Platte River Research Cooperative Agreement

Reconnaisance - Level Water Action Plan

Prepared for

GOVERNANCE COMMITTEE OF THE COOPERATIVE AGREEMENT FOR PLATTE RIVER RESEARCH

September 14, 2000

BOYLE
ENGINEERING CORPORATION

in association with
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I. Background Information

A. Purpose of the Proposed Program

The states of Nebraska, Wyoming and Colorado and the U.S. Department of the Interior (DOI) entered into a partnership to address endangered species issues affecting water use in the Platte River Basin. This partnership is guided by the Cooperative Agreement for Platte River Research (June 1997). The Proposed Platte River Recovery Implementation Program (Program) builds upon the Cooperative Agreement and lays out several activities and contributions from the three states and federal government that are to be conducted in specified increments. A primary goal of the Program is to assist in the recovery of the target species and their associated habitats through a basin-wide cooperative approach. One of the objectives of the first phase of the Program is to develop a Water Action Plan that identifies various projects in each state that can be applied to the overall water goals of the Program.

The U.S. Fish and Wildlife Service (FWS) developed recommendations for flows that it believes are needed at different times of the year for endangered species and other wildlife. The water goals of the Program are to reduce shortages to the FWS target flows by an average of 130,000 to 150,000 acre-feet per year (ac-ft/yr) over the next 10 to 13 years. A portion of the instream flow objectives will be met through an Environmental Account (EA) in Lake McConaughy, the Pathfinder Modification Project, and the Tamarack Plan. The remaining instream flow improvements will be met through a program of incentive-based water conservation and water supply activities. The Water Action Plan is intended to address the water conservation/supply component of the Program. The primary purpose of the Water Action Plan with respect to the Program is to identify ways of reducing shortages to target flows by 130,000 to 150,000 ac-ft/yr on average including the three specific projects mentioned above.

B. Need for the Proposed Program

The driving force behind the Cooperative Agreement and the Program is that many water projects in the Platte River Basin are subject to reviews of federal government permits. Under the Endangered Species Act (ESA), federal agencies must ensure that the water projects they authorize, fund, or carry out do not jeopardize the continued existence of endangered and threatened species or result in the destruction or modification of habitat that has been determined to be critical. The Cooperative Agreement is a comprehensive approach to address ESA requirements that will eliminate the need for each individual water project to undergo a separate review of its impacts on endangered and threatened species.

DOI and the states have proposed the Program to serve as the reasonable and prudent alternative for existing and certain new water related activities. If implemented, the Program will provide regulatory certainty under the ESA to existing water related activities and to certain new water related activities that are subject to review under section seven of the ESA.

II. Process

A. Development of the Water Action Plan

Boyle Engineering Corporation (Boyle) was retained to complete a Water Conservation/Supply Reconnaissance Study (Study) to identify and evaluate water supply and conservation alternatives within the three states that could contribute toward achieving the proposed program's objectives for reducing shortages to target flows. Boyle's services were performed under the direction of the Water Committee (WC). The Final Report for the Study, which was submitted to the WC on December 13, 1999, provides information on local net hydrologic effects, reductions to target flow shortages at the critical habitat, and costs at a reconnaissance level for each project evaluated. A preliminary assessment of legal and institutional requirements, social issues and environmental issues was also included.

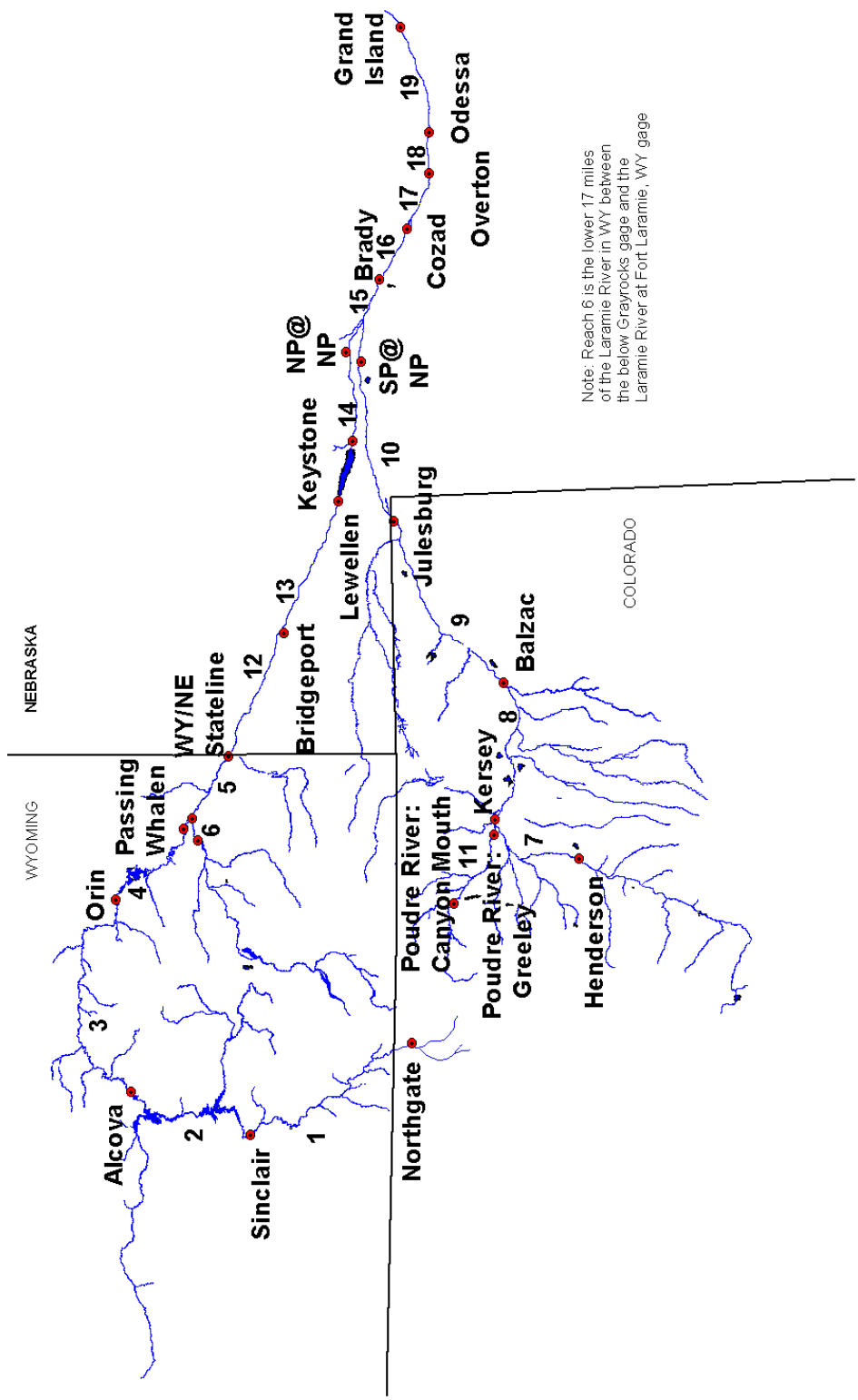
The Final Report was used by the Water Action Plan Committee in identifying and selecting the projects included in this Water Action Plan. However, the Water Action Plan includes some projects that were not analyzed by Boyle in the original study. Boyle relied on information provided by the three states and data presented in the Final Report to evaluate the projects included in this Water Action Plan. Representatives from the three states were contacted to acquire an understanding of how the states envision implementing the proposed projects. If the operating concept for a given project differed from that presented in the Final Report, information provided by the states was relied on. Likewise, if a more detailed analysis of a project has recently been completed and more information is now available regarding the yield and cost, that information has been taken into account.

The three states identified 13 potential projects for inclusion in the Water Action Plan. These projects are located throughout the Platte River Basin (Figure 1). Yield evaluations were made by the Platte River EIS/ESA team to refine the individual and cumulative yields of the projects and address the interactive effects of the projects. In developing the proposed program, each state identified a water reregulation project and agreed to the performance of the study and the development of a Water Action Plan. The combined effect of the original three projects and the Water Action Plan is intended to achieve the Program goal of reducing shortages to target flows by 130,000 to 150,000 ac-ft/yr in the first increment. A list of the projects included in the Water Action Plan is provided in the table below.

Table II-1
Water Action Plan Projects

State	Project
Nebraska	CNPPID Re-regulating Reservoir
Nebraska	Water Leasing
Nebraska	Water Management Incentives
Nebraska	North Dry Creek/Ft. Kearny Cutoffs
Nebraska	Dawson/Gothenburg Canal GW Recharge
Nebraska	Net Controllable Conserved Water
Nebraska	Groundwater Management
Nebraska	Power Interference
Wyoming	Pathfinder Municipal Account
Wyoming	Glendo Storage
Wyoming	Temporary Water Leasing
Wyoming	La Prele Reservoir
Colorado	Groundwater Management

Figure 1 – Platte River Basin and Study Reaches



The Water Action Plan Committee recognized that U. S. Forest Service (USFS) vegetation management may affect flows in the North, South, and Central Platte basins. The WAPC agreed that further study is required to determine these impacts and the USFS's responsibility to address these impacts. In addition, in the review of existing USFS management plans and future amendments to such plans, the FWS will establish a review criterion that vegetation management shall not lead to new depletions or a reduction in runoff from forest lands that adversely affect target flows or Program Projects for Threatened and Endangered Species. Whatever the outcome of these studies and reviews, the signatories will not be released from first increment commitments to reducing shortages to the FWS target flows by an average of 130,000 – 150,000 acre-feet per year.

All projects included in the Water Action Plan are voluntary and participation is incentive based. Inclusion of these projects in the Program is subject to reaching an agreement with the involved parties.

B. Additional Information Needs

The information presented for the projects included in the Water Action Plan is at a reconnaissance level of detail. Feasibility studies, final designs, and environmental permitting will be required before specific projects can be constructed. Where no construction is needed, implementation plans will be needed along with any necessary legislation.

Feasibility level studies will be required to address information requirements that are common to most projects. Those information needs are described in part C. of this Process.

Feasibility studies also may include the use of demonstration projects as discussed in Chapter 10 of the Study. Demonstration projects include small-scale projects that are constructed to test both the feasibility of larger scale projects and the assumptions used in their evaluation; projects that are not physically constructed, but provide further data through field investigations and measurements; and projects that focus on refining assumptions and methodologies used to analyze an alternative by developing more sophisticated analytic tools.

Additional project specific information needs are identified below.

CNPPID Re-regulating Reservoir: Information will be needed on reservoir seepage losses and the associated effects on surrounding landowners. The willingness of local landowners to sell their land will also need to be evaluated because specific parcels of land are required to construct the reservoirs evaluated.

Water Leasing in Nebraska and Wyoming: The willingness of irrigators to participate in this project must be evaluated before yields and costs can be further defined. This could be accomplished by regional or local questionnaires, public meetings, or many other methods.

Water Management Incentives: Baseline conditions will need to be established from which changes can be measured. The willingness of irrigators to participate in this project must be evaluated before yields and costs can be further defined.

Groundwater Management: Further investigation and monitoring is required prior to and during implementation of groundwater management programs to ensure the sustainability of these projects. A more in-depth hydrogeologic analysis is needed to address the dynamic response of the groundwater mound in Central Nebraska and the possible firm yield that can be attained without mining the mound. Any project designed to take water from the mound will need to be phased-in so that hydrologic impacts can be monitored and evaluated.

Dawson/Gothenburg Canal Recharge Projects: Information is needed on high groundwater levels in the area and the associated effects on surrounding landowners.

Power Interference: This project has several operational and contractual considerations that will need to be addressed, including how saved water is released, and how existing and new contractual arrangements with power generators can be executed.

La Prele Reservoir: Further analysis of the seepage from La Prele Reservoir is needed to determine whether a temporary storage contract in a downstream reservoir such as Glendo Reservoir is necessary to fully realize the yield associated with this project.

C. Process for Advancing Water Conservation/Water Supply Projects

The potential projects identified in Table II-1 have been evaluated at a reconnaissance level and will be funded for advancement to the feasibility level unless the Governance Committee decides otherwise. As more in-depth analyses of project yields and costs are completed, the Governance Committee may choose to replace projects in the Water Action Plan with alternative projects. Each state has expressed its desire to reserve the right to add or remove projects from consideration in the future if an issue arises that cannot be resolved. Circumstances that might result in projects being added to the Water Action Plan include insufficient yield to meet the water goals of the Program. A project can be removed from the Water Action Plan if the project is not implementable within the first increment (13 years), generates significantly less yield than was anticipated, is too expensive, is unacceptable to the Governance Committee for other reasons, or if an agreement cannot be negotiated with the project sponsor. New projects may or may not require a supplement to the Programmatic EIS. Elements of the Water Action Plan will be subject to site specific National Environmental Policy Act (NEPA) and ESA review as appropriate.

The following process will be used to add new projects for consideration and to advance projects, including those identified in the initial list, from conception of an idea, through reconnaissance study, through identification for feasibility study, through feasibility evaluation, to acceptance or rejection for implementation, and through implementation.

1. ADDING PROJECTS TO THOSE IDENTIFIED FOR FEASIBILITY STUDIES.

a. Anyone can propose to the Governance Committee an additional water conservation/supply project to be considered.

b. Any proposal to consider an additional project must be accompanied by a reconnaissance study by the project sponsor or a concept for a reconnaissance level study by the Program for that project. The Governance Committee will address funding by the Program if reconnaissance studies were not funded by the project sponsor or others.

c. The reconnaissance study shall include, at a minimum:

   i. preliminary estimates of shortage reduction;
   ii. preliminary estimates of cost, including any financial or other incentives necessary to implement the project;
   iii. preliminary identification of legal, socioeconomic and institutional impediments, compatibility with existing law, and any changes in law necessary to implement the project;
   iv. preliminary identification of beneficial and adverse environmental impacts, including impacts on surface water, groundwater, water quality, vegetation, wildlife, and on-site threatened and endangered species;
   v. preliminary identification of water availability based on historical flows and program projects;
   vi. preliminary assessment of relation of project yield to other program projects;

vii. preliminary analysis of potential beneficial and adverse direct and third party impacts, including hydrologic, economic, and social impacts on surface water and groundwater users, and preliminary identification of measures and estimate of costs to avoid, offset, or mitigate adverse impacts, if appropriate; and
viii. preliminary identification of federal, state, county, and other permits necessary to implement the project and process for obtaining such permits.

The Governance Committee will decide how to handle the proposal, which could include: (1) requesting additional information from the project proponent; (2) referring the proposal to a committee for consideration and a recommendation; (3) adding the project to the list of those advancing to the feasibility level of study and discussing with any project sponsor other than a state whether such study will be funded and/or contracted for by the Program or the project sponsor; or (4) rejecting the proposal.

2. FEASIBILITY STUDIES AND APPROVAL OR REJECTION BY G.C.

a. A proposal, budget and schedule for carrying out feasibility studies will be provided to the Governance Committee by the Water Committee or other Governance Committee designee. Anyone can carry out feasibility studies at their own expense and provide them to the Governance Committee for consideration.

b. Feasibility studies will include complete and refined information about each issue identified in items 1.c.i through 1.c.viii above. Feasibility studies will also include the following information:

i. A reasonable implementation schedule for the project;
ii. The process(es) for obtaining any necessary water rights for the project, any necessary agreements with water rights holders, and/or any necessary changes of water law;.
iii. A process for obtaining public input and reporting thereon;
iv. A proposed monitoring program for the project;
v. Proposed operating rules for the project;
vi. Any other necessary project construction requirements, methods, procedures, and schedules.

c. The Governance Committee will consider the feasibility level study for each project and decide whether to: (1) request additional information; (2) refer the proposal to a committee for consideration and a recommendation; (3) accept the proposed water conservation/water supply project for implementation; or (4) reject the project. At that time DOI will advise what activities, if any, are necessary to comply with NEPA.

d. Associated issues, such as property acquisition (if appropriate), "buy back" rights, avoidance or mitigation of direct and third party impacts, and equity and crediting if the program terminates must be resolved before a project is accepted for implementation.

3. *IMPLEMENTATION OF PROJECTS ACCEPTED BY THE GC AFTER FEASIBILITY STUDIES*

a. The Governance Committee must approve funding for the project for the project to be implemented.

b. The project may be implemented by the Governance Committee, by one or more states, or by another project sponsor or sponsors, in accordance with the plan and schedule included in the feasibility study and approved by the Governance Committee. If the project sponsor oversees implementation, the project sponsor will coordinate with a designated representative of the Governance Committee who would receive advice from the Water Committee.

c. Implementation tasks, which will be subject to Governance Committee oversight and approval as appropriate, may include: (1) complying with state and federal laws and regulations; (2) hiring contractors; (3) completing final project design; and (4) building and operating the project. The executive director, a contractor, a state or a project sponsor as appropriate may implement some or all of these tasks.

d. The executive director, contractor, state or project sponsor will provide appropriate information to the Governance Committee to ensure that the project is operating according to design and to determine if its performance can be improved to increase water yield, cut costs, or achieve other benefits. If the Governance Committee considers proposals to increase yield or performance of a project not operated by the executive director, another program contractor, or a state, discussions will include the project sponsor. Such changes shall not be implemented without the agreement of the project sponsor. If unanticipated changes occur during implementation, the issues shall be brought to the Governance Committee for resolution.

e. After implementation, monitoring and research will occur as directed by the Governance Committee in accordance with the Program's Integrated Monitoring and Research Plan. Monitoring shall also occur as needed to evaluate direct and third party impacts and any mitigation process instituted.

f. Tracking and accounting will be accomplished per Program procedures.

III. Projects

A. Introduction

The information presented in this Water Action Plan is intended to meet both the needs of the Governance Committee and the EIS/ESA Team. The proposed projects must be described in sufficient detail so the EIS/ESA Team can evaluate the benefits of the proposed Program for the target species and the general impacts of the Program on the Platte River Basin water resources and dependent economies.

The following information is provided for each project included in the Water Action Plan per the December 1, 1999 memo by Curt Brown, Platte River EIS Study Manager.

1. *Location of the Project:* Location of project facilities or associated actions.
2. *Basic Description:* The plan of operation that produces the intended benefit.
3. *On-site Yield and Timing:* A typical schedule of diversions, storage, or releases producing the local yield to the river. This corresponds with on-site hydrologic effects.
4. *Legal and Institutional Requirements for Implementation:* Issues critical to the successful implementation of the element. This may include issues related to permitting, water rights, contracts, state laws and regulations, interstate compacts, etc.
5. *Schedule for Implementation:* The likely schedule for full implementation of the project.
6. *Expected Project Life:* The projected life of the element, based on the estimated investment and operating costs.
7. *Capital and Operational Costs:* The initial and annual costs for the project.

In addition to these seven EIS team information requirements, the WAPC requested information be included on third-party impacts. Third party impacts may include hydrologic, economic, social, and environmental impacts associated with each project. A hydrologic analysis considers impacts on existing surface and groundwater users resulting from changes in the timing and quantity of water in the river while taking into account terms and conditions of interstate compacts, decrees and the Program. A socioeconomic analysis considers impacts on the local and regional economy, taxes, hydropower generation, and recreation. An environmental impact analysis considers changes in water quality and habitat areas.

A qualitative identification of potential third-party impacts associated with each project is provided, however, a more in-depth quantification of negative and positive costs, benefits, and specific impacts has not been completed. For example, third party costs may include power interference charges or compensation for adverse impacts to existing water right holders and groundwater users. Costs/benefits associated with third party impacts will need to be assessed prior to implementation. Costs associated with third party impacts could be relatively high for certain projects, resulting in higher costs than presented in this report. Likewise, positive third party impacts should be credited to the Program when possible, which could reduce the cost of a project. Information on third party impacts developed by the EIS team will be included when made available.

Two other types of information are mentioned in the WC's Scope of Services under Water Action Plan requirements, which include: 1) monitoring and accounting methods; and 2) recommendations concerning how Program water moves through the system to maximize benefits to the habitat. These two topics are addressed in Chapters IV and V, respectively.

B. Nebraska Projects

1. CNPPID RE-REGULATING RESERVOIR

◊ Location:

Several re-regulating reservoir options were evaluated by HDR Engineering Inc. (HDR) for Central Nebraska Public Power and Irrigation District (CNPPID). The HDR report, titled *Depletion Mitigation Study Phase I*, was made available to Boyle Engineering on April 13, 2000. The HDR report has been relied on for information on potential re-regulating reservoirs within CNPPID's system.

Nebraska indicated they are willing to consider a re-regulating reservoir(s) capable of yielding an annual average of up to 8,000 ac-ft of target flow reductions at the critical habitat, of which 4,000 to 5,500 ac-ft would be made available to the Program (Jim Cook, Nebraska Natural Resource's Commission, June 28, 2000 memo). The remaining portion of the yield will be retained by Nebraska to potentially offset future depletions. An average of up to 8,000 ac-ft/yr of target flow reductions could be attained through a single re-regulating reservoir or a combination of reservoirs. As such, the six most promising re-regulating reservoir options evaluated in the HDR report are presented below.

The site locations of the six re-regulating reservoirs listed in order by location from west to east are described as follows:

Option 1: Jeffrey Canyon Reservoir. This site is located south of Brady in Lincoln County on the south side of the Central District Supply (Canal). This reservoir would be fed from Jeffrey Reservoir. The reservoir capacity is estimated to be 10,390 ac-ft.

Option 2: Smith Canyon Reservoir. This site is located southwest of Gothenburg in Dawson County on the south side of the Canal. This reservoir would be fed by water pumped from the Canal. The reservoir capacity is estimated to be 12,895 ac-ft.

Options 3&4: Midway Lakes Reservoirs No. 2 and No. 5. These sites are located south of Willow Island in Dawson County on the south side of the Canal. These reservoirs would be fed by water pumped from the Canal. The capacities of Midway Lakes Reservoirs No. 2 and No. 5 are is estimated to be 6,433 ac-ft and 11,429 ac-ft, respectively.

Option 5: North Plum Creek Reservoir. This site is located southeast of Cozad in Dawson County on the north side of the Canal. This reservoir would be fed by water from the Canal. The reservoir capacity is estimated to be 2,320 ac-ft.

Option 6: J-2 Forebay Reservoir. This site is located southeast of Lexington in Gosper County in the Plum Creek basin, south of the J-2 Forebay on the south side of the Canal. This reservoir would be gravity fed from the Canal. The reservoir capacity is estimated to be 3,436 ac-ft.

◊ Basic Description:

Re-regulating reservoirs capture Platte River water beyond that required for irrigation deliveries and mainstem instream flows during periods of excess flow at the critical habitat. In general, water would be diverted from the Central District Supply Canal during periods of excess and released during periods of shortage at the critical habitat. In the case of the Jeffrey Canyon and the J-2 Forebay Reservoirs, water would be supplied from Jeffrey Reservoir and the J-2 Forebay, respectively, as opposed to the Canal. CNPPID is proposing to re-regulate flows in their system, in which case diversions will not be increased or decreased, only return flows will change.

◊ On-Site Hydrologic Effects:

The HDR Report was relied on for yield estimates. The on-site yields presented have not been discounted, therefore, the EIS team will need to consider the reservation of water for Nebraska's future depletions in determining the scores associated with these reservoirs.

HDR developed a spreadsheet to analyze the flow regime of each potential reservoir. Reservoir operations were modeled on a daily basis. Daily operation is possible due to the close proximity of the reservoirs to the habitat. Days of excess can occur in months that the monthly flow does not exceed monthly target flows, in which case, the reservoirs could be operated to store on *days* of excess and release on *days* of shortage. These reservoirs can take advantage of short-term excesses and shortages in a more efficient manner than other alternatives that are further upstream.

The following assumptions and operating rules were used by HDR to determine the yield and timing associated with these reservoirs.

- No dead pool was accounted for. All reservoirs were allowed to drop until they were dry.
- Type of year for purposes of defining target flows (wet, average, or dry) is known.
- Travel time from Overton to Grand Island is two days. Historic flows at Overton were used to determine the amount of water that should be stored or released from the reservoirs to meet the target flows at Grand Island.
- Buffers were used to incorporate a factor of safety in the decision to store or release. If the flow at Overton was more than 200 cfs above the target flow, then water was diverted to storage. If the flow at Overton was more than 500 cfs below the target flow, then water was released from storage. Changes to these buffers will affect yield results.

- Incremental changes in gains and losses between Overton and Grand Island are negligible.

- Rainfall falling on water surfaces was assumed to be added to the reservoir volume in full. Historical daily precipitation data was obtained from the Holdrege weather station.

- Runoff contributed from rainfall falling on the drainage basin surrounding the reservoirs was subject to SCS losses. Antecedent moisture conditions were used.

- Seepage through the dams was estimated using Darcy's Law and the geometry of the dam along with soil characteristics. Daily seepage rates were based on the water surface elevation at the beginning of the day.

- Evaporation was based on available climate data for the North Platte weather station. A constant water surface area associated with one-half the reservoir depth was used for each reservoir for the purpose of determining evaporative losses and direct rainfall.

- The reservoirs began the study period empty.

- Inflow and outflow capacities were preliminarily set by conversations with CNPPID. Fill capacities ranged from 100 to 400 cfs, while release capacities were set at 50 cfs for all reservoirs. Changes to these capacities will affect yield results.

- No freeboard was used in the hydraulic and hydrologic analyses. Water was considered to be spilled in full beyond the normal volume of the reservoir.

- Water was available in the Canal up to the amount of the historic J-2 Return during periods when diversions into the reservoirs were made. The water diverted from the Canal to be stored in the reservoir could not exceed the flow in the J-2 Return.

Daily reservoir operations data, including diversions to storage and releases, have not yet been made available by HDR and CNPPID.

◊ Legal And Institutional Requirements for Implementation:

There may be several legal and institutional requirements necessary to implement any of these reservoirs. As noted by NPPD in comments received May 3, 2000, the operational rules must insure that all senior water right demands are met before storage is considered or credited to a CNPPID re-regulating reservoir. This condition should be met if water is only available for storage on days that flows downstream of the J-2 Return exceed the needs of existing water rights.

Nebraska will also explore several institutional alternatives for capturing, releasing, and protecting water generated from a re-regulating reservoir if it moves forward (Nebraska's Comments on Boyle January 17, 2000 Memo). Potential institutional alternatives presented by CNPPID, which address legal requirements, are as follows. If the reservoir

is filled by re-timing water already diverted under an existing water right when river flows below the J-2 Return exceed target flows, there will be no additional diversions from the Platte River. Therefore, one alternative may be to modify the existing water rights to permit additional regulation provided no other water right is harmed. Another alternative may be to specify the Central District Supply Canal, rather than the Platte River, as the source of water for the reservoir. In this case, the argument could be made that water is available for storage on days that flows downstream of the J-2 Return exceed the needs of existing water rights and target flows. Another option may be to file for a new storage permit to divert water from the Platte River. A new storage permit with a junior priority date may not be a significant problem given CNPPID's intentions not to harm other water rights or target flows (CNPPID's comments, February 16, 2000).

If CNPPID is able to acquire a permit to divert under their existing water rights then water could be protected from diversion under the new storage right. However, even if releases are not protected, there is little opportunity for downstream users to divert additional water associated with this project given the proximity to the critical habitat.

Based on conversations with CNPPID personnel, it is possible that CNPPID may need an amendment to the current Federal Energy Regulatory Commission (FERC) license to construct this reservoir since it could affect operations of its current FERC licensed projects. However, there is no FERC requirement that CNNPID build this reservoir to improve their system. NEPA/ESA compliance would also have to be completed on the construction of the reservoir to address any on-site issues.

Other federal and state agency permit requirements investigated and identified in the HDR report include the following. A U.S. Army Corps of Engineers 404 permit would be required in addition to a 401 Water Quality Certification, which would be addressed via the 404 permitting process. Coordination with the Nebraska State Historic Preservation Officer would be required before construction. An NPDES Permit to Discharge Storm Water Associated with Construction Activity and associated Storm Water Pollution Prevention Plan for construction activity would be required. Construction activity would require review from the State of Nebraska DEQ-Air Quality Division. Permits may be required for the construction of structures within the affected counties in Nebraska.

◊ Schedule For Implementation:

Comments were received from Nebraska regarding draft implementation schedules for all Nebraska projects included in the Water Action Plan. The implementation schedules provided are estimated times to implementation from the start of the Program, or if action to implement that alternative does not commence until sometime after the first year of Program implementation, the estimated time to complete implementation once it has begun. Implementation times assume that principle efforts are directed at that alternative. To the extent that efforts are being made to implement multiple alternatives, the implementation times may be longer. All of the implementation times are subject to obtaining any necessary supporting water rights and/or changes to existing water rights used to support the Program.

As noted in comments received from Nebraska, a re-regulating reservoir within CNPPID's system is estimated to take five to seven years to implement. A final design study and several state and federal permits would be required prior to construction.

◊ Expected Project Life:

The project life of a re-regulating reservoir would most likely extend well beyond the first increment of the Program. If properly maintained and operated, reservoir lives can exceed 75 to 100 years. Existing seepage problems associated with some of these sites could impact the project life depending on whether seepage problems can be avoided or mitigated.

◊ Capital And Operational Costs:

The HDR report was relied on for cost estimates with the exception of hydropower impacts. The capital and annual costs for this project include costs associated with land acquisition, access, pump intake system, outlet structure and system, spillway, construction of the earthen dam, annual operations and maintenance costs, and lost hydropower revenue.

Most of the capital construction costs were determined by estimating the quantities of the components and multiplying by a unit cost for each. Some of the assumptions used by HDR for unit costs are as follows:

- $5 per cubic yard for embankment material complete in place.
- $35 per square yard for riprap with a sand filter.
- $340 per acre for mulching on the face of the dam.
- $8,000 per drop structure on spillway channels.
- Intake and outlet system costs are variable based on site conditions.
- $1000 per acre for land acquisition.
- Pump system costs were based on the power required to operate pumps at given flowrates and heads.
- Annual operations and maintenance costs were estimated to be 5 percent of pump capital costs.
- Mean annual lost hydropower costs were estimated to be $3 per acre-foot per hydropower plant bypassed. (Per personal communication with Mike Drain of CNPPID, May 16, 2000, this figure is in error and should have been $4 per acre-foot, therefore, the $4 figure has been used in this Water Action Plan. Furthermore, this figure represents loss of hydropower revenue to CNPPID but does not reflect loss in revenue to NPPD.)[1]
- $125,000 per mile for construction of access roadway.

The total capital costs and annual operations and maintenance costs are summarized in the table below. Nebraska is reserving 31 to 50 percent of the estimated 8,000 ac-ft/yr yield (or 2,500 to 4,000 ac-ft/yr of reserved yield) to offset future depletions, in which

[1] For some reservoirs there will be annual costs associated with lost hydropower generation because releases bypass a plant. Water diverted to storage will be taken out above the hydropower plant and released below the generator.

case only a proportionate share of the cost of this project would be attributable to the Program. Fifty (50) percent of the total capital costs and annual costs attributable to the Program were estimated to range from approximately $2.45 million to $4.61 million and $78,000 to $255,000, respectively. Sixty nine (69) percent of the total capital costs and annual costs range from approximately $3.39 million to $6.37 million and $108,000 to $352,000, respectively.

Table III-1
Re-regulating Reservoir Costs

	Jeffrey	Smith	Midway No. 2	Midway No. 5	N. Plum	J-2
CAPITAL COSTS						
Land Acquisition	524,000	715,000	276,000	421,000	221,000	206,000
Access Roadway	450,000	925,000	137,500	1,215,000	165,720	75,000
Pump Intake System	2,075,055	1,567,580	2,088,517	1,856,685	1,893,841	4,301,481
Outlet Structure	200,000	200,000	240,000	240,000	200,000	240,000
Spillway	315,833	226,983	218,000	194,517	280,500	242,083
Earth Dam	4,662,515	4,756,115	3,155,000	3,361,574	2,033,944	1,892,599
Outlet System	1,001,775	94,612	157,254	83,179	111,308	231,328
Total Capital Cost	**9,229,178**	**8,485,290**	**6,272,271**	**7,371,955**	**4,906,313**	**7,188,491**
50% of the Capital Cost	**4,614,589**	**4,242,645**	**3,136,136**	**3,685,978**	**2,453,157**	**3,594,246**
69% of the Capital Cost	**6,368,133**	**5,854,850**	**4,327,867**	**5,086,649**	**3,385,356**	**4,960,059**
ANNUAL COSTS						
Hydropower Lost	63,796	36,612	20,648	23,908	28,288	33,880
O&M and Power Costs	315,946	408,301	485,389	485,931	128,113	209,002
Total Annual Cost	**379,742**	**444,913**	**506,037**	**509,839**	**156,401**	**242,882**
50% of the Annual Cost	**189,871**	**222,457**	**253,019**	**254,920**	**78,201**	**121,441**
69% of the Capital Cost	**262,022**	**306,990**	**349,166**	**351,789**	**107,917**	**167,589**

Potential costs associated with third party impacts have not been evaluated. The project costs presented above may be higher if there are third party impact costs.

◊ Third-Party Impact Considerations:

Potential third party impacts include positive and negative effects on the following:

1. Hydrologic conditions: Includes changes in streamflows, canal flows, and return flows both in terms of timing and quantity.
2. Economic and fiscal conditions: Includes changes in income, employment, sales or expenditure patterns, tax revenues, related industries, and economic development.
3. Environmental conditions: Includes changes in water quality and habitat areas.
4. Social Conditions: Includes changes in recreational areas, visitations, and expenditures.

There are potential negative economic and hydrologic third party impacts associated with this project due to changes in the quantity and timing of streamflows. If the reservoir is filled by re-timing water already diverted under an existing water right there will be no additional diversions from the Platte River. Diversions to storage will decrease return flows at the J-2 Return and reduce available flows for new downstream water users in the

future or potentially existing downstream users if they are not protected through the water rights administration process. Storage releases and return flows from reservoir seepage will also alter the quantity and timing of water available to downstream users. Reservoir seepage is a particular concern due to existing seepage problems in the Plum Creek drainage for example. Additional seepage may increase groundwater levels in the vicinity, which could have both positive and negative third party impacts. Increased groundwater levels could reduce pumping costs for nearby groundwater irrigators. Alternatively, increased groundwater levels could result in waterlogging of nearby irrigated lands causing decreased productivity and yields.

A re-regulating reservoir could generate employment opportunities on a short-term basis during construction, which is a third party economic benefit. A re-regulating reservoir should not impact crop patterns or crop production, in which case regional changes in income, sales, or tax revenues are not likely.

A CNPPID re-regulating reservoir could provide an increase in recreational opportunities, which is a third party benefit. Recreational opportunities may include swimming, picnicking, fishing, nature study, sightseeing, hiking, and boating. The extent to which recreational opportunities are enhanced depends on how the reservoir is operated and whether the other reservoirs in the vicinity, including Johnson Lake and Elwood Reservoir, already provide similar recreational opportunities.

Third party environmental impacts associated with this project can be both positive and negative. There could be negative impacts to wetlands from reservoir impoundment and positive impacts resulting from the creation of additional wildlife habitat. Reservoir projects could also have both negative and positive impacts on water quality and downstream aquatic habitat. Water quality could improve during the summer months when additional flows are added to the river. However, water quality could be degraded and fish and aquatic habitat negatively impacted during the winter months when river flows are reduced. This possibility might be minimized if water is only pumped when target flows are being met.

2. WATER LEASING IN NEBRASKA

◊ Location:

Nebraska has not yet identified specific irrigation districts or individual farmers that are willing to participate in a leasing program in conjunction with the Program. The willingness to participate is also unknown at this time. Due to these conditions, a leasing program was evaluated for Reaches 10 (Julesburg, CO gage to South Platte at North Platte, NE gage) and 14 through 19 (Keystone Diversion gage to Grand Island, NE gage). ***It was assumed that representative leasing projects are located at the mid-point of each reach because specific irrigation districts and lands willing to participate in the Program are not yet known.*** The reaches are defined as follows:

Reach 10: Julesburg, CO gage to South Platte at North Platte, NE gage
Reach 14: Keystone Diversion gage to North Platte at North Platte, NE gage
Reach 15: North Platte at North Platte, NE, gage to Brady, NE gage
Reach 16: Brady, NE gage to Cozad, NE gage
Reach 17: Cozad, NE gage to Overton, NE gage
Reach 18: Overton, NE gage to Odessa, NE gage

Reach 19: Odessa, NE gage to Grand Island, NE gage

The principal canals or irrigation districts that have irrigated lands in reaches 10, and 14 through 19 are listed below. These irrigation districts and/or canals could potentially be involved in a leasing program.

Reach 14: Keith-Lincoln Canal, Paxton-Hershey Canal, North Platte Canal, Suburban Canal and Cody-Dillon Canal
Reach15: CNPPID
Reach 16: CNPPID, Six Mile Canal, Thirty Mile Canal, Orchard-Alfalfa Canal, Cozad and Gothenburg Canals
Reach 17: CNPPID and Dawson County
Reach 18: CNPPID and Kearney Canal
Reach 19: CNPPID

◊ Basic Description:

A voluntary temporary leasing program would provide incentives to farmers to annually lease water supplies that would otherwise have been used for irrigation. The amount of water available to the Program consists of the reduction in consumptive use. The project evaluated assumes that leased water rights are dependent on storage rights in Lake McConaughy. In general, water will be leased from an irrigation district or farmer with storage rights in Lake McConaughy. The reduction in consumptive use will likely be added to the EA when storage space is available and released during times of shortage at the critical habitat. The EA may not always be available to re-regulate downstream reductions in consumptive use, however, the opportunity for an exchange is greater if leasing is associated with a water right dependent on storage. For example, irrigation releases from Lake McConaughy for CNPPID and Nebraska Public Power District (NPPD) could be reduced, which would result in corresponding increases in the EA. Although it may be feasible to lease natural flow water rights, it will be more difficult to insure protection.

Under a temporary lease, irrigation districts or farmers would not relinquish ownership of their water rights. Pending approval of new legislation, water supplies could be leased for five years with an option to renew at the conclusion of the contract for another five years. To provide maximum flexibility the mix of farms participating in the program would be allowed to change over time. The leasing program that has been analyzed considers leasing approximately 25,500 ac-ft annually, which corresponds to a reduction of about 17,000 ac-ft/yr delivered on farm and a reduction in consumptive use of about 8,400 ac-ft/yr.

◊ On-Site Hydrologic Effects:

Estimates of on-site yield and timing presented below were based on the Final Report.

The number of acres that were assumed to be included in a leasing program are summarized in the following table. The acreage is based on the assumption that the full water supply and associated reductions in consumptive use consist of storage water. Many acres below Lake McConaughy receive storage water primarily as a supplement to natural flow supplies. To the extent that storage is used to supplement natural flow supplies, the acreage included in a leasing program and the yield it can produce may need to be adjusted.

Table III-2
Leasing Program

Reach	Program Acres (ac)
10	460
14	560
15	610
16	770
17	1,610
18	2,080
19	1,750
Total	7,840

The amount of water leased in each reach was based on the distribution of acres irrigated with surface supplies. Although a significant portion of the acreage included in this program is in reaches 18 and 19, which are within or near the end of the critical habitat, the savings in consumptive use may be stored in the EA as space is available. Releases from the Lake McConaughy EA will flow through the entire critical habitat, therefore, the yields of these programs have not been discounted. As mentioned earlier, the project assumes that leased water rights are associated with storage rights.

The tables below show the proposed average monthly reductions in diversions and the reductions in on-farm deliveries for each reach. Although the reductions in diversions were assigned to a reach based on the distribution of irrigated acres, in some cases the reductions would occur further upstream depending on the location of the mainstem headgate. The amount delivered on-farm was based on the average conveyance loss for each reach. Data on conveyance losses was based on county-level information obtained from the USGS Water Use Data for 1995.

Table III-3
Reductions in Diversions from the North Platte, South Platte and Platte Rivers (ac-ft)

Month	Reach 10	Reach 14	Reach 15	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0	0	0	0
November	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0
January	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0
April	16	19	14	19	34	23	9
May	34	41	31	41	80	55	21
June	288	279	293	458	905	983	819
July	683	639	696	1128	2622	2946	2347
August	613	575	625	1036	2115	2386	2023
September	50	59	45	80	147	134	83
Annual	1683	1611	1705	2762	5904	6528	5302

Table III-4
Reductions in the Amount Delivered On-Farm (ac-ft)

Month	Reach 10	Reach 14	Reach 15	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0	0	0	0
November	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0
January	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0
April	10	15	11	11	20	16	6
May	20	32	24	24	48	38	14
June	173	218	232	272	535	665	566
July	410	501	549	670	1551	1994	1620
August	368	450	494	616	1251	1615	1397
September	30	46	36	48	87	91	57
Annual	1010	1262	1346	1641	3492	4418	3661

A representative leasing program could reduce on-farm deliveries and consumptive use by about 17,000 ac-ft per year and 8,500 ac-ft per year, respectively. On-farm reductions in consumptive use were based on an on-farm efficiency of 50 percent.

The following table shows the average monthly reductions in consumptive use for the 1975-94 period.

Table III-5
Reductions in Consumptive Use (ac-ft)

Month	Reach 10	Reach 14	Reach 15	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0	0	0	0
November	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0
January	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0
April	5	8	6	6	10	8	3
May	10	16	12	12	24	19	7
June	87	109	116	136	268	333	283
July	205	251	275	335	776	997	810
August	184	225	247	308	626	808	699
September	15	23	18	24	44	46	29
Annual	505	631	673	821	1746	2210	1830

Based on the water budget spreadsheet, a reduction in consumptive use of about 8,400 ac-ft resulted in a yield of 7,000 ac-ft of shortage reductions at the critical habitat without diversion losses. In this case, it is important to note that flows in the critical habitat will only be increased by reductions in consumptive use. Therefore, the amount of leased water is considerably higher to account for historic return flows. The modeling being performed by the EIS team may indicate that the yield associated with 8,400 ac-ft of consumptive use savings is higher or lower than 7,000 ac-ft of reductions to target flow

shortages. If the EIS modeling indicates a yield that differs from 7,000 ac-ft at the critical habitat, the size of the leasing program may require adjustment.

◊ Legal And Institutional Requirements for Implementation:

There are several legal and institutional requirements necessary to implement this project. New legislation would be required to establish the conditions under which a water rights leasing program could be implemented in Nebraska. Two legislative bills, 671 and 672, which address water rights leasing, have been indefinitely postponed and will need to be reintroduced in a subsequent legislative session. These bills would need to be ratified before leasing could be implemented in Nebraska.

The Nebraska Department of Natural Resources would manage agricultural leases. Based on the conditions proposed in LBs 671 and 672, a leasing application must be approved by the DWR. For some leases, water not used for irrigation could be stored in the Lake McConaughy EA. Water released from the EA would be protected from diversion under water right A-17695. If an individual farmer within an irrigation district desires to lease water to the Program, the irrigation district must consent to the lease.

The terms and conditions under which the EA could be used to re-regulate reductions in irrigation water use downstream of Lake McConaughy would need to be agreed upon.

◊ Schedule For Implementation:

This project does not require any new construction or infrastructure, therefore, the implementation schedule is based primarily on the resolution of legal and institutional issues.

As noted in comments received from Nebraska, the draft schedule for implementing this project is as follows:

Year 1: Introduction of proposed legislation.

Year 2: Enactment of legislation and adoption of rules and regulations to implement leasing law.

Year 3: Governance Committee establishes an incentive based leasing program compatible with Nebraska water rights leasing law.

Year 4 to Year ? (will depend on cash flow to the Program and participant willingness): Water right leases are secured from individual water right holders and the Department of Natural Resources (DNR) reviews each lease for approval/disapproval. This assumes such approval would be required by the legislation.

◊ **Expected Project Life:**

The expected project life is dependent on the length of the leasing contracts. Proposed legislation provides for 5-year leases with an option to renew for another 5-year period at the conclusion of the lease. A leasing program could extend through the first increment of the Program and beyond if multiple lease renewals are allowed and farmers come in and out of the program.

◊ **Capital And Operational Costs:**

The Final Report was relied on for leasing cost estimates. The annual costs of a representative water leasing program were estimated based on the following components:

- Annual economic value of irrigation on lands in Reaches 10, and 14 through 19. The annual value of irrigation supplies was estimated at between $45 and $55 per ac-ft of consumptive use based on farm net income and land rental differentials between irrigated and non-irrigated lands. Farm net income estimates were based on average cropping patterns, yields, prices, and costs for the years 1992, 1994, and 1996 provided in an agricultural database compiled by Natural Resources Consulting Engineers, Inc. (NRCE). Information on land rental differentials was based on the information from the United States Department of Agriculture, Nation Agricultural Statistics Services (NASS) published in July 1999.

- An incentive premium of 25 percent to induce participation in the program.

- Transaction and administrative costs representing approximately 30 percent of total program costs.

On an annual basis, a leasing program was estimated to cost an average of about $80 per acre-foot of consumptive use saved on-farm. This cost includes an incentive premium and administrative costs. A separate leasing cost analysis was completed by Vernon Nelson, co-chairman of the Land Committee. Vernon Nelson estimated that leasing water in South Central Nebraska would cost about $123 per acre per year not including an incentive premium or administrative costs. More information is needed on the assumptions used by Vernon Nelson's study group to fully assess the reasons for the difference in costs. One potential difference could be the source of data used to determine yields, prices and costs. Vernon Nelson's estimate also assumed that taxes paid would be for irrigated land even if land involved in a lease was converted to dryland, whereas Boyle's estimate considered land rental differentials between irrigated and non-irrigated lands. Per CNPPID, (fax from Don Kraus, May 16, 2000) Mr. Nelson's approach reflects the provisions of proposed leasing bills. For comparison purposes a similar incentive premium of 25 percent and administration cost of 30 percent were added to Vernon Nelson's estimate, for a total of about $190 per acre. It was assumed that the administration cost includes CNPPID's lost irrigation delivery fee of $24.49 per contract acre. Both cost estimates have been provided in the table below to provide a range of potential costs associated with leasing. The total annual cost of a leasing program could range from about $660,000 to $1.5 million.

Table III-6
Leasing Program – Annual Costs

Reach	Program Acres (ac)	CU Saved (ac-ft)	Annual Cost based on Average of about $80/ac-ft of CU saved($)	Annual Cost based on $190/acre ($)
10	460	505	39,000	87,400
14	560	630	47,000	106,400
15	610	675	53,000	115,900
16	770	820	61,000	146,300
17	1,610	1,745	123,000	305,900
18	2,080	2,210	166,000	395,200
19	1,750	1,830	172,000	332,500
Total	7,840	8,415	661,000	1,489,600

Potential costs associated with third party impacts have not been evaluated. The costs presented above may be higher if there are third party impact costs. In addition, leasing contracts need to be renewed on a periodic basis, in which case there may be additional costs associated with permitting or re-negotiating leases.

◊ **Third-Party Impact Considerations:**

A leasing program can alter the timing and quantity of water in the river, in which case, there are potential hydrologic and corresponding economic third party impacts on downstream users. If water conserved is not protected from downstream diversion, there would be third party hydrologic benefits. Additional flows under this scenario may allow downstream junior water rights holders to make greater use of their water rights. However, changing the timing and quantity of water could also result in negative hydrologic impacts on downstream irrigators. Negative third party hydrologic impacts from these alternatives are most likely to occur to nearby farmers who have traditionally relied on tailwater runoff or groundwater recharge from participating farms for a portion of their water supply.

Apart from the potential third party hydrologic impacts identified above, there could also be third party economic impacts on agricultural equipment suppliers, farm workers, processing industries and local communities that depend on agriculture. The economy in the study area is dependent on agriculture to a large degree in which case economic and fiscal conditions could be negatively impacted by changes in crop patterns and crop production. If water deliveries are significantly reduced within an individual canal company or irrigation district's service area, company or district revenues may be negatively impacted. Depending on the conditions of the lease, if land is reclassified as dryland it will have reduced value for tax purposes. A reduction in tax revenues would be a negative fiscal impact.

Third party environmental impacts associated with leasing can be both positive and negative. Water quality could improve during the summer months when additional flows are added to the river. However, water quality could be degraded and fish and aquatic habitat negatively impacted during the winter months when river flows are reduced due to reductions in return flows. It is unlikely that a leasing program will have any third party impacts on recreational activities.

3. WATER MANAGEMENT INCENTIVES (CONSERVATION CROPPING, DEFICIT IRRIGATION, FALLOWING, AND ON-FARM IRRIGATION CHANGES)

◊ Location:

Nebraska has not yet identified specific irrigation districts or individual farmers that are willing to participate in a water management program in conjunction with the Program. The willingness to participate is also unknown at this time. Due to these conditions, the following options have been analyzed.

Option 1: Conservation cropping in Reaches 16 through 19.
Option 2: Deficit irrigation in Reaches 16 through 19.
Option 3: Land fallowing in Reaches 10, and 14 through 19.
Option 4: On-farm changes in irrigation techniques in Reaches 17 through 19.

Ideally these programs would be located in downstream locations close to the critical habitat to minimize difficulties associated with "protecting" the water. ***However, because specific irrigation districts and lands willing to participate in the Program are not yet known, it was assumed that representative water management projects are located at the mid-point of each reach.*** The reaches are defined under water leasing in Nebraska.

The principal irrigation districts and/or canals that have irrigated lands in Reaches 10, and 14 through 19 are described under water leasing in Nebraska. These irrigation districts and/or canals could potentially be involved in a water management program.

The yield and cost analyses of these programs has been limited to surface water irrigation, however, if additional water generated from these options is not protected it may be institutionally easier to apply these programs close to the critical habitat. In order to achieve the proposed yields below Kearney, Nebraska these types of projects would also have to be applied to lands irrigated with groundwater because there is not a sufficient amount of surface water irrigation below Kearney to realize the proposed yield. Analysis of the yields and costs of these options as they apply to groundwater irrigated lands could be completed once more information is obtained regarding specific groundwater irrigators willing to participate in the Program.

◊ **Basic Description:**

Water management alternatives consist primarily of programs resulting in reductions in consumptive use, or in the case of on-farm changes in irrigation techniques, reductions in return flows that do not return to the Platte River above the critical habitat. The programs evaluated assume the water rights involved are dependent on storage rights in Lake McConaughy. In general, an irrigation district or farmer with storage rights in Lake McConaughy will be paid to reduce their diversions through conservation cropping, deficit irrigation, land fallowing, or changes in irrigation techniques. The reduction in consumptive use will likely be added to the EA when storage space is available and released during times of shortage at the critical habitat. Although these programs could include reductions in natural flow diversions, it will be more difficult to insure protection. The EA may not always be available to re-regulate downstream reductions in consumptive use, however, the opportunity for an exchange is greater if the project is associated with a water right dependent on storage.

Option 1: Conservation cropping. Consists of a voluntary program to encourage the conversion of a portion of commonly irrigated, water intensive crops to production of less water intensive crops or crop rotations also found in the local area. Based upon local cropping pattern information, the conversion from continuous corn cropping to an alternating rotation of corn and soybeans was evaluated in Reaches 16 through 19.

Option 2: Deficit irrigation. Consists of a voluntary program to reduce irrigation water use. This analysis focuses on reducing irrigation on corn acres by six inches per acre in exchange for incentive payments.

Option 3: Land fallowing. Consists of a voluntary program under which farmers agree not to irrigate certain lands in exchange for payment. To effectively reduce consumptive use, this fallowed acreage must be over and above historical fallowing practices for purposes of land conservation.

Option 4: On-farm changes in irrigation techniques. Consists of a voluntary program aimed at improving irrigation efficiency. These measures focus on reducing return flows from farms rather than reducing consumptive use. In Reaches 17, 18, and 19 a large proportion of return flows do not return to the river above the critical habitat. These flows either accrete to the groundwater mound in the area, travel into the Republican Basin, or return to the Platte River below the critical habitat. This circumstance, along with the proximity of these reaches to the critical habitat, makes this area the most economically and hydrologically favorable for the implementation of on-farm improvements to irrigation techniques.

For Options 1 through 3 the amount of water available to the Program consists of the reduction in consumptive use, whereas, the amount available under option 4 consists of the reduction in return flows that do not return to the Platte River above the critical habitat.

◊ On-Site Hydrologic Effects:

Programs capable of reducing average annual target flow shortages by 7,000 ac-ft/yr have been evaluated for each water management alternative: conservation cropping, deficit irrigation, land fallowing, and on-farm changes in irrigation techniques. Each of these projects has been analyzed ***independently*** of each other. Ultimately, only one of these projects or a combination of these projects would be implemented for a total yield of 7,000 ac-ft/yr in accordance with Nebraska's estimate of the maximum yield attributable to water management that could be available to the Program.

Estimates of on-site yield and timing were based on the Final Report. Each water management alternative is described in more detail below.

Option 1: Conservation Cropping

The representative conservation cropping program evaluated focuses on a conversion from continuous corn cropping to an alternating rotation of corn and soybeans. The distribution of land involved in conservation cropping in each reach was based on the distribution of acres irrigated with surface supplies. The number of acres that were assumed to be included in a conservation cropping program are summarized in the following table. The acreage is based on the assumption that the full water supply and associated reductions in consumptive use consist of storage water. Many acres below Lake McConaughy receive storage water primarily as a supplement to natural flow supplies. To the extent that storage is used to supplement natural flow supplies, the acreage included in a conservation cropping program and the yield it can produce may need to be adjusted. This applies to all water management options.

Table III-7
Conservation Cropping Program

Reach	Acres Included in Program (ac)
16	3,200
17	7,200
18	9,300
19	11,000
Total	30,700

Although a significant portion of the acreage included in this program is in reaches 18 and 19, which are within or near the end of the critical habitat, the savings in consumptive use may be stored in the EA as space is available. Releases from the Lake McConaughy EA will flow through the entire critical habitat, therefore, the yields have not been discounted. This applies to all water management programs.

On-farm consumptive use savings from implementing an alternating corn and soybean rotation are estimated to be three inches per acre per year. The tables below show the proposed average monthly reductions in diversions and the reductions in on-farm deliveries for each reach. Although the reductions in diversions were assigned to a reach

based on the distribution of irrigated acres, in some cases the reductions would occur further upstream depending on the location of the mainstem headgate. The amount delivered on-farm was based on the average conveyance loss for each reach. Data on conveyance losses was based on county-level information obtained from USGS Water Use Data for 1995.

Table III-8
Conservation Cropping - Reductions in Diversions from the Platte River (ac-ft)

Month	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0
November	0	0	0	0
December	0	0	0	0
January	0	0	0	0
February	0	0	0	0
March	0	0	0	0
April	19	35	25	13
May	40	83	58	31
June	446	935	1037	1234
July	1098	2709	3107	3536
August	1010	2185	2517	3048
September	78	152	141	125
Annual	2691	6100	6887	7988

Table III-9
Conservation Cropping - Reductions in the Amount Delivered On-Farm (ac-ft)

Month	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0
November	0	0	0	0
December	0	0	0	0
January	0	0	0	0
February	0	0	0	0
March	0	0	0	0
April	11	21	17	9
May	24	49	40	22
June	265	553	702	852
July	652	1603	2103	2441
August	600	1292	1704	2105
September	46	90	96	86
Annual	1598	3608	4661	5515

A representative conservation cropping program could reduce on-farm deliveries and consumptive use by about 15,400 ac-ft per year and 7,700 ac-ft per year, respectively. On-farm reductions in consumptive use were based on an on-farm efficiency of 50 percent.

The following table shows the average monthly reductions in consumptive use for the 1975-94 period.

Table III-10
Conservation Cropping – Reductions in Consumptive Use (ac-ft)

Month	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0
November	0	0	0	0
December	0	0	0	0
January	0	0	0	0
February	0	0	0	0
March	0	0	0	0
April	6	10	8	5
May	12	25	20	11
June	133	277	351	426
July	326	801	1052	1221
August	300	646	852	1052
September	23	45	48	43
Annual	799	1804	2330	2758

Based on the water budget spreadsheet, a reduction in consumptive use of 7,700 ac-ft resulted in a yield of 7,000 ac-ft of shortage reductions at the critical habitat without diversion losses. In this case, it is important to note that flows in the critical habitat will only be increased by reductions in consumptive use. Therefore, the reduction in diversions is considerably higher to account for historic return flows. The modeling being performed by the EIS team may indicate that the yield associated with 7,700 ac-ft of consumptive use savings is higher or lower than 7,000 ac-ft of reductions to target flow shortages. If the EIS modeling indicates a yield that differs from 7,000 ac-ft at the critical habitat, the size of the water management program may require adjustment. This applies to all water management options evaluated.

Option 2: Deficit Irrigation Practices

A deficit irrigation program would focus on reducing water use in irrigated corn production. The representative deficit irrigation program would reduce irrigation on corn acres by six inches per year. The distribution of land involved in deficit irrigation in each reach was based on the distribution of acres irrigated with surface supplies. The number of acres that were assumed to be included in a deficit irrigation program are summarized in the following table.

Table III-11
Deficit Irrigation Program

Reach	Acres Included in Program (ac)
16	2,000
17	4,300
18	5,500
19	4,700
Total	16,500

The tables below show the proposed average monthly reductions in diversions and the reductions in on-farm deliveries for each reach. Although the reductions in diversions were assigned to a reach based on the distribution of irrigated acres, in some cases the reductions would occur further upstream depending on the location of the mainstem headgate. The amount delivered on-farm was based on the average conveyance loss for each reach. Data on conveyance losses was based on county-level information obtained from USGS Water Use Data for 1995.

Table III-12
Deficit Irrigation - Reductions in Diversions from the Platte River (ac-ft)

Month	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0
November	0	0	0	0
December	0	0	0	0
January	0	0	0	0
February	0	0	0	0
March	0	0	0	0
April	23	42	29	11
May	49	98	69	27
June	545	1107	1219	1063
July	1342	3207	3653	3045
August	1233	2586	2959	2625
September	95	180	166	107
Annual	3287	7220	8095	6879

Table III-13
Deficit Irrigation - Reductions in the Amount Delivered On-Farm (ac-ft)

Month	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0
November	0	0	0	0
December	0	0	0	0
January	0	0	0	0
February	0	0	0	0
March	0	0	0	0
April	14	25	20	8
May	29	58	47	19
June	324	655	825	734
July	797	1897	2472	2103
August	733	1530	2003	1813
September	57	107	112	74
Annual	1953	4271	5478	4750

A representative deficit irrigation program could reduce on-farm deliveries and consumptive use by about 16,500 ac-ft per year and 8,200 ac-ft per year, respectively. On-farm reductions in consumptive use were based on an on-farm efficiency of 50 percent. The following table shows the average monthly reductions in consumptive use for the 1975-94 period.

Table III-14
Deficit Irrigation – Reductions in Consumptive Use (ac-ft)

Month	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0
November	0	0	0	0
December	0	0	0	0
January	0	0	0	0
February	0	0	0	0
March	0	0	0	0
April	7	12	10	4
May	14	29	23	9
June	162	327	413	367
July	399	948	1236	1051
August	366	765	1001	906
September	28	53	56	37
Annual	976	2135	2739	2375

Option 3: Land Fallowing

It was assumed that 7,800 acres would be included in a land fallowing program in Nebraska, as summarized in the following table.

Table III-15
Land Fallowing Program

Reach	Acres Fallowed
Reach 10	500
Reach 14	500
Reach 15	600
Reach 16	800
Reach 17	1,600
Reach 18	2,000
Reach 19	1,800
Annual Total	7,800

The amount of land fallowed in each reach was based on the distribution of acres irrigated with surface supplies. The tables below show the proposed average monthly reductions in diversions and the reductions in on-farm deliveries for each reach. Although the reductions in diversions were assigned to a reach based on the distribution of irrigated acres, in some cases the reductions would occur further upstream depending on the location of the mainstem headgate. The amount delivered on-farm was based on the average conveyance loss for each reach. Data on conveyance losses was based on county-level information obtained from USGS Water Use Data for 1995.

Table III-16
Land Fallowing - Reductions in Diversions from the North, South and Platte Rivers (ac-ft)

Month	Reach 10	Reach 14	Reach 15	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0	0	0	0
November	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0
January	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0
April	16	19	15	20	34	23	9
May	35	40	32	42	80	54	21
June	295	274	301	468	904	963	826
July	700	627	713	1153	2620	2886	2368
August	628	564	641	1060	2113	2338	2041
September	51	58	46	82	147	131	83
Annual	1725	1581	1747	2824	5898	6395	5348

Table III-17
Land Fallowing - Reductions in the Amount Delivered On-Farm (ac-ft)

Month	Reach 10	Reach 14	Reach 15	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0	0	0	0
November	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0
January	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0
April	10	15	12	12	20	16	6
May	21	31	25	25	47	37	14
June	177	214	237	278	535	652	571
July	420	491	563	685	1550	1953	1635
August	377	442	506	630	1250	1582	1409
September	31	45	37	49	87	89	58
Annual	1035	1239	1380	1678	3489	4328	3693

A representative land fallowing program could reduce on-farm deliveries and consumptive use by about 16,800 ac-ft per year and 8,400 ac-ft per year, respectively. On-farm reductions in consumptive use were based on an on-farm efficiency of 50 percent. The following table shows the average monthly reductions in consumptive use for the 1975-94 period.

Table III-18
Land Fallowing – Reductions in Consumptive Use (ac-ft)

Month	Reach 10	Reach 14	Reach 15	Reach 16	Reach 17	Reach 18	Reach 19
October	0	0	0	0	0	0	0
November	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0
January	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0
April	5	7	6	6	10	8	3
May	10	16	13	12	24	18	7
June	89	107	119	139	267	326	285
July	210	246	282	342	775	976	817
August	188	221	253	315	625	791	705
September	15	23	18	24	44	44	29
Annual	517	619	690	839	1744	2164	1846

Option 4: Changes in Irrigation Techniques

In Reaches 17, 18, and 19 a large portion of return flows return to the Republican River Basin, accrete to the groundwater mound or return to the Platte River below the critical habitat. It was assumed that 50 percent of the return flows do not return to the Platte River above the critical habitat. A 1993 survey conducted by CNPPID indicated that about 50 percent of the surface supplied irrigated acreage within their district is irrigated with techniques that have substantial potential for increases in efficiency. The distribution of land involved in each reach was based on the distribution of acres irrigated with surface supplies. The number of acres that were assumed to be included in this program are summarized in the following table.

Table III-19
Changes in Irrigation Techniques

Reach	Acres Included in Program (ac)
17	6,800
18	8,700
19	7,400
Total	22,900

The tables below show the proposed average monthly reductions in diversions and the reductions in on-farm deliveries for each reach due to efficiency improvements. Although the reductions in diversions were assigned to a reach based on the distribution of irrigated acres, in some cases the reductions would occur further upstream depending on the location of the mainstem headgate. The amount delivered on-farm was based on the average conveyance loss for each reach. Data on conveyance losses was based on county-level information obtained from the USGS Water Use Data for 1995.

Table III-20
Changes in Irrigation Techniques - Reductions in Diversions from the Platte River (ac-ft)

Month	Reach 17	Reach 18	Reach 19
October	0	0	0
November	0	0	0
December	0	0	0
January	0	0	0
February	0	0	0
March	0	0	0
April	33	23	9
May	78	55	21
June	881	969	822
July	2553	2902	2354
August	2059	2351	2030
September	144	132	83
Annual	5748	6431	5318

Table III-21
Changes in Irrigation Techniques - Reductions in the Amount Delivered On-Farm (ac-ft)

Month	Reach 17	Reach 18	Reach 19
October	0	0	0
November	0	0	0
December	0	0	0
January	0	0	0
February	0	0	0
March	0	0	0
April	20	16	6
May	46	37	14
June	521	655	567
July	1510	1964	1626
August	1218	1591	1401
September	85	89	57
Annual	3400	4352	3672

A representative program to improve irrigation efficiency could reduce on-farm deliveries by about 11,400 ac-ft/yr. These reductions represent gross savings. The yield of this project may be lower to the extent that return flows would have returned to the Platte River.

◊ **Legal and Institutional Requirements for Implementation:**

There is currently no existing legislation or new legislation being considered which addresses the water management options described above, in which case, permits are not required to implement these projects. However, it is not clear how water saved under these programs would be protected. Technically it will be difficult to define how much additional water is added to the river on any given day, which will complicate efforts to protect this water. While it remains untested, it may be that Section 46-252 could be used to protect water saved under the water management options outlined above (Nebraska's

Comments on Boyle January 17, 2000 Memo). A permit would be required if water generated by these projects is to be protected by Section 46-252. Due to the uncertainty regarding protection it would be beneficial to locate water management projects in locations as close to the critical habitat as possible to minimize diversion losses. In order to achieve the proposed yields below Kearney, Nebraska, these types of projects would also need to be applied to lands irrigated with groundwater because there is not a sufficient amount of surface water irrigation below Kearney to realize the proposed yields.

Agreements, which establish the conditions under which water management projects would be operated, need to be negotiated with irrigation districts or individual farmers.

◊ Schedule For Implementation:

These projects do not require new construction or infrastructure, therefore, the implementation schedule is based primarily on the resolution of legal and institutional issues.

As noted in comments received from Nebraska, the draft schedule for implementing this project is as follows:

Year 1 or Year 2: Governance Committee establishes an incentive based program for implementing one or more of the options for reducing shortages through water management incentives.

Year 3 to Year ? (will depend on cash flow to the Program and participant willingness): Individual irrigators come to agreement with the Governance Committee to implement one or more of the water management incentive options selected by the Governance Committee. Applications are made and processed by the Nebraska DNR to determine how much, if any, protection can be given under Section 46-252 to "new water" produced by such implementation. Processing Section 46-252 applications could take up to one year.

◊ Expected Project Life:

These projects could be implemented indefinitely depending on the willingness of irrigation districts and/or individual farmers to participate in these voluntary programs.

◊ Capital and Operational Costs:

The Final Report was relied upon to develop cost estimates for the water management projects. Potential costs associated with third party impacts have not been evaluated. The costs presented below may be higher if there are third party impact costs. In addition, contracts with irrigators or districts need to be renewed on a periodic basis, in which case there may be additional costs associated with permitting or re-negotiating contracts. The annual costs of the representative water management projects are summarized below.

Option 1: Conservation cropping

At this time, it has been assumed that participating farmers would be compensated with payments per ac-ft conserved on-site comparable to estimates for short-term leasing arrangements. On an annual basis, the cost of a leasing program was estimated to range from about $80 to $190 per acre-foot of consumptive use saved on-farm. Therefore, the total annual cost for conservation cropping is estimated to range from $620,000 to $1.5 million based on an average annual reduction in consumptive use of about 7,700 ac-ft.

Option 2: Deficit Irrigation

Based on NRCE data regarding corn production, the estimated annual impact on farm revenues from the representative deficit irrigation program would be $90 to $100 per participating acre planted in corn. An incentive premium of 40 percent has been added to induce farmers to participate in the program. In addition, an annual administrative cost of $20 per participating acre has been included. The total average annual cost per participating acre is estimate to be about $150. Based on an estimated total of about 16,500 acres participating in the program, the annual cost would be about $2.5 million.

Option 3: Land Fallowing

The annual cost of a representative land fallowing program was estimated based on the following components:

- Annual value of irrigated lands. This value for the region as a whole is estimated to be between $100 and $110 per acre based on annual net income to farmers and irrigated land rental rates.

- An incentive premium of 25 percent to induce participation.

- Administrative costs, which average $20 per acre fallowed.

On an annual basis, a land fallowing program was estimated to cost an average of about $150 per acre. Based on an estimated total of 7,800 acres participating in the Program, the annual cost was estimated to be approximately $1.2 million.

Option 4: Changes in Irrigation Techniques

During the past seven years, CNPPID has calculated the average annual cost of these measures based on its program to implement on-farm conservation improvements at $217 per acre foot reduced on-farm deliveries. There is uncertainty regarding the use of this cost for the following reasons: 1) This cost may not apply to this analysis because it includes some items which are not incremental changes over the pre-improvement system (such as water delivery costs) and excludes some incremental costs to the landowner (such as production reduction in pivot corners), and 2) The validity of the method used to estimate the quantity of water saved by on-farm improvements is continuously being evaluated by CNPPID's Conservation Task Force.

Although there is uncertainty regarding the use of $217 per acre foot reduced on-farm deliveries, it is the best available information at this time. Based on an average annual reduction of 11,400 ac-ft of on-farm deliveries in Reaches 17 through 19, the total annual cost of this project would be about $2.5 million.

◊ **Third-Party Impact Considerations:**

A water management program can alter the timing and quantity of water in the river, in which case, there are potential hydrologic and corresponding economic third party impacts on downstream users. If water conserved through these alternatives is not protected from downstream diversion, there may be positive and negative third party hydrologic impacts. Additional flows under this scenario may allow downstream junior water rights holders to make greater use of their water rights. Additional hydrologic benefits related to changes in irrigation techniques exist for areas prone to high water tables because groundwater recharge will be reduced. Negative third party hydrologic impacts from these alternatives are most likely to occur to nearby farmers who have traditionally relied on tailwater runoff or groundwater recharge from participating farms for a portion of their water supply. Positive and negative third party hydrologic benefits may be minimal depending on how close to the critical habitat these programs are implemented.

Apart from the potential third party hydrologic impacts identified above, there could also be third party economic impacts on agricultural equipment suppliers, farm workers, processing industries and local communities that depend on agriculture. The economy in the study area is dependent on agriculture to a large degree, in which case economic and fiscal conditions are impacted by changes in crop patterns and crop production. For all programs, changes in the farm product can have negative impacts on processors, shippers, purchasers of farm products as well as local livestock growers, and local communities that depend on agriculture.

For conservation cropping there may be third party economic impacts on farm workers and input suppliers because of differing requirements between traditional crops and alternative crops grown as a result of the program. Deficit irrigation will likely result in reduced yield, potentially impacting processors, shippers, livestock growers and others relying on this production. If land is reclassified as dryland under a land fallowing program it will have reduced value for tax purposes. A reduction in tax revenues would be a negative fiscal impact. For all water management options considered, if water deliveries are significantly reduced within an individual canal company or irrigation district's service area, company or district revenues may be negatively impacted. Negative third party economic impacts can be reduced to a degree if participating properties are geographically dispersed because it is unlikely that regional crop patterns and the value of crop production would change significantly.

Third party environmental impacts associated with water management programs can be both positive and negative. Water quality could improve during the summer months when additional flows are added to the river. However, water quality could be degraded and fish and aquatic habitat negatively impacted during the winter months when river flows are reduced due to reductions in return flows. It is unlikely that a water management program will have any third party impacts on recreational activities.

4. GROUNDWATER MANAGEMENT

◊ Location:

Based on the principles submitted by Nebraska, groundwater management has been limited to a total yield of no more than 6,000 ac-ft/yr until it can be successfully demonstrated through a phased-in project that groundwater mining will not occur at this level. Nebraska has indicated they will not consider expanding groundwater management unless further investigation and study reveals that higher yields can be sustained. Nebraska also intends to reserve as much of the yield of this project as Nebraska believes is necessary to offset new depletions in that state. However, Nebraska currently estimates that 1,400 ac-ft/yr of the yield of this project would be in addition to that needed for new depletion offset and therefore could be made available to the Program. That is the yield used for purposes of the analysis in this plan.

A 13,000-acre area located under the Phelps Canal system is a potential groundwater management area due to high groundwater tables. The area is bounded by the Phelps Canal to the south and east, by the Township 6 line to the north, and by the Funk Odessa Road to the west. Another groundwater management area being considered by Tri-Basin Natural Resources District (TBNRD) is the Reynold's and Robb Wetland, which is located in Section 10, Township 8 North, Range 21 West. This area is approximately 60 acres in size and is currently managed for wildlife under an agreement with the Rainwater Basin Joint Venture. Other potential groundwater management areas in Phelps and Kearney Counties include approximately 22,000 acres in Township 7 North, Ranges 18 and 19 West, and 23,000 acres in Townships 6 and 7 North and Ranges 15, 16, and 17 West.

◊ Basic Description:

Groundwater management can be accomplished in a number of ways. Several options that could be implemented to manage the groundwater mound are described below.

Option 1: Active Groundwater Pumping from High Groundwater Areas. This would involve pumping from areas of high groundwater and returning water back to the Platte River.

If this option is implemented under the Phelps Canal system, wells capable of pumping 1,000 gpm for up to 100 days a year (mostly during the summer months) could be installed and tied into a collection system(s) that discharges water into Lost Creek and/or North Dry Creek for return to the Platte River. Approximately four wells would be required to pump 1,400 ac-ft/yr (roughly 30 percent additional capacity was added for redundancy).

Option 2: Passive Lowering of the Groundwater Table. This would involve paying farmers to dry-land farm every other year. The associated reduction in surface water use could either be returned to the Platte River or stored in the Lake McConaughy EA when storage space is available. This project could be implemented effectively under the Phelps Canal system. Irrigators would make beneficial use of their water every other

year in which case it would not be subject to forfeiture under the "use-it-or-lose-it" condition.

Option 3: Groundwater Irrigation. Farmers would be paid to put in wells and use groundwater as opposed to surface water to irrigate. Reductions in storage water diversions could be stored in the Lake McConaughy EA when storage is available and released as needed for the Program.

Option 4: Conjunctive Use. A conjunctive use project under CNPPID's system would consist of shallow wells that discharge directly into CNPPID's distribution system and a recharge system of wells, pits, or drains located in the same area. Each year, in late fall and winter, flows at the Johnson #2 Power Plant that exceed target flows would be diverted through CNPPID's distribution system for recharge to the local groundwater aquifer. The groundwater aquifer would be recharged to a pre-determined level. Each spring and summer, an equivalent amount of water would be pumped for irrigation. Pumping during the irrigation season would replace irrigation releases from Lake McConaughy.

◊ **On-Site Hydrologic Effects:**

The options described above could be implemented to yield a total of 1,400 ac-ft/yr for the Program. Each of these projects has been analyzed ***independently*** of each other. Ultimately, only one of these projects or a combination of these projects will be implemented for a total yield of 1,400 ac-ft/yr.

The following table summarizes how any one of these projects could be implemented in the areas described above to yield 1,400 ac-ft/yr. It was assumed that implementation of any one of these options will reduce the water supply for the others. However, it is possible that one option or a combination of these options could be implemented to yield a total of 1,400 ac-ft/yr. For active groundwater pumping from high groundwater areas it was assumed that 280 ac-ft would be pumped each month from May through September during periods of target flow shortage, for an annual total of 1,400 ac-ft. For passive lowering of the groundwater table and groundwater irrigation the monthly distribution of reductions in surface water consumptive use was based on the monthly distribution of diversions into the Phelps County Canal. For a conjunctive use project, 1,400 ac-ft will be diverted to recharge in November, and 280 ac-ft would be pumped each month from May through September to replace irrigation storage releases. For options 2 through 4, the yield to the Platte River represents storage increases in the Lake McConaughy EA which can be released to meet target flow shortages.

Table III-22
Groundwater Management – Yield to the Platte River

Month	Option 1 (ac-ft)	Options 2 (ac-ft)	Option 3 (ac-ft)	Option 4 (ac-ft)
October	0	0	0	0
November	0	0	0	-1,400
December	0	0	0	0
January	0	0	0	0
February	0	0	0	0
March	0	0	0	0
April	0	14	14	0
May	280	140	140	280
June	280	257	257	280
July	280	504	504	280
August	280	425	425	280
September	280	60	60	280
Annual	1400	1400	1400	0

Consideration will need to be given to whether the yields associated with some of these groundwater management options should be discounted because those yields would be provided through only a portion of the full habitat or whether there are other aspects of the benefits provided by those projects which would justify giving them full credit. Water returned to the Platte River via North Dry Creek or Lost Creek is introduced partway into the critical habitat. Additional water returned to the Platte River via the North Dry Creek cutoff or the Lost Creek/Ft. Kearny cutoff flows through roughly 60 percent of the critical habitat.

Impacts on return flows or Platte River flows should be minimal if the implementation of a groundwater management program yielding 1,400 ac-ft/yr results in maintaining the water table at a level that does not create problems for residents and farmers.

◊ **Legal and Institutional Requirements for Implementation:**

Certain groundwater management options can be accomplished under current Nebraska water law. For example, no permit would be required to convert to dry-land farming and a permit would only be required for conversion to groundwater irrigation if the well used for that purpose has not yet been constructed. For dry-land farming, CNPPID would seek a modification from the Nebraska DWR to increase the EA by the same amount of reduced storage use. For a conjunctive use project, an intentional recharge permit would most likely be required to recharge the aquifer. Although legislation exists regarding intentional recharge permits it is untested. If this project targets storage water for recharge then the use of the storage right would need to be changed to include recharge. A permit would also be required to pump back into the CNPPID's distribution system if the well used for that purpose has not yet been constructed.

Actively pumping from high groundwater areas could face several legal obstacles. Although current Nebraska water law would not require a permit from the Nebraska DWR to actively pump groundwater into North Dry Creek or Lost Creek, there is

currently no statutory authority to transfer groundwater off overlying land for environmental purposes. It is likely that new legislation would be required to implement this type of project. There is some ambiguity regarding whether this could be accomplished without new legislation, however, new legislation would be preferable if this type of project is included in the Program. According to Nebraska representatives on the WAPC, new legislation could be prepared for the legislative session next year.

Water added to the Lake McConaughy EA and released during periods of shortage would be protected downstream under water right A-17695. Protection would not be needed for water that is returned to the Platte River via North Dry Creek or Lost Creek because that water is added within the critical habitat reach and there are no significant diversions below that point which could remove water associated with these projects from the Platte River.

NEPA compliance and site-specific environmental permits may be required for the construction of infrastructure related to groundwater management depending on the severity of on-site impacts. A 404 permit from the U.S. Army Corps of Engineers would be required to construct a cutoff between Lost Creek and the Fort Kearny IPA.

◊ **Schedule For Implementation:**

As noted in comments received from Nebraska, a groundwater management project could be implemented in two years, however, it would need to be phased in over several years. Infrastructure including wells, pumps, pipeline, etc. would need to be installed. A water rights permit may need to be secured from the Nebraska DWR depending on which option is implemented. NEPA compliance and site-specific environmental permits may also be required prior to implementation.

◊ **Expected Project Life:**

The expected project life varies depending on the groundwater management plan implemented. Active pumping from the groundwater mound, groundwater irrigation, and conjunctive use projects could extend beyond the first increment of the Program. A constraint on the project life could be the wells and pumping hardware, which would most likely need to be replaced within 10 to 20 years. In addition, drawdown limits could be set by either TBNRD or CNPPID, in which case the project would be terminated if these limits are exceeded.

The project life of dry-land farming depends on the willingness of farmers to dry-land farm every other year. Some farmers may be willing to dry-land farm on a rotating cycle indefinitely, whereas, others may only be interested on an infrequent basis. However, in general, groundwater management projects have the capability of being extended through the first increment.

◊ **Capital and Operational Costs:**

Costs for the groundwater management projects summarized above include up-front infrastructure costs, consisting primarily of wells, pumps, and collection/distribution systems, and annual operations and maintenance costs. Potential costs associated with third party impacts have not been evaluated. The costs presented below may be higher if there are third party impact costs.

Several of the groundwater management options are the subject of the HDR report, *Depletion Mitigation Study Phase I*, which was recently made available to Boyle. Cost information provided in the HDR report was used to supplement this cost analysis. Costs for these projects are outlined below.

Option 1: Active Pumping from High Groundwater Areas. The cost to install a shallow well and pump capable of pumping up to 1000 gpm was estimated to be $15,000 based on recent cost estimates obtained from TBNRD in connection with the Plum Creek demonstration project. This cost may be higher depending on site specific conditions and the depth of the well. Assuming four wells are required to pump a total of 1,400 ac-ft/yr, the total cost for wells and pumps is estimated to be $60,000. The cost of the collection system could vary significantly depending on where this type of project is applied and the length of pipeline required to convey water back to a tributary, such as Lost Creek, or the Platte River. It was assumed that the project would be implemented under the Phelps Canal system and only one collection system would be required to deliver water to either Lost Creek or North Dry Creek. The cost of the collection system was estimated to be $530,000. The costs to improve the cutoffs are included under the Dry Creek/Ft. Kearny Cutoff projects. The total capital cost of this project is estimated to be about $590,000. Annual operations and maintenance costs were estimated to be $14,000.

Option 2: Passive Lowering of the Groundwater Table. It was assumed that the cost to induce farmers to dry land farm is comparable to the estimated cost to lease water. On an annual basis, the cost of a leasing program was estimated to range from about $80 to $190 per acre-foot of consumptive use saved. It was assumed that the upper range of these costs includes CNPPID's revenue losses of $24.49 per contract acre associated with reduced deliveries. The total cost could range from about $112,000 to $266,000 based on a reduction in consumptive use of 1,400 ac-ft/yr.

Option 3: Groundwater Irrigation. The cost associated with this project consists primarily of well construction and pump costs. Assuming four wells are required to pump up to 1,400 ac-ft/yr, the total cost for wells and pumps is estimated to be $60,000. This does not include annual operations and maintenance costs and other associated costs to improve irrigation equipment if necessary. The conversion from surface water irrigation to groundwater irrigation may require irrigation system improvements such as the installation of center pivots.

Option 4: Conjunctive use. The costs associated with this project consist primarily of well construction and pump costs and the cost of a recharge collection/distribution system. Assuming four wells are required to pump up to 1,400 ac-ft/yr, the total cost for wells and pumps is estimated to be $60,000. Depending on the configuration of the recharge system needed for a conjunctive use project, additional costs would be incurred

for recharge basins or pipe drains. The construction cost associated with recharge basins or pipe drains will vary based on the size and location of the basin or length of the drain. There will also be annual operations and maintenance costs. The cost of the recharge collection/distribution system and annual operations and maintenance costs were based on data provided by the EIS team. The total cost of the wells and recharge system and annual operations and maintenance costs were estimated to be about $161,000 and $5,900, respectively.

◊ **Third-Party Impact Considerations:**

A groundwater management program can alter the timing and quantity of water in the river, in which case, there are potential hydrologic and corresponding economic third party impacts on downstream users. Third party impacts associated with dry-land farming are similar to land fallowing as discussed under water management programs. Third party impacts associated with the remaining groundwater management programs are discussed below.

In general, groundwater programs result in positive hydrologic impacts. Actively pumping from high groundwater areas, conversion to groundwater irrigation, and conjunctive use projects all typically increase flows in the river. Additional flows under this scenario may allow downstream junior water rights holders to make greater use of their water rights. A conjunctive use project would reduce available flows for junior downstream water users during the winter months when water would typically be diverted for recharge.

Pumping from high groundwater areas may lower regional groundwater levels, which could have both positive and negative impacts. Negative impacts include increased pumping costs for nearby groundwater irrigators due to lower groundwater levels. Alternatively, lower groundwater levels would decrease waterlogging of nearby irrigated lands and alleviate problems with flooded basements, both of which are positive impacts. Conjunctive use projects will lower and raise groundwater levels at different times of the year, which could have both positive and negative impacts. There could be negative third party impacts on landowners adjacent to creeks or drains used to return groundwater to the Platte River if waterlogging problems are increased.

In general, these projects will have minimal direct or indirect impacts on business sales, employment, wages, and wealth. Any third party economic impacts will likely be related to impacts on agricultural production in the affected area. For example, lowering groundwater levels could decrease waterlogging problems and increase agricultural productivity. Diversions to recharge through existing canals will reduce the opportunity for the owner to use that conveyance capacity, however, it may increase revenues from delivery fees.

There could be numerous environmental impacts associated with groundwater management projects. Similar to the Tamarack Recharge Plan, conjunctive use projects can generate wetlands and wildlife habitat if recharge basins are incorporated. Impacts on water quality can be both positive and negative. Recharge projects could improve water quality on-site due to the creation of wetlands. Water quality could also improve during the summer months when additional flows resulting from these projects return to the

river. However, water quality could be degraded and fish and aquatic habitat negatively impacted during the winter months if river flows are reduced. Pumping and recharge in certain areas could result in the dissolution and mobilization of salts that are either native to the geologic material or a byproduct of fertilizers, which could have negative impacts on water quality.

The groundwater management programs described above would likely have minimal impact on recreational opportunities. If recharge basins are used for a conjunctive use project there could be some recreational benefits associated with the creation of additional wildlife habitat areas.

5. DRY CREEK/FORT KEARNY CUTOFFS

◊ Location:

The Dry Creek/Ft. Kearny Cutoffs consist of two projects within TBNRD, as shown in Figure 2. The first project involves a cutoff from Lost Creek to North Dry Creek located south of Kearney in Sections 9 and 16, Township 7 North, Range 16 West. The second project involves a cutoff from Lost Creek to the Fort Kearny Improvement Project Area (IPA) located south of Kearney in Sections 1 and 12 of Township 7 North, Range 16 West. Both of these projects are located within the area influenced by the groundwater mound. Further evaluation and study is required to define the relationship between the groundwater mound and these projects.

◊ Basic Description:

TBNRD has completed some preliminary investigations of the Lost-Creek cutoff projects. The two projects presented below would be operated to return existing flows in Lost Creek or releases from the Funk Lagoon to the Platte River. These cutoffs could also be operated similar to active pumping from the groundwater mound, described under groundwater management. The potential yields from active pumping were not included for these two cutoff projects since the yields were included under the groundwater management option. If active pumping were included with the cutoff projects, well(s) could be installed in high groundwater areas to pump water into Lost Creek during periods of target flow shortage.

Option 1: Lost Creek/North Dry Creek Cutoff. Through an agreement with the North Dry Creek Drainage Board, TBNRD installed a 20-cfs cutoff from Lost Creek in May 1998 to divert discharges from Funk Lagoon into North Dry Creek. North Dry Creek enters the Platte River about 1-1/2 miles west of the Kearney Bridge on Highway 44. A water management plan for Funk Lagoon is currently being developed among FWS, TBNRD, and CNPPID that will set target elevations for the lagoon's pools throughout the year for the benefit of migratory waterfowl. Opportunities within the FWS's mandate for management of the Funk Lagoon Wildlife Protection Area (WPA) may exist for the lagoon to be drawn down at times of the year when the discharged water will benefit the critical habitat along the Platte River. The water released from the lagoon would be routed to the Platte River via the existing connection between Lost Creek and North Dry Creek. Lowering lagoon levels in the summer could reduce shortages in the critical habitat and reduce flooding damage to surrounding cropland from high groundwater

levels. Replacement water for Funk Lagoon would be provided by CNPPID at the end of the irrigation season. Improvements to CNPPID's Phelps Canal may be needed to make deliveries to Funk Lagoon.

Option 2: Lost Creek/Ft. Kearny Cutoff. Lost Creek is a tributary to the Platte River. The creek flows approximately parallel and south of the river and converges with the Platte near the end of the critical habitat reach. The Fort Kearny IPA is a drainage ditch, maintained by TBNRD, which empties into the Platte River about one mile east of the Kearney Bridge on Highway 44.

This project would consist of the construction of a ditch about ¾ mile in length to connect Lost Creek to the Fort Kearny IPA, allowing increased flow through approximately 20 miles of the critical habitat. A pump station may be necessary to expand this project in the vicinity of Lost Creek. The pump station would likely be located along Crooked Creek, which intersects the IPA approximately one mile from the river.

◊ **On-Site Hydrologic Effects:**

Per discussions with TBNRD personnel (Rich Holloway, May 19, 2000), Lost Creek is often dry at the North Dry Creek Cutoff and is a gaining reach downstream of this point to the Ft. Kearny Cutoff. Typical flows at the downstream cutoff may be up to 15 cfs in May decreasing to about 6 cfs in September. Therefore, the yield of the upstream cutoff was assumed to be dependent on Funk Lagoon releases whereas flows available to the downstream Ft. Kearny Cutoff might take advantage of gaining flows. The total yield associated with these projects is estimated to be 4,400 ac-ft/yr, or the equivalent of a steady year-round flow of 6 cfs that is timed such that the diversions are effective in reducing shortages to target flows. As shown below, it is assumed that this yield would be most effectively delivered in relation to target flows in the May to September period.

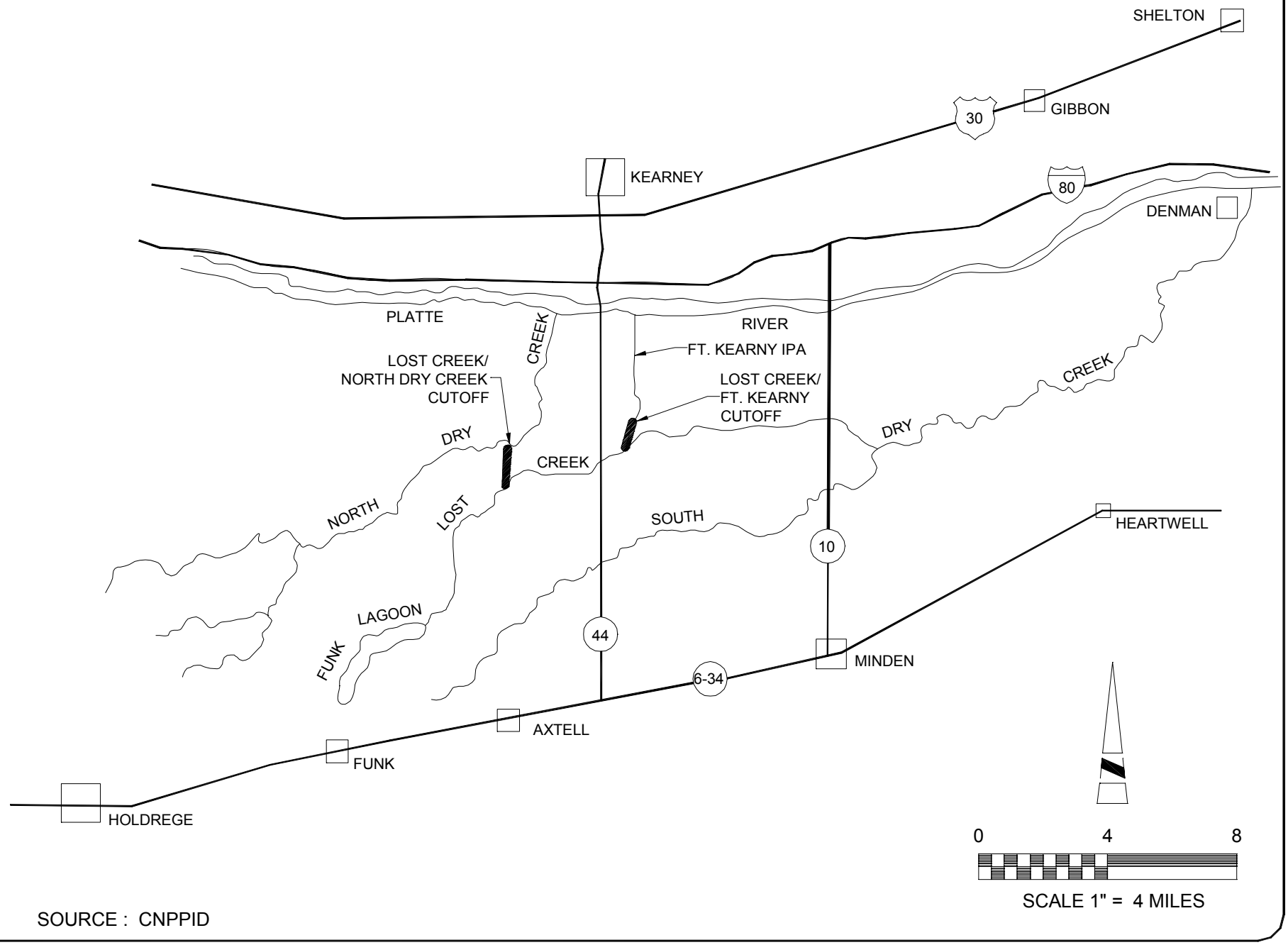
Per the discussion of Water Management Committee members, both of these projects would require consideration of whether the yields should be discounted because those yields would be provided through only a portion of the full habitat or whether there are other aspects of the benefits provided by those projects which would justify giving them full credit. Additional water returned to the Platte River via the North Dry Creek cutoff returns to the river approximately 1.5 miles west of Highway 44 near Kearney. The Lost Creek/Ft. Kearny cutoff returns to the river approximately one mile east of Highway 44 near Kearney. Water that is returned to the Platte River via these cutoffs flows through roughly 60 percent of the critical habitat.

Option 1: Lost Creek/North Dry Creek Cutoff. The diversion of Funk Lagoon discharges to North Dry Creek was carried out twice from 1998 to 1999, however, there is little data on the volume of water discharged and the resulting increases in flow in North Dry Creek.

BOYLE ENGINEERING CORPORATION

NORTH DRY CREEK/
FORT KEARNY CUTOFFS

FIGURE 2



SOURCE : CNPPID

The yield of this project is dependent on the management plan developed by the FWS. CNPPID excess flows that fill Funk Lagoon have been approximately 300 ac-ft/yr. The FWS currently has a contract for approximately 700 ac-ft/yr from CNPPID. Return flows from upstream irrigated lands are estimated to be in the range of 1,500 ac-ft to 2,500 ac-ft per year. Thus the potential releases from Funk Lagoon for the Lost Creek-North Dry Creek cutoff could be in the range of 2,500 ac-ft to 3,500 ac-ft per year.

It was assumed that 2,200 ac-ft would be available to make releases from Funk Lagoon during periods of shortage at the critical habitat from May through September. The replacement water would come from CNPPID's system or return flows at the end of the irrigation season. The average monthly net yield to the Platte River is provided in the table below. More data and analysis is required to determine release and filling sequences for the 1975-94 period and evaluate conveyance losses en route to the Platte River.

Table III-23
Lost Creek/North Dry Creek Cutoff – Net Yield to the Platte River

Month	Funk Lagoon Releases (ac-ft)	CNPPID Deliveries to Funk Lagoon (ac-ft)	Net Yield (ac-ft)
October	0	-1100	-1100
November	0	-1100	-1100
December	0	0	0
January	0	0	0
February	0	0	0
March	0	0	0
April	0	0	0
May	440	0	440
June	440	0	440
July	440	0	440
August	440	0	440
September	440	0	440
Annual	2,200	-2200	0

Option 2: Lost Creek/Ft. Kearny Cutoff. This yield analysis considers diverting existing flows in Lost Creek back to the Platte River during times of shortage at the critical habitat. Routing water pumped from high groundwater areas back to the river via the Ft. Kearny IPA cutoff is evaluated under groundwater management.

It was assumed that an average of 2,200 ac-ft/yr would be available for diversion back to Platte River via the cutoff as shown in the table below.

Table III-24
Lost Creek/Ft. Kearny IPA Cutoff – Net Yield to the Platte River (ac-ft)

Month	Net Yield (ac-ft)
October	60
November	60
December	50
January	50
February	60
March	60
April	60
May	360
June	360
July	360
August	360
September	360
Annual	2,200

◊ **Legal and Institutional Requirements for Implementation:**

A water rights permit would be required from the Nebraska DWR to divert water into Lost Creek. CNPPID's water rights will also need to be changed to include environmental uses to make deliveries to Funk Lagoon. Once permits are obtained water could be protected under Section 46-252, which provides for the protection of water for the purposes of instream beneficial uses. Under Section 46-252 the DWR is responsible for assuring that water conducted into or along natural channels for the purposes of instream beneficial uses is not subsequently diverted or withdrawn.

The Lost Creek/Ft. Kearny project involves the construction of a cutoff between Lost Creek and the Fort Kearny IPA, which requires a 404 permit from the U.S. Army Corps of Engineers. NEPA compliance and site-specific environmental permits may also be required for the construction of infrastructure related to this project depending on the severity of on-site impacts.

A FWS permit would be required under the Refuge Administration Act. Agreements would need to be negotiated with TBNRD, CNPPID, and FWS, which establish the conditions under which these projects would be operated if included in the Program.

Compliance with the City of Kearney Wellhead Protection Permit program would also be required.

◊ Schedule For Implementation:

As noted in comments received from Nebraska, the draft schedules for implementing these projects are as follows:

Option 1: Lost Creek/North Dry Creek Cutoff. The cutoff involved in this project is already constructed, therefore, the implementation schedule is based primarily on the resolution of legal and institutional issues. It may take one to two years to obtain a water rights permit and change of use from the DWR and negotiate a contract with TBNRD, FWS, and CNPPID, after which this project could be implemented.

Option 2: Lost Creek/Ft. Kearny Cutoff. The schedule for implementation is dependent on the time required to construct a cutoff between Lost Creek and the Fort Kearny IPA, obtain a permit from the Nebraska DWR, secure a 404 permit and NEPA compliance, and negotiate a contract with TBNRD. This project may take one to two years to implement.

◊ Expected Project Life:

The expected project lives are dependent on the agreements with TBNRD, CNPPID, and FWS. These contracts may need to be renewed on a year-to-year basis. In addition, these projects will likely be phased in and their continuation dependent on the results of monitoring impacts on local groundwater levels and Funk Lagoon. TBNRD could set drawdown limits to establish an upper bound on pumping from the Lost Creek watershed. If these limits are exceeded the project may be shutdown depending on the conditions set by TBNRD.

◊ Capital and Operational Costs:

The costs for these projects include up-front infrastructure costs, consisting primarily of wells, pumps, and improvements to ditches, culverts, and outlets, and annual operations and maintenance costs. Potential costs associated with third party impacts have not been evaluated. The costs presented below may be higher if there are third party impact costs.

Option 1: Lost Creek/North Dry Creek Cutoff. The Final Report was relied on for costs associated with this project. Costs to date are approximately $300,000. This includes installation of an underdrain at the upstream end of Funk Lagoon, maintenance of seven miles of creek channel, installation of the cutoff between Lost Creek and North Dry Creek, and concrete and road culverts associated with a mile connecting ditch. Improving the system to allow available water to be discharged in the spring and summer without affecting downstream agricultural activities would require rebuilding the North Dry Creek outlet and constructing pivot bridge crossings for center pivots. Estimated costs for these improvements are about $30,000. The total up-front capital cost associated with the entire project is $330,000. The annual operations and maintenance costs are estimated to be about $4,000. In addition, CNPPID would assess an annual water delivery fee. The current irrigation delivery fee is $24.49 per contract acre for a 15-inch contract (1.25 ac-ft), therefore, the cost per ac-ft is about $19.59. CNPPID could adjust this fee based upon changes in their irrigation delivery rates. The annual delivery fee would be $86,200

assuming CNPPID delivers an average of 4,400 ac-ft per year to Funk Lagoon. CNPPID deliveries may be less depending on the amount of return flows from upstream irrigated lands.

Option 2: Lost Creek/Ft. Kearny Cutoff. Assuming this project is operated to return existing flows in Lost Creek to the Platte River, the costs include up-front capital costs associated with the Lost Creek – Ft. Kearny IPA cutoff and annual operations and maintenance costs. Up-front costs associated with this project consist primarily of improvements to the Ft. Kearny Ditch, installation of the cutoff, diversion structures and gates, and pivot bridges along Lost Creek. If this project is operated to pump from high groundwater areas additional costs would be incurred for wells, pumps, and pipeline. These costs are addressed under groundwater management. Preliminary estimates of the costs associated with this project were provided by TBNRD.

The total up-front capital costs and annual operations and maintenance costs associated with this entire project were estimated to be about $333,000 and $6,000, respectively, as summarized in the following table.

Table III-25
Cost of Lost-Creek/Fort Kearny IPA Cutoff Project

DESCRIPTION	COST ($)
Diversion structure on Lost Creek	30,000
RTU and Measuring Device at Inlet	15,000
Excavate connecting ditch	60,000
Gated culvert on Crooked Ck Ditch	2,000
Bore under Highway 50A, Install Culvert	17,500
RTU and Measuring Device at Outlet	15,000
Flap Gate at Outlet	7,500
Clean Ft. Kearney Ditch, Install Culverts	65,000
Observation Wells	13,000
Pivot Crossings	20,000
Berm at Outlet	10,000
Clearing and grubbing trees along Lost Creek	42,500
Surveys	2,500
Secure 404 Permit, DWR Water Right	3,000
CNPPID Capitalized Costs	11,770
CNPPID Estimated Costs - Year 2000	9,500
TBNRD Capitalized Costs	4,815
TBNRD Estimated Costs - Year 2000	4,000
Total Capital Cost	**333,085**
Annual Operations and Maintenance Cost	**6,000**

◊ Third-Party Impact Considerations:

There are potential positive and negative hydrologic and economic third party impacts on downstream users due to changes in the quantity and timing of water in the river as a result of these projects. There could be third party benefits to homeowners and landowners in areas where groundwater levels are lowered due to pumping. Waterlogging

in several areas throughout the Central Platte has resulted in decreased agricultural productivity and yield. Lowering the groundwater table could improve productivity, and in some cases bring waterlogged land back into production. Conversely, lowering groundwater levels may have negative third party economic impacts if pumping costs are increased. There are also potential negative hydrologic impacts associated with potential increases in groundwater levels adjacent to diversion ditches, cutoffs and creeks that are used to return water to the Platte River.

There are potential third party hydrologic benefits associated with the Funk Lagoon project to downstream homeowners and landowners. The channel capacity of Lost Creek is currently not sufficient to handle irrigation return flows and storm events, therefore, diversions from Lost Creek via the cutoff would free up additional channel capacity.

These projects would likely have minimal impact on recreational opportunities. There are potential third party environmental impacts related to removing water from Lost Creek. Water quality could be degraded and fish and aquatic habitat negatively impacted when flows in the creek are reduced.

6. DAWSON AND GOTHENBURG CANAL GROUNDWATER RECHARGE

◊ Location:

The Dawson and Gothenburg Canals are both located on the north side of the Platte River primarily in Dawson County. The Gothenburg Canal headgate is located approximately eight miles upstream of Gothenburg, Nebraska. The Dawson Canal headgate is located near Cozad, Nebraska.

◊ Basic Description:

Recharge projects under the Dawson and Gothenburg Canals would involve diverting surface water directly from the Platte River into these canals during the non-irrigation season. Canal seepage would percolate into the alluvium and recharge the groundwater aquifer. Excess water that is not recharged would be returned to the river via spillways within the same month. Return flows that result from canal seepage would accrue to the river for some duration after the recharge event. Diversions should be possible throughout the non-irrigation season if there is enough hydraulic head in the canals to produce flow velocities high enough to prevent freezing.

It may be possible to check up the canals to enhance recharge. This would in effect create a recharge basin along the canal, which may help achieve the same recharge with less diversion. The use of check dams should not impact the yield analysis significantly because the same amount of recharge would be achieved. Wells and/or drains could also be used to enhance recharge by lowering areas of high groundwater in the vicinity of the canal. Lower groundwater tables would increase the potential for recharge. Yields could also be realized sooner if these projects are operated as conjunctive use projects. During late fall and winter, flows that exceed target flows could be diverted into the Gothenburg and Dawson Canals for recharge to the local aquifer. During spring and summer months, an equivalent amount of water could be pumped for irrigation. Pumping during the irrigation season would replace irrigation releases from Lake McConaughy.

◊ **On-Site Hydrologic Effects:**

The total potential yield associated with these projects is estimated to be 2,600 ac-ft/yr. Nebraska is reserving 800 ac-ft of that yield to offset future depletions, therefore, approximately 1,800 ac-ft/yr is available to the Program (Jim Cook, Nebraska Natural Resources Commission, June 28, 2000 memo). Yield estimates and timing were based on the Final Report. Diversions from the Platte River and monthly accretions to the river provided in the Final Report were prorated to reflect only 69 percent of the yield as available to the Program. Underlying canals, such as the Cozad Canal, could potentially intercept recharge water returning to the river, in which case the yields of these projects may be less. Further monitoring and investigation is required to determine the extent to which underlying canals and irrigated lands intercept recharge water returning to the Platte River.

Monthly diversions are limited based on the amount of flow that can seep from the canals without generating a significant amount of tailwater. Information was provided by NPPD regarding the maximum rates that can be diverted when no one is taking water for irrigation and the spillways back to the river are running at maximum capacity. Based on this information, monthly diversions to the Gothenburg and Dawson Canals were limited to 150 cfs and 200 cfs, respectively. The ditch loss is about 20 percent according to information provided by NPPD, therefore, the maximum ditch loss that would be lagged back to the river is 30 cfs and 40 cfs for the Gothenburg and Dawson Canals, respectively. Monthly diversions to recharge could also potentially be limited by climatic cycles. During wet years, it may not be possible to recharge the aquifer when groundwater levels are excessively high.

The available flow to the Gothenburg Canal during the non-irrigation season was assumed to be the flow at the North Platte River gage at Brady, which is just upstream of the headgate. The available flow to the Dawson Canal during the non-irrigation season was assumed to be the flow at the North Platte River gage at Cozad, which is just downstream of the headgate. The Gothenburg Canal and Dawson Canal recharge projects rely on the same water supply to a degree, in which case, the yield of these projects together may not be as great as the sum of the individual yields.

Diversions to recharge were limited to months of target flow excesses at the critical habitat. The amount diverted into the Gothenburg Canal is equal to the available flow or 150 cfs, whichever is less. The amount diverted into the Dawson Canal is equal to the available flow or 200 cfs, whichever is less. The distance from the canal to the river varies along the length of the canal. An average SDF factor of 3250 days was used to lag seepage from the canals back to the river. The following tables show the total depletion from the Platte River and the net yield to the Platte River for the 1975-1994 period for the Dawson and Gothenburg Canals, respectively. Negative numbers indicate months when diversions to recharge exceed the accretion to the river whereas positive numbers indicate months when river accretions exceed diversions to recharge.

Table III-26
Gothenburg Canal – Diversions from the Platte River (ac-ft)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	0	0	0	6140	0	0	0	0	0	0	0	0	6140
1976	0	0	5810	6120	0	0	0	0	0	0	0	0	11930
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	6380	0	0	0	0	0	0	6380
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	6380	6380	6380	6380	6380	0	0	0	0	0	31900
1981	0	0	4680	5130	0	0	0	0	0	0	0	0	9810
1982	0	0	6350	4730	0	0	0	0	0	0	0	0	11080
1983	0	0	6380	6380	6380	6380	6380	0	0	0	0	0	31900
1984	6380	0	6380	6380	6380	6380	6380	0	0	0	0	0	38280
1985	6380	6380	6380	6380	6380	6380	0	0	0	0	0	0	38280
1986	0	0	6380	6380	6380	6380	6380	0	0	0	0	0	31900
1987	6380	6380	6380	6380	6380	6380	6380	0	0	0	0	0	44660
1988	0	6380	6380	6380	6380	0	0	0	0	0	0	0	25520
1989	0	0	5870	6380	0	0	0	0	0	0	0	0	12250
1990	0	0	0	5450	0	0	0	0	0	0	0	0	5450
1991	0	0	5760	6220	0	0	0	0	0	0	0	0	11980
1992	0	0	6080	6330	0	6380	0	0	0	0	0	0	18790
1993	0	0	5840	6380	0	6380	0	0	0	0	0	0	18600
1994	5440	6380	6380	6380	0	0	0	0	0	0	0	0	24580
Average	1229	1276	4572	5196	2233	2871	1595	0	0	0	0	0	18972

Table III-27
Gothenburg Canal – Unlagged Seepage (ac-ft)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	0	0	0	1228	0	0	0	0	0	0	0	0	1228
1976	0	0	1163	1225	0	0	0	0	0	0	0	0	2387
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	1276	0	0	0	0	0	0	1276
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	1276	1276	1276	1276	1276	0	0	0	0	0	6381
1981	0	0	936	1027	0	0	0	0	0	0	0	0	1963
1982	0	0	1269	947	0	0	0	0	0	0	0	0	2216
1983	0	0	1276	1276	1276	1276	1276	0	0	0	0	0	6381
1984	1276	0	1276	1276	1276	1276	1276	0	0	0	0	0	7657
1985	1276	1276	1276	1276	1276	1276	0	0	0	0	0	0	7657
1986	0	0	1276	1276	1276	1276	1276	0	0	0	0	0	6381
1987	1276	1276	1276	1276	1276	1276	1276	0	0	0	0	0	8933
1988	0	1276	1276	1276	1276	0	0	0	0	0	0	0	5105
1989	0	0	1174	1276	0	0	0	0	0	0	0	0	2450
1990	0	0	0	1091	0	0	0	0	0	0	0	0	1091
1991	0	0	1153	1244	0	0	0	0	0	0	0	0	2397
1992	0	0	1215	1266	0	1276	0	0	0	0	0	0	3758
1993	0	0	1168	1276	0	1276	0	0	0	0	0	0	3720
1994	1088	1276	1276	1276	0	0	0	0	0	0	0	0	4916
Average	246	255	914	1039	447	574	319	0	0	0	0	0	3795

Table III-28
Gothenburg Canal – Net Yield to the Platte River (ac-ft)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	0	0	0	-1228	0	0	0	1	2	3	4	5	-1213
1976	7	7	-1154	-1216	9	10	11	12	14	17	20	22	-2242
1977	24	26	27	28	28	29	29	29	29	29	29	28	335
1978	28	27	27	27	26	-1251	25	25	24	24	25	26	-967
1979	27	28	28	29	29	30	30	30	29	29	29	29	346
1980	28	28	-1249	-1249	-1250	-1250	-1250	27	30	34	39	45	-6015
1981	51	57	-874	-961	69	71	73	75	78	80	82	83	-1116
1982	84	85	-1184	-861	85	84	84	84	85	87	88	89	-1191
1983	89	89	-1187	-1187	-1188	-1189	-1189	88	90	93	97	102	-5290
1984	-1169	112	-1160	-1157	-1155	-1152	-1150	130	134	139	144	150	-6135
1985	-1120	-1115	-1112	-1109	-1106	-1104	175	179	184	189	195	200	-5544
1986	205	208	-1066	-1065	-1065	-1065	-1066	210	211	213	215	219	-3848
1987	-1054	-1051	-1049	-1048	-1047	-1046	-1044	234	238	243	248	253	-6123
1988	258	-1015	-1012	-1010	-1010	266	267	267	269	271	274	275	-1899
1989	276	276	-899	-1003	271	269	266	264	263	262	260	259	765
1990	257	255	252	-841	246	243	240	236	234	231	229	226	1808
1991	223	221	-935	-1029	212	209	206	205	204	203	203	202	123
1992	201	200	-1016	-1069	195	-1083	191	191	191	191	192	194	-1422
1993	195	196	-972	-1081	195	-1082	193	193	193	194	195	197	-1385
1994	-889	-1077	-1077	-1077	199	199	201	203	206	209	212	214	-2479
Average	-114	-122	-781	-905	-313	-441	-185	134	135	137	139	141	-2175

Table III-29
Dawson Canal – Diversions from the Platte River (ac-ft)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	0	0	0	8510	0	0	0	0	0	0	0	0	8510
1976	0	0	8510	8510	0	0	0	0	0	0	0	0	17020
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	8510	0	0	0	0	0	0	8510
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	8510	8510	8510	8510	8510	0	0	0	0	0	42550
1981	0	0	7590	8200	0	0	0	0	0	0	0	0	15790
1982	0	0	8510	8170	0	0	0	0	0	0	0	0	16680
1983	0	0	8510	8510	8510	8510	8510	0	0	0	0	0	42550
1984	8510	0	8510	8510	8510	8510	8510	0	0	0	0	0	51060
1985	8510	8510	8510	8510	8510	8510	0	0	0	0	0	0	51060
1986	0	0	8510	8510	8510	8510	8510	0	0	0	0	0	42550
1987	8510	8510	8510	8510	8510	8510	8510	0	0	0	0	0	59570
1988	0	8510	8510	8510	8510	0	0	0	0	0	0	0	34040
1989	0	0	8510	8510	0	0	0	0	0	0	0	0	17020
1990	0	0	0	8510	0	0	0	0	0	0	0	0	8510
1991	0	0	8510	8380	0	0	0	0	0	0	0	0	16890
1992	0	0	8510	8510	0	8510	0	0	0	0	0	0	25530
1993	0	0	8510	8510	0	8510	0	0	0	0	0	0	25530
1994	8510	8510	8510	8510	0	0	0	0	0	0	0	0	34040
Average	1700	1700	6340	7190	2980	3830	2130	0	0	0	0	0	25870

Table III-30
Dawson Canal – Unlagged Seepage (ac-ft)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	0	0	0	1702	0	0	0	0	0	0	0	0	1702
1976	0	0	1702	1702	0	0	0	0	0	0	0	0	3403
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	1702	0	0	0	0	0	0	1702
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	1702	1702	1702	1702	1702	0	0	0	0	0	8508
1981	0	0	1518	1640	0	0	0	0	0	0	0	0	3158
1982	0	0	1702	1633	0	0	0	0	0	0	0	0	3335
1983	0	0	1702	1702	1702	1702	1702	0	0	0	0	0	8508
1984	1702	0	1702	1702	1702	1702	1702	0	0	0	0	0	10209
1985	1702	1702	1702	1702	1702	1702	0	0	0	0	0	0	10209
1986	0	0	1702	1702	1702	1702	1702	0	0	0	0	0	8508
1987	1702	1702	1702	1702	1702	1702	1702	0	0	0	0	0	11911
1988	0	1702	1702	1702	1702	0	0	0	0	0	0	0	6806
1989	0	0	1702	1702	0	0	0	0	0	0	0	0	3403
1990	0	0	0	1702	0	0	0	0	0	0	0	0	1702
1991	0	0	1702	1676	0	0	0	0	0	0	0	0	3378
1992	0	0	1702	1702	0	1702	0	0	0	0	0	0	5105
1993	0	0	1702	1702	0	1702	0	0	0	0	0	0	5105
1994	1702	1702	1702	1702	0	0	0	0	0	0	0	0	6806
Average	340	340	1267	1439	596	766	425	0	0	0	0	0	5173

Table III-31
Dawson Canal – Net Yield to the Platte River (ac-ft)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	0	0	0	-1702	0	0	0	1	2	4	6	7	-1682
1976	9	10	-1690	-1689	13	14	15	17	20	24	28	31	-3199
1977	34	36	38	39	40	41	41	41	41	41	40	40	473
1978	39	39	38	38	37	-1665	35	35	34	34	35	36	-1265
1979	37	38	40	40	41	41	41	41	41	40	40	40	480
1980	39	38	-1664	-1664	-1665	-1665	-1665	38	41	47	54	62	-8005
1981	70	77	-1435	-1552	93	96	99	102	105	109	112	115	-2009
1982	117	118	-1583	-1515	118	118	117	118	120	122	124	125	-1901
1983	126	127	-1575	-1575	-1576	-1577	-1577	125	127	131	137	144	-6961
1984	-1551	157	-1540	-1536	-1533	-1530	-1526	179	184	191	198	206	-8100
1985	-1488	-1482	-1476	-1473	-1470	-1467	239	244	250	257	265	272	-7328
1986	277	282	-1417	-1416	-1416	-1416	-1417	284	285	287	291	296	-5079
1987	-1401	-1397	-1395	-1393	-1392	-1391	-1389	316	321	327	333	341	-8122
1988	347	-1350	-1346	-1344	-1344	358	358	360	362	365	368	370	-2497
1989	371	371	-1332	-1334	364	361	358	355	353	352	350	348	917
1990	346	343	340	-1366	332	327	323	319	315	312	309	306	2206
1991	302	299	-1406	-1385	287	284	280	278	277	276	276	275	44
1992	274	273	-1431	-1433	266	-1438	261	260	260	261	263	265	-1918
1993	266	267	-1434	-1435	266	-1437	263	263	263	265	267	269	-1919
1994	-1431	-1430	-1429	-1430	272	272	274	277	282	286	290	292	-3475
Average	-161	-159	-1085	-1256	-413	-584	-244	183	184	187	189	192	-2967

Based on an SDF factor of 3,250 days, 28 percent of the amount recharged will have returned to the river within 3,250 days, or approximately nine years. As currently modeled, the majority of the benefits from this program would accrue after the first increment. Benefits could be realized sooner if recharge basins are constructed along the canal or the canals are checked up in locations that are close to the river corresponding with much smaller SDF factors. This would allow seepage to return to the river faster

and provide a more immediate benefit to the species. Alternatively, benefits could be realized sooner if these projects are operated as conjunctive use projects.

◊ Legal and Institutional Requirements for Implementation:

It is unlikely that new legislation would be required to implement this project. An intentional recharge permit to divert water into these canals for recharge must be obtained from the Nebraska DWR. The intent of these recharge projects would be to designate augmentation of stream flow to the Platte River as their major purpose, in which case seepage is intentional rather than incidental.

Although legislation regarding intentional recharge exists, it is untested. There are questions regarding the issue of protection and whether additional water generated from recharge projects would become natural flow or protected water. Recharge water may be protectable from diversion under Section 46-252, however, the use of Section 46-252 to protect return flows is untested. One obstacle could be that under current Nebraska law return flows from canal seepage are considered to be natural flow, which is available to the next senior water right holder. In addition, an accounting procedure would be needed to distinguish return flows associated with irrigation operations from return flows due to intentional off-season recharge. The accounting system could be similar to that which is used in Colorado, where numerous recharge projects are conducted using irrigation canals to offset the stream depletion caused by pumping of irrigation wells.

A contract would need to be negotiated, which establishes the conditions under which the Gothenburg and Dawson Canals are used for recharge during the non-irrigation season.

◊ Schedule For Implementation:

These projects require limited, if any, new construction or infrastructure, therefore, the implementation schedule is based primarily on the resolution of legal and institutional issues. As noted in comments received from Nebraska, it may take 2 to 4 years to implement these projects.

◊ Expected Project Life:

The expected project life of a Gothenburg/Dawson recharge project is dependent on the length of the contract and the conditions for contract renewal. This project could potentially extend well beyond the first increment of the Program.

◊ Capital and Operating Costs:

The costs of these projects include the construction of diversion and storage facilities and annual delivery fees. The costs were based on data provided by the Northern Colorado Water Conservancy District for the Tamarack Plan.

Up-front costs consider capital costs of subsurface investigations, a diversion structure and recharge basin if necessary, and measuring devices. A cost of $3,500 was included for subsurface investigations. The cost for a diversion structure off the main canal (to a recharge basin) and recharge basin was estimated to be about $9,000. A cost of $4,000 was included for regulation and measurement, which includes the cost of flumes, stilling wells, and stage recorders. Engineering costs were assumed to be 10 percent of the total construction cost of the project. The total capital cost associated with each of these recharge projects is $20,000. These costs may be incurred if the canal is checked up to simulate a recharge basin or if this project is operated as a conjunctive user project. If this project is operated as a conjunctive use project, these costs could be applied to wells or drains. Assuming Nebraska reserves 31 percent of the potential yield of these projects for offset purposes, the total capital cost attributable to the Program is $13,800.

A fee of $10 per ac-ft recharged per year is included as an annual operating cost. The annual operating cost or delivery fee was applied to the amount recharged as opposed to the amount diverted because it may be possible to check up the canals and achieve the same amount of recharge with significantly less diversion. The annual costs associated with the Gothenburg and Dawson Canal recharge projects are about $38,000 and $51,800, respectively.

Potential costs associated with third party impacts have not been evaluated. The costs presented above may be higher if there are third party impact costs.

◊ **Third-Party Impact Considerations:**

Third party impacts associated with these groundwater recharge projects are similar to those discussed for groundwater management. The primary hydrologic and economic third party impacts are due to changes in the quantity and timing of water in the river. Unlike projects that involve active pumping from high groundwater areas, however, these projects will likely result in higher groundwater levels due to increased recharge return flows. This could present a problem for lands underlying the Dawson and Gothenburg Canals as groundwater levels in these areas have risen in recent years. Raising groundwater levels could have the opposite positive and negative third party impacts as lowering groundwater levels.

7. CENTRAL PLATTE POWER INTERFERENCE

◊ **Location:**

A power interference project would operate primarily at CNPPID's Kingsley Dam Hydro, the two Johnson Hydros and Jeffrey Hydro in conjunction with the Lake McConaughy EA. NPPD's Sutherland System and North Platte Hydro facility would also be involved as NPPD and CNPPID power generation operations are closely related.

◊ **Basic Description:**

Nebraska intends to reserve as much of the yield of this project as Nebraska believes is necessary to offset new depletions in that state. However, Nebraska currently estimates that 1,400 ac-ft/yr of the yield of this project would be in addition to that needed for new

depletion offset and therefore could be made available to the Program. That is the yield used for purposes of the analysis in this plan. A power interference project entails a monetary payment to a hydroelectric generator sufficient to induce that generator to modify the release of water through the hydropower turbines. The modification might include a change in the timing of such generation or perhaps a bypass of the turbines in order to reduce target flow shortages at the critical habitat. The two Johnson units and Jeffrey are owned by CNPPID, which has expressed an interest in a power interference compensation program. Although CNPPID owns these facilities, it should be noted that any change to their operation affects NPPD's operations.

In general, Lake McConaughy releases would be scaled back during times of excess at the critical habitat. The "excess" flow could be stored in the EA to be released at a later time when planned releases and downstream river gains do not meet instream flow recommendations. When the water is subsequently released, it may or may not be available for diversion and routing through the district's hydro facilities depending on river conditions in effect. The monetary compensation must at least equal the market value of the hydropower that is forsaken on behalf of the target flows.

◊ **On-Site Yield and Timing:**

Yield estimates and timing were based on the Final Report. The following constraints reflect certain operational constraints and physical system relationships that define the maximum amount of water available for hydropower interference.

- An ac-ft loss to Jeffrey amounts to an ac-ft loss at Johnson No. 1 (J-1) and Johnson No. 2 (J-2) because the same water passes through all three plants and also the North Platte Hydro.

- Storage at Jeffrey or the two Johnson units is insufficient to effectively operate a power interference program. It is assumed that this alternative will rely upon Lake McConaughy storage without affecting total annual Kingsley generation.

- Following its authority, CNPPID has confirmed the priority of water releases for its irrigation customers. CNPPID believes that this priority can be accommodated with power interference.

- Minimum stream flow requirements under the new FERC license include a range of releases from Lake McConaughy, which will limit hydropower interference. These minimum flows change according to very wet to very dry conditions and are measured at the Keystone Diversion Dam and the CNPPID Diversion Dam in Nebraska. This constraint is reflected in this analysis.

- Since the benefit of power interference lies not with increases in average annual flows but with timing of releases, the "yield" of this alternative is in balancing periodic excesses at Grand Island with periodic shortages. This consideration has been accounted for in the yield analysis.

Modeling of power interference and Lake McConaughy storage contents was provided by CNPPID. The following steps offer additional detail regarding the calculation of yields and timing.

- The maximum theoretical water available for power interference is the minimum of the J-2 return flows and the maximum Kingsley Release, provided in Tables 8.H.20 and 8.H.21, respectively, in the Final Report. By considering the J-2 returns, this avoids a negative impact on CNPPID's irrigation customers since that water is not removed from the system. Although Kingsley may not experience diminished annual generation, this retiming could result in lost power generation at the North Platte, Jeffrey, and Johnson Nos.1 and 2 Hydros.

- The minimum stream flow requirements represent another constraint on power interference yield. Table 8.H.22 in the Final Report indicates the minimum release requirements below Keystone at the Sutherland Supply Canal. Because of minimum flow requirements at Keystone, minimum flow requirements at CNPPID's North Platte Diversion are likely to be met so any changes would not have substantive effects upon yield. The difference between historical McConaughy releases and minimum flow release requirements is presented in Table 8.H.23 of the Final Report. This represents potential storage without regard to Grand Island excesses, shortages or McConaughy storage restrictions.

- Potentially retimed hydropower interference volume, or the total available water, is equal to the minimum of: (1) J-2 return flows; (2) historical McConaughy releases less McConaughy minimum release requirements; and (3) Grand Island excesses, as shown in Table 8.H.24 of the Final Report. These amounts exceed McConaughy storage restrictions in some months.

- Excess flows at Grand Island are considered to be the source of potential storage. This storage cannot exceed available McConaughy storage, nor can it carry over to the following month without available storage during that month. Releases from Lake McConaughy were scaled back from the power interference project presented in the Final Report based on the ratio of the yield proposed by Nebraska to target flow reductions without diversion losses presented in Table 8.H.18 of the Final Report.

Based on the assumptions and criteria outlined above and the yield target provided by Nebraska, the re-timed releases from Lake McConaughy due to power interference are shown in the following table.

Table III-32
Re-timed Releases from Lake McConaughy

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	2843	0	0	0	0	0	0	0	2843
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	2176	0	2176
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	1070	1070
1982	0	0	0	0	296	0	0	0	0	0	0	0	296
1983	0	0	0	0	1567	0	0	0	0	0	0	0	1567
1984	1475	0	0	0	4372	0	0	0	5643	0	0	0	11491
1985	0	0	0	0	3312	677	416	157	0	0	0	0	4561
1986	479	0	0	0	379	0	0	0	2580	0	0	0	3437
1987	1088	2015	1580	0	3996	0	0	0	0	0	3252	0	11932
1988	4299	0	0	0	1224	2757	1153	0	0	0	0	0	9433
1989	0	0	0	0	1668	0	0	0	0	0	30	0	1698
1990	748	0	0	0	492	0	0	0	0	0	0	0	1239
1991	0	0	0	0	870	462	0	0	0	2549	0	0	3880
1992	0	0	0	0	542	0	195	0	0	0	0	0	737
1993	0	0	0	0	0	0	0	0	0	0	36	0	36
1994	0	0	0	0	5082	140	3850	0	0	0	661	0	9734
Average	404	101	79	0	1332	202	281	8	411	127	308	53	3306

NPPD noted in comments received May 3, 2000 that the analysis of water availability for hydropower interference must consider the existence of additional senior natural flow rights held by NPPD and others and cannot be based solely on Lake McConaughy storage and releases as related to target flows. This condition will have to be evaluated before implementing this project.

Based on the water budget spreadsheet, an average annual release of approximately 3,300 ac-ft will generate approximately 1,400 ac-ft of target flow reductions at the critical habitat without diversion losses. The losses appear relatively high for this project because some releases were made, particularly in February, when storage space was unavailable. As a result, releases were made during several months that shortages do not exist at the critical habitat due to storage capacity constraints. This project could be operated differently to reduce the amount of water that is retimed in an effort to minimize releases during periods of excess at the critical habitat.

◊ **Legal and Institutional Requirements for Implementation:**

A permit to increase contributions to the Lake McConaughy EA resulting from power interference must be obtained from the Nebraska DWR. Once a permit is obtained water released from the EA would be protected from downstream diversion losses under water right A-17695.

An agreement will need to be negotiated between CNPPID and NPPD, which establishes the conditions under which power interference would be implemented.

◊ **Schedule For Implementation:**

This project does not require any new construction or infrastructure, therefore, the implementation schedule is based on the resolution of legal and institutional issues. As noted in comments received from Nebraska, a power interference project could potentially be implemented in two to four years depending on how long it takes to

negotiate an agreement between CNPPID and NPPD. This agreement or contract would probably need to be renewed on an annual basis. This project would most likely be phased in to ensure that it is working as planned, there are no unanticipated effects, and it is acceptable to NPPD and CNPPID.

◊ **Expected Project Life:**

The project life of power interference is primarily dependent on the agreement between CNPPID and NPPD. This project could potentially be implemented on a year-to-year basis through the first increment of the Program.

◊ **Capital and Operating Costs:**

There are two elements of cost to consider for power interference charges: payments to CNPPID for the lost revenue (since less energy will be sold to NPPD) and the net cost NPPD will incur to replace the energy it would have received from CNPPID, plus the value of associated capacity loss encompassed by generation and replacement costs. The latter is not simply a third party impact because NPPD has a multi-year contract with CNPPID to obtain energy under specified terms. NPPD and CNPPID also signed an operating agreement in 1954 that recognizes responsibilities of both parties with regard to Lake McConaughy operations. NPPD might experience other losses associated with generation and capacity reductions at its North Platte Hydro if Lake McConaughy is storing for power interference when the North Platte Hydro is below capacity. Compensation for damages or losses to NPPD are likely to be required.

The first cost element can be derived by relating CNPPID's power revenues to net energy delivered and then to water released from the district's three hydrogenerating facilities. For the 1994 through 1998 period, this amounted to an average of $12 per ac-ft released by the three plants.

It is noted that power generation could still occur with power interference, but it will be at different times or later in the year. Except for the Kingsley hydro, power generation could only occur with power interference if water is released from the EA when canal capacity is available. A loss in value may result if power generation is re-timed. The loss/revenue associated with re-timed power generation requires further analysis.

The second cost component, NPPD's losses, is more uncertain. NPPD has indicated that it does, in fact, need this power and would have to replace it. Since NPPD relies on power generated by CNPPID, it would need to purchase outside power resources that would have the components of capacity charges, energy charges, transmission costs, and transmission losses. These costs would vary by peak, off-peak and season. The costs need to be projected in an electric industry marketplace that faces tightening supplies and is moving to market-based rates. These accumulated costs, less the payments to CNPPID, represent the avoided costs that NPPD faces and would seek to recover. As noted by NPPD in comments received May 3, 2000, lost hydropower revenue costs must also include additional hydropower generation replacement costs.

Avoided costs must be derived on a utility-specific and specific resource replacement basis. The value lost to NPPD in this circumstance depends on the nature of NPPD's system load over time, other generation capabilities within their system, and other opportunities to acquire power resources from other generators. A quantification of these

costs is complicated by considering electric industry restructuring and other uncertainties. A study of NPPD power system requirements and sources by cost over time will be needed to confirm present power values to NPPD. Information provided by NPPD included formulas to convert acre-feet of water retimed to the amount of power that could be generated at the North Platte, Jeffrey, Johnson, and Kingsley hydroelectric plants. NPPD also provided a forecast of the future market value of power generation from the New York Mercantile Exchange's "Entergy" forecast. The forecast projects monthly power values 18 months into the future. NPPD suggested that prices beyond the 18-month forecast period be escalated to a Consumer Price Index projection ranging from 2.7 to 3.4 percent annually over the next fifteen years. These escalation rates are generally consistent with the uniform 3.0 percent rate used to compute present value costs in chapter VI.

The following approach was used to prepare a conservative estimate of NPPD's costs (without transmission, operations, or maintenance costs, which are dependent on the source of replacement power). It was assumed that no power could be generated from re-timed releases from Lake McConaughy due to potential system constraints. In other words, NPPD would incur the additional cost to replace lost power associated with all re-timed releases.

It was assumed that water stored for hydropower interference would have been "historically" released and run through the generating plants. The costs associated with the "historical" releases represents NPPD's avoided costs. The following table shows water stored for hydropower interference. This water is then re-timed and released during periods of target flow shortages as shown previously in Table III-32.

Table III-33
Hydropower Interference Storage at End-of-Month
(ac-ft)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	1907	937	0	0	0	0	0	0	0	0	2843
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	2176	0	0	2176
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	1070	0	1070
1982	0	0	210	85	0	0	0	0	0	0	0	0	296
1983	0	0	899	668	0	0	0	0	0	0	480	995	3042
1984	0	0	0	4372	0	1927	532	3184	0	0	0	0	10015
1985	0	0	113	4448	0	0	0	0	0	0	0	479	5040
1986	0	0	68	310	0	0	0	2580	0	0	4010	2600	9568
1987	0	0	0	2069	0	508	2071	1179	1136	612	0	2045	9620
1988	0	1231	2662	1241	0	0	0	0	0	0	0	0	5134
1989	0	0	972	696	0	0	0	0	0	30	0	748	2445
1990	0	0	0	492	0	0	0	0	0	0	0	0	492
1991	0	0	541	791	0	0	0	1014	1535	0	0	0	3880
1992	0	0	342	395	0	0	0	0	0	0	0	0	737
1993	0	0	0	0	0	0	0	0	0	2884	0	1037	3921
1994	234	1878	1927	1150	0	0	0	0	0	661	0	0	5849
Average	12	155	482	883	0	122	130	398	134	318	278	395	3306

The average monthly volumes of water stored for hydropower were used to determine NPPD's avoided costs. Monthly averages were used to be consistent with all other alternatives. For all other alternatives the average annual net hydrologic effect was multiplied by a present day annual cost. In this case, it is not sufficient to use an annual cost because power values change on a monthly basis.

The average monthly volumes of water stored for hydropower interference were converted to MWH of power generation assuming a linear relationship exists between the flow through the turbines and power generation. The previously mentioned formulas for computing power generation at each of the four plants were reviewed with NPPD personnel on August 2, 2000. NPPD's more detailed spreadsheet model indicated that 3,300 af of flow would result in 2,100 MWH of energy production. Therefore, monthly flow volumes were multiplied by 2,100 MWH/3,100 ac-ft to convert to MWH. The projected monthly power values for the year 2001 were multiplied by the monthly hydropower generated to determine the monthly costs to NPPD to replace lost power. As shown in the following tables, the maximum total annual cost to NPPD would be about $123,100/year without ancillary transmission, operation, and maintenance costs.

Table III-34
Hydropower Generation (MWH)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Average	7	99	306	561	0	77	83	253	85	202	177	251	2100

Table III-35
Entergy Prices for Energy ($/MWH)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	51.75	48.25	44.00	44.00	49.75	79.00	147.50	127.50	45.00	40.50	40.50	40.50

Table III-36
Hydropower Costs ($)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Average	384	4764	13472	24671	0	6110	12195	32222	3817	8185	7153	10165	123137

The total cost to CNPPID would amount to about $12 per ac-ft or approximately $39,600 per year to redistribute 3,300 ac-ft. Therefore, the total annual cost would be about $162,700 plus ancillary costs. Potential costs associated with third party impacts have also not been evaluated. The costs presented above may be higher if there are third party impact costs. In addition, an agreement or contract between CNPPID and NPPD to implement power interference would need to be renewed on a periodic basis, in which case there may be additional costs associated with permitting or re-negotiating contracts.

◊ **Third-Party Impact Considerations:**

Power interference will likely produce third party hydrologic, economic and environmental effects. Water release schedules from Lake McConaughy will differ from the historical pattern, primarily in non-irrigation months. There will also be changes in the timing and quantity of water available downstream of the J-2 return. Changes in release schedules and J-2 returns could have potential positive and negative economic and hydrologic third party impacts on downstream water users that rely on these flows.

Economic effects might stem from modified stream flows, but more likely from the diverse impacts associated with securing replacement power. NPPD will experience direct impacts associated with acquiring power resources from other generators. NPPD may also experience an increased need for reactive volt-ampere (VAR) support and need to replace voltage control supplied by the hydros. NPPD customers could likely experience higher electricity costs because of more expensive non-hydro power or, worse, experience a reduction in power availability that could produce economic constraints. The loss of system generating capacity will be evident for the Mid-America Power Pool.

Third party environmental consequences are likely as hydro generation, usually very low in environmental impacts, is potentially replaced by fossil fuel generation, which often affects air quality and other environmental resources.

Third party impacts on recreational opportunities relate primarily to fluctuations in reservoir pools due to changes in storage and release schedules. Fluctuating reservoir levels can be a detriment to recreation activities such as boating and fishing if they occur.

8. NET CONTROLLABLE CONSERVED WATER

◊ **Location:**

This project consists of conservation activities implemented by CNPPID within their system.

◊ **Basic Description:**

Net controllable conserved water has resulted from actions taken by CNPPID to comply with the agreement with the National Wildlife Federation to provide reductions in average annual diversions of surface water. The net controllable conserved water resulting from a grant from the Bureau of Reclamation will be added to the EA at no cost to the Program. The net controllable conserved water not attributed to a grant from the Bureau of Reclamation will be made available to the Program at the average cost of the conservation activities.

The three main categories of water conservation measures that have been implemented address: 1) reservoirs, 2) canal distribution and delivery system, and 3) on-farm irrigation. Reservoir improvements include a water conservation alternative developed for Elwood Reservoir that revised the fill/release operations to minimize seepage. Canal distribution and delivery system improvements include installation of pipelines, earth

compaction, membrane lining, canal structures, structure automation and turnout relocation. These improvements are aimed at reducing losses in the system. On-farm irrigation changes include system improvements, such as installation of center pivots, gated pipe, flow meters, and surge valves, or management improvements, such as irrigation scheduling, adjustments to irrigation set times, and alternate furrow irrigation. On-farm irrigation changes are intended to improve irrigation efficiencies.

◊ **On-Site Yield and Timing:**

The amount of net controllable conserved water associated with conservation measures is currently being evaluated but has not yet been finalized. Nebraska has indicated that 5,000 ac-ft/yr of net controlled conserved water is available to the Program, however, there is uncertainty regarding this estimate as the yield analysis of CNPPID's conservation activities has not yet been completed. This amount is subject to change pending the results of an on-going study.

Conserved water will be added to the Lake McConaughy EA on October 1 of each year as specified in the license agreement. This water can then be released during times of shortage at the critical habitat.

◊ **Legal and Institutional Requirements for Implementation:**

Net controllable conserved water will be stored in the EA and released during periods of target flow shortages. Approval from the Nebraska DWR will be required to add additional conserved water to the EA. There should be no other legal and institutional requirements as these conservation activities have already been implemented.

◊ **Schedule For Implementation:**

The yield associated with this alternative is the result of conservation activities that have already been implemented. As noted in comments received from Nebraska, this project could be implemented in zero to two years.

◊ **Expected Project Life:**

The expected life of this project extends well beyond the first increment of the Program. Under the FERC license agreement, CNPPID is obligated to perform conservation activities for 40 years.

◊ **Capital and Operating Costs:**

The net controllable conserved water resulting from a grant from the Bureau of Reclamation will be added to the EA at no cost to the Program. It is assumed that 500 ac-ft/yr is available at no cost to the Program (Jim Cook, Nebraska Natural Resources Commission, June 28, 2000 memo). The 4,500 ac-ft/yr of net controllable conserved water, which is not attributed to the grant from the Bureau of Reclamation, will be made available to the Program at the cost of the conservation activities.

The Central Nebraska Regional Water Conservation Task Force (Task Force) developed a cost-effectiveness analysis to evaluate the feasibility of conservation improvements. There is uncertainty regarding the use of these costs because certain assumptions regarding project lifetimes and interest rates may differ from those used to evaluate other Program projects. As such, further evaluation of these costs is required. Based on information developed by the Task Force, the total cost for gross water savings associated with net controllable conserved water is estimated to be about $3.2 million. Of this amount, CNPPID received a $500,000 grant from the Bureau of Reclamation. The total cost to the Program excluding the Bureau of Reclamation funds is estimated to be about $2.7 million. Using a discount rate of 6 percent and a term of 13 years, the annual cost is $305,000.

The amount of conserved water available to the Program could change pending the results of an on-going study.

◊ **Third-Party Impact Considerations:**

Conservation activities associated with net controllable conserved water have already been implemented in which case there are no additional third party impacts associated with allocating this water to the Program.

C. Wyoming Projects

1. PATHFINDER MODIFICATION MUNICIPAL ACCOUNT

◊ **Location:**

Pathfinder Dam is located on the North Platte River about three miles below the confluence with the Sweetwater River and about 47 miles southwest of Casper, Wyoming.

◊ **Basic Description:**

The Pathfinder Modification Stipulation, agreed to by the parties to the Nebraska v. Wyoming lawsuit (NE, WY, CO, US) in September 1997, provides for the Pathfinder Modification Project, which would increase the capacity of the existing Pathfinder Reservoir by approximately 54,000 ac-ft. The increased capacity is proposed to be filled with water stored under the existing 1904 storage right for Pathfinder Reservoir with the exception that regulatory calls can not be placed on existing water rights upstream of Pathfinder Reservoir other than the storage rights pertaining to Seminoe Reservoir.

The Pathfinder Modification Project will serve both environmental and municipal uses. An environmental account of 34,000 acre-feet will be operated for the endangered species and habitat in Central Nebraska in accordance with certain conditions. A municipal account of 20,000 acre-feet will provide municipal water to North Platte communities in Wyoming through contracts between the municipalities and the State of Wyoming in accordance with certain conditions.

As noted in Wyoming comments received on April 5, 2000, the Bureau of Reclamation will operate the 20,000 acre-foot municipal storage account to provide an annual estimated firm yield of 9,600 ac-ft. The Pathfinder Modification Stipulation restricts municipal carry-over storage to 20,000 ac-ft. In any year the municipal demand is less than 9,600 ac-ft, the remaining balance is available to Wyoming to be released for the benefit of the endangered species in the critical habitat at Wyoming's discretion. The delivery of water contributed from the municipal account would be considered in addition to the storage and delivery of water from the Pathfinder environmental account.

As summarized in Wyoming's proposal, storage water in the Pathfinder municipal account would be made available to the Program each year as follows:

- Storage water that is not used to supplement the water rights of municipalities in the North Platte River basin in Wyoming and mitigate future depletions as defined in Wyoming's "Depletion Mitigation Program, Platte River Basin, Wyoming" could be leased to the Program.

- To determine the amount of water available to the Program, Wyoming would review the status of water availability within the North Platte River basin. Wyoming will not know in advance exactly how much water they will need to meet all anticipated uses, therefore, prior to June 1 of each year, state officials will make a conservative judgement as to the amount of water that may be required for Wyoming's purposes.

- Wyoming would advise the Governance Committee in June as to how much water the EA manager could move from Pathfinder municipal account to the EA in Lake McConaughy from July 1st through September 30th of the same year.

- After September 30th, Wyoming would quantify its depletions for the previous year (October 1 through September 30). If the quantification indicates that Wyoming exceeded it's "existing water related activity baseline", Wyoming will quantify the excess depletion at the Wyoming/Nebraska state line. Using the tracking and accounting procedures and providing for replacement water from its other sources, the amount of storage released from the Pathfinder municipal account needed to offset the excess depletions at the state line will be determined. This amount of storage would be subtracted from the amount of water provided to the Program to determine the amount of credit Wyoming would get from the Program. Wyoming would expect lease payments for the difference between the volume of water provided to the Program from July through September and any amount in excess of Wyoming's "existing water related activity baseline".

◊ **On-Site Hydrologic Effects:**

The total capacity of the municipal storage account is 20,000 ac-ft. As noted in Wyoming comments received on April 5, 2000, the firm yield of this account is 9,600 ac-ft. It is appropriate to consider the firm yield as opposed to average yield for this project because the municipal account will be operated to provide a firm yield. The amount of water available to the Program is dependent on the amount needed to supplement municipal water rights and/or mitigate excess depletions and cannot exceed the firm yield in any year. Wyoming anticipates that 4,800 ac-ft of storage water from the municipal account could be available for lease to the Program on an average annual basis (Wyoming's December 16, 1999 proposal). The amount available to the Program will vary on a year to year basis depending on Wyoming's needs. In some years no water from this account will be available to the Program, whereas, in other years, up to 9,600 ac-ft could be available to the Program.

Because the average annual amount that would be released from the Pathfinder Reservoir municipal account and delivered to the Lake McConaughy EA is relatively small, the EA manager may choose to move all of the water downstream during the month of September to minimize conveyance losses.

Two potential schedules are provided in the table below for releases from the Pathfinder Reservoir municipal account. Accumulations to storage are not required by the EIS/ESA team because they are already incorporated in the North Platte River Water Utilization Model (NPRWUM). The NPRWUM model stores water in Pathfinder Reservoir when the water rights are in priority.

Table III-37
Pathfinder Municipal Account – Yield to the North Platte River

Month	Option #1 : Releases from Pathfinder Municipal Account (ac-ft)	Option #2 : Releases from Pathfinder Municipal Account (ac-ft)
October	0	0
November	0	0
December	0	0
January	0	0
February	0	0
March	0	0
April	0	0
May	0	0
June	0	0
July	1,600	0
August	1,600	0
September	1,600	4,800
Annual	4,800	4,800

◊ Legal and Institutional Requirements for Implementation:

Although the 1997 Pathfinder Modification Stipulation was agreed to by the parties to the Nebraska v. Wyoming lawsuit, it has not yet been ratified by the Supreme Court. For this analysis, it was assumed that the Pathfinder Modification Stipulation will be ratified and approved by the U.S. Supreme Court. As the Pathfinder Modification Project will be funded by the Wyoming Water Development Program, the Wyoming Legislature must approve the project and its funding.

There are several other legal changes and requirements necessary to implement this project. The federal authorization of Pathfinder Reservoir will be amended, if necessary, to include municipal and environmental purposes. The 1904 Wyoming water right for Pathfinder Reservoir would have to undergo a partial change of use for Pathfinder storage water to be stored for municipal and downstream environmental purposes in the critical habitat. In addition, a secondary supply water right would be needed to ensure the protection of storage water downstream to the Wyoming/Nebraska state line. The change of use and the secondary supply water right would be contingent upon the existence of the Program and Wyoming's participation in that Program. The secondary supply water right would need to be secured from the Wyoming State Engineer and the change of use would need to be secured from the Wyoming Board of Control.

In order to obtain regulatory certainty for the delivery of Pathfinder storage releases to the Wyoming/Nebraska state line, the Wyoming State Engineer and Legislature must approve the export. In addition, a permit under Nebraska water law is needed to protect project environmental releases delivered to the Wyoming/Nebraska state line to specified locations between the state line and Chapman, Nebraska.

NEPA/ESA compliance and a federal 404 permit are also required to implement this project. It is anticipated that the NEPA/ESA review of the proposed Program will include the necessary NEPA/ESA review for this project in sufficient detail to secure the federal approvals required for implementation.

◊ Schedule For Implementation:

As noted in Wyoming comments received on April 5, 2000, the schedule for the implementation of this alternative is as follows. In year 1, the following activities will be completed by the State of Wyoming:

- Seek and obtain project authorization and funding from the Wyoming Legislature,
- Conduct environmental assessments required by NEPA,
- Seek an amendment to the federal authorization of Pathfinder Reservoir from Congress if necessary,
- Seek a partial change of use through the Wyoming Board of Control for the water right for Pathfinder Reservoir under Wyoming water law,

- Seek the statutory review by the Wyoming State Engineer on the potential export of storage water for downstream environmental uses.

In year 2, pending the outcome of year 1 activities, the State of Wyoming will:

- Seek approval from the Wyoming Legislature for the export of water for downstream environmental uses,

- Seek a secondary supply water right, issued to the Wyoming Water Development Commission, from the Wyoming State Engineer to protect the deliveries of Pathfinder storage water to the Wyoming/Nebraska state line,

- Seek a permit under Nebraska water law to protect project environmental releases delivered to the Wyoming/Nebraska state line to specified locations between the state line and Chapman, Nebraska.

In year 3, pending the outcome of year 2 activities, project construction will be initiated and completed. The storage and release of project water will be available upon completion of the project.

◊ Expected Project Life:

The inclusion of this project in the Program is contingent on the existence of the Program and Wyoming's participation in that Program. The expected project life is dependent on the length of the contract with the State of Wyoming. For purposes of this plan, it is assumed that the first increment of the program will be 13 years and Wyoming will participate in the Program for the duration of the first increment. Subject to these terms, it is likely Wyoming would agree to a contract length through year 13 year with an option to renew at the end of the first increment, depending on the terms of the second increment and Wyoming's participation in that second increment as noted in Wyoming's comments received on April 5, 2000.

◊ Capital And Operational Costs:

The amount of water available to the Program, for which Wyoming would expect lease payments, is the difference between the volume of water provided to the Program from July through September and any amount that Wyoming uses to replace depletions in excess of Wyoming's "existing water related activity baseline" during the water year.

Based on Wyoming's comments received on April 5, 2000, Wyoming has noted that the cost should be based on the projected costs of acquiring other Program water. Alternatively, the cost to lease this water could be based on recovering the capital cost attributable to the Pathfinder municipal account, including construction costs and costs of mitigating third party impacts, plus annual operating, maintenance and replacement costs. Wyoming has estimated that construction and third party mitigation costs for the Pathfinder Modification Project will total approximately $10 million. Of this amount, the total third party impact costs to irrigators are estimated to be $7.9 million as presented in the 3-Brick Proposal (Bureau of Reclamation, May 1996). Third party impact costs

include 1) an estimated cost of about $3.8 million for repayment of the Safety of Dams Corrective Action Study (SOD CAS) modifications that will be incurred by irrigators that benefit from the North Platte and Kendrick Projects and the Glendo Unit, and 2) an estimated cost of about $4.1 million for selenium remediation that will be incurred by the Kendrick Project irrigators. The total cost of this project is not comparable to other total costs presented in this report as third party impact costs are included.

Of the total cost of $10 million, approximately 37 percent (20,000/54,000) or $3.7 million can be attributed to the municipal account. Using a discount rate of 6 percent and a term of 13 years, the annual cost for the construction and mitigation of third party impacts is $418,000. Thus, the estimated cost per acre-foot of yield would be $418,000/9,600 ac-ft or $43.50 per ac-ft per year. The operation and maintenance costs that would be paid annually to the Bureau of Reclamation are estimated to be $20,000 per year. According to the 3-Brick Proposal the inflatable dam has a design life of 35 years. Based on an estimated cost of $1.9 million for the inflatable dam, which was prepared by the EIS team, the annual amount needed to replace the inflatable dam at the end of 35 years would be approximately $17,000. Therefore, the annual costs per acre-foot of yield would be $37,000/9,600 ac-ft or $4 per ac-ft per year. Under these assumptions, the annual breakeven cost to Wyoming would be $47.50 per acre-foot of yield. Assuming that Wyoming would lease water to the Program at this price, the average annual cost to the Program for 4,800 ac-ft is $47.50 times 4,800 ac-ft or $228,000 per year from year 4 through year 13 of the Program. However, Wyoming has noted it may reserve the right to recover the actual cost and loss in potential revenue earnings associated with third-party impacts when computing the lease price on an acre foot basis.

◊ **Third-Party Impact Considerations:**

Third party impacts that have been identified include costs to irrigators that benefit from the North Platte and Kendrick Projects and the Glendo Unit for repayment of the SOD CAS modification and costs incurred by Kendrick Project irrigators for selenium remediation.

Third party impacts on other Wyoming appropriators associated with the Pathfinder Modification Project will be evaluated by the Wyoming Board of Control during its consideration of the partial change of use for the water right for Pathfinder Reservoir and as part of the State Engineer's and legislators' review and approval of the export of water. Wyoming has attempted to address these impacts in its project implementation plan, however, the Wyoming Board of Control will make the final decision regarding impacts to other appropriators. Originally, the water in the municipal account would have only been released to meet the needs of the municipalities during times of water rights regulation or to mitigate excess depletions in Wyoming. Both of these events are expected to occur sporadically. Leasing water to the Program will result in a more constant demand on the municipal account. Water that is leased to the Program under this project will be protected downstream to Lake McConaughy in which case it must not be available to downstream diverters. Although leased water will not be available to users in Wyoming, it is anticipated that only water in excess of the amount required to meet all anticipated uses will be leased to the Program.

There is a possibility that fluctuating reservoir levels due to releases from the municipal account could have an impact on recreational activities within Wyoming. Leasing water from the municipal account of the Pathfinder Modification Project should not significantly increase the overall environmental impacts associated with this project.

2. GLENDO STORAGE

◊ Location:

Glendo Dam is located on the North Platte River about four and one half miles southeast of the town of Glendo, Wyoming upstream of Guernsey Reservoir.

◊ Basic Description:

The 1953 Order Modifying and Supplementing the North Platte Decree (1953 Order) provides for the storage of 40,000 ac-ft in Glendo Reservoir during any water year for the irrigation of lands in western Nebraska and in southeastern Wyoming below Guernsey Reservoir. Of the 40,000 ac-ft available for irrigation, the 1953 Order allocates 25,000 ac-ft for the irrigation of lands in western Nebraska and 15,000 ac-ft of storage for the irrigation of lands in southeastern Wyoming.

A recent stipulation entitled "Amendment of the 1953 Order to Provide for Use of Glendo Storage Water" (Glendo Stipulation) was agreed to by the parties to the Nebraska v. Wyoming lawsuit (WY, NE, CO, US) in September 1997. Although the parties have agreed to the stipulation, the Supreme Court has not yet ratified it. For this analysis, it has been assumed that the Glendo Stipulation will be ratified and become an amendment to the 1953 Order prior to the storage and release of water for the Program.

The Glendo Stipulation provides for several changes to the 1953 Order that relax the conditions under which Glendo storage water can be used. Significant changes include the following:

- The potential use of Glendo storage water was expanded to municipal, industrial, and other uses and the service area expanded from the North Platte River basin to the Platte River basin.
- Glendo storage may be used for fish and wildlife purposes downstream of Glendo Reservoir. Any releases made for such purposes shall be administered and protected as storage water in accordance with Wyoming and Nebraska law.

These changes facilitate the use of Glendo storage water as a component of the Program. Of the 15,000 ac-ft of Glendo storage water allocated to Wyoming, there are currently permanent contracts for 4,400 ac-ft. The remaining 10,600 ac-ft is leased by the Bureau of Reclamation under temporary water service contracts for up to one year. Wyoming is considering negotiating a permanent contract with the Bureau of Reclamation for all of the remaining 10,600 ac-ft of storage (Wyoming December 16, 1999 proposal).

Water in excess of that needed to meet Wyoming's contracted demands and replace Wyoming's potential excess depletions would be available to the Program. Wyoming estimates that 2,650 ac-ft of Glendo storage water could be available to the Program on an average annual basis (Wyoming's December 16, 1999 proposal).

Wyoming would make Glendo storage water available to the Program each year in the following manner.

- Any storage water that is not used for municipal, industrial, or agricultural purposes within Wyoming or to mitigate future depletions as defined in Wyoming's "Depletion Mitigation Program, Platte River Basin, Wyoming", could be leased to the Program.

- To determine the amount of water available to the Program, Wyoming would review the status of water availability within the North Platte River basin. Wyoming will not know in advance exactly how much water they will need to meet all anticipated uses, therefore, prior to June 1 of each year, state officials will make a conservative judgement as to the amount of water that may be required for Wyoming's purposes.

- Wyoming would advise the Governance Committee in June as to how much water the EA manager could move from Glendo Reservoir to the EA in Lake McConaughy from July 1st through September 30th of the same year.

- After September 30th, Wyoming would quantify its depletions for the previous year (October 1 through September 30). If the quantification indicates that Wyoming exceeded it's "existing water related activity baseline", Wyoming will quantify the excess depletion at the Wyoming/Nebraska state line. Using tracking and accounting procedures and providing for replacement water from its other sources, the amount of storage water released from Wyoming's contracted storage in Glendo Reservoir needed to offset the excess depletions at the state line will be determined. This amount of storage would be subtracted from the amount of water provided to the Program to determine the amount of credit Wyoming would get from the Program. Wyoming would expect lease payments for the difference between the volume of water provided to the Program from July through September and any amount in excess of Wyoming's "existing water related activity baseline".

◊ On-Site Hydrologic Effects:

The amount of water available to the Program is dependent on the yield of the uncontracted storage, which is presently 10,600 ac-ft and the amount needed by Wyoming to meet municipal, industrial, or agricultural uses within Wyoming or to mitigate future depletions. This amount will vary on a year to year basis, however, Wyoming anticipates that 2,650 ac-ft could be available for lease to the Program on an average annual basis. Because the average annual amount that would be moved from Glendo Reservoir to the Lake McConaughy EA is relatively small, the EA manager may choose to move all of the water downstream during the month of September to minimize conveyance losses.

Two potential schedules are provided in the table below for releases from Glendo Reservoir to the Lake McConaughy EA. Accumulations to storage are not included because they are already incorporated in the NPRWUM model. The NPRWUM model stores water in Glendo Reservoir when the water rights are in priority.

Table III-38
Glendo Reservoir – Yield to the North Platte River

Month	Option #1 : Releases from Glendo Reservoir (ac-ft)	Option #2 : Releases from Glendo Reservoir (ac-ft)
October	0	0
November	0	0
December	0	0
January	0	0
February	0	0
March	0	0
April	0	0
May	0	0
June	0	0
July	883	0
August	883	0
September	883	2,650
Annual	2,650	2,650

◊ **Legal and Institutional Requirements for Implementation:**

Although the recent Glendo Stipulation was agreed to by the parties to the Nebraska v. Wyoming lawsuit, it has not yet been ratified by the Supreme Court. For this analysis, it has been assumed that the Glendo Stipulation will be ratified and become an amendment to the 1953 Order.

A contract would need to be negotiated between the Bureau of Reclamation and the State of Wyoming. NEPA compliance will also be required on this contract. As Wyoming's obligations under the contract will be funded by the Wyoming Water Development Program, the Wyoming Legislature must review the proposal and approve the needed funding.

There are several other legal and institutional requirements necessary for implementation of this project. The Glendo Stipulation provides federal authorization to use Glendo storage water for fish and wildlife purposes, however, the state water right for Glendo Reservoir will need to be modified to provide for the use of Glendo storage water for environmental and related purposes. A secondary supply water right is also necessary to ensure the protection of Glendo storage water downstream to the Wyoming/Nebraska state line. The change of use and the secondary supply water right would be contingent upon the existence of the Program and Wyoming's participation in that Program. The secondary supply water right would need to be secured from the Wyoming State Engineer and the change of use would need to be secured from the Wyoming Board of Control.

In order to obtain regulatory certainty for the delivery of Glendo storage releases to the Wyoming/Nebraska state line, the approval of the Wyoming State Engineer and Legislature will be required under Wyoming's export law.

◊ Schedule For Implementation:

This project does not require any new construction or infrastructure, therefore the implementation schedule is based primarily on the resolution of legal and institutional issues.

As noted in Wyoming comments received on April 5, 2000, the schedule for the implementation of this alternative is as follows. In year 1, the following activities will be completed by the State of Wyoming:

- Conduct environmental assessments required by NEPA,
- Finalize the contract for Glendo storage between the Bureau of Reclamation and the State of Wyoming,
- Seek and obtain a modification to the 1945 Decree, as amended in 1953, in accordance with the 1997 stipulation,
- Seek authorization and funding from the Wyoming Legislature,
- Seek a partial change of use through the Wyoming Board of Control for the water right for Glendo Reservoir under Wyoming water law,
- Seek the statutory review by the Wyoming State Engineer on the potential export of storage water for downstream environmental uses.

In year 2, Wyoming will:

- Seek approval from the Wyoming Legislature for the export of water for downstream environmental uses,
- Seek a secondary supply water right, issued to the Wyoming Water Development Commission, from the Wyoming State Engineer to protect the deliveries of Glendo storage water to the Wyoming/Nebraska state line to the critical habitat,
- Seek a permit under Nebraska water law to protect project environmental releases delivered to the Wyoming/Nebraska state line to specified locations between the state line and Chapman, Nebraska.

In year 3, pending the outcome of year 2 activities, the storage and release of Glendo water will be available.

◊ **Expected Project Life:**

The inclusion of this project in the Program is contingent on the existence of the Program and Wyoming's participation in that Program. The expected project life is dependent on the length of the contract. For purposes of this plan, it is assumed that the first increment of the Program will be 13 years and Wyoming will participate in the Program for the duration of the first increment. Subject to these terms, it is likely Wyoming would agree to a contract length through year 13 with an option to renew at the end of the first increment, depending on the terms of the second increment and Wyoming's participation in that second increment as noted in Wyoming's comments received on April 5, 2000.

◊ **Capital and Operational Costs:**

The cost of this project consists of lease payments for the difference between the water provided to the Program from July through September and any amount that Wyoming is required to use to offset excess depletions during the water year. Wyoming has noted that the cost should be based on the project costs of acquiring other Program water. Alternatively, costs to lease Glendo storage water could be based on the costs of Bureau of Reclamation temporary water service contracts, which currently range from $5/ac-ft/yr for irrigation uses to $75/ac-ft/yr for municipal and industrial purposes. If the Program leases an average of 2,650 acre-feet annually, the total annual cost could range from $13,250 to $198,750 beginning in year 3 through year 13 of the Program.

Potential costs associated with third party impacts have not been evaluated. The costs presented above may be higher if there are third party impact costs.

◊ **Third-Party Impact Considerations:**

Glendo Reservoir is already constructed and the storage water considered under this alternative has been used for other purposes under short term contracts, therefore, third party impacts associated with leasing uncontracted for water will likely be minimal but will require further evaluation.

Water that is leased to the Program under this project will be protected downstream to Lake McConaughy in which case it must not be available to downstream diverters. Although leased water will not be available to users in Wyoming, it is anticipated that only water in excess of the amount required to meet all anticipated uses will be leased to the Program. Environmental impacts associated with this alternative are expected to be minimal.

3. TEMPORARY WATER LEASING

◊ Location:

Specific irrigation districts or individual farmers that are willing to participate in a temporary water leasing program are not yet known. At this time a temporary water leasing program has been evaluated for Reaches 1 through 4 (Northgate, CO gage to Whalen Diversion Dam gage) and Reach 6 (Laramie River below Grayrocks Reservoir gage to Fort Laramie, WY gage). ***It is assumed for this analysis that leasing projects are located at the mid-point of each reach because specific irrigation districts and landowners willing to participate in the Program are not yet known***. The reaches are defined as follows:

Reach 1: Northgate, CO gage to Sinclair, WY gage
Reach 2: Sinclair, WY gage to Alcova, WY gage
Reach 3: Alcova, WY gage to Orin, WY gage
Reach 4: Orin, WY gage to Passing Whalen Diversion Dam gage
Reach 6: Laramie River below Grayrocks Reservoir gage to Fort Laramie, WY gage

◊ Basic Description:

A voluntary temporary water leasing program would provide incentives to farmers to annually lease water supplies that would otherwise have been used in irrigation. The amount of water available to the Program consists of the reduction in consumptive use, which is reviewed and approved by the State Engineer or Board of Control, as provided by Wyoming law. The program evaluated assumes that leased water rights are dependent on storage rights. Although it may be feasible to lease natural flow water rights, it will be more difficult to insure protection from downstream water users.

Under a temporary water lease the irrigation districts or farmers would not relinquish ownership of their water rights. To provide maximum flexibility the mix of farms participating in the leasing program would be allowed to change over time and the length of the temporary lease allowed to vary based on the needs of the irrigation district or farmer. Individual farm owners could choose to lease a portion of their water supplies on a temporary basis, likely subject to a minimum lease volume to manage practical administrative and program management costs.

The leasing program that has been analyzed considers leasing approximately 22,700 ac-ft of water supplies annually, which corresponds to about 16,400 ac-ft delivered on farm and 8,200 ac-ft of historic consumptive use.

◊ On-Site Hydrologic Effects:

The Final Report was relied on for estimates of yield and on-farm timing. The estimated amount of water leased in each reach was based on the distribution of acres irrigated with surface supplies. The number of acres that were assumed to be included in a leasing program are summarized in the following table.

Table III-39
Leasing Program

Reach	Acres Included in Leasing Program (ac)
1	680
2	1,520
3	600
4	590
6	1,610
Total	5,000

The tables below show the proposed average monthly reductions in diversions and the reductions in on-farm deliveries for each reach. Although the reductions in diversions were assigned to a reach based on the distribution of irrigated acres, in some cases the reductions would occur further upstream depending on the location of the mainstem headgate. The amount delivered on-farm was based on the average conveyance loss for each reach. Data on conveyance losses was obtained from county-level information obtained from USGS Water Use Data for 1995.

Table III-40
Reductions in Diversions from the North Platte River (ac-ft)

Month	Reach 1	Reach 2	Reach 3	Reach 4	Reach 6
October	106	289	136	150	252
November	0	0	0	0	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	0	0	0	0	0
April	49	71	32	35	56
May	311	689	305	259	533
June	619	1572	698	522	1159
July	811	2205	1001	828	1528
August	660	1949	911	754	1347
September	350	932	436	391	721
Annual	2905	7707	3518	2939	5597

Table III-41
Reductions in the Amount Delivered On-Farm (ac-ft)

Month	Reach 1	Reach 2	Reach 3	Reach 4	Reach 6
October	80	210	84	108	194
November	0	0	0	0	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	0	0	0	0	0
April	38	52	20	24	44
May	236	500	190	184	410
June	468	1142	436	374	890
July	614	1602	626	592	1174
August	500	1416	570	538	1036
September	264	678	272	280	554
Annual	2200	5600	2198	2100	4302

A representative leasing program could potentially reduce on-farm deliveries and consumptive use by about 16,400 ac-ft per year and 8,200 ac-ft per year, respectively. On-farm reductions in consumptive use were based on an on-farm efficiency of 50 percent. The following table shows the average monthly reductions in consumptive use for the 1975-94 period.

Table III-42
Reductions in Consumptive Use (ac-ft)

Month	Reach 1	Reach 2	Reach 3	Reach 4	Reach 6
October	40	105	42	54	97
November	0	0	0	0	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	0	0	0	0	0
April	19	26	10	12	22
May	118	250	95	92	205
June	234	571	218	187	445
July	307	801	313	296	587
August	250	708	285	269	518
September	132	339	136	140	277
Annual	1100	2800	1100	1050	2150

Based on the water budget spreadsheet, a reduction in consumptive use of 8,200 ac-ft resulted in a yield of 3,900 ac-ft of shortage reductions at the critical habitat without diversion losses. In this case, it is important to note that flows in the critical habitat will only be increased by reductions in consumptive use. Therefore, the amount of leased water is considerably higher to account for historic return flows. The modeling being performed by the EIS team may indicate that the yield associated with 8,200 ac-ft of consumptive use savings is higher or lower than 3,900 ac-ft of reductions to target flow

shortages. If the EIS modeling indicates a yield that differs from 3,900 ac-ft at the critical habitat, the size of the leasing program may require adjustment.

◊ Legal and Institutional Requirements for Implementation:

There are several legal changes and requirements necessary to implement this project. There is an existing statute, 41-3-110, that provides for leasing on a temporary basis but it was originally intended for the acquisition of temporary water rights for highway or railroad roadbed construction or repair. This statute provides for temporary leases not to exceed two years. The Wyoming State Engineer is investigating whether this statute is broad enough to cover temporary agricultural leases for longer periods and for a broader set of users.

A temporary change of use would be required for the lease of irrigation water to be used for downstream environmental purposes in the critical habitat. The change of use would need to be secured from the Wyoming Board of Control. If the leased water is storage water or is converted to storage water, secondary supply water rights would have to be secured from the Wyoming State Engineer. The change of use and secondary supply water right would be contingent upon the existence of the Program and Wyoming's participation in that Program.

In order to obtain regulatory certainty for the delivery of leased water to the Wyoming/Nebraska state line, the approval of the Wyoming State Engineer and Legislature will be required under Wyoming's export law. The approval of the Bureau of Reclamation may also be required if storage water is leased from irrigation districts with federal contracts for storage water.

◊ Schedule For Implementation:

As noted in Wyoming comments received on April 5, 2000, the schedule for implementation of this alternative is as follows. In year 1, the following activities must be completed:

- The Governance Committee must develop procedures for seeking temporary water leases including the prices it is willing to offer and the terms needed for Program purposes. In addition, the determination must be make as to the NEPA compliance required for each transaction.

In year 2, the State of Wyoming will address the following activities:

- It is likely that statutory changes will be needed to implement intermediate and long-term temporary water leasing. The Wyoming State Engineer is discussing this issue with state legislators and other affected parties. Therefore, it is difficult to predict what the final decision of the Wyoming Legislature will be. For purposes of this analysis, it is assumed that the Wyoming Legislature will approve the needed statutory changes in year 2 of the Program. Further, it is assumed that, as the lease of water is a temporary change of use, the state's approval process will be similar to that of a permanent change of use.

In year 3, the following activities may occur:

- The Governance Committee must seek temporary water leases,
- Potential lessees will need to develop technical information regarding such issues as the historical consumptive use of the water they may be willing to lease,
- It is likely that agreements must also be negotiated with reservoir owners for the temporary storage of the leased water.

In year 4, the following activities may occur:

- The lessees must seek and obtain temporary changes of use through the Wyoming Board of Control,
- The lessees must seek and obtain the statutory reviews by the Wyoming State Engineer on the potential export of leased water for downstream environmental uses.

In year 5, the following activities may occur:

- The lessees must seek and obtain approval from the Wyoming Legislature for the export of water for downstream environmental uses,
- If the leased water is storage water, the lessees must seek and obtain a secondary water right, issued to the Wyoming Water Development Commission, from the Wyoming State Engineer to protect the deliveries of water to the Wyoming/Nebraska state line,
- A party, perhaps the State of Wyoming, must seek and obtain a permit under Nebraska water law to protect leased water for environmental purposes, delivered to the Wyoming/Nebraska state line to specified locations between the state line and Chapman, Nebraska.

In year 6, the storage and release of leased water could be available.

◊ **Expected Project Life:**

The inclusion of temporary water leasing in the Program is contingent on the existence of the Program and Wyoming's participation in that Program. The expected project life is dependent on the length of the temporary leasing contracts. The length of the temporary leasing contracts will depend of the requirements of the Program, the willingness of potential lessees to participate under those requirements, and the conditions placed in the proposed leasing statutes by the Wyoming Legislature.

◊ Capital and Operational Costs:

In order for this alternative to be feasible, Wyoming has noted that the price must be attractive to potential lessees. Potential lessees may expect lease payments commensurate with prices being paid by the Program for other water supplies providing the same benefits at the critical habitat. Prices have not been established for water supplies to be included in the Program, therefore, leasing cost estimates were based on the Final Report. The annual cost of a representative temporary water leasing program was estimated based on the following components:

- Annual economic value of irrigation on lands in Reaches 1, 2, 3, 4, and 6. The annual value of irrigation supplies was estimated at between $22 and $38 per ac-ft of consumptive use based on farm net income and land rental differentials between irrigated and non-irrigated lands. Farm net income estimates were based on average cropping patterns, yields, prices, and costs in the NRCE database for the years 1992, 1994, and 1996. Information on land rental differentials was based on the information from the United States Department of Agriculture, National Agricultural Statistics Services (NASS) published in July 1999.

- An incentive premium of 25 percent to induce participation in the program.

- Transaction and administrative costs representing approximately 30 percent of total program costs.

On an annual basis, the study team estimates that a temporary water leasing program would cost an average of $35 per acre foot of consumptive use saved on-farm in Reaches 1, 2, 3, 4, and 6. The cost to lease water on a temporary basis increases from upstream to downstream reaches. The total annual cost for water leasing in Reaches 1, 2, 3, 4, and 6 is estimated to be $279,000, as shown in the following table.

Table III-43
Temporary Water Leasing Program – Annual Costs

Month	CU Saved (ac-ft)	Estimated Annual Cost ($)
Reach 1	1,100	32,000
Reach 2	2,800	85,000
Reach 3	1,100	38,000
Reach 4	1,050	42,000
Reach 6	2,150	82,000
Total	8,200	279,000

Potential costs associated with third party impacts have not been evaluated. The costs presented above may be higher if there are third party impact costs. In addition, contracts with irrigators or districts need to be renewed on a periodic basis, in which case there may be additional costs associated with permitting or re-negotiating contracts.

◊ Third-Party Impact Considerations:

Third party impacts on other Wyoming appropriators associated with this alternative will be evaluated by the Wyoming Board of Control during its consideration of the temporary change of use for the various water rights offered for lease and as part of the State Engineer's and legislator's review and approval of the export of water. The Wyoming Board of Control will only allow a change of use of historic consumptive use. This will serve to reduce or eliminate third-party impacts to other Wyoming appropriators.

4. LA PRELE RESERVOIR

◊ Location:

La Prele Reservoir is an existing irrigation and industrial supply reservoir in Wyoming located on La Prele Creek approximately 13 miles upstream of the confluence with the North Platte River. The confluence of La Prele Creek and the North Platte River is approximately 115 miles downstream of the Alcova gage.

◊ Basic Description:

La Prele Reservoir was constructed between 1905 and 1909. The current capacity of the reservoir is approximately 20,000 ac-ft and it is permitted for irrigation, domestic and industrial uses. In 1974 an agreement was made between the Douglas Water Users Association (Association) and the Panhandle Eastern Pipeline Company (PEPL) to rehabilitate the reservoir. The terms of the agreement provided that PEPL buy 5,000 ac-ft of storage space at the price equivalent to the principal and interest of a loan which was used to rehabilitate the reservoir and associated ditches.

This analysis assumes that PEPL's storage right in La Prele Reservoir is available for lease by the Program. PEPL's 5,000 ac-ft share of space in La Prele Reservoir is limited by the yield of its share and the conditions under which it may be put to beneficial use in the context of the Program.

◊ On-Site Yield And Timing:

The Final Report was relied on to estimate yields and timing. To evaluate the yield of PEPL's portion of La Prele Reservoir, a simplified operations study was conducted for the study period from 1975 through 1994. The study is based on a similar investigation done by Banner and Associates in 1981. Further discussions with representatives with the La Prele Irrigation District and the local Hydrographer/Water Commissioner indicate that further evaluation is needed to accurately represent operations of the La Prele Reservoir as it relates to seepage, potential winter time releases and current irrigated acreages. Based on conversations with the La Prele Irrigation District, the Banner and Associates 1981 report does not accurately reflect *current* operations of the reservoir. The assumptions used to model La Prele Reservoir are outlined below:

- Inflow to La Prele Reservoir: The USGS maintained a streamflow gage on La Prele Creek a short distance above the reservoir. The Bureau of Reclamation (Bureau) estimated reservoir inflow as 105.5 percent of gage flow in a 1969 feasibility report

on La Prele Reservoir. The extra 5.5 percent accounts for inflow between the gage and the dam. Where USGS data does not exist (October through February 1975-92, and all of 1993 and 1994) averages were used.

- Senior Downstream Rights: The reservoir must bypass water to downstream senior, direct-flow diverters that have no storage in La Prele Reservoir. The bypass requirement is based on 1,469 irrigated acres and the statutory diversion allowance of 1 cfs per 70 irrigated acres. In addition, the bypass requirement is reduced by 800 ac-ft distributed uniformly over the irrigation season based on the Bureau's estimate of average annual return flows that are used for irrigation.

- La Prele Irrigation District (District) Demand: The reservoir must bypass water to project lands after the senior direct flow users have been satisfied. Project lands consist of 11,454 irrigated acres, of which, 10,305 acres are District lands, and about 1,150 acres are associated with "carrier rights". The bypass requirement is based on the Bureau's estimate of annual water requirements and its monthly distribution. Information provided by the La Prele Irrigation District indicates that District lands have increased to 11,472 irrigated areas since the 1981 Banner and Associates report. Further evaluation should consider any changes in irrigated acreage.

- Seepage: The current stage-seepage relationship as reported by the Hydrographer-Water Commissioner is that seepage varies linearly with stage, from 0 cfs at the dead pool elevation to 7 cfs at the spillway height. Seepage calculations were simplified to be 3.5 cfs throughout the study period. Further evaluations should consider any additional data compiled on seepage rates and stage relationships.

- Evaporation: Evaporation is based on the reservoir surface area and appropriate monthly evaporation rates. Evaporation calculations were simplified using an average surface area of approximately 450 acres throughout the study period, which corresponds with a storage volume of approximately 10,000 ac-ft, or half of the current capacity. Evaporation was prorated 25 percent to PEPL's storage account and 75 percent to the remaining storage, respectively, based on the maximum storage capacities of each account.

The District is currently using PEPL's storage water in La Prele Reservoir for irrigation purposes, therefore, diversions to storage under PEPL's account were not treated as negative flows. If water was available in PEPL's account it was released whenever there was a shortage at the critical habitat. The amount released is equal to the shortage at the critical habitat or the total storage attributable to PEPL's account, whichever amount is less. The table below shows monthly reservoir releases and seepage from PEPL's storage account in La Prele Reservoir for the 1975-94 period.

Table III-44
La Prele Reservoir – Net Yield to the North Platte River (ac-ft)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	549	537	513	211	672	0	0	786	0	0	0	0	3268
1976	549	537	211	211	965	0	0	1485	0	0	0	0	3958
1977	549	537	513	475	426	0	0	560	0	0	0	0	3060
1978	549	537	513	475	426	0	0	2500	0	0	0	0	5000
1979	549	537	513	475	426	0	0	143	0	0	0	0	2643
1980	549	537	211	211	211	211	211	211	211	2177	0	0	4740
1981	549	537	211	211	965	0	0	0	0	0	0	0	2473
1982	549	537	211	211	965	0	0	950	0	0	0	0	3423
1983	549	537	211	211	211	211	211	211	211	211	211	211	3195
1984	211	2257	211	211	211	211	211	211	211	211	471	0	4627
1985	211	211	211	211	211	211	1107	0	0	0	0	0	2373
1986	549	537	211	211	211	211	211	211	211	211	211	211	3195
1987	211	211	211	211	211	211	211	211	211	211	577	0	2687
1988	549	211	211	211	211	1045	0	2500	0	0	0	0	4938
1989	549	537	211	211	965	0	0	0	0	0	0	0	2473
1990	549	537	513	211	672	0	0	0	0	0	0	0	2482
1991	549	537	211	211	965	0	0	211	211	1897	0	0	4791
1992	549	537	211	211	965	0	0	0	0	0	0	0	2473
1993	549	537	211	211	965	0	0	2500	0	0	0	0	4973
1994	211	211	211	211	1581	0	0	2500	0	0	0	0	4925
Average	481	558	287	251	622	116	108	760	63	246	73	21	3585

Water released from La Prele Reservoir could be re-stored in the Lake McConaughy EA and re-regulated. One negative aspect of this project is that seepage from La Prele Reservoir is not controllable. A temporary storage contract in Glendo Reservoir would most likely be needed to store seepage losses attributable to PEPL's account, particularly during the non-irrigation season.

◊ Legal and Institutional Requirements for Implementation:

There are several legal changes and requirements necessary to implement this project. There is an existing statute, 41-3-110, that provides for leasing on a temporary basis but it was originally intended for the acquisition of temporary water rights for highway or railroad roadbed construction or repair. This statute provides for temporary leases not to exceed two years. The Wyoming State Engineer is investigating whether this statute is broad enough to cover leases with other entities for longer periods and for a broader set of uses.

La Prele Reservoir is currently permitted for irrigation, domestic, and industrial uses. A change of use of storage water rights would be required for this water to be used for downstream environmental purposes in the critical habitat. In addition, a secondary supply water right would be needed to ensure the protection of releases downstream to the Wyoming/Nebraska state line. The change of use and the secondary supply water right would be contingent upon the existence of the Program and Wyoming's participation in that Program. The secondary supply water right would need to be secured from the Wyoming State Engineer and the change of use would need to be secured from the Wyoming Board of Control.

In order to obtain regulatory certainty for the delivery of water to the Wyoming/Nebraska state line, the approval of the Wyoming State Engineer and Legislature will be required under Wyoming's export law.

Any agreement with PEPL to lease storage water would require the approval of the La Prele Irrigation District. The District may object to the lease of PEPL's water or to changing the use of this water right. It is possible that obtaining the approval of the District could impact the yield and cost of PEPL's storage water.

◊ Schedule For Implementation:

As this alternative is basically a water lease, its schedule for implementation would be the same as that depicted under the heading of "Water Leasing" in Wyoming, with the exception that prior to year 3 an agreement must be reached with PEPL. Any such agreement will need to address the impacts to the operations of the La Prele Irrigation District. The schedule for implementation will be negatively impacted if the District objects to the lease of PEPL's water or to changing the use of this water right.

◊ Expected Project Life:

The inclusion of this project in the Program is contingent on the existence of the Program and Wyoming's participation in that Program. PEPL's agreement with the Association/District began in October 1986 and is in effect for 25 years. At PEPL's option, the agreement can be extended for up to 15 years. Therefore, 12 years remain on PEPL's original agreement, with the option to renew the agreement for another 15 years. Accordingly this project could be sustainable well beyond the first increment of the Program. The expected project life is dependent on the length of the lease contract with PEPL. The lease could be short-term (two to five years) or could extend 13 years or longer through the first increment. An option to renew the lease at the end of the contract could also be provided depending on the terms of the second increment and Wyoming's participation in that second increment.

◊ Capital and Operational Costs:

PEPL's position in La Prele Reservoir was obtained, in effect, by PEPL agreeing to indemnify the full repayment of the rehabilitation loan that was made by the State of Wyoming Farm Loan Board to the District. The total loan by the Farm Loan Board to the District was $4,975,000 and bears interest at an annual rate of four percent on the declining balance. The annual debt service payment is a constant amount of about $318,460. The remaining principal payment on the note is approximately $1,156,000. The terms of the agreement between PEPL and the District indicate that PEPL is also responsible for a portion of the annual operation and maintenance costs associated with the reservoir, however, this cost is minimal.

The cost to lease PEPL's storage water would likely consist of the annual debt service payment of about $318,460, an incentive premium to induce participation in the Program, some transaction and administrative costs, and annual operation and maintenance costs associated with PEPL's share of the reservoir beginning in year 6 of the first increment. Any transaction involving the lease of PEPL's water right would require the approval of the Board of Directors of the District. Obtaining the approval of the District could further impact the cost of leasing PEPL's water and storage.

Potential costs associated with third party impacts have not been evaluated. The costs presented above may be higher if there are third party impact costs. In addition, a leasing contract with PEPL would need to be renewed on a periodic basis, in which case there may be additional costs associated with permitting or re-negotiating the contract.

◊ **Third-Party Impact Considerations:**

Potential third party economic impacts associated with La Prele Reservoir are related primarily to impacts on the District. The District is currently using water stored under PEPL's right for irrigation. If this water is purchased or leased for the Program it will no longer be available for use by the District, which is a potential negative third party economic impact depending on how reliant the District is on PEPL's storage right. As the District is already water short, any additional reductions in supply could potentially have a significant impact on the local agricultural economy and crop production.

Third party impacts on Wyoming appropriators associated with this alternative will be evaluated by the Wyoming Board of Control during its consideration of the temporary change of use for the water right offered for lease and as part of the State Engineer's and legislator's review and approval of the export of water. The Wyoming Board of Control will only allow a change of use of historic consumptive use. This will serve to reduce third-party impacts to other appropriators.

D. Colorado Projects

1. GROUNDWATER MANAGEMENT — TAMARACK III

◊ **Location:**

An expanded Tamarack project (Tamarack Phase III) will likely be located along the south side of the South Platte River in the Tamarack Ranch State Wildlife Area (SWA) and the Pony Express SWA, which is 40 miles upstream from the Colorado/Nebraska state line. Expanded recharge is also being considered for the Peterson and South Reservation Ditches, which divert from the South Platte River just downstream of Sedgwick, Colorado.

◊ **Basic Description:**

Colorado has proposed Tamarack Phase III in order to provide water to the Program. Per Colorado's comments and the direction of the WAPC Chair, the Beebe Draw project has been removed from further consideration and analysis. As a replacement, the yield associated with the Beebe Draw project will be provided by further expansion of Tamarack Phase III.

An expanded Tamarack project involves diverting surface water directly from the South Platte River via canals or wells located adjacent to the river. Water that is diverted or pumped is conveyed to recharge sites at various distances from the river where it is allowed to percolate into the alluvium for recharge of the groundwater aquifer. Return flows that result from such recharge accrue to the river for some duration after the

recharge event depending on the hydrogeologic conditions and the distance from the site to the river.

Recharge sites must overlie the alluvial aquifer and be hydraulically connected to the river. In general, Colorado is considering sites with SDF factors ranging from 60 days to 300 days. For this analysis it was assumed that representative recharge sites are located at an SDF factor of 270 days.

◊ On-Site Hydrologic Effects:

Estimates of yields and timing were based on the Final Report. The expanded Tamarack project that has been evaluated is expected to reduce target flow shortages by an average of approximately 17,000 ac-ft/yr. The facilities required for an expanded Tamarack Project include wells located adjacent to the South Platte River and existing canals that divert water from the South Platte River, including the Peterson and South Reservation Canals. Excess accretion credits associated with current ditch recharge programs that are not needed for well augmentation will also be targeted for Tamarack Phase I and Phase III.

The amount of water available for diversion was determined based on the following conditions:

- All existing legal rights and physical demands and GASP augmentation requirements are satisfied above the State Compact requirements. According to the Division 1 Office of the Colorado Department of Water Resources this condition occurs when the flows at the Colorado/Nebraska state line exceed 180 cfs between April 1 and October 15.

- The amounts needed for operation of Colorado's proposed Tamarack Plan (Phase I) are met. State line flows have been adjusted to account for depletions/additions to historic Julesburg gage flows from Phase 1.

- Water is only available when monthly target flow shortages do not exist at the critical habitat.

While the above conditions were used to determine the yield of Tamarack Phase III, the three states have initiated discussions about other potential criteria for use in determining when such recharge projects can withdraw from the river. The final yields will be dependent upon the conclusions reached in those discussions.

The following tables show the diversions to recharge, recharge accretions to the South Platte River, and the net yield to the South Platte River for the 1975-94 period. Diversions or depletions from the South Platte River were treated as negative numbers, whereas positive numbers indicate months when recharge back to the river exceeded diversions.

Table III-45
Enlarged Tamarack Project : Diversions from the South Platte River to Recharge(ac-ft)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	0	0	0	12791	0	0	0	0	0	0	0	0	12791
1976	0	0	14355	14355	0	0	0	0	0	0	0	0	28710
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	14355	0	0	0	0	0	0	14355
1979	0	0	0	0	0	0	0	0	0	11038	0	0	11038
1980	0	0	14355	14355	14355	14355	14355	14355	14355	0	0	0	100485
1981	0	0	14355	14355	0	0	0	0	0	0	0	0	28710
1982	0	0	14355	7842	0	0	0	0	0	0	0	0	22197
1983	0	0	14355	14355	14355	14355	14355	14355	14355	14355	14355	14355	143550
1984	14355	0	14355	14355	14355	14355	14355	14355	14355	0	0	14355	129195
1985	14355	14355	14355	14355	14355	14355	0	0	0	0	0	14355	100485
1986	0	0	14355	14355	14355	7014	14355	14355	14355	0	0	14355	107499
1987	14355	14355	14355	14355	3543	14355	14355	14355	14355	0	0	14355	132738
1988	0	14355	14355	14355	14355	0	0	0	0	0	0	0	57420
1989	0	0	13879	14355	0	0	0	0	0	0	0	14355	42589
1990	0	0	0	14355	0	0	0	0	0	0	0	0	14355
1991	0	0	6640	11440	0	0	0	0	14355	0	0	0	32435
1992	0	0	14355	14355	0	14355	0	0	0	0	0	0	43065
1993	0	0	11829	14355	0	14355	0	0	0	0	0	14355	54894
1994	2871	14355	14355	14355	0	0	0	0	0	0	0	0	45936
Average	2297	2871	10230	11652	4484	6093	3589	3589	4307	1270	718	5024	56122

Table III-46
Enlarged Tamarack Project : Recharge Accretions to the South Platte River (ac-ft)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	0	0	0	16	1079	1235	1011	767	631	514	418	366	6036
1976	307	277	297	1325	2844	2657	2179	1690	1422	1185	980	874	16036
1977	744	680	608	500	502	445	422	377	361	336	304	294	5573
1978	268	260	246	211	221	242	1431	1561	1307	1050	842	734	8372
1979	614	556	494	405	407	361	343	309	297	318	1150	1336	6590
1980	1066	897	801	1724	3262	4173	5166	5616	6364	6755	5725	4814	46363
1981	3867	3364	2939	3338	4890	4442	3834	3142	2789	2438	2100	1946	39087
1982	1710	1612	1534	2274	3374	3025	2631	2180	1959	1735	1514	1421	24970
1983	1265	1207	1175	1990	3687	4607	5612	6040	6793	7226	7326	7914	54840
1984	7917	8395	7417	6920	7931	8065	8672	8626	9146	9267	7944	6969	97269
1985	6952	7867	8391	7897	9161	9114	9575	8254	7230	6216	5287	4906	90850
1986	5405	5395	4815	4899	6543	7080	7324	7419	8207	8573	7446	6593	79697
1987	6688	7677	8267	7829	9089	8238	8591	8689	9344	9556	8281	7358	99607
1988	7316	7069	7421	7549	8702	8792	8189	6822	6123	5414	4718	4427	82542
1989	3939	3760	3548	3975	5686	5285	4758	4069	3767	3427	3060	2990	48263
1990	3831	4008	3569	2934	4144	4006	3653	3152	2941	2695	2422	2339	39694
1991	2134	2087	2007	2202	3445	3307	2994	2571	2447	3433	3344	3028	33000
1992	2595	2410	2253	3033	4556	4263	4949	4490	3957	3417	2926	2711	41560
1993	2394	2275	2156	2653	4261	4054	4782	4360	3846	3323	2847	2692	39640
1994	3506	3934	4756	5096	6494	5735	4979	4126	3710	3290	2876	2707	51208
Average	3126	3186	3135	3338	4514	4456	4555	4213	4132	4008	3575	3321	45560

Table III-47
Enlarged Tamarack Project : Net Yield to the South Platte River (ac-ft)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1975	0	0	0	-12775	1079	1235	1011	767	631	514	418	366	-6754
1976	307	277	-14058	-13030	2844	2657	2179	1690	1422	1185	980	874	-12674
1977	744	680	608	500	502	445	422	377	361	336	304	294	5573
1978	268	260	246	211	221	-14113	1431	1561	1307	1050	842	734	-5983
1979	614	556	494	405	407	361	343	309	297	-10720	1150	1336	-4448
1980	1066	897	-13554	-12631	-11093	-10182	-9189	-8740	-7991	6755	5725	4814	-54122
1981	3867	3364	-11416	-11017	4890	4442	3834	3142	2789	2438	2100	1946	10377
1982	1710	1612	-12821	-5568	3374	3025	2631	2180	1959	1735	1514	1421	2773
1983	1265	1207	-13180	-12365	-10669	-9748	-8743	-8315	-7562	-7129	-7030	-6441	-88710
1984	-6438	8395	-6938	-7435	-6424	-6290	-5683	-5729	-5209	9267	7944	-7386	-31926
1985	-7403	-6488	-5964	-6458	-5195	-5241	9575	8254	7230	6216	5287	-9449	-9635
1986	5405	5395	-9540	-9456	-7812	66	-7031	-6936	-6148	8573	7446	-7763	-27802
1987	-7667	-6678	-6088	-6526	5546	-6117	-5764	-5666	-5011	9556	8281	-6997	-33131
1988	7316	-7286	-6934	-6806	-5653	8792	8189	6822	6123	5414	4718	4427	25122
1989	3939	3760	-10331	-10380	5686	5285	4758	4069	3767	3427	3060	-11365	5674
1990	3831	4008	3569	-11421	4144	4006	3653	3152	2941	2695	2422	2339	25339
1991	2134	2087	-4633	-9239	3445	3307	2994	2571	-11908	3433	3344	3028	564
1992	2595	2410	-12102	-11322	4556	-10092	4949	4490	3957	3417	2926	2711	-1505
1993	2394	2275	-9673	-11702	4261	-10302	4782	4360	3846	3323	2847	-11663	-15253
1994	635	-10421	-9599	-9260	6494	5735	4979	4126	3710	3290	2876	2707	5272
Average	829	315	-7096	-8314	30	-1636	966	624	-174	2739	2858	-1703	-10562

Colorado has noted that Tamarack will be operated consistent with the operations of the Lake McConaughy EA. Comments received from Colorado imply that the same rules, which apply to the EA regarding diversions during periods of shortage at the critical habitat, should also apply to Tamarack. In other words, Colorado believes Tamarack should receive credit for bypassing water if the EA is storing water during times of shortage at the critical habitat.

◊ Legal and Institutional Requirements for Implementation:

Phase I of the Tamarack Plan fell under the auspices of NEPA because federal dollars are used to partially fund the state wildlife areas. To satisfy NEPA compliance an Environmental Assessment (EA) was completed for Phase I of the Tamarack Plan. The EA was approved for a total diversion of about 30,000 ac-ft from the South Platte River, of which approximately 20,000 ac-ft could be pumped from wells and 10,000 ac-ft could be diverted into existing canals. For an enlarged Tamarack project the existing EA would need to be amended to provide for increased diversions from the South Platte River.

A new water right filing is required for increased diversions under an enlarged Tamarack project. In Colorado, an in-state beneficial use, such as fishery or wildlife use, must be decreed for water generated from recharge projects to be protected within the State. Similar to Phase I of the Tamarack Plan, in-state wildlife enhancement benefits associated with the recharge sites could constitute an in-state beneficial use. The water rights filing should take less than one year. The necessary hardware could be installed and the project operated under a temporary substitute supply plan in the interim while the water rights filing is being approved.

◊ Schedule For Implementation:

The schedule for implementation is dependent on the time required to install the necessary hardware, i.e. wells, pumps, pipeline, recharge basins, etc., and the time needed to resolve legal and institutional requirements including the water rights filing, EA amendment, and approval of a temporary substitute supply plan if necessary.

Wells and credits from recharge in existing canals are the basis of Colorado's Tamarack Phase III. As noted in comments received from Colorado, agreements with existing canals would be developed by year 2. Wells for recharge on public SWA lands and private lands would be developed at a rate of about 10 wells per year or 5 years to develop up to 50 wells. An enlarged Tamarack project would be fully implemented after 5 years.

◊ Expected Project Life:

The expected project life of an expanded Tamarack project would extend beyond the first increment of the Program. A constraint on the project life could be the wells and pumping hardware, which would most likely need to be replaced within 10 to 20 years.

◊ Capital and Operational Costs:

The direct costs were estimated based on the capital costs associated with the construction of diversion and storage facilities and annual operating costs. The costs for these types of projects were based on data provided by Northern Colorado Water Conservancy District. Costs estimated for an expanded Tamarack project consider the following items.

- Subsurface investigations
- Construction of wells
- Pumps and related facilities
- Diversion facilities
- Construction of recharge ponds
- Regulation and measurement
- Conveyance facilities
- Engineering costs associated with the design of facilities and analysis of operations
- Compensation provided to the canal company
- Operations and maintenance

Up-front capital costs for an expanded Tamarack project were estimated as follows. A cost of $3,500 was included for subsurface investigations. A total cost of $30,000 per well was included for the well drilling, casing material, pump, pump column and shaft, discharge head assembly, and electric motor. It was assumed that electrical power would not be available at all well sites, therefore, an additional cost of $4,000 was included to provide power to the well. A pipeline cost of $20,000 per well was included for conveyance facilities and $7,000 was included for pipeline installation. A cost of $6,000 was included for recharge basin construction. Engineering costs associated with the design of facilities and analysis of operations were assumed to be 10 percent of the total construction cost of the project.

There are some additional capital costs associated with recharge diversions to existing canals. Costs for diversion structures from an existing canal are typically about $3,000. A cost of $4,000 was included for regulation and measurement, which includes the cost of flumes, stilling wells, and stage recorders.

Annual costs consist of operations and maintenance costs and delivery fees. Pump operation costs, which consist primarily of electricity costs, are typically about $8 per ac-ft pumped. Annual maintenance costs are minimal and typically less than $300 per well. For diversions to existing canals, canal companies typically charge the owner of the recharge basin a delivery fee per ac-ft delivered. The delivery fee was assumed to be $5 per ac-ft per year.

An expanded Tamarack project will consist of a combination of wells and diversions to existing canals. The maximum monthly amount diverted from the river is approximately 14,500 ac-ft. About 50 wells would be required to pump up to 14,500 ac-ft per month based on an average pumping rate of 2,200 gpm per well. The average annual diversion from the South Platte River is approximately 56,000 ac-ft. It was assumed that on average about one-third of the annual amount or 20,000 ac-ft/yr would be diverted into existing canals and about two-thirds or 36,000 ac-ft/yr would be diverted via pumps located adjacent to the river. It was assumed that 20 recharge sites would be needed for canal diversions to recharge, and about 50 sites would be needed for pumping to recharge (one site per well).

The total capital cost and annual cost for an expanded Tamarack project is estimated to be about $4.2 million, and $403,000, as shown in the table below.

Table III-48
Cost of an Enlarged Tamarack Project

DESCRIPTION	Cost for Existing Canals ($)	Cost for Wells ($)	Total Cost ($)
Subsurface Investigations	3,500	3,500	
Diversion Structures	3,000		
Recharge Basins	6,000	6,000	
Measuring Devices	4,000		
Well Construction & Pumps		30,000	
Conveyance Conduit		7,000	
Power Hook-up		4,000	
4000' 12" dia pipe @ $5/ft		20,000	
Total Cost per Structure or Well	**16,500**	**70,500**	
No. of structures or wells	20	50	
Total Construction Cost	330,000	3,525,000	
Engineering Fees (10%)	33,000	353,000	
Total Capital Cost	**363,000**	**3,878,000**	**4,241,000**
ANNUAL COSTS			
Amt. Diverted	20,000	36,000	
Delivery Cost	100,000		
Pump operation cost ($8/af)		288,000	
Annual Maintenance Costs ($300/well)		15,000	
Total Annual Cost	**100,000**	**303,000**	**403,000**

Potential costs associated with third party impacts have not been evaluated. Costs may be higher if there are third party impact costs.

◊ **Third-Party Impact Considerations:**

Third party impacts associated with an expanded Tamarack project are similar to those described for groundwater management programs and recharge projects in Nebraska. However, there are potential additional third party hydrologic and economic impacts associated with an expanded Tamarack project as it relates to downstream users. Third party hydrologic effects may include potential impacts on downstream users including CNPPID, NPPD, irrigated lands served by Lake McConaughy, the EA in Lake McConaughy, and hydropower production. These impacts may be minimal or significant depending on how the recharge project is operated. There could be potential negative economic and hydrologic impacts to downstream users if water that is diverted from the river for recharge was historically diverted by downstream irrigators and hydropower generators. Colorado representatives indicated that they have been working with water users in Nebraska to evaluate potential impacts on downstream users, including CNPPID and NPPD, due to an expansion of Tamarack. Preliminary work suggests that potential negative impacts may be minimal. At times an expansion of Tamarack may produce positive impacts.

The three states have initiated discussions about potential criteria, such as effects on downstream senior water rights that can be used in determining when such projects can withdraw from the river. The conditions of the interstate compact and the terms of the Program will impact how Tamarack is operated with regard to river withdrawals. Each state has the right to manage and use water within its boundaries consistent with interstate compacts and decrees and the terms of the Cooperative Agreement and Program.

E. Yield at the Critical Habitat:

The Platte River EIS team modeled the three states' projects (Pathfinder Modification Project, Lake McConaughy EA, and Tamarack Phase I) and the projects included in the Water Action Plan (Revision No. 3 dated April 18, 2000) to determine a total yield score. This score coincides with the average annual reduction to target flow shortages at the critical habitat. Based on the model results, the total score of the combined North Platte, South Platte, and Central Platte projects is approximately 144,000 ac-ft. The EIS team recommends the WAPC consider the "true score" to be in the range of approximately 135,000 to 137,000 ac-ft/yr to account for additional losses not captured in the current models. This score meets the water goals of the Program, which are to reduce shortages to the FWS target flows by 130,000 to 150,000 ac-ft/yr.

There are significant differences between the EIS team models and the water budget spreadsheet, which was used by Boyle to determine reductions in target flow shortages. As a result, the EIS team made adjustments to either the net hydrologic effects provided in the Water Action Plan or to the EIS models to simulate certain projects. Boyle was directed by the WAPC to meet with the EIS team to assist with interpretations of Boyle's methods and findings to minimize the possibility of changes to the proposed operations of the Water Action Plan projects. The primary assumptions or changes indicated by the EIS team are summarized below.

- **Study Period:** For all projects, the study period used by Boyle (1975-1994) is different than the study period being used for the Programmatic EIS (1947-1994). As such, the EIS team extended the net hydrologic effects data presented in the Water Action Plan to be consistent with the period of record used for the Programmatic EIS.

- **La Prele Reservoir:** La Prele Reservoir was modeling independently of the Boyle analysis. Most of the assumptions used by the EIS team were consistent with the Boyle analysis, however, the following additional assumptions were used by the EIS team: 1) any available storage is released each year from May through September, 2) the Program does not get credit for reservoir seepage, and 3) La Prele deliveries are charged a 10 percent loss between La Prele Reservoir and Glendo Reservoir.

- **Wyoming Water Leasing:** The consumptive use savings associated with leasing in Wyoming were assumed to be 8,200 ac-ft, which is consistent with Boyle's analysis. However, the EIS team determined the reduction in deliveries based on the assumption that 50 percent of any diversion returns to the river. The Boyle analysis takes into account both canal losses and farm losses, which average about 65 percent in reaches 1, 2, 3, 4, and 6. The difference in losses assumed by the EIS team and Boyle should not affect the yield score because the total reduction in consumptive use is the same for both analyses.

- **CNPPID Re-regulation Reservoir:** There are six potential re-regulating reservoirs presented in the Water Action Plan. To simplify the modeling of this project, the J-2 Forebay re-regulating reservoir was chosen as a representative project. OPstudy, which is a monthly model, was used by the EIS team to determine the score associated with the J-2 Forebay reservoir. Because daily operation of the reservoir is possible due to the close proximity of the reservoir to the habitat, the EIS team adjusted the score of this project by multiplying by a factor of 2.0 to account for the benefits of daily operation.

- **Nebraska Water Leasing and Water Management Incentives:** These projects were simulated together by the EIS team because the models do not distinguish between reductions in consumptive use due to water leasing versus water management incentives. Based on comments received from Nebraska during the April 26, 2000 WAPC meeting, the total yield associated with water management incentives was increased from 3,500 ac-ft/yr, presented in Revision #3 of the Water Action Plan, to 7,000 ac-ft/yr. There are four potential water management options presented in the Water Action Plan. To simplify the modeling of this project, conservation cropping was chosen as a representative project. All reductions in consumptive use were assumed to be tied to storage in Lake McConaughy except reductions associated with Reach 10, which coincides with the Western Canal. Water leasing in that reach is related to reductions in natural flow diversions and consumptive use. The reaches used in the Boyle analysis were translated into corresponding reaches used in the OPstudy model.

- **Groundwater Management:** There are four potential groundwater management options presented in the Water Action Plan. To simplify the modeling of groundwater management, a conjunctive use project was chosen as a representative project. The option chosen should not impact the yield score significantly because the intended yields of all four options are the same. The average annual volume diverted to recharge was 2,800 ac-ft, which is slightly lower than the 3,000 ac-ft/yr proposed in the Water Action Plan. The difference is due to the fact that the EIS team limited diversions to the J-2 return flow during the non-irrigation season when excesses occurred.

- **Lost Creek/North Dry Creek Cutoffs:** There are two potential cutoff options presented in the Water Action Plan. To simplify the modeling of these projects, the Lost Creek/Ft. Kearny cutoff was modeled assuming existing flows in Lost Creek are diverted back to the Platte River via the cutoff. The maximum monthly flow back to the river was assumed to be 500 ac-ft, which is slightly higher than the 440 ac-ft assumed by Boyle. This change was necessary to achieve a yield close to the 2,200 ac-ft/yr identified in the Water Action Plan. The EIS team reduced the final score of this project by 50 percent because water enters the river midway through the critical habitat.

- **Net Controllable Conserved Water:** Based on comments received from Nebraska during the April 26, 2000 WAPC meeting, the total yield available to the Program was increased from 2,000 ac-ft/yr, presented in Revision #3 of the Water Action Plan, to 5,000 ac-ft/yr.

- **Dawson/Gothenburg Canal:** Due to time constraints, the EIS team did not model this project.

The remainder of this Section E consists of a memo prepared by the EIS team and transmitted to Boyle on May 4, 2000. The memo discusses the results of the EIS team modeling effort and summarizes how each proposed component of the plan was incorporated into the North Platte and Central Platte EIS models.

The Platte River EIS team modeled the Draft Water Action Plan (Revision No. 3 dated April 18, 2000) after further guidance and clarification from Boyle Engineering. In many instances, the exact target yield or score of each separate project could not be "fixed" or held to the desired target due to interaction between the different projects. This effect is not deemed critical as the modeling demonstrates that the combined range of yield and/or score for the individual projects is available to the Water Action Plan. We are also not able to "score" each project individually in terms of its specific contribution to the total reduction in instream flow shortage. However, we do list either the yield of a project on site, the amount contributed to the Environmental Account (EA) if applicable, or an actual "score" for each project.

Although the total combined score is approximately 144,000 acre-feet in average shortage reduction, we recommend that the Water Action Plan Committee consider this value as an over-estimate because we have not been able to address Environmental Account losses to the extent we believe is necessary to fully support that "score". At this time, we recommend that the Committee consider the "true" score to be in the range of approximately 135,000 to 137,000 acre-feet in order to account for additional losses not captured in the current models. However, it is our assessment that the proposed mix of projects, if implemented to the scale outlined in the draft plan, is followed then the target result in re-regulating flows to reduce shortages will be achieved.

We also did not consider any competition between the Water Action Plan and the ability of the State's Future Depletion Plans to also provide water at the scale envisioned over the first proposed increment (13-15 years). This is mentioned not as a perceived problem, only to clarify the analysis that was done.

Following is a summary of how each proposed component of the plan was incorporated into the North Platte and Central Platte EIS OPstudy models.

NORTH PLATTE RIVER EIS MODEL

<u>La Prele Reservoir</u>
(Average yield = 2,225 acre-feet per year at the reservoir)
Because the study period used by Boyle Engineering to prepare the Water Action Plan is less than the study period being used for the Programmatic EIS, it was necessary to independently model La Prele Reservoir. To do so, the following assumptions were made.

1. Inflows to La Prele Reservoir are based on a USGS gage that was maintained on La Prele Creek a short distance above La Prele Reservoir. The inflow is assumed to be 105.5% of the gaged flow. This assumption was adopted from the DWAP prepared by Boyle. Where USGS data does not exist (November-February 1972, October-February 1973-1992, and all of 1993 and 1994) averages are used.

2. System bypass demands and the distribution of those demands are from the 1981 report titled "Preliminary Technical Data report, WyCoalGas Project Water System" prepared by Banner and Associates for Panhandle Eastern Pipe Line. These are also the demands that were utilized by Boyle for the DWAP and include senior downstream rights and La Prele Irrigation District demands.

3. Storable flows are the difference between the inflows and system bypass demands, storable flows are split 25% to PEPL and 75% to the district, and PEPL's storable flows are limited to 5000 acre-feet in any water year.

4. Seepage is 3.5 cfs throughout the study period. This assumption was adopted from the DWAP prepared by Boyle. All seepage is charged against the PEPL storage account to the extent that storable flows plus storage are greater than the seepage amount. In simple words, the PEPL account is not allowed to accrue negative amounts when seepage is greater than 25% of the inflows plus storage in PEPL's account.

5. Evaporation calculations are simplified using an average surface area of approximately 450 acres and evaporation is prorated 25% to Panhandle Eastern Pipe Line's account and 75% to the remaining storage. This assumption was adopted from the DWAP prepared by Boyle. Similar to seepage, evaporation is not allowed to cause PEPL storage to drop below zero. Evaporation rates for each month are from the 1981 report titled "Preliminary Technical Data report, WyCoalGas Project Water System" prepared by Banner and Associates for Panhandle Eastern Pipe Line.

6. Demand on the PEPL account for the Program was structured such that any available storage would be released each water year and releases occur in May-Sept.

7. The storage in the PEPL account equals the storage from the previous month plus the storable flow minus seepage minus 25% of the evaporation minus the demand, not to be less than zero. Therefore, demand is limited to the available storage adjusted for seepage and evaporation.

8. The Program does not get credit for seepage amounts because seepage is part of the current regime of the river and does not constitute "new" water.

9. La Prele deliveries are charged a 10% loss between La Prele Reservoir and Glendo Reservoir. This was adapted from the 1981 report titled "Preliminary Technical Data report, WyCoalGas Project Water System" prepared by Banner and Associates for Panhandle Eastern Pipe Line.

Using these assumptions the average annual delivery from the La Prele project for 1947-1994 is 2,225 acre-feet per year at the reservoir.

<u>Pathfinder Municipal Account</u>
(Average yield = 4,800 acre-feet per year at the reservoir)
The input to the North Platte River EIS model was modified such that the municipal demand is 4,800 acre-feet per year. The demand is 9,600 in dry years, 0 in wet years and 5,664 in the remaining years. The annual flows into Seminoe Reservoir for 1941-1994 were ranked from lowest (1954) to highest (1984) and the top 33% were considered wet and the bottom 25% were considered dry. After determining the Pathfinder Municipal demand, the remaining delivery (9,600 minus the municipal demand) was made available to the program and delivered in September.

Glendo Storage

(Average yield = 2,650 acre-feet per year at the reservoir)

The North Platte EIS model has a demand for the 10,600 acre-feet of Glendo conservation storage. In order to provide water for the Program, an additional demand had to be put on the system. The Program would not receive any storage during dry years as described above. In the remaining years, the Program could take up to the difference between the existing demand and the maximum 10,600 acre-feet delivery. In order to achieve a yield of 2,650 acre-feet at the reservoir, approximately 50% of the difference was delivered to the Program.

Water Leasing

(Average yield is approximately 8,200 acre-feet per year at the reservoir)

Given the declaration by the Water Committee that water leasing should be tied to storage, water leasing in reaches 1, 2, 3, and 4 was concentrated in the Kendrick Project. In order to achieve the reduction in consumptive use of approximately 6,100 acre-feet, the deliveries to the Kendrick Project were reduced by 17% or around 12,200 acre-feet per year. This incorporates the assumption that approximately 50% of any diversion returns to the North Platte River, which is different from Boyle's analysis. Boyle's analysis includes conveyance losses which are considered to be 100% consumptive use. The EIS analysis uses the assumptions that are included in the North Platte River EIS model, which are that 50% of any diversion returns to the river. Water leasing in reach 6 is assumed to be tied to the storage associated with the Wheatland Irrigation District and the consumptive use portion of the leasing is added as an inflow to the North Platte River EIS model at the Laramie River.

CENTRAL PLATTE RIVER EIS OPSTUDY MODEL

CNPPID Re-Regulating Reservoir

("Score" = 6.2 kaf)

Following receipt of Central's Depletion Mitigation Study Phase I (HDR Engineering, April 7, 2000), Boyle advised using the J-2 Forebay project as an example project with a capacity of 3,436 acre-feet. The project included an inflow rate (when instream flow excess existed at Overton, Grand Island, and the J2 return) of 100 cfs to the reservoir, and an outflow rate of 50 cfs whenever shortages were occurring. In the monthly OPstudy model, the average annual release was approximately 3,100 acre-feet. Based on EIS team comparisons of monthly and daily flow data for a reregulating project in the vicinity of the J2-Forebay area (and the size of the inlet & outlet), the EIS team scored this project by multiplying by a factor of 2.0. This resulted in a "score" of 6,200 acre-feet for this example project.

Water Leasing and Water Management Incentives

(Yield to EA = 15.9 kaf + Western Canal reduction of 0.947 kaf)

Projects of these types basically involve reductions in consumptive use and depending upon the location, the "saved" water may or may not be directly available to the McConaughy Environmental Account. For example, the Western Canal (Boyle reach 10) does not receive storage water from Lake McConaughy. Therefore, Water Leasing and Management Incentives in that reach are related to reductions in natural flow diversions combined with recognition of the saved volume and protection from diversion for consumptive use. The Western Canal volume associated with Leasing/Incentives averaged 947 acre-feet per year.

The other reaches in the Boyle report were translated into the corresponding OPstudy reaches and the reduction in consumptive use assumed to be from reduced storage deliveries:

Keystone - Sutherland Canals (North Platte River)	898 acre-feet
Sutherland - North Platte Canals (North Platte River)	268 acre-feet
Brady - Cozad Canals (Platte River)	1,558 acre-feet
Central District (Platte River)	12,217 acre-feet
Kearney Canal (Platte River)	221 acre-feet

The sum of the savings in consumptive use (except for the Western Canal) is 15,160 acre-feet. This volume was allocated annually to the EA in each October. The Boyle report recognizes that to achieve a certain volume of consumptive use reduction, a larger reduction in on-farm deliveries is needed in order to provide previous levels of return flow to the system. By modeling the reduction in Consumptive Use, the OPstudy model is consistent with Boyle's analysis.

Ground Water Management

(Amount stored below J2 area = 2.8 kaf, amount credited to EA = 4.5 kaf)

Option 4 in the Boyle report (conjunctive use project in CNPP&ID area) was used as a representative project. An annual target storage volume of 3,500 acre-feet was used in the OPstudy model, and diversion from the J2-return flow available was allowed during the non-irrigation season when excess occurred. The average annual volume stored over the study period from excess was approximately 2,800 acre-feet and it was assumed that this volume was subsequently pumped during the irrigation season to meet demands. Accounting for losses in the NPPD and Central District systems resulted in an average of 4,500 acre-feet being credited to the Environmental Account.

Lost Creek/North Dry Creek Cutoff

(2.2 acre-feet contributed to river, "score" = 1.1 kaf)

This project was simulated by introducing water into the OPstudy model above Kearney (in the Overton - Odessa reach of the model). A maximum inflow rate of 500 acre-feet was allowed whenever instream flow excess was occurring during May thru September. This is somewhat higher than the 440 acre-feet volume identified by Boyle in Table III-26 in order to achieve a yield closer to that identified in the draft plan (2,200 acre-feet). Because the water enters in the mid-section of the habitat, the final score was 50% of the volume introduced.

Power Interference

(Yield to EA of 5.5 kaf)

The OPstudy model was modified to make the operation of the Power Interference Scenario compatible with the analysis done by Boyle. Specifically, excess to FERC requirements is considered during the non-irrigation season, and excess to "system needs" (irrigation, minimum canal flow, etc.) is considered during the irrigation season. Nebraska identified a target yield from this component of 4,000 acre-feet. The potential yield of this component is greater than 4,000 acre-feet, and in order to achieve results closer to the target level only a portion of the available power interference volume was reregulated and credited to the Environmental Account. The total amount credited was 5,500 acre-feet and this is assumed to be close to 4,000 acre-feet in "score".

Net Controllable Conserved Water

Based on discussions with Boyle and direction from the Water Action Plan Committee, an annual volume of 5,000 acre-feet was contributed to the Environmental Account from Lake McConaughy storage in each October.

Dawson/Gothenburg Canal GW Recharge

Due to time constraints and the need for additional modifications to model this component, the EIS team did not model this recharge project. It is noted that the projected yield is approximately 1,300 acre-feet. It is assumed that the project is feasible (i.e. enough "excess" remains to reregulate), and that the yield of 1,300 acre-feet is somewhat included in the other projects over/under-estimate of the total yield.

Tamarack Phase III

(Yield of 27.8 kaf exchanged into EA)

This was modeled by increasing the pumping capacity of Wells 1, 2, 3, & 4 such that the reregulated volume exchanged into the McConaughy EA approximated the target level of 27,000 acre-feet.

Total Score

The total score of the combined North Platte, South Platte, and Central Platte projects is approximately 144 kaf

Source: EIS team.

IV. Monitoring and Accounting

A. Monitoring

Per the WC's Scope of Services, monitoring methods will be necessary to assess the effectiveness of projects as they are implemented. These methods must be compatible with the tracking and accounting methods being developed separately by the WC in concert with each state's water administration. To a certain extent there may be overlap between monitoring and tracking and accounting methods. This section provides information on the types of information needed to support assessments of project effectiveness.

The extent to which monitoring is necessary will depend to a large degree on how much information is currently available for each of the projects included in the Water Action Plan. Monitoring requirements will be similar for certain types of projects, therefore, they have been described for four general types of projects.

- **Reservoir Projects**

Reservoir projects include the CNPPID Re-regulating Reservoir, La Prele Reservoir, Glendo storage and the Pathfinder municipal account. For all these projects monitoring will be required to account for diversions to storage and releases. In the case of Pathfinder Reservoir and Glendo Reservoir, diversions to the municipal account, and the 40,000 ac-ft pool, respectively, are of primary interest. In the case of the CNPPID Re-regulating Reservoir and La Prele Reservoir, additional monitoring of seepage may be required to assess impacts on downstream landowners and track seepage gains to the river.

- **Agricultural Conservation**

These projects include water leasing and water management programs. For agricultural conservation projects it will be necessary to define baseline conditions prior to implementing the project. Baseline conditions are necessary to ensure the programs are implemented as designed. Monitoring will be required to assess the acreage involved in the program, crop mixes, consumptive irrigation requirements, natural flow and storage water deliveries, and surface and groundwater return flows. Baseline conditions can be determined primarily through surveys and diversion records, however, observation wells may need to be installed and hydrogeologic investigations conducted to measure return flows. On-farm efficiency tests may also be necessary to quantify surface and groundwater return flows.

Once baseline conditions are defined it will be possible to determine the incremental hydrologic effects of water leasing, land fallowing, deficit irrigation, conservation cropping, or changes in irrigation techniques, and monitor whether programs are being implemented as designed.

- **Groundwater Management**

These projects include groundwater management, groundwater recharge, and the North Dry Creek/Fort Kearny cutoff projects. There is a significant amount of monitoring required for groundwater management and recharge projects to confirm projects generate the proposed yields. The estimated yields of recharge projects were calculated using the Steam Depletion Factor (SDF)

method. These estimates do not account for site-specific variations in geologic conditions. Therefore, observation wells would need to be installed and hydrogeologic investigations and modeling conducted to more accurately measure recharge water returning to the river.

With respect to groundwater management projects in Nebraska there is uncertainty regarding the dynamic response of the groundwater mound in Central Nebraska and the extent to which water from the mound can be used to supplement streamflows. Further investigation and monitoring is required prior to implementing groundwater management programs in Central Nebraska to ensure the sustainability of these projects. Observation wells and hydrogeologic investigations will be needed to monitor and assess the impacts of the proposed projects. Any project designed to take water from the mound will need to be phased-in so that hydrologic impacts can be monitored and evaluated.

- **Power Interference**

The modeling tool that was appropriately used in the study for basin-wide comparisons of projects must be supplemented with a detailed reservoir operations model to more accurately predict the yield of the power interference project. Current uncertainties associated with this alternative are primarily the amount of water available for power interference, and the operation of Lake McConaughy as it relates to power interference.

In addition to the yield analysis, there are also needs for accurate monitoring and accounting tools. Monitoring and accounting methods for power interference must use reservoir operations data consistent with other day-to-day management activities. Accounting will be required to track how much water is available for power interference, power interference releases, and changes in storage.

B. Tracking and Accounting

Pursuant to Milestone W14-1 of the Cooperative Agreement, the three states have developed tracking and accounting procedures for tracking water contributions to the Program. To the extent possible, existing laws and water administration will be used, however, in some instances laws and/or water administration procedures may need to be changed. Presented below are tracking and accounting procedures provided by the three states.

1. NEBRASKA'S TRACKING AND ACCOUNTING

Under existing water law in Nebraska there are two types of water that can be tracked and protected from diversion: storage water and water conducted down a stream under statute 46-252. Essentially, the tracking and accounting program keeps track of the amount of storage water introduced and/or diverted in a given river reach. Pre-set conveyance losses are assessed in each reach. Losses to storage water are assessed in proportion to the relative amounts of storage water and natural flow in the reach. The residual water in the reach is considered to be natural flow. River reaches are established based on the distance water can travel within one day.

Storage water is water that has been permitted to be stored in a reservoir. In Nebraska before storage water released into a stream can be protected for specific uses, the water must also have a storage use permit. This permit indicates the use of the water, point of release and the point of use or diversion. For instream uses, the water is protected from diversions from its

point of release to the permitted end point of the beneficial use. Once storage water has passed the last point of diversion or the "end point" of the instream use indicated on the permit, any remaining water is considered to be natural flow.

Traditionally Nebraska statute 46-252 has allowed the state to protect from diversion water that is put into a natural stream simply to convey that water to a downstream point of diversion. This statute could also be used to protect water for instream uses from the point of introduction to the end point of the instream use. A key provision of this law is that the protected water is water that otherwise would not have been available in the stream.

There are several projects in the proposed Water Action Plan that rely on the release of water from a storage reservoir. The CNPPID Re-regulating Reservoir, Power Interference, Pathfinder Municipal Account, Glendo Storage, and La Prele Reservoir options would all involve the use of storage water. Under existing Nebraska law these projects could obtain a storage use permit allowing the state to protect the water for instream environmental uses.

As stated above, Nebraska statute 46-252 has traditionally been used to allow a natural stream to be used as a conduit to move water from release into the stream downstream to another point of diversion. The statute did contemplate allowing the state to protect from diversion water introduced into the stream for instream purposes. There is no reason to believe that this statute could not be used to protect water derived from the other projects listed in the proposed Water Action Plan. However, to date there are no legal precedents to indicate precisely how this law would work in any given situation. Until an actual application has been duly heard and granted, it is impossible to know whether such permits would be granted.

If permits are granted under statute 46-252, one key premise would be that the protected water would not otherwise have been available for use. In each case, the applicant would have to show that the water to be protected would not otherwise have been available. For example, return flows from a project that were historically available for other water rights would presumably have to remain available for use by these rights. However, if the applicant could show that water from water leasing, ground water management or a recharge project would not have been otherwise available in the stream, the Director could grant a permit to protect this water for beneficial instream uses.

2. WYOMING'S TRACKING AND ACCOUNTING

1. Wyoming has agreed to contribute water from the Environmental Account of the Pathfinder Modification Project to the proposed Program. The release from this account will be tracked by adding the necessary lines to the existing daily accounting program. Conveyance losses will be charged proportionally to the Program water in the same manner that losses will be charged to other storage deliveries, according to the North Platte Decree (Decree) and its stipulations.

2. Wyoming has suggested that water may be leased from the Municipal Account of the Pathfinder Modification Project and/or its allocation from Glendo Reservoir, subject to certain specified conditions. Again, the releases from these accounts will be tracked by adding the necessary lines to the existing daily accounting program. Conveyance losses will be charged proportionally to the Program water in the same manner that losses will be charged to other federal storage deliveries, according to the Decree.

3. Wyoming has also suggested that water may be leased to the proposed Program, subject to certain specified conditions. At a minimum, such a lease would require a temporary change of use and must meet the requirements of Wyoming water law. The lease would be subject to the review and approval of the Wyoming Board of Control. The Board of Control would place conditions on the transaction to ensure the protection of other appropriators. These restrictions will address the amount of water that can be leased and conveyance losses to be charged, as well as address other issues specific to the individual transactions. The existing daily accounting program can be revised to accommodate any of the four following categories of lease transaction:

   a. If the leased water comes from **federal storage**, it will be tracked and accounted as explained in item 2. above.
   b. If the leased water comes from **non-federal storage**, it will be assessed a conveyance loss by the Board of Control for the distance to the state line.
   c. If the leased water comes from **natural flow and is not stored**, the Board of Control will determine the appropriate conveyance loss from the point of historic use to the state line. It is likely that this category will be difficult, if not impossible, to achieve and implement.
   d. If leased **natural flow is to be stored** in a reservoir, the Board of Control will assess conveyance losses from the point of historic use to the reservoir. The release of such water from the reservoir will be assessed conveyance losses in accordance with a. or b. above depending on the ownership and location of the reservoir.

4. Future depletions will be computed and reported in accordance with Wyoming's Depletion Mitigation Program. Wyoming will calculate the impacts of any excess depletions to flows at the state line. Wyoming will determine the cause of the excess depletion and determine the amount of water that would have arrived at the state line had the excess not occurred. In order to make this determination, conveyance losses must be considered. The losses specified in the Decree and past Board of Control orders will be used to the extent possible. After the impact from the excess depletions has been determined, Wyoming will calculate the amount of water that would have to be released from the Municipal Account of the Pathfinder Modification Project or its contract storage in Glendo Reservoir to offset the impact, giving full consideration to the conveyance losses specified in the Decree. The resulting calculated release would be subtracted from releases made of leased water (see item 2 above). Wyoming would not expect lease payments for any water which served to offset the impact of excess depletions.

3. COLORADO'S TRACKING AND ACCOUNTING

In Colorado, water rights are property rights, which can be freely changed, subject to a non-injury standard. The Water Right Determination and Administration Act of 1969, § 37-92-101 et seq., C.R.S. (1990 & 1996 Supp.), requires the holder of a water right who wants an enforceable priority date to adjudicate the water right in water court. § 37-92-302 (1) (a). The Act allows the holder of a junior water right to adjudicate a water right so long as no injury occurs to other existing water rights.

The state engineer and division engineers are responsible for administering and distributing the waters of the state based on priorities. § 37-92-301 (1) and (3). This includes protecting water to a water right's decreed point of diversion and, in the case of storage releases or recharge

projects, delivering it to a beneficial use within Colorado. Examples of this could be the Tamarack Ranch and Pony Express State wildlife recharge projects. The division engineer has authority to protect the return flows from the recharge projects, which have a first beneficial use of wildlife and augmentation on the State Lands and then subsequently route water for beneficial uses close to the state line. Depending on the actual location of any project in the Lower South Platte River, diversion structures may have to be modified and measuring devices installed to assure that water can be delivered to the downstream point of beneficial use in Colorado. Transit losses would be assessed based upon river conditions at the time of delivery.

Existing Colorado law provides several possible mechanisms for protecting water to the state line. First, the Colorado Water Conservation Board would appropriate or acquire instream flows in Colorado to the state line. Colorado's instream flow statute, § 37-92-102 (3) & (4), C.R.S. (1990 & 1996 Supp.), vests the CWCB with the exclusive authority to obtain a decree adjudicating a water right for instream flows in a stream channel between specific points. The Board is empowered to appropriate such water or to acquire such water, water rights, or interests in water as it determines may be required for minimum stream flows to preserve the natural environment to a reasonable degree. Id. Under section 102 (3) (c), the Board must find, specifically,

> that the natural environment will be preserved to a reasonable degree by the water available for the appropriation to be made; that there is a natural environment that can be preserved to a reasonable degree with the board's water right, if granted; and that such environment can exist without material injury to water rights.

Section 102 (3) also provides that the Board is not authorized "to deprive the people of the State of Colorado of the beneficial use of those waters available by law and interstate compact."

Thus, to protect flows to the state line, the Board would have to determine that the amount and timing of flows was necessary to preserve the natural environment to a reasonable degree in Colorado and that doing so would not deprive the people of Colorado of the beneficial use of water available under the South Platte River Compact.

Another possible way to deliver additional water to Nebraska for the endangered species would be for some entity to appropriate or acquire water, water rights, or interests in water to be transported to and used in Nebraska. However, it is unlawful to divert, carry or transport any surface or ground water out of the state without complying with Colorado's export statute, § 37-81-101 et seq., C.R.S. (1990), which established standards for approving exports. The statute applies to the transportation of water from the state by any means, including natural streams or watercourses. § 37-81-101 (2). Depending on the source of water, the would-be exporter must file an application with and receive approval from the State Engineer, Ground Water Commission or water court. Id. Since the export statute has never been used, this would be a case of first impression.

A third option would be for Colorado to enact new legislation expressly authorizing the protection of water to the state line to benefit endangered species in Nebraska. If this alternative is selected by the Governance Committee and the water is proposed to be protected, the existing statutes would have to be changed. Any proposed change to the Export Statute would face stiff opposition in the State since it affects other Compacts throughout Colorado. Colorado would only consider changing the law if no other alternative is available to meet Colorado's obligation.

It is important to recognize that even water that is not legally protected to the state line may still reach it anyway depending on the location and timing. If a proposed project is located close to the state line, where no Colorado water user will have the opportunity to divert the water, this water will unavoidably result in changes in the timing of flows at the state line, for which Colorado may receive credit in a Platte Basin Endangered Species Recovery Program. Tracking and accounting of the recharge rates and subsequent return flow rates would have to be done by someone other than the State Engineer's Office. Depending on the actual location of any project in the lower river, diversion structures may have to be modified and measuring devices installed. If the water is not protected then Colorado would keep track of any water that is not diverted by vested water users. It should be noted that we are considering the possibility of tracking the use of any water that is diverted by any irrigation system. This tracking of the irrigation diversions would be done by someone other than the State Engineer's Office and is envisioned to happen if only a few diverters are involved. It is Colorado's position that if the water is new retimed water that any return flows that can be quantified should be credited towards the program. The tracking of any return flows to the river from the original recharge efforts and including subsequent return from any irrigation diversions would be reported to the State Engineer's Office.

The existing accounting of the State Engineer's Office would need to be revised to track the Tamarack Plan Water that moves through the lower reaches of the river. This would require making minor additions to our existing tracking system to specifically track this water.

V. Water Movement through the Hydrologic System

Water movement through the hydrologic system refers to effects on conserved or additional water as it flows downstream to the critical habitat. Depending on how a project is operated there are options for management, storage, and delivery that could maximize benefits for the critical habitat.

Conserved water or retimed water suffers losses en route to the critical habitat. Additional water flowing through the system as a result of an alternative is subject primarily to evaporation, seepage, and diversion losses. Depending on the water rights status associated with a project, diversion losses may or may not apply. If the additional water generated by a project can be protected there are no downstream diversion losses. However, if a project cannot be protected additional water will suffer diversion losses as is moves downstream through the system.

The primary method to increase a project's reductions to target flow shortages is to re-regulate additional water through the Lake McConaughy EA. As indicated in Section D of Attachment II of the Cooperative Agreement, "It is an operational goal to coordinate upstream conservation activities so as to increase storage in the Environmental Account." For projects that are upstream of Lake McConaughy, the EA could be used to re-regulate additional or retimed water provided storage space is available. Projects in Wyoming that are located on the North Platte River above Lake McConaughy can be easily re-regulated through the EA. The EA could also be used to re-regulate additional program water downstream of Lake McConaughy through exchanges, however, the EA may not always be available to re-regulate downstream projects. Users downstream of Lake McConaughy such as CNPPID and/or NPPD could divert the additional water generated by an alternative in exchange for reduced releases, which would result in corresponding increases in the EA. South Platte and Platte River exchanges for projects downstream of Lake McConaughy are less certain because of minimum flow requirements and the requirement that water be of use to CNPPID and NPPD. The opportunity for such exchanges is greater if a project, such as water leasing, is already associated with Lake McConaughy storage.

It may be possible to use storage accounts in other reservoirs to re-regulate Program water to enhance benefits at the critical habitat. For example, a temporary storage contract in Glendo Reservoir would most likely be needed to store seepage losses attributable to PEPL's storage account in La Prele Reservoir so that water can be released during periods of shortage. Likewise, temporary water leasing in Wyoming is more effective if it is tied to storage water. For example, there may be opportunities to lease water from the Kendrick Project and potentially store that water in an environmental account in Seminoe Reservoir.

VI. Summary

The Program is based on an incremental approach to achieve the goal of providing 130,000 to 150,000 ac-ft per year over the next 10 to 13 years. A portion of the instream flow objectives will be met through the Lake McConaughy EA, the Pathfinder Modification Project, and the Tamarack Plan. The primary purpose of the Water Action Plan with respect to the Program is to identify ways of reducing the remaining target flow shortages. The three states have identified 13 projects for inclusion in the Water Action Plan. These projects consist primarily of reservoir, groundwater management and recharge, agricultural leasing and conservation, and power interference projects.

A. Estimated Yields

The estimated yields at the critical habitat associated with the 13 projects are summarized in Table VI-1. These yields are based on model runs using the water budget. The EIS team has modeled the combined effects of the three state's projects and the 13 projects included in the Water Action Plan. Recent EIS team modeling of the three states' projects, which include the Lake McConaughy EA, Pathfinder Modification Project, and the Tamarack Plan indicate a score of about 80,000 ac-ft per year of average reductions to target flow shortages. The total score associated with the three state's projects and all 13 projects included in the Water Action Plan is 144,000 ac-ft/yr (EIS team memo, May 4, 2000). As stated in their May 4, 2000 memo, the EIS team recommends the WAPC consider the "true score" to be in the range of approximately 135,000 to 137,000 ac-ft/yr to account for additional losses not captured in the current models.

B. Cost Estimates

The initial and annual costs associated with each project are summarized in Table VI-1. The total up-front capital costs associated with the 13 projects range from 8.0 to 11.9 million. A financial analysis of the total funding requirements through the first increment has also been completed. To determine the total funding requirements through the first increment the annual operations and maintenance costs for 13 years of use were estimated and an equivalent present value cost was computed using a six-percent discount rate. The up-front capital costs were added to the present value of annual costs to obtain a total capitalized cost. The estimated total capitalized cost of the 13 projects ranges from $36.9 to $68.8 million, as summarized in Table VI-1. To provide distinction for projects that have an infrastructure value beyond the first increment, the total cost and unit cost of each project in year 14, which is the first year of the second increment, is included in Table VI-1. For example, the costs of a reservoir project in year 14 consist only of operations, maintenance, and replacement costs because the initial capital costs are included in their entirety in the first increment. However, the cost of an agricultural leasing project in year 14 is assumed to be the same as it is in year 1 because there are no large capital construction costs associated with this type of project.

Table VI-1
Water Action Plan
Summary Table[8]

Project	State	Initial Cost ($)	Annual Cost ($)	Present Value of Annual Cost through the First Increment[5] ($)	Present Value of Total Cost through the First Increment ($)	Estimated Yield at Critical Habitat (ac-ft)	First Increment Unit Cost ($/ac-ft)[6]	Year 14 Total Cost ($)	Year 14 Unit Cost ($/ac-ft)
1. CNPPID Reregulating Reservoir (min. yield	Nebraska	$2,450,000 - $4,610,000	$78,000 - $255,000	$690,000 - $2,258,000	$3,140,000 - $6,868,000	4,000	$790 - $1,720	$78,000 - $255,000	$20 - $60
CNPPID Reregulating Reservoir (max. yield	Nebraska	$3,390,000 - $6,370,000	$108,000 - $352,000	$956,000 - $3,120,000	$4,350,000 - $9,490,000	5,500	$790 - $1720	$108,000 - $352,000	$20 - $60
2. Water Leasing	Nebraska		$661,000 - $1,489,000	$5,852,000 - $13,182,000	$5,852,000 - $13,182,000	7,000	$840 - $1,880	$661,000 - $1,489,000	$90 - $210
3. Water Management Incentives[3]	Nebraska		$620,000 - $2,500,000	$5,489,000 - $22,132,000	$5,489,000 - $22,132,000	7,000	$780 - $3,160	$620,000 - $2,500,000	$90 - $360
4. GW Management [1]	Nebraska								
Active Pumping		$590,000	$14,000	$124,000	$714,000	1,400	$510	$14,000	$10
5. North Dry Creek/Fort Kearny Cutoffs	Nebraska								
Lost Ck/North Dry Ck Cutoff		$330,000	$86,200	$763,000	$1,093,000				
Lost Ck/Ft. Kearny IPA Cutoff		$333,000	$6,000	$53,000	$386,000				
Subtotal		$663,000	$92,200	$816,000	$1,479,000	4,400	$340	$92,200	$20
6. Dawson/Gothenburg Canal GW Recharge	Nebraska								
Gothenburg Canal GW Recharge		$13,800	$38,000	$336,000	$349,800				
Dawson Canal GW Recharge		$13,800	$51,700	$458,000	$471,800				
Subtotal		$27,600	$89,700	$794,000	$821,600	1,800	$460	$89,800	$50
7. Power Interference[2]	Nebraska		$162,700	$1,440,000	$1,440,000	1,400	$1,030 [2]	$162,700	$120
8a. Net Controllable Conserved Water	Nebraska		$0	$0	$0	500	$0	$0	$0
8b. Net Controllable Conserved Water	Nebraska		$305,000	$2,700,000	$2,700,000	4,500	$600	$305,000	$70
9. Pathfinder Municipal Account	Wyoming		$228,000	$2,018,000	$2,018,000	4,800	$420	$228,000	$50
10. Glendo Storage[4]	Wyoming		$13,250 - $198,750	$117,000 - $1,759,000	$117,000 - $1,759,000	2,650	$40 - $660	$13,250 - $198,750	$5 - $75
11. Water Leasing	Wyoming		$279,000	$2,470,000	$2,470,000	3,900	$630	$279,000	$70
12. LaPrele Reservoir	Wyoming		$318,500	$2,820,000	$2,820,000	2,200	$1,280	***	***
13. GW Management (Tamarack III)	Colorado	$4,241,000	$403,000	$3,568,000	$7,809,000	17,000	$460	$403,000	$20
Total/Average		**$8.0 - 11.9 million**			**$36.9 - $68.8 million**	**62,550 - 64,050**	**$580 - $1070**	**$2.9 - $6.1 million**	**$47 - $95**

Notes:

1: Potential groundwater management projects include active pumping, dry-land farming, conversion to groundwater irrigation and conjunctive use.
Only one of these projects is necessary to yield 1,400 ac-ft, therefore, only the costs associated with active pumping have been included in the total.
The estimated annual cost associated with passive lowering of the groundwater table with dry-land farming ranges from $112,000 to $266,000.
The estimated capital cost associated with conversion to groundwater irrigation is $60,000. This does not include costs to improve irrigation equipment if necessary.
The estimated capital cost associated with a conjunctive use project is $161,000, with an annual operations and maintenance cost of $5,900.

2: The annual costs associated with power interference include NPPD's generation costs but not transmission, operation and maintenance costs for replacement power.

3: Water management programs consist of conservation cropping, deficit irrigation, land fallowing, and on-farm irrigation changes. The costs presented provide the range for these projects.

4: The cost for Glendo storage is based on costs to lease Glendo storage water under temporary water service contracts, which range from $5/ac-ft/yr for irrigation uses to $75/ac-ft/yr for municipal and industrial purposes.

5: The present value of annual costs is based on a period of 13 years, which corresponds with the First Increment, and a discount rate of 6 percent. These costs may need to be adjusted once implementation schedules are better defined. Replacement costs were not included.

6: The unit cost equals the present value of total cost divided by the yield.

7: The minimum and maximum costs are based on the North Plum Creek and Jeffrey Canyon Reservoirs, respectively.

8: Costs to mitigate potential third party impacts are not included.

*** PEPL will no longer have an annual debt service payment after the remaining principal payment on the loan is paid off. After the remaining pricipal is paid off the annual cost per ac-ft may change.

It is important to note that the annual costs may not be incurred for the entire 13 years of the first increment. As discussed below, some projects will likely be phased in and other projects will take several years to implement. The present value of annual costs during the first increment will depend upon the time and level of implementation. There is considerable uncertainty regarding the implementation schedules, therefore, the present value of annual costs was based on the entire first increment, or 13 years. The total capitalized costs presented in Table VI-1 may be less depending on when projects are implemented and how many years annual costs are incurred. The funds for the Program are scheduled to be provided throughout all of the first increment. When potential schedules and costs are better defined, schedules will need to be reassessed and possibly modified strictly for cash flow reasons. This is further discussed in section E.

C. Legal and Institutional Issues

There are specific legal and institutional requirements related to each individual project, however, some generalizations can be made regarding the legal requirements in each state. In Nebraska for example, Section 46-252 provides for the protection of water for the purposes of instream beneficial uses. It is possible that additional water generated by several Nebraska projects included in the Water Action Plan will be protected under Section 46-252. In the case of agricultural conservation and leasing projects in Nebraska there is currently no existing legislation that addresses these programs. New legislation would be required to implement a leasing program in Nebraska. In general, permits would be required from the Nebraska DWR to implement any project in Nebraska. In Wyoming, secondary supply water rights would be required from the Wyoming State Engineer to ensure the protection of additional water downstream to the Wyoming/Nebraska state line. In addition, the Wyoming State Engineer and Legislature must approve any exports. Any partial change of use needed for water to be used for downstream environmental purposes in the critical habitat would need to be secured from the Wyoming Board of Control. It is likely that an amendment to existing legislation would be required to lease agricultural water rights or La Prele Reservoir water as the existing statute, 41-3-110, only provides for leases up to two years. In Colorado, in-state wildlife enhancement benefits must be decreed for water generated from recharge projects to be protected within Colorado. Such water may then reach Nebraska, where it can be delivered to the associated habitats. For all three states NEPA compliance and site-specific environmental permits may be required for the construction of any infrastructure depending on site impacts.

D. Third Party Impacts

Third party impacts were identified and discussed qualitatively. Third party effects that have been considered include hydrologic, economic, environmental and socioeconomic impacts. Third party hydrologic impacts on existing surface and groundwater users are due primarily to changes in the timing and quantity of water in the river. Diversions, storage releases, and return flows alter the quantity and timing of water available to downstream users. Third party economic impacts related to agricultural conservation and leasing programs are related primarily to effects on agricultural equipment suppliers, farm workers, processing industries and local communities that depend on agriculture. The economy in the study area is dependent on agriculture to a large degree in which case economic and fiscal conditions are impacted by changes in crop patterns and crop production. Some projects, including reservoir and recharge projects, provide an increase in recreational opportunities. Third party environmental impacts for most projects can be both positive and negative as they relate to water quality. Water quality could improve during the summer months when

additional flows are added to the river, and degrade during the winter months when river flows are reduced.

E. Implementation Schedule

The states were requested by the WAPC to develop implementation schedules for their projects as shown in the second column of Table VI-2 below. These schedules are estimated times to implementation from the start of the Program, or if action to implement the alternative does not commence until sometime after the first year of Program implementation, the estimated time to complete implementation once it has begun. The third column of Table VI-2 provides the estimated times used in the analysis of funding requirements presented below.

Table VI-2
Implementation Schedule

Project	Years to Implement	Assumed Time Required
CNPPID Re-regulating Reservoir	5-7	7
Water Leasing in Nebraska	4-?.	4
Water Management Incentives	3-?	3
Groundwater Management (Nebraska)	2	2
North Dry Creek/Ft. Kearny Cutoffs	1-2	2
Dawson/Gothenburg Canal GW Recharge	2-4	4
Power Interference	2-4	4
Net Controllable Conserved Water	0-2	2
Pathfinder Municipal Account	3	3
Glendo Storage	2	2
Temporary Water Leasing in Wyoming	5	5
La Prele Reservoir	5	5
Groundwater Management (Tamarack III)	5	5

Note: Groundwater management in Nebraska will be phased in over several years. Tamarack III will be phased in and fully implemented after 5 years.

All projects included in the Water Action Plan are capable of extending through the first increment. There are some projects that could potentially extend well beyond the first increment because of the infrastructure in place, while other projects, such as water leasing are subject to annual or periodic extensions.

Two of the basic ways to evaluate funding requirements for the program are: 1) Escalate the initial and annual costs to the year in which the costs are estimated to occur to account for inflation and compute the total cost that might be incurred in each year of the first increment of the Program; and 2) Compute the discounted funding required assuming that funds are set aside in the first year of the Program. Both analyses assume that funds are required in accordance with the implementation schedule shown in Table VI-2 above. The analyses also assume a three (3) percent compound annual rate of inflation. Since Table VI-1 presents a range of initial and annual costs for several projects, two figures are shown below to present the low and high range of costs. Under the first approach, the total funding required, including inflation, would range from approximately $50 million to $90 million for the low and high ranges, respectively.

Figure 3: Low Range Costs with Inflation

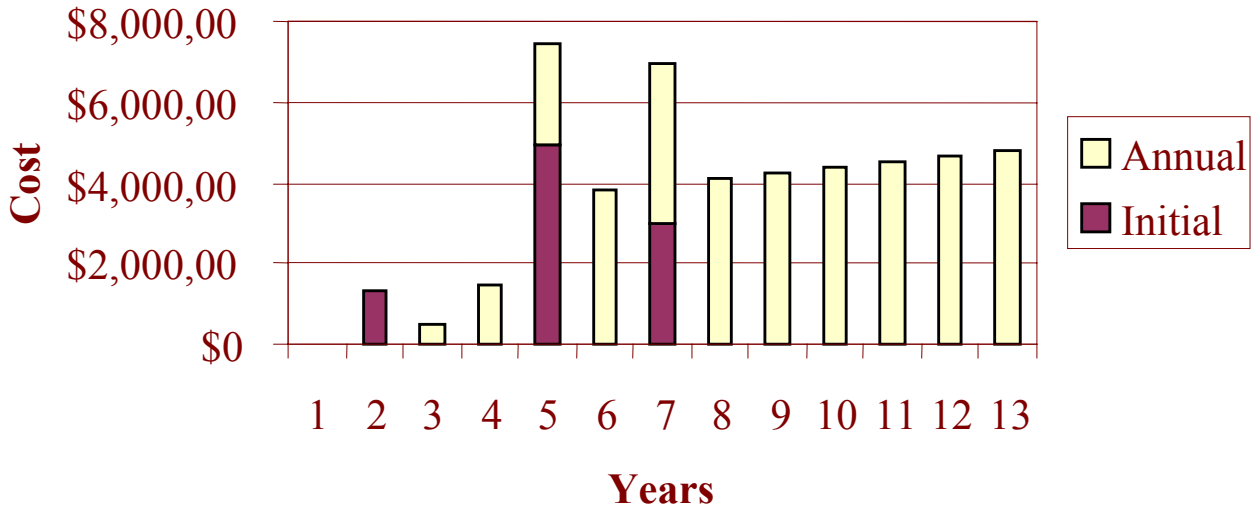
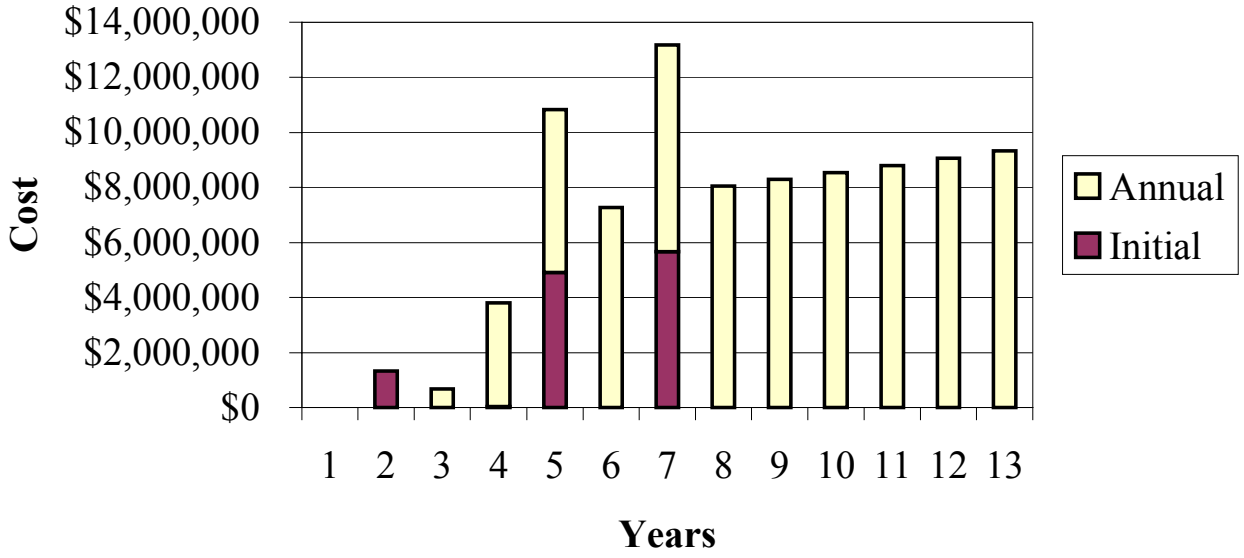


Figure 4: High Range Costs with Inflation



The second approach to evaluating funding requirements is to discount the costs expected to be incurred each year of the thirteen-year first increment to the same base year. Using a six percent discount rate, the Program's up-front funding requirement would be approximately $30 million for the low range costs and $55 million for the high range costs.

The information presented above is based on reconnaissance-level cost estimates and very general assumptions regarding when specific projects and programs would be implemented. Feasibility studies, final design, permitting, and the resolution of legal and institutional requirements will be necessary before the implementation of any project can proceed.