TO: WATER ADVISORY COMMITTEE
FROM: EXECUTIVE DIRECTOR'S OFFICE (ED OFFICE)
SUBJECT: REGIONAL GROUNDWATER RECAPTURE NETWORK PROJECT (DRAFT FOR REVIEW)
DATE: OCTOBER 11, 2019

I. BACKGROUND

The Platte River Recovery Implementation Program (Program) uses groundwater recharge to re-time excess flows in the Platte River. To accomplish this, excess flows, when present, are diverted into recharge facilities. The water in the recharge facilities (which are unlined irrigation canals, reservoirs and areas of broad-scale recharge) enters the alluvial aquifer via seepage. The recharge water in the aquifer migrates downgradient over time and returns to the river as baseflow or it is intercepted by creeks/drains that convey the recharge water to the river as surface flow. The Program receives credit towards its goal of reducing deficits to target flows based on the volume of water that returns to the river when river flows are less than mandated target flows (times of shortage). The Program does not receive credit for water that returns to the river when river flows are greater than mandated target flows (times of excess). Consequently, maximizing the volume of recharge water that returns to the river during shortages is an important concept to the Program.

Recharge recapture wells (or recharge re-timing wells) are an active measure by which the Program can maximize the volume of water that returns to the river during a shortage. The purpose of a recapture well is to intercept a portion of the water that will return during excesses by pumping groundwater during shortages, extracting it from the aquifer, and returning it directly to the river as surface water via a pipeline, creek or drain. Groundwater models and water accounting calculations can be used to optimize operation of the wells such that returns during shortages are maximized without causing a net depletion to the river due to lagged pumping depletions, and to ensure that wells are not recapturing a greater volume of water than has been recharged.

The Program owns and operates one recapture well on its Cook property. The Cook well was constructed in 2015 as a pilot recapture project and has been successfully operated for almost four years. Although the score and yield volumes for the Cook well are relatively low compared to those of other WAP projects (addressed later in this memo), constructing additional recapture wells in other areas to create a regional recapture well network could simultaneously increase the efficiency of Program recharge projects and increase the volume of controllable Program water.

This memorandum outlines the concept of a regional recapture network as developed by the Program's Executive Director's Office (EDO) and proposes a path for project implementation. This path assumes that the EDO (or a hired consultant managed directly by the EDO) will be responsible for designing, permitting and constructing the wellfield. However, the EDO and others have been involved in preliminary discussions with the Nebraska Department of Natural

Resources (DNR) and the Natural Resources Districts (NRDs) about these entities potentially leading the design, permitting and construction of the wellfield, which could change the approach and timeline. The purpose of this memorandum is to formally present the concept of a recapture network and the EDO's preliminary implementation approach as to inform future discussions between the Program, its stakeholders, DNR and the NRDs.

II. RECHARGE & RECAPTURE OPERATIONS

Elwood Reservoir and the Phelps County Canal (**Figure 1**) are the two most productive recharge facilities utilized by the Program in terms of the total and annual volume of water recharged (**Table 1**) and provide the most potential for recapture activities. Elwood Reservoir has been used to recharge a total of approximately 25,000 acre-feet (AF) during its first 4 years of operation from 2015 to 2018, which is an average of 6,200 acre-feet per year (AFY) annually (EDO, 2019). Phelps County Canal has been used to recharge approximately 29,300 AF during its first 8 years of operation from 2011 to 2018, which is an average of 3,700 AFY annually (EDO, 2019). Lagged accretions between the two projects total approximately 23,600 AF as of 2019, of which about 20,300 AF appear at the Grand Island gage after accounting for transit losses. Approximately 10,800 AF of this 20,300 AF (or about 53 percent) has passed the gage during times of shortage. This leaves about 9,500 AF over the last 8 years that returned during times of excess. This water did not "count" from a deficit reduction standpoint and could have been recaptured and re-timed. The same is true of the 30,700 AF that remains in aquifer storage en route to the river.

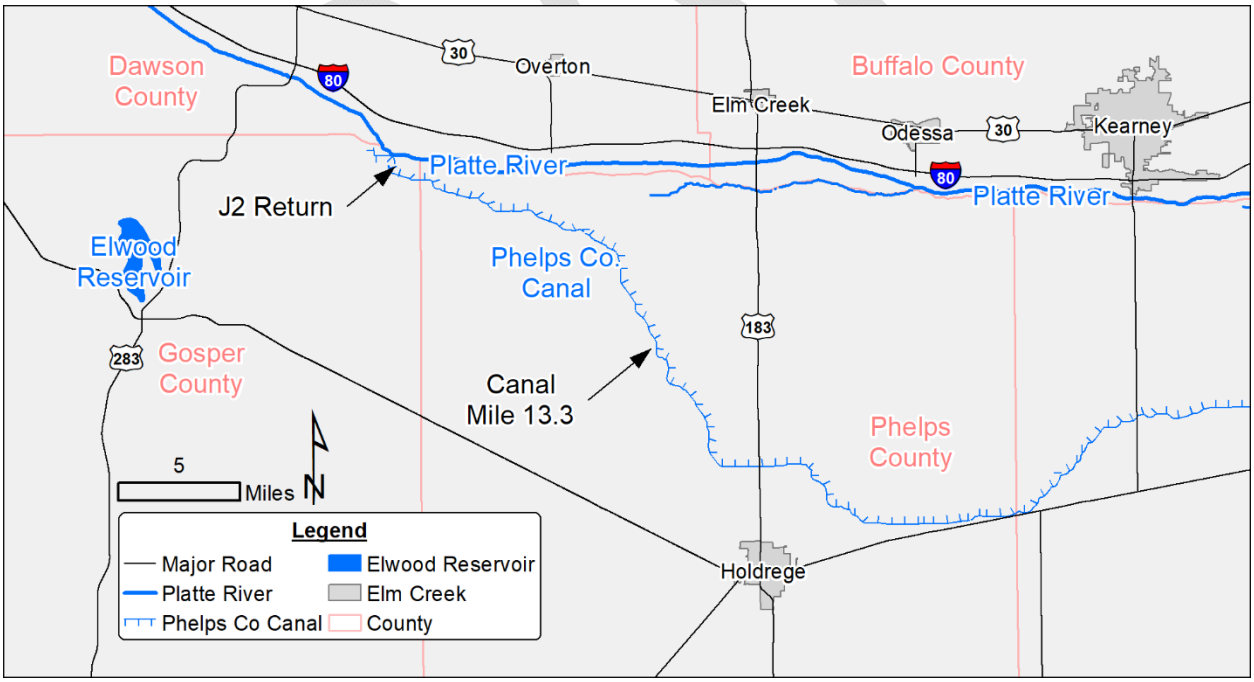

Figure 1: General recharge operations location map.

Table 1: Preliminary accounting for current Program recharge projects.

Project	Total Recharge [AF]	Avg. Annual Recharge [AF]	Total Accretions [AF]	Aquifer Storage [AF]	Yield at GI [AF]	Yield at GI during Shortage [AF]
Elwood Reservoir	25,000	6,200	4,200	20,800	3,600	1,800
Phelps Co. Canal	29,300	3,700	19,400	9,900	16,700	9,000
Total	54,300	9,900	23,600	30,700	20,300	10,800

The Cook well has been used to re-time a small portion of the water recharged via the Phelps County Canal. It has a Program score of 160 AFY. Operationally, it has been used to recapture 117, 152 and 59 AFY during its initial three years of operation in 2016, 2017 and 2018, respectively (EDO, 2019). Although small in comparison to the natural lagged accretions, the volumes augmented by the Cook well are included into the total accretions volume reported for the Phelps County Canal in **Table 1**.

Recharge via Elwood and Phelps and recapture via the Cook well will continue during the first Increment Extension. As a result, the annual and total accretions and the volume of water in storage in the aquifer will increase. The accretions will increase due to the volume of water currently in aquifer storage, particularly from Elwood (20,800 AF) and, to a lesser extent, Phelps (9,900 AF). If current operations continue "as is", preliminary forecasts suggest that the 30,700 AF of water in storage could increase to well over 50,000 or 60,000 AF by the end of the First Increment Extension in 2032. Total accretions could increase to well over 100,000 AF, of which only approximately 50% might appear at Grand Island during times of shortage (assuming current efficiencies regarding accretions, deficits and shortages are maintained). In addition, the broad-scale recharge project at Cottonwood Ranch is expected to be operational in 2020 and could provide an additional 10,000 AFY or so of recharge in the same general area as Elwood and Phelps.

III. REGIONAL RECAPTURE CONCEPT

The objective of the recapture well network is to maximize the efficiency of the Phelps, Elwood and Cottonwood Ranch recharge projects by maximizing the volume of water that returns to the river during times of shortage or other instances that would benefit Program management actions. This would be accomplished by increasing the number of recapture wells to create a regional recapture network.

An additional benefit of the recapture well network may be to provide relief from high groundwater to landowners in the project area. The Program will need to site recapture wells on property it does not own for the full potential of the regional recapture network to be realized. Dewatering is a benefit the Program can offer a landowner in exchange for access to their land for siting, operation and maintenance of recapture wells. This benefit would be available via an

agreement with the Program to pump a certain volume of water per year, during certain times of the year, or some other similar terms.

a. Location

Accretions from the three recharge projects appear in the Platte River between approximately the J2 Return and a point just up-river from the Elm Creek bridge (where Highway 183 crosses the river south of Interstate 80 in **Figure 1**). Based upon initial discussions with the Tri-Basin Natural Resources District (TBRND), the EDO assumes that it will be sufficient for regulatory purposes to demonstrate an overall water balance as long as recapture infrastructure is located in the general area of recharge and accretions. Consequently, the recapture wells will be sited on lands approximately adjacent to the J2 to Elm Creek reach. Lands considered around this reach include those where groundwater could be relatively easily captured and returned to the river via drain, creek or pipeline. Furthermore, priority is given to locations where the Program owns property, locations where the Program has a working relationship with the landowner, and/or locations where the Program could potentially provide high groundwater relief to landowners.

Three general priority areas for siting additional recapture wells were identified and are listed below (**Figure 2**), along with how they meet the above criteria:

1. The "Cook" area. The Cook area is where the currently operated Cook well is located. The Program owns a relatively small amount of land in this area and, based upon preliminary discussions, believes that landowners in this area would be willing to work with the Program to install additional recapture wells.

2. The "Batie" area. The Batie area is near the Batie Ditch, which discharges water into the Platte River near Cottonwood Ranch. The Program does not own land in this area but had discussions in the past about working with landowners in the area relative to high groundwater conditions.

3. The "Cottonwood Ranch" area. The Program owns a relatively large amount of land in this area and believes that landowners in this area would be willing to work with the Program to install recapture wells.

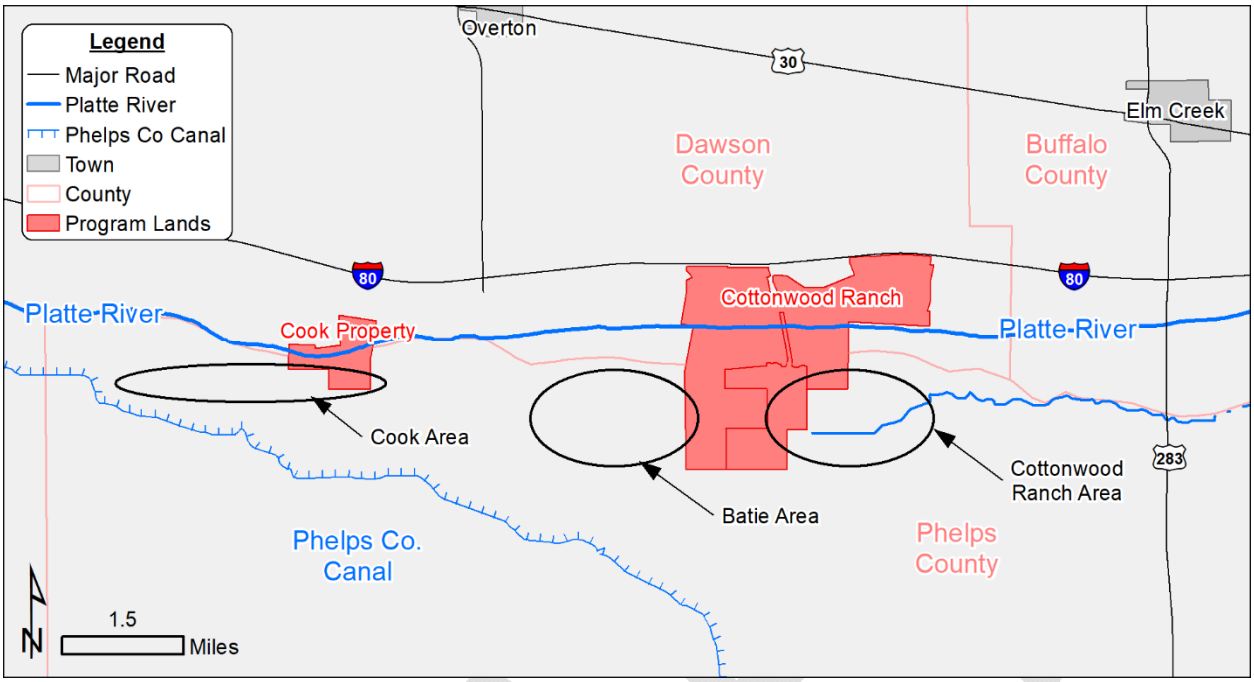

Figure 2: General areas of recapture well networks.

b. Operational Constraints

The recapture wells will be constrained operationally such that withdrawals from the aquifer do not exceed the volume of water "in storage" as a result of recharge, and such that lagged depletions to the river via operation of the wells do not exceed future accretions from recharge (particularly during times of shortage in the river). The EDO will work with the DNR and NRD regarding these and other constraints that might be imposed (well spacing requirements, aquifer drawdown limits, etc.).

Regarding net depletions to the aquifer, the preliminary forecasts described in Section II suggest that more than 100,000 AF could be available for retiming over the 13-year First Increment Extension (Extension). This is an average of approximately 7,500 AFY. This includes over 50,000 to 60,000 AF of water forecasted to be in storage and 50,000 AF available for retiming due to inefficient accretions. It is realized that these numbers will change over time with the addition of recapture wells. As such, the Program is currently developing accounting methods to track the water balance represented by recharge, subsurface accretions, interception by drains, pumping and lagged depletions related to pumping.

Regarding net depletions to the river, preliminary calculations suggest that continuous accretions from Elwood and Phelps are currently equal to approximately 8 cubic feet per second (cfs) and might be closer to 10 cfs by the end of the Extension in 2032. Additional accretions will occur when the recharge project at Cottonwood Ranch becomes operational in 2020. Preliminary calculations suggest that the Program could pump approximately 60 to 80 cfs in the general area of the recapture network for a duration of approximately 1 month while keeping maximum lagged depletions limited to approximately 10 cfs. In this way, the net effect of recharge and

recapture pumping is that no new net depletions are made to the river (particularly during times of shortage).

In addition to these accounting and depletive constraints, Tri-Basin Natural Resources District (TBNRD) enforces water well spacing requirements that limit the number of wells in an area based on their pumping capacity and configuration. Well spacing is addressed in section 8.3.2 of the TBNRD Rules and Regulations, which generally state the following requirements:

1. All wells or physically connected wells with a total pumping capacity in excess of 1,000 gallons per minute (gpm) must be 1,320 feet (1/4 mile) from all existing registered wells with a capacity in excess of 50 gpm, even if registered under the same ownership.

2. All wells or physically connected wells with a total pumping capacity in excess of 1,500 gpm must be 2,640 feet (1/2 mile) from all existing registered wells with a capacity in excess of 50 gpm, even if registered under the same ownership.

The recapture wells have a design capacity of 700 gpm per well. Therefore, these regulations will prevent connecting more than two recapture wells with common pipelines because their combined capacity will exceed the 1,500 gpm threshold associated with the 2,640 ft setback. This would eliminate from consideration most lands in the areas of interest due to the abundance of wells with a capacity in excess of 50 gpm. Preliminary discussions with TBNRD confirmed the EDO's interpretation of this regulation and the preliminary approach of not connecting more than two wells via a common pipeline. It is believed that the only potential opportunity for a variance would be regarding the statement "even [wells] registered under the same ownership" but this is uncertain.

There will also be constraints as to how much the Program can draw down the water table and how landowners might be able to use the wells for dewatering purposes, but these details have not been worked out with either the NRDs or the DNR. Preliminary calculations suggest that impacts to surround groundwater levels will be moderate and controllable. Similarly, given the proper forecasting tools, the recapture wells can be operated such that depletions do not occur during a shortage or at another time when augmentation is necessary. The Program will continue to work with the NRDs on these issues.

c. Preliminary Layouts

Preliminary wellfield layouts were developed for each of the three priority locations: Cook, Batie and Cottonwood Ranch. The layouts are not shown as they were developed at a feasibility level with the simple objective of developing representative layouts that adhere to the operational constraints outlined above while maximizing the recapture potential of each site such that realistic yield and cost estimates could be developed. Assumptions were made about where wells could be sited, where water could be returned to drains and where it could be returned to the river via pipeline. These alignments are not based on agreements or permissions with landowners, they are simply meant to portray possible alignments with the understanding that they are likely to change over time. In addition, supplemental wells were placed at locations other than the three priority locations to maximize the yield of the wellfield.

d. Preliminary Costs and Yields

Reconnaissance-level cost and yield estimates were developed from the wellfield layouts. Quantities were measured from the alignments on the layouts and unit costs were estimated from costs associated with the Cook well and past experience of the Program's groundwater special advisor. A few of the general assumptions regarding the wellfields are outlined below:

- It was assumed that each well would be supplied with a 20 to 25 horsepower pump that could produce about 700 gpm (1.6 cfs) per well. This is consistent with yields of irrigation wells in the area.

- Design engineering and management was assumed to be 10% of the construction subtotal.

- All costs include a 30% contingency.

Table 2: Costs and yields associated with wellfields at the priority locations.

	Number of Wells	Capacity [gpm]	Capacity [cfs]	Cost [$]
Cook	14	9,800	22	1,300,000
Batie	12	8,400	19	1,200,000
Cottonwood Ranch	10	7,000	16	1,200,000
Supplemental	6	4,200	9	800,000
Total	42	29,400	66	4,400,000

e. Preliminary Yield

As mentioned, the Cook well has an approved Program score of 160 AFY. Assuming the score scales linearly with the number of wells, the Program can anticipate a score of approximately 6,700 AFY from a wellfield with 42 wells. The Program believes this score could even be increased to 8,000 AFY or so if wells are sited further from the river than the current Cook well (such that the recaptured water is less likely to return during a shortage and lagged depletions from operations of the well are limited). Preliminary scoring is still being developed.

f. Permitting

New water well permits will need to be secured from the TBNRD. The Cook well was permitted as a dewatering/instream/environmental well. Each well in the recapture network will need to be permitted separately through the NRD. It is unclear who will be required to file the well permit application if the Program installs recapture/dewatering wells on land owned by another party (the Program or the landowner), but the Program will work with the NRD to make sure this is done in accordance with the NRD rules and regulations. The NRD has told the Program to

expect processing of permit applications to take about 30 days, and to expect to attend a public hearing regarding each well (likely at an NRD board meeting).

It is anticipated that the project will likely include minimal (if any) permanent or temporary impacts to wetlands. The likely approach will be to proceed under a Nationwide Permit 12. The Program will work with its permitting consultant, HDR Engineering, to ensure that proper notifications are provided to the United States Army Corps of Engineers. It is unlikely that this will be in a critical path for wellfield construction.

The project will include discharging water into a drain, creek and/or the river. Per written correspondence with the Nebraska Department of Environmental Quality during the design and construction of the Cook well, "a groundwater well that discharges directly, is uncontaminated, and used specifically for the purpose of surface water flow augmentation is not required to obtain a NPDES permit."

It is unlikely that permits will need to be secured from the DNR. As was the case with the Cook well, the Program will keep the DNR updated as to project progress but DNR permits will not be required. Groundwater is regulated by the NRDs.

IV. APPROACH AND SCHEDULE

As mentioned, the following approach reflects the EDO assuming responsibility for design, permitting and construction of the wellfield, which might ultimately be undertaken by the DNR, NDRs or both. However, the EDO would pursue a phased approach to project implementation. The first phase will include construction of a handful of wells, less than are planned for full buildout. This approach will allow the project to move forward while modeling, scoring, land negotiations and other activities associated with full buildout proceed this fall. It will also provide insight on construction and operational issues that might be unique to this project.

a. Phase I

Phase I will include the construction of 4 to 8 recapture wells, likely at the Cottonwood Ranch area. The Program plans to start at this location because it owns a large quantity of land in this area and there are landowners in the area who are interested in partnering with the Program on recapture/dewatering projects. The capacity developed in this initial phase of the project will be well below the capacity that theoretically could be developed, given the current volume of water available to pump and re-time.

A preliminary schedule for implementation of phase I is outlined below.

- Preliminary design: Present – November 2019
- Initiate permitting/agreements: Present – November 2019
- Permits secured: January 1, 2020
- Final design: mid-November – December 2019
- Bid letting and contracting: January 2020
- Construction: February – April 2020

Design of phase I will be undertaken by Program special advisor Bill Hahn, of Hahn Water Resources. The ED Office will coordinate project permitting, water accounting and coordination of the design and construction activities. The objective of phase I is to have approximately 4 to 8 recapture wells operational by the late spring or early summer of 2020.

b. Phase II

Phase II will include the construction of additional wells such that full buildout of the regional recapture network is realized. However, before final design of the full buildout phase takes place, the following tasks will need to be completed:

- Model and/or unit response function (URF) development encompassing Elwood, Phelps and Cottonwood Ranch recharge, and regional recapture network. This will determine the number of wells and locations of wells given operational constraints.

- Negotiations with area landowners regarding well siting agreements and/or easements.

- Design of the wellfield. This will likely be performed by a local engineer/contractor hired by the Program. This work is anticipated to be simple enough that a RFP can be developed for engineering services.

V. References

Executive Director's Office (EDO). Aug 27, 2019. Memo to PRRIP Water Advisory Committee: *2018 PRRIP Water Projects Accounting*.