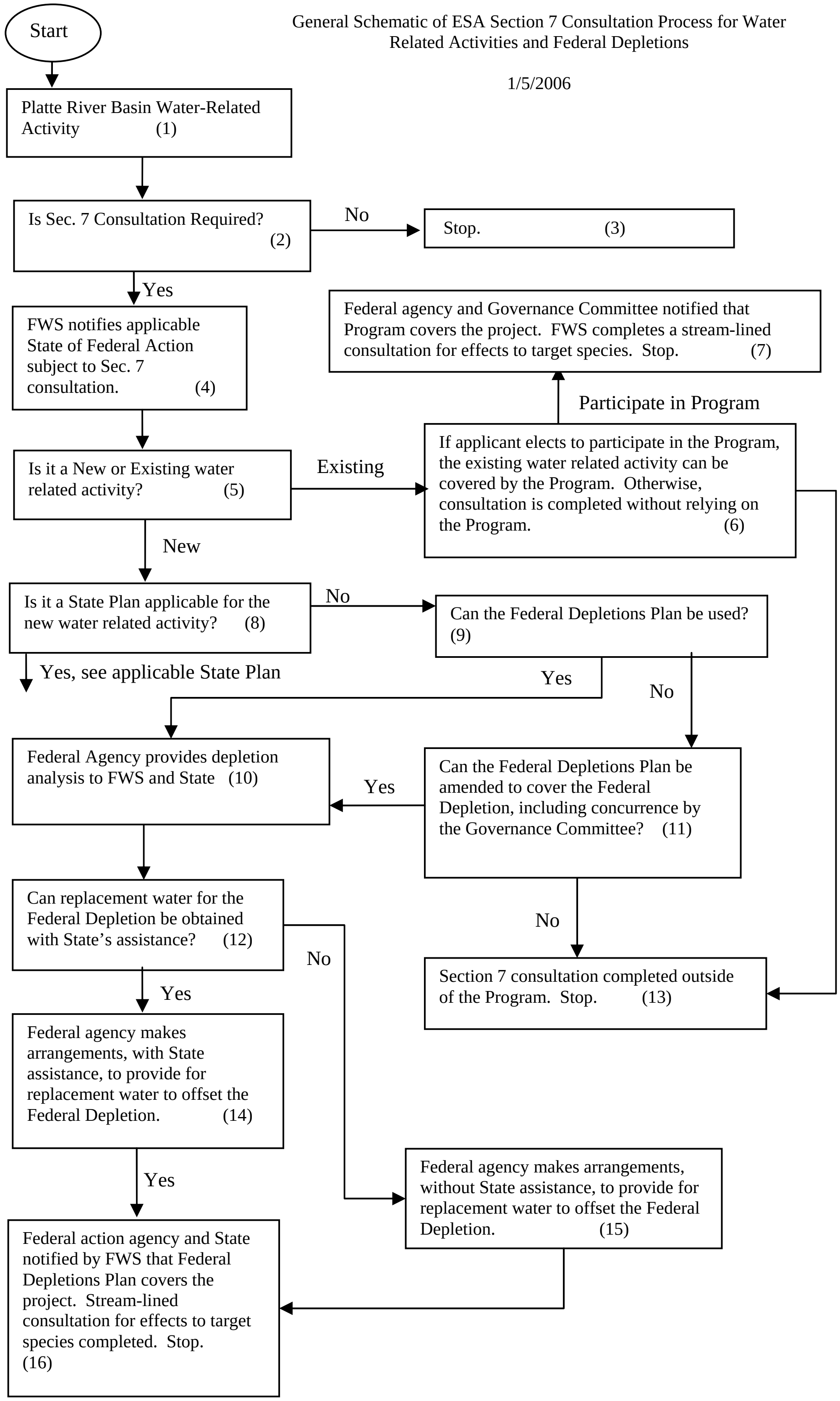
Box 14) **Federal agency makes arrangements, with State assistance, to provide for replacement water to offset the Federal Depletion.** Proceed to box 16.

Box 15) **Federal agency makes arrangements, without State assistance, to provide for replacement water to offset the Federal Depletion.** Proceed to box 16.

Box 16) **Federal action agency and State notified by FWS that Federal Depletions Plan covers the project. Stream-lined consultation for effects to target species completed.** Effects to other (non-target) listed species are also addressed, as needed, during consultation on that activity.

General Schematic of ESA Section 7 Consultation Process for Water Related Activities and Federal Depletions

1/5/2006



United States Department of Agriculture
Forest Service
Rocky Mountain Region
P.O. Box 25127
Lakewood, CO 80225-0127
Delivery: 740 Simms Street
Golden, CO 80401
Voice: 303-275-5350
TDD: 303-275-5367

ATTACHMENT B

File Code: 2500/2670
Date: December 2, 2005

Dale Strickland
Executive Director
Platte River Endangered Species Partnership
2003 Central Avenue
Cheyenne, WY 82001

Dear Mr. Strickland and Members of the Governance Committee:

I understand that after many years of hard work under the framework of the July 1997 Cooperative Agreement, a Recovery Program for endangered species on the central Platte River may soon be in place.

One issue that was investigated as part of the development of the Recovery Program is the relationship between forest condition and water yield on forested lands in the Platte River Basin. The Forest Service was able to make substantial contributions to understanding this issue in the Platte River Basin, and provided data and funding towards the completion of two reports that were used in the NEPA analysis for the development of the Recovery Program.

It is clear that the relationship between forest condition and water yield will continue to be important to understanding and evaluating the effectiveness of the Recovery Program as the first increment is implemented. As the manager for a significant proportion of the forested lands in the Platte River Basin, the Forest Service will continue to manage National Forest System lands to include support for goals of the Recovery Program. We will continue to aggressively manage for healthy forest conditions, consistent with the National Forest Management Act, and using tools available under the Healthy Forest Restoration Act, the Healthy Forest Initiative, and other Forest Service programs and authorities. We will also continue to provide data and analysis towards a more complete understanding of the relationships between forested landscapes and water yield.

In addition to being responsive to questions and concerns as they arise during the implementation and evaluation of the first increment of the Recovery Program, the Forest Service will be moving forward with the following specific contributions:

1. Actively participate in the implementation of the Federal Depletions Plan, and consult separately on any depletions which are not covered by the Federal Depletions Plan.

2. Track Forest Service vegetation management activities (timber harvest and fuels treatment) in the Platte River Basin on an annual basis. Analyze changes to water

United States Department of Agriculture | Forest Service | Rocky Mountain Region | P.O. Box 25127
Lakewood, CO 80225-0127
Delivery: 740 Simms Street
Golden, CO 80401
Voice: 303-275-5350
TDD: 303-275-5367

ATTACHMENT B

yield from these activities on a five-year basis, or more frequently if needed to evaluate the effectiveness of the first increment of the Recovery Program.

3. Conduct an analysis for the South Platte Basin parallel to the May 2003 report: "Impact of Forest Service Activities on the Stream Flow Regime in the Platte River" (Troendle, Nankervis, and Porth). This study is anticipated to be completed by September, 2006.

4. Work with the Governance Committee to conduct a renewed basin-wide analysis of water yield from National Forests in the Platte River Basin, using the most currently available vegetation data, at least once in twenty years or one year prior the end of the first increment, whichever occurs first, or as may be agreed to in writing by the Forest Service and the Governance Committee. In addition, this analysis will include a comparison with the 1997 basin-wide water yields modeled in the May 2003 report by Troendle, Nankervis, and Porth, and in the report from item #3 (above), and a projection into the future for at least one program increment.

5. Analyze the predicted changes in water yield from the 2003 North Platte study and the planned 2006 South Platte study to determine when the simulated effects of the forest regrowth, if actualized, would be reflected in stream gage data, using the reference gages identified in Troendle et al (2003). This analysis is anticipated to be completed by December, 2006.

6. Work with the Governance Committee, the USGS, and the NRCS to ensure that the reference stream flow and precipitation monitoring sites identified in Troendle et al, 2003, remain in operation.

7. Provide support to the National Academy of Sciences study titled: "The Hydrologic Impacts of Forest Management", which has been contracted by the Department of the Interior.

8. Work on an ongoing basis with the Water Management Committee to determine what additional studies may be needed to inform these issues, and develop appropriate timeframes for funding, contracting, and completing any needed studies.

The development of the Platte River Recovery Program is an important achievement. The Forest Service is committed to contributing to the successful implementation of the first increment of the Program.

Sincerely,

/s/ Rick D. Cables

RICK D. CABLES
Regional Forester

cc:
Russell George
Executive Director
Colorado Department of Natural Resources
Ann Bleed
Acting Director
Nebraska Department of Natural Resources
Mike Besson
Director
Wyoming Water Development Commission
Ralph Morgenweck
Regional Director
U.S. Fish and Wildlife Service
Maryanne Bach
Director Research and Development
Bureau of Reclamation

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 5
Section 11

Water Plan Reference Materials

December 7, 2005

Unlike all other attachments to the Program Document, Attachment 5, Section 11 has not been made a part of the Platte River Recovery Implementation Program (Program) by the Governance Committee. This attachment is provided for information only. Section 11 contains three types of informational material:

(1) U.S. Fish and Wildlife Service (FWS) Definitions and Recommendations Regarding Instream Flows and Opstudy Model

Appendix A was prepared by the FWS, not the Governance Committee. It documents the opinions and positions of FWS during the negotiations that led to the Program and it describes the FWS Instream Flow Recommendations referenced in the Program, which will be subject to adaptive management (See Section III.E of the Program Document). The Governance Committee members reserve the right to object to the FWS conclusions reflected herein.

Appendix B was also prepared by the FWS, not the Governance Committee. It describes the various uses of the Opstudy model by the FWS in evaluating Program water projects.

(2) Opstudy Assumptions Regarding Water Operations for Diversions at the Keystone Diversion Dam and Central District Supply Canal

Appendix C was developed by the Central Nebraska Public Power and Irrigation District (CNPPID) and Nebraska Public Power District (NPPD) (the Districts) and the Platte River EIS Team to provide reasonable assumptions for hydrologic modeling and analysis of diversions at the Keystone Diversion Dam and Central District Supply Canal for analysis in the EIS and Biological Opinion.

(3) Water Management Committee Subgroup Products

Appendices D, E, and F reflect the work of the July 1997 Cooperative Agreement Water Management Committee (WMC) subgroup and are intended to serve as initial guidelines for implementing Program activities when such activities are approved by the Governance Committee. The assessments and methods described therein are subject to review and revision by the Governance Committee throughout the First Increment as experience is gained during Program implementation.

List of Appendices

Group 1

Group 2

Group 3

1. Background

The purpose of this Section is to:

(1) Define the terminology used by the U.S. Fish and Wildlife Service (FWS) for its instream flow recommendations during implementation of the Platte River Recovery Implementation Program (Program) and future Section 7 consultations;
(2) Clarify how these flow recommendations have been (and will continue to be) used in the context of Program-related activities; and
(3) Provide historical context to the origin and use of these terms.

2. Definition of Terms

This document provides definitions for these six terms in the context of the Program:

- (FWS) Instream flow recommendations
- Species flows
- Annual pulse flows
- Peak flows
- Target flows
- Short-duration high flows

Figure 1 illustrates the relationship between these terms. The figure is followed by definitions.

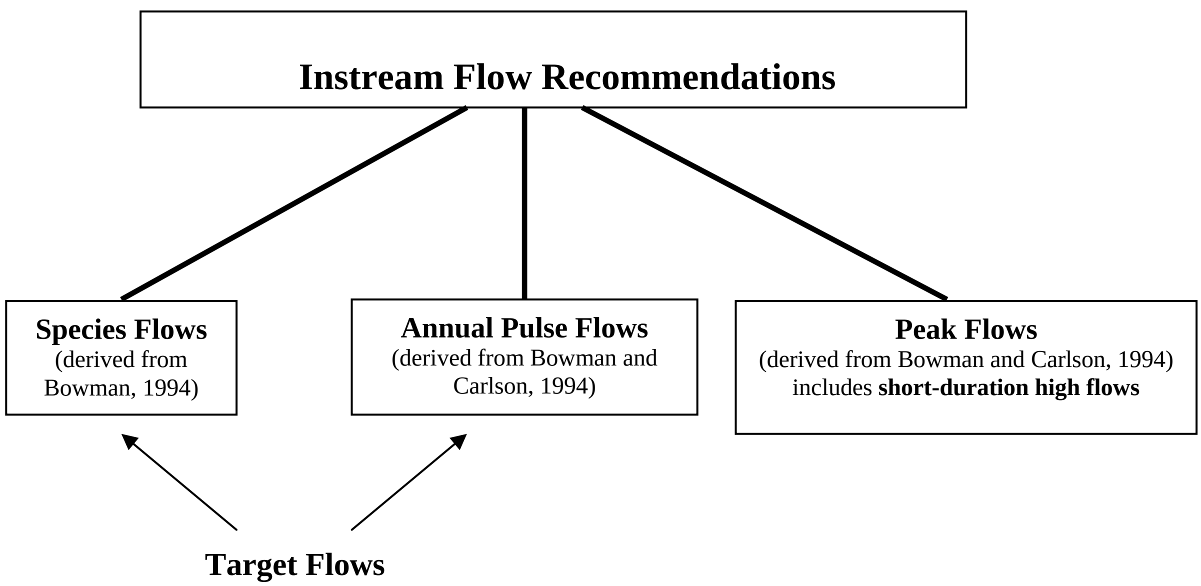


Figure 1. Schematic showing relationships between FWS-recommended flows

<u>Instream Flow Recommendations</u>

Defined as the entire suite of flow recommendations for the central Platte River articulated in two FWS documents: *Instream Flow Recommendations for the Central Platte River* (Bowman, May 23, 1994), and *Pulse Flow Requirements for the Central Platte River* (Bowman and Carlson, August 3, 1994). Collectively, these recommendations are intended to achieve the flow-dependent goal of "rehabilitating and maintaining the structure and function, patterns and processes, and habitat of the central Platte River Valley ecosystem". Subsets of these recommendations have since been categorized as "species flows", "annual pulse flows", and "peak flows" by FWS, as illustrated conceptually in **Figure 1**.

A strategy recommended by FWS, subject to adaptive management during the First Increment of the Program, includes the creation or augmentation of flows in the central Platte River to discourage seedling establishment in the active river channel and to promote sandbar creation/mobilization (Murphy et al., 2003). These are termed "short-duration high flows". FWS considers these to be encompassed under the peak flow recommendations.

Species Flows

Defined as all flow recommendations quantified in the document *Instream Flow Recommendations for the Central Platte River, Nebraska* (Bowman, 1994). These were established as recommended "wet year", "dry year" and "normal year" minimum flows for various periods of the year (for example, from February 1 through March 22) for the purpose of meeting the habitat needs of native biotic components of the ecosystem. They are presented in Table 1 of Bowman, 1994 (**Appendix A-1** to this document) and summarized as follows:

SPECIES FLOWS			
Period	**Wet year** [1]	**Normal year** [1]	**Dry year** [1]
Jan 1 – Jan 31	1000 cfs	1000 cfs	600 cfs
Feb 1 – Mar 22	1800	1800	1200
Mar 23 – May 10	2400	2400	1700
May 11 – Sep 15	1200	1200	800
Sep 16 – Sep 30	1000	1000	600
Oct 1 – Nov 15	2400	1800	1300
Nov 16 – Dec 31	1000	1000	600

1 "Wet years are defined as the wettest 33%, "dry" years as the driest 25%, and "normal" years all others. A method for declaring type-of-conditions in the central Platte in real time is provided in **Appendix D**.

Annual Pulse Flows

Defined as the recommended flows in excess of species flows which
- Occur in most (75%) or all years;
- Have a duration of 7 to 30 days;
- Are in the range of at least 2,000 to 3,600 cfs (varying with frequency-of-exceedance and time of year); and
- May be augmented or created by the Program.

Annual pulse flows are a subset of the flows quantified in Table 2 and Table 3 of Bowman and Carlson (1994; see **Appedices A-2 and A-3** to this document). They were identified as being important to maintaining the physical structure and other characteristics of the river for biological benefits. The annual pulse flows may be summarized as follows:

ANNUAL PULSE FLOWS		
Exceedance probability (recurrence interval)	**Recommended Flow In Cfs**	**Notes**
75% (3 of 4 years)	**3,100** to **3,600** (Feb-Mar) **3,000** (May-Jun) **3,400** (May-Jun)	• 30-day duration for Feb-Mar • 7- to 30-day duration for May-Jun • 10-year running mean of 30-consecutive-day exceedance
100% (all years)	**2,000** to **2,500** (Feb-Mar)	• 30-day duration for Feb-Mar

Annual pulse flows do not include the "peak flows" defined below, except in the sense that pulse flows may encompass the peak flow in years when the timing of the two coincide. In those years, Program-augmented annual pulse flows are likely to improve the peak flow 10-year running average, improving conditions relative to FWS running-average recommendations.

Peak Flows

In the context of the Program, "peak flows" refer to the highest flows maintained for five consecutive days in any given year. FWS peak flow recommendations were presented in Bowman and Carlson, 1994 (see **Appendices A-2 and A-3**). These are summarized as follows:

PEAK FLOWS		
Exceedance probability (recurrence interval)	**Recommended Flow In Cfs**	**Notes**
20% (1 in 5 years)	**16,000** (Feb-Jun)	• 5-day duration • At least 50% of these flows should occur between May 20 to June 20 • May-June preferred for habitat benefits • Feb-June OK for channel maintenance
40% (2 in 5 years)	**12,000** (Feb-Jun)	• 5-day duration
10-year running average of 5-consecutive-day exceedance	**8,300** to **10,800** (Feb-Jun)	

As described by Bowman and Carlson, the recommended peaks in excess of 12,000 cfs “will be natural occurrences beyond the control of water resources managers in the Platte River basin”. The Program will not create nor augment flows of this magnitude. However, the FWS recommends that efforts be made to protect the frequency and magnitude of these naturally-occurring peak flows as new water-related activities occur in the Platte River basin. Because the Program is likely to augment the annual peak flow in many lower-flow years, for example by augmenting short-duration high flows, it is anticipated that the Program will improve the 10-year running average peak flow relative to existing conditions.

Target Flows

Defined as the “species flow” plus the “annual pulse flow” recommendations, as described above. The Target flows are the flow levels that the Program actively seeks to establish through provision of Program water and re-timing of river flows. Target flows are used as the basis for “scoring” the water-related benefits of Program activities relative to the 130,000 - 150,000 acre-foot/year First-Increment goal for reductions in shortages to targets (see discussion in Section 3).[1]

Short-duration High Flows

In the context of the Program, these are defined as flows of approximately three to five days duration with magnitudes approaching but not exceeding bankfull channel capacity in the habitat reach. These flows are desired on an annual or near-annual basis to help scour vegetation encroaching on channel habitat areas and to mobilize sand and build ephemeral sandbars to benefit the target species.

The following applies to short-duration high flows:

- To the extent that Program water is used to create or augment these flows, they will be counted toward the Program score.
- Program water will not be used to achieve these flows when it may cause flows to rise above flood stage as defined by the National Weather Service.
- These are not included in target flows. That is, they will *not* be used as a basis for calculating shortages relative to the 130,000 to 150,000 acre-foot/year First Increment objective.
- To the extent that FWS uses Program water to produce such flows, such use shall not decrease the target flow shortage reduction credited to the Program’s initial three water projects or to any subsequently approved Program water project.
- Should the FWS EA Manager request that a Program water project avoid diverting or storing water for the sake of augmenting/protecting a short-duration high flow, that project will not be penalized for failing to achieve reductions in shortages to target flows that it otherwise would have achieved had no such request been made.

3. Application of Instream Flow Recommendations in the Context of the Proposed Program

[1] “Scoring” refers to quantifying (in thousands of acre-feet) the extent to which a water project results (or is anticipated to result) in reductions in stream flow shortages to target flows, as compared to the present condition. Scoring provides one tool for evaluating and comparing the potential benefits of water projects in the context of the Program, however it is not the only means of assessing potential benefits and adverse impacts.

The following table summarizes how FWS instream flow recommendations, as defined above, have been and will continue to be applied in the context of various Program-related activities:

	Instream flow recommendations used as basis for evaluation		
	Species	**Annual Pulse**	**Peak**
(1) FWS estimate of historic shortages to targets (417,000 af/year)	X	X	
(2) "Scoring" of the Program relative to the 130,000 - 150,000 af/year First Increment goal	X	X	
(3) Water Conservation/Supply Reconnaissance Study, Final Report and Reconnaissance-Level Water Action Plan: "scoring" of potential projects	X	X	
(4) FWS consideration/approval of any proposed Water Plan projects (new or substitutional) as an element of the Program	X	X	X
(5) Replacement obligations under state and federal depletions plans, for projects covered by the plans	X	X	Depends on commitments in Plans
(6) EIS and BO evaluation of the Program	X	X	X
(7) Future evaluations of Program benefits (for example, at the end of the First Increment)	X	X	X
(8) Operation of approved Water Plan projects relative to target flows	X	X	

The following discussion elaborates on this summary:

<u>(1) Calculation of historic shortages to target flows.</u>

In 1994, FWS estimated "Instream Flow Shortages" at Grand Island, Nebraska, by comparing 1943-1992 historic daily flows against the recommended daily instream flow over each of ten periods of the year (October 1 through November 15, etc.). The daily instream flows used for this comparison were the **species flows** and the **annual pulse flows** only (*i.e.*, the "Target flows"). Peak flows (as defined above) were not incorporated into the analysis, and thus do not factor into the estimated 417,000 af/year historic shortage (**Appendix A-4**).

<u>(2) "Scoring" the Proposed Program and alternatives relative to FWS instream flow recommendations.</u>

The impacts that various alternatives (including the Program) would have on flows in the central Platte River are "scored" for comparative purposes in the EIS on the basis of the extent to which they reduce shortages to **target flows**. This is consistent with the basis for calculation of historic shortages to targets (item #1).

Because scoring is typically calculated on a monthly shortage (not daily shortage) basis using the Opstudy model, "weighted monthly" Target flows (as total acre-feet/month) are used for scoring comparison purposes (**Appendix A-5**). The weighted-monthly technique follows an approach recommended by the Platte River Technical Group (Altenhofen, 1996). To fully recognize the benefits of all Program flows, flows that are greater than the weighted monthly average minimum targets and that are created or augmented by the Program are also counted as contributing to the score.

Appendix B describes in greater detail how FWS anticipates the Program score will be calculated, using OpStudy and/or other tools.

This is not intended to imply that evaluations of the Program will not also include the evaluation of impacts to **peak flows**. Because peak flows are identified as an essential component of the suite of recommended flows established in the 1994 FWS documents, impacts on peak flows must be evaluated, along with impacts relative to other flow recommendations, as the FWS believes peak flows are critical to the maintenance of river-associated habitat for the target species (see item 7).

<u>(3) Water Conservation/Supply Reconnaissance Study, Final Report (Boyle Report)</u>.

The Water Conservation/Supply Reconnaissance Study, Final Report, undertaken by Boyle Engineering Corporation (1999), pursuant to the Cooperative Agreement (1997), evaluated alternatives on the basis of their ability to "reduce target flow shortages". For their analysis, Boyle used what they term "FWS (July 1997) weighted-average monthly species instream flow recommendations" (Table 2.1 of their report). The target flows they used for their analysis were the same weighted-averages of **species flows and annual pulse flows** that are used to "score" Program alternatives (item #2). See Appendix A-5.

<u>(4) FWS Consideration/Approval of any Proposed Water Plan Projects (New or Substitutional) as an element of the Program.</u>

While the water-related benefits provided by the operation of any Program water conservation/supply project will be measured on the basis of reductions in shortages to species flows and annual pulse flows, the *evaluation* of any new or substitutional proposed project for inclusion in the Program must also include an evaluation of impacts to **peak flows** before being approved by the FWS. Presumably, the project will be approved only if its positive effects relative to meeting Target flows (species + annual pulse flows) outweigh any negative effects relative to maintaining peak flows. Projects that are included in the Water Plan at the time the Program is adopted will not be subject to further evaluation for impacts on peak flows, provided that the scope, location, and scale of the finalized project is consistent with its reconnaissance level description in the Water Plan.

(5) Replacement Obligations under State and Federal Depletions Plans, for Projects Covered by Plan

Because many flow re-regulation activities of benefit to target species in the central Platte River may have some negative effect on the frequency and/or magnitude of peak flows, FWS has agreed that water replacement obligations for projects covered by a corresponding state or federal depletions plan will be determined on the basis of the extent to which they create or increase shortages to **species flows and annual pulse flows** only, on average, relative to pre-1997 conditions. There are no replacement obligations relative to peak flows for projects covered by depletions plans, beyond those described within the corresponding plan and within the Program Document, Section E.

(6) EIS and Biological Opinion (BO) evaluations of the Program.

The environmental impacts of the Program are analyzed in an Environmental Impact Statement (EIS), and compliance of the Program with the requirements of the Endangered Species Act is evaluated separately in a Biological Opinion (BO).

EIS evaluations consider the effects of the Program (and other alternatives) on **all flows** in the central Platte River. For comparative "scoring" purposes, the EIS evaluation also estimates reductions in shortages to **target flows** (species flows and annual pulse flows) associated with each of the water alternatives.

Similarly, the BO considers the effects of the Program on **all flows**. This includes consideration of the Program's effects relative to the FWS's **species flows, annual pulse flows, and peak flow** recommendations, as the FWS considers *all* of these flow recommendations important to the structure and function, patterns and processes, and habitat of the central Platte River ecosystem.

(7) Future evaluations of Program benefits.

As noted above, only Target flows **(species flows and annual pulse flows)** have been used as the basis for:

- Calculating "historic shortages to target flows";
- Establishing replacement obligations for projects covered by state and federal future depletions plans;
- Reconnaissance-level evaluations of potential Program flow augmentation projects (Boyle's "Water Conservation/Supply Reconnaissance Study, Final Report"; and
- "Scoring" the Program and alternatives relative to FWS goals.

Nevertheless, **peak flow** recommendations are identified as an essential component of the suite of flow recommendations established by FWS for the central Platte River because of their importance for the maintenance of river-associated habitat. Thus they also will be evaluated in terms of Program benefits for the target species. It remains an objective of the FWS to (1) minimize reductions in the frequency and magnitude of the highest peak flows and (2) improve the long-term running average annual peak flow magnitudes in the central Platte River, because the FWS considers peak flows an essential factor in conserving the ecosystems upon which the listed species and other species depend. Future evaluations of the Program will require a balanced assessment of the positive effects on species and annual pulse flows versus the negative effects on peak flows.

(8) Operation of approved Water Plan projects relative to target flows.

Implementation of many water conservation and reregulation projects under the Program requires that they operate, to the extent practicable, with respect to target flows. The applicable target flows may be expressed in terms of **weighted-monthly averages, fixed daily values** or **flexible daily values**, depending upon the Program element. For any approved Program Water Plan project, the applicable Target flows will be decided upon as part of the project approval process. To apply these target flows, it will be necessary to determine whether the operations (past or projected) occur under "wet", "normal", or "dry" flow conditions.

Criteria that will be used to determine in real-time whether "wet", "normal", or "dry" hydrologic conditions exist are described in **Appendix D**.

For Program water activities operating against **weighted-monthly averages**, the monthly target flows will be quantified as shown in the final column of the tables in **Appendix A-5** for the corresponding "wet", "average", and "dry" conditions. As already discussed, these weighted-monthly averages are derived from the FWS's recommendations for species flows and annual pulse flows.

For Program water activities operating against **fixed daily values**, the daily target flows will be determined as shown in **Appendix E**. These values are based on FWS recommendations for both species flow targets and annual pulse flow targets. These values reflect the daily values used to calculate the weighted-monthly averages as shown in Appendix A-5.

For Program water activities operating against **flexible daily values**, the daily target flows in May and June will be determined as shown in **Appendix F**, or by some similar method agreed upon by the Governance Committee. These values also are based on FWS recommendations for both species flows and annual pulse flows. The methodology shown in Appendix F is intended to address the full suite of annual pulse flow timing, magnitude, and duration recommendations of FWS, while taking into account antecedent flows.

A Brief History of Instream Flow Recommendations Terminology and Usage

Early 1994 FWS identifies the need for a workshop to develop instream flow recommendations for the central Platte River. This resulted from the need to provide flow recommendations to the Federal Energy Regulatory Commission (FERC), and from comments received from representatives of the three Platte River basin states during discussions about establishing a cooperative Platte River Recovery Implementation Program.

May 23, 1994 *Instream Flow Recommendations for the Central Platte River* is prepared by David Bowman, FWS, presenting the results of a workshop held March 8-10, 1994, at the National Ecology Research Center of the National Biological Survey in Fort Collins, Colorado. The purposes of this workshop included (1) "to formulate the instream flow targets the Service will use in fulfilling its legislated responsibilities in the central Platte River Valley ecosystem", and (2) "to prioritize these instream flow targets by season and by normal, wet, and dry years". This document includes Table 1 quantifying instream flow recommendations ("targets") for average, wet, and dry years for the central Platte River, excluding pulse flows.

June 10, 1994 Memoradum of Agreement for the Central Platte River Basin Endangered Species Recovery Implementation Program is entered into by the Department of the Interior and the States of Colorado, Nebraska, and Wyoming, "to initiate the development of a mutually acceptable Program that would help conserve and recover federally listed species associated with the Platte River Basin in Nebraska upstream of the confluence with the Loup River; help protect designated critical habitat for such species; and help prevent the need to list more basin associated species pursuant to the Endangered Species Act."

August 3, 1994 *Pulse Flow Requirements for the Central Platte River* is prepared by David Bowman and Dave Carlson, FWS, presenting the results of a workshop held May 16-20, 1994, at the Midcontinent Ecological Science Center of the National Biological Survey in Fort Collins, Colorado. The purpose of the workshop was to "determine the pulse, or peak, flows needed to achieve the Service's flow-dependent goal for the central Platte River Valley ecosystem." "Pulse flow recommendations" are presented in Tables 2 and 3 of this document. These include both high flow events (above 12,000 cfs and 16,000 cfs) that last about five days and aren't expected to occur in the average year ("peak flows" as defined here); more moderate flows of 2,000 to 3,600 cfs lasting a week to a month and recommended in February/March or May/June most years ("annual pulse flows" as defined here); and 10-year running mean recommendations for five-consecutive day exceedance (8,300 to 10,800 cfs) and 30-consecutive-day exceedance (3,400 cfs).

October 1994 FWS estimates an average of 417,000 af/year of historic instream flow shortages relative to the FWS instream flow recommendations (document dated October 17, 1994). This estimate was based on an analysis of daily flows at Grand Island from 1943 to 1992 relative to recommended **species flows and annual pulse flows**.

March 1996 Jon Altenhofen (Northern Colorado Water Conservancy District) proposes a method for "more specifically quantifying the duration, magnitude, and frequency" of the FWS instream flow recommendations for the May-June period (memo to the Platte River Technical Group, March 4, 1996). These flow values were adopted by FWS to "score" the Program and alternatives in the EIS in terms of their ability to reduce shortages to **target flows** on a monthly weighted-average basis (Appendix A-5). These are used in subsequent proposed project evaluations and consultations, including the Kingsley Dam Biological Opinion (1997).

July 1997 Platte River Cooperative Agreement is signed by the three state governors and the Secretary of the Interior. A specific objective articulated in the Cooperative Agreement is to improve "the occurrence of Platte River flows in the associated habitats relative to the present occurrence of target flows (hereinafter referred to as 'reducing shortages to the target flows') by an average of 130,000 to 150,000 acre-feet per year". The term "target flows" is footnoted with a reference to the May 23, 1994 and August 3, 1994 FWS documents.

December 1999 Boyle Engineering Corporation delivers their *Water Conservation/Supply Reconnaissance Study, Final Report* to the Water Management Committee. In determining the hydrological effects of a specific project, Boyle assumed that diversion to recharge or storage are made "only during periods of target flow excesses at the critical habitat" and that releases for the benefit of the critical habitat are "only made during periods of target flow shortages". The "target flows" used by Boyle for this assessment were the same monthly weighted-average **species flow and annual pulse flow** recommendations used by the FWS and the Program since 1996.

January 2001 The U.S. Bureau of Reclamation (Murphy and Randle) release a report ("*Platte River Channel: History and Restoration*") that describes anticipated continued erosion of medium-sized sand and channel narrowing downstream toward Grand Island, Nebraska over the next several decades without changes in management of the river, and recommends **short-duration high flows** as one component of a strategy to "restore a small but significant portion" of the historic Platte River channel.

April 2001 FWS provides a table to the Water Management Committee summarizing all FWS instream flow recommendations, and introducing the conceptual categories of "**species flows**", "**annual pulse flows**", and "**peak flows**" as defined in this document.

February 2005 The National Research Council of the National Academies publishes their report *Endangered and Threatened Species of the Platte River* (2005). Among the questions reviewed by the NRC was: "*Were the processes and methodologies used by the USFWS in developing its central Platte River Instream Flow Recommendations (i.e., species, annual pulse flows, and peak flows) scientifically valid?*"

The NRC report included these conclusions:

- "The proposed instream flows that resulted from the DOI agencies' analysis and that are summarized in Table 4-3, 4-4, and 4-5 appear to the committee to be in the correct magnitude and timing to achieve the desired results of using river processes to foster habitat for the threatened and endangered species". (p 142)

- "USFWS has developed instream-flow recommendations through literature reviews, field observations, data collection and analysis, numerical modeling, workshops, and other approaches. Those processes and methods are scientifically valid, and the techniques applied in the Platte River continue to be used for many other rivers. DOI-recommended flow values appear reasonable, but their effects on this river system require further analysis based on empirical data collection and field observations …" (p. 151)

- "Although the Instream Flow Incremental Methodology (IFIM) and Physical Habitat Simulation System (PHABSIM) were the best available science when DOI agencies reached their recommendations regarding instream flows, there are newer developments and approaches, and they should be internalized in DOI's decision processes for determining instream flows. The new approaches, centered on the river as an ecosystem rather than focused on individual species, are embodied in the concepts of the normative flow regime. Continued credibility of DOI instream flow recommendations will depend on including the new approach." (p. 11)

References

Altenhofen, J. 1996. “Proposed specifics for May/June instream flow targets”. Memo to the Platte River Cooperative Agreement Technical Group. March 4, 1996. 2 pp. plus attached table.

Bowman, D., 1994. “Instream flow recommendations for the Central Platte River, Nebraska”. U.S. Fish and Wildlife Service, May 23, 1994. 9 pp.

Bowman, D. and D. Carlson, 1994. “Pulse flow requirements for the Central Platte River”. U.S. Fish and Wildlife Service, August 3, 1994. 11 pp.

Boyle Engineering Corporation (Boyle), 1999. Water Conservation/Supply Reconnaissance Study, Final Report. Prepared for the Governance Committee of the Cooperative Agreement for Platte River Research, December 1999. 12 chapters plus appendices.

Cooperative Agreement for Platte River Research and Other Efforts Relating to Endangered Species Habitats along the Central Platte River, Nebraska. July 1997. 14 pp. plus attachments.

Murphy, P.J., T.J. Randle, L.M. Fotherby, and J.A. Daraio, 2003. "Platte River Channel: History and Restoration," U.S. Department of the Interior, Bureau of Reclamation, Technical Service Center, Sedimentation and River Hydraulics Group, Denver, Colorado.

National Research Council of the National Academies, 2005. Endangered and Threatened Species of the Platte River. The National Academies Press, Washington, D.C. 299 pp.

U.S. Fish and Wildlife Service (USFWS), 1994. Untitled document quantifying instream flow shortages relative to the Service’s 1994 instream flow recommendations, including pulse flows. October 17, 1994. 6 pp. plus attachments.

Appendix A

FWS Mountain-Prairie Region Instream Flow Recommendations and Proposed Usage for the Platte River Recovery Implementation Program

APPENDIX A-1

(From Bowman, 1994)

Table 1. Instream flow targets by seasonal priorities (ranking) for normal (average), wet, and dry years for the central Platte River, Nebraska. Normal (average) year flows will be equaled or exceeded 3 out of 4 years. Normal and wet year target flows will be met 3 out of 4 years, and in the driest 25 percent of the years, the dry year targets will be met.

Season	Normal year Ranking & Flow (cfs)	Wet year Ranking & Flow (cfs)	Dry year Ranking & Flow (cfs)
May and June*	*	#1 *	*
Feb. and March*	*	#2 *	*
May 11-Sept. 15	**#1 @ 1,200**	**#3 @ 1,200**	**#1 @ 800**
March 23-May 10	#2 @ 2,400	#4 @ 2,400	#2 @ 1,700[1]
Feb. 1-March 22	#3 @ 1,800	#5 @ 1,800	#3 @ 1,200[2]
Sept. 16-30	#4 @ 1,000	#6 @ 1,000	#6(tie) @ 600
Oct. 1-Nov. 15	#5 @ 1,800	#7 @ 2,400	#6(tie) @ 1,300[3]
Nov. 16-Dec. 31	#6 @ 1,000	#8 @ 1,000	#5 @ 600
Jan. 1-31	#7 @ 1,000	#9 @ 1,000	#4 @ 600

* These specific flow recommendations were not provided in this 1994 document. They were developed in a subsequent workshop as described in Bowman and Carlson, 1994 (see Appendices A-2 and A-3).

[1] Includes 650 cfs for fish community.
[2] Includes 650 cfs for fish community.
[3] Includes 600 cfs for fish community.

APPENDIX A-2

(From Bowman and Carlson, 1994)

Table 2. Peak and annual pulse flow recommendations for the central Platte River Valley ecosystem during May and June.[1]

Flow	Period	(cfs)	Duration (days)	Frequency (yrs) Exceedence (%)
very wet	May 1 - June 30*	$\geq$ 16,000	5**	1 in 5 (20%)
wet	May 1 - June 30*	$\geq$ 12,000	5**	1 in 2.5 (40%)
normal	May 20 - June 20	$\geq$ 3,000	7-30***	3 in 4 (75%)
dry	May 11 - June 30	none****		all remaining (100%)

* At least 50% of these peak flows should occur during May 20 to June 20, with May 1 to June 30 as the timeframe for broadest benefit for channel maintenance, and instream and wet meadow habitats. Occurrence between February 1 and June 30 would accomplish the necessary effects for channel maintenance. The 10-year running average for the mean annual peak flow targets should range from approximately 8,300 cfs to 10,800 cfs.

** The duration of these peak flows should emulate the historic, natural pattern: (a) ascended over approximately 10 days, (b) cresting for approximately 5 days, and (c) descending over approximately 12 days.

*** The target is for a 10-year running average for the 30-day exceedence flow (i.e., 10-year running average of the annual level exceeded for 30 consecutive days) of at least 3,400 cfs. A flow of 3,000 cfs should be exceeded for 7-30 days in at least 75% of years. Annual pulse flows should be followed by descending flows approximating a rate of 800 cfs/day.

**** No annual pulse flows during May and June in driest years; target flows identified in the March 1994 workshop (Bowman 1994), apply under dry year conditions.

[1] The original Bowman and Carlson document collectively referred to these as “pulse” flows. Here the language has been changed to “peak” and “annual pulse” flows to maintain consistency with the terminology since developed in the context of the Platte River Recovery Implementation Program.

APPENDIX A-3

(From Bowman and Carlson, 1994)

Table 3. Peak and annual pulse flow recommendations for the central Platte River Valley ecosystem during February and March.[1]

Flow	Period	(cfs)	Duration (days)	Recurrence(yrs) Exceedence (%)
very wet	Feb 1 - March 31	$\geq$ 16,000*	5**	1 in 5 (20%)
wet	Feb 15 - March 15	$\geq$ 12,000*	5**	1 in 2.5 (40%)
normal	Feb 15 - March 15	3,100-3,600	30	3 in 4 (75%)
dry	Feb 15 - March 15	2,000-2,500	30	all remaining (100%)

* At least 50% of these peak flows should occur during May 20 to June 20, with May 1 to June 30 as the time frame for broadest benefit for channel maintenance, and instream and wet meadow habitats. Occurrence between February 1 and June 30 would accomplish the necessary effects for channel maintenance. The 10-year running average for the mean annual pulse flow targets should range from approximately 8,300 cfs to 10,800 cfs.

** The duration of these peak flows should emulate the historic, natural pattern: (a) ascended over approximately 10 days, (b) cresting for approximately 5 days, and (c) descending over approximately 12 days.

[1] The original Bowman and Carlson document collectively referred to these as "pulse" flows. Here the language has been changed to "peak" and "annual pulse" flows to maintain consistency with the terminology since developed in the context of the Platte River Recovery Implementation Program.

APPENDIX A-4

INSTREAM FLOW SHORTAGES AT GRAND ISLAND, NE 10/11/94

(Thousands of Acre-Feet, Sorted from highest to lowest)

Water Years 1943-1992

Wet and Average Years

Period	10/1 - 11/15	11/16 - 1/31	2/1 - 2/14	2/15 - 3/15	3/16 - 3/22	3/23 - 5/10	5/11 - 5/19	5/20 - 6/20	6/21 -9/15	9/16 - 9/30	Total
AVG IFR, CFS	**1,800**	**1,000**	**1,800**	**3,350**	**1,800**	**2,400**	**1,200**	**3,000**	**1,200**	**1,000**	**Annual**
Total KAF	**164.2**	**152.7**	**50.0**	**192.7**	**25.0**	**233.3**	**21.4**	**190.4**	**207.1**	**29.8**	**1266.5**
1978	80.6	27.7	23.8	103.8	0.0	71.5	4.4	159.6	187.5	16.7	675.6
1976	91.0	3.8	9.5	92.0	0.2	75.0	7.5	149.5	191.1	11.5	631.1
1943	119.4	25.2	0.4	98.6	18.2	56.7	0.9	97.7	172.3	29.2	618.6
1944	129.5	23.5	19.2	84.1	5.8	42.9	0.0	100.6	180.5	25.9	612.1
1948	87.2	9.8	20.4	72.8	0.0	67.7	8.4	175.2	139.0	22.6	603.0
1968	48.8	12.7	9.8	97.3	7.5	126.8	5.3	154.1	129.9	5.9	598.0
1965	101.3	33.1	18.4	115.5	7.1	129.5	13.5	84.3	86.0	0.4	589.1
1982	88.4	5.2	8.9	73.8	0.0	125.3	7.4	132.9	139.7	3.9	585.6
1967	75.9	18.7	8.1	119.8	11.3	174.2	12.5	75.1	81.4	2.8	579.8
1989	78.2	3.1	12.7	70.7	0.5	154.4	15.2	169.9	73.4	1.1	579.2
1979	108.2	27.2	28.6	87.9	0.0	56.6	1.4	144.1	95.6	18.5	568.1
1960	75.4	20.4	1.7	118.2	1.9	44.0	0.3	111.9	159.0	29.8	562.5
1975	82.9	15.8	18.5	102.1	0.1	87.4	5.2	131.0	112.2	0.9	556.1
1945	94.4	12.3	12.7	84.3	9.6	132.4	3.2	63.9	127.3	13.0	553.0
1977	94.9	22.6	16.0	116.9	1.2	46.0	0.6	95.0	140.9	8.6	542.6
1990	81.9	22.6	7.1	84.9	1.2	36.2	0.7	125.2	153.3	19.3	532.4
1966	0.0	1.9	4.5	59.4	0.0	42.7	11.8	169.6	181.1	17.5	488.6
1950	43.7	16.5	6.0	78.2	1.9	64.3	0.2	114.7	128.2	12.8	466.4
1962	54.3	15.5	0.1	98.6	0.0	102.5	16.6	69.0	93.2	10.7	460.4
1969	53.7	14.9	8.8	72.3	0.0	83.1	4.9	127.4	83.8	1.9	450.8
1947	34.0	14.7	20.2	88.4	0.0	83.9	6.0	114.7	78.2	10.7	450.7
1958	78.8	6.2	20.4	96.5	2.1	27.5	0.0	36.0	136.5	27.2	431.2
1949	100.0	18.2	22.2	44.2	1.0	19.3	0.0	43.0	95.9	7.8	351.6
1972	19.5	2.3	0.7	14.5	0.0	42.6	0.0	112.5	127.5	11.1	330.8
1970	24.6	1.3	0.0	52.7	0.0	11.8	0.0	114.6	124.1	0.2	329.3
1974	0.0	0.0	0.0	0.0	0.0	0.0	0.0	109.2	173.0	14.0	296.2
1988	13.5	0.9	0.0	19.4	0.0	36.1	0.0	120.8	104.7	0.0	295.3
1951	46.2	13.7	15.4	63.1	0.3	66.7	3.5	45.6	35.2	0.0	289.7
1980	120.4	6.8	2.2	9.1	0.0	0.3	0.0	0.0	131.2	9.8	279.9
1952	13.8	1.4	0.0	20.3	0.0	8.6	0.0	74.7	131.4	26.0	276.3
1971	27.9	3.8	2.1	46.2	0.0	18.8	0.0	0.0	100.6	7.4	206.8
1985	0.0	0.0	0.0	3.2	0.0	20.7	0.0	86.6	80.6	0.0	191.1
1986	8.7	2.0	5.1	25.2	0.0	0.1	0.0	67.7	8.8	0.0	117.6
1987	0.0	0.0	0.0	57.0	0.0	0.2	0.0	1.5	47.5	0.0	106.2
1983	71.5	0.0	0.0	17.1	0.0	0.1	0.0	0.0	0.0	0.0	88.7
1984	26.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.6	0.0	83.5
1973	13.9	0.6	0.0	12.0	0.0	0.0	0.0	0.0	26.2	0.0	52.6
Mean Shortag	**59.2**	**10.9**	**8.7**	**64.9**	**1.9**	**55.6**	**3.5**	**91.3**	**111.2**	**9.9**	**417.0**

Wet and Average years measured against Average Instream Flow Recommendation

Dry Years

Period	10/1 - 11/15	11/16 - 1/31	2/1 - 2/14	2/15 - 3/15	3/16 - 3/22	3/23 - 5/10	5/11 - 9/15	9/16 - 9/30	Total
Dry IFR, CFS	**1,300**	**600**	**1,200**	**2,250**	**1,200**	**1,700**	**800**	**600**	**Annual**
Total KAF	**118.6**	**91.6**	**33.3**	**129.4**	**16.7**	**165.2**	**203.1**	**17.9**	**775.8**
1956	99.6	17.3	10.7	65.9	1.3	98.2	199.2	17.9	510.1
1957	117.5	55.9	14.3	91.1	6.4	74.9	100.5	2.2	462.9
1955	79.2	4.0	7.0	42.2	3.2	92.9	167.8	17.9	414.1
1954	86.7	4.0	0.0	37.6	0.9	67.1	151.6	17.9	365.8
1961	68.1	5.5	2.5	61.0	0.0	71.4	113.0	10.4	331.8
1991	64.2	6.9	1.1	48.2	0.6	82.8	113.4	6.9	324.3
1964	47.2	3.1	3.2	65.0	0.3	41.7	150.1	8.4	319.0
1981	66.7	0.4	19.0	33.4	1.5	86.1	86.3	3.8	297.3
1959	65.8	13.9	4.7	24.5	0.0	1.8	150.6	11.5	272.7
1946	23.4	5.7	1.5	38.0	0.0	86.1	117.1	0.1	271.9
1953	44.0	0.6	0.0	33.1	0.0	31.8	141.6	17.9	269.0
1992	74.6	0.2	0.0	29.8	0.0	51.6	85.1	13.8	255.1
1963	14.7	0.7	0.0	16.7	0.0	43.8	159.3	1.2	236.4
Mean Shortag	**65.5**	**9.1**	**4.9**	**45.1**	**1.1**	**63.9**	**133.5**	**10.0**	**333.1**

Years were classified as being wet, average, or dry based on annual volume at the Grand Island gage for water years 1943-1992 (33% Wet, 42% Average, and 25% Dry).
Each daily flow was compared against the daily flow target, and the sum of calculated shortages is shown for each time period.
The only difference between wet and average year Instream Flow Recommendations is the 10/1-11/15 time period. For simplicity, the Wet and Average years are compared against the Average Instream Flow Recommendation.

APPENDIX A-5 (PAGE 1)

"Wet" Instream Flow Recommendation Hydrograph

Month	Begin	End	cfs	# Days	Kaf	Total Kaf	Average cfs
Jan	1	31	1,000	31	61.5		
Jan						61.5	1,000
Feb	1	14	1,800	14	50.0		
Feb	15	28	3,350	14	93.0	143.0	2,575
Mar	1	15	3,350	15	99.7		
Mar	16	22	1,800	7	25.0		
Mar	23	31	2,400	9	42.8	167.5	2,724
Apr	1	30	2,400	30	142.8		
Apr						142.8	2,400
May	1	10	2,400	10	47.6		
May	11	19	1,200	9	21.4		
May	20	26	4,900	7	68.0		
May	27	31	3,400	5	33.7	170.8	2,777
Jun	1	20	3,400	20	134.9		
Jun	21	30	1,200	10	23.8	158.7	2,667
Jul	1	31	1,200	31	73.8		
Jul						73.8	1,200
Aug	1	31	1,200	31	73.8		
Aug						73.8	1,200
Sep	1	15	1,200	15	35.7		
Sep	16	30	1,000	15	29.8	65.5	1,100
Oct	1	31	2,400	31	147.6		
Oct						147.6	2,400
Nov	1	15	2,400	15	71.4		
Nov	16	30	1,000	15	29.8	101.2	1,700
Dec	1	31	1,000	31	61.5		
Dec						61.5	1,000
Total Kaf						**1,367.5**	

"Average" Instream Flow Recommendation Hydrograph

Month	Begin	End	cfs	# Days	Kaf	Total Kaf	Average cfs
Jan	1	31	1,000	31	61.5		
Jan						61.5	1,000
Feb	1	14	1,800	14	50.0		
Feb	15	28	3,350	14	93.0	143.0	2,575
Mar	1	15	3,350	15	99.7		
Mar	16	22	1,800	7	25.0		
Mar	23	31	2,400	9	42.8	167.5	2,724
Apr	1	30	2,400	30	142.8		
Apr						142.8	2,400
May	1	10	2,400	10	47.6		
May	11	19	1,200	9	21.4		
May	20	31	3,400	12	80.9	150.0	2,439
Jun	1	20	3,400	20	134.9		
Jun	21	30	1,200	10	23.8	158.7	2,667
Jul	1	31	1,200	31	73.8		
Jul						73.8	1,200
Aug	1	31	1,200	31	73.8		
Aug						73.8	1,200
Sep	1	15	1,200	15	35.7		
Sep	16	30	1,000	15	29.8	65.5	1,100
Oct	1	31	1,800	31	110.7		
Oct						110.7	1,800
Nov	1	15	1,800	15	53.6		
Nov	16	30	1,000	15	29.8	83.3	1,400
Dec	1	31	1,000	31	61.5		
Dec						61.5	1,000
Total Kaf						**1,291.9**	

APPENDIX A-5 (PAGE 2)

"Dry" Instream Flow Recommendation Hydrograph

Month	Begin	End	cfs	# Days	Kaf	Total Kaf	Average cfs
Jan	1	31	600	31	36.9		
Jan						36.9	600
Feb	1	14	1,200	14	33.3		
Feb	15	28	2,250	14	62.5	95.8	1,725
Mar	1	15	2,250	15	66.9		
Mar	16	22	1,200	7	16.7		
Mar	23	31	1,700	9	30.3	114.0	1,853
Apr	1	30	1,700	30	101.2		
Apr						101.2	1,700
May	1	10	1,700	10	33.7		
May	11	31	800	21	33.3	67.0	1,090
Jun	1	30	800	30	47.6		
Jun						47.6	800
Jul	1	31	800	31	49.2		
Jul						49.2	800
Aug	1	31	800	31	49.2		
Aug						49.2	800
Sep	1	15	800	15	23.8		
Sep	16	30	600	15	17.9	41.7	700
Oct	1	31	1,300	31	79.9		
Oct						79.9	1,300
Nov	1	15	1,300	15	38.7		
Nov	16	30	600	15	17.9	56.5	950
Dec	1	31	600	31	36.9		
Dec						36.9	600
Total Kaf						**775.8**	

APPENDIX B

8-10-2005

FWS' Use of the Central Platte Opstudy Model in Computing Reductions in Shortages to Target Flows

1. Purpose

This document describes the Central Platte River OPSTUDY Model and its use by FWS in evaluating Program water projects during:

1.1) NEPA and ESA evaluations of planned First Increment Program Water Plan projects and the calculated reductions in shortage to target flows prior to Program implementation,
1.2) Evaluations during the First Increment of substituted, altered, or new Program Water Plan projects to assess the credit towards the Program's First Increment objective of 130,000 to 150,000 af/yr of average shortage reduction to target flows,
1.3) Annual review of Program water project operations relative to project descriptions and operating plans during the first Program increment, and
1.4) Evaluation of completed Program Water Plan projects near the end of the First Increment and calculating the reductions in shortage to target flows achieved during the First Increment.

ESA compliance is discussed in the Milestones Document, and steps 1.1-1.3 above are applicable to using Opstudy for purposes of measuring whether First Increment objectives are being attained. Step1.4 is not ESA compliance, but a NEPA/ESA activity for a second Program increment.

2. Central Platte River OPSTUDY Model

The Central Platte River OPSTUDY Model (CPR Model) was developed by the U.S. Bureau of Reclamation (BOR) and the U.S. Fish and Wildlife Service (FWS) as a tool for evaluating management alternatives affecting flows in the central Platte River in Nebraska. The model provides an accounting of water in the river system beginning around Lewellen, Nebraska (on the North Platte River) and at Julesburg, Colorado (on the South Platte River), continuing downstream to Duncan, Nebraska. The modeled region includes the entire "Big Bend" reach of the Platte River and also estimates flow changes at Louisville, Nebraska. Other models used for the South Platte River and North Platte River systems upstream of the CPR Model are described in BOR, 1997 and Hydrosphere, 2001. Program water provided by projects located upstream of the CPR Model is supplied as one of the input items to the CPR Model.

The CPR Model is a water accounting model for tracking gains, losses, diversions from and accretions to the central Platte River system. The model allows assessment of a wide variety of water management scenarios on a monthly time step and simulates river conditions based on inflows to, outflows from, and demands on the river system. For example, various strategies for the storage and release of water by reservoirs, recharge to and return flow from alluvial aquifers, and the use, conservation, and routing of irrigation waters diverted from the Platte River system may be assessed. The CPR Model allows alternatives to be compared in terms of estimated river flows, power generation, irrigation diversions, reservoir storage and release, return flows, losses associated with evaporation and seepage, and other measures. Model comparisons are made by simulating the effects of the proposed alternative(s) on stream flows and diversions in the central Platte River system assuming that the climatic conditions occurring in 1947 through 1994 are replicated for the modeled scenario.

The CPR model, in its current form, is *not* designed to:

- Forecast flows or river operations for any specific period in the future; nor
- Function as a detailed water rights model.

2.1 Calibration and Validation of the CPR Model

Calibration and validation of the CPR Model was performed by comparing monthly time-step model output to a recent historical period of record. The time period of 1975 through 1994 was chosen because few major water resource development activities nor significant changes in management procedures occurred in the Platte River basin upstream of Grand Island, Nebraska, during this time. This twenty-year period was further broken down into a 1985-1994 calibration period and a 1975-1984 validation period. A detailed discussion of the calibration/validation assumptions, procedures, and results are provided in a report generated by the Platte River EIS Office (2002a).

2.2 Present Conditions

A "Present Condition" or "Reference Condition" modeling scenario was defined for purposes of comparing the results of various model runs against a standardized baseline. The Present Condition scenario is intended to reflect present-day (pre-Program) operating criteria and demands on the central Platte River system, applied as if those same demands and projects had existed throughout the 1947-1994 modeling period. For example, the Present Condition scenario assumes that the NPPD and CNPPID facilities on the river system are operated during the 1947 - 1994 model period in a similar manner as practiced prior to the 1998 FERC relicensing (PREISO, 2003).

Ideally, July 1, 1997 is considered the "baseline date" for Present Conditions. However, because many river system facilities and operations are implemented gradually over a long period of time, it may be more realistic to think of the "baseline date" as being the general time frame of the mid- to late-1990s, and prior to establishment of the Environmental Account and the 1998 FERC license conditions for projects 1417 and 1835 (CNPPID and NPPD, respectively).

2.3 Program Water Operations

The Program, and other EIS alternatives, are included in the CPR Model based primarily on project descriptions provided in Program documents and by project proponents during the NEPA and ESA reviews. A description of Program Water Plan projects operations and Environmental Account releases is found in the Program Document, and in particular the Water Plan (Program Attachment 5). Examples of project description materials include Tamarack I descriptions and spreadsheets (Program Attachment 5, Section 3), discretional power release descriptions from CNPPID/NPPD (Program Attachment 5, Section 11 Appendix C), and Wyoming's description of Pathfinder Modification Project (Program Attachment 5, Section 4).

2.4 CPR Model Documentation

Documentation of the Central Platte OPSTUDY Model may be found in <u>Central Platte River OPSTUDY8 Model, Technical Documentation and Users Guide, Platte River EIS Office, Working Document: latest draft dated February 6, 2002.</u>

3. Calculating Reductions in Shortage to Target Flows

For Program purposes, various river management alternatives are evaluated and compared, in part, by determining the extent to which they contribute toward reductions in shortages to target flows in the central Platte River. The same application of the CPR Model is used for calculating shortage reductions in both future projections (modeling proposed/anticipated activities) and for past activities (evaluating projects implemented). Because the CPR Model is a monthly hydrologic model, any daily flow targets used must be expressed on a monthly basis. Appendix A-5 of Program Attachment 5, Section 11 shows the wet, average, and dry target flows expressed on a weighted monthly basis for purposes of calculating reductions in shortage to target flows using the CPR Model.

Analysis of reductions in shortage to target flows uses monthly modeled water project operations over a long term period of record (such as 1947 - 1994) and compares the resulting frequency of target flows relative to the "Present Condition" model run. The basic steps include:

> 3.1) CPR Model flow values at Grand Island for each month are sorted from highest to lowest,
> 3.2) The respective weighted monthly target flow values are subtracted from the model flows (the highest 33 percent of model flows compared against the weighted monthly wet target flow, the lowest 25 percent of model flows compared against the weighted monthly dry target flow, and the remaining 42 percent compared against the weighted monthly normal target flow),
> 3.3) producing either a monthly value of "shortage" or "excess".
> 3.4) The shortage values for each month are averaged, resulting in 12 average monthly shortage values.
> 3.5) The 12 monthly average shortage values are summed, resulting in one long term average annual reduction in shortage value. The magnitude, frequency, and distribution of flows that are in "excess" of the weighted monthly averages may be calculated in the same manner.

For modeled months when Program-controlled water releases occurred for other Program purposes (such as within channel capacity, short-term channel management "pulses" which may or may not be in excess of the weighted monthly average target flow used in the CPR Model), these are included in the shortage reduction calculations in the CPR Model supporting spreadsheets. Shortage reduction calculations in the CPR Model and supporting spreadsheets are consistent with the Program Document, Section E. Water, which discusses shortage reduction "credit", environmental account releases, and management of Program water.

The final average annual value of shortage reduction is often referred to as the "score" for the model run, and expresses the total amount (in thousands of acre-feet) by which the modeled scenario reduces the estimated shortage to target flows at Grand Island, Nebraska relative to the estimated "Present Conditions" shortage to target flows on an average annual basis. For example, a score of 50.0 kaf indicates that the modeled scenario reduces the annual average estimated shortage to target flows at Grand Island by 50,000 acre-feet.

4. Milestones Document: ESA Compliance during the First Increment

The Milestones Document (Program Attachment 2) describes how progress toward Program objectives for ESA compliance purposes will be measured during the first Program increment. For example, Milestone #4 discusses the Water Plan goal of at least 50,000 acre-feet of shortage reduction by the end of the First Increment:

> "The combined three state water projects (Pathfinder Modification, Tamarack I, and the Nebraska Environmental Account) were evaluated and determined to provide an average reduction in shortage of 80,000 acre-feet per year. The combined effect of the original three projects and the Reconnaissance-Level Water Action Plan is intended to achieve the Program objective of "improving the occurrence of Platte River flows in the central Platte River associated habitats relative to the present occurrence of species and annual pulse target flows.... by an average of 130,000 to 150,000 acre-feet per year at Grand Island...." (Platte River Recovery Implementation Program, III.A.3.b.(1)). Therefore, the Reconnaissance-Level Water Action Plan is intended to provide an average of at least 50,000 acre-feet per year reduction in shortage in addition to the three state water projects.
>
> As Reconnaissance-Level Water Action Plan projects move forward from the reconnaissance level, to feasibility, to project implementation, the reduction in shortage associated with an individual project will remain as evaluated and agreed upon by the Governance Committee prior to project implementation, so long as the project is implemented in general and reasonable conformance with the project description, and be capable of providing the level of benefit as determined by the Governance Committee. That amount of reduction in shortage for the Reconnaissance-Level Water Action Plan project will be credited towards the completion of Milestone 4, and is not dependent upon annual or day-to-day management decisions made by the Environmental Account Manager or future variations in hydrologic conditions during the First Increment."

Concepts embodied in the explanatory material above which are relevant to calculating reductions in shortage and reviewing project operations (items 1 through 4 below) include:

4.1) Daily project descriptions are incorporated in the monthly CPR Model.
4.2) Project credit towards shortage reduction uses the CPR Model and project descriptions simulated over a long term hydrologic record (e.g., 1947-1994 or longer).
4.3) The CPR Model does not determine what daily project operations should be, but only reflects the reduction in shortage associated with observed project operations and operating practices implemented over a long term hydrologic record.

5. NEPA and ESA Evaluations of Planned First Increment Program Water Plan Projects and the Calculated Reductions in Shortage to Target Flows Prior to Program Implementation

NEPA and ESA evaluations prior to a Program generally includes the following steps:

5.1) Use the calibrated/validated Present Condition CPR OPSTUDY Model run for the 1947-1994 time period, and
5.2) Incorporate proposed system changes and proposed project operations based on project descriptions into the CPR Model run, then
5.3) Compare flow changes and assess habitat conditions between the proposed alternative and Present Conditions over the long term period (1947-1994).
5.4) Estimate the reduction in shortage associated with proposed projects and their operating plans and supporting project descriptions.

5.5) Results may be used as appropriate during NEPA and ESA evaluations, Program negotiations, Governance Committee discussions and approvals, adaptive management, etc.

Project descriptions for the three initial Program projects are primarily contained in Program Attachment 5, Sections 3, 4, and 5 and Section 11 Appendix C. The operations described were included in the CPR Model and the average annual reduction in shortage determined for the 1947-1994 time period.

Based on the project descriptions, the initial Program projects (Pathfinder Modification, Tamarack I, and the Nebraska Environmental Account) were evaluated and determined using the CPR Model during NEPA review to provide an average reduction in shortage of 80,000 acre-feet per year. The shortage reduction assigned to each project individually has not been determined (at this time), and CPR Model results and sensitivity analysis (due to project interactions) may be considered during "fair share" negotiations of the Governance Committee.

Project descriptions for the Reconnaissance-Level Water Action Plan (WAP) projects are contained in Program Attachment 5, Section 6. Project details are also provided in various documents used for analysis during NEPA review. Based on the project descriptions, the combined Reconnaissance-Level Water Action Plan projects were evaluated and determined using the CPR Model during NEPA review to provide an average reduction in shortage of more than 60,000 acre-feet per year. The shortage reduction assigned to each Reconnaissance-Level Water Action Plan Project was initially presented for Governance Committee consideration in September 2000 (EIS Team memo, WAP pages 93-97). The final amount of shortage reduction credited to an implemented Reconnaissance-Level Water Action Plan project is discussed below in item 6.

6. Evaluations During the First Increment of Substituted, Altered, or New Program Water Plan Projects to Assess the Credit Towards the Program's First Increment Objective of 130,000 to 150,000 af/yr of Average Shortage Reduction to Target Flows.

As Program Water Plan projects move from reconnaissance level to implementation, the determination of reduction in shortage credit generally includes the following steps:

6.1) Use the calibrated/validated Present Condition CPR OPSTUDY Model run for the 1947-1994 time period, and
6.2) Incorporate proposed system changes and proposed Water Plan project operations based on project descriptions into the CPR Model run, then
6.3) Compare flow changes and assess habitat conditions between the Water Plan project (with other Program projects included) and Present Conditions over a long term period (e.g., 1947-1994).
6.4) Estimate the reduction in shortage associated with the Water Plan project and the proposed operating plans and supporting project description.
6.5) Results may be used as appropriate during Governance Committee discussions and approval of Program projects, "fair share" negotiations, adaptive management decisions, etc.

The final amount of shortage reduction credited to an implemented Water Plan project by the Governance Committee will be determined based on the final scope, scale, operating practices, and modeled shortage reduction at Grand Island using the CPR Model, and may be considered during "fair share" negotiations of the Governance Committee. CPR Model results and other relevant information may be considered by the Governance Committee in evaluating the acceptability of altered, changed, or substituted Water Plan projects.

7. Annual Review of Program Water Project Operations Relative to Project Descriptions and Operating Plans During the Program First Increment.

The following steps are generally used when evaluating actual Program Water Plan project operations relative to project descriptions upon which the reduction in shortage credit is based:

7.1) Use relevant project operation data, stream gage data, and the Program's water tracking and accounting reports and compare with

7.2) Project description and operation information subsequently included within the CPR Model to calculate the reduction in shortage credited towards the Program's First Increment objective of 130,000 - 150,000 af of shortage reduction.

Because the modeling assumptions include very simplified representations of ranges of District operations, actual annual operating data are not expected to "match up" with the modeling assumptions. If, however, data on actual operations indicates over time that the "operating assumptions" in the model are unrealistic, the operating assumptions in the model can be updated and the resulting change in scoring of shortage reduction towards the First Increment objective determined. Significant differences between actual operating data over time and operating assumptions which suggest to FWS that the operating assumptions are unrealistic must first be brought to the Governance Committee.

8. Evaluation of Completed Program Plan Projects Near the End of the First Increment and Calculating the Reductions in Shortage to Target Flows Achieved During the First Increment.

The initial three Program water projects are anticipated to be fully implemented by the end of year four of the First Increment (Milestones 1, 2, and 3, Program Attachment 2) and Reconnaissance-Level Water Action Plan projects will be implemented cumulatively throughout the First Increment. The CPR Model can be used to estimate the reduction in shortage associated with a) those Program projects currently in operation only, and b) for the total Program projects (currently operating and planned).

ESA compliance requires that certain reductions in shortages to target flows be achieved, and these will be quantified in terms of the modeled effects of the Program. ESA compliance does not require that these reductions in shortages actually occur under the specific conditions prevailing during the 13-year First Increment. Actual average annual reductions in shortages to target flows during the 13-year period may be greater or lesser than the modeled long-term reductions because of prevailing climatic and hydrologic conditions. During the First Increment, the modeled effects over the long term of 1947-1994 will be used for Program purposes of computing reductions in shortages to target flows.

References

Bureau of Reclamation (BOR), 1997. North Platte River Water Utilization Model Documentation. Bureau of Reclamation Wyoming Area Office, Mills, Wyoming, June 1997.

Hydrosphere Resource Consultants (Hydrosphere), 2001. Technical Appendix: Documentation for the South Platte River EIS Model (SPREISM), April 18, 2001.

Platte River EIS Office (PREISO), 2002a. Calibration/validation of the OpStudy Model. Lakewood, Colorado, 57 pp.

PREISO, 2003. Hydrology Appendix to the Platte River Recovery Program Draft Environmental Impact Statement, December 2003.

APPENDIX C

OPSTUDY Assumptions Regarding Water Operations for Diversions at the Keystone Diversion Dam and Central District Supply Canal

The following information was developed by Central Nebraska Public Power and Irrigation District (CNPPID) and Nebraska Public Power District (NPPD) (collectively the Districts) and the EIS Team to provide reasonable assumptions for hydrologic modeling and analysis of diversions at the Keystone Diversion Dam and Central Diversion Dam to be used for analysis in the EIS and BO.

This attachment describes how the procedures and priorities for storing and releasing water from Lake McConaughy (operations) are simulated for the Program. For the Program, the Districts suggested that the assumptions described below could be used by the EIS Team in the Central Platte OPSTUDY model to represent the range of future diversions at the facilities as part of a Program (Personal Communications, Mike Drain, CNPPID, and Frank Kwapnioski, NPPD, August 1999).

The licenses issued by the Federal Energy Regulatory Commission to the Districts in 1998 provide that certain flows are to be available at diversion structures owned by the Districts (see a description of non-irrigation season releases from Lake McConaughy for diversion at the Keystone Diversion Dam and the Central Diversion Dam, is in Program Attachment 5, Section 5, An Environmental Account for Storage Reservoirs on the Platte River System in Nebraska (EA Document)). In most instances, however, the Districts expect flows at the Central Diversion Dam will be greater than those required in the EA Document. In 1999, in order to make the OPSTUDY modeling more realistic than assuming only the required flows, the Districts assisted the EIS team in developing “Operational Assumptions” for use in OPSTUDY to evaluate the Program. The Districts believe those assumptions are still reasonable for the purpose of modeling, assuming water supply received from the North and South Platte Rivers and other conditions are similar to those in the 48 year study period in OPSTUDY (1947-1994). The Districts’ actual operations, however, will be in accordance with the Districts’ Annual Operating Plan (AOP), and will take into consideration many more factors than could be reflected in the “Operational Assumptions”. Actual flows likely will be greater or lesser than the flows in the “Operational Assumptions” used in OPSTUDY. For example, although specific diversion quantities are specified for modeling purposes for each storage condition, actual flows may be substantially less in years of extreme drought, and substantially greater in years that are closer to the transition between the “dry” and “very dry” ranges[2]. In addition, the severe drought conditions experienced from 2000 to 2005 may result in water supplies and diversions smaller than those assumed in the 1947 to 1994 period of analysis.

Appendix B (FWS’ Use of The Central Platte OPSTUDY Model in Computing Reductions in Shortages to target Flows) describes how Program water project operations are compared to project descriptions in annual reviews during the first Program increment. Because the modeling assumptions are very simplified representations of ranges of District operations, actual annual operating data is not expected to “match up” with the modeling assumptions. If, however, data on actual operations indicates over time that the “operating assumptions” in the model are unrealistic, the operating assumptions in the model can be updated and the resulting change in scoring of

---

[2]Note: Storage conditions defined in Attachment 5, Section 5, use classifications of “Very Wet”, “Wet”, “Transitional”, “Dry” and “Very Dry”. Storage Conditions defined in this document use classifications of “Very High”, “High”, “Normal”, “Low”, and “Very Low”. All storage conditions are included in the OPSTUDY model.

shortage reduction towards the First Increment objective determined. Significant differences between actual operating data over time and operating assumptions which suggest to FWS that the operating assumptions are unrealistic must first be brought to the Governance Committee.

OPSTUDY Modeling of Proposed Program Reservoir Operations

Water is often released from Lake McConaughy in excess of the volume needed to satisfy the downstream operating flows described in the EA Document. The size of the release depends on the amount of water requested by a water user holding rights to the water, how much water is available in Lake McConaughy, natural flow availability, system operational requirements, weather and drought conditions to the point of delivery, other demands on the river, the ability to produce power with the water, the need for power, and other factors.

In the Central Platte OPSTUDY model, the amount of water to release depends on the end of September and the end of March storage in Lake McConaughy. The model, beginning in October, determines a release level for the non-irrigation season based on the end of September Lake McConaughy storage. The model then reevaluates the release level based on the end of March Lake McConaughy storage plus the April though July inflow into Lake McConaughy. The model determines whether conditions are very high, high, normal, low, or very low, and also determines whether conditions are very wet, wet, transitional, dry, or very dry. The levels of estimated Lake McConaughy storage and inflow that trigger the various classifications are shown in the table below (see Attachment 5, Section 5, for classifications of "Very Wet", "Wet", "Transitional", "Dry" and "Very Dry"):

Condition	October Estimate (acre-feet).	April Estimate (acre-feet)
Very High	>1,400,000	>2,000,000
High	1,300,000 to 1,400,000	1,600,000 to 2,000,000
Normal	1,000,000 to 1,300,000	1,200,000 to 1,600,000
Low	800,000 to 1,000,000	800,000 to 1,200,000
Very Low	< 800,000	< 800,000

For each of the above conditions, the following modeling assumptions guide releases and deliveries.

Very high conditions

1. Meet the following diversion to Tri-County.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(cfs)	1600.	2000.	2000.	2200.	2200.	2200.	2200.	2200.	2000.	2000.	2000.	1600.

2. Also, ensure that the flow out of Lake McConaughy never goes below.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(cfs)	0.	0.	0.	2000.	2000.	2000.	2000.	0.	0.	0.	0.	0.

3. Also, ensure that the diversion to the Sutherland Canal never goes below.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(cfs)	0.	0.	0.	1000.	1000.	1000.	0.	0.	0.	0.	0.	0.

High conditions

1. Meet the following diversion to Tri-County.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(cfs)	1400.	1800.	1800.	2000.	2000.	2000.	2000.	2000.	2000.	1800.	1800.	1400.

Normal conditions

1. Meet the following diversion to Tri-County.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(cfs)	1200.	1400.	1400.	1600.	1600.	1600.	1600.	1600.	1600.	1400.	1400.	1200.

Low conditions

1. Meet the following diversion to Tri-County.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(cfs)	800.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	800.

Very low conditions

1. Meet the following diversion to Tri-County.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(cfs)	700.	700.	700.	700.	700.	700.	700.	700.	700.	700.	700.	700.

APPENDIX D

Determining Real-Time Hydrologic Conditions

The following criteria will define hydrologic conditions in the central Platte River ("wet" vs. "normal" vs. "dry") for the sake of setting real-time target flows, as the use of these targets is described in other Program documents. These criteria will serve as initial guidelines subject to modification during the First Increment, provided changes are approved by the Governance Committee.

Variables and Weightings to determine the Hydrologic Condition

Characterization Period	Variables and weightings *								Thresholds **	
	Q @ GI	**PDSI* ****	**Mac EOMC**	**NPlatte Res**	**Upper SPlatte Res**	**Q @ Julesburg**	**NPlatte Snow**	Constant Adjustment	Normal	Wet
Dec-Jan-Feb	0.579		0.138	0.317	0.236			- 0.129	0.25	N/A
Mar-Apr	0.120	0.662		0.198				- 0.011	0.25	N/A
May	0.601		0.271		0.031		0.252	- 0.065	0.30	0.70
June	0.648	0.121				0.023	0.082	+ 0.097	0.30	0.70
July	0.237	0.441	0.109	0.105		0.218		- 0.071	0.31	N/A
Aug-Sep			0.404					+ 0.061	0.29	N/A
Oct-Nov	0.658	0.342						- 0.048	0.25	0.67

0.464

* These weightings are applied to these variables expressed as *frequency of non-exceedance* values between 0 and 1. The frequency of non-exceedance is based on the 1947-1994 period of record for the Platte Basin.

** Resulting values of the weighting formula (the range of possible weighted values is approximately 0 to 1) above which basin conditions will be defined as "normal" or "wet", respectively. Thresholds are somewhat higher in May through September to account for the censoring of unusually high local precipitation years when developing the weightings. “N/A” indicates that this is not a relevant threshold for this period.

*** The PDSI considered was the average for the preceding month of 4 zones in northeastern Colorado, southeastern Wyoming, and western Nebraska EXCEPT for the Aug-Sep characterization period, for which the PDSI considered was the average for the preceding month of 2 zones in central Nebraska.

Key to Variables

Q @ GI	Previous-month mean streamflow in the Platte River at Grand Island, Nebraska
PDSI	Previous-month mean Palmer Drought Severity Index for four "divisions": NE #1 and #7, CO #4, and WY #8
Mac	Previous-month EOM content (as percent capacity) at Lake McConaughy
NPlatte Res	Previous-month EOM content of seven upper North Platte Reservoirs (above McConaughy). These reservoirs are: Seminoe, Pathfinder, Glendo, Alcova, Grey Reef, Guernsey, and Kortes
Upper SPlatte Res	Previous-month EOM content of three upper South Platte Reservoirs (above Denver). These reservoirs are: Antero, Eleven-Mile, and Cheesman.
Q @ Jules	Previous-month mean streamflow in the South Platte River at Julesburg, Colorado
NPlatte Snow	April 1 percent-of-normal snowpack as defined by NRCS, North Platte basin in Wyoming

Example Application:

To set the "hydrologic condition" for Oct/Nov, September streamflow and PDSI data are acquired:

1. Streamflow at Grand Island in September was at the 10-percentile level of the 1947-94 September flows (i.e., 0.10 frequency of non-exceedance)
2. The basin-averaged PDSI value in September was at the 20-percentile level of the 1947-1994 distribution of values (i.e., 0.20 frequency of non-exceedance)

Using the weightings in the above table, our equation would be:

$$0.658(0.10) + 0.342(0.20) - 0.048 = 0.086$$

The "thresholds" value defines whether 0.086 corresponds to "dry", "normal", or "wet". Because 0.086 is less than 0.25, conditions would be classified as "dry".

If both the Grand Island streamflow and the PDSI values in September had been at the 80-percentile level, the equation would be:

$$0.658(0.80) + 0.342(0.80) - 0.048 = 0.752.$$

Because 0.752 is greater than the threshold of 0.67, conditions would be classified as "wet".

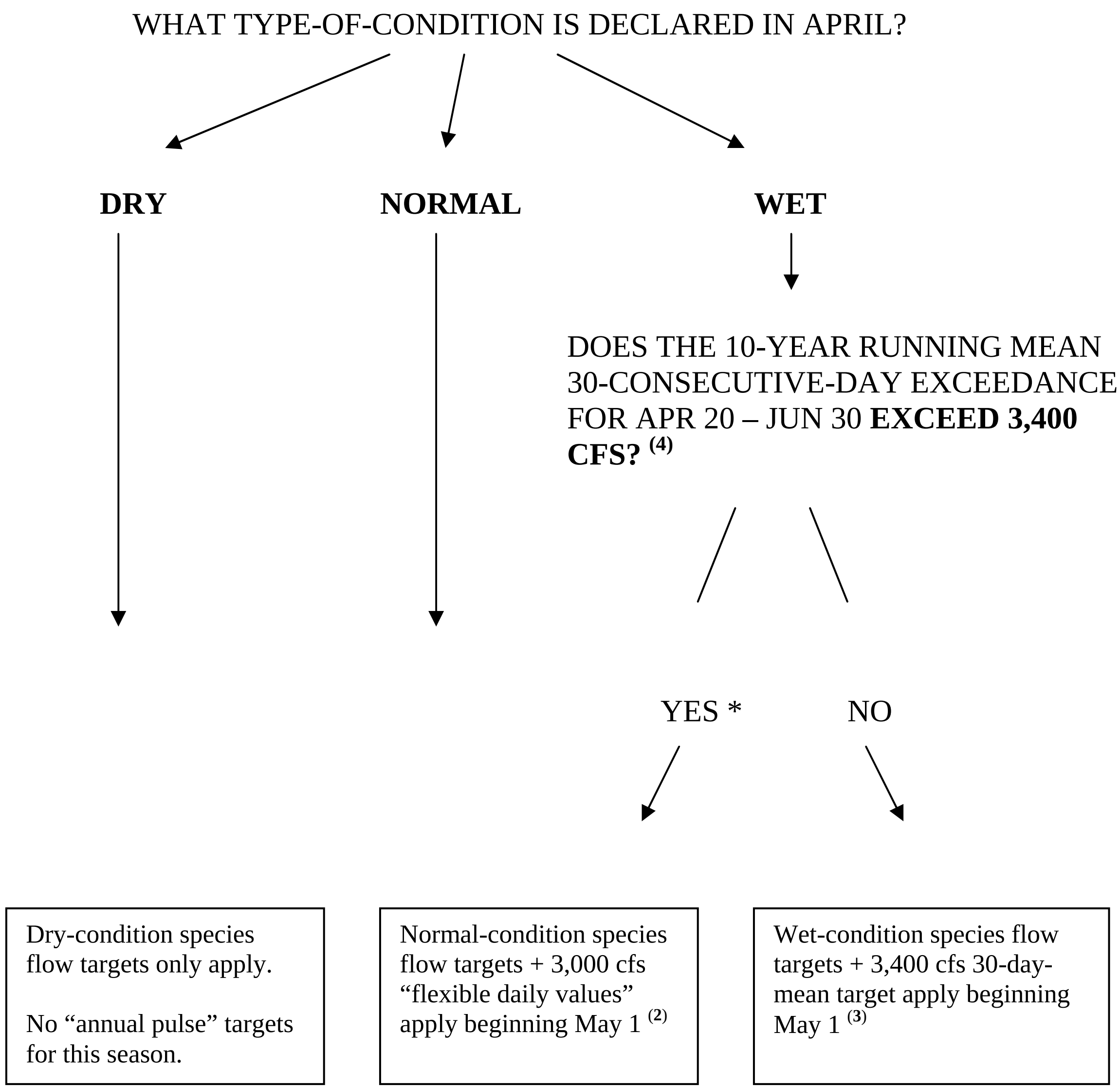
APPENDIX E

Fixed Daily Target Flows

	Condition		
Period	**Wet**	**Normal**	**Dry**
Jan 1 – Jan 31	1,000	1,000	600
Feb 1 – Feb 14	1,800	1,800	1,200
Feb 15 – Mar 15	3,350	3,350	2,250
Mar 16 – Mar 22	1,800	1,800	1,200
Mar 23 – May 10	2,400	2,400	1,700
May 11 – May 19	1,200	1,200	800
May 20 – June 20	3,700	3,400	800
June 21 – Sept 15	1,200	1,200	800
Sept 16 – Sept 30	1,000	1,000	600
Oct 1 – Nov 15	2,400	1,800	1,300
Nov 16 – Dec 31	1,000	1,000	600

APPENDIX F

"Flexible Daily Values" for May and June (1)



1. This scheme assumes that Water Plan projects operating against daily values will not collectively divert/store at a rate greater than currently anticipated in the Plan. If or when Water Plan projects would divert at a greater rate, this scheme might need to be re-visited. This scheme also assumes that EA releases are not included in the total flow basis for the Platte River at Grand Island.

If a Program water element avoids diverting water due to a request from the EA Manager, under conditions when it would otherwise have the opportunity to divert relative to these values, neither that water element nor the Program will be penalized for shortage-to-target-flow reductions that are not achieved because of that request.

2. From May 1 through June 20, the daily target flow will be **3,000 cfs** until this flow has been exceeded for at least **7 out of any 14 consecutive days** (beginning April 20). This means no diversions will be made to Program projects operating against "flexible daily values" if the projected flow at Grand Island is less than 3,000 cfs (with or without diversions), until this flow exceedance is achieved, or until June 21, whichever comes first.

3. From May 1 through June 20, the daily target flow will be **3,400 cfs** until the **30-day running mean** exceeds 3,400 cfs (counting back 30 days beginning May 20). This means no diversions will be made to Program projects operating against "flexible daily values" if the projected flow at Grand Island is less than 3,400 cfs (with or without diversions), until this running mean is achieved, or until June 21, whichever comes first.

4. Calculated by determining the mean daily flow that was exceeded for 30 consecutive days in each of the previous 10 years, beginning on April 20 and ending on June 30. For the period of 1947-1994, this 3,400 cfs 10-year running mean was exceeded going into four years: 1986, 1987, 1988, and 1989.

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM

ATTACHMENT 6

ORGANIZATIONAL STRUCTURE
FOR THE PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM

Table of contents

List of Appendices

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 6

Organizational Structure for the Platte River Recovery Implementation Program

December 7, 2005

I. PURPOSES

This document describes an organizational structure (Figure 1) for making decisions and carrying out activities related to the Platte River Recovery Implementation Program (Program), implemented pursuant to the Platte River Recovery Implementation Program Cooperative Agreement (Program Agreement). This document also identifies the responsibilities and authorities of each component of that structure.

The Signatories (Colorado, Nebraska, Wyoming and the Department of the Interior (DOI)) have agreed to carry out financial and contracting responsibilities in coordination with the Governance Committee as described below. Otherwise, Program decision-making lies with the Governance Committee, which is made up of Signatory and non-Signatory members. The Governance Committee is described first below, followed by a discussion of the Signatories and the Oversight Committee. Notwithstanding the cooperative nature of the Program, the Signatories have statutory responsibilities that cannot be delegated. This document is not intended to abrogate any Signatory's non-delegable statutory responsibilities.

II. GOVERNANCE COMMITTEE

The Governance Committee will make Program decisions and implement the Program.

A. The membership of the Governance Committee is as follows:

1. One (1) representative from the State of Wyoming.
2. One (1) representative from the State of Colorado.
3. One (1) representative from the State of Nebraska.
4. One (1) representative from the United States Fish and Wildlife Service (FWS).
5. One (1) representative from the United States Bureau of Reclamation (BOR).
6. Environmental entities in the three states shall have three (3) representatives (2 votes).
7. The water users in the Upper Platte River basin in Wyoming, and those water users in the North Platte River basin in Nebraska located above Lake McConaughy who have storage contracts for water in the federal reservoirs in Wyoming (Upper Platte Water Users), shall have one (1) representative.

8. The water users on the South Platte River above the Western Canal diversion and those water users on the North Platte River in Colorado (Colorado Water Users) shall have one (1) representative.
9. The water users downstream of Lake McConaughy and the Western Canal, and those water users upstream of Lake McConaughy who do not have federal storage contracts (Downstream Water Users), shall have one (1) representative.

The Governors of Colorado, Nebraska and Wyoming will select their respective representatives, and alternates to serve in the representative's absence. The Secretary of the Interior will select the representatives and alternates for the FWS and BOR. Representatives to fill the other seats, and alternates to serve in their absence, will be selected using the processes described in Appendix A (Environmental Entities), Appendix B (Upper Platte Water Users), Appendix C (Colorado Water Users), and Appendix D (Downstream Water Users). More than one alternate may be designated as long as the order among them is clear for serving in the absent representative's place.

B. Within 15 days of execution of the Program Agreement, DOI will identify the initial FWS and BOR representatives to the Governance Committee. The FWS representative promptly will request that the states, environmental entities and water users, through contacts designated in the attached selection processes, identify their representatives and alternates and notify FWS in writing within 30 days. If an initial representative has not been identified during that time period, or in the event of a vacancy, that seat shall be considered vacant.

C. At any time after initial representatives are identified, the Secretary of the Interior or Governors, or the environmental entities, or water users using their respective selection processes, may select replacement representatives or alternates.

D. The Governance Committee's responsibilities include, but are not necessarily limited to, the following:

1. Meet as needed but no less than on a quarterly basis for the first year of the Program and twice a year thereafter.

2. Elect a chair and vice chair annually.

3. Adopt rules for carrying out its responsibilities.

4. Select an Executive Director, a land interest holding entity, a financial management entity, and other contractors as it deems appropriate.

5. Establish committees as needed, including but not necessarily limited to those described in Sections VI and VII below, and modify the committee charters as needed.

6. Approve budgets and request funds or financing from the Signatories for Program purposes, which would be provided pursuant to applicable federal and state procedures and subject to the availability of appropriated funds.

7. Approve Program activities and criteria (such as land and water acquisition and management criteria, management actions, and revisions to milestones or land and water plans or the Adaptive Management Plan), after considering recommendations from the Executive Director and committees.

8. Review accomplishments annually, including consideration of the schedules, operations of the initial Program water projects, and other Water Plan projects and Land Plan projects.

9. Evaluate Program management activities, as described in the Adaptive Management Plan, and take action as appropriate using the procedures described in the Plan.

10. Annually compare accomplishments with the milestones, and implement measures to correct shortfalls, if needed, and as necessary revise milestones so long as such revisions are consistent with the Program's long-term and First Increment goals and objectives.

11. Review implementation of the States' and Federal government's Depletions Plans; approve modifications to plans; and, provide a forum for resolution of any issues related to implementation and modification of the plans.

12. Assess the need to extend the term of a Program increment to assure transition to any subsequent Program increment. The Governance Committee may extend the term of a Program increment if the extension does not require the commitment of additional funds by the signatories.

13. Develop milestones and recommend to the Signatories the duration, goals, and objectives for future increments as appropriate, to ensure that the Program can continue to provide ESA compliance for certain new and existing water related activities.

E. The chair shall provide reasonable notice of all Governance Committee meetings and a proposed agenda to all members through their representatives and alternates. Meetings may be held in person or via conference calls, videoconferences or other long-distance communication systems. The Governance Committee will attempt to operate by informal consensus. Votes will be taken when appropriate. For the purpose of voting on any issue, a quorum shall consist of the representative or alternate appointed by each Governor, the representatives or alternates of the FWS and BOR and two (2) other representatives or their alternates. Nine (9) of the ten (10) representatives to the Governance Committee, including the representative or alternate appointed by each Governor and the representatives or alternates for the FWS and BOR, must vote in the affirmative for the Governance Committee to act. For votes related to financial matters, the affirmative vote by a Governance Committee representative of a Signatory constitutes authorization to use that Signatory's funds. If a representative and alternate of a water user or environmental member are absent from a meeting, abstain from voting or the seat is vacant, the voting requirements will be reduced accordingly.

III. SIGNATORIES

The Signatories have agreed to undertake the following responsibilities:

A. Each state and DOI will provide representatives, without compensation from any other Signatory, to the Governance Committee, Oversight Committee, and to any committees established by the Governance Committee.

B. Each state and DOI will carry out contracting and financial responsibilities on behalf of, and at the request of, the Governance Committee (as described in Section II.D. above).

C. The States and the Federal government each will operate its own Depletions Plan and will coordinate the implementation of its Plan with the Governance Committee and, as appropriate, with the Executive Director.

D. One or more states may choose to serve as a Project Sponsor for components of the Program's Water Plan and/or the Land Plan.

IV. OVERSIGHT COMMITTEE

The Oversight Committee is to be convened to address potential modification of the Program as described in Section III.B.1 of the Program Document or to address potential dissolution issues as described in Section IV of the Program Document and Section II.E, of the Program Agreement. The Committee is made up of the Secretary of the Interior and the Governors of the States of Colorado, Nebraska and Wyoming.

V. EXECUTIVE DIRECTOR

The Governance Committee will select an Executive Director to serve at the pleasure of the Governance Committee. The Executive Director's responsibilities include, but are not necessarily limited to, the following:

A. Carry out the directions of the Governance Committee.

B. Facilitate day-to-day communication among Program participants.

C. Coordinate Program activities with the Governance Committee's advisory committees by regularly collaborating with the committees on activities for which they have advisory responsibilities.

D. Provide staff support for the Program and committees.

E. Communicate with local governments, the public, the media, and federal and state agencies.

F. Prepare budgets for review by the Finance Committee and approval by the Governance Committee.

G. Prepare contractor selection procedures for review by the Finance Committee and approval by the Governance Committee.

H. Prepare and provide outreach/public education activities for the Program.

I. Prepare agreements/contracts and amendments.

J. Review invoices for accuracy and consistency with work accomplishments and compliance with contracts and amendments. Submit the approved invoices for payment.

K. Prepare quarterly expenditure reports and submit them to the Finance Committee and Governance Committee.

L. Maintain a Program office and manage Program staff.

M. Provide recommendations and advice to the Governance Committee.

N. Provide a review of Program tasks and periodically report on the status and progress of each task to the Governance Committee.

O. Perform such other functions as requested by the Governance Committee.

VI. FINANCE COMMITTEE

Policy decisions regarding financial aspects of the Program are the responsibility of the Governance Committee. The Governance Committee will establish a Finance Committee to monitor the agreement with the financial management entity (FME) and to assist the Governance Committee and Signatories with financial matters. The Finance Committee will operate in accordance with its charter (Appendix E), which may be amended by the Governance Committee. The Finance Committee representatives and alternates for the States and DOI will have the necessary authority to carry out the administrative functions described in that charter. The Finance Committee is an advisory committee that also provides a forum for the Signatory representatives on the committee to coordinate their administrative and contractual functions.

VII. ADVISORY COMMITTEES

As described in Section II.D.5 above, the Governance Committee will establish committees.

A. Standing Advisory Committees

The Governance Committee will establish the following standing Advisory Committees to provide advice on Program activities:

1. Land Advisory Committee.
2. Technical Advisory Committee.
3. Water Advisory Committee.
4. Independent Scientific Advisory Committee

Each committee shall carry out the responsibilities assigned in its charter (Appendices F-I), as may be amended by the Governance Committee. Any committee can raise an issue to the Governance Committee for its consideration and for potential action.

B. Ad Hoc Advisory Committees

The Governance Committee may, from time to time, establish ad hoc committees to deal with individual or time specific issues. Ad hoc committees will provide advice to and receive direction from the Governance Committee. The Governance Committee may direct any ad hoc committee to work directly with the Executive Director for specific tasks if the Governance Committee also instructs the Executive Director to manage or participate in such tasks.

VIII. RELATIONSHIP OF PROGRAM TO OTHER ENTITIES AND PARTICIPANTS

The Governance Committee may enter into agreements with other entities to facilitate the completion of Program activities.

A. Financial Management Entity

The Governance Committee through the Signatories will enter into an agreement with a financial management entity (FME) to provide financial management services. The FME will hold funds contributed by the Signatories and any other contributors. The FME will make payments to contractors and distribute the charges according to cost sharing agreements established by the Signatories and operating rules established by the Governance Committee and monitored by the Finance Committee. The FME will submit reports to the Governance Committee, Finance Committee and Executive Director describing the status of all funds and will carry out all transactions consistent with federal and state laws and regulations.

B. Land Interest Holding Entity

The Governance Committee through the Signatories will enter into an agreement with a Land Interest Holding Entity to hold title to Program lands, or to enter into leases, easements, and other contractual arrangements for Program lands. All purchases, leases, easements, and other land-holding transactions will be made at the direction of the Governance Committee.

C. Water Project Sponsors.

Sponsors of Program water projects are: (1) entities or individuals who construct, modify or make operational changes in water projects to yield water for the Program, while retaining ownership of the water project itself; or, (2) entities that have entered into water supply contracts or management agreements with water users or water rights holders to obtain water for the Program. A Signatory may sponsor Program water projects. To do so, it must identify the responsible operating agency and provide operating rules or plans which give appropriate assurances of management consistent with the Program's goals and objectives. A non-Signatory entity may also sponsor Program water projects. To do so, it must enter into arrangements that provide appropriate assurances of management consistent with the Program's goals and objectives.

A sponsored water project may be included in the Program only if approved by the Governance Committee consistent with the Water Plan. All sponsorship arrangements between the Program and a sponsor will be developed on a case-by-case basis considering the Program's investment in the project. The Water Plan describes provisions to be addressed in sponsorship arrangements, including coordination with the Environmental Account Manager and other Program water projects. Sponsors of water projects include The Central Nebraska Public Power and Irrigation District (Environmental Account in Lake McConaughy), the State of Colorado (Tamarack I) and the State of Wyoming, as contractor with the BOR (Pathfinder Modification Project).

D. Sponsors of Program Lands

Sponsors of Program lands are entities or individuals who dedicate the use of such lands to the Program, but retain ownership of the property rights that allow Program use of the lands. Sponsored lands must be protected by other federal, state or local programs, managed under regulatory oversight as habitat, or protected by non-profit conservation groups or government agencies. A Signatory may sponsor Program lands. To do so, it must identify a responsible agency and provide plans for land management, Program access and/or Program coordination to provide appropriate assurances of management consistent with the Program's goals and objectives. A non-Signatory may also sponsor Program lands. To do so, it must enter into arrangements such as management and/or access agreements with the Land Interest Holding Entity, a Program Signatory or

Signatories or a conservation organization, or must have a management plan in place that is required by a regulatory agency. Any agreements, management plans or other arrangements must be satisfactory to the Governance Committee and assure Program access and management consistent with the Program's goals and objectives

Program lands owned by Sponsors include the Nebraska Public Power District's (NPPD's) Cottonwood Ranch Property (2,650 acres), lands acquired by Wyoming (470 acres), and any lands acquired in the associated habitats utilizing funds that were contributed prior to the Program as a result of ESA consultations and held in the Platte River Trust II Account held by the National Fish and Wildlife Foundation. NPPD's tern and plover islands and sandpits may also be sponsored. Examples of lands which might be considered for inclusion in the Program in future sponsorship arrangements include those owned, leased or under easements held by the Nebraska Game and Parks Commission, the Platte River Whooping Crane Maintenance Trust, the National Audubon Society, The Nature Conservancy, and The Central Nebraska Public Power and Irrigation District (CNPPID). Lands managed by these entities prior to July 1, 1997 for the benefit of endangered and threatened species, and CNPPID's Jeffrey Island Habitat Area may be credited to the Program's long-term objective, but not toward the First Increment objectives of the Program without prior approval of the Governance Committee and the Sponsor. Other lands acquired by these entities after July 1, 1997 could contribute toward First Increment objectives, and are more likely to come into the Program under sponsorship arrangements during the First Increment. Other federal, state and local programs could also provide lands to the extent consistent with the law and policy governing such programs.

A parcel of sponsored land may be included in the Program only if approved by the Governance Committee consistent with the Land Plan. All sponsorship arrangements will be developed on a case-by-case basis considering the Program's investment in the project. The Land Plan describes provisions to be addressed in sponsorship arrangements.

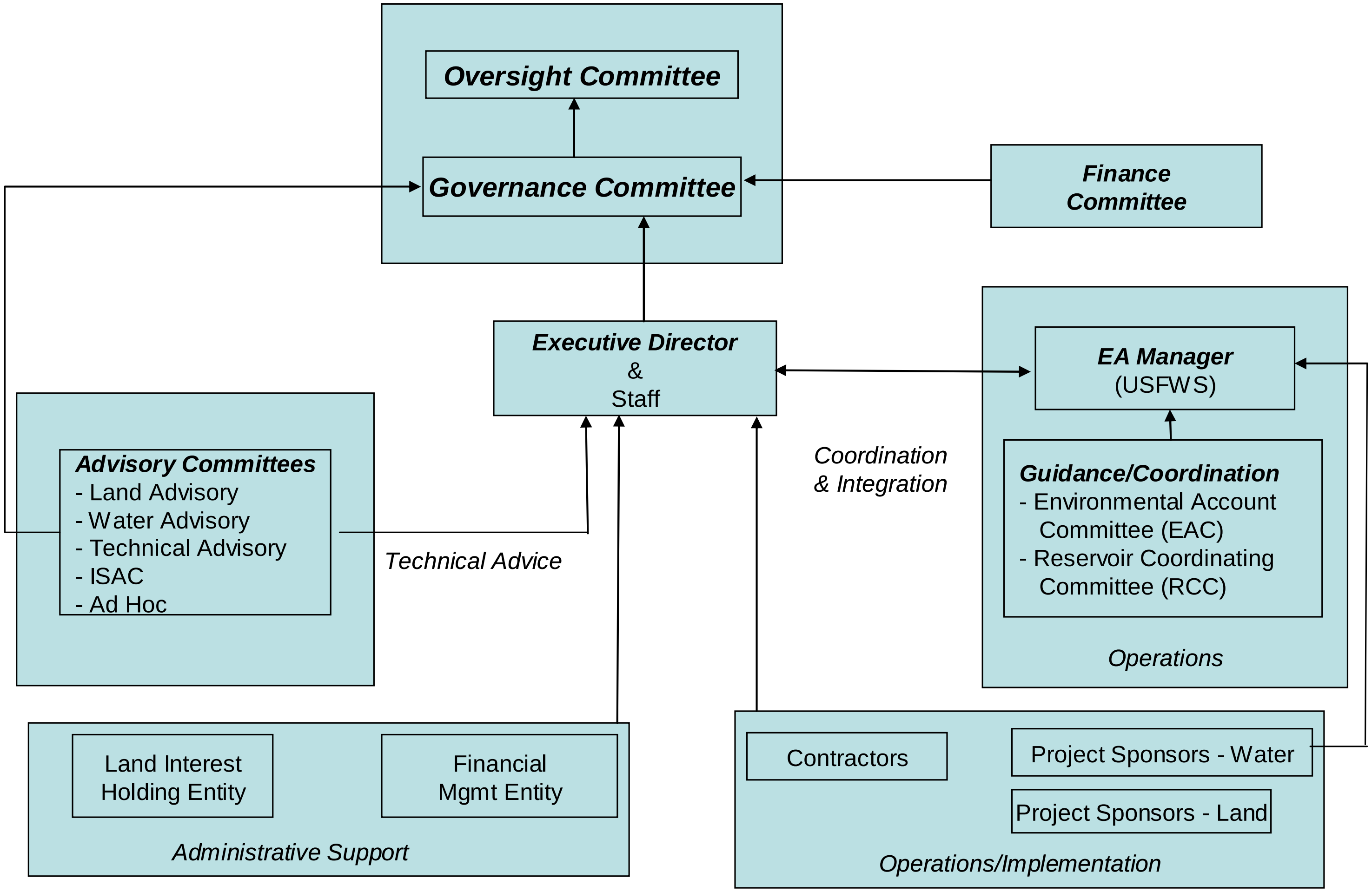


Figure 1. Organizational Structure for the Platte River Recovery Implementation Program.

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 6
Appendix A

Process for Selection of the Environmental Entities Representatives to the Governance Committee

December 7, 2005

1) After the Final EIS and Record of Decision are issued, the conservation organizations that are currently involved in the July 1997 Cooperative Agreement (Audubon, Platte River Trust, Nebraska Wildlife Federation, American Rivers, and the National Wildlife Federation) will develop a list of non-profit conservation organizations with a potential interest in the Program, including:

- wildlife, conservation, and environmental groups.
- national, state-wide, and local groups from all three states.
- Consulting with representatives of the three states and the DOI on the list of non-profit conservation organizations.

Conservation organizations currently involved in the July 1997 Cooperative Agreement will make a decision on the invitation list but the intent is to be inclusive.

2) Once the Program Agreement is signed, the 5 conservation organizations currently active in the July 1997 Cooperative Agreement will convene a meeting inviting the conservation organizations identified above to:

- Explain the program and representative responsibilities.
- Establish rules for the meeting, operating by consensus wherever possible.
- Select representatives, alternates, and their terms of appointment subject to the approval of the 5 conservation organizations currently involved in the July 1997 Cooperative Agreement.
- Determine a process for filling vacancies, and future representation upon term expiration subject to the approval of the 5 conservation organizations currently involved in the July 1997 Cooperative Agreement.
    - Note: The 5 conservation organizations currently involved in the July 1997 Cooperative Agreement are interested in developing a consensus process that provides that at least one of the two program representatives be actively involved in conservation issues on the central Platte River in Nebraska, and that allows for integration of new conservation interests into the program.

3) Decisions on representatives and alternates will be communicated to the Program Governance Committee.

4) Current Governance Committee representatives will continue to serve as the Program representatives until replaced. We intend that the selection process would be completed within 60 days of the signing of the Program Agreement.

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 6
Appendix B

Process for Selection of the Upper Platte Water Users Representative to the Governance Committee

December 7, 2005

The Upper Platte Water Users are the water users in the Platte River basin in Wyoming and those water users in the North Platte River basin in Nebraska located above Lake McConaughy who have storage contracts for water in the federal reservoirs in Wyoming. The standing Governance Committee representative and alternate representative shall cause a meeting of the Upper Platte Water Users prior to the implementation of the Platte River Recovery Implementation Program and no longer than every four (4) years thereafter for the purpose of electing or re-electing the Governance Committee representative and alternate representative.

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 6
Appendix C

Process for Selection of the Colorado Water Users Representative to the Governance Committee

December 7, 2005

The Colorado Water Users representative and alternate to the Governance Committee will be designated in writing by South Platte Water Related Activities Program, Inc. (SPWRAP).

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 6
Appendix D

Identification of the Downstream Water Users Representatives to the Governance Committee

Revised March 11, 2020

Downstream Water Users
The Downstream Water Users are those Nebraska surface water and groundwater users in the Platte River basin downstream of Lake McConaughy and the Western Canal headgate, and those water users upstream of Lake McConaughy who do not have federal storage contracts.

Considerations
Nebraska Public Power District (NPPD) and The Central Nebraska Public Power Distinct (Central) are providing a significant portion of Nebraska's share of the First Increment commitments through the Environmental Account and Cottonwood Ranch and have FERC licenses and the associated ESA consultations dependent on the program.

The Natural Resource Districts along the Platte Rivers above Columbus are responsible for administration of groundwater in Nebraska and are responsible for implementing portions of the Nebraska Depletions Plan related to groundwater uses.

All representatives must consider the needs and impacts to all Nebraska water users when making recommendations and casting votes for decisions on program activities.

Representatives
The Downstream Water Users will have 4 representatives (Representatives) to the Governance Committee with one vote to be cast. The Downstream Water Users will have no designated alternatives with representation to consist of those representatives in attendance at a Governance Committee meeting.

The Representatives will include one from Central, one from NPPD and two from the Platte Basin NRD's. The Platte Basin NRD's consist of the South Platte NRD, The North Platte NRD, the Twin Platte NRD, the TriBasin NRD, and the Central Platte NRD.

The Representatives will be appointed by the respective organizations and serve until a new representative is designated by the organizations. Replacement Representatives must be appointed within 60 days of a vacancy occurring.

The NRD Representatives will not participate in Governance Committee discussions and decisions related to the operation of the Central and NPPD facilities (storage of water, release of water, delivery of water to customers); activities that affect hydropower generation of NPPD or Central; operations of the Environmental Account; Central's or NPPD's FERC Licenses; activities related to ESA compliance of Central and NPPD (habitat development; sediment, monitoring, etc.); activities involving the use of Central's or NPPD's property and/or facilities.

Advisory Committee

An Advisory Committee will be established to provide input from the Downstream Water Users to their Representatives and a forum in which the Representatives can communicate with the Downstream Water Users regarding the Program.

The Advisory Committee will consist of one representative from each of the following groups 1) farm and agricultural groups; 2) water user groups (surface water and groundwater groups); (3) municipalities and 4) surface water irrigation districts.

The Governance Committee Representatives will hold meetings as necessary with the Advisory Committee.

Notes and e-mails of the Governance Committee will be distributed to the Advisory Committee and it is the responsibility of the Advisory Committee representatives to distribute the information to the rest of their constituency.

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 6
Appendix E

Finance Committee Charter

December 7, 2005

I. BACKGROUND

The Governance Committee is responsible for making all policy decisions and providing oversight regarding financial aspects of the Platte River Recovery Implementation Program (Program). The Governance Committee, in its present form, has no legal authority to enter into contracts, collect and retain funds, or incur debt. This charter assumes that the Signatories will perform these Program functions through an agreement with a financial management entity (FME), on behalf of, and as authorized by the Governance Committee. If the Governance Committee acquires such authorities in the future, this charter will be revised accordingly.

The Finance Committee (FC) established by the Governance Committee is to administer the agreement with the FME and to provide assistance and advice on financial matters as herein described and as further directed by the Governance Committee.

II. COMMITTEE STRUCTURE

A. The shall have seven (7) members:

1. One representative and one alternate from the State of Colorado;
2. One representative and one alternate from the State of Nebraska;
3. One representative and one alternate from the State of Wyoming;
4. One representative and one alternate from the U.S. Bureau of Reclamation;
5. One representative and one alternate from the U.S. Fish and Wildlife Service;
6. One representative and one alternate from the Governance Committee's environmental representatives; and
7. One representative and one alternate from the Governance Committee's water user representatives.

The Governance Committee members representing the states, the Department of the Interior (DOI), the environmental groups, and the water users will appoint their respective representatives and alternates to the FC (e.g., State of Colorado Governance Committee member will appoint Colorado's member and alternate). The FC representatives will serve at the pleasure of their respective appointing Governance Committee member or members. The FC representatives and alternates for the states and DOI will have the necessary authority to carry out the administrative functions of the FC described in Section III.A below.

B. The FC shall annually select a Chairperson and Vice-Chairperson. The Chairperson will chair meetings of the FC and report to the Governance Committee. The Vice-Chairperson will assume these duties when the Chairperson is absent. Such selections will be noted in the official minutes of the meetings during which the elections are held.

C. The Executive Director will provide staff assistance to the FC.

D. The FC may seek technical assistance from other Program participants. However, non-committee members will have no vote in consensus determinations.

III. COMMITTEE PURPOSES

A. Administrative Functions

1. The Governance Committee, through the Signatories, will enter into an agreement with an FME. The FME will hold funds contributed by the Signatories and any other contributors. The FME will make payments to vendors and distribute the charges according to cost sharing agreements established by the Signatories and internal procedures established by the Governance Committee. The FME will be closely monitored by the FC.

2. The Governance Committee will approve all Program budgets and statements/scopes of work for contracts and amendments. An affirmative vote by a Signatory's Governance Committee representative shall constitute the authorization necessary for the use of that Signatory's funds to the extent such funds have been or are later made available to the Program. The FC will implement a procedure with the FME for authorization of day-to-day contract expenditures that comply with budgets and contracts authorized by the Governance Committee and enacted by the Signatories. The FC, working through the Signatories, will ensure that Program funds are used for Program purposes only; that such funds are used pursuant to decisions of the Governance Committee; and that all expenditures comply with the applicable federal and state laws, regulations, and procedures. All financial commitments are subject to the availability of appropriated funds.

B. Advisory Functions

The FC will provide assistance and advice on financial matters as directed by the Governance Committee. The following are examples of some of the tasks that the Governance Committee may assign the FC:

1. Assist in the selection of the FME;

2. Recommend FME agreement language for concurrence by the Governance Committee and approval of the Signatories in a manner consistent with Governance Committee direction and federal and state laws, rules and regulations;

3. Recommend a procedure and schedule for contributions to the Program by Signatories and other contributors and review reports prepared by the Executive

Director and FME documenting the contributions made;

4. Review all contract~~s~~ language prepared by the Executive Director to determine whether it conforms to the authorized Governance Committee budget and other applicable actions and recommend Governance Committee concurrence or rejection;

5. Review requests for credit against Program cash and cash equivalent commitments for contributions made by the states and the federal government based on Governance Committee or Program policy and provide recommendations to the Governance Committee regarding those requests;

6. Review the proposed annual budgets and any adjustments proposed by the Executive Director and recommend action to the Governance Committee and Executive Director as to availability of funds to meet anticipated expenditures;

7. Review the proposed contractor selection procedures to be developed by the Executive Director and provide recommendations and propose amendments that may be required to comply with state and federal law and procedures needed to secure funding;

8. Review quarterly reports prepared by the Executive Director that describe the actual expenditures as compared to the annual budgets and that describe the payments of invoices against contracts approved by the Governance Committee and report review results to the Governance Committee;

9. Arrange and review financial audits;

10. Participate in the activities of ad hoc committees to provide guidance regarding funding of particular elements of the Program;

11. Review financial matters associated with implementation of the exit strategies in the event of Program failure or discontinuation and make recommendations for Governance Committee action, if appropriate;

12. From time to time**,** review conformance with “fair share” responsibilities developed by the Governance Committee and make recommendations for Governance Committee action, if appropriate;

13. Meet with the Executive Director to discuss major funding decisions and initiatives, short and long-term funding needs, significant budget issues and their status and outcome and any other budget issues relating to Land and Water Plans, monitoring and research, and Program milestones**,** and make recommendations for Governance Committee action, if appropriate.

IV. COMMITTEE PROCEDURES

1. The FC will meet as needed to accomplish its purposes outlined in Section III of this Charter.

2. FC meetings will be open to other interested parties and Program participants**,** except when discussing confidential legal and personnel matters. Any meetings attended by members of the public will include an open comment period.

3. Agendas, meeting minutes, reports, and other information will be furnished by the Executive Director to FC members prior to scheduled meetings and to other interested parties upon request. Information related to confidential financial matters will be made available to FC representatives only.

4. A quorum shall be required for the FC to conduct business. A quorum requires attendance by the representative or alternate for each state, the BOR and the FWS.

5. The decisions of the Finance Committee regarding the administrative functions described in Section III.A above will be made only if approved by the representatives for the states and the DOI during a meeting in which there is a quorum.

6. The decisions of the FC regarding the advisory functions described in Section III.B above, including any recommendations to the Governance Committee, will be made only by consensus during a meeting in which there is a quorum. Any issue that cannot be resolved by consensus agreement shall be elevated to the Governance Committee for decision. The FC will present all viewpoints on such unresolved issues to the Governance Committee without identifying majority or minority views. However, no FC member or alternate shall be prevented from providing the Governance Committee with their views on an unresolved issue.

7. FC meetings may be held in person or via conference calls, videoconferences or other long-distance communication systems.

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 6
Appendix F

Land Advisory Committee Charter

December 7, 2005

I. PURPOSE

Section VII.A of the *Organizational Structure* for the *Platte River Recovery Implementation Program* (Program) calls for the Governance Committee to establish a standing Land Advisory Committee (LAC) to provide advice on Program activities to accomplish the purposes specified in this charter, as it may be amended by the Governance Committee.

Ultimate responsibility for implementing the Program's Land Plan lies with the Governance Committee, including approval of all acquisitions, management plans, budgets and expenditures. A number of activities will be carried out by the LAC to assist in the Land Plan's implementation (as described in Section IV below), generally coordinated or in collaboration with the Program's Executive Director (as described in Section III below). The LAC will also provide meaningful local input into decisions about operations of the land component, including making recommendations to the Governance Committee about how the Program can both be a "good neighbor" and effectively further the purposes of the Program.

II. COMMITTEE STRUCTURE

A. The representation to the LAC is as follows:

1. One (1) representative of the State of Colorado
2. One (1) representative of the State of Nebraska
3. One (1) representative of the State of Wyoming
4. One (1) representative of the U.S. Bureau of Reclamation
5. One (1) representative of the U.S. Fish and Wildlife Service
6. One (1) representative of the environmental Governance Committee representatives.
7. One (1) representative of the Central Nebraska Public Power and Irrigation District and the Nebraska Public Power District (the Districts).
8. Three (3) representatives of local Nebraskans.

B. For the representatives identified in items 1-6 above, Governance Committee representatives will appoint their respective representatives to the LAC and alternates to serve in the representative's absence (e.g., State of Colorado Governance Committee member will appoint Colorado's LAC member and alternate). At any time after the initial representatives are selected, the Governance Committee representatives may appoint replacement representatives or alternates.

C. For the representative identified in item 7 above, both Districts together will choose one representative and alternate, and may subsequently appoint a replacement representative or alternate at any time.

D. For the representatives identified in item 8 above, the three local Nebraska representatives, and alternates to serve in each respective representative's absence, will be selected by the local Natural Resource Districts (NRDs) with one representative and alternate chosen by the Central Platte NRD, one representative and alternate chosen by the Tri-Basin NRD, and one representative and alternate chosen by both NRD's to represent an area not already represented. Local Nebraska representatives will serve three-year terms that rotate so only one member is either renewed or replaced each year. Initial appointments will be for one, two, or three years to insure proper rotation, with the initial terms of appointment to be worked out by the two NRDs. The appropriate NRD or NRDs may appoint a replacement or alternate as needed to complete the term of a local representative or alternate who is unable or unwilling to do so.

E. The LAC shall select a Chairperson, Vice Chairperson, and Recording Secretary during the first meeting following the creation of the committee and each year thereafter.

F. The Program's Executive Director shall maintain an official membership list and record the Chairperson, Vice Chairperson, and Recording Secretary designations.

G. Non-committee members may be requested by the LAC to serve on subgroups, workgroups, etc. However, non-committee members will not be included in final determination of consensus.

III. COORDINATION WITH THE GOVERNANCE COMMITTEE AND EXECUTIVE DIRECTOR

In addition to carrying out assigned tasks, the LAC can raise an issue to the Governance Committee for its consideration and for potential action.

The Governance Committee will assign a Governance Committee representative to sponsor the LAC. This sponsorship will serve to provide the coordination, advice, and input from the LAC to the Governance Committee in an efficient and effective manner.

As described in the Organizational Structure document, the LAC is not supervised or directed by the Program's Executive Director, nor does the LAC supervise or give direction to the Executive Director. As a practical matter, the two entities must closely cooperate and coordinate their activities because the Program's Executive Director will implement many aspects of the Land Plan that the LAC is to review to offer comments and advice. In carrying out its responsibilities, the LAC may work with the Executive Director as follows:

A. The LAC may request the Executive Director to arrange facilities, maintain documentation of LAC meetings and agendas, and provide other administrative assistance.

B. The LAC may work directly with the Executive Director to provide advice on land evaluations or draft plans or budgets early in the development process, to assure meaningful and timely opportunities for the Executive Director to make adjustments. This cooperation is in addition to the LAC's recommendations and/or comments to the Governance Committee at a later stage.

C. Because the Executive Director also provides administrative support to the Governance Committee, when the LAC prepares advice, recommendations and comments for the Governance Committee, the LAC will work with the Executive Director on meeting the Governance Committee's schedule, coordinating with other committees, scheduling time on the agenda, arranging for distribution of materials, etc.

D. The LAC may request the Executive Director to facilitate the development of consensus.

E. The LAC may request Program staff assistance for specific tasks from the Executive Director, who may provide such assistance or refer the request to the Governance Committee.

F. When the Governance Committee assigns a task to the LAC, the LAC should anticipate that the Executive Director will provide information about the task and schedule to the LAC. This may include providing LAC assistance in a task assigned to the Executive Director.

IV. COMMITTEE RESPONSIBILITIES

Specific LAC functions and responsibilities are:

A. Working through the Executive Director using the evaluation process and Worksheet in the Land Plan, evaluating potential acquisitions and providing recommendations and advice to the Governance Committee regarding whether to pursue an acquisition;

B. If approached by landowners regarding a potential acquisition, passing the information on to the Executive Director for evaluation, and, if requested by the Executive Director, working with the Executive Director in any further discussions with the landowner;

C. If requested by the Governance Committee and/or Executive Director, working with the Executive Director in approaching a landowner and/or assisting in negotiating a potential acquisition the Governance Committee has decided to pursue;

D. Reviewing negotiated potential acquisitions and recommending acquisition actions to the Governance Committee for approval;

E. Reviewing and providing advice to the Executive Director during the Executive Director's development of parcel-specific land management plans and identification of monitoring, research and data collection needs related to those parcels of land;

F. Providing comments and/or recommendations to the Governance Committee regarding adoption of each parcel-specific management plan, including management plans provided by Program sponsors;

G. If requested by the Governance Committee, providing advice to the Executive Director regarding any issues arising during implementation of the Program's land management plans;

H. Reviewing and providing comments and/or recommendations on periodic progress and status reports by land management contractors or Sponsors for consideration by the Governance Committee along with the progress and status reports;

I. Reviewing the results of management and monitoring of Program lands, peer review and other activities related to the Land Plan, and, if warranted, providing comments and/or recommendations (potentially in coordination with the Technical Advisory Committee, U.S. Fish and Wildlife Service, or other committees as appropriate) regarding Governance Committee revisions to management plans consistent with the Adaptive Management Plan;

J. Providing advice to the Executive Director in the development of budgets for Land Plan activities, and subsequently providing comments and/or recommendations to the Governance Committee regarding the adoption of proposed land-related budgets;

K. Reviewing and providing comments to the Executive Director and/or the Governance Committee on the Executive Director's records and status reports regarding land-related Program milestones;

L. Participating in Program outreach efforts to neighbors, stakeholders and the community regarding the Program's plans and practices on Program lands;

M. Providing an opportunity for local input and questions as recommendations are being formulated, as approved plans are implemented, or as local concerns arise, and raising issues to the Governance Committee as appropriate;

N. If the Program is terminated in a way that the Governance Committee and LAC remain active, monitoring implementation of Governance Committee approved "exit" activities if requested to do so by the Governance Committee.

V. COMMITTEE PROCEDURES

A. The LAC will meet as needed to accomplish the responsibilities outlined in Section IV of this charter and the Program.

B. LAC meetings will be open to the public except when discussing confidential matters, as the LAC deems necessary. Meetings attended by interested members of the public will include an open comment period.

C. Agendas, meeting minutes, reports, and other information will be furnished to LAC members prior to scheduled meetings and to participating nonmembers and the public upon request. Agendas, meeting minutes, reports, and other information related to confidential land acquisition or personnel or contract matters will be made available to only LAC representatives and their designated alternates.

D. A quorum shall be required for the LAC to conduct business. A quorum shall be present if the meeting is attended by the representatives of each of the three states, a representative of the U.S. Fish and Wildlife Service, and by three other members or alternates, at least one of which shall be a local Nebraska representative.

E. The decisions of the committee, including those regarding recommendations to the Governance Committee, must be by consensus during a meeting in which a quorum is present. Any issue that cannot be resolved with consensus agreement shall be elevated to the Governance Committee. The LAC will present all viewpoints on such unresolved issues to the Governance Committee without identifying majority or minority views.

F. The LAC may elect to use subcommittees to carry out some of its tasks under the Land Plan.

G. LAC may rotate the location of meetings among the three states and may use teleconferencing or other alternatives to attending meetings.

H. Local Nebraska representatives to the LAC who do not have a duty to participate in LAC activities as part of their employment or under a contract with an NRD may request reimbursement of actual expenses and per diem associated with attending LAC meetings or other activities as directed by the LAC or Governance Committee. The Finance Committee will develop the procedure for payment of reimbursement requests.

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 6
Appendix G

Technical Advisory Committee Charter

December 7, 2005

I. BACKGROUND

The Platte River Recovery Implementation Program (Program) establishes a Technical Advisory Committee (TAC) to accomplish the purposes specified in this charter. The TAC will provide assistance and advice to the Governance Committee on issues related to biological response monitoring and research provided for in the Adaptive Management Plan, peer review, and other tasks as requested.

II. COMMITTEE STRUCTURE

1. Each member of the Governance Committee may appoint a member and alternate to the TAC. The Governance Committee may appoint additional members, as it deems appropriate. The TAC Chairperson will maintain a current list of the TAC members and alternates.

2. The TAC shall select a Chairperson annually, with such selection being noted in the official minutes of the meeting where elections are held.

3. The Executive Director will provide staff support to the TAC.

4. Non-committee members with appropriate technical expertise are encouraged to serve on subgroups, workgroups, etc. However, non-committee members will not be included in final determination of consensus.

5. The TAC may seek technical assistance from other Program participants.

III. COMMITTEE PURPOSES

The TAC will provide assistance and advice on monitoring, research, peer review, and adaptive management matters as directed by the Governance Committee. Potential TAC tasks include but are not limited to the following:

1. Advise the Governance Committee on implementation of the Integrated Monitoring and Research Plan (First Increment Milestone 6), and associated subtasks.

2. Review and advise the Governance Committee on monitoring and research reports.

3. Advise the Governance Committee on adaptive management issues.

4. Review and advise the Governance Committee on research and monitoring protocols developed by Program staff or contractors.

5. Review and advise the Governance Committee on land and water management plans as they relate to monitoring and research activities.

6. Advise the Governance Committee, other committees, and staff on implementation of the Peer Review Guidelines for protocols, models, reports, and other documents being peer reviewed, including advice on those reviews.

7. Provide consultation and advice to the Executive Director.

8. Complete other tasks as directed by the Governance Committee.

IV. COMMITTEE PROCEDURES

1. The TAC will meet as needed to accomplish its purposes outlined in Section III of this charter.

2. TAC meetings will be open to other interested parties except when discussing confidential matters. Meetings in which interested parties from the public attend will include an open comment period.

3. Agendas, meeting minutes, reports, and other information will be maintained by the Executive Director and will be furnished to TAC members prior to scheduled meetings and to other interested parties upon request. Information will also be posted on the Platte River web site.

4. The decisions of the committee, including those regarding recommendations to the Governance Committee, must be by consensus of TAC members. Consensus is the unanimous consent of the members at the meeting when the action or determination is made. Any issue that cannot be resolved with consensus agreement shall be elevated to the Governance Committee. The TAC will present all viewpoints on such unresolved issues to the Governance Committee without identifying majority or minority views.

5. TAC meetings will be held at locations convenient to effective completion of agendas and, when possible will rotate among the three states. Meetings maybe held in person, via conference calls, videoconferencing, or other long-distance communication systems.

6. The TAC may form subgroups to accomplish assignments from the Governance Committee. The TAC Chair will appoint the subgroups and will appoint a person from the subgroup to chair the effort. The subgroup chair will be responsible for the recommendations produced by the subgroup. The recommendations produced by the subgroup will be reviewed and approved by the TAC.

7. Draft and final documents related to TAC recommendations, including those offered by subgroups, will be sent to the Chair for compilation and distribution, unless other wise directed. Final TAC recommendations will be provided to the Governance Committee, which will distribute those products as it deems appropriate.

8. TAC members not otherwise reimbursed by agencies or institutions may request reimbursement of actual expenses and per diem associated with attending TAC meetings or other activities as directed by the TAC or Governance Committee. The Governance Committee will work with the four government entities to develop the procedure for reimbursement requests.

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 6
Appendix H

Water Advisory Committee Charter

December 7, 2005

I. BACKGROUND

The Platte River Recovery Implementation Program (Program) establishes a Water Advisory Committee (WAC) to accomplish the purposes specified in this charter. The WAC will provide assistance and advice on water related matters, as directed, to the Governance Committee.

II. COMMITTEE STRUCTURE

1. Each member of the Governance Committee may appoint a member and an alternate to the WAC. The Governance Committee may appoint additional members, as it deems appropriate. The Chairperson of the WAC will maintain a current listing of the WAC members and alternates.

2. The WAC shall select a Chairperson annually, with such selection being noted in the official minutes of the meeting when elections are held.

3. The Executive Director will provide staff support to the WAC.

4. The WAC may seek technical assistance from other Program participants.

III. COMMITTEE PURPOSES

The WAC will provide assistance and advice on water related matters as directed by the Governance Committee. The following are examples of some of the tasks that the Governance Committee may assign the WAC:

1. Review and comment on the annual operating plans (AOP) for individual Program water supplies, the Program annual operating plan, and the Environmental Account Manager’s year-end report.

2. Review and comment on the state’s tracking, accounting, regulating and protecting of Program water.

3. Review and comment on matters relating to any component of the Program Water Plan.

4. Review and comment on the reconnaissance and feasibility studies and implementation plans for new Program water conservation/supply projects.

5. Advise on the need for peer reviews and review and comment on those reviews.

6. Review and comment on water related monitoring and research activities.

7. Provide consultation and assistance to the Executive Director.

8. Complete other tasks as directed by the Governance Committee.

IV. COMMITTEE PROCEDURES

1. The WAC will meet as needed to accomplish its purposes outlined in Section III of this charter.

2. WAC meetings will be open to other interested parties. Meetings in which interested parties from the public attend will include an open comment period.

3. Agendas, meeting minutes, reports, and other information will be maintained by the Executive Director and will be furnished to WAC members prior to scheduled meetings and to other interested parties upon request. Agendas and minutes will also be posted on the Platte River Web Site.

4. The decisions of the committee, including those regarding recommendations to the Governance Committee, must be by consensus of the WAC members. Any issue that cannot be resolved with consensus agreement shall be elevated to the Governance Committee. The WAC will present all viewpoints on such unresolved issues to the Governance Committee without identifying which views are held by the majority or the minority of the committee members.

5. WAC meetings may be held in person or via conference calls, videoconferences or other long-distance communication systems.

6. The WAC may form subgroups to accomplish assignments from the Governance Committee. The Chairperson of the WAC will appoint the subgroups and will appoint a person from the subgroup to be chair. The Chair of the subgroup will be responsible for the recommendations produced by the subgroup. The recommendations produced by the subgroup will be reviewed and approved by the WAC.

7. Comments provided on draft WAC recommendations, including those offered by subgroups, will be sent to the Chairperson for compilation and distribution, unless otherwise directed.

8. Final WAC recommendations will be provided to the Governance Committee, which will distribute those work products as it deems appropriate.

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 6
Appendix I

Independent Scientific Advisory Committee Charter

December 7, 2005

I. BACKGROUND

The Platte River Recovery Implementation Program (Program) establishes an Independent Scientific Advisory Committee (ISAC) to accomplish the purposes specified in this charter. The ISAC will provide independent scientific advice to the Executive Director (ED) and to the Governance Committee (GC), as requested, on scientific issues during the First Increment of the Program. The ISAC will be composed of approximately five independent scientists knowledgeable in technical areas critical to the implementation of the Adaptive Management Plan (AMP) (Program Attachment 3).

II. MEMBERSHIP

Members of the ISAC should be experienced scientists with demonstrated achievement and high standing in their field. They will be chosen to fill specific areas of expertise that are needed by the Program. There should be a balance between scientists with specific knowledge of the Platte River basin and those with more broad and diverse experience. Members will be expected to provide objective scientific advice in a timely and professional manner, and work effectively in multi-disciplinary setting. ISAC membership will be open to individuals employed by all agencies, institutions, and organizations, with the exception that members may not be salaried employees of members of the GC or organizations with specific mandated representation on the Land Advisory Committee, Water Advisory Committee, or Technical Advisory Committee.

1. Appointment Procedures

Members of the ISAC will be appointed by the GC. The GC will base their appointments on candidates submitted by a Selection Panel selected by the GC and convened by the ED. The Panel will review nominees and make recommendations to the GC. Nominations to the ISAC shall be solicited from the GC, sponsoring entities, as well as other agencies, groups, professional societies, the National Research Council, and the public. While nominations to the ISAC may come from any of a variety of sources, members of the ISAC are independent scientists and do not represent the interests of the nominating entity or any other entity. The Selection Panel will pay careful attention to suggestions by advisory committees and the GC regarding membership and needed expertise. A selection panel will be convened when vacancies arise on the ISAC.

2. Length of Appointments

The initial appointment to the ISAC will be for one to three years. Appointments can be renewed as requested by the GC.

3. Membership Considerations

Considerations will include, but not be limited to, the following when members are selected:

- a. High achievement in a relevant scientific discipline which may include biology, ecology, fisheries, hydrology, river geomorphology, statistics, wildlife ecology, and other relevant disciplines.
- b. A strong record of scientific accomplishment documented by contribution to the peer-reviewed literature or other evidence of creative scientific accomplishment.
- c. High standards of scientific integrity, independence and objectivity.
- d. Ability to forge creative solutions to complex problems.
- e. Interest in and ability to work effectively in an interdisciplinary setting.

III. COMMITTEE PURPOSES

The ISAC is to foster a scientific approach to adaptive management, monitoring and research in meeting the goals and objectives of the Program by providing advice to the GC and the ED. The ISAC must retain as much independence from the adaptive management program as possible. This independence requires that their role focus on reviewing products produced by the Program.

The tasks to be undertaken by ISAC will be identified in a scope of work prepared by the ED and approved by the GC. The tasks may include, but are not necessarily limited to, the following:

1. Advise the ED and GC on implementation of the AMP in two primary areas:
    - a. The ISAC should provide an independent opinion on the design of the adaptive management program and associated monitoring and research, most likely after completion of the final AMP and first year work plan in October 2006 and in subsequent years. The focus of this opinion should be on the scientific rigor of the proposed management activities and associated monitoring and research.
    - b. The ISAC should be asked to review the scientific information collected and to provide their opinion of these results in terms of the response (or lack of response) to management interventions.
2. Respond to specific questions of scientific nature from the GC and ED. Questions for consideration by the ISAC should be submitted through the ED.
3. Advise the GC and the ED on the need for additional peer review.

IV. COMMITTEE PROCEDURES

1. The ISAC shall select a Chairperson and Vice Chair annually, with such selection being noted in the official minutes of the meeting where elections are held.
2. The Chair, and Vice Chair in his/her absence, is the executive officer of the ISAC. The Chair conducts the meetings; seeing that business is conducted in a timely and efficient manner and that each member has the opportunity to be heard.
3. The ED will provide administrative oversight and staff support to the ISAC.

4. The ED will act as the point of contact for requests to the ISAC. The ED will ensure that these communications are conveyed to the ISAC.
5. ISAC will receive a stipend to be determined by the GC. Members not otherwise reimbursed by agencies or institutions may request reimbursement of actual expenses and per diem associated with attending ISAC meetings or other activities as directed by the ED or GC. The ED will work with the appropriate entities to develop the procedure for reimbursement requests.

PROGRAM DOCUMENT CHANGE LOG:

DATE	DESCRIPTION OF CHANGES
4/1/2007	Revisions to Wyoming's Depletions Plan to clarify process for Streamlined ESA Consultation.
6/20/2007	Revision to Colorado's Plan for Future Depletions to remove requirements for a Recovery Agreement.
8/20/2007	Amendment to Colorado's Plan for Future Depletions to include Cumulative Effect Report.
12/12/2007	Revisions to Wyoming's Depletions Plan Page 5.
4/8/2008	Revisions to Colorado's Plan for New Depletions Plan to clarify reporting dates.
6/2/2009	Revisions to Nebraska New Depletion Plan to extend time for Section IV, Bullet #2 and Section IV. ESA Consultations.
8/11/2009	Revisions to Wyoming's Depletions Plan to clarify baseline assumptions.
10/13/2009	Revisions to Colorado's Plan for New Depletions to revise assumptions.
12/8/2009	Revised whooping crane management objective in Adaptive Management Plan.
12/7/2012	Revisions to Attachment 6 Appendix D: Identification of the Downstream Water Users Representatives to the Governance Committee. Reduced frequency of Governance Committee Representative meetings from twice to once annually.
12/1/2015	Revisions to Colorado's Plan for New Depletions.
12/3/2019	Revisions to Colorado's Plan for New Depletions and Wyoming's Depletions Plan update template biological assessments and template biological opinion.
12/20/2019	Platte River Recovery Implementation Program Cooperative Agreement Amendment 1 executed and added to document.
3/11/2020	Revisions to Attachment 6 Appendix D: Identification of the Downstream Water Users Representatives to the Governance Committee. Reduced frequency of Governance Committee Representative meetings from once annually to as needed.