
LRE WATER
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RJH CONSULTANTS, INC.
PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Water Advisory Committee Meeting
Tuesday, August 6th, 2024 – 10:30AM CT
Expanded Recapture Reconnaissance Study
Jonathan Mohr, Environmental Scientist/PM
Mark Mitisek, PH, Senior PM
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ROCKY MOUNTAIN | MIDWEST | SOUTHWEST | TEXAS

PRESENTATION OUTLINE

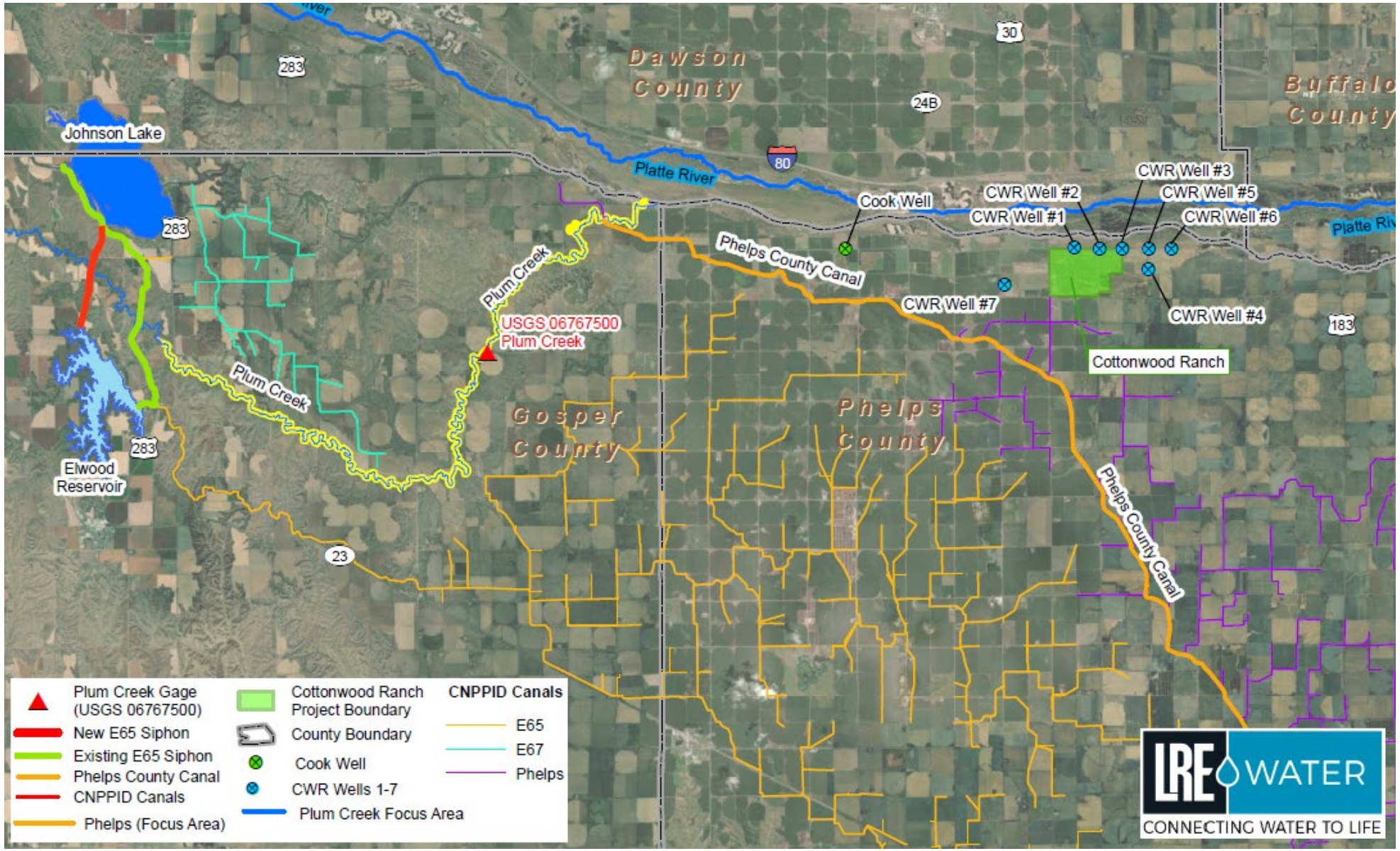
1) Review Study Objectives
2) Plum Creek Assessment
3) Elwood Reservoir Gravity Outlet
4) Recapture Well Assessment
5) Trade Off Analysis
6) Cost Analysis
7) Key Questions & Answers
8) Considerations/Next Steps

REVIEW OF STUDY OBJECTIVES

- **Goal:** Optimize the use of excess flow diversions into existing groundwater recharge projects to reduce deficits to target flows at the Platte River near Grand Island
- **Partners:** PRRIP, NeDNR, TBNRD
- **Team:** LRE Water, RJH, Inter-Fluve

Photo credit: Janet Williams (LRE Water)

PROJECT AREA



PROGRAM QUESTIONS

1. What is the capability of Plum Creek to effectively convey flows to the Platte River?

2. If Plum Creek is used to convey flows, what impacts and what will it cost to mitigate those impacts?

3. What type of infrastructure would be associated with a gravity outlet from Elwood Reservoir?

PROGRAM QUESTIONS

4. Can additional recapture wells operated by the Program improve the net benefit (score) to the river?

5. How would a potential combination of a gravity outlet and recapture wells work in offsetting target flows?

6. What is the most cost-effective method to leverage excess flows through groundwater recharge and recapture and/or surface water releases from Elwood Reservoir?

NEDNR QUESTIONS

7. If the NeDNR were to develop a recapture well program to aid in the retiming of available recharge from Elwood Reservoir, how much could recapture wells offset shortages to the river?

8. What is the most cost-effective method for NeDNR to maximize groundwater recharge and offset shortages in the Platte River below Overton, Nebraska?

PLUM CREEK ASSESSMENT

PLUM CREEK ASSESSMENT

- ✓Review of stream gage data, reports, install two loggers
- ✓Field geomorphic assessment
- ✓1-D HEC-RAS hydraulic model
- ✓Risk assessment
- ✓Planning level cost

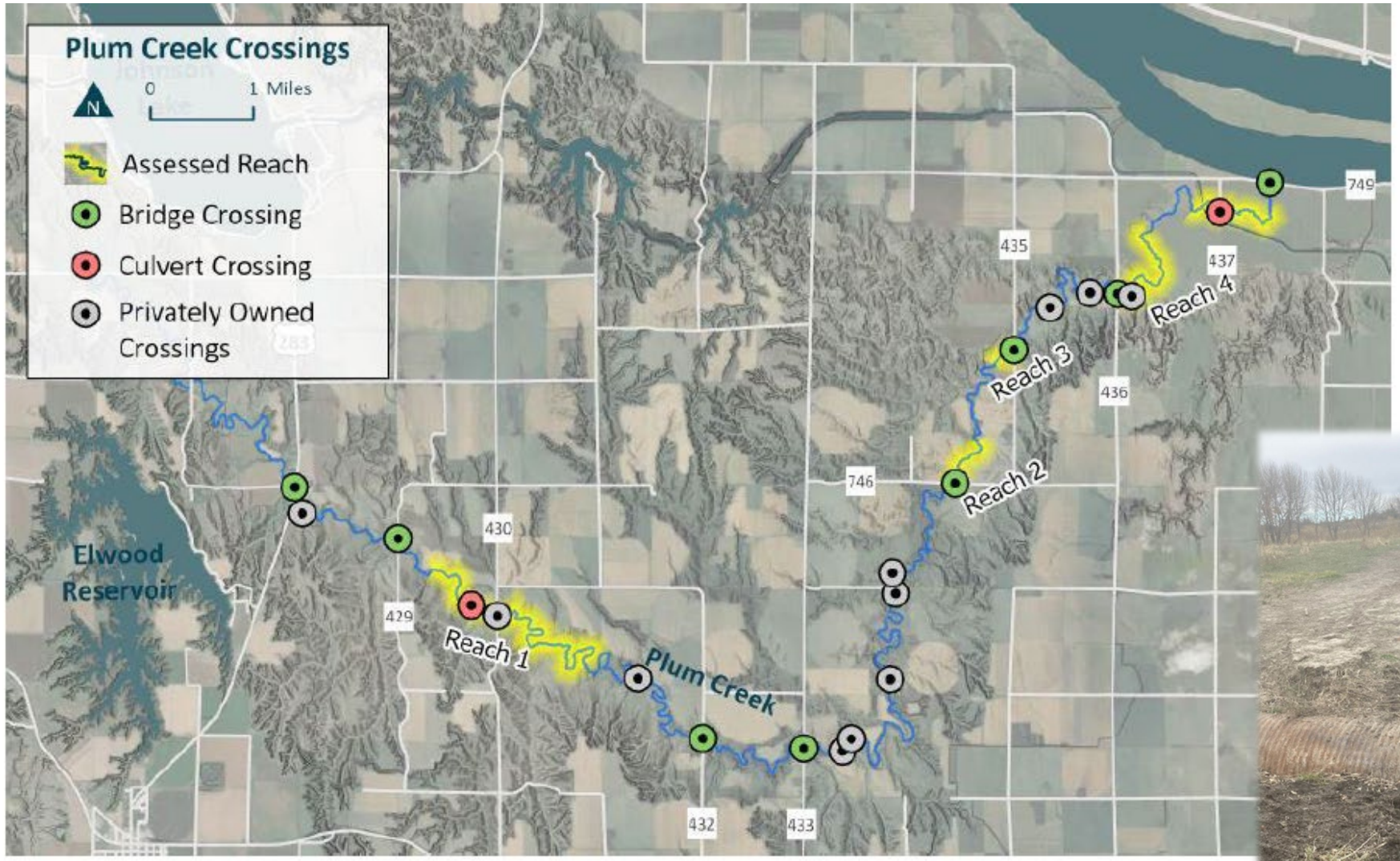
Plum Creek Geomorphic Reconnaissance & Hydrologic Assessment, Inter-Fluve, July 19, 2024

PLUM CREEK ASSESSMENT

- One active USGS gage data
- Baseflow separation (~12 cfs)
- Modeled 25 – 1,400 cfs
- 50 cfs = Ordinary High Water Line (OHWL)
- Concerns with long-duration flow > 100 cfs (bank sloughing, erosion, lateral/vertical adjustment)

Plum Creek near Smithfield, NE (06767500)
Photo Credit: John Thornburn, TBNRD
July 3rd @ ~ 100 CFS

PLUM CREEK ASSESSEMET: GEOMORPHOLOGY



PLUM CREEK ASSESSMENT: RISK

Target Release (AF)	Duration of Release (Days)						
	50	75	100	150	200	250	300
13,500	148.1	102.7	80.1	57.4	46.0	39.2	34.7
12,000	133.0	92.7	72.5	52.3	42.2	36.2	32.2
10,000	112.8	79.2	62.4	45.6	37.2	32.2	28.8
8,000	92.7	65.8	52.3	38.9	32.2	28.1	25.4
6,000	72.5	52.3	42.2	32.2	27.1	24.1	22.1
4,000	52.3	38.9	32.2	25.4	22.1	20.1	18.7
2,000	32.2	25.4	22.1	18.7	17.0	16.0	15.4
1,000	22.1	18.7	17.0	15.4	14.5	14.0	13.7
500	17.0	15.4	14.5	13.7	13.3	13.0	12.8

Moderate Risk

Plum Creek Flow (cfs)*

Low Risk

Moderate Risk

*Plum Creek Flow includes an assumed 12 cfs of baseflow.

PLUM CREEK MITIGATION: COSTS

- Capital cost in first 5-yrs (mitigation & infrastructure)
- Cost estimate based on sub-reaches (2.2 miles)
- Extrapolated to full reach (28.4 miles)
- 2 public crossings, at least 11 ag. Crossings
- Utilized a median cost for Trade Off analysis

	50 cfs Scenario		100cfs Scenario	
Item	**Lower**	**Upper**	**Lower**	**Upper**
Plum Creek Mitigation* Costs	$0	$1,230,662	$971,575	$7,513,516
Culverts & Stream Crossings	$449,000	$449,000	$449,000	$449,000
Total	$449,000	$1,679,662	$1,420,575	$7,962,516
30% Contingency	$134,700	$503,899	$426,173	$2,388,755
Total w/ contingency	***$583,700***	***$2,183,561***	***$1,846,748***	***$10,351,271***
Median		**$1,383,630**		**$6,099,009**

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ELWOOD RESERVOIR GRAVITY OUTLET

ELWOOD GRAVITY OUTLET

- ✓In collaboration with CNPPID
- ✓Utilization of existing infrastructure (E65 canal / Elwood Evacuation Pipeline)
- ✓Initially four alternatives, narrowed to two
- ✓Evaluation of 50 and 100 cfs

E65 Canal @ Siphon 3 Outlet

Evacuation Pipeline Outlet

RJH CONSULTANTS, INC.

Concept and Cost Opinions for Conveyance Facilities to Plum Creek, RJH Consultants, July 17, 2024

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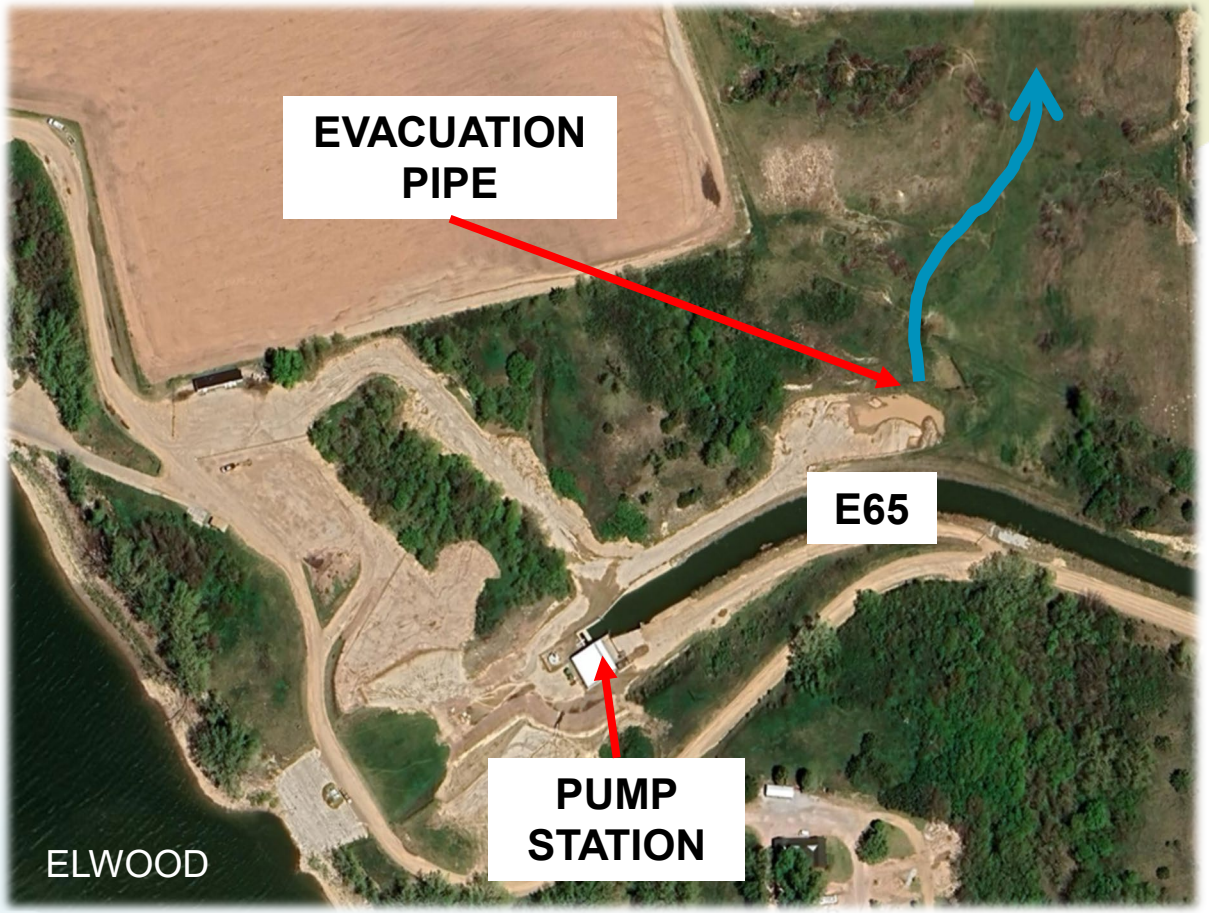
ELWOOD GRAVITY OUTLET: ALT A

- **Alternative A: Open Channel**
  - Spill water from 42-inch Elwood evacuation pipeline
  - Discharge to 5,900-ft riprap lined channel through natural drainage to Highway 283 culvert
  - Crossing to maintain vehicle access along E65
- **Challenges**
  - Confirm soil depth over Siphon 3
  - 404 permitting
  - Three property owners



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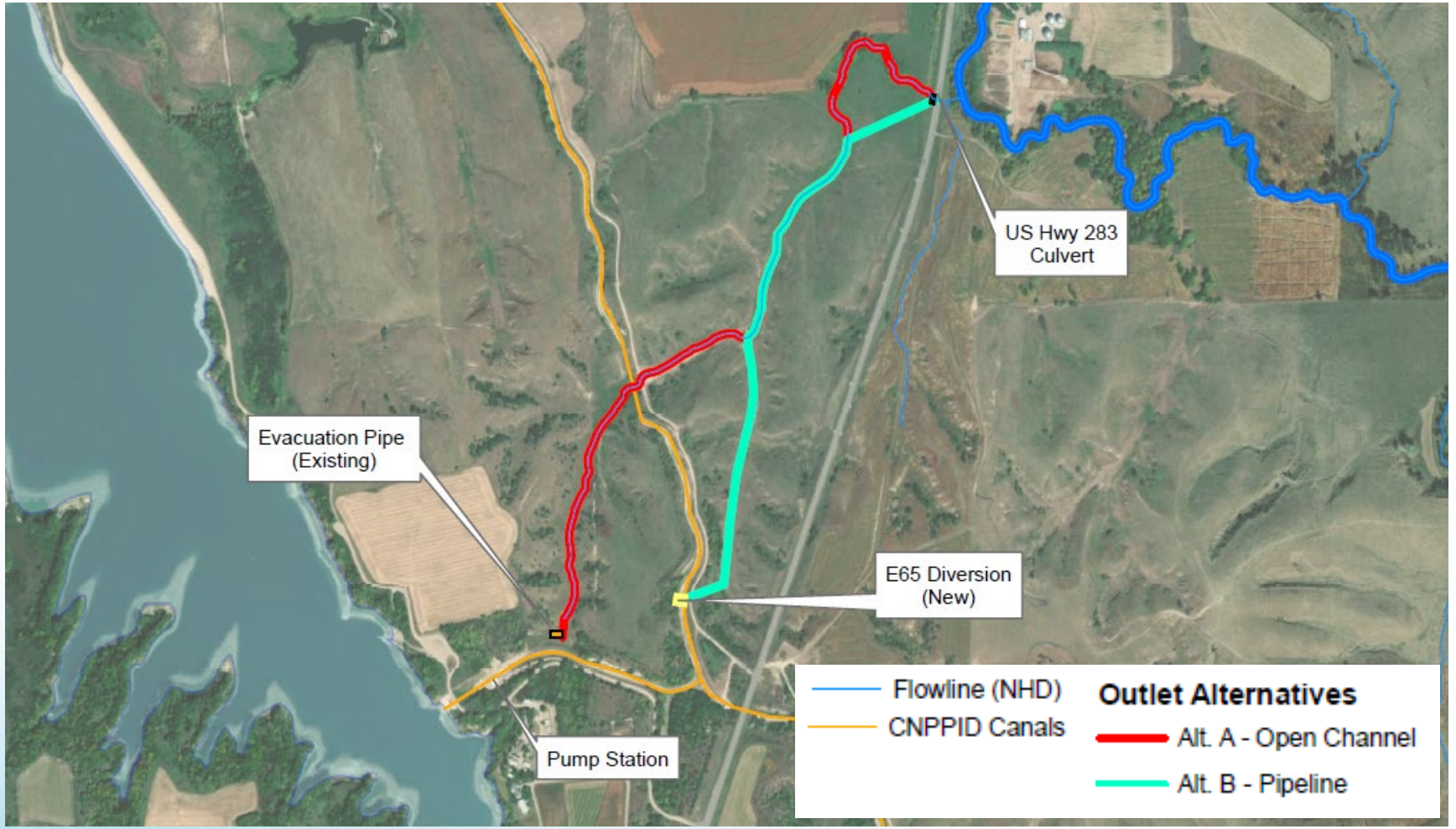
ELWOOD GRAVITY OUTLET: ALT B

- **Alternative B: Pipeline**
  - Spill water from new turnout on E65 ~2,250 ft north of pump station
  - Headgate south of Siphon 3
  - 4,500-ft pipeline to Highway 283 culvert
- **Challenges**
  - Higher construction cost
  - Two private property owners
  - Managing water availability

From E65 near turnout location looking north towards Plum Creek

ELWOOD GRAVITY OUTLET



ELWOOD GRAVITY OUTLET COSTS

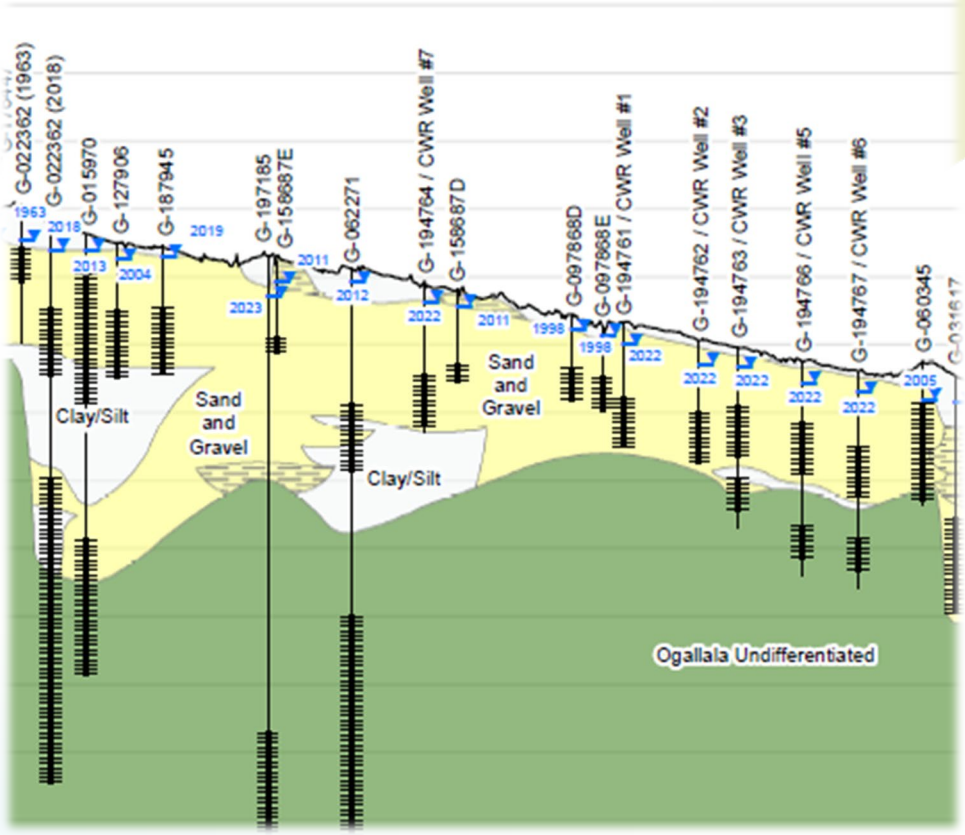
- Feasibility-level design (1-15%)
- Open channel vs Pipeline (Steel & PVC)
- 30% contingency included
- Does not include permitting, land, O&M, Highway 283 culvert considerations

Concept	OPPC ($)
Alt A1: Open Channel, 100 cfs	$3,300,000
Alt A2: Open Channel, 50 cfs	$2,820,000
Alt B1: Steel Pipeline, 100 cfs	$9,470,000
Alt B2: Steel Pipeline, 50 cfs	$7,500,000
Alt B1: PVC Pipeline, 100 cfs	$7,144,000
Alt B2: PVC, Pipeline, 50 cfs	$6,340,000

RECAPTURE WELL ASSESSMENT

RECAPTURE WELL ASSESSMENT

- ✓Complete hydrogeologic cross-sections
- ✓Evaluate the potential of natural conveyance/drains
- ✓Establish Recapture Zones (1-3)
- ✓Develop/site 7 conceptual recapture well areas with conveyance
- ✓Complete a well performance evaluation to determine well/pipeline capacity and infrastructure requirements based on available recharge (Program & NeDNR)
- ✓Estimated well and pipeline costs for each conceptual recapture well area in Recapture Zones 1-3 (Program & NeDNR)



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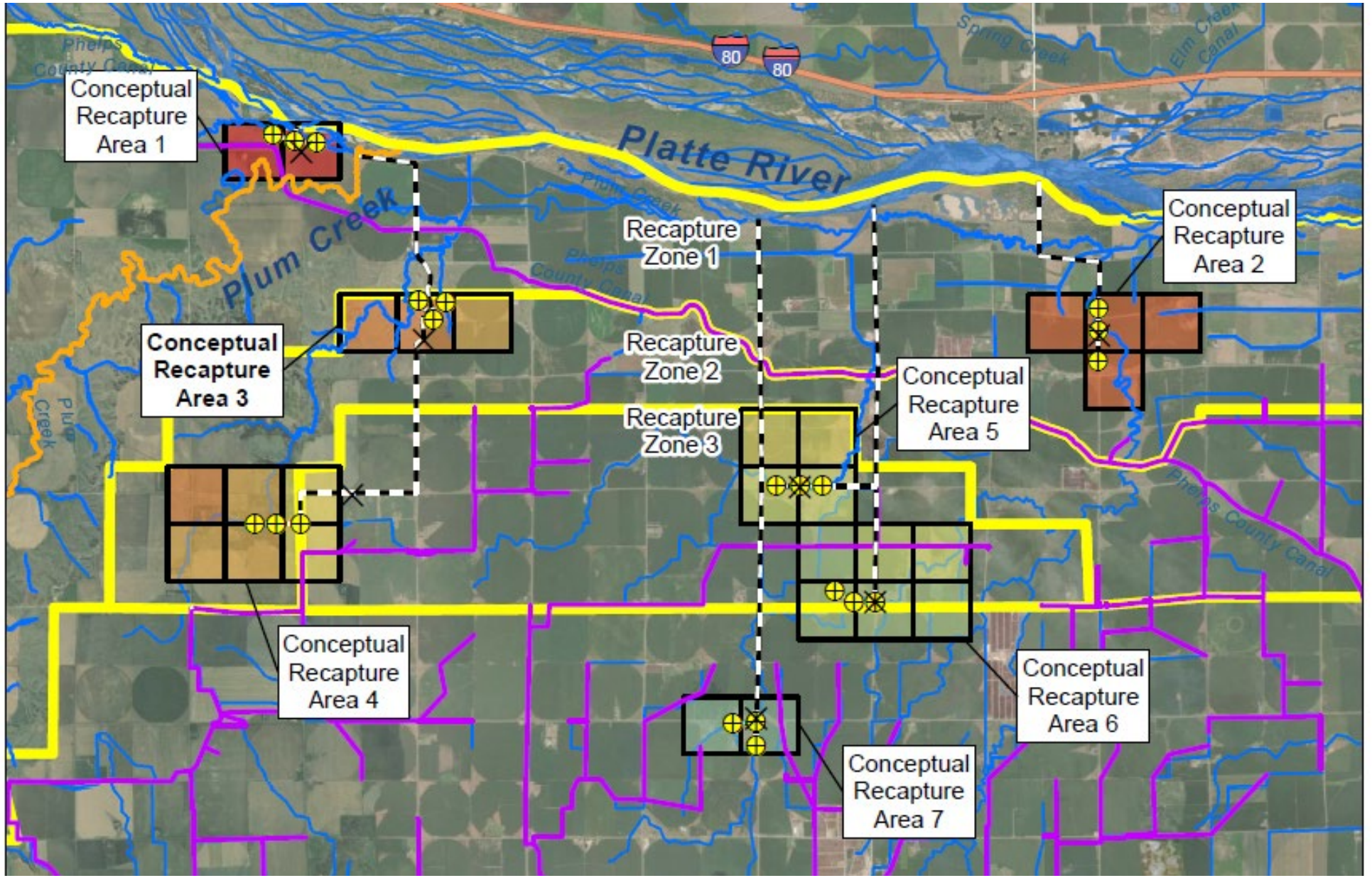
RECAPTURE ZONES/CONCEPTUAL RECAPTURE AREAS



Legend

- Conceptual Recapture Well Placement
- Closest Power Location
- Plum Creek
- NHD Streams
- CNPPID Canal/Lateral
- Conceptual Conveyance
- COHYST Cell
- Recapture Zone

COHYST Stream Depletion Factor (%)

- 0.21 - 10.0
- 10.01 - 20.0
- 20.01 - 30.0
- 30.01 - 40.0
- 40.01 - 50.0
- 50.01 - 60.0
- 60.01 - 70.0
- 70.01 - 80.0
- 80.01 - 90.0
- 90.01 - 100.0

RECAPTURE WELL/PIPELINE COSTS

Platte River Recovery Implementation Program

Elwood + Phelps Recharge & 8 Existing Recapture Wells

Program Well and Pipeline Requirements and Capital Cost for Additional Recapture Wells

Requirement	Recapture Zone 1 (Recapture Area 1 & 2)		Recapture Zone 2 (Recapture Area 3 & 4)		Recapture Zone 3 (Recapture Area 5 & 6)	
Well Count	6		6		6	
Well Capacity (gpm/well)	600		500		1000	
Well Cost ($)*	$475,474		$653,862		$709,038	
Conveyance Pipeline (Miles)	2.53 miles[1]		5.61 miles[2]		4.68 miles[3]	
Pipeline Cost ($)*	PVC	Steel	PVC	Steel	PVC	Steel
	$1,727,220	$2,630,343	$4,180,477	$6,555,857	$7,401,977	$12,108,169
OPPC ($)*	**$2,202,694**	**$3,105,817**	**$4,834,340**	**$7,209,720**	**$8,111,015**	**$12,817,207**

*Costs include a 30% design and construction contingency

1. Recapture Zone 1 includes the following estimated pipe capacities: 10" = 0.63 mi, 12" = 0.19 mi, 14" = 1.72 mi
2. Recapture Zone 2 includes the following estimated pipe capacities: 8" = 0.57 mi, 12" = 3.11 mi, 18" = 1.93 mi
3. Recapture Zone 3 includes the following estimated pipe capacities: 12" = 0.38 mi, 16" = 0.38 mi, 18" = 1.46 mi, 24" = 2.46 mi

NEBRASKA DEPT. OF NATURAL RESOURCES

Elwood Recharge

NeDNR Well and Pipeline Requirements and Capital Cost for New Recapture Wells

Requirement	Recapture Zone 1 (Recapture Area 1 & 2)		Recapture Zone 2 (Recapture Area 3 & 4)		Recapture Zone 3 (Recapture Area 5 & 6)	
Well Count	6		6		6	
Well Capacity (gpm/well)	900		700		900	
Well Cost ($)*	$521,365		$684,457		$693,741	
Conveyance Pipeline (Miles)	2.53 miles[1]		5.60 miles[2]		4.68 miles[3]	
Pipeline Cost ($)*	PVC	Steel	PVC	Steel	PVC	Steel
	$2,642,526	$4,155,853	$5,756,970	$9,287,854	$7,301,429	$11,940,589
OPPC ($)*	**$3,163,891**	**$4,677,218**	**$6,441,427**	**$9,972,311**	**$7,995,170**	**$12,634,330**

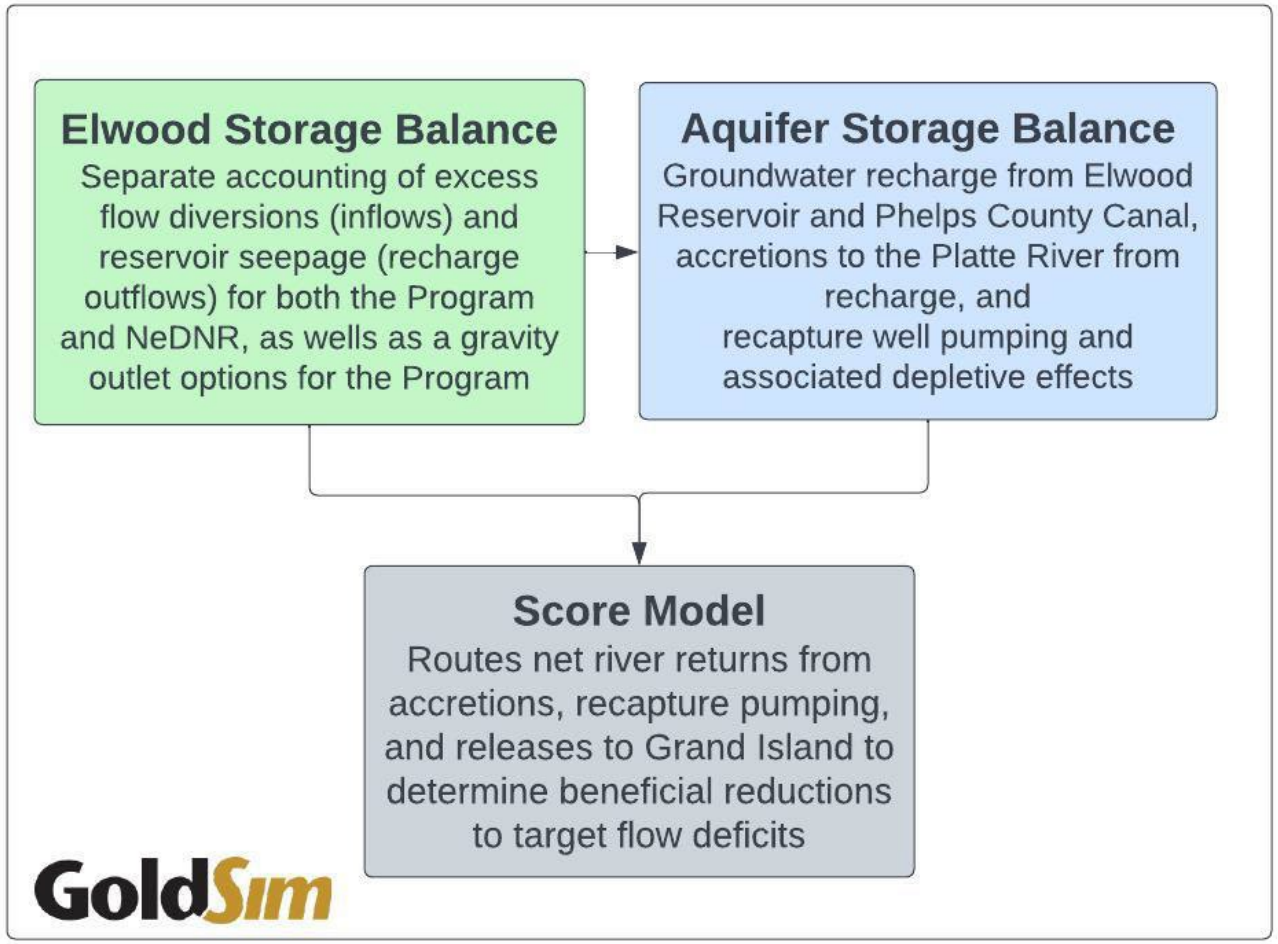
*Costs include a 30% design and construction contingency

1. Recapture Zone 1 includes the following estimated pipe capacities: 10" = 0.63 mi, 14" = 0.19 mi, 18" = 1.72 mi
2. Recapture Zone 2 includes the following estimated pipe capacities: 10" = 0.57 mi, 12" = 0.19 mi, 16" = 2.92 mi, 20" = 1.93 mi
3. Recapture Zone 3 includes the following estimated pipe capacities: 10" = 0.38 mi, 14" = 0.38 mi, 18" = 1.46 mi, 24" = 2.46 mi

TRADE OFF ANALYSIS

TRADE OFF ANALYSIS: GOLDSIM

- GoldSim Model developed to replicate Elwood Score Model + gravity outlet + new/existing recapture wells
- Developed in consultation w/EDO staff
- Validated with established scores (Cook well and Elwood)
- Utilizes accounting records (2015-2023) to establish antecedent conditions
- Supports scoring of project portfolios 1947-1994 and 1995-2023 based on target flow deficits at Grand Island



TRADE OFF ANALYSIS: SCENARIOS

Platte River Recovery Implementation Program

Elwood + Phelps Recharge & 8 Existing Recapture Wells

Scenario	Scenario Description
1.0	No Elwood Outlet, 8 Existing Recapture Wells, No New Recapture Wells (Program Baseline)
1.1	No Elwood Outlet, 8 Existing Recapture Wells, New Recapture Wells (Zone 1)
1.2	No Elwood Outlet, 8 Existing Recapture Wells, New Recapture Wells (Zone 2)
1.3	No Elwood Outlet, 8 Existing Recapture Wells, New Recapture Wells (Zone 3)
2.0	50 cfs Elwood Outlet, 7 Existing Recapture Wells, No New Recapture Wells
3.0	100 cfs Elwood Outlet, 6 Existing Recapture Wells, No New Recapture Wells

Established Score* = 6,800 AF

*Established Score: Program established score based on the aggregate score for Elwood Reservoir (2,800 AF), Phelps County Canal (2,700 AF), and an estimated 1,300 AF for the 8 existing recapture wells (based on an approved score of 160 AF for the Cook well). Does not include Cottonwood BSR.

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TRADE OFF ANALYSIS: SCENARIOS

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Elwood Recharge

Scenario	Scenario Description
4.0	Elwood Reservoir Recharge Only (NeDNR Baseline)
4.1	Elwood Reservoir Recharge and New Recapture Wells (Zone 1)
4.2	Elwood Reservoir Recharge and New Recapture Wells (Zone 2)
4.3	Elwood Reservoir Recharge and New Recapture Wells (Zone 3)

Estimated Score* = 3,400 AF (Based on Scenario 4)

*Estimated Score: NeDNR estimated score above Overton based on the approximate modeled results of Elwood Reservoir Recharge Only (Scenario 4.0). Does not include WMC Losses to Grand Island.

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TRADE OFF ANALYSIS - RESULTS

Scenario	Scenario Description	Elwood Outlet Capacity (cfs)	Existing Recapture Well Count	New Recapture Well Count	New Well Yield (gpm)	New Well Yield Per Well for 6 wells (gpm)	Established Score (1947-1994)	Score (1947-1994)	Incremental Gain from Established Score (1947-1994)	Score (1995-2023)	Incremental Gain from Established Score (1995-2023)
1.0	No Elwood Outlet, 8 Existing Recapture Wells, No New Recapture Wells (Program Baseline)	0	8	0	-	-	6,800[1]	7,089	289	6,377	-423
1.1	No Elwood Outlet, 8 Existing Recapture Wells, New Recapture Wells (Zone 1)	0	8	6	3600	600		7,687	887	6,853	53
1.2	No Elwood Outlet, 8 Existing Recapture Wells, New Recapture Wells (Zone 2)	0	8	6	3000	500		8,055	1,255	7,078	278
1.3	No Elwood Outlet, 8 Existing Recapture Wells, New Recapture Wells (Zone 3)	0	8	6	6000	1000		10,435	3,635	8,864	2,064
2.0	50 cfs Elwood Outlet, 7 Existing Recapture Wells, No New Recapture Wells	50	7	0	-	-		11,265	4,465	10,391	3,591
3.0	100 cfs Elwood Outlet, 6 Existing Recapture Wells, No New Recapture Wells	100	6	0	-	-		11,809	5,009	11,122	4,322
4.0	Elwood Reservoir Recharge Only (NeDNR Baseline)	0	0	0	-	-	3,400[2]	3,422	22	3,545	145
4.1	Elwood Reservoir Recharge and New Recapture Wells (Zone 1)	0	0	6	5400	900		4,526	1,126	4,424	1,024
4.2	Elwood Reservoir Recharge and New Recapture Wells (Zone 2)	0	0	6	4200	700		5,111	1,711	4,820	1,420
4.3	Elwood Reservoir Recharge and New Recapture Wells (Zone 3)	0	0	6	5400	900		7,209	3,809	6,487	3,087

1. Established Score: Program established score based on the aggregate score for Elwood Reservoir (2,800 AF), Phelps County Canal (2,700 AF), and an estimated 1,300 AF for the 8 existing recapture wells (based on an approved score of 160 AF for the Cook well). Does not include Cottonwood BSR.
2. NeDNR estimated score above Overton based on the approximate modeled results of Elwood Reservoir Recharge Only (Scenario 4.0). Does not include WMC Losses to Grand Island.

TRADE OFF ANALYSIS - RESULTS

Platte River Recovery Implementation Program (Established Score = 6,800 AF)

- **Scenario 3.0**: 100 cfs gravity outlet with 6 existing wells results in the highest incremental score adding 5,009 AF
- **Scenario 1.3**: If an outlet is not pursued, six additional wells in Recapture Zone 3 result in the highest incremental score adding 3,635 AF

NEBRASKA DEPT. OF NATURAL RESOURCES (Estimated Score = 3,400 AF)

- **Scenario 4.3**: If the NeDNR were to develop a recapture well program, six new wells in Recapture Zone 3 result in the highest incremental score adding 3,809 AF

COST ANALYSIS

COST ANALYSIS

- **Total Capital Costs**
  - Gravity Outlet + Plum Creek + Recapture Wells + Conveyance Pipelines
- **O&M (50-Yr Project Life)**
  - Wells – pump replacement, SCADA, HP/electric, TBNRD staff time, etc.
  - Gravity outlet – typical O&M
  - Plum Creek - cleanout, phragmites, beavers, easements, etc.
  - Includes a 10% contingency / escalated at 3%/yr for 50-yr.
- **Total Costs ($)** = Total Capital Costs + O&M (50-Yr)
  - Plus $25,000 for permitting of recapture wells or $100,000 for permitting of outlet/stream
- **Unit Costs ($/AF)** = Total Costs ($) / Total Score (50-Yr Project Life) (AF)

COST SUMMARY

Scenario	Cost Scenario	Scenario Name	Total Capital Cost	Total Costs (50-Yr Project Life)	Annual Score (AF/Yr) (1947-1994)	Total Score (AF) (50-yr Project Life)	Unit Cost ($/AF) (1947-1994)	Annual Score (AF/Yr) (1995-2023)	Total Score (AF) (50-yr Project Life)	Unit Cost ($/AF) (1995-2023)
1	1.0	No Elwood Outlet, 8 Existing Recapture Wells, No New Recapture Wells (Program Baseline)	$0	$0	289	14,449	$0	-423	-21,172	$0
1.1	1.1A	No Elwood Outlet, 8 Existing Recapture Wells, New Recapture Wells (Zone 1) (PVC)	$2,202,694	$17,113,239	887	44,351	$386	53	2,645	$6,470
	1.1B	No Elwood Outlet, 8 Existing Recapture Wells, New Recapture Wells (Zone 1) (Steel)	$3,105,817	$18,016,362	887	44,351	$406	53	2,645	$6,811
1.2	1.2A	No Elwood Outlet, 8 Existing Recapture Wells, New Recapture Wells (Zone 2) (PVC)	$4,834,340	$18,583,968	1,255	62,741	$296	278	13,885	$1,338
	1.2B	No Elwood Outlet, 8 Existing Recapture Wells, New Recapture Wells (Zone 2) (Steel)	$7,209,720	$20,959,348	1,255	62,741	$334	278	13,885	$1,510
1.3	1.3A	No Elwood Outlet, 8 Existing Recapture Wells, New Recapture Wells (Zone 3) (PVC)	$8,111,015	$25,573,974	3,635	181,762	$141	2,064	103,214	$248
	1.3B	No Elwood Outlet, 8 Existing Recapture Wells, New Recapture Wells (Zone 3) (Steel)	$12,817,207	$30,280,166	3,635	181,762	$167	2,064	103,214	$293
2	2.0	50 cfs Elwood Outlet (Open Channel), 7 Existing Recapture Wells	$4,199,734	$7,407,565	4,465	223,257	$33	3,591	179,557	$41
	2A	50 cfs Elwood Outlet (PVC), 7 Existing Recapture Wells	$7,723,550	$10,931,381	4,465	223,257	$49	3,591	179,557	$61
	2B	50 cfs Elwood Outlet (Steel), 7 Existing Recapture Wells	$8,886,350	$12,094,181	4,465	223,257	$54	3,591	179,557	$67
3	3	100 cfs Elwood Outlet (Open Channel), 6 Existing Recapture Wells	$9,389,201	$20,575,231	5,009	250,446	$82	4,322	216,102	$95
	3A	100 cfs Elwood Outlet (PVC), 6 Existing Recapture Wells	$13,243,009	$24,429,039	5,009	250,446	$98	4,322	216,102	$113
	3B	100 cfs Elwood Outlet (Steel), 6 Existing Recapture Wells	$15,568,609	$26,754,639	5,009	250,446	$107	4,322	216,102	$124
4	4.0	Elwood Recharge Only (No New Infrastructure) - NeDNR Baseline	$0	$0	22	1,091	$0	145	7,234	$0
4.1	4.1A	New Recapture Wells Only (Zone 1) (PVC)	$3,163,891	$20,511,560	1,126	56,320	$364	1,024	51,210	$401
	4.1B	New Recapture Wells Only (Zone 1) (Steel)	$4,677,218	$22,024,887	1,126	56,320	$391	1,024	51,210	$430
4.2	4.2A	New Recapture Wells Only (Zone 2) (PVC)	$6,441,427	$21,815,805	1,711	85,535	$255	1,420	71,022	$307
	4.2B	New Recapture Wells Only (Zone 2) (Steel)	$9,972,311	$25,346,689	1,711	85,535	$296	1,420	71,022	$357
4.3	4.3A	New Recapture Wells Only (Zone 3) (PVC)	$7,995,170	$24,645,754	3,809	190,440	$129	3,087	154,341	$160
	4.3B	New Recapture Wells Only (Zone 3) (Steel)	$12,634,330	$29,284,914	3,809	190,440	$154	3,087	154,341	$190

COST ANALYSIS - RESULTS

Platte River Recovery Implementation Program

- **Scenario 2.0**: 50 cfs gravity outlet (open channel) with 7 existing wells results in the highest incremental score at the lowest cost adding 4,465 AF/yr at a cost cost $7.4M ($33/AF) over the 50-yr life of the project.
- **Scenario 1.3A**: If an outlet is not pursued, six additional wells in Recapture Zone 3 (PVC) results in the highest incremental score at the lowest cost adding 3,635 AF/yr at a cost of $25.6M ($141/AF) over the 50-yr life of the project.

NEBRASKA DEPT. OF NATURAL RESOURCES

- **Scenario 4.3**: If the NeDNR were to develop a recapture well program, six new wells in Recapture Zone 3 (PVC) results in the highest incremental score at the lowest cost adding 3,809 AF/yr at a cost of $24.6M ($129/AF) over the 50-yr life of the project.

PROGRAM QUESTIONS

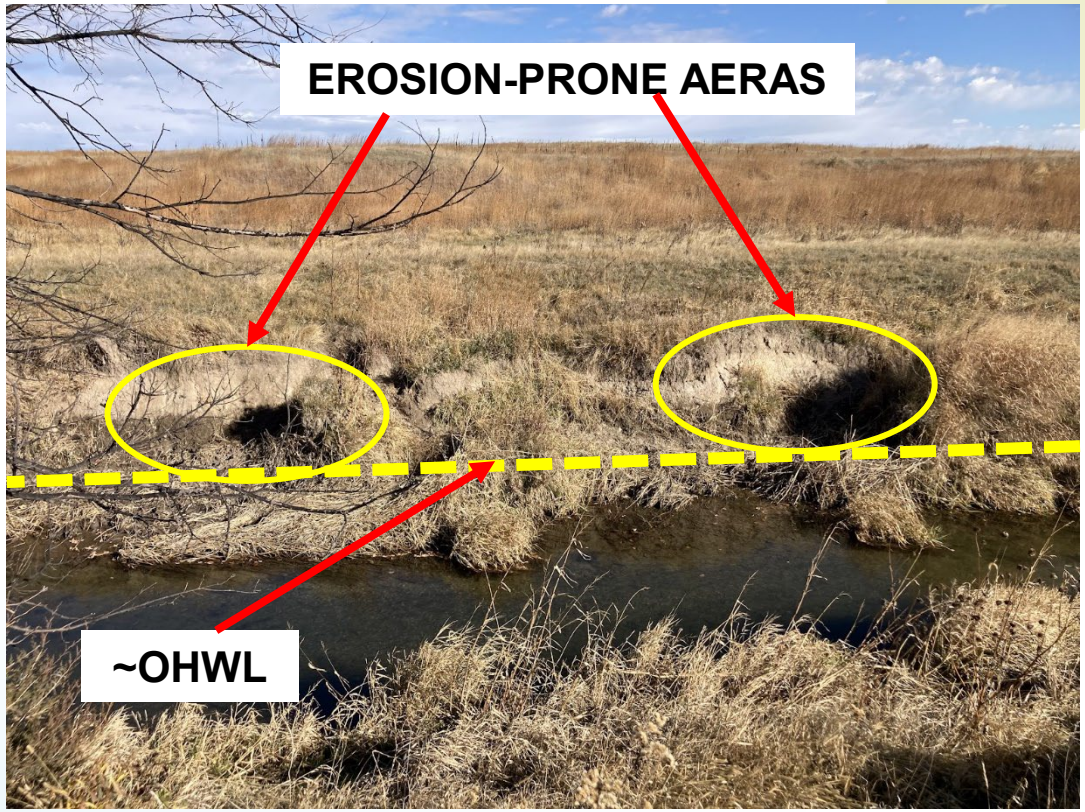
PROGRAM QUESTIONS

1) **What is the capability to convey flows through Plum Creek?**
   - The stream appears fully capable to convey augmented flows up to 100 cfs (112 cfs w/baseflow)
   - Augmented flow of 50 cfs ~ Ordinary High-Water Line would result in minimal impacts (minor bank repairs)
   - Augmented flow of 100 cfs require minor to major bank repairs
   - Shorter-duration, lower flow events result in the lowest geomorphic risk

PROGRAM QUESTIONS

2) What impacts to Plum Creek can be expected?

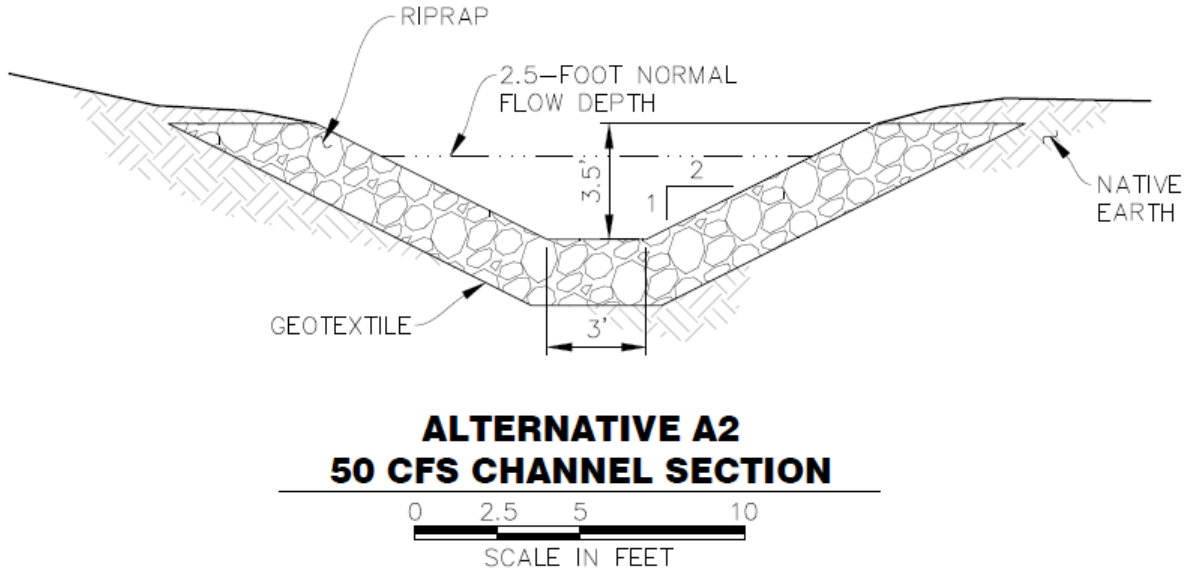
- Infrastructure
  - At least 11 agricultural crossings need upgraded
  - CR430 – replace culvert
  - CR437 – remove dilapidated culverts (on dead-end)
  - Estimated capital cost of $450,000
- Stream Mitigation
  - Capital expenditures for adaptive management for bank repair estimates range from $1.2M to $10M
  - 50 cfs = Minor Bank Repairs (at or below OHWL)
  - 100 cfs = Minor & Major Bank Repairs (above OHWL)



PROGRAM QUESTIONS

3) What are the expectations for a gravity outlet?

- Communication and co-management with CNPPID required
- 50 and 100 cfs were evaluated
- Utilization of existing CNPPID infrastructure is anticipated
- Alternative A – Open Channel (50 cfs) is the least capital cost ($2.28M)
- Alternative B1 – Steel Pipeline (100 cfs) is the most capital cost ($9.47M)



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PROGRAM QUESTIONS

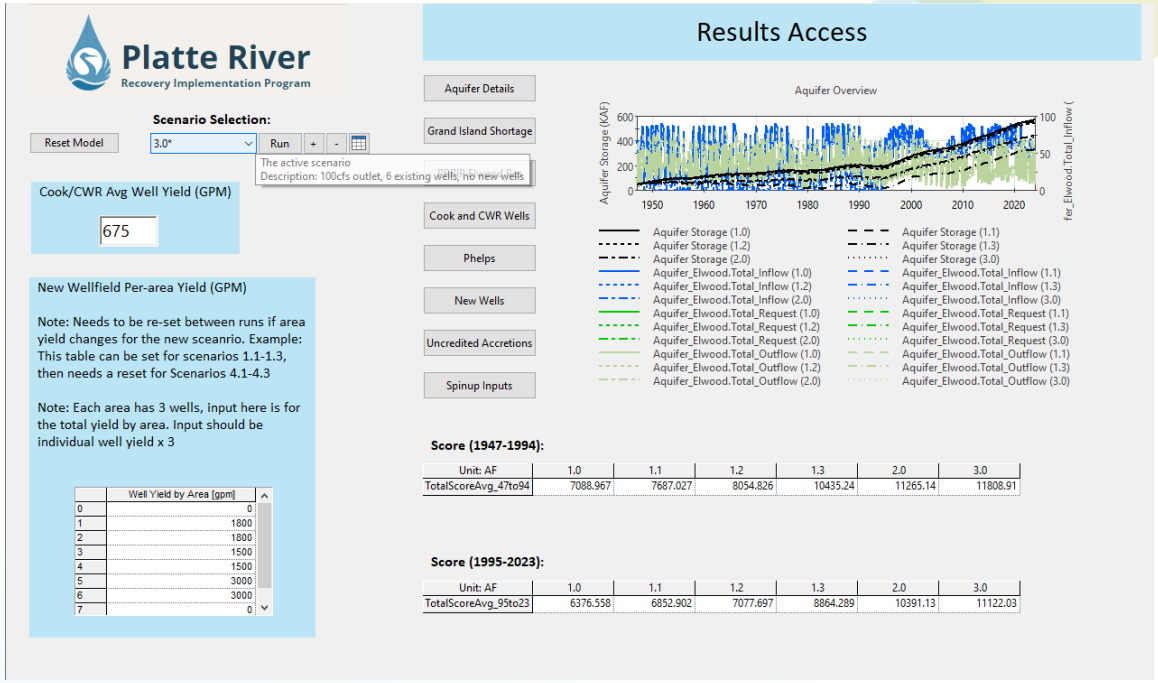
4) Do additional recapture wells improve the net benefit to the river?

- Yes, wells located further from the river yield higher net benefit where impacts to accretions are less.
  - Recapture Zone 1 (close the river) = 887 AF (148 AF/well)
  - Recapture Zone 3 (further from the river) = 3,635 AF (606 AF/well)
- Cost increase when a pipeline becomes necessary.
- Natural conveyance not feasible/practical (transit loss, beavers, phragmites, etc.) further from the river.

PROGRAM QUESTIONS

5) How about a combination of a gravity outlet and recapture wells?

- Based on currently available recharge, 8 existing wells, in combination with an Elwood Reservoir gravity outlet, results in the maximum net benefit to the stream
  - 50 cfs + 7 existing wells adds 4,465 AF to the established score of 6,800 AF
  - 100 cfs + 6 existing wells adds 5,009 AF to the established score of 6,800 AF
- Capacity to recapture is largely dependent on the volume of excess flows stored and managed in Elwood Reservoir (i.e. outlet decreases available recharge)
- A management plan is recommended for the existing 8 wells if used in combination with a gravity outlet



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PROGRAM QUESTIONS

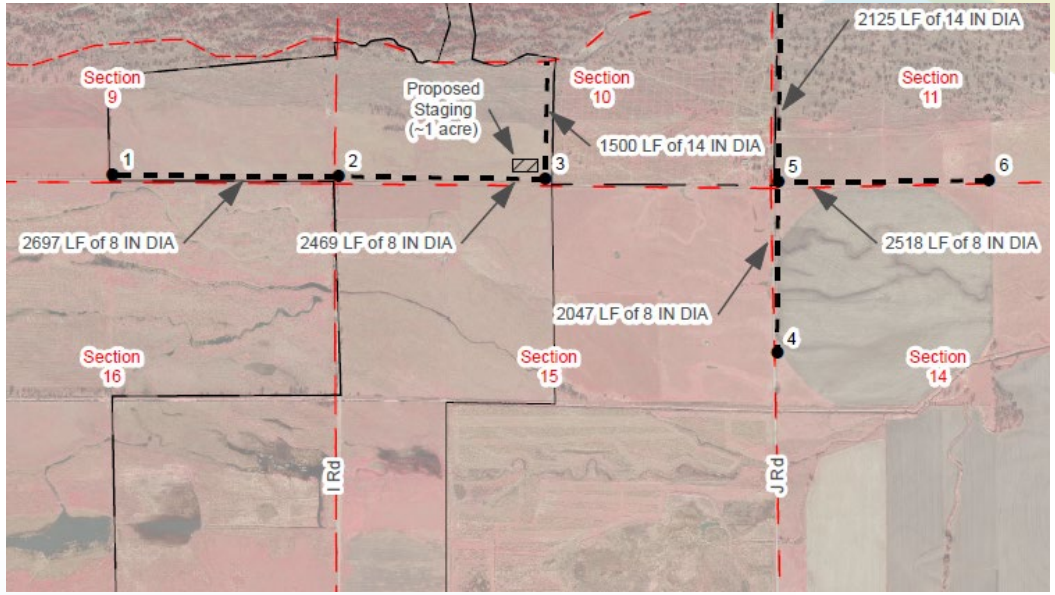
6) What is the most cost-effective method to leverage excess flows?

- The most cost-effective alternative is the 50 cfs gravity outlet utilizing an open channel, with the use of existing recapture wells, cost $7.4M ($33/AF) over 50-year project life cycle
- If a gravity outlet isn't pursued, Recapture Zone 3 (PVC), $25.6M ($141/AF) over 50-yr project life is the most the most cost-effective

NEDNR QUESTIONS

NEDNR QUESTIONS

7) **If a recapture well program was developed, how effective are recapture wells in reducing shortages above Overton?**
   - New wells can offset up to 1,100 AF (183 AF/well) in Recapture Zone 1
   - As much as 3,800 AF (633 AF/well) in Recapture Zone 3



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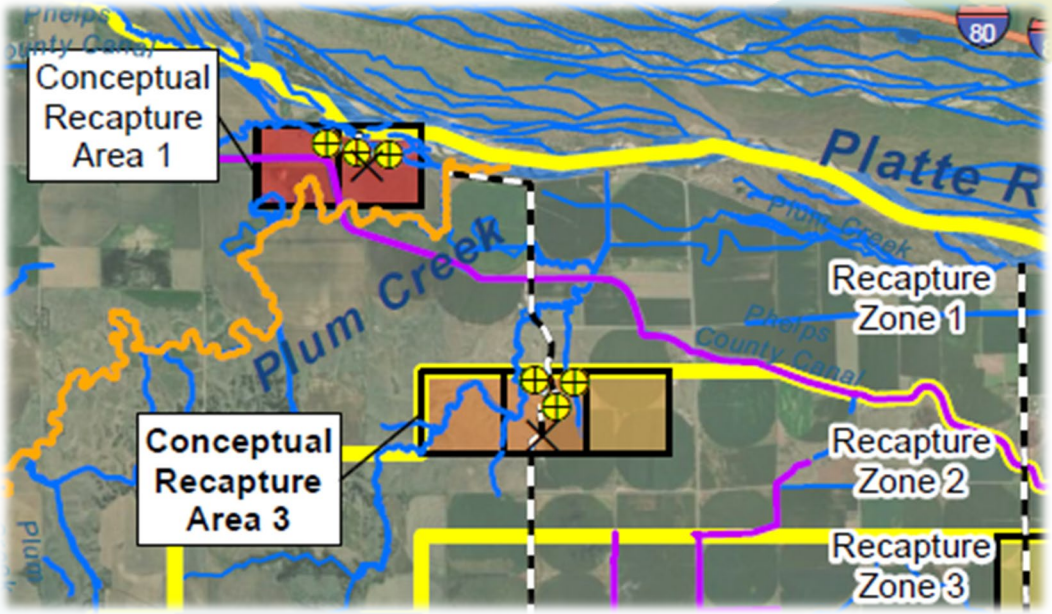
NEDNR QUESTIONS

8) What is the most cost-effective method for NeDNR to maximize recharge flows?

- Recapture Zone 3, assuming a PVC pipeline, cost $24.6M, or $129/AF, over a 50 yr project life cycle
- SDF 60-70%, or 3-4 miles south of the Platte River



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CONSIDERATIONS FOR NEXT STEPS

CONSIDERATIONS FOR NEXT STEPS

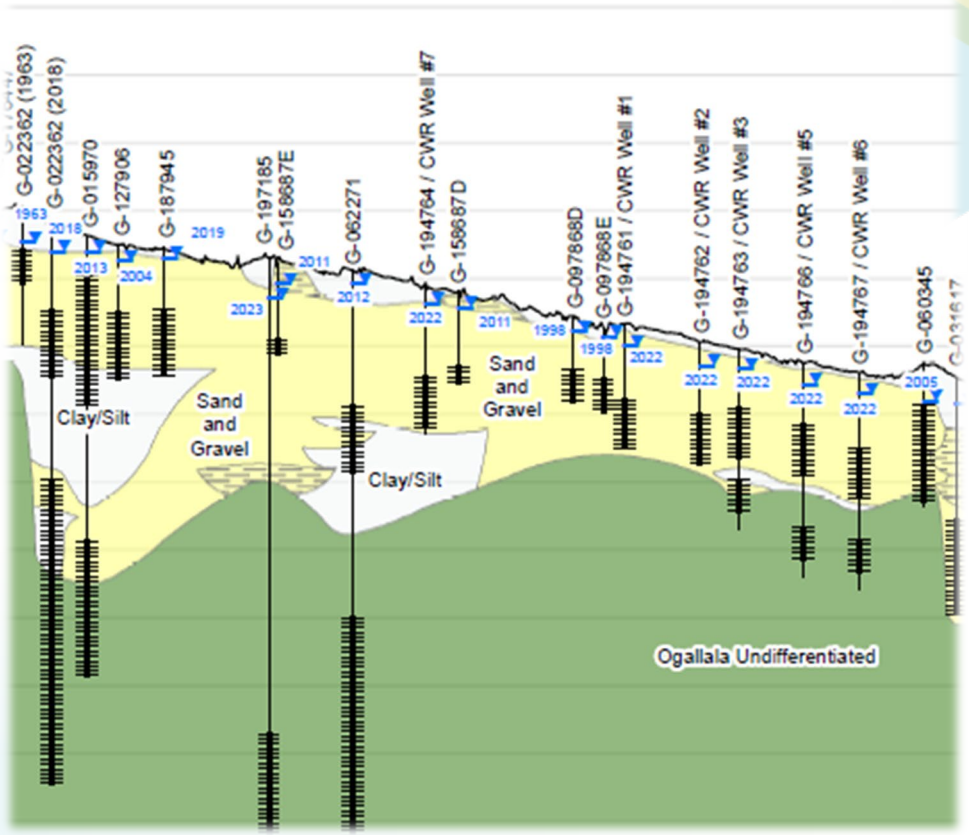
- **Hydrogeologic Studies** – additional/new recapture wells should be sited based on a site-specific evaluation of hydrogeology and aquifer conditions.

- **Elwood Reservoir Operations** – modeling assumes status quo (water pumped into Elwood). Results will change after the new E65 siphon is complete. Model refinements will be necessary.

CONSIDERATIONS FOR NEXT STEPS

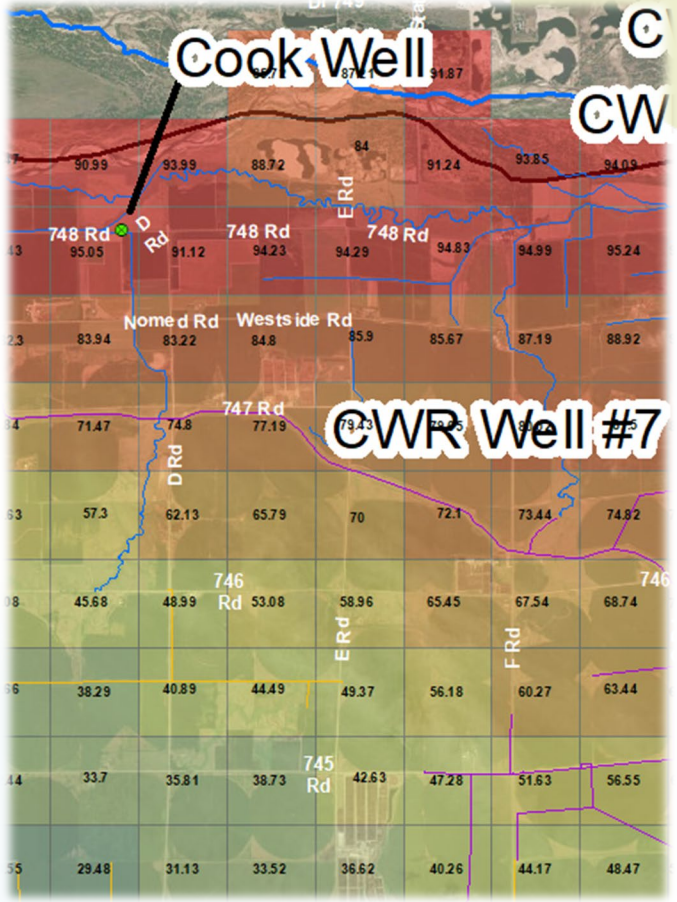
- **Alluvial Saturated Sand** – existing recapture wells pump from alluvial saturated sand. Areas further away may include pumping from the Ogallala.

- **Aquifer Accounting** – the Program would benefit from a Recapture Well Operations & Management Plan to ensure pumping is sustainable.



CONSIDERATIONS FOR NEXT STEPS

- **Model Refinement** – Unit Response Functions (URFs) used by the Program (IDS AWAS) differ from NeDNR (COHYST).
- **Collective Scoring –** historically, all Program projects are scored individually. This exercise highlights the benefit of collectively scoring net benefit to the river.
- **Geomorphic Assessment Phase 2 -** H&H modeling would need to be advanced and supported by additional survey and stream assessment to support refined costs.



CONSIDERATIONS FOR NEXT STEPS

- **Cost Estimates**
  - All cost were established at a reconnaissance level resulting in conservative estimates.
  - A 30% contingency was utilized on all cost.
  - A detailed cost analysis should be refined in subsequent phases.

- **Plum Creek Monitoring –** Ongoing streamflow monitoring on Plum Creek is recommended.

RJH CONSULTANTS, INC.

LRE WATER

CONNECTING WATER TO LIFE

inter·fluve

ELWOOD EVACUATION PIPELINE

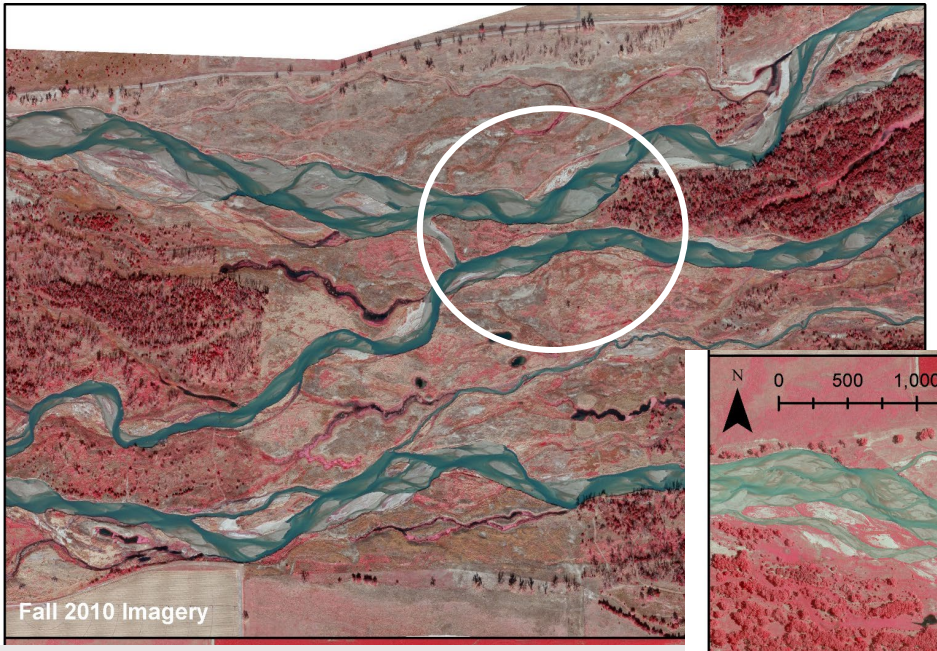
OUTLET LOOKING NORTH

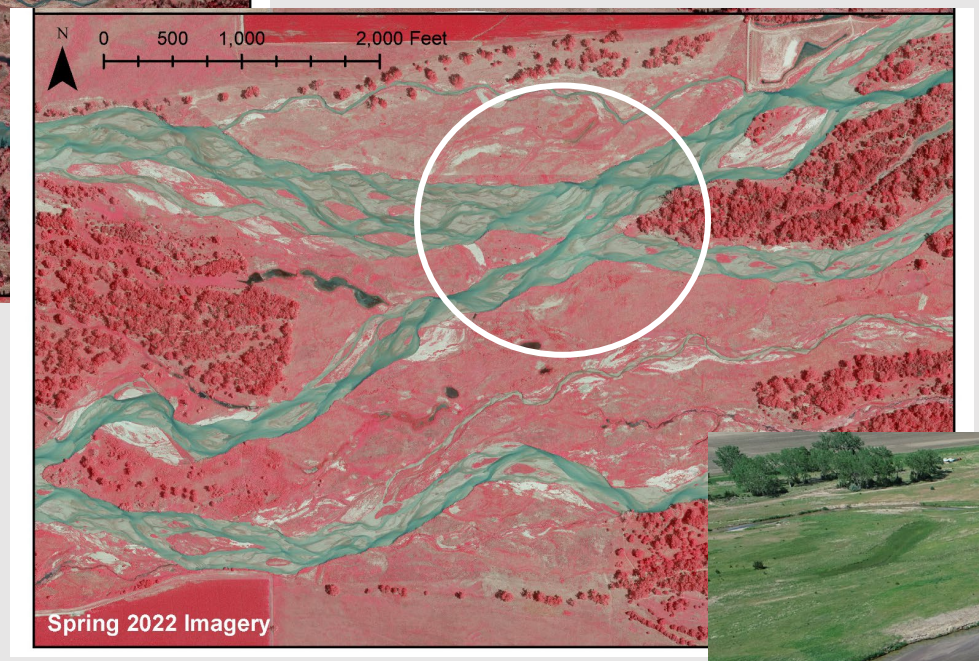
ELWOOD EVACUATION PIPELINE

OUTLET

Wyoming Flow Split Project

Libby Casavant, P.E.


Fall 2010 Imagery


N
0
500
1,000
2,000 Feet
Spring 2022 Imagery


Spring 2024

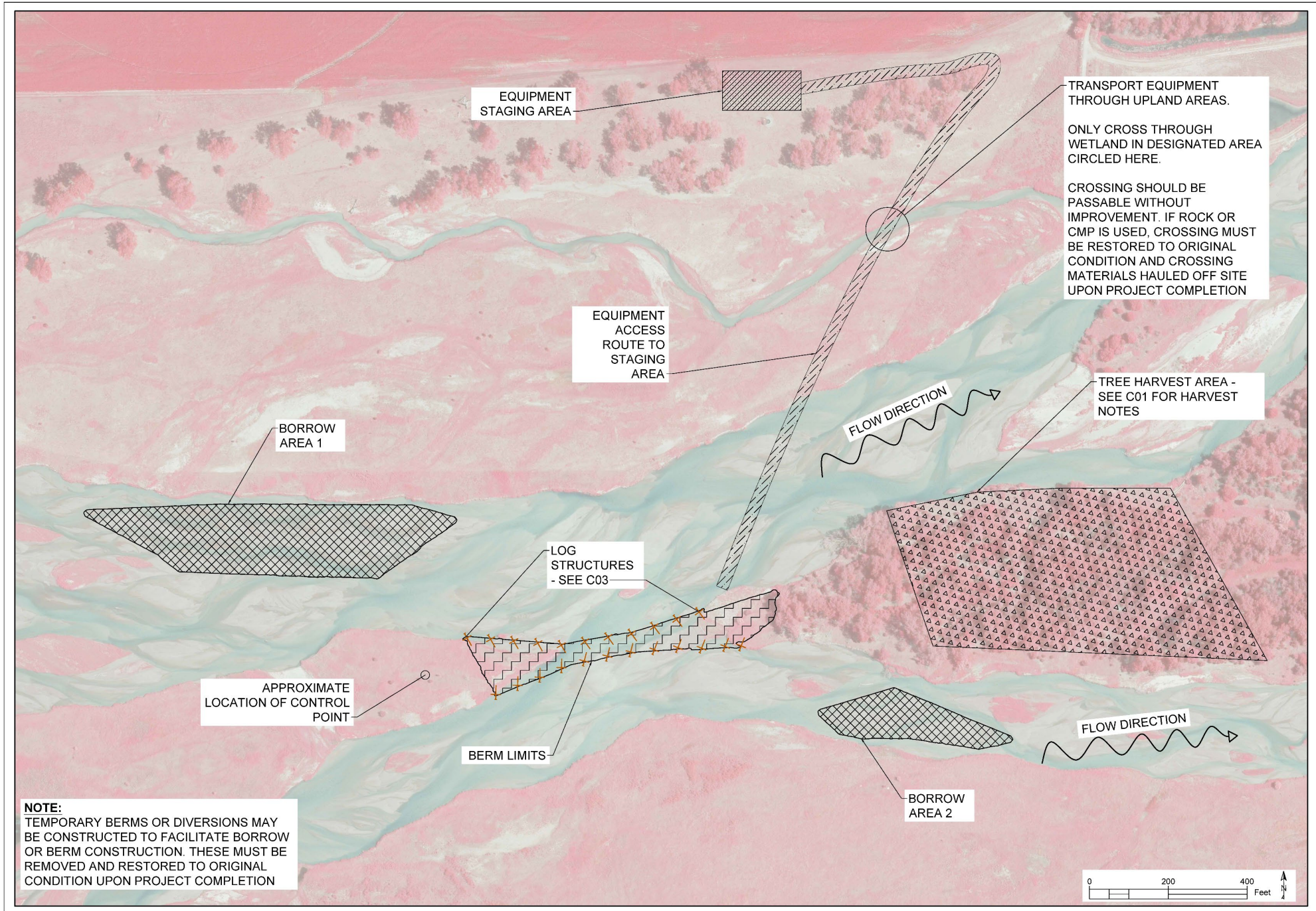
Wetland Delineation: August 2023

Permit Issued: March 2024

Bid Selection: April 2024

Construction: May to June 2024

Seeding: Winter 2024



MARK	DESCRIPTION	DATE

DESIGNED	DRAWN	CHECKED	APPROVED
OCT 2023	DEC 2023	---	---

Headwaters Corporation
405 Urban Street, Suite 401
Lakewood, CO 80228
(P) 720-524-6115

WYOMING PROPERTY FLOW SPLIT CORRECTION BERM

GENERAL SITE PLAN AND SURVEY CONTROL

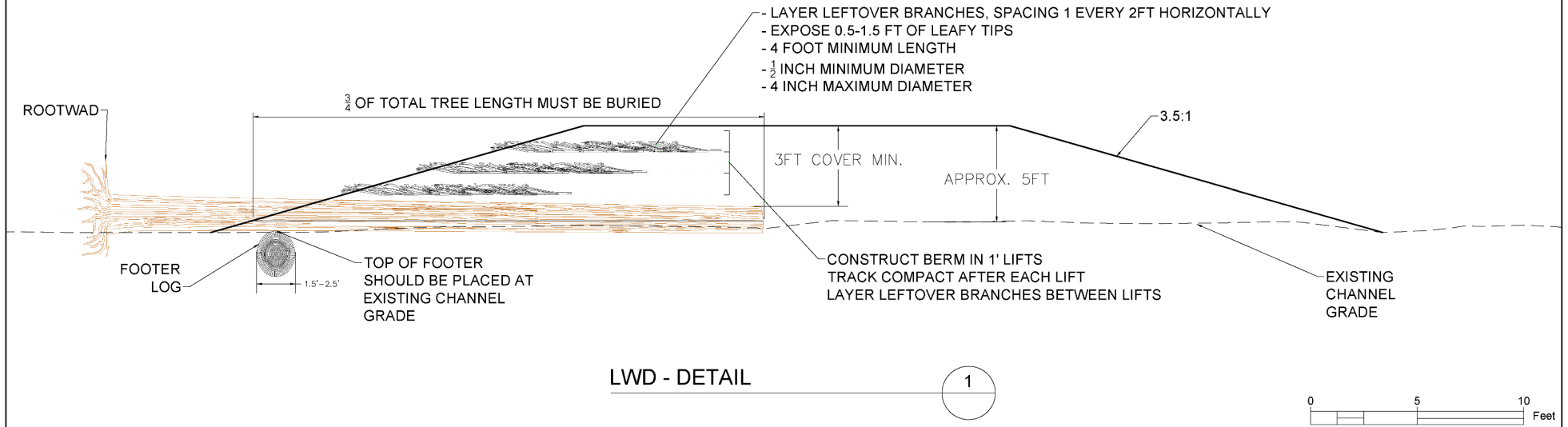
NEAR KEARNEY, NEBRASKA

PROJECT NO.
P23-021

SHEET IDENTIFICATION:
G02

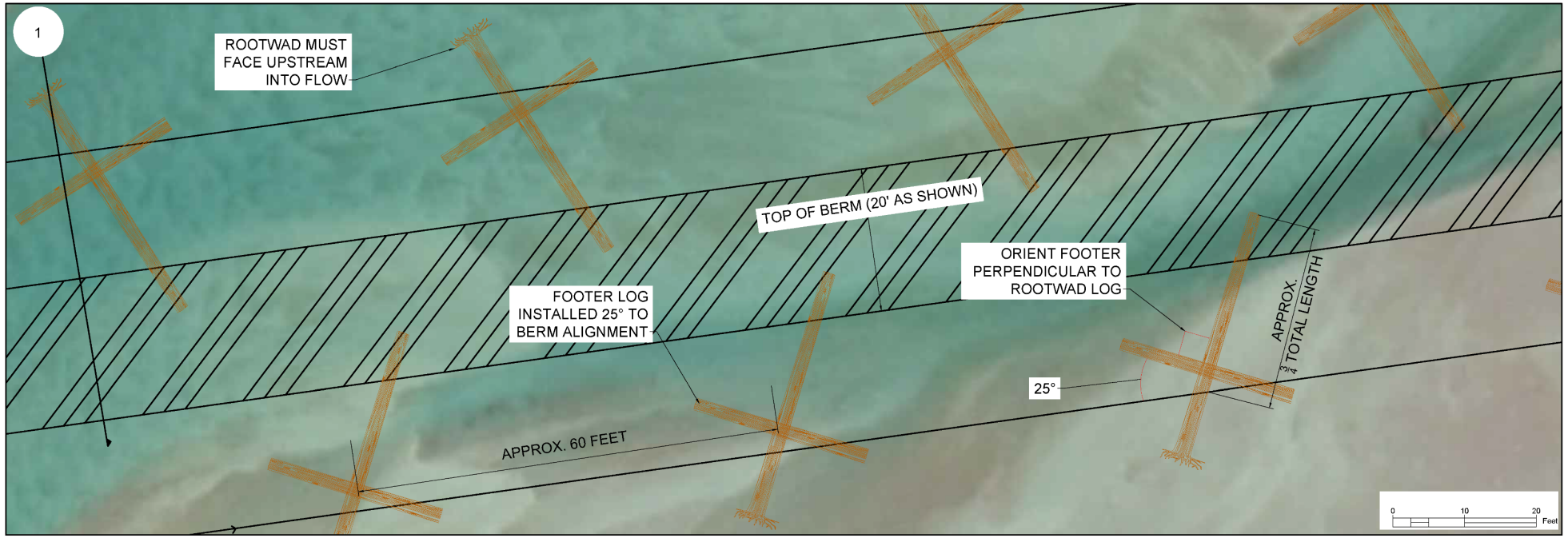
SHT NO. 2 OF 5

LOG STRUCTURE, BRANCH PLACEMENT, AND BERM DETAIL



LWD - DETAIL 1

0 5 10 Feet



MARK	DESCRIPTION	DATE
DESIGNED		OCT 2023
DRAWN		DEC 2023
CHECKED		---
APPROVED		---

Headwaters CORPORATION
405 Urban Street, Suite 401
Lakewood, CO 80228
(P) 720-524-6115

WYOMING PROPERTY FLOW SPLIT CORRECTION BERM

LOG STRUCTURE AND BERM DETAIL

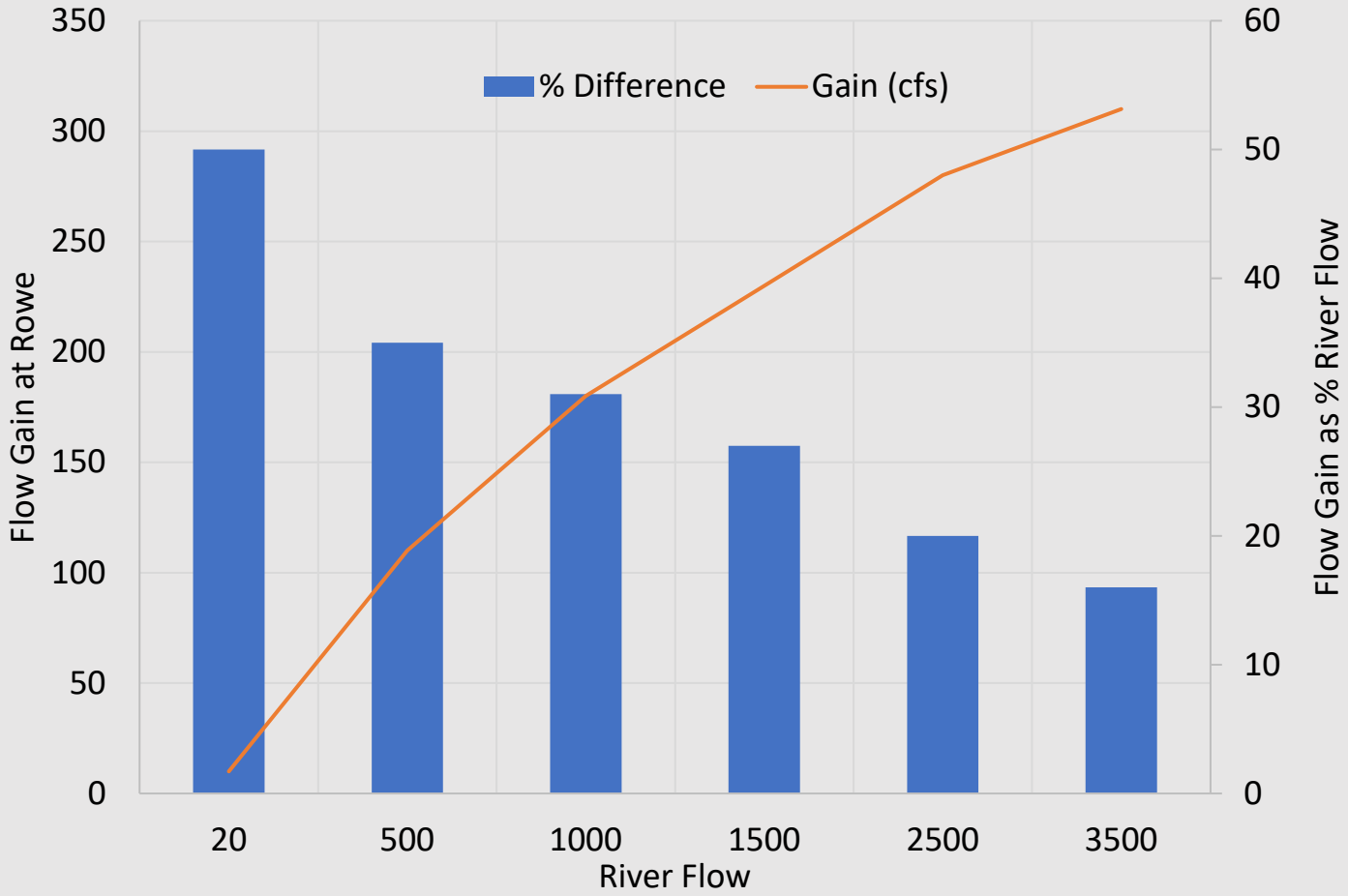
NEAR KEARNEY, NEBRASKA

PROJECT NO.
P23-021

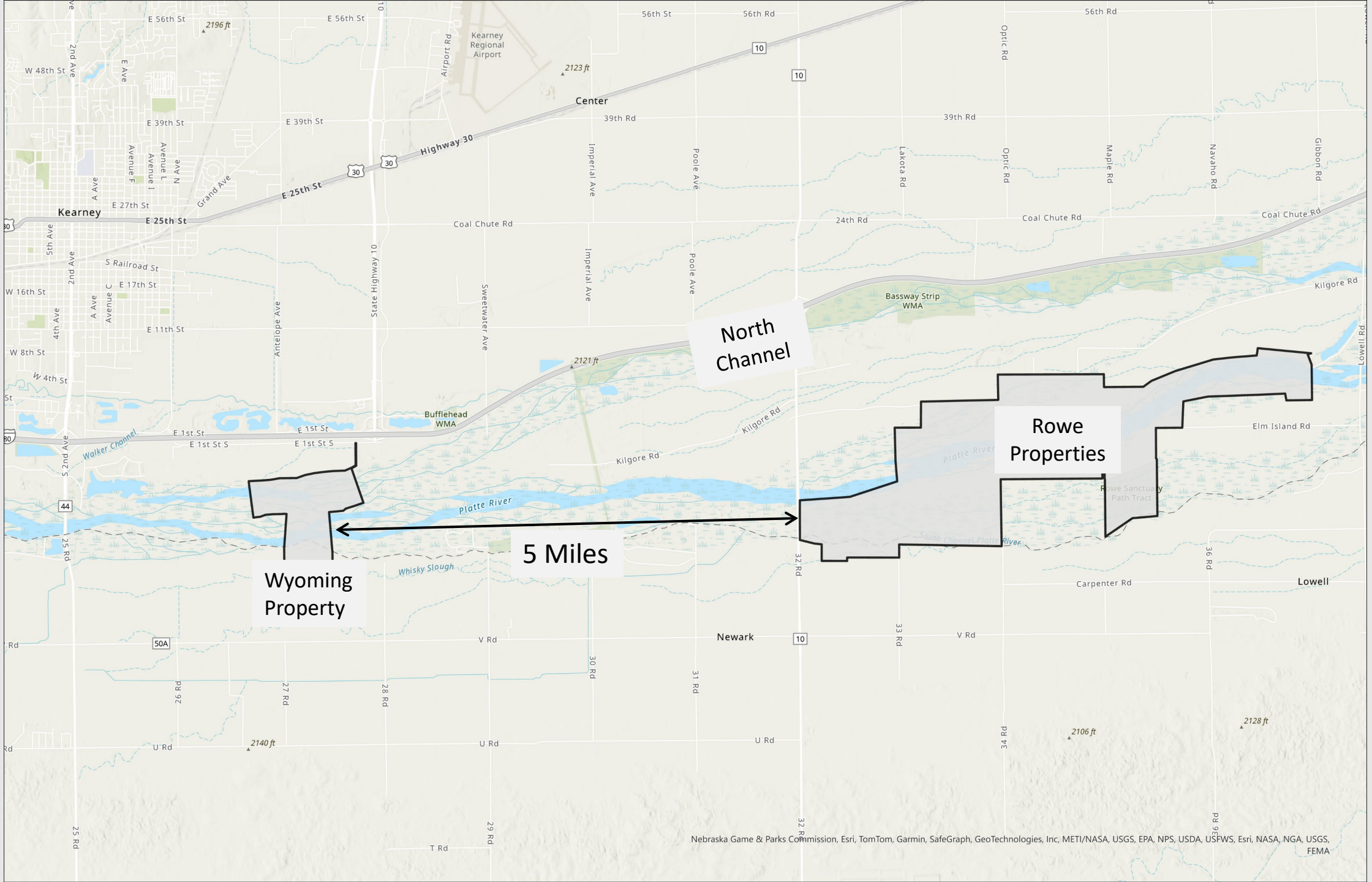
SHEET IDENTIFICATION:
C03

SHT NO. 5 OF 5

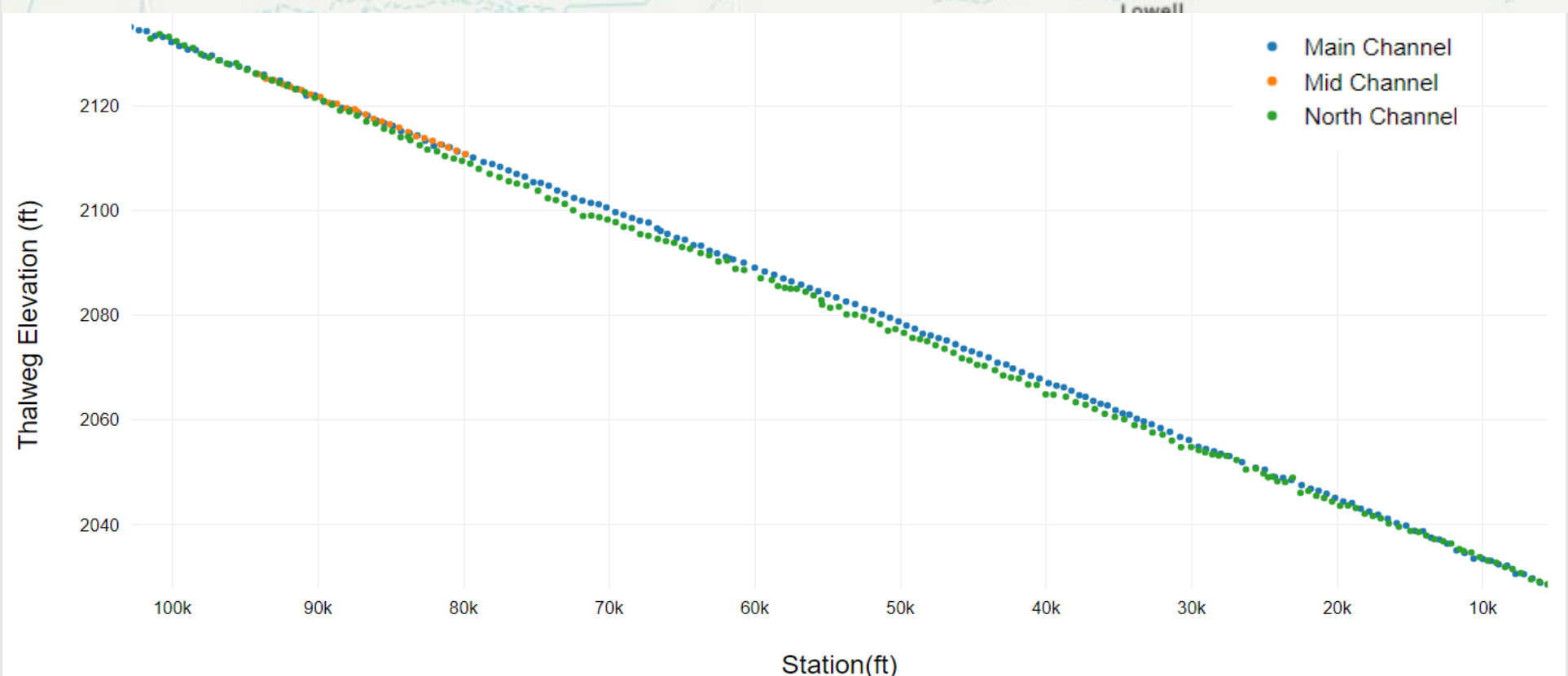
Predicted Effect of Berm

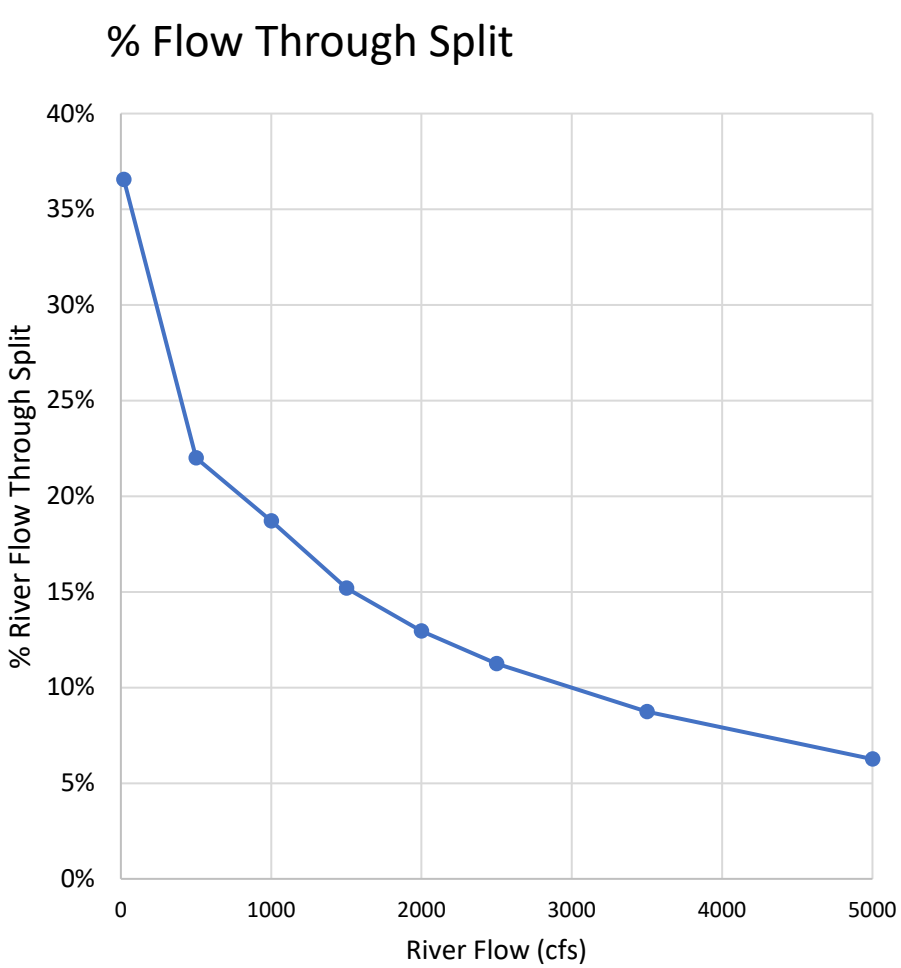


	Flow at Rowe (cfs)			
River Flow (cfs)	No berm	With Berm	Gain (cfs)	% Difference
20	10	20	10	50%
500	200	300	110	35%
1000	400	590	180	31%
1500	630	860	230	27%
2500	1,110	1,390	280	20%
3500	1,610	1,920	310	16%


North Channel
Rowe Properties
5 Miles
Wyoming Property
Kearney
Center
Newark
Lowell
Bufflehead WMA
Bassway Strip WMA
Rowe Sanctuary Path Tract
Kearney Regional Airport
Highway 30
E 25th St
Coal Chute Rd
Kilgore Rd
Platte River
Walker Channel
Whisky Slough
Carpenter Rd
Elm Island Rd
Nebraska Game & Parks Commission, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Esri, NASA, NGA, USGS, FEMA


Center
Kearney
Bassway Strip WMA
2121 ft
Fort Kearny SRA
South Channel Platte River
Lowell
0
5000
10000
15000
20000
25000
30000
35000
40000
45000
50000
55000
60000
65000
70000
75000
80000
85000
90000
95000
100000
105000
110000


Main Channel
Mid Channel
North Channel
Thalweg Elevation (ft)
2120
2100
2080
2060
2040
100k
90k
80k
70k
60k
50k
40k
30k
20k
10k
Station(ft)


% Flow Through Split
40%
35%
30%
25%
20%
15%
10%
5%
0%
% River Flow Through Split
0
1000
2000
3000
4000
5000
River Flow (cfs)

August 2024
Water Plan Updates

Seth M Turner, PE

PRRIP Water Plan Coordinator

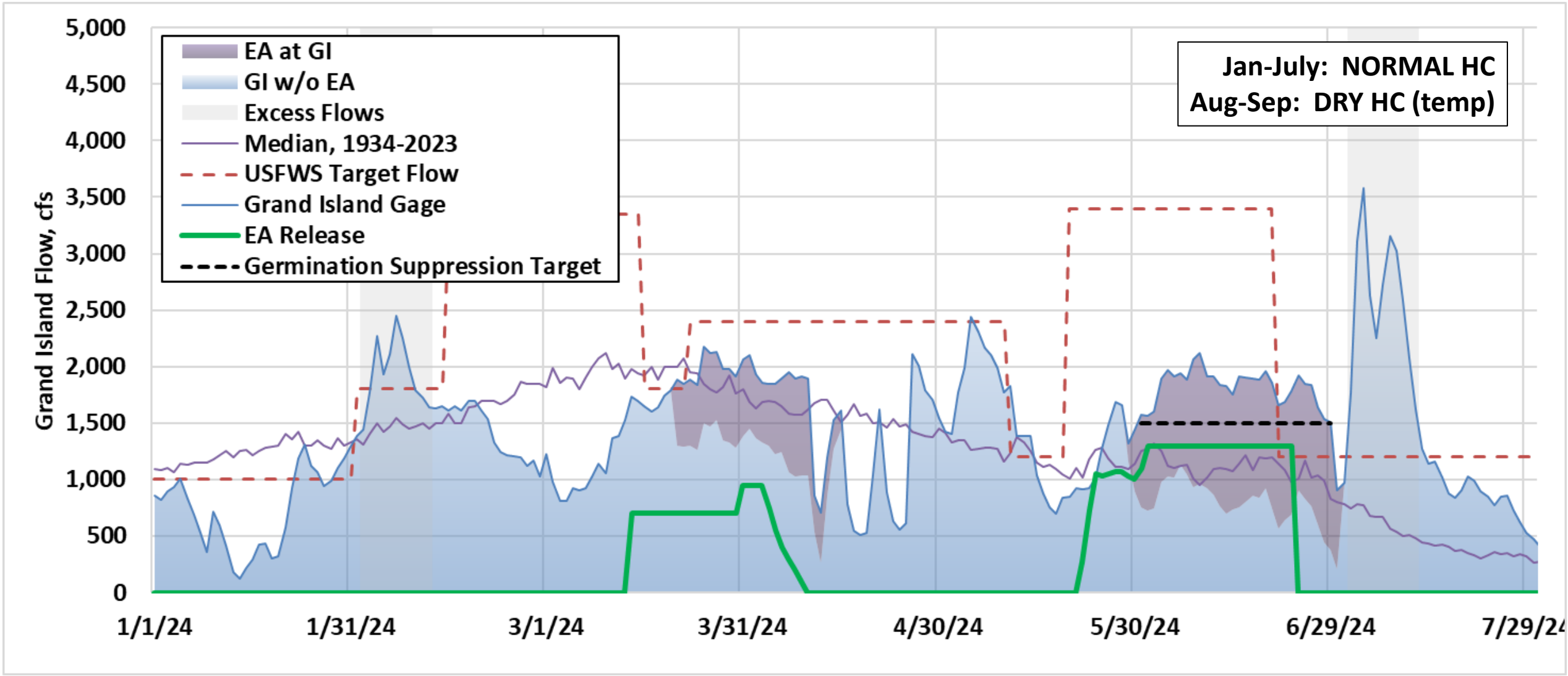
Water Advisory Committee Meeting

August 6, 2024

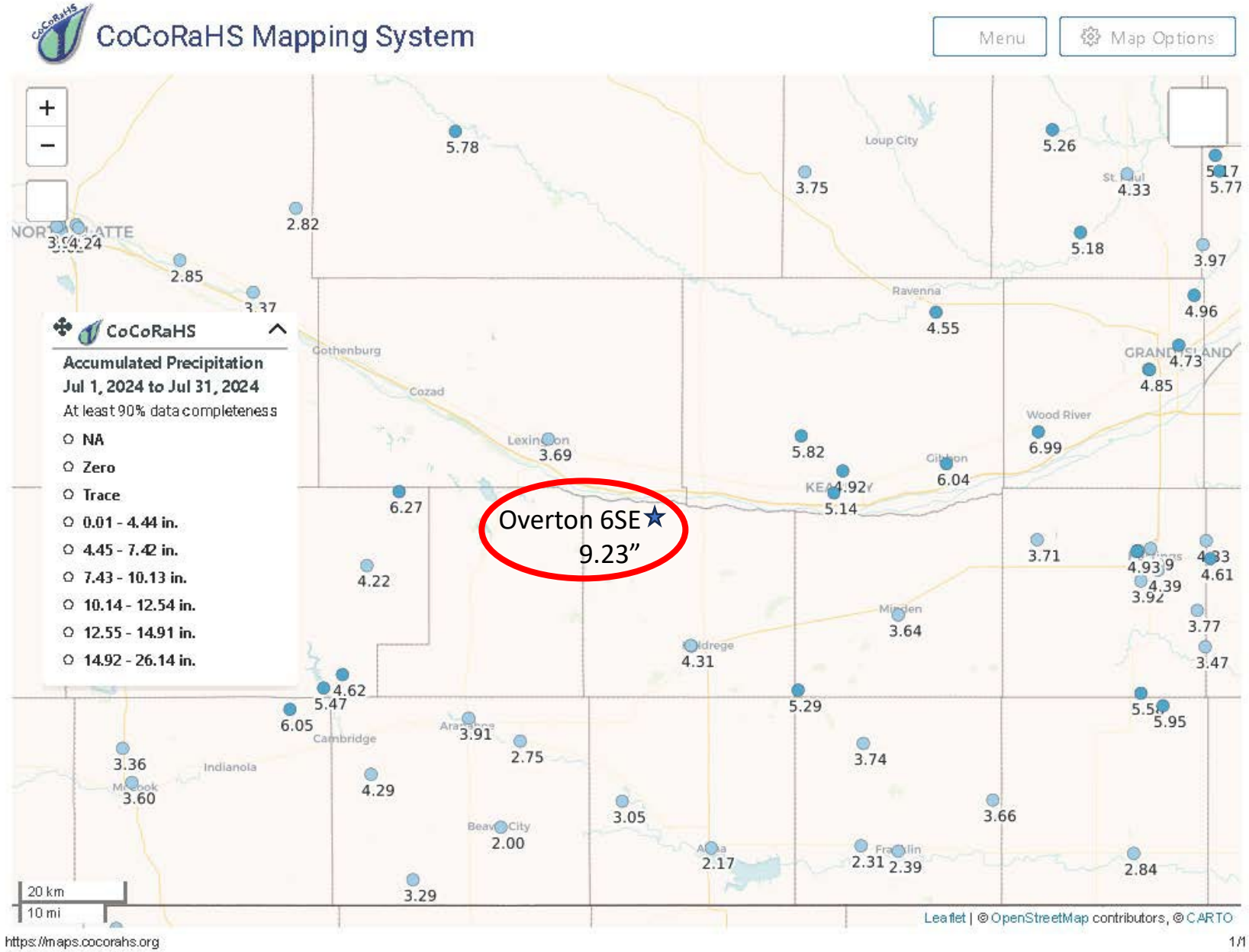
PLATTE RIVER
RECOVERY IMPLEMENTATION PROGRAM

Platte Basin Hydrology

2024 Grand Island Year-to-Date Flow Summary

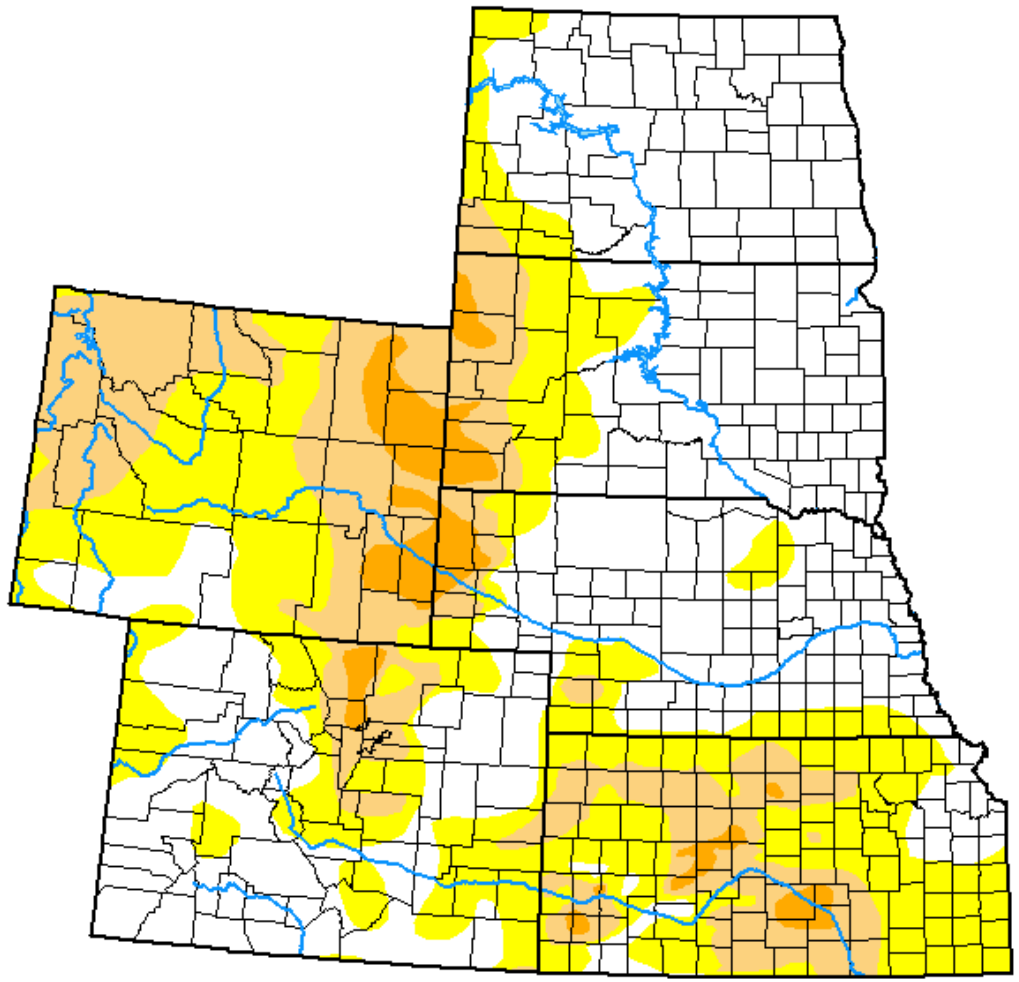


PLATTE RIVER
RECOVERY IMPLEMENTATION PROGRAM



PLATTE RIVER
RECOVERY IMPLEMENTATION PROGRAM

U.S. Drought Monitor
High Plains



July 30, 2024
(Released Thursday, Aug. 1, 2024)
Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	48.71	51.29	22.03	3.95	0.00	0.00
Last Week *07-23-2024*	57.55	42.45	17.23	2.30	0.00	0.00
3 Months Ago *04-30-2024*	57.02	42.98	19.66	6.35	0.00	0.00
Start of Calendar Year *01-02-2024*	54.96	45.04	22.00	8.80	1.97	0.03
Start of Water Year *09-26-2023*	57.69	42.31	26.84	15.07	5.46	0.97
One Year Ago *08-01-2023*	51.65	48.35	29.33	14.29	7.10	0.99

Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to https://droughtmonitor.unl.edu/About.aspx

Author:

Lindsay Johnson
National Drought Mitigation Center

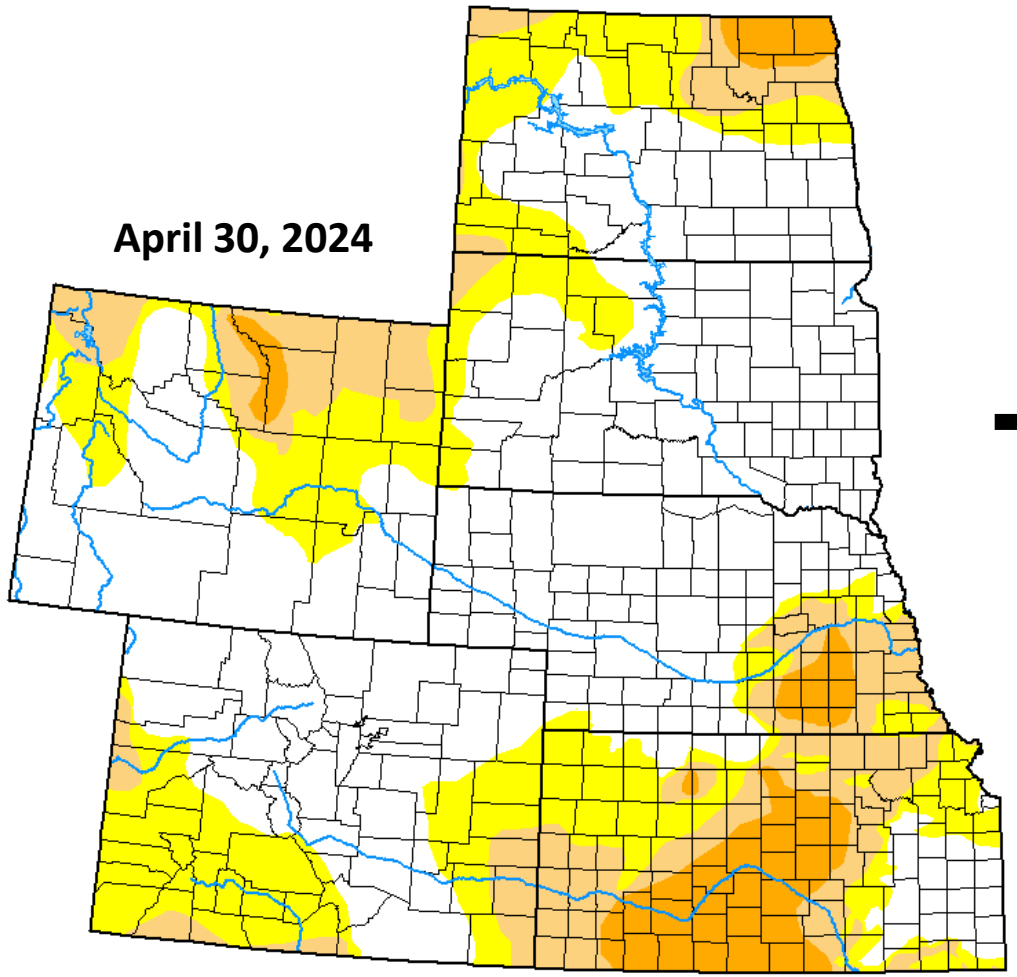
droughtmonitor.unl.edu

PLATTE RIVER RECOVERY IMPLEMI

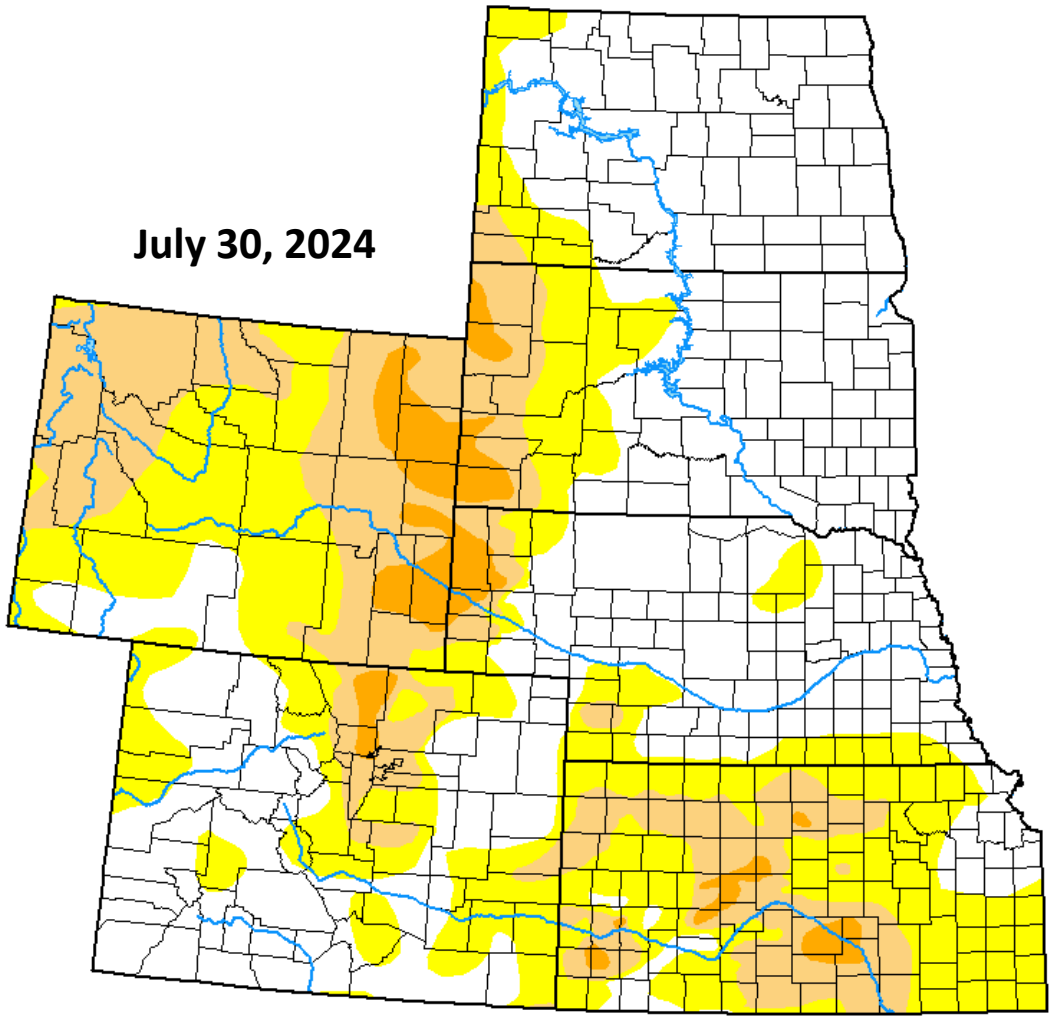
Drought Classification

- None
- D0 (Abnormally Dry)
- D1 (Moderate Drought)
- D2 (Severe Drought)
- D3 (Extreme Drought)
- D4 (Exceptional Drought)
- No Data

April 30, 2024



July 30, 2024



PLATTE RIVER
RECOVERY IMPLEMENTATION PROGRAM

Leasing, Recharge, and Recapture Project Operations

Recharge and Recapture

- Cottonwood Ranch recharge
  - Excess flows available July 2-12
  - **Excess flow deliveries July 2-7 = 253.4 AF**
  - 2024 total excess flow deliveries = 798 AF
  - Over 9” rain at project site from July 1-16
  - Storm damage and maintenance (north outlet valve controls knocked out on July 6)
- Recapture wells
  - **2024 cumulative pumping = 2,440 AF**
  - Most wells ran from mid-February to early July

Surface Water Leases

- CPNRD and NPPD
  - GC approved 1-year agreements after June meeting
  - CPNRD = 15,000 AF max, NPPD = 3,306 AF max, $90/AF
  - GC to discuss approach to longer-term agreements in September
- Pathfinder Municipal Account
  - Filled in early June (20,000 AF)
  - Program accepted lease offer of 9,600 AF at $65/AF
- Pathfinder EA
  - Filled in early June (33,493 AF)
  - Evaporation losses deducted during rest of summer
  - Program receives all remaining EA water (WY in-kind contribution)
  - Deliveries to Lake McConaughy EA expected late August or September

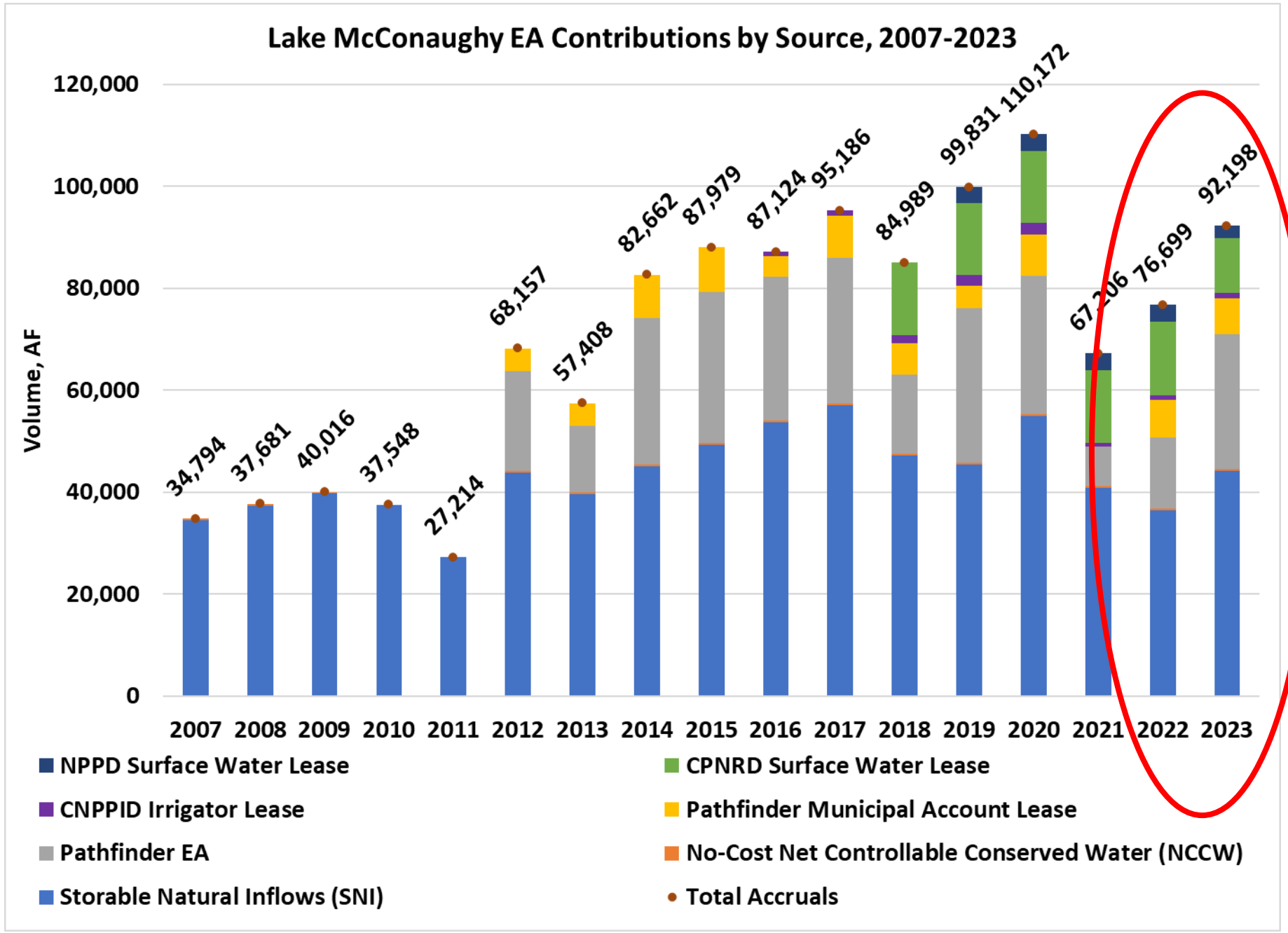
2022-2023
Water Projects Accounting

PRRIP Water Projects Accounting

- PURPOSE: Evaluate operations data for Program water projects to estimate resulting deficit reductions at Grand Island
- Scoring is model analysis to estimate project POTENTIAL deficit reductions with assumed operations
- Accounting shows what really happens
- Specified in Program Document
  - Attachment 2 Milestones Document, Steps 4.6 and 4.7
    - "…water produced by projects…is included in approved tracking and accounting procedures.."
  - Attachment 5, Section 11 Water Plan Reference Materials, Appendix B, item #7
    - "use…project operation data, stream gage data, and the Program's water tracking and accounting reports…" to compare with modeling
    - "…actual annual operating data are not expected to 'match up' with the modeling assumptions…"

PRRIP Water Projects Accounting

- Original analysis for 2007-2018 documented in August 2019 memo
- Updates to include 2019-2020 documented in November 2021 memo
- Updates for 2021 presented to WAC in February 2023
- New updates for 2022-2023
  - Lake McConaughy EA accruals and releases
  - Integrated accounting of Phelps recharge, Elwood recharge, and 8 recapture wells
  - No means of evaluating NPPD (252 AF in 2023) and Cottonwood Ranch (2,750 AF in 2022-2023) recharge



PLATTE RIVER
RECOVERY IMPLEMENTATION PROGRAM

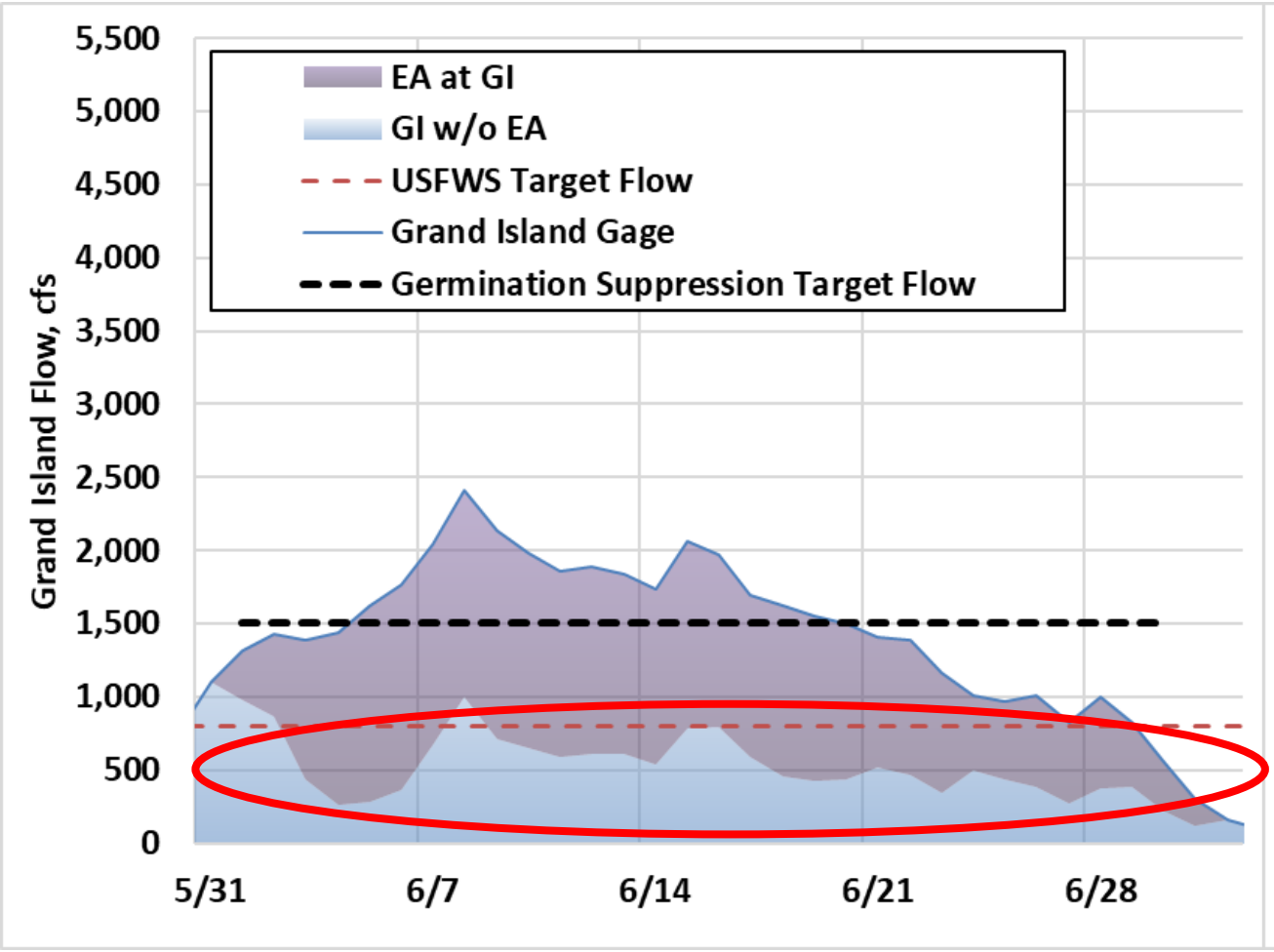
Lake McConaughy EA Overall Mass Balance:

- **1/1/07 EA storage = 125,473 AF**
- **Accruals = 1,186,866 AF**
- **Evap, Seepage, and Reset losses = 255,672 AF**
- **Releases = 909,857 AF**
- **12/31/23 EA storage = 145,971 AF**
- **Error = 839 AF**

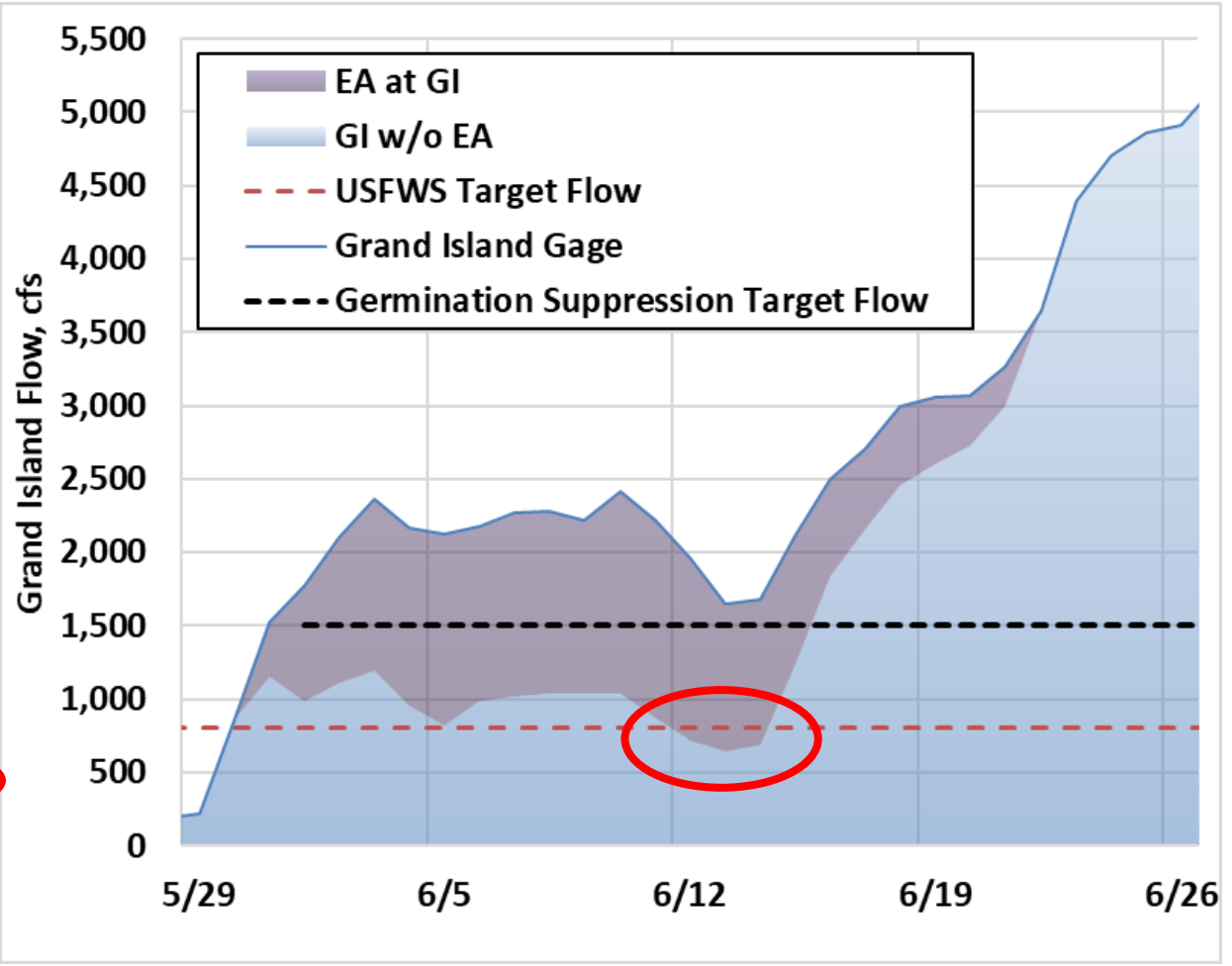
Year of Operation	Total Accruals to EA (AF)	Net Losses (AF)	Total EA Releases (AF)	EA Volume Reaching Grand (AF)	Reductions to Deficits (AF)
2007	34,794	17,282	34,374	24,406	13,000
2008	37,681	17,650	30,123	17,833	13,400
2009	40,016	9,199	22,953	13,313	8,200
2010	37,548	8,941	0	0	0
2011	27,214	47,194	0	0	0
2012	68,157	11,135	80,969	43,303	43,000
2013	57,408	5,449	74,642	56,025	28,900
2014	82,662	6,417	45,818	37,634	37,600
2015	87,979	9,296	51,459	43,452	42,600
2016	87,124	43,640	23,288	18,288	15,700
2017	95,186	7,566	142,336	118,175	90,100
2018	84,989	5,956	89,332	74,561	73,800
2019	99,831	9,746	5,653	5,105	900
2020	110,172	12,632	109,307	87,491	43,900
2021	67,206	13,163	70,375	53,458	32,000
2022	76,700	15,519	79,359	61,531	19,100
2023	92,198	14,886	49,870	40,342	700
Total, 2007-2023	**1,186,866**	**255,672**	**909,857**	**694,918**	**462,900**
Average, 2007-2023	**69,816**	**15,040**	**53,521**	**40,878**	**27,200**
Total, 2012-2023	**1,009,613**	**155,406**	**822,408**	**639,366**	**428,300**
Average, 2012-2023	**84,134**	**12,950**	**68,534**	**53,280**	**35,700**

PLATTE RIVER
RECOVERY IMPLEMENTATION PROGRAM

2022



2023



PLATTE RIVER
RECOVERY IMPLEMENTATION PROGRAM

Phelps, Elwood Recharge + Recapture

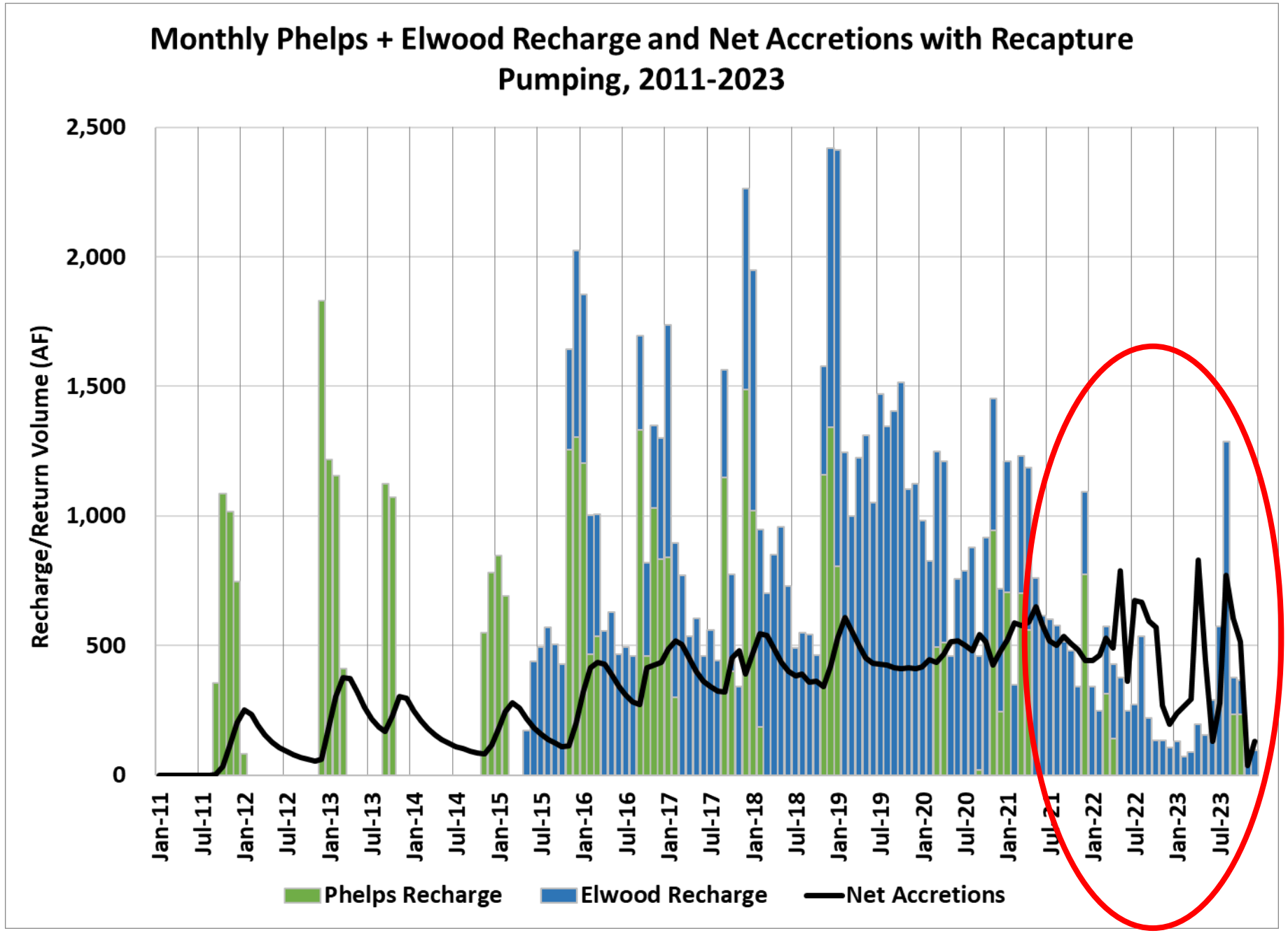
Year of Operation	Phelps		Elwood		Recapture Well Pumping[1]	Phelps + Elwood + Recapture Lagged Accretions near Overton	Accretions Reaching Grand Island[2]	Reductions to Target Flow Deficits at Grand Island[2]
	Invoiced Diversions (AF)	Volume Recharged (AF)	Invoiced Diversions (AF)	Volume Recharged (AF)	(AF)	(AF)	(AF)	(AF)
2011	2,709	3,200	0	0	0	360	300	0
2012	1,685	1,900	0	0	0	1,500	1,200	780
2013	4,418	5,000	0	0	0	3,200	2,500	1,800
2014	1,173	1,300	0	0	0	1,600	1,400	1,000
2015	3,613	4,100	14,785	3,700	0	2,200	2,000	890
2016	5,182	5,900	2,880	5,800	117	4,500	4,000	1,300
2017	3,687	4,200	11,524	6,800	152	5,000	4,200	2,200
2018	3,258	3,700	14,916	8,500	59	5,100	4,500	2,800
2019	712	810	18,539	15,400	26	5,600	5,000	1,500
2020	1,986	2,200	0	8,500	217	5,700	5,000	2,300
2021	2,482	2,700	3,764	6,200	541	6,500	5,500	3,700
2022	400	460	0	3,200	2,261	6,100	4,100	3,400
2023	410	470	3,173	3,300	2,768	4,500	3,200	2,300
Total	**31,714**	**36,000**	**69,580**	**61,300**	**6,140**	**52,000**	**42,800**	**24,000**
Average[3,4]	**2,440**	**2,800**	**7,731**	**6,800**	**768**	**4,000**	**3,300**	**1,800**

1 Recapture Well Pumping from 2016-2021 includes Cook well only; from 2022-2023 includes aggregate of Cook well + 7 new recapture wells near Cottonwood Ranch
2 Accretions and Deficit Reductions at Grand Island include Habitat Adjustment for the portion of Phelps recharge that returns downstream of Overton
3 Elwood averages include only 2015-2023
4 Recapture Well averages include only 2016-2023

Phelps, Elwood Recharge + Recapture

- Total invoiced diversions, 2011-2023 = 101,300 AF
- Total recharge, 2011-2023 = 97,200 AF
- Total recapture pumping, 2015-2023 = 6,140 AF
- Total river returns, accretions + pumping, 2011-2023 = 52,000 AF
- Volume remaining in aquifer storage as of 12/31/2023 = 45,200 AF

- Volume remaining in Elwood Reservoir storage as of 12/31/2023 = 1,440 AF (no new excess flow diversions, very likely zero as of August 2024)



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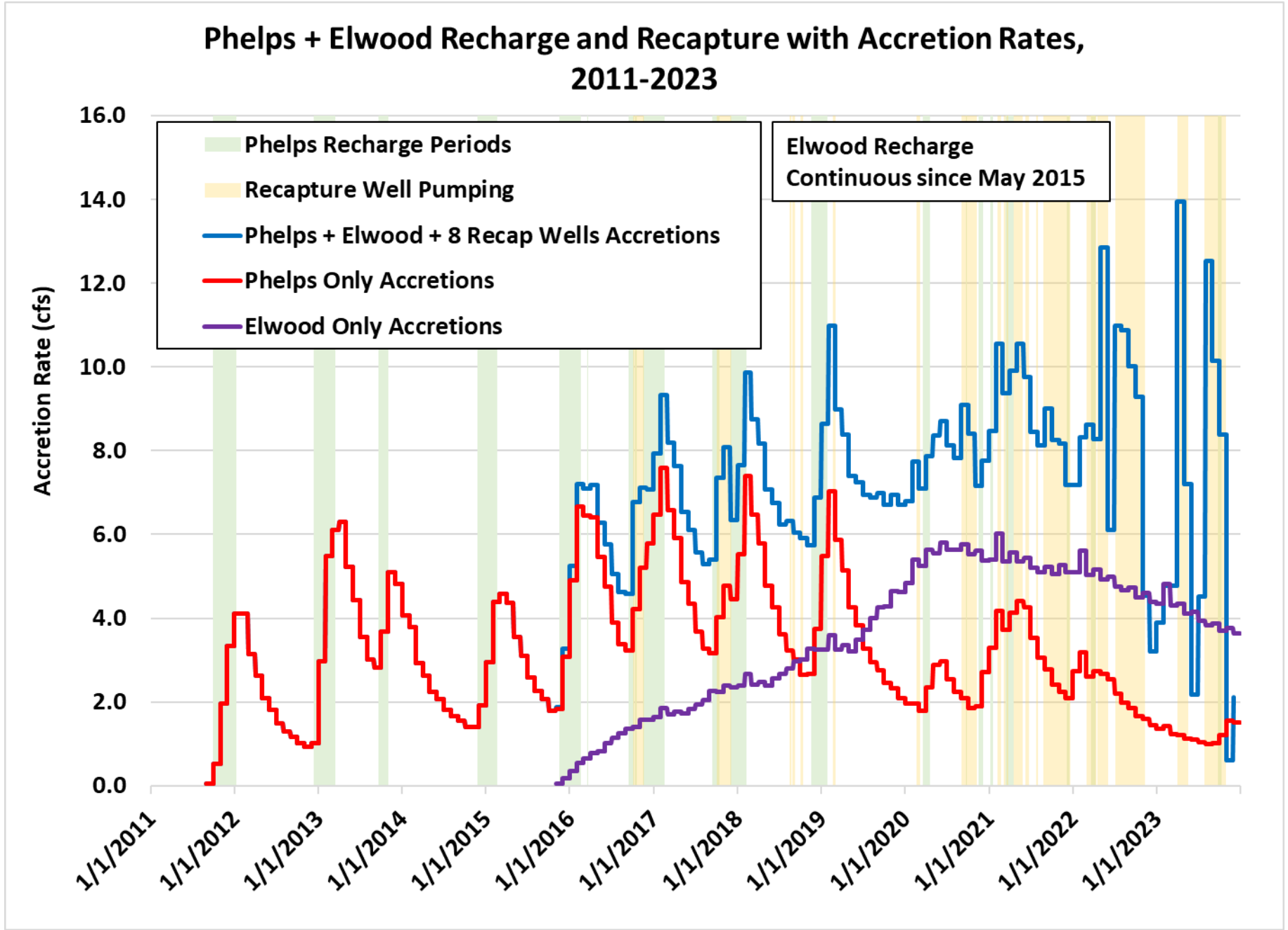

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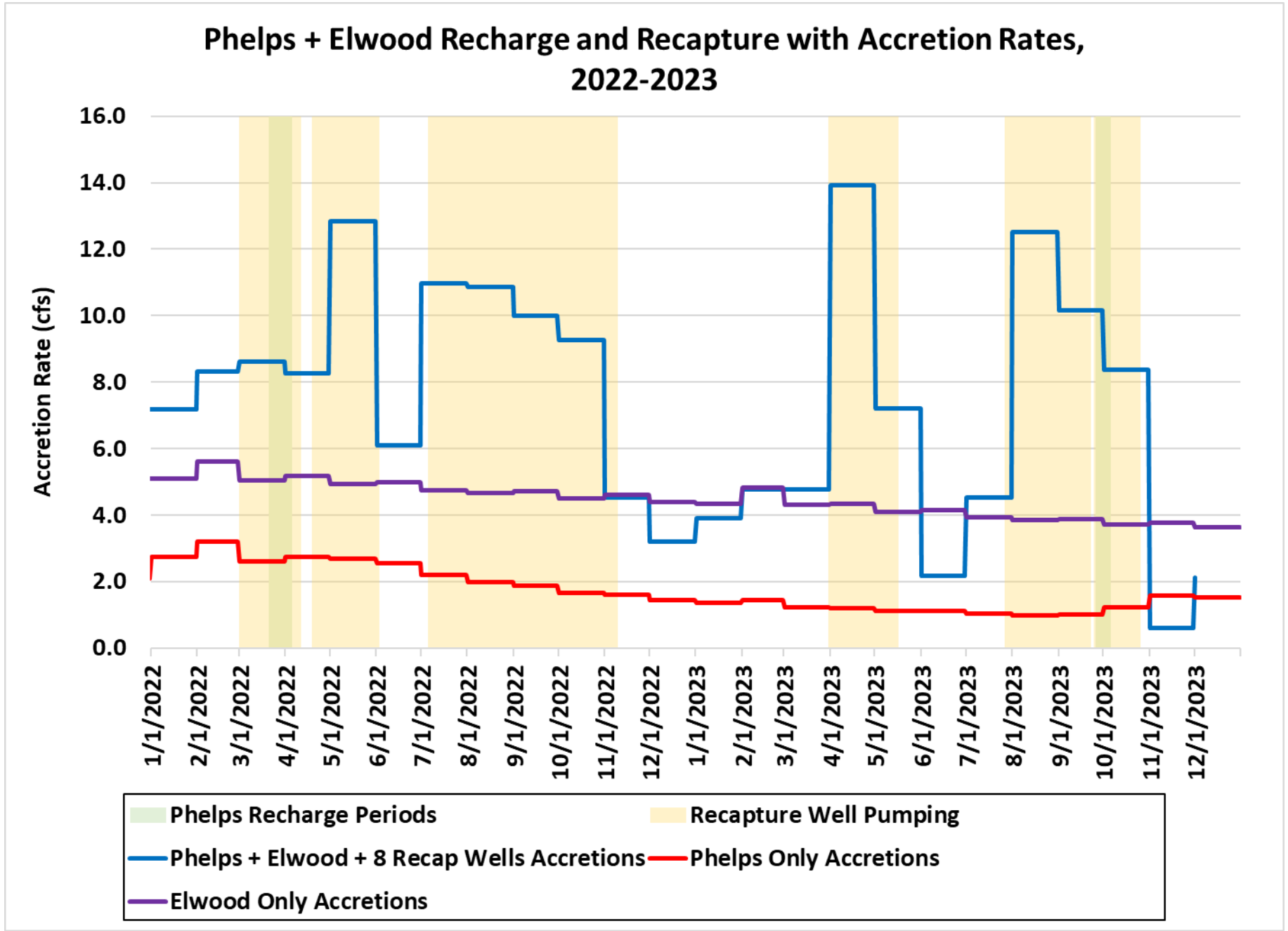

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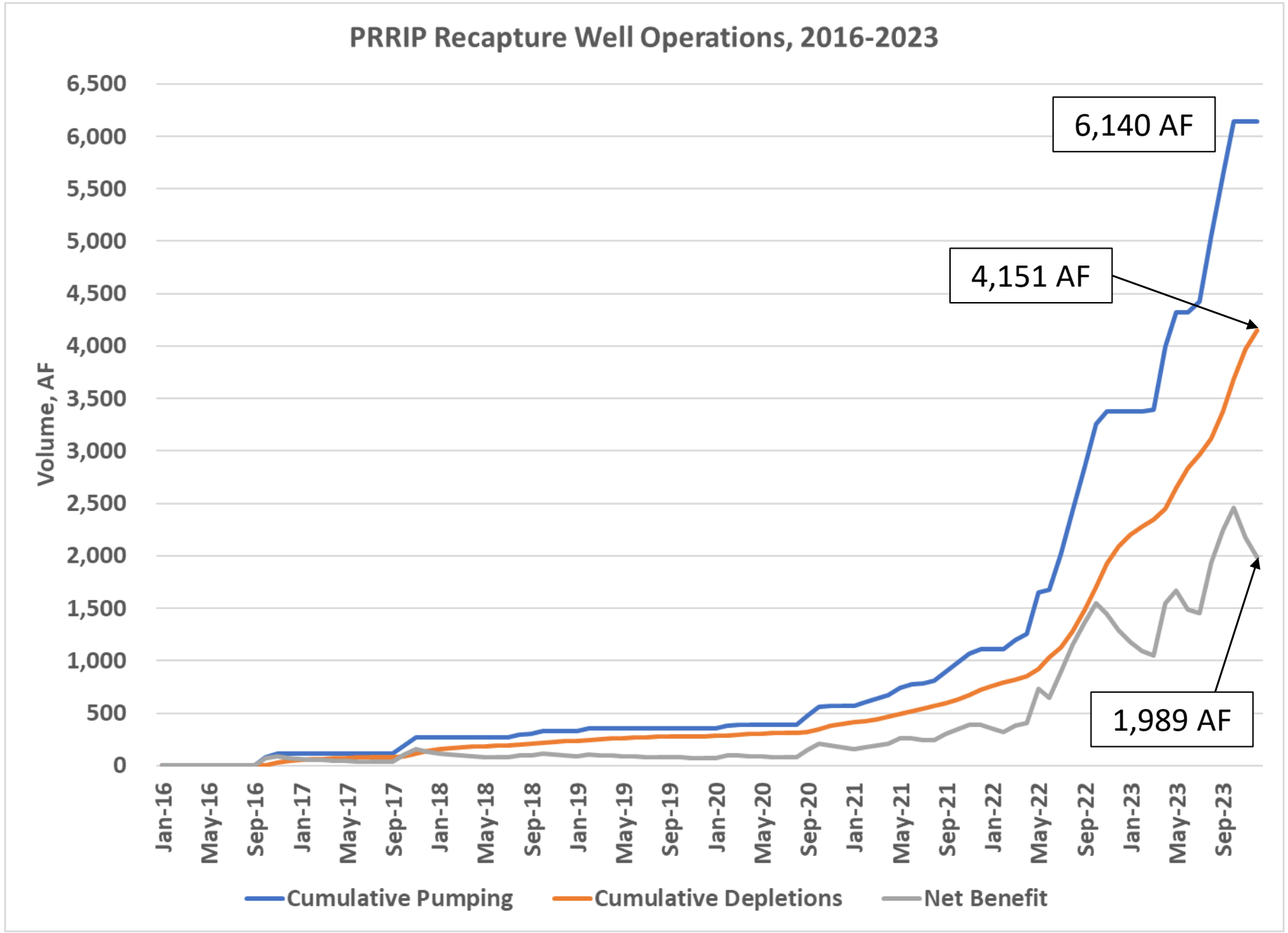

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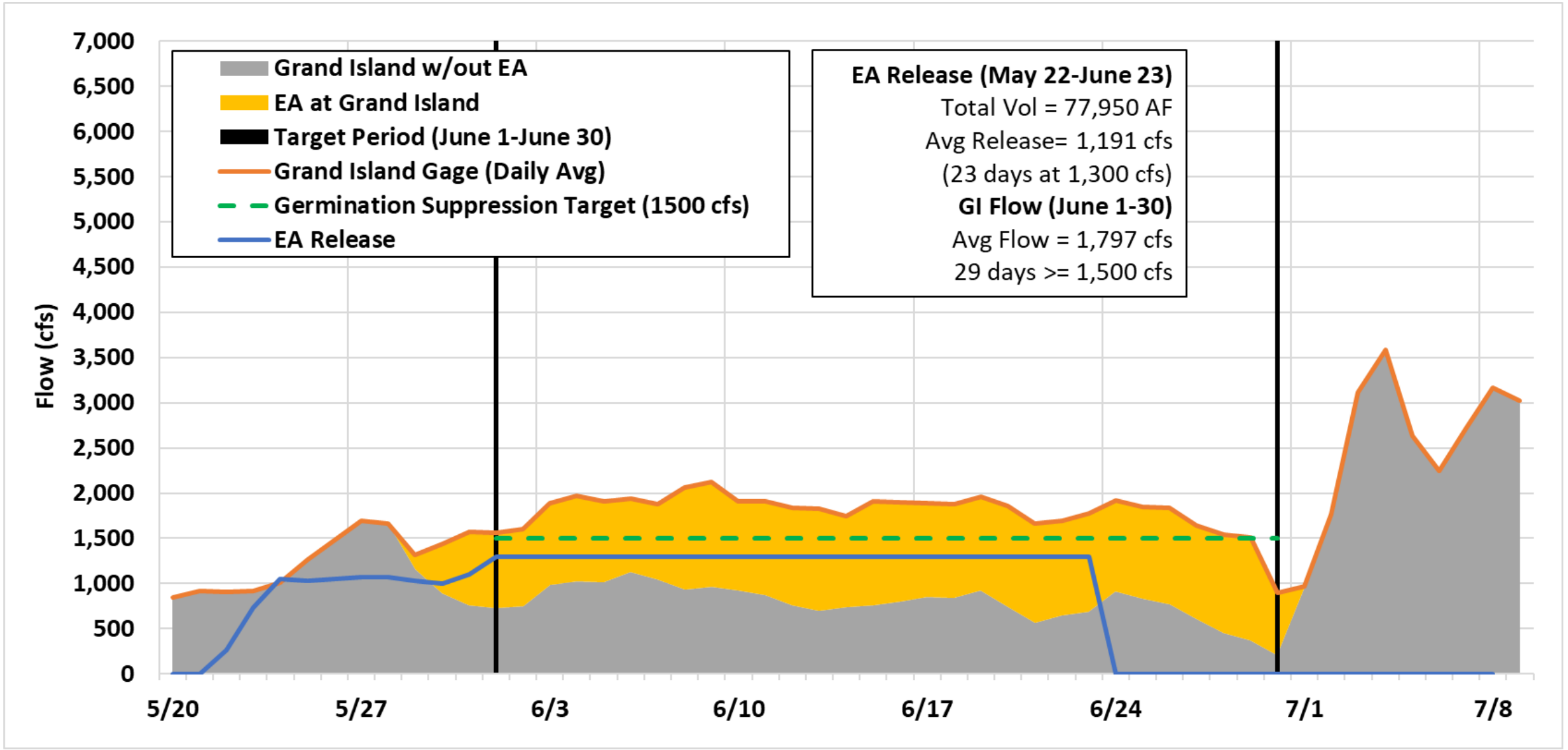
North Platte Chokepoint Study

Chokepoint Study – Project Status

- Geomorphology
  - Committee comments returned to project team to address and finalize report
  - EDO developed supplemental memo supporting conclusions
- Alternatives analysis
  - Conceptual design/cost for bypass canal near complete
  - 1D hydraulic/sediment modeling in progress: no action, dredging, modification of Tri-County Diversion Dam
  - 1 or 2 alternatives to be selected for 2D modeling (met with EDO to review on 8/5)
  - Permitting investigation related to wetlands
- Reporting
  - Alternatives report in October
  - Modeling report in Nov/Dec
  - Present to WAC in October, GC in December

Germination Suppression EA Release

2024 EA Release for Germination Suppression



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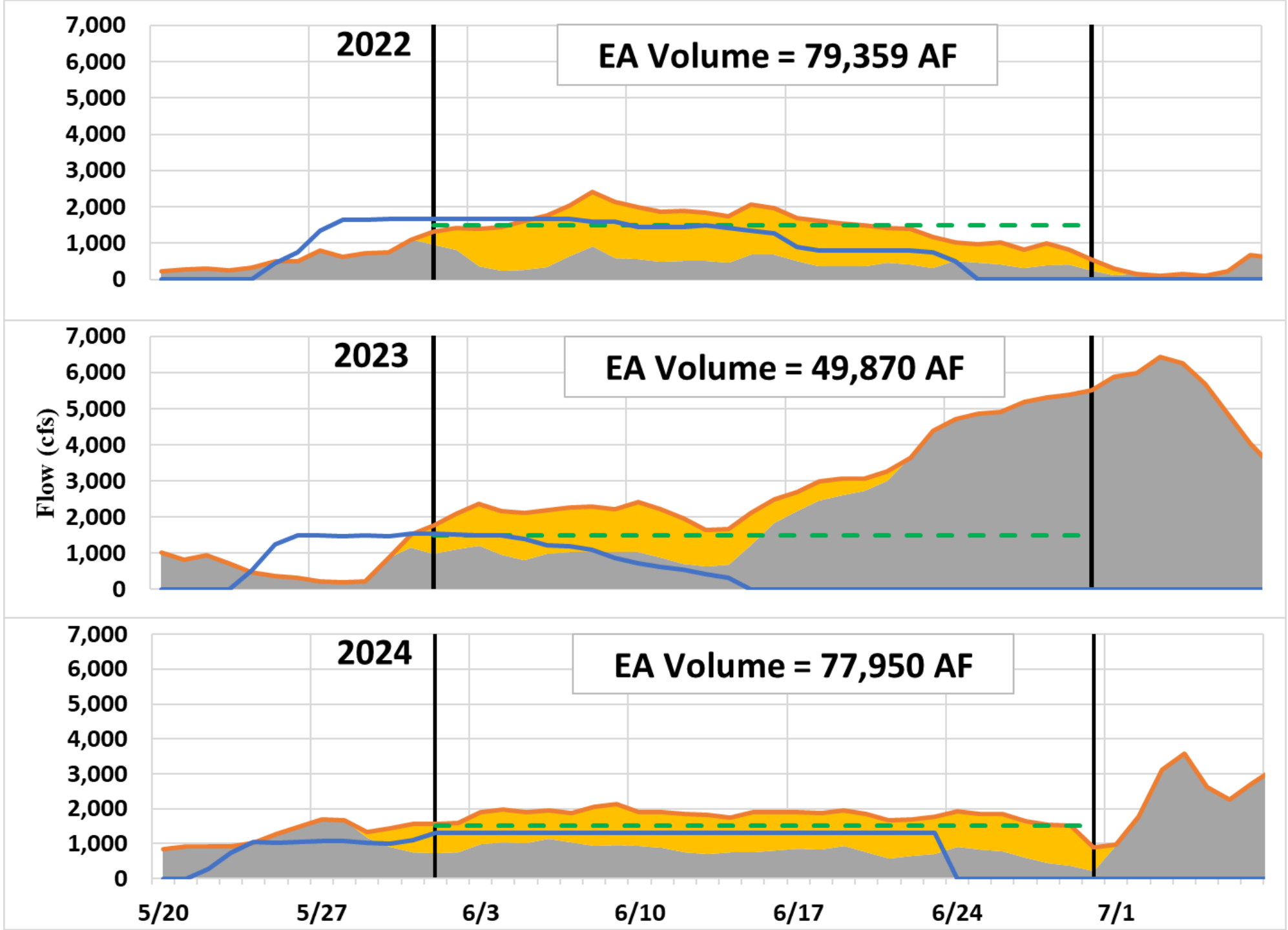
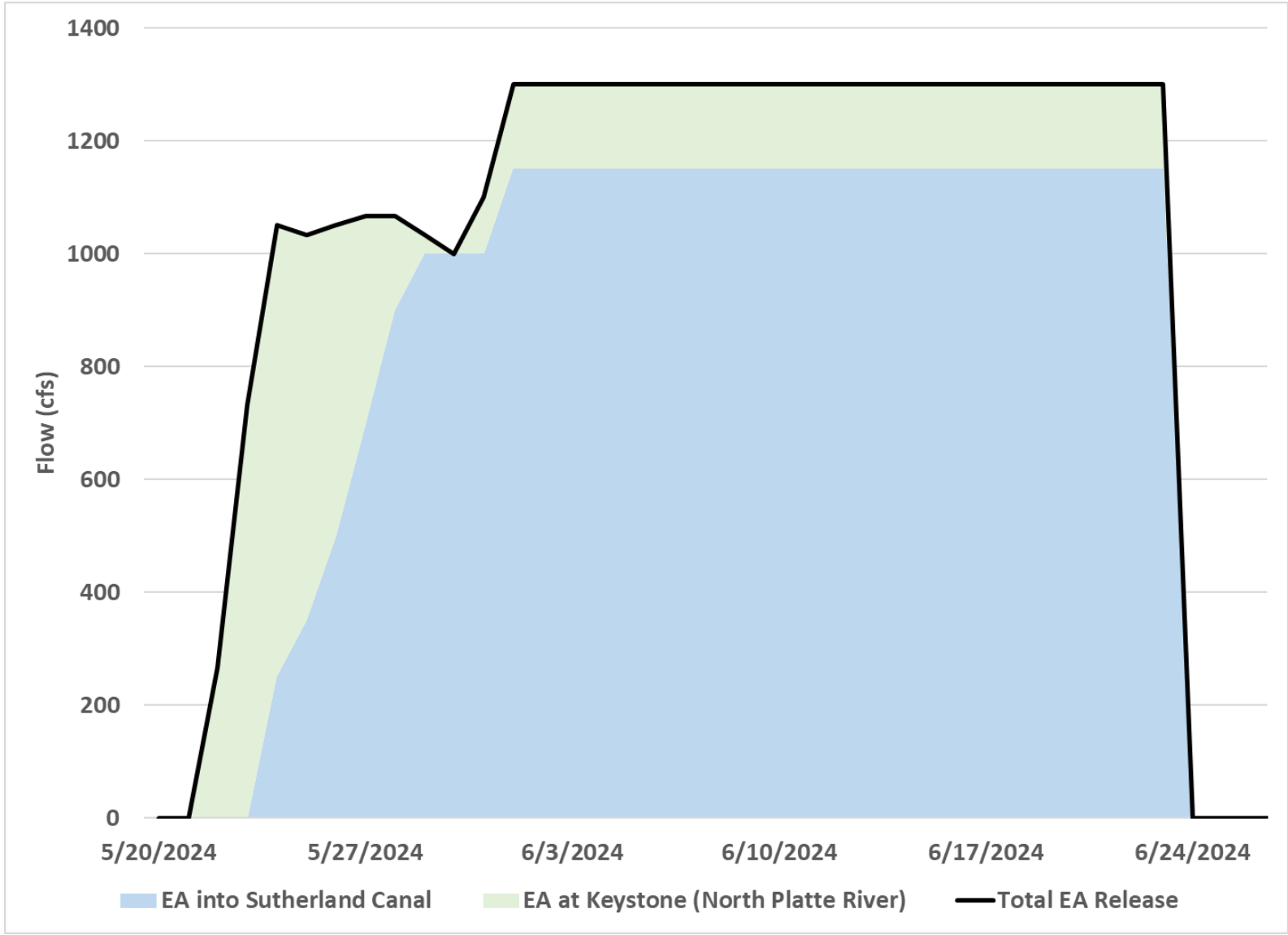

2022
EA Volume = 79,359 AF
2023
EA Volume = 49,870 AF
2024
EA Volume = 77,950 AF
Flow (cfs)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
5/20
5/27
6/3
6/10
6/17
6/24
7/1

EA Release Routing – North Platte Chokepoint

- Most water routed through Sutherland Canal
- Less than 20% down North Platte River (150 cfs in June)
- North Platte Chokepoint a non-factor
- Only 10 days (in 2022) with Chokepoint capacity constraint in 5 years of EA releases for germination suppression



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Thank You!!!

- USFWS (Matt and Mark)
- CNPPID (Tyler)
- NPPD (Nick and Jeff)
- Nebraska DNR (Jeremy and Jim)