



## **PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM 2009 Water Action Plan Update**



Prepared by the Office of the Executive Director and the  
Water Advisory Committee

**FINAL APPROVAL  
February 23, 2010**

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## **I. EXECUTIVE SUMMARY**

The Platte River Recovery Implementation Program (Program) includes a water objective of reducing shortages to target flows by an average of 130,000 to 150,000 acre-feet per year (AFY) in the central Platte River through a combination of reregulation and water conservation/supply projects. Implementation of three initial water projects – the Environmental Account in Lake McConaughy, the Pathfinder Modification Project, and Tamarack I – will be credited an average annual 80,000 AFY toward Program First Increment water objective. The remaining portion of the First Increment water objective will be met through a program of incentive-based water conservation and water supply activities that were first identified in the Reconnaissance-Level Water Action Plan (WAP). The Program's Water Plan budget was subsequently based on the information in the Reconnaissance-Level WAP.

This document provides an update to the Reconnaissance-Level WAP and reflects information available through the end of 2009. In addition to updating information on project yields, costs, and implementation schedules, it addresses the Program's directive to augment Short Duration High Flows, which is a new component of the WAP that was not previously considered. It also advances the concepts of quantifying water supply associated with excesses to Program target flows, another concept that was not addressed in detail under the Reconnaissance-Level WAP, and emphasizes the need to coordinate planning for multiple projects that rely on excess flows.

Updating the WAP has reinforced the importance of maintaining a methodical, cautious approach when assessing potential projects for implementation, particularly given the interrelated nature of projects and other efforts progressing within the Platte River basin. With the recommended project sequencing, the updated yield and cost estimates indicate that there are still combinations of projects that can likely be implemented within the First Increment to meet the Program water objectives within the Water Plan budget. However, certain combinations of projects are most certainly cost prohibitive. Operating within the Water Plan budget will require selecting combinations of projects with high and low unit costs – the current budget is not sufficient if all of the projects with the highest unit costs are selected.

The 2009 WAP Update provides a working document that can be utilized to assess progress toward the Program water objectives into the future; information was prepared by the Program's Executive Director's Office in conjunction with the Program's Water Advisory Committee (WAC), and has been provided to the Governance Committee. Actual updated yield projections, costs, and Program scoring cannot be provided with more certainty until full feasibility studies are completed. To that extent, the Program partners have agreed to continue investigating the WAP projects described herein, to develop more accurate yield and cost projections, but are not bound by any of the current estimates. The process for advancing WAP projects will remain as previously identified in the Reconnaissance-Level WAP, with specific proposals, budgets, and schedules for carrying out WAP project feasibility studies being provided to the Governance Committee for approval or rejection prior to implementing any projects.

## II. BACKGROUND

The Department of Interior and the states of Colorado, Nebraska, and Wyoming have committed to achieving the following water objective<sup>1</sup> by the end of the First Increment (13 years ending in 2019) of the Program:

*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 (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. 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.*

Implementation of the three initial water projects – the Environmental Account in Lake McConaughy, the Pathfinder Modification Project, and Tamarack I – will be credited an average annual 80,000 acre-feet (AFY) toward the Program First Increment water objective.<sup>2</sup> The remaining portion of the First Increment water objective will be met through a program of incentive-based water conservation and water supply activities.<sup>3</sup> The Reconnaissance-Level Water Action Plan<sup>4</sup> (WAP) included a combination of potential projects located in each of the three states: 9 projects in Nebraska, 3 projects in Wyoming, and 1 project in Colorado. The Reconnaissance-Level WAP also described the processes for including other water conservation/supply projects in the Program and for moving water projects through feasibility studies and implementation. **Figure 1** and **Figure 2** are provided for general orientation of the Platte River Basin and Central Platte River in Nebraska, respectively.

Progress toward the Program water objectives will be measured against the water-related milestones<sup>5</sup>. Milestone 4 addresses implementation of the Reconnaissance-Level WAP:

*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.*

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<sup>1</sup> PRRIP (2006). Program Document (pp. 3-4).

<sup>2</sup> PRRIP (2006). Program Document (p. 14).

<sup>3</sup> PRRIP (2006). Program Document (p. 14-15).

<sup>4</sup> PRRIP (2006). Attachment 5. Water Plan – Section 6.

<sup>5</sup> PRRIP (2006). Attachment 2. Milestones Document.

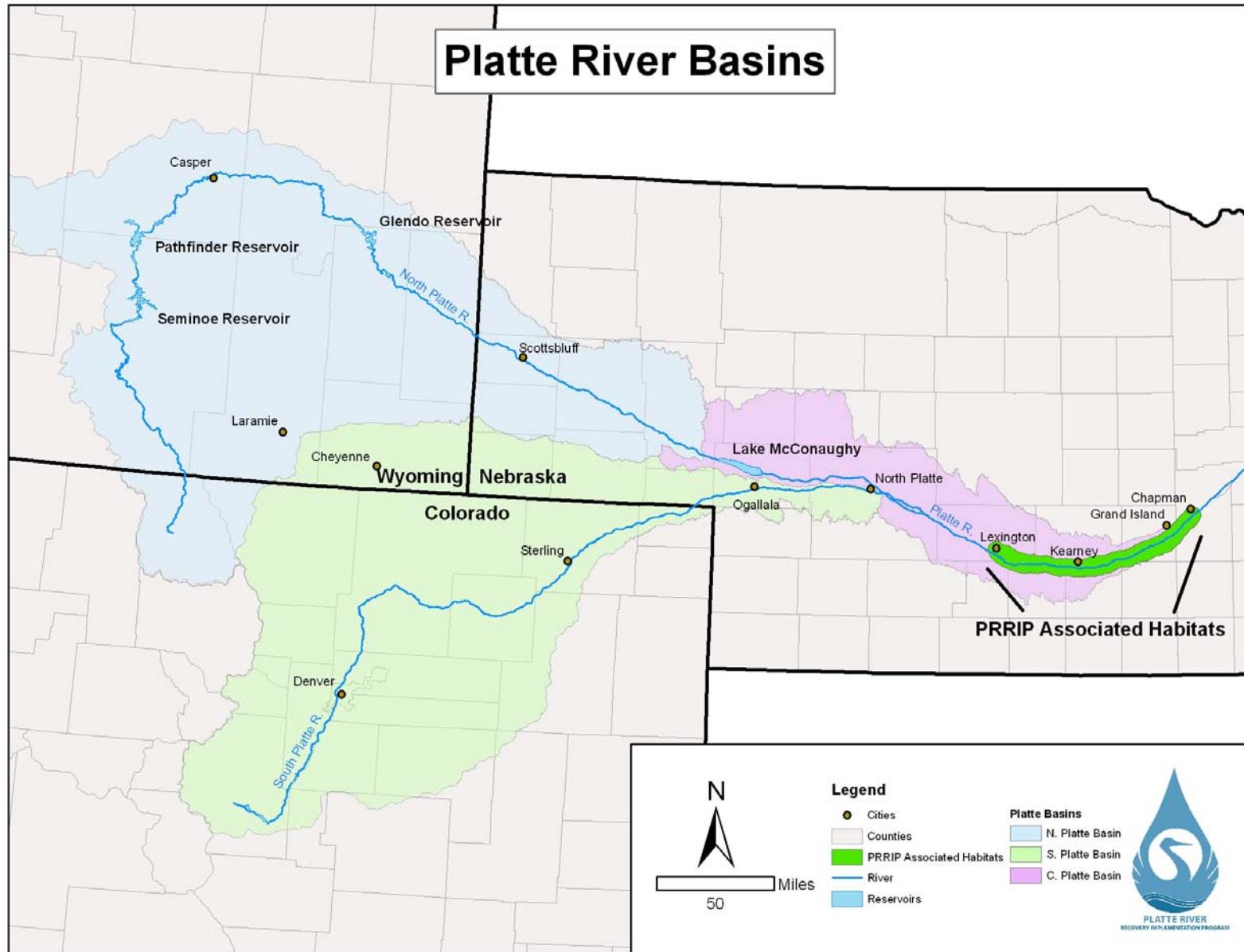
The explanatory materials in the Milestones Document provide estimated time frames for anticipated interim steps toward meeting each milestone (note that while these interim steps provide guidance, they are not to be considered as individual milestones for purposes of Endangered Species Act compliance). One such interim step toward implementing Milestone 4 is for the Governance Committee to complete feasibility studies on proposed projects and to develop an updated WAP by the end of 2009. The updated WAP was to 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 2014.

This document serves as the update to the Reconnaissance-Level WAP and provides a roadmap to meeting the 2014 interim goal and the 2019 water objective. While the update was commenced to fulfill the interim step for Milestone 4, it also provides great value in identifying changes since the Reconnaissance-Level WAP and in planning the sequencing of WAP projects. The update represents information available through the end of 2009, and may be updated as WAP feasibility studies are completed and projects are implemented. It will be used by the Program Office of the Executive Director (ED Office) as a guide to track milestone progress and to assist the Program partners in identifying next steps toward additional project feasibility investigations. Further, it is a working document that captures an overview of key information for the Program partners' reference. Provided as a supplement to the Reconnaissance-Level WAP, information is updated where necessary but not repeated in entirety.

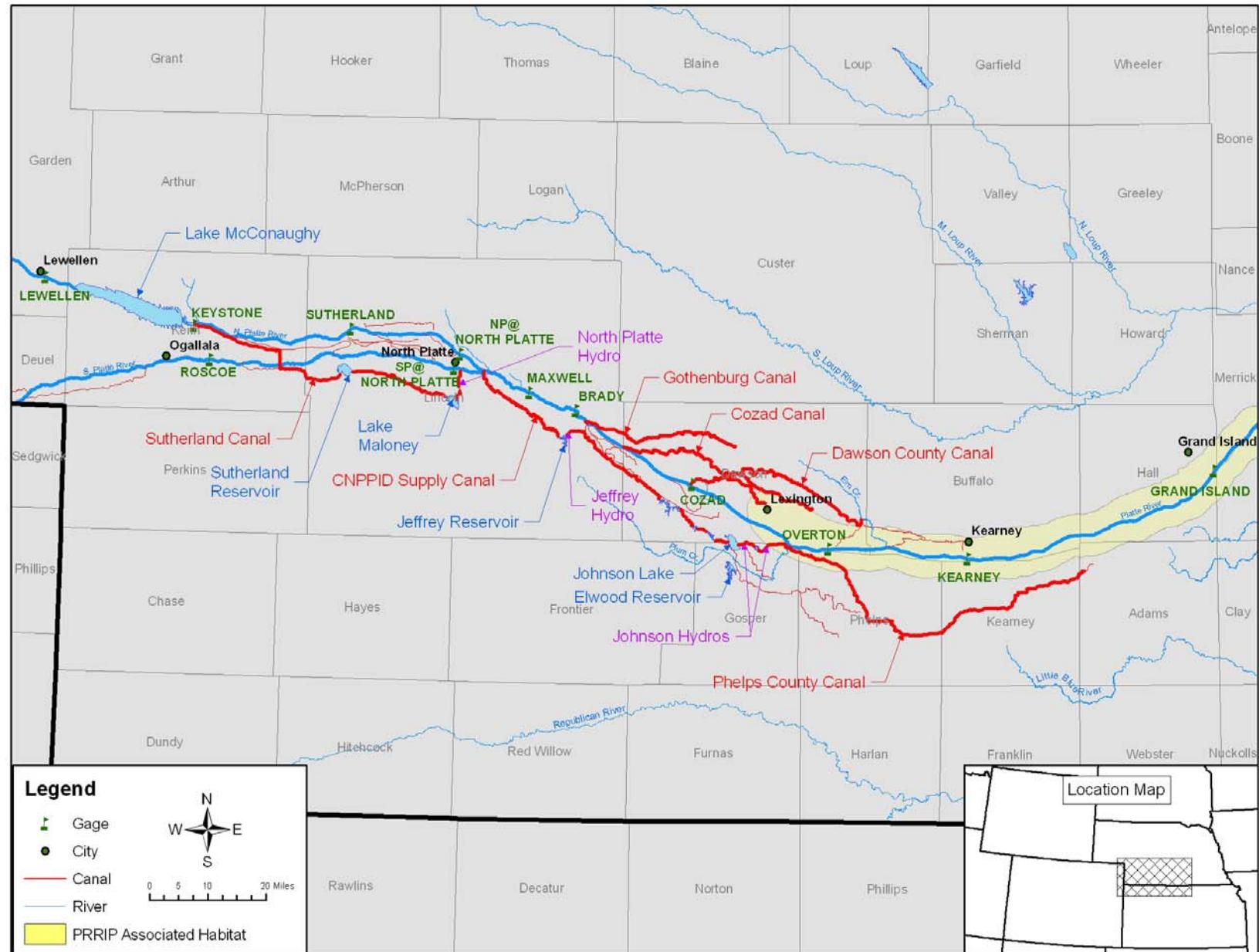
WAP projects are currently at various stages of advancement. The ED Office has compiled extensive information in the format of background reports and initial feasibility study findings, which will be utilized as the updated WAP is implemented. Feasibility investigations have been initiated for several priority projects (Tier 1) including CNPPID Reregulating Reservoir(s), Elm Creek Reregulating Reservoir, and Nebraska Ground Water Recharge projects. Permitting for the Pathfinder Municipal Account project is in process and construction is scheduled to begin in 2010. Recent analyses have decreased annual Glendo Reservoir yield so that storage is no longer available to the Program. However, legal and policy issues currently being evaluated may determine that the Program could receive some credit for replacement water released from Glendo Reservoir by Wyoming to mitigate depletions to the North Platte. The Net Controllable Conserved Water project could potentially be implemented once a leasing contract is arranged with CNPPID. The Colorado Ground Water Management project is contingent on full construction of Tamarack I, anticipated in 2010, and updated accounting and project analyses being completed before an agreement with the Program and Colorado can be developed. As information advances and feasibility studies are completed, the WAC will provide recommendations to the Governance Committee for approval.

Though initial feasibility studies have already been initiated for several WAP projects, actual updated yield projections, costs, and Program scoring cannot be provided with more certainty until final feasibility studies are completed. To that extent, the Program partners have agreed to continue investigating the WAP projects described herein, to develop more accurate yield and cost projections, but are not bound by any of the current

estimates presented herein. Additionally, project sponsors, and possibly the State of Nebraska (for projects in Nebraska) may reserve a portion of projects yields. As a result, the total average annual yield to the Program resulting from WAP projects may be less than the currently estimated values.



**Figure 1. Platte River Basin**



**Figure 2. Central Platte River Location Map**

### III. TARGET FLOWS AND SHORT DURATION HIGH FLOWS

The United States Fish and Wildlife Service (FWS) instream flow recommendations for the central Platte River are described in the Program Document<sup>6</sup> and are quantified in the Program Water Plan Reference Materials.<sup>7</sup> These FWS recommendations for the central Platte River include target flows, peak flows and other flows deemed important by the FWS, and are to be examined through the Program's Adaptive Management Plan and may be modified by the FWS accordingly. Two subsets of instream flows are addressed throughout this document:

- Target flows are defined as the “species flow” plus the “annual pulse flow” recommendations and 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 AFY First Increment goal for reductions in shortages to target flows. The Program daily target flows are provided in the Program Document Attachment 5 Water Plan, Section 11 Water Plan Reference Material, Appendix A-5.<sup>8</sup>
- Short-duration high flows (SDHF) 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 Reconnaissance-Level WAP identified water projects that could be used toward reducing shortages to target flows; at that time, there was no consideration of how projects could be operated to augment a SDHF. The ability to produce a bankfull SDHF, a substantially higher peak than the maximum target flow, and to control that flow for a specific three days in order to perform the scientific experiments under the Adaptive Management Plan requires a different project planning approach than those conceived under the Reconnaissance-Level WAP.

To address the ability to deliver Program water at the appropriate time, place, and quantities, including a SDHF, the Governance Committee completed a Water Management Study (WMS) to evaluate the feasibility of delivering by the end of 2011 (Year 5) a SDHF of 5,000 cfs of Program water for three days to the upper end of the associated habitat (Overton gage) from September 1 through May 31, and an irrigation season flow of 800 cfs.<sup>9</sup>

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<sup>6</sup> PRRIP (2006). Program Document (pp. 11-14).

<sup>7</sup> PRRIP (2006). Attachment 5. Water Plan – Section 11.

<sup>8</sup> The Water Advisory Committee and Governance Committee have advised to use Appendix A-5 in evaluating Water Action Plan project yields. This is being further reviewed by the Governance Committee Scoring Subcommittee (see Section V.D. WAP Project Scoring below).

<sup>9</sup> PRRIP (2006). Program Document (pp. 16-17).

The WMS was completed in two phases. Phase I evaluated the ability of the existing river and irrigation/hydropower systems to be operated to achieve these flows. WMS Phase I concluded that capacity constraints in the Platte River and in the Nebraska Public Power District (NPPD) and Central Nebraska Public Power and Irrigation District (CNPPID) systems' current infrastructure prohibit a SDHF of the magnitude desired without additional new infrastructure. This conclusion was made even after modeling the North Platte River capacity at 3,000 cfs at North Platte, in anticipation of improvements currently being made under the Program. The WMS Phase I study recommended storage near the associated habitat to help achieve the SDHF objective. Although a somewhat similar storage project had been included in the Reconnaissance-Level WAP, the design of a storage facility utilized to augment a SDHF would require considerably larger storage and outlet works capacity.

The purpose of the WMS Phase II was to identify, screen, and evaluate the technical, cost, environmental, and institutional attributes of selected water storage projects that could contribute to Program flow objectives. A preliminary list of 47 individual projects was considered and three projects were studied in detail: (a) use of the existing Elwood Reservoir, (b) a potential new Plum Creek Reservoir, and (c) potential new re-regulating reservoirs supplied by the CNPPID Supply Canal. A key finding from the WMS Phase II, also demonstrated in the 2009 Flow Routing Test<sup>10</sup> conducted by the Program in cooperation with FWS, CNPPID, NPPD, and Nebraska Department of Natural Resources (Nebraska DNR), is the importance to continue work toward expanding the safe-conveyance capacity of the North Platte River at North Platte (choke point) and other channel restrictions as channel capacity is critical to achieving flow targets, and to the extent possible minimizing the need and size of additional structural solutions. The WMS Phase II results showed that storage near the associated habitat could theoretically suffice in augmenting a SDHF and contributing to the AMP experiments, but that costs may be prohibitive considering the estimated yield of water produced toward Program water objectives and the Water Plan budget of \$90.14 million (in 2005 dollars) for water conservation/ supply activities<sup>11</sup>.

The WMS results prompted the Program to initiate feasibility studies to evaluate the use of Elwood Reservoir and potential new reregulating reservoir(s) under the CNPPID system for Program purposes to supplement a SDHF. The Program is also participating with Central Platte Natural Resource District (NRD) and NPPD in the feasibility investigation of constructing a new reservoir on Elm Creek. These investigations will be used to further assess the ability to augment a SDHF while meeting the other Program water objectives within the Program Water Plan budget. These studies are in progress, and will further assess the ability of any WAP project that is operated to augment a SDHF to also be operated to meet target flows. The Program Document specifies:<sup>12</sup>

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<sup>10</sup> FWS, et. Al. (2009). Platte River Flow Routing Test: Results, Information Gleaned, Lessons Learned.

<sup>11</sup> PRRIP (2009). Attachment 1, Finance Document (p. 5).

<sup>12</sup> PRRIP (2006). Program Document (p. 4, footnote 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.*

Given the conclusions from the WMS and the need to provide SDHF water early in the First Increment to support the Program's Adaptive Management Plan (AMP) experiments, the Water Plan activities to date have focused heavily on projects that support a SDHF. Feasibility studies for projects that provide storage close to the associated habitat have been advanced prior to other potential water projects, primarily to support the AMP goals. The FWS is evaluating its policy to consider whether a 'bonus' score or other incentive may be appropriate for such actions. FWS is also considering whether a 'bonus' score may be applied for projects that only help augment a SDHF (e.g. expansion of the North Platte choke point capacity).

#### **IV. EXCESS FLOWS AS A SOURCE OF SUPPLY FOR WAP PROJECTS**

In forming the Program Cooperative Agreement and developing scores for the initial three water projects, the target flows were evaluated at Grand Island<sup>13</sup>. Several WAP projects also rely on excess flows for a portion or all of their water supply:

- CNPPID Reregulating Reservoir
- Elm Creek Reregulating Reservoir
- Nebraska Ground Water Recharge<sup>14</sup>
- Colorado Ground Water Management (Tamarack III)
- Nebraska Ground Water Management<sup>15</sup>
- Power Interference

The Reconnaissance-Level WAP referred to excess flows as flows greater than target flows at the associated habitat. Flows at the Grand Island gage were compared to Program target flows to calculate excess flows and shortages to target flows, with the exception of the CNPPID Reregulating Reservoir project. This exception for the CNPPID Reregulating Reservoir analysis was to consider the projects' close proximity to the associated habitat, and evaluate how use of the closer Overton gage could be utilized to make daily operational decisions.<sup>16</sup> Historic flows at Overton were used to determine the amount of water that should be stored or released from the reservoir to meet target flows at Grand Island, with buffers incorporated to provide a factor of safety in the decision to store or release.

Further, in the Reconnaissance-Level WAP, a daily excess flow analysis was considered

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<sup>13</sup> Grand Island flows greater than the target flows are considered "excesses" to target flows (excess flows). Grand Island flows less than the target flows are considered "shortages" to target flows.

<sup>14</sup> Referred to as "Dawson and Gothenburg Canal Groundwater Recharge" in the Reconnaissance-Level WAP; the updated project concept includes recharge in potential new locations and integration of ground water management (see Appendix A Section I.C. below).

<sup>15</sup> Referred to as "Groundwater Management Active Pumping" in the Reconnaissance-Level WAP.

<sup>16</sup> PRRIP (2006). Attachment 5. Water Plan – Section 6 (p10).

appropriate for some projects while monthly, or a combination of monthly and daily, analyses were used for others. To determine project supply, excess flows were then typically further constrained by project specifics such as physical supplies available at the project site and project infrastructure capacities.

Quantification of excess flows as a water supply will be further evaluated under WAP feasibility investigations and when developing project scores. The importance of evaluating available excess flows has been elevated due to the recent preliminary designation of the Lower Platte by the Nebraska DNR as "almost fully appropriated". The Central Platte and North and South Platte upstream of Columbus have all been designated as "fully appropriated" in the past, and much is designated as "over appropriated". New and additional information gathered since the Reconnaissance-Level WAP as well as ongoing discussions with the WAC, WAP project workgroups, and the FWS have led to changes in how excess flows may be calculated for Program feasibility analyses. Project complexities, project operational analyses, or the interactions between projects may impact excess flow availability. It is also likely that official project scores, which will be developed separately from feasibility and design analyses, may evaluate excess flows differently than within feasibility investigations (see Section V.D. below for more information).

The potential effect of multiple WAP projects relying on excess flows as a water supply is another important consideration. To date, the Program has been under the directive of considering projects that can be implemented as soon as possible to augment a SDHF, to support the AMP experiments. Depending on the Governance Committee's assessment of the current reregulating reservoir investigation results, and if these projects continue to advance, future feasibility studies and scoring of other projects that depend on excess flows as a water supply may need to consider effects of excess flows being prioritized first toward reregulating reservoir storage. The ED Office is working directly with the WAC, WAP project workgroups, FWS, and Program contractors regarding excess flow estimates used for WAP project feasibility analyses.

## **V. WAP PROJECT UPDATES**

The WAP project descriptions from the Reconnaissance-Level WAP have been updated with new information available through the end of 2009 (**Appendix A**). Several WAP projects are under initial feasibility investigations or are being advanced by project sponsors, while others remain at a conceptual status. Based on updated information, the Dry Creek/Ft. Kearney Cutoffs project described in the Reconnaissance-Level WAP has been re-categorized as an option under the broader Nebraska Ground Water Management project. Consideration of a potential new reregulating reservoir on Elm Creek has been added as a new project. With these changes, there are still 13 potential projects under the updated WAP.

The update confirms that meeting Program water objectives in a region of Nebraska that has been declared fully or over-appropriated will be extremely difficult. The Program is searching for water to meet Program water objectives concurrent to other Nebraska

entities searching for water to meet the State of Nebraska Depletions Plan and other legislative requirements. Through a combination of retiming excess flows and producing water through water conservation/supply activities, the WAP project updates still indicate that the volume of water needed to meet Program water objectives may be attainable. The projects also provide a range of alternatives and flexibility toward achieving different Program water-related objectives (SDHF versus target flows) with a variety of types of water (excess flows versus water conservation projects).

An updated analysis of the costs, as further described below, indicates that the project costs will require the Governance Committee to make careful choices and that further direction on the priority toward making a SDHF and meeting Program water objectives may be needed, given the expense of reregulating reservoir projects. The potential WAP projects have a large range of unit costs – one AFY yield does not come at the same price for all projects. The cost information provided in this update is anticipated to be useful in evaluating options as prior WAP project implementation decisions are made and associated costs are quantified.

#### **A. Approach**

Due to the Program schedule, including the goals of producing a SDHF by 2011 and achieving 25,000 AFY reduction in target flow shortages by 2014, the ED Office and WAC determined that it is necessary to prioritize and sequence projects so that some projects can advance while additional information is gained for other projects. The process for advancing water projects described in the Reconnaissance-Level WAP (adding new projects, conducting feasibility studies and approval/rejection by the Governance Committee, and project implementation) was reviewed and remains as previously described.<sup>17</sup> All projects must be approved or rejected by the Program Governance Committee.

To date, a substantial portion of Program water-related efforts have been focused on how WAP projects can be used to augment a SDHF by 2011 or as soon as practical. As part of the WMS and the WAP update, the potential WAP projects were characterized to identify those projects that could be managed to meet SDHF goals (**Table 1**). Table 1 also identifies projects that are based on retiming excess flows and projects that result in “new water” through water conservation activities. Projects that include a storage component, that result in water conservation/supply associated with storage water rights in Lake McConaughy, or that produce water that can be routed to Lake McConaughy are also identified.

Based on results of the WMS and considering the lead time needed to potentially design and construct a new reservoir, the CNPPID Reregulating Reservoir project was given first priority, feasibility studies were initiated by the Program in 2009, and significant progress is being made. Similarly, the Program is also participating in the Elm Creek Reregulating Reservoir feasibility investigation.

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<sup>17</sup> PRRIP (2006). Attachment 5. Water Plan – Section 6 (pp. 5-7).

The process for identifying the sequencing between other WAP projects is described below. Updated information on project yield and cost estimates was considered in the sequencing. The recommendation for sequencing projects will be continually reassessed as new or better information on the yield, cost, and project constraints are obtained through project feasibility investigations. Similar to the adaptive management concept, the fundamental approach to implementing the Water Action Plan will be to move forward with the best available information at this time while also continuing to assess new information to make informed decisions.

**Table 1. Overview of Water Action Plan Project Components**

WAP PROJECT	TYPE OF WATER <sup>a</sup>		SOURCE OF WATER SUPPLY			APPLICATION	
	Re-timed Water	New Water	Excess to Target Flows	Lake McConaughy <sup>b</sup>	Other Source	SDHF <sup>c</sup>	Target Flows
CNPPID Rereg Reservoir	X		X			X	X
Elm Cr Rereg Reservoir	X	X	X			X	X
NE Ground Water Recharge	X		X				X
Net Cntrl Conserved Water	X	X		X		X	X
Pathfinder Municipal Accnt	X	X			N Platte	X	X
Glendo Storage		X			N Platte	X	X
CO Ground Water Management	X		X		S Platte		X
NE Water Leasing		X		X		X	X
NE Water Management Incentives		X		X		X	X
NE Ground Water Management	X	X	X	X		X	X
Power Interference	X			X		X	X
WY Water Leasing		X			N Platte	X	X
LaPrele Reservoir		X			N Platte	X	X

<sup>a</sup> Approximately half of the water supply source in the Reconnaissance-Level WAP was re-timed water and half was “new” water resulting from water conservation/supply projects.

<sup>b</sup> Lake McConaughy water results from water conservation/supply projects that are associated with storage water rights.

<sup>c</sup> Any project that results in water in Lake McConaughy is considered available to augment a SDHF; certain projects may be designed specifically to make SDHF releases.

## B. WAP Project Sequencing

Projections of WAP project yields, costs, time to implement, and other factors (legal, institutional, social, and environmental issues) were considered in evaluating how to sequence WAP projects. Criteria modified from the 1999 Water Conservation/Supply Study were used to provide a simplified ranking approach. Other considerations included:

- Priority on investigating projects that can be used to augment a SDHF,
- Priority on projects already being advanced by Program partners (project sponsors),
- Achieving a balance between projects that retime excess flows and projects that result in “new” water added to the Platte River through water conservation/supply activities, and
- Achieving a balance between projects with high capital costs, and consequently high salvage values, with those that have perpetual annual leasing costs.

Technical expertise and institutional knowledge from WAC members was heavily relied upon for this process, given that most projects are still at either a conceptual or initial feasibility investigation status. The purpose of this ranking was not necessarily to select one project over another, but rather to identify a general sequencing of projects to help focus the WAP related efforts.

Projects that will be advanced through feasibility studies and other next steps in the upcoming two years are categorized as Tier 1 (**Table 2**). As further described under the subsequent project yield section of this document, these projects are anticipated to be implemented and capable of meeting the interim goal of reducing shortages to target flows by 25,000 AFY, or being used for other Program purposes, by the end of 2014. Projects that require additional scoping before feasibility studies can be initiated, projects with high unit costs, or where the least amount of information is available at this time were considered Tier 2 and Tier 3.

**Table 2. Water Action Plan Project Prioritization<sup>a b</sup>**

		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
TIER 1	CNPPID Reregulating Res											
	Elm Cr Reregulating Res											
	NE GW Recharge											
	NCCW											
	Pathfinder Municipal Accnt											
	Glendo Storage											
TIER 2	CO GW Management											
	NE Water Leasing											
	NE Water Mang Incentives											
TIER 3	NE GW Management											
	Power Interference											
	WY Water Leasing											
	LaPrele Reservoir											

<sup>a</sup> The cost analysis update provided in Section V.E. below assumes project is operating by the end of year shown. Depending on the project, it may not yet be complete or producing the full yield by this time.

<sup>b</sup> 314 AFY of the Net Controllable Conserved Water associated with a Bureau of Reclamation grant is already being provided to the Lake McConaughy Environmental Account, at no cost to the Program.

### C. WAP Project Yield Estimates

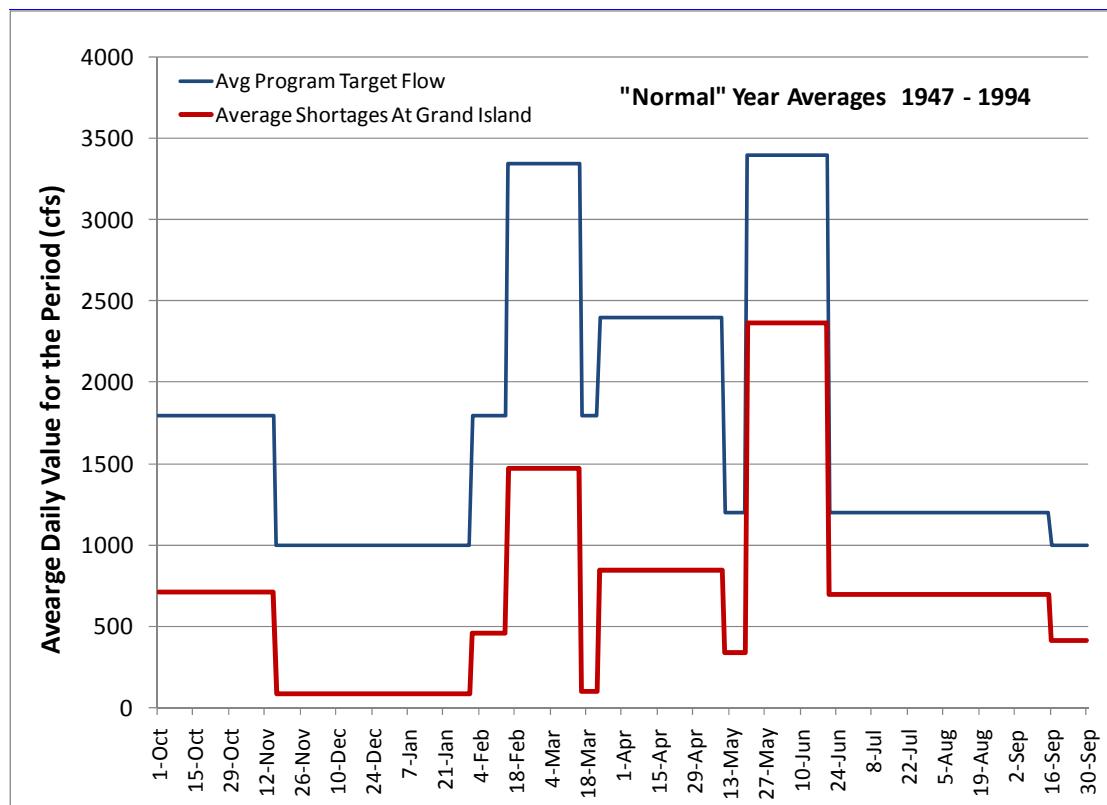
Although the OpStudy model was not utilized for this WAP update, it is anticipated that it will continue to be used to develop project scoring toward Program water objectives, particularly to assess the combined effects as multiple projects are implemented. Project yields have been updated where new information is available, otherwise yields remain the same as presented in the Reconnaissance-Level WAP. Updated yield estimates have been routed to the associated habitat, using the Program WMC Loss model.<sup>18</sup> This allows comparison of updated yields to those reported under the Reconnaissance-Level WAP without requiring OpStudy analysis at this time.

In the process of updating yield projections, it was identified that in the Reconnaissance-Level WAP, individual projects yields were *generally* estimated at a project location and then routed to the associated habitat using the WMC Loss model. However, the yield estimates for the Net Controllable Conserved Water, Pathfinder Municipal Account, and Glendo Storage projects were only provided at the project location and were not routed to the associated habitat. The Reconnaissance-Level WAP describes a process whereby the Platte River EIS/ESA team calculated individual and cumulative yields for each project as well as the potential interactive effects between the projects, using the OpStudy model.

The Net Controllable Conserved Water, Pathfinder Municipal Account, and Glendo Storage projects provide a benefit in that storage in upstream reservoirs allows added flexibility to make releases when needed to meet target flow shortages. However, a challenge in routing the flows to the associated habitat and estimating the transit loss effects on the yield at the associated habitat is that the transit losses vary significantly

<sup>18</sup> The WMC Loss model was first developed for the 1999 Water Conservation/Supply Study and was utilized in the Reconnaissance-Level WAP. The WMC Loss model was updated by Boyle/AECOM for the WMS Study.

throughout the year. **Figure 3** depicts the Program target flow for the “normal” year hydrologic category and the average historical shortages in normal years at Grand Island. This shows that while shortages are relatively low and releases from Lake McConaughy are less likely in the months of December and January, shortages occur in all months and releases could be made any time of year.



**Figure 3. Program Target Flows and Average Shortages at Grand Island**

In support of this WAP update, the effects of routing these three project yields to the associated habitat using the WMC Loss Model were evaluated. The loss estimates developed for the WMC Loss Model include open river segment evaporation and seepage losses. Per discussions with the Wyoming Water Development Office (WWDO), analysis for the Pathfinder Municipal Account and Glendo Reservoir Storage assumed that water was routed to Lake McConaughy in September. River losses from Wyoming projects to Lake McConaughy should be considered preliminary. As additional information is provided by the WWDO, routing will be updated. No seepage or evaporative losses were applied to water in Lake McConaughy storage. Water from these projects and the Net Controllable Conserved Water project was then routed to Grand Island throughout the year. This analysis assumed that the water was protected from diversions. River losses were smallest in March and greatest in September. **Table 3** presents the high- and low-end range of losses to route the water from the project location to Grand Island for the three projects which had previously been evaluated at the project locations. These data have been used to provide a range of yields for these projects at the associated habitat, as described in more detail in Appendix A.

**Table 3. High and Low Average Monthly Losses from the WMC Loss Model**

WAP PROJECT <sup>19</sup>	LOW (March)	HIGH (September)
Net Controllable Conserved Water	4%	31%
Pathfinder Municipal Account	10%	35%
Glendo Reservoir Storage	7%	33%

The resulting yield estimates at the associated habitat are provided in **Table 4**. Yields will continue to be updated as project feasibility investigations advance and as projects are further defined.

The yield estimates in the Reconnaissance-Level WAP represented anticipated yield to the Program and accounted for any yield that the State of Nebraska would reserve toward its depletions plan. At that time, Nebraska indicated interest in most of the projects located within Nebraska. The updated yields for project located in Nebraska *do not* account for any water that would be reserved by Nebraska or any other project sponsors. Therefore, the yields presented in this update are higher than the yield that will ultimately be available to the Program. Similarly, the total WAP costs are likely to be less as individual project costs are reduced proportionally to project partners reserving portions of the project yield.

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<sup>19</sup> Pathfinder and Glendo water was routed to Lake McConaughy in September with an average loss of 4%. Water was then routed from Lake McConaughy to Grand Island during the March and September period. The losses shown in the table are the total loss incurred, including routing the water to Lake McConaughy.

**Table 4. Estimated Average Annual WAP Project Yields at the Associated Habitat.**

SEQUENCING PRIORITY	WAP PROJECT	ESTIMATED YIELD <sup>a</sup> (AFY)
TIER 1	CNPPID Reregulating Reservoir <sup>b</sup>	30,000
	Elm Creek Reregulating Reservoir <sup>c</sup>	NA
	NE Ground Water Recharge <sup>d</sup>	1,800
	Net Controllable Conserved Water (a) <sup>e</sup>	217 - 300
	Net Controllable Conserved Water (b) <sup>a, e</sup>	4,930 - 10,160
	Pathfinder Municipal Account <sup>f</sup>	3,250 - 4,500
	Glendo Storage <sup>g</sup>	0
	CO GW Management	17,000
<b>Tier 1 Project Total</b>		<b>57,197 — 63,760</b>
TIER 2	NE Water Leasing	7,000
	NE Water Management Incentives	7,000
	NE Ground Water Management	1,400
	<b>Tier 2 Project Total</b>	<b>15,400</b>
TIER 3	Power Interference	1,400
	WY Water Leasing	3,900
	LaPrele Reservoir	2,200
	<b>Tier 3 Project Total</b>	<b>7,500</b>
<b>WAP TOTAL</b>		<b>80,097 — 86,660</b>

<sup>a</sup> Updated yield estimates do not account for water that may be reserved by Nebraska or other project sponsors. Italicized yields were updated from those presented in the Reconnaissance-Level WAP, based on information provided in Appendix A below.

<sup>b</sup> As a result of pre-feasibility analysis, a new reservoir supplied with excess flows from the J-2 Return is likely. A combination reservoir located between the south channel of the Platte River and the Phelps County Canal (J-2 Return Alternative 2, Area 1 & 2 Combination) rose to the top as a preferred alternative due to target flow yields, SDHF augmentation, and project costs. Yields estimated for this alternative ranged from 34,237 AFY in a representative dry year to 57,931 AFY in a representative wet year. 30,000 AFY is used as a conservative estimate for this project until full feasibility is completed.

<sup>c</sup> Estimated yields and costs for the Elm Creek project are anticipated to be available in late 2009/early 2010. In the interim, Elm Creek is being carried forward as a potential WAP project because of its potential to be utilized for both Program SDHF and target flow objectives.

<sup>d</sup> Estimated yields will be updated with information from preliminary feasibility analyses being completed in 2009 and 2010; information to date indicates that updated yields may be higher than previously estimated.

<sup>e</sup> NCCW yield is calculated by applying a methodology developed by CNPPID, consulted on with the Program's Governance Committee, and approved by FERC. Yield at the associated habitat was routed using the WMC Loss model.

<sup>f</sup> Wyoming has indicated that loss from Pathfinder to Lake McConaughy may be closer to 12% as compared to the 6.34% loss from the WMC Loss model used to develop these yields. Project yields will be updated as additional loss data becomes available.

<sup>g</sup> Wyoming has advised that there is no longer any yield from Glendo available for the Program without a FWS policy clarification. Glendo is being carried forward as a potential project until this issue is further explored.

## D. WAP Project Scoring

Yield estimates will continue to be updated as feasibility investigations provide new information. FWS has indicated that a combination of detailed analyses developed under feasibility investigations along with information from evaluating combined projects with OpStudy (or OpStudy hydrology) will be considered in developing a project score.

Feasibility studies that consider daily operations and sensitivity analyses will provide information that may be used to adjust the OpStudy results for effects that cannot be captured in a monthly system model. Daily OpStudy output may also be used to evaluate projects when daily operations are beneficial. The following assumptions are currently being utilized for feasibility studies, but may also be developed as additional information is obtained:

- **Hydrologic Period of Record** – A period of 1947-1994 hydrology will be used to provide a consistent analysis period to compare results with previous Program modeling and scoring conducted under the Environmental Impact Statement, Biological Opinion, and preliminary scoring for the Reconnaissance-Level WAP. Other periods of record may also be appropriate for project feasibility studies for purposes of estimating a “firm yield” or cost-effectiveness during a drought period. It is anticipated that actual project scoring will be conducted with 1947-1994 OpStudy-modeled hydrology that has already (a) been adjusted for ‘present conditions’, and (b) simulated hydrologic impacts of the initial three state projects (Lake McConaughy Environmental Account, Pathfinder Modification, and Tamarack I).
- **Combined Effects of Multiple Projects** – It is anticipated that a *cumulative* scoring approach will be used to identify combined effects as multiple projects are implemented, *i.e.*, the cumulative effect of the three initial water projects plus the WAP projects on flows at the associated habitat. It may be difficult to track individual projects scores as subsequent projects result in necessary changes to earlier project management. The cumulative approach is analogous to and consistent with the approach taken earlier to assign a collective score of 80,000 AFY to the three initial water projects.
- **Partial Scores Based on Project Location** – A “full score” will likely only be provided for projects that provide all of the yield upstream of Lexington (in the Platte River north channel) or Overton (in the Platte River south channel). Zero score will be provided for projects that only return water downstream of Grand Island. For water returned between Lexington and Grand Island, the score will be pro-rated in proportion to the percent-of-habitat-reach that benefits (Lexington to Grand Island).

A Scoring Subcommittee was recently formed to further advance discussions regarding the scoring analysis of proposed WAP projects. The ED Office is currently developing a case study to assist the Scoring Subcommittee in determining how the CNPPID Reregulating Reservoir project will be scored, based on results from the pre-feasibility investigation.

## E. WAP Project Cost Estimates

The following information describes an update on the costs estimates, based on the ED Office consultation with a private economist, George Oamek of Honey Creek Resources.

### 1. Initial WAP Cost Estimates

The Reconnaissance-Level WAP provided estimated costs for the 13 WAP projects identified at that time, and estimated the length of time required for their implementation. Those cost estimates, expressed in 2000 dollars which was the year the report was completed, are shown in **Table 5**. The range of total present value cost was originally estimated to be \$36.9 to \$68.8 million.

### 2. Impact of Cost Inflation and WAP Implementation Schedule

There has been significant escalation of construction and other water-related costs between the years 2000 and 2009. Depending on the specific cost index considered, this inflation has ranged from about 3.4 percent<sup>20</sup> to about 4.8 percent<sup>21</sup> per year between 2000-2008, or about 4 percent per year for analysis purposes. This range is higher than the longer-term historical trend of approximately 3.0 percent for both. It is likely that for some cost items, the rate of inflation has been higher than this average while it has been lower for some other items. Updating costs for inflation results in increased cost projections. However, in addition to inflation, the Program First Increment is currently in year 3 of a 13 year program. Therefore, the maximum project implementation period has been reduced by at least 3 years. This change serves to reduce the cost projection.

**Table 6** shows the result of updating the original cost estimates with inflation and the reduced time horizon. When expressed on the same basis as the Reconnaissance-Level WAP cost analysis, the high end of the total present value cost estimate has increased from \$68.8 million to \$84.3 million, or by about 23 percent. The updated range (low end of range is not provided in Table 6) of estimated total cost is \$45.5 million to \$84.3 million.

**Table 7** updates the costs in Table 6 with more recent estimates of cost and yield.

The Reconnaissance-Level WAP noted that these costs were reconnaissance-level estimates for planning purposes and qualified their results accordingly. Specific qualifications included:

- The cost analysis assumed that all projects were constructed in their entirety in year 1 of the analysis. Operating and maintenance (O&M) costs were also assumed to begin in year 1.
- The rate of future inflation was assumed to be zero.

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<sup>20</sup> Engineering News Record, Construction Cost Index (CCI), 2000-08.

<sup>21</sup> Consumer Price Index for Water and Sewer Utilities, CPI W&S, 2000-2008.

The report goes on to recommend and demonstrate that capital costs should be allocated over time according to an implementation schedule and that inflation be explicitly considered. However, aside from the issues of implementation schedule and inflation, Tables 6 and 7 also paint a misleading picture when comparing alternative projects. Underlying the First Increment unit costs in Tables 6 and 7 is the assumption that the project costs have to be fully recovered by the end of the First Increment. As an example, the cost of a re-regulating reservoir, which would typically have a useful life of 40 to 50 years, gets compressed into a 10-year time frame. In effect, the economic costs of the reservoir are 4 to 5 times higher than one would expect if considering the long-term.

While acknowledging the need for the First Increment time frame, a more realistic economic cost comparison would either:

- Amortize the projects' capital costs over their useful lives and use this "annual equivalent" value, or
- Subtract the projects' salvage values at the end of the First Increment.

Both of these methods would be consistent with guidelines established for the economic evaluation of federal natural resource projects.<sup>22</sup> For this analysis, the first option, amortizing the project's capital costs over their useful lives, is considered.

**Table 8** re-evaluates the updated WAP cost estimates using amortized, annual equivalent costs to represent that annual capital costs associated with projects with long-term useful lives.

For purposes of assessing the "bang for the buck" with respect to the projects, **Figure 4** ranks the projects by annual yield and shows the associated annual equivalent cost per acre-foot of each. Figure 4 shows that, in terms of economic costs, the Re-Regulating Reservoir and Colorado Ground Water Management (Tamarack III) projects provide the most economical water supply. On a per acre-foot basis, Net Controllable Conserved Water and Nebraska Water Management Incentives appear to be the most costly projects. However, preliminary information obtained on potential water management incentives indicates that the previous cost estimates from the Reconnaissance-Level WAP may be overstated.

In addition to economic feasibility, the financial feasibility of the combination of projects is critical. That is, can the most economical combinations of the projects be financed considering possible high up-front costs? The following section re-evaluates the Reconnaissance-Level WAP cost estimates with an explicit implementation schedule for each project and considering inflation since 2000 and through 2019. This results in a cash flow analysis for the updated WAP through 2019.

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<sup>22</sup> U.S. Water Resources Council. 1983. *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*.

### **3. Cash Flow Analysis**

The assumed implementation schedule for the various WAP projects was shown in Table 2, above. Planning, construction (if applicable), and other implementation activities are assumed to be conducted within the implementation period.

For most projects, capital costs are assumed to be distributed evenly throughout the implementation period and O&M expenditures begin at the completion of the project. The exceptions include the Net Controllable Conserved Water, Nebraska and Wyoming Water Leasing, and Nebraska Water Management Incentives projects. It is probable that these projects will ramp-up during the implementation period, so some O&M costs and conservation credits accrue during the implementation phase. This is accounted for in the analysis by assuming that a fraction of the O&M costs begin the initial year of implementation and increase in a steady manner to the “full” annual O&M at the end of the implementation period.

The cash flow analysis provided in **Table 9** was developed by combining the implementation schedule with the updated cost estimates. The rate of future inflation is assumed to be 3 percent. This is applied to all costs through the First Increment. It should also be reiterated that only the high end of the estimated cost ranges are considered. Updated cost estimates can be inserted as they become available through feasibility studies and, with implementation of projects, actual costs will supersede all cost estimates. It should also be emphasized that Table 9 shows implementation of all WAP projects toward an estimated yield of between 80,097 and 86,660AFY, which is beyond the Program water objectives. It is anticipated that project sponsors will reserve a portion of this yield and proportional project costs.

Observations about the cash flow analysis include:

- Based on the current implementation schedule, total annual costs are relatively high during the period 2009-2013 as the CNPPID re-regulating reservoir is being planned and constructed. After, 2013, annual costs decrease significantly, from about \$17 million per year to \$10 million per year, but tend to ramp-up again as other projects are implemented.
- After 2013, annual costs of the Net Controllable Conserved Water project make-up a high proportion of total annual costs.
- Based on 3.0 percent annual inflation and the current implementation schedules, total cash outlays for all WAP projects (including an average total yield of 83,400 AFY) in the First Increment are estimated to be approximately \$161 million.
- Proportioning the First Increment cost to 60,000 AFY yield results in \$116 million cash outlays.

It is likely that some feasibility studies will reveal updated costs lower than projected through this simple economic analysis update. However, the updated cash flow analysis shows that the Program Water Plan budget of \$90.14 million, which was based on the

Reconnaissance-Level WAP, may not be sufficient with certain combinations of higher priced alternatives (e.g. Reregulating Reservoirs and Net Controllable Conserved Water). This emphasizes the need to cautiously consider early project implementation decisions as some choices would almost certainly preclude certain combinations of projects within the current Water Plan budget.

**Table 5. Reconnaissance-Level Estimated WAP Project Cost Estimates (in 2000 dollars)**

	<i>Discount rate:</i> <i>6.00%</i>	<i>Term (years)</i> <i>13</i>	<i>Annual inflation, 2000-09</i> <i>0.00%</i>	<i>Present value of annual cost through First Increment</i>	<i>Present value of total costs through the First Increment</i>	<i>Yield towards Target Flow (acre-feet)</i>	<i>First increment unit cost (\$/acre-foot)</i>
	<b>Initial cost</b>	<b>Annual cost</b>					
<b>Nebraska</b>							
CNPPD re-reg reservoir, min yield	\$ -	\$ -		\$ -	\$ -	-	\$ -
CNPPD re-reg reservoir, max yield	6,370,000	352,000	3,116,100	9,486,100	5,500	1,725	
Water leasing	-	1,489,000	13,181,600	13,181,600	7,000	1,883	
Water management incentives	-	2,500,000	22,131,700	22,131,700	7,000	3,162	
Groundwater management. Active pumping	590,000	14,000	123,900	713,900	1,400	510	
North Dry Creek/Fort Kearny cutoffs	663,000	92,200	816,200	1,479,200	4,400	336	
Dawson/Gothenburg Canal groundwater recharge	27,600	89,700	794,100	821,700	1,800	457	
Power interference	-	162,700	1,440,300	1,440,300	1,400	1,029	
Net controllable conserved water	-	305,000	2,700,100	2,700,100	5,000	540	
<b>Wyoming</b>							
Pathfinder municipal account	-	228,000	2,018,400	2,018,400	4,800	421	
Glendo storage	-	198,750	1,759,500	1,759,500	2,650	664	
Water leasing	-	279,000	2,469,900	2,469,900	3,900	633	
LaPrele Reservoir	-	318,500	2,819,600	2,819,600	2,200	1,282	
<b>Colorado</b>							
Groundwater management (Tamarack III)	4,241,000	403,000	3,567,600	7,808,600	17,000	459	
		\$ 11,891,600		\$ 68,830,600	64,050	\$ 1,075	

Source: Boyle Engineering Corp., in association with BBC Research & Consulting and Anderson Consulting Engineers, *Reconnaissance -Level Water Action Plan*. Prepared for the Governance Committee of the Cooperative Agreement for Platte River Research. September 14, 2000. p 106.

Note: For projects in which a range of costs were shown in the Boyle WAP, the high point of the range is shown here.

**Table 6. Updated WAP Costs, 2009-2019**

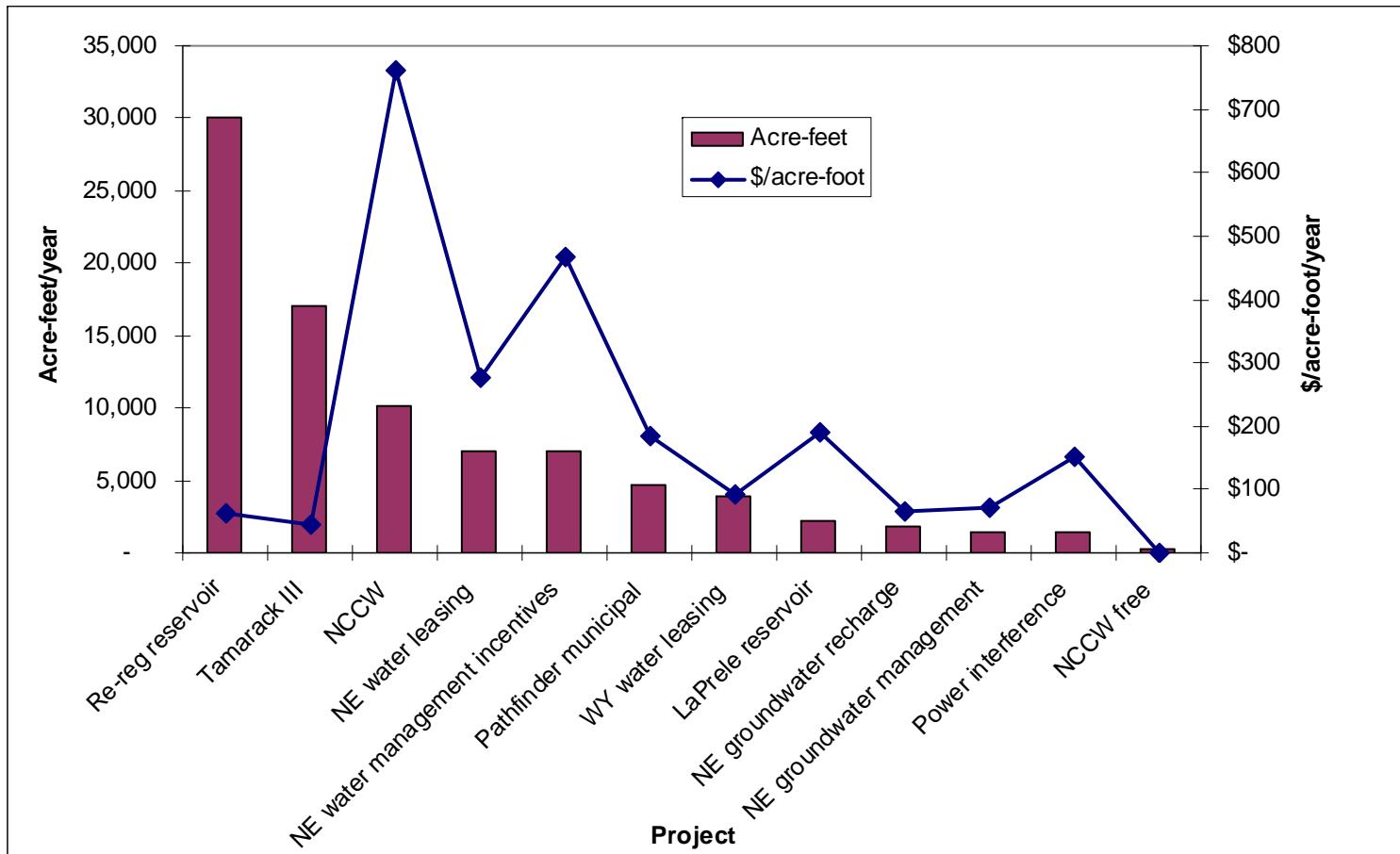
	<i>Discount rate:</i> <i>6.00%</i>	<i>Term (years)</i> <i>10</i>	<i>Annual inflation, 2000-09</i> <i>4.00%</i>	<i>Initial cost</i>	<i>Annual cost</i>	<i>Present value of annual cost through First Increment</i>	<i>Present value of total costs through the First Increment</i>	<i>Yield towards Target Flow (acre-feet)</i>	<i>First increment unit cost (\$/acre-foot)</i>
<b>Nebraska</b>									
CNPPD re-reg reservoir, min yield	\$ -	\$ -	\$ -	\$ 9,066,496	\$ 501,006	\$ 3,687,400	\$ 12,753,896	-	\$ -
CNPPD re-reg reservoir, max yield								5,500	2,319
Water leasing								7,000	2,228
Water management incentives								7,000	3,741
Groundwater management. Active pumping	839,754				19,926	146,700	986,454	1,400	705
North Dry Creek/Fort Kearny cutoffs	943,656				131,229	965,900	1,909,556	4,400	434
Dawson/Gothenburg Canal groundwater recharge	39,283				127,671	939,700	978,983	1,800	544
Power interference					231,573	1,704,400	1,704,400	1,400	1,217
Net controllable conserved water					434,110	3,195,100	3,195,100	5,000	639
<b>Wyoming</b>									
Pathfinder municipal account					324,515	2,388,500	2,388,500	4,800	498
Glendo storage					282,883	2,082,000	2,082,000	2,650	786
Water leasing					397,104	2,922,700	2,922,700	3,900	749
LaPrele Reservoir					453,325	3,336,500	3,336,500	2,200	1,517
<b>Colorado</b>									
Groundwater management (Tamarack III)	6,036,265				573,595	4,221,700	10,257,965	17,000	603
	\$ 16,925,455						\$ 84,303,555	64,050	\$ 1,316

**Table 7. Replication of the Reconnaissance-Level WAP Approach, with Updated 2009 Estimates of Cost and Yields**

	<i>Discount rate:</i> <i>Term (years)</i>	<i>6.00%</i> <i>10</i>						
				<i>Present value of annual cost through First Increment</i>	<i>Present value of total costs through the First Increment</i>	<i>Yield towards Target Flow (acre- feet)</i>	<i>First increment unit cost (\$/acre-foot)</i>	
			<i>Initial cost</i>	<i>Annual cost</i>				
<b>Tier 1</b>								
CNPPD re-reg reservoir			\$ 40,039,000	\$ 321,000	\$ 2,362,600	\$ 42,401,600	<i>30,000</i>	\$ 1,413
Elm Creek re-reg reservoir								
NE groundwater recharge			36,000	117,038	861,400	897,400	<i>1,800</i>	499
Net controllable conserved water (NCCW)			-	-	-	-	<i>300</i>	-
NCCW			-	5,700,700	41,957,600	41,957,600	<i>7,500</i>	5,594
Pathfinder municipal account			-	716,100	5,270,600	5,270,600	<i>3,900</i>	1,351
Glendo Storage			-	-	-	-	<i>-</i>	-
CO groundwater management			-	765,000	5,630,500	5,630,500	<i>17,000</i>	331
<b>Tier 2</b>								
NE water leasing			-	1,942,807	14,299,200	14,299,200	<i>7,000</i>	2,043
NE water management incentives			-	3,261,933	24,008,100	24,008,100	<i>7,000</i>	3,430
NE groundwater management			1,634,900	18,267	134,400	1,769,300	<i>1,400</i>	1,264
<b>Tier 3</b>								
Power interference			-	212,287	1,562,400	1,562,400	<i>1,400</i>	1,116
WY water leasing			-	364,032	2,679,300	2,679,300	<i>3,900</i>	687
LaPrele Reservoir			-	415,570	3,058,600	3,058,600	<i>2,200</i>	1,390
			<b>\$ 41,709,900</b>	<b>\$ 13,834,734</b>	<b>\$ 101,824,700</b>	<b>\$ 143,534,600</b>	<b>83,400</b>	<b>\$ 1,721</b>

**Table 8. Economic Comparison of WAP Costs, 2009 Update**

		<i>Discount rate:</i>		3.00%					
		Initial cost	Useful life	Amortized initial cost, using assumed discount rate and useful life	Annual operations and maintenence	Total annual cost		Yield towards Target Flow (acre-feet)	Annual equivalent cost per acre-foot
Tier 1									
	CNPPD re-reg reservoir	\$ 40,039,000	50	\$ 1,556,100	\$ 321,000	\$ 1,877,100		30,000	\$ 63
	Elm Creek re-reg reservoir								
	NE groundwater recharge	36,000	30	1,800	117,038	118,838	1,800		66
	Net controllable conserved water (NCCW)	-	-		-	-	300		-
	NCCW	-			5,700,700	5,700,700	7,500		760
	Pathfinder municipal account				716,100	716,100	3,900		184
	Glendo Storage								-
	CO groundwater management (Tarmarack III)				765,000	765,000	17,000		45
Tier 2									
	NE water leasing				1,942,807	1,942,807	7,000		278
	NE water management incentives				3,261,933	3,261,933	7,000		466
	NE groundwater management	1,634,900	30	83,400	18,267	101,667	1,400		73
Tier 3									
	Power interference				212,287	212,287	1,400		152
	WY water leasing				364,032	364,032	3,900		93
	LaPrele Reservoir				415,570	415,570	2,200		189
	Totals	\$ 41,709,900		\$ 1,641,300	\$ 13,834,734	\$ 15,476,034	83,400	\$ 186	



**Figure 4. Comparison of Project Yields and Annual Equivalent Cost per Acre-Foot.**

**Table 9. Cash Flow Analysis, Including Anticipated Inflation from 2009-2019**

Assumed inflation		3.00%											
		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total	
Tier 1													
	CNPPD re-reg reservoir, max yield	\$ 8,007,800	\$ 8,248,034	\$ 8,495,475	\$ 8,750,339	\$ 9,012,849	\$ 372,127	\$ 383,291	\$ 394,790	\$ 406,633	\$ 418,832	\$ 431,397	\$ 44,921,568
	Elm Creek re-reg reservoir	9,000	9,270	9,548	9,835	131,727	135,679	139,750	143,942	148,260	152,708	157,289	1,047,009
	NE groundwater recharge	-	-	-	-	-	-	-	-	-	-	-	-
	Net controllable conserved water (NCCW)	-	5,871,721	6,047,873	6,229,309	6,416,188	6,608,674	6,806,934	7,011,142	7,221,476	7,438,120	7,661,264	67,312,701
	Pathfinder municipal account	-	-	-	-	805,977	830,156	855,061	880,713	907,134	934,348	962,379	6,175,767
	Glendo Storage	-	-	-	-	-	-	-	-	-	-	-	-
	CO groundwater management	-	-	-	-	-	-	913,450	940,854	969,079	998,151	1,028,096	4,849,630
Tier 2													
	NE water leasing	-	-	-	-	-	1,126,123	2,319,813	2,389,408	2,461,090	2,534,923	2,610,971	13,442,328
	NE water management incentives	-	-	-	-	-	-	1,947,459	4,011,766	4,132,119	4,256,083	4,383,765	18,731,192
	NE groundwater management	-	-	-	-	-	631,766	650,719	670,240	23,140	23,834	24,549	2,024,248
Tier 3													
	Power interference	-	-	-	-	-	-	-	-	-	-	285,295	285,295
	WY water leasing	-	-	-	-	-	-	217,336	447,713	461,144	474,979	489,228	2,090,401
	LaPrele Reservoir	-	-	-	-	-	-	-	-	-	-	-	-
		\$ 8,016,800	\$ 14,129,025	\$ 14,552,896	\$ 14,989,483	\$ 16,366,742	\$ 9,704,525	\$ 14,233,813	\$ 16,890,567	\$ 16,730,077	\$ 17,231,979	\$ 18,034,234	\$ 160,880,140

## VI. CONCLUSIONS

This document captures key information and provides an update to the WAP. As a working document, it will be used as the roadmap for implementing projects toward meeting the Program water objectives and relevant water-related milestones. Potential water projects are located within the North Platte, South Platte, and Platte River from the confluence downstream to the associated habitat. The geographical extent of the projects provides opportunities to capture excess flows and develop new water supplies through a variety of water conservation efforts. It also allows for projects to be implemented and operated such that the combined effects are more beneficial than if projects were operated independently.

The sequencing identified in this WAP update will be implemented such that feasibility studies for the Tier 1 projects will be initiated over the next two years and is anticipated to result in at least 25,000 AFY reduction in shortages to target flows by 2014. Feasibility investigations for projects in Tier 2 and Tier 3 will be undertaken as progress is made toward Tier 1 projects, and where warranted, collection of supporting information related to these projects will be initiated beforehand. Tier 2 and 3 projects will also require pre-feasibility analyses to be completed prior to advancing to update older and inconsistently calculated costs from the Reconnaissance-Level WAP; background information will be collected for these projects as early as 2010. Given the interrelated nature of many of these projects (e.g. dependence on excess flows), the design and scope of future projects will evolve as information is gained through feasibility investigations and implementation of the early projects. Similar to the adaptive management concept, the Water Action Plan allows for the collection of information to support water projects moving forward with the best available information at the time, while continuing to assess new information to make informed decisions about future projects and the coordinated efforts of the Program Water Plan. Recommendations for advancing projects will be brought to the Program Governance Committee as sufficient information becomes available.

The following key findings were identified as part of this Water Action Plan Update:

- Updating the WAP has reinforced the importance of maintaining a methodical, cautious approach when assessing potential projects for implementation, particularly given the interrelated nature of projects and other efforts progressing within the Platte River basin.
- It is anticipated that project sponsors will reserve a portion of the yields and proportional costs presented, and that projects will be operated in cooperation toward meeting the Program goals and individual states' water needs. A high level of coordination between the Program and projects sponsors will be critical considering all groups are currently in the market for water.
- There appear to be combinations of projects that can be implemented within the First Increment to meet Program water objectives within the Water Plan budget, however certain combinations of projects would certainly be cost prohibitive. Operating within the Program Water Plan budget will require selecting combinations of projects with high and low unit cost – the current budget is not sufficient if all of the projects with the highest unit costs are selected.

- Regulating and retiming excess flows to supplement deficits to target flows can provide considerable yield toward the water objectives but the dependence of multiple WAP projects on excess flows needs to be carefully coordinated to avoid double accounting.
- Potential legal issues related to the ability to file a water right for excess flows and to protect yields from certain WAP projects should be evaluated in project feasibility studies to determine potential impacts on the ability to meet the Program water objectives.

There are several outstanding critical pieces of information that may have significant impacts on the Water Action Plan. The following list includes issues that the WAC and ED Office are currently working on. Resolution of these issues may influence changes to some of the information presented in this report:

- Future phases of reservoir feasibility studies, if approved by the Governance Committee, will be important in further identifying the ability of the Program to achieve both the SDHF and water objectives toward the Target Flows within the available Program Water Plan budget. FWS is currently evaluating its policy on potential bonus scores for water projects that are designed toward the SDHF goals.
- Historically, projects were scored based on streamflow at Grand Island. The excess flow analysis being utilized for current WAP feasibility studies is quantifying excesses and shortages at Overton, versus Grand Island. The ED Office is currently working with FWS to understand the appropriate application of the target flows provided in the Program Document. This may affect future WAP project scoring.
- Several WAP projects rely on excess flows for the water supply. Feasibility investigations and project implementation will need to be coordinated to ensure that excess flows are generally available for all relevant projects at the locations and times needed. Depending on the Governance Committee's assessment of the current reregulating reservoir investigation results, and if these projects continue to advance, future feasibility studies of other projects that depend on excess flows as a water supply may need to consider effects of excess flows being prioritized first toward reregulating reservoir storage.
- The updated yield and cost estimates for projects located in Nebraska do not account for any yield that may be reserved by project sponsors. The State of Nebraska has indicated interest in partnering on water projects toward the state's depletions plan. Project yields and relative costs to the Program will be updated as Nebraska and/or other project sponsors determine level of interest in project partnership.
- Several WAP projects require the ability to protect flows for the benefit of instream uses. Nebraska statutes allows this, though limitations on what can be protected may apply. The Program will work with the State to determine and apply for relevant water rights permits to secure and protect flows for Program target flow uses.
- Project scoring is anticipated to be based on a combination of information gleaned from feasibility studies and OpStudy modeling. The ED Office is working with the FWS to further define this process in anticipation of scoring needs.

# Appendix A

## Water Action Plan Project Descriptions

The following represents updates to information provided in the Reconnaissance-Level WAP, based on information currently available from WAP projects at various stages of feasibility investigation and information provided by the potential project sponsors represented on the WAC. A brief description is provided for each project, however, information is primarily focused on areas with new or different information since the Reconnaissance-Level WAP.

A general update that applies to several WAP projects is the need to address limitations in Nebraska's statutes that limit the ability of the Nebraska DNR to administer and protect accretions to the river for the beneficial use of instream flows. Nebraska is further investigating this issue through the Platte Basin Habitat Enhancement Program and the WAC and ED Office are actively monitoring this issue as it relates to the ability to successfully implement certain WAP projects.

## **I. TIER 1 PROJECTS**

Tier 1 projects are currently under varying levels of feasibility investigations and updated information reflects the information available through the end of 2009.

### **A. CNPPID Reregulating Reservoir**

#### **1. Project Description**

CNPPID Reregulating Reservoir(s) would capture water in CNPPID's system during periods of excess flows at the associated habitat. Water would then be released during periods of shortages to target flows. The primary source of water supply for this project is via storing water that CNPPID has been routed through the J-2 hydropower plant and would have otherwise returned to the river via the J-2 Return<sup>23</sup>, thereby reregulating flows in CNPPID's system while not changing diversions into their Supply Canal. The WMS and 2009 Flow Routing Test also emphasized the importance of staging and releasing water to augment SDHFs. Water stored in CNPPID reregulating reservoirs for SDHFs may be excess flows and/or Lake McConaughy EA water routed and staged prior to a SDHF event.

In 2009, an initial feasibility study evaluated Elwood Reservoir and potential new reservoir sites and designs in the vicinity of the J-2 Return including the south channel of the Platte River (J-2 alternatives). The study found that a combination of reservoir operations are possible to augment a SDHF and that the J-2 alternatives also provide substantial potential to retime excess flows toward reducing shortages to target flows. A new J-2 Return reservoir located between the south channel of the Platte River and the Phelps County Canal (J-2 Return Alternative 2, Area 1 & 2 Combination) rose to the top as a preferred alternative in the pre-feasibility study as a result of target flow yields, SDHF augmentation, and project costs. Yields and costs presented below are for this alternative.

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<sup>23</sup> Excess flows stored in a J-2 Return reservoir would continue to be routed through the J-2 hydropower plant prior to being stored. Excess flows stored in Elwood Reservoir would no longer be routed through the J-2 hydropower plant and therefore would incur power bypass costs.

## **2. Yield**

The close proximity of the project to the associated habitat provides an advantage in that water can be released to quickly improve target flows in the associated habitat. As a result, CNPPID reregulating reservoir project yield was evaluated on a daily basis to assess the ability to reduce shortages to target flows and also for the ability to contribute to a SDHF.

The 2009 feasibility study evaluated Elwood Reservoir and J-2 alternatives for impacts on target flows in a representative normal, wet, and dry year. Yields estimated for the J-2 Return Alternative 2, Area 1 and 2 Combination were 34,237 AF in the representative dry year, 47,480 AF in the representative normal year, and 57,931 AF in the representative wet year. 30,000 AFY is used as a conservative estimate in this WAP update document until full feasibility is completed. This yield estimate does not account for water that may be reserved towards Nebraska's depletions plan or by any other project sponsor. Per the Reconnaissance Level Water Action Plan, Nebraska may wish to reserve 2,500 to 4,000 acre-feet of reregulating reservoir project yield to offset depletions.

Alternatives were also evaluated for their ability to augment a SDHF. For this analysis, it was assumed that EA water would be routed from Lake McConaughy and stored in the reregulating reservoir immediately prior to a SDHF, with excess flows also being stored if available during this period. The reregulating reservoir alternative objective was to provide 2,000 cfs at Overton for a three day SDHF. Combined with potential contributions from other systems components, estimated at around 4,650 cfs available in the Platte River below the J-2 Return, this would result in Overton flows of 6,650 cfs. The preferred J-2 alternative would be able to provide 2,000 cfs for three days.

## **3. Costs**

A range of costs were estimated for the various reregulating reservoir alternatives in the 2009 feasibility study. A capital cost of \$40,039,000 and annual operating costs of \$321,000 are estimated for the preferred J-2 alternative. These cost estimates do not account for cost sharing through participation of other project sponsors.

## **4. Next Steps**

Pending results of the initial feasibility analysis completed in 2009 and Governance Committee approval, the next level of feasibility study is expected to start in early 2010. Future phases will include final design, permitting, land acquisition, bidding and construction. Effects of utilizing excess flows for this and other WAP projects would also be further evaluated. Following an aggressive schedule could result in project completion as early as the end of 2013, however this is directly dependent on the final design which will affect the other outstanding tasks.

## **B. Elm Creek Reregulating Reservoir**

### **1. Project Description**

In 2009, Central Platte NRD and NPPD initiated feasibility investigation of a new reservoir located on Elm Creek. The primary use of the reservoir would be toward regulating flood flows on Elm Creek. The Program is partnering in the feasibility investigation to identify additional uses of the reservoir toward reregulating excess flows for Program purposes. This project has potential for use toward augmenting a SDHF and reducing shortages to target flows.

### **2. Yield**

Project yield estimates are currently being evaluated and will be provided at the end of 2009 or early 2010.

### **3. Costs**

Project cost estimates are currently being evaluated and will be provided at the end of 2009 or early 2010.

### **4. Next Steps**

Information will be updated based on pending results of the initial feasibility analysis being completed in 2009. Effects of utilizing excess flows for this and other WAP projects would also be further evaluated. Pending additional feasibility investigation results, it is anticipated that this project may be completed by the end of 2013.

## **C. Nebraska Ground Water Recharge**

### **1. Project Description**

Recharge projects involve diverting surface water from the Platte River during times of excess flow into irrigation canals during the non-irrigation season or within excess canal capacity during the irrigation season. Excess flows could also be diverted using alluvial “headgate” wells located close to the Platte River. A preliminary feasibility investigation was initiated in 2009 to further define some of the concepts and hydrogeology parameters identified in the Reconnaissance-Level WAP. Based on this investigation, in addition to the Dawson County and Gothenburg Canals which were examined in the Reconnaissance-Level WAP, this project concept has been expanded to also investigate recharge under the Phelps County Canal. Seepage would percolate into the alluvium and recharge the ground water 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 and reservoir seepage would accrue to the river for some duration after the recharge event.

Additional operational scenarios considered under the 2009/2010 preliminary feasibility investigation that were not considered in the Reconnaissance-Level WAP include ground water management and conjunctive operations to increase the yield and efficiency of recharge projects. In addition to natural ground water recharge through canals and constructed basins, active pumping, pumping of high water tables, and in-lieu pumping are also being considered. As part of the preliminary feasibility investigation, ground water recharge and management concepts are being developed, and example project

configurations/locations will be identified for each of the concepts in terms of methods for diversion, recharge, and recovery of recharged water.

*Pre-feasibility findings indicate that this project is likely to encompass options identified under the Nebraska Ground Water Management project described in Section J below. Additional ground water management options may also be identified under that project that are independent from ground water recharge.*

## **2. Yield**

As envisioned in the Reconnaissance-Level WAP, total yield of ground water recharge would be 2,600 AFY, of which 1,800 AFY would be available to the Program. These estimates were carried forward in the current report. The 2009/2010 preliminary feasibility study will provide updated yield estimates, which will be further refined through a feasibility study to be completed in 2010/2011 if approved by the Governance Committee. Yield updates for these studies will likely be higher than the Reconnaissance-Level WAP estimates because of the potential increase in yield associated with ground water management scenarios. Additionally, yield from ground water recharge projects may be higher than originally anticipated if recharge projects are implemented at more than one location and if excess canal capacity allows operation of projects during portions of the irrigation season.

## **3. Costs**

Costs from the Reconnaissance-Level WAP were carried forward in the current report but are being updated in the 2009/2010 preliminary feasibility investigation that may be further refined in 2010/2011 feasibility studies. Updated cost estimates may be similar to those provided in the Reconnaissance-Level WAP, but may also need to include additional costs for infrastructure that would be needed to implement ground water management scenarios (e.g., installation of ground water pumping wells, and/or the cost of reimbursing pumping costs for ground water irrigators).

## **4. Next Steps**

A preliminary feasibility analysis for this project will be completed in 2010. Pending approval by the GC, a feasibility study to further evaluate this project will likely begin in 2010. The feasibility study would include engineering analyses and small scale demonstration projects to further refine yield and cost estimates. Additionally, the feasibility of implementing ground water management scenarios to increase potential yield of ground water recharge projects will be vetted in the feasibility study. Effects of utilizing excess flows for this and other WAP projects would also be further evaluated. Discussions are ongoing with CPNRD, NPPD, and CNPPID regarding possible Program use of canals and the existing B1 Reservoir. Pending additional feasibility investigation results, it is anticipated that this project may be completed by the end of 2013.

## **D. Net Controllable Conserved Water (NCCW)**

### **1. Project Description**

NCCW in Lake McConaughy is a result of water conserved by CNPPID, through increased system and irrigation efficiency projects, to comply with an agreement with the National and Nebraska Wildlife Federations (NWF Agreement). Per CNPPID's 1998 FERC License

(specifically Article 402 of the license), conserved water in Lake McConaughy resulting from conservation projects to comply with the NWF Agreement is referred to as “net controllable conserved water” (NCCW). CNPPID received a grant from the US Bureau of Reclamation (USBR) for several conservation projects. Per their FERC license, NCCW resulting from the USBR grant (314 AF) is added to the EA on October 1 each year at no cost to the Program. Also, per their FERC license, NCCW not attributed to this grant is available to the Program at the average unit cost and water purchased by the Program will also be added to the EA on October 1 of each year. In determining unit costs, CNPPID is using the total cost to implement conservation measures, though only a portion of the water conserved is available as net controllable conserved water at Lake McConaughy.

## **2. Yield**

Yields estimates in the Reconnaissance-Level WAP were preliminary as most projects had not yet been implemented or evaluated at that time. Further, the yields that were identified in Table VI-1 of the Reconnaissance-Level WAP (500 AF of water at no cost and 4,500 AF of water for lease) were incorrectly stated as being yield at the associated habitat. The NCCW yields in that table are actually yield to the Lake McConaughy EA. This does not account for losses in routing the water to the associated habitat.

Updated NCCW yield estimates were calculated by applying a methodology developed by CNPPID, consulted on with the Program’s Governance Committee, and approved by FERC. To comply with the NWF Agreement, CNPPID must conserve 27,444 AFY *at the point of conservation (project location)*. In many years, CNPPID has included additional projects in their reporting which provides a buffer toward meeting this requirement: savings *at the point of conservation* were estimated at 40,045 AFY in 2003 and 37,126 AFY as of January 2009. The most recent estimate of the corresponding amount of NCCW in Lake McConaughy, based upon 2003 data, is 10,900 AFY. An estimated 314 AFY of this has resulted from a USBR grant and is provided automatically to the Lake McConaughy EA each October 1, at no cost to the Program. This portion of water is anticipated to be available through the Program First Increment, but will eventually be retired as the lifecycles of the associated project mature and yields drops off. The remaining 10,586 AFY of NCCW (10,900 AFY – 314 AFY) is available for lease by the Program.

NCCW yields are likely to vary over time as project lifetimes expire and new projects are added. Additionally, in the future CNPPID may decrease the buffer to get closer to the NWF Agreement requirements. Because NCCW is estimated on a per project basis, it is difficult to translate the potential impact of reduced water conservation project efforts on resulting NCCW in Lake McConaughy. A rough estimate of the impact of removing the entire buffer can be made by assuming that the ratio of NCCW resulting in Lake McConaughy divided by the water savings at the point of water conservation remains constant. CNPPID’s 2003 estimates of NCCW in Lake McConaughy divided by the savings at the point of conservation results in a ratio of 0.272 (10,900 AFY/ 40,045 AFY). If CNPPID removed the entire buffer, applying this factor to the required conservation savings of 27,444 AFY would result in 7,465 AFY of NCCW at Lake McConaughy. Removing the 314 AFY from the USBR grant would leave 7,151 AFY available for purchase by the Program.

For this WAP Update, the new estimated project yields were routed to Grand Island using the WMC Loss Model. The average monthly percent loss between Lake McConaughy and the associated habitat is estimated to range from 4% in March to 31% in September. If these losses are applied to an assumed 314 AFY of no-cost water, and the range of 7,151 AFY to 10,586 AFY of potential NCCW lease water in the Lake McConaughy EA, the project yield at the associated habitat is shown in **Table A-1**. Based upon these results, the range of potential yields at the associated habitat is 5,150 AF to 10,460 AF (for an average of 7,800 AFY of which 300 AFY is available to the Program at no cost). Actual yields will depend on the number of CNPPID conservation projects, specific project conservation savings, and the timing of when water is routed from Lake McConaughy to the associated habitat.

**Table A-1: NCCW Estimated Project Yield at the Associated Habitat**

Range of Yields (AFY)	Project Yield at the Associated Habitat (AFY)	
	Applying 4% Loss	Applying 31% Loss
No Cost	314	300
Min Lease	7,151	6,865
Max Lease	10,586	10,160

### **3. Costs**

The Reconnaissance-Level WAP incorrectly underestimated the costs associated with NCCW by assuming an annual lease cost to be a present value of total project costs. Per CNPPID, the 2010 cost for NCCW in Lake McConaughy is estimated to be \$376/AFY. Assuming between 4% and 31% of NCCW is lost in transit results in a range of 2010 costs between \$392/AFY and \$545/AFY for yield at the associated habitat. This approach to adjusting costs is based on CNPPID's interpretation of their FERC license; this may be further explored as this project advances. Per the NCCW cost methodology, an inflation factor is applied to unit costs which result in increasing costs each year. NCCW cost may also increase as older projects lifetimes expires and new, and likely more costly, projects are added.

### **4. Next Steps**

This project could be implemented as soon as a leasing contract is arranged with CNPPID. A variety of agreements and payment methods could likely be negotiated with CNPPID. The 314 AFY resulting from the USBR grant is already added to the Lake McConaughy EA each year by CNPPID, at no cost, as a requirement of their FERC license. Pending negotiations, a lease arrangement between the Program and CNPPID may be completed by the end of 2010.

## **E. Pathfinder Municipal Account**

### **1. Project Description**

The Pathfinder Modification Project involves the recapture of storage space that has been lost to sedimentation, through increasing the capacity of the existing Pathfinder Reservoir by approximately 53,493 AF for municipal (20,000 AF) and environmental (33,493 AF) needs.

Yield to the Pathfinder Environmental Account is Wyoming's contribution to the WAP and is one of the initial three water projects that together will be credited 80,000 AFY toward the Program water objective. The State of Wyoming has the exclusive right to contract with the Bureau of Reclamation for the use of the remaining 20,000 AF of capacity in a "Wyoming Account." The municipal/Wyoming Account is estimated to provide an average annual yield of 4,800 AFY at Pathfinder Reservoir, with a potential range of between zero and 9,600 AFY yield, depending on hydrologic conditions and the demands from other Wyoming uses. As additional river loss data is provided by the WWDO to route water from Pathfinder to Lake McConaughy, project yields may be updated.

Additional restrictions have been placed on this projects since time of the Reconnaissance-Level WAP. To comport with settlement of the Nebraska v. Wyoming law suit, the "Wyoming Account" would serve the following purposes, in order of priority:

- i. A supplemental water supply for Wyoming's municipalities during times of water rights regulation.
- ii. A replacement water supply to meet certain obligations under the Nebraska v. Wyoming settlement agreement including, but not necessarily limited to, providing replacement water for diversions from wells and tributaries between the Whalen Diversion Dam and the state line as more specifically discussed under Glendo Storage WAP project.
- iii. A replacement water supply to mitigate water use in excess of Wyoming's existing water related baselines defined in Wyoming's Depletions Plan.
- iv. An additional water supply for the Program under temporary annual lease agreements.

This operation was codified by the Wyoming Legislature in 2009 with the passage of W.S. 41-2-1301, which states in part: "*....., , the Wyoming water development office is hereby authorized to transfer a maximum of nine thousand six hundred (9,600) acre feet of storage water per year from the Wyoming account in the Pathfinder Modification Project within Pathfinder reservoir to the Wyoming-Nebraska state line through annual temporary water use agreements with the Platte River Recovery Implementation Program in any year the storage water in the Wyoming Account is not needed by the state of Wyoming as a municipal water supply or a replacement water supply to meet the state of Wyoming's obligations in the Nebraska v. Wyoming settlement agreement and the Platte River Recovery Implementation Program.*"

## **2. Yield**

In years where there is excess water supply after meeting the first three priority uses identified above, the remaining Wyoming Account balance may be available for lease to the Program. In water years in which the hydrologic conditions are below average, water from the Wyoming Account will be needed to meet the demands of municipalities whose water rights will be subject to administration (regulation) and to supplement the supply from Wyoming's contract for Glendo Reservoir water to meet the demands for replacement water in the Whalen Diversion Dam to state line reach of the North Platte River, as stipulated in the modified North Platte Decree. It is anticipated that the water available to the Program will vary between 0 and 3,000 ac-feet and will average 1,500 ac-ft per year under "below average" conditions during the first increment of the Program.

When hydrologic conditions are above average, there should not be water rights administration imposed on municipalities and less water will be required to supplement the supply from Glendo Reservoir for replacement water. It is anticipated that the water available to the Program will vary between 7,500 and 9,600 ac-feet and will average 8,500 ac-ft per year under “above average” conditions during the first increment of the Program.

Therefore, Wyoming is hopeful that an average of 5,000 ac-ft of water per year can be leased to the Program during the First Increment of the Program. However, achieving this threshold will be dependent on hydrologic conditions and presently unforeseen increased demands for municipal and replacement water. The above described quantities of water are available at Pathfinder Reservoir and will be assessed losses by water officials in Wyoming and Nebraska as described above. Per Wyoming Water Development Office, water from Pathfinder Reservoir will most likely be routed down to Lake McConaughy in September when the stream is gaining. To develop yield estimates at Grand Island, the ED Office routed water from Pathfinder to Lake McConaughy in September (6.34% loss) and then to Grand Island throughout the year using average monthly losses from the WMC Loss Model<sup>24</sup>. Wyoming has indicated that loss from Pathfinder to Lake McConaughy may be closer to 12% which preliminary analyses show could decrease the project yield by 200 to 300 acre-feet in an average year. As additional river loss data is provided by the WWDO to route water from Pathfinder to Lake McConaughy, project yields may be updated. No seepage or evaporative losses were applied to water in Lake McConaughy storage and the analysis assumed that the water was protected from diversions. This resulted in between 975 and 7,650 AFY at the associated habitat, depending on the type or year and time of year water is routed. **Table A-2** provides high and low routed yields for all hydrologic year types.

**Table A-2. Pathfinder Municipal Account Potential Program Yields<sup>1</sup>**

Hydrologic Condition	Average Yield at Pathfinder Reservoir (AFY)	Average Project Yield at the Associated Habitat (AFY)	
		Applying 10% Loss	Applying 35% Loss
Average Year	5,000	4,500	3,250
Above Average Year	8,500	7,650	5,525
Below Average Year	1,500	1,350	975

<sup>1</sup> The yield is at the associated habitat and reflects routing (river losses) from Pathfinder to the habitat.

### **3. Costs**

Updated cost estimates provided by the Wyoming Water Development Commission estimate \$16,725,000 in combined capital and annual operations and maintenance costs. The unit cost per acre foot to the Program will be established in negotiations between Wyoming and the Program. Presently, Wyoming estimates that a price ranging from \$80 to \$100 per acre foot at the reservoir would be equitable for Wyoming and the Program. Assuming an average

<sup>24</sup> The North Platte Settlement Decree (NPSD), Exhibit 9, specifies conveyance losses and methodologies for the North Platte from Alcova to Lewellen. For this WAP update analysis losses from the WMC Loss Model, which display a similar monthly pattern to losses in the NPSD was deemed sufficient.

annual yield of 5,000 AFY at the reservoir, and applying losses of between 10% and 35%, yield at the associated habitat would be between 3,250 AFY and 4,500 AFY (for an average of 3,900 AFY). Assuming a unit cost of \$100 per AF of water at the reservoir, and a range of yield at the associated habitat of 3,250 to 4,500 AFY, this translates to an annual cost of between \$154 and \$111/AF at the associated habitats.

#### **4. Next Steps**

Pathfinder construction is scheduled to begin in 2010, and anticipated to be complete sometime between 2011 and 2012. As of fall 2009, the following items have been accomplished:

- A partial change in the federal authorization for Pathfinder Reservoir was obtained from Congress.
- A partial change of use for the water right for Pathfinder Reservoir was obtained from the Wyoming Board of Control.
- The approval to export water from the Project was obtained from the Wyoming Legislature.
- Clearance was obtained from the U.S. Army Corps of Engineers.
- The technical design is 90 percent complete.
- An application was submitted to the Nebraska DNR to conduct water in the stream channels in Nebraska.
- Funding for the project was appropriated by the Wyoming Legislature.

Reclamation and Wyoming are currently going through the NEPA permitting process, and are negotiating a contract for the use of Pathfinder water. Final construction documents must be prepared in anticipation of construction. The project is expected to be completed between 2011 and 2012, depending on completion of federal requirements for contract negotiations, and the length of time needed for the construction process. Additional project cost and yield analyses will be ongoing as the project moves forward.

An agreement will need to be developed between Wyoming and the Program regarding the annual leasing of water from the Wyoming Account. However, this agreement cannot be finalized until contract for the Pathfinder Modification Project between Reclamation and the State of Wyoming is finalized and terms and conditions of Wyoming's acquisition of Glendo Reservoir storage water are defined. If Wyoming cannot achieve the water it anticipates from Glendo Reservoir for replacement water, the quantities of water that Wyoming can provide the Program from the Pathfinder Wyoming Account will be affected. Pending negotiations, a lease arrangement between the Program and Wyoming may be completed by the end of 2012.

### **F. Glendo Reservoir Storage**

#### **1. Project Description**

As identified in the Reconnaissance-Level WAP, this project assumed that water in Glendo Reservoir in excess of what is needed to meet Wyoming's contracted demands and replace Wyoming's potential excess depletions would be available to the Program. The 2001 Final

Settlement Stipulation for the Nebraska v. Wyoming law suit was adopted subsequent to the Reconnaissance-Level WAP. The Final Settlement Stipulation calls for the modification of the original 1945 North Platte Decree, as amended in the 1953 Modified Decree. Provisions in the Final Settlement Stipulation (Exhibits 10 and 11) require Wyoming to provide replacement water for depletions from wells and tributaries in the Whalen Diversion Dam to the state line reach of the North Platte River. Wyoming's allocation of Glendo storage water is needed to meet, in part, these replacement water obligations. Therefore, Wyoming's allocation of Glendo storage water is no longer directly available to meet Program water objectives.

## **2. Yield**

Analyses completed since the Reconnaissance-Level WAP have decreased the average annual Glendo yield and determined that Glendo Reservoir Storage is no longer available to the Program due to the low priority of Program uses. It is possible that some of the water used for irrigation well depletion replacement could count towards the Program.

## **3. Costs**

Currently, this project is not estimated to yield water to the Program so there are no project costs to the Program.

## **4. Next Steps**

Legal and FWS policy issues need to be assessed to determine if the Program can obtain some credit for the unprotected releases of replacement water made by Wyoming to mitigate depletions to the North Platte River from wells and tributaries between the Whalen Diversion Dam and the state line. Conceptually, the replacement water increases Platte River stream flow relative to pre-1997 conditions. If the Program can obtain some credit for Wyoming's replacement water operations, it would mitigate, in part, that Wyoming can no longer provide Glendo storage water to the Program. If the outcome of this investigation is positive, the yield at the habitat will be reevaluated and it is anticipated that a lease arrangement may be completed between the Program and Wyoming by the end of 2012.

## **G. Colorado Ground Water Management (Tamarack III)**

### **1. Project Description**

The first phase of the Tamarack Plan (Tamarack I) is included as one of the Program's initial three water projects and involves retiming flows from periods of excess to target flows to periods of shortage to target flows through aquifer recharge projects located in the lower South Platte basin upstream from the Colorado-Nebraska state line. The second phase is being utilized by Colorado under its depletions plan (Tamarack II). Further expansion of the Tamarack Plan (Tamarack III) may provide additional water toward the WAP, but would always be secondary to the needs being met under the first two phases, as determined by Colorado.

Building on the current project infrastructure, Tamarack III would involve diverting surface water directly from the South Platte River via canals or wells located adjacent to the river during periods of excess to target flows. Water would then be diverted or pumped to recharge

sites at various distances from the river, where it percolates into the alluvium for recharge of the ground water aquifer. Ground water return flows to the river that exceed the needs of the first two phases of the Tamarack Plan and that result in return flows during periods of deficit to Program target flows could be leased by the Program.

## **2. Yield**

The average annual yield from this Tamarack III project was previously estimated to be 17,000 AF per year based on historic hydrology for excesses to target flows. Colorado is doing analyses in early 2010 on the availability of excesses to targets for Tamarack I and III operations for different historic periods as compared to the recent drought period of the 2000s.

## **3. Costs**

Any infrastructure associated with a Tamarack III project would be provided and paid for by the State of Colorado and/or the South Platte Water Related Activities Program, Inc. (SPWRAP). SPWRAP is a non-profit group of Colorado water users working with the State to meet Colorado's Program water obligations. Under a leasing arrangement for the first increment, the Program would pay Colorado/SPWRAP some dollar amount per AF per year, based on prevailing rates, of ground water return flows to the South Platte River routed to the Colorado-Nebraska state line during periods of deficit to Program target flows. This annual payment to Colorado/SPWRAP by the Program for actually developed Tamarack III water credits would last for the duration of the first Program increment subject to renegotiation for a future increment and Colorado's need in that future increment. Based on information in the Reconnaissance-Level WAP, a possible current cost for this WAP update has been estimated at \$45/AFY of retimed water resulting in flows contributed to associated habitat during periods of deficit to Program target flows, however the actual leasing cost will be negotiated at a later date.

## **4. Next Steps**

Colorado is in the process of updating Tamarack I accounting and project analyses. Updated information is expected to be available in early 2010, and Colorado is committed to completing construction of Tamarack I and commencing full operations by the end of 2010. An agreement would need to be developed between Colorado/SPWRAP and the Program regarding the annual leasing of water for Tamarack III. However, this agreement cannot be finalized until Colorado has completed its assessment of Tamarack I performance. It is anticipated that the modeling and assessment needed to advance the Tamarack III project may be initiated in 2011 and that the project may be operational by the end of 2014. Coordinated operations of Tamarack III and other WAP projects for utilizing excess flows to targets need to be further evaluated by the Program.

## **II. TIER 2 PROJECTS**

Feasibility studies have not been initiated for Tier 2 projects, however collection of additional information has been initiated toward further defining the next steps for these projects.

## **H. Nebraska Water Leasing**

### **1. Project 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 Reconnaissance-Level WAP projects evaluated assumed that leased water rights are dependent on storage rights in Lake McConaughy.

### **2. Yield**

The project yield has not been updated since the Reconnaissance-Level WAP. The leasing program that was analyzed results in a yield of approximately 7,000 AFY of shortage reductions at the associated habitat. Because flows in the associated habitat will only be increased by reductions in consumptive use, the amount of leased water would actually be considerably higher to account for historic irrigation return flows.

### **3. Costs**

Costs have not been updated since the Reconnaissance-Level WAP.

### **4. Next Steps**

There is not currently an active water leasing market in Nebraska. The ED Office is working with several agricultural and economic specialists to develop this project, including an assessment of a fair market value of the water. Preliminary conversations have been initiated with irrigation districts to assess their willingness to explore water leasing opportunities. This and other relevant information will be used to further define and scope this project. It is anticipated that this project may be initiated in 2012 and completed by the end of 2016.

## **I. Nebraska Water Management Incentives**

### **1. Project Description**

Water management incentives 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 associated habitat. The programs evaluated for the Reconnaissance-Level WAP assumed 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 would be added to the Lake McConaughy EA when storage space is available and released during times of shortage at the associated habitat.

### **2. Yield**

The project yield has not been updated since the Reconnaissance-Level WAP. Previously programs capable of reducing average annual target flow shortages by 7,000 AFY were evaluated for each water management alternative: conservation cropping, deficit irrigation, land fallowing, and on-farm changes in irrigation techniques. Each program was analyzed independently of the others under the assumption that one program or a combination would be implemented for a total yield of 7,000 AFY at the associated habitat.

### **3. Costs**

Costs have not been updated since the Reconnaissance-Level WAP, however preliminary research indicates that the previous cost estimates from the Reconnaissance-Level WAP may be overstated.

### **4. Next Steps**

The ED Office has begun gathering information about cooperative efforts to incentivize water conservation technology and management techniques in agriculture, toward developing background information that will be used to refine a scope, budget, and schedule for this project. Preliminary investigations in 2010 will be utilized to collect information that will assist in focusing on particular water conservation practices and prioritize methods that are both cost-effective and most likely to succeed in central Nebraska. It is anticipated that implementation of this project may be initiated in 2015 and completed by the end of 2019.

## **J. Nebraska Ground Water Management**

### **1. Project Description**

A ground water management project could be accomplished by a number of options including: active ground water pumping, passive lowering of the ground water table, switching irrigators to ground water from surface water, or a conjunctive use project under CNPPID's system. In the Reconnaissance-Level WAP, the Dry Creek/Fort Kearny Cutoffs project consisted of two projects within the Tri-Basin Natural Resources District (TBNRD). Since that time the project's anticipated water source has decreased and the project focus changed. New concepts are being explored with TBNRD, all of which would entail ground water management of water on the south side of the Platte River, therefore any new concepts will be further explored under the broader Nebraska Ground Water Management Project. Ground water management options are also being explored in conjunction with ground water recharge, as described in Section C above. The Ground Water Management projects refers to additional project options not included under the Ground water management project.

### **2. Yield**

The project yield has not been updated since the Reconnaissance-Level WAP, at which time Nebraska estimated that 1,400 AFY of the yield of this project could be made available to the Program. Each ground water management option was analyzed independently of the others under the assumption that one project or a combination would be implemented for a total Program yield of 1,400 AFY at the associated habitat. Considering the additional opportunities for ground water management with TBNRD and discussions between the ED Office and potential project sponsors, it is anticipated that the yield from this project could potentially be much higher than originally anticipated.

### **3. Costs**

Costs have not been updated since the Reconnaissance-Level WAP.

### **4. Next Steps**

There is a natural overlap between this broader Nebraska Ground Water Management project and the Nebraska Ground Water Recharge project. For example, a concept being explored under

the Recharge project is conjunctive management of recharged ground water including active pumping of recharged water for release to the Platte River during times of shortages to target flows. Opportunities to integrate ground water management components into the Nebraska Ground Water Recharge project are currently being considered in the Nebraska Ground Water Recharge preliminary feasibility study. Additional components of the Nebraska Ground Water Management project may be included in other WAP projects as opportunities arise and it is anticipated that this Nebraska Ground Water Management Project will be further defined based on information collected from other investigations. Effects of utilizing excess flows for this and other WAP projects would also be further evaluated.

Ground water management subcategories provide different opportunities and involve different parties. Legal constraints need to be further considered. It is anticipated that implementation of this project may be initiated in 2014 and completed by the end of 2016.

### **III. TIER 3 PROJECTS**

No new information has been obtained for Tier 3 WAP projects. A brief description of the project as conceived under the Reconnaissance-Level WAP is provided below for completeness.

#### **K. Power Interference**

This 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 associated habitat. A power interference project may involve CNPPID and NPPD and operate at Kingsley Dam Hydro, the two Johnson Hydros, Jeffrey Hydro, or the North Platte Hydro facility in conjunction with the Lake McConaughy EA. Third party impacts from this project have potential to be substantial and operational/contractual considerations need to be explored further.

#### **L. Wyoming Water Leasing**

A voluntary temporary water 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 evaluation completed for the Reconnaissance-Level WAP assumed that leased water rights were dependent on storage rights.

#### **M. LaPrele Reservoir**

The project assumes that the Program could lease 5,000 AF of storage in LaPrele Reservoir that is available to the Panhandle Eastern Pipeline Company (PEPL). PEPL's share of space in the 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.