Water Resources Appendix

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Hydrology Appendix

1.0 Introduction

The Platte River drains parts of Colorado, Wyoming, and Nebraska. The river, which has been extensively developed for agriculture and municipal uses, contains 15 major dams, and provides water supplies for about 3.4 million people. Existing facilities on the river also provide hydroelectric power, flood control, recreation, and fish and wildlife habitat. The Platte River also provides essential habitat for endangered or threatened species, including the piping plover, whooping crane, least tern, and pallid sturgeon—the four "target species" discussed in the draft programmatic environmental impact statement (DEIS).

The Federal action considered in this DEIS is implementation of the first phase (10-13 years) of a Recovery Implementation Program to benefit four threatened and endangered species and their habitat in and along the Platte River in Nebraska. In 1997, the States of Nebraska, Wyoming, and Colorado and the Department of the Interior signed a *Cooperative Agreement for Platte River Research and Other Efforts Relating to Endangered Species Habitats Along the Central Platte River, Nebraska*. In this agreement, the signatories committed to pursue a basinwide, cooperative effort to improve and maintain habitat for the four endangered species using the Platte River in Nebraska.

The process of improving and maintaining habitat involves reversing or minimizing habitat changes that have reduced the value of the Central Platte for the target species. The Fish and Wildlife Service has assessed the needs of the three bird species for Platte River channel and adjacent habitat in the Central Platte Valley and identified various potential habitat changes to improve conditions for the target species. These changes include:

1. **Maintain broad, shallow, river with clear sand bars.** Historically, high spring peak flows, combined with a large sediment load in the river, maintained a broad river channel clear of vegetation except for some high islands. Maintaining or increasing spring peak flows, within existing channel capacity, can help maintain or increase the amount of open, unwooded channel, providing more low sandbars for crane roosting and tern and plover nesting.

2. **Increase sediment supply and transport.** Historically, the Central Platte carried a substantial load of sediment. Sediment has been reduced, primarily by dams on the North Platte. Restoring some of the sediment supply to the river can help maintain a broader, shallower river channel.

3. **Regulate the river to produce certain flows** for optimal species use or habitat development.

    - Crane roosting: Spring roosting flows, March 23 – May 10: 2,400 cfs.
    - Tern and Plover nesting: High May and June flows, greater than 3,000 cfs, to keep

initiation of nesting on higher ground to protect nests from subsequent inundation.

- Tern foraging: Adequate minimum flows to maintain a diverse fish community, providing forage fish for terns during nesting season. May 11– September 15: 1,200 cfs.
- Pulse flows for sediment transport and vegetation management.

4. **Clear channel islands and banks**: Due to changes in flow patterns and sediment load, woody vegetation has encroached upon the historic Platte River channel, substantially narrowing the river channel. Many channel islands and river banks are "armored" with trees and shrubs and can no longer be eroded by even high river flows. Clearing these areas would create better roosting and nesting habitat for cranes, terns, and plovers and may move sediment back into the zone of erosion and deposition, allowing for a wider, shallower river.

5. **Reduce disturbance on roost, nest, and while foraging**: Some activities along the river at some times of the year have the potential to disturb roosting or nesting target species. Through land acquisition, easements, or leases, these activities can be managed to reduce disturbance of the species whether they are roosting, nesting, or foraging.

6. **Protect/increase wet meadows for crane foraging**: The extent of wet meadows, which are especially important for crane forage, has been reduced substantially. These areas can be protected and, in some cases, restored through clearing, changes in land use, or through other means.

Changes 1, 3, and 6 have the most impact on the hydrology of the Platte River Basin and there are two parts to each of these three changes. The first part is the acquisition of the water needed to achieve the change and the second part is the management of the water. The DEIS evaluates various alternatives for acquiring and managing water for the benefit of the four target species.

The simulation of the hydrology for this DEIS required the use of three hydrologic river models, the stream flow depletion model SDFView, and many preprocessing and post-processing programs and spreadsheets. Each of the three hydrologic river models will be discussed in this appendix. The various alternatives will be described and the results will be discussed.

2.0 Hydrologic Models

As mentioned above, the simulation of the hydrology for this DEIS required the use of three hydrologic river models. These include models for the North Platte River, the South Platte River, and the Central Platte River. The North Platte River model simulates the North Platte River from the inflow to Seminoe Reservoir to the inflow to Lake McConaughy. The South Platte River model simulates the South Platte River from Chatfield Reservoir to Julesburg, Colorado. The Central Platte River model simulates the North Platte River from the inflow to Lake McConaughy to the confluence of the North and South Platte Rivers, the South Platte River from Julesburg, Colorado to the confluence of the North and South Platte Rivers, the Platte River from the confluence of the North and South Platte Rivers to the mouth of the Platte River at Louisville, Nebraska. Therefore, the operation of the North and South Platte River models is necessary for the operation of the Central Platte River model.

2.1 North Platte River EIS model

The North Platte River EIS model (NPREIS) is based on the OPSTUDY program developed by Fred J. Otradowsky (1986) of the Bureau of Reclamation Kansas-Nebraska Projects Office in Grand Island, Nebraska. The NPREIS model is programmed to simulate reservoir operations, natural flow segregation, storage ownership accounting, and operation of the river below Guernsey Reservoir, while providing flow estimates at various points on the North Platte River.

The NPREIS is a water balance and accounting model that uses a monthly time step and operates on a water year (October - September). The model begins its simulation at the inflow to Seminoe Reservoir in south-central Wyoming and the simulation ends at the inflow to Lake McConaughy (Lewellen, Nebraska). The NPREIS requires four input files to define the hydrologic and power generation characteristics of a model scenario and produces thirteen output files that contain the results.

2.1.1 Model Structure

The NPREIS is organized according to the four sections each representing a function performed by the model. These are the physical reservoir operations, the natural flow accounting, the storage ownership accounting, and the operation of the North Platte River below Guernsey Reservoir and above Lewellen, Nebraska.

In the physical reservoir operations subroutine, the North Platte facilities are operated beginning with the most downstream reservoir and working upstream. The inflow, outflow, power generation, evaporation, and end of month contents for each reservoir and power plant are calculated in this section. This subroutine also ensures that the minimum flows in critical river reaches are maintained.

For natural flow accounting, the model takes the physical inflows that occur during the irrigation season (May-September) and calculates the total natural flow available to meet irrigation demands. The total available natural flow is distributed among irrigation districts as set forth in the North Platte Decree. Any portion of a demand not fully satisfied from the natural flow must be satisfied from storage if the irrigation district has a storage contract with Reclamation.

When performing the storage ownership accounting, the model determines the accrual, the end of month content, the evaporation, and the storage deliveries for each ownership account. Water available for accrual in the non-irrigation season (October-April) is equal to the total inflow above Guernsey Reservoir; and the water available for accrual in the irrigation season is equal to any unused portion of the natural flow. Water is accrued to each ownership account according to its priority and the physical location of the reservoir. The storage deliveries assigned in the natural flow accounting are passed to storage ownership accounting, where they are delivered from the appropriate ownership account.

During the operation of the North Platte River below Guernsey Reservoir and above Lewellen, Nebraska, the model takes the Guernsey Reservoir outflow, accounts for reach gains, models irrigation deliveries from the river, and computes the flow at various points on the river. It also determines the water returning to the river from irrigation deliveries and adjusts the gains to the river accordingly.

A discussion of the forms of input and output data employed by the program is given in the original OPSTUDY documentation prepared by Otradowski in 1986. A complete listing of the FORTRAN code for the program a listing of all input data files used in this EIS are on a CD/ROM included at the end of this appendix.

The following is a qualitative discussion of the NPREIS. It is essentially a qualitative summary of the computational procedures in the NPREIS, including the 4 main computational subroutines. The purpose of the NPREIS was to evaluate Reclamation projects on the North Platte River for the potential to affect threatened and endangered species in central Nebraska. Details are given in the *North Platte River Water Utilization Model Documentation*, dated June 1997, prepared by the U. S. Bureau of Reclamation Wyoming Area Office, Mills, WY, hereafter referred to as the *Model Documentation*. This discussion describes how the model computations were carried out.

2.1.2 Hydrologic Data Input

The NPREIS has 3 main input files. These are: Physical Reservoir Operations, Natural Flow Accounting, and Storage Accounting. Discussions of these files and the information contained in each follow.

2.1.2.1 Physical Reservoir Operations Input File.

The Physical Reservoir Operations input file contains the data to operate the North Platte system based on physical parameters. These can be grouped as: reservoir parameters, delivery/irrigation parameters, return flow timing parameters, rules for the movement of water between Seminoe and Pathfinder Reservoirs, gain utilization parameters, Glendo low flow outlet control, Pathfinder-Fremont Canyon bypass control, power plant availability parameters, and various “flags” which are used to select or de-select operational options.

2.1.2.2 Natural Flow Accounting File.

The storage and natural flow accounting input file contains the data to calculate natural flow available at Tri-State Diversion Dam and to segregate storage and natural flow demands. The data can be grouped as: natural flow rights and contracts for storage, distribute natural flow below Tri-State Dam by appropriation control, natural flow section gains and losses set by the North Platte Decree, historic irrigation deliveries, factors to distribute gains in the Tri-State-to-Lewellen reach, irrigation re-use factors, and quantities for well irrigation.

2.1.2.3 Storage Ownership Input File.

The storage ownership accounting input file contains the data necessary to track water accrued to and delivered from the ownership accounts. The data can be grouped as: ownership parameters, Excess-to-Ownership (ETO) options, irrigation efficiencies, options that control environmental water accrual, and various flags.

2.1.3 Computations

The NPREIS was developed to simulate 1997 levels of operation on the North Platte River. This includes the operation of seven dams and reservoirs (Seminoe, Kortes, Pathfinder, Alcova, Gray Reef, Glendo, and Guernsey); power generation at six generation units (Seminoe, Kortes, Fremont Canyon, Alcova, Glendo, and Guernsey); water rights and storage for Lakes Alice, Little Alice, Winters Creek, and Minitare (hereafter referred to as "the Inland Lakes"); gauged inflows from the Medicine Bow River, North Platte River above Seminoe Reservoir, Sweetwater River, Deer Creek, Laramie River, and Blue Creek; reach gains defined by reservoir placement (Kortes-Pathfinder, Alcova-Glendo, Glendo-Guernsey, Guernsey-Whalen, Whalen-Tri-State, and Tri-State-Lewellen); and return flows determined from diversion amounts. In addition to current levels of operation, procedures were included that allow greater flexibility and analysis when modeling and comparing scenarios. The model incorporates operational criteria that reflect the 1997 operation of the river. These criteria do not exactly simulate the historic operation since no operating criteria exist to accurately describe the system over an extended period. These criteria illustrate how the system would function given present operations and management practices employed on the river.

The computations are performed in four steps: Physical Operation of the North Platte River Reservoirs, Natural Flow and Storage Flow Accounting, Storage Ownership Accounting, and Operation of the River Downstream of Guernsey Dam. These steps are discussed in the following paragraphs. Detailed discussions of the computations can be found in the *Model Documentation*.

2.1.3.1 Physical Operation of the North Platte River Reservoirs.

This section discusses the criteria utilized by the model to control the physical reservoir system of the North Platte River. The criteria that have been developed include; how to move water between reservoirs, target contents for controlled reservoirs, reservoir evaporation, and how/when to release water.

The model operates the physical system by storing inflows in vacant storage space and releasing water for demands. The model determines the total demand below Guernsey Reservoir for the given month and computes the required Guernsey Reservoir outflow needed to satisfy this demand.

Once the Guernsey Reservoir outflow has been established, the model operates the reservoirs on the North Platte River beginning with Guernsey Reservoir and continuing upstream to Seminoe Reservoir until inflows, outflows, and end-of-month contents are determined for each reservoir. The model establishes the operation of each reservoir based on demands, inflows, and operational criteria, without violating minimum and maximum reservoir capacities. In addition to staying within operating capacity, all reservoirs have targets or other operating criteria that determine reservoir storage and water movement. For example, the model attempts to balance the storage in Seminoe and Pathfinder Reservoirs during June through September.

Reservoir spills and dry reservoirs can not be handled using normal operating criteria. Reservoir spills occur when a reservoir is full and inflows are greater than the outflow capacity. During a spill, the outlet and spillway capacities are maximized and the excess water is passed to the next downstream reservoir until the spill is either captured or spilled from Guernsey Reservoir. If a reservoir runs dry and the inflow to the reservoir is insufficient to meet demands and there is no storage upstream of the reservoir, the model reoperates each reservoir starting at Seminoe and working downstream to Guernsey. During this reoperation, the model only stores what is needed to maintain each reservoir at its minimum storage and the remainder is passed downstream to the next reservoir. This process is repeated until the Guernsey Reservoir outflow is determined. This newly computed Guernsey outflow becomes the total amount of water available to meet demands below Guernsey Reservoir and is the basis for the natural flow and storage ownership accounting performed that month.

The model also calculates the amount of water, stored above Alcova, to move to Glendo Reservoir during the non-irrigation season. The water is used to generate power at the Seminoe, Kortes, Fremont Canyon, and Alcova power plants, and is re-stored in Glendo Reservoir. By moving less water than the maximum possible, storage space will remain in Glendo Reservoir when the irrigation season begins. This storage space can be used to store high gains that often occur below Gray Reef Dam early in the irrigation season. This restored water is often called excess-to-ownership (ETO).

After the operation of Seminoe Reservoir, the physical operation of the reservoirs for one month has been completed. Water has been released downstream to meet demands, inflows not used to meet downstream demands have been stored in vacant storage space, and excess water above the capacity of reservoirs or specified targets contents has been passed downstream as necessary. No consideration has been given to meeting ownership criteria at this time; this is done elsewhere in the model.

Physical Reservoir and Storage Ownership Evaporation. Evaporation is simulated for Seminoe, Kortes, Pathfinder, Alcova, Gray Reef, Glendo, and Guernsey reservoirs and the Inland Lakes. Evaporation is simulated with average evaporation factors (calculated from historic evaporation factors) and the current area-capacity relationship for each reservoir. Storage ownership evaporation is also modeled using these factors. Evaporation is modeled for all ownerships held on the main stem of the North Platte River. For all calculations of ownership evaporation, water is assumed to be stored in the reservoir of ownership. For example, all Kendrick Seminoe ownership is assumed to be stored in Seminoe Reservoir.

Power Generation/Reservoir Releases. The NPREIS power generation subroutines utilize the same method of computing monthly power generation, outlet works releases, and spillway releases as the corresponding subroutines in Reclamation's North Platte River Annual Operating Plan (NPRAOP) model. The NPRAOP Model is used by Reclamation's Wyoming Area Office to produce the Annual Operating Plan for Reclamation Facilities on the North Platte River.

The method uses lookup tables which relate average reservoir content to megawatt hours per acre-foot of turbine release, to the maximum release rate in cubic feet per second, and to generation capacity. Maximum turbine discharge in KAF/month is determined using the megawatt hours per acre-foot factor, the maximum release rate, and a power plant availability factor. The total volume of reservoir release minus the turbine release determines the total turbine bypass and monthly generation is calculated from the actual turbine release.

2.1.3.1.1 Physical Reservoir and Storage Ownership Evaporation..................................... 7
Natural flow is distributed below Tri-State diversion dam by priority according to the water appropriation laws of Nebraska. 9

Natural Flow and Storage Flow Accounting. The Natural Flow section of the NPREIS simulates the natural flow/storage flow segregation and distribution procedures performed by Reclamation. These procedures are set forth in the Storage Ownership and Natural Flow Accounting Procedures agreed to every year by Reclamation, Wyoming, and Nebraska, and summarized in the following paragraphs.

Accounting of natural flow in the North Platte River and distribution to Wyoming and Nebraska appropriations is only performed during the May-September irrigation season. During this time, available natural flow is determined on a monthly basis and distributed to the appropriate Wyoming and Nebraska canals in amounts set forth by the North Platte Decree. Irrigation demands are satisfied with the available natural flow before water is requested from storage. Any portion of the available natural flow that occurs above Guernsey Reservoir and not used to satisfy irrigation demands is available for accrual to storage ownership.

The calculation of natural flow begins at Gray Reef Dam and proceeds downstream to determine the natural flow available at Tri-State diversions Dam. These calculations are based on the methods and procedures for calculating natural flow that are in the annual Storage Ownership and Natural Flow Accounting Procedures agreements.

The available natural flow is distributed to Wyoming and Nebraska canals as set by the North Platte Decree. If any portion of one state's share of the available natural flow is not consumed, it is available for use by irrigators in the other state. The natural flow allocated to each canal is determined by the priority, size, and number of its appropriations and by the water diverted. Canals that receive water from a Reclamation reservoir have a storage contract that controls how much water the canal may receive during a water year.

Due to daily fluctuations within the system, accurate simulation of the daily distribution of the natural flow is difficult using monthly quantities. This would affect calculations of natural flow, storage deliveries, ETO, and system gains and losses.

Storage Ownership Accounting. The Storage Ownership Accounting section simulates Reclamation's storage ownership accounting on a monthly basis. The Storage Ownership Accounting Procedures are modeled for all ownerships including environmental ownerships. Accrual and storage of water are computed separately for each ownership. Accrual is determined according to the priority and location of projects and facilities on the North Platte River. This section of the model also balances the physical reservoir storage with the ownership storage.

Ownership accruals are operated according to priority and location. Water in a reach is available to any ownership that accrues water downstream of the reach as long as another storage right with a senior priority is not violated.

The excess-to-ownership account is kept only by agreement between Reclamation, Wyoming, and Nebraska. The water available to the excess-to-ownership account is any water remaining in the system after removing natural flow and filling all storage ownerships downstream of the reach in which the excess occurred. This water is held in the system and used to replace evaporation lost from the ownerships and to augment natural flow. Any excess-to-ownership water not used to replace evaporation from the ownerships is released to augment natural flow and be diverted before any ownership storage water is released.

Operation of the River Downstream of Guernsey Reservoir. The final phase of the NPREIS is to operate the North Platte River system below Guernsey Reservoir.

Historical reach gains were developed using historical gauged records. These historical reach gains include all water returned to the river from the drains; both irrigation return flow and storm water runoff. When an adjustment to the historical reach gain is made, it is intended that the portion of the reach gain associated with the irrigation return flow is adjusted, leaving the storm water runoff portion intact.

The model simulates the river below Guernsey Reservoir in an iterative fashion beginning with the flow below Guernsey Reservoir and continuing downstream to Lewellen, Nebraska. If the diversions within the reach are not identical to the historical demands, the historical reach gain is adjusted using the Glover method of calculating return flows. Otherwise, the adjusted reach gain will be equal to the historical reach gain. On the first pass through a reach, the model assumes that the available water in the reach will satisfy all the diversions in the reach. If a shortage of water is identified in the reach, i.e. the outflow from the reach is less than zero; the available water in the reach is apportioned amongst the appropriators in the reach to determine which diversions are shorted. If possible, the shortage is called from storage and the reach reiterated with the increased inflow. Otherwise, the reach is reiterated with the reduced diversion(s). This process continues until the outflow of the reach is greater than or equal to zero. Although the geographical location of the canals, ditches, and return flows within the reaches are not explicitly modeled, each reach maintains a water balance and the available water in each reach is appropriated according the priority dates of the water rights within the reach. Hence, all shortages reported by the model are according to priority, assuming the diverters in the reach were physically able to divert their apportioned water.

Natural flow is distributed below Tri-State diversion dam by priority according to the water appropriation laws of Nebraska.

Return Flows. The model employs an analytical method of computing return flow from irrigated areas as developed by Robert E. Glover, Professor of Civil Engineering at Colorado State University. The method developed by Professor Glover utilizes the hydrologic properties of the aquifer underlying the irrigated area, the distance between drainage channels, and the percolation to the ground-water reservoir. The model has been equipped with a subroutine called GLOVER that estimates return flows based on the Glover method. The GLOVER subroutine uses five input parameters to calculate return flow: transmissivity, storage coefficient or specific yield, reach width or drain spacing, initial condition recharge, and deep percolation from canal seepage and irrigation.

The model simulates return flows for the Kendrick Project, the Guernsey to Whalen reach, the Whalen to Tri-State reach, and the Tri-State to Lewellen reach. The return flows are used to adjust the historical reach gains entered in the model. If irrigation deliveries within a reach are identical to historic, then the historic reach gain will be used to compute the flow at the next accounting point. If the irrigation deliveries within a reach are not equal to historic, the model will calculate an adjusted reach gain. This adjusted reach gain is then used to calculate the flow at the next accounting point, revealing the change in flow to the reach from reduced or increased deliveries.

Inland Lakes. The Inland Lakes receive water through the Interstate Canal and are operated by the Pathfinder Irrigation District. Due to the limited capacity of the Interstate Canal, the Inland Lakes function is to store water and deliver water to lands irrigated by the Pathfinder Irrigation District as needed. These functions are simulated in the model.

2.1.4 Summary of Model Modification/Development

The basis for the North Platte River EIS (NPREIS) model was the North Platte River Water Utilization Model (NPRWUM) developed by the Bureau of Reclamation's Wyoming Area Office (WYAO) located in Mills, Wyoming. Copies of the NPRWUM and all associated documentation were obtained from the WYAO and the model was modified to allow the simulation of additional hydrologic scenarios necessary for this DEIS. As part of these modifications, significant amounts of documentation were added within the code to describe model operations.

2.1.4.1 Model specifications

The NPREIS model was developed using Digital FORTRAN 5.0; therefore, attempting to compile the program with another compiler (such as Lahey) may produce errors. In addition, the input and output structures were revised during the development of the NPREIS model and the NPRWUM input files **will not work** with the NPREIS model. Every effort has been made to duplicate all NPRWUM input files with new data files that are compatible with the NPREIS model.

Input to the NPREIS model consists of three files in addition to the file NPRAOP.TBL. The files may be named using up to eight alpha-numeric characters followed by the extensions *.rsv, *.flw, and *.soa for the reservoir operations, natural flow, and storage ownership input files. Output from the model consists of 13 files. These files are listed below.

Resop.lst	Reservoir operations output grouped by year.
Natflow.lst	Natural flow accounting output grouped by year.
Storown.lst	Storage ownership accounting grouped by year.
Resop.tab	Reservoir operations output grouped by subject (tabular output).
Natflow.tab	Natural flow accounting output grouped by subject (tabular output).
Storown.tab	Storage ownership accounting grouped by subject (tabular output).
Resop.txt	Reservoir operations output grouped by subject (comma delimitated tabular output for importation into Excel).
Natflow.txt	Natural flow accounting output grouped by subject (comma delimitated tabular output for importation into Excel).
Storown.txt	Storage ownership accounting grouped by subject (comma delimitated tabular output for importation into Excel).
Message.lst	File of run time messages.
Summary.tab	Average values for information in Resop.tab, Natflow.tab, and Storown.tab.
Retflow.tim	Return flow timing by reach.
Debug	File used to locate errors in the model.

To compile the NPREIS, it is necessary to have Npreis.for, Setconst.for, and NPlatte.inc. These are the main body of the program, the subroutines that assign variables to constants, and the file that declares all the common variables.

2.1.4.2 Water Banking

One source of water considered in this EIS is to compensate irrigators for the temporary use of part of their water supply. Water would be obtained through any combination of leasing, on-farm conservation, delivery system conservation, and deficit irrigation. The general concept is to create a water bank that receives water through payments made to irrigators and/or irrigation districts. How individual irrigators and/or irrigation districts change operations in order to supply the water could either be negotiated when writing the contract for payment or it could be left to the discretion of the irrigators and/or irrigation districts. Of the water received in the water bank, the program would only be able to utilize that portion that was consumed by the previous use. For the purpose of this EIS, consumptive use is estimated at 50% of the amount diverted. Thus, the program receives 50% of the water purchased and the other 50% is released to simulate return flows.

The NPREIS model has the ability to analyze two types of water banking. The first method is by irrigation district and the second method is by river reach. Each of these methods is discussed in the following sections.

By irrigation district. Water deliveries in the NPREIS model are calculated from the demand set for each irrigation district. In order to implement water banking in the NPREIS model, irrigation reduction factors were added for each irrigation district in the model. The factors consist of twelve values so that water banking may be varied by month (set in the *.soa input file).

The irrigation reduction factors are used to determine the irrigation reduction by district. The irrigation reduction is subtracted from the demand to obtain the reduced delivery. If the reduction comes from an irrigation district that receives storage from the Bureau of Reclamation, the reduced amount is added to water banking and protected from diversion. Otherwise, the water comes from natural flow and is left in the river to be diverted by the next natural flow appropriator. These calculations are done at the beginning of each month during the May through September irrigation season. Whether the irrigation reduction calculations are performed is controlled by a variable set in the (*.rsv) input file.

The portion of water that the program receives (the consumptive use) can either be released for use in the central Platte, or held in the ownership of origin to maintain reservoir levels and irrigation supplies. If the water is tied to project storage, the water is protected to Lake McConaughy with appropriate losses. Currently, the model does not protect water that does not come from project storage. Water released for environmental purposes is charged losses similar to the losses charged to other storage diversions in the model.

After implementing the ability to reduce irrigation deliveries, it was necessary to restructure the output files to report the reductions.

By river reach. The ability to lease water from non-project lands in various reaches of the North Platte River in Wyoming has also been added to the model. Other than water coming from the Laramie River, this water cannot be protected from diversion and becomes part of the natural inflow and gains that the model uses to calculate stream flows and diversions.

2.1.4.3 Leased space in La Prele Reservoir

Because the Douglas Water Users Association agreed to provide water to the Panhandle Eastern

Pipeline Company for a pipeline that was never built, there is the possibility that the program could lease 5,000 acre-feet of water in La Prele Reservoir. The leased storage in La Prele Reservoir is simulated with an Excel spreadsheet and the results are used as input to the NPREIS model. The NPREIS model applies a 10% loss to La Prele water between the mouth of La Prele Creek and the outflow from Guernsey Reservoir. From Guernsey Reservoir outflow, the water is protected to Lake McConaughy and losses are calculated the same as for any other storage release.

2.1.4.4 Track ETO that is not stored

Water is often held in the Bureau of Reclamation's reservoirs on the North Platte River in excess-to-ownership (ETO) or, said another way, water is held without a permanent water right. The water is stored by agreement of Nebraska, Wyoming, and the Bureau of Reclamation. Code was added to the NPREIS model to allow the user to not store ETO, but to track the amount that could have been stored. The total amount is limited to 334 kaf in a single year, which is the size of the space in Glendo Reservoir set aside for the restorage of water from Pathfinder Reservoir.

2.1.4.5 Expanded delivery capabilities

The delivery from an environmental account in Glendo Reservoir was changed from an input item with twelve values to one with twelve values for each year of model operations. This allows the model operator more flexibility when making deliveries from this account. Similar changes were made for deliveries to municipal uses from the Kendrick Project and from the Pathfinder Modification Municipal account. The changes to the Pathfinder Modification Municipal account were also made to include deliveries to environmental uses.

2.1.4.6 Model calculation of generation capacity

The NPREIS model was modified to calculate the generation capacity at each power plant. This information is written to the output files for the six generators and the total capacity.

2.1.4.7 Losses charged to deliveries to the McConaughy EA

Another function that has been added to the NPREIS model is the ability to charge losses to any environmental water that is released from the system. To determine losses, environmental releases are assumed to come from the reservoir of ownership. For example, Pathfinder Modification EA releases come from Pathfinder Reservoir and Glendo uncontracted water EA releases come from Glendo reservoir. Therefore, when Pathfinder EA releases are made, the flow out of Gray Reef Reservoir must be greater than or equal to the release amount. Furthermore, all environmental releases are considered to be releases of storage water and will be charged a carriage loss proportioned according to the total flow in the river. Carriage losses are the same as used for natural flow accounting. The state line to Lewellen reach of the river carriage losses were obtained from the stipulation regarding carriage losses that is currently part of the Nebraska versus Wyoming lawsuit.

2.1.4.8 Delivery of Glendo uncontracted water for EA purposes

The model was modified to allow the delivery of water from Glendo uncontracted water to environmental purposes in central Nebraska. The releases that come from Glendo uncontracted ownership are added to the total Glendo Unit delivery.

2.1.5 Assumptions

In order to simulate the North Platte River for the 48 years covered by the hydrologic models, it was necessary to make some assumptions regarding the operation of the North Platte River system. These assumptions are discussed in the following sections.

2.1.5.1 Full development in the North Platte

There have been many changes to the North Platte River during the period of record covered by the NPREIS model. These changes range from the construction of new facilities to how existing facilities are operated. The following is a list of the changes from historic to Present Condition (1947 to 1994) that are included in the NPREIS model.

- Construction of Glendo Reservoir
- Construction of Alcova Reservoir
- Construction of Gray Reef Reservoir
- Construction of Kortes Reservoir
- Construction of Gray Rocks Reservoir
- Construction of Fremont Canyon Power Plant
- Construction of Glendo Reservoir minimum flow bypass
- Excess to Ownership operations (varied historically)
- Increasing Kendrick and Glendo irrigation use

If an item has been included in the NPREIS model, it is operated as if it had existed for the entire period of record. For example, construction of Glendo Reservoir was not completed until 1958, but the reservoir is included in the North Platte Model for the entire period of record. Other items are not as easy to visualize because they involve changes in the physical environment that have occurred over time (i.e., irrigation demand changes or adjusted river gains or inflows) or changes in how existing facilities are operated (i.e., Excess to Ownership operations). These factors and the inflows and gains from 1947 to 1994 are combined to from what is referred to as the "Present Condition".

The present condition model run demonstrates the operation of Reclamation's facilities on the North Platte River using current operating criteria with present day demands for the 48-year period from 1947-94. It also provides a reference point against which the other runs may be compared to measure the incremental effects due to each project. The following adjustments were made to the input data to reflect Present Condition. These adjustments are used consistently by the NPREIS for the present condition and all alternatives, unless otherwise noted.

Irrigation districts were considered to be requesting a present day demand whenever the land in production was at least 90% of the maximum possible irrigated acreage. The maximum possible irrigated acreage is established for the purpose of taxing district members and is determined when an irrigation district is formed. The irrigated acreages associated with the historic deliveries to individual irrigation entities were analyzed and when the irrigated acreage for a year was historically less than 90% of the maximum acreage, the historic delivery was proportionally increased to reflect an irrigation demand of 90% of the maximum acreage. This is done without exceeding the canal capacity for the district. Historic deliveries associated with irrigated acreages within 90% to 100% of the maximum acreage were used directly to represent present day demands and were not adjusted.

The historic irrigation deliveries for the North Platte, Kendrick, and Glendo Unit contractors were adjusted using the 90% criterion with the following exceptions. For water years 1947 through 1948, the present day demand for the Kendrick Project are the average of the 1949 through 1994 present day demands. Glendo Unit demands were adjusted to reflect the contracting of the fully authorized 40,000 AF per year of potential irrigation demands. Currently only 29,400 AF of Glendo's water is under contract. The remaining 10,600 AF is available for Wyoming irrigation use and is currently made available for use on an annual basis via temporary contracts. To model Wyoming's remaining share of demand on the Glendo irrigation pool, the 10,600 AF of available water was modeled as an "unassigned" delivery that diverts and returns water between the Whalen Diversion Dam and the Tri-State Diversion Dam. The "unassigned" delivery demand was patterned after the other Glendo Wyoming contracts using wet, dry, and average criteria.

For water years prior to the initiation of the individual Glendo Unit contracts, the present day demand for the Glendo contractors under this 90% criterion used the average irrigated acreage, computed from the irrigated acreage reported historically, to determine the adjustment to the individual historic deliveries. Deliveries for the Central Nebraska Public Power and Irrigation District (CNPPID) from Glendo use the historic deliveries from water years 1987 through 1994 to represent the present day demands. For water years 1947 through 1986, the average of the historic deliveries (1987-1994) was used to represent the present day demand.

The irrigation deliveries for all North Platte and Glendo Contractors were further adjusted in allocation years (1953, 1954, 1955, 1956, 1957, 1964, 1977, 1989, 1990, & 1992) by taking the average of the annual historic delivery for allocation years 1989, 1990, and 1992 and comparing it to the adjusted delivery for a given allocation year. If the average 1989, 1990, and 1992 delivery were greater, the delivery for the allocation year was increased to equal the average of 1989, 1990, and 1992. The Casper Alcova Irrigation District (CAID) deliveries in allocation years were set equal to the lesser of the given allocation year's delivery or 70,000 AF.

Deliveries for the Ramshorn Irrigation District, a private irrigation district located just below the Wyoming Nebraska State Line which was dissolved in September of 1992, were set to zero.

Historic inflows into the System were used as input to all the NPREIS runs, with the exception of the Laramie River near Fort Laramie. The flow of the Laramie River near Fort Laramie was adjusted to reflect Grayrocks Reservoir depletions prior to water year 1983. The Grayrocks Reservoir Operational Program (GROP), developed by Basin Electric, was used to generate the stream flows of the Laramie River near Fort Laramie for the water years 1947 through 1982 (Grayrocks Reservoir began storing water in April of 1980). The historic gaged stream flow values were used from water year 1983 through 1994. The proposed Corn Creek Project's depletion on the Laramie River was not included as part of the present condition run.

The minimum outflow for Kortes Reservoir is set at 500 cfs and the minimum outflow for Gray Reef Reservoir is set at 500 cfs.

2.1.5.2 River Gains/Losses

The gains and inflows used in the NPREIS model are historically recorded data taken from Reclamation's Wyoming Area Office compiled water records and United States Geological Survey (USGS) published stream discharge records. These were analyzed using statistical techniques to determine the adequacy of the data to represent Present Condition. The analysis showed that all inflow and gain data is an adequate representation of Present Condition (US. Bureau of Reclamation, January 1999).

The return flow is used to adjust the historical reach gains entered in the model. If irrigation deliveries within a reach are identical to historic, then the historic reach gain will be used to compute the flow at the next accounting point. If the irrigation deliveries within a reach are not equal to historic, the model will calculate an adjusted reach gain by adding the difference between the return flow computed for the new/altered deliveries and the return flow computed for the historic deliveries to the historical reach gain. This adjusted reach gain is then used to calculate the flow at the next accounting point, revealing the change in flow to the reach from reduced or increased deliveries.

2.1.5.3 Reservoir Gains/Losses

The NPREIS model's bank/storage seepage functions for Pathfinder, Seminoe, and Glendo reservoirs and the Inland Lakes were used. This allows water to be lost to bank storage within the reservoirs during periods of rising reservoir contents and allows for returns from bank storage during times of declining reservoir levels.

2.1.5.4 Channel/canal restrictions

There currently are no channel capacity restrictions that limit Reclamation's ability to make reservoir releases. When the system is full and a spill is possible, water is moved out of the system in an effort to minimize flooding along the river as much as possible. However, the model does not make any attempt to reduce river flows. Capacities are checked by the model for the major ditches and canals served by the Reservoirs of the upper North Platte System.

2.1.5.5 ETO in the North Platte

The ETO account is kept only by agreement between Reclamation, Wyoming, and Nebraska. The ETO operation was governed by the following criteria:

A. River gains upstream from Guernsey Reservoir and below Pathfinder Dam in excess of natural flow demand and not applied to the Inland Lakes, North Platte Guernsey, and Glendo ownerships will accrue to ETO. River gains upstream of Pathfinder Dam in excess of natural flow demand will also accrue to ETO, if all ownerships have filled.

B. The maximum ETO end-of-month content is limited to the capacity of the restorage space in Glendo Reservoir (334,247 AF for Present Condition). Glendo Reservoir can hold an additional 271,917 AF of water in its exclusive flood pool.

C. ETO water will be used to replace evaporation from the Glendo and Guernsey ownerships, once the ownerships are filled, and until the first release of ownership water occurs from either ownership account.

D. Any ETO water which is captured in quantities greater than needed to accomplish item C above will be converted and released to fill natural flow demand when natural flow demand exceeds the actual natural flow for the month.

E. Any ETO water which is captured in quantities greater than needed to accomplish item D above will be converted to natural flow and released to fill or reduce storage demand below Guernsey when ETO water is available for the month.

2.1.5.6 Casper, Wy M&I Use

The City of Casper's municipal contract for 7,000 acre-feet per year from the Kendrick ownership account was included in Present Condition. It is assumed that this water is used to extinction and has no effect on the Alcova to Glenrock reach gain. The City of Casper’s deliveries were patterned after the deliveries for the Pathfinder Municipal Account of 9,600 acre-feet. The City of Casper’s 7,000 acre-feet demand was assumed to be satisfied by deliveries from the Pathfinder Modification Municipal Account for all alternatives.

The alternatives assume the yield of the municipal account would be required to meet municipal demands. The estimated monthly demand on the annual yield (9,600 AF per year) of the municipal account was set as follows:

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Wet												
0	0	0	0	0	0	0	0	0	0	0	0	0
Average												
118	59	59	59	59	59	59	236	885	1770	1711	59	5664
Dry												
200	100	100	100	100	100	100	400	1500	3000	2900	1000	9600
Values in acre-feet												

2.2 Central Platte EIS Model

The following is a qualitative discussion of the Central Platte River OPSTUDY model. The purpose of this application was to model present and proposed operating conditions in the basin for the period 1947-1994 for a proposed habitat recovery program over a reach of the Platte River roughly between Overton and Grand Island, Nebraska. Details of the program are given in the many comment statements contained in the code. This discussion describes how the model computations were carried out.

2.2.1 Hydrologic data input

The Central Platte OPSTUDY model is an accounting model that uses a monthly time step and simulates alternatives on a calendar year (January - December).

2.2.1.1 Inflow

There are three inflow points in the model. These can be thought of as external boundary conditions. They are the North Platte River at Lewellen, NE, which is the inflow point into Lake McConaughy, the South Platte River near Julesburg, CO, and Birdwood Creek near Hershey, NE.

2.2.1.2 Reach gains

One of the two groups of internal boundary conditions is the reach gains. The reaches over which gains have been determined are defined by gaging stations located on the river. The reaches defined for the determination of reach gains are given in **Table 1.** "Present Condition", which assumes a current level of development, were considered for the reach gains. The development of the "Present Condition" reach gains is given in the U. S. Bureau of Reclamation Great Plains Region report, Review of Present Condition Stream Reach Flow Gains for the Central Platte River OPSTUDY Model, Platte River EIS (U.S. Bureau of Reclamation, May 1999).

Table 1 Reach Definitions, by Basin

Basin	Reaches
North Platte	Keystone, NE, to Sutherland, NE; Sutherland, NE, to North Platte, NE
South Platte	Julesburg, CO, to Paxton, NE; Paxton, NE, to North Platte, NE
Platte R. main stem	North Platte, NE, to Brady, NE; Brady, NE to Cozad, NE; Cozad, NE, to Overton, NE; Overton, NE, to Odessa, NE; Odessa, NE, to Grand Island, NE; Grand Island, NE to Duncan, NE

In addition to the above reaches, the historic reach gains from Duncan, NE to Louisville, NE were calculated. This quantity was estimated by taking the difference between the historic flow at Louisville, NE and the historic flow at Duncan, NE. Its value was determined for every month of the study period, and used in the model to estimate the flow of the Platte River at Louisville based on the computed Platte River flow at Duncan. The purpose of this estimate is to determine what impact, if any, that a given proposed plan would have on Pallid Sturgeon habitat in the Lower Platte River.

2.2.1.3 Irrigation Demand

The other significant group of internal boundary conditions is the irrigation demand. The reaches over which irrigation demand is compiled on a by-reach basis are: Keystone to Sutherland, Sutherland to North Platte, and Brady to Cozad. In addition, the following were considered on an individual basis: the Western Canal on the South Platte River between Julesburg and Paxton, the Tri-

County System, and the Kearney Canal on the Platte River main stem between Overton and Grand Island. The individual irrigation canals by reach are listed in **Table 2**.

Table 2 **Irrigation Canals, by Reach**	
Reach	**Canals**
Western Canal	Western Canal
Keystone to Sutherland	Keith-Lincoln, Sheridan-Wilson, North Platte, Paxton-Hershey
Sutherland to North Platte	Suburban, Cody-Dillon
Brady-Cozad	Gothenburg, 30-Mile, Six-Mile, Cozad, Orchard-Alfalfa, Dawson
Tri-County System	E-65 Lateral, E-67 Lateral, Phelps County
Kearney Canal	Kearney Canal

2.2.1.4 Physical Data

This includes standard information about the physical characteristics of the rivers, canals, and reservoirs represented in the model. These would include, but not necessarily be limited to, such information as: Lake McConaughy elevation-storage table, area-capacity curve parameters for Lake McConaughy and other reservoirs, discharge parameters for outflow from Lake McConaughy and other reservoirs, canal capacities and content limits, and others.

2.2.1.5 Miscellaneous Hydrologic Data

Also included as input are a number of initial conditions quantities and other hydrologic variables. These include, but are not necessarily limited to: Lake McConaughy Starting Content; starting content for other reservoirs in the system, including proposed reservoirs where applicable; net average monthly Lake McConaughy surface evaporation; average reservoir losses by month; average river and canal conveyance losses by month; recommended flows for wildlife habitat at Overton and Grand Island by month; seepage capacities for groundwater management; and others.

Also input at the beginning of the input file and in the list of constants, are program control parameters and a wide range of operational parameters and flags, many of which change from one proposed plan to the next.

2.2.2 Computations

The computations performed by the Central Platte OPSTUDY model are performed in 3 phases. The 3 phases are: Phase I - estimate of releases required from Lake McConaughy to meet downstream demands; Phase II - summation of demands, routing of flows downstream, and "loop-backs" to re-compute releases whenever shortages are computed; and Phase III - final computations and setup for the next month's computations. The following discussion summarized each phase.

2.2.2.1 Phase I

In Phase I, selected variables which change each month are initialized and the computations of estimated required release to meet downstream demand are performed. The Phase I computations are discussed in the order in which they occur.

Lake McConaughy Operational Release. The operational release from Lake McConaughy is calculated differently depending on the scenario being modeled. If Present Condition are being simulated, the model will attempt to match the historic diversions at Keystone and Maxwell. These are the diversions to the Sutherland Canal and the Tri-County Canal. The model suspends the historic diversion operating criteria whenever lake levels drop below 900,000 acre-feet

Otherwise the operational release from Lake McConaughy is based primarily on the hydrologic condition of the lake. The two parameters that determine the release are the time of the year (October through March; April through September) and the storage and inflow conditions at Lake McConaughy. For October through March, the determining factor for the condition of Lake McConaughy is the end-of-month content for the previous September. For April through September, the determining factor is the end-of-month content for the previous March plus the inflow for April through July (as measured at Lewellen). Five conditions are defined: very high, high, normal, low, very low.

North Platte River. The flow available for diversion in the North Platte River at North Platte and the unsatisfied North Platte River irrigation demand at Keystone are computed. The unsatisfied irrigation demand is calculated from demands on the North Platte River below Lake McConaughy. These values are determined by attempting to satisfy the irrigation demands between Keystone and North Platte with naturally occurring gains and other unregulated flows. The end products are the naturally occurring flow in the North Platte River at North Platte and the unsatisfied irrigation demand at Keystone.

South Platte River. The flow available for diversion in the South Platte River at North Platte is computed. Along the way, the Western Canal Diversion, the flow at Korty, the Sutherland system demand at Keystone, the estimated return from the North Platte Hydro operation, and the storage demand at Keystone are also computed. The end products are the flow available for diversion in the South Platte River at North Platte, the flow available for diversion at Korty, the unsatisfied storage demands at Keystone, and the total flow available for diversion in the North and South Platte Rivers at North Platte.

Central District System Demand. The Tri-County (Central Nebraska Public Power and Irrigation District, or CNPPID) diversion requirement is computed. This is done by calculating the demand and comparing it to any minimum flow required for canal maintenance and to any operational flow required by the alternative. The end product is the Tri-County diversion requirement.

Platte River below North Platte. The storage demand at North Platte is computed by first calculating the amount of water that needs to bypass the Tri-County diversion to satisfy irrigation demands along the Platte River main stem. This, added to the previously computed Tri-County diversion requirement, constitutes the total demand at North Platte. The storage demand is the total demand at North Platte minus the previously computed total available flow at North Platte.

The computations then proceed downstream. Computational estimates are performed in the following order: total flow at North Platte, Tri-County diversion and canal loss, flow passing Tri-County diversion, Platte River near Brady, return from Jeffrey hydropower operation, return from Johnson hydropower operation, Platte River flow above Johnson return, available flow at Overton, Kearney Canal demand, and available flow at Grand Island.

Environmental Demand for Wildlife. The storage demand for environmental and wildlife targets at Overton and Grand Island is computed. This is done by summing gains, losses, and hydro returns. The available flows at Overton and Grand Island are then computed. These are then compared to the FWS target flows at these locations, which are given as input. The increase in losses in the Tri-County and Sutherland Canals associated with the increased demands for wildlife are also computed.

Environmental Account. An essential part of all proposed plans is the establishment of an "Environmental Account" (EA) in Lake McConaughy to store and release water specifically to satisfy downstream environmental demands for wildlife. The instream flows targeted by the EA are set primarily by values contained in each OPSTUDY input file associated with an alternative. After the instream flow target has been set, the model then determines how much water should be released, if any, in order to meet the target flow at Grand Island. Therefore, the actual release from the EA will depend upon the EA contents, the target in effect, and the flow in the river. Using the different EA content and flow target levels allows the model user to allocate the EA supply between months and to emphasize either the high, middle, or lower ranges of flow in a month. This is done by examining the model output and adjusting the content triggers and targets according to the user's goals.

There are other input settings that also control the EA operation. For example, the minimum EA release allowed is 50 CFS. This was selected because it is unlikely that EA releases lower than this amount would occur in actual daily operations.

At the very end of Phase I a special aspect of the EA is acted upon. This is the EA pulse release, which is computed in May to simulate a natural spring high water in the Platte River. There is a requirement that at least 40 KAF be reserved in the EA prior to May in order to have sufficient water available during May so that the EA can target releases to achieve annual pulse flow recommendations.

2.2.2.2 Phase II

In Phase II, the total demand on Lake McConaughy and the Lake McConaughy storage and outflow are computed, and all flows are routed down the Platte River main stem. The computations are performed in the following order:

Total Demand on Lake McConaughy. The total demand on Lake McConaughy is a function of operational release, Keystone storage demand, EA release, North Platte storage demand, Kearney Canal demand, and loss increases for the Sutherland and Tri-County Canals. Two additional, natural impacts on lake storage are surface evaporation and reservoir seepage.

Adjustment for Upstream Components. In addition to the EA, there are two other components which are part of all alternatives. These are: additional North Platte River storage upstream of Lake McConaughy, in Pathfinder Reservoir in Wyoming; and underground storage in the Tamarack State Wildlife Area (Tamarack) on the South Platte River upstream of Julesburg. Releases from Pathfinder Reservoir are added to the inflow into Lake McConaughy and credited to the EA. Any flow out of Tamarack which reaches the Korty diversion is also credited to the EA.

Lake McConaughy Storage and Outflow. The Lake McConaughy end-of-month content (EOMC) is estimated first. This estimate cannot violate the minimum and maximum contents of Lake McConaughy. After adjustments are made to account for EA usage, the final Lake McConaughy release, shortage, spill, and EOMC are computed. The total Lake McConaughy outflow is the release (through the gates/hydro plant) plus any spill (over the Morning Glory spillway).

North Platte River. Once the total Lake McConaughy outflow is computed, the following computations are performed: Sutherland Canal Diversion at Keystone; Korty Canal Diversion from the South Platte River; North Platte River Flow at Keystone; Keystone-Sutherland Irrigation Diversion and Shortage; North Platte River Flow at Sutherland; Sutherland-North Platte Irrigation Diversion and Shortage; and North Platte River Flow at North Platte.

South Platte River and Total Flow at North Platte. The following computations are performed: Total Flow in the Sutherland Canal; South Platte River Flow at Paxton; South Platte River Flow at North Platte; Sutherland System Loss; North Platte Hydro Return to the South Platte River; and Total Flow in the Platte River at North Platte.

CNPPID System Operation. The following computations are performed: Tri-County Bypass Demand; Total Physically Available Flow at North Platte; Tri-County Diversion and Canal Loss; Platte River Flow Passing the Tri-County Diversion; Platte River Flow at Brady; Jeffrey Hydro Return to the Platte River at Brady; CNPPID Demand on System Storage; Central District Irrigation Diversion and Shortage; and J2 Hydro Return to the Platte River.

Platte River from Brady to Overton. The following computations are performed: Brady-Cozad Irrigation Diversion and Shortage; Platte River Flow at Cozad; Platte River Flow above J2 Hydro Return; Platte River Flow at Overton; and Additional Wildlife Storage Release.

2.2.2.2 Phase III

In Phase III, the Platte River flow is routed to the downstream, the Kearney Canal is accounted for, other final computations are performed, and conditions are set up for the next month's computations. The Platte River computations are performed in the following order: EA EOMC (preliminary); Kearney Canal Diversion, Irrigation Shortage, and Hydro Return; Platte River Flow at Odessa; Platte River Flow at Grand Island; Platte River Flow at Duncan; Platte River Flow at Louisville; and instream flow shortages/excesses at Overton, Odessa, and Grand Island. Other final computations and operations performed are, in order: hydropower generation at Sutherland-North Platte, Jeffrey, and Johnson plants; elevation and surface area of Lake McConaughy; final computation of EA EOMC (including impacts of evaporation and proposed project operation); mass balance checks at Duncan and Lake McConaughy; saving Lake McConaughy EOMC in another variable location for use in the next month's computations; Total Irrigation Shortage; Overton Peak Daily Flow; and maximum storage allowed in Lake McConaughy (for use in the next month's computations).

2.2.3 Summary of Model Modification/Development

The preceding narrative is based on the "present condition" with the three main Platte River Recovery Program components: the Lake McConaughy EA in Nebraska, the Pathfinder Reservoir modification in Wyoming, and the Tamarack project in Colorado. The final plan could include a number of other water conservation projects, many of which have been programmed into the Central Platte OPSTUDY model. A brief summary of how these were modeled follows.

2.2.3.1 Non-irrigation season Lake McConaughy operational release capability

This section describes how the procedures and priorities for storing and releasing water from Lake McConaughy (operating criteria) are changed for all alternatives. Central Nebraska Public Power and Irrigation District (CNPPID) suggested that the operating criteria described below should be implemented in the Central Platte OPSTUDY model to represent future operation of the facilities as part of a Program. These "rules" are also used to simulate all of the other alternatives for the Platte River Programmatic Environmental Impact Statement. Because this change in operations has a significant effect upon the benefits gained from the Program (improvement to target flows), the new rules and their application are described in some detail.

Background. Water is often released from Lake McConaughy in excess of the volume needed to satisfy downstream demands. The size of the release depends on how much water is available in Lake McConaughy, the ability to produce power with the water, and the need for power.

In the Central Platte OPSTUDY model, the amount of water to release depends on the end of September and the end of March storage in Lake McConaughy. The model, beginning in October, determines a release level for the non-irrigation season based on the end of September Lake McConaughy storage. The model then reevaluates the release level based on the end of March Lake McConaughy storage plus the April though July inflow into Lake McConaughy. During both evaluations, the model determines whether conditions are very high, high, normal, low, or very low.

Representation of Proposed Modified Reservoir Operations. Under the proposed modified operations, the amount of releases made in each month depends upon the current reservoir level and the project inflow. The expected storage and inflow levels for each month are classified ranging from very low to very high. These estimates of storage and inflow are made in October and updated in April.

The levels of estimated Lake McConaughy storage and inflow that trigger the various classifications are shown in the table below:

Condition	October Estimate (acre-feet).	April Estimate (acre-feet)
Very High	>1,400,000	>2,000,000
High	1,300,000 to 1,400,000	1,600,000 to 2,000,000
Normal	1,000,000 to 1,300,000	1,200,000 to 1,600,000
Low	800,000 to 1,000,000	800,000 to 1,200,000
Very Low	<800,000	<800,000

For each of the conditions, the following criteria guide releases and deliveries.

Very high conditions

1. Meet the following diversion to Tri-County.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(cfs)	1600.	2000.	2000.	2200.	2200.	2200.	2200.	2200.	2000.	2000.	2000.	1600.

2. Also, ensure that the flow out of Lake McConaughy never goes below.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(cfs)	0.	0.	0.	2000.	2000.	2000.	2000.	0.	0.	0.	0.	0.

3. Also, ensure that the diversion to the Sutherland Canal never goes below.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(cfs)	0.	0.	0.	1000.	1000.	1000.	0.	0.	0.	0.	0.	0.

High conditions

1. Meet the following diversion to Tri-County.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(cfs)	1400.	1800.	1800.	2000.	2000.	2000.	2000.	2000.	2000.	1800.	1800.	1400.

Normal conditions:

1. Meet the following diversion to Tri-County.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(cfs)	1200.	1400.	1400.	1600.	1600.	1600.	1600.	1600.	1600.	1400.	1400.	1200.

Low conditions

1. Meet the following diversion to Tri-County.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(cfs)	800.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	800.

Very low conditions

1. Meet the following diversion to Tri-County.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(cfs)	700.	700.	700.	700.	700.	700.	700.	700.	700.	700.	700.	700.

Representation of Present Operations. The criteria described previously differ from those used to model Present Condition, which assume that the diversions to the Sutherland Canal and the Tri-County Canal will be the similar to historic diversions. The trigger levels are adjusted and operating criteria are used to model Present Condition. A comparison of trigger levels for the proposed program and Present Condition are shown in the following table.

Condition	Present Condition		Proposed Program and Alternatives	
	September (Maf)	March (Maf)	September (Maf)	March (Maf)
Very high	1.550	2.250	1.400	2.000
High	1.325	2.000	1.300	1.600
Low	1.100	1.600	1.000	1.200
Very Low	0.800	0.800	0.900	1.250

2.2.3.2 Irrigation season Lake McConaughy operational release capability

The irrigation demands placed on Lake McConaughy range from 10 to 100 miles downstream of Kingsley Dam and the largest demands are the furthest from the dam. In addition, releases from Lake McConaughy are made up to 10 days prior to when the water will be diverted and used to irrigate crops. The Central Platte OPSTUDY is a monthly model and as such could fully utilize gains below Lake McConaughy to satisfy downstream irrigation demands. This 100% efficient use of gains in unattainable when the system is operated in real time. Therefore, heuristics were developed to control the release of water from Lake McConaughy and the bypass of water at the Keystone Diversion during the irrigation season. These heuristics are based on system inflows, reach gains, and downstream demands.

2.2.3.3 Simulation of flows between Duncan and Louisville

This quantity was estimated by taking the difference between the historic flow at Louisville, NE and the historic flow at Duncan. Its value was determined for every month of the study period, and used in the model to estimate the flow of the Platte River at Louisville based on the computed Platte River flow at Duncan. The purpose of this estimate is to determine what impact, if any, that a given proposed plan would have on Pallid Sturgeon habitat in the Lower Platte River.

2.2.3.3 Colorado Conservation Water

This is water from sources in Colorado other than the Tamarack project. Because it would enter the system at Julesburg, it would impact every computation along the South Platte River and the Platte River main stem, including the canals and hydropower diversions. It is questionable whether or not this conservation water would be protected from diversion into the supply canals once it reached the central Platte system. For these reasons, the capability was built into the model to protect simulated waters from these sources by means of user-defined flags. Two such flags can be defined by the user in the input, one to protect Colorado conservation water from diversion at the Korty Diversion and one to protect Colorado conservation water from diversion at the Tri-County Diversion.

2.2.3.4 Riverside Drains

This project would consist of groundwater drains installed along the Platte River between Cozad and Overton to drain excess groundwater from nearby higher ground which typically has a high water table. In the model, this project is activated by an input flag and the water from the drains, given as input, is added to the Cozad-Overton reach gain during Phase I as part of the computation of the demand on Lake McConaughy.

2.2.3.5 North Dry Creek Groundwater Pumping Project

This project would pump excess groundwater from the area served by the Phelps County irrigation canal and divert it into Lost Creek. Lost Creek would then carry the water into the Fort Kearney IPA drainage ditch, which would then discharge it into the Platte River 1 mile downstream of the Kearney Bridge. The project would be activated whenever the instream flows at Overton and Grand Island do not satisfy the instream flow recommendation for wildlife habitat. In the model, the project is activated by an input flag and the water from the project, given as input, is added to the Platte River between Overton and Grand Island during Phase I, as part of the computation of the demand on Lake McConaughy.

2.2.3.6 Power reregulation

This project, which would be implemented at Kingsley Dam, Jeffrey Hydro and both Johnson Hydro plants, would consist of scaling back hydropower releases during periods of excess flow in the wildlife habitat area, storing the unreleased water in the EA, then releasing it from the EA during times of shortage. The power districts would be compensated for revenue lost as a result of these reductions. In the model, the project is activated by an input flag and water from the project, estimated from computed excesses downstream, would be stored in the EA until needed.

2.2.3.8 Ground water Management

This project, which would most likely consist of a number of small, independent groundwater projects, would manage the volume of ground water which exists primarily along the right bank of the Platte River roughly between Lexington and Kearney. In the model, the project is activated by an input flag and the water from the project is added to the Platte River flow at Overton. Because this activity would occur during the winter, the water is credited to the EA in April for use in May through September.

2.2.3.9 Central Platte reregulatory reservoir

The Central Platte reregulatory reservoir, as defined in the model, is actually a generic reference to any one of a number of proposed re-regulating reservoirs along the right bank of the Platte River between Brady and Kearney. It is possible that more than one of these will be implemented. This project would hold water in excess of demand for later use during shortages. In the model, the project is activated by an input flag and the water from the project is added to the flow at Overton.

2.2.3.10 EA Pulse Releases

These are releases which will be made to simulate the occurrence of spring high-flow events in the North Platte River. The determining factor for a pulse flow releases is whether the peak daily flow at Overton is either expected to exceed a pre-determined target flow during May or June or has exceeded the target flow at Overton since the previous October 1. The target flow value is the flow needed to cause the sediment movement necessary to form channel features such as sandbars, which are favorable for nesting and roosting for the target species. If the target daily peak flow is not expected to occur during May or June and has not occurred since the previous October 1, then a pulse flow release will be simulated during May. The magnitude of the pulse flow release will not exceed either the maximum release capacity through the Kingsley dam turbine penstocks, nor will it cause the flow at Overton to exceed a pre-determined value. Pulse flow releases will also be limited by the potential for flood stage exceedance at any downstream location. In any event, there will be no pulse flow releases if there is insufficient volume in the lake McConaughy EA to sustain the releases.

2.2.3.11 Switches to Not Divert EA Waters

In addition, there is some question as to whether Lake McConaughy EA releases would be protected from diversion. For this reason, the capability was built into the model to protect simulated waters from the EA by means of user-defined flags. The flag protects Lake McConaughy EA releases from diversion at the Tri-County Diversion.

2.2.3.12 Canal Diversion Efficiencies

As flows increase along the South Platte River and the Platte River main stem, the efficiency at which water is diverted into the Korty and the Tri-County supply canals begins to decrease. That is, not all of the river flow can be diverted into the canals; some will remain in the rivers. This is represented in the Central Platte OPSTUDY model by a quantity called the diversion efficiency. The diversion efficiency is a measure of how much of the flow in a river can be diverted into a canal and is expressed as a percentage of the total river flow. In the model, it can either be specified as a constant or calculated. Which procedure is used is determined by the value of a user-defined constant. For the Korty Canal, the calculated diversion efficiency is a linear function of the South Platte River flow at Korty which is used for all months. For the Tri-County Canal, the calculated diversion efficiency is a quadratic function of the Platte River flow with a different equation for each month. These equations were reevaluated during the programming of the Central Platte OPSTUDY model for the EIS and the new equations are currently used in the model. More information on the equations can be obtained from the Central Platte OPSTUDY reference and user manual. For both canals, the diversion is never allowed to exceed the channel capacity.

There is no diversion efficiency assignment or calculation for the Keystone Diversion. Instead, there is a given monthly maximum value which the flow through the Keystone Diversion is not allowed to exceed.

2.2.3.13 Control of EA Operations

How the EA operates in the model is controlled by the user. The following EA monthly control quantities can be user-defined:

Percent of EA Volume Available. This quantity determines what percent of the EA volume in a given month will be allowed to be released if there is the need.

Minimum EA Release Allowed. This is the minimum discharge from the EA, in CFS, that must be requested from the EA before an EA release will be made.

Flags to Meet Minimum Flow Requirements. These tell the model at what location, Overton or Grand Island, the minimum flow requirements for the target species are to be met.

EA Threshold Volumes and Downstream Flow Requirements. This is volume of water stored in the EA that determines what the downstream target flow will be for a month. The model checks the EA threshold volume against the amount stored in the EA in Lake McConaughy by month. If the EA storage is greater than the threshold the value assigned to the threshold becomes the target flow at Overton or Grand Island for that month.

This “threshold volume” in the EA does not by itself determine whether there will be an EA release. It only determines what the target flow at Overton or Grand Island will be if an EA release is required. If there is sufficient flow coming from other sources to meet the target, such as the South Platte River or operational releases from Lake McConaughy, then there would be no

EA release.

Conservation Water from Reclamation Funds Added to the EA. One of the outcomes of a settlement between CNPPID and the National Wildlife Federation was the development of a conservation plan for Elwood Reservoir in the CNPPID system. This plan was funded in part by the Reclamation, which then contributed to the EA that portion of the water conserved by this plan that can be attributed to its funding.

Flag to Allow EA "Borrowing" from May through **July.** The value of this flag tells the model whether it may "borrow" water from Lake McConaughy storage other than EA storage to meet downstream flow requirements from May through July.

2.2.3.14 July/August Flows at Keystone

During the months of July and August, the releases from Lake McConaughy often exceed the actual downstream demand between Keystone and North Platte. There is no set pattern or science used to determine the volume of these releases. They are made by Central to provide "insurance" water for downstream users when additional in-stream losses of one kind or another are anticipated. Usually there is more water released than is needed to satisfy demands. Because of this, simulated release and in-stream flow computations based on the downstream demands underestimates the flow. Thus, the demand at Keystone is adjusted upward by an empirical constant dependent on month and (for July only) the actual irrigation demand between Keystone and North Platte. This adjusted "demand" is then used to compute the release from Lake McConaughy and, consequently, all downstream flow values that are dependent on this release.

2.2.3.15 Monthly EA Calculations and Scoring

Monthly EA Calculations. The model calculates and writes to the output files a number of quantities relating directly to the Lake McConaughy Environmental Account (EA). These quantities are:

End-of-Month Content of the EA (KAF)
Monthly Release from the EA (KAF)
EA Release Flow Rate (CFS)
Sum of Contributions to Lake McConaughy Environmental Account (KAF)
EA Percentage Accrual of Inflow at Lewellen (KAF)
Colorado Water Exchanged into the EA (including losses) (KAF)
EA Adjustments when Lake McConaughy Fills
Lake McConaughy EA Evaporation
EA Pulse Release (Does not include monthly release) (KAF)
Total EA Release, Monthly + Pulse (KAF)
EA Pulse Release (Does not include monthly release) (CFS)
EA Loss Increment in Sutherland and Tri-County Systems (KAF)
Power Interference Volume Credited to EA (KAF)
EA Volume at Grand Island
EA Volume at Overton

EA Volume at Cozad
EA Volume at Brady
EA Volume in North Platte at North Platte
EA Volume in South Platte at North Platte

Score. The score is calculated by first calculating the average shortage to target flows for Present Condition. Next, the average shortage to target flows is calculated for an alternative. The difference of these two values (alternative minus Present Condition) produces the score, which is defined as the reduction to shortages to target flows. Thus, score represents the average change in the flow through the critical habitat area over the period of record for a given alternative, relative to the present condition. The model computes scores at Grand Island for each month and for the entire year. A positive score indicates an increase in monthly or annual average flow relative to the present condition, and hence an improvement in flow conditions in the critical habitat area. A negative score indicates a decrease in flow and a resulting deterioration in flow conditions in the critical habitat area. The model computes the scores after all other computations have been completed and the results written to the various output files.

2.2.3 Assumptions

In order to simulate the Central Platte River for the 48 years covered by the hydrologic models, it was necessary to make some assumptions regarding the operation of the Platte River system. These assumptions are discussed in the following sections.

2.2.3.1 Demands

The demands for irrigation used in the Central Platte OPSTUDY model have been adjusted to represent Present Condition. This adjustment was performed by Reclamation when the original Central Platte OPSTUDY model was developed and is described in the Central Platte OPSTUDY model documentation. These demands are the same as those used in the FERC relicensing and Cooperative Agreement negotiations

2.2.3.2 River Gains/Losses

The gains and inflows used in the Central Platte OPSTUDY have been adjusted to represent Present Condition. The historical gains were analyzed using statistical techniques to determine the adequacy of the data to represent Present Condition. Where the analysis showed that the gain data was not consistent through time, the gains were adjusted to represent Present Condition (US. Bureau of Reclamation, January 1999).

2.2.3.3 Reservoir Gains/Losses

The model uses the historic gains and losses to represent Lake McConaughy's bank storage and seepage.

2.2.3.4 FERC content limits in McConaughy

Prior to 1974, the Central District considered elevation 3269.0 as being full for Lake McConaughy (approximately 1,868,400 acre-feet). There have been historic contents exceeding this general criterion. After the May 1, 1972 windstorm, a Board of Consultants recommended a mode of operation to minimize the cost of repairs caused by future storms. These limits were subsequently imposed by FERC in November, 1986, and are used in the model as maximum storage limits. These storage limits are the same as those used in the FERC relicensing studies, the Cooperative Agreement negotiations, and the Kingsley biological opinion.

2.2.3.4 Full development

There have been many changes to the Platte River during the period of record covered by the Central Platte OPSTUDY model. These changes range from the construction of new facilities to how existing facilities are operated. The following is a list of the changes from historic to Present Condition (1943 to 1994) that are included in the Central Platte OPSTUDY model.

a. Construction of Gerald Gentleman Station
b. Maximum/minimum canal diversion requirements
c. Sutherland Reservoir operation changes
d. FERC elevation limits
e. Irrigation demand changes
f. Construction of Elwood Reservoir (old fill pattern)
g. Construction of Kingsley Hydro
h. Adjusted river gains (addressed, not necessarily agreed upon)
i. Howel-Bunger valve operations
j. Korty diversion operations
k. Present condition Julesburg flows
l. CNPP&ID and NPPD contract changes

All of the changes in the North Platte above Lake McConaughy and in the South Platte River above Julesburg are reflected in the modified Lewellen and Julesburg inflow data sets that are used for Central Platte OPSTUDY Model.

If an item has been included in the Central Platte OPSTUDY model, it is operated as if it had existed for the entire period of record. For example, construction of the Howel-Bunger valve was not completed until the 1980's, but the operation is included in the Central Platte OPSTUDY model for the entire period of record. Other items are not as easy to visualize because they involve changes in the physical environment that have occurred over time (i.e., irrigation demand changes or adjusted river gains or inflows) or changes in how existing facilities are operated (i.e., CNPP&ID and NPPD contracts).

2.2.4 Tamarack modeling (order, SDFView)

The Tamarack Plan involves the use of wells and other water facilities in Colorado to reregulate excess flows in Colorado in a manner that is consistent with the flow-related goals of the Platte River Recovery Implementation Program. The Tamarack project is modeled using SDFView, which determines the rate of return for the water pumped from the South Platte River. Because the Tamarack project only removes water from the river when flows at Grand Island are in excess of the FWS instream flow targets, SDFView requires the flows at Grand Island. Therefore, the Central Platte OPSTUDY is operated with all features except Tamarack being simulated. This provides the flows at Grand Island that are necessary for the operation of SDFView. The Central Platte OPSTUDY model is then reoperated with the Tamarack project being simulated.

2.3 Model Assumptions

2.3.1 Time Period/Period of Record

The simulations use hydrology from 1947 to 1994. The criteria for selecting a time period were to include the drought of the 1950's and to have as long a period as possible. The constraints were the availability of data. Prior to the initiation of the analysis for this EIS, the most recent data available in NPREIS and the Central Platte OPSTUDY models was 1994. The selection of 1994 as an ending date was reinforced by the South Platte Model consultant. 1947 was selected because it is the earliest year that could be simulated by all three hydrologic models.

2.3.2 Monthly Time Step

The hydrology was simulated using time increments of one month. This is the time step that was used in the NPREIS and the Central Platte OPSTUDY prior to the initiation of this EIS. Furthermore, a monthly time step is considered adequate for this level of a planning study.

3.0 Model Simulations, Analysis, and Results

3.1 No Action Alternative

NEPA guidelines require that an EIS describe, in addition to the proposed action and alternatives, a special condition—the condition that would occur if the proposed Federal action is not taken. In the event that the Proposed Program, or similar program, is not implemented, the ESA requirements for protection of the species would be met by undertaking ESA Section 7 consultations for each water and land activity in the basin which might affect the species or their habitat and which requires Federal approval, or funding. These consultations would involve an analysis of the effect that each project is having on the target species. Where a project or action is found to have contributed to the current jeopardy of the species or adversely modified or destroyed critical habitat, measures would be developed and implemented to offset the negative effects on the species or critical habitat. These measures are referred to as "reasonable and prudent alternatives (RPAs)".

The Service has determined what is necessary to offset the historic basin-wide depletions to the river flows and associated land habitat needed for the target species through previous Section 7 consultations, studies, and workshops involving species experts and hydrology experts. The basin-wide goals for protection of the species are to protect an additional 29,000 acres of suitable land habitat between Lexington and Chapman, NE, and to meet the Service's target flows for the species (**citation** -- **Kingsley BO?).** Currently, river flows fall short of meeting target flows by an average of 417,000 acre-feet each year.

The Service would informally consult with <u>all</u> Federal Agencies carrying out activities in the Platte Basin to ascertain the scope of consultation and to determine if any or all of their actions "may effect" listed species or designated critical habitat. Federal actions which clearly will require consultation include those carried out by Reclamation (North Platte Reservoirs and water deliveries to irrigation facilities) and by the Corps of Engineers, including the Corps' own actions (e.g., operation of Cherry Creek, Chatfield, and Bear Creek reservoirs in the Denver area) or those projects the Corps approves through the Clean Water Act Section 404 program. In absence of a basin-wide program, consultations would be reinitiated on the Kingsley Projects and related facilities in Nebraska, on Forest Service Permits along the Front Range of Colorado, on the Service's Arapahoe National Wildlife Refuge, and on all other projects that received interim Biological Opinions since 1994 and rely on a Program to finalize those opinions.

Other Federal actions may require Section 7 consultation. These include activities carried out by the Natural Resources Conservation Service—such as the Conservation Reserve Program, Wetlands Reserve Program, Conservation Technical Assistance, and other programs—that may affect listed endangered or threatened species through the change in timing or depletion of Platte River flows and the change in sediment movement.

Other USDA programs that may require consultation are the Rural Economic & Community Development that provides financial support for public facilities and services such as funding for projects that result in the expansion of municipal well fields; the Rural Electric Program that provides ensured loans to finance the construction of facilities to generate, transmit and distribute electric power in rural areas including power to operate pumps for irrigation wells; and the Rural Utilities Service, which provides technical assistance for the operation of rural water systems.

Additionally, without a Program, ESA Section 7 consultation would include future foreseeable Federal actions or Federally authorized projects including such things as the proposed Chatfield Reservoir reregulation being studied by the Corps of Engineers, the South Park Water Supply Project for the City of Aurora, conjunctive use projects, gravel operations near the river, Northern Colorado Water Conservancy District's proposed projects for additional storage and recharge, Denver Water Board's proposed reservoir near Rocky Flats, and South Adams County's Water and Sanitation District's project.

Prior to completing consultation on any individual water project, it is not possible to determine if the project is or will contribute to these basin-wide deficits or what measures would be required to offset the project's impacts on the species. However, it is reasonable to expect that generally all projects in the basin would share in offsetting the basin-wide deficits in land and water habitat specified above, either by providing water for improved river flows, or funds for acquisition of land habitat, or both. Offsetting measures would be roughly in proportion to the projects' historic depletion of river flows, or equal to any newly created depletions, measured at Grand Island, NE.

3.2 Present Condition

In an EIS, the proposed action and alternatives are all compared to the same baseline condition, usually the no action alternative. In order for the no action condition to serve as a quantitative baseline for the EIS, it would be necessary to assess quantitatively the conditions that would result under no action. This would include estimating, at a minimum, the state of all important habitat variables as well as basin-wide river flows and reservoir levels and associated agricultural and economic conditions that would result after ESA consultation on every water and associated land activity in the basin with a Federal connection. To attempt such estimates would be highly speculative. While it is possible to judge the aggregate contribution required from all projects, allocating those contributions to individual projects prior to actual consultation is not possible.

Therefore, the Present Condition that exist in the basin will be used as the quantitative baseline for comparing alternatives. These conditions can reasonably serve as the baseline for comparing the impacts of the alternatives because:

1. They rePresent Condition with which affected groups are most familiar.
2. The levels of river diversion and water use in the basin are currently quite stable.
3. Trends in land use in the habitat area are quite stable.
4. The FWS species target flows and land habitat requirements are based upon Present Condition.

The hydrologic models used to rePresent Condition in the North Platte, South Platte, and Central Platte River basins are configured to represent the current level of water storage and diversion facilities and water demands. The natural variability of precipitation and runoff are represented by running the various alternatives over a 48-year "period of record", that is, the precipitation and runoff conditions in the Platte Basin for the years 1947 to 1994.

Sections 2.3.3 and 2.3.3.1 describe how Present Condition was represented in the Central Platte Model. **Section 2.2.5** describes how the South Platte Model simulates Present Condition. **Section 2.1.5** covers Present Condition for the North Platte Model.

The results of the analysis for Present Condition in the central Platte River basin are summarized in **Tables 3.2-17** through **3.2-35** and in **Figures 3.2-6** and **3.2-14**. The results for the alternatives discussed below will be evaluated with respect to the changes from these results, where applicable.

In the evaluation of the alternatives, the following terms are defined according to how they are used in the discussion:

<u>Central Platte</u> - That reach of the Platte River beginning at Lewellen, NE, on the North Platte River and at Julesburg, Co, on the South Platte River, and ending at the confluence of the Loup and Platte Rivers near Columbus, NE.

<u>Diversion</u> - Water removed from a river into an off-river system such as a canal or reservoir

by means of a gravity-driven control structure.

Environmental Accrual - Water stored in a project for transportation and/or exchange into the Lake McConaughy EA.

Irrigation Demand - Water diverted for irrigation; water right existing for this purpose.

Power Generation - Refers to electricity generated by the hydroelectric stations at Kingsley Dam and along the Sutherland and Tri-County supply canals.

Shortage - A shortage measures water that was needed for irrigation, but was not delivered due to an inadequate supply of water.

Spill - Water flowing out of a reservoir in excess of the turbine capacity that is in excess of what will be used downstream for power production or irrigation.

Storage - Water retained in a reservoir (surface or ground water) for future use.

Target Flow - A specific flow value at a location for which a water management system is being operated. For this study, this refers specifically to flows at Grand Island determined by the Fish and Wildlife Service to be necessary for endangered species recovery.

Water Banking - Amount of water in storage that is temporarily leased to the Program.

Water Conservation - Reduction in consumptive water use due to improved irrigation efficiency, leasing, outright purchase, or some other means; such conserved water is credited to the Lake McConaughy EA.

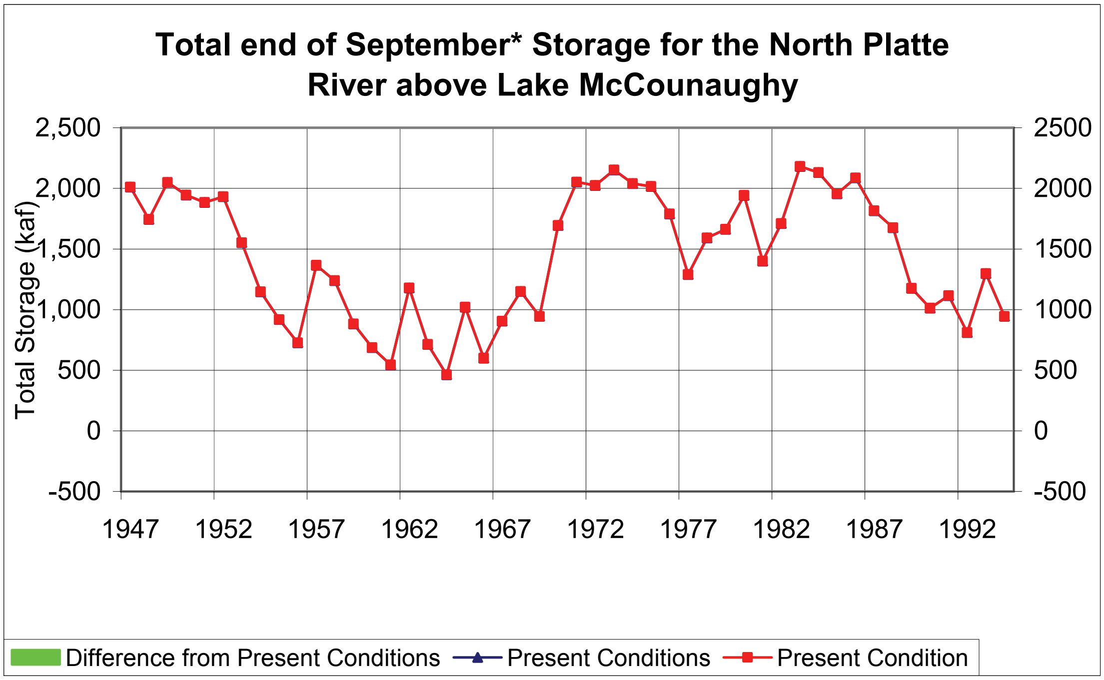
3.2.1 North Platte River Basin

The results of the analysis of the North Platte River basin for Present Condition are summarized in **Figures 3.2-1** through **3.2-5** and **Tables 3.2-1** through **3.2-16**.

Storage above Lake McConaughy. The results for storage conditions above Lake McConaughy are given in **Figure 3.2-1**.

Present Condition

North Platte River above Lake McConaughy



* September is the end of the water year when storage is at a minimum value for the year.

Figure 3.2- 1. End of September storage above Lake McConaughy.

Figure 3.2-1 shows that the end-of-September storage above Lake McConaughy was generally lower in the 1950’s, 1960’s, and the late 1980’s and early 1990’s for the Present Condition. Storage is generally high during the wet periods in the early 1970's and much of the 1980's.

Present Condition													**Inland**		**Total**	
North Platte River above Lake McConaughy	**Seminoe**		**Pathfinder**		**Alcova**		**Glendo**		**Guernsey**		**Lakes**		**Storage**			
Reservoir Storage	**Value**	**% Δ**[1]	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**		
Minimum end-of-month storage for 48-year simulation (kaf)	92.3	0%	31.4	0%	156	0%	63.1	0%	0	0%	3.8	0%	461.9	0%		
Maximum end-of-month storage for 48-year simulation (kaf)	1,017.3	0%	1,016.6	0%	179.5	0%	683.0	0%	45.6	0%	72.0	0%	2894.0	0%		
Average end-of-month storage for 48-year simulation (kaf)	599.0	0%	562.0	0%	167.8	0%	331.3	0%	19.0	0%	35.6	0%	1684.9	0%		
Low storage indicator: years with storage < ### kaf	6 < 200 kaf		12 < 200 kaf		0 < 150 kaf		9 < 100 kaf		0 < 0 kaf		0 < 0 kaf		6 < 650 kaf			
Percent change from Present Conditions[2]		0%		0%		0%		0%		0%		0%		0%		
Year that minimum first occurred	1965		1964		1947		1964		1949		1962		1964			
Largest single month drawdown for this alternative (kaf)	152.5	0%	278.3	0%	23.5	0%	258.6	0%	28	0%	29.5	0%	365.2	0%		
Month of largest drawdown	July-54		July-81		October-47		July-83		September-47		August-51		July-84			
File that contains the data		Resop.tab		Resop.tab		Resop.tab		Resop.tab		Resop.tab		Resop.tab		Resop.tab		
Table number		3		2		25		1		4		5		6		

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

[2] NA in the % Δ column indicates that there were no years with storage < ### kaf in the Present Condtion Run

Table 3.2- 1. Reservoir storage statistics for the North Platte River above Lake McConaughy.

The minimum, maximum, and average end-of-month storage for Present Condition are shown in **Table 3.3-1**. **Table3.3-1** also contains statistics on low reservoir storage and largest monthly drawdown.

Present Condition

North Platte River above Lake McConaughy

Reservoir Storage		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
Seminoe Reservoir														Resop.tab Table 3
	Min (kaf)	157	147	134	122	110	92	110	185	303	193	181	180	92
	Max (kaf)	963	927	903	880	837	846	940	1,017	1,017	1,017	962	963	1,017
	Avg (kaf)	603	587	565	543	518	509	534	644	751	696	629	609	599
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Pathfinder Reservoir														Resop.tab Table 2
	Min (kaf)	58	60	60	63	66	47	53	157	202	128	101	31	31
	Max (kaf)	924	959	976	990	1,014	1,016	1,017	1,017	1,017	1,017	924	908	1,017
	Avg (kaf)	520	532	544	555	572	585	612	645	670	529	495	485	562
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Alcova Reservoir														Resop.tab Table 25
	Min (kaf)	156	156	156	156	156	156	180	180	180	180	180	180	156
	Max (kaf)	156	156	156	156	156	156	180	180	180	180	180	180	180
	Avg (kaf)	156	156	156	156	156	156	180	180	180	180	180	180	168
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Glendo Reservoir														Resop.tab Table 1
	Min (kaf)	102	137	168	201	236	278	286	292	219	210	80	63	63
	Max (kaf)	346	379	413	446	481	515	502	653	683	516	314	312	683
	Avg (kaf)	203	245	284	325	366	419	426	447	448	410	242	160	331
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Guernsey Reservoir														Resop.tab Table 4
	Min (kaf)	0	0	0	0	0	5	35	40	35	30	30	2	0
	Max (kaf)	8	13	16	19	27	30	46	46	45	30	30	2	46
	Avg (kaf)	2	5	8	11	13	15	36	40	35	30	30	2	19
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 3.2- 2. Monthly reservoir storage statistics for the North Platte River above Lake McConaughy.

Minimum, maximum, and average end-of-month storage by month are shown in **Table 3.2-2**. This table shows that storage is usually the lowest in the late summer and winter (September-March) and highest in the spring and summer (April-July).

Present Condition

North Platte River above Lake McConaughy

Spills from the system	Spills Value	% Δ[1]
Average annual spill for 48-year simulation period (kaf)	118.0	0%
Number of years with spills	12	0%
Average annual spill for years with spills (kaf)	472.1	0%
Largest annual spill (kaf)	1313.5	0%
Year of largest annual spill	1984	
File that contains the data	Storown.lst	
Output line number	8	

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

Table 3.2- 3. Spills from Guernsey Reservoir.

The average annual spill from Guernsey Reservoir for Present Condition is shown in **Table 3.2-3**.

Reservoir elevations above Lake McConaughy.

Present Condition North Platte River above Lake McConaughy Reservoir Elevations	Seminoe Value	Seminoe % Δ[1]	Pathfinder Value	Pathfinder % Δ	Alcova Value	Alcova % Δ	Glendo Value	Glendo % Δ	Guernsey Value	Guernsey % Δ
Minimum average elevation for 48-year simulation (kaf)	6,265	0.0%	5,746	0.0%	5,488	0.0%	4,570	0.0%	4,370	0.0%
Maximum average elevation for 48-year simulation (kaf)	6,357	0.0%	5,850	0.0%	5,498	0.0%	4,647	0.0%	4,420	0.0%
Average average elevation for 48-year simulation (kaf)	6,328	0.0%	5,819	0.0%	5,493	0.0%	4,615	0.0%	4,403	0.0%
Low storage indicator: years with elevation < #### ft	6 < 6,289 ft		12 < 5,787 ft		0 < 5,486 ft		8 < 4,580 ft		0 < 4,370 ft	
Percent change from Present Conditions[2]		0%		0%		0%		0%		0%
Year that minimum first occurred	1965		1964		1947		1964		1949	
Average May-August drawdown for this alternative (feet)	1.3	0%	11.2	0%	0.0	0%	23.7	0%	4.8	0%
Largest May-August drawdown for this alternative (feet)	21.4	0%	29.7	0%	0.0	0%	45.9	0%	7.1	0%
Year of largest drawdown	1954		1954		1947		1956		1971	
File that contains the data	Natflow.tab		Natflow.tab		Natflow.tab		Natflow.tab		Natflow.tab	
Table number	13		12		11		10		9	

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

[2] NA in the % Δ column indicates that there were no years with elevation < #### ft in the Present Condtion Run

Table 3.2- 4. Reservoir elevation statistics for the North Platte River above Lake McConaughy.

Table 3.2-4 shows the same statistics for reservoir elevation as are shown in **Table 3.2-1** for end-of-month reservoir storage.

Present Condition North Platte River above Lake McConaughy Reservoir Elevation Minimum and Maximum	Seminoe	Pathfinder	Alcova	Glendo	Guernsey
Elevation for empty reservoir:	6160.0	5690.0	5320.0	4508.0	4370.0
Historic minimum elevation:	6253.3	5690.0	5408.8	4549.3	4370.0
Minimum elevation for alternative:	6265.2	5746.0	5488.0	4570.0	4370.0
Years min. elev. Achieved	1	1	48	1	25
Years min. < Reference	0	0	0	0	0
Years min. < Historic	0	0	0	0	0
Elevation for full reservoir[1]:	6357.0	5850.1	5500.0	4669.0	4420.0
Historic maximum elevation[2]:	6359.3	5853.5	5499.9	4650.8	4421.7
Maximum elevation for alternative:	6357.0	5850.1	5498.0	4646.7	4420.0
Years max. elev. Achieved	10	13	48	1	6
Years max. > Reference	0	0	0	0	0
Years max. > Historic	0	0	0	0	0

[1] Elevation for the top of the conservation capacity.

[2] Historic elevations that are greater than the elevation for a full reservoir are the result of flood storage and reservoir surcharge.

Table 3.2- 5. Minimum and maximum reservoir elevation statistics for the North Platte River above Lake McConaughy.

Table 3.2-5 compares the minimum and maximum elevation for each reservoir to historic values. **Table 3.2-5** shows that there were no instances where the minimum or maximum storage for Present Condition were greater than the historic values.

Present Condition

North Platte River above Lake McConaughy

Reservoir Elevations		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
Seminoe Reservoir												Natflow.tab Table 13		
	Min (feet)	6,281	6,279	6,276	6,273	6,270	6,265	6,270	6,286	6,303	6,287	6,285	6,285	6,265
	Max (feet)	6,354	6,352	6,351	6,350	6,347	6,348	6,353	6,357	6,357	6,357	6,354	6,354	6,357
	Avg (feet)	6,328	6,327	6,326	6,324	6,322	6,321	6,323	6,332	6,340	6,336	6,331	6,329	6,328
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Pathfinder Reservoir												Natflow.tab Table 12		
	Min (feet)	5,756	5,756	5,756	5,757	5,758	5,752	5,754	5,779	5,787	5,773	5,767	5,746	5,746
	Max (feet)	5,846	5,848	5,848	5,849	5,850	5,850	5,850	5,850	5,850	5,850	5,846	5,845	5,850
	Avg (feet)	5,817	5,817	5,818	5,819	5,820	5,821	5,823	5,826	5,828	5,817	5,815	5,813	5,819
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Alcova Reservoir												Natflow.tab Table 11		
	Min (feet)	5,488	5,488	5,488	5,488	5,488	5,488	5,498	5,498	5,498	5,498	5,498	5,498	5,488
	Max (feet)	5,488	5,488	5,488	5,488	5,488	5,488	5,498	5,498	5,498	5,498	5,498	5,498	5,498
	Avg (feet)	5,488	5,488	5,488	5,488	5,488	5,488	5,498	5,498	5,498	5,498	5,498	5,498	5,493
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Glendo Reservoir												Natflow.tab Table 10		
	Min (feet)	4,581	4,589	4,594	4,600	4,605	4,611	4,612	4,612	4,603	4,601	4,575	4,570	4,570
	Max (feet)	4,619	4,622	4,626	4,629	4,632	4,635	4,634	4,645	4,647	4,635	4,615	4,615	4,647
	Avg (feet)	4,599	4,606	4,611	4,616	4,620	4,626	4,627	4,628	4,628	4,625	4,605	4,592	4,615
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Guernsey Reservoir												Natflow.tab Table 9		
	Min (feet)	4,370	4,370	4,370	4,370	4,370	4,395	4,415	4,418	4,415	4,413	4,413	4,388	4,370
	Max (feet)	4,398	4,403	4,405	4,407	4,412	4,413	4,420	4,420	4,420	4,413	4,413	4,388	4,420
	Avg (feet)	4,382	4,394	4,397	4,400	4,402	4,404	4,416	4,418	4,415	4,413	4,413	4,388	4,403
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 3.2- 6. Monthly reservoir elevation statistics for the North Platte River above Lake McConaughy.

Table 3.2-6 shows the minimum, maximum, and average reservoir elevation for the five major reservoirs above Lake McConaughy by month.

North Platte River flow into Lake McConaughy. The results for North Platte River flow into Lake McConaughy for Present Condition are given in **Figure 3.2-2**.

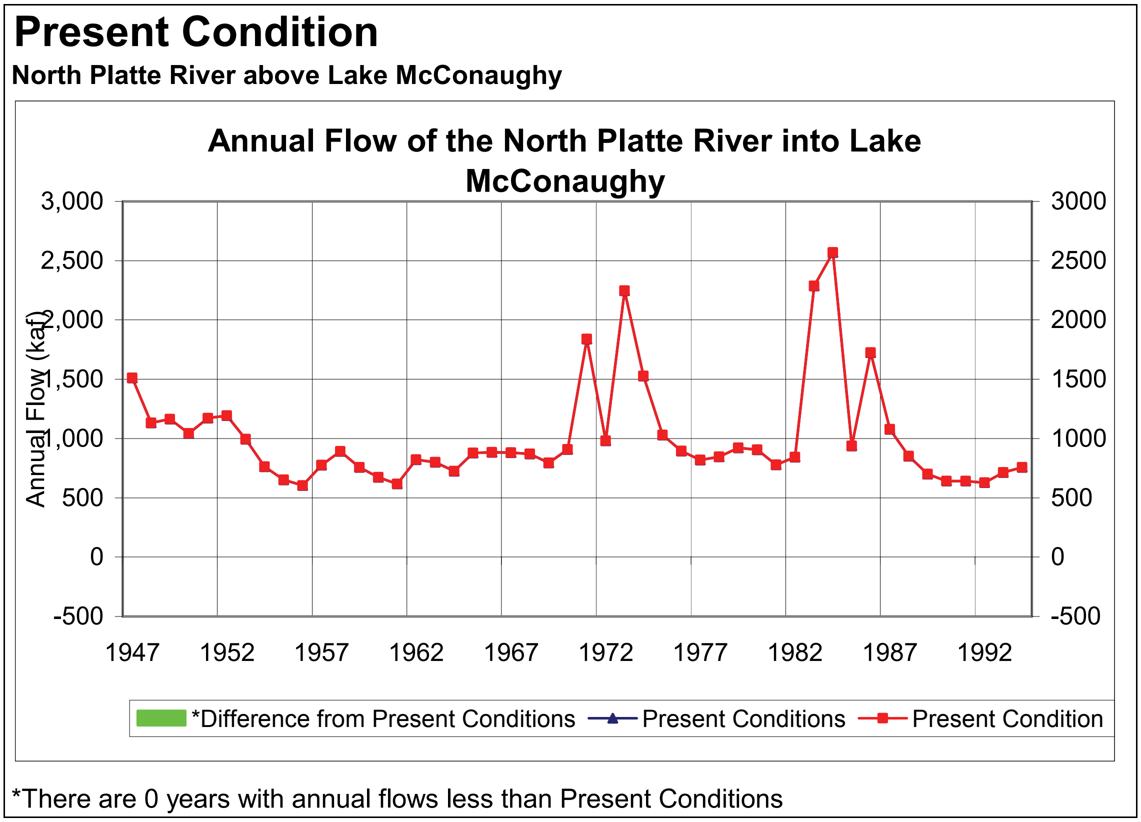
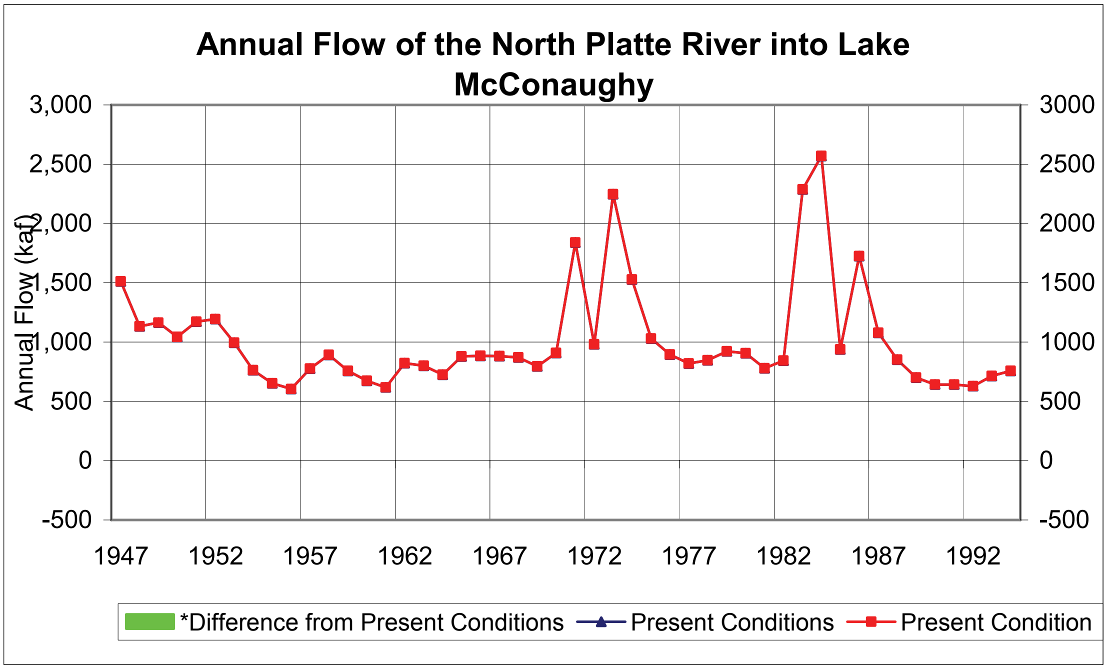


Figure 3.2- 2. Annual flow of the North Platte River into Lake McConaughy.

Figure 3.2-2 shows the North Platte River flow into Lake McConaughy for Present Condition. The highest flow occurs in the early 1970's and 1980's.

Present Condition

North Platte River above Lake McConaughy



*There are 0 years with annual flows less than Present Conditions

Figure 3.2- 3. Average monthly flow of the North Platte River into Lake McConaughy.

Present Condition North Platte River above Lake McConaughy													
Flows	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Ann**
N.P. River flow into Lake McConaughy											Resop.tab Table 9		
Min (Monthly (cfs), Annual (kaf))	758	1,062	862	805	911	862	534	275	376	124	189	356	604
Max (Monthly (cfs), Annual (kaf))	2,318	2,038	1,888	1,825	1,889	2,126	3,062	12,858	12,254	7,627	2,137	2,828	2,568
Avg (Monthly (cfs), Annual (kaf))	1,662	1,495	1,317	1,206	1,285	1,215	1,261	1,741	2,221	1,282	785	1,335	1,014
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 3.2- 7. Monthly flow of the North Platte River into Lake McConaughy.

On a monthly basis, inflows into Lake McConaughy from the North Platte River are shown in **Figure 3.2-3** and **Table 3.2-7**.

Present Condition North Platte River above Lake McConaughy													
Enviromental Flows Delivered to Lake McConaughy	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Ann**
											Natflow.tab Table 31		
Min (kaf)	0	0	0	0	0	0	0	0	0	0	0	0	0
Max (kaf)	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (kaf)	0	0	0	0	0	0	0	0	0	0	0	0	0
Year that minimum first occurred	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947

Table 3.2- 8. Environmental deliveries from above Lake McConaughy.

There are no environmental deliveries to Lake McConaughy (**Table 3.2-8**) under Present Condition.

Project Ownership, Project Shortages, Irrigation Demand, Water Leasing. The results for project ownership for Present Condition are given in **Table 3.2-9**.

Present Condition								
North Platte River above Lake McConaughy	**North Platte[1]**		**Kendrick[2]**		**Glendo**		**Total**	
Project Ownership	**Value**	**% Δ[3]**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**
Minimum end-of-month ownership for 48-year simulation (kaf)	49.7	0%	173.2	0%	11.6	0%	461.9	0%
Maximum end-of-month ownership for 48-year simulation (kaf)	1,099.8	0%	1,201.7	0%	180.0	0%	2,894.0	0%
Average end-of-month ownership for 48-year simulation (kaf)	698.3	0%	839.1	0%	126.3	0%	1,684.9	0%
Years with ownership < ### kaf	3 < 100 kaf		4 < 300 kaf		8 < 63 kaf		0 < 400 kaf	
Percent change from Present Conditions[4]		0%		0%		0%		NA
Year that minimum first occurred	1964		1968		1962		1964	
Largest single month accrual for this alternative (kaf)	469.6	0%	540.9	0%	57.5	0%	570.6	0%
Month of largest accrual	June-65		June-70		May-91		June-70	
File that contains the data	Storown.tab		Storown.tab		Storown.tab		Resop.tab	
Table numbers	1, 8, & 9		2 & 3		4, 5, & 6		6	

[1] The North Platte Project includes Pathfinder Reservoir, Guernsey Reservoir, and the Inland Lakes.
[2] The Kendrick Project includes Seminoe Reservoir and Alcova Reservoir.
[3] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)
[4] NA in the % Δ column indicates that there were no years with ownership < ### kaf in the Present Condtion Run

Table 3.2- 9. Project ownership on the North Platte River above Lake McConaughy.

Project ownership. Table 3.2-9 shows project ownership for Present Condition for all projects.

Present Condition / **North Platte River above Lake McConaughy**	**North Platte Project**		**Kendrick Project**		**Glendo Unit**		**Non-project Lands**		**Total Shortages**	
Project Shortages	**Value**	**% Δ[1]**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**
Average annual shortage for 48-year simulation period (kaf)[2]	0.2	0%	2.9	0%	3.7	0%	0.5	0%	7.3	0%
Number of years with shortages	2	0%	3	0%	21	0%	26	0%	33	0%
Average annual shortage for years with shortage (kaf)	5.4	0%	46.6	0%	8.5	0%	0.9	0%	10.7	0%
As a percentage of demand for years with shortage (%)	0.9%		66.6%		12.9%		0.4%		1.0%	
Largest annual shortage (kaf)	10.4	0%	70	0%	24.4	0%	3.8	0%	70.6	0%
As a percentage of demand (%)	1.7%		100.0%		40.7%		1.4%		7.0%	
Year of largest annual shortage	1957		1967		1959		1960		1967	
Data is contained in the file Resop.tab table number	30 & 52		31 & 54		32 & 53		42 & 55		30-32,42,52-55	

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)
[2] NA in the % Δ column indicates that there were no shortages in the Present Condtion Run

Table 3.2- 10. Project shortages on the North Platte River above Lake McConaughy.

Project shortages. Figure 3.2-10 shows project shortages for Present Condition for the North Platte River above Lake McConaughy. There are shortages for the Present Condition prior to implementing any Program.

Present Condition / **North Platte River above Lake McConaughy**	**North Platte Project**		**Kendrick Project**		**Glendo Unit**		**Non-project Lands**		**Total Demand**	
Project Irrigation Demand	**Value**	**% Δ[1]**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**
Average annual demand for 48-year simulation period (kaf)	763.0	0%	70.0	0%	67.5	0%	254.0	0%	1154.4	0%
Maximum annual demand (kaf)	988.5	0%	70.0	0%	91.9	0%	303.0	0%	1427.6	0%
Minimum annual demand (kaf)	504.4	0%	70.0	0%	47.8	0%	190.0	0%	875.2	0%
Data is contained in the file Resop.tab table number	52		54		53		55		52-55	

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

Table 3.2- 11. Project irrigation demand on the North Platte River above Lake McConaughy.

Irrigation demand. There are no changes in irrigation demand between Present Condition and any of the Alternatives. The demands are shown in **Table 3.2-11** for comparison to irrigation deliveries and water leasing.

Present Condition North Platte River above Lake McConaughy													
Irrigation Deliveries	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Ann**
North Platte Project Irrigation Deliveries													Resop.tab Table 3
Min (kaf)	0	0	0	0	0	0	0	0	27	216	255	87	701
Max (kaf)	9	2	1	0	1	1	7	221	285	361	357	278	1,482
Avg (kaf)	2	0	0	0	0	0	2	117	134	319	324	200	1,098
Percent change from Present Conditions													
Min	NA	NA	NA	NA	NA	NA	NA	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	NA	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	NA	0%	0%	0%	0%	0%	0%	0%	0%	0%
Kendrick Project Irrigation Deliveries													Resop.tab Table 2
Min (kaf)	0	0	0	0	0	0	0	0	0	0	0	0	0
Max (kaf)	0	0	0	0	0	0	0	11	17	22	19	9	77
Avg (kaf)	0	0	0	0	0	0	0	10	16	21	18	9	74
Percent change from Present Conditions													
Min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Max	NA	NA	NA	NA	NA	NA	NA	0%	0%	0%	0%	0%	0%
Avg	NA	NA	NA	NA	NA	NA	NA	0%	0%	0%	0%	0%	0%
Glendo Project Irrigation Deliveries													Resop.tab Table 25
Min (kaf)	0	0	0	0	0	0	0	0	2	6	5	6	35
Max (kaf)	11	1	0	0	0	0	0	17	22	22	22	20	92
Avg (kaf)	1	0	0	0	0	0	0	8	11	16	14	13	64
Percent change from Present Conditions													
Min	NA	NA	NA	NA	NA	NA	NA	0%	0%	0%	0%	0%	0%
Max	0%	0%	NA	NA	NA	NA	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	NA	NA	NA	NA	0%	0%	0%	0%	0%	0%	0%
Non-Project Irrigation Deliveries													Resop.tab Table 1
Min (kaf)	0	0	0	0	0	0	0	8	9	31	52	26	190
Max (kaf)	16	2	0	0	0	0	16	52	56	78	74	62	303
Avg (kaf)	6	0	0	0	0	0	2	29	40	62	66	48	253
Percent change from Present Conditions													
Min	NA	NA	NA	NA	NA	NA	NA	0%	0%	0%	0%	0%	0%
Max	0%	0%	NA	NA	NA	NA	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	NA	NA	NA	NA	0%	0%	0%	0%	0%	0%	0%

Table 3.2- 12. Project irrigation delivery on the North Platte River above Lake McConaughy.

Irrigation deliveries. Table 3.2-12 shows the minimum, maximum, and average irrigation deliveries by month for each of the North Platte River projects.

Water leasing. The results for water banking and conservation above Lake McConaughy are given in **Table 3.2 -13**.

Present Condition North Platte River above Lake McConaughy					
Water Banking / Conservation	**North Platte Project**	**Kendrick Project**	**Glendo Unit**	**Non-project Lands**	**Total**
Average annual conservation for 48-year simulation period (kaf)	0.0	0.0	0.0	0.0	0.0
Number of years with conservation	0	0	0	0	0
Average annual conservation for years with conservation (kaf)	0.0	0.0	0.0	0.0	0.0
As a percentage of demand (%)	0.0%	0.0%	0.0%	0.0%	0.0%
Largest annual conservation (kaf)	0	0	0	0	0
As a percentage of demand (%)	0.0%	0.0%	0.0%	0.0%	0.0%
Year of largest annual conservation	1947	1947	1947	1947	1947
Data is contained in the file Resop.tab table number	56 & 52	58 & 54	57 & 53	59 & 55	52-55 & 56-59

Table 3.2- 13. Water leasing by project above Lake McConaugy.

Table 3.2-13 shows that no water leasing is occurring in the Present Condition run.

Flows. The results for flows in the North Platte River for Present Condition are given in **Table 3.2-14**.

Present Condition

North Platte River above Lake McConaughy

Flows	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
N.P. River below Kortes Reservoir											Resop.tab Table 20		
Min (Monthly (cfs), Annual (kaf))	503	502	503	503	502	503	502	503	502	503	503	502	512
Max (Monthly (cfs), Annual (kaf))	1,265	1,420	1,137	1,057	1,597	1,929	2,775	8,735	8,893	6,170	2,775	2,075	1,870
Avg (Monthly (cfs), Annual (kaf))	689	770	770	747	878	828	1,304	1,847	3,075	2,467	1,624	632	945
Months with flow below 500 cfs[1,4]	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Months with flow below 500 cfs[2]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N.P. River below Gray Reef Reservoir											Natflow.tab Table 21		
Min (Monthly (cfs), Annual (kaf))	501	502	503	503	502	503	502	503	502	1,407	532	502	500
Max (Monthly (cfs), Annual (kaf))	776	776	768	768	796	1,265	1,476	9,299	9,544	5,656	3,928	2,165	1,898
Avg (Monthly (cfs), Annual (kaf))	653	571	570	569	574	695	643	1,524	2,666	4,603	1,927	641	949
Months with flow below 500 cfs[3,4]	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Months with flow below 500 cfs[2]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N.P. River below Guernsey Reservoir											Resop.tab Table 7		
Min (Monthly (cfs), Annual (kaf))	5	3	5	7	5	5	104	31	383	3,388	3,625	1,171	706
Max (Monthly (cfs), Annual (kaf))	501	25	24	86	61	398	1,649	10,687	10,329	10,077	5,863	3,948	2,304
Avg (Monthly (cfs), Annual (kaf))	156	5	6	9	10	28	749	2,299	3,071	5,176	4,652	2,790	1,152
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

[1] The flow below Kortes Reservoir is required by law to be greater than 500 cfs.
[2] NA indicates that there were no months in Present Conditions with flows less than 500 cfs.
[3] The flow below Gray Reef Reservoir isrequired by law to be greater than 330 cfs, but flow of 500 cfs is maintained (when possible) by Reclamation.
[4] The value in the Ann column is the number of years where at least one month had average flows below 500 cfs.

Table 3.2- 14. Flow in the North Platte River above Lake McConaughy.

Table 3.2-14 shows no flows less than 500 cfs below both Kortes and Gray Reef reservoirs for Present Condition.

Power generation and by pass flows. The results for power generation in the North Platte River basin upstream of Lake McConaughy are given in **Figure 3.2-5**.

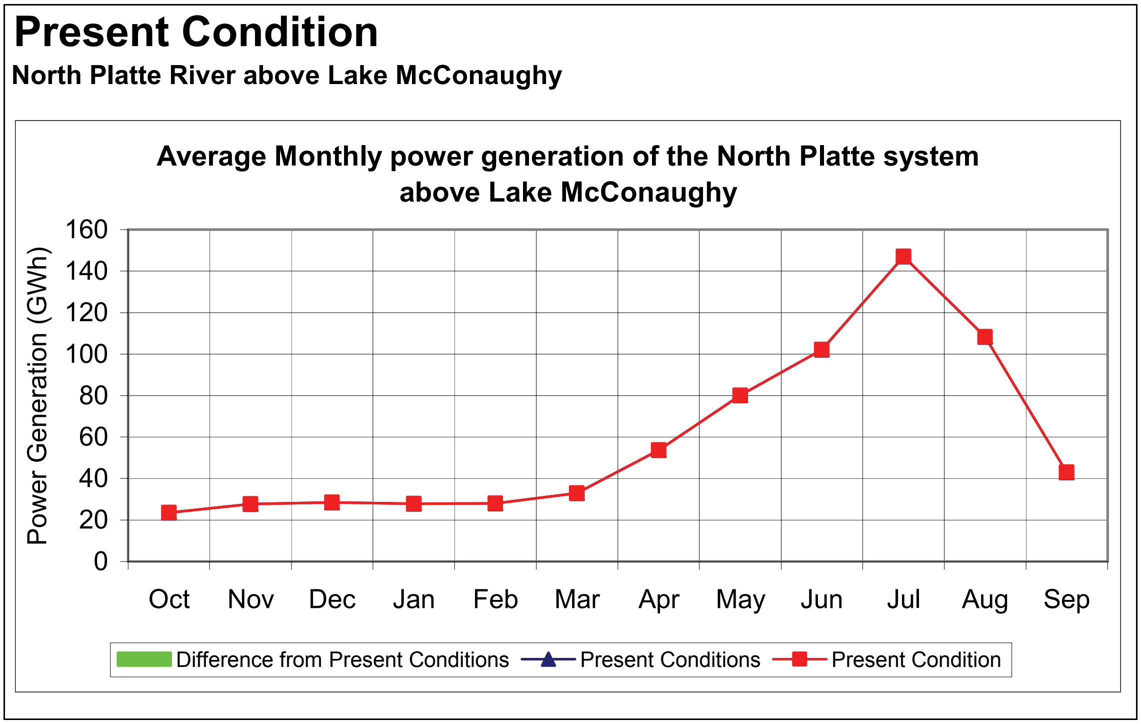


Figure 3.2- 4. Average Monthly power generation of the North Platte System above Lake McConaughy.

Present Condition
North Platte River above Lake McConaughy

Power Generation	**Seminoe** Value	% Δ[1]	**Kortes** Value	% Δ	**Fremont Canyon** Value	% Δ	**Alcova** Value	% Δ	**Glendo** Value	% Δ	**Guernsey** Value	% Δ	**Total** Value	% Δ
Minimum (GWh)	73.2	0%	87.8	0%	123.1	0%	69.5	0%	53.6	0%	15.1	0%	451.108	0%
Maximum (GWh)	211.8	0%	199.8	0%	263.9	0%	146.8	0%	133.3	0%	21.4	0%	921.202	0%
Average (GWh)	140.3	0%	145.5	0%	193.5	0%	110.9	0%	93.7	0%	18.8	0%	702.7	0%
Year that minimum occurred	1955		1955		1955		1970		1961		1990		1955	
Data is contained in the file Resop.tab table number		13		14		15		16		17		18		19

[1] % Δ indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

Table 3.2- 15. Power generation statistics for the North Platte system above Lake McConaughy.

Figure 3.2-4 shows that the most power produced on a monthly basis occurs during the summer (May-August) when water is being moved for irrigation.

Present Condition

North Platte River above Lake McConaughy

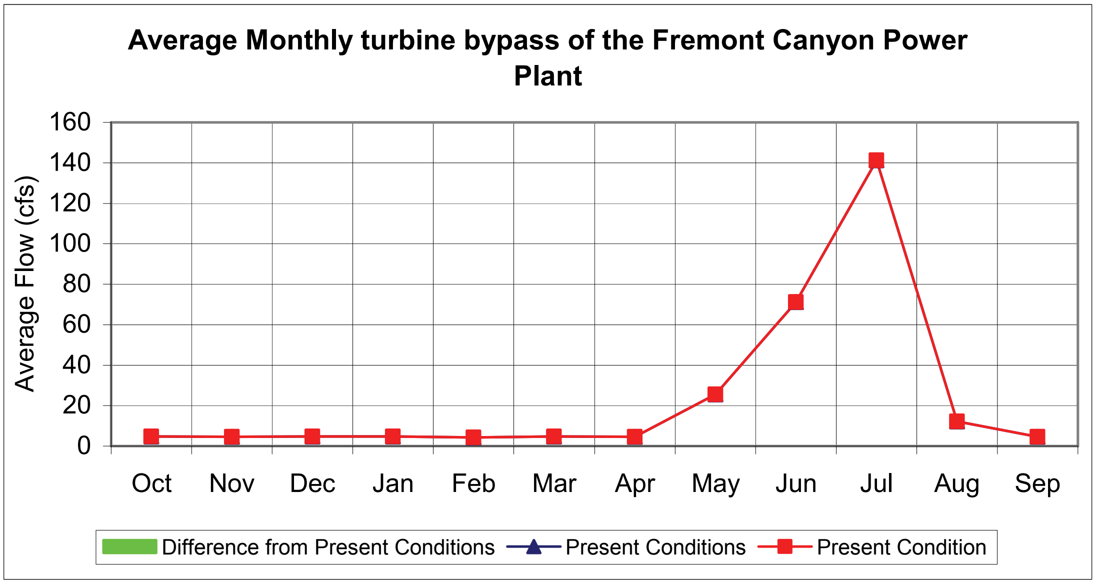


Figure 3.2- 5. Average Monthly turbine bypass of the Fremont Canyon Power Plant.

Present Condition

North Platte River above Lake McConaughy Flows that Bypass Turbines	Seminoe Value	Seminoe % Δ[1]	Kortes Value	Kortes % Δ	Fremont Canyon Value	Fremont Canyon % Δ	Alcova Value	Alcova % Δ	Glendo Value	Glendo % Δ	Guernsey Value	Guernsey % Δ
Average annual bypass for 48-year simulation period (kaf)	78.4	0%	98.6	0%	286.9	0%	219.4	0%	221.4	0%	877.1	0%
Number of years with bypasses	20	0%	36	0%	48	0%	47	0%	48	0%	48	0%
Average annual bypass for years with a bypass (kaf)	188.1	0%	131.5	0%	286.9	0%	224.1	0%	221.4	0%	877.1	0%
Largest annual bypass (kaf)	775.3	0%	819.6	0%	1049.5	0%	928.4	0%	1130.7	0%	2025.3	0%
Year of largest annual bypass	1984		1984		1984		1984		1984		1984	
File that contains the data	Resop.lst		Resop.lst		Resop.lst		Resop.lst		Resop.lst		Resop.lst	
Output line number	13		27		43		59		83		99	

[1] % Δ indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

Table 3.2- 16. Turbine bypass flow statistics for the North Platte system above Lake McConaughy.

Table 3.2-16 shows bypass flows occurring for at least one hydroelectric plant each year. **Figure 3.2-5** shows how the bypass flows would be distributed on a monthly basis for the Fremont Canyon hydroelectric plant. Bypass flows at Fremont Canyon are most likely to occur during the summer (May-August) when water is being moved for delivery to irrigation districts.

3.2.2 Platte River Basin in central Nebraska

The results of the analysis of the central Platte River basin for Present Condition are summarized in **Figures 3.2-6** through **3.2-14** and **Tables 3.2-17** through **3.2-35**. The terms used below were defined earlier in **Section 3.2** according to how they are used in this discussion.

Lake McConaughy. Conditions in Lake McConaughy resulting from Present Condition are shown on **Figure 3.2-6**.

Present Condition

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

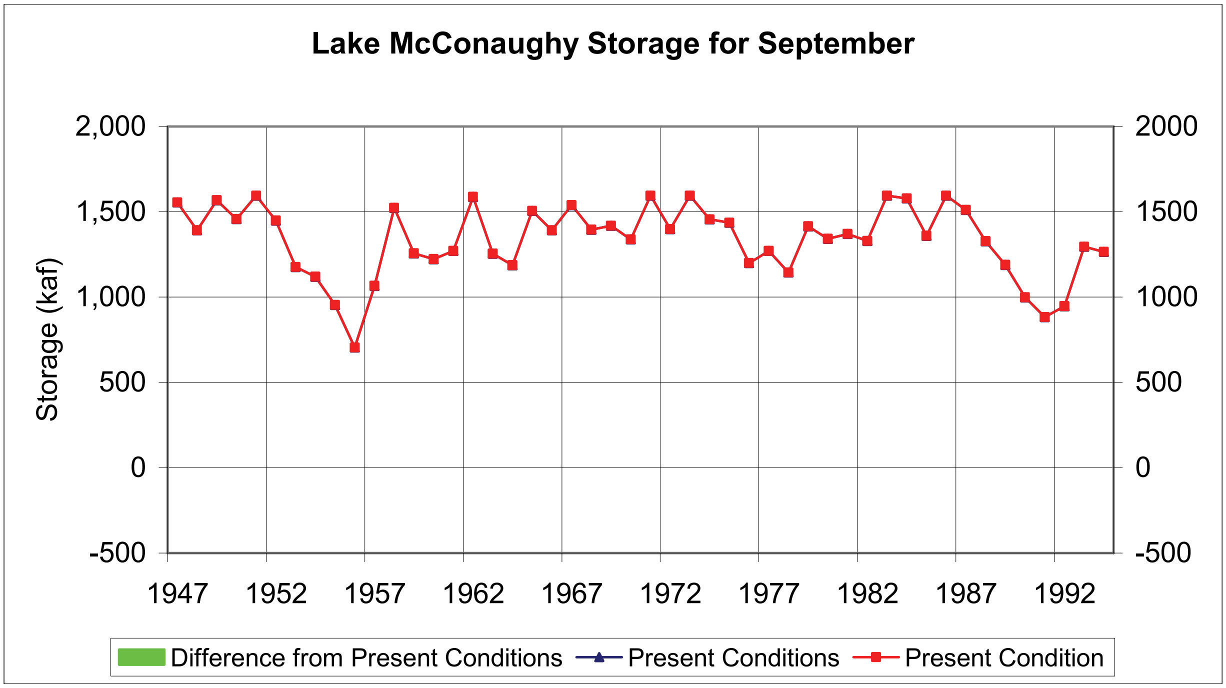


Figure 3.2- 6. End of September storage in Lake McConaughy.

Figure 3.2-6 shows periods of low storage in the 1950's and the late 1980's and early 1990's. There are periods of high storage in the early 1970's and 1980's.

Present Condition

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Lake McConaughy Reservoir Storage	Value	% Δ[1]
Minimum end-of-month storage for 48-year simulation (kaf)	703.8	0%
Maximum end-of-month storage for 48-year simulation (kaf)	1743.1	0%
Average end-of-month storage for 48-year simulation (kaf)	1451.6	0%
Low storage indicator: years with storage < 500 kaf	0	0%
Year that minimum first occurred		1956
Largest single month drawdown for this alternative (kaf)	238	0%
Month of largest drawdown		July-80
Table number in file .tab.		1

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

Table 3.2- 17. Reservoir storage statistics for Lake McConaughy.

Over all months of the simulation period, the average end-of-month storage for Present Condition is 1,451,600 acre-feet with no years with storage less than 500,000 acre-feet.

Present Condition Central Platte (North Platte below Lewellen and South Platte below Julesburg) Lake McConaughy Storage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
											Table 1 in file .tab.		
Min (kaf)	891	950	995	1,072	1,126	1,051	924	801	704	732	806	868	704
Max (kaf)	1,594	1,594	1,594	1,609	1,743	1,743	1,743	1,669	1,594	1,594	1,594	1,594	1,743
Avg (kaf)	1,456	1,483	1,513	1,537	1,561	1,554	1,444	1,339	1,333	1,370	1,402	1,428	1,452
Year that minimum first occurred	1957	1957	1957	1957	1956	1956	1956	1956	1956	1956	1956	1956	1956
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 3.2- 18. Monthly reservoir storage statistics for Lake McConaughy.

Minimum, maximum, and average storage by month for Present Condition are shown in **Table 3.2-18**.

Present Condition

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Lake McConaughy Spills	Value	% Δ[1]
Average annual spill for 48-year simulation period (kaf)	169.1	0%
Number of years with spills	29	0%
Average annual spill for years with spills (kaf)	280.0	0%
Largest annual spill (kaf)	1397.7	0%
Year of largest annual spill		1984
Table number in file .tab.		6

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

Table 3.2- 19. Spills from Lake McConaughy.

The number of years with spills for Present Condition is 29 and the average spill is about 280,000 acre-feet. Spills include when water is released from Lake McConaughy in order to comply with the FERC storage limits.

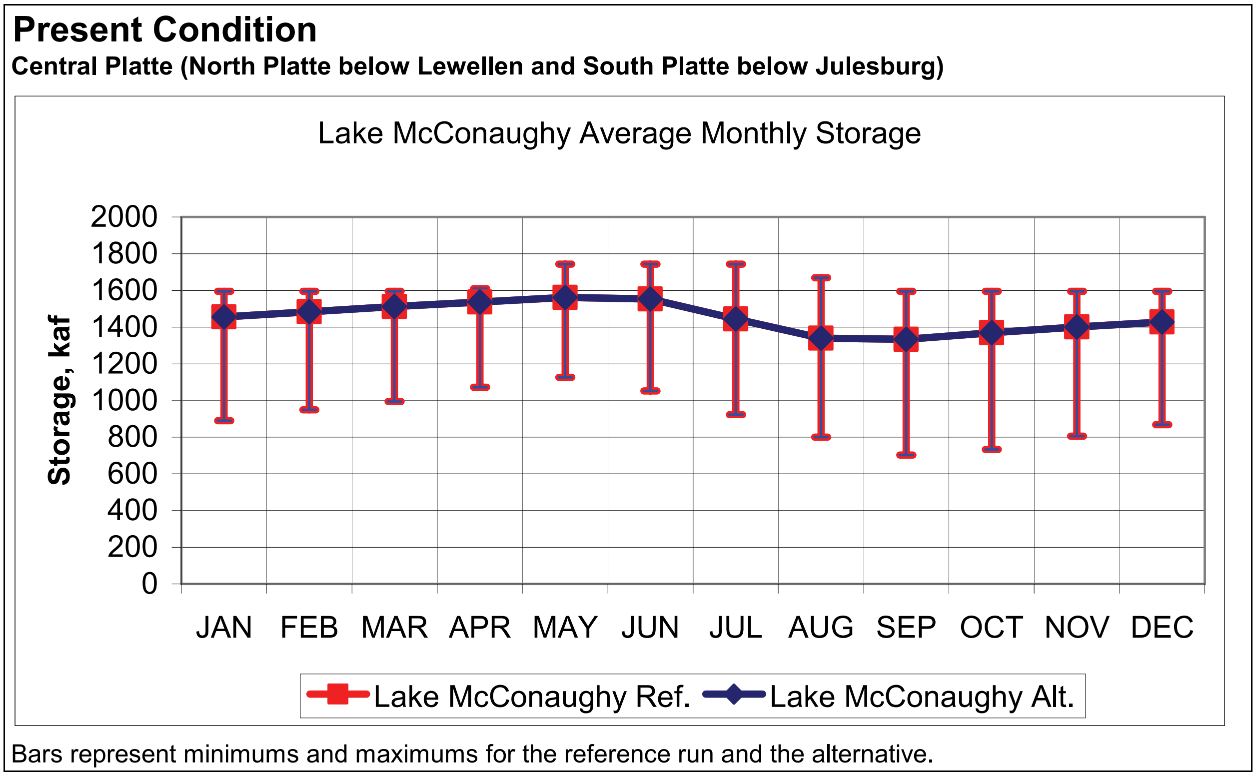


Figure 3.2- 7. Lake McConaughy average monthly storage with error bars for minimum and maximum.

Figure 3.2-7 shows the average monthly storage with minimums and maximums represented by bars. This figure shows that the lowest storage occurs in September. It also shows that storage typically peaks in May or June and declines during the irrigation season.

Figure 3.2-8 shows the average monthly release from Lake McConaughy including releases from the Environmental Account. The figure shows high releases during the irrigation season and no releases for environmental purposes for Present Condition.

Figure 3.2-9 shows the average monthly storage for Sutherland, Elwood, and Johnson Lake reservoirs.

Table 3.2-10 shows the flow targets for average conditions along with the average monthly flow for Present Condition.

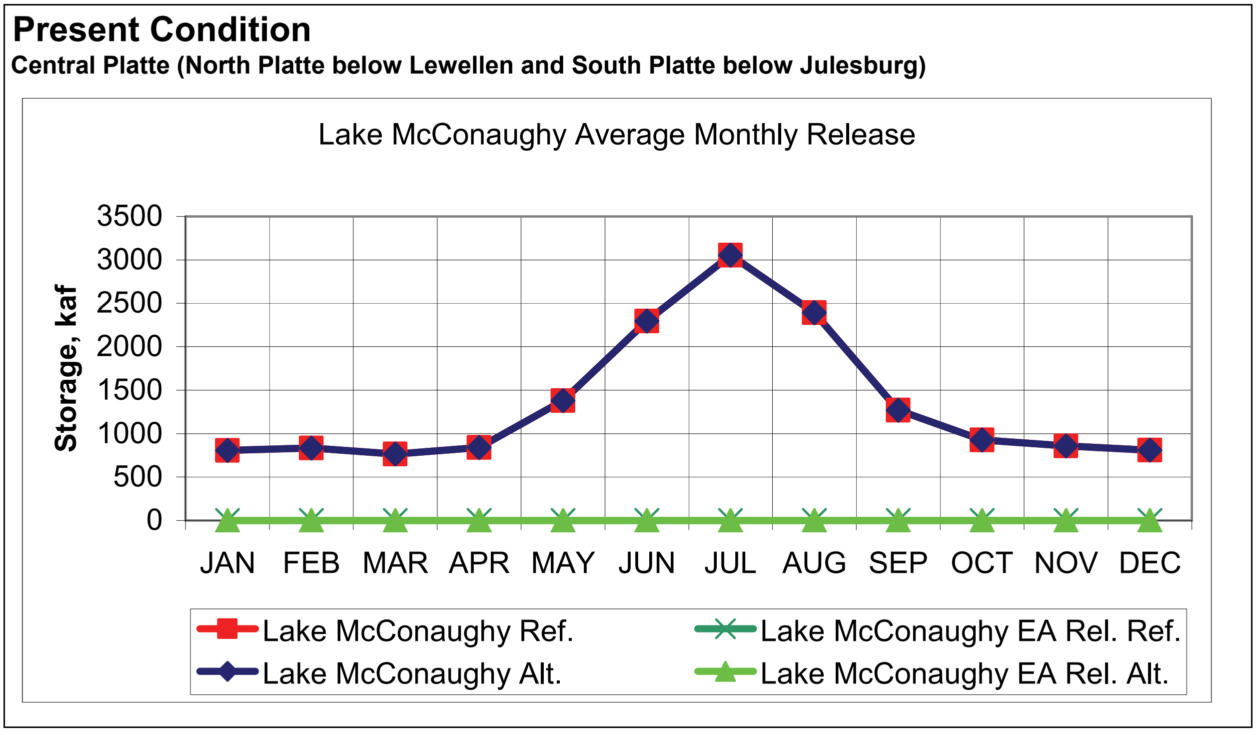


Figure 3.2- 8. Average monthly release from Lake McConaughy showing environmental releases.

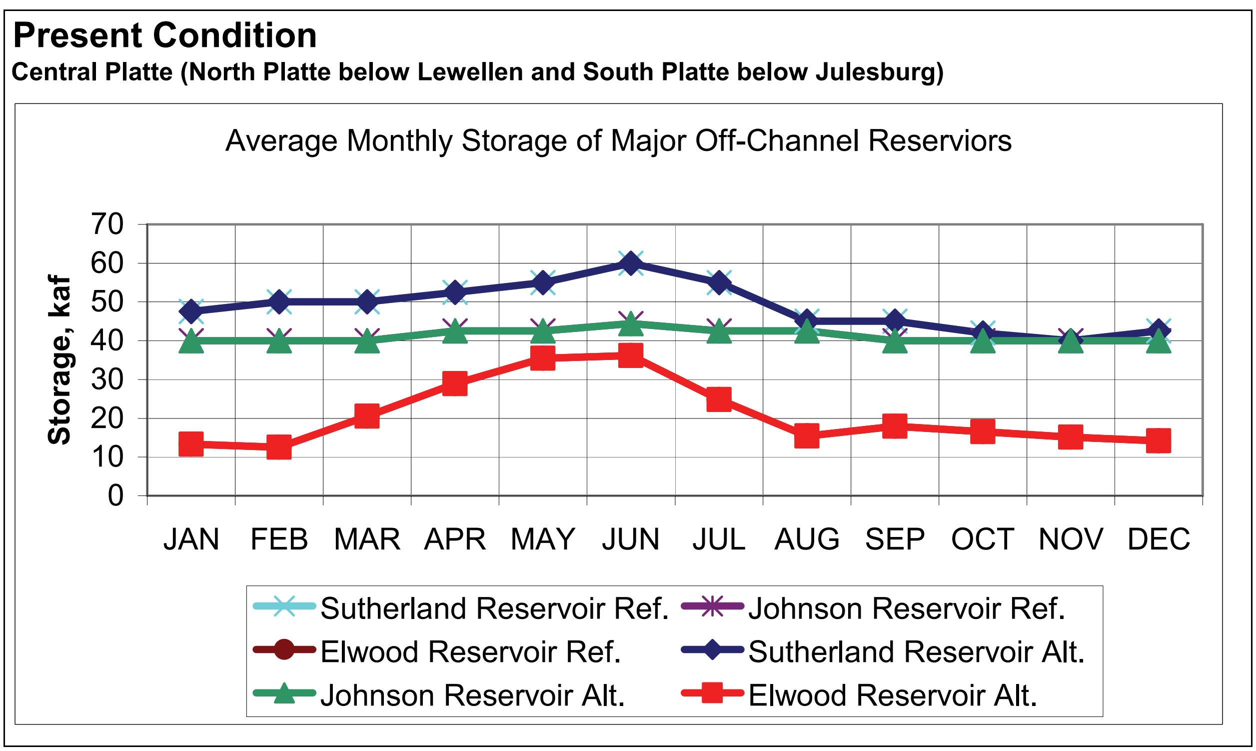


Figure 3.2- 9. Average monthly storage for major off-channel reservoirs.

Grand Island Target Flows. Conditions at Grand Island resulting from Present Condition are shown on **Table 3.2-10**.

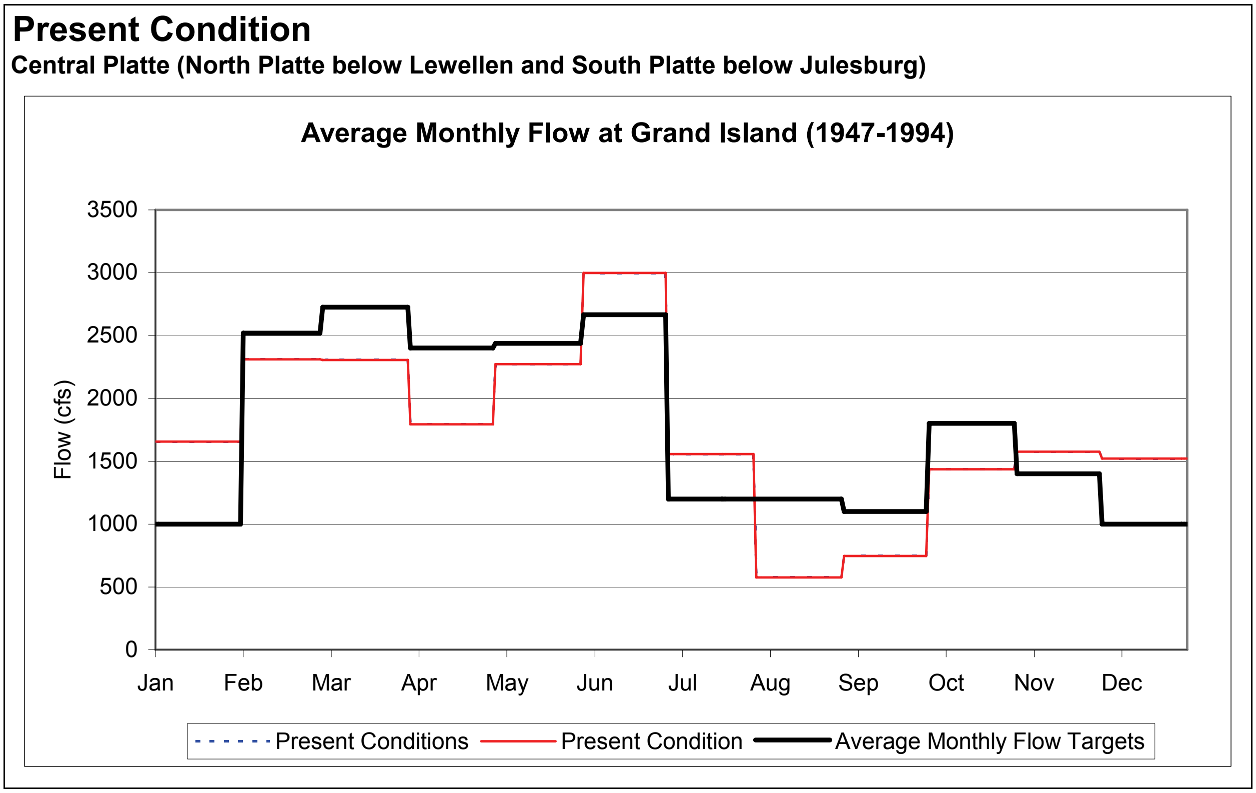


Figure 3.2- 10. Average monthly flow at Grand Island, Nebraska compared to flow targets.

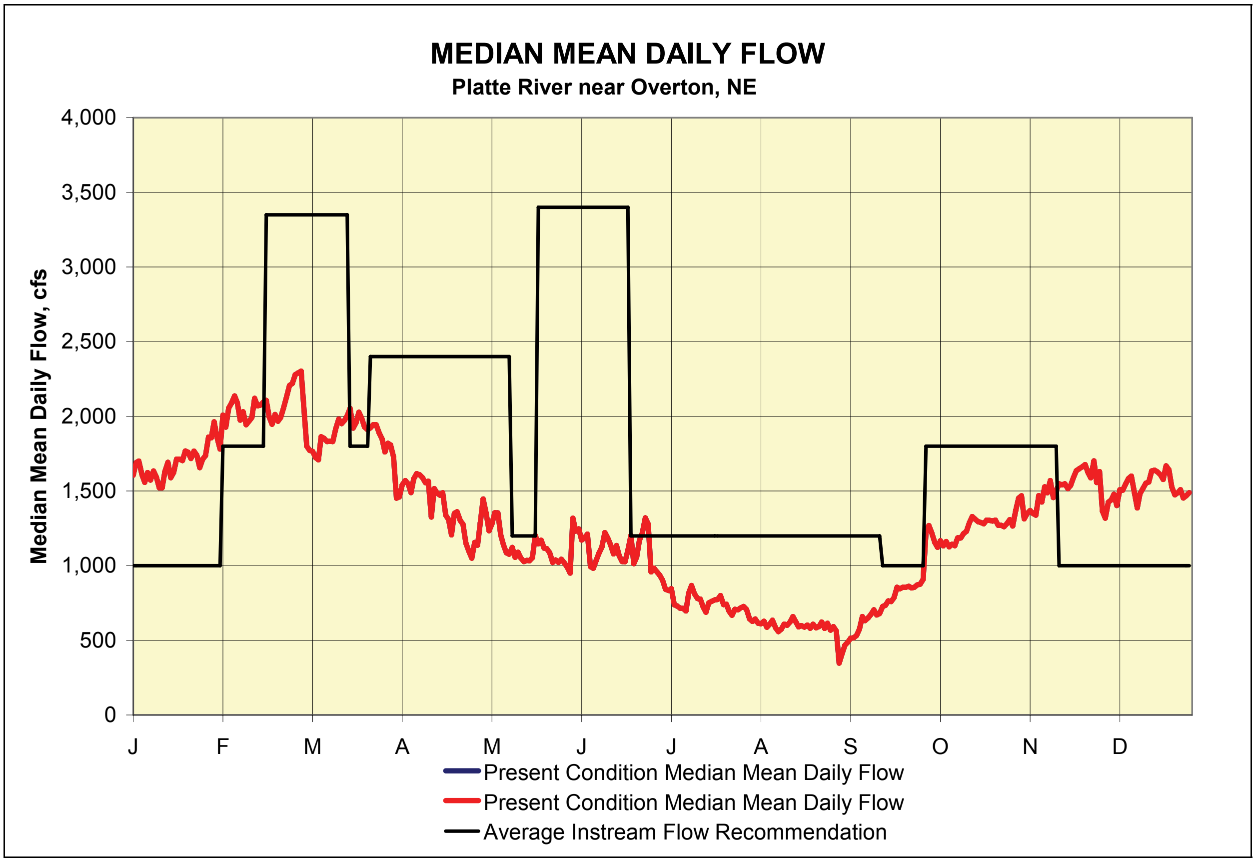
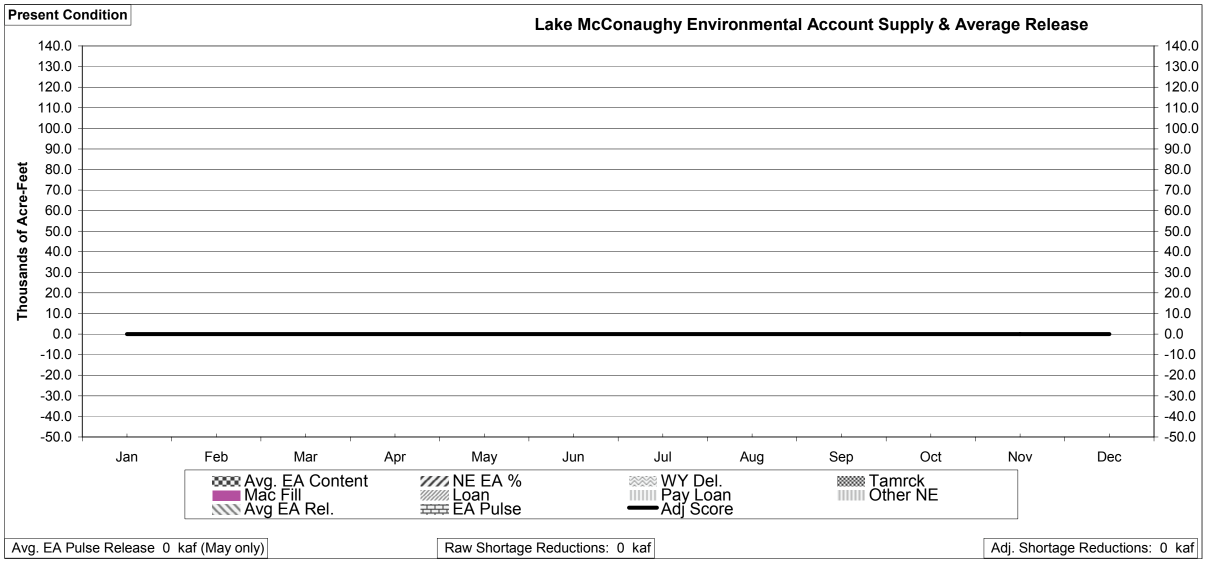


Figure 3.2- 11. Median mean daily flow near Overton, Nebraska compared to flow targets.

Figure 3.2-11 shows the daily flow targets for average conditions compared to the median daily flow for Present Condition. Flows fall short of flow targets most of the time.

Score.

Present Condition



Present Condition

# Zero Flow Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Present	0	0	0	0	0	1	0	1	2	0	0	0	4
Present	0	0	0	0	0	1	0	1	2	0	0	0	4
Raw Shortage Reduction, kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Adjusted Shortage Reduction, kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Present		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	Begin Month Content	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
plus	NE EA % accrual	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
plus	WY EA contribution	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
plus	CO EA exchanged	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
plus	Other NE Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
plus	EA credit/Mac Fill	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
minus	EA Release	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
minus	EA Evaporation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
minus	EA Pulse Release	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
plus	EA borrow from Mac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
minus	EA paid back to Mac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	End-of-Month Content	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Figure 3.2- 12. Accruals, storage, and releases for the Environmental Account in Lake McConaughy.

Figure 3.2-12 shows the accruals, storage, and releases for the Environmental Account in Lake McConaughy in both graphical and tabular format. The figure shows the contributions by state and adjustments to the amount stored in the Environmental Account when Lake McConaughy fills. There is also a comparison to the number of months that have zero flow for Present Condition and Present Condition. All values are zero for Present Condition because there is no Environmental Account in Lake McConaughy for Present Condition.

Present Condition										Adjusted Shortage Reduction:				0.0
Present	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Adj.
Groundwater Mgmt Storage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Groundwater Mgmt Contribution	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Riverside Drains	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
North Dry Ck GW inflow at Kearney[1]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dawson and Gothenburg Recharge[2]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C. Platte Rereg. Reservoir Release[3]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Power Interference credited to EA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Net Controllable Conserved Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
NE Irrigation Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Other CO at Jules. (no exchange)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Average EA Pulse Release[4]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average Tri-County Irr. Rel. for pulse[5]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average Johnson Lake Rel. for pulse[6]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Number of times EA Borrowed	0	0	0	0	0	0	0	0	0	0	0	0	0	--
Number of time EA Paid Back	0	0	0	0	0	0	0	0	0	0	0	0	0	--
Credit for other Program flows[7]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CP Rereg. Res "Spike" Attenuation[8]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Johnson Lake "Spike" Attenuation[8]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--

1 For N. Dry Creek, adj. shortage reduction = 1/2 * the reduction in target flow shortages calculated by the C.P. OPSTUDY model.
2 Dawson and Gothenburg recharge is not modeled; values are from the Water Action Plan.
3 Central Platte reregulatory reservoir operates using daily flows and is added to the reduction in target flow shortages calculated from the monthly flow values.
4 For EA Pulses, the volume of release is added to the reduction in target flow shortages calculated from the monthly flow values.
5 Pulse augmentation from the Tri-County Canal system (Irrigation water and Elwood Reservoir Storage water).
6 Not added to score because it is assummed to be the rerelease of water from the EA in Lake McConaughy.
7 These are Program contributions that are above targets flows and also greater than the flows under Present Conditions
8 "Spike" attenuation does not reduce shortages to target flows but does provide benefit to the Program.

Table 3.2- 20. Central Platte accruals to and releases from the Environmental Account in Lake. McConaughy.

Table 3.2-20 shows the contributions to the Program from all the Water Action Plan elements in the central Platte. The table also shows other flows that contribute to the Score of the Program.

Pulse and Short duration near-bankful flows.

Pulse flows occur during two time periods February/March and May/June. Short duration near-bankful flows are events that last for three days. **Table 3.2-21** quantifies the effects of the Program on pulse and short duration near-bankful flows.

Present Condition **Central Platte (North Platte below Lewellen and South Platte below Julesburg)**				
	Present Condtion	**Present Condition**		
	Value	**Value**	**Change**	**% Change**
30-day pulse flow				
Apr/Jun (highest 75%), cfs	4,822	4,822	0	0%
Apr/Jun (lowest 25%), cfs	809	809	0	0%
Feb/Mar (all years), cfs	2,168	2,168	0	0%
3-day pulse flows				
Years w/flows > 7,500 cfs	12	12	0	0%
Largest 30%, cfs	13,101	13,101	0	0%
Middle 40%, cfs	4,589	4,589	0	0%
Smallest 30%, cfs	2,333	2,333	0	0%
% of Years 3-day pulse flow objectives achieved (**6,500** cfs @ Overton)	38%	38%	0%	0%
Low Flows				
Years w/flows < 100 cfs	17	17	0	0%
Years w/flows = 0 cfs	0	0	0	NA
J2-Return (avg ann flow), kaf	593	593	0	0%

Table 3.2- 21. Pulse flow and short duration near-bankful flow summary for the Platte River near Overton.

Table 3.2-22 also shows information regarding the short duration near-bankful flows. The short duration near-bankful flow target is 6,500 cfs for three days.

Present Condition Central Platte (North Platte below Lewellen and South Platte below Julesburg)		
Pulse flow target summary (at Overton, NE)	**Value**	**% Δ**[1]
Years with pulse flow releases[2]	0	NA
Average duration of pulse flow releases for years with pulse releases (days)[2]	0	NA
Years that pulse flow targets were achieved	18	0%
Average maximum Peak Daily Flow when pulse targets were achieved (cfs)	12,083	0%
Average maximum Peak Daily Flow for remaining years (cfs)	3,471	0%

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

[2] NA in the % Δ column indicates that pulse flows are not part of the Present Condtion Run

Table 3.2- 22. Short duration near-bankful flow summary for the Platte River near Overton.

Table 3.2-23 shows how the short duration near-bankful flows affect the flows in the central Platte river basin. The table shows the average and maximum volumes associated with the short duration near-bankful flow release at various points on the North Platte and Platte rivers. A negative value in a volume column indicates that the canal curtailed diversions (diverted less) during the short duration near-bankful flow event. The table also shows the average and maximum flow during the short duration near-bankful flow event for these same locations. All values are zero because there were no short duration near-bankful flows in Present Condition.

Present Condition Central Platte (North Platte below Lewellen and South Platte below Julesburg)				
	Average Pulse Volume (acre-feet)	Maximum Pulse Volume (acre-feet)	Average flow during a pulse release (cfs)	Maximum flow during a pulse release (cfs)
Mac Out	0	0	0	0
North Platte River	0	0	0	0
Sutherland Canal	0	0	0	0
Tri-County Canal	0	0	0	0
Platte River above the Jeffrey Return	0	0	0	0
Platte River below the Jeffrey Return	0	0	0	0
Platte River below the J2 Return	0	0	0	0

Table 3.2- 23. Flow summary during the short duration near-bankful flow period.

Figure 3.2-13 shows that the number of years with flows in specified flow ranges for Present Condition.

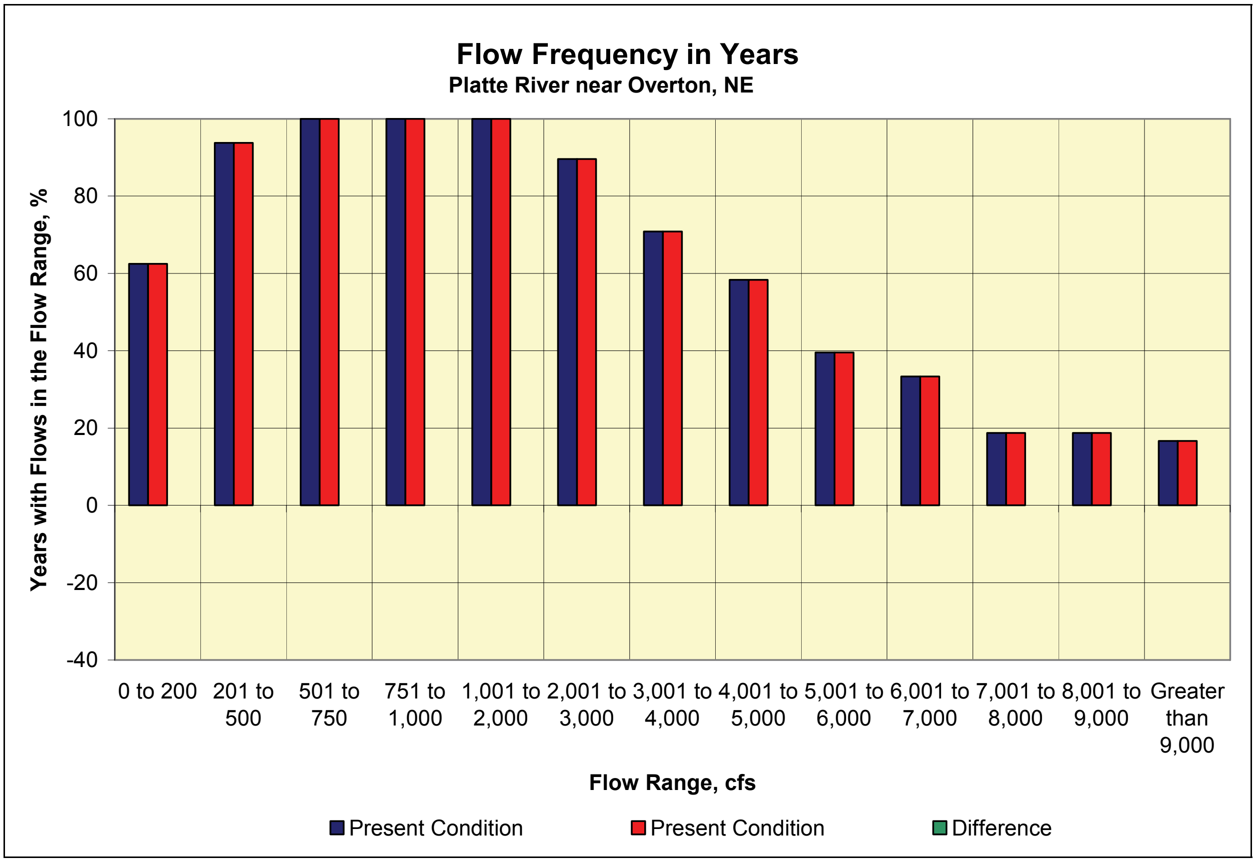


Figure 3.2- 13. Flow frequency by flow range in years for the Platte River near Overton.

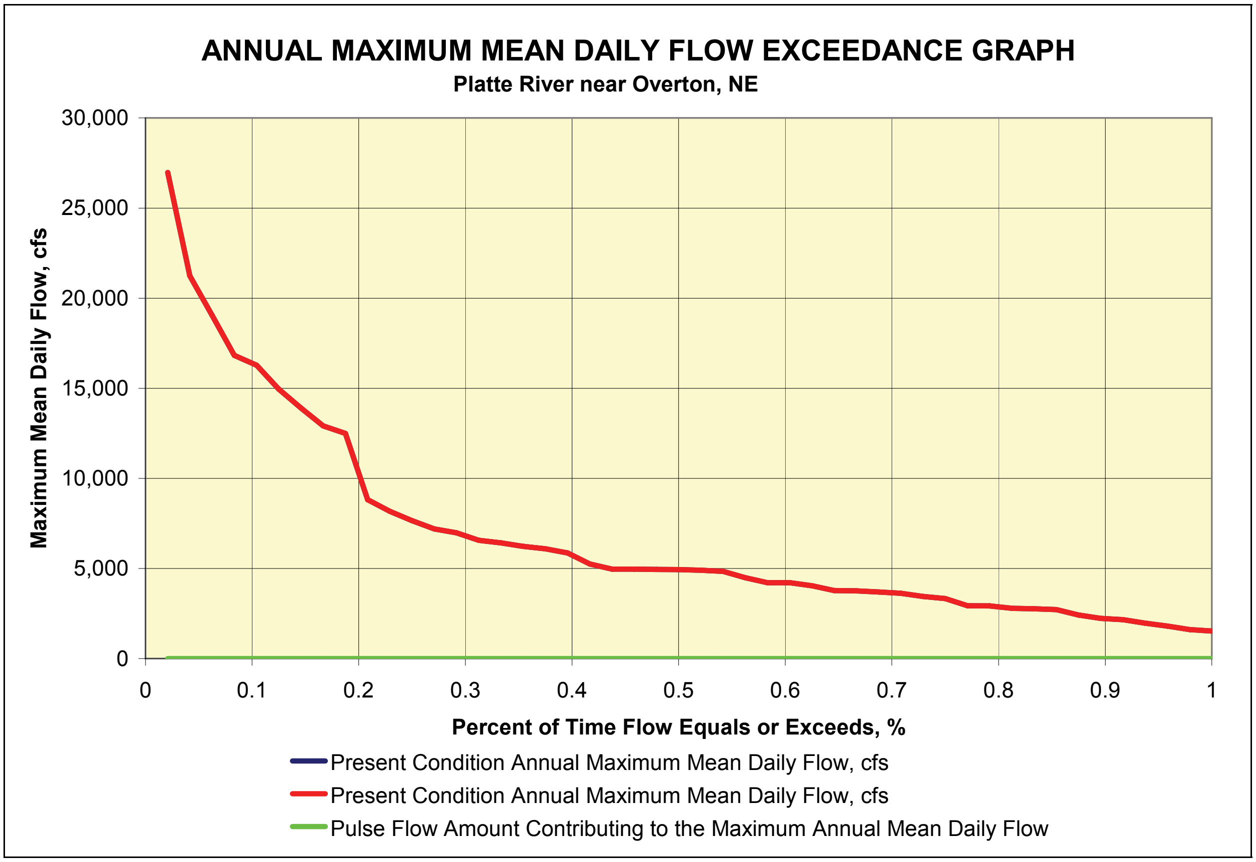


Figure 3.2- 14. Exceedance curve for the annual maximum mean daily flow near Overton, Nebraska.

Figure 3.2-14 shows a graph of the annual maximum mean daily flow sorted from largest to smallest. Also shown is the release from the Environmental Account for the short duration near-bankful flows.

North Platte Channel Capacity.

Present Condition **Central Platte (North Platte below Lewellen and South Platte below Julesburg)**	
Interaction of the North Platte Channel Capacity with the Environmental Account Operations	
Pulse release limited by North Platte channel capacity (years)	0
Environmental Account release limited by North Platte channnel capacity (months)	0
Environmental Account release limited by North Platte channnel capacity (years)	0

Table 3.2- 24. Summary of North Platte channel restrictions on environmental flow deliveries.

Table 3.2-24 shows that short duration near-bankful flow releases were limited by the capacity of the North Platte River at North Platte, Nebraska in no years. Other releases from the Environmental Account were limited in none out of 48 years. There are no conflicts with channel capacity because no environmental deliveries were made.

Environmental/Project Accruals by Basin. The average monthly and annual environmental accruals by basin are given in **Table 3.2-25**.

Present Condition

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Environmental Accruals by Basin	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
North Platte (above Lake McConaughy)											Table 66 in file .tab.		
Min (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Avg (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Year that minimum first occurred	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947
South Platte (above Julesburg Gage)[1]										Tables 67 and 83 in file .tab.			
Min (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Avg (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Year that minimum first occurred	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947
Central Platte[2]										Tables 66, 67 and 63 in file .tab.			
Min (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Avg (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Year that minimum first occurred	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947
Total											Table 63 in file .tab.		
Min (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Avg (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Year that minimum first occurred	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947

[1] Water from the Western Canal is included in the Central Platte Accruals

[2] This includes the water that accures to the Environmental Account in Lake McCounaughy

Table 3.2- 25. Environmental accruals by basin.

Table 3.2-25 shows there were no environmental accrual or deliveries for Present Condition.

North Platte (above Lake McConaughy). Table 3.2-25 shows there were no environmental accrual or deliveries for Present Condition.

South Platte (above Julesburg, CO). Table 3.2-25 shows there were no environmental accrual or deliveries for Present Condition.

Central Platte (including Lake McConaughy). Table 3.2-25 shows there were no environmental accrual or deliveries for Present Condition.

Shortages, Water Banking/Conservation, Irrigation Demand. The results for shortages, conservation, and irrigation demand are summarized in **Table 3.2-26** through **3.2-30**.

Present Condition

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

	Western Canal		Keystone - Sutherland		Sutherland - North Platte		Brady - Cozad		Tri-County Canal		Kearney Canal	
Irrigation Demand by Reach / Canal	**Value**	**% Δ**[1]	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**
Average annual demand for 48-year simulation period (kaf)	26.3	0%	88.3	0%	26.4	0%	172.7	0%	205.5	0%	13.3	0%
Maximum annual demand (kaf)	51.1	0%	113.4	0%	37.9	0%	236.5	0%	290.5	0%	22.7	0%
Minimum annual demand (kaf)	11.5	0%	52.1	0%	14.3	0%	76.8	0%	89.4	0%	3.2	0%
Table number in file .tab.		111		112		113		114		115		116

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

Table 3.2- 26. Irrigation demand by reach/canal.

Irrigation Demand. There is no change in average annual irrigation demand between Present Condition and the other alternatives.

Present Condition **Central Platte (North Platte below Lewellen and South Platte below Julesburg)**												
	Western Canal		**Keystone - Sutherland**		**Sutherland - North Platte**		**Brady - Cozad**		**Tri-County Canal**		**Kearney Canal**	
Shortages by Reach / Canal	**Value**	**% Δ**[1]	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**
Average annual shortage for 48-year simulation period (kaf)[2]	0.3	0%	0.0	NA	0.0	NA	0.0	NA	0.0	NA	0.0	NA
Number of years with shortages[2]	8	0%	0	NA	0	NA	0	NA	0	NA	0	NA
Average annual shortage for years with shortage (kaf)[2]	1.9	0%	0.0	NA	0.0	NA	0.0	NA	0.0	NA	0.0	NA
As a percentage of demand for years with shortage (%)	7.6%		0.0%		0.0%		0.0%		0.0%		0.0%	
Largest annual shortage (kaf)[2]	4.2	0%	0	NA	0	NA	0	NA	0	NA	0	NA
As a percentage of demand (%)	17.6%		0.0%		0.0%		0.0%		0.0%		0.0%	
Year of largest annual shortage		1955		----		----		----		----		----
Table number in file .tab.		123		124		125		126		127		128

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

[2] NA in the % Δ column indicates that there value for the Present Condtion Run is zero

Table 3.2- 27. Shortages to irrigation by reach/canal.

Shortages. Figure 3.2-7 shows that only one system, the Western Canal, has any shortages for Present Condition. Only 8 years of the 48 years simulated had any shortages. The average annual shortage over the entire simulation period is 0.3 KAF.

Irrigation Deliveries. Tables 3.2-28 and **3.2-29** show the irrigation deliveries for the central Platte river basin. **Table 3.2-28** shows the deliveries to the irrigators on the North and South Platte rivers. **Table 3.2-29** shows the deliveries to irrigators below the town of North Platte.

Present Condition **Central Platte (North Platte below Lewellen and South Platte below Julesburg)**												
Irrigation Deliveries	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Ann**
Western Canal Irrigation Deliveries											Table 53 in file .tab.		
Min (kaf)	0	0	0	0	0	0	1	1	1	0	0	0	12
Max (kaf)	0	0	2	8	13	14	15	11	13	6	4	1	51
Avg (kaf)	0	0	0	1	4	4	5	4	4	3	1	0	26
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Keystone-Sutherland Irrigation Deliveries											Table 50 in file .tab.		
Min (kaf)	0	0	0	0	3	6	10	15	3	0	0	0	52
Max (kaf)	0	0	1	9	22	23	33	29	20	11	1	0	113
Avg (kaf)	0	0	0	2	10	14	24	23	13	3	0	0	88
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Sutherland-North Platte Irrigation Deliveries											Table 55 in file .tab.		
Min (kaf)	0	0	0	0	0	1	3	3	1	0	0	0	14
Max (kaf)	0	0	0	2	6	7	10	8	7	4	1	0	38
Avg (kaf)	0	0	0	0	3	4	7	7	4	1	0	0	26
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 3.2- 28. Irrigation deliveries by reach/canal for the North and South Platte rivers.

Present Condition Central Platte (North Platte below Lewellen and South Platte below Julesburg)													
Irrigation Deliveries	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Ann**
Brady-Cozad Irrigation Deliveries											Table 53 in file .tab.		
Min (kaf)	0	0	0	0	3	4	5	35	3	0	0	0	77
Max (kaf)	0	0	2	13	28	46	95	79	34	25	3	0	237
Avg (kaf)	0	0	0	2	12	23	60	57	16	3	0	0	173
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Central (Tri-County) Irrigation Deliveries											Table 50 in file .tab.		
Min (kaf)	0	0	0	0	7	14	18	31	1	0	0	0	89
Max (kaf)	0	0	0	6	44	68	102	84	53	0	0	0	291
Avg (kaf)	0	0	0	4	24	35	62	60	21	0	0	0	206
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Kearney Canal Irrigation Deliveries											Table 55 in file .tab.		
Min (kaf)	0	0	0	0	0	0	0	1	0	0	0	0	3
Max (kaf)	0	0	1	7	5	4	6	6	5	2	1	0	23
Avg (kaf)	0	0	0	1	1	1	3	4	2	0	0	0	13
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 3.2- 29. Irrigation deliveries by reach/canal for the Platte Rivers.

Present Condition Central Platte (North Platte below Lewellen and South Platte below Julesburg)						
Water Banking / Conservation by Reach / Canal	**Western Canal**	**Keystone - Sutherland**	**Sutherland - North Platte**	**Brady - Cozad**	**Tri-County Canal**	**Kearney Canal**
Average annual conservation for 48-year simulation period (kaf)	0.0	0.0	0.0	0.0	0.0	0.0
Number of years with conservation	0	0	0	0	0	0
Average annual conservation for years with conservation (kaf)	0.0	0.0	0.0	0.0	0.0	0.0
As a percentage of demand (%)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Largest annual conservation (kaf)	0	0	0	0	0	0
As a percentage of demand (%)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Year of largest annual conservation	----	----	----	----	----	----
Table number in file .tab.	129	130	131	132	133	134

Table 3.2- 30. Water leasing/management incentives by reach/canal.

Water Banking/Conservation. Figure 3.2.1 shows that the amount of water leased under Present Condition.

Flows. The results for the flows at significant locations are given in **Tables 3.2-31** through **3.2-33**.

Present Condition													
Central Platte (North Platte below Lewellen and South Platte below Julesburg)													
Flows	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Ann**
North Platte River at Keystone											Table 39 in file .tab.		
Min (Monthly (cfs), Annual (kaf))	0	0	0	0	46	101	159	239	45	0	0	0	88
Max (Monthly (cfs), Annual (kaf))	224	219	141	813	7,792	10,127	5,391	1,657	1,830	1,851	24	0	1,290
Avg (Monthly (cfs), Annual (kaf))	5	10	4	63	490	1,256	1,679	1,053	262	224	2	0	307
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
North Platte River at North Platte											Table 42 in file .tab.		
Min (Monthly (cfs), Annual (kaf))	138	266	216	193	197	272	543	281	181	254	284	304	296
Max (Monthly (cfs), Annual (kaf))	729	730	763	1,388	8,258	10,246	5,638	1,537	2,111	2,407	556	467	1,491
Avg (Monthly (cfs), Annual (kaf))	347	390	423	422	716	1,324	1,507	1,015	442	564	393	371	479
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Platte River at Maxwell (Below Tri-County Diversion)											Table 16 in file .tab.		
Min (Monthly (cfs), Annual (kaf))	0	0	0	0	0	0	42	94	0	0	0	0	31
Max (Monthly (cfs), Annual (kaf))	1,452	1,933	1,373	2,512	13,307	21,060	10,408	1,916	2,507	2,391	1,820	903	2,915
Avg (Monthly (cfs), Annual (kaf))	322	379	216	290	1,104	1,983	1,237	582	203	233	174	201	419
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 3.2- 31. Flows in the central Platte basin.

Present Condition													
Central Platte (North Platte below Lewellen and South Platte below Julesburg)													
Flows	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Ann**
Platte River at Overton											Table 53 in file .tab.		
Min (Monthly (cfs), Annual (kaf))	732	1,007	750	570	111	160	392	23	103	431	781	729	448
Max (Monthly (cfs), Annual (kaf))	3,913	4,976	3,926	6,250	17,137	23,650	12,129	1,794	4,808	4,863	4,576	3,576	4,306
Avg (Monthly (cfs), Annual (kaf))	1,798	2,243	2,027	1,692	2,252	3,009	1,454	666	948	1,561	1,691	1,648	1,264
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Platte River at Odessa											Table 50 in file .tab.		
Min (Monthly (cfs), Annual (kaf))	659	1,079	738	250	0	0	67	0	0	106	726	773	335
Max (Monthly (cfs), Annual (kaf))	3,932	5,068	4,243	5,983	16,758	22,916	12,041	1,469	4,595	4,632	4,131	3,443	4,156
Avg (Monthly (cfs), Annual (kaf))	1,801	2,336	2,060	1,467	2,026	2,802	1,291	427	675	1,283	1,578	1,637	1,166
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Platte River at Grand Island											Table 55 in file .tab.		
Min (Monthly (cfs), Annual (kaf))	340	942	844	467	42	0	182	0	0	208	375	633	391
Max (Monthly (cfs), Annual (kaf))	4,588	5,311	4,890	6,078	16,733	21,667	11,557	1,314	5,010	5,503	4,050	3,267	4,024
Avg (Monthly (cfs), Annual (kaf))	1,656	2,310	2,305	1,794	2,274	2,997	1,558	576	747	1,437	1,576	1,521	1,249
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 3.2- 32. Flows in the central Platte basin.

Present Condition

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Flows	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
South Platte River at Julesburg											Table 38 in file .tab.		
Min (Monthly (cfs), Annual (kaf))	57	86	16	47	33	40	26	23	7	24	8	16	46
Max (Monthly (cfs), Annual (kaf))	1,895	1,811	1,368	2,549	9,854	12,473	5,082	1,654	1,697	2,222	1,790	1,568	2,202
Avg (Monthly (cfs), Annual (kaf))	734	854	584	547	1,250	1,769	454	230	363	345	426	552	488
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Sourth Platte River at Paxton (below Korty Diversion)											Table 43 in file .tab.		
Min (Monthly (cfs), Annual (kaf))	0	0	0	0	0	0	0	0	0	0	0	0	0
Max (Monthly (cfs), Annual (kaf))	1,012	1,509	948	2,175	8,136	11,777	5,056	1,023	988	2,134	1,607	768	1,924
Avg (Monthly (cfs), Annual (kaf))	304	426	280	286	883	1,317	293	73	136	199	183	209	276
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 3.2- 33. Flows in the central Platte basin.

Diversion. The average monthly and annual diversions for the 3 major supply canals are given in **Table 3.2-34**.

Present Condition

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Diversions	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Keystone diversion											Table 18 in file .tab.		
Min (Monthly (cfs), Annual (kaf))	250	250	250	250	250	250	324	603	208	0	250	250	299
Max (Monthly (cfs), Annual (kaf))	1,597	1,685	2,000	1,800	2,000	2,000	2,000	2,000	2,000	1,800	1,835	1,683	1,186
Avg (Monthly (cfs), Annual (kaf))	802	823	761	777	889	1,038	1,374	1,339	1,008	703	856	811	676
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Korty Diversion											Table 19 in file .tab.		
Min (Monthly (cfs), Annual (kaf))	55	76	0	0	0	0	0	0	0	0	0	0	44
Max (Monthly (cfs), Annual (kaf))	771	971	766	812	1,099	1,101	904	852	849	629	716	670	435
Avg (Monthly (cfs), Annual (kaf))	387	469	363	283	333	443	208	130	182	124	235	307	208
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tri-County diversion											Table 17 in file .tab.		
Min (Monthly (cfs), Annual (kaf))	690	699	694	672	1,049	1,302	1,556	1,576	933	699	771	690	871
Max (Monthly (cfs), Annual (kaf))	1,997	2,198	2,090	2,097	2,178	2,250	2,202	2,148	2,136	2,087	2,205	1,982	1,514
Avg (Monthly (cfs), Annual (kaf))	1,344	1,647	1,555	1,362	1,574	1,822	2,090	2,050	1,480	1,357	1,450	1,371	1,154
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 3.2- 34. Diversions by major canals in the central Platte basin.

Table 3.2-34 shows the highest diversions for the Keystone and Tri-County diversions occur during the irrigation season.

Power Generation. Present Condition power generation results are shown in **Table 3.2-35**.

Present Condition

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Power Generation	Sutherland		Central		Kingsley		Total	
	Value	% Δ[1]	Value	% Δ	Value	% Δ	Value	% Δ
Minimum (MKWh)	63	0%	156	0%	40	0%	300	0%
Maximum (MKWh)	187	0%	358	0%	241	0%	786	0%
Average (MKWh)	111	0%	252	0%	104	0%	466	0%
Year that minimum occurred		1991		1956		1993		1956
Table number in file .tab.		23		24		25		26

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

Table 3.2- 35. Power generation statistics for the central Platte basin below Lake McConaughy.

3.3 Governance Committee Alternative

This plan consists of the basic Three-States Plan, including an expanded Tamarack Project, plus additional programs and projects contained in the Draft Water Action Plan developed by Boyle Engineering Corporation.

3.3.1 Features simulated in the alternative

3.3.1.1 3-States Plan

Pathfinder Modification. The Pathfinder Modification Project would increase the capacity of the existing Pathfinder Reservoir by approximately 54,000 acre feet to recapture storage space lost to sediment. The modification would be accomplished by raising the elevation of the existing spillway by approximately 2.39 feet with the installation of an inflatable dam or some other means. The recaptured storage space would store water under the existing 1904 storage right for Pathfinder Reservoir and would enjoy the same entitlements as other uses in the reservoir with the exception that the recaptured storage space could not place regulatory calls on existing water rights upstream of Pathfinder Reservoir other than the rights pertaining to Seminoe Reservoir.

Of this 54,000 acre-feet, 34,000 acre-feet would be from an environmental account, which would be operated for the benefit of endangered species and habitat in central Nebraska. The State of Wyoming would retain, under contract with the Bureau of Reclamation, the remaining 20,000 acre feet of the modification capacity to provide municipal water to North Platte communities in Wyoming through contracts between the municipalities and the State of Wyoming.

Tamarack. The Tamarack Plan involves the use of wells and other water facilities in Colorado to re-regulate excess flows in Colorado in a manner that is consistent with the flow-related goals of the Platte River Recovery Implementation Program. Excess flows are not need to satisfy legal rights to and physical demands for water. As a result of the geographic location of the Tamarack Plan near the state line, groundwater recharge that results from the Tamarack Plan is estimated to increase flows at the Julesburg gage during the period of April through September by an average of approximately 10,000 acre-feet over the flows that would otherwise occur during that period. Water rights for the operation of the components of the Tamarack Plan will be obtained and exercised under Colorado law for beneficial uses in Colorado. All facilities will be operated by Colorado and its water users in compliance with the requirements of the South Platte River Compact.

The components of the Tamarack Plan will be developed within the 40 miles above the state line beginning at about the Tamarack Ranch State Wildlife Area owned by the Colorado Division of Wildlife near Crook, Colorado. These facilities will include wells located adjacent to the South Platte River that divert groundwater from the alluvial aquifer and canals that divert water from the South Platte River. Water that percolates into the groundwater alluvium from these facilities will return to the South Platte River at a later time. Inflows to canals and recharge basins will be identified as for Program or other purposes, and inflows for Program purposes will be measured and recharge or seepage will be computed as inflows minus evaporation. Evaporation in acre-feet will be determined by using available weather station data and the surface areas of the recharge sites. Recharge basins are typically located in sandy upland areas with high infiltration rates such that free water surface areas are minimal, resulting in low evaporation amounts.

Lake McConaughy Environmental Account. An Environmental Account (EA) will be established in Lake McConaughy, Nebraska. Water contributed to the EA, regardless of its source, loses any separate identity upon entering Lake McConaughy or other approved storage facility, and simply becomes part of the EA. Water remaining in the EA after September 30 of each year may be carried over and added to the following year's contributions to the EA, subject to limitations on the size of the Environmental Account.

3.3.1.2 Other Elements

EA Short duration near-bankful Flows. Management of the Lake McConaughy Environmental Account (EA) would seek to provide short duration near-bankful flows in the habitat reach of the river. This would be accomplished by timing EA releases to increase the frequency of short duration near-bankful flows released from Kingsley Dam. The magnitudes of the short duration near-bankful flows would not be allowed to exceed the flood stage of the North and central Platte Rivers as determined by the National Weather Service.

The EA would be operated in such a manner as to augment South Platte River flows in order to increase the magnitude and frequency of within-channel flows (flows near bank full) and subsequent sediment transport to the Overton to Grand Island reach of the Platte River. The purpose is to supply sediment to the remaining downstream braided river below the J2-Return. By adding additional water from the EA which would bypass the Tri-County Diversion Dam, sediment stored in the reach from North Platte to the J2-Return could be mobilized and supplied to the reaches below the J2 Return.

Short duration near-bankful flows would be released through the Kingsley Dam Powerplant at a rapid but safe rate and would not exceed the maximum powerplant capacity for a two to three-day duration (about 5,000 cfs). The maximum rate of increasing discharge would be determined so that the downstream river stage would not increase by a rate faster than could be accommodated by downstream structures. Releases would then reduce back to normal operating levels at the maximum practicable rate. The rate of increasing and decreasing discharge would be determined in cooperation with the operators of Kingsley Dam. These short duration near-bankful flows are designed to temporarily mobilize or scour the channel bed rather than transport tremendous quantities of sediment. The discharge hydrograph, released from Kingsley Dam, is expected to transform from a trapezoidal shape to a triangular shape as it travels downstream toward Grand Island. This will result in a decrease in sediment transport capacity as the discharge wave travels downstream.

The purpose of this aspect of EA operation would be to release short duration near-bankful flows, within bank capacity, in order to scour young vegetation from the river channel. If the cottonwood seed germination is minimal during a particular year or if the plants are scoured by naturally occurring floods, no short duration near-bankful flows for vegetation scour would be implemented. If cottonwood seed dispersal and germination were significant then several different short duration near-bankful flow options would be available.

The short duration near-bankful flows would be generated by season as follows:

Early fall short duration near-bankful flow (October/September). This short duration near-bankful flow would have a maximum discharge of 5,000 cfs from Kingsley Dam and would occur during an otherwise low-flow period. A short duration near-bankful flow in fall would be designed to temporarily scour the channel bed soon after the cottonwood-seed germination and growing season while the plants are still small and vulnerable to scour. Attempts would be made to schedule such releases when the water diversions through the tri-county power canal are at a minimum.

Winter ice formation flow. This would be a small magnitude (less than 5,000 cfs), short duration near-bankful flow designed to wet the channel at the onset of freezing weather and form ice across the channel. A second small magnitude, short duration near-bankful flow would be initiated at the onset of warmer weather to help break and lift the ice and scour the channel bed.

Spring runoff short duration near-bankful flow (May/June). The target value for the spring short duration near-bankful flow would be 6,500 cfs at Overton during the last 2 weeks of May. The spring short duration near-bankful flow would augment flows from the South Platte River for a total Platte River flow not to exceed the flood stage as determined by the National Weather Service (considered to be 10,000 ft^3/s for analysis purposes). The short duration near-bankful flow in spring would provide for the greatest peak discharge compared to the fall or winter periods. However, a short duration near-bankful flow in spring would allow one or two more months of growing time for the plants.

Only one of the three short duration near-bankful flows would be necessary in any given year. However, they could be used in combination in certain years. Each short duration near-bankful flow type would be implemented experimentally during the adaptive management program (but not in the same water year) to determine their relative effectiveness in maintaining a wide active channel. A mixture of these options may prove to be the most desirable approach over the long term.

A key component of the short duration near-bankful flow implementation would be the operational monitoring of weather, river flows, sediment loads, channel cross sections, endangered species activity, and cottonwood seed dispersal and growth. Monitoring during the various stages of vegetation establishment and growth would be critical to the effective use of flow in removing vegetation and maintaining a wide active channel.

FERC Requirements. The Federal Energy Regulatory Commission (FERC) has issued rules that require certain operations of CNPP&ID and NPPD. These operation are called the FERC requirements.

Minimum Canal Diversions. FERC has set minimum and average canal diversion requirements for the Tri-County Diversion. These are discussed in detail in the *Cooperative Agreement* dated July 1997, and are summarized below in **Table 3.3.1-1**. FERC has also set release requirements for Lake McConaughy for the Keystone Diversion during the non-irrigation season. These are summarized in **Table 3.3.1-2**.

Table 3.3.1-1

Diversion Requirements for the Tri-County Diversion during the Non-Irrigation Season

	Diversion Requirements (cfs)					
	10/1 - 11/15		**11/16 - 2/14**		**2/15-beginning of Irrigation Season**	
Condition	**Min.**	**Avg.**	**Min.**	**Avg.**	**Min.**	**Avg.**
Very Wet	1,000	1,600	800	1,000	1,100	1,400
Wet	900	1,200	800	1,000	1,000	1,240
Transitional	900	1,000	800	950	850	1,100
Dry	700	900	700	850	800	960
Very Dry	Consultation among affected parties to maximize multiple use and share effects of shortages.					

Table 3.3.1-2

Releases from Lake McConaughy for Keystone Diversion during the Non-Irrigation Season

Condition	**Minimum (cfs)**	**Average (cfs)**
Very Wet	700	875
Wet	450-700	Not defined
Transitional	450	900
Dry	250	700
Very Dry	250	700

Flow Attenuation Plan. During the irrigation season, precipitation events can cause a decrease in demand for water to meet the irrigation needs in the Central Nebraska Public Power and Irrigation District (CNPP&ID) system. This can be thought of as a "rejection" of water. The rejection of water already in the system but not yet delivered leads to an increase in water returned to the Platte River at the Johnson #2 hydropower return (J2 Return). In combination with higher flows in the Platte River due to the precipitation event, the unused

irrigation water may increase the total flow in the Platte River to a level where it can inundate least tern and piping plover nests. Article 212 of CNPP&ID's 1417 FERC license requires CNPP&ID to use its best efforts to attenuate the increased flows in the Platte River that sometimes result from the rejection of irrigation water during the nesting season (approximately June 1 to August 15).

The discussions below summarize operational changes at Johnson Lake and adjacent facilities. Johnson Lake is the reservoir closest to the J2 return and provides the best opportunity to attenuate flows. Details of these operational changes and related issues can be found in CNPP&ID's *Flow Attenuation Plan* document dated July 2000.

Johnson Lake

Regular Operation. Johnson Lake is located near the downstream end of the Central District Supply Canal. Inflows into Johnson Lake fluctuate as a result of many conditions including changes in the diversion rate at North Platte, the discharge rate through the Jeffrey hydropower planed, flow through the Jeffrey return, precipitation and irrigation from the supply canal and the E-65 irrigation canal. Johnson Lake is operated within a narrow elevation range to provide hydropower head on the Johnson #1 (J1) hydropower plant, head for the E-67 irrigation canal, recreation, and to provide a limited amount of water during peak irrigation demand. Normally, outflows form Johnson Lake fluctuate as inflows fluctuate to avoid either increasing the elevation of the reservoir to a level which can cause bank erosion or decreasing the elevation to a level which would result in less efficient hydropower and irrigation operations. The normal operating range for Johnson Lake is approximately 2618.0 to 2618.5 feet during the summer months and approximately 2617.5 to 2618.0 feet during the winter months.

Operation for Flow Attenuation. CNPP&ID's flow attenuation efforts are intended to manage lake levels within the range of 2617.5 to 2619.0 feet to provide space in Johnson Lake to capture runoff from a precipitation event while keeping the elevation from exceeding 2619.5 feet on most occasions. When Johnson lake operations are considered along with the space available in the J2 forebay, there are approximately 2,500 acre-feet of space available to attenuate flows that result from the rejection of irrigation water. For example, the space could be used to attenuate 250 cfs of rejected irrigation water for about 5 days.

The objective of the Attenuation Plan is, where feasible, to avoid exceeding the benchmark flow at the Platte River gage near Overton. If rejected irrigation water available to be returned to the Platte River will not cause the flow at the Overton gage to exceed the benchmark flow, no attenuation is necessary, and the space in Johnson lake will remain available for future attenuation.

Elwood Reservoir

Regular Operation. Elwood Reservoir is located about 3 miles south of Johnson Lake. It was constructed about 5 miles downstream of the headgate of the E-65 irrigation canal to supplement diversion at the headgate and meet the irrigation demand on the E-65 system. Prior to the irrigation season, water is diverted into the E-65 canal and pumped into Elwood Reservoir for use later in the irrigation season. Depending on the elevation of Elwood Reservoir, each of the three pumps at the station can pump 50 cfs to 75 cfs into Elwood

Reservoir. The three pumps combined can pump 150mto 225 cfs. Irrigation demand along the E-65 system typically requires 400 to 500 cfs during the irrigation season. During the irrigation season, when irrigation demand on the E-65 system exceeds the amount available to be diverted, water is released from Elwood Reservoir. Fluctuations in irrigation demand are usually covered by adjusting the rate of outflow from Elwood Reservoir and keeping a relatively steady diversion at the headgate of the E-65 canal.

Operation for Flow Attenuation. After a precipitation event, if the continuing irrigation on the E-65 system is between 350 cfs and 500 cfs, the diversion into the E-65 canal will not normally be reduced but the outflow from Elwood Reservoir will be reduced to avoid overtopping the canal system. If the continuing irrigation demand decreases below 350 cfs, in addition to stopping the outflow from Elwood Reservoir and meeting the irrigation demand for the E-65 canal, CNPP&ID will pump water into Elwood Reservoir whenever it is operationally and mechanically feasible provided the following conditions are met:

- irrigation demand is sufficiently low that the diversion capacity into the E-65 canal exceeds the demand by enough to operate at least one pump at its design capacity.

- Water rights must allow the available water to be pumped into Elwood Reservoir.

- Consistent with conservation commitments, CNPP&ID will only pump water into Elwood Reservoir that it anticipates will be used for irrigation during the non-irrigation season and avoid high Reservoir elevation during the non-irrigation season that would increase total losses and out-of-basin losses.

Other Methods to Attenuate Increased Flows

Rainwater Basin Wetlands. CNPP&ID will continue to deliver surface water to Rainwater Basin wetlands which hold valid state water rights and will serve additional wetlands that obtain valid state water rights.

Additional Storage Facilities. CNPP&ID has in the past, is currently, and is likely in the future, to investigate additional storage options along the Supply Canal upstream and downstream of Johnson Lake. If additional storage space is constructed, CNPP&ID will evaluate these reservoirs during the design phase to determine whether they could be efficiently operated to aid in attenuating increased flows in the Platte River due to rejected irrigation water while fulfilling their intended functions.

Net Controllable Conserved Water Attributable to Reclamation Funds. According to the CNPP&ID report, “Estimate of Net Controllable Conserved Water”, Reclamation funds were used on six conservation projects at the downstream end of the CNPP&ID system, all of which were distribution system improvements. The “Net Controllable Conserved Water” from these projects is estimated to be 487 acre-feet per year. The percentage of Net Controllable Conserved Water from these projects that is attributable to Reclamation funds is equal to the percentage of costs for these conservation projects that was paid for by Reclamation funds.

CNPP&ID examined the total costs associated with implementation of the distribution system improvements partially funded with Reclamation funds. The purpose for examining these costs

was to determine the percentage of costs attributable to Reclamation funds, so that a proportionate share of conservation savings could be credited to the Reclamation funds. These costs, and assumptions relating thereto, are summarized as follows:

Direct Improvement Costs - These are direct costs associated with installation of the distribution system improvements. These would include costs of materials, costs of installation, and administrative costs. One half of these costs were paid by Reclamation funds.

Operations and Maintenance Costs - these are ongoing costs associated with operating and maintaining the distribution system improvements. These improvements also have some offsetting reductions in the operations and maintenance (O & M) costs that preceded implementation, i.e. maintenance costs of a new pipeline could be offset by the reduced maintenance costs from eliminating an open lateral. The new O & M costs are only slightly higher ore nearly equal to the offsetting reductions in other O & M costs. Therefore, for purposes of simplicity and economy of scale, net changes to O & M costs are assumed to be zero.

Hydropower Impacts - Conservation of water in the irrigation system, and the contribution of some of that water to the Environmental Account, can have positive and negative effects of hydropower generation at CNPP&ID's three supply canal hydropower plants. Fore example, some of the conserved water that would have been lost in the E-65 or E-67 systems will potentially be available to pass through two more supply canal hydropower plants. On the other hand, conserved water from any irrigation system, if added to the Environmental Account, can potentially be released at a time when no capacity exists for CNPP&ID to divert, which would represent a loss of supply canal hydropower generation. While it is difficult to assess all potential impacts to the supply canal hydropower plants, it appears the net affect would be no change or possibly a slight loss in generation. For purposes of simplicity and economy of scale, net changes to supply canal hydropower generation are assumed to be zero.

Because the net impacts to O & M costs and hydropower generation are assumed to be zero, the approximate cost of the conservation projects partially funded by Reclamation funds is therefore assumed to be equal to the direct improvement costs, of which the Reclamation funds paid about 50 percent. Therefore, the Net Controllable Conserved Water attributable to Reclamation funds is calculated to be 50 percent of 487 acre-feet pre year, or 244 acre-feet per year (approximately 0.2 KAF/year). Pursuant to Article 402 of CNPP&ID's FERC license, CNPP&ID will contribute this amount of water to the Environmental Account on October 1 of each year.

North Platte Choke Point. The terminology "North Platte Choke Point" refers to the channel capacity in the North Platte River at North Platte, Nebraska, at the official flood stage defined by the national Weather Service. This capacity is currently 1,980 cfs, which is significantly lower than the channel capacities at other locations along the North Platte, South Platte, and Platte Rivers. This significantly limits releases from Lake McConaughy for purposes such as EA short duration near-bankful flows to discharges such that flood stage will not be exceeded in the North Platte River at North Platte. The central Platte OPSTUDY model assumes that this "choke point" limits environmental flows past the town of North Platte, Nebraska.

Central Platte Re-Regulating Reservoir

Location. The State of Nebraska (Nebraska) has indicated that it is willing to consider one or more re-regulating reservoirs. Details of how these reservoirs might be implemented are given in the Water Action Plan dated September, 2000. The six most promising site locations for these re-regulating reservoirs, listed in order by location from west to east, are described as follows:

- Jeffrey Canyon Reservoir - This site is located south of Brady in Lincoln County on the south side of the Central District (or CNPP&ID) Supply Canal (Canal). The reservoir would be fed from Jeffrey Reservoir. The reservoir capacity is estimated to be 10,390 acre-feet.

- 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 123,895 acre-feet.

- 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 estimated to be 6,433 acre-feet and 11,429 acre-feet, respectively.

- 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 acre-feet.

- 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 J-2 Forebay. The reservoir capacity is estimated to be 3,436 acre-feet.

For the Proposed Program Alternative, the target capacity is 3,436 acre-feet. It is possible that more than one of these reservoirs will be implemented to meet this storage target.

Basic Description. The re-regulating reservoirs would capture Platte River water beyond that required for irrigation deliveries and in-stream flows in the Platte River 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. CNPP&ID is proposing to re-regulate flows in their system. In this case, diversions will not be increased or decreased; only return flows will change.

Study Method. The value of an off-stream storage facility near the J2 Return canal was analyzed using flows at Grand Island and Overton and the historic outflows from the J2 return from 1947 through 1994 along with the "dry year" and "average year" target flows at the Grand Island gage on the Platte River. The logic used was if there was flow in excess to the daily Instream Flow Target at the Grand Island and Overton gages and there was water entering the Platte River at the J2 return in excess of the minimum flow for the power plant to operate, the

J2 water could be diverted into the off-stream reservoir up to the capacity of the reservoir. If there was a shortage at the Grand Island gage, water would be released from storage (if available) to offset the shortage up to the size of the outlet works. The operation of the reservoir is assumed to be a "fill and spill" approach. The reservoir could be drawn down as necessary, and fill as water was available.

Daily inflow and outflow data for 1947 through 1994 were summed to show monthly inflow and outflow, and average monthly storage. Average annual values were calculated from these data for the study period and used in the analysis.

Constraints on the model included not diverting any flows into the reservoir during "pulse flow" periods, February 15 through March 15, and all of May and June. If the flows are less than the target flows, additional water was delivered from storage. The inlet and outlet canals and outlet works were sized the same.

As explained in the water action plan there are several legal and institutional requirements for implementation of the central Platte re-regulating reservoir.

Power Interference. The Power Interference element is envisioned to operate primarily at CNPP&ID's Kingsley Dam/Lake McConaughy facility in conjunction with the McConaughy Environmental Account. NPPD's Sutherland System and North Platte Hydro facility would also be involved as the Districts projects operate cooperatively.

There are periods when releases from Lake McConaughy in combination with South Platte River flows and/or downstream river gains result in flows between Overton and Grand Island which exceed the Service's instream flow recommendations. Scaling back a portion of the McConaughy releases (while still meeting NPPD's and CNPP&ID's "basic needs") would allow dowstream flows to still meet instream flow targets, and the "excess" flow could be "purchased" by the EA to be released at a later time when the Districts planned releases and downstream river gains would not meet instream flow recommendations. When the water is subsequently released, it may or may not be available for diversion and routing through the Districts hydro facilities depending on river conditions in effect. The differences in generation, both in amount and time of year, would be considered in the cost of the water purchased.

The amount of the planned release from McConaughy that is available for purchase by the EA is limited to the smaller value of:

- Excess instream flow at Grand Island.
- Excess instream flow at Overton.
- Excess flow at Tri-County Diversion Dam (amount in excess of canal maintenance flow, flow to refill Johnson Lake and Elwood Reservoir).
- Excess flow at NPPD's Keystone Diversion Dam (amount in excess of canal maintenance flow, including icing considerations, and flow needed for Sutherland Reservoir operation.
- Flow from the J2 return greater than the minimum necessary to operate the power plant.

Because of travel times from Lake McConaughy to Grand Island (7-10 days), river conditions would have to be fairly steady or predictable in order to agree upon what volume of water is available for purchase by the EA. Other considerations would include current storage levels in both Lake McConaughy (total storage), the storage volume in the EA, and whether a spill condition may exist in the near future.

Table 3.3.1-3 shows the Average EA Accrual and Average EA release for 1) the 3-State Plans (Nebraska EA, Pathfinder Modification, and Tamarack Plan) and 2) the 3-State Plans plus Power Interference. As shown in this table, the volume of water "purchased" (19,000 af) was subsequently lost as spill due to the reservoir being at regulatory capacity and may not have provided and instream flow benefit (7,100 af).

Table 3.3.1-3

Effect of Power Interference on EA Accrual and Release

Month	Average EA Accrual, KAF		Average EA Release, KAF	
	3-State Plans	3- State Plans Plus Power Interference	3-State Plans	3- State Plans Plus Power Interference
Oct.	11.6	13.1	7.9	3.3
Nov.	9.9	12.8	5.7	6.8
Dec	8.5	14.3	0.0	0.0
Jan	7.9	14.0	0.0	0.0
Feb.	8.7	9.8	12.0	18.7
Mar.	8.9	9.5	16.8	14.3
Apr.	8.7	9.6	0.0	0.0
May.	3.2	3.2	22.1	21.6
Jun.	1.1	1.1	12.0	14.0
Jul.	14.2	14.2	4.5	5.4
Aug.	14.8	14.8	15.4	19.5
Sep.	1.1	1.1	6.9	7.0
Total Yield	98.5	117.5	103.3	110.5

Operations would primarily be done during the non-irrigation season (October through April), with the potential for other time periods depending upon storage and flow conditions.

Water Leasing (25 KAF) and Management Incentives in Nebraska

Conservation. This feature consists of conservation activities implemented by

CNPP&ID within their system.

Leasing. 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 would consist of the reduction in consumptive use. It is assumed 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 CNPP&ID and 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.

The leasing program that has been analyzed considers leasing approximately 25,500 acre-feet annually, which corresponds to a reduction of about 17,000 acre-feet/year delivered on-farm and a reduction in consumptive use of about 8,400 acre-feet/year.

Seven river reaches have been evaluated for potential water leasing in Nebraska. These reaches are defined by the following gage locations:

North Platte River

Keystone Diversion to North Platte, NE

South Platte River

Julesburg, CO, to North Platte, NE

Platte River Main Stem (all in NE)

North Platte to Brady
Brady to Cozad
Cozad to Overton
Overton to Odessa
Odessa to Grand Island

In addition, the following canals or irrigation districts could potentially be included in a leasing program: Keith-Lincoln, Paxton-Hershey, North Platte, Suburban, Cody-Dillon, Six Mile, Thirty Mile, Orchard-Alfalfa, Cozad, Gothenburg, Dawson County, Kearney, and the CNPP&ID system.

The goal is to obtain 25 KAF of water annually through leasing in Nebraska.

Groundwater Management

Introduction. The potential for developing the CNPP&ID groundwater mound as a reservoir for Platte River flow augmentation was evaluated. The concept is to design a well field that would allow withdrawl of water during the irrigation season, and recharge during periods of excess flows. The pumped water will be discharged to the CNPP&ID distribution system for irrigation. Recharge would be provided through canal seepage, surface spreading, seepage pits, injection wells, injection drains, or some combination of these methods.

Only relatively shallow water table areas were considered and only the top 5 to 10 feet of saturated thickness is to be used as a reservoir. These restrictions were imposed for several reasons.

- Wetland areas can be easily protected if drawdown curves are shallow.

- Low head pumps can be operated on single phase power.

- Power costs are minimized when pumping from shallow depths.

- Well construction costs are small for shallow, small diameter wells.

The well spacing, depth, diameter, screened interval and other design considerations are based on typical aquifer characteristics that have been reported for the service area. This feasibility level estimate will need to be refined by site specific data collection before final designs can be made. However, the estimated values used are reasonable for the target aquifer and are mutually compatible.

<u>Location.</u> Based on the principles submitted by Nebraska, groundwater management has been limited to a total yield of no more than 6,000 acre-feet/year until it can be successfully demonstrated through a phased-in project that groundwater mining will not occur at this level. Nebraska has indicated that they will not consider expanding groundwater management unless further investigation and study reveals that higher yields can be sustained. Nebraska is reserving 50 percent of the total groundwater yield to offset net depletions, in which case the remaining 50 percent, or 3,000 acre-feet/year, can be made available to the Program.

Locations in Nebraska being considered for groundwater management include a 13,000-acre area under the Phelps Canal, the Reynolds and Robb wetland area, other, smaller areas in Phelps and Kearney counties, and areas under the Dawson and Gothenburg Canals on the north side of the Platte River.

<u>Basic Description.</u> Groundwater management can be accomplished in a number of ways. Several options that could be implemented are listed below.

<u>Active Groundwater Pumping from High Groundwater Areas.</u> With this option, 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 discharge water into Lost Creek and/or North Dry Creek for return to the Platte River. Up to nine wells would be required to pump 3,000 acre-feet/year.

<u>Passive Lowering of the Groundwater Table.</u> With this option, farmers would be paid 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.

Groundwater Irrigation. Farmers would be paid to install 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.

Conjunctive Use. A conjunctive use project under CNPP&ID's system would consist of shallow wells that discharge directly into CNPP&ID'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 CNPP&ID's distribution system for recharge to the local groundwater aquifer. The aquifer would be recharged to a pre-determined lever. Every 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.

Direct Diversion from the Platte River. This option would be considered for the Dawson and Gothenburg Canals only. It 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. Return flows that result from canal seepage would accrue to river for some duration after the recharge event. Diversion 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.

Service area definition. To evaluate the feasibility of this proposal, the location of observation wells were identified on a map of the state. Records for wells within the mound area were sorted to include those with readings in 1995 or later and where water table levels are less than 40 feet from the ground surface. The mound contains two separate lobes. The eastern lobe lies in Gosper, Phelps, and Kearney Counties while the western lobe lies in Lincoln County.

Recharge Plan. Recharge water will be transported to the recharge facilities through the canal system during non-irrigation season periods of excess flows. The recharge facilities may consist of pits, wells, pipe drains, surface spreading through irrigation machines, or a combination of these methods. Each has its strengths and weaknesses. The O'Neill Unit Special Report Ground Water Recharge Plan dated January 1992 is based on research conducted by the Reclamation Kansas-Nebraska Projects Office. Recharge lines (drains), recharge pits, saturated recharge wells, and unsaturated recharge wells were compared. Only the unsaturated wells produced unsatisfactory results and the recharge lines were the most hydraulically efficient. Similar demonstration projects may be useful in determining the preferred recharge methods to be used here.

Pipe drain recharge lines will be placed midway between the wells at a nominal depth of 5 feet. The drains will consist of High Density Polyethylene corrugated perforated pipe laid in a graded sand and gravel envelope. They will be sloped for gravity flow.

Recharge pits will be located in the corners of center pivot irrigation systems. They will be about 3 feet in depth with a berm around the edge to prevent surface flows containing silty sediments from entering. The primary problems with recharge pits are algae growth and frequent cleaning.

Recharge wells would be similar construction to the production wells and may even be the same wells, although this arrangement can introduce new problems. For instance, if recharge water degrades the aquifer, a production well may be lost.

Surface spreading would be accomplished by operating irrigation machines during the non-irrigation season. Surface spreading is simple and effective but carries relatively high operation and maintenance costs, has relatively high evaporation loses, and may flush nutrients from the root zone.

North Dry Creek Groundwater Pumping Project

Location. The North Dry Creek Groundwater Pumping Project consists of a cutoff from Lost Creek to the Fort Kearney Improvement Project Area (IPA). Both of these features are in the Tri-Basin Natural Resources District (TBNRD), and are located within the area influenced by high groundwater levels associated with the are irrigated by the Tri-County canal.

Basic Description. The Fort Kearney IPA is a drainage ditch, maintained by TBNRD, which empties into the Platte River about one mile east of the Highway 44 Bridge. This project would consist of the construction of a ditch about .75 mile in length to connect Lost Creek to the Fort Kearney 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. If so, this pump station would likely be located along Crooked Creek, which intersects the IPA approximately one mile from the river. TBNRD has made some preliminary estimates that the Lost Creek-Fort Kearney IPA cutoff can maintain a relatively steady rate of diversion. This project would be operated similar to active pumping from the groundwater mound. Wells would be installed in high groundwater areas to pump water into Lost Creek during periods of target flow shortage. Water would then be routed to the Platte River through the Fort Kearney IPA cutoff. Because the cutoff enters the Platte River in the middle of the critical reach, the Program only receives credit for half of the water provided.

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.

Yield and On-Site Timing. The total potential yield associated with these projects is estimated to be 2,600 ac-ft. Nebraska is reserving 50 percent of that yield to offset future depletions; therefore, approximately 1,300 ac-ft is available to the Program. The Final Report was relied on for yield estimates and timing. Diversions from the Platte River and monthly accretions to the river provided in the Final Report and described below were prorated to reflect only 50 percent of the yield as available to the Program.

The EIS team does not model this with the CPOPS model, but agrees to credit the program for 1,300 acre-feet.

Net Controllable Conserved Water 3.8 KAF. "Net Controllable Conserved Water" has been identified as a result of actions taken by CNPP&ID to comply with the agreement with the National Wildlife Federation to accomplish reductions in average annual diversions of surface water. The three main categories of water conservation measures that have been implemented address reservoirs, canal distribution and delivery systems, and on-farm irrigation. Reservoir improvements would include a water conservation alternative developed for Elwood Reservoir that revised the fill/release operations to minimize seepage. Canal distribution and delivery system improvements would 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; and/or management improvements, such as irrigation scheduling, adjustment to irrigation set times, and alternate furrow irrigation. On-farm irrigation changes are intended to improve irrigation efficiencies.

Glendo Reservoir, Wyoming, Unassigned Water

Location of project. Glendo Reservoir is on the North Platte River in east central Wyoming, about halfway between Casper, Wyoming, and the Wyoming-Nebraska state line.

Basic description of project/ operating concept. 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 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. The Glendo Stipulation provides for several changes to the 1953 Order that relax the conditions under which Glendo storage can be used. Significant changes with respect to the Program 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 currently 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 the remaining 10,600 ac-ft of storage (Wyoming December 16, 1999 proposal).

Water in excess of that needed to meet contracted demands and potentially replace Wyoming's excess depletions would be available to the Program. Wyoming estimates that 2,700 ac-ft of Glendo storage would be available to the Program on an average annual basis (Wyoming's December 16, 1999 proposal). The amount available is subject to further evaluation of the average annual yield that may be derived from the 10,600 ac-ft of storage and may change.

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, they will make a conservative judgment as to the amount of water that may be required prior to June 1 of each year. Accounting for depletions will occur after September 30th.

- 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 its "existing water related activity baseline", the amount of excess would be subtracted from the amount of water provided to the Program to determine the amount for which Wyoming would get credit 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". Wyoming will quantify the amount of excess at the Wyoming/Nebraska state line, in which case, tracking and accounting procedures will need to be agreed upon.

Temporary Water Leasing in Wyoming

Location. The Water Action Plan prepared by Boyle Engineering evaluated a temporary water leasing program for 5 reaches of the North Platte River. The five reaches that were considered are defined by the following gage locations:

<u>North Platte River</u>

Reach 1 Northgate, CO, to Sinclair, WY
Reach 2 Sinclair, WY, to Alcova, WY
Reach 3 Alcova, WY, to Orin, WY
Reach 4 Orin, WY, to Whalen Diversion Dam, WY

<u>Laramie River</u>

Reach 6 below Greyrocks Reservoir, WY, to Fort Laramie, WY

The goal is to obtain 25 KAF of water annually through leasing in Nebraska.

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 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 program could be allowed to change over time and the length of the lease allowed to vary based on the needs of the irrigation district or farmer. Leasing contracts may be possible for periods up to 13 years (the length of the first increment) with an option to renew at the conclusion of the contract. Individual farm owners could choose to lease a portion of their water supplies, likely subject to a minimum lease volume to manage administrative and program management costs.

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

Average Annual On-Site Yield and Timing. The yield from reaches 1 through 4 was modeled by reducing deliveries to the Casper Alcova Irrigation District by 17%. Half of this reduction was available to the program the other half was used to offset reductions in return flows due to the leasing. The water from leasing was released every month during the irrigation season and was not stored in a reservoir for later release. The half that was available to the program was protected to Lake McConaughy and the other half was released from Alcova

Reservoir to become part of the natural flow available to other water right holders.

The yield from reach six was modeled as an input item that enters the North Platte River at the Laramie River. The pattern of input is shown in **Table 3.3.1-4**.

Table 3.3.1-4

Pattern for Input of Water Leasing in the Laramie River Basin (kaf)

April	May	June	July	August	September
0.022	0.205	0.445	0.587	0.518	0.277

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 its confluence with the North Platte River. This confluence is located approximately 115 river miles downstream of the gage at Alcova, WY.

Basic Description. La Prele Reservoir was constructed between 1905 and 1909. The current capacity of the reservoir is approximately 20,000 acre-feet. It is permitted for irrigation and domestic and industrial uses. In 1974 an agreement was made between the Douglas Water Users Association and the Panhandle Eastern Pipeline Company (PEPL) to rehabilitate the reservoir. The terms of the agreement provided that PEPL buy 5,000 acre-feet of storage space in the reservoir. This analysis assumes that PEPL's storage right in La Prele Reservoir is available for lease by the Program. PEPL's 5,000 acre-foot share of space in La Prele Reservoir is limited by the yield of its share and the conditions under which it maybe put to beneficial use in the context of the Program.

Average Annual On-Site Yield and Timing. Because the Water Action Plan only covered the 1975-94 period, it was necessary to recalculate the reservoir releases for incorporation into the NPREIS model. The releases were recalculated using the same assumptions regarding seepage, evaporation, senior downstream demands, and La Prele Irrigation demands as were used to prepare the Water Action Plan. However, the EIS analysis does not count seepage as contributing to the program. This water is currently part of the system and is treated the same as return flows from irrigation, which are not counted as contributing to the program. The other difference is that the program water is released in May through September in order to not violate the maximum release clause of the PEPL contract.

The record for the gage above La Prele Reservoir ends in 1992, thus 1993 and 1994 use the average flow. In addition, there are no flows for October through February1972-94 and averages are also included for these values.

The La Prele Reservoir Net Yield to the Platte River is shown in **Table 3.3.1-5**.

Table 3.3.1-5

La Prele Reservoir Net Yield to the Platte River

Year	May	Jun	Jul	Aug	Sep	Total	Year	May	Jun	Jul	Aug	Sep	Total
	Yield (acre-feet)												
1947	700	700	1400	697	0	3497	1971	700	700	1400	745	0	3545
1948	700	700	679	0	0	2079	1972	700	700	1400	898	0	3698
1949	700	700	1400	1074	0	3874	1973	700	700	1400	1019	0	3819
1950	700	700	515	0	0	1915	1974	700	700	1400	0	0	2800
1951	700	700	1400	87	0	2887	1975	700	150	0	0	0	850
1952	700	700	1400	926	0	3726	1976	700	700	492	0	0	1892
1953	700	700	1400	53	0	2853	1977	700	700	151	0	0	1551
1954	514	0	0	0	0	514	1978	700	700	1400	937	0	3737
1955	700	265	0	0	0	965	1979	436	0	0	0	0	436
1956	0	0	0	0	0	0	1980	700	700	1400	1034	0	3834
1957	700	700	1400	772	0	3572	1981	0	0	0	0	0	0
1958	700	596	0	0	0	1296	1982	700	0	0	0	0	700
1959	700	700	157	0	0	1557	1983	700	700	1400	1019	0	3819
1960	700	21	0	0	0	721	1984	700	700	1400	1019	0	3819
1961	543	0	0	0	0	543	1985	0	0	0	0	0	0
1962	700	700	1400	761	0	3561	1986	700	700	1400	1019	0	3819
1963	276	0	0	0	0	276	1987	700	286	0	0	0	986
1964	700	700	1400	1400	0	4200	1988	700	700	1400	1019	0	3819
1965	700	700	1400	1311	0	4111	1989	0	0	0	0	0	0
1966	700	452	0	0	0	1152	1990	0	0	0	0	0	0
1967	700	700	373	0	0	1773	1991	700	700	1400	638	0	3438
1968	700	700	1400	903	0	3703	1992	113	0	0	0	0	113
1969	700	224	0	0	0	924	1993	700	700	1400	504	0	3304
1970	700	700	1400	1041	0	3841	1994	700	700	1400	504	0	3304

Pathfinder 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 would be filled with water stored under the existing 1904 storage right for Pathfinder Reservoir with the exception that regulatory calls could not be placed on existing water rights upstream of Pathfinder Reservoir other than the 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.

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 that 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, they will make a conservative judgment as to the amount of water that may be required prior to June 1 of each year. Accounting for depletions will occur after September 30th.

- 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 its "existing water related activity baseline" the amount of excess would be subtracted from the amount of water provided to the Program to determine the amount that Wyoming would get credit from the Program for. 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". Wyoming will quantify the amount of excess at the Wyoming/Nebraska state line in which case, tracking and accounting procedures will need to be agreed upon.

Average Annual On-Site Yield and Timing. The amount of water available to the Program is dependent on the amount needed to supplement municipal water rights and/or mitigate excess depletions. This amount will vary on a year to year basis, however, Wyoming anticipates that 4,800 ac-ft would be available to the Program on an average annual basis (Wyoming's December 16, 1999 proposal). 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 in the month of September to minimize conveyance losses.

Firm yield has been defined as the mean annual reservoir release that can be guaranteed based on the analysis of historic data. Predicated on this information, the demand for use of the Pathfinder Municipal account set in the NPREIS was equal to 9,600 AF annually. Putting additional demands on this account would cause shortages during dry periods. Therefore, it was necessary to recalculate these demands such that the combination of deliveries for Wyoming and deliveries for the program never exceeded 9,600 AF in any year.

Wet, dry, and average years were determined from the Grand Island Gage, dry years are the bottom 25% of the flow years, wet years are the top 33% of the flow years, and the remaining years are average. The EIS assumes that the program receives no water in dry years, 9,600 AF in wet years, and 3,900 AF in average years.

Tamarack Phase III. The Enlarged Tamarack Plan will also include canals that divert water directly from the South Platte River and wells located adjacent to the river that pump groundwater from the alluvial aquifer. Water that is diverted or pumped will be conveyed to recharge sites in sandy uplands away from the river where the water would percolate into the alluvium and return to the South Platte River at a later time.

Average operational effects of an enlarged Tamarack Plan on the South Platte River estimated on the basis of historical data for the 1943-94 period are given in **Table 3.3.1-6.**

Table 3.3.1-6 Enlarged Tamarack Plan Average Operational Effects		
Month	**Total depletion from South Platte River (acre-feet)**	**Net yield to South Platte River (acre-feet)**
October	0	2,340 to 2,790
November	0	2,070 to 2,480
December	-8,890 to -11,000	-6,980 to -8,710
January	-9,060 to -11,290	-6,680 to -8,410
February	-9,240 to -11,580	-6,205 to -7,880
March	-9,180 to - 11,380	-5,510 to -6,890
April	-5,070	-630 to 370
May	-3,030	1,790 to 2,700
June	0	4,540 to 5,300
July	0	3,630 to 4,280
August	0	3,040 to 3,600
September	0	2,640 to 3,140
Annual	44,460 to 53,350	-5,960 to -7,230

Expanded recharge is also being considered for the Peterson and South Reservation Ditches, which divert from the South Platte River immediately downstream of Sedgwick, Colorado. Return flows that result from such recharge accrue to the river for some duration after the recharge event depending on the hydro-geologic conditions and the distance from the site to the river. Recharge sites will need to overlie the alluvial aquifer and be hydrologically connected to the river. In general, Colorado is considering sites with SDF factors ranging from 60 days to 300 days.

Colorado will also operate the Tamarack Plan, after consultation with the manager of the Environmental Account in Kingsley Reservoir, in a manner that does not cause an increase in target flow shortages at the critical habitat unless requested otherwise by the Environmental Account Manager, as measured at the Grand Island gage and using FWS target flows which are then in effect.

The Tamarack Plan would need to be operated under the flow requirements of the South Platte River Compact, which requires that discharge at the South Platte River at Julesburg, CO, not be less than 150 cubic feet per second from April 1 through October 15 of each year. Some of the depletions from the South Platte River would be by surface diversion, but the diversion capacity would be reduced during the irrigation season because of agricultural priority for the diverted water. During the winter months, when surplus water seems to be more available, surface diversions would play a smaller role because of freezing temperatures, requiring a heavier reliance on pumping.

Depletions from the South Platte River also may not be possible for some months because designated target flows in the habitat area in Nebraska are not being met.

3.3.2 Run description

3.3.2.1 3-States Plan

Pathfinder Modification. The Pathfinder Environmental Account is operated as has been described in Program Documents. For the EIS, releases from the account are modeled as occurring in April, July, and August. The entire amount stored in the account is released each year to maximize each year's accrual. A summary of its proposed operation, as modeled in the NPREIS, fol1ows:

1. Water accrues to the environmental account on an equal priority with other uses from Pathfinder Reservoir. The 34,000 acre foot account is approximately 3.18% (34,000/1,070,000) of the active capacity of Pathfinder Reservoir. Therefore, the account accrues 3.18% of the inflow that is storable under the 1904 storage right.

2. The environmental account does not contain more than 34,000 acre feet at any one time. For example, if at the end of a water year, which is defined as October 1 to September 30, 10,000 acre feet of water are in the account, the account can only accrue 24,000 acre feet under its priority fill during the forthcoming water year.

3. The environmental account is assessed its proportionate share of evaporation losses based on the water stored in the account.

4. The environmental account is administered and operated in a manner consistent with Wyoming water law and the North Platte Decree.

The modeling of three state elements in the Central Platte OPSTUDY model during the MOA negotiations assumed deliveries from the Pathfinder Environmental Account during July and August. After discussing the issue with the Fish and Wildlife Service in Grand Island, Nebraska, we concluded that there are biological benefits to having water available either prior to May or early in the irrigation season. Water is not moved in May and June due to the possibility of high flows during these months, thus the water is delivered in April, July, and August. Losses to

environmental deliveries are assigned based on the carriage losses in the settlement to the Nebraska vs. Wyoming lawsuit and the losses in April are assumed to be the same as those in September. The losses in July and August are greater than those in September, thus there is a reduction in the amount of water reaching the Wyoming/Nebraska state line and the EA in Lake McConaughy in Nebraska.
Deliveries from the Pathfinder Environmental Account in April, and any other month, are limited to the water stored.

Tamarack. The Tamarack Project is operated as has been described in Program Documents. A summary of the proposed operation and how it is modeled fol1ows:

1. The maximum diversion capacity into the Tamarack Project by month is as shown in **Table 3.3.2-1**:

Table 3.3.2-1

Diversion Capacity by Month in Acre-Feet

Mnth	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Vol	6800	6800	9800	9800	6800	6800	6800	6800	6800	9800	12800	6800

2. The project is operated in such a way as to increase flows at the Julesburg gage during the period April through September by an average of approximately 10,000 acre-feet over the flows that would otherwise occur during the period.

3. At other times of the year, the magnitude of diversions into the Tamarack Project is dependent on the shortage/excess of flow at Grand Island with respect to target flows.

Lake McConaughy Environmental Account. The Lake McConaughy Environmental Account (EA) is operated as has been described in Program Documents. For the EIS, releases from the account are modeled as occurring in all months except December through February, and water is held in the EA for May short duration near-bankful flow releases. Pulse flow releases have priority, followed by summer low-flow releases. The volume remaining in the EA at the end of a water year is carried over into the next water year. A summary of the proposed operation, as modeled in the Central Platte OPSTUDY model, fol1ows:

1. Ten percent of Lake McConaughy inflows between October and March of a given year are credited to the EA.

2. The total quantity of water in the EA in Lake McConaughy is not allowed to exceed 200,000 acre-feet at any time.

3. Whenever Lake McConaughy fills to regulatory capacity as defined by FERC's dam safety requirements for Project No. 1417 and the EA is less than 100,000 AF, the EA is increased to 100,000 AF regardless of the quantity of EA water already released during

that water year.

4. At any time that Lake McConaughy reaches regulatory capacity as defined by FERC's dam safety requirements for Project No. 1417 and the EA exceeds 100,000 AF, the EA is reduced to 100,000 AF regardless of the sum of the contributions from the states and from Conservation Activities or the quantity of carryover from a prior year.

5. Storage losses for Lake McConaughy and other Approved Storage Facilities shall be calculated and assigned monthly to the EA using the following formula: ((average monthly storage in the EA)/(average monthly storage in total)) * (total losses for the storage facility for that month).

6. Contributions to the EA are protected from groundwater or surface water depletion from the state line or the source of contribution from within Nebraska to Lake McConaughy or other Approved Storage Facilities.

7. Water stored in projects in Wyoming may be **transported** to the EA. That is, water is released from these projects and flows directly into Lake McConaughy for storage in the EA. This water is subject to conveyance and other losses. Projects in Wyoming include the Pathfinder Modification, Glendo ETO, La Prele Reservoir leasing, etc.

8. Water stored in projects in Nebraska may be **credited** to the EA. That is, the volume of the EA will be considered to have increased by the volume of water that is located and/or stored as a result of these projects. Projects in Nebraska include the central Platte re-regulating reservoir, central Platte power interference, groundwater conjunctive use, and other projects as the water becomes available to the Program and the EA.

The EA in Lake McConaughy is operated to increase flows in the central Platte habitat area. Water is released from the EA depending on the Platte River flows in the habitat area, the time of year, and the amount of water available in the EA. The amount available in the EA is calculated by subtracting any amount held in reserve for use later in the year from the amount stored in Lake McConaughy. If the amount available from the EA is not greater than the amount needed to make the minimum EA release, no release will be made.

3.3.2.2 Other Elements

Short duration near-bankful flows. The modeling of short duration near-bankful flow releases from Lake McConaughy is based on simulated daily flows at which are computed by the OPSTUDY model. Short duration near-bankful flow releases are only generated in April or May. The generation of short duration near-bankful flows includes several elements besides the EA in Lake McConaughy. The following text describes each element and how it is used during the short duration near-bankful flow event.

Lake McConaughy Environmental Account. The goal of a short duration near-bankful flow is to have a flow near bank full capacity (~10,000 cfs), but below flood stage, at

Overton every year (100% of the time). Based on the estimated flow out of Lake McConaughy for May the model estimates the flow at Overton without a short duration near-bankful flow release. The potential short duration near-bankful flow release is.

> The difference between 10,000 cfs and the estimated flow at Overton.
> Constrained by.
> The available release capacity form Lake McConaughy,
> the combined flow capacity in the Sutherland Canal and the North Platte River at North Platte, Nebraska,
> The ramp rate for releases from Lake McConaughy (the Keystone diversion and down the North Platte River), and
> The volume of water available in the EA.

After calculating the potential short duration near-bankful flow release, the model will only make a short duration near-bankful flow release if the following conditions are true.

> The estimated May peak flow at Overton without a short duration near-bankful flow is less than 6,500 cfs.
> The estimated average flows in May and June are less than 3,800 cfs individually or both are less than 2,000 cfs.
> Lake McConaughy is not estimated to spill in June and the average flow in the South Platte River at Julesburg in June is not greater than 700 cfs.
> There were no flows since October 1 in excess of 5,500 cfs.
> The flow at Overton will be greater than 3,500 cfs with a short duration near-bankful flow.
> The short duration near-bankful flow will increase the flow at Overton by at least 1,000 cfs.

Simplified, the above criteria are: do not make a short duration near-bankful flow if.

> There is a good chance that there will be a natural peak in May or June greater than 6,500 cfs,
> There has already been a natural peak of at least 5,500 cfs since last October 1, or
> The short duration near-bankful flow release will not significantly increase flows at Overton.

North Platte River. Ramping rates on the North Platte River are likely to be a concern. Short duration near-bankful flows will require a great deal of coordination with downstream irrigation canal operators. The concerns are trash, deadwood, and other debris that will be mobilized by short duration near-bankful flows that could clog or otherwise damage diversion facilities. Another concern is the effect of short duration near-bankful flows on facilities such as sand dams. Therefore, it will be necessary to test and monitor small short duration near-bankful flows to determine the effect on downstream facilities. The carrying capacity of the North Platte River at North Platte, Nebraska will determine the magnitude of the release from Lake McConaughy. The amount released from Lake McConaughy will be the carrying capacity at North Platte minus the expected gains between Lake McConaughy and North Platte minus any margin of safety.

Keystone Diversion. The goal is to divert enough at Keystone such that the maximum amount (1,850 cfs) can be released from the Sutherland return to the South Platte River. Given the system losses, it will be necessary to divert more than 1,850 cfs at the Keystone diversion. The other constraint is that the Keystone diversion can not be increased or decreased (ramped) by more than 200 cfs per day. The Keystone diversion to the Sutherland Canal is increased (ramped) by 200 cfs per day with the intent of reaching up to the maximum diversion of 2,100 cfs on the first day of the short duration near-bankful flow release down the North Platte River. Assuming that the short duration near-bankful flow release on the North Platte continues for three days, maintain the Keystone diversion for three days. On the fourth day reduce the diversion by 200 cfs and continue to reduce the diversion by 200 cfs per day until the diversion is at the level it was prior to ramping up for the short duration near-bankful flow. Time the diversions such that the water reaches the Sutherland return to the South Platte River at the same time that the short duration near-bankful flows in the North Platte River reach the town of North Platte, Nebraska.

Korty Diversion. This analysis assumes no diversion at Korty during short duration near-bankful flow time period. To the degree that this assumption is not correct changes will have to be made in the operation of facilities. The purpose of not diverting at Korty is to allow for a greater release out of the EA in Lake McConaughy by not using the Sutherland Canal to transport South Platte water.

Sutherland Reservoir. Hold Sutherland Reservoir at a constant level during the ramping and short duration near-bankful flow release times.

Sutherland Return to the South Platte River. Release the amount coming down the Sutherland Canal from the Keystone diversion up to the maximum of 1,850 cfs. Time the return such that the water is released to the South Platte River at the same time that the short duration near-bankful flows in the North Platte River reach the town of North Platte, Nebraska. Maintain the releases for three days or until the short duration near-bankful flow event has passed the town of North Platte, Nebraska.

Lake Maloney. Hold Lake Maloney at a constant level during the ramping and short duration near-bankful flow release times.

Tri-County Diversion. Assume that the Tri-County Diversion is the same as the Sutherland Return to the South Platte River. To the degree that this is not true indicates that releases from the Jeffrey return and diversions to Elwood Reservoir must increase. Diversions to Elwood Reservoir would be prior to the maximum pulsing and after maximum pulsing (Elwood could be used to store excess ramping flows)

Jeffrey Return. As the short duration near-bankful flow passes the Jeffrey Return release water from the Jeffrey Return that is not needed to maintain minimum flows in the Tri-County canal between the Jeffrey Return and Johnson Lake. The amount released cannot exceed the capacity of the Jeffrey Return or about 1,000 cfs. The Jeffrey hydro plant has no bypass capability. The purpose of releasing water from the Jeffrey Return is to allow pulsing out of Johnson Lake. The limiting factor on the Tri-County Canal is often the J2 return. If Johnson

Lake is used to augment the short duration near-bankful flow out of the Lake McConaughy EA, a significant portion of the J2 Return capacity is used and unavailable to pass water coming down the Tri-County canal. Using the Jeffrey Return allows the water to be used to generate electricity at the Jeffrey hydro plant, but does not take up J2 Return capacity.

J1 Hydro Plant. As the short duration near-bankful flow passes the J2 Return release the up to the capacity of the J2 Return (2,000 cfs) for up to two days. Then bring the release back to what it was prior to any changes for pulsing.

Johnson Lake. Store water used to ramp the Keystone diversion in Johnson Lake. Storage in Johnson Lake prior to releasing 2,000 cfs for two days will be about 2,600 acre-feet. After the short duration near-bankful flow is stopped the storage will increase to about 2,000 acre-feet, which may be released for a broad based pulse flow or diverted and stored in Elwood Reservoir.

J2 Hydro Plant. As the short duration near-bankful flow passes the J2 Return release the up to the capacity of the J2 Return (2,000 cfs) for up to two days or longer if water is available in Johnson Lake and the J2 forebay. Then bring the release back to what it was prior to any changes for pulsing.

J2 forebay. Store water used to ramp the Keystone diversion in the J2 forebay. Storage in the J2 forebay prior to releasing 2,000 cfs for two days will be about 1,000 acre-feet.

Phelps County Canal diversion. Do not divert water to the Phelps County Canal during the short duration near-bankful flow event. This is to allow the full capacity of the J2 Return (2,000 cfs) to enter the Platte River and augment the short duration near-bankful flows already in the Platte River. Any water that would have been diverted during the short duration near-bankful flow period will be charged against the EA in Lake McConaughy.

Elwood Reservoir. Do not store water in Elwood Reservoir during the time that water is being released from the Jeffrey Return. Elwood Reservoir may be used to store water that is used to ramp the Keystone Diversion.

FERC Requirements

Minimum Canal Diversions. The values for the minimum diversion requirements are given in the input file. Minimum values are given for the Keystone Diversion, the Sutherland Canal (and hence, indirectly, the Korty Diversion), and the Tri-County Diversion.

Flow Attenuation Plan. The storage in Johnson Lake that is available for "spike flow" attenuation is 2,500 acre-feet. Attenuation is only allowed to occur between June 10 and August 15. If, during this time, the simulated daily flow at Overton exceeds 1,200 cfs, the flow at Overton is attenuated by storing water in Johnson Reservoir up to the maximum storage available for attenuation. Once the flow at Overton drops back to an acceptable level, the stored "spike flow" is released back into the system.

North Platte Choke Point. Because of a channel constriction in the North Platte River at North Platte, there is a very low flood stage and a corresponding very low channel capacity in the river at this location. If either a daily or a mean monthly flow in the North Platte River at North Platte exceeds this value, then EA releases are reduced so that channel capacity is below this value. Reductions are applied to the continuous and/or the short duration near-bankful flow releases, as appropriate for the operational condition being simulated at the time the excess at North Platte occurs. This run assumes a capacity of 3,000 cfs in the North Platte River at North Platte, Nebraska.

Reclamation Net Controllable Conserved Water, 4.0 KAF. As presented in the WAP, an annual volume of 4,000 acre-feet was contributed to the Environmental Account from Lake McConaughy storage in October of each year.

Central Platte Re-Regulating Reservoir. Regarding the CNPP&ID Re-regulating Reservoir, the Reconnaissance - Level Water Action Plan (WAP) states:

> "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 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."
>
> Middle of Page 9.

Of the six re-regulating reservoir options presented in the WAP, option 6 a J-2 Forebay Reservoir was selected for modeling by the EIS team. In order to simulate the portion of the reservoir that Nebraska would reserve to meet future depletions, the size of the reservoir was reduced from 3,436 to 1,718 acre-feet. The 100 cfs inlet and 50 cfs outlet capacities presented in the HDR report *Depletion Mitigation Study Phase I* were retained. Inlet and Outlet capacities were not reduced because the EIS team assumed that the reservoir would only be used for one purpose at a time. If the reservoir was storing or releasing water to offset future depletions for example, no capacity would remain for Program purposes. Water is stored or released from the reservoir based on the simulated daily flows produced by the Central Platte Opstudy model. The decision to store or release water is based on the FWS flow recommendations and the reservoir is not allowed to store water during the annual pulse flow periods from February 15 through March 15 and from May 20 through June 20. The "Score" from the CNPP&ID re-regulating reservoir is very sensitive to the capacity of the inlet and outlet structures.

Storage and release from the Central Platte re-regulating reservoir is based on flow targets at Grand Island, flow at Grand Island, outflow from the J2 return, and minimum flow requirements for the J2 return. If the flow at Grand Island is greater than the flow target and the outflow from the J2 return is greater than the minimum flow for the J2 return and there is space in the Central Platte re-regulating reservoir, water is stored in the reservoir up to the capacity of the inlet. If the flow at Grand Island is less than the flow target and storage is available in the reservoir, water is released up to the outlet capacity.

Central Platte Power Interference. The Central Platte Opstudy model was modified to make the operation of the Power Interference Scenario compatible with the analysis done in the WAP. Specifically, flows available for re-timing are flows excess to FERC requirements during the non-irrigation season, and flows excess to "system needs" (irrigation, minimum canal flow, etc.) during the irrigation season. Nebraska identified a target yield from this component of 1,400 acre-feet. The potential yield of this component is greater than 1,400 acre-feet, and in order to achieve results closer to the target level, only a portion of the available power interference volume was re-regulated and credited to the Environmental Account. The total amount credited was 3,200 acre-feet, which is close to the 3,306 acre-feet of re-regulation at Lake McConaughy that is in the WAP (Table III-32).

Water Leasing (25 KAF) and Management Incentives in Nebraska. This is actually two features which are modeled as one feature. They are modeled by irrigation reach as a reduction to diversion in each reach. The water identified through these features is credited to the EA once a year, every year, in October. This allows for a determination of how much water is actually available before it is credited.

Fundamentally, these projects 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 (WAP reach 10) does not receive storage water from Lake McConaughy. Therefore, Water Leasing and Management Incentives in reach 10 involve reductions in natural flow diversions and the water is protected from diversion for consumptive use.

To determine the reduction in consumptive use due to water management incentives in each reach, the reductions in consumptive use for each of the four incentive methods were summed and divided by four (the consumptive use for irrigation technology techniques was assumed to be the on-farm delivery (Table III-211) divided by two). Summing and dividing by four incorporates the assumption that water management incentives would be a mix of the four methods. The consumptive use from water management incentives added to the reduction in consumptive use from water leasing equals the total reduction in consumptive use in each reach. Because of the channel restrictions near the town of North Platte, all water leasing and water management incentives in Nebraska were concentrated in the river reaches below North Platte. This is shown in the following table.

Water Action Plan — Reductions in Consumptive Use (ac-ft)

WAP's Canals	Reach	Water Leasing ac-ft	Cons. Cropping	Deficit Irrigation	Land Fallowing	Irrig. Tech. Changes	Leasing Plus Incentives
			<-----Four Methods / Combinations------>				
Western	10						0
Key-NP	14						0
Central	15	778			798		978
Central +Brady to Cozad	16	949	799	976	970		1635
Central +Dawson	17	2018	1804	2135	2016	1700	3932
Central + Kearney	18	2555	2330	2739	2502	2176	4992
Central	19	2116	2758	2375	2134	1836	4392
	Total	8416	7691	8225	8420	5712	15928
	Source Table:	III-5	III-10	III-14	III-18	III-21/2	

In order to simulate these reductions in consumptive use with the Central Platte Opstudy model, the reductions in consumptive use in the WAP had to be assigned to the irrigation demands (grouped by reach) used in the Central Platte Opstudy model. This was done by dividing the demand for a canal/district by the sum of the demands for all canals/districts listed for the reach in the WAP. For example, the consumptive use assigned to the Central district in reach 16 is the Central demand divided by the sum of the Central demand and the Brady to Cozad demand multiplied by the consumptive use for reach 16. The factors used to distribute the WAP's reach estimates to Central Platte Opstudy model reaches are shown in the following table.

Percentage Factors to Distribute WAP's Reach Estimates into Opstudy Reaches					
Reach 14		Reach 18		Reach 16 & 17	
Keystone-North Platte		Kearney & Central		Central & Brady-Cozad	
0.770	Key-Suth%	0.052	Kearney	0.581	Central
0.230	Suth-NP %	0.948	Central	0.419	Brady-Cozad
1.000	Total	1.000	Total	1.000	Total

This results in the following distribution of reductions in consumptive use to the reaches/districts used in the Central Platte Opstudy model.

	Acre-Feet			Percent
Western Canal	0			0.000
Keystone-Sutherland	0			0.000
Sutherland- North Platte	0			0.000
Brady-Cozad	1,668			0.105
Kearney	303	1,971	sub total	0.019
Central	13,957			0.876
Total	15,928			1.000

The reductions in consumptive use were used to determine irrigation reduction factors for each of the reaches in the Central Platte Opstudy model. These are simply the reduction in consumptive use divided by the average annual diversion. The values are shown in the following table.

Present Condition Irrigation Demands (kaf) & Cons. Factor			
Canal	Average Diversion	Target Reduction	**Irrigation Reduction Factor**
Western Canal	26.3	0.000	**1.00000**
Keystone-Sutherland Canals	88.3	0.000	**1.00000**
Sutherland-North Platte Canals	26.4	0.000	**1.00000**
Tri-County Canals	239.5	13.957	**0.93209**
Brady-Cozad Canals	172.7	1.668	**0.99034**
Kearney Canal	13.3	0.303	**0.97718**
Total	566.4	15.928	

The sum of the savings in consumptive use (except for the Western Canal) is 15,928 acre-feet. This volume was allocated to the EA annually in October (after the consumptive use savings have occurred). The WAP report recognizes that to achieve a certain volume of consumptive use reductions, 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 and assuming the remaining water is released to maintain return flows at pre-leasing levels, the Central Platte Opstudy model is consistent with the WAP's analysis.

Ground Water Management. Option 4 in the WAP report (conjunctive use project in CNPP&ID area) was used as a representative project. An annual target storage volume of 2,000 acre-feet was used in the Central Platte Opstudy model. Water was diverted from the Tri-County Canal or the J2-return flow during the non-irrigation season when flows in excess of target flows occurred in the Overton to Grand Island reach. This water is used to recharge the ground water that is depleted by pumping during the summer irrigation season in the Central Districts service area. The average annual volume stored from excess over the study period was approximately 1,400 acre-feet and it was assumed that this volume was subsequently pumped during the irrigation season to meet irrigation demands.

Lost Creek\North Dry Creek Groundwater Pumping Project. The Central Platte OPSTUDY model computes the instream flow excess at Odessa and Grand Island. These two locations are used because North Dry Creek enters the Platte River just west of Kearney (below the Odessa gage). If instream flow requirements at both Odessa and Grand Island are being met, then the well pumping is not active and the additional flow via North Dry Creek will be zero (any "normal" flow is already included in the Odessa to Grand Island gain). If instream flows are not being met at either location, then the wells are pumping and 500 acre-feet of flow are added to the Platte River flow. This flow is given as input.

This project was simulated by introducing water into the Central Platte Opstudy model above Kearney (in the Overton - Odessa reach of the model). A maximum monthly inflow rate of 500 acre-feet was allowed whenever shortages to target flows were occurring during May through September. This is higher than the 360 acre-feet volume identified in Table III-24 of the WAP in order to achieve a yield closer to that identified in the WAP (2,200 acre-feet). Because the water enters in the mid-section of the habitat, the final "score" was 50% of the volume introduced.

Dawson/Gothenberg Canal Groundwater Recharge. The EIS team did not model this recharge project. It is noted that the projected yield is approximately 1,621 acre-feet (Tables III-28 and III-31 in the WAP). It is assumed that the project is feasible (i.e. enough "excess" remains to re-regulate), and the yield of 1,621 acre-feet is added to the "score" at the end of each model run.

It should be noted that the EIS team is very skeptical that this project is feasible due to high ground water levels north of the Platte River in the project area.

Glendo Reservoir, Wyoming, Unassigned Water. Regarding the 10,600 acre-feet of Wyoming's Glendo water that currently has no long term contract, the Reconnaissance - Level Water Action Plan (WAP) states:

> "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)."

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This was modeled in the North Platte River EIS model (NPREIS) by placing an additional demand on the unassigned Wyoming Glendo Water account. This additional demand was calculated based on the following assumptions.

1. No water would be available to the Program in dry years.
2. Dry years occur roughly 25% of the time.
3. The total demand on the account could not exceed 10,600 acre-feet in a year.
4. The average annual yield to the program would be 2,650 acre-feet.

We assume that all available water will be reserved for Wyoming's uses during dry years. This is based on page 70 second bullet of the Reconnaissance - Level Water Action Plan which states that "...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". Our assumption is that such a conservative judgement would reserve all available water for use in Wyoming during dry years.

To determine dry years, the annual flows of the Medicine Bow River and the North Platte River above Seminoe Reservoir were summed and ranked from lowest to highest for the 54 year period from 1941 to 1994 (1941-1994 is the hydrologic record available in the NPREIS model). The 14 years (14/54 =0.2593) that had the lowest flows were classified as dry.

The existing demand from the Glendo account were summed for the remaining average and wet years. The annual demands were subtracted from 10,600 to determine the maximum amount available from the Glendo account each year. A portion of this amount was assigned as an additional demand on the unassigned Wyoming Glendo Water account such that the annual yield was approximately 2,650 acre-feet. The Glendo water leased to the Program was delivered in September of each year. The annual values are as follows.

1941	3.3368	1956	2.1456	1971	4.8288	1986	3.2112
1942	3.3368	1957	2.1552	1972	4.0416	1987	0
1943	3.3272	1958	2.6208	1973	3.9456	1988	1.2672
1944	3.3272	1959	0	1974	4.6128	1989	0
1945	3.3368	1960	2.9664	1975	4.1376	1990	0
1946	3.332	1961	0	1976	4.4496	1991	3.3216
1947	3.332	1962	2.8368	1977	0	1992	0
1948	3.3368	1963	0	1978	4.6032	1993	4.6752
1949	3.332	1964	2.1456	1979	4.5216	1994	0
1950	3.332	1965	4.9248	1980	4.2		
1951	3.332	1966	0	1981	0		
1952	3.332	1967	4.1904	1982	4.8432		
1953	0	1968	4.5456	1983	4.9056		
1954	0	1969	3.5384	1984	3.3944		
1955	0	1970	4.8144	1985	4.1952		

Temporary Water Leasing in Wyoming. Regarding Temporary Water Leasing, the Reconnaissance - Level Water Action Plan (WAP) states:

> "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 reductions 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."

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Water leasing in reaches 4 and 6 was modeled by creating another input to the North Platte River EIS model (NPREIS). This input increases flows from the Laramie River. Once in the model, flows are protected from diversion and losses are calculated like any other environmental water.

Water leasing in reaches 1, 2, and 3 was modeled in the NPREIS model by reducing the irrigation demand for the Kendrick Project. The Kendrick Project was chosen for the following reasons.

1. The EIS team wanted to show the hydrologic and economic effects of temporary water leasing on an irrigation district.
2. The Kendrick Project is the only project with storage in the NPREIS that makes deliveries to areas close to regions 1, 2, and 3 described in the WAP.
3. For the EIS, the Kendrick Project is in the same economic region as regions 1, 2, and 3 in the WAP. Thus, economic results are applicable to those regions.

A factor was used to reduce the irrigation delivery. The factor was determined as the average annual amount of water delivered to the program divided by the efficiency divided by the average annual delivery to the project. Leased water is delivered in the same month that the water would have been delivered and water leasing only occurs in July-September. The portion of the leased water that would have otherwise contributed to the river gains via return flows is released and added to natural flow in the same month that the water would have been delivered.

It can not be stressed enough that the choice of the Kendrick Project was to allow the EIS team to analyze the impacts of temporary water leasing on an irrigation district and the choice is not an indication of where temporary water leasing will occur.

La Prele Reservoir. Because the Reconnaissance - Level Water Action Plan (WAP) was based on a 1975 - 1994 period of record and the EIS is based on a 1947 - 1994 period, it was necessary to model the contribution of La Prele Reservoir to the Program. The assumptions used to model La Prele Reservoir are outlined below, *italicized text is in addition to what was provided in the WAP*.

1. Inflow to La Prele Reservoir: The USGS maintained a stream flow 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) average were used.

2. Senior Downstream Rights: The reservoir must bypass water to downstream senior direct-flow diversions 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 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. *This volume of demand was distributed in the same proportions as the La Prele Irrigation District (District) Demand discussed in assumption 3. The demands are as follows in acre-feet:*

May	*Jun*	*Jul*	*Aug*	*Sep*
724	*1,392*	*1,782*	*1,169*	*501*

3. 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. *These demands were taken from a 1981 report by Banner and Associates and are as follows in acre-feet:*

May	*Jun*	*Jul*	*Aug*	*Sep*
4,611	*8,868*	*11,351*	*7,449*	*3,194*

4. 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 3.4 cfs throughout the study period. Further evaluations should consider any additional data compiled on seepage rates and stage relationships.

5. 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 100,000 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 following assumptions are additions, alterations, or clarifications to the WAP assumptions to allow the inclusion of La Prele Reservoir in the NPREIS model.

1. Accrual: PEPL's account receives 25% of the storable inflows to La Prele Reservoir.

2. Seepage: Seepage from La Prele Reservoir will not be credited to the Program. This seepage is currently occurring and is now the water supply for someone else. Removing this water supply from these people would result in a violation of the willing buyer/ willing seller policy set forth in the cooperative agreement. However, seepage will be charged against the PEPL account up to the amount of inflows into the account plus any storage in the account.

3. Releases: Releases from the account do not depend on shortages to target flows. Release are made on an annual basis and may be restored in Lake McConaughy for use by the Program. Releases are only made during the May through September irrigation season when releases are being made from Guernsey Reservoir. The release pattern is as follows (releases are only made if storage exists in the reservoir):

May	Jun	Jul	Aug	Sep
700	700	1400	1400	800

The State of Wyoming would be responsible for conveyance of release to the Wyoming/Nebraska state line. The State of Nebraska would be responsible for coordinating with the Environmental Account Manager to protect water delivered to the state line and to administer delivery of the water to the central Platte River. The entire account, or portions thereof, could be released from Lake McConaughy and bypassed to the critical habitat, or the water could be temporarily stored and used to augment the benefits of an environmental account in Lake McConaughy. If all environmental accounts are properly coordinated, the yield of the accounts would be managed to maximize endangered species benefits in the central Platte River.

4. Storage: Only PEPL's storage account was modeled. The District account was not modeled and the effect on the District of using the PEPL account for the Program has not been determined.

5. A loss of 10% is applied to La Prele water before it enters Glendo Reservoir. Below Guernsey Reservoir, La Prele water is assessed losses the same as any other storage water.

Pathfinder Modification Municipal Account. Regarding the Pathfinder Modification Municipal Account, the Reconnaissance - Level Water Action Plan (WAP) states:

> "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 of the amount needed to supplement municipal water rights and/or mitigate excess depletions and can not 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"

This was modeled in the North Platte River EIS model (NPREIS) by placing an additional demand on the Pathfinder Modification Municipal Account. This additional demand was calculated based on the following assumptions.

4. No water would be available to the Program in dry years.
5. Dry years occur roughly 25% of the time.
6. 9,600 acre-feet would be available to the Program during wet years.
7. Wet years occur roughly 33% of the time.
8. The total demand on the account could not exceed 9,600 acre-feet in a year.
9. The average annual yield to the program would be 4,800 acre-feet.

We assume that all available water will be reserved for Wyoming's uses during dry years. This is based on page 64 second bullet of the Reconnaissance - Level Water Action Plan which states that "...prior to June 1 of each year, state officials will make a conservative judgment as to the amount of water that may be required for Wyoming's purposes". Our assumption is that such a conservative judgment would reserve all available water for use in Wyoming during dry years.

To determine wet and dry years, the annual flows of the Medicine Bow River and the North Platte River above Seminoe Reservoir were summed and ranked from lowest to highest for the 54 year period from 1941 to 1994 (1941-1994 is the hydrologic record available in the NPREIS model). The 14 years (14/54 =0.2593) that had the lowest flows were classified as dry and the 18 years (18/54=0.3333) that had the highest flows were classified as wet.

The demand for the remaining years was adjusted such that the annual average yield to the Program was 4,800 acre-feet. The water leased to the Program was delivered in September of each year. The Pathfinder Modification Municipal Demand was adjusted so that the total demand on the Municipal Account equals the firm yield of 9,600 acre-feet per year.

(81) Deliveries from the Pathfinder Municipal Account

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	Total
1941	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1942	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1943	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1944	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1945	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1947	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1948	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1951	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1952	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1954	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1955	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1956	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1959	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1960	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1961	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1964	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1965	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1967	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1968	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1969	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1976	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1977	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
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	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1986	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1988	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1989	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1990	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1991	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1992	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6

Tamarack Phase III. The "Phase III" enlargement of the Tamarack project is modeled in the same way as the original project, except that it is operated to increase flows at the Julesburg gage by approximately 17,000 acre-feet during the period April through September.

3.3.3 Run results

3.3.3.1 North Platte River Basin

The results of the analysis of the North Platte River basin for the Governance Committee Alternative are summarized in **Figures 3.3.3-1** through **3.3.3-5** and **Tables 3.3.3-1** through **3.3.3-16**.

Storage above Lake McConaughy. The results for storage conditions above Lake McConaughy are given in **Figure 3.3.3-1**.

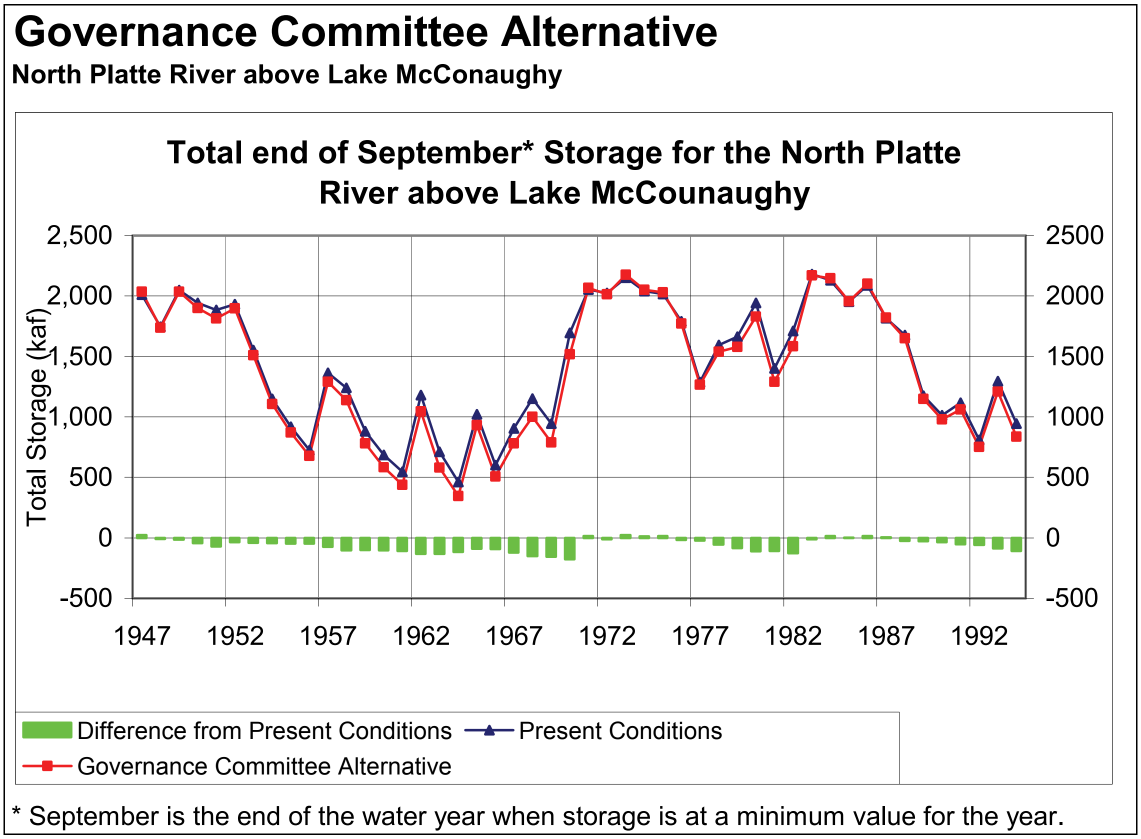


Figure 3.3.3- 1. End of September storage above Lake McConaughy.

Figure 3.3.3-1 shows that the end-of-September storage above Lake McConaughy was generally lower for the Governance Committee Alternative than for the Present Condition, except for wet periods in the early 1970's and much of the 1980's, when the two were equal or the storage for the Governance Committee Alternative was slightly higher. The increased storage during these time periods is due to the increased capacity of Pathfinder Reservoir.

Governance Committee Alternative **North Platte River above Lake McConaughy**	**Seminoe**		**Pathfinder**		**Alcova**		**Glendo**		**Guernsey**		**Inland Lakes**		**Total Storage**	
Reservoir Storage	**Value**	**% Δ**[1]	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**
Minimum end-of-month storage for 48-year simulation (kaf)	31.2	-66%	31.4	0%	156	0%	63.1	0%	0	0%	3.8	0%	346	-25%
Maximum end-of-month storage for 48-year simulation (kaf)	1,017.3	0%	1,070.1	5%	179.5	0%	824.5	21%	45.6	0%	72.0	0%	2881.1	0%
Average end-of-month storage for 48-year simulation (kaf)	583.2	-3%	546.6	-3%	167.8	0%	312.3	-6%	18.9	-1%	32.5	-9%	1634.7	-3%
Low storage indicator: years with storage < ### kaf	8 < 200 kaf		15 < 200 kaf		0 < 150 kaf		11 < 100 kaf		0 < 0 kaf		0 < 0 kaf		8 < 650 kaf	
Percent change from Present Conditions[2]		33%		25%		0%		22%		0%		0%		33%
Year that minimum first occurred	1965		1961		1947		1960		1949		1962		1964	
Largest single month drawdown for this alternative (kaf)	152.3	0%	276.6	-1%	23.5	0%	271.1	5%	28	0%	29.5	0%	336.7	-8%
Month of largest drawdown	July-54		July-81		October-47		August-92		September-47		August-51		July-87	
File that contains the data		Resop.tab		Resop.tab		Resop.tab		Resop.tab		Resop.tab		Resop.tab		Resop.tab
Table number		3		2		25		1		4		5		6

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)
[2] NA in the % Δ column indicates that there were no years with storage < ### kaf in the Present Condtion Run

Table 3.3.3- 1. Reservoir storage statistics for the North Platte River above Lake McConaughy.

The average end-of-month storage, as shown in **Table 3.3.3-1**, shows a percentage decrease of 3 percent with respect to the Present Condition. The greatest percentage decrease for an individual project is 9 percent for the Inland Lakes project. Significant percentage decreases are also present at Glendo Reservoir (6 percent). The other projects considered showed little or no change.

Governance Committee Alternative

North Platte River above Lake McConaughy

Reservoir Storage		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
Seminoe Reservoir														Resop.tab Table 3
	Min (kaf)	48	38	31	31	31	31	31	150	276	180	155	64	31
	Max (kaf)	970	933	909	886	841	807	906	1,017	1,017	1,017	1,001	980	1,017
	Avg (kaf)	589	571	550	527	503	489	519	626	733	681	619	592	583
Percent change from Present Conditions	Min	-70%	-74%	-77%	-74%	-72%	-66%	-72%	-19%	-9%	-7%	-14%	-64%	-66%
	Max	1%	1%	1%	1%	1%	-5%	-4%	0%	0%	0%	4%	2%	0%
	Avg	-2%	-3%	-3%	-3%	-3%	-4%	-3%	-3%	-2%	-2%	-2%	-3%	-3%
Pathfinder Reservoir														Resop.tab Table 2
	Min (kaf)	52	55	48	39	31	31	56	127	184	79	31	31	31
	Max (kaf)	930	966	982	997	1,023	1,067	1,070	1,070	1,070	1,070	961	904	1,070
	Avg (kaf)	505	517	529	541	557	571	593	628	659	510	480	469	547
Percent change from Present Conditions	Min	-9%	-9%	-20%	-38%	-52%	-33%	4%	-19%	-9%	-38%	-69%	0%	0%
	Max	1%	1%	1%	1%	1%	5%	5%	5%	5%	5%	4%	0%	5%
	Avg	-3%	-3%	-3%	-3%	-3%	-2%	-3%	-3%	-2%	-4%	-3%	-3%	-3%
Alcova Reservoir														Resop.tab Table 25
	Min (kaf)	156	156	156	156	156	156	180	180	180	180	180	180	156
	Max (kaf)	156	156	156	156	156	156	180	180	180	180	180	180	180
	Avg (kaf)	156	156	156	156	156	156	180	180	180	180	180	180	168
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Glendo Reservoir														Resop.tab Table 1
	Min (kaf)	92	126	156	186	220	253	250	286	275	198	80	63	63
	Max (kaf)	341	374	409	442	475	511	526	825	652	644	391	308	825
	Avg (kaf)	176	218	258	299	340	397	406	434	438	410	238	134	312
Percent change from Present Conditions	Min	-10%	-8%	-7%	-7%	-7%	-9%	-13%	-2%	26%	-6%	0%	0%	0%
	Max	-1%	-1%	-1%	-1%	-1%	-1%	5%	26%	-4%	25%	24%	-1%	21%
	Avg	-13%	-11%	-9%	-8%	-7%	-5%	-5%	-3%	-2%	0%	-2%	-16%	-6%
Guernsey Reservoir														Resop.tab Table 4
	Min (kaf)	0	0	0	0	0	5	35	40	35	30	30	2	0
	Max (kaf)	8	13	16	19	21	30	46	46	44	30	30	2	46
	Avg (kaf)	2	5	8	11	12	15	36	40	35	30	30	2	19
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	-23%	0%	0%	0%	-3%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	-2%	0%	-1%	0%	0%	0%	0%	0%	0%

Table 3.3.3- 2. Monthly reservoir storage statistics for the North Platte River above Lake McConaughy.

Minimum, maximum, and average storage by month are shown in **Table 3.3.3-2**. This table shows that the largest percent change occurs in the minimum reservoir storage attained during the simulation of the Governance Committee alternative.

Governance Committee Alternative North Platte River above Lake McConaughy	Spills	
Spills from the system	**Value**	**% Δ[1]**
Average annual spill for 48-year simulation period (kaf)	101.9	-14%
Number of years with spills	9	-25%
Average annual spill for years with spills (kaf)	543.6	15%
Largest annual spill (kaf)	1239.3	-6%
Year of largest annual spill	1984	
File that contains the data	Storown.lst	
Output line number	8	

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

Table 3.3.3- 3. Spills from Guernsey Reservoir.

The average annual spill decreased by 25 percent with respect to the Present Condition and the number of years with spills decreased from 12 to 9. These results are consistent with the lower average storage associated with the use of North Platte River basin water for environmental purposes under the Governance Committee Alternative.

Reservoir elevations above Lake McConaughy.

Governance Committee Alternative North Platte River above Lake McConaughy	Seminoe		Pathfinder		Alcova		Glendo		Guernsey	
Reservoir Elevations	**Value**	**% Δ[1]**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**
Minimum average elevation for 48-year simulation (kaf)	6,239	-0.4%	5,746	0.0%	5,488	0.0%	4,570	0.0%	4,370	0.0%
Maximum average elevation for 48-year simulation (kaf)	6,357	0.0%	5,853	0.0%	5,498	0.0%	4,655	0.2%	4,420	0.0%
Average average elevation for 48-year simulation (kaf)	6,326	0.0%	5,817	0.0%	5,493	0.0%	4,613	-0.1%	4,403	0.0%
Low storage indicator: years with elevation < #### ft	8 < 6,289 ft		16 < 5,787 ft		0 < 5,486 ft		11 < 4,580 ft		0 < 4,370 ft	
Percent change from Present Conditions[2]		33%		33%		0%		38%		0%
Year that minimum first occurred	1965		1961		1947		1960		1949	
Average May-August drawdown for this alternative (feet)	0.9	-36%	11.8	5%	0.0	0%	23.2	-2%	4.8	0%
Largest May-August drawdown for this alternative (feet)	28.7	34%	38.8	31%	0.0	0%	51.6	12%	7.1	0%
Year of largest drawdown	1994		1964		1947		1983		1971	
File that contains the data	Natflow.tab		Natflow.tab		Natflow.tab		Natflow.tab		Natflow.tab	
Table number	13		12		11		10		9	

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)
[2] NA in the % Δ column indicates that there were no years with elevation < #### ft in the Present Condtion Run

Table 3.3.3- 4. Reservoir elevation statistics for the North Platte River above Lake McConaughy.

Table 3.3.3-4 shows the same statistics for reservoir elevation as are shown in **Table 3.3.3-1** for end-of-month reservoir storage. **Table 3.3.3-4** shows that there will be less water in Seminoe, Pathfinder, and Glendo reservoirs under the Governance Committee Alternative.

Governance Committee Alternative					
North Platte River above Lake McConaughy Reservoir Elevation Minimum and Maximum	**Seminoe**	**Pathfinder**	**Alcova**	**Glendo**	**Guernsey**
Elevation for empty reservoir:	6160.0	5690.0	5320.0	4508.0	4370.0
Historic minimum elevation:	6253.3	5690.0	5408.8	4549.3	4370.0
Minimum elevation for alternative:	6238.7	5746.0	5488.0	4570.0	4370.0
Years min. elev. Achieved	1	3	48	4	25
Years min. < Reference	2	0	0	0	0
Years min. < Historic	1	0	0	0	0
Elevation for full reservoir[1]:	6357.0	5850.1	5500.0	4669.0	4420.0
Historic maximum elevation[2]:	6359.3	5853.5	5499.9	4650.8	4421.7
Maximum elevation for alternative:	6357.0	5852.5	5498.0	4654.9	4420.0
Years max. elev. Achieved	8	7	48	1	5
Years max. > Reference	0	14	0	1	0
Years max. > Historic	0	0	0	1	0

[1] Elevation for the top of the conservation capacity.
[2] Historic elevations that are greater than the elevation for a full reservoir are the result of flood storage and reservoir surcharge.

Table 3.3.3- 5. Minimum and maximum reservoir elevation statistics for the North Platte River above Lake McConaughy.

Table 3.3.3-5 compares the minimum and maximum elevation for each reservoir to the minimum and maximum elevations for the Present Condition (Reference) run and to historic values. **Table 3.3.3-5** shows that the storage in Seminoe and Pathfinder reservoirs was less than the minimum storage for these reservoirs in the Present Condition run and Seminoe Reservoir was lower than it has been historically.

Governance Committee Alternative North Platte River above Lake McConaughy														
Reservoir Elevations		**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Ann**
Seminoe Reservoir														Natflow.tab Table 13
	Min (feet)	6,248	6,243	6,239	6,239	6,239	6,239	6,239	6,279	6,300	6,285	6,280	6,256	6,239
	Max (feet)	6,355	6,353	6,351	6,350	6,348	6,346	6,351	6,357	6,357	6,357	6,356	6,355	6,357
	Avg (feet)	6,326	6,325	6,323	6,321	6,319	6,318	6,321	6,330	6,339	6,334	6,329	6,327	6,326
Percent change from Present Conditions	Min	-1%	-1%	-1%	-1%	-1%	0%	-1%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Pathfinder Reservoir														Natflow.tab Table 12
	Min (feet)	5,754	5,755	5,753	5,749	5,746	5,746	5,755	5,773	5,784	5,762	5,746	5,746	5,746
	Max (feet)	5,846	5,848	5,849	5,849	5,850	5,852	5,853	5,853	5,853	5,853	5,848	5,845	5,853
	Avg (feet)	5,814	5,815	5,816	5,817	5,818	5,818	5,820	5,824	5,826	5,815	5,812	5,811	5,817
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Alcova Reservoir														Natflow.tab Table 11
	Min (feet)	5,488	5,488	5,488	5,488	5,488	5,488	5,498	5,498	5,498	5,498	5,498	5,498	5,488
	Max (feet)	5,488	5,488	5,488	5,488	5,488	5,488	5,498	5,498	5,498	5,498	5,498	5,498	5,498
	Avg (feet)	5,488	5,488	5,488	5,488	5,488	5,488	5,498	5,498	5,498	5,498	5,498	5,498	5,493
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Glendo Reservoir														Natflow.tab Table 10
	Min (feet)	4,578	4,586	4,592	4,597	4,603	4,607	4,607	4,612	4,610	4,599	4,575	4,570	4,570
	Max (feet)	4,618	4,622	4,625	4,628	4,631	4,634	4,636	4,655	4,645	4,644	4,623	4,614	4,655
	Avg (feet)	4,595	4,602	4,607	4,613	4,618	4,624	4,625	4,627	4,628	4,624	4,604	4,587	4,613
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Guernsey Reservoir														Natflow.tab Table 9
	Min (feet)	4,370	4,370	4,370	4,370	4,370	4,395	4,415	4,418	4,415	4,413	4,413	4,388	4,370
	Max (feet)	4,398	4,403	4,405	4,407	4,408	4,413	4,420	4,420	4,419	4,413	4,413	4,388	4,420
	Avg (feet)	4,382	4,394	4,397	4,400	4,402	4,404	4,416	4,418	4,415	4,413	4,413	4,388	4,403
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 3.3.3- 6. Monthly reservoir elevation statistics for the North Platte River above Lake McConaughy.

Table 3.3.3-6 shows the minimum, maximum, and average reservoir elevation for the five major reservoirs above Lake McConaughy by month.

North Platte River flow into Lake McConaughy. The results for North Platte River flow into Lake McConaughy for the Governance Committee Alternative are given in **Figure 3.3.3-2**.

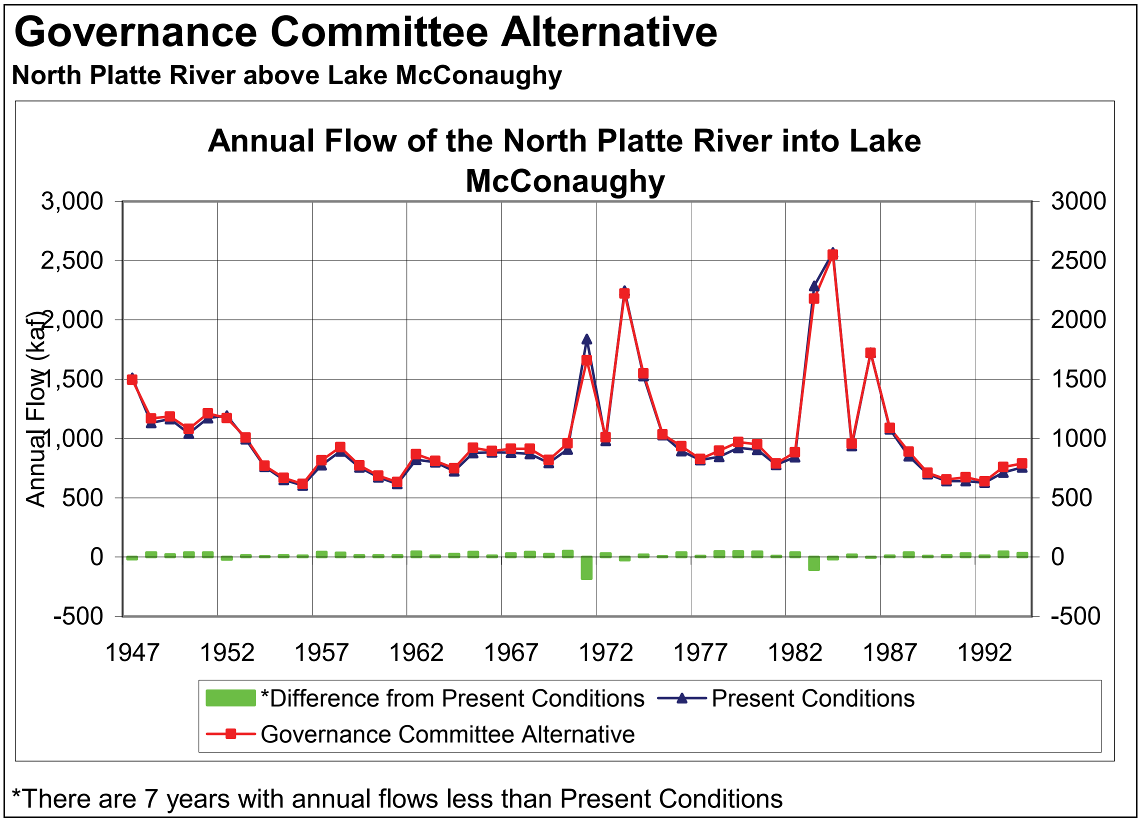


Figure 3.3.3- 2. Annual flow of the North Platte River into Lake McConaughy.

Figure 3.3.3-2 shows that the differences in North Platte River flow into Lake McConaughy between the Governance Committee Alternative and the Present Condition are relatively small, with values for the Governance Committee Alternative being slightly higher for most years. The two exceptions to this pattern are 1971 and 1983, for which the values for the Governance Committee Alternative are noticeably lower. 1971 and 1983 are high runoff years with high inflows into Seminoe Reservoir that allow all the reservoirs above Lake McConaughy to fill. Because storage is lower prior to these years, it takes more water to fill the reservoirs and flows into Lake McConaughy are less.

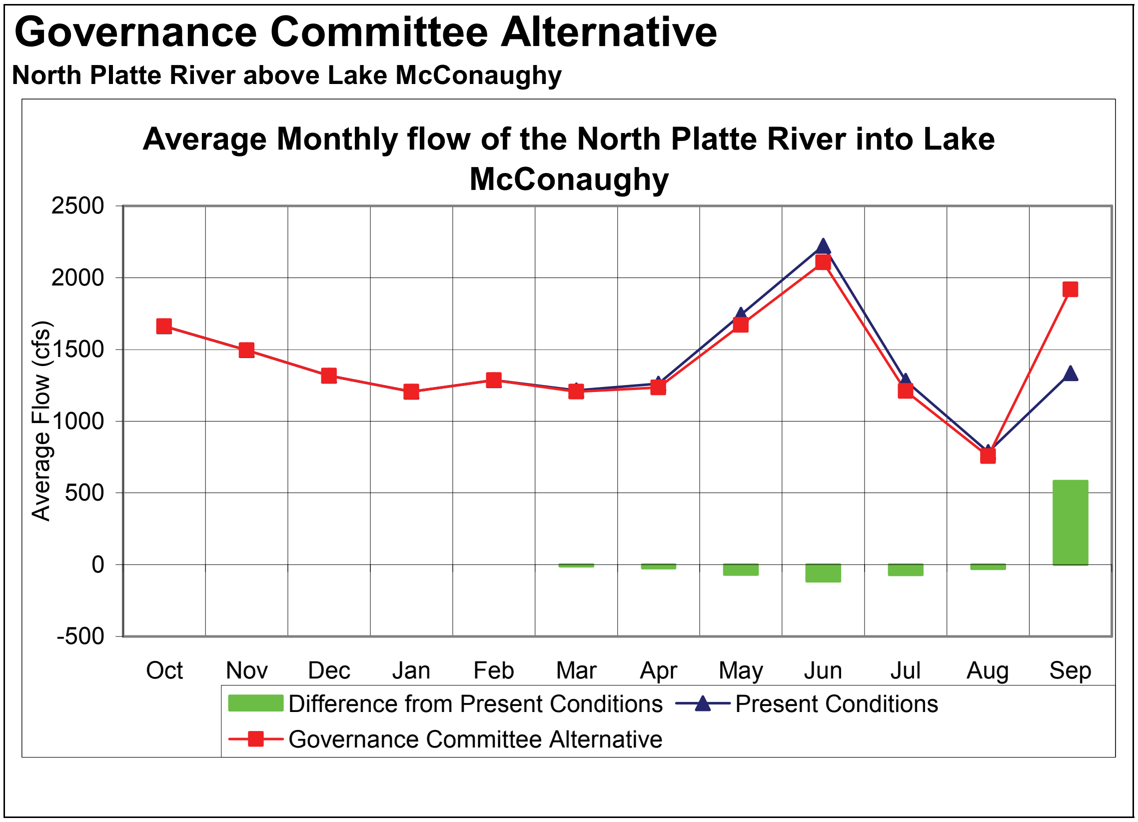


Figure 3.3.3- 3. Average monthly flow of the North Platte River into Lake McConaughy.

Governance Committee Alternative **North Platte River above Lake McConaughy**													
Flows	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Ann**
N.P. River flow into Lake McConaughy											Resop.tab Table 9		
Min (Monthly (cfs), Annual (kaf))	758	1,062	862	805	911	701	534	262	318	114	181	674	616
Max (Monthly (cfs), Annual (kaf))	2,318	2,038	1,888	1,825	1,889	2,126	3,030	12,687	12,248	6,910	1,361	3,541	2,549
Avg (Monthly (cfs), Annual (kaf))	1,662	1,495	1,317	1,206	1,285	1,205	1,235	1,672	2,106	1,211	757	1,918	1,029
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	-19%	0%	-5%	-16%	-8%	-4%	89%	2%
Max	0%	0%	0%	0%	0%	0%	-1%	-1%	0%	-9%	-36%	25%	-1%
Avg	0%	0%	0%	0%	0%	-1%	-2%	-4%	-5%	-6%	-4%	44%	1%

Table 3.3.3- 7. Monthly flow of the North Platte River into Lake McConaughy.

On a monthly basis, inflows are greater by 44 percent in September and less by between 1 and 6 percent in March through August. There is little or no change in October through February. September is when environmental deliveries are made under this alternative. October through March are winter months in the high country headwaters of the North Platte River.

Governance Committee Alternative **North Platte River above Lake McConaughy**													
Enviromental Flows Delivered to Lake McConaughy	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Ann**
											Natflow.tab Table 31		
Min (kaf)	0	0	0	0	0	0	-0.2	-0.1	0.1	0.2	0.3	10.1	11.2
Max (kaf)	0	0	0	0	0	0	0	0.9	1.3	2.1	1	47.4	51.6
Avg (kaf)	0	0	0	0	0	0	0	0.3	0.6	1	0.5	32.6	35
Year that minimum first occurred	1947	1947	1947	1947	1947	1947	1966	1956	1960	1959	1990	1966	1966

Table 3.3.3- 8. Environmental deliveries from above Lake McConaughy.

September has the greatest environmental delivery to Lake McConaughy (**Table 3.3.3-8**) under the Governance Committee Alternative.

Project Ownership, Project Shortages, Irrigation Demand, Water Leasing. The results for project ownership for the Governance Committee Alternative are given in **Table 3.3.3-9**.

Governance Committee Alternative								
North Platte River above Lake McConaughy	**North Platte[1]**		**Kendrick[2]**		**Glendo**		**Total**	
Project Ownership	**Value**	**% Δ[3]**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**
Minimum end-of-month ownership for 48-year simulation (kaf)	38.3	-23%	145	-16%	7.5	-35%	346	-25%
Maximum end-of-month ownership for 48-year simulation (kaf)	1,099.6	0%	1,201.7	0%	180.1	0%	2,881.1	0%
Average end-of-month ownership for 48-year simulation (kaf)	670.6	-4%	800.0	-5%	122.1	-3%	1,634.7	-3%
Years with ownership < ### kaf	7 < 100 kaf		8 < 300 kaf		8 < 63 kaf		2 < 400 kaf	
Percent change from Present Conditions[4]		133%		100%		0%		NA
Year that minimum first occurred	1964		1968		1962		1964	
Largest single month accrual for this alternative (kaf)	484	3%	477.7	-12%	58.8	2%	573.3	0%
Month of largest accrual	June-57		June-70		May-91		June-70	
File that contains the data	Storown.tab		Storown.tab		Storown.tab		Resop.tab	
Table numbers	1, 8, & 9		2 & 3		4, 5, & 6		6	

[1] The North Platte Project includes Pathfinder Reservoir, Guernsey Reservoir, and the Inland Lakes.
[2] The Kendrick Project includes Seminoe Reservoir and Alcova Reservoir.
[3] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)
[4] NA in the % Δ column indicates that there were no years with ownership < ### kaf in the Present Condtion Run

Table 3.3.3- 9. Project ownership on the North Platte River above Lake McConaughy.

Project ownership. Table 3.3.3-9 shows that project ownership decreased for the Governance Committee Alternative with respect to the Present Condition for all projects considered. There were also major increases in the number of years with reduced ownership. This is consistent with the use of Pathfinder water and other water elements for downstream environmental purposes.

Governance Committee Alternative										
North Platte River above Lake McConaughy	**North Platte Project**		**Kendrick Project**		**Glendo Unit**		**Non-project Lands**		**Total Shortages**	
Project Shortages	**Value**	**% Δ[1]**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**
Average annual shortage for 48-year simulation period (kaf)[2]	0.5	150%	5.8	100%	3.6	-3%	0.8	60%	10.7	47%
Number of years with shortages	3	50%	7	133%	22	5%	27	4%	36	9%
Average annual shortage for years with shortage (kaf)	8.2	52%	40.0	-14%	7.8	-8%	1.4	56%	14.3	34%
As a percentage of demand for years with shortage (%)	1.1%		57.2%		11.8%		0.5%		1.3%	
Largest annual shortage (kaf)	13.6	31%	70	0%	24.1	-1%	8.3	118%	70.8	0%
As a percentage of demand (%)	1.6%		100.0%		40.2%		2.8%		5.7%	
Year of largest annual shortage	1964		1965		1959		1964		1966	
Data is contained in the file Resop.tab table number	30 & 52		31 & 54		32 & 53		42 & 55		30-32,42,52-55	

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)
[2] NA in the % Δ column indicates that there were no shortages in the Present Condtion Run

Table 3.3.3- 10. Project shortages on the North Platte River above Lake McConaughy.

Project shortages. Table 3.3.3-10 shows that, for the Governance Committee Alternative, there were very large percentage increases in project shortages with respect to the Present Condition for the North Platte and Kendrick projects and lesser but still significant decreases for the Glendo Unit and non-project lands. The very large percentage increases in shortages for the North Platte and Kendrick projects occurred for all shortage quantities considered except for the number of years with shortages for the North Platte project, which were unchanged from the Present Condition. For the Glendo Unit and non-project lands, there was no change in largest annual shortage and relatively slight to moderate increases in other shortage quantities.

Governance Committee Alternative North Platte River above Lake McConaughy Project Irrigation Demand	North Platte Project		Kendrick Project		Glendo Unit		Non-project Lands		Total Demand	
	Value	% Δ[1]	Value	% Δ	Value	% Δ	Value	% Δ	Value	% Δ
Average annual demand for 48-year simulation period (kaf)	763.0	0%	70.0	0%	67.5	0%	254.0	0%	1154.4	0%
Maximum annual demand (kaf)	988.5	0%	70.0	0%	91.9	0%	303.0	0%	1427.6	0%
Minimum annual demand (kaf)	504.4	0%	70.0	0%	47.8	0%	190.0	0%	875.2	0%
Data is contained in the file Resop.tab table number		52		54		53		55		52-55

[1] % Δ indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

Table 3.3.3- 11. Project irrigation demand on the North Platte River above Lake McConaughy.

Irrigation demand. There are no changes in irrigation demand for the Governance Committee Alternative with respect to the Present Condition.

Governance Committee Alternative
North Platte River above Lake McConaughy

Irrigation Deliveries	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
North Platte Project Irrigation Deliveries													Resop.tab Table 3
Min (kaf)	0	0	0	0	0	0	0	0	27	216	255	87	701
Max (kaf)	9	2	1	0	1	1	7	221	285	361	357	278	1,482
Avg (kaf)	2	0	0	0	0	0	2	117	134	319	324	200	1,098
Percent change from Present Conditions													
Min	NA	NA	NA	NA	NA	NA	NA	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	NA	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	NA	0%	0%	0%	0%	0%	0%	0%	0%	0%
Kendrick Project Irrigation Deliveries													Resop.tab Table 2
Min (kaf)	0	0	0	0	0	0	0	0	0	0	0	0	0
Max (kaf)	0	0	0	0	0	0	0	11	17	22	15	8	70
Avg (kaf)	0	0	0	0	0	0	0	8	14	16	14	7	59
Percent change from Present Conditions													
Min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Max	NA	NA	NA	NA	NA	NA	NA	0%	0%	0%	-19%	-18%	-9%
Avg	NA	NA	NA	NA	NA	NA	NA	-18%	-14%	-22%	-22%	-24%	-20%
Glendo Project Irrigation Deliveries													Resop.tab Table 25
Min (kaf)	0	0	0	0	0	0	0	1	2	6	5	6	36
Max (kaf)	11	1	0	0	0	0	0	17	22	22	22	20	92
Avg (kaf)	1	0	0	0	0	0	0	8	11	16	14	13	64
Percent change from Present Conditions													
Min	NA	NA	NA	NA	NA	NA	NA	250%	0%	0%	0%	0%	3%
Max	0%	0%	NA	NA	NA	NA	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	NA	NA	NA	NA	0%	2%	0%	0%	0%	0%	0%
Non-Project Irrigation Deliveries													Resop.tab Table 1
Min (kaf)	0	0	0	0	0	0	0	8	9	31	52	26	190
Max (kaf)	16	2	0	0	0	0	16	52	56	78	74	59	303
Avg (kaf)	6	0	0	0	0	0	2	29	40	62	66	48	253
Percent change from Present Conditions													
Min	NA	NA	NA	NA	NA	NA	NA	0%	0%	0%	0%	0%	0%
Max	0%	0%	NA	NA	NA	NA	0%	0%	0%	0%	0%	-6%	0%
Avg	0%	0%	NA	NA	NA	NA	0%	0%	0%	0%	0%	0%	0%

Table 3.3.3- 12. Project irrigation delivery on the North Platte River above Lake McConaughy.

Irrigation deliveries. Table 3.3.3-12 shows the greatest change in irrigation deliveries occurs for the Kendrick projects. This is mostly due to water leasing from the Kendrick project for environmental purposes.

Water leasing. The results for water banking and conservation above Lake McConaughy are given in **Table 3.3.3-13**.

Governance Committee Alternative North Platte River above Lake McConaughy					
Water Banking / Conservation	**North Platte Project**	**Kendrick Project**	**Glendo Unit**	**Non-project Lands**	**Total**
Average annual conservation for 48-year simulation period (kaf)	0.0	11.7	0.0	0.0	11.7
Number of years with conservation	0	45	0	0	45
Average annual conservation for years with conservation (kaf)	0.0	12.5	0.0	0.0	12.5
As a percentage of demand (%)	0.0%	17.9%	0.0%	0.0%	1.1%
Largest annual conservation (kaf)	0	14.7	0	0	14.7
As a percentage of demand (%)	0.0%	21.0%	0.0%	0.0%	1.2%
Year of largest annual conservation	1947	1953	1947	1947	1953
Data is contained in the file Resop.tab table number	56 & 52	58 & 54	57 & 53	59 & 55	52-55 & 56-59

Table 3.3.3- 13. Water leasing by project above Lake McConaughy.

Table 3.3.3-13 shows that water leasing is only being practiced in the area of the Kendrick Project for the Governance Committee Alternative. Water is leased in 45 of the 48 years of the simulation. 17.9 percent of the water supply for the Kendrick Project and 1.1 percent of the system-wide water supply are leased to the Program.

Flows. The results for flows in the North Platte River for the Governance Committee Alternative are given in **Table 3.3.3-14**.

Governance Committee Alternative North Platte River above Lake McConaughy													
Flows	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Ann**
N.P. River below Kortes Reservoir											Resop.tab Table 20		
Min (Monthly (cfs), Annual (kaf))	503	502	392	306	284	355	502	503	502	503	503	502	507
Max (Monthly (cfs), Annual (kaf))	1,160	1,455	1,080	1,025	1,361	1,961	2,775	8,039	8,893	6,170	2,775	2,176	1,878
Avg (Monthly (cfs), Annual (kaf))	680	782	775	755	855	919	1,226	1,885	3,089	2,410	1,542	773	948
Months with flow below 500 cfs[1,4]	0	0	1	1	1	1	0	0	0	0	0	0	1
Percent change from Present Conditions													
Min	0%	0%	-22%	-39%	-43%	-29%	0%	0%	0%	0%	0%	0%	-1%
Max	-8%	2%	-5%	-3%	-15%	2%	0%	-8%	0%	0%	0%	5%	0%
Avg	-1%	2%	1%	1%	-3%	11%	-6%	2%	0%	-2%	-5%	22%	0%
Months with flow below 500 cfs[2]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N.P. River below Gray Reef Reservoir											Natflow.tab Table 21		
Min (Monthly (cfs), Annual (kaf))	501	502	503	503	472	366	502	503	502	2,709	569	502	568
Max (Monthly (cfs), Annual (kaf))	867	776	768	768	808	1,148	1,232	8,628	9,591	5,715	3,589	2,516	1,904
Avg (Monthly (cfs), Annual (kaf))	657	573	572	571	579	750	662	1,576	2,627	4,748	1,848	940	977
Months with flow below 500 cfs[3,4]	0	0	0	0	1	1	0	0	0	0	0	0	1
Percent change from Present Conditions													
Min	0%	0%	0%	0%	-6%	-27%	0%	0%	0%	93%	7%	0%	14%
Max	12%	0%	0%	0%	2%	-9%	-17%	-7%	0%	1%	-9%	16%	0%
Avg	1%	0%	0%	0%	1%	8%	3%	3%	-1%	3%	-4%	47%	3%
Months with flow below 500 cfs[2]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N.P. River below Guernsey Reservoir											Resop.tab Table 7		
Min (Monthly (cfs), Annual (kaf))	5	3	5	7	5	5	104	24	360	3,384	3,614	1,430	722
Max (Monthly (cfs), Annual (kaf))	501	25	24	86	61	171	1,618	10,516	10,322	9,359	5,144	4,746	2,285
Avg (Monthly (cfs), Annual (kaf))	156	5	6	9	10	17	723	2,232	2,956	5,105	4,620	3,364	1,167
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	-21%	-6%	0%	0%	22%	2%
Max	0%	0%	0%	0%	0%	-57%	-2%	-2%	0%	-7%	-12%	20%	-1%
Avg	0%	0%	0%	0%	0%	-39%	-3%	-3%	-4%	-1%	-1%	21%	1%

[1] The flow below Kortes Reservoir is required by law to be greater than 500 cfs.
[2] NA indicates that there were no months in Present Conditions with flows less than 500 cfs.
[3] The flow below Gray Reef Reservoir isrequired by law to be greater than 330 cfs, but flow of 500 cfs is maintained (when possible) by Reclamation.
[4] The value in the Ann column is the number of years where at least one month had average flows below 500 cfs.

Table 3.3.3- 14. Flow in the North Platte River above Lake McConaughy.

Table 3.3.3-14 shows annual changes in flow of less than 5 percent for the three locations considered. On a monthly basis, below Kortes Reservoir the greatest percentage changes with respect to the Present Condition are in April, and August (decreases) and in March and September (increases). Below Gray Reef Reservoir there are very large percentage increases in September; smaller increases in March through May; decreases between 1 and 5 percent in June and August; and little change in all other months. Below Guernsey Reservoir there are very large percentage decrease in March, a large increase in September, and changes of less than 5 percent in all other months. Flows less than 500 cfs below both Kortes and Gray Reef reservoirs do not occur for the Governance Committee Alternative.

Power generation and bypass flows. The results for power generation in the North Platte River basin upstream of Lake McConaughy are given in **Figure 3.3.3-4** and **Table 3.3.3-15**.

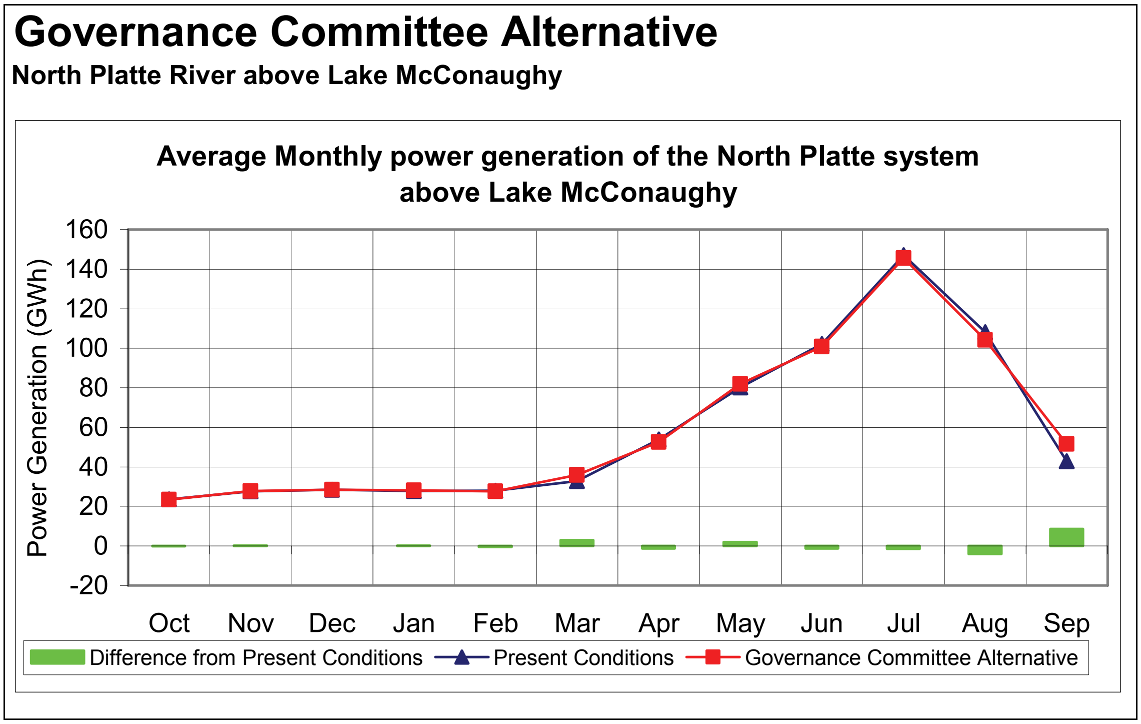


Figure 3.3.3- 4. Average Monthly power generation of the North Platte System above Lake McConaughy.

Governance Committee Alternative
North Platte River above Lake McConaughy

Power Generation	Seminoe Value	Seminoe % Δ[1]	Kortes Value	Kortes % Δ	Fremont Canyon Value	Fremont Canyon % Δ	Alcova Value	Alcova % Δ	Glendo Value	Glendo % Δ	Guernsey Value	Guernsey % Δ	Total Value	Total % Δ
Minimum (GWh)	71.3	-3%	87	-1%	123.4	0%	76.2	10%	49.4	-8%	15.1	0%	451.282	0%
Maximum (GWh)	205.9	-3%	191.5	-4%	269.4	2%	150.1	2%	134.1	1%	20.1	-6%	958.195	4%
Average (GWh)	140.0	0%	146.7	1%	195.0	1%	113.4	2%	94.2	1%	18.8	0%	708.1	1%
Year that minimum occurred	1955		1955		1955		1955		1961		1990		1955	
Data is contained in the file Resop.tab table number		13		14		15		16		17		18		19

[1] % Δ   indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

Table 3.3.3- 15. Power generation statistics for the North Platte system above Lake McConaughy.

Figure 3.3.3-4 and **Table 3.3.3-15** show a 1% gain in power generation system-wide for the Governance Committee Alternative with respect to the Present Condition, and percentage changes of 2 percent or less for the individual projects in the system. The changes are also relatively insignificant on a monthly basis.

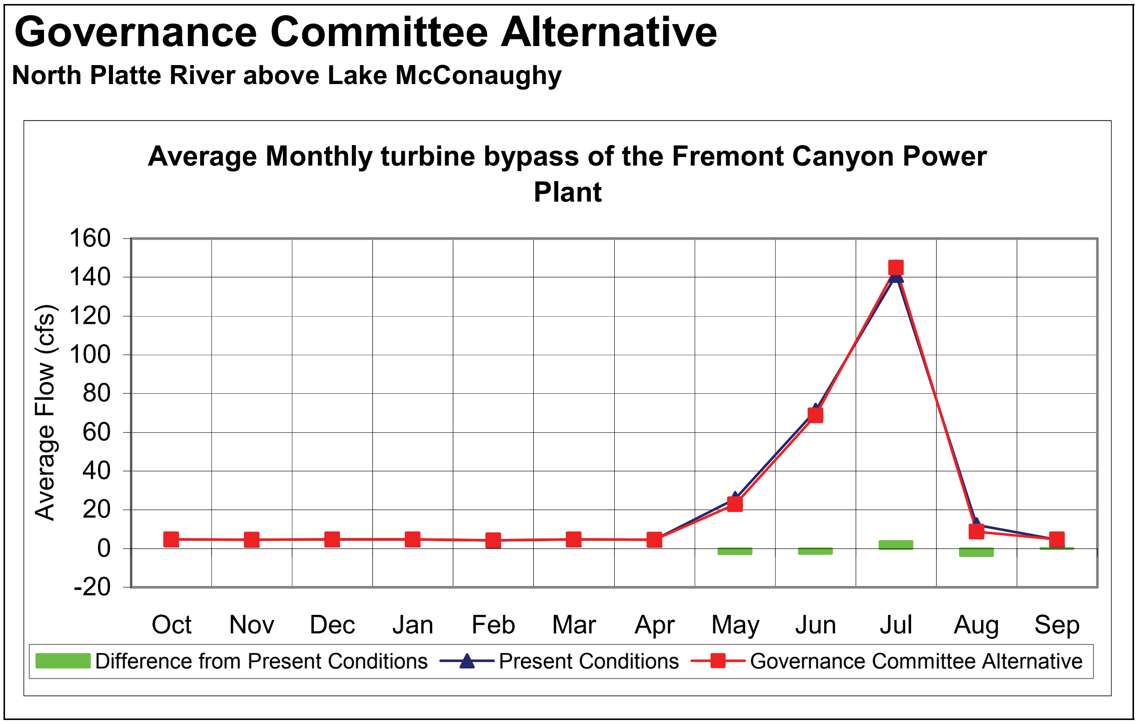


Figure 3.3.3- 5. Average Monthly turbine bypass of the Fremont Canyon Power Plant.

Governance Committee Alternative

North Platte River above Lake McConaughy Flows that Bypass Turbines	Seminoe Value	 % Δ[1]	Kortes Value	 % Δ	Fremont Canyon Value	 % Δ	Alcova Value	 % Δ	Glendo Value	 % Δ	Guernsey Value	 % Δ
Average annual bypass for 48-year simulation period (kaf)	75.5	-4%	95.5	-3%	282.1	-2%	207.0	-6%	215.1	-3%	892.6	2%
Number of years with bypasses	19	-5%	37	3%	48	0%	47	0%	48	0%	48	0%
Average annual bypass for years with a bypass (kaf)	190.7	1%	123.9	-6%	282.1	-2%	211.4	-6%	215.1	-3%	892.6	2%
Largest annual bypass (kaf)	731.1	-6%	765	-7%	1005.7	-4%	879.4	-5%	1075.1	-5%	2006.2	-1%
Year of largest annual bypass	1984		1984		1984		1984		1984		1984	
File that contains the data	Resop.lst		Resop.lst		Resop.lst		Resop.lst		Resop.lst		Resop.lst	
Output line number	13		27		43		59		83		99	

[1] % Δ indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

Table 3.3.3- 16. Turbine bypass flow statistics for the North Platte system above Lake McConaughy.

Table 3.3.3-16 shows a net decrease in bypass flows for all of the hydroelectric plants except Guernsey on the North Platte River for the Governance Committee Alternative with respect to Present Condition. This is most likely due to reduced spills from the North Platte System. Percentage changes range from increases of 2 percent to a decrease of 6 percent for the individual projects in the system. **Figure 3.3.3-5** shows how the bypass flows would be distributed on a monthly basis for the Fremont Canyon hydroelectric plant.

3.3.3.2 Platte River Basin in central Nebraska

The results of the analysis of the central Platte River basin for the Governance Committee Alternative are summarized in **Figures 3.3.3-6** through **3.3.3-14** and **Tables 3.3.3-17** through **3.3.3-36**. The terms used below are defined at the end of **Section 3.2** according to how they are used in this discussion.

Lake McConaughy. Conditions in Lake McConaughy resulting from the Governance

Committee Alternative are shown on **Figure 3.3.3-6**.

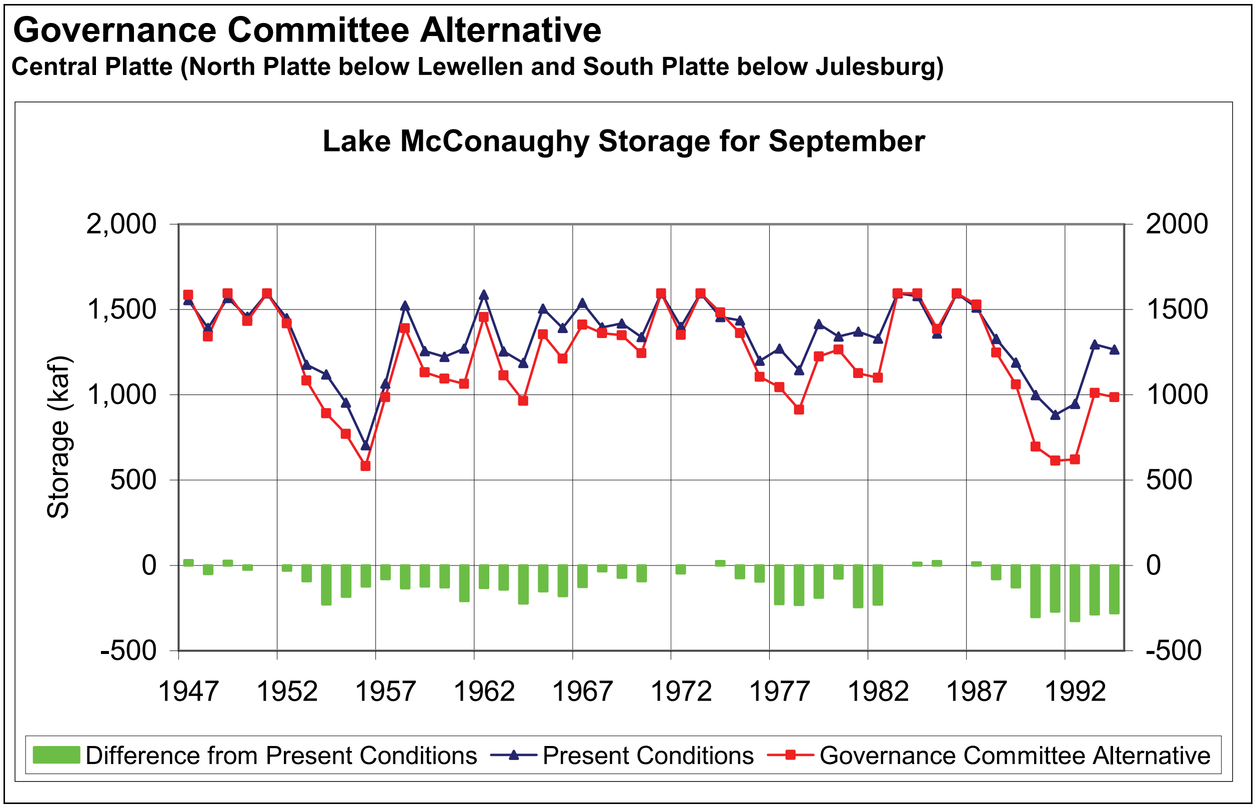


Figure 3.3.3- 6. End of September storage in Lake McConaughy.

Figure 3.3.3-6 shows that, for most years, end-of-September storage in Lake McConaughy for the Governance Committee Alternative is lower than that for the Present Condition. This is consistent with the establishment of the EA and its use for downstream flow augmentation. Of the years when the two are nearly equal or the Governance Committee Alternative is slightly higher, most are wet years or years that immediately follow wet years. All water from Reclamation's reservoirs on the North Platte is delivered in September, which causes the end-of-September storage in Lake McConaughy to increase with respect to Present Conditions in wet years.

Governance Committee Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Lake McConaughy Reservoir Storage	Value	% Δ[1]
Minimum end-of-month storage for 48-year simulation (kaf)	569.2	-19%
Maximum end-of-month storage for 48-year simulation (kaf)	1743.1	0%
Average end-of-month storage for 48-year simulation (kaf)	1321.1	-9%
Low storage indicator: years with storage < 500 kaf	0	0%
Year that minimum first occurred		1991
Largest single month drawdown for this alternative (kaf)	238.3	0%
Month of largest drawdown		July-91
Table number in file GovnComm.tab.		1

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

Table 3.3.3- 17. Reservoir storage statistics for Lake McConaughy.

Over all months of the simulation period, the average end-of-month storage for the Governance Committee Alternative shows a 9 percent decrease with respect to the Present Condition.

Governance Committee Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Lake McConaughy Storage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
										Table 1 in file GovnComm.tab.			
Min (kaf)	758	817	861	900	834	811	710	569	582	615	659	722	569
Max (kaf)	1,632	1,639	1,594	1,609	1,743	1,743	1,743	1,615	1,594	1,594	1,594	1,594	1,743
Avg (kaf)	1,357	1,370	1,391	1,412	1,391	1,390	1,289	1,186	1,219	1,249	1,284	1,316	1,321
Year that minimum first occurred	1957	1957	1957	1992	1992	1992	1992	1991	1956	1956	1956	1956	1991
Percent change from Present Conditions													
Min	-15%	-14%	-13%	-16%	-26%	-23%	-23%	-29%	-17%	-16%	-18%	-17%	-19%
Max	2%	3%	0%	0%	0%	0%	0%	-3%	0%	0%	0%	0%	0%
Avg	-7%	-8%	-8%	-8%	-11%	-11%	-11%	-11%	-9%	-9%	-8%	-8%	-9%

Table 3.3.3- 18. Monthly reservoir storage statistics for Lake McConaughy.

Minimum, maximum, and average storage by month are shown in **Table 3.3.3-18**. This table shows that the largest percent change occurs in the minimum reservoir storage attained during the simulation of the Governance Committee Alternative.

Governance Committee Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Lake McConaughy Spills	Value	% Δ[1]
Average annual spill for 48-year simulation period (kaf)	93.5	-45%
Number of years with spills	14	-52%
Average annual spill for years with spills (kaf)	320.6	15%
Largest annual spill (kaf)	1310.7	-6%
Year of largest annual spill		1984
Table number in file GovnComm.tab.		6

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

Table 3.3.3- 19. Spills from Lake McConaughy.

The number of years with spills for the Governance Committee Alternative shows a 52 percent decrease from 29 to 14 with respect to the Present Condition, and the average annual spill shows a 45 percent decrease. Spills include when water is released from Lake McConaughy in order to comply with the FERC storage limits.

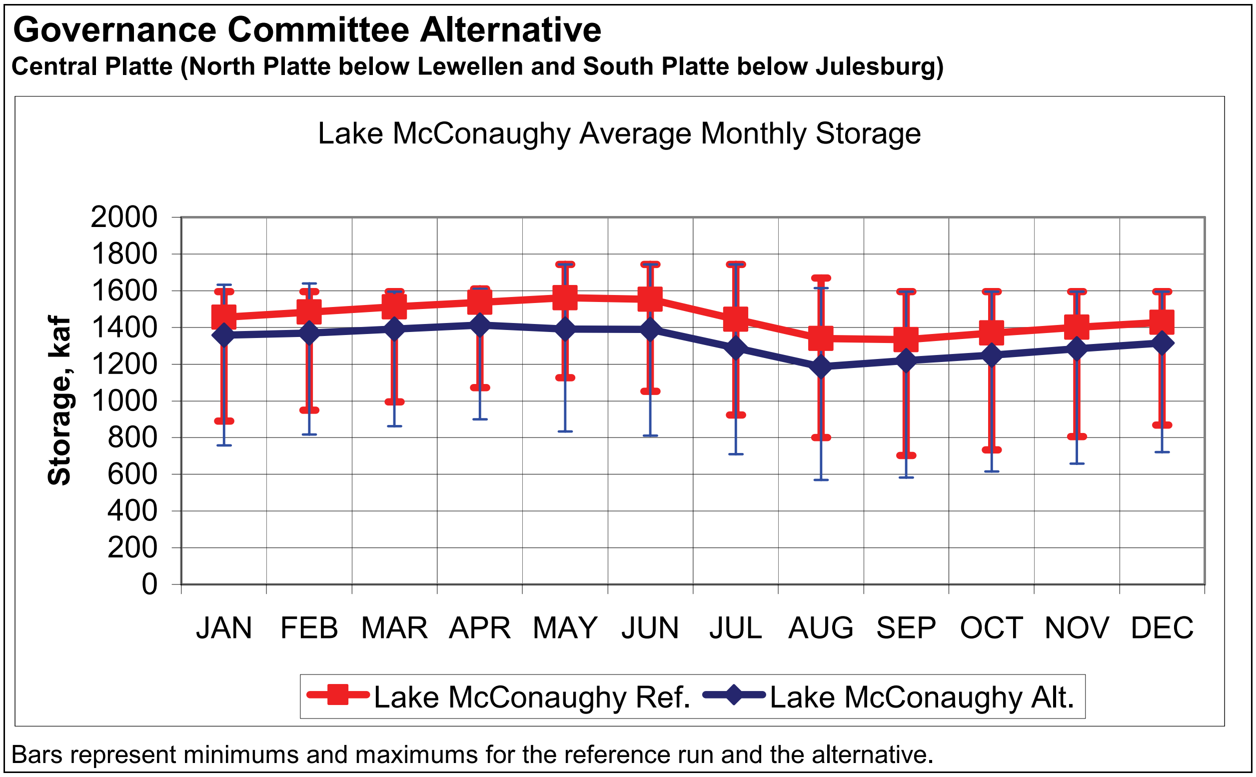


Figure 3.3.3- 7. Lake McCaughey average monthly storage with error bars for minimum and maximum.

Figure 3.3.3-7 shows the average monthly storage with minimums and maximums represented by bars. This figure shows that the lowest storage occurs in August and September. It also shows that the average storage and the minimum storage for the Governance Committee Alternative are less than Present Condition. The maximum storage is higher than Present Condition in January and February due to the use of power interference reducing releases from Lake McConaughy.

Figure 3.3.3-8 shows the average monthly release from Lake McConaughy including releases from the Environmental Account. The figure shows lower releases in November through December due to power interference. Releases are higher in February, March, May and October due to releases from the Environmental Account.

Figure 3.3.3-9 shows the average monthly storage for Sutherland, Elwood, and Johnson Lake reservoirs. This figure shows that there is no change in storage in these reservoirs between the Governance Committee Alternative and Present Condition.

Figure 3.3.3-10 shows that, for most months, the Governance Committee Alternative constitutes an improvement to flow targets over the Present Condition for average monthly flow at Grand Island. However, flows fall short of flow targets approximately half of the time.

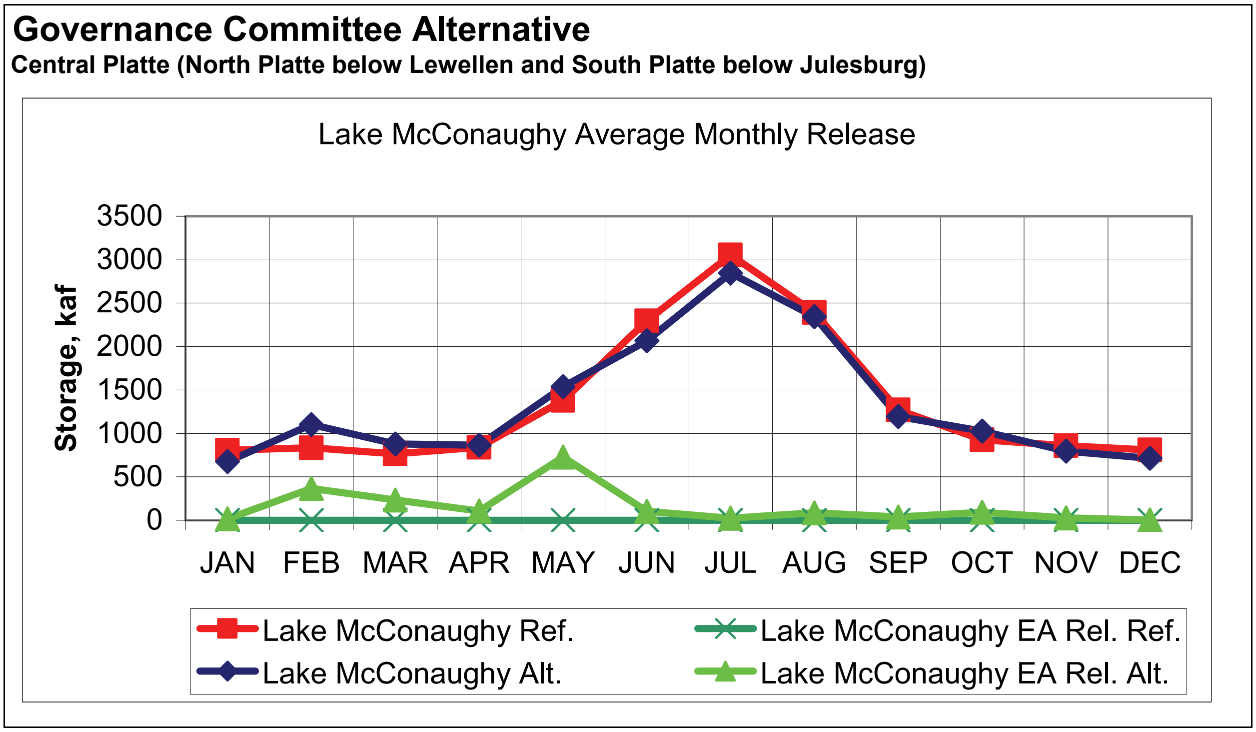


Figure 3.3.3- 8. Average monthly release from Lake McConaughy showing environmental releases.

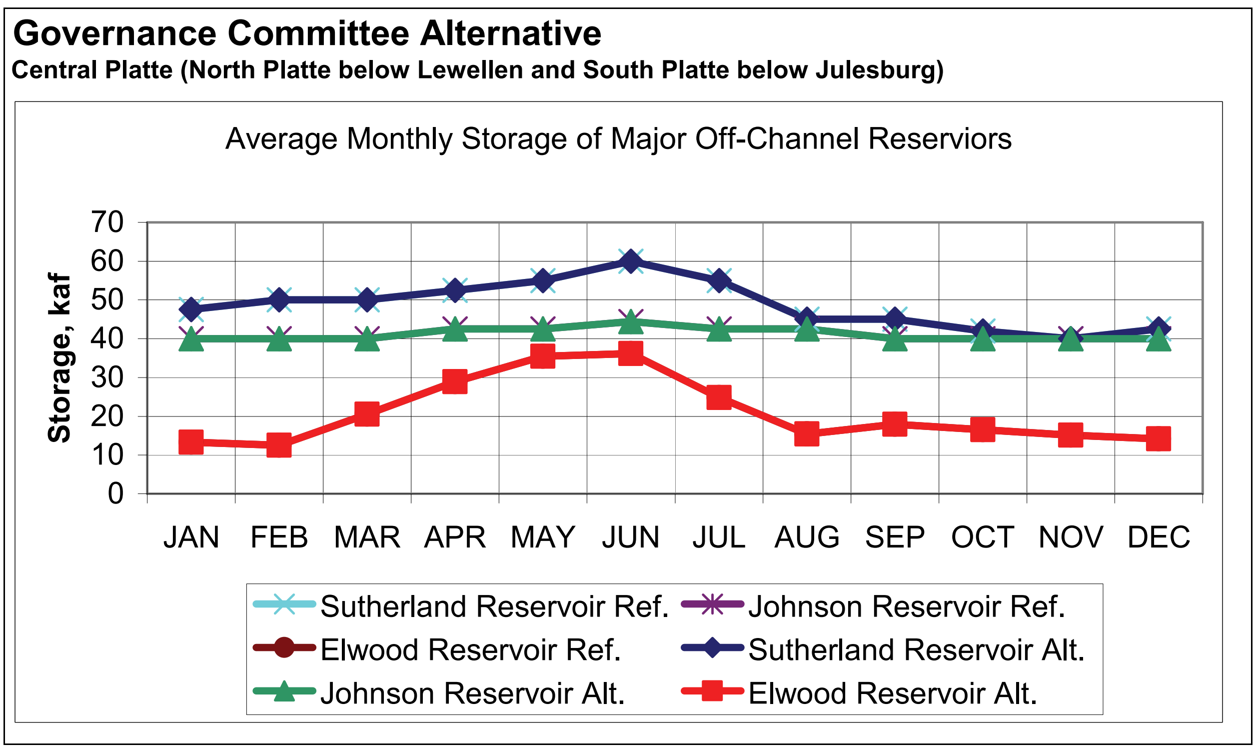


Figure 3.3.3- 9. Average monthly storage for major off-channel reservoirs.

Grand Island Target Flows. Conditions at Grand Island resulting from the Governance Committee Alternative are shown on **Figure 3.3.3-10**.

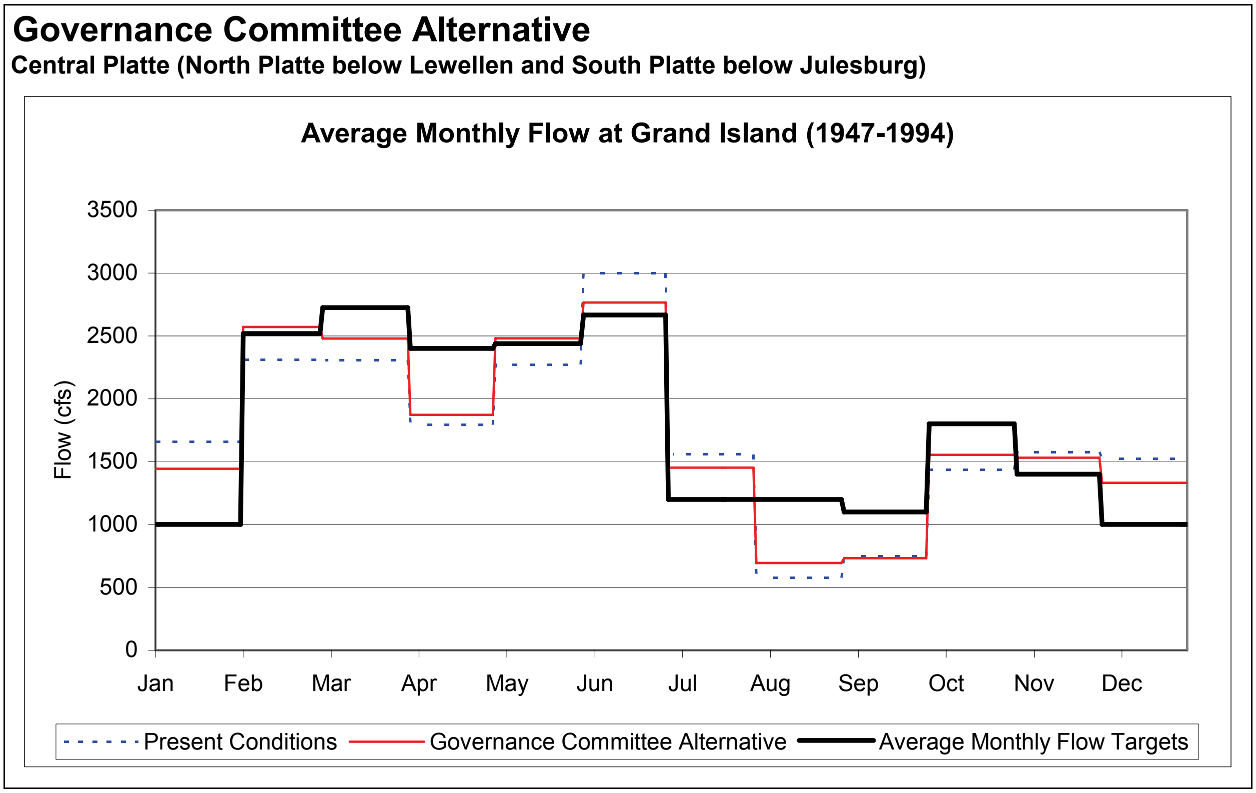


Figure 3.3.3- 10. Average monthly flow at Grand Island, Nebraska compared to flow targets.

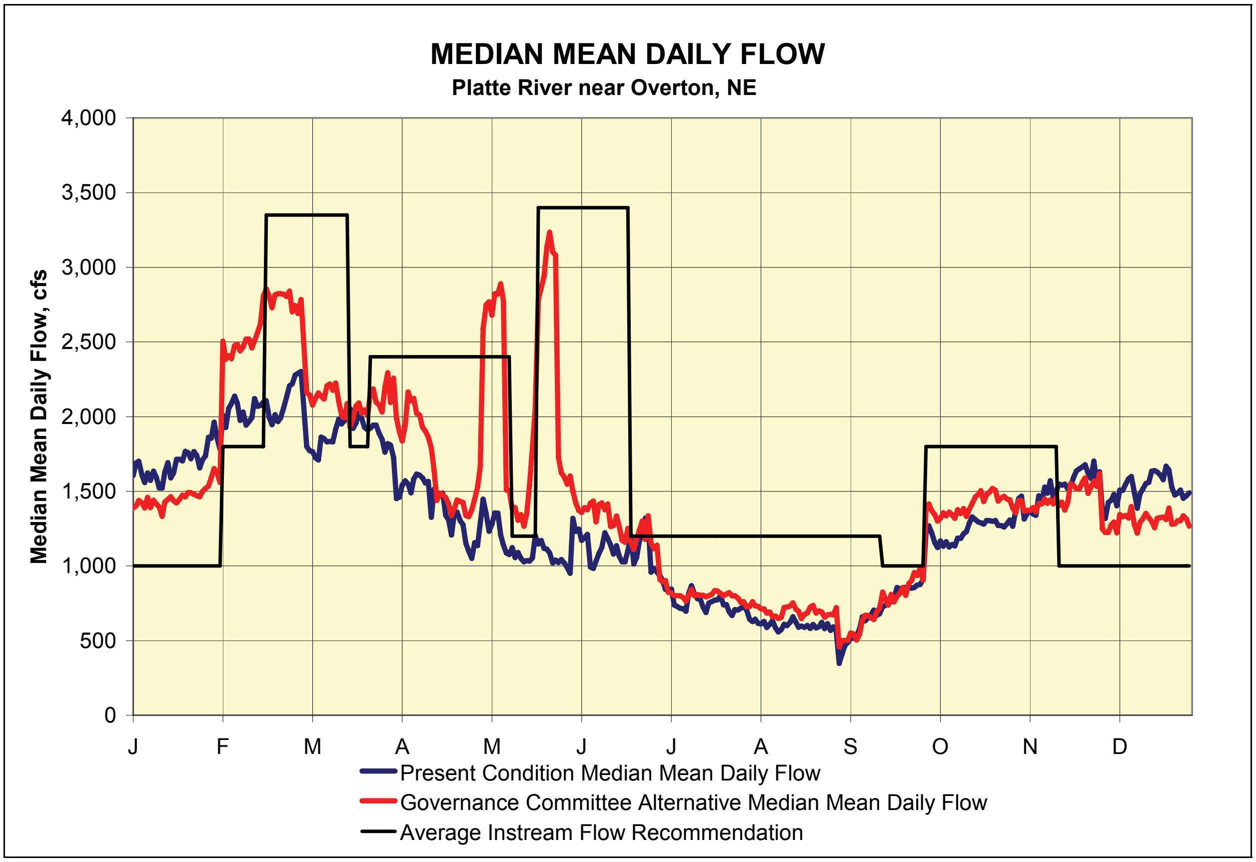
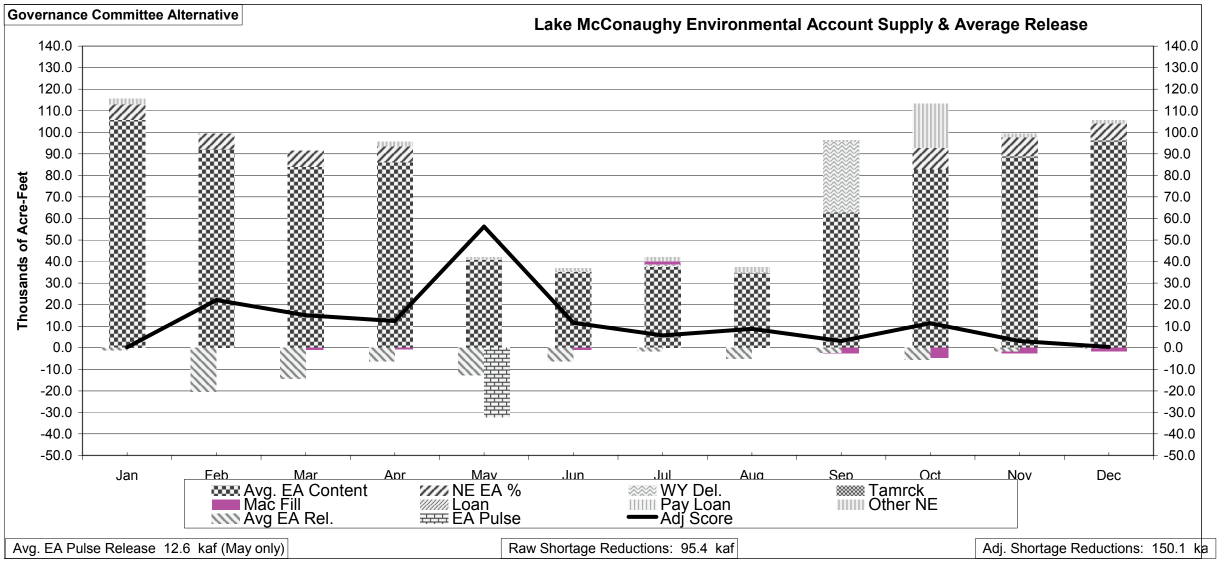


Figure 3.3.3- 11. Median mean daily flow near Overton, Nebraska compared to flow targets.

Figure 3.3.3-11 shows the daily flow targets for average conditions compared to the median daily flow for the Governance Committee Alternative and Present Condition. The figure shows that the Governance Committee Alternative constitutes an improvement to flow targets over the Present Condition at Grand Island. However, flows fall short of flow targets most of the time.

Score.



Governance Committee Alternative

# Zero Flow Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Present	0	0	0	0	0	1	0	1	2	0	0	0	4
GovnComm	0	0	0	0	0	0	0	0	0	0	0	0	0
Raw Shortage Reduction, kaf	0.0	16.1	13.7	10.6	19.9	9.5	3.4	7.2	1.5	10.7	2.8	0.0	95.4
Adjusted Shortage Reduction, kaf	0.3	22.2	15.1	12.4	56.2	11.6	5.7	8.8	3.1	11.3	3.2	0.4	150.1

GovnComm		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	Begin Month Content	97.3	105.9	92.2	84.1	86.1	40.9	35.1	37.8	34.7	63.0	82.8	88.8	
plus	NE EA % accrual	7.2	7.0	7.4	7.3	0.0	0.0	0.0	0.0	0.0	10.1	8.8	8.0	55.8
plus	WY EA contribution	0.0	0.0	0.0	0.0	0.3	0.6	1.0	0.5	32.6	0.0	0.0	0.0	35.0
plus	CO EA exchanged	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
plus	Other NE Water	2.5	0.0	0.0	2.1	0.8	1.2	2.1	2.0	0.8	20.3	1.7	1.4	34.9
plus	EA credit/Mac Fill	0.0	0.0	-1.0	-0.8	-1.4	-1.1	1.3	0.0	-2.7	-4.7	-2.7	-1.6	-14.7
minus	EA Release	-1.1	-20.5	-14.3	-6.2	-12.6	-6.2	-1.5	-5.2	-2.2	-5.6	-1.6	-0.2	-77.4
minus	EA Evaporation	-0.1	-0.2	-0.2	-0.3	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.2	-0.1	-2.6
minus	EA Pulse Release	0.0	0.0	0.0	0.0	-32.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-32.1
plus	EA borrow from Mac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
minus	EA paid back to Mac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	End-of-Month Content	105.8	92.2	84.1	86.2	40.9	35.2	37.7	34.8	62.9	82.8	88.8	96.3	

Figure 3.3.3- 12. Accruals, storage, and releases for the Environmental Account in Lake McConaughy.

Figure 3.3.3-12 shows the accruals, storage, and releases for the Environmental Account in Lake McConaughy in both graphical and tabular format. The figure shows the contributions by state and adjustments to the amount stored in the Environmental Account when Lake McConaughy fills. There is also a comparison to the number of months that have zero flow for Present Condition and the Governance Committee Alternative.

Governance Committee Alternative										Adjusted Shortage Reduction:				150.1
GovnComm	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Adj.
Groundwater Mgmt Storage	1.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.2	2.6	7.4	--
Groundwater Mgmt Contribution	0.0	0.0	0.0	0.0	0.8	1.2	2.1	2.0	0.7	0.0	0.0	0.0	6.9	--
Riverside Drains	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
North Dry Ck GW inflow at Kearney[1]	0.0	0.0	0.0	0.0	0.4	0.4	0.3	0.5	0.4	0.0	0.0	0.0	2.1	1.1
Dawson and Gothenburg Recharge[2]	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4	0.4	0.0	0.0	0.0	2.0	2.0
C. Platte Rereg. Reservoir Release[3]	0.3	3.1	1.3	1.6	2.2	0.3	1.3	1.3	1.3	0.6	0.3	0.4	14.0	14.0
Power Interference credited to EA	2.5	0.1	0.0	2.1	0.0	0.0	0.0	0.0	0.0	0.3	1.7	1.4	8.1	--
Net Controllable Conserved Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	4.0	
NE Irrigation Savings	0.0	0.0	0.0	0.3	1.8	2.6	4.9	4.7	1.7	0.0	0.0	0.0	15.9	--
Other CO at Jules. (no exchange)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Average EA Pulse Release[4]	0.0	0.0	0.0	0.0	32.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.1	32.1
Average Tri-County Irr. Rel. for pulse[5]	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.3
Average Johnson Lake Rel. for pulse[6]	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	--
Number of times EA Borrowed	0	0	0	0	0	0	0	0	0	0	0	0	0	--
Number of time EA Paid Back	0	0	0	0	0	0	0	0	0	0	0	0	0	--
Credit for other Program flows[7]	0.0	3.0	0.1	0.1	0.5	1.6	0.7	0.1	0.1	0.0	0.1	0.0	6.3	6.3
CP Rereg. Res "Spike" Attenuation[8]	0.0	0.0	0.0	0.0	0.0	1.2	0.3	0.1	0.0	0.0	0.0	0.0	1.6	--
Johnson Lake "Spike" Attenuation[8]	0.0	0.0	0.0	0.0	0.0	1.9	0.7	0.2	0.0	0.0	0.0	0.0	2.9	--

1 For N. Dry Creek, adj. shortage reduction = 1/2 * the reduction in target flow shortages calculated by the C.P. OPSTUDY model.
2 Dawson and Gothenburg recharge is not modeled; values are from the Water Action Plan.
3 Central Platte reregulatory reservoir operates using daily flows and is added to the reduction in target flow shortages calculated from the monthly flow values.
4 For EA Pulses, the volume of release is added to the reduction in target flow shortages calculated from the monthly flow values.
5 Pulse augmentation from the Tri-County Canal system (Irrigation water and Elwood Reservoir Storage water).
6 Not added to score because it is assummed to be the rerelease of water from the EA in Lake McConaughy.
7 These are Program contributions that are above targets flows and also greater than the flows under Present Conditions
8 "Spike" attenuation does not reduce shortages to target flows but does provide benefit to the Program.

Table 3.3.3- 20. Central Platte accruals to and releases from the Environmental Account in Lake McConaughy.

The annual reduction to shortages to the flow targets produced by the Governance Committee Alternative is 150.1 kaf (**Table 3.3.3-20**). This satisfies the goal for the First Increment of a reduction to shortages of between 130 and 150 KAF. **Table 3.3.3-20** shows the contributions to the Program from all the Water Action Plan elements in the central Platte. The table also shows other flows that contribute to the Score of the Program.

Pulse and Short duration near-bankful flows.

Pulse flows occur during two time periods February/March and May/June. Short duration near-bankful flows are events that last for three days. **Table 3.3.3-21** quantifies the effects of the Program on pulse and short duration near-bankful flows. The table shows that the 30 day pulse in the April through June time period decreases for the 75% of the years that have the highest flows. These same events increase for the 25% of the years that have the lowest flows. The February/March 30 day pulse flow increases. The short duration near-bankful flows decrease for the highest 30%, increase for the middle 40% and the smallest 30%. The number of years with flows greater than 6,500 cfs near Overton, Nebraska increase and the years with flows less than 100 cfs decrease. The final row in **Table 3.3.3-21** is the average annual flow in the J2 return, which increases for the Governance Committee Alternative.

Governance Committee Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

	Present Condition	**Governance Committee**		
	Value	**Value**	**Change**	**% Change**
30-day pulse flow				
Apr/Jun (highest 75%)	4,822	4,758	-64	-1%
Apr/Jun (lowest 25%)	809	1,604	795	98%
Feb/Mar (all years)	2,168	2,439	272	13%
3-day pulse flows				
Years w/flows > 7,500 cfs	12	13	1	8%
Largest 30%	13,101	11,543	-1,558	-12%
Middle 40%	4,589	5,824	1,234	27%
Smallest 30%	2,333	4,072	1,739	75%
% of Years 3-day pulse flow objectives achieved (**6,500** cfs @ Overton)	38%	96%	59%	156%
Low Flows				
Years w/flows < 100 cfs	17	9	-8	-47%
Years w/flows = 0 cfs	0	7	7	NA
J2-Return (avg ann flow), kaf	593	643	50.7	9%

Table 3.3.3- 21. Pulse flow and short duration near-bankful flow summary for the Platte River near Overton.

Table 3.3.3-22 also shows information regarding the short duration near-bankful flows. There were 30 years that water was released for short duration near-bankful flows. The short duration near-bankful flow target is 6,500 cfs for three days.

Governance Committee Alternative **Central Platte (North Platte below Lewellen and South Platte below Julesburg)**		
Pulse flow target summary (at Overton, NE)	**Value**	**% Δ[1]**
Years with pulse flow releases[2]	30	NA
Average duration of pulse flow releases for years with pulse releases (days)[2]	4.7	NA
Years that pulse flow targets were achieved	46	156%
Average maximum Peak Daily Flow when pulse targets were achieved (cfs)	7,751	-36%
Average maximum Peak Daily Flow for remaining years (cfs)	1,825	-47%

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

[2] NA in the % Δ column indicates that pulse flows are not part of the Present Condtion Run

Table 3.3.3- 22. Short duration near-bankful flow summary for the Platte River near Overton.

Table 3.3.3-23 shows how the short duration near-bankful flows affect the flows in the central Platte river basin. The table shows the average and maximum volumes associated with the short duration near-bankful flow release at various points on the North Platte and Platte rivers. A negative value in a volume column indicates that the canal curtailed diversions (diverted less) during the short duration near-bankful flow event. The table also shows the average and maximum flow during the short duration near-bankful flow event for these same locations.

Governance Committee Alternative **Central Platte (North Platte below Lewellen and South Platte below Julesburg)**				
	Average Pulse Volume (acre-feet)	Maximum Pulse Volume (acre-feet)	Average flow during a pulse release (cfs)	Maximum flow during a pulse release (cfs)
Mac Out	34,266	64,563	3,913	5,517
North Platte River	22,708	55,504	2,395	3,500
Sutherland Canal	9,692	23,951	1,729	2,100
Tri-County Canal	-739	-1,874	1,661	2,024
Platte River above the Jeffrey Return	32,532	58,944	3,466	5,068
Platte River below the Jeffrey Return	33,944	62,716	3,942	5,675
Platte River below the J2 Return	36,479	69,585	4,900	7,837

Table 3.3.3- 23. Flow summary during the short duration near-bankful flow period.

Figure 3.3.3-13 shows that the number of years with flows in the 3,000 to 7,000 range increased with the Governance Committee Alternative compared to Present Condition.

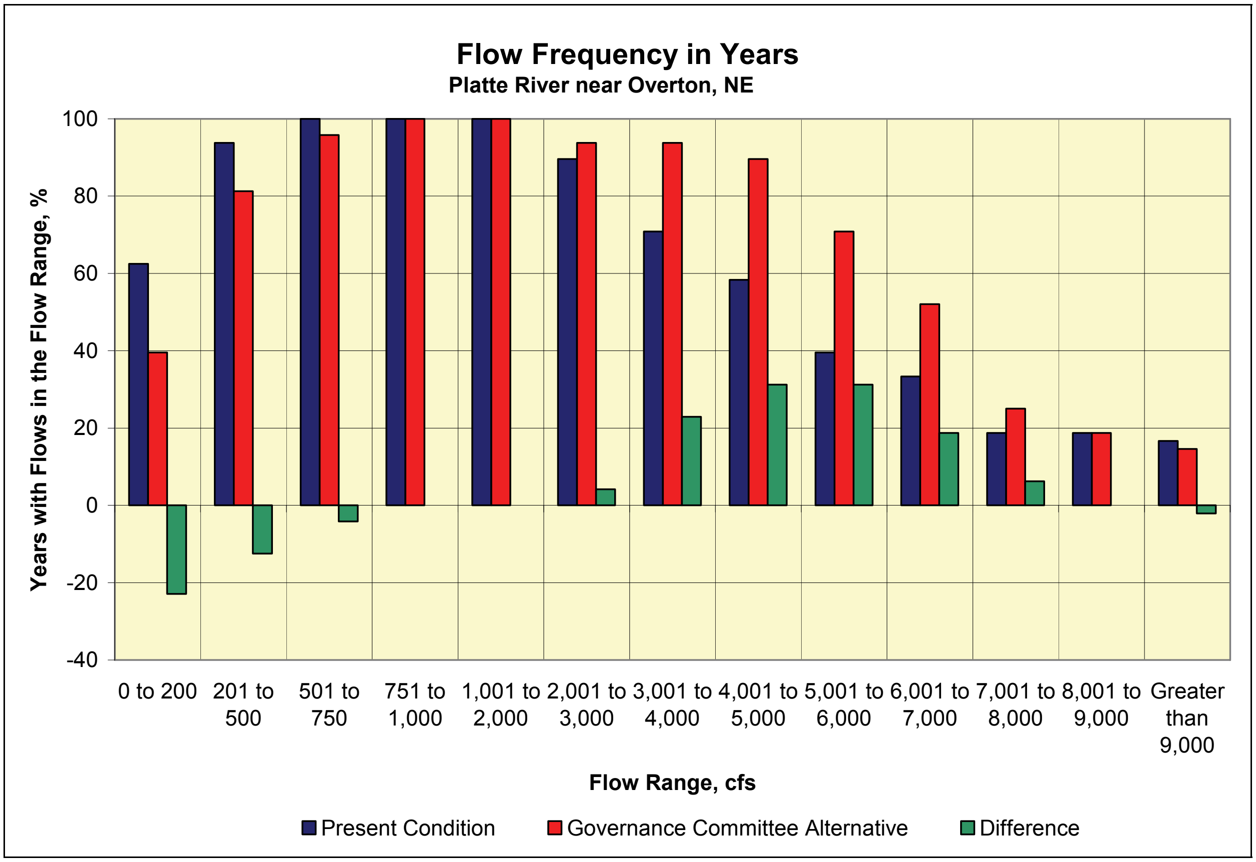


Figure 3.3.3- 13. Flow frequency by flow range in years for the Platte River near Overton.

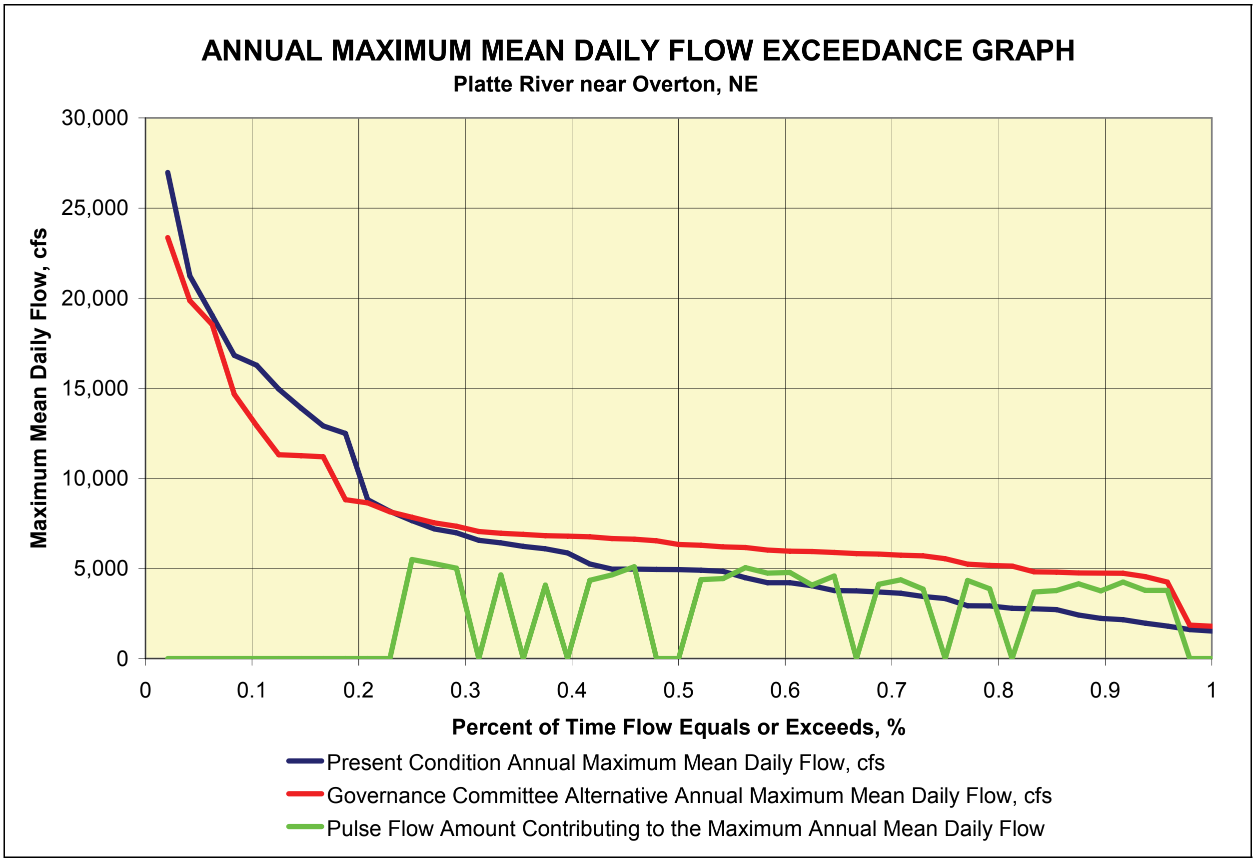


Figure 3.3.3- 14. Exceedance curve for the annual maximum mean daily flow near Overton, Nebraska.

Figure 3.3.3-14 shows a graph of the annual maximum mean daily flow sorted from largest to smallest. Also shown is the release from the Environmental Account for the short duration near-bankful flows. The figure shows that highest 20% of flows are reduced and flows in the 3,000 to 7,000 cfs range are increased.

North Platte Channel Capacity.

Governance Committee Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)	
Interaction of the North Platte Channel Capacity with the Environmental Account Operations	
Pulse release limited by North Platte channel capacity (years)	7
Environmental Account release limited by North Platte channnel capacity (months)	0
Environmental Account release limited by North Platte channnel capacity (years)	0

Table 3.3.3- 24. Summary of North Platte channel restrictions on environmental flow deliveries.

Table 3.3.3-24 shows that short duration near-bankful flow releases were limited by the capacity of the North Platte River at North Platte, Nebraska in 7 years. Other releases from the Environmental Account were not limited in any years.

Environmental/Project Accruals by Basin. The average monthly and annual environmental accruals by basin are given in **Table 3.3.3-25**.

Governance Committee Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Environmental Accruals by Basin	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
North Platte (above Lake McConaughy)													Table 66 in file GovnComm.tab.
Min (kaf)	0.0	0.0	0.0	-0.2	-0.1	0.1	0.2	0.3	10.1	0.0	0.0	0.0	11.2
Max (kaf)	0.0	0.0	0.0	0.0	0.9	1.3	2.1	1.0	47.4	0.0	0.0	0.0	51.6
Avg (kaf)	0.0	0.0	0.0	0.0	0.3	0.6	1.0	0.5	32.6	0.0	0.0	0.0	35.0
Year that minimum first occurred	1947	1947	1947	1966	1956	1960	1959	1990	1966	1947	1947	1947	1966
South Platte (above Julesburg Gage)[1]													Tables 67 and 83 in file GovnComm.tab.
Min (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Avg (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Year that minimum first occurred	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947
Central Platte[2]													Tables 66, 67 and 63 in file GovnComm.tab.
Min (kaf)	0.2	0.3	4.3	3.1	0.3	0.0	0.0	0.5	0.0	24.6	6.3	5.3	63.1
Max (kaf)	27.7	10.5	13.0	47.1	2.3	3.3	4.4	4.1	2.7	40.4	24.4	19.7	136.3
Avg (kaf)	9.7	7.0	7.4	9.4	1.2	1.6	2.4	2.5	1.2	30.4	10.5	9.4	92.8
Year that minimum first occurred	1986	1986	1974	1980	1984	1957	1965	1965	1965	1956	1992	1992	1992
Total													Table 63 in file GovnComm.tab.
Min (kaf)	0.2	0.3	4.3	3.1	0.4	0.2	0.6	0.9	11.8	24.6	6.3	5.3	79.6
Max (kaf)	27.7	10.5	13.0	47.1	2.7	4.0	6.3	4.9	48.0	40.4	24.4	19.7	185.9
Avg (kaf)	9.7	7.0	7.4	9.4	1.5	2.2	3.4	3.1	33.8	30.4	10.5	9.4	127.8
Year that minimum first occurred	1986	1986	1974	1980	1956	1979	1979	1955	1966	1956	1992	1992	1992

[1] Water from the Western Canal is included in the Central Platte Accruals

[2] This includes the water that accures to the Environmental Account in Lake McCounaughy

Table 3.3.3- 25. Environmental accruals by basin.

Table 3.3.3-25 shows that the mean annual environmental accrual for the Governance Committee Alternative is 127.8 kaf, with the greatest accruals by month occurring in September and October. October is when Program accruals from water conservation, water leasing, water management incentives, and net controllable conserved water are added to the Environmental Account in Lake McConaughy; September is when water is first moved from the North Platte River above Lake McConaughy to the Environmental Account.

North Platte (above Lake McConaughy). Table 3.3.3-25 shows that the environmental deliveries from the North Platte River above Lake McConaughy occur in September, with significantly less deliveries in May, June, and August and none at all in the months October through March.

South Platte (above Julesburg, CO). Table 3.3.3-25 shows that no water was exchanged into the EA in Lake McConaughy from the retiming of flows by the Tamarack project. **Table 3.3.3-26** shows the operations of the Tamarack project in Colorado.

Governance Committee Alternative South Platte (South Platte above Julesburg)													
Tamarack Operations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Pumped or Diverted for Recharge													
Maximum, kaf	17,183	17,183	17,183	17,183	17,183	17,183	17,183	0	17,183	17,183	17,183	17,183	187,030
Minimum, kaf	0	0	0	0	0	0	0	0	0	0	0	0	2,400
Average, kaf	14,471	9,037	5,434	2,487	2,525	6,415	4,389	0	3,820	2,148	4,636	11,889	67,251
Median, kaf	17,183	12,800	1,750	0	0	0	0	0	0	0	0	17,183	59,899
Months with recharge at max., months[1]	34	18	11	6	5	14	11	N/A	9	6	11	26	1
Months with no recharge, months	3	19	24	39	32	25	30	48	37	42	27	4	0
Net Impact on South Platte River													
Maximum, kaf [2]	3,012	7,118	10,188	10,444	9,235	8,999	8,445	9,501	6,954	8,982	6,627	4,824	36,654
Minimum, kaf [2]	-14,169	-10,677	-14,383	-12,097	-12,354	-15,841	-15,078	1,780	-13,633	-13,263	-14,917	-15,069	-85,623
Average, kaf [2]	-9,008	-2,064	754	2,865	2,575	-1,834	125	4,441	309	1,893	-858	-8,031	-8,834
Median, kaf [2]	-10,870	-4,774	3,546	4,171	3,616	2,117	3,014	4,186	2,828	3,155	2,237	-9,539	-3,690

[1] N/A indicates that no recharge occurred during this month.
[2] Negative values indicate recharge and positive values indicate return flows.

Table 3.3.3- 26. Tamarack operations.

Central Platte (including Lake McConaughy). Table 3.3.3-25 shows that the greatest environmental accruals occur in October through April, with the least environmental accruals occurring in May through September. The difference in accruals between these two periods is quite large. This is consistent with the way in which the Lake McConaughy Environmental Account is managed.

Shortages, Water Banking/Conservation, Irrigation Demand. The results for shortages, conservation, and irrigation demand are summarized in **Tables 3.3.3-27** through **3.3.3-31**.

Governance Committee Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)	Western Canal		Keystone - Sutherland		Sutherland - North Platte		Brady - Cozad		Tri-County Canal		Kearney Canal	
Irrigation Demand by Reach / Canal	Value	% Δ[1]	Value	% Δ	Value	% Δ	Value	% Δ	Value	% Δ	Value	% Δ
Average annual demand for 48-year simulation period (kaf)	26.3	0%	88.3	0%	26.4	0%	172.7	0%	205.5	0%	13.3	0%
Maximum annual demand (kaf)	51.1	0%	113.4	0%	37.9	0%	236.5	0%	290.5	0%	22.7	0%
Minimum annual demand (kaf)	11.5	0%	52.1	0%	14.3	0%	76.8	0%	89.4	0%	3.2	0%
Table number in file GovnComm.tab.		111		112		113		114		115		116

[1] % Δ indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

Table 3.3.3- 27. Irrigation demand by reach/canal.

Irrigation Demand. There is no change in average annual irrigation demand for the Governance Committee Alternative with respect to the Present Condition.

Governance Committee Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)												
	Western Canal		Keystone - Sutherland		Sutherland - North Platte		Brady - Cozad		Tri-County Canal		Kearney Canal	
Shortages by Reach / Canal	Value	% Δ[1]	Value	% Δ	Value	% Δ	Value	% Δ	Value	% Δ	Value	% Δ
Average annual shortage for 48-year simulation period (kaf)[2]	0.0	-100%	0.0	NA	0.0	NA	0.0	NA	0.0	NA	0.0	NA
Number of years with shortages[2]	1	-88%	0	NA	0	NA	0	NA	0	NA	0	NA
Average annual shortage for years with shortage (kaf)[2]	0.5	-74%	0.0	NA	0.0	NA	0.0	NA	0.0	NA	0.0	NA
As a percentage of demand for years with shortage (%)	1.7%		0.0%		0.0%		0.0%		0.0%		0.0%	
Largest annual shortage (kaf)[2]	0.5	-88%	0	NA	0	NA	0	NA	0	NA	0	NA
As a percentage of demand (%)	1.7%		0.0%		0.0%		0.0%		0.0%		0.0%	
Year of largest annual shortage		1947		----		----		----		----		----
Table number in file GovnComm.tab.		123		124		125		126		127		128

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)
[2] NA in the % Δ column indicates that there value for the Present Condtion Run is zero

Table 3.3.3- 28. Shortages to irrigation by reach/canal.

Shortages. Table 3.3.3-28 shows that only one system, the Western Canal, has any shortages or changes in shortage for the Governance Committee Alternative with respect to the Present Condition. The Governance Committee Alternative does not materially change this hydrologic condition with respect to the Present Condition.

Irrigation Deliveries. Tables 3.3.3-29 and **3.3.3-30** show the irrigation deliveries for the central Platte river basin. **Table 3.3.3-29** shows the deliveries to the irrigators on the North and South Platte rivers. The table shows no differences in deliveries with the exception of the Western Canal. **Table 3.3.3-30** shows the deliveries to irrigators below the town of North Platte. These deliveries have been reduced using water conservation, water leasing, and water management incentives to lessen the impacts on Program deliveries due to the North Platte channel capacity.

Governance Committee Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)													
Irrigation Deliveries	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Ann**
Western Canal Irrigation Deliveries									Table 53 in file GovnComm.tab.				
Min (kaf)	0	0	0	0	0	0	1	1	1	0	0	0	12
Max (kaf)	0	0	2	8	13	14	15	11	13	7	4	1	51
Avg (kaf)	0	0	0	1	4	4	5	4	4	3	1	0	26
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	11%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	4%	0%	1%
Keystone-Sutherland Irrigation Deliveries									Table 50 in file GovnComm.tab.				
Min (kaf)	0	0	0	0	3	6	10	15	3	0	0	0	52
Max (kaf)	0	0	1	9	22	23	33	29	20	11	1	0	113
Avg (kaf)	0	0	0	2	10	14	24	23	13	3	0	0	88
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Sutherland-North Platte Irrigation Deliveries									Table 55 in file GovnComm.tab.				
Min (kaf)	0	0	0	0	0	1	3	3	1	0	0	0	14
Max (kaf)	0	0	0	2	6	7	10	8	7	4	1	0	38
Avg (kaf)	0	0	0	0	3	4	7	7	4	1	0	0	26
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 3.3.3- 29. Irrigation deliveries by reach/canal for the North and South Platte rivers.

Governance Committee Alternative **Central Platte (North Platte below Lewellen and South Platte below Julesburg)**													
Irrigation Deliveries	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Ann**
Brady-Cozad Irrigation Deliveries									Table 53 in file GovnComm.tab.				
Min (kaf)	0	0	0	0	3	4	5	35	3	0	0	0	76
Max (kaf)	0	0	2	13	28	45	94	79	34	25	3	0	234
Avg (kaf)	0	0	0	2	11	22	60	57	16	3	0	0	171
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	-1%	0%	0%	0%	0%	-1%
Max	0%	0%	0%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	0%	0%	-1%
Avg	0%	0%	0%	0%	-1%	-1%	-1%	-1%	-1%	-1%	0%	0%	-1%
Central (Tri-County) Irrigation Deliveries									Table 50 in file GovnComm.tab.				
Min (kaf)	0	0	0	0	6	13	16	27	1	0	0	0	78
Max (kaf)	0	0	0	6	41	61	95	76	49	0	0	0	271
Avg (kaf)	0	0	0	3	21	31	56	54	19	0	0	0	185
Percent change from Present Conditions													
Min	0%	0%	0%	0%	-12%	-9%	-12%	-12%	0%	0%	0%	0%	-12%
Max	0%	0%	0%	-7%	-7%	-11%	-7%	-9%	-7%	0%	0%	0%	-7%
Avg	0%	0%	0%	-6%	-10%	-10%	-10%	-10%	-10%	0%	0%	0%	-10%
Kearney Canal Irrigation Deliveries									Table 55 in file GovnComm.tab.				
Min (kaf)	0	0	0	0	0	0	0	1	0	0	0	0	3
Max (kaf)	0	0	1	7	5	4	6	6	5	2	1	0	22
Avg (kaf)	0	0	0	1	1	1	3	3	2	0	0	0	13
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	-3%	-2%	-2%	-2%	-2%	-2%	-5%	0%	0%	-3%
Avg	0%	0%	0%	-1%	-1%	-1%	-2%	-2%	-2%	0%	0%	0%	-2%

Table 3.3.3- 30. Irrigation deliveries by reach/canal for the Platte Rivers.

Governance Committee Alternative **Central Platte (North Platte below Lewellen and South Platte below Julesburg)**						
Water Banking / Conservation by Reach / Canal	**Western Canal**	**Keystone - Sutherland**	**Sutherland - North Platte**	**Brady - Cozad**	**Tri-County Canal**	**Kearney Canal**
Average annual conservation for 48-year simulation period (kaf)	0.0	0.0	0.0	1.6	13.9	0.3
Number of years with conservation	0	0	0	48	48	46
Average annual conservation for years with conservation (kaf)	0.0	0.0	0.0	1.6	13.9	0.3
As a percentage of demand (%)	0.0%	0.0%	0.0%	0.9%	6.8%	2.2%
Largest annual conservation (kaf)	0	0	0	2.2	19.7	0.6
As a percentage of demand (%)	0.0%	0.0%	0.0%	0.9%	6.8%	2.6%
Year of largest annual conservation	----	----	----	1988	1956	1985
Table number in file GovnComm.tab.	129	130	131	132	133	134

Table 3.3.3- 31. Water leasing/management incentives by reach/canal.

Water Banking/Conservation. Table 3.3.3-31 shows that the amount of water leased under the Governance Committee Alternative is less than 2 KAF for all systems except the Tri-County Canal, where is 13.9 KAF. There is leasing and incentives in all 48 years of the simulation. The leasing in the Tri-County Canal system represent 6.8 percent of the demand on the system, but is less than 2 percent for all other systems.

Flows. The results for the flows at significant locations are given in **Table 3.3.3-32** through **3.3.3-34**.

Governance Committee Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Flows	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
North Platte River at Keystone									Table 39 in file GovnComm.tab.				
Min (Monthly (cfs), Annual (kaf))	0	0	0	0	46	101	159	239	45	0	0	0	86
Max (Monthly (cfs), Annual (kaf))	0	864	707	455	7,771	7,436	4,666	1,696	780	1,844	24	0	1,242
Avg (Monthly (cfs), Annual (kaf))	0	93	16	50	484	976	1,564	1,049	259	233	2	0	287
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-3%
Max	-100%	295%	400%	-44%	0%	-27%	-13%	2%	-57%	0%	0%	0%	-4%
Avg	-100%	830%	300%	-21%	-1%	-22%	-7%	0%	-1%	4%	0%	0%	-7%
North Platte River at North Platte									Table 42 in file GovnComm.tab.				
Min (Monthly (cfs), Annual (kaf))	132	259	210	187	101	266	276	397	178	247	277	298	289
Max (Monthly (cfs), Annual (kaf))	498	1,253	1,220	884	8,231	7,549	4,907	1,569	1,057	2,394	550	460	1,438
Avg (Monthly (cfs), Annual (kaf))	336	466	428	402	703	1,037	1,385	1,004	432	567	387	364	455
Percent change from Present Conditions													
Min	-5%	-3%	-3%	-3%	-49%	-2%	-49%	41%	-2%	-3%	-2%	-2%	-2%
Max	-32%	72%	60%	-36%	0%	-26%	-13%	2%	-50%	-1%	-1%	-1%	-4%
Avg	-3%	19%	1%	-5%	-2%	-22%	-8%	-1%	-2%	1%	-2%	-2%	-5%
Platte River at Maxwell (Below Tri-County Diversion)									Table 16 in file GovnComm.tab.				
Min (Monthly (cfs), Annual (kaf))	0	0	0	0	0	3	42	94	0	0	0	0	23
Max (Monthly (cfs), Annual (kaf))	805	1,853	2,005	2,117	12,807	17,593	9,145	1,714	1,412	2,104	1,469	685	2,293
Avg (Monthly (cfs), Annual (kaf))	222	504	305	270	1,115	1,598	1,037	609	181	234	148	145	384
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-25%
Max	-45%	-4%	46%	-16%	-4%	-16%	-12%	-11%	-44%	-12%	-19%	-24%	-21%
Avg	-31%	33%	41%	-7%	1%	-19%	-16%	5%	-11%	0%	-15%	-28%	-8%

Table 3.3.3- 32. Flows in the central Platte basin.

Governance Committee Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Flows	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Platte River at Overton									Table 53 in file GovnComm.tab.				
Min (Monthly (cfs), Annual (kaf))	712	1,017	919	472	628	509	424	177	94	423	874	660	545
Max (Monthly (cfs), Annual (kaf))	3,340	4,883	4,277	5,833	16,627	20,229	10,955	1,574	3,611	4,451	4,122	3,344	3,917
Avg (Monthly (cfs), Annual (kaf))	1,590	2,509	2,205	1,775	2,458	2,775	1,348	784	930	1,683	1,652	1,465	1,274
Percent change from Present Conditions													
Min	-3%	1%	23%	-17%	468%	219%	8%	679%	-8%	-2%	12%	-9%	22%
Max	-15%	-2%	9%	-7%	-3%	-14%	-10%	-12%	-25%	-8%	-10%	-7%	-9%
Avg	-12%	12%	9%	5%	9%	-8%	-7%	18%	-2%	8%	-2%	-11%	1%
Platte River at Odessa									Table 50 in file GovnComm.tab.				
Min (Monthly (cfs), Annual (kaf))	647	1,113	906	168	311	229	153	8	8	98	761	756	425
Max (Monthly (cfs), Annual (kaf))	3,358	4,974	4,163	5,563	16,249	19,492	10,865	1,257	3,396	4,126	3,675	3,209	3,782
Avg (Monthly (cfs), Annual (kaf))	1,591	2,600	2,236	1,548	2,232	2,569	1,189	548	659	1,404	1,537	1,452	1,176
Percent change from Present Conditions													
Min	-2%	3%	23%	-33%	0%	0%	129%	0%	0%	-8%	5%	-2%	27%
Max	-15%	-2%	-2%	-7%	-3%	-15%	-10%	-14%	-26%	-11%	-11%	-7%	-9%
Avg	-12%	11%	9%	6%	10%	-8%	-8%	28%	-2%	9%	-3%	-11%	1%
Platte River at Grand Island									Table 55 in file GovnComm.tab.				
Min (Monthly (cfs), Annual (kaf))	325	918	878	558	468	395	356	13	45	195	573	603	487
Max (Monthly (cfs), Annual (kaf))	4,011	5,214	4,511	5,657	16,221	18,240	10,379	1,368	3,808	4,952	3,591	3,051	3,814
Avg (Monthly (cfs), Annual (kaf))	1,443	2,572	2,478	1,872	2,482	2,765	1,454	695	732	1,555	1,532	1,333	1,258
Percent change from Present Conditions													
Min	-4%	-2%	4%	19%	1008%	0%	96%	0%	0%	-6%	53%	-5%	25%
Max	-13%	-2%	-8%	-7%	-3%	-16%	-10%	4%	-24%	-10%	-11%	-7%	-5%
Avg	-13%	11%	8%	4%	9%	-8%	-7%	21%	-2%	8%	-3%	-12%	1%

Table 3.3.3- 33. Flows in the central Platte basin.

Governance Committee Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)													
Flows	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Ann**
South Platte River at Julesburg									Table 38 in file GovnComm.tab.				
Min (Monthly (cfs), Annual (kaf))	18	227	91	151	254	200	125	93	72	124	133	39	164
Max (Monthly (cfs), Annual (kaf))	1,849	1,903	1,220	2,240	8,026	11,703	4,542	1,364	1,351	1,690	1,607	1,535	1,915
Avg (Monthly (cfs), Annual (kaf))	683	907	676	627	1,291	1,731	449	317	394	413	505	518	512
Percent change from Present Conditions													
Min	-69%	163%	460%	221%	680%	396%	381%	307%	975%	407%	1480%	140%	257%
Max	-2%	5%	-11%	-12%	-19%	-6%	-11%	-18%	-20%	-24%	-10%	-2%	-13%
Avg	-7%	6%	16%	15%	3%	-2%	-1%	38%	9%	20%	19%	-6%	5%
Sourth Platte River at Paxton (below Korty Diversion)									Table 43 in file GovnComm.tab.				
Min (Monthly (cfs), Annual (kaf))	0	85	0	89	67	0	0	0	0	0	0	0	41
Max (Monthly (cfs), Annual (kaf))	686	1,434	1,173	1,780	6,308	11,007	4,516	782	681	1,602	1,250	564	1,553
Avg (Monthly (cfs), Annual (kaf))	256	439	361	314	854	1,196	242	89	132	220	200	180	270
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	-32%	-5%	24%	-18%	-22%	-7%	-11%	-24%	-31%	-25%	-22%	-26%	-19%
Avg	-16%	3%	29%	10%	-3%	-9%	-17%	22%	-3%	11%	9%	-14%	-2%

Table 3.3.3- 34. Flows in the central Platte basin.

The most significant result shown in **Table 3.3.3-33** is the pattern of the changes in average monthly and annual flow with respect to the Present Condition at Overton and Grand Island There is either a decrease or only a small increase in November through January and in June-July, with increases for February through May and August and October. May is the month of operation for high spring flows (also known as annual pulse flows). August and September are the two months with the lowest mean monthly flow and the summer flow months. The effect of operation for high spring flow in May also shows up at both Keystone and the flow passing the Central Diversion. The average annual flow increases with respect to the Present Condition at both Overton and Grand Island, while it decreases at the other locations considered.

Diversion. The average monthly and annual diversions for the 3 major supply canals are given in **Table 3.3.3-35**.

Governance Committee Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)													
Diversions	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Ann**
Keystone diversion										Table 18 in file GovnComm.tab.			
Min (Monthly (cfs), Annual (kaf))	250	250	250	250	250	250	319	745	134	0	250	250	277
Max (Monthly (cfs), Annual (kaf))	1,192	1,657	2,000	1,800	2,000	2,000	2,000	1,963	2,000	1,800	1,828	1,677	1,210
Avg (Monthly (cfs), Annual (kaf))	675	1,007	862	814	1,054	1,091	1,280	1,294	935	794	795	713	683
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	-2%	23%	-35%	0%	0%	0%	-7%
Max	-25%	-2%	0%	0%	0%	0%	0%	-2%	0%	0%	0%	0%	2%
Avg	-16%	22%	13%	5%	19%	5%	-7%	-3%	-7%	13%	-7%	-12%	1%
Korty Diversion										Table 19 in file GovnComm.tab.			
Min (Monthly (cfs), Annual (kaf))	23	175	0	0	0	0	0	37	0	0	133	3	113
Max (Monthly (cfs), Annual (kaf))	751	1,025	649	1,034	1,099	1,101	859	681	697	535	778	657	421
Avg (Monthly (cfs), Annual (kaf))	383	509	372	334	403	526	254	202	218	169	296	299	238
Percent change from Present Conditions													
Min	-59%	131%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	156%
Max	-3%	6%	-15%	27%	0%	0%	-5%	-20%	-18%	-15%	9%	-2%	-3%
Avg	-1%	9%	2%	18%	21%	19%	22%	55%	20%	36%	26%	-3%	14%
Tri-County diversion										Table 17 in file GovnComm.tab.			
Min (Monthly (cfs), Annual (kaf))	690	913	885	750	1,021	1,502	1,556	1,574	978	699	872	694	924
Max (Monthly (cfs), Annual (kaf))	1,974	2,200	2,152	2,087	2,170	2,250	2,194	2,147	2,250	2,088	2,136	2,022	1,518
Avg (Monthly (cfs), Annual (kaf))	1,258	1,806	1,651	1,472	1,748	1,926	2,082	2,049	1,456	1,508	1,484	1,287	1,191
Percent change from Present Conditions													
Min	0%	31%	27%	12%	-3%	15%	0%	0%	5%	0%	13%	1%	6%
Max	-1%	0%	3%	0%	0%	0%	0%	0%	5%	0%	-3%	2%	0%
Avg	-6%	10%	6%	8%	11%	6%	0%	0%	-2%	11%	2%	-6%	3%

Table 3.3.3- 35. Diversions by major canals in the central Platte basin.

Table 3.3.3-35 shows an increase in average annual diversion into the Korty, Keystone, and Tri-County diversions for the Governance Committee Alternative with respect to the Present Condition. The greatest decreases in diversion with respect to the Present Condition occur in December and January for all 3 diversions. The greatest increases in diversions occur in May for the Keystone and Tri-County diversions, and in June through September for the Korty Diversion. The very large increase in diversion into the Keystone diversion in May coincides with a significant decrease in flow in the North Platte River at Keystone. The even larger increase in May, along with the increase at Keystone in May, is consistent with there being pulse flow releases from Lake McConaughy in May.

Governance Committee Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)								
	Sutherland		**Central**		**Kingsley**		**Total**	
Power Generation	**Value**	**% Δ**[1]	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**
Minimum (MKWh)	57	-10%	177	14%	30	-24%	282	-6%
Maximum (MKWh)	189	1%	362	1%	238	-1%	790	0%
Average (MKWh)	116	5%	264	5%	103	-1%	484	4%
Year that minimum occurred		1993		1956		1993		1993
Table number in file GovnComm.tab.		23		24		25		26

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

Table 3.3.3- 36. Power generation statistics for the central Platte basin below Lake McConaughy.

Power Generation. The Governance Committee Alternative results in an increase in power generation with respect to the Present Condition in the Sutherland and Central systems, and a slight decrease at Kingsley Dam/Lake McConaughy.

3.4 Water Emphasis Alternative

With this alternative, the focus is on providing more than 150,000 acre-feet of water for use in the central Platte habitat area.

3.4.1 Features simulated in the alternative

3.4.1.1 3-States Plan

Pathfinder Modification. The Pathfinder Modification Project would increase the capacity of the existing Pathfinder Reservoir by approximately 54,000 acre feet to recapture storage space lost to sediment. The modification would be accomplished by raising the elevation of the existing spillway by approximately 2.39 feet with the installation of an inflatable dam or some other means. The recaptured storage space would store water under the existing 1904 storage right for Pathfinder Reservoir and would enjoy the same entitlements as other uses in the reservoir with the exception that the recaptured storage space could not place regulatory calls on existing water rights upstream of Pathfinder Reservoir other than the rights pertaining to Seminoe Reservoir.

Of this 54,000 acre-feet, 34,000 acre-feet would be from an environmental account, which would be operated for the benefit of endangered species and habitat in central Nebraska. The State of Wyoming would retain, under contract with the Bureau of Reclamation, the remaining 20,000 acre feet of the modification capacity to provide municipal water to North Platte communities in Wyoming through contracts between the municipalities and the State of Wyoming.

Tamarack. The Tamarack Plan involves the use of wells and other water facilities in Colorado to re-regulate excess flows in Colorado in a manner that is consistent with the flow-related goals of the Platte River Recovery Implementation Program. Excess flows are not need to satisfy legal rights to and physical demands for water. As a result of the geographic location of the Tamarack Plan near the state line, groundwater recharge that results from the Tamarack Plan is estimated to increase flows at the Julesburg gage during the period of April through September by an average of approximately 10,000 acre-feet over the flows that would otherwise occur during that period. Water rights for the operation of the components of the Tamarack Plan will be obtained and exercised under Colorado law for beneficial uses in Colorado. All facilities will be operated by Colorado and its water users in compliance with the requirements of the South Platte River Compact.

The components of the Tamarack Plan will be developed within the 40 miles above the state line beginning at about the Tamarack Ranch State Wildlife Area owned by the Colorado Division of Wildlife near Crook, Colorado. These facilities will include wells located adjacent to the South Platte River that divert groundwater from the alluvial aquifer and canals that divert water from the South Platte River. Water that percolates into the groundwater alluvium from these facilities will return to the South Platte River at a later time. Inflows to canals and recharge basins will be identified as for Program or other purposes, and inflows for Program purposes will be measured and recharge or seepage will be computed as inflows minus evaporation. Evaporation in acre-feet will be determined by using available weather station data and the surface areas of the recharge sites. Recharge basins are typically located in sandy upland areas with high infiltration rates such that free water surface areas are minimal, resulting in low evaporation amounts.

Lake McConaughy Environmental Account. An Environmental Account (EA) will be established in Lake McConaughy, Nebraska. Water contributed to the EA, regardless of its source, loses any separate identity upon entering Lake McConaughy or other approved storage facility, and simply becomes part of the EA. Water remaining in the EA after September 30 of each year may be carried over and added to the following year's contributions to the EA, subject to limitations on the size of the Environmental Account.

3.4.1.2 Other Elements

EA Short duration near-bankful Flows. Management of the Lake McConaughy Environmental Account (EA) would seek to provide short duration near-bankful flows in the habitat reach of the river. This would be accomplished by timing EA releases to increase the frequency of short duration near-bankful flows released from Kingsley Dam. The magnitudes of the short duration near-bankful flows would not be allowed to exceed the flood stage of the North and central Platte Rivers as determined by the National Weather Service.

The EA would be operated in such a manner as to augment South Platte River flows in order to increase the magnitude and frequency of within-channel flows (flows near bank full) and subsequent sediment transport to the Overton to Grand Island reach of the Platte River. The purpose is to supply sediment to the remaining downstream braided river below the J2-Return. By adding additional water from the EA which would bypass the Tri-County Diversion Dam, sediment stored in the reach from North Platte to the J2-Return could be mobilized and supplied to the reaches below the J2 Return.

Short duration near-bankful flows would be released through the Kingsley Dam Powerplant at a rapid but safe rate and would not exceed the maximum powerplant capacity for a two to three-day duration (about 5,000 cfs). The maximum rate of increasing discharge would be determined so that the downstream river stage would not increase by a rate faster than could be accommodated by downstream structures. Releases would then reduce back to normal operating levels at the maximum practicable rate. The rate of increasing and decreasing discharge would be determined in cooperation with the operators of Kingsley Dam. These short duration near-bankful flows are designed to temporarily mobilize or scour the channel bed rather than transport tremendous quantities of sediment. The discharge hydrograph, released from Kingsley Dam, is expected to transform from a trapezoidal shape to a triangular shape as it travels downstream toward Grand Island. This will result in a decrease in sediment transport capacity as the discharge wave travels downstream.

The purpose of this aspect of EA operation would be to release short duration near-bankful flows, within bank capacity, in order to scour young vegetation from the river channel. If the cottonwood seed germination is minimal during a particular year or if the plants are scoured by naturally occurring floods, then no short duration near-bankful flows for vegetation scour would be implemented. If cottonwood seed dispersal and germination were significant then several different short duration near-bankful flow options would be available.

The short duration near-bankful flows would be generated by season as follows:

Early fall short duration near-bankful flow (October/September). This short duration near-bankful flow would have a maximum discharge of 5,000 cfs from Kingsley Dam and would occur during an otherwise low-flow period. A short duration near-bankful flow in fall would be designed to temporarily scour the channel bed soon after the cottonwood-seed germination and growing season while the plants are still small and vulnerable to scour. Attempts would be made to schedule such releases when the water diversions through the tri-county power canal are at a minimum.

Winter ice formation flow. This would be a small magnitude (less than 5,000 cfs), short duration near-bankful flow designed to wet the channel at the onset of freezing weather and form ice across the channel. A second small magnitude, short duration near-bankful flow would be initiated at the onset of warmer weather to help break and lift the ice and scour the channel bed.

Spring runoff short duration near-bankful flow (May/June). The target value for the spring short duration near-bankful flow would be 6,500 cfs at Overton during the last 2 weeks of May. The spring short duration near-bankful flow would augment flows from the South Platte River for a total Platte River flow not to exceed the flood stage as determined by the National Weather Service (considered to be 10,000 ft^3/s for analysis purposes). The short duration near-bankful flow in spring would provide for the greatest peak discharge compared to the fall or winter periods. However, a short duration near-bankful flow in spring would allow one or two more months of growing time for the plants.

Only one of the three short duration near-bankful flows would be necessary in any given year. However, they could be used in combination in certain years. Each short duration near-bankful flow type would be implemented experimentally during the adaptive management program (but not in the same water year) to determine their relative effectiveness in maintaining a wide active channel. A mixture of these options may prove to be the most desirable approach over the long term.

A key component of the short duration near-bankful flow implementation would be the operational monitoring of weather, river flows, sediment loads, channel cross sections, endangered species activity, and cottonwood seed dispersal and growth. Monitoring during the various stages of vegetation establishment and growth would be critical to the effective use of flow in removing vegetation and maintaining a wide active channel.

FERC Requirements. The Federal Energy Regulatory Commission (FERC) has issued rules that require certain operations of CNPP&ID and NPPD. These operation are called the FERC requirements.

Minimum Canal Diversions. FERC has set minimum and average canal diversion requirements for the Tri-County Diversion. These are discussed in detail in the *Cooperative Agreement* dated July 1997, and are summarized below in **Table 3.4.1-1**. FERC has also set release requirements for lake McConaughy for the Keystone Diversion during the non-irrigation season. These are summarized in **Table 3.4.1-2**.

Table 3.4.1-1

Diversion Requirements for the Central Diversion during the Non-Irrigation Season

	Diversion Requirements (cfs)					
	10/1 - 11/15		**11/16 - 2/14**		**2/15-beginning of Irrigation Season**	
Condition	**Min.**	**Avg.**	**Min.**	**Avg.**	**Min.**	**Avg.**
Very Wet	1,000	1,600	800	1,000	1,100	1,400
Wet	900	1,200	800	1,000	1,000	1,240
Transitional	900	1,000	800	950	850	1,100
Dry	700	900	700	850	800	960
Very Dry	Consultation among affected parties to maximize multiple use and share effects of shortages.					

Table 3.4.1-2

Releases from Lake McConaughy for Keystone Diversion during the Non-Irrigation Season

Condition	**Minimum (cfs)**	**Average (cfs)**
Very Wet	700	875
Wet	450-700	not defined
Transitional	450	900
Dry	250	700
Very Dry	250	700

Flow Attenuation Plan. During the irrigation season, precipitation events can cause a decrease in demand for water to meet the irrigation needs in the Central Nebraska Public Power and Irrigation District (CNPP&ID) system. This can be thought of as a "rejection" of water. The rejection of water already in the system but not yet delivered leads to an increase in water returned to the Platte River at the Johnson #2 hydropower return (J2 Return). In combination with higher flows in the Platte River due to the precipitation event, the unused

irrigation water may increase the total flow in the Platte River to a level where it can inundate least tern and piping plover nests. Article 212 of CNPP&ID's 1417 FERC license requires CNPP&ID to use its best efforts to attenuate the increased flows in the Platte River that sometimes result from the rejection of irrigation water during the nesting season (approximately June 1 to August 15).

The discussions below summarize operational changes at Johnson Lake and adjacent facilities. Johnson lake is the reservoir closest to the J2 return and provides the best opportunity to attenuate flows. Details of these operational changes and related issues can be found in CNPP&ID's *Flow Attenuation Plan* document dated July 2000.

Johnson Lake

Regular Operation. Johnson Lake is located near the downstream end of the Central District Supply Canal. Inflows into Johnson Lake fluctuate as a result of many conditions including changes in the diversion rate at North Platte, the discharge rate through the Jeffrey hydropower planed, flow through the Jeffrey return, precipitation and irrigation from the supply canal and the E-65 irrigation canal. Johnson Lake is operated within a narrow elevation range to provide hydropower head on the Johnson #1 (J1) hydropower plant, head for the E-67 irrigation canal, recreation, and to provide a limited amount of water during peak irrigation demand. Normally, outflows form Johnson Lake fluctuate as inflows fluctuate to avoid either increasing the elevation of the reservoir to a level which can cause bank erosion or decreasing the elevation to a level which would result in less efficient hydropower and irrigation operations. The normal operating range for Johnson Lake is approximately 2618.0 to 2618.5 feet during the summer months and approximately 2617.5 to 2618.0 feet during the winter months.

Operation for Flow Attenuation. CNPP&ID's flow attenuation efforts are intended to manage lake levels within the range of 2617.5 to 2619.0 feet to provide space in Johnson Lake to capture runoff from a precipitation event while keeping the elevation from exceeding 2619.5 feet on most occasions. When Johnson lake operations are considered along with the space available in the J2 forebay, there are approximately 2,500 acre-feet of space available to attenuate flows that result from the rejection of irrigation water. For example, the space could be used to attenuate 250 cfs of rejected irrigation water for about 5 days.

The objective of the Attenuation Plan is, where feasible, to avoid exceeding the benchmark flow at the Platte River gage near Overton. If rejected irrigation water available to be returned to the Platte River will not cause the flow at the Overton gage to exceed the benchmark flow, no attenuation is necessary, and the space in Johnson lake will remain available for future attenuation.

Elwood Reservoir

Regular Operation. Elwood Reservoir is located about 3 miles south of Johnson Lake. It was constructed about 5 miles downstream of the headgate of the E-65 irrigation canal to supplement diversion at the headgate and meet the irrigation demand on the E-65 system. Prior to the irrigation season, water is diverted into the E-65 canal and pumped into Elwood Reservoir for use later in the irrigation season. Depending on the elevation of Elwood Reservoir, each of the three pumps at the station can pump 50 cfs to 75 cfs into Elwood

Reservoir. The three pumps combined can pump 150mto 225 cfs. Irrigation demand along the E-65 system typically requires 400 to 500 cfs during the irrigation season. During the irrigation season, when irrigation demand on the E-65 system exceeds the amount available to be diverted, water is released from Elwood Reservoir. Fluctuations in irrigation demand are usually covered by fluctuating the rate of outflow from Elwood Reservoir and keeping a relatively steady diversion at the headgate of the E-65 canal.

Operation for Flow Attenuation. After a precipitation event, if the continuing irrigation on the E-65 system is between 350 cfs and 500 cfs, the diversion into the E-65 canal will not normally be reduced but the outflow from Elwood Reservoir will be reduced to avoid overtopping the canal system. If the continuing irrigation demand decreases below 350 cfs, in addition to stopping the outflow from Elwood Reservoir and meeting the irrigation demand for the E-65 canal, CNPP&ID will pump water into Elwood Reservoir whenever it is operationally and mechanically feasible provided the following conditions are met:

- irrigation demand is sufficiently low that the diversion capacity into the E-65 canal exceeds the demand by enough to operate at least one pump at its design capacity.

- Water rights must allow the available water to be pumped into Elwood Reservoir.

- Consistent with conservation commitments, CNPP&ID will only pump water into Elwood Reservoir that it anticipates will be used for irrigation during the non-irrigation season and avoid high Reservoir elevation during the non-irrigation season that would increase total losses and out-of-basin losses.

Other Methods to Attenuate Increased Flows

Rainwater Basin Wetlands. CNPP&ID will continue to deliver surface water to Rainwater Basin wetlands which hold valid state water rights and will serve additional wetlands that obtain valid state water rights.

Additional Storage Facilities. CNPP&ID has in the past, is currently, and is likely in the future, to investigate additional storage options along the Supply Canal upstream and downstream of Johnson Lake. If additional storage space is constructed, CNPP&ID will evaluate these reservoirs during the design phase to determine whether they could be efficiently operated to aid in attenuating increased flows in the Platte River due to rejected irrigation water while fulfilling their intended functions.

Net Controllable Conserved Water Attributable to Reclamation Funds. According to the CNPP&ID report, “Estimate of Net Controllable Conserved Water”, Reclamation funds were used on six conservation projects at the downstream end of the CNPP&ID system, all of which were distribution system improvements. The “Net Controllable Conserved Water” from these projects is estimated to be 487 acre-feet per year. The percentage of Net Controllable Conserved Water from these projects that is attributable to Reclamation funds is equal to the percentage of costs for these conservation projects that was paid for by Reclamation funds.

CNPP&ID examined the total costs associated with implementation of the distribution system improvements partially funded with Reclamation funds. The purpose for examining these costs

was to determine the percentage of costs attributable to Reclamation funds, so that a proportionate share of conservation savings could be credited to the Reclamation funds. These costs, and assumptions relating thereto, are summarized as follows:

Direct Improvement Costs - These are direct costs associated with installation of the distribution system improvements. These would include costs of materials, costs of installation, and administrative costs. One half of these costs were paid by Reclamation funds.

Operations and Maintenance Costs - these are ongoing costs associated with operating and maintaining the distribution system improvements. These improvements also have some offsetting reductions in the operations and maintenance (O & M) costs that preceded implementation, i.e. maintenance costs of a new pipeline could be offset by the reduced maintenance costs from eliminating an open lateral. The new O & M costs are only slightly higher ore nearly equal to the offsetting reductions in other O & M costs. Therefore, for purposes of simplicity and economy of scale, net changes to O & M costs are assumed to be zero.

Hydropower Impacts - Conservation of water in the irrigation system, and the contribution of some of that water to the Environmental Account, can have positive and negative effects of hydropower generation at CNPP&ID's three supply canal hydropower plants. Fore example, some of the conserved water that would have been lost in the E-65 or E-67 systems will potentially be available to pass through two more supply canal hydropower plants. On the other hand, conserved water from any irrigation system, if added to the Environmental Account, can potentially be released at a time when no capacity exists for CNPP&ID to divert, which would represent a loss of supply canal hydropower generation. While it is difficult to assess all potential impacts to the supply canal hydropower plants, it appears the net affect would be no change or possibly a slight loss in generation. For purposes of simplicity and economy of scale, net changes to supply canal hydropower generation are assumed to be zero.

Because the net impacts to O & M costs and hydropower generation are assumed to be zero, the approximate cost of the conservation projects partially funded by Reclamation funds is therefore assumed to be equal to the direct improvement costs, of which the Reclamation funds paid about 50 percent. Therefore, the Net Controllable Conserved Water attributable to Reclamation funds is calculated to be 50 percent of 487 acre-feet pre year, or 244 acre-feet per year (approximately 0.2 KAF/year). Pursuant to Article 402 of CNPP&ID's FERC license, CNPP&ID will contribute this amount of water to the Environmental Account on October 1 of each year.

North Platte Choke Point. The terminology "North Platte Choke Point" refers to the channel capacity in the North Platte River at North Platte, Nebraska, at the official flood stage defined by the national Weather Service. This capacity is currently 1,980 cfs, which is significantly lower than the channel capacities at other locations along the North Platte, South Platte, and Platte Rivers. This significantly limits releases from Lake McConaughy for purposes such as EA short duration near-bankful flows to discharges such that flood stage will not be exceeded in the North Platte River at North Platte. The central Platte OPSTUDY model assumes that this "choke point" limits environmental flows past the town of North Platte, Nebraska.

Pathfinder 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 would be filled with water stored under the existing 1904 storage right for Pathfinder Reservoir with the exception that regulatory calls could not be placed on existing water rights upstream of Pathfinder Reservoir other than the 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.

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 that 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, they will make a conservative judgment as to the amount of water that may be required prior to June 1 of each year. Accounting for depletions will occur after September 30th.

- 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 its "existing water related activity baseline" the amount of excess would be subtracted from the amount of water provided to the Program to determine the amount that Wyoming would get credit from the Program for. 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". Wyoming will quantify the amount of excess at the Wyoming/Nebraska state line in which case, tracking and accounting procedures will need to be agreed upon.

Average Annual On-Site Yield and Timing. The amount of water available to the Program is dependent on the amount needed to supplement municipal water rights and/or mitigate excess depletions. This amount will vary on a year to year basis, however, Wyoming anticipates that 4,800 ac-ft would be available to the Program on an average annual basis (Wyoming's December 16, 1999 proposal). 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 in the month of September to minimize conveyance losses.

Firm yield has been defined as the mean annual reservoir release that can be guaranteed based on the analysis of historic data. Predicated on this information, the demand for use of the Pathfinder Municipal account set in the NPREIS was equal to 9,600 AF annually. Putting additional demands on this account would cause shortages during dry periods. Therefore, it was necessary to recalculate these demands such that the combination of deliveries for Wyoming and deliveries for the program never exceeded 9,600 AF in any year.

Wet, dry, and average years were determined from the Grand Island Gage, dry years are the bottom 25% of the flow years, wet years are the top 33% of the flow years, and the remaining years are average. The EIS assumes that the program receives no water in dry years, 9,600 AF in wet years, and 3,900 AF in average years.

Tamarack Phase III. The Enlarged Tamarack Plan will also include canals that divert water directly from the South Platte River and wells located adjacent to the river that pump groundwater from the alluvial aquifer. Water that is diverted or pumped will be conveyed to recharge sites in sandy uplands away from the river where the water would percolate into the alluvium and return to the South Platte River at a later time.

Average operational effects of an enlarged Tamarack Plan on the South Platte River estimated on the basis of historical data for the 1943-94 period are given in **Table 3.4.1-3.**

Table 3.4.1-3

Enlarged Tamarack Plan Average Operational Effects

	Total depletion from	**Net yield to**

Month	South Platte River (acre-feet)	South Platte River (acre-feet)
October	0	2,340 to 2,790
November	0	2,070 to 2,480
December	-8,890 to -11,000	-6,980 to -8,710
January	-9,060 to -11,290	-6,680 to -8,410
February	-9,240 to -11,580	-6,205 to -7,880
March	-9,180 to - 11,380	-5,510 to -6,890
April	-5,070	-630 to 370
May	-3,030	1,790 to 2,700
June	0	4,540 to 5,300
July	0	3,630 to 4,280
August	0	3,040 to 3,600
September	0	2,640 to 3,140
Annual	44,460 to 53,350	-5,960 to -7,230

Expanded recharge is also being considered for the Peterson and South Reservation Ditches, which divert from the South Platte river immediately downstream of Sedgwick, Colorado. Return flows that result from such recharge accrue to the river for some duration after the recharge event depending on the hydro-geologic conditions and the distance from the site to the river. Recharge sites will need to overlie the alluvial aquifer and be hydrologically connected to the river. In general, Colorado is considering sites with SDF factors ranging from 60 days to 300 days.

Colorado will also operate the Tamarack Plan, after consultation with the manager of the Environmental Account in Kingsley Reservoir, in a manner that does not cause an increase in target flow shortages at the critical habitat unless requested otherwise by the Environmental Account Manager, as measured at the Grand Island gage and using FWS target flows which are then in effect.

The Tamarack Plan would need to be operated under the flow requirements of the South Platte River Compact, which requires that discharge at the South Platte River at Julesburg, CO, not be less than 150 cubic feet per second from April 1 through October 15 of each year. Some of the depletions from the South Platte River would be by surface diversion, but the diversion capacity would be reduced during the irrigation season because of agricultural priority for the diverted water. During the winter months, when surplus water seems to be more available, surface diversions would play a smaller role because of freezing temperatures, requiring a heavier reliance on pumping.

Depletions from the South Platte River also may not be possible for some months because designated target flows in the habitat area in Nebraska are not being met.

Glendo Reservoir, Wyoming, Unassigned Water

Location of project. Glendo Reservoir is on the North Platte River in east central Wyoming, about halfway between Casper, Wyoming, and the Wyoming-Nebraska state line.

Basic description of project/ operating concept. 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 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. The Glendo Stipulation provides for several changes to the 1953 Order that relax the conditions under which Glendo storage can be used. Significant changes with respect to the Program 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 currently 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 the remaining 10,600 ac-ft of storage (Wyoming December 16, 1999 proposal).

Water in excess of that needed to meet contracted demands and potentially replace Wyoming's excess depletions would be available to the Program. Wyoming estimates that 2,700 ac-ft of Glendo storage would be available to the Program on an average annual basis (Wyoming's December 16, 1999 proposal). The amount available is subject to further evaluation of the average annual yield that may be derived from the 10,600 ac-ft of storage and may change.

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, they will make a conservative judgment as to the amount of water that may be required prior to June 1 of each year. Accounting for depletions will occur after September 30th.

- 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 its "existing water related activity baseline", the amount of excess would be subtracted from the amount of water provided to the Program to determine the amount for which Wyoming would get credit 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". Wyoming will quantify the amount of excess at the Wyoming/Nebraska state line, in which case, tracking and accounting procedures will need to be agreed upon.

100,000 Acre-Feet in Glendo Reservoir

Location of project. Glendo Reservoir is on the North Platte River in East Central Wyoming, about halfway between Casper, Wyoming, and the Wyoming-Nebraska state line.

Basic description of project/ operating concept. Convert 100 kaf of restorage space in Glendo Reservoir to an environmental account for the use of threatened and endangered species. This right would have a current priority and would be junior to all other rights in the system. The space would collect water that is currently being collected in the excess-to-ownership (ETO) for the North Platte reservoirs. Waters stored in this account would be moved down to the Lake McConaughy EA in late summer. In very wet years, some water might be carried over to the next water year.

Average Annual On-Site Yield and Timing. Estimated average operational effects of the 100,000 acre-foot account in Glendo Reservoir on the North Platte River are given in **Table 3.4.1-4**.

Table 3.4.1-4

Glendo Account Estimated Average Operational Effects

	Storage	**Release/Exchange/ Yield to River**

Month	(acre-feet)	(acre-feet)
October	0.0	0.0
November	0.0	0.0
December	0.0	0.0
March	0.0	0.0
April	0.6	0.0
May	6.4	0.0
June	12.7	0.0
July	13.0	19.5
August	0.0	13.3
September	0.0	0.0
Total Local Yield	32.6	30.8

Legal and institutional requirements for implementation. The space in Glendo reservoir currently has a water right to restore water released from Pathfinder Reservoir through Fremont Canyon Power Plant during the non-irrigation season. Reclamation would have to file for a change of use on 100 kaf of this space. Then Reclamation must file for a 2000+ water right on the 100 kaf space. The Wyoming legislature would need to approve the exportation of the stored water from the state. The right would have to be consistent with the North Platte Decree.

Power Interference. The Power Interference element is envisioned to operate primarily at CNPP&ID's Kingsley Dam/Lake McConaughy facility in conjunction with the McConaughy Environmental Account. NPPD's Sutherland System and North Platte Hydro facility would also be involved as the Districts projects operate cooperatively.

There are periods when releases from Lake McConaughy in combination with South Platte River flows and/or downstream river gains result in flows between Overton and Grand Island which exceed the Service's instream flow recommendations. Scaling back a portion of the McConaughy releases (while still meeting NPPD's and CNPP&ID's "basic needs") would allow dowstream flows to still meet instream flow targets, and the "excess" flow could be "purchased" by the EA to be released at a later time when the Districts planned releases and downstream river gains would not meet instream flow recommendations. When the water is subsequently released, it may or may not be available for diversion and routing through the Districts hydro facilities depending on river conditions in effect. The differences in generation, both in amount and time of year, would be considered in the cost of the water purchased.

The amount of the planned release from McConaughy that is available for purchase by the EA is limited to the smaller value of:

- Excess instream flow at Grand Island.
- Excess instream flow at Overton.
- Excess flow at Tri-County Diversion Dam (amount in excess of canal maintenance flow, flow to refill Johnson Lake and Elwood Reservoir).
- Excess flow at NPPD's Keystone Diversion Dam (amount in excess of canal maintenance flow, including icing considerations, and flow needed for Sutherland Reservoir operation.
- Flow from the J2 return greater than the minimum necessary to operate the power plant.

Because of travel times from Lake McConaughy to Grand Island (7-10 days), river conditions would have to be fairly steady or predictable in order to agree upon what volume of water is available for purchase by the EA. Other considerations would include current storage levels in both Lake McConaughy (total storage), the storage volume in the EA, and whether a spill condition may exist in the near future.

Table 3.4.1-5 shows the Average EA Accrual and Average EA release for 1) the 3-State Plans (Nebraska EA, Pathfinder Modification, and Tamarack Plan) and 2) the 3-State Plans plus Power Interference. As shown in this table, the volume of water "purchased" was subsequently lost as spill due to the reservoir being at regulatory capacity and may not have provided and instream flow benefit.

Table 3.4.1-5

Effect of Power Interference on EA Accrual and Release

Month	Average EA Accrual, KAF		Average EA Release, KAF	
	3-State Plans	3- State Plans Plus Power Interference	3-State Plans	3- State Plans Plus Power Interference
Oct.	11.6	13.1	7.9	3.3
Nov.	9.9	12.8	5.7	6.8
Dec	8.5	14.3	0.0	0.0
Jan	7.9	14.0	0.0	0.0
Feb.	8.7	9.8	12.0	18.7
Mar.	8.9	9.5	16.8	14.3
Apr.	8.7	9.6	0.0	0.0
May.	3.2	3.2	22.1	21.6
Jun.	1.1	1.1	12.0	14.0
Jul.	14.2	14.2	4.5	5.4
Aug.	14.8	14.8	15.4	19.5

Sep.	1.1	1.1	6.9	7.0
Total Yield	98.5	117.5	103.3	110.5

Operations would primarily be done during the non-irrigation season (October through April), with the potential for other time periods depending upon unusual circumstances.

Groundwater Mound

Introduction. The potential for developing the CNPP&ID groundwater mound as a reservoir for Platte River flow augmentation was evaluated. The concept is to design a well field that would allow withdrawl of water during the irrigation season, and recharge during periods of excess flows. The pumped water will be discharged to the CNPP&ID distribution system for irrigation. Recharge would be provided through canal seepage, surface spreading, seepage pits, injection wells, injection drains, or some combination of these methods.

Only relatively shallow water table areas were considered and only the top 5 to 10 feet of saturated thickness is to be used as a reservoir. These restrictions were imposed for several reasons.

- Wetland areas can be easily protected if drawdown curves are shallow.

- Low head pumps can be operated on single phase power.

- Power costs are minimized when pumping from shallow depths.

- Well construction costs are small for shallow, small diameter wells.

The well spacing, depth, diameter, screened interval and other design considerations are based on typical aquifer characteristics that have been reported for the service area. This feasibility level estimate will need to be refined by site specific data collection before final designs can be made. However, the estimated values used are reasonable for the target aquifer and are mutually compatible.

<u>Location.</u> Based on the principles submitted by Nebraska, groundwater management has been limited to a total yield of no more than 6,000 acre-feet/year until it can be successfully demonstrated through a phased-in project that groundwater mining will not occur at this level. Nebraska has indicated that they will not consider expanding groundwater management unless further investigation and study reveals that higher yields can be sustained. Nebraska is reserving 50 percent of the total groundwater yield to offset net depletions, in which case the remaining 50 percent, or 3,000 acre-feet/year, can be made available to the Program.

Locations in Nebraska being considered for groundwater management include a 13,000-acre area under the Phelps Canal, the Reynolds and Robb wetland area, other, smaller areas in Phelps and Kearney counties, and areas under the Dawson and Gothenburg Canals on the north side of the Platte River.

<u>Basic Description.</u> Groundwater management can be accomplished in a

number of ways. Several options that could be implemented are listed below.

Active Groundwater Pumping from High Groundwater Areas. With this option, 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 discharge water into Lost Creek and/or North Dry Creek for return to the Platte River. Up to nine wells would be required to pump 3,000 acre-feet/year.

Passive Lowering of the Groundwater Table. With this option, farmers would be paid 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.

Groundwater Irrigation. Farmers would be paid to install 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.

Conjunctive Use. A conjunctive use project under CNPP&ID's system would consist of shallow wells that discharge directly into CNPP&ID'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 CNPP&ID's distribution system for recharge to the local groundwater aquifer. The aquifer would be recharged to a pre-determined lever. Every 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.

Direct Diversion from the Platte River. This option would be considered for the Dawson and Gothenburg Canals only. It 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. Return flows that result from canal seepage would accrue to river for some duration after the recharge event. Diversion 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.

Service area definition. To evaluate the feasibility of this proposal, the location of observation wells were identified on a map of the state. Records for wells within the mound area were sorted to include those with readings in 1995 or later and where water table levels are less than 40 feet from the ground surface . The mound contains two separate lobes. The eastern lobe lies in Gosper, Phelps, and Kearney Counties while the western lobe lies in Lincoln County.

Recharge Plan. Recharge water will be transported to the recharge facilities through the canal system during non-irrigation season periods of excess flows. The recharge facilities may consist of pits, wells, pipe drains, surface spreading through irrigation machines, or a combination of these methods. Each has its strengths and weaknesses. The O'Neill Unit Special Report Ground Water Recharge Plan dated January 1992 is based on research conducted by the Reclamation Kansas-Nebraska Projects Office. Recharge lines (drains), recharge pits, saturated recharge wells, and unsaturated recharge wells were compared. Only the unsaturated wells produced unsatisfactory results and the recharge lines were the most hydraulically efficient. Similar demonstration projects may be useful in determining the preferred recharge methods to be used here.

Pipe drain recharge lines will be placed midway between the wells at a nominal depth of 5 feet. The drains will consist of High Density Polyethylene corrugated perforated pipe laid in a graded sand and gravel envelope. They will be sloped for gravity flow.

Recharge pits will be located in the corners of center pivot irrigation systems. They will be about 3 feet in depth with a berm around the edge to prevent surface flows containing silty sediments from entering. The primary problems with recharge pits are algae growth and frequent cleaning.

Recharge wells would be similar construction to the production wells and may even be the same wells, although this arrangement can introduce new problems. For instance, if recharge water degrades the aquifer, a production well may be lost.

Surface spreading would be accomplished by operating irrigation machines during the non-irrigation season. Surface spreading is simple and effective but carries relatively high operation and maintenance costs, has relatively high evaporation loses, and may flush nutrients from the root zone.

Riverside Drains

Introduction. Agricultural lands near the Platte River often experience water logging problems due to the flat gradient toward the river. Some of these lands could be drained by agricultural drains. Lands which are actively cultivated and have a typical spring water table of less than 5 feet would be considered for drainage. Drains would provide supplemental water for in-stream flows as well as benefiting the lands. Alternatively the water could be used for drought cycle sustenance or for enhancement of existing wet meadows. The water would tend to cool the river water to a limited extent during hot weather periods, and would warm the water during winter months.

Possible sites for treatment were identified using USGS 7.5 minute quadrangle sheets; existing monitoring well records from the State of Nebraska web site and from the CNPPID files; satellite images taken on May 26, 1999 with wetness factor emphasis; and color infrared photos taken on May 12, 1999. The most recent precipitation event previous to the 2 photo episodes was on May 4 and 5 when Platte Valley between North Platte and Kearney received between ½ inch and 2 inches of precipitation. Wet soils from that event could possibly be visible in some of the May 12 infrared photos. The soils would have been well dried by the time the May 26 satellite images were taken. The next most recent precipitation event was on April 21 and would have been well dissipated before any of the photos were taken. Only those lands that are under active cultivation were designated. Lands that are not currently cultivated were considered to be wet meadows and therefore exempt from this proposal. These lands could be considered if they do not meet all the criteria of a wet meadow as defined by F&WS. No field verification has been carried out.

Geologic/Hydrologic Setting. The Central Platte River lies in a wide shallow valley embedded in quaternary deposits of sands, gravels, silts and clays. The quaternary deposits overlie the Ogallala Formation and in the Central Platte Valley this combination constitutes the High Plains Aquifer. The soil profile is generally more than 100 feet thick and has relatively high hydraulic conductivity. There are no extensive barriers to ground water movement which would complicate management of the ground water by artificial drainage facilities. The connection between ground water and the Platte River is well established and continuous.

Ground water to the south of the Central Platte is elevated due to seepage from irrigation and related distribution systems. The seepage has created a ground water mound with a gradient toward the Platte River, resulting in continuous accretions to the river from the mound. To the north, the ground water level is generally at or near the elevation of the river and fluctuates with seasonal precipitation and irrigation withdrawals. Water table depths of less than 5 feet are common on both sides of the river.

Geographic Setting. The lands that appear to be adaptable to this plan lie along either side of the Platte River on the first or second terrace. On the south side of the river, lands meeting the criteria of shallow water table, occur intermittently from the Tri County Canal diversion a length of about 70 miles to the east edge of Range 21 West. From there, lands meeting the criteria lie in a continuous strip that extends to the east edge of Range 14 west; a distance of 42 miles. A reasonable estimate for development would be 25 miles of drain in each of the 2 segments for a total of 50 miles of drains.

The areas meeting the water depth criteria on the north side tend to be discontinuous but more broad than those on the south side. The strip generally lies south of highway 30 and is from 1/4 mile to about 3 miles wide. It extends from the town of Maxwell to east of Kearney for a distance of about 100 miles. Within this area, possibly 50 miles of drain could be constructed to produce supplemental flows. About half of these drains would be west of the town of Overton and half would be to the east of Overton.

General Plan Description. Drains could be constructed across lands on the first or second terrace above the river that are experiencing reduced agricultural productivity due to seepage and salinity. The drains would be constructed in locations and at depths which would provide relief to seeped agricultural lands but would not lower the water level in nearby wetlands. Such construction requires intensive investigations and is not always practical. Some of the lands are wet meadows and would not be considered for this treatment. Only fields that are actively cultivated would be considered for drainage.

If 100 miles of drains were constructed, the flow from the drains would be on the order of 40,000 acre-feet annually of which about 8,000 acre-feet would be salvaged water. The other 32,000 acre-feet currently reach the river and would not add to the flows. Drains on the south side of the river would yield more than drains on the north side because the ground water mound would maintain flows during the non-irrigation season while drains not influenced by the mound would have reduced flows during the late fall and winter.

Much of this water reaches the river under current conditions, and would not add water to the system. However, non-beneficial evapo-transpiration reduces the volume of water reaching the river and that water would be recovered and added to the system through pipe drains. The magnitude of non-beneficial evapo'transpiration is influenced by topography, geology, depth to ground water, land use and cropping practices, and wetland habitat value. As used here the term non-beneficial evapo-transpiration means ground water that evaporates directly from the soil surface, or is used by vegetation which has no value to wildlife or agriculture. The depth of water (acre-feet per acre) may range from about one tenth of a foot per year where cultivated fields remain green after harvest, to more than a foot per year in saline seep areas, sometimes called "slick spots." A reasonable assumption of average depth of water that could be salvaged would be 0.5 feet.

Certain farmsteads and other residences that are found to be adversely affected by the project could be treated in the same fashion. The benefit cost ratio may be less attractive but would add some water to the project while promoting good will and satisfying a Nebraska law that prohibits degradation of property by causing ground water seepage.

The outflow from the drains would be a point source of warm water in the winter and cool water in the summer. Typically, an area of open water will remain during very cold weather periods for several hundred feet downstream from a drain outlet. The same sort of cool water area exists during hot weather periods in the summer. These areas become a haven for small fish which sometimes even migrate up the drains for considerable distances. On Reclamation drainage projects in Nebraska, minnows have been seen in manholes more than 1,000 feet from the drain outlet. The temperature change would not have a significant impact over long reaches of river nor would the cooling or warming extend across the braided channel. **(NOTE: The biological significance of this phenomenon is under consideration.)**

Typical Drain Design. Typical construction would be 6-inch to 18-inch corrugated perforated plastic pipe buried 6 to 10 feet deep and encased in a graded gravel envelope. Typical design depth would be 8 feet. Manholes would be installed as needed or at 1,000 foot spacing. Outlet structures would consist of a 20-foot length of corrugated metal pipe with coarse rock protection on the disturbed section of stream bank. A typical drain would be about 5,000 feet long and would discharge up to a peak of 500 gallons per minute with seasonal variation.

The land area influenced by the drain would average 1/4 mile wide and 1 mile long and would produce 80 acre feet of salvaged water annually. The significant difference between salvaged water quantity and estimated flows from the drain reflects the fact that much of the water reaches the river under current conditions and therefore is not salvaged water. Also, the values assumed for this estimate are of reconnaissance level accuracy and are subject to wide variations upon implementation.

Wet Meadow Enhancement. An alternative use for the water from drained agricultural fields would be to sustain wet meadows through drought cycles or to enhance them during normal precipitation periods. The drains could be routed to the wet meadows where the water would be spread on the surface or distributed through a system of buried pipe drains similar to a septic drain field. The criteria used to identify the sites was 1) The wet meadow is located near the farmland to be drained to minimize outlet costs, and 2) the wet meadow is several feet lower in elevation than the drained farmland, so that water will flow to the meadow without pumping. The relative area of the drained farmland to the area of wet meadow that can be benefited is a question at this point. Each situation will be different. A good rule of thumb may be one acre of drained land for one acre of receiving wet meadow.

The drains would need to be provided with an auxiliary outlet to the river that could be used in the event the wet meadow would be harmed by additional water. In that case the water would be added to the flow in the river, possibly precluding the need to release water from the environmental account in Lake McConaughy.

80 KAF Water Bank in 3 States

Basic description of concept. A water bank can be used to facilitate transfers that need to occur to ensure that the correct target flows reach endangered species in the Platte River Basin. A Platte River water bank would more than likely consist of three separate water banks i.e., one in each state of the Proposed Program. It is highly likely that reservoir storage will be a component of these water banks, although water can be either recharged into aquifers which can be used as storage or the banks can manage water use entitlements so that no storage is involved at all. A single bank may operate using all three of these methods as well. There are a few steps in the process of developing a water bank with storage rights. The first step requires getting water from the supply source or original area of use to a storage facility. The second is getting that water from storage to the critical habitat area. Once water is acquired and stored, the next step is to work within the legal and institutional framework set among the three states. Generally, water will be shifted from consumptive uses to instream flows and will have to cross state lines. Interstate transfers may pose some legal and/or institutional problems, but this analysis will assume that the states engaged in the cooperative agreement will manage those issues. The banks should facilitate both temporary and permanent transfers of water rights. Timing of releases is the last step in getting this water to the species and habitat area.

For the Program Water Alternative, it is proposed that 80 KAF of new water be found through the use of water banking. This new water would be equally distributed among the 3 states participating in the Program.

Research[1] has revealed the following regarding water banks in the West:

- In the last 10 years, the average cost of water from the Upper Snake River Water Bank was approximately $4.88/AF.

- Washington's East Columbia Water Banks' average cost was $11.88/AF from 1991-95.

- The Drought Water Bank in California charged $125/AF in 1991 and $50/AF in 1992 and $67.50/AF in 1994 after more efficient planning for their water.

- Water purchased outright for instream uses in the West sold for about $400/AF between 1990 and 1997[2].

Past and current water rights prices (whether it be short-term leases, long-term leases, or permanent acquisition) are scattered all over the board. Water acquisitions among the three states over the past decade have ranged from $7/AF to over $5,000/AF. The price of water can

[1] Water Strategist. Stratecom, Inc. 1990-1999.

[2] Clay L. Landry. Saving our Streams Through Water Marketing: A Practical Guide. Political Economy Research Center, 1998.

be dependent on a number of factors including quantity, quality, use, location, seniority of the right, supply dependability, weather, etc. Without looking at specific sites throughout the West, it is nearly impossible to estimate the price of water. In addition, relatively few transactions may occur in a given area, making it difficult to estimate a relationship between variables, even on a site-specific level. Virtually no research has been conducted to identify factors that may explain market prices or establish relationships to assist in evaluating or forecasting water right prices (Michelson, 1993). The value for water can be expected to fluctuate even over a small period of time due to market and other factors. Willingness to pay for and willingness to accept water for various uses follows a dynamic evolution, because the demand function relies on factors that are dynamic themselves (i.e., economic, social, climatic factors) (Michelson, 1994). Therefore, water bank prices that may be acceptable to irrigators one year, may not be acceptable the next. In light of these facts, we will use the California Drought Water Bank and other water market/bank prices as a proxy for the conceptual Platte River water banks.

Land Fallowing. The method behind pricing water due to land fallowing is to offer a price that would yield a net income to the irrigator similar to what he/she would have earned from farming plus some additional amount to encourage him/her to enter into a contract with a new water bank. Precautions need to be taken when estimating the price paid to fallow land. The total acre feet saved by fallowing a crop is estimated to be the net amount of applied water used by that crop. However, third party impacts are usually not accounted for. By limiting the percent of water acquired through land fallowing is one way to keep these impacts at a minimum. Another way is to rotate irrigators who fallow their land to make a deposit into the water bank. Still another is to set a minimum amount of water sold or land acreage that may be fallowed by a single irrigator or district.

Third Party Impacts. Transfers of water may impact water quantity (availability), quality, and cost. Surface water transfers must accurately duplicate the quantity and timing of the foregone consumptive use of the seller. Water quality improvements may occur if water is left in the stream rather than diverted and returned as agricultural runoff. Reducing non-point runoff from agricultural lands and improving water quality sources may reduce treatment costs of potable water supplies to water users. However, upstream levels that may be reduced can have negative impacts. As streamflows become depleted, water quality standards may be compromised and municipal and industrial dischargers may have to incur greater costs to ensure compliance with national and/or state standards[3]. Suppliers of seed, fertilizer, other chemicals, application and hauling services and the farm labor source may be adversely impacted while firms specializing in farm improvements such as laser leveling may experience positive impacts such as increased sales.

Third Party Impacts should be taken into account in all states and, perhaps, mitigated for especially those that may occur from the practice of fallowing lands currently in irrigation. The amount of land fallowed should be no more than 20% of the total amount of water received from the project to minimize these impacts. Ideally, most water would come from conservation practices. These include:

- conservation cropping patterns

[3] Water Transfers in the West:Efficiency, Equity and the Environment. National research Council. National Academy Press, Washington D.C., 1992.

- deficit irrigation patterns
- conveyance channel modification (structural)
- water control structure modification
- conservation pricing (nonstructural)
- demand based scheduling

Boyle Cost Summary. A preliminary cost summary of some of these conservation practices was provided by Boyle[4]:

Average capitalized cost from deficit irrigation in Colorado per AF of reduction in shortage at the critical habitat would be $4,575 if the saved water in reaches 8 and 9 can be protected from downstream water users. This amount would yield approximately 5,560 AF per year of reductions in target flow shortages at the habitat without diversion losses.

Structural measures in these same reaches would cost an average of approximately $3,755/AF per year and yield an average of 4,232 AF per year of reductions in target flow shortages at the habitat without diversion losses.

Boyle estimated that the average capitalized cost of deficit irrigation in Nebraska per AF of reduction in shortage at the critical habitat would be $4,817 if the saved water in these reaches can be protected from downstream water users. This amount would yield approximately 3,527 AF per year of reductions in target flow shortages at the habitat without diversion losses.

Structural measures in these same reaches would cost an average of approximately $8,912/AF per year and yield an average of 1,132 AF per year of reductions in target flow shortages at the habitat without diversion losses.

Boyle estimated that the average capitalized cost of deficit irrigation in Wyoming per AF of reduction in shortage at the critical habitat would be $5,902 if the saved water in these reaches can be protected from downstream water users. This amount would yield approximately 1,609 AF per year of reductions in target flow shortages at the habitat without diversion losses.

Structural measures in these same reaches would cost an average of approximately $14,628/AF per year and yield an average of 365 AF per year of reductions in target flow shortages at the habitat without diversion losses.

Summary. Possible water rights transfers for water banking purposes are given by state in **Table 3.4.1-6**. A list of potential water banking dams is given in **Table 3.4.1-7**.

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[4] Note that Boyle makes many assumptions surrounding their analysis. For a complete and detailed description of these assumptions and the analysis, please consult the Boyle Report entitled Water Conservation/Supply Reconnaissance Study-Evaluation Memoranda.

Table 3.4.1-6 Possible Water Rights Transfers for Water Banking Purposes				
	Type of Transfer			
State	**Short Term Lease**	**Long Term Lease**	**Purchase**	**Other**
COLORADO	$25-$125/AF+ trans. costs		$4000-$5000/AF	
NEBRASKA				>$19/AF for GW
WYOMING	$3-$5/AF+ O&M	$50-$150/AF	$2500-$5000/AF	

Table 3.4.1-7 Potential Water Banking Dams	
POUDRE DRAINAGE	
Boyd Lake	can deliver water to Big Thompson River via outlet ditch
Fossil Creek	can deliver water to Poudre River via Fossil Cr. Outlet @ dam
S. PLATTE DRAINAGE	
Jackson Lake	can deliver water to S. Platte River via Jackson Lake outlet canal
Prewitt	can deliver water to S. Platte River via Prewitt outlet canal
Riverside	No direct return, map shows possible 3 mile ditch that returns to river
Empire	No return, shortest run ~2 miles to S. Platte River
Sterling	(need maps) - D. Stenzel stated no return to S. Platte River
Julesburg	possible outlet to Cottonwood Creek from dam, CC flows to S. Platte

3.4.2 Run description

3.4.2.1 3-States Plan

Pathfinder Modification. The Pathfinder Environmental Account is operated as has been described in Program Documents. For the EIS, releases from the account are modeled as occurring in April, July, and August. The entire amount stored in the account is released each year to maximize each years accrual. A summary of its proposed operation, as modeled in the NPREIS, fol1ows:

1. Water accrues to the environmental account on an equal priority with other uses from Pathfinder Reservoir. The 34,000 acre foot account is approximately 3.18% (34,000/1,070,000) of the active capacity of Pathfinder Reservoir. Therefore, the account accrues 3.18% of the inflow that is storable under the 1904 storage right.

2. The environmental account does not contain more than 34,000 acre feet at any one time. For example, if at the end of a water year, which is defined as October 1 to September 30, 10,000 acre feet of water is in the account, the account can only accrue 24,000 acre feet under its priority fill during the forthcoming water year.

3. The environmental account is assessed its proportionate share of evaporation losses based on the water stored in the account.

4. The environmental account is administered and operated in a manner consistent with Wyoming water law and the North Platte Decree.

The modeling of three state elements in the Central Platte OPSTUDY model during the MOA negotiations assumed deliveries from the Pathfinder Environmental Account during July and August. After discussing the issue with the Fish and Wildlife Service in Grand Island, Nebraska, we concluded that there are biological benefits to having water available either prior to May or early in the irrigation season. Water is not moved in May and June due to the possibility of high flows during these months, thus the water is delivered in April, July, and August. Losses to environmental deliveries are assigned based on the carriage losses in the settlement to the Nebraska vs. Wyoming lawsuit and the losses in April are assumed to be the same as those in September. The losses in July and August are greater than those in September, thus there is a reduction in the amount of water reaching the Wyoming/Nebraska state line and the EA in Lake McConaughy in Nebraska.
Deliveries from the Pathfinder Environmental Account in April, and any other month, are limited to the water stored.

Tamarack. The Tamarack Project is operated as has been described in Program Documents. A summary of the proposed operation and how it is modeled fol1ows:

1. The maximum diversion capacity into the Tamarack Project by month is as shown in **Table 3.4.2-1**:

Table 3.4.2-1 Diversion Capacity by Month in Acre-Feet												
Mo.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Vol	6800	6800	9800	9800	0	0	0	0	0	9800	12800	6800

2. The project is operated in such a way as to increase flows at the Julesburg gage during the period April through September by an average of approximately 10,000 acre-feet over the flows that would otherwise occur during the period.

3. At other times of the year, the magnitude of diversions into the Tamarack Project is dependent on the shortage/excess of flow at Grand Island with respect to target flows.

Lake McConaughy Environmental Account. The Lake McConaughy Environmental Account (EA) is operated as has been described in Program Documents. For the EIS, releases from the account are modeled as occurring in all months except December through February, and water is held in the EA for May short duration near-bankful flow releases. Pulse flow releases have priority, followed by summer low-flow releases. The volume remaining in the EA at the end of a water year is carried over into the next water year. A summary of the proposed operation, as modeled in the Central Platte OPSTUDY model, fol1ows:

1. Ten percent of Lake McConaughy inflows between October and March of a given year are credited to the EA.

2. The total quantity of water in the EA in Lake McConaughy is not allowed to exceed 200,000 acre-feet (af) at any time.

3. Whenever Lake McConaughy fills to regulatory capacity as defined by FERC's dam safety requirements for Project No. 1417 and the EA is less than 100,000 AF, the EA is increased to 100,000 AF regardless of the quantity of EA water already released during that water year.

4. At any time that Lake McConaughy reaches regulatory capacity as defined by FERC's dam safety requirements for Project No. 1417 and the EA exceeds 100,000 AF, the EA is reduced to 100,000 AF regardless of the sum of the contributions from the states and from Conservation Activities, or the quantity of carryover from a prior year.

5. Storage losses for Lake McConaughy and other Approved Storage Facilities shall be calculated and assigned monthly to the EA using the following formula: ((average monthly storage in the EA)/(average monthly storage in total)) * (total losses for the storage facility for that month).

6. Contributions to the EA are protected from groundwater or surface water depletion from the state line or the source of contribution from within Nebraska to Lake McConaughy or other Approved Storage Facilities.

7. Water stored in projects in Wyoming may be **transported** to the EA. That is, water is released from these projects and flows directly into Lake McConaughy for storage in the EA. This water is subject to conveyance and other losses. Projects in Wyoming include the Pathfinder Modification, Glendo ETO, La Prele Reservoir leasing, etc.

8. Water stored in projects in Nebraska may be **credited** to the EA. That is, the volume of the EA will be considered to have increased by the volume of water that is located and/or stored as a result of these projects. Projects in Nebraska include the central Platte re-regulating reservoir, central Platte power interference, groundwater conjunctive use, and other projects as the water becomes available to the Program and the EA.

The EA in Lake McConaughy is operated to increase flows in the central Platte habitat area. Water is released from the EA depending on the Platte River flows in the habitat area, the time of year, and the amount of water available in the EA. The amount available in the EA is calculated by subtracting any amount held in reserve for use later in the year from the amount stored in Lake McConaughy. If the amount available from the EA is not greater than the amount needed to make the minimum EA release, no release will be made.

3.4.2.2 Other Elements

Short duration near-bankful Flows. The modeling of short duration near-bankful flow releases from Lake McConaughy is based on simulated daily flows at which are computed by the OPSTUDY model. Short duration near-bankful flow releases are only generated in April or May. The generation of short duration near-bankful flows includes several elements besides the EA in Lake McConaughy. The following text describes each element and how it is used during the short duration near-bankful flow event.

Lake McConaughy Environmental Account. The goal of a short duration near-bankful flow is to have a flow near bank full capacity (~10,000 cfs), but below flood stage, at Overton every year (100% of the time). Based on the estimated flow out of Lake McConaughy for May the model estimates the flow at Overton without a short duration near-bankful flow release. The potential short duration near-bankful flow release is.

> The difference between 10,000 cfs and the estimated flow at Overton.

> Constrained by.

- > the available release capacity form Lake McConaughy,
- > the combined flow capacity in the Sutherland Canal and the North Platte River at North Platte, Nebraska,
- > the ramp rate for releases from Lake McConaughy (the Keystone diversion and down the North Platte River), and
- > the volume of water available in the EA.

After calculating the potential short duration near-bankful flow release, the model will only make a short duration near-bankful flow release if the following conditions are true.

- > The estimated May peak flow at Overton without a short duration near-bankful flow is less than 6,500 cfs.

> The estimated average flows in May and June are less than 3,800 cfs individually or both are less than 2,000 cfs.

> Lake McConaughy is not estimated to spill in June and the average flow in the South Platte River at Julesburg in June is not greater than 700 cfs.

> There were no flows since October 1 in excess of 5,500 cfs.

> The flow at Overton will be greater than 3,500 cfs with a short duration near-bankful flow.

> The short duration near-bankful flow will increase the flow at Overton by at least 1,000 cfs.

Simplified, the above criteria are: do not make a short duration near-bankful flow if.

> there is a good chance that there will be a natural peak in May or June greater than 6,500 cfs,

> there has already been a natural peak of at least 5,500 cfs since last October 1, or

> the short duration near-bankful flow release will not significantly increase flows at Overton.

North Platte River. Ramping rates on the North Platte River are likely to be a concern. Short duration near-bankful flows will require a great deal of coordination with downstream irrigation canal operators. The concerns are trash, deadwood, and other debris that will be mobilized by short duration near-bankful flows that could clog or otherwise damage diversion facilities. Another concern is the effect of short duration near-bankful flows on facilities such as sand dams. Therefore, it will be necessary to test and monitor small short duration near-bankful flows to determine the effect on downstream facilities. The carrying capacity of the North Platte River at North Platte, Nebraska will determine the magnitude of the release from Lake McConaughy. The amount released from Lake McConaughy will be the carrying capacity at North Platte minus the expected gains between Lake McConaughy and North Platte minus any margin of safety.

Keystone Diversion. The goal is to divert enough at Keystone such that the maximum amount (1,850 cfs) can by released from the Sutherland return to the South Platte River. Given the system losses, it will be necessary to divert more than 1,850 cfs at the Keystone diversion. The other constraint is that the Keystone diversion can not be increased or decreased (ramped) by more than 200 cfs per day. Increase (ramp) the Keystone diversion to the Sutherland Canal by 200 cfs per day with the intent of reaching up to the maximum diversion of 2,100 cfs on the first day of the short duration near-bankful flow release down the North Platte River. Assuming that the short duration near-bankful flow release on the North Platte continues for three days, maintain the Keystone diversion for three days. On the fourth day reduce the diversion by 200 cfs and continue to reduce the diversion by 200 cfs per day until the diversion is at the level it was prior to ramping up for the short duration near-bankful flow. Time the diversions such that the water reaches the Sutherland return to the South Platte River at the same time that the short duration near-bankful flows in the North Platte River reach the town of North Platte, Nebraska.

Korty Diversion. This analysis assumes no diversion at Korty during short duration near-bankful flow time period. To the degree that this assumption is not correct changes will have to be made in the operation of facilities. The purpose of not diverting at Korty is to allow for a greater release out of the EA in Lake McConaughy by not using the Sutherland Canal to transport South Platte water.

Sutherland Reservoir. Hold Sutherland Reservoir at a constant level during the ramping and short duration near-bankful flow release times.

Sutherland Return to the South Platte River. Release the amount coming down the Sutherland Canal from the Keystone diversion up to the maximum of 1,850 cfs. Time the return such that the water is released to the South Platte River at the same time that the short duration near-bankful flows in the North Platte River reach the town of North Platte, Nebraska. Maintain the releases for three days or until the short duration near-bankful flow event has passed the town of North Platte, Nebraska.

Lake Maloney. Hold Lake Maloney at a constant level during the ramping and short duration near-bankful flow release times.

Tri-County Diversion. Assume that the Tri-County Diversion is the same as the Sutherland Return to the South Platte River. To the degree that this is not true indicates that releases from the Jeffrey return and diversions to Elwood Reservoir must increase. Diversions to Elwood Reservoir would be prior to the maximum pulsing and after maximum pulsing (Elwood could be used to store excess ramping flows)

Jeffrey Return. As the short duration near-bankful flow passes the Jeffrey Return release water from the Jeffrey Return that is not needed to maintain minimum flows in the Tri-County canal between the Jeffrey Return and Johnson Lake. The amount released cannot exceed the capacity of the Jeffrey Return or about 1,000 cfs. The Jeffrey hydro plant has no bypass capability. The purpose of releasing water from the Jeffrey Return is to allow pulsing out of Johnson Lake. The limiting factor on the Tri-County Canal is often the J2 return. If Johnson Lake is used to augment the short duration near-bankful flow out of the Lake McConaughy EA, a significant portion of the J2 Return capacity is used and unavailable to pass water coming down the Tri-County canal. Using the Jeffrey Return allows the water to be used to generate electricity at the Jeffrey hydro plant, but does not take up J2 Return capacity.

J1 Hydro Plant. As the short duration near-bankful flow passes the J2 Return release the up to the capacity of the J2 Return (2,000 cfs) for up to two days. Then bring the release back to what it was prior to any changes for pulsing.

Johnson Lake. Store water used to ramp the Keystone diversion in Johnson Lake. Storage in Johnson Lake prior to releasing 2,000 cfs for two days will be about 2,600 acre-feet. After the short duration near-bankful flow is stopped the storage will increase to about 2,000 acre-feet, which may be released for a broad based pulse flow or diverted and stored in Elwood Reservoir.

J2 Hydro Plant. As the short duration near-bankful flow passes the J2 Return release the up to the capacity of the J2 Return (2,000 cfs) for up to two days or longer if water is available in Johnson Lake and the J2 forebay. Then bring the release back to what it was prior to any changes for pulsing.

J2 forebay. Store water used to ramp the Keystone diversion in the J2 forebay. Storage in the J2 forebay prior to releasing 2,000 cfs for two days will be about 1,000 acre-feet.

Phelps County Canal diversion. Do not divert water to the Phelps County Canal during the short duration near-bankful flow event. This is to allow the full capacity of the J2 Return (2,000 cfs) to enter the Platte River and augment the short duration near-bankful flows already in the Platte River. Any water that would have been diverted during the short duration near-bankful flow period will be charged against the EA in Lake McConaughy.

Elwood Reservoir. Do not store water in Elwood Reservoir during the time that water is being released from the Jeffrey Return. Elwood Reservoir may be used to store water that is used to ramp the Keystone Diversion.

FERC Requirements

Minimum Canal Diversions. The values for the minimum diversion requirements are given in the input file. Minimum values are given for the Keystone Diversion, the Sutherland Canal (and hence, indirectly, the Korty Diversion), and the Tri-County Diversion.

Flow Attenuation Plan. The storage in Johnson Lake that is available for "spike flow" attenuation is 2,500 acre-feet. Attenuation is only allowed to occur between June 10 and August 15. If, during this time, the simulated daily flow at Overton exceeds 1,200 cfs, the flow at Overton is attenuated by storing water in Johnson Reservoir up to the maximum storage available for attenuation. Once the flow at Overton drops back to an acceptable level, the stored "spike flow" is released back into the system.

North Platte Choke Point. Because of a channel constriction in the North Platte River at North Platte, there is a very low flood stage and a corresponding very low channel capacity in the river at this location. If either a daily or a mean monthly flow in the North Platte River at North Platte exceeds this value, then EA releases are reduced so that channel capacity is below this value. Reductions are applied to the continuous and/or the short duration near-bankful flow releases, as appropriate for the operational condition being simulated at the time the excess at North Platte occurs. This run assumes a capacity of 3,000 cfs in the North Platte River at North Platte, Nebraska.

Reclamation Net Controllable Conserved Water, 0.2 KAF. An annual volume of 200 acre-feet was contributed to the Environmental Account from Lake McConaughy storage in October of each year.

Pathfinder Modification Municipal Account. Regarding the Pathfinder Modification Municipal Account, the Reconnaissance - Level Water Action Plan (WAP) states:

"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 of the amount needed to supplement municipal water rights and/or mitigate excess depletions and can not 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"

This was modeled in the North Platte River EIS model (NPREIS) by placing an additional demand on the Pathfinder Modification Municipal Account. This additional demand was calculated based on the following assumptions.

10. No water would be available to the Program in dry years.
11. Dry years occur roughly 25% of the time.
12. 9,600 acre-feet would be available to the Program during wet years.
13. Wet years occur roughly 33% of the time.
14. The total demand on the account could not exceed 9,600 acre-feet in a year.
15. The average annual yield to the program would be 4,800 acre-feet.

We assume that all available water will be reserved for Wyoming's uses during dry years. This is based on page 64 second bullet of the Reconnaissance - Level Water Action Plan which states that "...prior to June 1 of each year, state officials will make a conservative judgment as to the amount of water that may be required for Wyoming's purposes". Our assumption is that such a conservative judgment would reserve all available water for use in Wyoming during dry years.

To determine wet and dry years, the annual flows of the Medicine Bow River and the North Platte River above Seminoe Reservoir were summed and ranked from lowest to highest for the 54 year period from 1941 to 1994 (1941-1994 is the hydrologic record available in the NPREIS model). The 14 years (14/54 =0.2593) that had the lowest flows were classified as dry and the 18 years (18/54=0.3333) that had the highest flows were classified as wet.

The demand for the remaining years was adjusted such that the annual average yield to the Program was 4,800 acre-feet. The water leased to the Program was delivered in September of each year. The Pathfinder Modification Municipal Demand was adjusted so that the total demand on the Municipal Account equals the firm yield of 9,600 acre-feet per year.

(81) Deliveries from the Pathfinder Municipal Account

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	Total
1941	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1942	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1943	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1944	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1945	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1947	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1948	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1951	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1952	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1954	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1955	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1956	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1959	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1960	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1961	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1964	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1965	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1967	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1968	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1969	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1976	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1977	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
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	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1986	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1988	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1989	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1990	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1991	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1992	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6

Tamarack Phase III. The "Phase III" enlargement of the Tamarack project is modeled in the same way as the original project, except that it is operated to increase flows at the Julesburg gage by approximately 17,000 acre-feet during the period April through September.

Glendo Reservoir, Wyoming, Unassigned Water. Regarding the 10,600 acre-feet of Wyoming's Glendo water that currently has no long term contract, the Reconnaissance - Level Water Action Plan (WAP) states:

> "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)."

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This was modeled in the North Platte River EIS model (NPREIS) by placing an additional demand on the unassigned Wyoming Glendo Water account. This additional demand was calculated based on the following assumptions.

5. No water would be available to the Program in dry years.
6. Dry years occur roughly 25% of the time.
7. The total demand on the account could not exceed 10,600 acre-feet in a year.
8. The average annual yield to the program would be 2,650 acre-feet.

We assume that all available water will be reserved for Wyoming's uses during dry years. This is based on page 70 second bullet of the Reconnaissance - Level Water Action Plan which states that "...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". Our assumption is that such a conservative judgement would reserve all available water for use in Wyoming during dry years.

To determine dry years, the annual flows of the Medicine Bow River and the North Platte River above Seminoe Reservoir were summed and ranked from lowest to highest for the 54 year period from 1941 to 1994 (1941-1994 is the hydrologic record available in the NPREIS model). The 14 years (14/54 =0.2593) that had the lowest flows were classified as dry.

The existing demand from the Glendo account were summed for the remaining average and wet years. The annual demands were subtracted from 10,600 to determine the maximum amount available from the Glendo account each year. A portion of this amount was assigned as an additional demand on the unassigned Wyoming Glendo Water account such that the annual yield was approximately 2,650 acre-feet. The Glendo water leased to the Program was delivered in September of each year. The annual values are as follows.

1941	3.3368	1956	2.1456	1971	4.8288	1986	3.2112
1942	3.3368	1957	2.1552	1972	4.0416	1987	0
1943	3.3272	1958	2.6208	1973	3.9456	1988	1.2672
1944	3.3272	1959	0	1974	4.6128	1989	0
1945	3.3368	1960	2.9664	1975	4.1376	1990	0
1946	3.332	1961	0	1976	4.4496	1991	3.3216
1947	3.332	1962	2.8368	1977	0	1992	0
1948	3.3368	1963	0	1978	4.6032	1993	4.6752
1949	3.332	1964	2.1456	1979	4.5216	1994	0
1950	3.332	1965	4.9248	1980	4.2		
1951	3.332	1966	0	1981	0		
1952	3.332	1967	4.1904	1982	4.8432		
1953	0	1968	4.5456	1983	4.9056		
1954	0	1969	3.5384	1984	3.3944		
1955	0	1970	4.8144	1985	4.1952		

100,000 Acre-Foot Account in Glendo Reservoir. This is modeled in the NPREIS model by creating a new 100,000 acre-foot ownership account in Glendo Reservoir. The new right would have the lowest priority in the system. The creation of the new account would reduce the restorage space in Glendo Reservoir by 100,000 acre-feet. This account stores water entering the reservoir that is currently being stored in excess-to-ownership. Evaporation is pro-rated against storage for whatever volume enters this account. Releases are made from this account from April through September for delivery to the Lake McConaughy EA. The water contributed by this feature is included in the input to the Central Platte OPSTUDY Model as a portion of the "Environmental Account Deliveries at Lewellen".

Central Platte Power Interference. The OPSTUDY model checks whether there is excess flow in the Platte River at Overton and Grand Island, and whether there is excess release from the J2 return and Lake McConaughy. If any of these are occurring in a given month, then releases are reduced from Lake McConaughy ONLY, and the appropriate credit is made to the EA. Flows available for re-timing are flows excess to FERC requirements during the non-irrigation season, and flows excess to "system needs" (irrigation, minimum canal flow, etc.) during the irrigation season.

Groundwater Mound. The Groundwater Mound was modeled according to procedures described in the Water Action Plan under the heading, "Conjunctive Use". With this concept, shallow wells will discharge directly into CNPP&ID's distribution system and a recharge system located in the same area. Each year, in late fall in winter, flows at the Johnson #2 power plant that exceed target flows are diverted into the local aquifer for recharge to a pre-determined level. In the summer, an equivalent amount of water is pumped for irrigation. Pumping during the irrigation season would replace irrigation releases from Lake McConaughy.

The figures modeled for the yield to the Platte River are given in **Table 3.4.2-2**.

Table 3.4.2-2

Groundwater mound Conjunctive Use - Yield to the Platte River in acre-feet

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Year
0	-1,400	0	0	0	0	0	280	280	280	280	280	0

Riverside Drains. The inflow from riverside drains is given as input and added to the flow of the Platte River between Cozad and Overton.

80 KAF Conservation in 3 States.

South Platte in Colorado. As part of a basin-wide water banking alternative, water rights would be leased or purchased from several reservoirs in the South Platte River basin. These rights would be changed to allow for release and delivery of the historically consumed portion of the storage water to Julesburg as needed to meet target flows during May and June. For every acre-foot of water needed for delivery at Julesburg, 2.2 acre-feet of storage water would leased or purchased to provide for makeup of historical return flows and evaporation and transit losses.

Basin-wide banking alternatives were specified based upon the net amount of water to be delivered: 80,000 acre-feet basin wide, 26,666 AF (1/3) coming from Colorado.

The delivery volumes associated with this amount was assumed to be distributed among eight reservoirs within the South Platte basin of Colorado (Boyd Lake, Fossil Creek, Jackson Lake, Prewitt, Riverside, Empire, North Sterling and Julesburg reservoirs) as a pro rata portion of each reservoir's active capacity.

Modeling Approach. In modeling this alternative, only the historically consumed water and the water reserved for evaporation and seepage losses were explicitly represented. The water reserved for makeup of historical return flows was excluded from the model under the assumption that this water would be correctly administered to address injury issues.

Historical end-of-month contents records were obtained for each of the eight reservoirs mentioned. These records were inspected to determine the degree of fill obtained by each reservoir by the end of April in each year of the model study period. Inflows were added to the model to represent the storage banking accounts associated with involved reservoirs. The capacity of each inflow was set to the pro rata portion of each reservoir's degree of fill, minus the amount needed to make up historical return flows, as shown in the following table. Inflows were modeled to allow for release from each account to the degree available and as needed to meet target flows at Julesburg during May and June. Outlet capacity was not assumed to be a constraint upon releases.

Water Banking Alternative: Potentially Deliverable Water, AF

Boyd Lake	Fossil Creek	Riverside	Empire	Jackson Lake	Prewitt	North Sterling	Julesburg
4,500	1,000	5,800	2,550	3,200	3,050	6,650	2,600

The 27 KAF contributed by South Platte water banking in Colorado is included in the input to the Central Platte OPSTUDY Model as "program water", separate from the input of the gauged flow in the South Platte River at Julesburg, Colorado.

Platte in Nebraska. Water banking is modeled by irrigation reach as a reduction to diversion in each reach. The water identified through these features is credited to the EA once a year, every year, in October. This allows for a determination of how much water is actually available before it is credited.

Fundamentally, water banking involves 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 (WAP reach 10) does not receive storage water from Lake McConaughy. Therefore, water banking in reach 10 involve reductions in natural flow diversions and the water is protected from diversion for consumptive use.

Because of the channel restrictions near the town of North Platte, all water leasing and water management incentives in Nebraska were concentrated in the river reaches below North Platte. This is shown in the following table.

Water Action Plan **Reductions in Consumptive Use (ac-ft)**

WAP's Canals	Reach	Water Leasing ac-ft	Cons. Cropping	Deficit Irrigation	Land Fallowing	Irrig. Tech. Changes	Leasing Plus Incentives
			<-----Four Methods / Combinations------>				
Western	10						0
Key-NP	14						0
Central	15	1656					1656
Central +Brady to Cozad	16	2772					2772
Central +Dawson	17	6665					6665
Central + Kearney	18	8462					8462
Central	19	7445					7445
	Total	27000	0	0	0	0	27000
	Source Table:	III-5	III-10	III-14	III-18	III-21/2	

In order to simulate these reductions in consumptive use with the Central Platte Opstudy model, the reductions in consumptive use in the WAP had to be assigned to the irrigation demands (grouped by reach) used in the Central Platte Opstudy model. This was done by dividing the demand for a canal/district by the sum of the demands for all canals/districts listed for the reach in the WAP. For example, the consumptive use assigned to the Central district in reach 16 is the Central demand divided by the sum of the Central demand and the Brady to Cozad demand multiplied by the consumptive use for reach 16. The factors used to distribute the WAP's reach estimates to Central Platte Opstudy model reaches are shown in the following table.

Percentage Factors to Distribute WAP's Reach Estimates into Opstudy Reaches

Reach 14		Reach 18		Reach 16 & 17	
Keystone-North Platte		Kearney & Central		Central & Brady-Cozad	
0.770	Key-Suth%	0.052	Kearney	0.581	Central
0.230	Suth-NP %	0.948	Central	0.419	Brady-Cozad
1.000	Total	1.000	Total	1.000	Total

This results in the following distribution of reductions in consumptive use to the reaches/districts used in the Central Platte Opstudy model.

	Acre-Feet			Percent
Western Canal	0			0.000
Keystone-Sutherland	0			0.000
Sutherland- North Platte	0			0.000
Brady-Cozad	4,309			0.160
Kearney	513	4,822	sub total	0.019
Central	22,178			0.821
Total	27,000			1.000

The reductions in consumptive use were used to determine irrigation reduction factors for each of the reaches in the Central Platte Opstudy model. These are simply the reduction in consumptive use divided by the average annual diversion. The values are shown in the following table.

Present Cond. Irrigation Demands (kaf) & Cons. Factor			
Canal	Average Diversion	Target Reduction	**Irr. Red. Factor**
Western Canal	26.3	0.000	**1.00000**
Keystone-Sutherland Canals	88.3	0.000	**1.00000**
Sutherland-North Platte Canals	26.4	0.000	**1.00000**
Tri-County Canals	239.5	22.178	**0.89209**
Brady-Cozad Canals	172.7	4.309	**0.97505**
Kearney Canal	13.3	0.513	**0.96132**
Total	566.4	27.000	

The sum of the savings in consumptive use (except for the Western Canal) is 27,000 acre-feet. This volume was allocated to the EA annually in October (after the consumptive use savings have occurred). The WAP report recognizes that to achieve a certain volume of consumptive use reductions, 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 and assuming the remaining water is released to maintain return flows at pre-leasing levels, the Central Platte Opstudy model is consistent with the WAP's analysis.

North Platte in Wyoming and Nebraska. Water banking in the North Platte basin in Wyoming and Nebraska was modeled in the NPREIS model by reducing the irrigation demand for the North Platte, Kendrick, and Glendo projects. The Kendrick Project was chosen for the following reasons.

A factor was used to reduce the irrigation delivery. The factor was determined as the average annual amount of water delivered to the Program divided by the efficiency divided by the average annual delivery to the project. Leased water is delivered in the same month that the water would have been delivered and water leasing only occurs in July-September. The portion of the leased water that would have otherwise contributed to the river gains via return flows is released and added to natural flow in the same month that the water would have been delivered.

The 27 KAF contributed by water banking in the North Platte basin in Wyoming and Nebraska is included in the input as a portion of the "Environmental Account Deliveries at Lewellen". It is modeled in the NPREIS model as a percentage reduction in irrigation demand in districts connected to the North Platte, Kendrick, and Glendo projects.

3.4.3 Run results

3.4.3.1 North Platte River Basin

The results of the analysis of the North Platte River basin for the Water Emphasis Alternative are summarized in **Figures 3.4.3-1** through **3.4.3-5** and **Tables 3.4.3-1** through **3.4.3-16**.

Storage above Lake McConaughy. The results for storage conditions above Lake McConaughy are given in **Figure 3.4.3-1**.

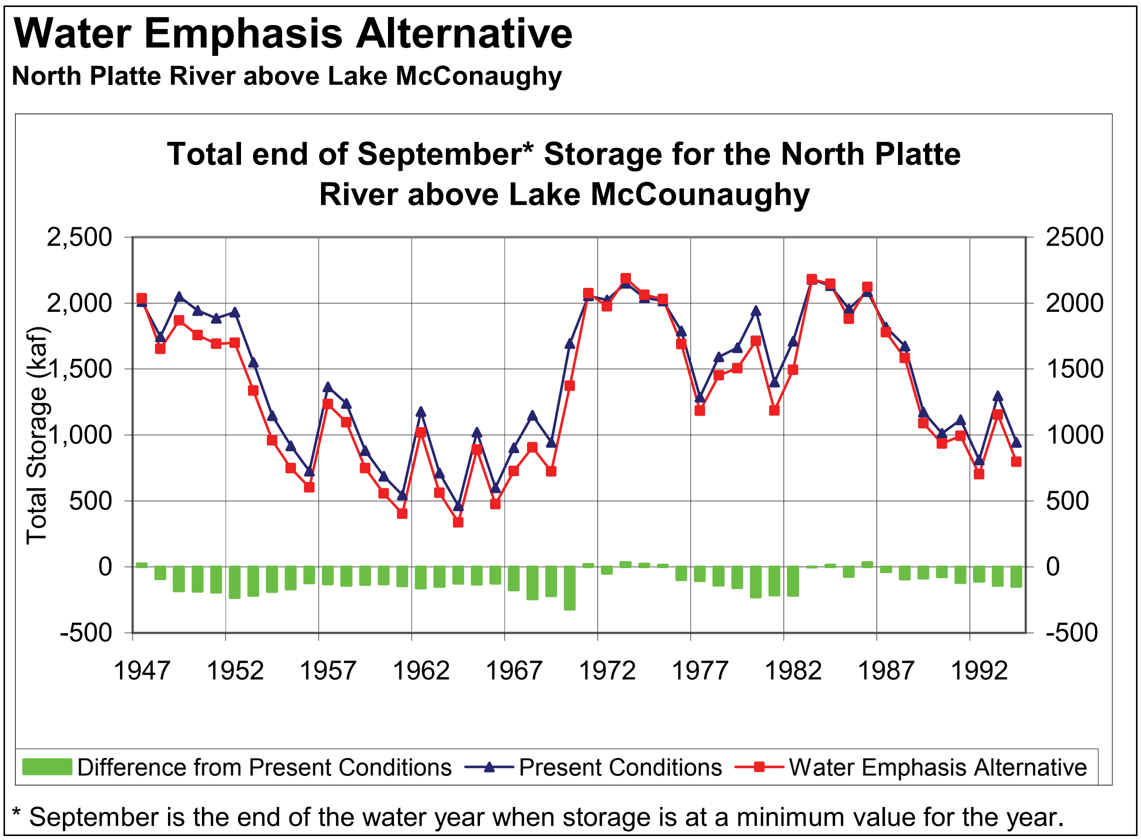


Figure 3.4.3- 1. End of September storage above Lake McConaughy.

Figure 3.4.3-1 shows that the end-of-September storage above Lake McConaughy was generally lower for the Water Emphasis Alternative than for the Present Condition, except for wet periods in the early 1970's and much of the 1980's, when the two were equal or the storage for the Water Emphasis Alternative was slightly higher. The increased storage during these time periods is due to the increased capacity of Pathfinder Reservoir.

Water Emphasis Alternative North Platte River above Lake McConaughy Reservoir Storage	Seminoe Value	% Δ[1]	Pathfinder Value	% Δ	Alcova Value	% Δ	Glendo Value	% Δ	Guernsey Value	% Δ	Inland Lakes Value	% Δ	Total Storage Value	% Δ
Minimum end-of-month storage for 48-year simulation (kaf)	31.2	-66%	31.4	0%	156	0%	63.1	0%	0	0%	7.8	105%	336.1	-27%
Maximum end-of-month storage for 48-year simulation (kaf)	1,017.3	0%	1,070.0	5%	179.5	0%	814.8	19%	45.6	0%	74.1	3%	2921.6	1%
Average end-of-month storage for 48-year simulation (kaf)	564.6	-6%	521.2	-7%	167.8	0%	304.3	-8%	18.8	-1%	43.3	22%	1582.6	-6%
Low storage indicator: years with storage < ### kaf	10 < 200 kaf		16 < 200 kaf		0 < 150 kaf		27 < 100 kaf		0 < 0 kaf		0 < 0 kaf		10 < 650 kaf	
Percent change from Present Conditions[2]		67%		33%		0%		200%		0%		0%		67%
Year that minimum first occurred	1965		1961		1947		1960		1949		1962		1964	
Largest single month drawdown for this alternative (kaf)	144.6	-5%	255.8	-8%	23.5	0%	264.8	2%	28	0%	30.6	4%	365.8	0%
Month of largest drawdown	July-94		July-87		October-47		June-83		September-47		August-51		September-52	
File that contains the data		Resop.tab		Resop.tab		Resop.tab		Resop.tab		Resop.tab		Resop.tab		Resop.tab
Table number		3		2		25		1		4		5		6

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

[2] NA in the % Δ column indicates that there were no years with storage < ### kaf in the Present Condtion Run

Table 3.4.3- 1. Reservoir storage statistics for the North Platte River above Lake McConaughy.

The average end-of-month storage showed a percentage decrease of 6 percent with respect to the Present Condition. The greatest percentage decrease for an individual project was 8 percent for Glendo Reservoir. A significant percentage decrease was also noted at Pathfinder Reservoir (7 percent). The Inland Lakes show percentage increases in storage; the Inland Lakes show a percentage increase of 22 percent. There was no change for Alcova. The increased storage in the Inland Lakes is due to reduced demand created by leasing water from North Platte Project irrigators.

Water Emphasis Alternative
North Platte River above Lake McConaughy

Reservoir Storage		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
Seminoe Reservoir														Resop.tab Table 3
	Min (kaf)	38	31	31	31	31	31	31	147	266	180	131	54	31
	Max (kaf)	978	941	917	894	848	823	922	1,017	1,017	1,017	1,017	988	1,017
	Avg (kaf)	565	549	529	509	486	475	506	607	711	663	608	568	565
Percent change from Present Conditions	Min	-76%	-79%	-77%	-74%	-72%	-66%	-72%	-21%	-12%	-7%	-27%	-70%	-66%
	Max	2%	2%	2%	2%	1%	-3%	-2%	0%	0%	0%	6%	3%	0%
	Avg	-6%	-6%	-6%	-6%	-6%	-7%	-5%	-6%	-5%	-5%	-3%	-7%	-6%
Pathfinder Reservoir														Resop.tab Table 2
	Min (kaf)	52	51	38	31	31	31	55	125	177	119	31	31	31
	Max (kaf)	938	974	991	1,005	1,032	1,068	1,070	1,070	1,070	1,070	1,002	916	1,070
	Avg (kaf)	480	491	501	511	527	537	554	594	637	504	477	442	521
Percent change from Present Conditions	Min	-9%	-15%	-37%	-50%	-52%	-33%	4%	-20%	-12%	-7%	-69%	0%	0%
	Max	1%	2%	2%	2%	2%	5%	5%	5%	5%	5%	8%	1%	5%
	Avg	-8%	-8%	-8%	-8%	-8%	-8%	-10%	-8%	-5%	-5%	-4%	-9%	-7%
Alcova Reservoir														Resop.tab Table 25
	Min (kaf)	156	156	156	156	156	156	180	180	180	180	180	180	156
	Max (kaf)	156	156	156	156	156	156	180	180	180	180	180	180	180
	Avg (kaf)	156	156	156	156	156	156	180	180	180	180	180	180	168
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Glendo Reservoir														Resop.tab Table 1
	Min (kaf)	92	126	156	186	220	253	243	282	275	147	80	63	63
	Max (kaf)	263	307	343	384	434	492	575	815	696	627	379	211	815
	Avg (kaf)	164	206	245	285	326	386	400	435	447	406	230	122	304
Percent change from Present Conditions	Min	-10%	-8%	-7%	-7%	-7%	-9%	-15%	-4%	26%	-30%	0%	0%	0%
	Max	-24%	-19%	-17%	-14%	-10%	-5%	14%	25%	2%	21%	20%	-33%	19%
	Avg	-19%	-16%	-14%	-12%	-11%	-8%	-6%	-3%	0%	-1%	-5%	-24%	-8%
Guernsey Reservoir														Resop.tab Table 4
	Min (kaf)	0	0	0	0	0	5	35	40	35	30	30	2	0
	Max (kaf)	8	13	16	19	21	24	46	46	45	30	30	2	46
	Avg (kaf)	2	5	8	11	12	14	35	40	35	30	30	2	19
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	-23%	-19%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	-2%	-6%	-2%	0%	0%	0%	0%	0%	-1%

Table 3.4.3- 2. Monthly reservoir storage statistics for the North Platte River above Lake McConaughy.

Minimum, maximum, and average storage by month is shown in **Table 3.4.3-2**. This table shows that the largest percent change occurs in the minimum reservoir storage attained during the simulation of the Water Emphasis alternative.

Water Emphasis Alternative **North Platte River above Lake McConaughy**		
	Spills	
Spills from the system	**Value**	**% Δ[1]**
Average annual spill for 48-year simulation period (kaf)	81.4	-31%
Number of years with spills	8	-33%
Average annual spill for years with spills (kaf)	488.6	3%
Largest annual spill (kaf)	1182	-10%
Year of largest annual spill	1984	
File that contains the data	Storown.lst	
Output line number	8	

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

Table 3.4.3- 3. Spills from Guernsey Reservoir.

The average annual spill decreased by 31 percent with respect to the Present Condition and the number of years with spills decreased from 12 to 8.

Reservoir elevations above Lake McConaughy.

Water Emphasis Alternative **North Platte River above Lake McConaughy**	**Seminoe**		**Pathfinder**		**Alcova**		**Glendo**		**Guernsey**	
Reservoir Elevations	**Value**	**% Δ[1]**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**
Minimum average elevation for 48-year simulation (kaf)	6,239	-0.4%	5,746	0.0%	5,488	0.0%	4,570	0.0%	4,370	0.0%
Maximum average elevation for 48-year simulation (kaf)	6,357	0.0%	5,853	0.0%	5,498	0.0%	4,654	0.2%	4,420	0.0%
Average average elevation for 48-year simulation (kaf)	6,324	-0.1%	5,815	-0.1%	5,493	0.0%	4,611	-0.1%	4,403	0.0%
Low storage indicator: years with elevation < #### ft	10 < 6,289 ft		16 < 5,787 ft		0 < 5,486 ft		25 < 4,580 ft		0 < 4,370 ft	
Percent change from Present Conditions[2]		67%		33%		0%		213%		0%
Year that minimum first occurred	1965		1961		1947		1960		1949	
Average May-August drawdown for this alternative (feet)	0.2	-86%	9.9	-12%	0.0	0%	24.7	4%	4.8	0%
Largest May-August drawdown for this alternative (feet)	25.7	20%	38	28%	0.0	0%	53.8	17%	7.1	0%
Year of largest drawdown	1994		1964		1947		1983		1971	
File that contains the data	Natflow.tab		Natflow.tab		Natflow.tab		Natflow.tab		Natflow.tab	
Table number	13		12		11		10		9	

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)
[2] NA in the % Δ column indicates that there were no years with elevation < #### ft in the Present Condtion Run

Table 3.4.3- 4. Reservoir elevation statistics for the North Platte River above Lake McConaughy.

Table 3.4.3-4 shows the same statistics for reservoir elevation as are shown in **Table 3.4.3-1** for end-of-month reservoir storage. **Table 3.4.3-4** shows that there will be less water in Seminoe, Pathfinder, and Glendo reservoirs under the Water Emphasis Atlernative.

Water Emphasis Alternative					
North Platte River above Lake McConaughy Reservoir Elevation Minimum and Maximum	**Seminoe**	**Pathfinder**	**Alcova**	**Glendo**	**Guernsey**
Elevation for empty reservoir:	6160.0	5690.0	5320.0	4508.0	4370.0
Historic minimum elevation:	6253.3	5690.0	5408.8	4549.3	4370.0
Minimum elevation for alternative:	6238.7	5746.0	5488.0	4570.0	4370.0
Years min. elev. Achieved	1	3	48	8	25
Years min. < Reference	2	0	0	0	0
Years min. < Historic	2	0	0	0	0
Elevation for full reservoir[1]:	6357.0	5850.1	5500.0	4669.0	4420.0
Historic maximum elevation[2]:	6359.3	5853.5	5499.9	4650.8	4421.7
Maximum elevation for alternative:	6357.0	5852.5	5498.0	4654.4	4420.0
Years max. elev. Achieved	10	9	48	1	4
Years max. > Reference	0	11	0	2	0
Years max. > Historic	0	0	0	1	0

[1] Elevation for the top of the conservation capacity.
[2] Historic elevations that are greater than the elevation for a full reservoir are the result of flood storage and reservoir surcharge.

Table 3.4.3- 5. Minimum and maximum reservoir elevation statistics for the North Platte River above Lake McConaughy.

Table 3.4.3-5 compares the minimum and maximum elevation for each reservoir to the minimum and maximum elevations for the Present Condition run and to historic values. **Table 3.4.3-5** shows that the storage in Seminoe Reservoir was less than the minimum storage for these reservoirs in Present Condition and Seminoe Reservoir was lower than it has been historically.

Water Emphasis Alternative
North Platte River above Lake McConaughy

Reservoir Elevations		**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Ann**
Seminoe Reservoir												Natflow.tab Table 13		
	Min (feet)	6,243	6,239	6,239	6,239	6,239	6,239	6,239	6,279	6,299	6,285	6,275	6,251	6,239
	Max (feet)	6,355	6,353	6,352	6,351	6,348	6,347	6,352	6,357	6,357	6,357	6,357	6,356	6,357
	Avg (feet)	6,324	6,323	6,321	6,319	6,317	6,317	6,320	6,328	6,337	6,333	6,328	6,324	6,324
Percent change from Present Conditions	Min	-1%	-1%	-1%	-1%	-1%	0%	-1%	0%	0%	0%	0%	-1%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Pathfinder Reservoir												Natflow.tab Table 12		
	Min (feet)	5,754	5,754	5,749	5,746	5,746	5,746	5,755	5,773	5,782	5,771	5,746	5,746	5,746
	Max (feet)	5,846	5,848	5,849	5,850	5,851	5,852	5,853	5,853	5,853	5,853	5,849	5,845	5,853
	Avg (feet)	5,812	5,813	5,814	5,814	5,816	5,816	5,817	5,821	5,825	5,815	5,811	5,808	5,815
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Alcova Reservoir												Natflow.tab Table 11		
	Min (feet)	5,488	5,488	5,488	5,488	5,488	5,488	5,498	5,498	5,498	5,498	5,498	5,498	5,488
	Max (feet)	5,488	5,488	5,488	5,488	5,488	5,488	5,498	5,498	5,498	5,498	5,498	5,498	5,498
	Avg (feet)	5,488	5,488	5,488	5,488	5,488	5,488	5,498	5,498	5,498	5,498	5,498	5,498	5,493
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Glendo Reservoir												Natflow.tab Table 10		
	Min (feet)	4,578	4,586	4,592	4,597	4,603	4,607	4,606	4,611	4,610	4,591	4,575	4,570	4,570
	Max (feet)	4,609	4,614	4,618	4,623	4,628	4,633	4,639	4,654	4,648	4,643	4,622	4,601	4,654
	Avg (feet)	4,593	4,600	4,606	4,611	4,616	4,623	4,624	4,627	4,628	4,624	4,602	4,584	4,611
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Guernsey Reservoir												Natflow.tab Table 9		
	Min (feet)	4,370	4,370	4,370	4,370	4,370	4,395	4,415	4,418	4,415	4,413	4,413	4,388	4,370
	Max (feet)	4,398	4,403	4,405	4,407	4,408	4,410	4,420	4,420	4,420	4,413	4,413	4,388	4,420
	Avg (feet)	4,382	4,394	4,397	4,400	4,402	4,403	4,415	4,418	4,415	4,413	4,413	4,388	4,403
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 3.4.3- 6. Monthly reservoir elevation statistics for the North Platte River above Lake McConaughy.

Table 3.4.3-6 shows the minimum, maximum, and average reservoir elevation for the five major reservoirs above Lake McConaughy by month.

North Platte River Flow into Lake McConaughy. The results for North Platte River flow into Lake McConaughy for the Water Emphasis Alternative are given in **Figure 3.4.3-2**.

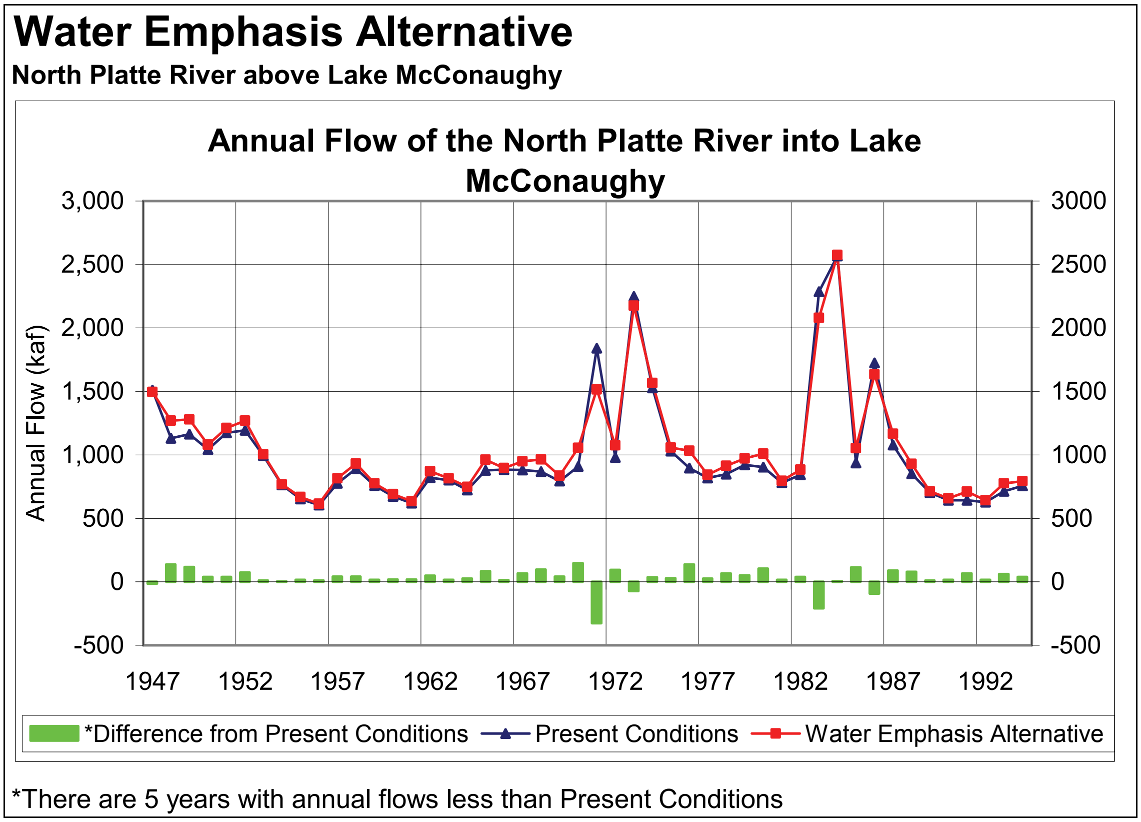


Figure 3.4.3- 2. Annual flow of the North Platte River into Lake McConaughy.

Figure 3.4.3-2 shows that North Platte River flow into Lake McConaughy for the Water Emphasis Alternative is somewhat higher than that for the Present Condition in most years. The exceptions to this pattern are high runoff years with high inflows into Seminoe Reservoir that allow all the reservoirs above Lake McConaughy to fill. Because storage is lower prior to these years, it takes more water to fill the reservoirs and flows into Lake McConaughy are less.

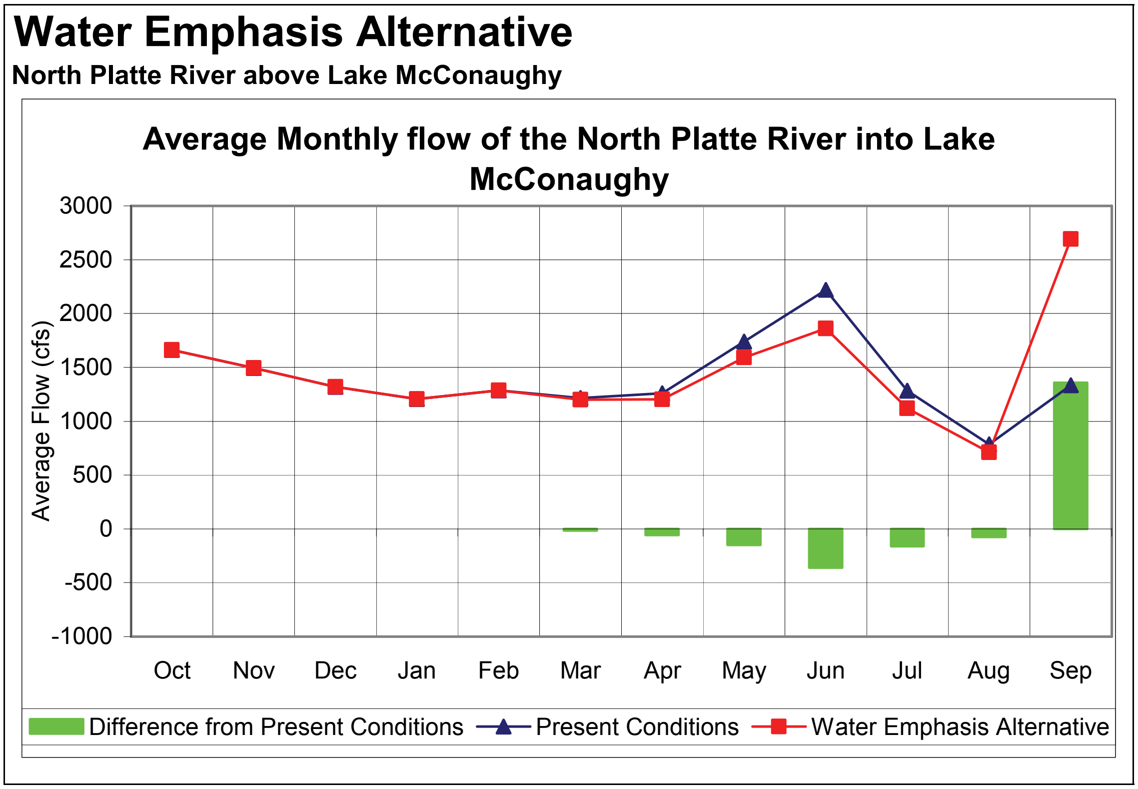


Figure 3.4.3- 3. Average monthly flow of the North Platte River into Lake McConaughy.

Water Emphasis Alternative
North Platte River above Lake McConaughy

Flows	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
N.P. River flow into Lake McConaughy											Resop.tab Table 9		
Min (Monthly (cfs), Annual (kaf))	758	1,062	862	805	911	636	534	255	328	60	135	761	615
Max (Monthly (cfs), Annual (kaf))	2,318	2,038	1,888	1,825	1,889	2,126	2,669	12,180	11,315	6,935	1,314	4,991	2,574
Avg (Monthly (cfs), Annual (kaf))	1,662	1,495	1,317	1,206	1,285	1,199	1,204	1,593	1,862	1,120	710	2,691	1,045
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	-26%	0%	-7%	-13%	-51%	-28%	114%	2%
Max	0%	0%	0%	0%	0%	0%	-13%	-5%	-8%	-9%	-39%	76%	0%
Avg	0%	0%	0%	0%	0%	-1%	-5%	-9%	-16%	-13%	-10%	102%	3%

Table 3.4.3- 7. Monthly flow of the North Platte River into Lake McConaughy.

On a monthly basis, inflows are greater in September; and less by more than 5 percent in April through August. There are decreases of less than 5 percent in March. September is the main month for environmental deliveries for this alternative. October through March are considered to be the winter months in the high country headwaters of the North Platte River. The decrease in flows for March are the result of reduced return flows associated with water leasing below Guernsey Reservoir.

Water Emphasis Alternative
North Platte River above Lake McConaughy

Enviromental Flows Delivered to Lake McConaughy	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
											Natflow.tab Table 31		
Min (kaf)	0	0	0	0	0	0	0	0	0	0	0	19.2	19.2
Max (kaf)	0	0	0	0	0	0	0	0	0	0	0	153.6	153.6
Avg (kaf)	0	0	0	0	0	0	0	0	0	0	0	80.3	80.3
Year that minimum first occurred	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1954	1954

Table 3.4.3- 8. Environmental deliveries from above Lake McConaughy.

September has the greatest average environmental delivery to Lake McConaughy (**Table 3.4.3-8**) under the Water Emphasis Alternative.

Project Ownership, Project Shortages, Irrigation Demand, Water Leasing. The results for project ownership, project shortages, and irrigation demand for the Water Emphasis Alternative are given in **Table 3.4.3-9**.

Water Emphasis Alternative								
North Platte River above Lake McConaughy	**North Platte**[1]		**Kendrick**[2]		**Glendo**		**Total**	
Project Ownership	**Value**	**% Δ**[3]	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**
Minimum end-of-month ownership for 48-year simulation (kaf)	37.3	-25%	142.9	-17%	2.3	-80%	336.1	-27%
Maximum end-of-month ownership for 48-year simulation (kaf)	1,099.6	0%	1,201.7	0%	179.8	0%	2,921.6	1%
Average end-of-month ownership for 48-year simulation (kaf)	637.9	-9%	780.3	-7%	114.4	-9%	1,582.6	-6%
Years with ownership < ### kaf	8 < 100 kaf		8 < 300 kaf		9 < 63 kaf		2 < 400 kaf	
Percent change from Present Conditions[4]		167%		100%		13%		NA
Year that minimum first occurred	1955		1968		1962		1964	
Largest single month accrual for this alternative (kaf)	496.4	6%	414.7	-23%	57.5	0%	575.8	1%
Month of largest accrual	June-57		June-70		May-91		June-70	
File that contains the data	Storown.tab		Storown.tab		Storown.tab		Resop.tab	
Table numbers	1, 8, & 9		2 & 3		4, 5, & 6		6	

[1] The North Platte Project includes Pathfinder Reservoir, Guernsey Reservoir, and the Inland Lakes.
[2] The Kendrick Project includes Seminoe Reservoir and Alcova Reservoir.
[3] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)
[4] NA in the % Δ column indicates that there were no years with ownership < ### kaf in the Present Condtion Run

Table 3.4.3- 9. Project ownership on the North Platte River above Lake McConaughy.

Project Ownership. Table 3.4.3-9 shows that project ownership decreased for the Water Emphasis Alternative with respect to the Present Condition for all projects considered. There were also large increases in the number of years with reduced ownership, mainly in the North Platte and Kendrick projects. This is consistent with the use of Pathfinder water and other water elements for downstream environmental purposes.

Water Emphasis Alternative										
North Platte River above Lake McConaughy	**North Platte Project**		**Kendrick Project**		**Glendo Unit**		**Non-project Lands**		**Total Shortages**	
Project Shortages	**Value**	**% Δ**[1]	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**
Average annual shortage for 48-year simulation period (kaf)[2]	1.2	500%	7.1	145%	4.7	27%	0.6	20%	13.6	86%
Number of years with shortages	4	100%	7	133%	26	24%	26	0%	37	12%
Average annual shortage for years with shortage (kaf)	15.0	178%	48.9	5%	8.6	1%	1.0	11%	17.6	64%
As a percentage of demand for years with shortage (%)	2.1%		69.8%		12.8%		0.4%		1.6%	
Largest annual shortage (kaf)	33	217%	70	0%	25.2	3%	4.2	11%	78.4	11%
As a percentage of demand (%)	4.9%		100.0%		42.6%		1.6%		6.2%	
Year of largest annual shortage	1956		1965		1961		1956		1964	
Data is contained in the file Resop.tab table number	30 & 52		31 & 54		32 & 53		42 & 55		30-32,42,52-55	

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)
[2] NA in the % Δ column indicates that there were no shortages in the Present Condtion Run

Table 3.4.3- 10. Project shortages on the North Platte River above Lake McConaughy.

Project Shortages. Table 3.4.3-10 shows that, for the Water Emphasis Alternative, there were very large percentage increases in project shortages with respect to the Present Condition for the North Platte and Kendrick projects, lesser but still significant decreases for the Glendo Unit and for non-project lands. The very large percentage increases in shortages for the North Platte and Kendrick projects occurred for all shortage quantities considered.

Water Emphasis Alternative **North Platte River above Lake McConaughy** **Project Irrigation Demand**	**North Platte Project**		**Kendrick Project**		**Glendo Unit**		**Non-project Lands**		**Total Demand**	
	Value	**% Δ[1]**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**
Average annual demand for 48-year simulation period (kaf)	763.0	0%	70.0	0%	67.5	0%	254.0	0%	1154.4	0%
Maximum annual demand (kaf)	988.5	0%	70.0	0%	91.9	0%	303.0	0%	1427.6	0%
Minimum annual demand (kaf)	504.4	0%	70.0	0%	47.8	0%	190.0	0%	875.2	0%
Data is contained in the file Resop.tab table number		52		54		53		55		52-55

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

Table 3.4.3- 11. Project irrigation demand on the North Platte River above Lake McConaughy.

Irrigation Demand. There are no changes in irrigation demand for the Water Emphasis Alternative compared to Present Condition**.**

Water Emphasis Alternative **North Platte River above Lake McConaughy**													
Irrigation Deliveries	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Ann**
North Platte Project Irrigation Deliveries													Resop.tab Table 3
Min (kaf)	0	0	0	0	0	0	0	0	27	213	243	79	671
Max (kaf)	9	2	1	0	1	1	7	221	285	360	354	265	1,445
Avg (kaf)	2	0	0	0	0	0	2	117	133	310	311	192	1,067
Percent change from Present Conditions													
Min	NA	NA	NA	NA	NA	NA	NA	0%	0%	-2%	-5%	-9%	-4%
Max	0%	0%	0%	NA	0%	0%	0%	0%	0%	0%	-1%	-4%	-2%
Avg	0%	0%	0%	NA	0%	0%	0%	0%	0%	-3%	-4%	-4%	-3%
Kendrick Project Irrigation Deliveries													Resop.tab Table 2
Min (kaf)	0	0	0	0	0	0	0	0	0	0	0	0	0
Max (kaf)	0	0	0	0	0	0	0	11	17	22	16	8	71
Avg (kaf)	0	0	0	0	0	0	0	8	14	16	14	7	59
Percent change from Present Conditions													
Min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Max	NA	NA	NA	NA	NA	NA	NA	0%	0%	0%	-17%	-16%	-8%
Avg	NA	NA	NA	NA	NA	NA	NA	-18%	-15%	-22%	-22%	-22%	-20%
Glendo Project Irrigation Deliveries													Resop.tab Table 25
Min (kaf)	0	0	0	0	0	0	0	1	2	3	5	5	34
Max (kaf)	11	1	0	0	0	0	0	16	20	22	22	20	92
Avg (kaf)	1	0	0	0	0	0	0	8	11	16	14	13	63
Percent change from Present Conditions													
Min	NA	NA	NA	NA	NA	NA	NA	250%	0%	-43%	0%	-18%	-3%
Max	0%	0%	NA	NA	NA	NA	0%	-6%	-7%	0%	0%	-1%	0%
Avg	0%	0%	NA	NA	NA	NA	0%	1%	-1%	-3%	-2%	-4%	-2%
Non-Project Irrigation Deliveries													Resop.tab Table 1
Min (kaf)	0	0	0	0	0	0	0	8	9	31	52	26	190
Max (kaf)	16	2	0	0	0	0	16	52	56	78	74	62	303
Avg (kaf)	6	0	0	0	0	0	2	29	40	62	66	48	253
Percent change from Present Conditions													
Min	NA	NA	NA	NA	NA	NA	NA	0%	0%	0%	0%	0%	0%
Max	0%	0%	NA	NA	NA	NA	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	NA	NA	NA	NA	0%	0%	0%	0%	0%	0%	0%

Table 3.4.3- 12. Project irrigation delivery on the North Platte River above Lake McConaughy.

Irrigation deliveries. Table 3.4.3-12 shows the greatest change in irrigation deliveries occurs for the Kendrick projects. This is due to shortages to and leasing from the Kendrick project.

Water leasing. The results for water banking and conservation in Wyoming and are given in **Table 3.4.3-13**.

Water Emphasis Alternative North Platte River above Lake McConaughy					
Water Banking / Conservation	**North Platte Project**	**Kendrick Project**	**Glendo Unit**	**Non-project Lands**	**Total**
Average annual conservation for 48-year simulation period (kaf)	29.7	10.4	0.3	0.0	40.4
Number of years with conservation	48	45	39	0	48
Average annual conservation for years with conservation (kaf)	29.7	11.1	0.4	0.0	40.4
As a percentage of demand (%)	4.0%	15.8%	0.6%	0.0%	3.6%
Largest annual conservation (kaf)	48.9	13	1	0	58.1
As a percentage of demand (%)	5.8%	18.6%	1.3%	0.0%	4.8%
Year of largest annual conservation	1966	1951	1977	1947	1994
Data is contained in the file Resop.tab table number	56 & 52	58 & 54	57 & 53	59 & 55	52-55 & 56-59

Table 3.4.3- 13. Water leasing by project above Lake McConaugy.

Table 3.4.3-13 shows that water leasing occurs in the area of all three projects for the Water Emphasis Alternative. There is no water leasing for no-project lands. Water is leased in all 48 years of the simulation. 3.6 percent of the system-wide water supply are leased to the Program.

Flows. The results for flows in the North Platte River for the Water Emphasis Alternative are given in **Table 3.4.3-14**.

Water Emphasis Alternative North Platte River above Lake McConaughy													
Flows	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Ann**
N.P. River below Kortes Reservoir											Resop.tab Table 20		
Min (Monthly (cfs), Annual (kaf))	503	442	288	306	284	355	502	503	502	503	503	502	509
Max (Monthly (cfs), Annual (kaf))	1,421	1,472	1,077	1,002	1,368	2,057	2,775	8,317	8,809	6,170	2,775	2,576	1,880
Avg (Monthly (cfs), Annual (kaf))	691	754	744	714	847	872	1,197	1,992	3,142	2,353	1,426	1,005	951
Months with flow below 500 cfs[1,4]	0	1	1	1	1	1	0	0	0	0	0	0	1
Percent change from Present Conditions													
Min	0%	-12%	-43%	-39%	-43%	-29%	0%	0%	0%	0%	0%	0%	-1%
Max	12%	4%	-5%	-5%	-14%	7%	0%	-5%	-1%	0%	0%	24%	1%
Avg	0%	-2%	-3%	-4%	-4%	5%	-8%	8%	2%	-5%	-12%	59%	1%
Months with flow below 500 cfs[2]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N.P. River below Gray Reef Reservoir											Natflow.tab Table 21		
Min (Monthly (cfs), Annual (kaf))	501	502	503	450	349	363	502	503	502	610	566	539	564
Max (Monthly (cfs), Annual (kaf))	867	776	768	768	808	1,321	2,570	8,902	8,776	5,707	3,903	3,798	1,903
Avg (Monthly (cfs), Annual (kaf))	649	566	566	563	569	780	733	1,591	2,481	4,408	1,690	1,517	977
Months with flow below 500 cfs[3,4]	0	0	0	1	1	1	0	0	0	0	0	0	1
Percent change from Present Conditions													
Min	0%	0%	0%	-10%	-30%	-28%	0%	0%	0%	-57%	6%	7%	13%
Max	12%	0%	0%	0%	2%	4%	74%	-4%	-8%	1%	-1%	75%	0%
Avg	-1%	-1%	-1%	-1%	-1%	12%	14%	4%	-7%	-4%	-12%	137%	3%
Months with flow below 500 cfs[2]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N.P. River below Guernsey Reservoir											Resop.tab Table 7		
Min (Monthly (cfs), Annual (kaf))	5	3	5	7	5	5	104	20	336	3,282	3,519	1,321	718
Max (Monthly (cfs), Annual (kaf))	501	25	24	86	61	60	1,326	10,233	9,614	9,382	5,032	6,483	2,297
Avg (Monthly (cfs), Annual (kaf))	156	5	6	9	10	12	692	2,130	2,686	4,982	4,530	4,109	1,173
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	-37%	-12%	-3%	-3%	13%	2%
Max	0%	0%	0%	0%	0%	-85%	-20%	-4%	-7%	-7%	-14%	64%	0%
Avg	0%	0%	0%	0%	0%	-57%	-8%	-7%	-13%	-4%	-3%	47%	2%

[1] The flow below Kortes Reservoir is required by law to be greater than 500 cfs.
[2] NA indicates that there were no months in Present Conditions with flows less than 500 cfs.
[3] The flow below Gray Reef Reservoir isrequired by law to be greater than 330 cfs, but flow of 500 cfs is maintained (when possible) by Reclamation.
[4] The value in the Ann column is the number of years where at least one month had average flows below 500 cfs.

Table 3.4.3- 14. Flow in the North Platte River above Lake McConaughy.

Table 3.4.3-14 shows annual changes in flow of less than 5 percent for the three locations considered. On a monthly basis, below Kortes Reservoir the greatest percentage change with respect to the Present Condition is in September (increases). Below Gray Reef Reservoir there is also a significant percentage increases in September. Below Guernsey Reservoir there are somewhat significant percentage decreases in March and a large increase in September. Flows less than 500 cfs below both Kortes and Gray Reef reservoirs are unchanged compared to Present Condition. The increases in flows in September are the result of environmental deliveries to Lake McConaughy. The flow decrease in March below Guernsey is due to reduced spills in the very high flow years of the 1980's.

Power Generation and bypass flows. The results for power generation in the North Platte River basin upstream of Lake McConaughy are given in **Figure 3.4.3-4** and **Table 3.4.3-15**.

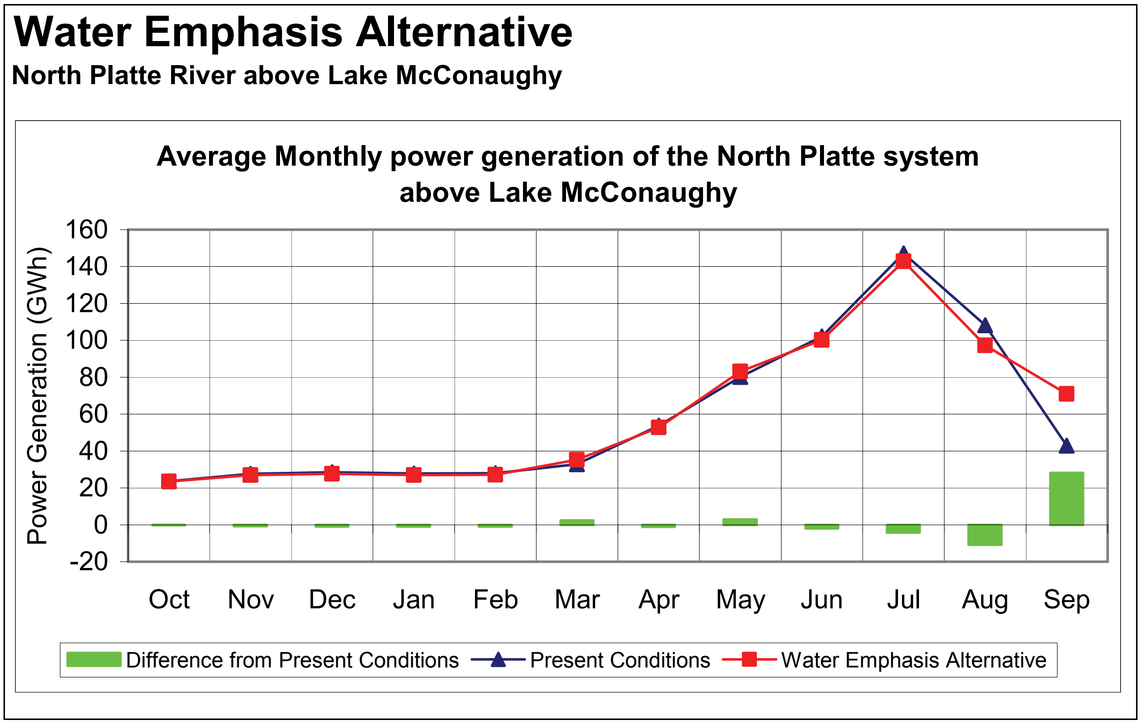


Figure 3.4.3- 4. Average Monthly power generation of the North Platte System above Lake McConaughy.

Water Emphasis Alternative
North Platte River above Lake McConaughy

Power Generation	Seminoe Value	Seminoe % Δ[1]	Kortes Value	Kortes % Δ	Fremont Canyon Value	Fremont Canyon % Δ	Alcova Value	Alcova % Δ	Glendo Value	Glendo % Δ	Guernsey Value	Guernsey % Δ	Total Value	Total % Δ
Minimum (GWh)	71.5	-2%	87.3	-1%	123.5	0%	75.9	9%	48.2	-10%	15.1	0%	440.043	-2%
Maximum (GWh)	203.3	-4%	188.9	-5%	276.3	5%	153.5	5%	138.8	4%	19.9	-7%	950.729	3%
Average (GWh)	138.8	-1%	146.7	1%	200.7	4%	116.6	5%	93.0	-1%	18.7	-1%	714.4	2%
Year that minimum occurred	1955		1955		1955		1955		1961		1990		1955	
Data is contained in the file Resop.tab table number		13		14		15		16		17		18		19

[1] % Δ   indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

Table 3.4.3- 15. Power generation statistics for the North Platte system above Lake McConaughy.

Figure 3.4.3-4 and **Table 3.4.3-15** show a net gain of power generation system-wide for the Water Emphasis Alternative with respect to the Present Condition, increases for Kortes, Fremont Canyon, and Alcova, and decreaseas for Seminoe, Glendo, and Guernsey. The changes are also relatively insignificant on a monthly basis, except for September, when there is a somewhat significant increase. This is consistent with the previously noted increase in river flows in September for this alternative.

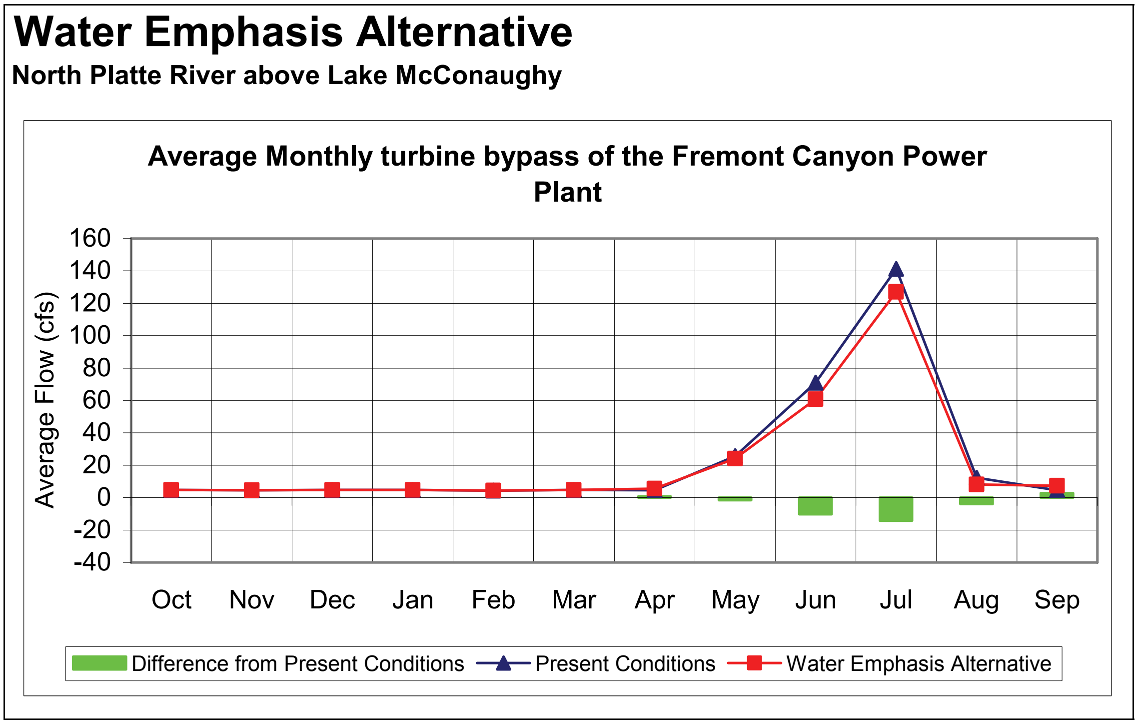


Figure 3.4.3- 5. Average Monthly turbine bypass of the Fremont Canyon Power Plant.

Water Emphasis Alternative

North Platte River above Lake McConaughy Flows that Bypass Turbines	Seminoe Value	 % Δ[1]	Kortes Value	 % Δ	Fremont Canyon Value	 % Δ	Alcova Value	 % Δ	Glendo Value	 % Δ	Guernsey Value	 % Δ
Average annual bypass for 48-year simulation period (kaf)	77.4	-1%	97.5	-1%	260.9	-9%	189.6	-14%	225.5	2%	900.3	3%
Number of years with bypasses	21	5%	35	-3%	48	0%	47	0%	48	0%	48	0%
Average annual bypass for years with a bypass (kaf)	177.0	-6%	133.7	2%	260.9	-9%	193.7	-14%	225.5	2%	900.3	3%
Largest annual bypass (kaf)	748.7	-3%	782.1	-5%	1022.8	-3%	897.2	-3%	1075.7	-5%	2018.2	0%
Year of largest annual bypass	1984		1984		1984		1984		1984		1984	
File that contains the data		Resop.lst		Resop.lst		Resop.lst		Resop.lst		Resop.lst		Resop.lst
Output line number		13		27		43		59		83		99

[1] % Δ indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

Table 3.4.3- 16. Turbine bypass flow statistics for the North Platte system above Lake McConaughy.

Table 3.4.3-16 shows a net decrease in bypass flows for all but two of the hydroelectric plants on the North Platte River for the Water Emphasis Alternative with respect to the Present Condition. This is most likely due to lower reservoir levels in the North Platte System. Percentage changes range from increases of 3 percent to a decrease of 14 percent for the individual projects in the system. **Figure 3.4.3-5** shows how the bypass flows would be distributed on a monthly basis for the Fremont Canyon hydroelectric plant.

3.4.3.2 Platte River Basin in central Nebraska

The results of the analysis of the central Platte River basin for the Water Emphasis Alternative are summarized in **Figures 3.4.3-6** through **3.4.3-14** and **Tables 3.4.3-17** through **3.4.3-36**. The terms used below are defined at the end of **Section 3.2** according to how they are used in this discussion.

Lake McConaughy. Conditions in Lake McConaughy resulting from the Water

Emphasis Alternative are shown on **Figure 3.4.3-6**.

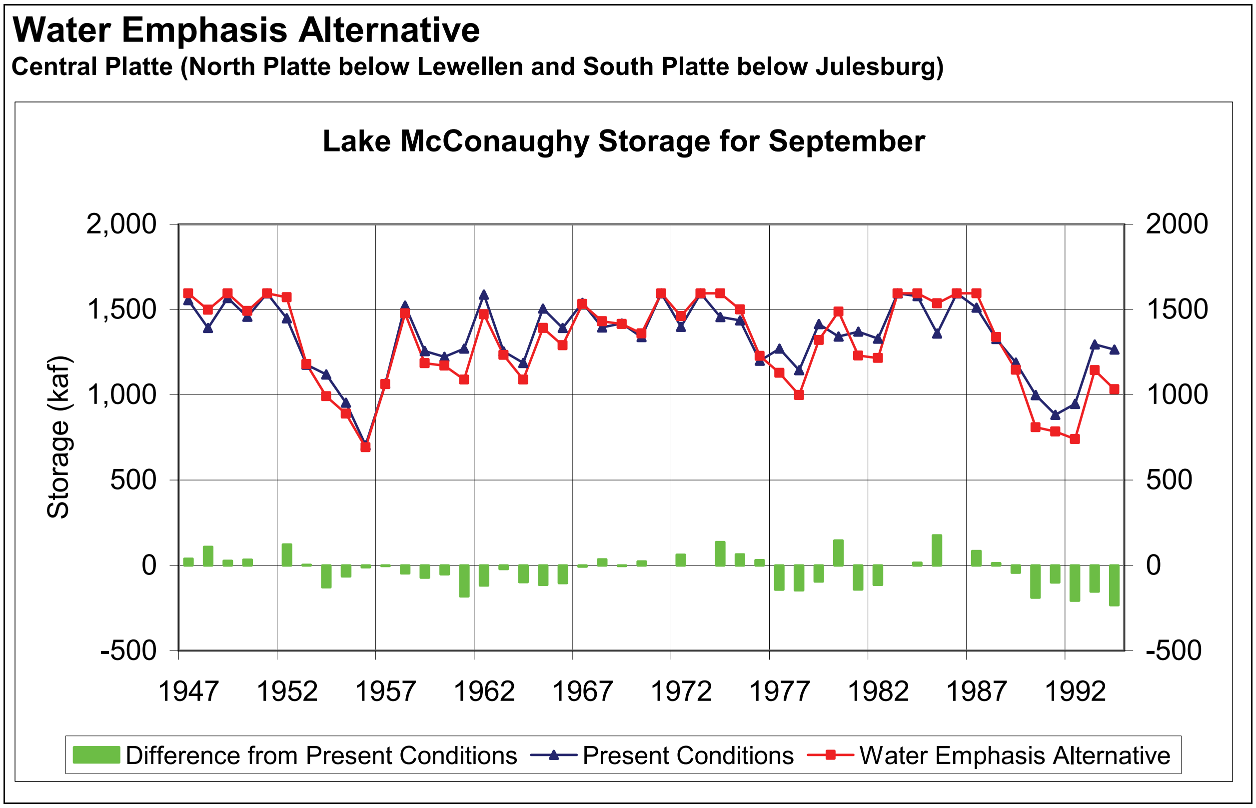


Figure 3.4.3- 6. End of September storage in Lake McConaughy.

Figure 3.4.3-6 shows that, for most years, end-of-September storage in Lake McConaughy for the Water Emphasis Alternative is lower than that for the Present Condition. This is consistent with the establishment of the EA and its use for downstream flow augmentation. Of the years when the two are nearly equal or the Water Emphasis Alternative is slightly higher, most are wet years or years that immediately follow wet years. All water from Reclamation's reservoirs on the North Platte is delivered in September, which causes the end-of-September storage in Lake McConaughy to increase with respect to Present Conditions in wet years.

Water Emphasis Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Lake McConaughy Reservoir Storage	Value	% Δ[1]
Minimum end-of-month storage for 48-year simulation (kaf)	689.4	-2%
Maximum end-of-month storage for 48-year simulation (kaf)	1743.1	0%
Average end-of-month storage for 48-year simulation (kaf)	1374.7	-5%
Low storage indicator: years with storage < 500 kaf	0	0%
Year that minimum first occurred		1956
Largest single month drawdown for this alternative (kaf)	230.1	-3%
Month of largest drawdown		July-91
Table number in file H2OEmphs.tab.		1

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

Table 3.4.3- 17. Reservoir storage statistics for Lake McConaughy.

Over all months of the simulation period, the average end-of-month storage for the Water Emphasis Alternative shows a 5 percent decrease with respect to the Present Condition.

Water Emphasis Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Lake McConaughy Storage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
										Table 1 in file H2OEmphs.tab.			
Min (kaf)	814	873	914	987	928	916	822	694	693	689	735	785	689
Max (kaf)	1,633	1,640	1,594	1,609	1,743	1,743	1,743	1,625	1,594	1,594	1,594	1,594	1,743
Avg (kaf)	1,414	1,414	1,425	1,445	1,429	1,429	1,335	1,240	1,303	1,327	1,356	1,380	1,375
Year that minimum first occurred	1957	1957	1957	1992	1992	1992	1992	1991	1956	1956	1956	1956	1956
Percent change from Present Conditions													
Min	-9%	-8%	-8%	-8%	-18%	-13%	-11%	-13%	-2%	-6%	-9%	-10%	-2%
Max	2%	3%	0%	0%	0%	0%	0%	-3%	0%	0%	0%	0%	0%
Avg	-3%	-5%	-6%	-6%	-8%	-8%	-8%	-7%	-2%	-3%	-3%	-3%	-5%

Table 3.4.3- 18. Monthly reservoir storage statistics for Lake McConaughy.

Minimum, maximum, and average storage by month are shown in **Table 3.4.3-18**. This table shows that the largest percent change occurs in the minimum reservoir storage attained during the simulation of the Water Emphasis Alternative.

Water Emphasis Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

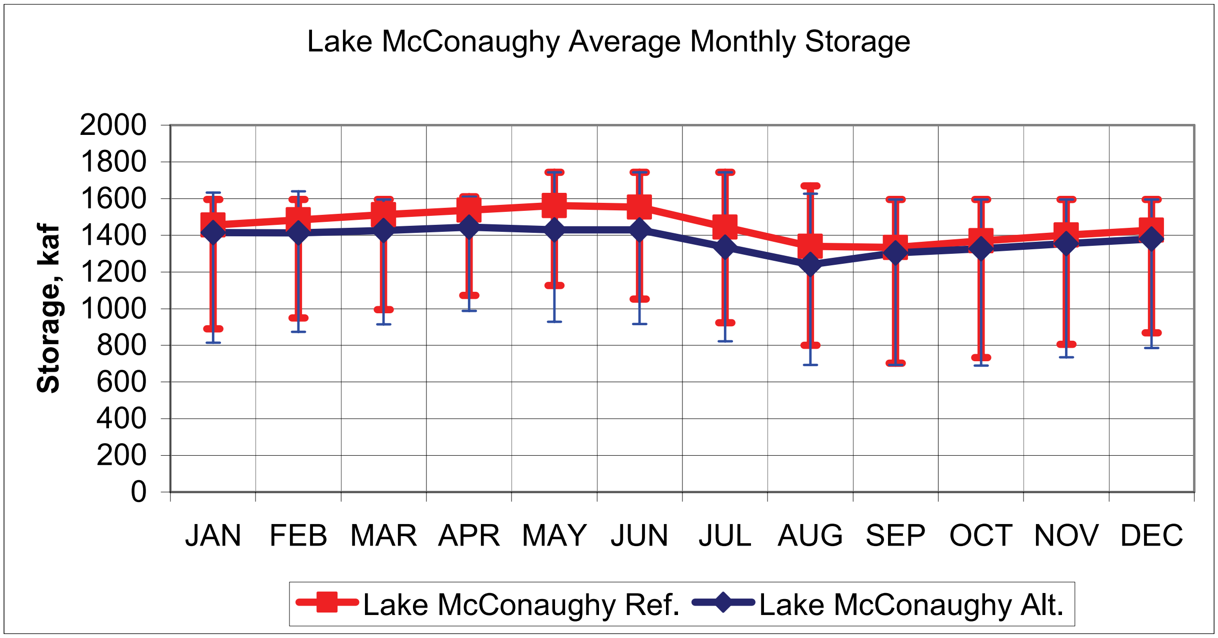
Lake McConaughy Spills	Value	% Δ[1]
Average annual spill for 48-year simulation period (kaf)	102.2	-40%
Number of years with spills	17	-41%
Average annual spill for years with spills (kaf)	288.6	3%
Largest annual spill (kaf)	1365.7	-2%
Year of largest annual spill		1984
Table number in file H2OEmphs.tab.		6

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

Table 3.4.3- 19. Spills from Lake McConaughy.

The number of years with spills for the Water Emphasis Alternative shows a 41 percent decrease from 31 to 17 with respect to the Present Condition, and the average annual spill shows a 40 percent decrease. Spills include when water is released from Lake McConaughy in order to comply with the FERC storage limits.

Water Emphasis Alternative
Central Platte (North Platte below Lewellen and South Platte below Julesburg)



Bars represent minimums and maximums for the reference run and the alternative.

Figure 3.4.3- 7. Lake McConuaghy average monthly storage with error bars for minimum and maximum.

Figure 3.4.3-7 shows the average monthly storage with minimums and maximums represented by bars. This figure shows that the lowest storage occurs in August and September. It also shows that the average storage and the minimum storage for the Water Emphasis Alternative are less than Present Condition. The maximum storage is higher than Present Condition in September through February due to the use of water leasing reducing releases from Lake McConaughy.

Figure 3.4.3-8 shows the average monthly release from Lake McConaughy including releases from the Environmental Account. The figure shows lower releases in May through August due to reduced spills. Releases are higher in February, March, and October due to releases from the Environmental Account.

Figure 3.4.3-9 shows the average monthly storage for Sutherland, Elwood, and Johnson Lake reservoirs. This figure shows that there is no change in storage in these reservoirs between the Water Emphasis Alternative and Present Condition.

Figure 3.4.3-10 shows that, for most months, the Water Emphasis Alternative constitutes an improvement over the Present Condition for average monthly flow at Grand Island. Flows equal or exceed target flows slightly more than half of the time.

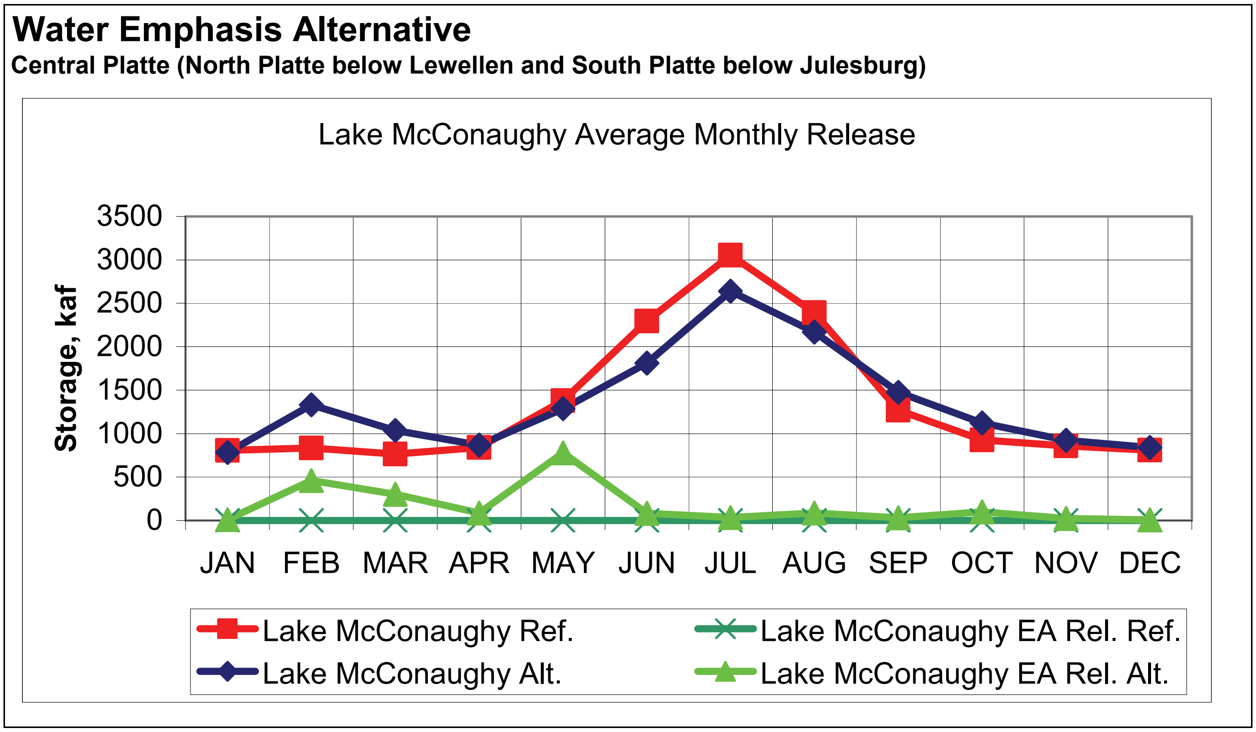


Figure 3.4.3- 8. Average monthly release from Lake McConaughy showing environmental releases.

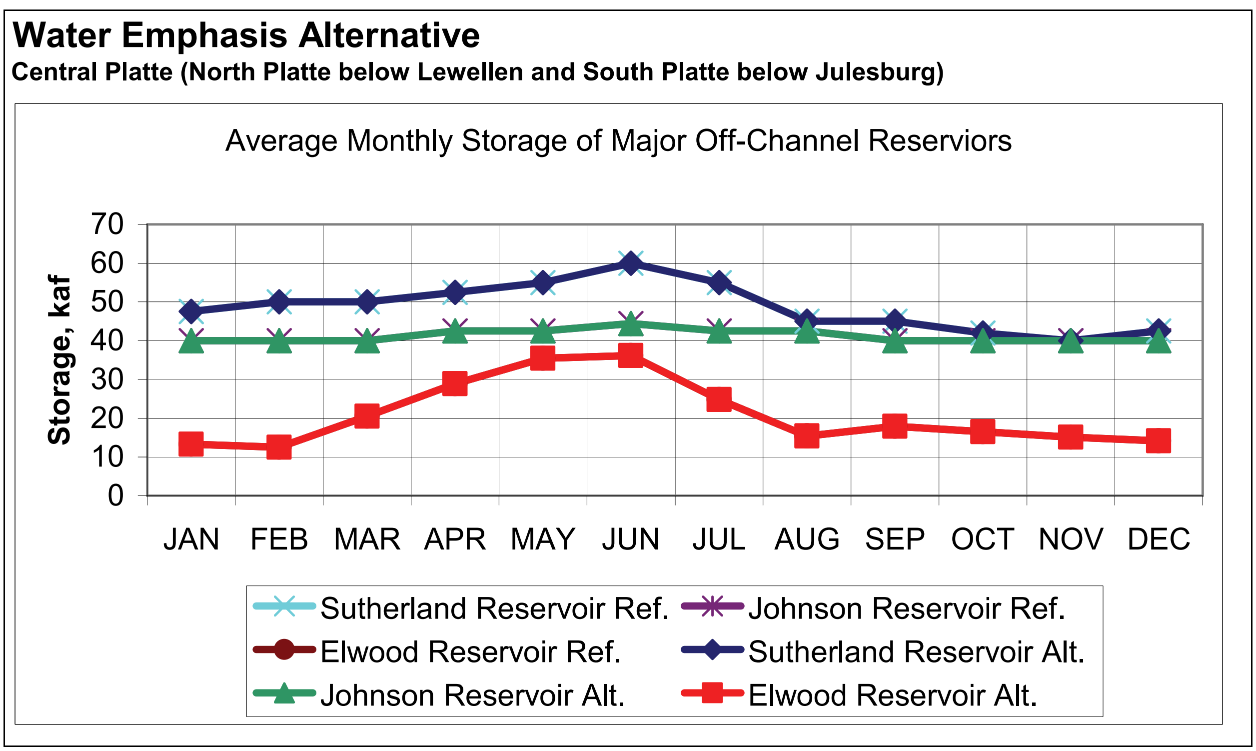


Figure 3.4.3- 9. Average monthly storage for major off-channel reservoirs.

Grand Island Target Flows. Conditions at Grand Island resulting from the Water

Emphasis Alternative are shown on **Figure 3.4.3-10**.

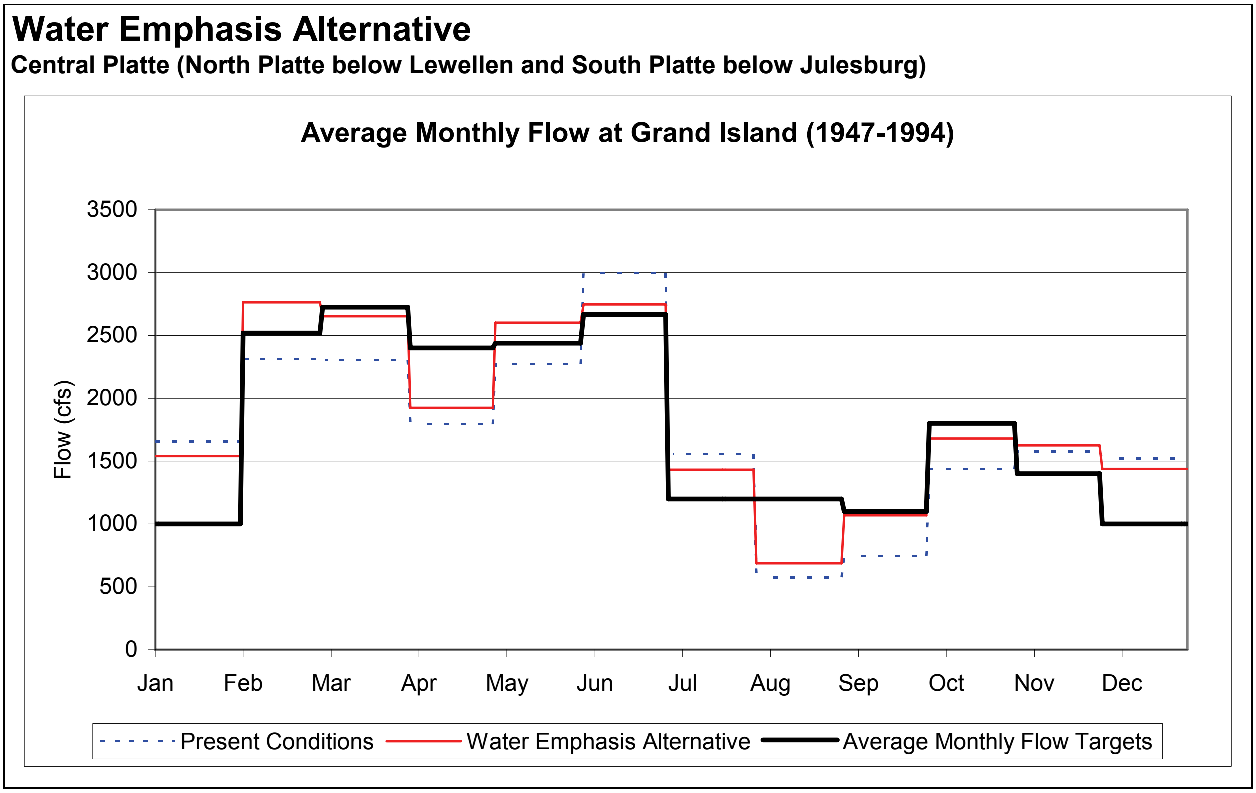


Figure 3.4.3- 10. Average monthly flow at Grand Island, Nebraska compared to flow targets.

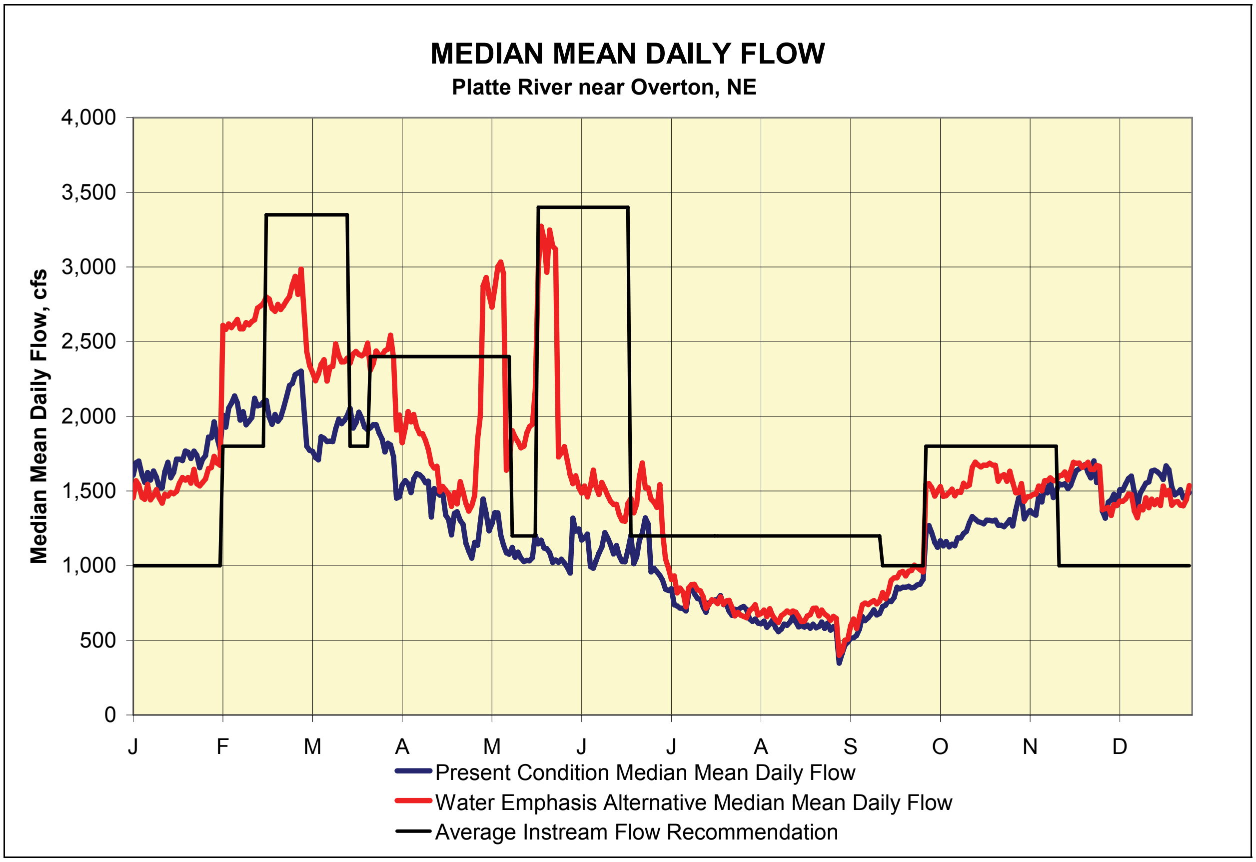
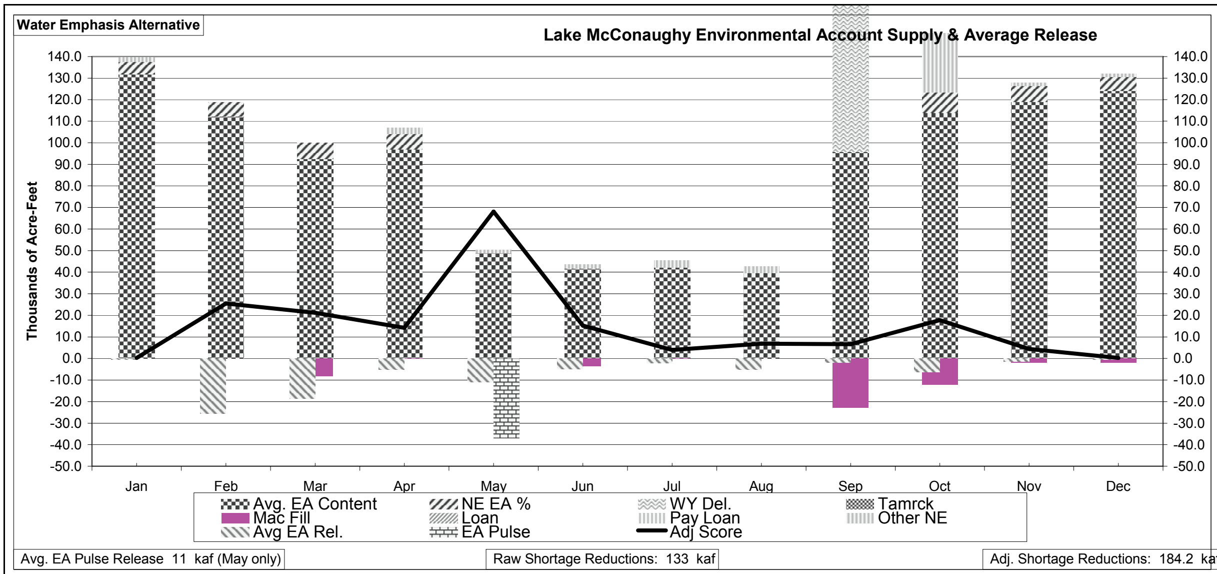


Figure 3.4.3- 11. Median mean daily flow near Overton, Nebraska compared to flow targets.

Figure 3.4.3-11 shows the daily flow targets for average conditions compared to the median daily flow for the Water Emphasis Alternative and Present Condition. The figure shows that the Water Emphasis Alternative constitutes an improvement to flow targets over the Present Condition at Grand Island. However, flows fall short of flow targets most of the time.

Score.



Water Emphasis Alternative

# Zero Flow Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Present	0	0	0	0	0	1	0	1	2	0	0	0	4
H2OEmphs	0	0	0	0	0	0	0	0	0	0	0	0	0
Raw Shortage Reduction, kaf	0.2	20.5	20.8	14.2	27.0	12.9	3.4	6.8	5.3	17.7	4.4	0.0	133.0
Adjusted Shortage Reduction, kaf	0.3	25.5	21.1	14.2	68.0	15.3	3.9	6.9	6.6	17.7	4.4	0.3	184.2

H2OEmphs		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	Begin Month Content	124.6	131.7	112.2	92.6	97.2	48.9	42.0	42.2	39.7	95.9	114.1	118.9	
plus	NE EA % accrual	5.9	6.4	7.3	7.2	0.0	0.0	0.0	0.0	0.0	9.5	7.3	6.4	50.0
plus	WY EA contribution	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.3	0.0	0.0	0.0	80.3
plus	CO EA exchanged	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
plus	Other NE Water	1.9	0.0	0.0	2.8	1.2	1.8	3.1	3.0	1.1	27.4	1.4	1.4	44.9
plus	EA credit/Mac Fill	0.0	0.0	-8.1	-0.2	-1.1	-3.7	-0.2	0.0	-22.9	-12.2	-2.1	-2.0	-52.5
minus	EA Release	-0.6	-25.6	-18.6	-5.1	-11.0	-5.0	-2.2	-5.2	-1.9	-6.2	-1.4	-0.5	-83.2
minus	EA Evaporation	-0.1	-0.2	-0.2	-0.3	-0.3	-0.2	-0.4	-0.3	-0.4	-0.4	-0.3	-0.1	-3.3
minus	EA Pulse Release	0.0	0.0	0.0	0.0	-37.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-37.0
plus	EA borrow from Mac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
minus	EA paid back to Mac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	End-of-Month Content	131.7	112.3	92.6	97.0	49.0	41.8	42.3	39.7	95.9	114.0	119.0	124.1	

Figure 3.4.3- 12. Accruals, storage, and releases for the Environmental Account in Lake McConaughy.

Figure 3.4.3-12 shows the accruals, storage, and releases for the Environmental Account in Lake McConaughy in both graphical and tabular format. The figure shows the contributions by state and adjustments to the amount stored in the Environmental Account when Lake McConaughy fills. There is also a comparison to the number of months that have zero flow for Present Condition and the Water Emphasis Alternative

Water Emphasis Alternative										Adjusted Shortage Reduction:				184.2
H2OEmphs	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Adj.
Groundwater Mgmt Storage	2.6	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	1.1	2.9	3.7	10.9	--
Groundwater Mgmt Contribution	0.0	0.0	0.0	0.0	1.2	1.8	3.1	3.0	1.1	0.0	0.0	0.0	10.1	--
Riverside Drains	0.0	0.0	0.5	1.0	1.0	2.0	2.0	2.0	1.0	0.5	0.0	0.0	10.0	
North Dry Ck GW inflow at Kearney[1]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dawson and Gothenburg Recharge[2]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C. Platte Rereg. Reservoir Release[3]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Power Interference credited to EA	1.8	0.0	0.0	2.9	0.0	0.0	0.0	0.0	0.0	0.1	1.4	1.4	7.6	--
Net Controllable Conserved Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	
NE Irrigation Savings	0.0	0.0	0.0	0.4	2.5	4.1	8.7	8.3	2.7	0.2	0.0	0.0	27.0	--
Other CO at Jules. (no exchange)	0.0	0.0	0.0	0.0	19.5	8.3	0.0	0.0	0.0	0.0	0.0	0.0	27.8	--
Average EA Pulse Release[4]	0.0	0.0	0.0	0.0	37.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.0	37.0
Average Tri-County Irr. Rel. for pulse[5]	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	1.4
Average Johnson Lake Rel. for pulse[6]	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	--
Number of times EA Borrowed	0	0	0	0	0	0	0	0	0	0	0	0	0	--
Number of time EA Paid Back	0	0	0	0	0	0	0	0	0	0	0	0	0	--
Credit for other Program flows[7]	0.1	5.0	0.4	0.0	2.7	2.4	0.5	0.1	1.3	0.0	0.0	0.3	12.8	12.8
CP Rereg. Res "Spike" Attenuation[8]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Johnson Lake "Spike" Attenuation[8]	0.0	0.0	0.0	0.0	0.0	2.0	0.7	0.3	0.0	0.0	0.0	0.0	3.0	--

1 For N. Dry Creek, adj. shortage reduction = 1/2 * the reduction in target flow shortages calculated by the C.P. OPSTUDY model.
2 Dawson and Gothenburg recharge is not modeled; values are from the Water Action Plan.
3 Central Platte reregulatory reservoir operates using daily flows and is added to the reduction in target flow shortages calculated from the monthly flow values.
4 For EA Pulses, the volume of release is added to the reduction in target flow shortages calculated from the monthly flow values.
5 Pulse augmentation from the Tri-County Canal system (Irrigation water and Elwood Reservoir Storage water).
6 Not added to score because it is assummed to be the rerelease of water from the EA in Lake McConaughy.
7 These are Program contributions that are above targets flows and also greater than the flows under Present Conditions
8 "Spike" attenuation does not reduce shortages to target flows but does provide benefit to the Program.

Table 3.4.3- 20. Central Platte accruals to and releases from the Environmental Account in Lake McConaughy.

The annual reduction to shortages to the flow targets produced by the Water Emphasis Alternative is 184.2 kaf (**Table 3.4.3-20**). **Table 3.4.3-20** shows the contributions to the Program from all the Water Action Plan elements in the central Platte. The table also shows other flows that contribute to the Score of the Program.

Pulse and Short duration near-bankful flows.

Pulse flows occur during two time periods February/March and May/June. Short duration near-bankful flows are events that last for three days. **Table 3.4.3-21** quantifies the effects of the Program on pulse and short duration near-bankful flows. The table shows that the 30 day pulse in the April through June time period decreases for the 75% of the years that have the highest flows. These same events increase for the 25% of the years that have the lowest flows. The February/March 30 day pulse flow increases. The short duration near-bankful flows decrease for the highest 30%, increase for the middle 40% and the smallest 30%. The number of years with flows greater than 6,500 cfs near Overton, Nebraska increase and the years with flows less than 100 cfs decrease. The final row in **Table 3.4.3-21** is the average annual flow in the J2 return, which increases for the Water Emphasis Alternative.

Water Emphasis Alternative **Central Platte (North Platte below Lewellen and South Platte below Julesburg)**				
	Present Condition	**Water Emphasis**		
	Value	**Value**	**Change**	**% Change**
30-day pulse flow				
Apr/Jun (highest 75%)	4,822	4,787	-35	-1%
Apr/Jun (lowest 25%)	809	1,825	1,016	126%
Feb/Mar (all years)	2,168	2,564	397	18%
3-day pulse flows				
Years w/flows > 7,500 cfs	12	12	0	0%
Largest 30%	13,101	11,221	-1,881	-14%
Middle 40%	4,589	6,067	1,478	32%
Smallest 30%	2,333	4,622	2,289	98%
% of Years 3-day pulse flow objectives achieved (**6,500** cfs @ Overton)	38%	100%	63%	167%
Low Flows				
Years w/flows < 100 cfs	17	8	-9	-53%
Years w/flows = 0 cfs	0	3	3	NA
J2-Return (avg ann flow), kaf	593	663	70.2	12%

Table 3.4.3- 21. Pulse flow and short duration near-bankful flow summary for the Platte River near Overton.

Table 3.4.3-22 also shows information regarding the short duration near-bankful flows. There were 32 years that water was released for short duration near-bankful flows. The short duration near-bankful flow target is 6,500 cfs for three days.

Water Emphasis Alternative **Central Platte (North Platte below Lewellen and South Platte below Julesburg)**		
Pulse flow target summary (at Overton, NE)	**Value**	**% Δ[1]**
Years with pulse flow releases[2]	32	NA
Average duration of pulse flow releases for years with pulse releases (days)[2]	4.9	NA
Years that pulse flow targets were achieved	48	167%
Average maximum Peak Daily Flow when pulse targets were achieved (cfs)	7,717	-36%
Average maximum Peak Daily Flow for remaining years (cfs)	NA	NA

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

[2] NA in the % Δ column indicates that pulse flows are not part of the Present Condtion Run

Table 3.4.3- 22. Short duration near-bankful flow summary for the Platte River near Overton.

Table 3.4.3-23 shows how the short duration near-bankful flows affect the flows in the central Platte river basin. The table shows the average and maximum volumes associated with the short duration near-bankful flow release at various points on the North Platte and Platte rivers. A negative value in a volume column indicates that the canal curtailed diversions (diverted less) during the short duration near-bankful flow event. The table also shows the average and maximum flow during the short duration near-bankful flow event for these same locations.

Water Emphasis Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)				
	Average Pulse Volume (acre-feet)	Maximum Pulse Volume (acre-feet)	Average flow during a pulse release (cfs)	Maximum flow during a pulse release (cfs)
Mac Out	35,534	86,284	3,967	5,700
North Platte River	21,698	65,620	2,374	3,500
Sutherland Canal	12,346	26,890	1,861	2,100
Tri-County Canal	-904	-2,202	1,514	1,770
Platte River above the Jeffrey Return	34,407	81,958	3,807	7,021
Platte River below the Jeffrey Return	35,803	84,737	4,167	6,664
Platte River below the J2 Return	38,253	89,138	5,006	8,852

Table 3.4.3- 23. Flow summary during the short duration near-bankful flow period.

Figure 3.4.3-13 shows that the number of years with flows in the 3,000 to 8,000 range increased with the Water Emphasis Alternative compared to Present Condition.

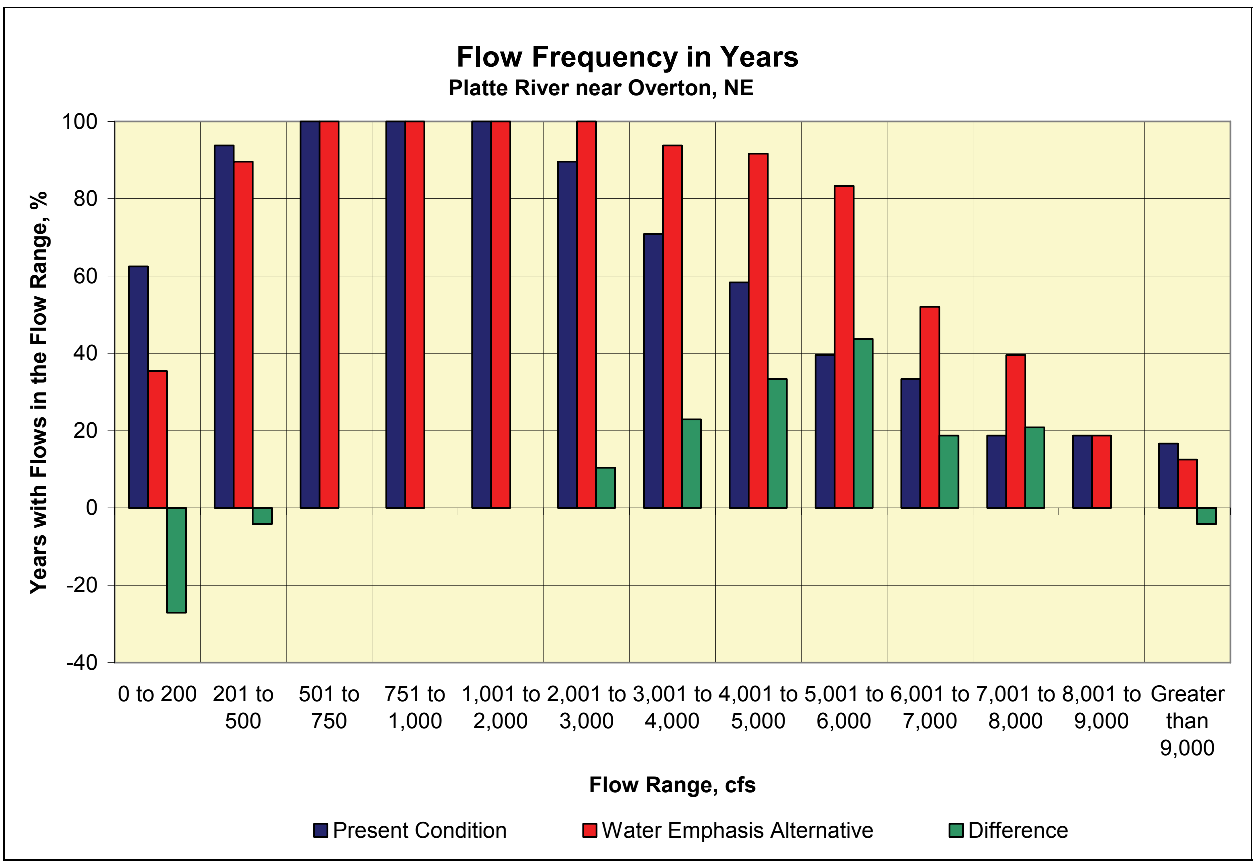


Figure 3.4.3- 13. Flow frequency by flow range in years for the Platte River near Overton.

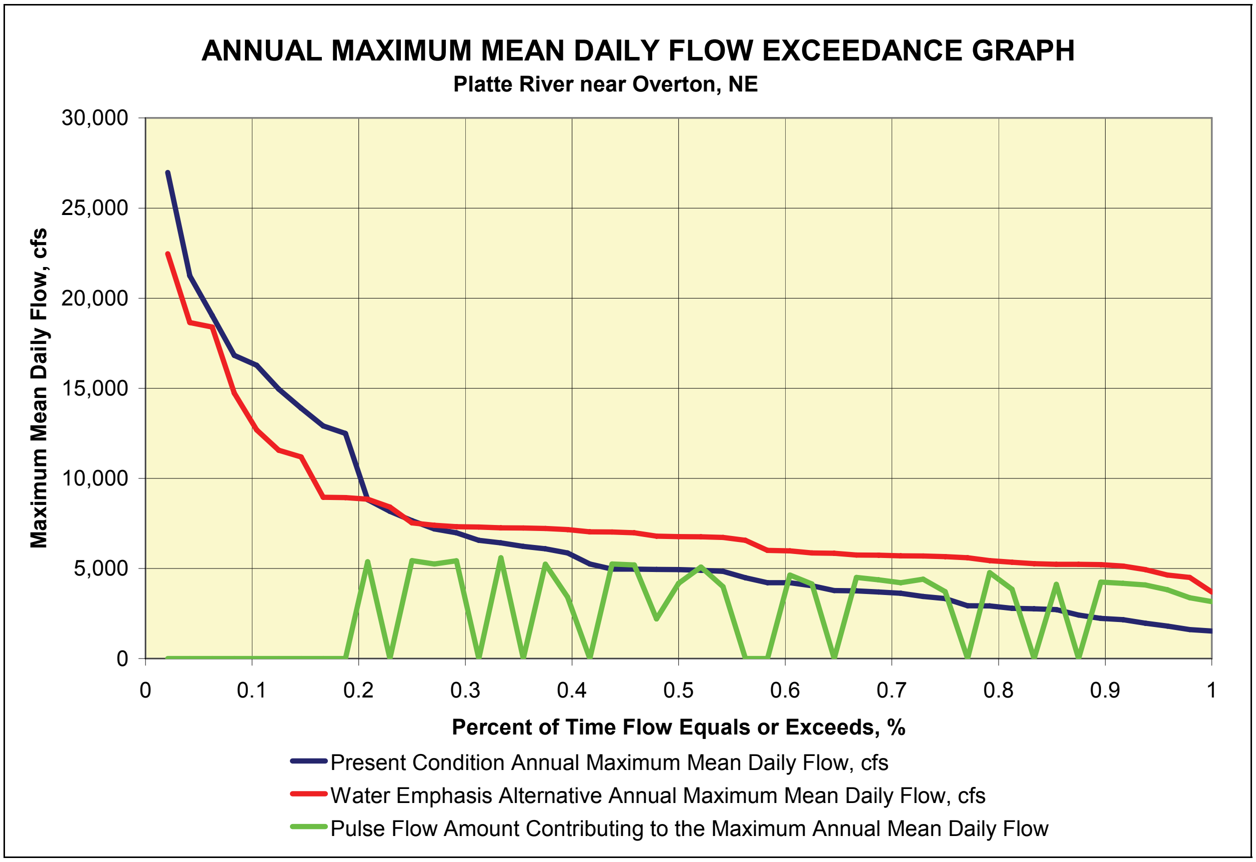


Figure 3.4.3- 14. Exceedance curve for the annual maximum mean daily flow near Overton, Nebraska.

Figure 3.4.3-14 shows a graph of the annual maximum mean daily flow sorted from largest to smallest. Also shown is the release from the Environmental Account for the short duration near-bankful flows. The figure shows that highest 20% of flows are reduced and flows in the 3,000 to 8,000 cfs range are increased.

North Platte Channel Capacity.

Water Emphasis Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)	
Interaction of the North Platte Channel Capacity with the Environmental Account Operations	
Pulse release limited by North Platte channel capacity (years)	11
Environmental Account release limited by North Platte channnel capacity (months)	1
Environmental Account release limited by North Platte channnel capacity (years)	1

Table 3.4.3- 24. Summary of North Platte channel restrictions on environmental flow deliveries.

Table 3.4.3-24 shows that short duration near-bankful flow releases were limited by the capacity of the North Platte River at North Platte, Nebraska in 11 years. Other releases from the Environmental Account were limited in 1 out of 48 years.

Environmental/Project Accruals by Basin. The average monthly and annual environmental accruals by basin are given in **Table 3.4.3-25**.

Water Emphasis Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Environmental Accruals by Basin	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
North Platte (above Lake McConaughy)										Table 66 in file H2OEmphs.tab.			
Min (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.2	0.0	0.0	0.0	19.2
Max (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	153.6	0.0	0.0	0.0	153.6
Avg (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.3	0.0	0.0	0.0	80.3
Year that minimum first occurred	1947	1947	1947	1947	1947	1947	1947	1947	1954	1947	1947	1947	1954
South Platte (above Julesburg Gage)[1]									Tables 67 and 83 in file H2OEmphs.tab.				
Min (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max (kaf)	0.0	0.0	0.0	0.0	22.6	22.2	0.0	0.0	0.0	0.0	0.0	0.0	32.1
Avg (kaf)	0.0	0.0	0.0	0.0	19.5	8.3	0.0	0.0	0.0	0.0	0.0	0.0	27.8
Year that minimum first occurred	1947	1947	1947	1947	1973	1949	1947	1947	1947	1947	1947	1947	1980
Central Platte[2]								Tables 66, 67 and 63 in file H2OEmphs.tab.					
Min (kaf)	0.2	0.3	4.4	4.2	1.0	2.0	2.0	2.0	1.0	28.3	0.4	0.2	78.2
Max (kaf)	22.4	10.5	13.6	51.4	3.7	6.1	7.8	7.4	4.0	45.2	24.1	23.2	146.6
Avg (kaf)	7.8	6.4	7.8	11.0	2.2	3.8	5.1	5.0	2.1	37.4	8.7	7.8	104.9
Year that minimum first occurred	1949	1963	1974	1980	1955	1955	1955	1955	1955	1952	1948	1948	1992
Total										Table 63 in file H2OEmphs.tab.			
Min (kaf)	0.2	0.3	4.4	4.2	1.4	2.0	2.0	2.0	22.2	28.3	0.4	0.2	114.4
Max (kaf)	22.4	10.5	13.6	51.4	25.8	26.9	7.8	7.4	157.5	45.2	24.1	23.2	320.6
Avg (kaf)	7.8	6.4	7.8	11.0	21.7	12.1	5.1	5.0	82.3	37.4	8.7	7.8	213.0
Year that minimum first occurred	1949	1963	1974	1980	1984	1955	1955	1955	1954	1952	1948	1948	1955

[1] Water from the Western Canal is included in the Central Platte Accruals

[2] This includes the water that accures to the Environmental Account in Lake McCounaughy

Table 3.4.3- 25. Environmental accruals by basin.

Table 3.4.3-25 shows the greatest accruals by month occurring in September, and October. October is when Program accruals from water conservation, water leasing, water management incentives, and net controllable conserved water are added to the Environmental Account in Lake McConaughy; September is when water is first moved from the North Platte River above Lake McConaughy to the Environmental Account.

North Platte (above Lake McConaughy). Table 3.4.3-25 shows that the environmental deliveries occur in September, with no accrurls in the remaining months of the year. The months of October through March are effectively the winter months in the higher elevations upstream of the North Platte reservoirs.

South Platte (above Julesburg, CO). Table 3.4.3-25 shows very high deliveries occurring in May and June. May and June are when water from leasing in Colorado is delivered to the central Platte. **Table 3.4.3-25** also shows that no water was exchanged into the EA in Lake McConaughy from the retiming of flows by the Tamarack project. **Table 3.4.3-26** shows the operations of the Tamarack project in Colorado.

Water Emphasis Alternative South Platte (South Platte above Julesburg)													
Tamarack Operations	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Ann**
Pumped or Diverted for Recharge													
Maximum, kaf	17,183	17,183	17,183	17,183	17,183	17,183	17,183	0	17,183	17,183	17,183	17,183	189,013
Minimum, kaf	0	0	0	0	0	0	0	0	0	0	0	0	3,700
Average, kaf	15,738	12,071	6,706	2,860	3,940	7,231	4,382	0	4,246	2,506	7,733	13,609	81,022
Median, kaf	17,183	14,300	3,900	0	0	3,250	0	0	0	0	6,605	17,183	74,373
Months with recharge at max., months[1]	38	23	13	6	5	15	11	N/A	11	7	12	29	1
Months with no recharge, months	1	8	18	39	27	22	30	48	36	41	14	1	0
Net Impact on South Platte River													
Maximum, kaf [2]	2,829	7,105	10,423	10,884	9,606	9,383	8,895	9,972	7,853	9,421	5,371	4,310	37,194
Minimum, kaf [2]	-13,504	-12,204	-12,415	-11,516	-11,565	-15,249	-13,892	1,859	-12,863	-12,509	-14,766	-14,533	-86,322
Average, kaf [2]	-9,242	-3,983	578	3,541	2,205	-1,680	1,112	5,373	718	2,336	-3,248	-8,981	-11,271
Median, kaf [2]	-10,453	-5,584	3,754	5,840	4,435	1,302	4,364	5,093	3,946	4,122	-4,036	-10,900	-6,232

[1] N/A indicates that no recharge occurred during this month.
[2] Negative values indicate recharge and positive values indicate return flows.

Table 3.4.3- 26. Tamarack operations.

Central Platte (including Lake McConaughy). Table 3.4.3-25 shows that the greatest environmental accruals occur in October, with the least environmental accruals occurring in May through August and somewhat higher accruals occurring in November through April. This is generally consistent with the way in which the Lake McConaughy EA is managed. The high value in October can be attributed to conservation credits that accrue in October.

Shortages, Water Banking/Conservation, Irrigation Demand. The results for shortages, conservation, and irrigation demand are summarized in **Tables 3.4.3-27** through **3.4.3-31**.

Water Emphasis Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)												
	Western Canal		**Keystone - Sutherland**		**Sutherland - North Platte**		**Brady - Cozad**		**Tri-County Canal**		**Kearney Canal**	
Irrigation Demand by Reach / Canal	**Value**	**% Δ**[1]	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**
Average annual demand for 48-year simulation period (kaf)	26.3	0%	88.3	0%	26.4	0%	172.7	0%	205.5	0%	13.3	0%
Maximum annual demand (kaf)	51.1	0%	113.4	0%	37.9	0%	236.5	0%	290.5	0%	22.7	0%
Minimum annual demand (kaf)	11.5	0%	52.1	0%	14.3	0%	76.8	0%	89.4	0%	3.2	0%
Table number in file H2OEmphs.tab.		111		112		113		114		115		116

[1] % Δ indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

Table 3.4.3- 27. Irrigation demand by reach/canal.

Irrigation Demand. There is no change in average annual irrigation demand for the Water Emphasis Alternative with respect to the Present Condition.

Water Emphasis Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)												
	Western Canal		Keystone - Sutherland		Sutherland - North Platte		Brady - Cozad		Tri-County Canal		Kearney Canal	
Shortages by Reach / Canal	Value	% Δ[1]	Value	% Δ	Value	% Δ	Value	% Δ	Value	% Δ	Value	% Δ
Average annual shortage for 48-year simulation period (kaf)[2]	0.0	-100%	0.0	NA	0.0	NA	0.0	NA	0.0	NA	0.0	NA
Number of years with shortages[2]	1	-88%	0	NA	0	NA	0	NA	0	NA	0	NA
Average annual shortage for years with shortage (kaf)[2]	0.5	-74%	0.0	NA	0.0	NA	0.0	NA	0.0	NA	0.0	NA
As a percentage of demand for years with shortage (%)	1.7%		0.0%		0.0%		0.0%		0.0%		0.0%	
Largest annual shortage (kaf)[2]	0.5	-88%	0	NA	0	NA	0	NA	0	NA	0	NA
As a percentage of demand (%)	1.7%		0.0%		0.0%		0.0%		0.0%		0.0%	
Year of largest annual shortage		1947		----		----		----		----		----
Table number in file H2OEmphs.tab.		123		124		125		126		127		128

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)
[2] NA in the % Δ column indicates that there value for the Present Condtion Run is zero

Table 3.4.3- 28. Shortages to irrigation by reach/canal.

Shortages. Table 3.4.3-28 shows that only one system, the Western Canal, has any shortages for the Water Emphasis Alternative. Only 1 years of the 48 years simulated had any shortages. The average annual shortage over the entire simulation period is 0.0 kaf, which is a 100 percent decrease with respect to the Present Condition. These figures are not highly significant, since the actual values for both the alternative and the Present Condition are very small. The reduction in shortages for the Western Canal is due to increased flows at Julesburg predicted by future development in Colorado.

Irrigation Deliveries. Tables 3.4.3-29 and **3.4.3-30** show the irrigation deliveries for the central Platte river basin. **Table 3.4.3-29** shows the deliveries to the irrigators on the North and South Platte rivers. The table shows no differences in deliveries with the exception of the Western Canal that are due to shortages. **Table 3.4.3-30** shows the deliveries to irrigators below the town of North Platte. These deliveries have been reduced using water conservation, water leasing, and water management incentives to lessen the impacts on Program deliveries due to the North Platte channel capacity.

Water Emphasis Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Irrigation Deliveries	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Western Canal Irrigation Deliveries										Table 53 in file H2OEmphs.tab.			
Min (kaf)	0	0	0	0	0	0	1	1	1	0	0	0	12
Max (kaf)	0	0	2	8	13	14	15	11	13	7	4	1	51
Avg (kaf)	0	0	0	1	4	4	5	4	4	3	1	0	26
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	11%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	4%	0%	1%
Keystone-Sutherland Irrigation Deliveries										Table 50 in file H2OEmphs.tab.			
Min (kaf)	0	0	0	0	3	6	10	15	3	0	0	0	52
Max (kaf)	0	0	1	9	22	23	33	29	20	11	1	0	113
Avg (kaf)	0	0	0	2	10	14	24	23	13	3	0	0	88
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Sutherland-North Platte Irrigation Deliveries										Table 55 in file H2OEmphs.tab.			
Min (kaf)	0	0	0	0	0	1	3	3	1	0	0	0	14
Max (kaf)	0	0	0	2	6	7	10	8	7	4	1	0	38
Avg (kaf)	0	0	0	0	3	4	7	7	4	1	0	0	26
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 3.4.3- 29. Irrigation deliveries by reach/canal for the North and South Platte rivers.

Water Emphasis Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Irrigation Deliveries	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Brady-Cozad Irrigation Deliveries										Table 53 in file H2OEmphs.tab.			
Min (kaf)	0	0	0	0	3	4	5	33	3	0	0	0	72
Max (kaf)	0	0	2	12	26	42	88	74	32	24	3	0	220
Avg (kaf)	0	0	0	2	11	21	56	53	15	3	0	0	161
Percent change from Present Conditions													
Min	0%	0%	0%	0%	-7%	-7%	-8%	-7%	-7%	0%	0%	0%	-7%
Max	0%	0%	-9%	-7%	-7%	-7%	-7%	-7%	-7%	-7%	-6%	0%	-7%
Avg	0%	0%	-7%	-7%	-7%	-7%	-7%	-7%	-7%	-7%	-6%	0%	-7%
Central (Tri-County) Irrigation Deliveries										Table 50 in file H2OEmphs.tab.			
Min (kaf)	0	0	0	0	6	12	16	27	1	0	0	0	78
Max (kaf)	0	0	0	6	41	59	95	76	49	0	0	0	271
Avg (kaf)	0	0	0	3	21	31	55	53	19	0	0	0	181
Percent change from Present Conditions													
Min	0%	0%	0%	0%	-13%	-12%	-12%	-12%	0%	0%	0%	0%	-12%
Max	0%	0%	0%	-7%	-7%	-13%	-7%	-10%	-7%	0%	0%	0%	-7%
Avg	0%	0%	0%	-6%	-12%	-12%	-12%	-12%	-12%	0%	0%	0%	-12%
Kearney Canal Irrigation Deliveries										Table 55 in file H2OEmphs.tab.			
Min (kaf)	0	0	0	0	0	0	0	1	0	0	0	0	3
Max (kaf)	0	0	1	7	5	4	6	5	4	2	1	0	21
Avg (kaf)	0	0	0	1	1	1	3	3	2	0	0	0	12
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	-9%	0%	0%	0%	0%	-6%
Max	0%	0%	-10%	-7%	-6%	-7%	-7%	-7%	-7%	-9%	0%	0%	-7%
Avg	0%	0%	-3%	-6%	-7%	-7%	-7%	-7%	-7%	-5%	0%	0%	-7%

Table 3.4.3- 30. Irrigation deliveries by reach/canal for the Platte Rivers.

Water Emphasis Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)						
Water Banking / Conservation by Reach / Canal	Western Canal	Keystone - Sutherland	Sutherland - North Platte	Brady - Cozad	Tri-County Canal	Kearney Canal
Average annual conservation for 48-year simulation period (kaf)	0.0	0.0	0.0	11.9	14.2	0.9
Number of years with conservation	0	0	0	48	48	48
Average annual conservation for years with conservation (kaf)	0.0	0.0	0.0	11.9	14.2	0.9
As a percentage of demand (%)	0.0%	0.0%	0.0%	6.9%	6.9%	6.8%
Largest annual conservation (kaf)	0	0	0	16.2	20	1.6
As a percentage of demand (%)	0.0%	0.0%	0.0%	6.8%	6.9%	7.0%
Year of largest annual conservation	----	----	----	1988	1956	1985
Table number in file H2OEmphs.tab.	129	130	131	132	133	134

Table 3.4.3- 31. Water leasing/management incentives by reach/canal.

Water Banking/Conservation. Table 3.4.3-31 shows that the amount of water leased under the Water Emphasis Alternative is less than 2 kaf for the Kearney system; 11.9 kaf for the Brady-Cozad reach; and 14.2 kaf for the Tri-County Canal. There is leasing in all 48 years of the simulation. The leasing in all systems represents 6.8 percent or more of the demand on each system.

Flows. The results for the flows at significant locations are given in **Tables 3.4.3-32** through **3.4.3-34**.

Water Emphasis Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)													
Flows	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
North Platte River at Keystone										Table 39 in file H2OEmphs.tab.			
Min (Monthly (cfs), Annual (kaf))	0	0	0	0	46	101	159	239	45	0	0	0	82
Max (Monthly (cfs), Annual (kaf))	0	841	724	462	7,834	7,136	4,698	1,607	2,788	1,851	24	0	1,223
Avg (Monthly (cfs), Annual (kaf))	0	106	16	46	453	833	1,483	982	461	250	2	0	282
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-6%
Max	-100%	284%	411%	-43%	1%	-30%	-13%	-3%	52%	0%	0%	0%	-5%
Avg	-100%	960%	300%	-27%	-8%	-34%	-12%	-7%	76%	12%	0%	0%	-8%
North Platte River at North Platte										Table 42 in file H2OEmphs.tab.			
Min (Monthly (cfs), Annual (kaf))	138	266	216	193	252	272	275	345	181	254	284	304	290
Max (Monthly (cfs), Annual (kaf))	504	1,237	1,243	897	8,301	7,250	4,946	1,486	3,102	2,407	556	467	1,424
Avg (Monthly (cfs), Annual (kaf))	343	486	435	405	679	902	1,311	944	641	591	393	371	454
Percent change from Present Conditions													
Min	0%	0%	0%	0%	28%	0%	-49%	23%	0%	0%	0%	0%	-2%
Max	-31%	69%	63%	-35%	1%	-29%	-12%	-3%	47%	0%	0%	0%	-4%
Avg	-1%	25%	3%	-4%	-5%	-32%	-13%	-7%	45%	5%	0%	0%	-5%
Platte River at Maxwell (Below Tri-County Diversion)										Table 16 in file H2OEmphs.tab.			
Min (Monthly (cfs), Annual (kaf))	0	0	0	0	78	27	42	70	0	0	0	0	52
Max (Monthly (cfs), Annual (kaf))	823	1,874	2,033	2,138	12,884	16,414	9,197	1,560	3,405	2,126	1,492	707	2,324
Avg (Monthly (cfs), Annual (kaf))	266	593	383	267	1,227	1,502	897	515	435	260	170	181	404
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	-26%	0%	0%	0%	0%	71%
Max	-43%	-3%	48%	-15%	-3%	-22%	-12%	-19%	36%	-11%	-18%	-22%	-20%
Avg	-17%	56%	77%	-8%	11%	-24%	-27%	-12%	114%	12%	-2%	-10%	-4%

Table 3.4.3- 32. Flows in the central Platte basin.

Water Emphasis Alternative													
Central Platte (North Platte below Lewellen and South Platte below Julesburg)													
Flows	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Ann**
Platte River at Overton										Table 53 in file H2OEmphs.tab.			
Min (Monthly (cfs), Annual (kaf))	727	1,081	1,007	674	504	571	424	322	118	1,021	916	655	601
Max (Monthly (cfs), Annual (kaf))	3,383	4,915	4,324	5,882	16,745	19,128	11,134	1,573	5,154	4,494	4,151	3,298	4,008
Avg (Monthly (cfs), Annual (kaf))	1,682	2,695	2,373	1,822	2,580	2,757	1,324	777	1,266	1,802	1,740	1,566	1,347
Percent change from Present Conditions													
Min	-1%	7%	34%	18%	356%	258%	8%	1314%	15%	137%	17%	-10%	34%
Max	-14%	-1%	10%	-6%	-2%	-19%	-8%	-12%	7%	-8%	-9%	-8%	-7%
Avg	-6%	20%	17%	8%	15%	-8%	-9%	17%	34%	15%	3%	-5%	7%
Platte River at Odessa										Table 50 in file H2OEmphs.tab.			
Min (Monthly (cfs), Annual (kaf))	768	1,227	995	373	358	284	141	33	17	696	803	751	481
Max (Monthly (cfs), Annual (kaf))	3,402	5,007	4,211	5,613	16,367	18,393	11,048	1,249	4,736	4,168	3,706	3,165	3,874
Avg (Monthly (cfs), Annual (kaf))	1,685	2,788	2,405	1,597	2,352	2,546	1,160	535	989	1,523	1,626	1,555	1,248
Percent change from Present Conditions													
Min	17%	14%	35%	49%	0%	0%	112%	0%	0%	558%	11%	-3%	44%
Max	-13%	-1%	-1%	-6%	-2%	-20%	-8%	-15%	3%	-10%	-10%	-8%	-7%
Avg	-6%	19%	17%	9%	16%	-9%	-10%	25%	47%	19%	3%	-5%	7%
Platte River at Grand Island										Table 55 in file H2OEmphs.tab.			
Min (Monthly (cfs), Annual (kaf))	477	1,102	920	729	437	578	368	158	66	799	850	603	544
Max (Monthly (cfs), Annual (kaf))	4,058	5,250	4,661	5,710	16,343	17,145	10,566	1,376	4,511	5,004	3,625	3,022	3,909
Avg (Monthly (cfs), Annual (kaf))	1,540	2,763	2,650	1,925	2,603	2,747	1,431	687	1,068	1,679	1,625	1,439	1,333
Percent change from Present Conditions													
Min	40%	17%	9%	56%	935%	0%	102%	0%	0%	284%	127%	-5%	39%
Max	-12%	-1%	-5%	-6%	-2%	-21%	-9%	5%	-10%	-9%	-10%	-8%	-3%
Avg	-7%	20%	15%	7%	14%	-8%	-8%	19%	43%	17%	3%	-5%	7%

Table 3.4.3- 33. Flows in the central Platte basin.

Water Emphasis Alternative													
Central Platte (North Platte below Lewellen and South Platte below Julesburg)													
Flows	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Ann**
South Platte River at Julesburg										Table 38 in file H2OEmphs.tab.			
Min (Monthly (cfs), Annual (kaf))	18	193	109	151	481	309	140	106	86	133	71	52	179
Max (Monthly (cfs), Annual (kaf))	1,857	1,736	1,229	2,212	8,044	11,718	4,555	1,371	1,326	1,698	1,506	1,451	1,922
Avg (Monthly (cfs), Annual (kaf))	680	873	673	639	1,602	1,874	465	332	402	421	465	503	538
Percent change from Present Conditions													
Min	-69%	123%	570%	221%	1380%	667%	438%	364%	1175%	447%	740%	220%	288%
Max	-2%	-4%	-10%	-13%	-18%	-6%	-10%	-17%	-22%	-24%	-16%	-7%	-13%
Avg	-7%	2%	15%	17%	28%	6%	2%	44%	11%	22%	9%	-9%	10%
Sourth Platte River at Paxton (below Korty Diversion)										Table 43 in file H2OEmphs.tab.			
Min (Monthly (cfs), Annual (kaf))	0	0	0	99	272	97	0	0	0	0	0	0	49
Max (Monthly (cfs), Annual (kaf))	691	1,448	1,174	1,788	6,326	11,023	4,529	711	1,282	1,610	1,267	566	1,553
Avg (Monthly (cfs), Annual (kaf))	256	440	369	311	1,288	1,365	245	89	168	226	178	177	308
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	-32%	-4%	24%	-18%	-22%	-6%	-10%	-31%	30%	-25%	-21%	-26%	-19%
Avg	-16%	3%	32%	9%	46%	4%	-16%	22%	24%	14%	-3%	-15%	12%

Table 3.4.3- 34. Flows in the central Platte basin.

The most significant result shown in **Table 3.4.3-33** is the very large increase in mean monthly flow over the Present Condition in May at all locations except locations on the North Platte River. There are also significant increases at both Overton and Grand Island in August and September, and in February and March at Keystone. At Keystone, **Table 3.4.3-32** shows very large percentage increases in October, February, and March. The very large percentage increases in October also show up in the Keystone Diversion and downstream at the Tri-County diversion.

Diversion. The average monthly and annual diversions for the 3 major supply canals are given in **Table 3.4.3-35**.

Water Emphasis Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Diversions	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Keystone diversion										Table 18 in file H2OEmphs.tab.			
Min (Monthly (cfs), Annual (kaf))	250	250	250	250	250	250	250	662	106	0	250	250	274
Max (Monthly (cfs), Annual (kaf))	1,241	1,694	2,000	1,800	2,000	2,000	2,000	1,883	2,000	1,800	1,835	1,693	1,259
Avg (Monthly (cfs), Annual (kaf))	783	1,224	1,021	821	835	979	1,157	1,187	1,014	871	922	840	702
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	-23%	10%	-49%	0%	0%	0%	-8%
Max	-22%	1%	0%	0%	0%	0%	0%	-6%	0%	0%	0%	1%	6%
Avg	-2%	49%	34%	6%	-6%	-6%	-16%	-11%	1%	24%	8%	4%	4%
Korty Diversion										Table 19 in file H2OEmphs.tab.			
Min (Monthly (cfs), Annual (kaf))	11	175	0	0	0	0	0	83	0	0	50	5	103
Max (Monthly (cfs), Annual (kaf))	755	951	655	1,020	1,099	1,101	950	686	486	459	734	620	407
Avg (Monthly (cfs), Annual (kaf))	381	474	362	349	281	500	267	217	189	171	278	286	226
Percent change from Present Conditions													
Min	-79%	131%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	131%
Max	-2%	-2%	-14%	26%	0%	0%	5%	-19%	-43%	-27%	3%	-8%	-6%
Avg	-2%	1%	0%	23%	-16%	13%	28%	67%	4%	38%	18%	-7%	9%
Tri-County diversion										Table 17 in file H2OEmphs.tab.			
Min (Monthly (cfs), Annual (kaf))	818	906	951	904	1,034	1,462	1,556	1,521	1,000	1,216	904	828	953
Max (Monthly (cfs), Annual (kaf))	1,976	2,202	2,147	2,084	2,171	2,250	2,194	2,145	2,128	2,101	2,149	1,971	1,510
Avg (Monthly (cfs), Annual (kaf))	1,323	1,903	1,726	1,493	1,696	1,926	2,069	2,011	1,492	1,590	1,554	1,366	1,216
Percent change from Present Conditions													
Min	19%	30%	37%	35%	-1%	12%	0%	-4%	7%	74%	17%	20%	9%
Max	-1%	0%	3%	-1%	0%	0%	0%	0%	0%	1%	-3%	-1%	0%
Avg	-2%	16%	11%	10%	8%	6%	-1%	-2%	1%	17%	7%	0%	5%

Table 3.4.3- 35. Diversions by major canals in the central Platte basin.

Table 3.4.3-35 shows an increase in average annual diversion into the Korty, Keystone, and Tri-County diversions for the Water Emphasis Alternative with respect to the Present Condition. Diversions at the Keystone Diversion are significantly higher in February, March, and October. For the Tri-County Diversion, the month-by-month pattern is similar to that for the Keystone Diversion but with lower values. The Korty Diversion shows large increases of 10 percent or more in June, July, October, and November. The pattern for the spring months at all three diversions, especially for May, can be attributed to operation for high spring flows in the central Platte River, with South Platte River flow and diverted Lake McConaughy releases being the main sources of these flows.

Water Emphasis Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

	Sutherland		Central		Kingsley		Total	
Power Generation	**Value**	**% Δ**[1]	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**
Minimum (MKWh)	63	-1%	187	20%	35	-12%	307	2%
Maximum (MKWh)	192	3%	361	1%	242	0%	795	1%
Average (MKWh)	118	7%	271	8%	107	3%	496	6%
Year that minimum occurred		1991		1956		1957		1993
Table number in file H2OEmphs.tab.		23		24		25		26

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

Table 3.4.3- 36. Power generation statistics for the central Platte basin below Lake McConaughy.

Power Generation. The Water Emphasis Alternative results in an increase in power generation with respect to the Present Condition in the Kingsley Dam/Lake McConaughy, Sutherland, and Central systems.

3.5 Wet Meadow Alternative

This feature would emphasize solutions to critical habitat problems based on restoring wetlands and other land acquisition to establish new habitat areas, rather than structural features for obtaining new water for the critical habitat. It consists of the basic Three States Plan plus a new account involving excess-to-ownership water in Glendo Reservoir, Wyoming.

3.5.1 Features simulated in the alternative

3.5.1.1 3-States Plan

Pathfinder Modification. The Pathfinder Modification Project would increase the capacity of the existing Pathfinder Reservoir by approximately 54,000 acre feet to recapture storage space lost to sediment. The modification would be accomplished by raising the elevation of the existing spillway by approximately 2.39 feet with the installation of an inflatable dam or some other means. The recaptured storage space would store water under the existing 1904 storage right for Pathfinder Reservoir and would enjoy the same entitlements as other uses in the reservoir with the exception that the recaptured storage space could not place regulatory calls on existing water rights upstream of Pathfinder Reservoir other than the rights pertaining to Seminoe Reservoir.

Of this 54,000 acre-feet, 34,000 acre-feet would be from an environmental account, which would be operated for the benefit of endangered species and habitat in central Nebraska. The State of Wyoming would retain, under contract with the Bureau of Reclamation, the remaining 20,000 acre feet of the modification capacity to provide municipal water to North Platte communities in Wyoming through contracts between the municipalities and the State of Wyoming.

Tamarack. The Tamarack Plan involves the use of wells and other water facilities in Colorado to re-regulate excess flows in Colorado in a manner that is consistent with the flow-related goals of the Platte River Recovery Implementation Program. Excess flows are not need to satisfy legal rights to and physical demands for water. As a result of the geographic location of the Tamarack Plan near the state line, groundwater recharge that results from the Tamarack Plan is estimated to increase flows at the Julesburg gage during the period of April through September by an average of approximately 10,000 acre-feet over the flows that would otherwise occur during that period. Water rights for the operation of the components of the Tamarack Plan will be obtained and exercised under Colorado law for beneficial uses in Colorado. All facilities will be operated by Colorado and its water users in compliance with the requirements of the South Platte River Compact.

The components of the Tamarack Plan will be developed within the 40 miles above the state line beginning at about the Tamarack Ranch State Wildlife Area owned by the Colorado Division of Wildlife near Crook, Colorado. These facilities will include wells located adjacent to the South Platte River that divert groundwater from the alluvial aquifer and canals that divert water from the South Platte River. Water that percolates into the groundwater alluvium from these facilities will return to the South Platte River at a later time. Inflows to canals and recharge basins will be identified as for Program or other purposes, and inflows for Program purposes will be measured and recharge or seepage will be computed as inflows minus evaporation. Evaporation in acre-feet will be determined by using available weather station data and the surface areas of the recharge sites. Recharge basins are typically located in sandy upland areas with high infiltration rates such that free water surface areas are minimal, resulting in low evaporation amounts.

Lake McConaughy Environmental Account. An Environmental Account (EA) will be established in Lake McConaughy, Nebraska. Water contributed to the EA, regardless of its source, loses any separate identity upon entering Lake McConaughy or other approved storage facility, and simply becomes part of the EA. Water remaining in the EA after September 30 of each year may be carried over and added to the following year's contributions to the EA, subject to limitations on the size of the Environmental Account.

3.5.1.2 Other Elements

EA Short duration near-bankful Flows. Management of the Lake McConaughy Environmental Account (EA) would seek to provide short duration near-bankful flows in the habitat reach of the river. This would be accomplished by timing EA releases to increase the frequency of short duration near-bankful flows released from Kingsley Dam. The magnitudes of the short duration near-bankful flows would not be allowed to exceed the flood stage of the North and central Platte Rivers as determined by the National Weather Service.

The EA would be operated in such a manner as to augment South Platte River flows in order to increase the magnitude and frequency of within-channel flows (flows near bank full) and subsequent sediment transport to the Overton to Grand Island reach of the Platte River. The purpose is to supply sediment to the remaining downstream braided river below the J2-Return. By adding additional water from the EA which would bypass the Tri-County Diversion Dam, sediment stored in the reach from North Platte to the J2-Return could be mobilized and supplied to the reaches below the J2 Return.

Short duration near-bankful flows would be released through the Kingsley Dam Powerplant at a rapid but safe rate and would not exceed the maximum powerplant capacity for a two to three-day duration (about 5,000 cfs). The maximum rate of increasing discharge would be determined so that the downstream river stage would not increase by a rate faster than could be accommodated by downstream structures. Releases would then reduce back to normal operating levels at the maximum practicable rate. The rate of increasing and decreasing discharge would be determined in cooperation with the operators of Kingsley Dam. These short duration near-bankful flows are designed to temporarily mobilize or scour the channel bed rather than transport tremendous quantities of sediment. The discharge hydrograph, released from Kingsley Dam, is expected to transform from a trapezoidal shape to a triangular shape as it travels downstream toward Grand Island. This will result in a decrease in sediment transport capacity as the discharge wave travels downstream.

The purpose of this aspect of EA operation would be to release short duration near-bankful flows, within bank capacity, in order to scour young vegetation from the river channel. If the cottonwood seed germination is minimal during a particular year or if the plants are scoured by naturally occurring floods, then no short duration near-bankful flows for vegetation scour would be implemented. If cottonwood seed dispersal and germination were significant then several different short duration near-bankful flow options would be available.

The short duration near-bankful flows would be generated by season as follows:

Early fall short duration near-bankful flow (October/September). This short duration near-bankful flow would have a maximum discharge of 5,000 cfs from Kingsley Dam and would occur during an otherwise low-flow period. A short duration near-bankful flow in fall would be designed to temporarily scour the channel bed soon after the cottonwood-seed germination and growing season while the plants are still small and vulnerable to scour. Attempts would be made to schedule such releases when the water diversions through the tri-county power canal are at a minimum.

Winter ice formation flow. This would be a small magnitude (less than 5,000 cfs), short duration near-bankful flow designed to wet the channel at the onset of freezing weather and form ice across the channel. A second small magnitude, short duration near-bankful flow would be initiated at the onset of warmer weather to help break and lift the ice and scour the channel bed.

Spring runoff short duration near-bankful flow (May/June). The target value for the spring short duration near-bankful flow would be 6,500 cfs at Overton during the last 2 weeks of May. The spring short duration near-bankful flow would augment flows from the South Platte River for a total Platte River flow not to exceed the flood stage as determined by the National Weather Service (considered to be 10,000 ft^3/s for analysis purposes). The short duration near-bankful flow in spring would provide for the greatest peak discharge compared to the fall or winter periods. However, a short duration near-bankful flow in spring would allow one or two more months of growing time for the plants.

Only one of the three short duration near-bankful flows would be necessary in any given year. However, they could be used in combination in certain years. Each short duration near-bankful flow type would be implemented experimentally during the adaptive management program (but not in the same water year) to determine their relative effectiveness in maintaining a wide active channel. A mixture of these options may prove to be the most desirable approach over the long term.

A key component of the short duration near-bankful flow implementation would be the operational monitoring of weather, river flows, sediment loads, channel cross sections, endangered species activity, and cottonwood seed dispersal and growth. Monitoring during the various stages of vegetation establishment and growth would be critical to the effective use of flow in removing vegetation and maintaining a wide active channel.

FERC Requirements. The Federal Energy Regulatory Commission (FERC) has issued rules that require certain operations of CNPP&ID and NPPD. These operation are called the FERC requirements.

Minimum Canal Diversions. FERC has set minimum and average canal diversion requirements for the Tri-County Diversion. These are discussed in detail in the *Cooperative Agreement* dated July 1997, and are summarized below in **Table 3.5.1-1**. FERC has also set release requirements for lake McConaughy for the Keystone Diversion during the non-irrigation season. These are summarized in **Table 3.5.1-2**.

Table 3.5.1-1 Diversion Requirements for the Central Diversion during the Non-Irrigation Season						
	Diversion Requirements (cfs)					
	10/1 - 11/15		**11/16 - 2/14**		**2/15-beginning of Irrigation Season**	
Condition	**Min.**	**Avg.**	**Min.**	**Avg.**	**Min.**	**Avg.**
Very Wet	1,000	1,600	800	1,000	1,100	1,400
Wet	900	1,200	800	1,000	1,000	1,240
Transitional	900	1,000	800	950	850	1,100
Dry	700	900	700	850	800	960
Very Dry	Consultation among affected parties to maximize multiple use and share effects of shortages.					

Table 3.5.1-2 Releases from Lake McConaughy for Keystone Diversion during the Non-Irrigation Season		
Condition	**Minimum (cfs)**	**Average (cfs)**
Very Wet	700	875
Wet	450-700	not defined
Transitional	450	900
Dry	250	700
Very Dry	250	700

Flow Attenuation Plan. During the irrigation season, precipitation events can cause a decrease in demand for water to meet the irrigation needs in the Central Nebraska Public Power and Irrigation District (CNPP&ID) system. This can be thought of as a "rejection" of water. The rejection of water already in the system but not yet delivered leads to an increase in water returned to the Platte River at the Johnson #2 hydropower return (J2 Return). In combination with higher flows in the Platte River due to the precipitation event, the unused

irrigation water may increase the total flow in the Platte River to a level where it can inundate least tern and piping plover nests. Article 212 of CNPP&ID's 1417 FERC license requires CNPP&ID to use its best efforts to attenuate the increased flows in the Platte River that sometimes result from the rejection of irrigation water during the nesting season (approximately June 1 to August 15).

The discussions below summarize operational changes at Johnson Lake and adjacent facilities. Johnson lake is the reservoir closest to the J2 return and provides the best opportunity to attenuate flows. Details of these operational changes and related issues can be found in CNPP&ID's *Flow Attenuation Plan* document dated July 2000.

Johnson Lake

Regular Operation. Johnson Lake is located near the downstream end of the Central District Supply Canal. Inflows into Johnson Lake fluctuate as a result of many conditions including changes in the diversion rate at North Platte, the discharge rate through the Jeffrey hydropower planed, flow through the Jeffrey return, precipitation and irrigation from the supply canal and the E-65 irrigation canal. Johnson Lake is operated within a narrow elevation range to provide hydropower head on the Johnson #1 (J1) hydropower plant, head for the E-67 irrigation canal, recreation, and to provide a limited amount of water during peak irrigation demand. Normally, outflows form Johnson Lake fluctuate as inflows fluctuate to avoid either increasing the elevation of the reservoir to a level which can cause bank erosion or decreasing the elevation to a level which would result in less efficient hydropower and irrigation operations. The normal operating range for Johnson Lake is approximately 2618.0 to 2618.5 feet during the summer months and approximately 2617.5 to 2618.0 feet during the winter months.

Operation for Flow Attenuation. CNPP&ID's flow attenuation efforts are intended to manage lake levels within the range of 2617.5 to 2619.0 feet to provide space in Johnson Lake to capture runoff from a precipitation event while keeping the elevation from exceeding 2619.5 feet on most occasions. When Johnson lake operations are considered along with the space available in the J2 forebay, there are approximately 2,500 acre-feet of space available to attenuate flows that result from the rejection of irrigation water. For example, the space could be used to attenuate 250 cfs of rejected irrigation water for about 5 days.

The objective of the Attenuation Plan is, where feasible, to avoid exceeding the benchmark flow at the Platte River gage near Overton. If rejected irrigation water available to be returned to the Platte River will not cause the flow at the Overton gage to exceed the benchmark flow, no attenuation is necessary, and the space in Johnson lake will remain available for future attenuation.

Elwood Reservoir

Regular Operation. Elwood Reservoir is located about 3 miles south of Johnson Lake. It was constructed about 5 miles downstream of the headgate of the E-65 irrigation canal to supplement diversion at the headgate and meet the irrigation demand on the E-65 system. Prior to the irrigation season, water is diverted into the E-65 canal and pumped into Elwood Reservoir for use later in the irrigation season. Depending on the elevation of Elwood Reservoir, each of the three pumps at the station can pump 50 cfs to 75 cfs into Elwood

Reservoir. The three pumps combined can pump 150mto 225 cfs. Irrigation demand along the E-65 system typically requires 400 to 500 cfs during the irrigation season. During the irrigation season, when irrigation demand on the E-65 system exceeds the amount available to be diverted, water is released from Elwood Reservoir. Fluctuations in irrigation demand are usually covered by fluctuating the rate of outflow from Elwood Reservoir and keeping a relatively steady diversion at the headgate of the E-65 canal.

Operation for Flow Attenuation. After a precipitation event, if the continuing irrigation on the E-65 system is between 350 cfs and 500 cfs, the diversion into the E-65 canal will not normally be reduced but the outflow from Elwood Reservoir will be reduced to avoid overtopping the canal system. If the continuing irrigation demand decreases below 350 cfs, in addition to stopping the outflow from Elwood Reservoir and meeting the irrigation demand for the E-65 canal, CNPP&ID will pump water into Elwood Reservoir whenever it is operationally and mechanically feasible provided the following conditions are met:

- irrigation demand is sufficiently low that the diversion capacity into the E-65 canal exceeds the demand by enough to operate at least one pump at its design capacity.

- Water rights must allow the available water to be pumped into Elwood Reservoir.

- Consistent with conservation commitments, CNPP&ID will only pump water into Elwood Reservoir that it anticipates will be used for irrigation during the non-irrigation season and avoid high Reservoir elevation during the non-irrigation season that would increase total losses and out-of-basin losses.

Other Methods to Attenuate Increased Flows

Rainwater Basin Wetlands. CNPP&ID will continue to deliver surface water to Rainwater Basin wetlands which hold valid state water rights and will serve additional wetlands that obtain valid state water rights.

Additional Storage Facilities. CNPP&ID has in the past, is currently, and is likely in the future, to investigate additional storage options along the Supply Canal upstream and downstream of Johnson Lake. If additional storage space is constructed, CNPP&ID will evaluate these reservoirs during the design phase to determine whether they could be efficiently operated to aid in attenuating increased flows in the Platte River due to rejected irrigation water while fulfilling their intended functions.

Net Controllable Conserved Water Attributable to Reclamation Funds. According to the CNPP&ID report, "Estimate of Net Controllable Conserved Water", Reclamation funds were used on six conservation projects at the downstream end of the CNPP&ID system, all of which were distribution system improvements. The "Net Controllable Conserved Water" from these projects is estimated to be 487 acre-feet per year. The percentage of Net Controllable Conserved Water from these projects that is attributable to Reclamation funds is equal to the percentage of costs for these conservation projects that was paid for by Reclamation funds.

CNPP&ID examined the total costs associated with implementation of the distribution system improvements partially funded with Reclamation funds. The purpose for examining these costs

was to determine the percentage of costs attributable to Reclamation funds, so that a proportionate share of conservation savings could be credited to the Reclamation funds. These costs, and assumptions relating thereto, are summarized as follows:

Direct Improvement Costs - These are direct costs associated with installation of the distribution system improvements. These would include costs of materials, costs of installation, and administrative costs. One half of these costs were paid by Reclamation funds.

Operations and Maintenance Costs - these are ongoing costs associated with operating and maintaining the distribution system improvements. These improvements also have some offsetting reductions in the operations and maintenance (O & M) costs that preceded implementation, i.e. maintenance costs of a new pipeline could be offset by the reduced maintenance costs from eliminating an open lateral. The new O & M costs are only slightly higher ore nearly equal to the offsetting reductions in other O & M costs. Therefore, for purposes of simplicity and economy of scale, net changes to O & M costs are assumed to be zero.

Hydropower Impacts - Conservation of water in the irrigation system, and the contribution of some of that water to the Environmental Account, can have positive and negative effects of hydropower generation at CNPP&ID's three supply canal hydropower plants. Fore example, some of the conserved water that would have been lost in the E-65 or E-67 systems will potentially be available to pass through two more supply canal hydropower plants. On the other hand, conserved water from any irrigation system, if added to the Environmental Account, can potentially be released at a time when no capacity exists for CNPP&ID to divert, which would represent a loss of supply canal hydropower generation. While it is difficult to assess all potential impacts to the supply canal hydropower plants, it appears the net affect would be no change or possibly a slight loss in generation. For purposes of simplicity and economy of scale, net changes to supply canal hydropower generation are assumed to be zero.

Because the net impacts to O & M costs and hydropower generation are assumed to be zero, the approximate cost of the conservation projects partially funded by Reclamation funds is therefore assumed to be equal to the direct improvement costs, of which the Reclamation funds paid about 50 percent. Therefore, the Net Controllable Conserved Water attributable to Reclamation funds is calculated to be 50 percent of 487 acre-feet pre year, or 244 acre-feet per year (approximately 0.2 KAF/year). Pursuant to Article 402 of CNPP&ID's FERC license, CNPP&ID will contribute this amount of water to the Environmental Account on October 1 of each year.

North Platte Choke Point. The terminology "North Platte Choke Point" refers to the channel capacity in the North Platte River at North Platte, Nebraska, at the official flood stage defined by the national Weather Service. This capacity is currently 1,980 cfs, which is significantly lower than the channel capacities at other locations along the North Platte, South Platte, and Platte Rivers. This significantly limits releases from Lake McConaughy for purposes such as EA short duration near-bankful flows to discharges such that flood stage will not be exceeded in the North Platte River at North Platte. The central Platte OPSTUDY model assumes that this "choke point" limits environmental flows past the town of North Platte, Nebraska.

Pathfinder 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 would be filled with water stored under the existing 1904 storage right for Pathfinder Reservoir with the exception that regulatory calls could not be placed on existing water rights upstream of Pathfinder Reservoir other than the 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.

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 that 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, they will make a conservative judgment as to the amount of water that may be required prior to June 1 of each year. Accounting for depletions will occur after September 30th.

- 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 its "existing water related activity baseline" the amount of excess would be subtracted from the amount of water provided to the Program to determine the amount that Wyoming would get credit from the Program for. 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". Wyoming will quantify the amount of excess at the Wyoming/Nebraska state line in which case, tracking and accounting procedures will need to be agreed upon.

Average Annual On-Site Yield and Timing. The amount of water available to the Program is dependent on the amount needed to supplement municipal water rights and/or mitigate excess depletions. This amount will vary on a year to year basis, however, Wyoming anticipates that 4,800 ac-ft would be available to the Program on an average annual basis (Wyoming's December 16, 1999 proposal). 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 in the month of September to minimize conveyance losses.

Firm yield has been defined as the mean annual reservoir release that can be guaranteed based on the analysis of historic data. Predicated on this information, the demand for use of the Pathfinder Municipal account set in the NPREIS was equal to 9,600 AF annually. Putting additional demands on this account would cause shortages during dry periods. Therefore, it was necessary to recalculate these demands such that the combination of deliveries for Wyoming and deliveries for the program never exceeded 9,600 AF in any year.

Wet, dry, and average years were determined from the Grand Island Gage, dry years are the bottom 25% of the flow years, wet years are the top 33% of the flow years, and the remaining years are average. The EIS assumes that the program receives no water in dry years, 9,600 AF in wet years, and 3,900 AF in average years.

Glendo Reservoir, Wyoming, Unassigned Water

Location of project. Glendo Reservoir is on the North Platte River in east central Wyoming, about halfway between Casper, Wyoming, and the Wyoming-Nebraska state line.

Basic description of project/ operating concept. 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 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. The Glendo Stipulation provides for several changes to the 1953 Order that relax the conditions under which Glendo storage can be used. Significant changes with respect to the Program 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 currently 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 the remaining 10,600 ac-ft of storage (Wyoming December 16, 1999 proposal).

Water in excess of that needed to meet contracted demands and potentially replace Wyoming's excess depletions would be available to the Program. Wyoming estimates that 2,700 ac-ft of Glendo storage would be available to the Program on an average annual basis (Wyoming's December 16, 1999 proposal). The amount available is subject to further evaluation of the average annual yield that may be derived from the 10,600 ac-ft of storage and may change.

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, they will make a conservative judgment as to the amount of water that may be required prior to June 1 of each year. Accounting for depletions will occur after September 30th.

- 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 its "existing water related activity baseline", the amount of excess would be subtracted from the amount of water provided to the Program to determine the amount for which Wyoming would get credit 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". Wyoming will quantify the amount of excess at the Wyoming/Nebraska state line, in which case, tracking and accounting procedures will need to be agreed upon.

100,000 Acre-Foot Account in Glendo Reservoir

Location of project. Glendo Reservoir is on the North Platte River in East Central Wyoming, about halfway between Casper, Wyoming, and the Wyoming-Nebraska state line.

Basic description of project/ operating concept. Convert 100 kaf of restorage space in Glendo Reservoir to an environmental account for the use of threatened and endangered species. This right would have a current priority and would be junior to all other rights in the system. The space would collect water that is currently being collected in the excess-to-ownership (ETO) for the North Platte reservoirs. Waters stored in this account would be moved down to the Lake McConaughy EA in late summer. In very wet years, some water might be carried over to the next water year.

Average Annual On-Site Yield and Timing. Estimated average operational effects of the 100,000 acre-foot account in Glendo Reservoir on the North Platte River are given in **Table 3.5.1-3**.

Table 3.5.1-3

Glendo Account Estimated Average Operational Effects

	Storage	**Release/Exchange/ Yield to River**

Month	(acre-feet)	(acre-feet)
October	0.0	0.0
November	0.0	0.0
December	0.0	0.0
March	0.0	0.0
April	0.6	0.0
May	6.4	0.0
June	12.7	0.0
July	13.0	19.5
August	0.0	13.3
September	0.0	0.0
Total Local Yield	32.6	30.8

Legal and institutional requirements for implementation. The space in Glendo reservoir currently has a water right to restore water released from Pathfinder Reservoir through Fremont Canyon Power Plant during the non-irrigation season. Reclamation would have to file for a change of use on 100 kaf of this space. Then Reclamation must file for a 2000+ water right on the 100 kaf space. The Wyoming legislature would need to approve the exportation of the stored water from the state. The right would have to be consistent with the North Platte Decree.

3.5.2 Run Description

3.5.2.1 3-States Plan

Pathfinder Modification. The Pathfinder Environmental Account is operated as has been described in Program Documents. For the EIS, releases from the account are modeled as occurring in April, July, and August. The entire amount stored in the account is released each year to maximize each years accrual. A summary of its proposed operation, as modeled in the NPREIS, fol1ows:

1. Water accrues to the environmental account on an equal priority with other uses from Pathfinder Reservoir. The 34,000 acre foot account is approximately 3.18% (34,000/1,070,000) of the active capacity of Pathfinder Reservoir. Therefore, the account accrues 3.18% of the inflow that is storable under the 1904 storage right.

2. The environmental account does not contain more than 34,000 acre feet at any one time. For example, if at the end of a water year, which is defined as October 1 to September 30, 10,000 acre feet of water is in the account, the account can only accrue 24,000 acre feet under its priority fill during the forthcoming water year.

3. The environmental account is assessed its proportionate share of evaporation losses based on the water stored in the account.

4. The environmental account is administered and operated in a manner consistent with Wyoming water law and the North Platte Decree.

The modeling of three state elements in the Central Platte OPSTUDY model during the MOA negotiations assumed deliveries from the Pathfinder Environmental Account during July and August. After discussing the issue with the Fish and Wildlife Service in Grand Island, Nebraska, we concluded that there are biological benefits to having water available either prior to May or early in the irrigation season. Water is not moved in May and June due to the possibility of high flows during these months, thus the water is delivered in April, July, and August. Losses to environmental deliveries are assigned based on the carriage losses in the settlement to the Nebraska vs. Wyoming lawsuit and the losses in April are assumed to be the same as those in September. The losses in July and August are greater than those in September, thus there is a reduction in the amount of water reaching the Wyoming/Nebraska state line and the EA in Lake McConaughy in Nebraska.
Deliveries from the Pathfinder Environmental Account in April, and any other month, are limited to the water stored.

Tamarack. The Tamarack Project is operated as has been described in Program Documents. A summary of the proposed operation and how it is modeled fol1ows:

1. The maximum diversion capacity into the Tamarack Project by month is as shown in the following table:

Table 3.5.2-1

Diversion Capacity by Month in Acre-Feet

Mnth	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Vol	6800	6800	9800	9800	0	0	0	0	0	9800	12800	6800

2. The project is operated in such a way as to increase flows at the Julesburg gage during the period April through September by an average of approximately 10,000 acre-feet over the flows that would otherwise occur during the period.

3. At other times of the year, the magnitude of diversions into the Tamarack Project is dependent on the shortage/excess of flow at Grand Island with respect to target flows.

Lake McConaughy Environmental Account. The Lake McConaughy Environmental Account (EA) is operated as has been described in Program Documents. For the EIS, releases from the account are modeled as occurring in all months except December through February, and water is held in the EA for May short duration near-bankful flow releases. Pulse flow releases have priority, followed by summer low-flow releases. The volume remaining in the EA at the end of a water year is carried over into the next water year. A summary of the proposed operation, as modeled in the Central Platte OPSTUDY model, fol1ows:

1. Ten percent of Lake McConaughy inflows between October and March of a given year are credited to the EA.

2. The total quantity of water in the EA in Lake McConaughy is not allowed to exceed 200,000 acre-feet (af) at any time.

3. Whenever Lake McConaughy fills to regulatory capacity as defined by FERC's dam safety requirements for Project No. 1417 and the EA is less than 100,000 AF, the EA is increased to 100,000 AF regardless of the quantity of EA water already released during that water year.

4. At any time that Lake McConaughy reaches regulatory capacity as defined by FERC's dam safety requirements for Project No. 1417 and the EA exceeds 100,000 AF, the EA is reduced to 100,000 AF regardless of the sum of the contributions from the states and from Conservation Activities, or the quantity of carryover from a prior year.

5. Storage losses for Lake McConaughy and other Approved Storage Facilities shall be calculated and assigned monthly to the EA using the following formula: ((average monthly storage in the EA)/(average monthly storage in total)) * (total losses for the storage facility for that month).

6. Contributions to the EA are protected from groundwater or surface water depletion from the state line or the source of contribution from within Nebraska to Lake McConaughy or other Approved Storage Facilities.

7. Water stored in projects in Wyoming may be **transported** to the EA. That is, water is released from these projects and flows directly into Lake McConaughy for storage in the EA. This water is subject to conveyance and other losses. Projects in Wyoming include the Pathfinder Modification, Glendo ETO, La Prele Reservoir leasing, etc.

8. Water stored in projects in Colorado may be **exchanged** into the EA. That is, water which comes from these projects either remains in the South Platte River or is diverted into the Korty Diversion and thence downstream, and the volume of the EA will be considered to have increased by the volume of this water. The Tamarack Project is the main contributor from Colorado.

9. Water stored in projects in Nebraska may be **credited** to the EA. That is, the volume

of the EA will be considered to have increased by the volume of water that is located and/or stored as a result of these projects. Projects in Nebraska include the central Platte re-regulating reservoir, central Platte power interference, groundwater conjunctive use, and other projects as the water becomes available to the Program and the EA.

The EA in Lake McConaughy is operated to increase flows in the central Platte habitat area. Water is released from the EA depending on the Platte River flows in the habitat area, the time of year, and the amount of water available in the EA. The amount available in the EA is calculated by subtracting any amount held in reserve for use later in the year from the amount stored in Lake McConaughy. If the amount available from the EA is not greater than the amount needed to make the minimum EA release, no release will be made.

3.5.2.2 Other Elements

Short duration near-bankful Flows. The modeling of short duration near-bankful flow releases from Lake McConaughy is based on simulated daily flows at which are computed by the OPSTUDY model. Short duration near-bankful flow releases are only generated in April or May. The generation of short duration near-bankful flows includes several elements besides the EA in Lake McConaughy. The following text describes each element and how it is used during the short duration near-bankful flow event.

Lake McConaughy Environmental Account. The goal of a short duration near-bankful flow is to have a flow near bank full capacity (~10,000 cfs), but below flood stage, at Overton every year (100% of the time). Based on the estimated flow out of Lake McConaughy for May the model estimates the flow at Overton without a short duration near-bankful flow release. The potential short duration near-bankful flow release is.

> The difference between 10,000 cfs and the estimated flow at Overton.
> Constrained by.
> the available release capacity form Lake McConaughy,
> the combined flow capacity in the Sutherland Canal and the North Platte River at North Platte, Nebraska,
> the ramp rate for releases from Lake McConaughy (the Keystone diversion and down the North Platte River), and
> the volume of water available in the EA.

After calculating the potential short duration near-bankful flow release, the model will only make a short duration near-bankful flow release if the following conditions are true.

> The estimated May peak flow at Overton without a short duration near-bankful flow is less than 6,500 cfs.
> The estimated average flows in May and June are less than 3,800 cfs individually or both are less than 2,000 cfs.
> Lake McConaughy is not estimated to spill in June and the average flow in the South Platte River at Julesburg in June is not greater than 700 cfs.
> There were no flows since October 1 in excess of 5,500 cfs.
> The flow at Overton will be greater than 3,500 cfs with a short duration near-

bankful flow.

> The short duration near-bankful flow will increase the flow at Overton by at least 1,000 cfs.

Simplified, the above criteria are: do not make a short duration near-bankful flow if.

> there is a good chance that there will be a natural peak in May or June greater than 6,500 cfs,
> there has already been a natural peak of at least 5,500 cfs since last October 1, or
> the short duration near-bankful flow release will not significantly increase flows at Overton.

North Platte River. Ramping rates on the North Platte River are likely to be a concern. Short duration near-bankful flows will require a great deal of coordination with downstream irrigation canal operators. The concerns are trash, deadwood, and other debris that will be mobilized by short duration near-bankful flows that could clog or otherwise damage diversion facilities. Another concern is the effect of short duration near-bankful flows on facilities such as sand dams. Therefore, it will be necessary to test and monitor small short duration near-bankful flows to determine the effect on downstream facilities. The carrying capacity of the North Platte River at North Platte, Nebraska will determine the magnitude of the release from Lake McConaughy. The amount released from Lake McConaughy will be the carrying capacity at North Platte minus the expected gains between Lake McConaughy and North Platte minus any margin of safety.

Keystone Diversion. The goal is to divert enough at Keystone such that the maximum amount (1,850 cfs) can by released from the Sutherland return to the South Platte River. Given the system losses, it will be necessary to divert more than 1,850 cfs at the Keystone diversion. The other constraint is that the Keystone diversion can not be increased or decreased (ramped) by more than 200 cfs per day. Increase (ramp) the Keystone diversion to the Sutherland Canal by 200 cfs per day with the intent of reaching up to the maximum diversion of 2,100 cfs on the first day of the short duration near-bankful flow release down the North Platte River. Assuming that the short duration near-bankful flow release on the North Platte continues for three days, maintain the Keystone diversion for three days. On the fourth day reduce the diversion by 200 cfs and continue to reduce the diversion by 200 cfs per day until the diversion is at the level it was prior to ramping up for the short duration near-bankful flow. Time the diversions such that the water reaches the Sutherland return to the South Platte River at the same time that the short duration near-bankful flows in the North Platte River reach the town of North Platte, Nebraska.

Korty Diversion. This analysis assumes no diversion at Korty during short duration near-bankful flow time period. To the degree that this assumption is not correct changes will have to be made in the operation of facilities. The purpose of not diverting at Korty is to allow for a greater release out of the EA in Lake McConaughy by not using the Sutherland Canal to transport South Platte water.

Sutherland Reservoir. Hold Sutherland Reservoir at a constant level during the ramping and short duration near-bankful flow release times.

Sutherland Return to the South Platte River. Release the amount coming down the Sutherland Canal from the Keystone diversion up to the maximum of 1,850 cfs. Time the return such that the water is released to the South Platte River at the same time that the short duration near-bankful flows in the North Platte River reach the town of North Platte, Nebraska. Maintain the releases for three days or until the short duration near-bankful flow event has passed the town of North Platte, Nebraska.

Lake Maloney. Hold Lake Maloney at a constant level during the ramping and short duration near-bankful flow release times.

Tri-County Diversion. Assume that the Tri-County Diversion is the same as the Sutherland Return to the South Platte River. To the degree that this is not true indicates that releases from the Jeffrey return and diversions to Elwood Reservoir must increase. Diversions to Elwood Reservoir would be prior to the maximum pulsing and after maximum pulsing (Elwood could be used to store excess ramping flows)

Jeffrey Return. As the short duration near-bankful flow passes the Jeffrey Return release water from the Jeffrey Return that is not needed to maintain minimum flows in the Tri-County canal between the Jeffrey Return and Johnson Lake. The amount released cannot exceed the capacity of the Jeffrey Return or about 1,000 cfs. The Jeffrey hydro plant has no bypass capability. The purpose of releasing water from the Jeffrey Return is to allow pulsing out of Johnson Lake. The limiting factor on the Tri-County Canal is often the J2 return. If Johnson Lake is used to augment the short duration near-bankful flow out of the Lake McConaughy EA, a significant portion of the J2 Return capacity is used and unavailable to pass water coming down the Tri-County canal. Using the Jeffrey Return allows the water to be used to generate electricity at the Jeffrey hydro plant, but does not take up J2 Return capacity.

J1 Hydro Plant. As the short duration near-bankful flow passes the J2 Return release the up to the capacity of the J2 Return (2,000 cfs) for up to two days. Then bring the release back to what it was prior to any changes for pulsing.

Johnson Lake. Store water used to ramp the Keystone diversion in Johnson Lake. Storage in Johnson Lake prior to releasing 2,000 cfs for two days will be about 2,600 acre-feet. After the short duration near-bankful flow is stopped the storage will increase to about 2,000 acre-feet, which may be released for a broad based pulse flow or diverted and stored in Elwood Reservoir.

J2 Hydro Plant. As the short duration near-bankful flow passes the J2 Return release the up to the capacity of the J2 Return (2,000 cfs) for up to two days or longer if water is available in Johnson Lake and the J2 forebay. Then bring the release back to what it was prior to any changes for pulsing.

J2 forebay. Store water used to ramp the Keystone diversion in the J2 forebay. Storage in the J2 forebay prior to releasing 2,000 cfs for two days will be about 1,000 acre-feet.

Phelps County Canal diversion. Do not divert water to the Phelps County Canal during the short duration near-bankful flow event. This is to allow the full capacity of the J2 Return (2,000 cfs) to enter the Platte River and augment the short duration near-bankful flows already in the Platte River. Any water that would have been diverted during the short duration near-bankful flow period will be charged against the EA in Lake McConaughy.

Elwood Reservoir. Do not store water in Elwood Reservoir during the time that water is being released from the Jeffrey Return. Elwood Reservoir may be used to store water that is used to ramp the Keystone Diversion.

FERC Requirements

Minimum Canal Diversions. The values for the minimum diversion requirements are given in the input file. Minimum values are given for the Keystone Diversion, the Sutherland Canal (and hence, indirectly, the Korty Diversion), and the Tri-County Diversion.

Flow Attenuation Plan. The storage in Johnson Lake that is available for "spike flow" attenuation is 2,500 acre-feet. Attenuation is only allowed to occur between June 10 and August 15. If, during this time, the simulated daily flow at Overton exceeds 1,200 cfs, the flow at Overton is attenuated by storing water in Johnson Reservoir up to the maximum storage available for attenuation. Once the flow at Overton drops back to an acceptable level, the stored "spike flow" is released back into the system.

North Platte Choke Point. Because of a channel constriction in the North Platte River at North Platte, there is a very low flood stage and a corresponding very low channel capacity in the river at this location. If either a daily or a mean monthly flow in the North Platte River at North Platte exceeds this value, then EA releases are reduced so that channel capacity is below this value. Reductions are applied to the continuous and/or the short duration near-bankful flow releases, as appropriate for the operational condition being simulated at the time the excess at North Platte occurs. This run assumes a capacity of 3,000 cfs in the North Platte River at North Platte, Nebraska.

Reclamation Net Controllable Conserved Water, 0.2 KAF. This is provided as input as part of the total Net Controllable Conserved Water. The total Net Controllable Conserved Water is added to the EA once a year, every year, in October.

Pathfinder Modification Municipal Account. Regarding the Pathfinder Modification Municipal Account, the Reconnaissance - Level Water Action Plan (WAP) states:

> "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 of the amount needed to supplement municipal water rights and/or mitigate excess depletions and can not 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"

This was modeled in the North Platte River EIS model (NPREIS) by placing an additional demand on the Pathfinder Modification Municipal Account. This additional demand was calculated based on the following assumptions.

1. No water would be available to the Program in dry years.
2. Dry years occur roughly 25% of the time.
3. 9,600 acre-feet would be available to the Program during wet years.
4. Wet years occur roughly 33% of the time.
5. The total demand on the account could not exceed 9,600 acre-feet in a year.

6. The average annual yield to the program would be 4,800 acre-feet.

We assume that all available water will be reserved for Wyoming's uses during dry years. This is based on page 64 second bullet of the Reconnaissance - Level Water Action Plan which states that "...prior to June 1 of each year, state officials will make a conservative judgment as to the amount of water that may be required for Wyoming's purposes". Our assumption is that such a conservative judgment would reserve all available water for use in Wyoming during dry years.

To determine wet and dry years, the annual flows of the Medicine Bow River and the North Platte River above Seminoe Reservoir were summed and ranked from lowest to highest for the 54 year period from 1941 to 1994 (1941-1994 is the hydrologic record available in the NPREIS model). The 14 years (14/54 =0.2593) that had the lowest flows were classified as dry and the 18 years (18/54=0.3333) that had the highest flows were classified as wet.

The demand for the remaining years was adjusted such that the annual average yield to the Program was 4,800 acre-feet. The water leased to the Program was delivered in September of each year. The Pathfinder Modification Municipal Demand was adjusted so that the total demand on the Municipal Account equals the firm yield of 9,600 acre-feet per year.

(81) Deliveries from the Pathfinder Municipal Account

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	Total
1941	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1942	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1943	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1944	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1945	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1947	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1948	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1951	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1952	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1954	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1955	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1956	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1959	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1960	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1961	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1964	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1965	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1967	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1968	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1969	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1976	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1977	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
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	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1986	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1988	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1989	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6

1990	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1991	0	0	0	0	0	0	0	0	0	5	0.673	0	5.673
1992	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0.71	0.84	1.07	1.16	1.42	1.7	1.7	1	9.6

Glendo Reservoir, Wyoming, Unassigned Water. Regarding the 10,600 acre-feet of Wyoming's Glendo water that currently has no long term contract, the Reconnaissance - Level Water Action Plan (WAP) states:

> "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)."

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This was modeled in the North Platte River EIS model (NPREIS) by placing an additional demand on the unassigned Wyoming Glendo Water account. This additional demand was calculated based on the following assumptions.

9. No water would be available to the Program in dry years.
10. Dry years occur roughly 25% of the time.
11. The total demand on the account could not exceed 10,600 acre-feet in a year.
12. The average annual yield to the program would be 2,650 acre-feet.

We assume that all available water will be reserved for Wyoming's uses during dry years. This is based on page 70 second bullet of the Reconnaissance - Level Water Action Plan which states that "...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". Our assumption is that such a conservative judgement would reserve all available water for use in Wyoming during dry years.

To determine dry years, the annual flows of the Medicine Bow River and the North Platte River above Seminoe Reservoir were summed and ranked from lowest to highest for the 54 year period from 1941 to 1994 (1941-1994 is the hydrologic record available in the NPREIS model). The 14 years (14/54 =0.2593) that had the lowest flows were classified as dry.

The existing demand from the Glendo account were summed for the remaining average and wet years. The annual demands were subtracted from 10,600 to determine the maximum amount available from the Glendo account each year. A portion of this amount was assigned as an additional demand on the unassigned Wyoming Glendo Water account such that the annual yield was approximately 2,650 acre-feet. The Glendo water leased to the Program was delivered in September of each year. The annual values are as follows.

1941	3.3368	1956	2.1456	1971	4.8288	1986	3.2112
1942	3.3368	1957	2.1552	1972	4.0416	1987	0
1943	3.3272	1958	2.6208	1973	3.9456	1988	1.2672
1944	3.3272	1959	0	1974	4.6128	1989	0
1945	3.3368	1960	2.9664	1975	4.1376	1990	0
1946	3.332	1961	0	1976	4.4496	1991	3.3216
1947	3.332	1962	2.8368	1977	0	1992	0
1948	3.3368	1963	0	1978	4.6032	1993	4.6752
1949	3.332	1964	2.1456	1979	4.5216	1994	0

1950	3.332	1965	4.9248	1980	4.2
1951	3.332	1966	0	1981	0
1952	3.332	1967	4.1904	1982	4.8432
1953	0	1968	4.5456	1983	4.9056
1954	0	1969	3.5384	1984	3.3944
1955	0	1970	4.8144	1985	4.1952

100,000 Acre-Foot Account in Glendo Reservoir. This is modeled in the NPREIS model by creating a new 100,000 acre-foot ownership account in Glendo Reservoir. The new right would have the lowest priority in the system. The creation of the new account would reduce the restorage space in Glendo Reservoir by 100,000 acre-feet. This account stores water entering the reservoir that is currently being stored in excess-to-ownership. Evaporation is pro-rated against storage for whatever volume enters this account. Releases are made from this account from April through September for delivery to the Lake McConaughy EA. The water contributed by this feature is included in the input to the Central Platte OPSTUDY Model as a portion of the "Environmental Account Deliveries at Lewellen".

3.5.3 Run results

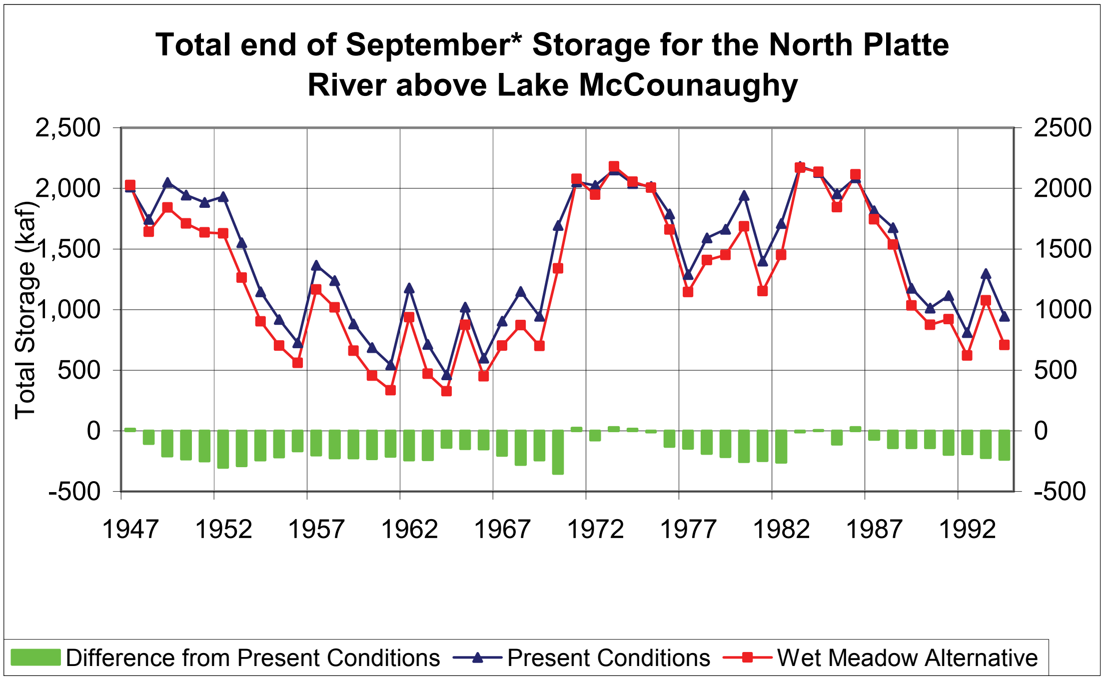
3.5.3.1 North Platte River Basin

The results of the analysis of the North Platte River basin for the Wet Meadow Alternative are summarized in **Figures 3.5.3-1** through **3.5.3-5** and **Tables 3.4.3-1** through **3.4.3-16**.

Storage above Lake McConaughy. The results for Wet Meadow conditions above Lake McConaughy are given in **Figure 3.5.3-1**.

Wet Meadow Alternative

North Platte River above Lake McConaughy



* September is the end of the water year when storage is at a minimum value for the year.

Figure 3.5.3- 1. End of September storage above Lake McConaughy.

Figure 3.5.3-1 shows that the end-of-September storage above Lake McConaughy was generally lower for the Wet Meadow Alternative than for the Present Condition, except for wet periods in the early 1970's and much of the 1980's, when the two were equal or the Wet Meadow Alternative was slightly higher. The increased storage during these time periods is due to the increased capacity of Pathfinder Reservoir.

Wet Meadow Alternative **North Platte River above Lake McConaughy** **Reservoir Storage**	**Seminoe** **Value**	 **% Δ**[1]	**Pathfinder** **Value**	 **% Δ**	**Alcova** **Value**	 **% Δ**	**Glendo** **Value**	 **% Δ**	**Guernsey** **Value**	 **% Δ**	**Inland Lakes** **Value**	 **% Δ**	**Total Storage** **Value**	 **% Δ**
Minimum end-of-month storage for 48-year simulation (kaf)	31.2	-66%	31.4	0%	156	0%	63.1	0%	0	0%	1.5	-61%	326.2	-29%
Maximum end-of-month storage for 48-year simulation (kaf)	1,017.3	0%	1,070.0	5%	179.5	0%	792.6	16%	45.6	0%	72.0	0%	2921.5	1%
Average end-of-month storage for 48-year simulation (kaf)	545.3	-9%	501.1	-11%	167.8	0%	299.9	-9%	18.8	-1%	31.1	-13%	1538.7	-9%
Low storage indicator: years with storage < ### kaf	11 < 200 kaf		18 < 200 kaf		0 < 150 kaf		24 < 100 kaf		0 < 0 kaf		0 < 0 kaf		12 < 650 kaf	
Percent change from Present Conditions[2]		83%		50%		0%		167%		0%		0%		100%
Year that minimum first occurred	1961		1961		1947		1955		1949		1956		1964	
Largest single month drawdown for this alternative (kaf)	139.8	-8%	261.2	-6%	23.5	0%	255.6	-1%	28	0%	29.5	0%	357	-2%
Month of largest drawdown	July-89		July-87		October-47		August-70		September-47		August-51		September-52	
File that contains the data		Resop.tab		Resop.tab		Resop.tab		Resop.tab		Resop.tab		Resop.tab		Resop.tab
Table number		3		2		25		1		4		5		6

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

[2] NA in the % Δ column indicates that there were no years with storage < ### kaf in the Present Condtion Run

Table 3.5.3- 1. Reservoir storage statistics for the North Platte River above Lake McConaughy.

The average end-of-month storage shows a percentage decrease of 9 percent with respect to the Present Condition. The greatest percentage decrease for an individual project was 11 percent for Pathfinder Reservoir. Significant percentage decreases were also noted at Seminoe Reservoir (9 percent) and the Inland Lakes (13 percent). Glendo and Guernsey reservoirs also show percentage decreases in storage. There was no change for Alcova Reservoir.

Wet Meadow Alternative
North Platte River above Lake McConaughy

Reservoir Storage		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
Seminoe Reservoir														Resop.tab Table 3
	Min (kaf)	31	31	31	31	31	31	31	118	206	121	31	31	31
	Max (kaf)	973	936	912	889	843	812	912	1,017	1,017	1,017	1,017	982	1,017
	Avg (kaf)	546	532	511	489	467	455	487	587	694	646	581	548	545
Percent change from Present Conditions	Min	-80%	-79%	-77%	-74%	-72%	-66%	-72%	-36%	-32%	-37%	-83%	-83%	-66%
	Max	1%	1%	1%	1%	1%	-4%	-3%	0%	0%	0%	6%	2%	0%
	Avg	-9%	-9%	-10%	-10%	-10%	-11%	-9%	-9%	-8%	-7%	-8%	-10%	-9%
Pathfinder Reservoir														Resop.tab Table 2
	Min (kaf)	31	31	31	31	31	31	55	100	137	75	31	31	31
	Max (kaf)	932	969	985	1,000	1,026	1,067	1,070	1,070	1,070	1,070	991	911	1,070
	Avg (kaf)	460	470	482	493	509	520	535	573	611	486	453	422	501
Percent change from Present Conditions	Min	-46%	-48%	-48%	-50%	-52%	-33%	3%	-36%	-32%	-41%	-69%	0%	0%
	Max	1%	1%	1%	1%	1%	5%	5%	5%	5%	5%	7%	0%	5%
	Avg	-12%	-12%	-11%	-11%	-11%	-11%	-13%	-11%	-9%	-8%	-8%	-13%	-11%
Alcova Reservoir														Resop.tab Table 25
	Min (kaf)	156	156	156	156	156	156	180	180	180	180	180	180	156
	Max (kaf)	156	156	156	156	156	156	180	180	180	180	180	180	180
	Avg (kaf)	156	156	156	156	156	156	180	180	180	180	180	180	168
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Glendo Reservoir														Resop.tab Table 1
	Min (kaf)	92	126	156	186	220	252	243	285	272	90	80	63	63
	Max (kaf)	271	310	348	385	438	492	553	793	695	629	373	214	793
	Avg (kaf)	161	202	241	281	322	382	397	433	444	392	225	118	300
Percent change from Present Conditions	Min	-10%	-8%	-7%	-7%	-7%	-9%	-15%	-2%	24%	-57%	0%	0%	0%
	Max	-22%	-18%	-16%	-14%	-9%	-5%	10%	21%	2%	22%	19%	-31%	16%
	Avg	-21%	-17%	-15%	-13%	-12%	-9%	-7%	-3%	-1%	-4%	-7%	-26%	-9%
Guernsey Reservoir														Resop.tab Table 4
	Min (kaf)	0	0	0	0	0	5	35	40	35	30	11	2	0
	Max (kaf)	8	13	16	19	21	30	46	46	45	30	30	2	46
	Avg (kaf)	2	5	8	11	12	14	35	40	35	30	30	2	19
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-65%	0%	0%
	Max	0%	0%	0%	0%	-23%	-1%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	-2%	-5%	-2%	0%	0%	0%	-1%	0%	-1%

Table 3.5.3- 2. Monthly reservoir storage statistics for the North Platte River above Lake McConaughy.

Minimum, maximum, and average storage by month are shown in **Table 3.5.3-2**. This table shows that the largest percent change occurs in the minimum reservoir storage attained during the simulation of the Wet Meadow alternative.

Wet Meadow Alternative
North Platte River above Lake McConaughy

Spills from the system	Spills Value	Spills % Δ[1]
Average annual spill for 48-year simulation period (kaf)	76.5	-35%
Number of years with spills	7	-42%
Average annual spill for years with spills (kaf)	524.5	11%
Largest annual spill (kaf)	1157.6	-12%
Year of largest annual spill	1984	
File that contains the data	Storown.lst	
Output line number	8	

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

Table 3.5.3- 3. Spills from Guernsey Reservoir.

The average annual spill decreased by 35 percent with respect to the Present Condition and the number of years with spills decreased from 12 to 7. These results are consistent with the lower average storage associated with the use of North Platte River basin water for environmental purposes under the Wet Meadow Alternative.

Reservoir elevations above Lake McConaughy.

Wet Meadow Alternative **North Platte River above Lake McConaughy** **Reservoir Elevations**	**Seminoe** **Value**	 **% Δ**[1]	**Pathfinder** **Value**	 **% Δ**	**Alcova** **Value**	 **% Δ**	**Glendo** **Value**	 **% Δ**	**Guernsey** **Value**	 **% Δ**
Minimum average elevation for 48-year simulation (kaf)	6,239	-0.4%	5,746	0.0%	5,488	0.0%	4,570	0.0%	4,370	0.0%
Maximum average elevation for 48-year simulation (kaf)	6,357	0.0%	5,853	0.0%	5,498	0.0%	4,653	0.1%	4,420	0.0%
Average average elevation for 48-year simulation (kaf)	6,322	-0.1%	5,813	-0.1%	5,493	0.0%	4,611	-0.1%	4,403	0.0%
Low storage indicator: years with elevation < #### ft	12 < 6,289 ft		18 < 5,787 ft		0 < 5,486 ft		23 < 4,580 ft		0 < 4,370 ft	
Percent change from Present Conditions[2]		100%		50%		0%		188%		0%
Year that minimum first occurred	1961		1961		1947		1955		1949	
Average May-August drawdown for this alternative (feet)	1.5	13%	10.4	-7%	0.0	0%	25.6	8%	5.05208	5%
Largest May-August drawdown for this alternative (feet)	33.5	57%	31.7	7%	0.0	0%	52.5	14%	16.8	137%
Year of largest drawdown	1961		1964		1947		1981		1961	
File that contains the data		Natflow.tab		Natflow.tab		Natflow.tab		Natflow.tab		Natflow.tab
Table number		13		12		11		10		9

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

[2] NA in the % Δ column indicates that there were no years with elevation < #### ft in the Present Condtion Run

Table 3.5.3- 4. Reservoir elevation statistics for the North Platte River above Lake McConaughy.

Table 3.5.3-4 shows the same statistics for reservoir elevation as are shown in **Table 3.5.3-1** for end-of-month reservoir storage. **Table 3.5.3-4** shows that there will be less water in Seminoe, Pathfinder, and Glendo reservoirs under the Wet Meadow Alternative.

Wet Meadow Alternative **North Platte River above Lake McConaughy** **Reservoir Elevation Minimum and Maximum**	**Seminoe**	**Pathfinder**	**Alcova**	**Glendo**	**Guernsey**
Elevation for empty reservoir:	6160.0	5690.0	5320.0	4508.0	4370.0
Historic minimum elevation:	6253.3	5690.0	5408.8	4549.3	4370.0
Minimum elevation for alternative:	6238.7	5746.0	5488.0	4570.0	4370.0
Years min. elev. Achieved	2	4	48	9	25
Years min. < Reference	5	0	0	0	0
Years min. < Historic	4	0	0	0	0
Elevation for full reservoir[1]:	6357.0	5850.1	5500.0	4669.0	4420.0
Historic maximum elevation[2]:	6359.3	5853.5	5499.9	4650.8	4421.7
Maximum elevation for alternative:	6357.0	5852.5	5498.0	4653.2	4420.0
Years max. elev. Achieved	10	8	48	1	4
Years max. > Reference	0	10	0	2	0
Years max. > Historic	0	0	0	1	0

[1] Elevation for the top of the conservation capacity.

[2] Historic elevations that are greater than the elevation for a full reservoir are the result of flood storage and reservoir surcharge.

Table 3.5.3- 5. Minimum and maximum reservoir elevation statistics for the North Platte River above Lake McConaughy.

Table 3.5.3-5 compares the minimum and maximum elevation for each reservoir to the minimum and maximum elevations for the Present Condition run and to historic values. **Table 3.5.3-5** shows that the storage in Seminoe and Pathfinder reservoirs was less than the minimum storage for these reservoirs in the Present Condition run and Seminoe Reservoir was lower than it has been historically.

Wet Meadow Alternative

North Platte River above Lake McConaughy

Reservoir Elevations		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
Seminoe Reservoir												Natflow.tab Table 13		
	Min (feet)	6,239	6,239	6,239	6,239	6,239	6,239	6,239	6,272	6,290	6,273	6,239	6,239	6,239
	Max (feet)	6,355	6,353	6,352	6,350	6,348	6,346	6,352	6,357	6,357	6,357	6,357	6,355	6,357
	Avg (feet)	6,321	6,320	6,318	6,316	6,315	6,314	6,317	6,326	6,336	6,331	6,325	6,322	6,322
Percent change from Present Conditions	Min	-1%	-1%	-1%	-1%	-1%	0%	-1%	0%	0%	0%	-1%	-1%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Pathfinder Reservoir												Natflow.tab Table 12		
	Min (feet)	5,746	5,746	5,746	5,746	5,746	5,746	5,755	5,767	5,775	5,761	5,746	5,746	5,746
	Max (feet)	5,846	5,848	5,849	5,849	5,851	5,852	5,853	5,853	5,853	5,853	5,849	5,845	5,853
	Avg (feet)	5,810	5,810	5,811	5,812	5,814	5,814	5,815	5,819	5,823	5,813	5,809	5,806	5,813
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Alcova Reservoir												Natflow.tab Table 11		
	Min (feet)	5,488	5,488	5,488	5,488	5,488	5,488	5,498	5,498	5,498	5,498	5,498	5,498	5,488
	Max (feet)	5,488	5,488	5,488	5,488	5,488	5,488	5,498	5,498	5,498	5,498	5,498	5,498	5,498
	Avg (feet)	5,488	5,488	5,488	5,488	5,488	5,488	5,498	5,498	5,498	5,498	5,498	5,498	5,493
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Glendo Reservoir												Natflow.tab Table 10		
	Min (feet)	4,578	4,586	4,592	4,597	4,603	4,607	4,606	4,611	4,610	4,578	4,575	4,570	4,570
	Max (feet)	4,610	4,615	4,619	4,623	4,628	4,633	4,638	4,653	4,648	4,643	4,622	4,602	4,653
	Avg (feet)	4,592	4,599	4,605	4,611	4,616	4,622	4,624	4,627	4,628	4,622	4,601	4,583	4,611
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Guernsey Reservoir												Natflow.tab Table 9		
	Min (feet)	4,370	4,370	4,370	4,370	4,370	4,395	4,415	4,418	4,415	4,413	4,401	4,388	4,370
	Max (feet)	4,398	4,403	4,405	4,407	4,408	4,413	4,420	4,420	4,420	4,413	4,413	4,388	4,420
	Avg (feet)	4,382	4,394	4,397	4,400	4,402	4,404	4,415	4,418	4,415	4,413	4,413	4,388	4,403
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 3.5.3- 6. Monthly reservoir elevation statistics for the North Platte River above Lake McConaughy.

Table 3.5.3-6 shows the minimum, maximum, and average reservoir elevation for the five major reservoirs above Lake McConaughy by month.

North Platte River Flow into Lake McConaughy. The results for North Platte River flow into Lake McConaughy for the Wet Meadow Alternative are given in **Figure 3.5.3-2**.

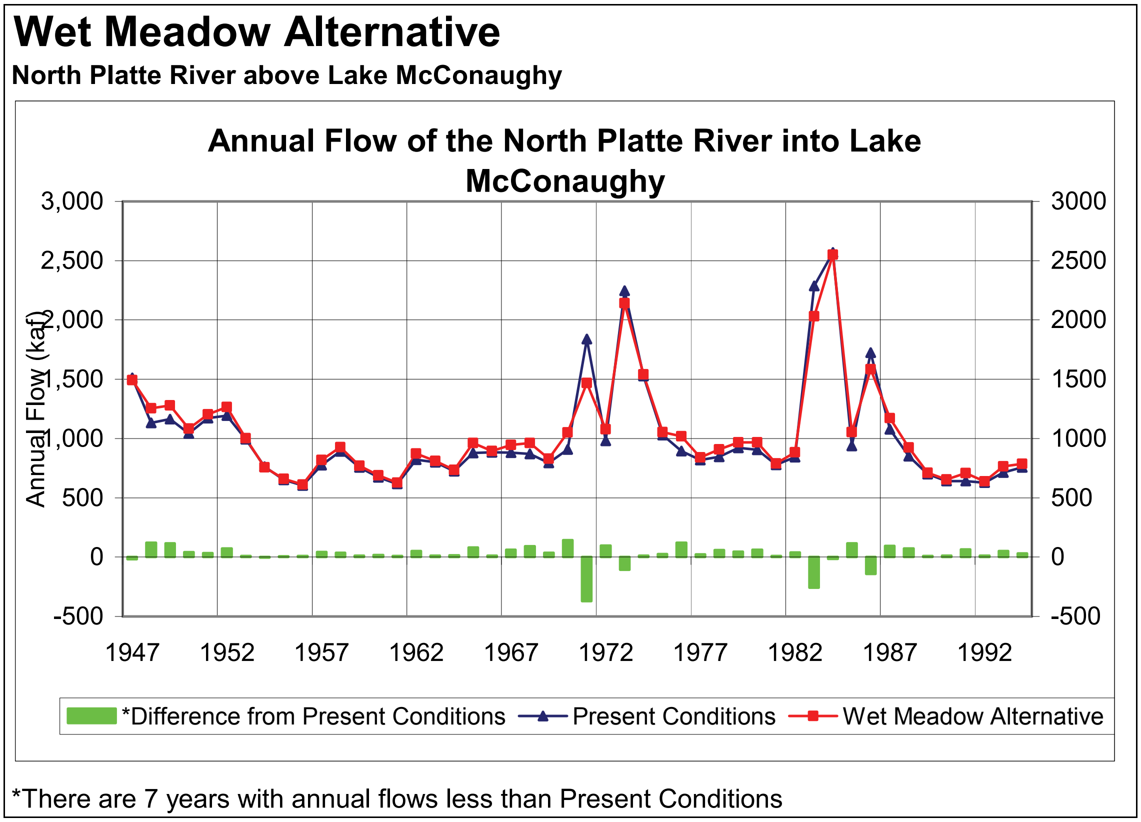


Figure 3.5.3- 2. Annual flow of the North Platte River into Lake McConaughy.

Figure 3.5.3-2 shows that the North Platte River flow into Lake McConaughy for the Wet Meadow Alternative is somewhat higher than that for the Present Condition in most years. The exceptions to this pattern are high runoff years with high inflows into Seminoe Reservoir that allow all the reservoirs above Lake McConaughy to fill. Because storage is lower prior to these years, it takes more water to fill the reservoirs and flows into Lake McConaughy are less.

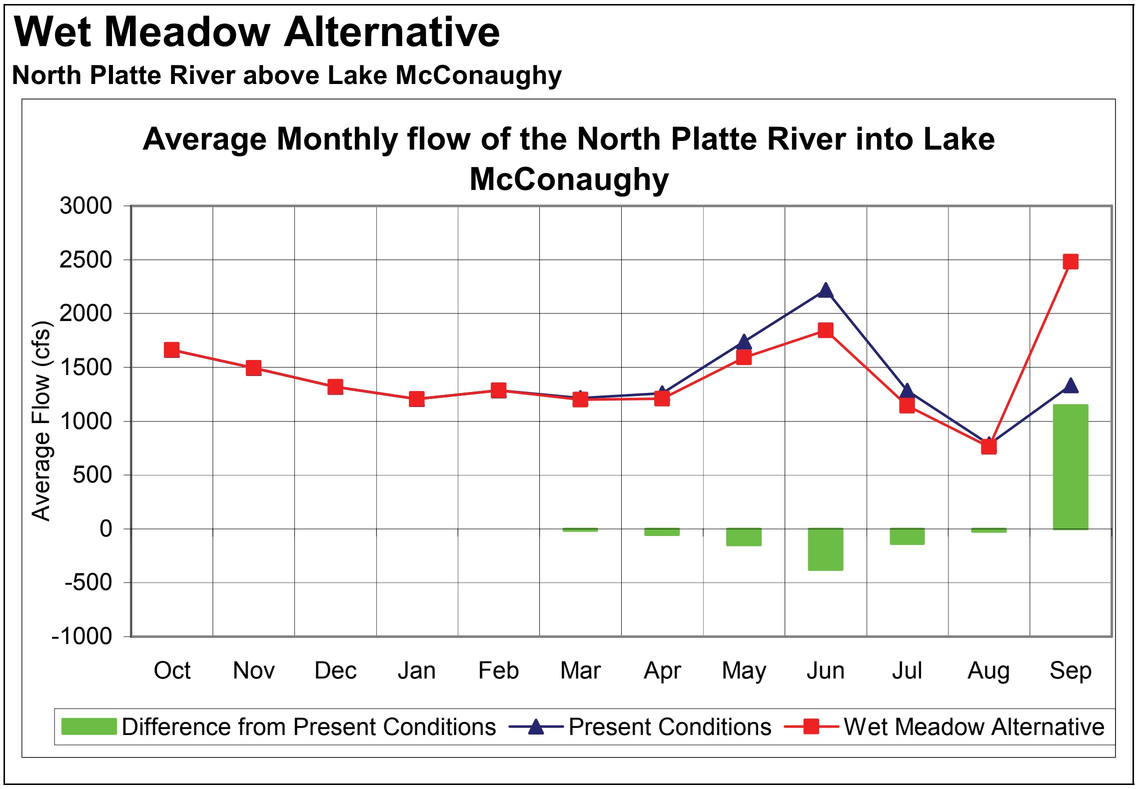


Figure 3.5.3- 3. Average monthly flow of the North Platte River into Lake McConaughy.

Wet Meadow Alternative
North Platte River above Lake McConaughy

Flows	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
N.P. River flow into Lake McConaughy											Resop.tab Table 9		
Min (Monthly (cfs), Annual (kaf))	758	1,062	862	805	911	636	534	275	376	124	190	489	612
Max (Monthly (cfs), Annual (kaf))	2,318	2,038	1,888	1,825	1,889	2,126	2,736	12,126	10,508	6,881	1,360	4,953	2,551
Avg (Monthly (cfs), Annual (kaf))	1,662	1,495	1,317	1,206	1,285	1,199	1,208	1,593	1,843	1,145	762	2,481	1,036
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	-26%	0%	0%	0%	0%	1%	37%	1%
Max	0%	0%	0%	0%	0%	0%	-11%	-6%	-14%	-10%	-36%	75%	-1%
Avg	0%	0%	0%	0%	0%	-1%	-4%	-9%	-17%	-11%	-3%	86%	2%

Table 3.5.3- 7. Monthly flow of the North Platte River into Lake McConaughy.

On a monthly basis, inflows are greater in September; and less in April through August. There is little or no change in October through March. September is the month for environmental deliveries for this alternative. October through March are considered to be winter months in the high country headwaters of the North Platte River. Flows in April through August are less due to reduced spills.

Wet Meadow Alternative
North Platte River above Lake McConaughy

Enviromental Flows Delivered to Lake McConaughy	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
											Natflow.tab Table 31		
Min (kaf)	0	0	0	0	0	0	0	0	0	0	0	6	6
Max (kaf)	0	0	0	0	0	0	0	0	0	0	0	139	139
Avg (kaf)	0	0	0	0	0	0	0	0	0	0	0	66	66
Year that minimum first occurred	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1954	1954

Table 3.5.3- 8. Environmental deliveries from above Lake McConaughy.

September has the greatest environmental delivery to Lake McConaughy (**Table 3.5.3-8**) under the Wet Meadow Alternative.

Project Ownership, Project Shortages, Irrigation Demand, Water Leasing. The results for project ownership for the Wet Meadow Alternative are given in **Table 3.5.3-9**.

Wet Meadow Alternative								
North Platte River above Lake McConaughy	North Platte[1]		Kendrick[2]		Glendo		Total	
Project Ownership	Value	% Δ[3]	Value	% Δ	Value	% Δ	Value	% Δ
Minimum end-of-month ownership for 48-year simulation (kaf)	37.7	-24%	131.1	-24%	2.3	-80%	326.2	-29%
Maximum end-of-month ownership for 48-year simulation (kaf)	1,099.6	0%	1,201.7	0%	179.9	0%	2,921.5	1%
Average end-of-month ownership for 48-year simulation (kaf)	624.5	-11%	755.9	-10%	111.0	-12%	1,538.7	-9%
Years with ownership < ### kaf	12 < 100 kaf		11 < 300 kaf		11 < 63 kaf		3 < 400 kaf	
Percent change from Present Conditions[4]		300%		175%		38%		NA
Year that minimum first occurred	1956		1968		1961		1964	
Largest single month accrual for this alternative (kaf)	477.4	2%	461.3	-15%	60	4%	572.9	0%
Month of largest accrual	June-57		June-70		May-91		June-70	
File that contains the data		Storown.tab		Storown.tab		Storown.tab		Resop.tab
Table numbers		1, 8, & 9		2 & 3		4, 5, & 6		6

[1] The North Platte Project includes Pathfinder Reservoir, Guernsey Reservoir, and the Inland Lakes.
[2] The Kendrick Project includes Seminoe Reservoir and Alcova Reservoir.
[3] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)
[4] NA in the % Δ column indicates that there were no years with ownership < ### kaf in the Present Condtion Run

Table 3.5.3- 9. Project ownership on the North Platte River above Lake McConaughy.

Project Ownership. Table 3.5.3-9 shows that project ownership decreased for the Wet Meadow Alternative with respect to the Present Condition for all projects considered. There were also major increases in the number of years with reduced ownership. This is consistent with the use of Pathfinder water and other water elements for downstream environmental purposes.

Wet Meadow Alternative North Platte River above Lake McConaughy	North Platte Project		Kendrick Project		Glendo Unit		Non-project Lands		Total Shortages	
Project Shortages	Value	% Δ[1]	Value	% Δ	Value	% Δ	Value	% Δ	Value	% Δ
Average annual shortage for 48-year simulation period (kaf)[2]	3.3	1550%	7.6	162%	5.2	41%	1.3	160%	17.3	137%
Number of years with shortages	6	200%	8	167%	26	24%	27	4%	37	12%
Average annual shortage for years with shortage (kaf)	26.3	387%	45.5	-2%	9.6	13%	2.2	144%	22.5	110%
As a percentage of demand for years with shortage (%)	4.0%		65.0%		14.3%		0.9%		2.1%	
Largest annual shortage (kaf)	51.7	397%	70	0%	34.9	43%	18.5	387%	140.5	99%
As a percentage of demand (%)	6.2%		100.0%		59.1%		6.2%		11.0%	
Year of largest annual shortage	1964		1964		1961		1964		1964	
Data is contained in the file Resop.tab table number		30 & 52		31 & 54		32 & 53		42 & 55		30-32,42,52-55

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)
[2] NA in the % Δ column indicates that there were no shortages in the Present Condtion Run

Table 3.5.3- 10. Project shortages on the North Platte River above Lake McConaughy.

Project Shortages. Table 3.5.3-10 shows that, for the Wet Meadow Alternative, there were very large percentage increases in project shortages with respect to the Present Condition for the North Platte and Kendrick projects and non-project lands and less change for the Glendo Unit. The very large percentage increases in shortages for the North Platte and Kendrick projects occurred for all shortage quantities considered.

Wet Meadow Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)	Western Canal		Keystone - Sutherland		Sutherland - North Platte		Brady - Cozad		Tri-County Canal		Kearney Canal	
Irrigation Demand by Reach / Canal	Value	% Δ[1]	Value	% Δ	Value	% Δ	Value	% Δ	Value	% Δ	Value	% Δ
Average annual demand for 48-year simulation period (kaf)	26.3	0%	88.3	0%	26.4	0%	172.7	0%	205.5	0%	13.3	0%
Maximum annual demand (kaf)	51.1	0%	113.4	0%	37.9	0%	236.5	0%	290.5	0%	22.7	0%
Minimum annual demand (kaf)	11.5	0%	52.1	0%	14.3	0%	76.8	0%	89.4	0%	3.2	0%
Table number in file WetMdow.tab.		111		112		113		114		115		116

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

Table 3.5.3- 11. Project irrigation demand on the North Platte River above Lake McConaughy.

Irrigation Demand. There are no changes in irrigation demand for the Wet Meadow Alternative**.**

Irrigation deliveries. Table 3.5.3-12 shows the greatest change in irrigation deliveries occurs for the Kendrick projects. This is mostly due to shortages to irrigation from the Kendrick project.

Wet Meadow Alternative
North Platte River above Lake McConaughy

Irrigation Deliveries	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
North Platte Project Irrigation Deliveries													Resop.tab Table 3
Min (kaf)	0	0	0	0	0	0	0	0	27	216	255	58	673
Max (kaf)	9	2	1	0	1	1	7	221	285	361	357	278	1,482
Avg (kaf)	2	0	0	0	0	0	2	117	134	319	324	197	1,094
Percent change from Present Conditions													
Min	NA	NA	NA	NA	NA	NA	NA	0%	0%	0%	0%	-33%	-4%
Max	0%	0%	0%	NA	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	NA	0%	0%	0%	0%	0%	0%	0%	-2%	0%
Kendrick Project Irrigation Deliveries													Resop.tab Table 2
Min (kaf)	0	0	0	0	0	0	0	0	0	0	0	0	0
Max (kaf)	0	0	0	0	0	0	0	11	17	22	19	9	77
Avg (kaf)	0	0	0	0	0	0	0	9	15	19	17	8	69
Percent change from Present Conditions													
Min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Max	NA	NA	NA	NA	NA	NA	NA	0%	0%	0%	0%	0%	0%
Avg	NA	NA	NA	NA	NA	NA	NA	-9%	-6%	-7%	-7%	-9%	-7%
Glendo Project Irrigation Deliveries													Resop.tab Table 25
Min (kaf)	0	0	0	0	0	0	0	0	2	3	4	0	24
Max (kaf)	11	1	0	0	0	0	0	16	20	22	22	20	92
Avg (kaf)	1	0	0	0	0	0	0	8	11	16	14	13	62
Percent change from Present Conditions													
Min	NA	NA	NA	NA	NA	NA	NA	0%	0%	-43%	-23%	#####	-31%
Max	0%	0%	NA	NA	NA	NA	0%	-6%	-7%	0%	0%	0%	0%
Avg	0%	0%	NA	NA	NA	NA	0%	-1%	-1%	-3%	-2%	-4%	-2%
Non-Project Irrigation Deliveries													Resop.tab Table 1
Min (kaf)	0	0	0	0	0	0	0	8	9	31	52	26	190
Max (kaf)	16	2	0	0	0	0	16	52	56	78	74	59	303
Avg (kaf)	6	0	0	0	0	0	2	29	40	62	66	48	252
Percent change from Present Conditions													
Min	NA	NA	NA	NA	NA	NA	NA	0%	0%	0%	0%	0%	0%
Max	0%	0%	NA	NA	NA	NA	0%	0%	0%	0%	0%	-6%	0%
Avg	0%	0%	NA	NA	NA	NA	0%	0%	0%	0%	0%	-1%	0%

Table 3.5.3- 12. Project irrigation delivery on the North Platte River above Lake McConaughy.

Water leasing. There is no water leasing in the North Platte River basin with this alternative.

Wet Meadow Alternative
North Platte River above Lake McConaughy

Water Banking / Conservation	North Platte Project	Kendrick Project	Glendo Unit	Non-project Lands	Total
Average annual conservation for 48-year simulation period (kaf)	0.0	0.0	0.0	0.0	0.0
Number of years with conservation	0	0	0	0	0
Average annual conservation for years with conservation (kaf)	0.0	0.0	0.0	0.0	0.0
As a percentage of demand (%)	0.0%	0.0%	0.0%	0.0%	0.0%
Largest annual conservation (kaf)	0	0	0	0	0
As a percentage of demand (%)	0.0%	0.0%	0.0%	0.0%	0.0%
Year of largest annual conservation	1947	1947	1947	1947	1947
Data is contained in the file Resop.tab table number	56 & 52	58 & 54	57 & 53	59 & 55	52-55 & 56-59

Table 3.5.3- 13. Water leasing by project above Lake McConaugy.

Flows. The results for flows in the North Platte River for the Wet Meadow Alternative are given in **Table 3.5.3-14**.

Wet Meadow Alternative North Platte River above Lake McConaughy													
Flows	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Ann**
N.P. River below Kortes Reservoir											Resop.tab Table 20		
Min (Monthly (cfs), Annual (kaf))	449	329	288	306	284	355	502	503	502	503	503	502	513
Max (Monthly (cfs), Annual (kaf))	1,124	1,469	1,106	1,121	1,363	2,304	2,775	8,130	8,809	6,170	2,775	2,422	1,880
Avg (Monthly (cfs), Annual (kaf))	679	736	766	736	832	885	1,182	2,011	3,085	2,371	1,592	887	953
Months with flow below 500 cfs[1,4]	1	1	1	1	1	1	0	0	0	0	0	0	1
Percent change from Present Conditions													
Min	-11%	-34%	-43%	-39%	-43%	-29%	0%	0%	0%	0%	0%	0%	0%
Max	-11%	3%	-3%	6%	-15%	19%	0%	-7%	-1%	0%	0%	17%	1%
Avg	-1%	-4%	-1%	-1%	-5%	7%	-9%	9%	0%	-4%	-2%	40%	1%
Months with flow below 500 cfs[2]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N.P. River below Gray Reef Reservoir											Natflow.tab Table 21		
Min (Monthly (cfs), Annual (kaf))	501	371	288	351	349	359	502	503	502	600	532	442	559
Max (Monthly (cfs), Annual (kaf))	867	776	768	768	808	1,321	2,304	8,688	8,727	5,647	4,988	3,482	1,891
Avg (Monthly (cfs), Annual (kaf))	651	560	559	558	566	783	740	1,638	2,462	4,272	1,897	1,312	971
Months with flow below 500 cfs[3,4]	0	1	1	1	1	1	0	0	0	0	0	1	2
Percent change from Present Conditions													
Min	0%	-26%	-43%	-30%	-30%	-28%	0%	0%	0%	-57%	0%	-12%	12%
Max	12%	0%	0%	0%	2%	4%	56%	-7%	-9%	0%	27%	61%	0%
Avg	0%	-2%	-2%	-2%	-1%	13%	15%	7%	-8%	-7%	-2%	105%	2%
Months with flow below 500 cfs[2]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N.P. River below Guernsey Reservoir											Resop.tab Table 7		
Min (Monthly (cfs), Annual (kaf))	5	3	5	7	5	5	104	31	383	3,373	3,607	733	677
Max (Monthly (cfs), Annual (kaf))	501	25	24	86	61	60	1,326	10,233	9,433	9,329	5,154	6,332	2,287
Avg (Monthly (cfs), Annual (kaf))	156	5	6	9	10	12	696	2,151	2,696	5,032	4,619	3,885	1,171
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-37%	-4%
Max	0%	0%	0%	0%	0%	-85%	-20%	-4%	-9%	-7%	-12%	60%	-1%
Avg	0%	0%	0%	0%	0%	-57%	-7%	-6%	-12%	-3%	-1%	39%	2%

[1] The flow below Kortes Reservoir is required by law to be greater than 500 cfs.
[2] NA indicates that there were no months in Present Conditions with flows less than 500 cfs.
[3] The flow below Gray Reef Reservoir isrequired by law to be greater than 330 cfs, but flow of 500 cfs is maintained (when possible) by Reclamation.
[4] The value in the Ann column is the number of years where at least one month had average flows below 500 cfs.

Table 3.5.3- 14. Flow in the North Platte River above Lake McConaughy.

Table 3.5.3-14 shows annual changes in flow of 2 percent or less for the three locations considered. On a monthly basis, below Kortes Reservoir the greatest percentage changes with respect to the Present Condition are in September (increase). Below Gray Reef Reservoir there is a very large percentage increase in September. Below Guernsey Reservoir there are somewhat significant percentage decreases in March, a large increase in September. September is the months with the greatest environmental deliveries to Lake McConaughy under the Wet Meadow Alternative. Flows less than 500 cfs below both Kortes and Gray Reef reservoirs remain unchanged compared to Present Condition. The increases in flows in September are the result of environmental deliveries to Lake McConaughy. The flow decrease in March below Guernsey is due to reduced spills in the very high flow years of the 1980's.

Power Generation and bypass flows. The results for power generation in the North Platte River basin upstream of Lake McConaughy are given in **Figure 3.5.3-4** and **Table 3.5.3-15**.

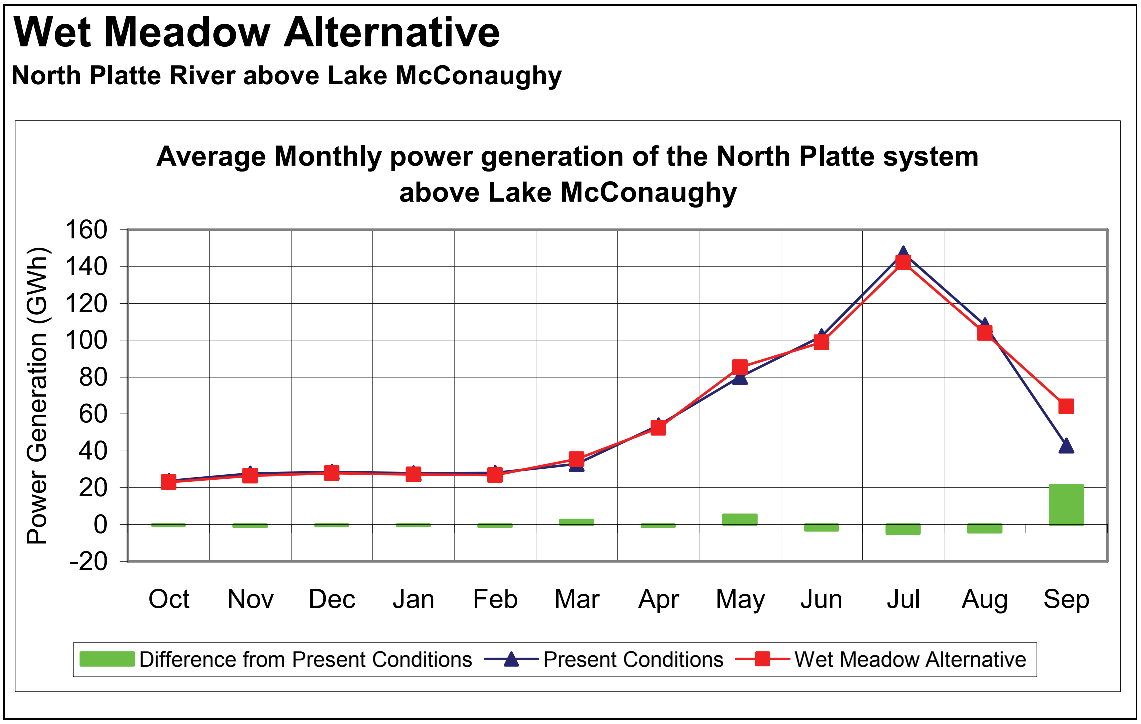


Figure 3.5.3- 4. Average Monthly power generation of the North Platte System above Lake McConaughy.

Wet Meadow Alternative
North Platte River above Lake McConaughy

Power Generation	Seminoe Value	Seminoe % Δ[1]	Kortes Value	Kortes % Δ	Fremont Canyon Value	Fremont Canyon % Δ	Alcova Value	Alcova % Δ	Glendo Value	Glendo % Δ	Guernsey Value	Guernsey % Δ	Total Value	Total % Δ
Minimum (GWh)	65.2	-11%	88.1	0%	127.8	4%	77.6	12%	46.3	-14%	15.1	0%	442.569	-2%
Maximum (GWh)	205.2	-3%	193.3	-3%	278.5	6%	154.2	5%	139.6	5%	19.9	-7%	959.372	4%
Average (GWh)	137.6	-2%	147.6	1%	200.6	4%	116.6	5%	92.2	-2%	18.7	-1%	713.2	1%
Year that minimum occurred	1961		1955		1955		1955		1961		1961		1955	
Data is contained in the file Resop.tab table number		13		14		15		16		17		18		19

[1] % Δ indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

Table 3.5.3- 15. Power generation statistics for the North Platte system above Lake McConaughy.

Figure 3.5.3-4 and **Table 3.5.3-15** show no significant net gain or loss of power generation system-wide for the Wet Meadow Alternative with respect to the Present Condition, and percent changes of 5 percent or less for the individual projects in the system. The changes are also relatively insignificant on a monthly basis, except for September, when there is a somewhat significant increase. This is consistent with the previously noted increase in river flows in September for this alternative.

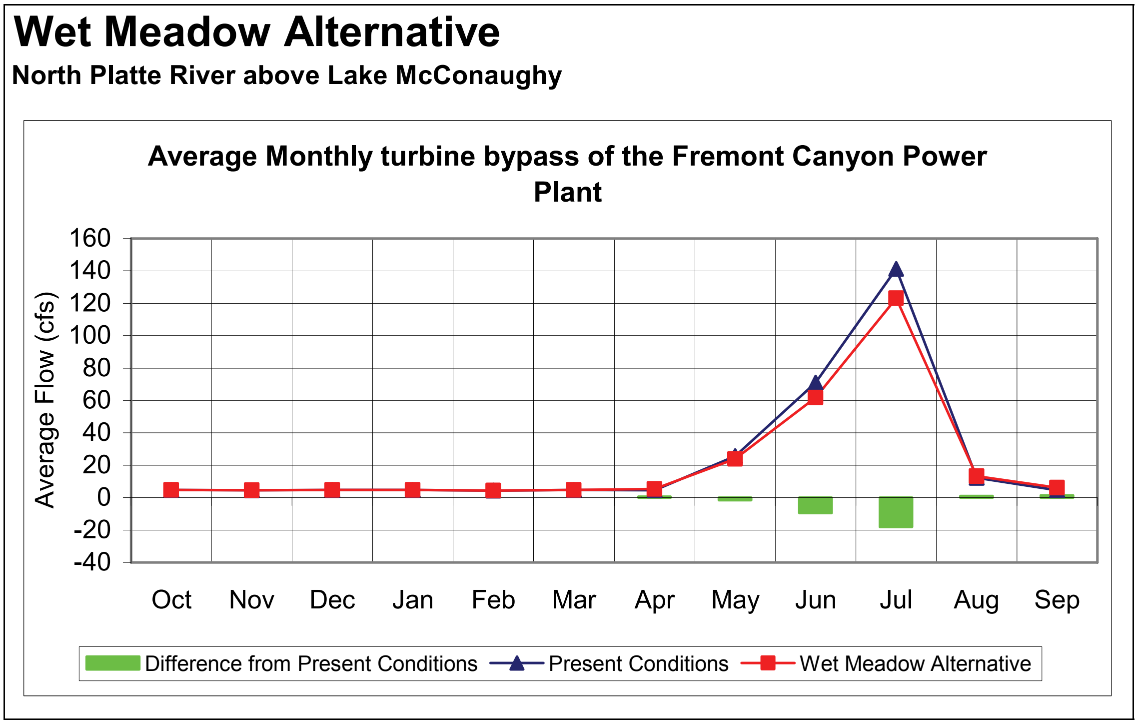


Figure 3.5.3- 5. Average Monthly turbine bypass of the Fremont Canyon Power Plant.

Wet Meadow Alternative North Platte River above Lake McConaughy Flows that Bypass Turbines	Seminoe Value	Seminoe % Δ[1]	Kortes Value	Kortes % Δ	Fremont Canyon Value	Fremont Canyon % Δ	Alcova Value	Alcova % Δ	Glendo Value	Glendo % Δ	Guernsey Value	Guernsey % Δ
Average annual bypass for 48-year simulation period (kaf)	75.9	-3%	94.8	-4%	261.0	-9%	194.0	-12%	226.0	2%	897.6	2%
Number of years with bypasses	20	0%	34	-6%	48	0%	47	0%	48	0%	48	0%
Average annual bypass for years with a bypass (kaf)	182.1	-3%	133.8	2%	261.0	-9%	198.1	-12%	226.0	2%	897.6	2%
Largest annual bypass (kaf)	736.9	-5%	770.6	-6%	1011.3	-4%	890.3	-4%	1066.4	-6%	2008.6	-1%
Year of largest annual bypass	1984		1984		1984		1984		1984		1984	
File that contains the data		Resop.lst		Resop.lst		Resop.lst		Resop.lst		Resop.lst		Resop.lst
Output line number		13		27		43		59		83		99

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

Table 3.5.3- 16. Turbine bypass flow statistics for the North Platte system above Lake McConaughy.

Table 3.5.3-16 shows a net decrease in bypass flows for five of the hydroelectric plants on the North Platte River for the Wet Meadow Alternative with respect to Present Condition. This is most likely due to lower reservoir contents for this alternative. Percentage changes range from increases of 2 percent to a decrease of 12 percent for the individual projects in the system. **Figure 3.5.3-5** shows how the bypass flows would be distributed on a monthly basis for the Fremont Canyon hydroelectric plant.

3.5.3.2 Platte River Basin in central Nebraska

The results of the analysis of the central Platte River basin for the Wet Meadow Alternative are summarized in **Figures 3.5.3-6** through **3.5.3-14** and **Tables 3.5.3-17** through **3.5.3-36**. The terms used below are defined at the end of **Section 3.2** according to how they are used in this discussion.

Lake McConaughy. Conditions in Lake McConaughy resulting from the Wet Meadow Alternative are shown on **Figure 3.5.3-6**.

Wet Meadow Alternative
Central Platte (North Platte below Lewellen and South Platte below Julesburg)

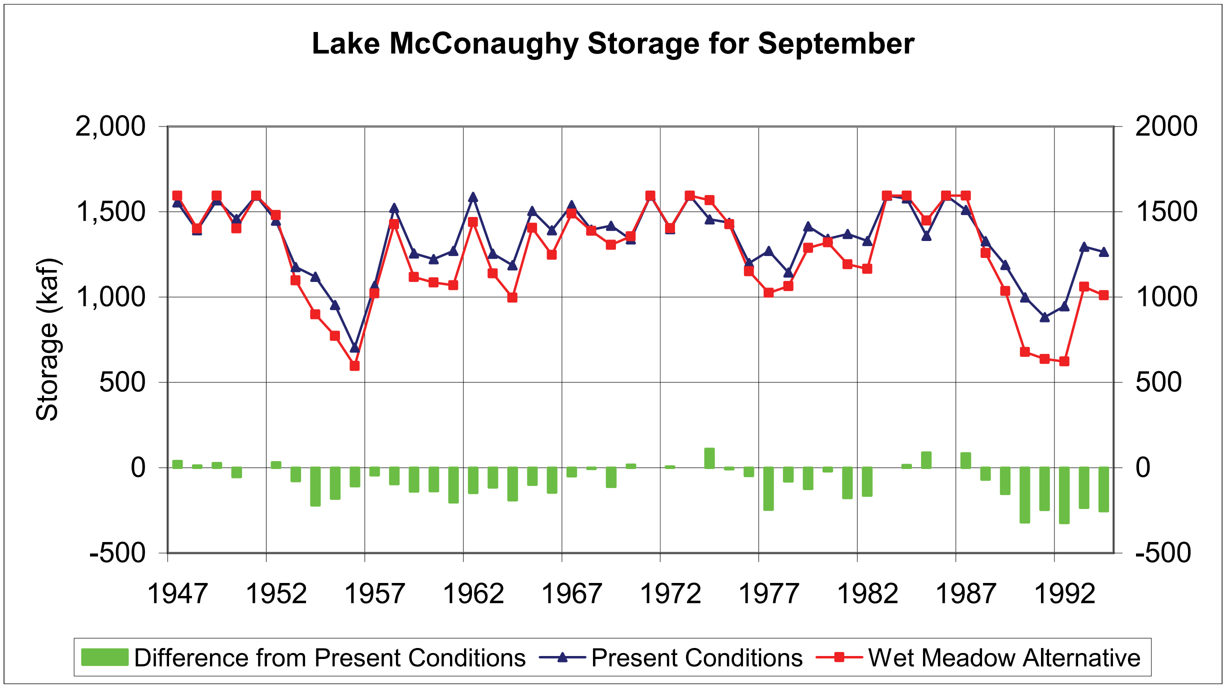


Figure 3.5.3- 6. End of September storage in Lake McConaughy.

Figure 3.5.3-6 shows that, for most years, end-of-September storage in Lake McConaughy for the Wet Meadow Alternative is lower than that for the Present Condition. This is consistent with the establishment of the EA and its use for downstream flow augmentation. Of the years when the two are nearly equal or the Wet Meadow Alternative is slightly higher, most are wet years or years that immediately follow wet years. All water from Reclamation's reservoirs on the North Platte is delivered in September, which causes the end-of-September storage in Lake McConaughy to increase with respect to Present Conditions in wet years.

Wet Meadow Alternative
Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Lake McConaughy Reservoir Storage	Value	% Δ[1]
Minimum end-of-month storage for 48-year simulation (kaf)	559.6	-20%
Maximum end-of-month storage for 48-year simulation (kaf)	1743.1	0%
Average end-of-month storage for 48-year simulation (kaf)	1342.5	-8%
Low storage indicator: years with storage < 500 kaf	0	0%
Year that minimum first occurred		1991
Largest single month drawdown for this alternative (kaf)	245.9	3%
Month of largest drawdown		July-91
Table number in file WetMdow.tab.		1

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

Table 3.5.3- 17. Reservoir storage statistics for Lake McConaughy.

Over all months of the simulation period, the average end-of-month storage for the Wet Meadow Alternative shows a 20 percent decrease with respect to the Present Condition.

Wet Meadow Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)													
Lake McConaughy Storage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
										Table 1 in file WetMdow.tab.			
Min (kaf)	801	846	900	913	853	837	732	560	596	629	704	761	560
Max (kaf)	1,633	1,640	1,594	1,609	1,743	1,743	1,743	1,614	1,594	1,594	1,594	1,594	1,743
Avg (kaf)	1,379	1,396	1,415	1,433	1,414	1,410	1,299	1,191	1,247	1,277	1,310	1,339	1,343
Year that minimum first occurred	1992	1992	1992	1992	1992	1992	1992	1991	1956	1956	1956	1992	1991
Percent change from Present Conditions													
Min	-10%	-11%	-10%	-15%	-24%	-20%	-21%	-30%	-15%	-14%	-13%	-12%	-20%
Max	2%	3%	0%	0%	0%	0%	0%	-3%	0%	0%	0%	0%	0%
Avg	-5%	-6%	-6%	-7%	-9%	-9%	-10%	-11%	-7%	-7%	-7%	-6%	-8%

Table 3.5.3- 18. Monthly reservoir storage statistics for Lake McConaughy.

Minimum, maximum, and average storage by month are shown in **Table 3.5.3-18**. This table shows that the largest percent change occurs in the minimum reservoir storage attained during the simulation of the Wet Meadow Alternative.

Wet Meadow Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)		
Lake McConaughy Spills	Value	% Δ[1]
Average annual spill for 48-year simulation period (kaf)	82.3	-51%
Number of years with spills	15	-48%
Average annual spill for years with spills (kaf)	263.2	-6%
Largest annual spill (kaf)	1288.6	-8%
Year of largest annual spill		1984
Table number in file WetMdow.tab.		6

[1] % Δ indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

Table 3.5.3- 19. Spills from Lake McConaughy.

The number of years with spills for the Wet Meadow Alternative shows a 48 percent decrease from 31 to 15 with respect to the Present Condition, and the average annual spill shows a 51 percent decrease. Spills are when water is released from Lake McConaughy in order to comply with the FERC storage limits.

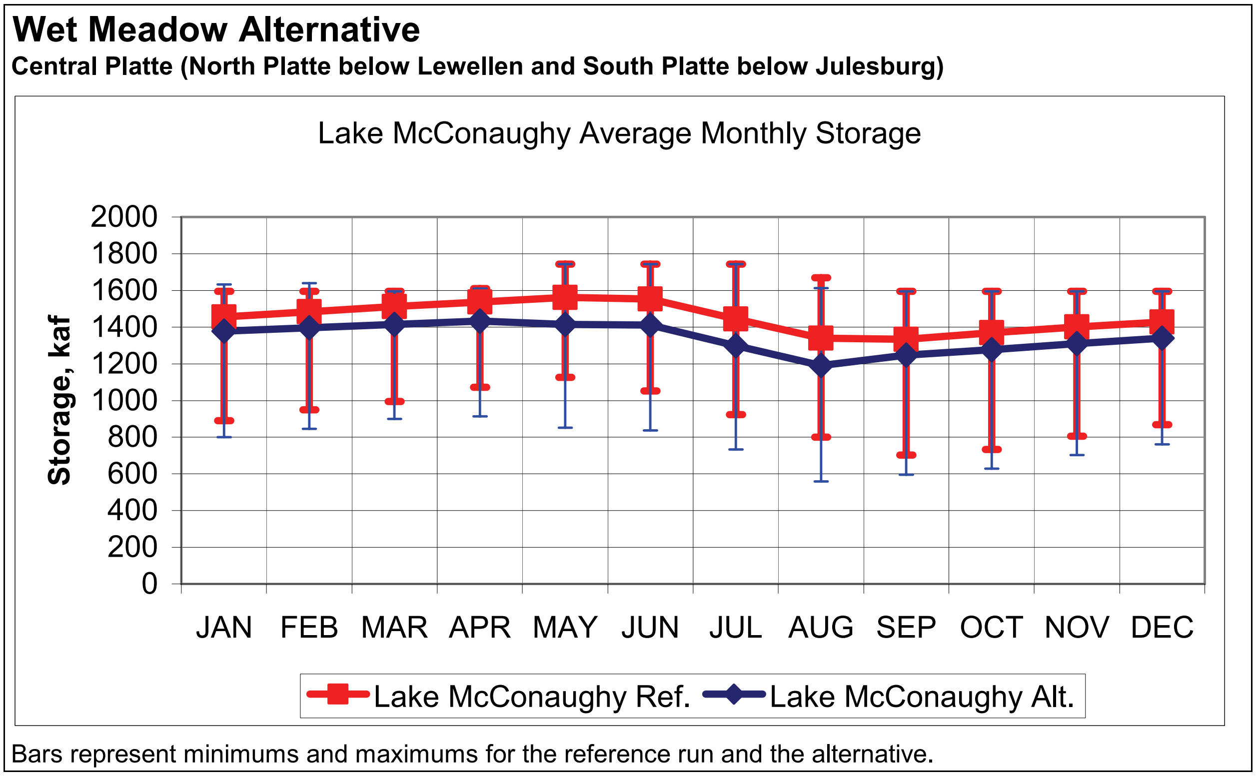


Figure 3.5.3- 7. Lake McConuaghy average monthly storage with error bars for minimum and maximum.

Figure 3.5.3-7 shows the average monthly storage with minimums and maximums represented by bars. This figure shows that the lowest storage occurs in August and September. It also shows that the average storage and the minimum storage for the Wet Meadow Alternative are less than Present Condition. The maximum storage is higher than Present Condition in January and February.

Figure 3.5.3-8 shows the average monthly release from Lake McConaughy including releases from the Environmental Account. The figure shows lower releases in May through July due to reduced spills. Releases are higher in February, March, September, and October due to releases from the Environmental Account.

Figure 3.5.3-9 shows the average monthly storage for Sutherland, Elwood, and Johnson Lake reservoirs. This figure shows that there is no change in storage in these reservoirs between the Wet Meadow Alternative and Present Condition.

Figure 3.5.3-10 shows that, over the 12 months of the year, the Wet Meadow Alternative and the Present Condition approximately balance out for average monthly flow at Grand Island. Flows fall short of target flows approximately half of the time.

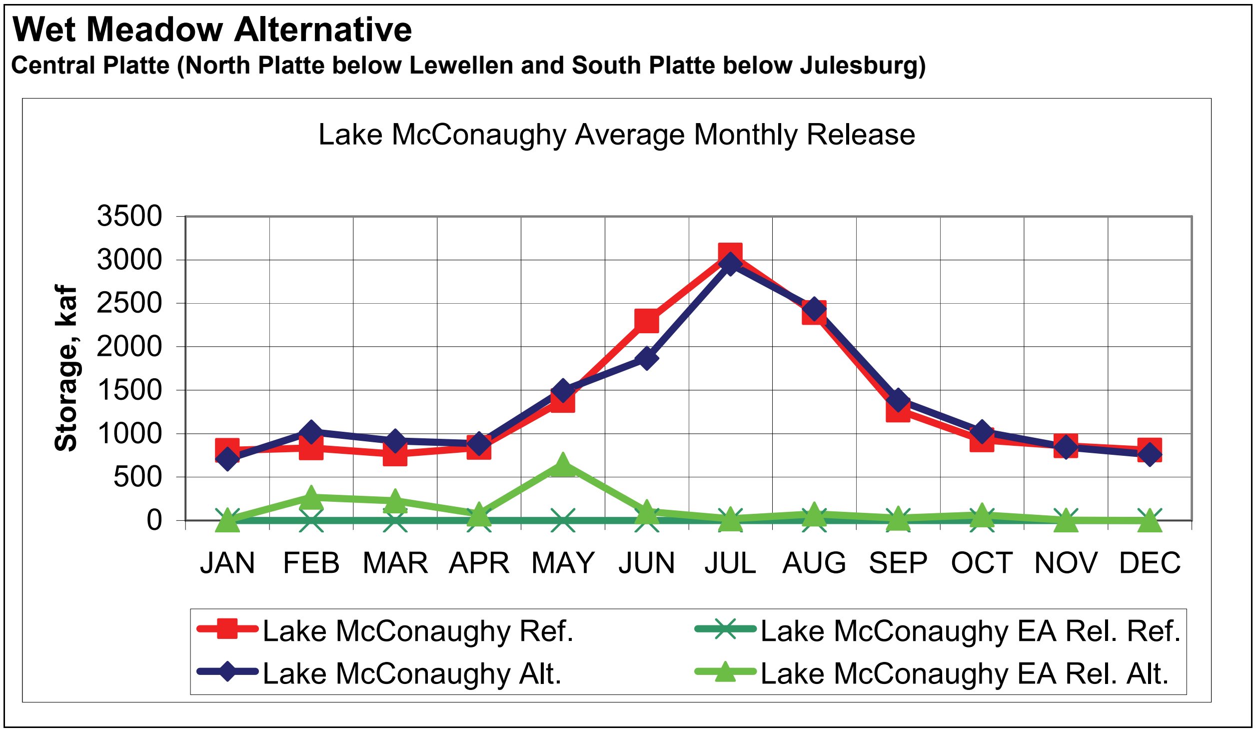


Figure 3.5.3- 8. Average monthly release from Lake McConaughy showing environmental releases.

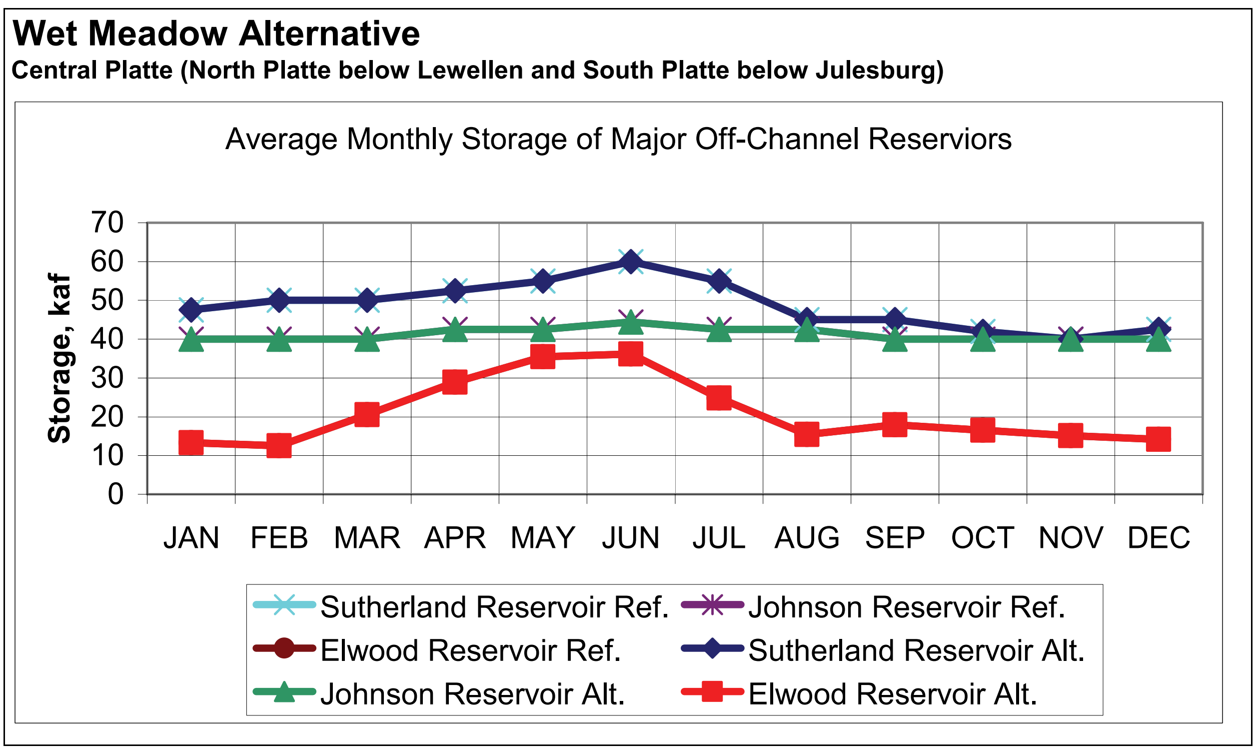


Figure 3.5.3- 9. Average monthly storage for major off-channel reservoirs.

Grand Island Target Flows. Conditions at Grand Island resulting from the Wet Meadow Alternative are shown on **Figure 3.5.3-10**.

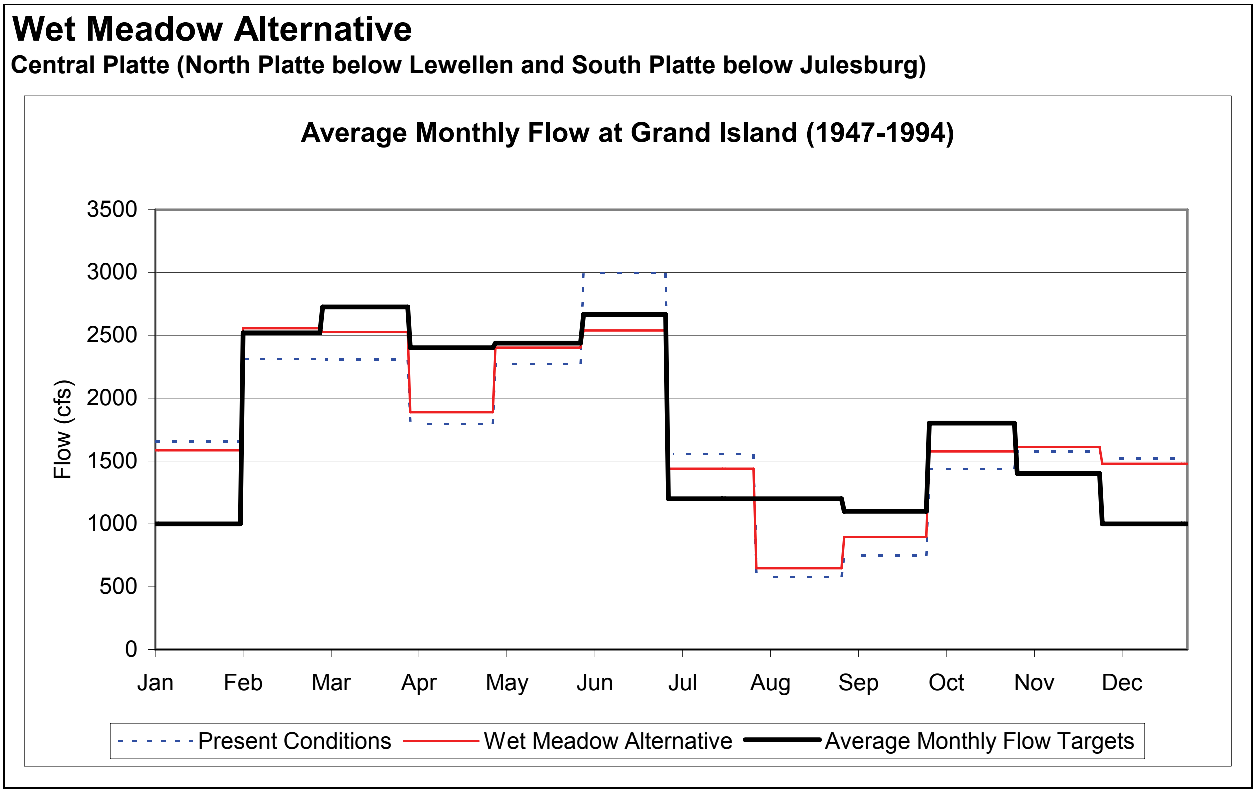


Figure 3.5.3- 10. Average monthly flow at Grand Island, Nebraska compared to flow targets.

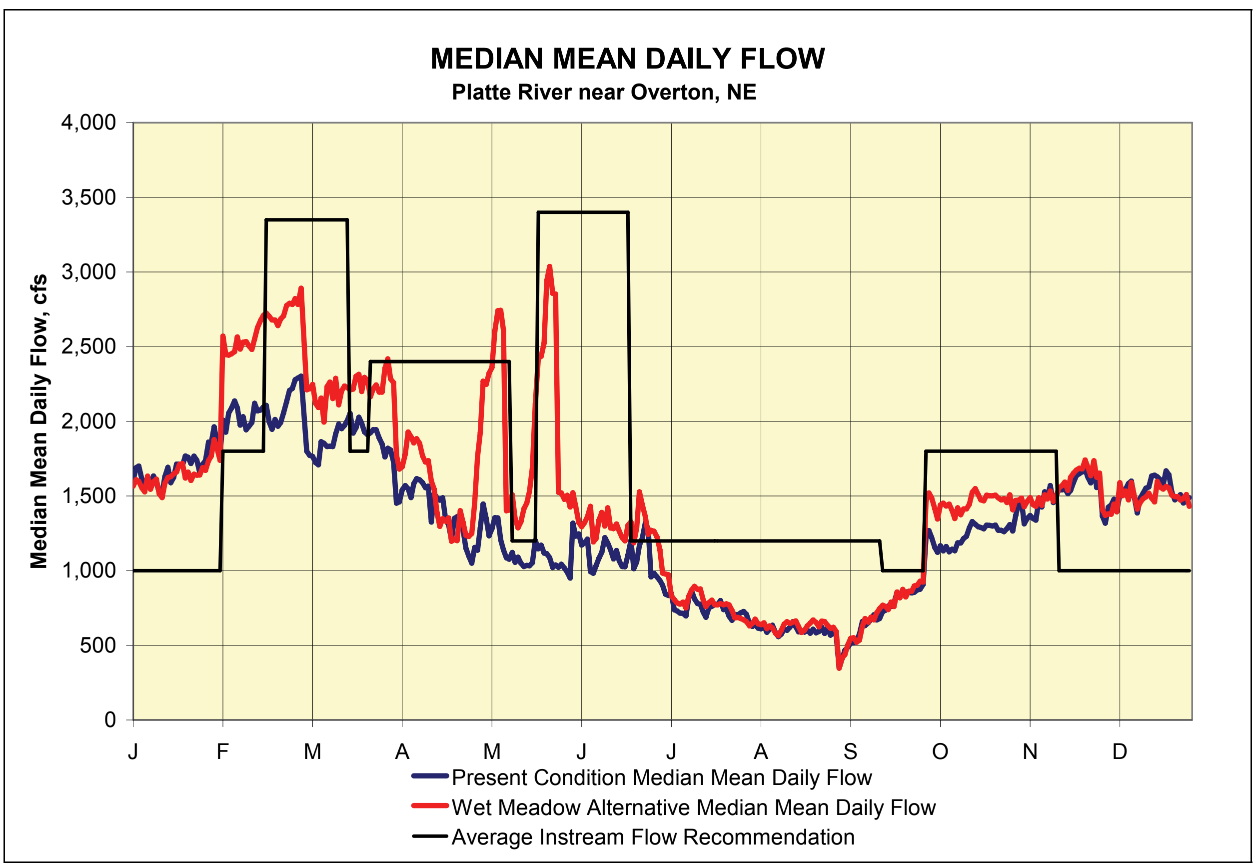
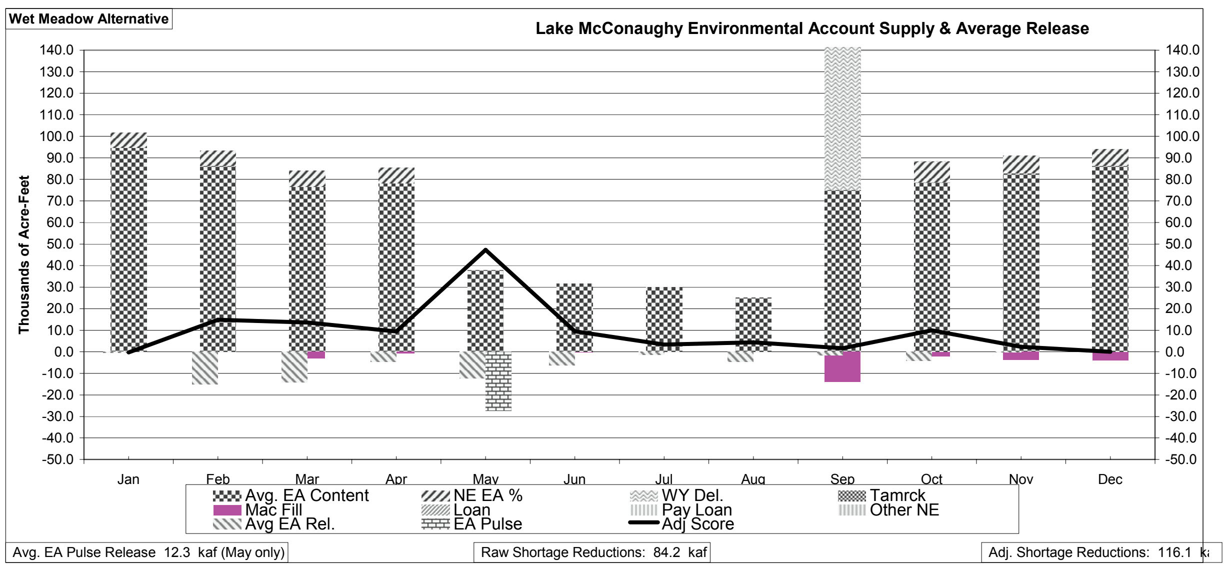


Figure 3.5.3- 11. Median mean daily flow near Overton, Nebraska compared to flow targets.

Figure 3.5.3-11 shows the daily flow targets for average conditions compared to the median daily flow for the Wet Meadow Alternative and Present Condition. The figure shows that the Wet Meadow Alternative constitutes an improvement to flow targets over the Present Condition at Grand Island. However, flows fall short of flow targets most of the time.

Score.



Wet Meadow Alternative

# Zero Flow Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Present	0	0	0	0	0	1	0	1	2	0	0	0	4
WetMdow	0	0	0	0	0	0	0	0	0	0	0	0	0
Raw Shortage Reduction, kaf	-0.2	13.2	13.6	9.4	18.4	8.2	3.4	4.4	1.6	10.0	2.3	0.0	84.2
Adjusted Shortage Reduction, kaf	-0.2	14.9	13.6	9.4	47.3	9.5	3.4	4.4	1.6	10.0	2.3	0.0	116.1

WetMdow		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	Begin Month Content	88.0	94.6	86.5	76.7	78.1	38.1	31.6	29.9	25.2	75.3	78.8	82.9	
plus	NE EA % accrual	7.2	7.0	7.4	7.2	0.0	0.0	0.0	0.0	0.0	9.7	8.3	7.6	54.4
plus	WY EA contribution	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.0	0.0	0.0	0.0	66.0
plus	CO EA exchanged	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
plus	Other NE Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2
plus	EA credit/Mac Fill	0.0	0.0	-3.0	-0.8	-0.1	-0.2	0.0	0.0	-14.0	-2.1	-3.8	-3.9	-27.9
minus	EA Release	-0.5	-15.0	-14.0	-4.6	-12.3	-6.2	-1.3	-4.6	-1.6	-4.1	-0.3	-0.1	-64.5
minus	EA Evaporation	-0.1	-0.1	-0.2	-0.3	-0.2	-0.2	-0.3	-0.2	-0.3	-0.3	-0.2	-0.1	-2.4
minus	EA Pulse Release	0.0	0.0	0.0	0.0	-27.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-27.5
plus	EA borrow from Mac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
minus	EA paid back to Mac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	End-of-Month Content	94.6	86.5	76.7	78.2	38.0	31.5	30.0	25.1	75.3	78.7	82.8	86.4	

Figure 3.5.3- 12. Accruals, storage, and releases for the Environmental Account in Lake McConaughy.

Figure 3.5.3-12 shows the accruals, storage, and releases for the Environmental Account in Lake McConaughy in both graphical and tabular format. The figure shows the contributions by state and adjustments to the amount stored in the Environmental Account when Lake McConaughy fills. There is also a comparison to the number of months that have zero flow for Present Condition and the Wet Meadow Alternative

Wet Meadow Alternative										Adjusted Shortage Reduction:				116.1
WetMdow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Adj.
Groundwater Mgmt Storage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Groundwater Mgmt Contribution	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Riverside Drains	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
North Dry Ck GW inflow at Kearney[1]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dawson and Gothenburg Recharge[2]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C. Platte Rereg. Reservoir Release[3]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Power Interference credited to EA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Net Controllable Conserved Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	
NE Irrigation Savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Other CO at Jules. (no exchange)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Average EA Pulse Release[4]	0.0	0.0	0.0	0.0	27.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.5	27.5
Average Tri-County Irr. Rel. for pulse[5]	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.3
Average Johnson Lake Rel. for pulse[6]	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	--
Number of times EA Borrowed	0	0	0	0	0	0	0	0	0	0	0	0	0	--
Number of time EA Paid Back	0	0	0	0	0	0	0	0	0	0	0	0	0	--
Credit for other Program flows[7]	0.0	1.6	0.0	0.0	0.2	1.3	0.0	0.0	0.0	0.0	0.0	0.0	3.1	3.1
CP Rereg. Res "Spike" Attenuation[8]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Johnson Lake "Spike" Attenuation[8]	0.0	0.0	0.0	0.0	0.0	1.9	0.7	0.3	0.0	0.0	0.0	0.0	2.9	--

1 For N. Dry Creek, adj. shortage reduction = 1/2 * the reduction in target flow shortages calculated by the C.P. OPSTUDY model.
2 Dawson and Gothenburg recharge is not modeled; values are from the Water Action Plan.
3 Central Platte reregulatory reservoir operates using daily flows and is added to the reduction in target flow shortages calculated from the monthly flow values.
4 For EA Pulses, the volume of release is added to the reduction in target flow shortages calculated from the monthly flow values.
5 Pulse augmentation from the Tri-County Canal system (Irrigation water and Elwood Reservoir Storage water).
6 Not added to score because it is assummed to be the rerelease of water from the EA in Lake McConaughy.
7 These are Program contributions that are above targets flows and also greater than the flows under Present Conditions
8 "Spike" attenuation does not reduce shortages to target flows but does provide benefit to the Program.

Table 3.5.3- 20. Central Platte accruals to and releases from the Environmental Account in Lake McConaughy.

The annual reduction to shortages to the flow targets produced by the Wet Meadow Alternative is 116.1 kaf (**Table 3.5.3-20**). . **Table 3.5.3-20** shows the contributions to the Program from all the Water Action Plan elements in the central Platte. The table also shows other flows that contribute to the Score of the Program.

Pulse and Short duration near-bankful flows.

Pulse flows occur during two time periods February/March and May/June. Short duration near-bankful flows are events that last for three days. **Table 3.5.3-21** quantifies the effects of the Program on pulse and short duration near-bankful flows. The table shows that the 30 day pulse in the April through June time period decreases for the 75% of the years that have the highest flows. These same events increase for the 25% of the years that have the lowest flows. The February/March 30 day pulse flow increases. The short duration near-bankful flows decrease for the highest 30%, increase for the middle 40% and the smallest 30%. The number of years with flows greater than 6,500 cfs near Overton, Nebraska increase and the years with flows less than 100 cfs decrease. The final row in **Table 3.5.3-21** is the average annual flow in the J2 return, which increases for the Wet Meadow Alternative.

Wet Meadow Alternative **Central Platte (North Platte below Lewellen and South Platte below Julesburg)**				
	Present Condition	**Wet Meadow**		
	Value	**Value**	**Change**	**% Change**
30-day pulse flow				
Apr/Jun (highest 75%)	4,822	4,421	-402	-8%
Apr/Jun (lowest 25%)	809	1,475	666	82%
Feb/Mar (all years)	2,168	2,402	234	11%
3-day pulse flows				
Years w/flows > 7,500 cfs	12	10	-2	-17%
Largest 30%	13,101	10,675	-2,426	-19%
Middle 40%	4,589	5,611	1,022	22%
Smallest 30%	2,333	3,950	1,617	69%
% of Years 3-day pulse flow objectives achieved (**6,500** cfs @ Overton)	38%	92%	55%	145%
Low Flows				
Years w/flows < 100 cfs	17	10	-7	-41%
Years w/flows = 0 cfs	0	3	3	NA
J2-Return (avg ann flow), kaf	593	644	51.4	9%

Table 3.5.3- 21. Pulse flow and short duration near-bankful flow summary for the Platte River near Overton.

Table 3.5.3-22 also shows information regarding the short duration near-bankful flows. There were 28 years that water was released for short duration near-bankful flows. The short duration near-bankful flow target is 6,500 cfs for three days.

Wet Meadow Alternative **Central Platte (North Platte below Lewellen and South Platte below Julesburg)**		
Pulse flow target summary (at Overton, NE)	**Value**	**% Δ[1]**
Years with pulse flow releases[2]	28	NA
Average duration of pulse flow releases for years with pulse releases (days)[2]	4.5	NA
Years that pulse flow targets were achieved	44	144%
Average maximum Peak Daily Flow when pulse targets were achieved (cfs)	7,543	-38%
Average maximum Peak Daily Flow for remaining years (cfs)	2,488	-28%
[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)		
[2] NA in the % Δ column indicates that pulse flows are not part of the Present Condtion Run		

Table 3.5.3- 22. Short duration near-bankful flow summary for the Platte River near Overton.

Table 3.5.3-23 shows how the short duration near-bankful flows affect the flows in the central Platte river basin. The table shows the average and maximum volumes associated with the short duration near-bankful flow release at various points on the North Platte and Platte rivers. A negative value in a volume column indicates that the canal curtailed diversions (diverted less) during the short duration near-bankful flow event. The table also shows the average and maximum flow during the short duration near-bankful flow event for these same locations.

Wet Meadow Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)				
	Average Pulse Volume (acre-feet)	Maximum Pulse Volume (acre-feet)	Average flow during a pulse release (cfs)	Maximum flow during a pulse release (cfs)
Mac Out	31,481	66,909	3,880	5,700
North Platte River	20,742	53,360	2,325	3,500
Sutherland Canal	9,014	20,133	1,769	2,100
Tri-County Canal	-796	-1,849	1,424	1,823
Platte River above the Jeffrey Return	29,869	59,255	3,388	6,463
Platte River below the Jeffrey Return	31,364	62,191	3,912	6,091
Platte River below the J2 Return	33,917	66,191	4,793	8,006

Table 3.5.3- 23. Flow summary during the short duration near-bankful flow period.

Figure 3.5.3-13 shows that the number of years with flows in the 3,000 to 7,000 range increased with the Wet Meadow Alternative compared to Present Condition.

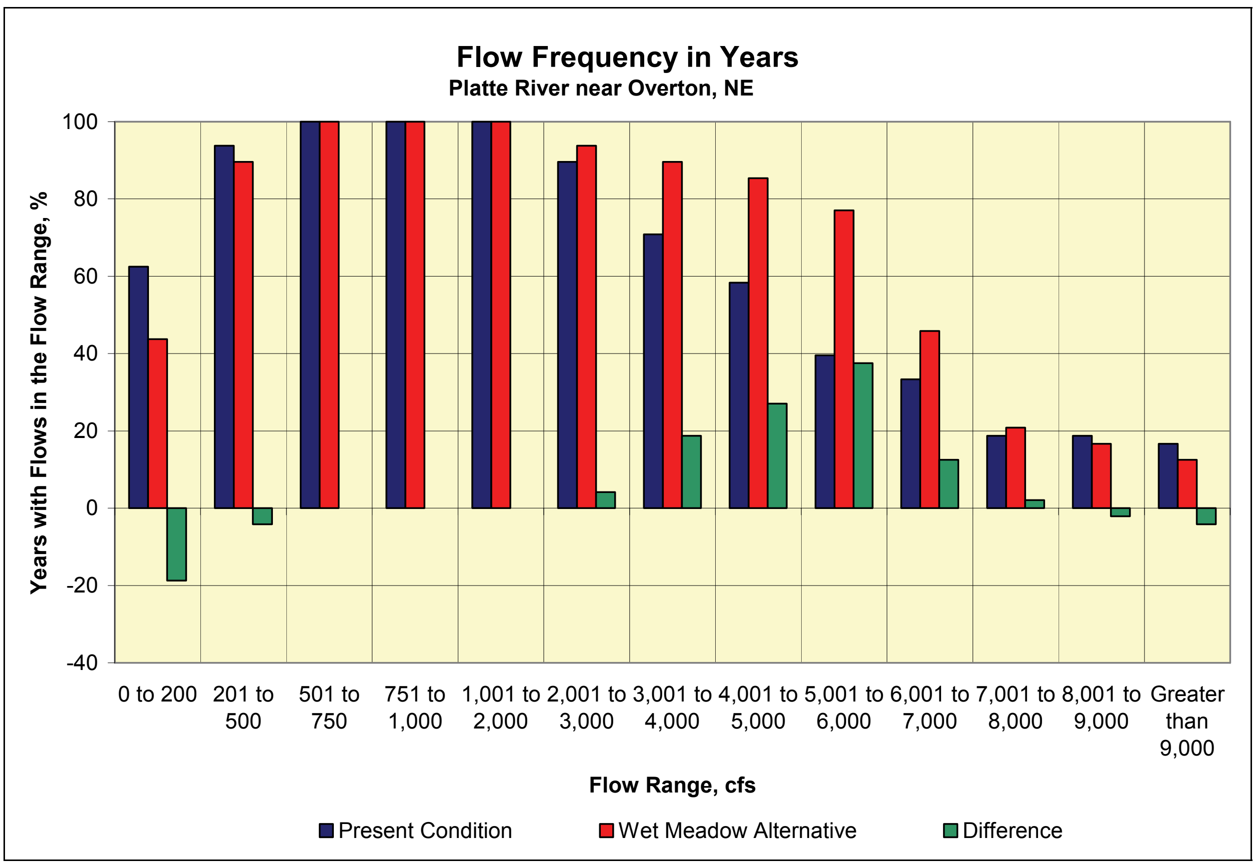


Figure 3.5.3- 13. Flow frequency by flow range in years for the Platte River near Overton.

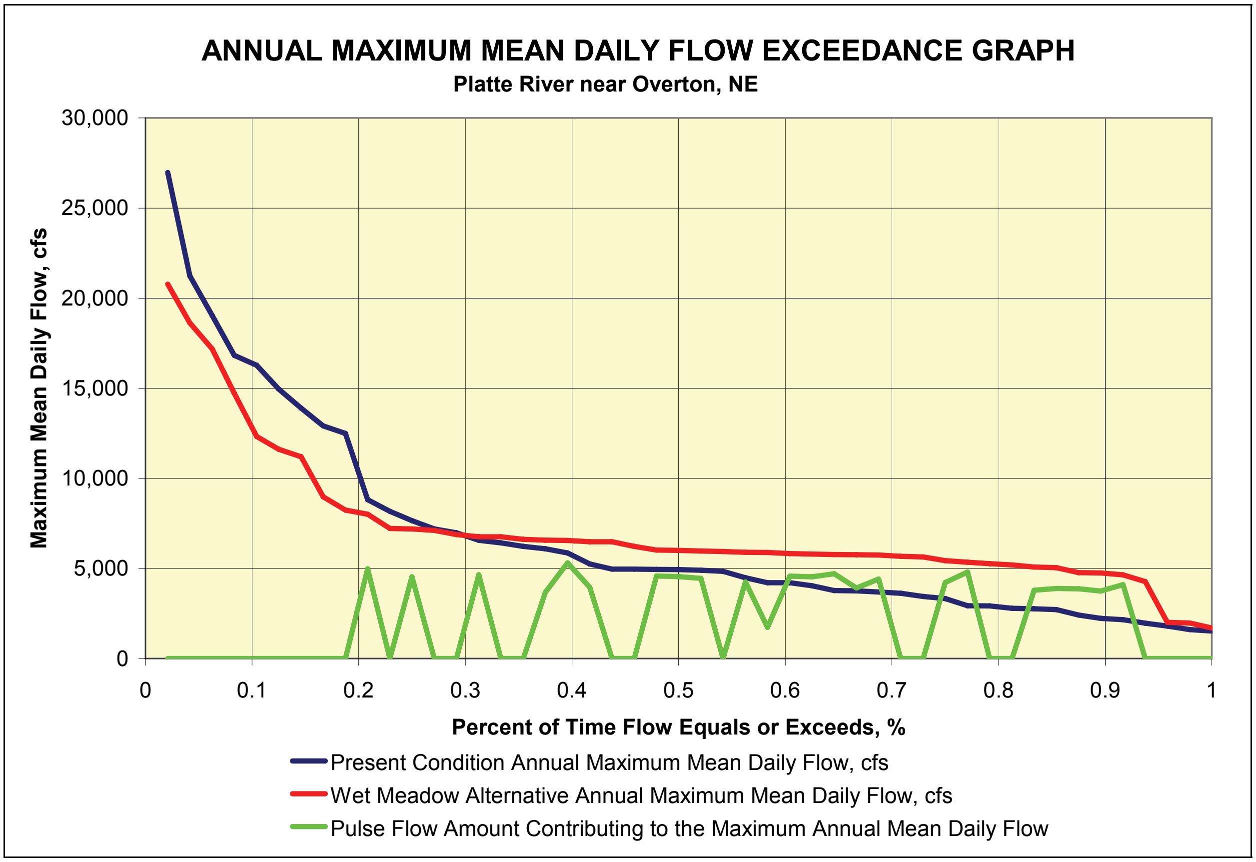


Figure 3.5.3- 14. Exceedance curve for the annual maximum mean daily flow near Overton, Nebraska.

Figure 3.5.3-14 shows a graph of the annual maximum mean daily flow sorted from largest to smallest. Also shown is the release from the Environmental Account for the short duration near-bankful flows. The figure shows that highest 20% of flows are reduced and flows in the 3,000 to 7,000 cfs range are increased.

North Platte Channel Capacity.

Wet Meadow Alternative **Central Platte (North Platte below Lewellen and South Platte below Julesburg)**	
Interaction of the North Platte Channel Capacity with the Environmental Account Operations	
Pulse release limited by North Platte channel capacity (years)	5
Environmental Account release limited by North Platte channnel capacity (months)	0
Environmental Account release limited by North Platte channnel capacity (years)	0

Table 3.5.3- 24. Summary of North Platte channel restrictions on environmental flow deliveries.

Table 3.5.3-24 shows that short duration near-bankful flow releases were limited by the capacity of the North Platte River at North Platte, Nebraska in 5 years. Other releases from the Environmental Account were not limited in the 48 years simulated.

Environmental/Project Accruals by Basin. The average monthly and annual environmental accruals by basin are given in **Table 3.5.3-25**.

Wet Meadow Alternative **Central Platte (North Platte below Lewellen and South Platte below Julesburg)**													
Environmental Accruals by Basin	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Ann**
North Platte (above Lake McConaughy)													Table 66 in file WetMdow.tab.
Min (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	6.0
Max (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	139.0	0.0	0.0	0.0	139.0
Avg (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.0	0.0	0.0	0.0	66.0
Year that minimum first occurred	1947	1947	1947	1947	1947	1947	1947	1947	1954	1947	1947	1947	1954
South Platte (above Julesburg Gage)[1]													Tables 67 and 83 in file WetMdow.tab.
Min (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Avg (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Year that minimum first occurred	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947
Central Platte[2]													Tables 66, 67 and 63 in file WetMdow.tab.
Min (kaf)	0.2	0.3	3.9	3.2	0.0	0.0	0.0	0.0	0.0	0.8	0.4	0.2	29.9
Max (kaf)	11.2	10.5	13.1	16.3	0.0	0.0	0.0	0.0	0.0	14.4	12.1	11.6	76.2
Avg (kaf)	7.2	7.0	7.4	7.2	0.0	0.0	0.0	0.0	0.0	9.9	8.3	7.7	54.7
Year that minimum first occurred	1986	1986	1974	1980	1947	1947	1947	1947	1947	1974	1974	1952	1985
Total													Table 63 in file WetMdow.tab.
Min (kaf)	0.2	0.3	3.9	3.2	0.0	0.0	0.0	0.0	6.0	0.8	0.4	0.2	52.3
Max (kaf)	11.2	10.5	13.1	16.3	0.0	0.0	0.0	0.0	139.0	14.4	12.1	11.6	212.2
Avg (kaf)	7.2	7.0	7.4	7.2	0.0	0.0	0.0	0.0	66.0	9.9	8.3	7.7	120.7
Year that minimum first occurred	1986	1986	1974	1980	1947	1947	1947	1947	1954	1974	1974	1952	1992

[1] Water from the Western Canal is included in the Central Platte Accruals

[2] This includes the water that accures to the Environmental Account in Lake McCounaughy

Table 3.5.3- 25. Environmental accruals by basin.

Table 3.5.3-25 shows the greatest accruals by month occurring in September.

North Platte (above Lake McConaughy). Table 3.5.3-25 shows that the environmental deliveries occur in September with none at all in the remaining months of the year. The months of October through March are effectively the winter months in the higher elevations upstream of the North Platte reservoirs.

South Platte (above Julesburg, CO). Table 3.5.3-25 shows that no water was exchanged into the EA in Lake McConaughy from the retiming of flows by the Tamarack project. **Table 3.6.3-26** shows the operations of the Tamarack project in Colorado. The size of Tamarack is consistent with the overall aspect of the alternative that emphasizes off-river components. Only the basic Tamarack project in the 3-states plan is included in this plan for the South Platte River basin.

Wet Meadow Alternative **South Platte (South Platte above Julesburg)**													
Tamarack Operations	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Ann**
Pumped or Diverted for Recharge													
Maximum, kaf	14,688	7,425	8,220	7,955	8,220	7,955	8,220	0	7,955	8,220	7,955	8,220	88,565
Minimum, kaf	0	0	0	0	0	0	0	0	0	0	0	0	2,700
Average, kaf	7,826	4,419	3,494	1,548	1,369	3,463	2,366	0	1,823	1,199	4,562	7,579	39,647
Median, kaf	8,220	7,425	3,550	0	0	0	0	0	0	0	6,405	8,220	35,820
Months with recharge at max., months[1]	1	28	16	9	5	19	12	N/A	11	7	21	40	1
Months with no recharge, months	2	19	23	38	34	26	30	48	37	41	15	1	0
Net Impact on South Platte River													
Maximum, kaf [2]	2,308	4,839	5,192	5,215	4,759	4,538	4,655	4,948	3,723	4,699	2,242	2,864	22,093
Minimum, kaf [2]	-12,140	-3,927	-6,113	-5,143	-5,038	-6,924	-7,048	1,362	-6,172	-6,013	-6,833	-6,942	-46,330
Average, kaf [2]	-4,536	-340	156	1,604	1,645	-751	298	2,605	591	1,154	-2,377	-5,302	-5,254
Median, kaf [2]	-4,972	-1,738	1,315	2,616	2,331	1,654	1,945	2,415	1,857	1,893	-3,548	-5,964	-1,327

[1] N/A indicates that no recharge occurred during this month.

[2] Negative values indicate recharge and positive values indicate return flows.

Table 3.5.3- 26. Tamarack operations.

Central Platte (including Lake McConaughy). **Table 3.5.3-25** shows that environmental accruals occur in October through April, with no environmental accruals occurring in May through September. This is consistent with the way in which the Lake McConaughy EA is managed.

Shortages, Water Banking/Conservation, Irrigation Demand. The results for shortages, conservation, and irrigation demand are summarized in **Table 3.5.3-27** through **Table 3.5.3-31**.

Wet Meadow Alternative
Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Irrigation Demand by Reach / Canal	Western Canal Value	% Δ[1]	Keystone - Sutherland Value	% Δ	Sutherland - North Platte Value	% Δ	Brady - Cozad Value	% Δ	Tri-County Canal Value	% Δ	Kearney Canal Value	% Δ
Average annual demand for 48-year simulation period (kaf)	26.3	0%	88.3	0%	26.4	0%	172.7	0%	205.5	0%	13.3	0%
Maximum annual demand (kaf)	51.1	0%	113.4	0%	37.9	0%	236.5	0%	290.5	0%	22.7	0%
Minimum annual demand (kaf)	11.5	0%	52.1	0%	14.3	0%	76.8	0%	89.4	0%	3.2	0%
Table number in file WetMdow.tab.		111		112		113		114		115		116

[1] % Δ indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

Table 3.5.3- 27. Irrigation demand by reach/canal.

Irrigation Demand. There is no change in average annual irrigation demand for the Wet Meadow Alternative with respect to the Present Condition.

Wet Meadow Alternative
Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Shortages by Reach / Canal	Western Canal Value	% Δ[1]	Keystone - Sutherland Value	% Δ	Sutherland - North Platte Value	% Δ	Brady - Cozad Value	% Δ	Tri-County Canal Value	% Δ	Kearney Canal Value	% Δ
Average annual shortage for 48-year simulation period (kaf)[2]	0.0	-100%	0.0	NA	0.0	NA	0.0	NA	0.0	NA	0.0	NA
Number of years with shortages[2]	1	-88%	0	NA	0	NA	0	NA	0	NA	0	NA
Average annual shortage for years with shortage (kaf)[2]	0.5	-74%	0.0	NA	0.0	NA	0.0	NA	0.0	NA	0.0	NA
As a percentage of demand for years with shortage (%)	1.7%		0.0%		0.0%		0.0%		0.0%		0.0%	
Largest annual shortage (kaf)[2]	0.5	-88%	0	NA	0	NA	0	NA	0	NA	0	NA
As a percentage of demand (%)	1.7%		0.0%		0.0%		0.0%		0.0%		0.0%	
Year of largest annual shortage		1947		----		----		----		----		----
Table number in file WetMdow.tab.		123		124		125		126		127		128

[1] % Δ indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)
[2] NA in the % Δ column indicates that there value for the Present Condtion Run is zero

Table 3.5.3- 28. Shortages to irrigation by reach/canal.

Shortages. **Table 3.5.3-28** shows that only one system, the Western Canal, has any shortages for the Wet Meadow Alternative. Only 1 years of the 48 years simulated had any shortages. The average annual shortage over the entire simulation period is 0.0 kaf, which is a 100 percent decrease with respect to the Present Condition. These figures are not highly significant, since the actual values for both the alternative and the Present Condition are very small. The reduction in shortages for the Western Canal is due to increased flows at Julesburg predicted by future development in Colorado.

Irrigation Deliveries. **Tables 3.5.3-29** and **3.5.3-30** show the irrigation deliveries for the central Platte river basin. **Table 3.5.3-29** shows the deliveries to the irrigators on the North and South Platte rivers. **Table 3.5.3-30** shows the deliveries to irrigators below the town of North Platte.

Wet Meadow Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Irrigation Deliveries	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Western Canal Irrigation Deliveries										Table 53 in file WetMdow.tab.			
Min (kaf)	0	0	0	0	0	0	1	1	1	0	0	0	12
Max (kaf)	0	0	2	8	13	14	15	11	13	7	4	1	51
Avg (kaf)	0	0	0	1	4	4	5	4	4	3	1	0	26
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	11%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	4%	0%	1%
Keystone-Sutherland Irrigation Deliveries										Table 50 in file WetMdow.tab.			
Min (kaf)	0	0	0	0	3	6	10	15	3	0	0	0	52
Max (kaf)	0	0	1	9	22	23	33	29	20	11	1	0	113
Avg (kaf)	0	0	0	2	10	14	24	23	13	3	0	0	88
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Sutherland-North Platte Irrigation Deliveries										Table 55 in file WetMdow.tab.			
Min (kaf)	0	0	0	0	0	1	3	3	1	0	0	0	14
Max (kaf)	0	0	0	2	6	7	10	8	7	4	1	0	38
Avg (kaf)	0	0	0	0	3	4	7	7	4	1	0	0	26
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 3.5.3- 29. Irrigation deliveries by reach/canal for the North and South Platte rivers.

Wet Meadow Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Irrigation Deliveries	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Brady-Cozad Irrigation Deliveries										Table 53 in file WetMdow.tab.			
Min (kaf)	0	0	0	0	3	4	5	35	3	0	0	0	77
Max (kaf)	0	0	2	13	28	46	95	79	34	25	3	0	237
Avg (kaf)	0	0	0	2	12	23	60	57	16	3	0	0	173
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Central (Tri-County) Irrigation Deliveries										Table 50 in file WetMdow.tab.			
Min (kaf)	0	0	0	0	7	14	18	31	1	0	0	0	89
Max (kaf)	0	0	0	6	44	68	102	84	53	0	0	0	291
Avg (kaf)	0	0	0	4	24	35	62	60	21	0	0	0	206
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Kearney Canal Irrigation Deliveries										Table 55 in file WetMdow.tab.			
Min (kaf)	0	0	0	0	0	0	0	1	0	0	0	0	3
Max (kaf)	0	0	1	7	5	4	6	6	5	2	1	0	23
Avg (kaf)	0	0	0	1	1	1	3	4	2	0	0	0	13
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 3.5.3- 30. Irrigation deliveries by reach/canal for the Platte Rivers.

Wet Meadow Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)						
Water Banking / Conservation by Reach / Canal	Western Canal	Keystone - Sutherland	Sutherland - North Platte	Brady - Cozad	Tri-County Canal	Kearney Canal
Average annual conservation for 48-year simulation period (kaf)	0.0	0.0	0.0	0.0	0.0	0.0
Number of years with conservation	0	0	0	0	0	0
Average annual conservation for years with conservation (kaf)	0.0	0.0	0.0	0.0	0.0	0.0
As a percentage of demand (%)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Largest annual conservation (kaf)	0	0	0	0	0	0
As a percentage of demand (%)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Year of largest annual conservation	----	----	----	----	----	----
Table number in file WetMdow.tab.	129	130	131	132	133	134

Table 3.5.3- 31. Water leasing/management incentives by reach/canal.

Water Banking/Conservation. There is no water banking or water conservation for the Wet Meadow Alternative.

Flows. The results for the flows at significant locations are given in **Tables 3.5.3-32** through **3.5.3-34**.

Wet Meadow Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)													
Flows	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
North Platte River at Keystone										Table 39 in file WetMdow.tab.			
Min (Monthly (cfs), Annual (kaf))	0	0	0	0	46	101	159	239	45	0	0	0	88
Max (Monthly (cfs), Annual (kaf))	0	812	724	462	7,780	6,798	4,645	1,880	2,013	1,851	24	0	1,201
Avg (Monthly (cfs), Annual (kaf))	0	48	16	60	415	769	1,591	1,051	359	241	2	0	277
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	-100%	271%	411%	-43%	0%	-33%	-14%	13%	10%	0%	0%	0%	-7%
Avg	-100%	380%	300%	-5%	-15%	-39%	-5%	0%	37%	8%	0%	0%	-10%
North Platte River at North Platte										Table 42 in file WetMdow.tab.			
Min (Monthly (cfs), Annual (kaf))	138	266	216	193	104	272	304	398	181	254	284	304	296
Max (Monthly (cfs), Annual (kaf))	504	1,208	1,243	897	8,247	6,912	4,892	1,760	2,311	2,407	556	467	1,402
Avg (Monthly (cfs), Annual (kaf))	343	428	435	420	641	838	1,418	1,013	539	582	393	371	450
Percent change from Present Conditions													
Min	0%	0%	0%	0%	-47%	0%	-44%	42%	0%	0%	0%	0%	0%
Max	-31%	65%	63%	-35%	0%	-33%	-13%	14%	9%	0%	0%	0%	-6%
Avg	-1%	10%	3%	0%	-10%	-37%	-6%	0%	22%	3%	0%	0%	-6%
Platte River at Maxwell (Below Tri-County Diversion)										Table 16 in file WetMdow.tab.			
Min (Monthly (cfs), Annual (kaf))	0	0	0	0	0	3	86	106	0	0	0	0	26
Max (Monthly (cfs), Annual (kaf))	885	1,940	2,098	2,212	12,898	14,108	9,247	1,865	2,842	2,189	1,565	768	2,316
Avg (Monthly (cfs), Annual (kaf))	271	500	329	293	1,061	1,414	1,115	648	334	244	164	179	396
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	104%	12%	0%	0%	0%	0%	-17%
Max	-39%	0%	53%	-12%	-3%	-33%	-11%	-3%	13%	-8%	-14%	-15%	-21%
Avg	-16%	32%	52%	1%	-4%	-29%	-10%	11%	65%	5%	-6%	-11%	-5%

Table 3.5.3- 32. Flows in the central Platte basin.

Wet Meadow Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)													
Flows	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Ann**
Platte River at Overton										Table 53 in file WetMdow.tab.			
Min (Monthly (cfs), Annual (kaf))	678	866	932	592	628	395	439	260	103	431	751	655	521
Max (Monthly (cfs), Annual (kaf))	3,485	4,982	4,381	5,941	16,722	16,696	10,960	1,579	4,469	4,664	4,312	3,438	3,969
Avg (Monthly (cfs), Annual (kaf))	1,728	2,489	2,249	1,788	2,382	2,551	1,336	741	1,098	1,698	1,726	1,607	1,288
Percent change from Present Conditions													
Min	-7%	-14%	24%	4%	468%	147%	12%	1043%	0%	0%	-4%	-10%	16%
Max	-11%	0%	12%	-5%	-2%	-29%	-10%	-12%	-7%	-4%	-6%	-4%	-8%
Avg	-4%	11%	11%	6%	6%	-15%	-8%	11%	16%	9%	2%	-2%	2%
Platte River at Odessa										Table 50 in file WetMdow.tab.			
Min (Monthly (cfs), Annual (kaf))	659	821	920	291	356	109	153	0	0	106	724	776	399
Max (Monthly (cfs), Annual (kaf))	3,505	5,075	4,287	5,672	16,343	15,962	10,874	1,254	4,193	4,339	3,867	3,305	3,835
Avg (Monthly (cfs), Annual (kaf))	1,731	2,582	2,281	1,563	2,150	2,339	1,172	499	818	1,420	1,613	1,596	1,189
Percent change from Present Conditions													
Min	0%	-24%	25%	16%	0%	0%	129%	0%	0%	0%	0%	0%	19%
Max	-11%	0%	1%	-5%	-2%	-30%	-10%	-15%	-9%	-6%	-6%	-4%	-8%
Avg	-4%	11%	11%	7%	6%	-17%	-9%	17%	21%	11%	2%	-3%	2%
Platte River at Grand Island										Table 55 in file WetMdow.tab.			
Min (Monthly (cfs), Annual (kaf))	340	826	893	682	589	439	376	91	49	208	497	603	463
Max (Monthly (cfs), Annual (kaf))	4,160	5,318	4,643	5,769	16,318	14,713	10,387	1,345	4,608	5,164	3,786	3,175	3,869
Avg (Monthly (cfs), Annual (kaf))	1,586	2,557	2,526	1,890	2,403	2,539	1,439	648	897	1,575	1,611	1,480	1,273
Percent change from Present Conditions													
Min	0%	-12%	6%	46%	1292%	0%	106%	0%	0%	0%	33%	-5%	19%
Max	-9%	0%	-5%	-5%	-2%	-32%	-10%	2%	-8%	-6%	-7%	-3%	-4%
Avg	-4%	11%	10%	5%	6%	-15%	-8%	13%	20%	10%	2%	-3%	2%

Table 3.5.3- 33. Flows in the central Platte basin.

Wet Meadow Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)													
Flows	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Ann**
South Platte River at Julesburg										Table 38 in file WetMdow.tab.			
Min (Monthly (cfs), Annual (kaf))	156	256	89	138	210	160	119	86	67	112	59	67	156
Max (Monthly (cfs), Annual (kaf))	1,943	1,847	1,316	2,111	8,132	11,836	4,659	1,334	1,400	1,765	1,526	1,568	1,966
Avg (Monthly (cfs), Annual (kaf))	759	938	666	606	1,276	1,753	455	287	399	401	479	563	516
Percent change from Present Conditions													
Min	174%	196%	450%	193%	545%	296%	356%	279%	900%	360%	600%	310%	238%
Max	3%	2%	-4%	-17%	-17%	-5%	-8%	-19%	-18%	-21%	-15%	0%	-11%
Avg	3%	10%	14%	11%	2%	-1%	0%	25%	10%	16%	12%	2%	6%
Sourth Platte River at Paxton (below Korty Diversion)										Table 43 in file WetMdow.tab.			
Min (Monthly (cfs), Annual (kaf))	0	94	0	87	80	0	0	0	0	0	0	0	36
Max (Monthly (cfs), Annual (kaf))	740	1,516	1,269	1,864	6,414	11,140	4,633	859	1,356	1,677	1,343	629	1,608
Avg (Monthly (cfs), Annual (kaf))	291	484	356	323	844	1,191	242	82	169	215	193	206	276
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	-27%	0%	34%	-14%	-21%	-5%	-8%	-16%	37%	-21%	-16%	-18%	-16%
Avg	-4%	14%	27%	13%	-4%	-10%	-17%	12%	24%	8%	5%	-1%	0%

Table 3.5.3- 34. Flows in the central Platte basin.

Table 3.5.3-33 shows that monthly flow increases with respect to the Present Condition in February through May and August through November at the 3 locations in the central Platte area. Percentage increases are also present at Keystone and Julesburg.

Diversion. The average monthly and annual diversions for the 3 major supply canals are given in **Table 3.5.3-35**.

Wet Meadow Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)													
Diversions	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Ann**
Keystone diversion													Table 18 in file WetMdow.tab.
Min (Monthly (cfs), Annual (kaf))	250	250	250	250	250	250	250	813	103	0	250	250	288
Max (Monthly (cfs), Annual (kaf))	1,192	1,684	2,000	1,800	2,000	2,000	2,000	2,000	2,000	1,800	1,835	1,683	1,258
Avg (Monthly (cfs), Annual (kaf))	707	973	901	824	1,082	1,098	1,358	1,385	1,029	779	841	759	709
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	-23%	35%	-51%	0%	0%	0%	-4%
Max	-25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	6%
Avg	-12%	18%	18%	6%	22%	6%	-1%	3%	2%	11%	-2%	-6%	5%
Korty Diversion													Table 19 in file WetMdow.tab.
Min (Monthly (cfs), Annual (kaf))	135	194	0	0	0	0	0	0	0	0	39	5	111
Max (Monthly (cfs), Annual (kaf))	792	1,001	685	901	1,099	1,101	1,010	672	472	504	716	670	407
Avg (Monthly (cfs), Annual (kaf))	424	496	368	304	398	553	261	179	186	162	278	317	236
Percent change from Present Conditions													
Min	144%	157%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	150%
Max	3%	3%	-11%	11%	0%	0%	12%	-21%	-44%	-20%	0%	0%	-6%
Avg	10%	6%	1%	7%	20%	25%	25%	38%	2%	31%	18%	3%	13%
Tri-County diversion													Table 17 in file WetMdow.tab.
Min (Monthly (cfs), Annual (kaf))	690	906	888	854	1,033	1,516	1,649	1,599	988	699	872	694	920
Max (Monthly (cfs), Annual (kaf))	1,978	2,204	2,108	2,087	2,171	2,250	2,194	2,147	2,107	2,072	2,215	2,009	1,510
Avg (Monthly (cfs), Annual (kaf))	1,322	1,774	1,662	1,454	1,753	1,938	2,100	2,065	1,502	1,488	1,496	1,348	1,201
Percent change from Present Conditions													
Min	0%	30%	28%	27%	-2%	16%	6%	1%	6%	0%	13%	1%	6%
Max	-1%	0%	1%	0%	0%	0%	0%	0%	-1%	-1%	0%	1%	0%
Avg	-2%	8%	7%	7%	11%	6%	0%	1%	1%	10%	3%	-2%	4%

Table 3.5.3- 35. Diversions by major canals in the central Platte basin.

Table 3.5.3-35 shows a small increase in average annual diversion into the Korty, Keystone, and Tri-County diversions for the Wet Meadow Alternative with respect to the Present Condition. Diversions at the Keystone Diversion are significantly higher in April and May, with lesser increases in February through October (except June); diversions are lower in November through January. For the Tri-County Diversion, the month-by-month pattern is the same (except June is positive) as that for the Keystone Diversion but the values are lower. The Korty Diversion shows increases in all months. The pattern for the spring months at all three diversions can be attributed to operation for high spring flows in the central Platte River, with South Platte River flow and diverted Lake McConaughy releases being the main sources of these flows.

Power Generation. The Wet Meadow Alternative results in slight increases in power generation with respect to the Present Condition in the Kingsley Dam/Lake McConaughy, Sutherland, and Central systems. Power generation is shown in **Table 3.5.3-36**.

Wet Meadow Alternative **Central Platte (North Platte below Lewellen and South Platte below Julesburg)**								
	Sutherland		**Central**		**Kingsley**		**Total**	
Power Generation	**Value**	**% Δ**[1]	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**
Minimum (MKWh)	57	-10%	172	11%	27	-32%	282	-6%
Maximum (MKWh)	192	3%	358	0%	242	1%	793	1%
Average (MKWh)	120	8%	267	6%	106	2%	492	6%
Year that minimum occurred		1993		1956		1993		1993
Table number in file WetMdow.tab.		23		24		25		26

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

Table 3.5.3- 36. Power generation statistics for the central Platte basin below Lake McConaughy.

3.6 Full Water Leasing Alternative

This alternative emphasizes the use of basin-wide water conservation or leasing to meet the river flow goals of the Program.

3.6.1 Features simulated in the alternative

3.6.1.1 3-States Plan

Pathfinder Modification. The Pathfinder Modification Project is not included in this alternative.

Tamarack. The Tamarack Plan is not included in this alternative.

Lake McConaughy Environmental Account. An Environmental Account (EA) will be established in Lake McConaughy, Nebraska. Water contributed to the EA, regardless of its source, loses any separate identity upon entering Lake McConaughy or other approved storage facility, and simply becomes part of the EA. Water remaining in the EA after September 30 of each year may be carried over and added to the following year's contributions to the EA, subject to limitations on the size of the Environmental Account.

3.6.1.2 Other Elements

EA Short duration near-bankful Flows. Management of the Lake McConaughy Environmental Account (EA) would seek to provide short duration near-bankful flows in the habitat reach of the river. This would be accomplished by timing EA releases to increase the frequency of short duration near-bankful flows released from Kingsley Dam. The magnitudes of the short duration near-bankful flows would not be allowed to exceed the flood stage of the North and central Platte Rivers as determined by the National Weather Service.

The EA would be operated in such a manner as to augment South Platte River flows in order to increase the magnitude and frequency of within-channel flows (flows near bank full) and subsequent sediment transport to the Overton to Grand Island reach of the Platte River. The purpose is to supply sediment to the remaining downstream braided river below the J2-Return. By adding additional water from the EA which would bypass the Tri-County Diversion Dam, sediment stored in the reach from North Platte to the J2-Return could be mobilized and supplied to the reaches below the J2 Return.

Short duration near-bankful flows would be released through the Kingsley Dam Powerplant at a rapid but safe rate and would not exceed the maximum powerplant capacity for a two to three-day duration (about 5,000 cfs). The maximum rate of increasing discharge would be determined so that the downstream river stage would not increase by a rate faster than could be accommodated by downstream structures. Releases would then reduce back to normal operating levels at the maximum practicable rate. The rate of increasing and decreasing discharge would be determined in cooperation with the operators of Kingsley Dam. These short duration near-bankful flows are designed to temporarily mobilize or scour the channel bed rather than transport tremendous quantities of sediment. The discharge hydrograph, released from Kingsley Dam, is expected to transform from a trapezoidal shape to a triangular shape as it travels downstream toward Grand Island. This will result in a decrease in sediment transport capacity as the discharge wave travels downstream.

The purpose of this aspect of EA operation would be to release short duration near-bankful flows, within bank capacity, in order to scour young vegetation from the river channel. If the cottonwood seed germination is minimal during a particular year or if the plants are scoured by naturally occurring floods, then no short duration near-bankful flows for vegetation scour would be implemented. If cottonwood seed dispersal and germination were significant then several different short duration near-bankful flow options would be available.

The short duration near-bankful flows would be generated by season as follows:

> Early fall short duration near-bankful flow (October/September). This short duration near-bankful flow would have a maximum discharge of 5,000 cfs from Kingsley Dam and would occur during an otherwise low-flow period. A short duration near-bankful flow in fall would be designed to temporarily scour the channel bed soon after the cottonwood-seed germination and growing season while the plants are still small and vulnerable to scour. Attempts would be made to schedule such releases when the water diversions through the tri-county power canal are at a minimum.
>
> Winter ice formation flow. This would be a small magnitude (less than 5,000 cfs), short duration near-bankful flow designed to wet the channel at the onset of freezing weather and form ice across the channel. A second small magnitude, short duration near-bankful flow would be initiated at the onset of warmer weather to help break and lift the ice and scour the channel bed.
>
> Spring runoff short duration near-bankful flow (May/June). The target value for the spring short duration near-bankful flow would be 6,500 cfs at Overton during the last 2 weeks of May. The spring short duration near-bankful flow would augment flows from the South Platte River for a total Platte River flow not to exceed the flood stage as determined by the National Weather Service (considered to be 10,000 ft^3/s for analysis purposes). The short duration near-bankful flow in spring would provide for the greatest peak discharge compared to the fall or winter periods. However, a short duration near-bankful flow in spring would allow one or two more months of growing time for the plants.

Only one of the three short duration near-bankful flows would be necessary in any given year. However, they could be used in combination in certain years. Each short duration near-bankful flow type would be implemented experimentally during the adaptive management program (but not in the same water year) to determine their relative effectiveness in maintaining a wide active channel. A mixture of these options may prove to be the most desirable approach over the long term.

A key component of the short duration near-bankful flow implementation would be the operational monitoring of weather, river flows, sediment loads, channel cross sections, endangered species activity, and cottonwood seed dispersal and growth. Monitoring during the various stages of vegetation establishment and growth would be critical to the effective use of flow in removing vegetation and maintaining a wide active channel.

FERC Requirements. The Federal Energy Regulatory Commission (FERC) has issued rules that require certain operations of CNPP&ID and NPPD. These operation are called the FERC requirements.

Minimum Canal Diversions. FERC has set minimum and average canal diversion requirements for the Tri-County Diversion. These are discussed in detail in the *Cooperative Agreement* dated July 1997, and are summarized below in **Table 3.6.1-1**. FERC has also set release requirements for lake McConaughy for the Keystone Diversion during the non-irrigation season. These are summarized in **Table 3.6.1-2**.

Table 3.6.1-1

Diversion Requirements for the Central Diversion during the Non-Irrigation Season

	Diversion Requirements (cfs)					
	10/1 - 11/15		**11/16 - 2/14**		**2/15-beginning of Irrigation Season**	
Condition	**Min.**	**Avg.**	**Min.**	**Avg.**	**Min.**	**Avg.**
Very Wet	1,000	1,600	800	1,000	1,100	1,400
Wet	900	1,200	800	1,000	1,000	1,240
Transitional	900	1,000	800	950	850	1,100
Dry	700	900	700	850	800	960
Very Dry	Consultation among affected parties to maximize multiple use and share effects of shortages.					

Table 3.6.1-2

Releases from Lake McConaughy for Keystone Diversion during the Non-Irrigation Season

Condition	**Minimum (cfs)**	**Average (cfs)**
Very Wet	700	875
Wet	450-700	not defined
Transitional	450	900
Dry	250	700

Very Dry	250	700

Flow Attenuation Plan. During the irrigation season, precipitation events can cause a decrease in demand for water to meet the irrigation needs in the Central Nebraska Public Power and Irrigation District (CNPP&ID) system. This can be thought of as a "rejection" of water. The rejection of water already in the system but not yet delivered leads to an increase in water returned to the Platte River at the Johnson #2 hydropower return (J2 Return). In combination with higher flows in the Platte River due to the precipitation event, the unused irrigation water may increase the total flow in the Platte River to a level where it can inundate least tern and piping plover nests. Article 212 of CNPP&ID's 1417 FERC license requires CNPP&ID to use its best efforts to attenuate the increased flows in the Platte River that sometimes result from the rejection of irrigation water during the nesting season (approximately June 1 to August 15).

The discussions below summarize operational changes at Johnson Lake and adjacent facilities. Johnson lake is the reservoir closest to the J2 return and provides the best opportunity to attenuate flows. Details of these operational changes and related issues can be found in CNPP&ID's *Flow Attenuation Plan* document dated July 2000.

Johnson Lake

Regular Operation. Johnson Lake is located near the downstream end of the Central District Supply Canal. Inflows into Johnson Lake fluctuate as a result of many conditions including changes in the diversion rate at North Platte, the discharge rate through the Jeffrey hydropower planed, flow through the Jeffrey return, precipitation and irrigation from the supply canal and the E-65 irrigation canal. Johnson Lake is operated within a narrow elevation range to provide hydropower head on the Johnson #1 (J1) hydropower plant, head for the E-67 irrigation canal, recreation, and to provide a limited amount of water during peak irrigation demand. Normally, outflows form Johnson Lake fluctuate as inflows fluctuate to avoid either increasing the elevation of the reservoir to a level which can cause bank erosion or decreasing the elevation to a level which would result in less efficient hydropower and irrigation operations. The normal operating range for Johnson Lake is approximately 2618.0 to 2618.5 feet during the summer months and approximately 2617.5 to 2618.0 feet during the winter months.

Operation for Flow Attenuation. CNPP&ID's flow attenuation efforts are intended to manage lake levels within the range of 2617.5 to 2619.0 feet to provide space in Johnson Lake to capture runoff from a precipitation event while keeping the elevation from exceeding 2619.5 feet on most occasions. When Johnson lake operations are considered along with the space available in the J2 forebay, there are approximately 2,500 acre-feet of space available to attenuate flows that result from the rejection of irrigation water. For example, the space could be used to attenuate 250 cfs of rejected irrigation water for about 5 days.

The objective of the Attenuation Plan is, where feasible, to avoid exceeding the benchmark flow at the Platte River gage near Overton. If rejected irrigation water available to be returned to the Platte River will not cause the flow at the Overton gage to exceed the benchmark flow, no attenuation is necessary, and the space in Johnson lake will remain available for future attenuation.

Elwood Reservoir

Regular Operation. Elwood Reservoir is located about 3 miles south of Johnson Lake. It was constructed about 5 miles downstream of the headgate of the E-65 irrigation canal to supplement diversion at the headgate and meet the irrigation demand on the E-65 system. Prior to the irrigation season, water is diverted into the E-65 canal and pumped into Elwood Reservoir for use later in the irrigation season. Depending on the elevation of Elwood Reservoir, each of the three pumps at the station can pump 50 cfs to 75 cfs into Elwood Reservoir. The three pumps combined can pump 150mto 225 cfs. Irrigation demand along the E-65 system typically requires 400 to 500 cfs during the irrigation season. During the irrigation season, when irrigation demand on the E-65 system exceeds the amount available to be diverted, water is released from Elwood Reservoir. Fluctuations in irrigation demand are usually covered by fluctuating the rate of outflow from Elwood Reservoir and keeping a relatively steady diversion at the headgate of the E-65 canal.

Operation for Flow Attenuation. After a precipitation event, if the continuing irrigation on the E-65 system is between 350 cfs and 500 cfs, the diversion into the E-65 canal will not normally be reduced but the outflow from Elwood Reservoir will be reduced to avoid overtopping the canal system. If the continuing irrigation demand decreases below 350 cfs, in addition to stopping the outflow from Elwood Reservoir and meeting the irrigation demand for the E-65 canal, CNPP&ID will pump water into Elwood Reservoir whenever it is operationally and mechanically feasible provided the following conditions are met:

- irrigation demand is sufficiently low that the diversion capacity into the E-65 canal exceeds the demand by enough to operate at least one pump at its design capacity.

- Water rights must allow the available water to be pumped into Elwood Reservoir.

- Consistent with conservation commitments, CNPP&ID will only pump water into Elwood Reservoir that it anticipates will be used for irrigation during the non-irrigation season and avoid high Reservoir elevation during the non-irrigation season that would increase total losses and out-of-basin losses.

Other Methods to Attenuate Increased Flows

Rainwater Basin Wetlands. CNPP&ID will continue to deliver surface water to Rainwater Basin wetlands which hold valid state water rights and will serve additional wetlands that obtain valid state water rights.

Additional Storage Facilities. CNPP&ID has in the past, is currently, and is likely in the future, to investigate additional storage options along the Supply Canal upstream and downstream of Johnson Lake. If additional storage space is constructed, CNPP&ID will evaluate these reservoirs during the design phase to determine whether they could be efficiently operated to aid in attenuating increased flows in the Platte River due to rejected irrigation water while fulfilling their intended functions.

Net Controllable Conserved Water Attributable to Reclamation Funds. According to the CNPP&ID report, "Estimate of Net Controllable Conserved Water", Reclamation funds were used on six conservation projects at the downstream end of the CNPP&ID system, all of which were distribution system improvements. The "Net Controllable Conserved Water" from these projects is estimated to be 487 acre-feet per year. The percentage of Net Controllable Conserved Water from these projects that is attributable to Reclamation funds is equal to the percentage of costs for these conservation projects that was paid for by Reclamation funds.

CNPP&ID examined the total costs associated with implementation of the distribution system improvements partially funded with Reclamation funds. The purpose for examining these costs was to determine the percentage of costs attributable to Reclamation funds, so that a proportionate share of conservation savings could be credited to the Reclamation funds. These costs, and assumptions relating thereto, are summarized as follows:

Direct Improvement Costs - These are direct costs associated with installation of the distribution system improvements. These would include costs of materials, costs of installation, and administrative costs. One half of these costs were paid by Reclamation funds.

Operations and Maintenance Costs - these are ongoing costs associated with operating and maintaining the distribution system improvements. These improvements also have some offsetting reductions in the operations and maintenance (O & M) costs that preceded implementation, i.e. maintenance costs of a new pipeline could be offset by the reduced maintenance costs from eliminating an open lateral. The new O & M costs are only slightly higher ore nearly equal to the offsetting reductions in other O & M costs. Therefore, for purposes of simplicity and economy of scale, net changes to O & M costs are assumed to be zero.

Hydropower Impacts - Conservation of water in the irrigation system, and the contribution of some of that water to the Environmental Account, can have positive and negative effects of hydropower generation at CNPP&ID's three supply canal hydropower plants. Fore example, some of the conserved water that would have been lost in the E-65 or E-67 systems will potentially be available to pass through two more supply canal hydropower plants. On the other hand, conserved water from any irrigation system, if added to the Environmental Account, can potentially be released at a time when no capacity exists for CNPP&ID to divert, which would represent a loss of supply canal hydropower generation. While it is difficult to assess all potential impacts to the supply canal hydropower plants, it appears the net affect would be no change or possibly a slight loss in generation. For purposes of simplicity and economy of scale, net changes to supply canal hydropower generation are assumed to be zero.

Because the net impacts to O & M costs and hydropower generation are assumed to be zero, the approximate cost of the conservation projects partially funded by Reclamation funds is therefore assumed to be equal to the direct improvement costs, of which the Reclamation funds paid about 50 percent. Therefore, the Net Controllable Conserved Water attributable to Reclamation funds is calculated to be 50 percent of 487 acre-feet pre year, or 244 acre-feet per year (approximately 0.2 KAF/year). Pursuant to Article 402 of CNPP&ID's FERC license, CNPP&ID will contribute this amount of water to the Environmental Account on October 1 of each year.

North Platte Choke Point. The terminology "North Platte Choke Point" refers to the channel capacity in the North Platte River at North Platte, Nebraska, at the official flood stage defined by the national Weather Service. This capacity is currently 1,980 cfs, which is significantly lower than the channel capacities at other locations along the North Platte, South Platte, and Platte Rivers. This significantly limits releases from Lake McConaughy for purposes such as EA short duration near-bankful flows to discharges such that flood stage will not be exceeded in the North Platte River at North Platte. The central Platte OPSTUDY model assumes that this "choke point" limits environmental flows past the town of North Platte, Nebraska.

Water Banking

Basic description of concept. A water bank can be used to facilitate transfers that need to occur to ensure that the correct target flows reach endangered species in the Platte River Basin. A Platte River water bank would more than likely consist of three separate water banks i.e., one in each state of the Proposed Program. It is highly likely that reservoir storage will be a component of these water banks, although water can be either recharged into aquifers which can be used as storage or the banks can manage water use entitlements so that no storage is involved at all. A single bank may operate using all three of these methods as well. There are a few steps in the process of developing a water bank with storage rights. The first step requires getting water from the supply source or original area of use to a storage facility. The second is getting that water from storage to the critical habitat area. Once water is acquired and stored, the next step is to work within the legal and institutional framework set among the three states. Generally, water will be shifted from consumptive uses to instream flows and will have to cross state lines. Interstate transfers may pose some legal and/or institutional problems, but this analysis will assume that the states engaged in the cooperative agreement will manage those issues. The banks should facilitate both temporary and permanent transfers of water rights. Timing of releases is the last step in getting this water to the species and habitat area.

For the Water Conservation Alternative, it is proposed that 80 KAF of new water be found through the use of water banking. This new water would be equally distributed among the three states participating in the Program.

Research[5] has revealed the following regarding water banks in the West:

- In the last 10 years, the average cost of water from the Upper Snake River Water Bank was approximately $4.88/AF.

- Washington's East Columbia Water Banks' average cost was $11.88/AF from 1991-1995.

- The Drought Water Bank in California charged $125/AF in 1991 and $50/AF in 1992 and $67.50/AF in 1994 after more efficient planning for their water.

- Water purchased outright for instream uses in the West sold for about $400/AF between 1990-1997[6].

[5] Water Strategist. Stratecom, Inc. 1990-1999.

[6] Clay L. Landry. Saving our Streams Through Water Marketing: A Practical Guide.

Past and current water rights prices (whether it be short-term leases, long-term leases, or permanent acquisition) are scattered all over the board. Water acquisitions among the three states over the past decade have ranged from $7/AF to over $5,000/AF. The price of water can be dependent on a number of factors including quantity, quality, use, location, seniority of the right, supply dependability, weather, etc. Without looking at specific sites throughout the West, it is nearly impossible to estimate the price of water. In addition, relatively few transactions may occur in a given area, making it difficult to estimate a relationship between variables, even on a site-specific level. Virtually no research has been conducted to identify factors that may explain market prices or establish relationships to assist in evaluating or forecasting water right prices (Michelson, 1993). The value for water can be expected to fluctuate even over a small period of time due to market and other factors. Willingness to pay for and willingness to accept water for various uses follows a dynamic evolution, because the demand function relies on factors that are dynamic themselves (i.e., economic, social, climatic factors) (Michelson, 1994). Therefore, water bank prices that may be acceptable to irrigators one year, may not be acceptable the next. In light of these facts, we will use the California Drought Water Bank and other water market/bank prices as a proxy for the conceptual Platte River water banks.

Land Fallowing. The method behind pricing water due to land fallowing is to offer a price that would yield a net income to the irrigator similar to what he/she would have earned from farming plus some additional amount to encourage him/her to enter into a contract with a new water bank. Precautions need to be taken when estimating the price paid to fallow land. The total acre feet saved by fallowing a crop is estimated to be the net amount of applied water used by that crop. However, third party impacts are usually not accounted for. By limiting the percent of water acquired through land fallowing is one way to keep these impacts at a minimum. Another way is to rotate irrigators who fallow their land to make a deposit into the water bank. Still another is to set a minimum amount of water sold or land acreage that may be fallowed by a single irrigator or district.

Third Party Impacts. Transfers of water may impact water quantity (availability), quality, and cost. Surface water transfers must accurately duplicate the quantity and timing of the foregone consumptive use of the seller. Water quality improvements may occur if water is left in the stream rather than diverted and returned as agricultural runoff. Reducing non-point runoff from agricultural lands and improving water quality sources may reduce treatment costs of potable water supplies to water users. However, upstream levels that may be reduced can have negative impacts. As streamflows become depleted, water quality standards may be compromised and municipal and industrial dischargers may have to incur greater costs to ensure compliance with national and/or state standards[7]. Suppliers of seed, fertilizer, other chemicals, application and hauling services and the farm labor source may be adversely impacted while firms specializing in farm improvements such as laser leveling may experience positive impacts such as increased sales.

Third Party Impacts should be taken into account in all states and, perhaps, mitigated for especially those that may occur from the practice of fallowing lands currently in irrigation. The amount of land fallowed should be no more than 20% of the total amount of water received from the project to minimize these impacts. Ideally, most water would come from conservation practices. These include:

- conservation cropping patterns
- deficit irrigation patterns
- conveyance channel modification (structural)
- water control structure modification
- conservation pricing (nonstructural)
- demand based scheduling

Boyle Cost Summary. A preliminary cost summary of some of these conservation practices was provided by Boyle[8]:

Average capitalized cost from deficit irrigation in Colorado per AF of reduction in shortage at the critical habitat would be $4,575 if the saved water in reaches 8 and 9 can be protected from downstream water users. This amount would yield approximately 5,560 AF per year of reductions in target flow shortages at the habitat without diversion losses.

Structural measures in these same reaches would cost an average of approximately $3,755/AF per year and yield an average of 4,232 AF per year of reductions in target flow shortages at the habitat without diversion losses.

Boyle estimated that the average capitalized cost of deficit irrigation in Nebraska per AF of reduction in shortage at the critical habitat would be $4,817 if the saved water in these reaches can be protected from downstream water users. This amount would yield approximately 3,527 AF per year of reductions in target flow shortages at the habitat without diversion losses.

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[7] Water Transfers in the West:Efficiency, Equity and the Environment. National research Council. National Academy Press, Washington D.C., 1992.

[8] Note that Boyle makes many assumptions surrounding their analysis. For a complete and detailed description of these assumptions and the analysis, please consult the Boyle Report entitled Water Conservation/Supply Reconnaissance Study-Evaluation Memoranda.

Structural measures in these same reaches would cost an average of approximately $8,912/AF per year and yield an average of 1,132 AF per year of reductions in target flow shortages at the habitat without diversion losses.

Boyle estimated that the average capitalized cost of deficit irrigation in Wyoming per AF of reduction in shortage at the critical habitat would be $5,902 if the saved water in these reaches can be protected from downstream water users. This amount would yield approximately 1,609 AF per year of reductions in target flow shortages at the habitat without diversion losses.

Structural measures in these same reaches would cost an average of approximately $14,628/AF per year and yield an average of 365 AF per year of reductions in target flow shortages at the habitat without diversion losses.

Summary. Possible water rights transfers for water banking purposes are given by state in **Table 3.6.1-3**. A list of potential water banking dams is given in **Table 3.6.1-4**.

Table 3.6.1-3

Possible Water Rights Transfers for Water Banking Purposes

State	**Type of Transfer**			
	Short Term Lease	**Long Term Lease**	**Purchase**	**Other**
COLORADO	$25-$125/AF+ trans. costs		$4000-$5000/AF	
NEBRASKA				>$19/AF for GW
WYOMING	$3-$5/AF+ O&M	$50-$150/AF	$2500-$5000/AF	

Table 3.6.1-4 Potential Water Banking Dams	
POUDRE DRAINAGE	
Boyd Lake	can deliver water to Big Thompson River via outlet ditch
Fossil Creek	can deliver water to Poudre River via Fossil Cr. Outlet @ dam
S. PLATTE DRAINAGE	
Jackson Lake	can deliver water to S. Platte River via Jackson Lake outlet canal
Prewitt	can deliver water to S. Platte River via Prewitt outlet canal
Riverside	No direct return, map shows possible 3 mile ditch that returns to river
Empire	No return, shortest run ~2 miles to S. Platte River
Sterling	(need maps) - D. Stenzel stated no return to S. Platte River
Julesburg	possible outlet to Cottonwood Creek from dam, CC flows to S. Platte

3.6.2 Run description

3.6.2.1 3-States Plan

Pathfinder Modification. The Pathfinder Environmental Account is not included in this alternative.

Tamarack. The Tamarack Project is not included in this alternative.

Lake McConaughy Environmental Account. The Lake McConaughy Environmental Account (EA) is similar to as has been described in Program Documents. For the EIS, releases from the account are modeled as occurring in all months except December through February, and water is held in the EA for May short duration near-bankful flow releases. Pulse flow releases have priority, followed by summer low-flow releases. The volume remaining in the EA at the end of a water year is carried over into the next water year. A summary of the proposed operation, as modeled in the Central Platte OPSTUDY model, fol1ows:

1. The total quantity of water in the EA in Lake McConaughy is not allowed to exceed

200,000 acre-feet (af) at any time.

2. At any time that Lake McConaughy reaches regulatory capacity as defined by FERC's dam safety requirements for Project No. 1417 and the EA exceeds 100,000 AF, the EA is reduced to 100,000 AF regardless of the sum of the contributions from the states and from Conservation Activities, or the quantity of carryover from a prior year.

3. Storage losses for Lake McConaughy and other Approved Storage Facilities shall be calculated and assigned monthly to the EA using the following formula: ((average monthly storage in the EA)/(average monthly storage in total)) * (total losses for the storage facility for that month).

4. Contributions to the EA are protected from groundwater or surface water depletion from the state line or the source of contribution from within Nebraska to Lake McConaughy or other Approved Storage Facilities.

5. Water stored in projects in Wyoming may be **transported** to the EA. That is, water is released from these projects and flows directly into Lake McConaughy for storage in the EA. This water is subject to conveyance and other losses. Projects in Wyoming include the Pathfinder Modification, Glendo ETO, La Prele Reservoir leasing, etc.

6. Water stored in projects in Nebraska may be **credited** to the EA. That is, the volume of the EA will be considered to have increased by the volume of water that is located and/or stored as a result of these projects. Projects in Nebraska include the central Platte re-regulating reservoir, central Platte power interference, groundwater conjunctive use, and other projects as the water becomes available to the Program and the EA.

The EA in Lake McConaughy is operated to increase flows in the central Platte habitat area. Water is released from the EA depending on the Platte River flows in the habitat area, the time of year, and the amount of water available in the EA. The amount available in the EA is calculated by subtracting any amount held in reserve for use later in the year from the amount stored in Lake McConaughy. If the amount available from the EA is not greater than the amount needed to make the minimum EA release, no release will be made.

3.6.2.2 Other Elements

Short duration near-bankful Flows. The modeling of short duration near-bankful flow releases from Lake McConaughy is based on simulated daily flows at which are computed by the OPSTUDY model. Short duration near-bankful flow releases are only generated in April or May. The generation of short duration near-bankful flows includes several elements besides the EA in Lake McConaughy. The following text describes each element and how it is used during the short duration near-bankful flow event.

Lake McConaughy Environmental Account. The goal of a short duration near-bankful flow is to have a flow near bank full capacity (~10,000 cfs), but below flood stage, at Overton every year (100% of the time). Based on the estimated flow out of Lake McConaughy for May the model estimates the flow at Overton without a short duration near-bankful flow release. The potential short duration near-bankful flow release is.

> The difference between 10,000 cfs and the estimated flow at Overton.
> Constrained by.
> the available release capacity form Lake McConaughy,
> the combined flow capacity in the Sutherland Canal and the North Platte River at North Platte, Nebraska,
> the ramp rate for releases from Lake McConaughy (the Keystone diversion and down the North Platte River), and
> the volume of water available in the EA.

After calculating the potential short duration near-bankful flow release, the model will only make a short duration near-bankful flow release if the following conditions are true.

> The estimated May peak flow at Overton without a short duration near-bankful flow is less than 6,500 cfs.
> The estimated average flows in May and June are less than 3,800 cfs individually or both are less than 2,000 cfs.
> Lake McConaughy is not estimated to spill in June and the average flow in the South Platte River at Julesburg in June is not greater than 700 cfs.
> There were no flows since October 1 in excess of 5,500 cfs.
> The flow at Overton will be greater than 3,500 cfs with a short duration near-bankful flow.
> The short duration near-bankful flow will increase the flow at Overton by at least 1,000 cfs.

Simplified, the above criteria are: do not make a short duration near-bankful flow if.

> there is a good chance that there will be a natural peak in May or June greater than 6,500 cfs,
> there has already been a natural peak of at least 5,500 cfs since last October 1, or
> the short duration near-bankful flow release will not significantly increase flows at Overton.

North Platte River. Ramping rates on the North Platte River are likely to be a concern. Short duration near-bankful flows will require a great deal of coordination with downstream irrigation canal operators. The concerns are trash, deadwood, and other debris that will be mobilized by short duration near-bankful flows that could clog or otherwise damage diversion facilities. Another concern is the effect of short duration near-bankful flows on facilities such as sand dams. Therefore, it will be necessary to test and monitor small short duration near-bankful flows to determine the effect on downstream facilities. The carrying capacity of the North Platte River at North Platte, Nebraska will determine the magnitude of the release from Lake McConaughy. The amount released from Lake McConaughy will be the carrying capacity at North Platte minus the expected gains between Lake McConaughy and North Platte minus any margin of safety.

Keystone Diversion. The goal is to divert enough at Keystone such that the maximum amount (1,850 cfs) can by released from the Sutherland return to the South Platte River. Given the system losses, it will be necessary to divert more than 1,850 cfs at the Keystone diversion. The other constraint is that the Keystone diversion can not be increased or decreased (ramped) by more than 200 cfs per day. Increase (ramp) the Keystone diversion to the Sutherland Canal by 200 cfs per day with the intent of reaching up to the maximum diversion of 2,100 cfs on the first day of the short duration near-bankful flow release down the North Platte River. Assuming that the short duration near-bankful flow release on the North Platte continues for three days, maintain the Keystone diversion for three days. On the fourth day reduce the diversion by 200 cfs and continue to reduce the diversion by 200 cfs per day until the diversion is at the level it was prior to ramping up for the short duration near-bankful flow. Time the diversions such that the water reaches the Sutherland return to the South Platte River at the same time that the short duration near-bankful flows in the North Platte River reach the town of North Platte, Nebraska.

Korty Diversion. This analysis assumes no diversion at Korty during short duration near-bankful flow time period. To the degree that this assumption is not correct changes will have to be made in the operation of facilities. The purpose of not diverting at Korty is to allow for a greater release out of the EA in Lake McConaughy by not using the Sutherland Canal to transport South Platte water.

Sutherland Reservoir. Hold Sutherland Reservoir at a constant level during the ramping and short duration near-bankful flow release times.

Sutherland Return to the South Platte River. Release the amount coming down the Sutherland Canal from the Keystone diversion up to the maximum of 1,850 cfs. Time the return such that the water is released to the South Platte River at the same time that the short duration near-bankful flows in the North Platte River reach the town of North Platte, Nebraska. Maintain the releases for three days or until the short duration near-bankful flow event has passed the town of North Platte, Nebraska.

Lake Maloney. Hold Lake Maloney at a constant level during the ramping and short duration near-bankful flow release times.

Tri-County Diversion. Assume that the Tri-County Diversion is the same as the Sutherland Return to the South Platte River. To the degree that this is not true indicates that releases from the Jeffrey return and diversions to Elwood Reservoir must increase. Diversions to Elwood Reservoir would be prior to the maximum pulsing and after maximum pulsing (Elwood could be used to store excess ramping flows)

Jeffrey Return. As the short duration near-bankful flow passes the Jeffrey Return release water from the Jeffrey Return that is not needed to maintain minimum flows in the Tri-County canal between the Jeffrey Return and Johnson Lake. The amount released cannot exceed the capacity of the Jeffrey Return or about 1,000 cfs. The Jeffrey hydro plant has no bypass capability. The purpose of releasing water from the Jeffrey Return is to allow pulsing out of Johnson Lake. The limiting factor on the Tri-County Canal is often the J2 return. If Johnson Lake is used to augment the short duration near-bankful flow out of the Lake McConaughy EA, a significant portion of the J2 Return capacity is used and unavailable to pass water coming down the Tri-County canal. Using the Jeffrey Return allows the water to be used to generate electricity at the Jeffrey hydro plant, but does not take up J2 Return capacity.

J1 Hydro Plant. As the short duration near-bankful flow passes the J2 Return release the up to the capacity of the J2 Return (2,000 cfs) for up to two days. Then bring the release back to what it was prior to any changes for pulsing.

Johnson Lake. Store water used to ramp the Keystone diversion in Johnson Lake. Storage in Johnson Lake prior to releasing 2,000 cfs for two days will be about 2,600 acre-feet. After the short duration near-bankful flow is stopped the storage will increase to about 2,000 acre-feet, which may be released for a broad based pulse flow or diverted and stored in Elwood Reservoir.

J2 Hydro Plant. As the short duration near-bankful flow passes the J2 Return release the up to the capacity of the J2 Return (2,000 cfs) for up to two days or longer if water is available in Johnson Lake and the J2 forebay. Then bring the release back to what it was prior to any changes for pulsing.

J2 forebay. Store water used to ramp the Keystone diversion in the J2 forebay. Storage in the J2 forebay prior to releasing 2,000 cfs for two days will be about 1,000 acre-feet.

Phelps County Canal diversion. Do not divert water to the Phelps County Canal during the short duration near-bankful flow event. This is to allow the full capacity of the J2 Return (2,000 cfs) to enter the Platte River and augment the short duration near-bankful flows already in the Platte River. Any water that would have been diverted during the short duration near-bankful flow period will be charged against the EA in Lake McConaughy.

Elwood Reservoir. Do not store water in Elwood Reservoir during the time that water is being released from the Jeffrey Return. Elwood Reservoir may be used to store water that is used to ramp the Keystone Diversion.

FERC Requirements

Minimum Canal Diversions. The values for the minimum diversion requirements are given in the input file. Minimum values are given for the Keystone Diversion, the Sutherland Canal (and hence, indirectly, the Korty Diversion), and the Tri-County Diversion.

Flow Attenuation Plan. The storage in Johnson Lake that is available for "spike flow" attenuation is 2,500 acre-feet. Attenuation is only allowed to occur between June 10 and August 15. If, during this time, the simulated daily flow at Overton exceeds 1,200 cfs, the flow at Overton is attenuated by storing water in Johnson Reservoir up to the maximum storage available for attenuation. Once the flow at Overton drops back to an acceptable level, the stored "spike flow" is released back into the system.

North Platte Choke Point. Because of a channel constriction in the North Platte River at North Platte, there is a very low flood stage and a corresponding very low channel capacity in the river at this location. If either a daily or a mean monthly flow in the North Platte River at North Platte exceeds this value, then EA releases are reduced so that channel capacity is below this value. Reductions are applied to the continuous and/or the short duration near-bankful flow releases, as appropriate for the operational condition being simulated at the time the excess at North Platte occurs. This run assumes a capacity of 3,000 cfs in the North Platte River at North Platte, Nebraska.

Reclamation Net Controllable Conserved Water, 0.2 KAF. This is provided as input as part of the total Net Controllable Conserved Water. The total Net Controllable Conserved Water is added to the EA once a year, every year, in October.

140 KAF Conservation in 3 States.

South Platte in Colorado. As part of a basin-wide water banking alternative, water rights would be leased or purchased from several reservoirs in the South Platte River basin. These rights would be changed to allow for release and delivery of the historically consumed portion of the storage water to Julesburg as needed to meet target flows during May and June. For every acre-foot of water needed for delivery at Julesburg, 2.2 acre-feet of storage water would leased or purchased to provide for makeup of historical return flows and evaporation and transit losses.

Basin-wide banking alternatives were specified based upon the net amount of water to be delivered: 140,000 acre-feet basin wide, 46,666 AF (1/3) coming from Colorado.

The delivery volumes associated with this amount was assumed to be distributed among eight reservoirs within the South Platte basin of Colorado (Boyd Lake, Fossil Creek, Jackson Lake, Prewitt, Riverside, Empire, North Sterling and Julesburg reservoirs) as a pro rata portion of each reservoir's active capacity.

Modeling Approach. In modeling this alternative, only the historically consumed water and the water reserved for evaporation and seepage losses were explicitly represented. The water reserved for makeup of historical return flows was excluded from the model under the assumption that this water would be correctly administered to address injury issues.

Historical end-of-month contents records were obtained for each of the eight reservoirs mentioned. These records were inspected to determine the degree of fill obtained by each reservoir by the end of April in each year of the model study period. Inflows were added to the model to represent the storage banking accounts associated with involved reservoirs. The capacity of each inflow was set to the pro rata portion of each reservoir's degree of fill, minus the amount needed to make up historical return flows, as shown in the following table. Inflows were modeled to allow for release from each account to the degree available and as needed to meet target flows at Julesburg during May and June. Outlet capacity was not assumed to be a constraint upon releases.

Water Banking Alternative: Potentially Deliverable Water, AF

Boyd Lake	Fossil Creek	Riverside	Empire	Jackson Lake	Prewitt	North Sterling	Julesburg
4,500	1,000	5,800	2,550	3,200	3,050	6,650	2,600

The 27 KAF contributed by South Platte water banking in Colorado is included in the input to the Central Platte OPSTUDY Model as "program water", separate from the input of the gauged flow in the South Platte River at Julesburg, Colorado.

Platte in Nebraska. Water banking is modeled by irrigation reach as a reduction to diversion in each reach. The water identified through these features is credited to the EA once a year, every year, in October. This allows for a determination of how much water is actually available before it is credited.

Fundamentally, water banking involves 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 (WAP reach 10) does not receive storage water from Lake McConaughy. Therefore, water banking in reach 10 involve reductions in natural flow diversions and the water is protected from diversion for consumptive use.

Because of the channel restrictions near the town of North Platte, all water leasing and water management incentives in Nebraska were concentrated in the river reaches below North Platte. This is shown in the following table.

54,000 ac-ft leasing			Reductions in Consumptive Use (ac-ft)				
WAP's Canals	Reach	Water Leasing ac-ft	Conserve Cropping	Deficit Irrigation	Land Fallowing	Irrig. Tech. Changes	Leasing Plus Conservation
			<----------Four Options / Combinations--------->				
Western	10						0
Key-NP	14						0
Central	15						0
Central +Brady to Cozad	16	10562					10562
Central +Dawson	17	13330					13330
Central + Kearney	18	30108					30108
Central	19						0
	Total	54000	0	0	0	0	54000

In order to simulate these reductions in consumptive use with the Central Platte Opstudy model, the reductions in consumptive use in the WAP had to be assigned to the irrigation demands (grouped by reach) used in the Central Platte Opstudy model. This was done by dividing the demand for a canal/district by the sum of the demands for all canals/districts listed for the reach in the WAP. For example, the consumptive use assigned to the Central district in reach 16 is the Central demand divided by the sum of the Central demand and the Brady to Cozad demand multiplied by the consumptive use for reach 16. The factors used to distribute the WAP's reach estimates to Central Platte Opstudy model reaches are shown in the following table.

Percentage Factors to Distribute WAP's Reach Estimates into Opstudy Reaches					
Reach 14		Reach 18		Reach 16 & 17	
Keystone-North Platte		Kearney & Central		Central & Brady-Cozad	
0.770	Key-Suth%	0.052	Kearney	0.581	Central
0.230	Suth-NP %	0.948	Central	0.419	Brady-Cozad
1.000	Total	1.000	Total	1.000	Total

This results in the following distribution of reductions in consumptive use to the reaches/districts used in the Central Platte Opstudy model.

	Acre-Feet		Percent
Western Canal	0		0.000
Keystone-Sutherland	0		0.000
Sutherland- North Platte	0		0.000
Brady-Cozad	10,909		0.202
Kearney	1,825	12,735 sub total	0.034
Central	41,265		0.764
Total	54,000		1.000

The reductions in consumptive use were used to determine irrigation reduction factors for each of the reaches in the Central Platte Opstudy model. These are simply the reduction in consumptive use divided by the average annual diversion. The values are shown in the following table.

Present Cond. Irrigation Demands (kaf) & Cons. Factor			
Canal	Average Diversion	Target Reduction	**Cdata Factor**
Western Canal	26.3	0.000	**1.00000**
Keystone-Sutherland Canals	88.3	0.000	**1.00000**
Sutherland-North Platte Canals	26.4	0.000	**1.00000**
Tri-County Canals	205.5	28.283	**0.86239**
Brady-Cozad Canals	172.7	23.767	**0.86239**
Kearney Canal	13.3	1.825	**0.86239**
Total	532.4	53.875	

The sum of the savings in consumptive use (except for the Western Canal) is 27,000 acre-feet. This volume was allocated to the EA annually in October (after the consumptive use savings have occurred). The WAP report recognizes that to achieve a certain volume of consumptive use reductions, 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 and assuming the remaining water is released to maintain return flows at pre-leasing levels, the Central Platte

Opstudy model is consistent with the WAP's analysis.

North Platte in Wyoming and Nebraska. Water banking in the North Platte basin in Wyoming and Nebraska was modeled in the NPREIS model by reducing the irrigation demand for the North Platte, Kendrick, and Glendo projects. The Kendrick Project was chosen for the following reasons.

A factor was used to reduce the irrigation delivery. The factor was determined as the average annual amount of water delivered to the Program divided by the efficiency divided by the average annual delivery to the project. Leased water is delivered in the same month that the water would have been delivered and water leasing only occurs in July-September. The portion of the leased water that would have otherwise contributed to the river gains via return flows is released and added to natural flow in the same month that the water would have been delivered.

The 54 KAF contributed by water banking in the North Platte basin in Wyoming and Nebraska is included in the input as a portion of the "Environmental Account Deliveries at Lewellen". It is modeled in the NPREIS model as a percentage reduction in irrigation demand in districts connected to the North Platte, Kendrick, and Glendo projects.

3.6.3 Run results

3.6.3.1 North Platte River Basin

The results of the analysis of the North Platte River basin for the Full Water Leasing Alternative are summarized in **Figures 3.6.3-1** through **3.6.3-5** and **Tables 3.6.3-1** through **3.6.3-16**.

Storage above Lake McConaughy. The results for storage conditions above Lake McConaughy are given in **Figure 3.6.3-1**.

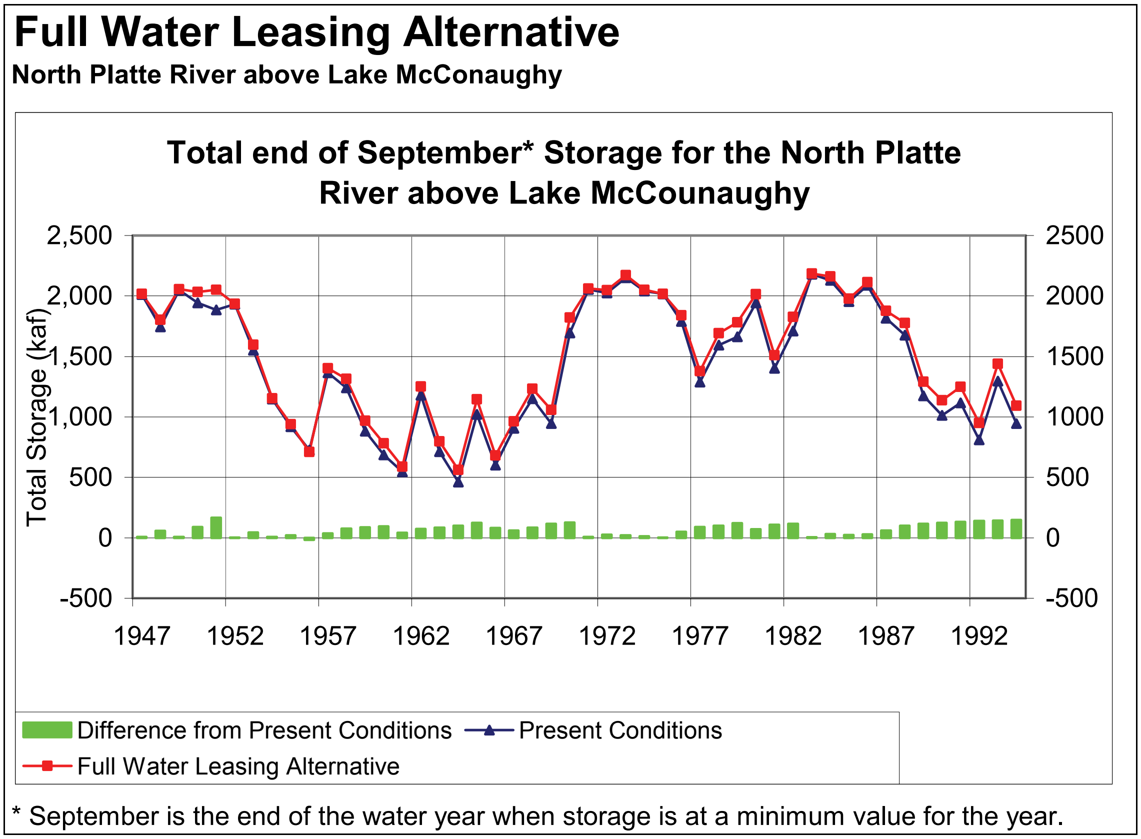


Figure 3.6.3- 1. End of September storage above Lake McConaughy.

Figure 3.6.3-1 shows that the end-of-September storage above Lake McConaughy was generally higher for the Full Water Leasing Alternative than for the Present Condition. This is consistent with the use of water leasing to provide water for the Program.

Full Water Leasing Alternative **North Platte River above Lake McConaughy** **Reservoir Storage**	**Seminoe** **Value**	 **% Δ**[1]	**Pathfinder** **Value**	 **% Δ**	**Alcova** **Value**	 **% Δ**	**Glendo** **Value**	 **% Δ**	**Guernsey** **Value**	 **% Δ**	**Inland Lakes** **Value**	 **% Δ**	**Total Storage** **Value**	 **% Δ**
Minimum end-of-month storage for 48-year simulation (kaf)	112.7	22%	76.5	144%	156	0%	63.1	0%	0	0%	0	0%	561.9	22%
Maximum end-of-month storage for 48-year simulation (kaf)	1,017.3	0%	1,016.6	0%	179.5	0%	723.7	6%	45.6	0%	74.1	3%	2977.8	3%
Average end-of-month storage for 48-year simulation (kaf)	636.4	6%	609.7	8%	167.8	0%	318.7	-4%	19.2	1%	49.8	40%	1757.5	4%
Low storage indicator: years with storage < ### kaf	4 < 200 kaf		9 < 200 kaf		0 < 150 kaf		15 < 100 kaf		0 < 0 kaf		0 < 0 kaf		3 < 650 kaf	
Percent change from Present Conditions[2]		-33%		-25%		0%		67%		0%		0%		-50%
Year that minimum first occurred	1965		1965		1947		1961		1949		1961		1964	
Largest single month drawdown for this alternative (kaf)	146.2	-4%	279.4	0%	23.5	0%	248.4	-4%	28	0%	32	8%	420.7	15%
Month of largest drawdown	July-63		June-89		October-47		July-83		September-47		August-58		August-83	
File that contains the data		Resop.tab		Resop.tab		Resop.tab		Resop.tab		Resop.tab		Resop.tab		Resop.tab
Table number		3		2		25		1		4		5		6

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)
[2] NA in the % Δ column indicates that there were no years with storage < ### kaf in the Present Condtion Run

Table 3.6.3- 1. Reservoir storage statistics for the North Platte River above Lake McConaughy.

The average end-of-month storage shows a percentage increase of 4 percent with respect to the Present Condition. The greatest percentage decrease for an individual reservoir was 4 percent for the Glendo Reservoir. The Inland Lakes show a percentage increase of 40 percent; there was no change or an increase for all other projects considered. The increases at Seminoe and Pathfinder are consistent with the use of water leasing to meet environmental requirements from the North Platte River basin under the Full Water Leasing Alternative. The increased storage in the Inland Lakes is due to reduced demand created by leasing water from North Platte Project irrigators.

Full Water Leasing Alternative
North Platte River above Lake McConaughy

Reservoir Storage		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
Seminoe Reservoir														Resop.tab Table 3
	Min (kaf)	170	159	146	134	122	113	168	211	362	288	258	187	113
	Max (kaf)	959	925	900	878	841	861	977	1,017	1,017	1,017	947	960	1,017
	Avg (kaf)	646	627	604	579	553	535	564	680	786	732	678	653	636
Percent change from Present Conditions	Min	8%	8%	9%	10%	11%	22%	52%	14%	19%	49%	43%	4%	22%
	Max	0%	0%	0%	0%	0%	2%	4%	0%	0%	0%	-1%	0%	0%
	Avg	7%	7%	7%	7%	7%	5%	6%	6%	5%	5%	8%	7%	6%
Pathfinder Reservoir														Resop.tab Table 2
	Min (kaf)	145	147	146	149	152	108	77	179	241	191	172	124	77
	Max (kaf)	919	957	972	987	1,014	1,016	1,017	1,017	1,017	1,017	905	890	1,017
	Avg (kaf)	568	580	592	604	623	639	659	687	703	574	551	534	610
Percent change from Present Conditions	Min	150%	144%	144%	138%	131%	130%	44%	14%	20%	49%	70%	296%	144%
	Max	-1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-2%	-2%	0%
	Avg	9%	9%	9%	9%	9%	9%	8%	7%	5%	8%	11%	10%	8%
Alcova Reservoir														Resop.tab Table 25
	Min (kaf)	156	156	156	156	156	156	180	180	180	180	180	180	156
	Max (kaf)	156	156	156	156	156	156	180	180	180	180	180	180	180
	Avg (kaf)	156	156	156	156	156	156	180	180	180	180	180	180	168
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Glendo Reservoir														Resop.tab Table 1
	Min (kaf)	92	127	158	202	238	284	291	253	301	241	80	63	63
	Max (kaf)	283	322	375	435	481	492	502	653	724	494	332	238	724
	Avg (kaf)	180	223	263	305	347	404	417	443	450	415	242	136	319
Percent change from Present Conditions	Min	-10%	-7%	-6%	1%	1%	2%	2%	-14%	37%	15%	0%	0%	0%
	Max	-18%	-15%	-9%	-3%	0%	-5%	0%	0%	6%	-4%	6%	-24%	6%
	Avg	-11%	-9%	-7%	-6%	-5%	-4%	-2%	-1%	0%	1%	0%	-15%	-4%
Guernsey Reservoir														Resop.tab Table 4
	Min (kaf)	0	0	0	0	0	5	35	40	35	30	30	2	0
	Max (kaf)	8	13	17	21	30	30	46	44	46	30	30	2	46
	Avg (kaf)	3	6	8	11	13	15	36	40	35	30	30	2	19
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	1%	2%	7%	14%	9%	0%	0%	-5%	2%	0%	0%	0%	0%
	Avg	16%	7%	4%	3%	3%	0%	0%	0%	0%	0%	0%	0%	1%

Table 3.6.3- 2. Monthly reservoir storage statistics for the North Platte River above Lake McConaughy.

Minimum, maximum, and average storage by month are shown in **Table 3.6.3-2**. This table shows that the largest percent change occurs in the minimum reservoir storage attained during the simulation of the Full Water Leasing Alternative.

Full Water Leasing Alternative
North Platte River above Lake McConaughy

Spills from the system	Spills Value	Spills % Δ[1]
Average annual spill for 48-year simulation period (kaf)	144.2	22%
Number of years with spills	12	0%
Average annual spill for years with spills (kaf)	576.8	22%
Largest annual spill (kaf)	1373.5	5%
Year of largest annual spill	1984	
File that contains the data	Storown.lst	
Output line number	8	

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

Table 3.6.3- 3. Spills from Guernsey Reservoir.

The average annual spill increased by 22 percent with respect to the Present Condition and the number of years with spills is unchanged. These results are consistent with the higher average storage associated with the use of North Platte River basin water for environmental purposes under the Full Water Leasing Alternative.

Reservoir elevations above Lake McConaughy

Full Water Leasing Alternative North Platte River above Lake McConaughy Reservoir Elevations	Seminoe Value	Seminoe % Δ[1]	Pathfinder Value	Pathfinder % Δ	Alcova Value	Alcova % Δ	Glendo Value	Glendo % Δ	Guernsey Value	Guernsey % Δ
Minimum average elevation for 48-year simulation (kaf)	6,271	0.1%	5,761	0.3%	5,488	0.0%	4,570	0.0%	4,370	0.0%
Maximum average elevation for 48-year simulation (kaf)	6,357	0.0%	5,850	0.0%	5,498	0.0%	4,649	0.1%	4,420	0.0%
Average average elevation for 48-year simulation (kaf)	6,332	0.1%	5,824	0.1%	5,493	0.0%	4,614	0.0%	4,404	0.0%
Low storage indicator: years with elevation < #### ft	5 < 6,289 ft		9 < 5,787 ft		0 < 5,486 ft		14 < 4,580 ft		0 < 4,370 ft	
Percent change from Present Conditions[2]		-17%		-25%		0%		75%		0%
Year that minimum first occurred	1965		1965		1947		1961		1949	
Average May-August drawdown for this alternative (feet)	0.0	-103%	9.2	-17%	0.0	0%	23.0	-3%	4.73125	-1%
Largest May-August drawdown for this alternative (feet)	24.9	16%	34.5	16%	0.0	0%	44.2	-4%	6.2	-13%
Year of largest drawdown	1966		1989		1947		1961		1971	
File that contains the data	Natflow.tab		Natflow.tab		Natflow.tab		Natflow.tab		Natflow.tab	
Table number	13		12		11		10		9	

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

[2] NA in the % Δ column indicates that there were no years with elevation < #### ft in the Present Condtion Run

Table 3.6.3- 4. Reservoir elevation statistics for the North Platte River above Lake McConaughy.

Table 3.6.3-4 shows the same statistics for reservoir elevation as are shown in **Table 3.6.3-1** for end-of-month reservoir storage. **Table 3.6.3-4** shows that there will be more water in Seminoe, Pathfinder, and Glendo reservoirs under the Water Leasing Atlernative.

Full Water Leasing Alternative North Platte River above Lake McConaughy Reservoir Elevation Minimum and Maximum	Seminoe	Pathfinder	Alcova	Glendo	Guernsey
Elevation for empty reservoir:	6160.0	5690.0	5320.0	4508.0	4370.0
Historic minimum elevation:	6253.3	5690.0	5408.8	4549.3	4370.0
Minimum elevation for alternative:	6270.8	5761.2	5488.0	4570.0	4370.0
Years min. elev. Achieved	1	1	48	3	20
Years min. < Reference	0	0	0	0	0
Years min. < Historic	0	0	0	0	0
Elevation for full reservoir[1]:	6357.0	5850.1	5500.0	4669.0	4420.0
Historic maximum elevation[2]:	6359.3	5853.5	5499.9	4650.8	4421.7
Maximum elevation for alternative:	6357.0	5850.1	5498.0	4649.2	4420.0
Years max. elev. Achieved	12	16	48	1	7
Years max. > Reference	0	0	0	1	0
Years max. > Historic	0	0	0	0	0

[1] Elevation for the top of the conservation capacity.

[2] Historic elevations that are greater than the elevation for a full reservoir are the result of flood storage and reservoir surcharge.

Table 3.6.3- 5. Minimum and maximum reservoir elevation statistics for the North Platte River above Lake McConaughy.

Table 3.6.3-5 compares the minimum and maximum elevation for each reservoir to the minimum and maximum elevations for the Present Condition run and to historic values. **Table 3.6.3-5** shows that the storage in Seminoe and Pathfinder reservoirs was greater than the minimum storage for these reservoirs in the Present Condition run.

Full Water Leasing Alternative
North Platte River above Lake McConaughy

Reservoir Elevations		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
Seminoe Reservoir														Natflow.tab Table 13
	Min (feet)	6,283	6,281	6,279	6,276	6,273	6,271	6,283	6,290	6,310	6,301	6,297	6,286	6,271
	Max (feet)	6,354	6,352	6,351	6,350	6,348	6,349	6,355	6,357	6,357	6,357	6,354	6,354	6,357
	Avg (feet)	6,332	6,331	6,329	6,327	6,325	6,324	6,326	6,335	6,343	6,339	6,335	6,333	6,332
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Pathfinder Reservoir														Natflow.tab Table 12
	Min (feet)	5,777	5,777	5,777	5,777	5,778	5,769	5,761	5,783	5,793	5,785	5,782	5,772	5,761
	Max (feet)	5,846	5,847	5,848	5,849	5,850	5,850	5,850	5,850	5,850	5,850	5,845	5,844	5,850
	Avg (feet)	5,821	5,822	5,823	5,824	5,825	5,825	5,826	5,829	5,831	5,822	5,820	5,818	5,824
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Alcova Reservoir														Natflow.tab Table 11
	Min (feet)	5,488	5,488	5,488	5,488	5,488	5,488	5,498	5,498	5,498	5,498	5,498	5,498	5,488
	Max (feet)	5,488	5,488	5,488	5,488	5,488	5,488	5,498	5,498	5,498	5,498	5,498	5,498	5,498
	Avg (feet)	5,488	5,488	5,488	5,488	5,488	5,488	5,498	5,498	5,498	5,498	5,498	5,498	5,493
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Glendo Reservoir														Natflow.tab Table 10
	Min (feet)	4,578	4,586	4,593	4,600	4,605	4,611	4,612	4,607	4,613	4,606	4,575	4,570	4,570
	Max (feet)	4,611	4,616	4,622	4,628	4,632	4,633	4,634	4,645	4,649	4,633	4,617	4,605	4,649
	Avg (feet)	4,596	4,603	4,608	4,614	4,618	4,625	4,626	4,628	4,629	4,625	4,605	4,588	4,614
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Guernsey Reservoir														Natflow.tab Table 9
	Min (feet)	4,370	4,370	4,370	4,370	4,370	4,395	4,415	4,418	4,415	4,413	4,413	4,388	4,370
	Max (feet)	4,398	4,403	4,406	4,408	4,413	4,413	4,420	4,419	4,420	4,413	4,413	4,388	4,420
	Avg (feet)	4,384	4,394	4,398	4,400	4,402	4,404	4,416	4,418	4,416	4,413	4,413	4,388	4,404
Percent change from Present Conditions	Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 3.6.3- 6. Monthly reservoir elevation statistics for the North Platte River above Lake McConaughy.

Table 3.6.3-6 shows the minimum, maximum, and average reservoir elevation for the five major reservoirs above Lake McConaughy by month.

North Platte River Flow into Lake McConaughy. The results for North Platte River flow into Lake McConaughy for the Full Water Leasing Alternative are given in **Figure 3.6.3-2**.

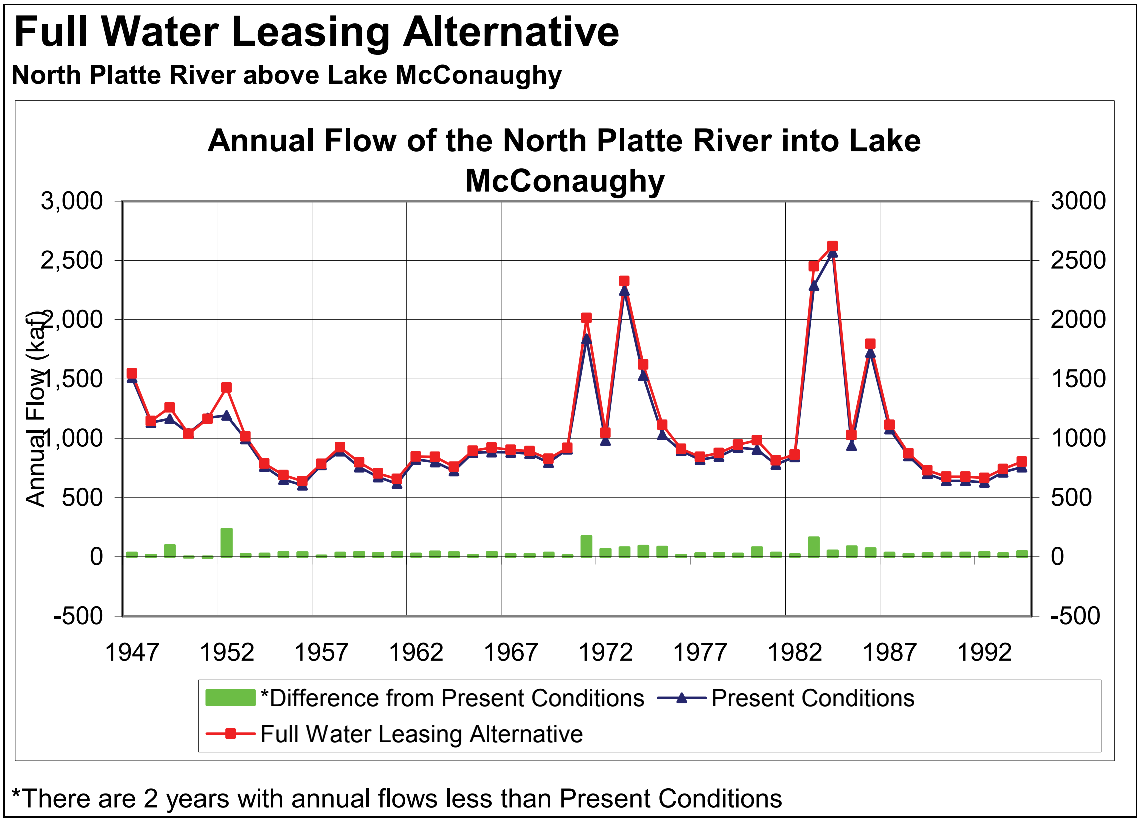


Figure 3.6.3- 2. Annual flow of the North Platte River into Lake McConaughy.

Figure 3.6.3-2 shows that the differences in North Platte River flow into Lake McConaughy between the Full Water Leasing Alternative and the Present Condition are relatively small, with values for the Full Water Leasing Alternative being slightly higher for all years. This is consistent with the leasing of consumptive use for environmental purposes and the increased storage in Reclamation's North Platte system.

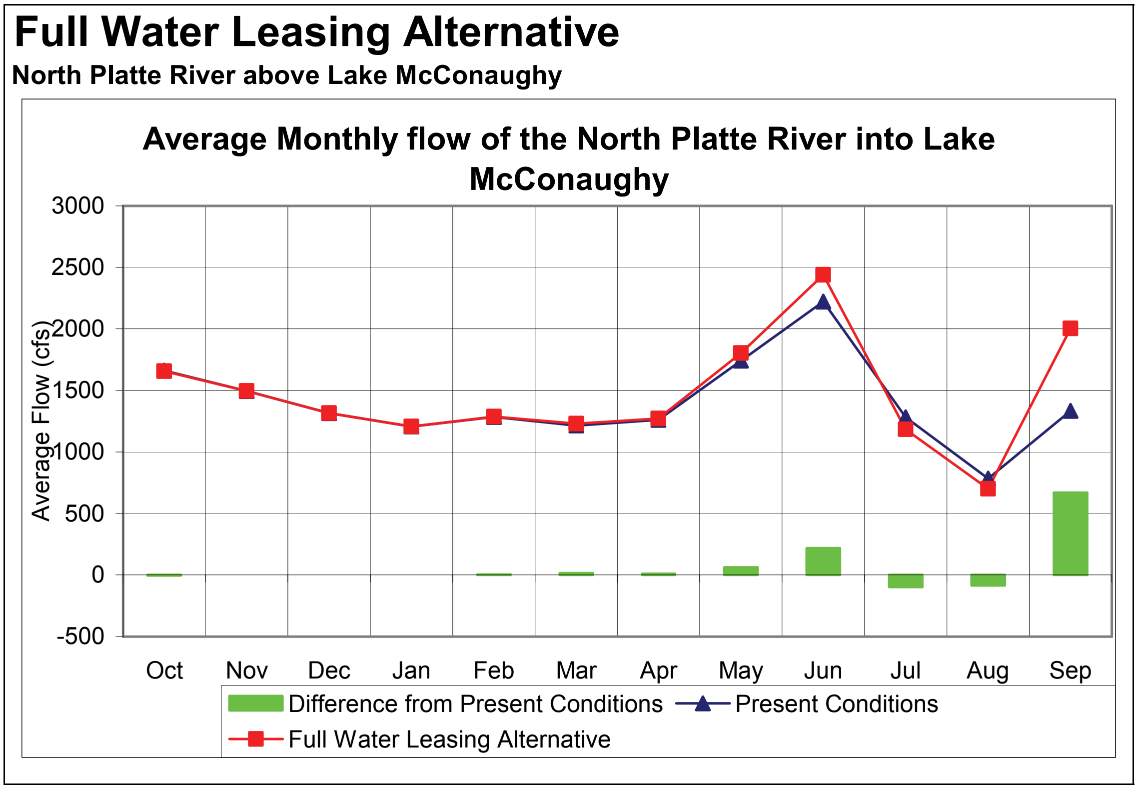


Figure 3.6.3- 3. Average monthly flow of the North Platte River into Lake McConaughy.

Full Water Leasing Alternative North Platte River above Lake McConaughy													
Flows	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Ann**
N.P. River flow into Lake McConaughy											Resop.tab Table 9		
Min (Monthly (cfs), Annual (kaf))	758	1,062	862	805	911	862	534	255	304	0	18	1,323	639
Max (Monthly (cfs), Annual (kaf))	2,287	2,038	1,888	1,825	1,889	2,126	3,131	13,230	12,498	7,631	4,747	3,126	2,621
Avg (Monthly (cfs), Annual (kaf))	1,657	1,495	1,317	1,206	1,288	1,230	1,271	1,805	2,441	1,184	700	2,004	1,061
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	-7%	-19%	-100%	-91%	271%	6%
Max	-1%	0%	0%	0%	0%	0%	2%	3%	2%	0%	122%	11%	2%
Avg	0%	0%	0%	0%	0%	1%	1%	4%	10%	-8%	-11%	50%	5%

Table 3.6.3- 7. Monthly flow of the North Platte River into Lake McConaughy.

On a monthly basis, inflows are greater September; and less in July and August. September is the month for environmental deliveries for this alternative. October through March are considered to be the winter months in the high country headwaters of the North Platte River.

Full Water Leasing Alternative North Platte River above Lake McConaughy													
Enviromental Flows Delivered to Lake McConaughy	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Ann**
											Natflow.tab Table 31		
Min (kaf)	0	0	0	0	0	0	0	0	0	0	0	9.9	9.9
Max (kaf)	0	0	0	0	0	0	0	0	0	0	0	75.9	75.9
Avg (kaf)	0	0	0	0	0	0	0	0	0	0	0	44	44
Year that minimum first occurred	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1983	1983

Table 3.6.3- 8. Environmental deliveries from above Lake McConaughy.

September has the greatest environmental delivery to Lake McConaughy (**Table 3.6.3-8**) under the Full Water Leasing Alternative.

Project Ownership, Project Shortages, Irrigation Demand, Water Leasing. The results for project ownership for the Full Water Leasing Alternative are given in **Table 3.6.3-9**.

Full Water Leasing Alternative								
North Platte River above Lake McConaughy	**North Platte[1]**		**Kendrick[2]**		**Glendo**		**Total**	
Project Ownership	**Value**	**% Δ[3]**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**
Minimum end-of-month ownership for 48-year simulation (kaf)	73.3	47%	198.7	15%	5.8	-50%	561.9	22%
Maximum end-of-month ownership for 48-year simulation (kaf)	1,102.3	0%	1,201.7	0%	180.1	0%	2,977.8	3%
Average end-of-month ownership for 48-year simulation (kaf)	729.2	4%	873.2	4%	125.9	0%	1,757.5	4%
Years with ownership < ### kaf	4 < 100 kaf		4 < 300 kaf		8 < 63 kaf		0 < 400 kaf	
Percent change from Present Conditions[4]		33%		0%		0%		NA
Year that minimum first occurred	1961		1968		1962		1964	
Largest single month accrual for this alternative (kaf)	471.7	0%	475.5	-12%	55.7	-3%	580.8	2%
Month of largest accrual	June-65		June-70		May-91		June-70	
File that contains the data		Storown.tab		Storown.tab		Storown.tab		Resop.tab
Table numbers		1, 8, & 9		2 & 3		4, 5, & 6		6

[1] The North Platte Project includes Pathfinder Reservoir, Guernsey Reservoir, and the Inland Lakes.
[2] The Kendrick Project includes Seminoe Reservoir and Alcova Reservoir.
[3] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)
[4] NA in the % Δ column indicates that there were no years with ownership < ### kaf in the Present Condtion Run

Table 3.6.3- 9. Project ownership on the North Platte River above Lake McConaughy.

Project Ownership. Table 3.6.3-9 shows that project ownership increased for the Full Water Leasing Alternative with respect to the Present Condition for the North Platte and Kendrick projects and decreased for the Glendo Project. There were also decreases in the number of years with reduced ownership. This is consistent with the conservation and leasing element in the North Platte River above Lake McConaughy that is part of the Full Water Leasing Alternative.

Full Water Leasing Alternative	North Platte Project		Kendrick Project		Glendo Unit		Non-project Lands		Total Shortages	
North Platte River above Lake McConaughy										
Project Shortages	**Value**	**% Δ[1]**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**
Average annual shortage for 48-year simulation period (kaf)[2]	0.3	50%	1.6	-45%	3.9	5%	0.5	0%	6.3	-14%
Number of years with shortages	2	0%	2	-33%	27	29%	26	0%	36	9%
Average annual shortage for years with shortage (kaf)	6.0	11%	39.3	-16%	6.9	-19%	0.9	0%	8.4	-21%
As a percentage of demand for years with shortage (%)	1.0%		56.1%		10.4%		0.4%		0.8%	
Largest annual shortage (kaf)	11.4	10%	68.9	-2%	23.9	-2%	3.8	0%	69.6	-1%
As a percentage of demand (%)	1.9%		98.4%		39.9%		1.4%		6.9%	
Year of largest annual shortage	1957		1967		1959		1960		1967	
Data is contained in the file Resop.tab table number		30 & 52		31 & 54		32 & 53		42 & 55		30-32,42,52-55

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)
[2] NA in the % Δ column indicates that there were no shortages in the Present Condtion Run

Table 3.6.3- 10. Project shortages on the North Platte River above Lake McConaughy.

Project Shortages. Table 3.6.3-10 shows that, for the Full Water Leasing Alternative, there were very large little change in project shortages with respect to the Present Condition for all projects considered and for non-project lands.

Full Water Leasing Alternative	North Platte Project		Kendrick Project		Glendo Unit		Non-project Lands		Total Demand	
North Platte River above Lake McConaughy										
Project Irrigation Demand	**Value**	**% Δ[1]**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**
Average annual demand for 48-year simulation period (kaf)	763.0	0%	70.0	0%	67.5	0%	254.0	0%	1154.4	0%
Maximum annual demand (kaf)	988.5	0%	70.0	0%	91.9	0%	303.0	0%	1427.6	0%
Minimum annual demand (kaf)	504.4	0%	70.0	0%	47.8	0%	190.0	0%	875.2	0%

Table 3.6.3- 11. Project irrigation demand on the North Platte River above Lake McConaughy.

Irrigation Demand. There are no changes in irrigation demand for the Full Water Leasing Alternative**.**

Full Water Leasing Alternative **North Platte River above Lake McConaughy**													
Irrigation Deliveries	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Ann**
North Platte Project Irrigation Deliveries													Resop.tab Table 3
Min (kaf)	0	0	0	0	0	0	0	0	27	180	198	83	565
Max (kaf)	9	2	1	0	1	1	7	221	285	359	354	216	1,380
Avg (kaf)	2	0	0	0	0	0	2	117	132	285	268	167	972
Percent change from Present Conditions													
Min	NA	NA	NA	NA	NA	NA	NA	0%	0%	-17%	-22%	-4%	-19%
Max	0%	0%	0%	NA	0%	0%	0%	0%	0%	0%	-1%	-22%	-7%
Avg	0%	0%	0%	NA	0%	0%	0%	0%	-1%	-11%	-17%	-17%	-11%
Kendrick Project Irrigation Deliveries													Resop.tab Table 2
Min (kaf)	0	0	0	0	0	0	0	0	0	0	0	0	1
Max (kaf)	0	0	0	0	0	0	0	11	17	22	13	7	69
Avg (kaf)	0	0	0	0	0	0	0	8	14	15	13	6	56
Percent change from Present Conditions													
Min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Max	NA	NA	NA	NA	NA	NA	NA	0%	0%	0%	-29%	-28%	-10%
Avg	NA	NA	NA	NA	NA	NA	NA	-18%	-16%	-27%	-27%	-27%	-24%
Glendo Project Irrigation Deliveries													Resop.tab Table 25
Min (kaf)	0	0	0	0	0	0	0	1	2	6	5	6	36
Max (kaf)	11	1	0	0	0	0	0	17	20	22	21	19	89
Avg (kaf)	1	0	0	0	0	0	0	8	11	15	13	12	60
Percent change from Present Conditions													
Min	NA	NA	NA	NA	NA	NA	NA	250%	0%	-3%	0%	0%	3%
Max	0%	0%	NA	NA	NA	NA	0%	-2%	-5%	-4%	-5%	-9%	-4%
Avg	0%	0%	NA	NA	NA	NA	0%	0%	-2%	-6%	-6%	-12%	-6%
Non-Project Irrigation Deliveries													Resop.tab Table 1
Min (kaf)	0	0	0	0	0	0	0	8	9	31	52	26	190
Max (kaf)	16	2	0	0	0	0	16	52	56	78	74	62	303
Avg (kaf)	6	0	0	0	0	0	2	29	40	62	66	48	253
Percent change from Present Conditions													
Min	NA	NA	NA	NA	NA	NA	NA	0%	0%	0%	0%	0%	0%
Max	0%	0%	NA	NA	NA	NA	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	NA	NA	NA	NA	0%	0%	0%	0%	0%	0%	0%

Table 3.6.3- 12. Project irrigation delivery on the North Platte River above Lake McConaughy.

Irrigation deliveries. Table 3.6.3-12 shows the greatest change in irrigation deliveries occurs for the Kendrick projects. This is mostly due to water leasing from the Kendrick project for environmental purposes.

Water Banking and Conservation. The results for water banking and conservation in Wyoming are given in **Table 3.6.3-13**.

Full Water Leasing Alternative **North Platte River above Lake McConaughy**					
Water Banking / Conservation	**North Platte Project**	**Kendrick Project**	**Glendo Unit**	**Non-project Lands**	**Total**
Average annual conservation for 48-year simulation period (kaf)	124.9	18.8	3.4	0.0	147.2
Number of years with conservation	48	48	42	0	48
Average annual conservation for years with conservation (kaf)	124.9	18.8	3.9	0.0	147.2
As a percentage of demand (%)	17.0%	26.9%	5.8%	0.0%	13.0%
Largest annual conservation (kaf)	218.2	22.5	8.2	0	247.3
As a percentage of demand (%)	26.0%	32.1%	13.4%	0.0%	19.9%
Year of largest annual conservation	1966	1953	1994	1947	1966
Data is contained in the file Resop.tab table number	56 & 52	58 & 54	57 & 53	59 & 55	52-55 & 56-59

Table 3.6.3- 13. Water leasing by project above Lake McConaugy.

Table 3.6.3-13 shows that water banking is practiced in the area of all three projects for the Full Water Leasing Alternative. There is no water banking for non-project lands. Water is leased in all 48 years of the simulation. 5.8 percent of the system-wide water supply is leased to the Program.

Flows. The results for flows in the North Platte River for the Full Water Leasing Alternative are given in **Table 3.6.3-14**.

Full Water Leasing Alternative

North Platte River above Lake McConaughy

Flows	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
N.P. River below Kortes Reservoir											Resop.tab Table 20		
Min (Monthly (cfs), Annual (kaf))	503	502	503	503	502	503	502	503	502	503	503	502	516
Max (Monthly (cfs), Annual (kaf))	1,122	1,447	1,212	1,132	1,356	2,041	2,775	7,712	9,324	6,170	2,775	1,998	1,834
Avg (Monthly (cfs), Annual (kaf))	686	805	797	778	911	982	1,232	1,733	3,094	2,431	1,395	722	941
Months with flow below 500 cfs[1,4]	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
Max	-11%	2%	7%	7%	-15%	6%	0%	-12%	5%	0%	0%	-4%	-2%
Avg	0%	5%	4%	4%	4%	19%	-6%	-6%	1%	-1%	-14%	14%	0%
Months with flow below 500 cfs[2]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N.P. River below Gray Reef Reservoir											Natflow.tab Table 21		
Min (Monthly (cfs), Annual (kaf))	501	502	503	503	502	503	502	503	524	600	590	551	463
Max (Monthly (cfs), Annual (kaf))	776	776	768	768	796	1,321	1,496	8,325	9,680	5,759	5,190	3,087	1,821
Avg (Monthly (cfs), Annual (kaf))	672	586	585	584	591	776	691	1,543	2,908	4,449	1,569	1,029	969
Months with flow below 500 cfs[3,4]	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	4%	-57%	11%	10%	-7%
Max	0%	0%	0%	0%	0%	4%	1%	-10%	1%	2%	32%	43%	-4%
Avg	3%	3%	3%	3%	3%	12%	7%	1%	9%	-3%	-19%	61%	2%
Months with flow below 500 cfs[2]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N.P. River below Guernsey Reservoir											Resop.tab Table 7		
Min (Monthly (cfs), Annual (kaf))	5	3	5	7	5	5	104	20	237	3,110	3,301	2,301	766
Max (Monthly (cfs), Annual (kaf))	501	25	24	86	196	652	1,659	10,687	10,325	10,075	8,421	4,401	2,292
Avg (Monthly (cfs), Annual (kaf))	135	5	6	9	13	43	695	2,233	3,176	4,938	4,378	3,389	1,155
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	-37%	-38%	-8%	-9%	96%	9%
Max	0%	0%	0%	0%	223%	64%	1%	0%	0%	0%	44%	11%	-1%
Avg	-13%	0%	0%	0%	30%	54%	-7%	-3%	3%	-5%	-6%	21%	0%

[1] The flow below Kortes Reservoir is required by law to be greater than 500 cfs.

[2] NA indicates that there were no months in Present Conditions with flows less than 500 cfs.

[3] The flow below Gray Reef Reservoir isrequired by law to be greater than 330 cfs, but flow of 500 cfs is maintained (when possible) by Reclamation.

[4] The value in the Ann column is the number of years where at least one month had average flows below 500 cfs.

Table 3.6.3- 14. Flow in the North Platte River above Lake McConaughy.

Table 3.6.3-14 shows annual changes in flow of less than 2 percent for the three locations considered. On a monthly basis, below Kortes Reservoir the greatest percentage changes with respect to the Present Condition are in August (decreases) and in March and September (increases). Below Gray Reef Reservoir there are significant percentage increases in September; lesser increases in March, April, and June; somewhat significant decreases in August; and little change in all other months. Below Guernsey Reservoir there are significant percentage decreases in February and March, a large increase in September. September are the months with the greatest environmental deliveries to Lake McConaughy under the Full Water Leasing Alternative. Flows less than 500 cfs below both Kortes and Gray Reef reservoirs are unchanged compared to Present Condition.

Power Generation and bypass flows. The results for power generation in the North Platte River basin upstream of Lake McConaughy are given in **Figure 3.6.3-4** and **Table 3.6.3-15**.

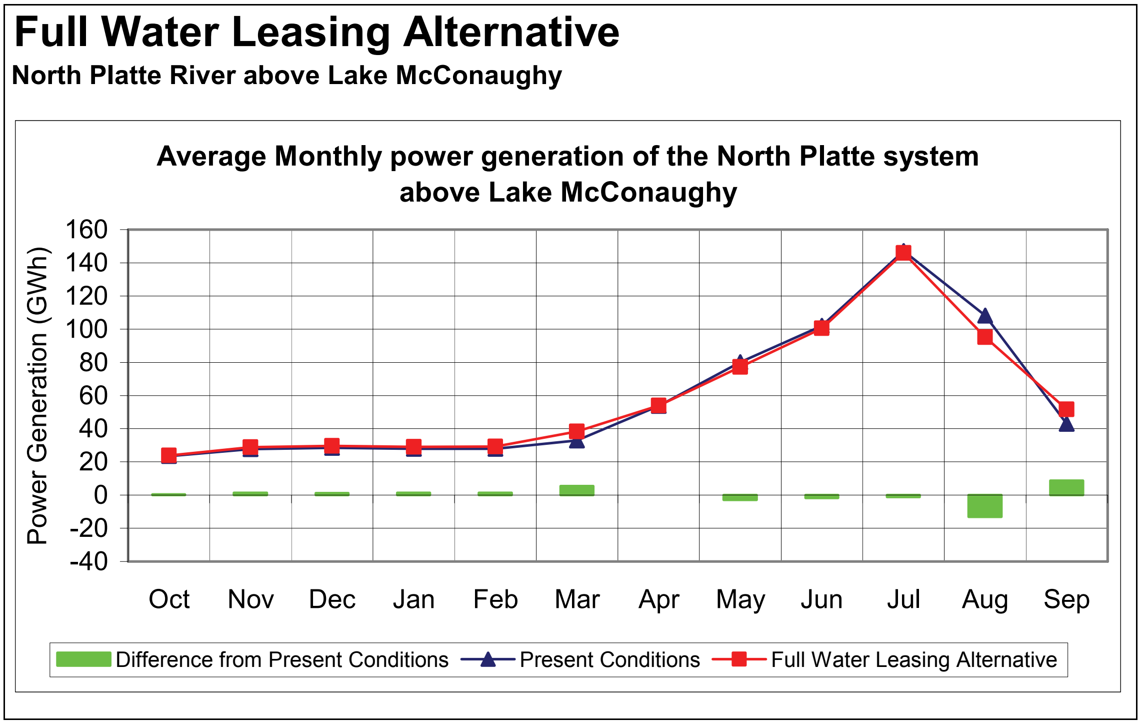


Figure 3.6.3- 4. Average Monthly power generation of the North Platte System above Lake McConaughy.

Full Water Leasing Alternative
North Platte River above Lake McConaughy

Power Generation	Seminoe Value	Seminoe % Δ[1]	Kortes Value	Kortes % Δ	Fremont Canyon Value	Fremont Canyon % Δ	Alcova Value	Alcova % Δ	Glendo Value	Glendo % Δ	Guernsey Value	Guernsey % Δ	Total Value	Total % Δ
Minimum (GWh)	76	4%	88.7	1%	120.5	-2%	63.6	-8%	57.3	7%	15.1	0%	466.969	4%
Maximum (GWh)	205.9	-3%	196.2	-2%	254.6	-4%	143.3	-2%	134.2	1%	22.1	3%	926.04	1%
Average (GWh)	140.8	0%	144.4	-1%	194.1	0%	111.1	0%	94.7	1%	18.8	0%	703.9	0%
Year that minimum occurred	1955		1955		1970		1970		1961		1990		1955	
Data is contained in the file Resop.tab table number		13		14		15		16		17		18		19

[1] % Δ indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

Table 3.6.3- 15. Power generation statistics for the North Platte system above Lake McConaughy.

Figure 3.6.3-4 and **Table 3.6.3-15** shows no significant net gain or loss of power generation system-wide for the Full Water Leasing Alternative with respect to the Present Condition, and percentage changes of 2 percent or less for the individual projects in the system. The changes are also relatively insignificant on a monthly basis.

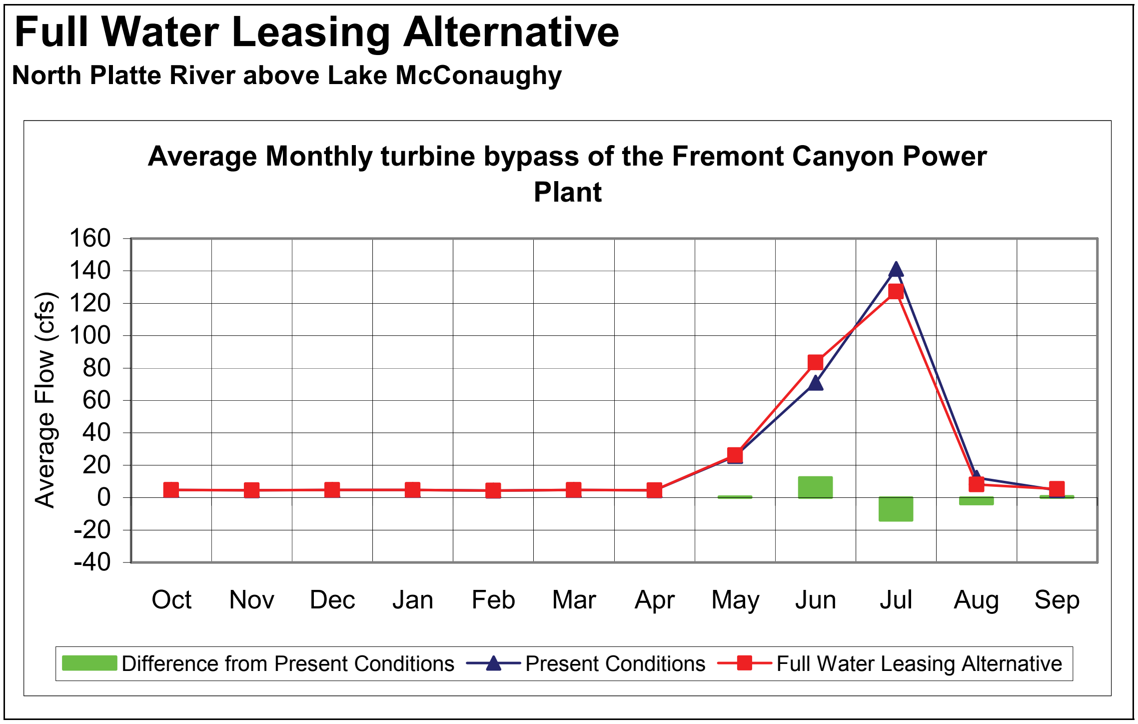


Figure 3.6.3- 5. Average Monthly turbine bypass of the Fremont Canyon Power Plant.

Full Water Leasing Alternative												
North Platte River above Lake McConaughy	**Seminoe**		**Kortes**		**Fremont Canyon**		**Alcova**		**Glendo**		**Guernsey**	
Flows that Bypass Turbines	**Value**	**% Δ**[1]	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**
Average annual bypass for 48-year simulation period (kaf)	84.2	7%	100.8	2%	282.8	-1%	207.0	-6%	205.0	-7%	881.4	0%
Number of years with bypasses	22	10%	36	0%	48	0%	48	2%	48	0%	48	0%
Average annual bypass for years with a bypass (kaf)	183.7	-2%	134.4	2%	282.8	-1%	207.0	-8%	205.0	-7%	881.4	0%
Largest annual bypass (kaf)	710.3	-8%	751.2	-8%	986.5	-6%	857.5	-8%	1061.1	-6%	1980.8	-2%
Year of largest annual bypass	1984		1984		1984		1984		1984		1984	
File that contains the data		Resop.lst		Resop.lst		Resop.lst		Resop.lst		Resop.lst		Resop.lst
Output line number		13		27		43		59		83		99

[1] % Δ indicates the percent change between the alternative and Present Conditions ([Alternative Value / Present Condition Value] -1)

Table 3.6.3- 16. Turbine bypass flow statistics for the North Platte system above Lake McConaughy.

Table 3.6.3-16 shows a net decrease in bypass flows for five of the hydroelectric plants on the North Platte River for the Full Water Leasing Alternative with respect to Present Condition. This is most likely due to moving less water during the irrigation season. Percentage changes range from increases of 7 percent to a decrease of 7 percent for the individual projects in the system. **Figure 3.6.3-5** shows how the bypass flows would be distributed on a monthly basis for the Fremont Canyon hydroelectric plant.

3.6.3.2 Platte River Basin in central Nebraska

The results of the analysis of the central Platte River basin for the Full Water Leasing Alternative are summarized in **Figures 3.6.3-6** through **3.6.3-14** and **Tables 3.6.3-17** through **3.6.3-35**. The terms used below are defined at the end of **Section 3.2** according to how they are used in this discussion.

Lake McConaughy. Conditions in Lake McConaughy resulting from the Full Water Leasing Alternative are shown on **Figure 3.6.3-6**.

Full Water Leasing Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

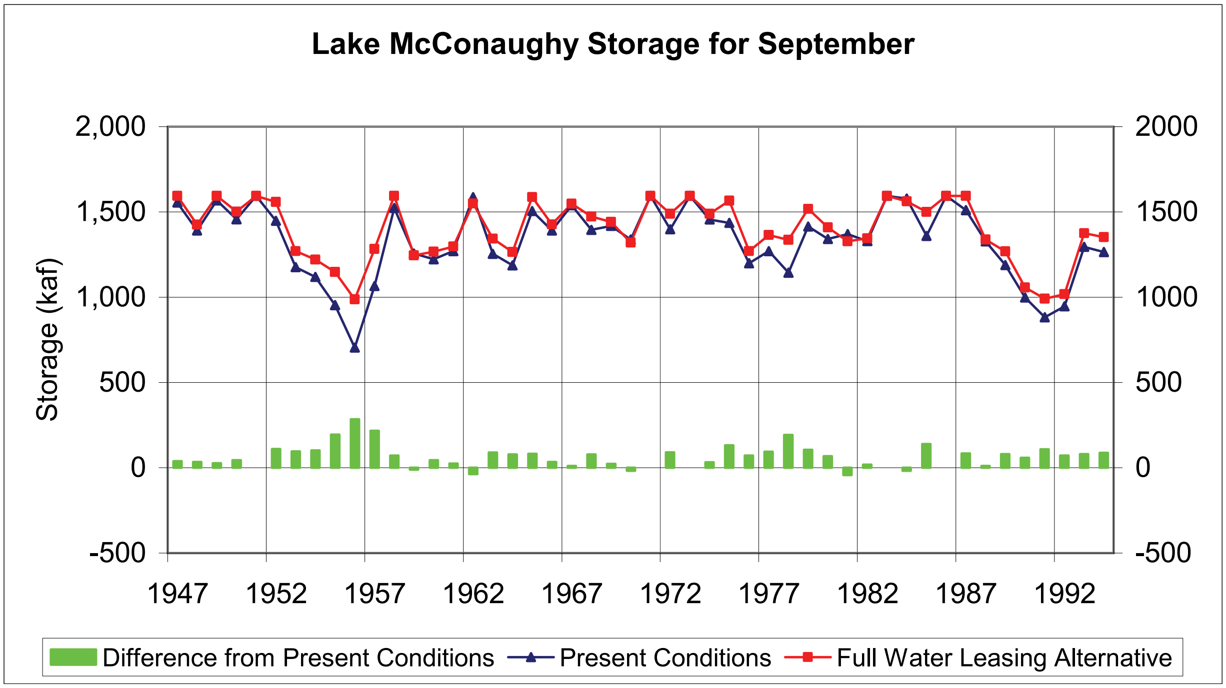


Figure 3.6.3- 6. End of September storage in Lake McConaughy.

Figure 3.6.3-6 shows that, for most years, end-of-September storage in Lake McConaughy for the Full Water Leasing Alternative is higher than that for the Present Condition. This is consistent with the emphasis with this plan on locating water for downstream flow augmentation through leasing consumptive use as opposed to storage and release. All water from Reclamation's reservoirs on the North Platte is delivered in September, which causes the end-of-September storage in Lake McConaughy to increase with respect to Present Conditions in wet years.

Full Water Leasing Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Lake McConaughy Reservoir Storage	Value	% Δ[1]
Minimum end-of-month storage for 48-year simulation (kaf)	925.3	31%
Maximum end-of-month storage for 48-year simulation (kaf)	1743.1	0%
Average end-of-month storage for 48-year simulation (kaf)	1470.2	1%
Low storage indicator: years with storage < 500 kaf	0	0%
Year that minimum first occurred		1991
Largest single month drawdown for this alternative (kaf)	231.6	-3%
Month of largest drawdown		July-90
Table number in file Leasing.tab.		1

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

Table 3.6.3- 17. Reservoir storage statistics for Lake McConaughy.

Over all months of the simulation period, the average end-of-month storage for the Full Water Leasing Alternative shows a 31 percent increase with respect to Present Condition.

Full Water Leasing Alternative
Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Lake McConaughy Storage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
										Table 1 in file Leasing.tab.			
Min (kaf)	1,063	1,117	1,146	1,196	1,142	1,120	1,034	925	988	948	998	1,047	925
Max (kaf)	1,594	1,594	1,594	1,609	1,743	1,743	1,743	1,669	1,594	1,594	1,594	1,594	1,743
Avg (kaf)	1,485	1,489	1,507	1,525	1,547	1,546	1,456	1,365	1,398	1,417	1,444	1,464	1,470
Year that minimum first occurred	1957	1957	1957	1992	1992	1992	1992	1991	1956	1956	1956	1956	1991
Percent change from Present Conditions													
Min	19%	18%	15%	11%	1%	7%	12%	15%	40%	30%	24%	21%	31%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	2%	0%	0%	-1%	-1%	0%	1%	2%	5%	3%	3%	3%	1%

Table 3.6.3- 18. Monthly reservoir storage statistics for Lake McConaughy.

Minimum, maximum, and average storage by month are shown in **Table 3.6.3-18**. This table shows that the largest percent change occurs in the minimum reservoir storage attained during the simulation of the Full Water Leasing Alternative.

Full Water Leasing Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Lake McConaughy Spills	Value	% Δ[1]
Average annual spill for 48-year simulation period (kaf)	165.6	-2%
Number of years with spills	24	-17%
Average annual spill for years with spills (kaf)	331.3	18%
Largest annual spill (kaf)	1437.2	3%
Year of largest annual spill		1984
Table number in file Leasing.tab.		6

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

Table 3.6.3- 19. Spills from Lake McConaughy.

The number of years with spills for the Full Water Leasing Alternative shows a 17 percent decrease from 31 to 13 with respect to the Present Condition, and the average annual spill shows a 2 percent decrease. Spills include when water is released from Lake McConaughy in order to comply with the FERC storage limits.

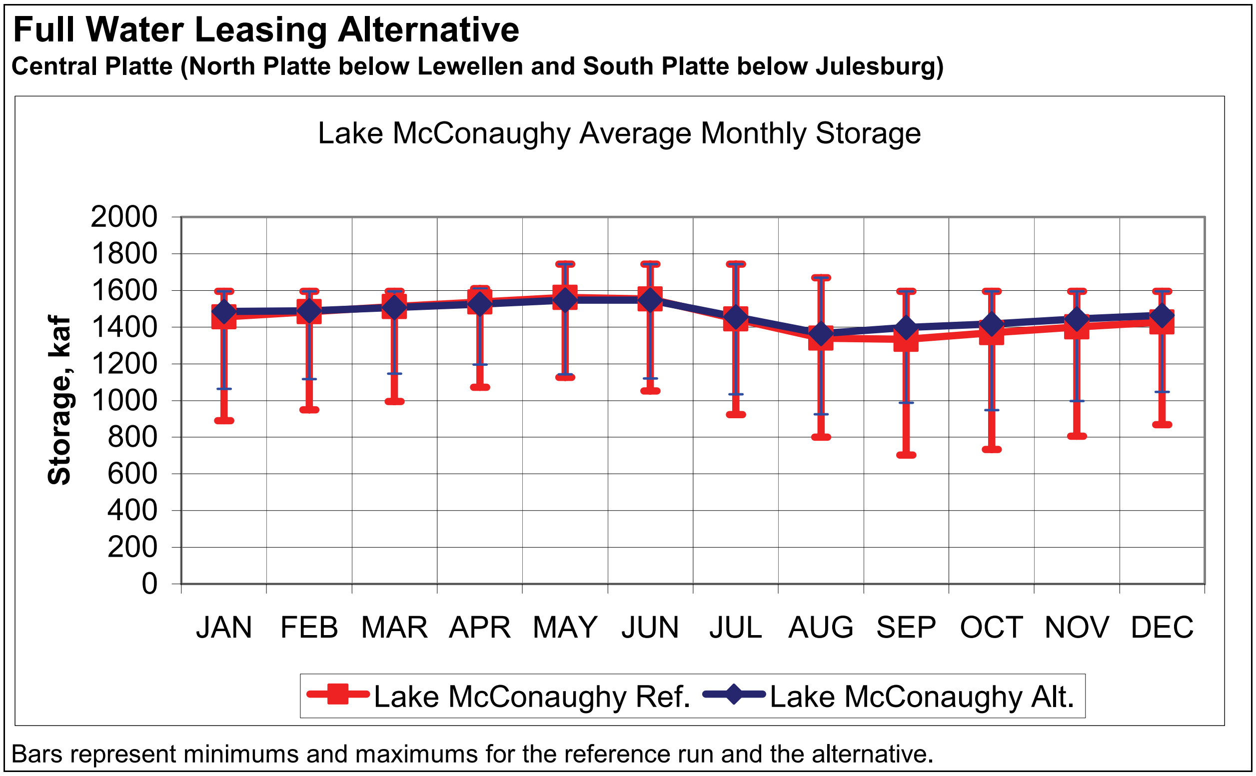


Figure 3.6.3- 7. Lake McConuaghy average monthly storage with error bars for minimum and maximum.

Figure 3.6.3-7 shows the average monthly storage with minimums and maximums represented by bars. This figure shows that the lowest storage occurs in August. It also shows that the average storage and the minimum storage for the Full Water Leasing Alternative are greater than or equal to Present Condition.

Figure 3.6.3-8 shows the average monthly release from Lake McConaughy including releases from the Environmental Account. The figure shows lower releases in May, July, and August due to reduced releases for irrigation. Releases are higher in February, March, April, and October due to releases from the Environmental Account.

Figure 3.6.3-9 shows the average monthly storage for Sutherland, Elwood, and Johnson Lake reservoirs. This figure shows that there is no change in storage in these reservoirs between the Full Water Leasing Alternative and Present Condition.

Table 3.6.3-10 shows that, for most months, the Full Water Leasing Alternative constitutes no change or some improvement over the Present Condition for average monthly flow at Grand Island. Flows equal or exceed target flows slightly more than half of the time.

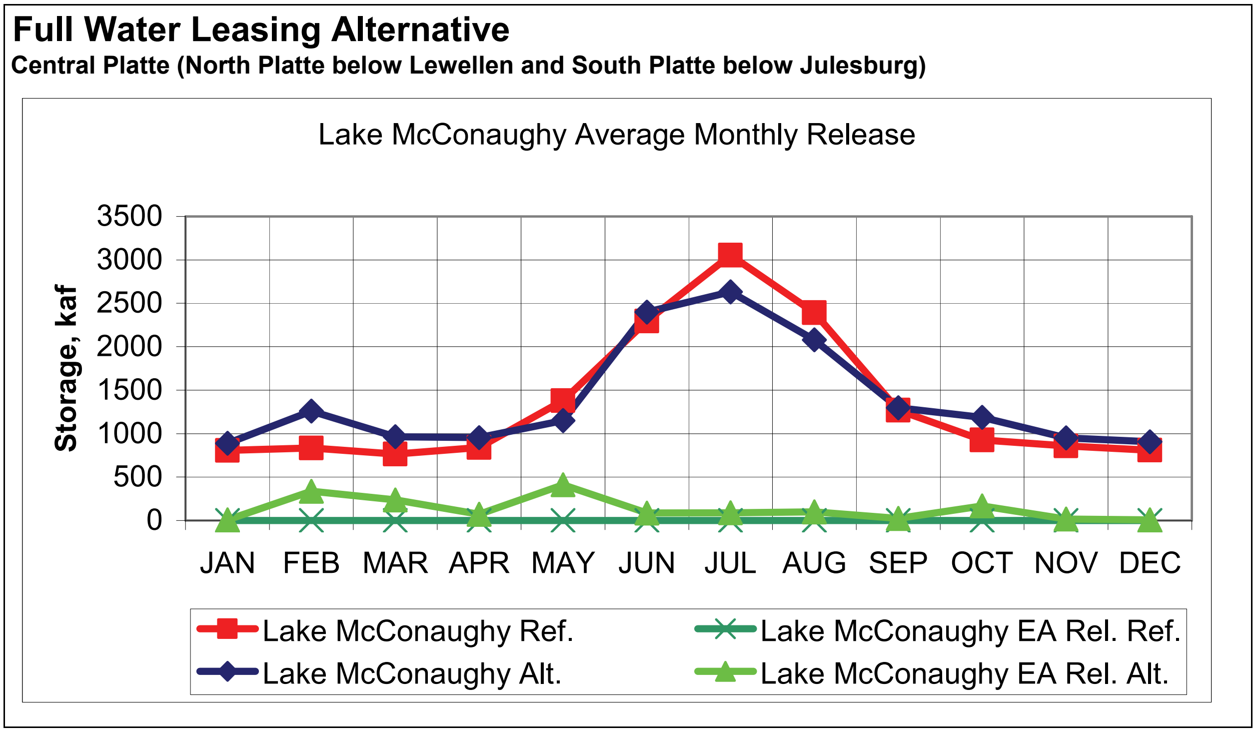


Figure 3.6.3- 8. Average monthly release from Lake McConaughy showing environmental releases.

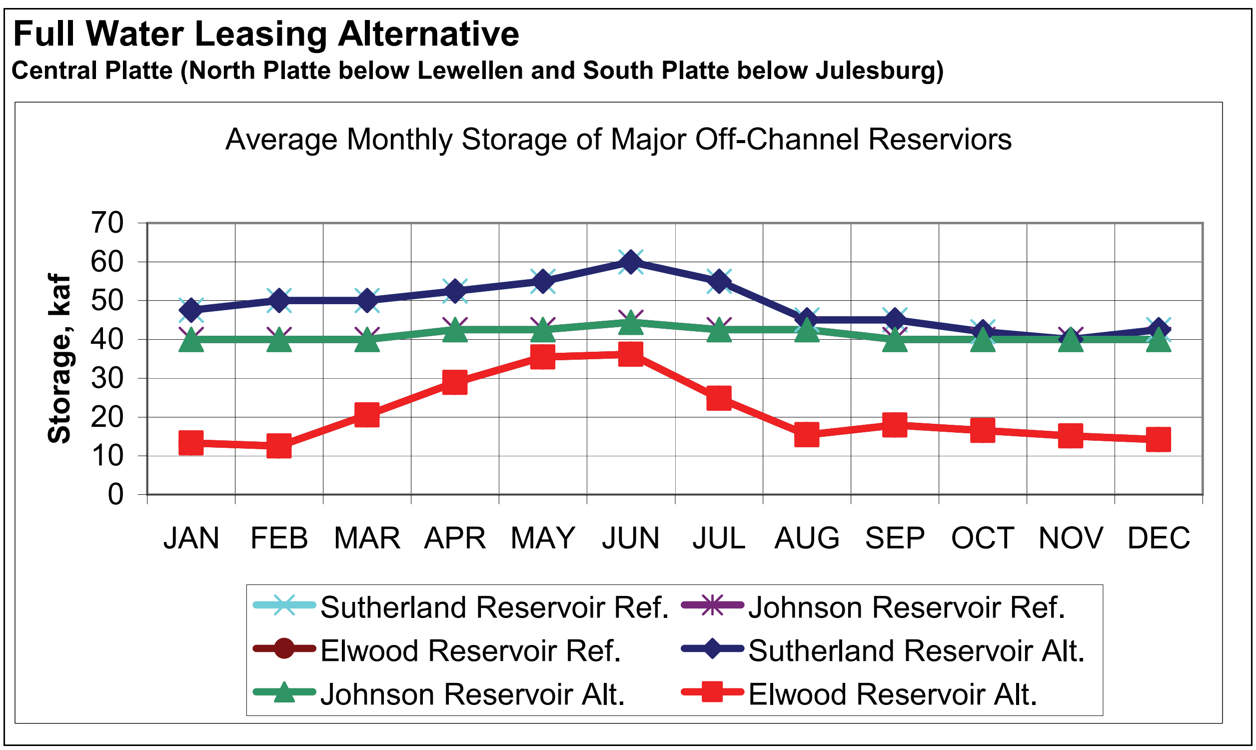


Figure 3.6.3- 9. Average monthly storage for major off-channel reservoirs.

Grand Island Target Flows. Conditions at Grand Island resulting from the Full Water Leasing Alternative are shown on **Table 3.6.3-10**.

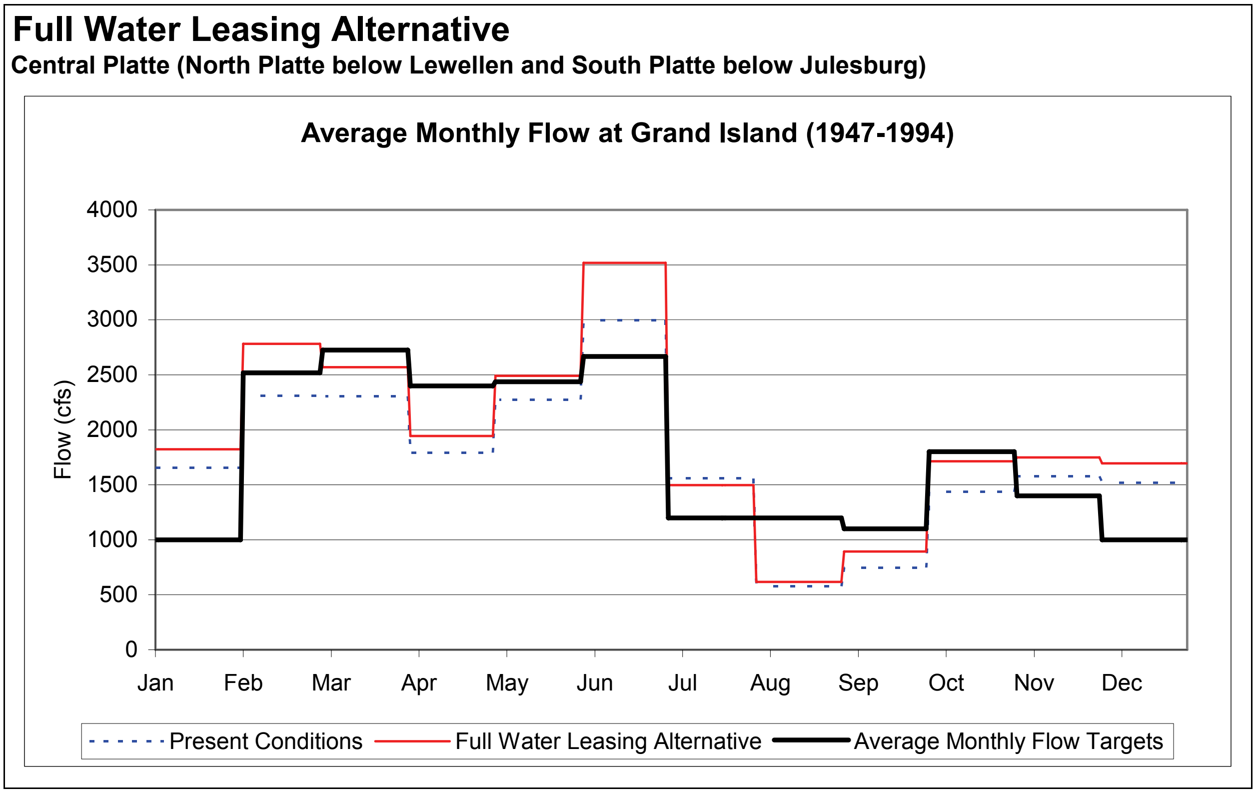


Figure 3.6.3- 10. Average monthly flow at Grand Island, Nebraska compared to flow targets.

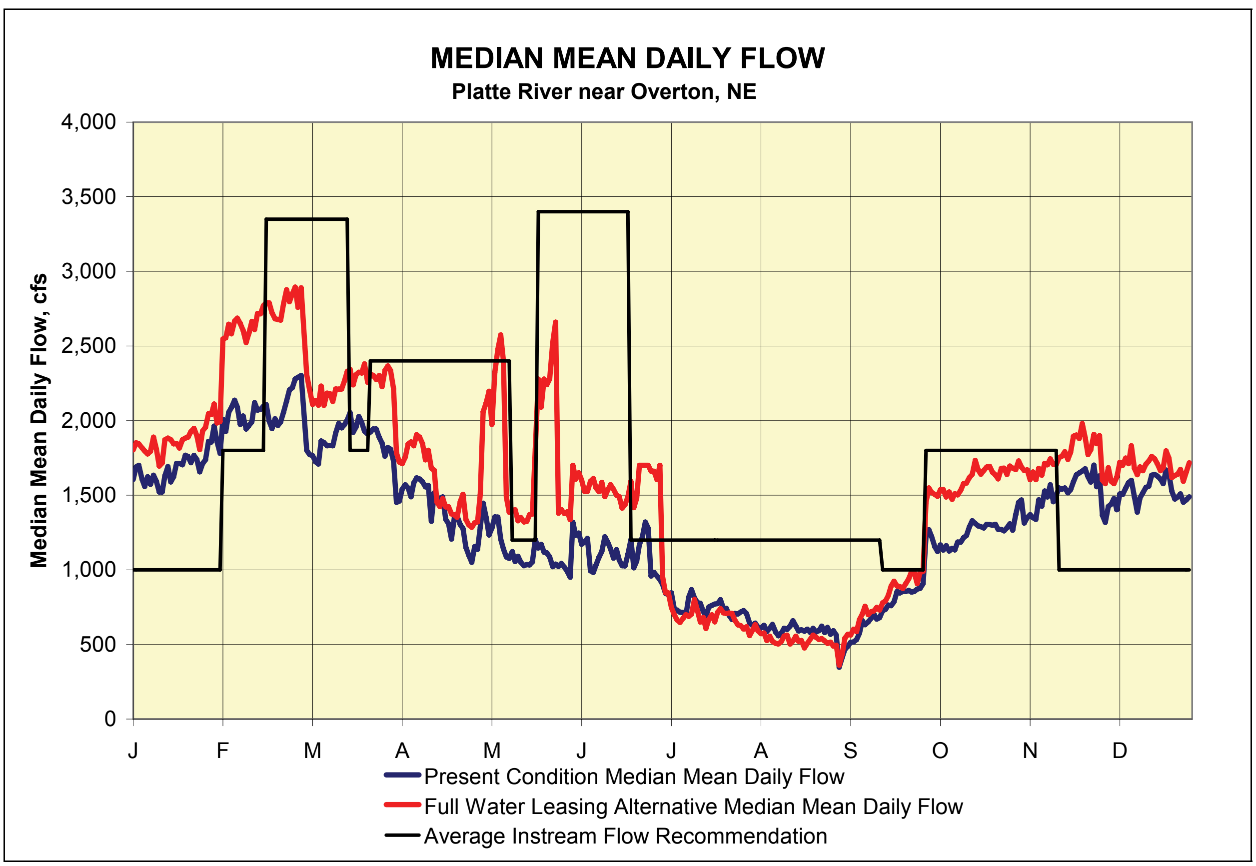
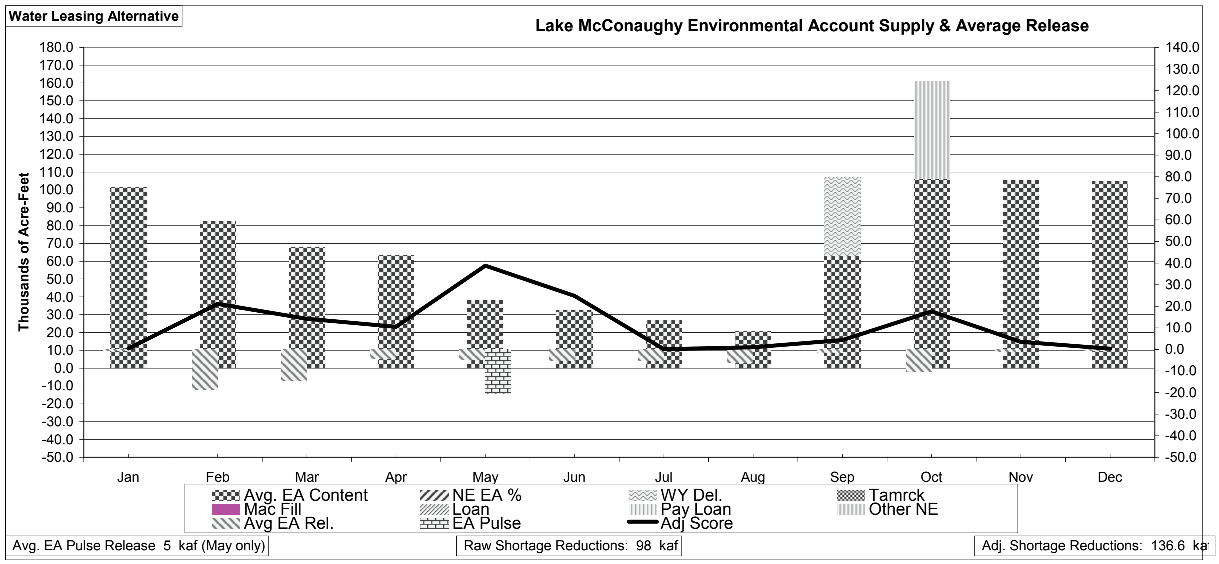


Figure 3.6.3- 11. Median mean daily flow near Overton, Nebraska compared to flow targets.

Figure 3.6.3-11 shows the daily flow targets for average conditions compared to the median daily flow for the Full Water Leasing Alternative and Present Condition. The figure shows that the Full Water Leasing Alternative constitutes an improvement to flow targets over the Present Condition at Grand Island. However, flows fall short of flow targets most of the time.

Score.



Water Leasing Alternative

# Zero Flow Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Present	0	0	0	0	0	1	0	1	2	0	0	0	4
Leasing	0	0	0	0	0	0	0	1	2	0	0	0	3
Raw Shortage Reduction, kaf	0.3	19.4	13.9	10.5	16.2	14.8	-0.5	-0.7	3.1	17.5	3.3	0.0	98.0
Adjusted Shortage Reduction, kaf	0.4	21.0	14.2	10.5	38.9	24.8	0.1	1.0	4.3	17.6	3.5	0.3	136.6

Leasing		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	Begin Month Content	102.1	101.4	82.7	67.9	63.5	37.9	32.4	26.8	20.5	62.9	106.5	105.4	
plus	NE EA % accrual	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
plus	WY EA contribution	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44.0	0.0	0.0	0.0	44.0
plus	CO EA exchanged	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
plus	Other NE Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54.2	0.0	0.0	54.2
plus	EA credit/Mac Fill	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
minus	EA Release	-0.5	-18.7	-14.5	-4.3	-5.0	-5.2	-5.4	-6.1	-1.4	-10.3	-1.0	-0.4	-72.8
minus	EA Evaporation	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	-2.2
minus	EA Pulse Release	0.0	0.0	0.0	0.0	-20.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-20.4
plus	EA borrow from Mac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
minus	EA paid back to Mac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	End-of-Month Content	101.5	82.6	68.0	63.4	37.9	32.5	26.8	20.5	62.9	106.6	105.3	104.9	

Figure 3.6.3- 12. Accruals, storage, and releases for the Environmental Account in Lake McConaughy.

Figure 3.6.3-12 shows the accruals, storage, and releases for the Environmental Account in Lake McConaughy in both graphical and tabular format. The figure shows the contributions by state and adjustments to the amount stored in the Environmental Account when Lake McConaughy fills. There is also a comparison to the number of months that have zero flow for Present Condition and the Full Water Leasing Alternative.

Water Leasing Alternative										Adjusted Shortage Reduction:				136.6
Leasing	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Adj.
Groundwater Mgmt Storage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Groundwater Mgmt Contribution	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Riverside Drains	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
North Dry Ck GW inflow at Kearney[1]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dawson and Gothenburg Recharge[2]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C. Platte Rereg. Reservoir Release[3]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Power Interference credited to EA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Net Controllable Conserved Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	
NE Irrigation Savings	0.0	0.0	0.0	0.8	5.1	8.1	17.3	16.6	5.4	0.5	0.0	0.0	53.9	--
Other CO at Jules. (no exchange)	0.0	0.0	0.0	0.0	22.3	16.7	0.0	0.0	0.0	0.0	0.0	0.0	39.0	--
Average EA Pulse Release[4]	0.0	0.0	0.0	0.0	20.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.4	20.4
Average Tri-County Irr. Rel. for pulse[5]	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0
Average Johnson Lake Rel. for pulse[6]	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	--
Number of times EA Borrowed	0	0	0	0	0	0	0	0	0	0	0	0	0	--
Number of time EA Paid Back	0	0	0	0	0	0	0	0	0	0	0	0	0	--
Credit for other Program flows[7]	0.1	1.6	0.3	0.0	1.3	10.0	0.6	1.6	1.2	0.0	0.2	0.3	17.2	17.2
CP Rereg. Res "Spike" Attenuation[8]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Johnson Lake "Spike" Attenuation[8]	0.0	0.0	0.0	0.0	0.0	1.9	0.7	0.1	0.0	0.0	0.0	0.0	2.7	--

1 For N. Dry Creek, adj. shortage reduction = 1/2 * the reduction in target flow shortages calculated by the C.P. OPSTUDY model.
2 Dawson and Gothenburg recharge is not modeled; values are from the Water Action Plan.
3 Central Platte reregulatory reservoir operates using daily flows and is added to the reduction in target flow shortages calculated from the monthly flow values.
4 For EA Pulses, the volume of release is added to the reduction in target flow shortages calculated from the monthly flow values.
5 Pulse augmentation from the Tri-County Canal system (Irrigation water and Elwood Reservoir Storage water).
6 Not added to score because it is assummed to be the rerelease of water from the EA in Lake McConaughy.
7 These are Program contributions that are above targets flows and also greater than the flows under Present Conditions
8 "Spike" attenuation does not reduce shortages to target flows but does provide benefit to the Program.

Table 3.6.3- 20. Central Platte accruals to and releases from the Environmental Account in Lake McConaughy.

The annual reduction to shortages to the flow targets produced by the Full Water Leasing Alternative is 136.6 KAF (**Table 3.6.3-20**). This satisfies the goal for the First Increment of a reduction to shortages of between 130 and 150 KAF. **Table 3.6.3-20** shows the contributions to the Program from all the Water Action Plan elements in the central Platte. The table also shows other flows that contribute to the Score of the Program.

Pulse and Short duration near-bankful flows.

Pulse flows occur during two time periods February/March and May/June. Short duration near-bankful flows are events that last for three days. **Table 3.6.3-21** quantifies the effects of the Program on pulse and short duration near-bankful flows. The table shows that the 30 day pulse in the April through June time period increases for the 75% of the years that have the highest flows and the 25% of the years that have the lowest flows. The February/March 30 day pulse flow increases. The short duration near-bankful flows increase for the highest 30%, the middle 40%, and the smallest 30%. The number of years with flows greater than 6,500 cfs near Overton, Nebraska increase and the years with flows less than 100 cfs decrease. The final row in **Table 3.6.3-21** is the average annual flow in the J2 return, which increases for the Full Water Leasing Alternative.

Full Water Leasing Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)				
	Present Condition	WaterLeasing		
	Value	Value	Change	% Change
30-day pulse flow				
Apr/Jun (highest 75%)	4,822	5,420	598	12%
Apr/Jun (lowest 25%)	809	1,357	547	68%
Feb/Mar (all years)	2,168	2,529	362	17%
3-day pulse flows				
Years w/flows > 7,500 cfs	12	12	0	0%
Largest 30%	13,101	13,482	381	3%
Middle 40%	4,589	5,619	1,030	22%
Smallest 30%	2,333	3,239	906	39%
% of Years 3-day pulse flow objectives achieved (**6,500** cfs @ Overton)	38%	88%	51%	135%
Low Flows				
Years w/flows < 100 cfs	17	17	0	0%
Years w/flows = 0 cfs	0	9	9	NA
J2-Return (avg ann flow), kaf	593	668	74.9	13%

Table 3.6.3- 21. Pulse flow and short duration near-bankful flow summary for the Platte River near Overton.

Table 3.6.3-22 also shows information regarding the short duration near-bankful flows. There were 24 years that water was released for short duration near-bankful flows. The short duration near-bankful flow target is 6,500 cfs for three days.

Full Water Leasing Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)		
Pulse flow target summary (at Overton, NE)	**Value**	**% Δ**[1]
Years with pulse flow releases[2]	24	NA
Average duration of pulse flow releases for years with pulse releases (days)[2]	4	NA
Years that pulse flow targets were achieved	42	133%
Average maximum Peak Daily Flow when pulse targets were achieved (cfs)	8,460	-30%
Average maximum Peak Daily Flow for remaining years (cfs)	2,748	-21%
[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)		
[2] NA in the % Δ column indicates that pulse flows are not part of the Present Condtion Run		

Table 3.6.3- 22. Short duration near-bankful flow summary for the Platte River near Overton.

Table 3.6.3-23 shows how the short duration near-bankful flows affect the flows in the central Platte river basin. The table shows the average and maximum volumes associated with the short duration near-bankful flow release at various points on the North Platte and Platte rivers. A negative value in a volume column indicates that the canal curtailed diversions (diverted less) during the short duration near-bankful flow event. The table also shows the average and maximum flow during the short duration near-bankful flow event for these same locations.

Full Water Leasing Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)	Average Pulse Volume (acre-feet)	Maximum Pulse Volume (acre-feet)	Average flow during a pulse release (cfs)	Maximum flow during a pulse release (cfs)
Mac Out	27,380	82,024	3,106	5,187
North Platte River	14,703	43,996	1,775	3,500
Sutherland Canal	13,850	29,271	1,831	2,100
Tri-County Canal	-1,142	-2,815	1,414	1,499
Platte River above the Jeffrey Return	25,789	73,272	2,969	5,106
Platte River below the Jeffrey Return	27,095	76,121	3,361	5,844
Platte River below the J2 Return	33,375	80,121	4,716	8,268

Table 3.6.3- 23. Flow summary during the short duration near-bankful flow period.

Figure 3.6.3-13 shows that the number of years with flows in the 3,000 to 8,000 range increased with the Full Water Leasing Alternative compared to Present Condition.

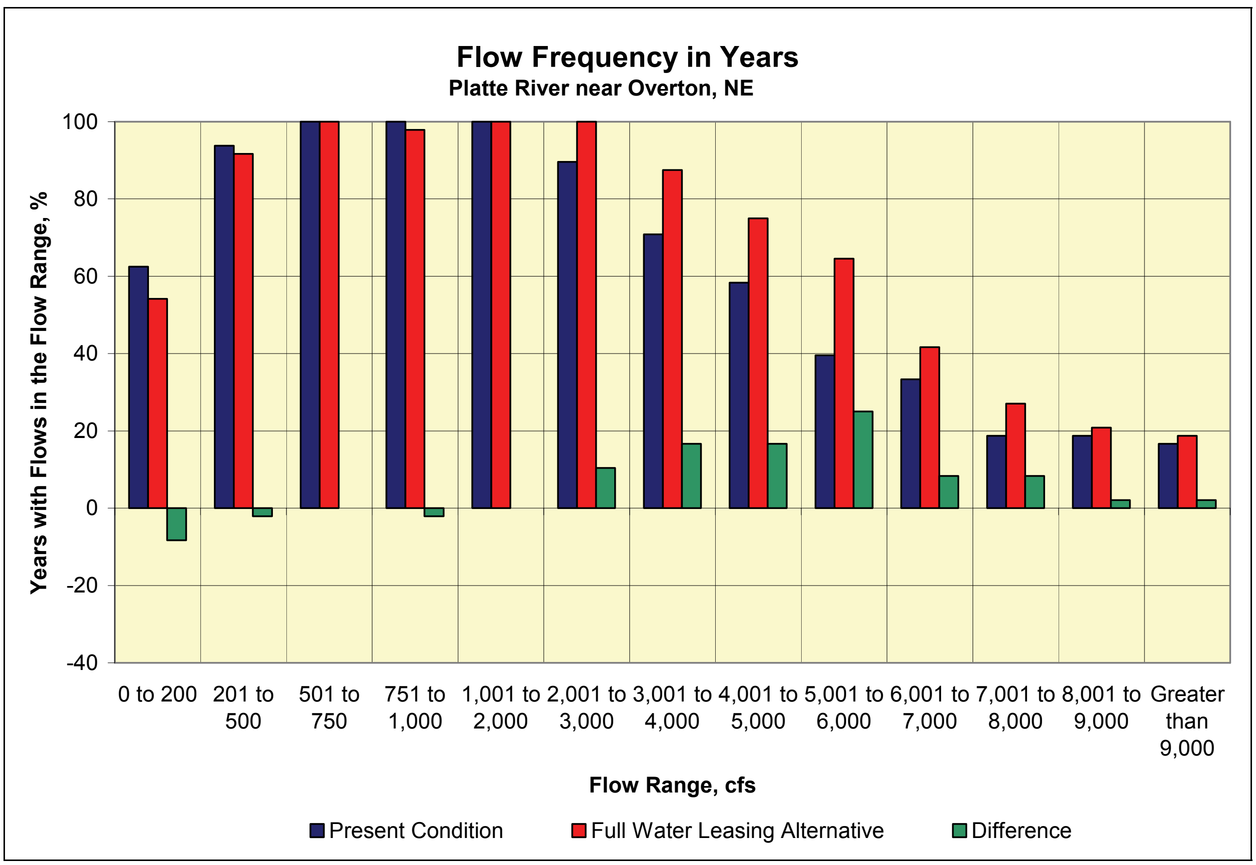


Figure 3.6.3- 13. Flow frequency by flow range in years for the Platte River near Overton.

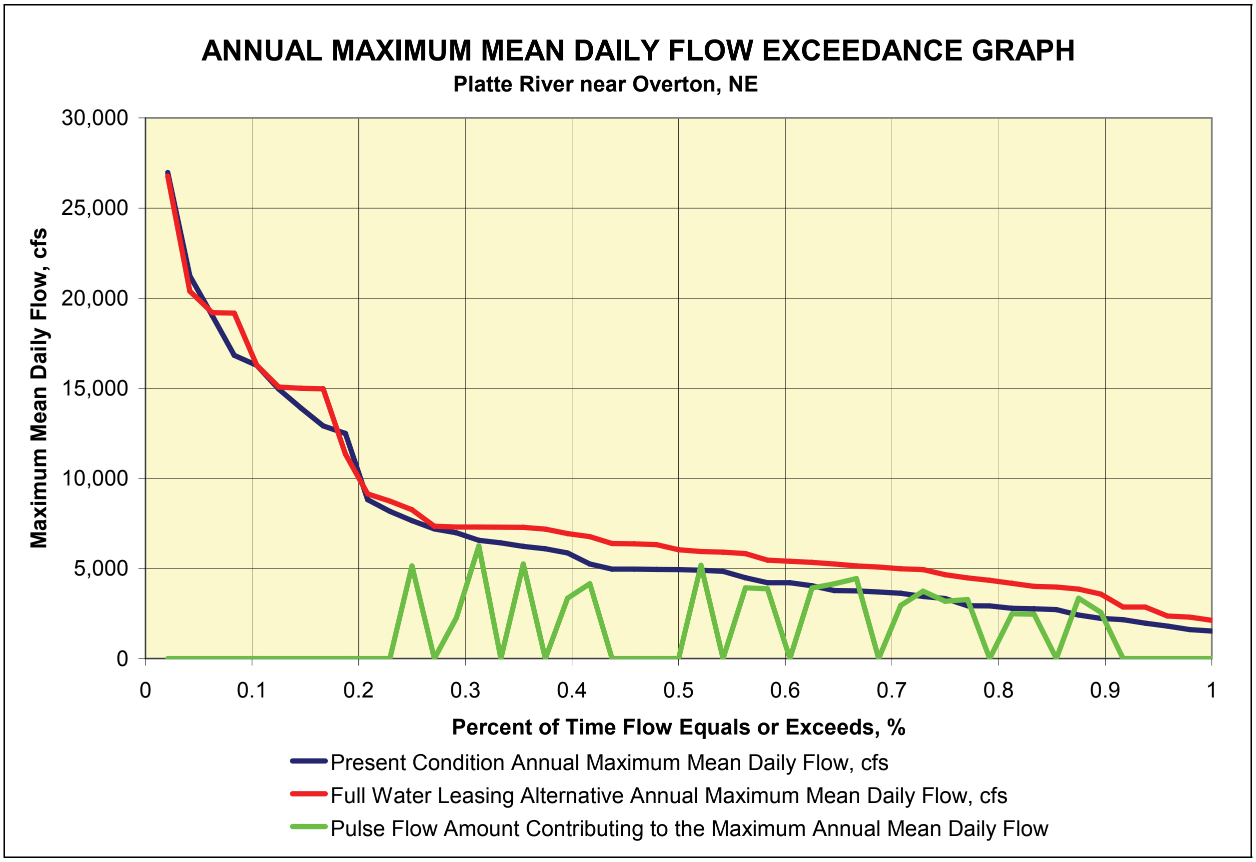


Figure 3.6.3- 14. Exceedance curve for the annual maximum mean daily flow near Overton, Nebraska.

Figure 3.6.3-14 shows a graph of the annual maximum mean daily flow sorted from largest to smallest. Also shown is the release from the Environmental Account for the short duration near-bankful flows. The figure shows that highest 20% of flows are increased along with flows in the 3,000 to 8,000 cfs range.

North Platte Channel Capacity.

Full Water Leasing Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)	
Interaction of the North Platte Channel Capacity with the Environmental Account Operations	
Pulse release limited by North Platte channel capacity (years)	2
Environmental Account release limited by North Platte channnel capacity (months)	1
Environmental Account release limited by North Platte channnel capacity (years)	1

Table 3.6.3- 24. Summary of North Platte channel restrictions on environmental flow deliveries.

Table 3.6.3-24 shows that short duration near-bankful flow releases were limited by the capacity of the North Platte River at North Platte, Nebraska in 2 years. Other releases from the Environmental Account were limited in 1 out of 48 years.

Environmental/Project Accruals by Basin. The average monthly and annual environmental accruals by basin are given in **Table 3.6.3-25**.

Full Water Leasing Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Environmental Accruals by Basin	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
North Platte (above Lake McConaughy)										Table 66 in file Leasing.tab.			
Min (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.9	0.0	0.0	0.0	9.9
Max (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.9	0.0	0.0	0.0	75.9
Avg (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44.0	0.0	0.0	0.0	44.0
Year that minimum first occurred	1947	1947	1947	1947	1947	1947	1947	1947	1983	1947	1947	1947	1983
South Platte (above Julesburg Gage)[1]										Tables 67 and 83 in file Leasing.tab.			
Min (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max (kaf)	0.0	0.0	0.0	0.0	25.1	25.1	0.0	0.0	0.0	0.0	0.0	0.0	45.2
Avg (kaf)	0.0	0.0	0.0	0.0	22.3	16.7	0.0	0.0	0.0	0.0	0.0	0.0	39.0
Year that minimum first occurred	1947	1947	1947	1947	1973	1949	1947	1947	1947	1947	1947	1947	1980
Central Platte[2]										Tables 66, 67 and 63 in file Leasing.tab.			
Min (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54.2	0.0	0.0	54.2
Max (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54.2	0.0	0.0	54.2
Avg (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54.2	0.0	0.0	54.2
Year that minimum first occurred	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947	1947
Total										Table 63 in file Leasing.tab.			
Min (kaf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.9	54.2	0.0	0.0	64.1
Max (kaf)	0.0	0.0	0.0	0.0	25.1	25.1	0.0	0.0	75.9	54.2	0.0	0.0	174.2
Avg (kaf)	0.0	0.0	0.0	0.0	22.3	16.7	0.0	0.0	44.0	54.2	0.0	0.0	137.2
Year that minimum first occurred	1947	1947	1947	1947	1973	1949	1947	1947	1983	1947	1947	1947	1983

[1] Water from the Western Canal is included in the Central Platte Accruals

[2] This includes the water that accures to the Environmental Account in Lake McCounaughy

Table 3.6.3- 25. Environmental accruals by basin.

Table 3.6.3-25 shows that the mean annual environmental accrual for the Full Water Leasing Alternative is 137.2 KAF, with the accruals occurring in May, July, September, and October.

North Platte (above Lake McConaughy). Table 3.6.3-25 shows that the environmental deliveries occur in September. The months of October through March are effectively the winter months in the higher elevations upstream of the North Platte reservoirs.

South Platte (above Julesburg, CO). Table 3.6.3-25 shows high environmental deliveries occurring in May and June. May and June are when water leased in the South Platte is delivered to the central Platte. There are no Tamarack operations in this alternative.

Central Platte (including Lake McConaughy). Table 3.6.3-25 shows that the greatest environmental accruals occur in October, with no environmental accruals occurring in May through August and lesser accruals occurring in November through April. This is generally consistent with the way in which the Lake McConaughy EA is managed. The high value in October can be attributed to conservation credits that accrue to the EA in October.

Shortages, Water Banking/Conservation, Irrigation Demand. The results for shortages, conservation, and irrigation demand are summarized in **Tables 3.6.3-26** through **3.6.3-30**.

Full Water Leasing Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)	Western Canal		Keystone - Sutherland		Sutherland - North Platte		Brady - Cozad		Tri-County Canal		Kearney Canal	
Irrigation Demand by Reach / Canal	Value	% Δ[1]	Value	% Δ	Value	% Δ	Value	% Δ	Value	% Δ	Value	% Δ
Average annual demand for 48-year simulation period (kaf)	26.3	0%	88.3	0%	26.4	0%	172.7	0%	205.5	0%	13.3	0%
Maximum annual demand (kaf)	51.1	0%	113.4	0%	37.9	0%	236.5	0%	290.5	0%	22.7	0%
Minimum annual demand (kaf)	11.5	0%	52.1	0%	14.3	0%	76.8	0%	89.4	0%	3.2	0%
Table number in file Leasing.tab.		111		112		113		114		115		116

[1] % Δ indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

Table 3.6.3- 26. Irrigation demand by reach/canal.

Irrigation Demand. There is no change in average annual irrigation demand for the Full Water Leasing Alternative with respect to the Present Condition.

Full Water Leasing Alternative Central Platte (North Platte below Lewellen and South Platte below Julesburg)	Western Canal		Keystone - Sutherland		Sutherland - North Platte		Brady - Cozad		Tri-County Canal		Kearney Canal	
Shortages by Reach / Canal	Value	% Δ[1]	Value	% Δ	Value	% Δ	Value	% Δ	Value	% Δ	Value	% Δ
Average annual shortage for 48-year simulation period (kaf)[2]	0.0	-100%	0.0	NA	0.0	NA	0.0	NA	0.0	NA	0.0	NA
Number of years with shortages[2]	1	-88%	0	NA	0	NA	0	NA	0	NA	0	NA
Average annual shortage for years with shortage (kaf)[2]	0.5	-74%	0.0	NA	0.0	NA	0.0	NA	0.0	NA	0.0	NA
As a percentage of demand for years with shortage (%)	1.7%		0.0%		0.0%		0.0%		0.0%		0.0%	
Largest annual shortage (kaf)[2]	0.5	-88%	0	NA	0	NA	0	NA	0	NA	0	NA
As a percentage of demand (%)	1.7%		0.0%		0.0%		0.0%		0.0%		0.0%	
Year of largest annual shortage		1947		----		----		----		----		----
Table number in file Leasing.tab.		123		124		125		126		127		128

[1] % Δ indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)
[2] NA in the % Δ column indicates that there value for the Present Condtion Run is zero

Table 3.6.3- 27. Shortages to irrigation by reach/canal.

Shortages. Table 3.6.3-27 shows that only one system, the Western Canal, has any shortages or changes in shortage for the Full Water Leasing Alternative with respect to the Present Condition.

Irrigation Deliveries. Tables 3.6.3-28 and **3.6.3-29** show the irrigation deliveries for the central Platte river basin. **Table 3.6.3-28** shows the deliveries to the irrigators on the North and South Platte rivers. The table shows no differences in deliveries with the exception of the Western Canal that are due to shortages. **Table 3.6.3-29** shows the deliveries to irrigators below the town of North Platte. These deliveries have been reduced using water conservation, water leasing, and water management incentives to lessen the impacts on Program deliveries due to the North Platte channel capacity.

Full Water Leasing Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Irrigation Deliveries	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Western Canal Irrigation Deliveries										Table 53 in file Leasing.tab.			
Min (kaf)	0	0	0	0	0	0	1	1	1	0	0	0	12
Max (kaf)	0	0	2	8	13	14	15	11	13	7	4	1	51
Avg (kaf)	0	0	0	1	4	4	5	4	4	3	1	0	26
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	11%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	4%	0%	1%
Keystone-Sutherland Irrigation Deliveries										Table 50 in file Leasing.tab.			
Min (kaf)	0	0	0	0	3	6	10	15	3	0	0	0	52
Max (kaf)	0	0	1	9	22	23	33	29	20	11	1	0	113
Avg (kaf)	0	0	0	2	10	14	24	23	13	3	0	0	88
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Sutherland-North Platte Irrigation Deliveries										Table 55 in file Leasing.tab.			
Min (kaf)	0	0	0	0	0	1	3	3	1	0	0	0	14
Max (kaf)	0	0	0	2	6	7	10	8	7	4	1	0	38
Avg (kaf)	0	0	0	0	3	4	7	7	4	1	0	0	26
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Avg	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 3.6.3- 28. Irrigation deliveries by reach/canal for the North and South Platte rivers.

Full Water Leasing Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Irrigation Deliveries	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Brady-Cozad Irrigation Deliveries										Table 53 in file Leasing.tab.			
Min (kaf)	0	0	0	0	3	4	4	30	3	0	0	0	66
Max (kaf)	0	0	2	11	24	39	82	69	30	22	3	0	204
Avg (kaf)	0	0	0	1	10	20	52	50	14	2	0	0	149
Percent change from Present Conditions													
Min	0%	0%	0%	0%	-14%	-14%	-14%	-14%	-13%	0%	0%	0%	-14%
Max	0%	0%	-13%	-13%	-14%	-14%	-14%	-14%	-14%	-14%	-15%	0%	-14%
Avg	0%	0%	-14%	-14%	-14%	-14%	-14%	-14%	-14%	-14%	-13%	0%	-14%
Central (Tri-County) Irrigation Deliveries										Table 50 in file Leasing.tab.			
Min (kaf)	0	0	0	0	6	12	15	27	1	0	0	0	77
Max (kaf)	0	0	0	5	38	59	88	72	45	0	0	0	251
Avg (kaf)	0	0	0	3	20	30	53	52	18	0	0	0	177
Percent change from Present Conditions													
Min	0%	0%	0%	0%	-13%	-14%	-14%	-14%	-17%	0%	0%	0%	-14%
Max	0%	0%	0%	-13%	-14%	-14%	-14%	-14%	-14%	0%	0%	0%	-14%
Avg	0%	0%	0%	-14%	-14%	-14%	-14%	-14%	-14%	0%	0%	0%	-14%
Kearney Canal Irrigation Deliveries										Table 55 in file Leasing.tab.			
Min (kaf)	0	0	0	0	0	0	0	1	0	0	0	0	3
Max (kaf)	0	0	1	6	4	4	5	5	4	2	1	0	20
Avg (kaf)	0	0	0	1	1	1	3	3	2	0	0	0	11
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	-25%	-18%	0%	0%	0%	0%	-16%
Max	0%	0%	-10%	-14%	-14%	-15%	-13%	-14%	-13%	-14%	-14%	0%	-14%
Avg	0%	0%	-3%	-13%	-14%	-14%	-14%	-14%	-14%	-13%	-12%	0%	-14%

Table 3.6.3- 29. Irrigation deliveries by reach/canal for the Platte Rivers.

Full Water Leasing Alternative **Central Platte (North Platte below Lewellen and South Platte below Julesburg)**						
Water Banking / Conservation by Reach / Canal	**Western Canal**	**Keystone - Sutherland**	**Sutherland - North Platte**	**Brady - Cozad**	**Tri-County Canal**	**Kearney Canal**
Average annual conservation for 48-year simulation period (kaf)	0.0	0.0	0.0	23.8	28.3	1.8
Number of years with conservation	0	0	0	48	48	48
Average annual conservation for years with conservation (kaf)	0.0	0.0	0.0	23.8	28.3	1.8
As a percentage of demand (%)	0.0%	0.0%	0.0%	13.8%	13.8%	13.6%
Largest annual conservation (kaf)	0	0	0	32.6	40	3.2
As a percentage of demand (%)	0.0%	0.0%	0.0%	13.8%	13.8%	14.1%
Year of largest annual conservation	----	----	----	1988	1956	1985
Table number in file Leasing.tab.	129	130	131	132	133	134

Table 3.6.3- 30. Water leasing/management incentives by reach/canal.

Water Banking/Conservation. Table 3.6.3-30 shows that the amount of water leased under the Full Water Leasing Alternative is less than 2 kaf for the Kearney system; 23.8 kaf for the Brady-Cozad reach; and 28.3 kaf for the Tri-County Canal. There is leasing in all 48 years of the simulation. The leasing in all systems represents 13.8 percent or more of the demand on each system. These values are generally higher than those for most of the other alternatives, which is consistent with the inclusion of water leasing throughout the greater Platte River basin as part of this alternative.

Flows. The results for the flows at significant locations are given in **Tables 3.6.3-31** through **3.6.3-33**.

Full Water Leasing Alternative **Central Platte (North Platte below Lewellen and South Platte below Julesburg)**													
Flows	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Ann**
North Platte River at Keystone										Table 39 in file Leasing.tab.			
Min (Monthly (cfs), Annual (kaf))	0	0	0	0	46	101	159	239	45	0	0	0	79
Max (Monthly (cfs), Annual (kaf))	224	621	18	1,044	8,263	10,371	5,395	3,773	2,128	1,851	24	0	1,294
Avg (Monthly (cfs), Annual (kaf))	7	47	1	67	499	1,384	1,502	981	305	267	2	0	308
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-10%
Max	0%	184%	-87%	28%	6%	2%	0%	128%	16%	0%	0%	0%	0%
Avg	40%	370%	-75%	6%	2%	10%	-11%	-7%	16%	19%	0%	0%	0%
North Platte River at North Platte										Table 42 in file Leasing.tab.			
Min (Monthly (cfs), Annual (kaf))	138	266	216	193	104	272	480	289	181	254	284	304	287
Max (Monthly (cfs), Annual (kaf))	729	906	621	1,479	8,730	10,490	5,642	3,638	2,408	2,392	556	467	1,495
Avg (Monthly (cfs), Annual (kaf))	350	427	420	427	725	1,453	1,329	942	485	608	393	371	480
Percent change from Present Conditions													
Min	0%	0%	0%	0%	-47%	0%	-12%	3%	0%	0%	0%	0%	-3%
Max	0%	24%	-19%	7%	6%	2%	0%	137%	14%	-1%	0%	0%	0%
Avg	1%	9%	-1%	1%	1%	10%	-12%	-7%	10%	8%	0%	0%	0%
Platte River at Maxwell (Below Tri-County Diversion)										Table 16 in file Leasing.tab.			
Min (Monthly (cfs), Annual (kaf))	0	0	0	0	122	5	5	34	0	0	0	0	80
Max (Monthly (cfs), Annual (kaf))	1,524	1,973	1,441	2,827	13,429	20,746	10,067	4,285	2,833	1,716	1,622	823	2,876
Avg (Monthly (cfs), Annual (kaf))	390	602	345	307	1,255	2,282	928	468	273	279	218	255	458
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	-88%	-64%	0%	0%	0%	0%	160%
Max	5%	2%	5%	13%	1%	-1%	-3%	124%	13%	-28%	-11%	-9%	-1%
Avg	21%	59%	60%	6%	14%	15%	-25%	-20%	34%	20%	25%	27%	9%

Table 3.6.3- 31. Flows in the central Platte basin.

Full Water Leasing Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Flows	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Platte River at Overton										Table 53 in file Leasing.tab.			
Min (Monthly (cfs), Annual (kaf))	912	1,104	1,130	665	743	760	304	0	44	995	933	750	645
Max (Monthly (cfs), Annual (kaf))	3,968	5,017	3,945	6,576	17,289	23,448	12,040	4,495	5,211	4,746	4,371	3,495	4,337
Avg (Monthly (cfs), Annual (kaf))	1,964	2,713	2,291	1,842	2,466	3,527	1,387	699	1,089	1,839	1,865	1,824	1,414
Percent change from Present Conditions													
Min	25%	10%	51%	17%	572%	376%	-22%	-100%	-57%	131%	19%	3%	44%
Max	1%	1%	0%	5%	1%	-1%	-1%	151%	8%	-2%	-4%	-2%	1%
Avg	9%	21%	13%	9%	10%	17%	-5%	5%	15%	18%	10%	11%	12%
Platte River at Odessa										Table 50 in file Leasing.tab.			
Min (Monthly (cfs), Annual (kaf))	891	1,250	1,119	365	442	455	0	0	0	761	882	1,029	529
Max (Monthly (cfs), Annual (kaf))	3,988	5,109	4,001	6,309	16,914	22,717	11,952	4,170	4,998	4,422	3,926	3,362	4,187
Avg (Monthly (cfs), Annual (kaf))	1,967	2,806	2,323	1,617	2,235	3,316	1,223	463	817	1,561	1,752	1,813	1,316
Percent change from Present Conditions													
Min	35%	16%	52%	46%	0%	0%	-100%	0%	0%	620%	22%	33%	58%
Max	1%	1%	-6%	5%	1%	-1%	-1%	184%	9%	-5%	-5%	-2%	1%
Avg	9%	20%	13%	10%	10%	18%	-5%	8%	21%	22%	11%	11%	13%
Platte River at Grand Island										Table 55 in file Leasing.tab.			
Min (Monthly (cfs), Annual (kaf))	611	1,182	1,025	711	668	538	208	0	0	1,020	855	698	588
Max (Monthly (cfs), Annual (kaf))	4,643	5,353	4,650	6,405	16,889	21,469	11,475	3,737	5,415	5,214	3,845	3,243	4,051
Avg (Monthly (cfs), Annual (kaf))	1,822	2,781	2,569	1,945	2,491	3,518	1,497	616	894	1,715	1,750	1,697	1,401
Percent change from Present Conditions													
Min	80%	26%	21%	52%	1481%	0%	14%	0%	0%	390%	128%	10%	51%
Max	1%	1%	-5%	5%	1%	-1%	-1%	184%	8%	-5%	-5%	-1%	1%
Avg	10%	20%	11%	8%	10%	17%	-4%	7%	20%	19%	11%	12%	12%

Table 3.6.3- 32. Flows in the central Platte basin.

Full Water Leasing Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Flows	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
South Platte River at Julesburg										Table 38 in file Leasing.tab.			
Min (Monthly (cfs), Annual (kaf))	252	301	70	161	447	444	94	60	47	88	121	130	171
Max (Monthly (cfs), Annual (kaf))	2,018	1,858	1,399	2,191	8,210	11,915	4,736	1,293	1,455	1,825	1,585	1,682	2,009
Avg (Monthly (cfs), Annual (kaf))	831	948	664	580	1,612	2,049	453	245	390	382	517	648	561
Percent change from Present Conditions													
Min	343%	248%	330%	243%	1275%	1000%	263%	164%	600%	260%	1340%	700%	271%
Max	7%	3%	2%	-14%	-17%	-4%	-7%	-22%	-14%	-18%	-11%	7%	-9%
Avg	13%	11%	14%	6%	29%	16%	0%	7%	7%	11%	21%	17%	15%
Sourth Platte River at Paxton (below Korty Diversion)										Table 43 in file Leasing.tab.			
Min (Monthly (cfs), Annual (kaf))	0	95	0	0	289	212	0	0	0	0	0	0	56
Max (Monthly (cfs), Annual (kaf))	1,067	1,551	1,018	1,919	6,492	11,219	4,710	799	871	1,535	1,402	686	1,704
Avg (Monthly (cfs), Annual (kaf))	362	513	345	302	1,345	1,668	274	72	166	213	211	253	345
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Max	5%	3%	7%	-12%	-20%	-5%	-7%	-22%	-12%	-28%	-13%	-11%	-11%
Avg	19%	20%	23%	6%	52%	27%	-6%	-1%	22%	7%	15%	21%	25%

Table 3.6.3- 33. Flows in the central Platte basin.

Table 3.6.3-32 shows that percentage mean monthly flow increases with respect to the Present Condition occur throughout the year at all locations except those on the North Platte River.

Diversion. The average monthly and annual diversions for the 3 major supply canals are given in **Table 3.6.3-34**.

Full Water Leasing Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

Diversions	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Ann**
Keystone diversion										Table 18 in file Leasing.tab.			
Min (Monthly (cfs), Annual (kaf))	250	250	250	250	250	250	250	520	173	0	264	250	320
Max (Monthly (cfs), Annual (kaf))	1,693	1,694	1,982	1,800	2,000	2,000	2,000	2,000	2,000	1,800	1,835	1,693	1,230
Avg (Monthly (cfs), Annual (kaf))	881	1,213	965	888	652	1,013	1,131	1,100	992	919	948	907	700
Percent change from Present Conditions													
Min	0%	0%	0%	0%	0%	0%	-23%	-14%	-17%	0%	5%	0%	7%
Max	6%	1%	-1%	0%	0%	0%	0%	0%	0%	0%	0%	1%	4%
Avg	10%	47%	27%	14%	-27%	-2%	-18%	-18%	-2%	31%	11%	12%	4%
Korty Diversion										Table 19 in file Leasing.tab.			
Min (Monthly (cfs), Annual (kaf))	168	196	18	0	0	0	0	0	0	0	101	0	95
Max (Monthly (cfs), Annual (kaf))	825	1,005	716	901	1,099	1,101	831	659	743	486	766	720	404
Avg (Monthly (cfs), Annual (kaf))	426	476	377	300	233	373	227	146	180	146	298	355	213
Percent change from Present Conditions													
Min	203%	160%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	114%
Max	7%	4%	-7%	11%	0%	0%	-8%	-23%	-12%	-23%	7%	8%	-7%
Avg	10%	1%	4%	6%	-30%	-16%	9%	12%	-1%	18%	27%	16%	2%
Tri-County diversion										Table 17 in file Leasing.tab.			
Min (Monthly (cfs), Annual (kaf))	937	999	1,067	904	909	1,361	1,460	1,425	916	1,130	985	953	973
Max (Monthly (cfs), Annual (kaf))	1,999	2,206	2,090	2,107	2,179	2,250	2,199	2,163	2,107	2,091	2,176	2,010	1,511
Avg (Monthly (cfs), Annual (kaf))	1,450	1,903	1,687	1,483	1,540	1,911	2,034	1,916	1,466	1,599	1,586	1,498	1,211
Percent change from Present Conditions													
Min	36%	43%	54%	35%	-13%	5%	-6%	-10%	-2%	62%	28%	38%	12%
Max	0%	0%	0%	0%	0%	0%	0%	1%	-1%	0%	-1%	1%	0%
Avg	8%	16%	8%	9%	-2%	5%	-3%	-7%	-1%	18%	9%	9%	5%

Table 3.6.3- 34. Diversions by major canals in the central Platte basin.

Table 3.6.3-34 shows an increase in average annual diversion into the Korty, Keystone, and Tri-County diversions for the Full Water Leasing Alternative with respect to the Present Condition. Diversions at the Keystone Diversion are higher in October through April; and lower in May through August. For the Tri-County Diversion, the month-by-month pattern is similar to that for the Keystone Diversion but with lower values.

Power Generation. The Full Water Leasing Alternative results in an increase in power generation with respect to the Present Condition in the Kingsley Dam/Lake McConaughy, Sutherland, and Central systems. Power Generation is shown in **Table 3.6.3-35**.

Full Water Leasing Alternative

Central Platte (North Platte below Lewellen and South Platte below Julesburg)

	Sutherland		**Central**		**Kingsley**		**Total**	
Power Generation	**Value**	**% Δ**[1]	**Value**	**% Δ**	**Value**	**% Δ**	**Value**	**% Δ**
Minimum (MKWh)	58	-8%	194	25%	44	10%	324	8%
Maximum (MKWh)	190	2%	361	1%	241	0%	792	1%
Average (MKWh)	116	5%	269	7%	109	5%	493	6%
Year that minimum occurred		1991		1956		1957		1991
Table number in file Leasing.tab.		23		24		25		26

[1] **% Δ** indicates the percent change between the alternative and Present Conditions ([Value / PC Value] -1)

Table 3.6.3- 35. Power generation statistics for the central Platte basin below Lake McConaughy.

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South Platte River EIS Modeling

December 9, 2005

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This document describes methods used to model the hydrology of the South Platte River for the Platte River Recovery Implementation Program (Program) Environmental Impact Study (EIS). This includes information about: (1) the South Platte EIS Model (SPEISM) and its use in evaluating two Colorado water leasing alternatives for the EIS, (2) a description of the methods used to estimate the effects of water development in Colorado during the first 13-year increment of the Program, and (3) a description of the methods used to simulate Tamarack I, II, and III re-regulation of water above the Colorado-Nebraska state line.

The Central Platte OpStudy Model has been the primary tool used to evaluate various EIS alternatives in terms of likely hydrologic effects on the Platte River in Nebraska. Among other inputs, the OpStudy model requires that monthly inflows (January 1947 through December 1994) be provided for two input nodes to the model: the North Platte River at Lewellen, Nebraska, and the South Platte River at Julesburg, Colorado. The following discussions address how monthly inflows to the OpStudy Model at the Julesburg, Colorado inflow node were modified for the various modeling analyses.

1. The South Platte River EIS Model (SPEISM)

SPREISM was developed by Hydrosphere Resource Consultants of Boulder, Colorado (Hydrosphere) for the Platte EIS Office of the Bureau of Reclamation (Reclamation) for use in developing the EIS.

The purpose of SPREISM was to provide Reclamation with a tool to use in conjunction with the Central Platte OpStudy and North Platte River Water Utilization models to evaluate the effectiveness of various EIS alternatives in meeting flow targets in the Big Bend reach of the Central Platte River in Nebraska. Specifically, SPREISM was designed to estimate monthly South Platte River flows at Julesburg, Colorado, under current conditions and with various EIS alternatives superimposed upon current conditions. Output from SPREISM (flows at Julesburg) is used as input to Central Platte OpStudy at this location for EIS alternatives analysis. Output from SPREISM is also used to assist in identifying environmental and socioeconomic impacts of EIS alternatives, such as recreational impacts, within the study area.

SPREISM was designed to depict current water development conditions superimposed upon a 1947-1994 period of climatic and hydrologic record. This was accomplished by adjusting historical inflows, diversions, gains and losses during this period to reflect current water development conditions, many aspects of which did not exist throughout the historical period. SPREISM was then used to evaluate South Platte components of EIS alternatives relative to this 'current conditions' baseline.

SPREISM is a general model designed to produce results that are suitable for EIS analysis. It is not a detailed water rights model and does not simulate the operation of individual water rights and augmentation plans. Its representation of existing conditions was derived using a variety of information sources and approximation techniques. SPREISM does not represent actual historical conditions, nor does it reflect future water development conditions. It is therefore not suitable for analysis of historical or future operations of the South Platte River. Details of the SPREIS Model and specific caveats and limitations associated with that model are discussed in detail in the document *Technical Appendix: The South Platte River EIS Model* (Hydrosphere, 2001).

1.1 SPREISM Modeling Configuration

The following is a general overview of the modeling approach used by the SPREIS Model. For a more detailed description of the modeling methods and solution steps, the reader is referred to the technical documentation for the model (Hydrosphere, 2001).

Three point-flow studies were used by Hydrosphere to initially configure SPREISM to represent the historical operation of the South Platte River main stem over the modeled period of 1947-1994.

> (1) The Northern Colorado Water Conservancy District (NCWCD) point-flow study of the Lower South Platte River from Kersey to Julesburg, covering the period 1970 through 1994 (NCWCD, 1994);

(2) The U.S. Bureau of Reclamation point-flow study of the South Platte River from Henderson to Julesburg, covering the period 1931 through 1983. (U.S. Bureau of Reclamation, 1989); and

(3) Stream gage data, other inflow data and diversion data from the State of Colorado's Hydrobase database was used by Hydrosphere to develop a new point flow study for the South Platte from Henderson to Kersey for years 1984 through 1994 (because no historical point-flow data existed for the South Platte between these two gauge locations).

These point-flow data for diversions, measured inflows, gains and losses were aggregated according to the node structure of SPREISM[1]. This historical representation was then modified to account for major trends that occurred over the modeled period, as described in the following section.

SPREISM does not explicitly represent the South Platte upstream of Chatfield or the South Platte's major tributary sub-basins (i.e. Cherry Creek, Clear Creek, St. Vrain Creek, Big Thompson River, Cache La Poudre River, Box Elder Creek, Bijou Creek). Instead, these tributaries were represented as inflows to SPREISM using data from stream gages located at the mouth of these tributaries, point-flow study calculated gains data, or output data from Denver Water's PACSM model.

1.2 Model Adjustments to Reflect Current Conditions

The historical version of SPREISM was adjusted to reflect current conditions with respect to several significant water management-related trends that have occurred within the South Platte basin of Colorado, and to portray these trends in a normalized manner reflecting current water development and use conditions over the modeled study period of 1947 though 1994. These trends include growth and subsequent partial decline of alluvial well-related depletions; growth in transbasin imports including the onset of the Colorado-Big Thompson project in the 1950's; growth in Front-Range municipal water use and associated changes in water rights and water use patterns; and large-scale implementation of recharge projects along the South Platte.

This included adjustments made to certain major tributary inflows to SPREISM (South Platte at Henderson, St. Vrain, Big Thompson, Poudre) to reflect changes in inflow regime due to the following factors: urban growth in the metro Denver area and associated increases in transbasin imports; onset of the CBT project; and effects of northern Front Range urban growth.

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[1] The methods applied by Hydrosphere to account for missing data, tributary inflows, evaporation and seepage, simulation of dry points, and to test the model calibration against historic data are described in the SPREIS Model technical documentation.

This ‘current conditions’ version of SPREISM was then used as a baseline upon which various EIS alternatives were superimposed.

1.3 Model Representation of EIS Alternatives

The ‘current conditions’ version of SPREISM was modified to represent and evaluate various EIS action alternatives and the results of those alternatives.

In modeling EIS action alternatives, several global assumptions were reflected in SPREISM. The modeling results would change significantly if any of these assumptions were modified.

1. For the purposes of this EIS analysis, institutional issues regarding the potential export of water from Colorado were not addressed. Specifically, it was assumed that water could be stored by EIS storage alternatives under a Colorado water right, and that water released from EIS storage alternatives could be exported from Colorado and administered down the South Platte River in a ‘protected’ mode.

2. Implementation of modeled alternatives would require a variety of agreements with ditch and reservoir companies, new water rights and, in some cases, changes of water rights. The feasibility or costs of securing such agreements and water rights was not evaluated. In this analysis it was assumed that the necessary agreements and water rights would be in place.

3. Implementation of modeled alternatives would require new facilities or modifications to existing facilities for diversion, storage, pumping, conveyance and delivery of water. Released water was assumed to be deliverable to Julesburg past any intervening diversion structures on the river. The feasibility or cost of providing such facilities was not evaluated. In this analysis it was assumed that the necessary facilities would be in place.

4. EIS storage alternatives were modeled as superimposed upon the current conditions baseline. The current conditions baseline reflects current water management and demand conditions; no conditional water rights were represented nor were any future plans involving increases or decreases in water reuse and exchanges, transbasin imports, nontributary groundwater use, changes in water rights, etc.

1.4 EIS Alternatives Modeled

Initially, at an early “screening” level of analysis, ten different Colorado alternatives were considered for possible EIS modeling and thus incorporated into the SPEIS Model. Ultimately, only two Colorado alternatives were modeled for the final EIS in addition to the Governance Committee’s “Preferred Alternative”. These two alternatives involved the leasing or purchase of storage and/or direct-flow water rights from multiple reservoirs and water users in the lower South Platte River basin of Colorado. Both would be part of basin-wide alternatives implementing similar measures in Wyoming and in Nebraska (the “Water Emphasis” and “Full Water Leasing” alternatives).

These water rights would be changed to allow for release, delivery, and/or bypass of the historically-consumed portion to the Platte River at Julesburg as needed to help meet target flows or support pulse flows during May and June. For every acre-foot of water needed for instream flow releases, it was assumed that 2.0 acre-feet of storage water would be leased or purchased to also provide for makeup of historical return flows. It was further assumed that additional evaporation and transit losses would be suffered by the instream flows between their point of release or non-diversion and the Julesburg gage, as simulated by SPREISM.

Two water leasing alternatives were specified, distinguished by the amount of water to be leased:

- Approximately 70,000 acre-feet of gross water leasing to net approximately 28,000 acre-feet of consumptive use transfer to instream flow for Program purposes in the South Platte River at Julesburg, Colorado, and
- Approximately 100,000 acre-feet of gross water leasing to net approximately 39,000 acre-feet of consumptive use transferred to instream flow for Program purposes in the South Platte River at Julesburg, Colorado.

The leased volumes associated with each of these two alternatives were assumed to be distributed among six reservoirs within the South Platte basin of Colorado (Jackson Lake, Prewitt, Riverside, Empire, North Sterling and Julesburg reservoirs). A disproportionate share of this water was assumed to be leased from the North Sterling, Prewitt and Julesburg reservoirs, as these are the three reservoirs closest to the state line and therefore more likely to yield greater volumes of augmented flow at the state line after transit losses are accounted for.

Model Approach. In modeling this alternative, only the historically-consumed water and the water reserved for evaporation and seepage losses were explicitly represented. The water reserved for makeup of historical return flows was excluded from SPREISM under the assumption that this water would be correctly administered to address injury issues.

Historical end-of-month content records were obtained for each of the six reservoirs mentioned. These records were inspected to determine the degree of fill obtained by each reservoir by the end of April and May in each year of the model study period. Inflows were added to SPREISM to represent the storage banking accounts associated with involved reservoirs. The capacity of each inflow was set to the pro rata portion of each reservoir's degree of fill, minus the amount needed to make up historical return flows, as shown in the following table. Inflows were modeled to allow for release from each account to the degree available and as needed to meet target flows at Julesburg during May and June. Outlet capacity was not assumed to be a constraint upon releases.

For the draft EIS, leased Program water was released to the South Platte River in May/June by the SPREIS model only when flows in the central Platte River were presumed to fall short of Program targets (based on monthly flows volumes at the Julesburg gauge). This constraint was relaxed for the final EIS analysis, on the assumption that there would few or no years in which available leased water could not be used by the Program, either for extended flow augmentation to meet target flows, for exchange with Program Environmental Account water stored in Lake McConaughy, and/or for purposes of helping create short-duration pulse flows in the central Platte.

Water Banking Alternatives: Potentially Deliverable Water, acre-feet

Alternative	Riverside Reservoir	Empire Reservoir	Jackson Reservoir	Prewitt Reservior	N. Sterling Reservoir	Julesburg Reservoir	Direct Flow
70 KAF gross lease	4,000	2,000	4,000	5,000	15,000	5,000	0
100 KAF gross lease	4,000	2,000	4,000	5,000	15,000	5,000	15,000

1.5 Estimating Changes in Reservoir Surface Areas

For the sake of analyzing the effects of Colorado water leasing on reservoir recreation and the regional economy, May-through-September changes in the surface area of each of the six reservoirs ultilized were estimated, as compared to the baseline condition.

The following methods were applied:
(1) Historic end-of-month volumes were compiled for each reservoir (1947-1994);
(2) Corresponding end-of-month surface areas were calculated for each reservoir;
(3) Volumes of water leased (delivered) from each reservoir in May and June of each year were estimated for the modeled EIS scenarios;
(4) Because the same volumes of water eventually (by the end of September in each year) would have been delivered for agricultural uses, differences in storage resulting from accelerated deliveries in May and June that otherwise would not have been delivered until later in the irrigation season (July, August, and September) were calculated. The following steps were applied to estimate the resulting monthly (May through September) differences in reservoir storage:

- Historic delivery patterns of water from these reservoirs was estimated by evaluating their historic summer drawdown patterns. These patterns were relatively consistent among the reservoirs, averaging 4%-10%-35%-36%-15% distribution for the months May, June, July, August and September, respectively;
- For each reservoir and each year, the differences between the modeled delivery pattern and the historic reservoir delivery pattern for that share of leased water was estimated;
- The end-of-month volume of each reservoir in May, June, July, and August was reduced by the corresponding difference. The assumption was made that everything "returns to normal" (*i.e.*, would correspond to historic conditions) by the end of September of each year;
- The corresponding difference-in-surface-area was calculated for the end of May, June, July, and August of each year, based on tables of storage versus surface area for each reservoir;
- The results for each year for each reservoir were averaged.

A table summarizing these results is included as **Appendix A**.

The percent changes summarized in Appendix A are relative to the historic average content of these reservoirs in the corresponding months. Historic average contents were used in lieu of “adjusted historic” averages, because the South Platte EIS Model does not explicitly model the adjusted monthly reservoir contents that would result from the adjusted historic flow conditions. The use of historic reservoir contents was considered a reasonable approximation for this evaluation, because the variables of interest were the *difference* in reservoir contents and surface areas under the modeled scenarios, rather than the actual reservoir contents. It was assumed that these net differences in content and surface area would be approximately the same under both historic and adjusted baseline conditions.

The calculated percentage change in surface areas sometimes appears small relative to the volumes of water leased at the corresponding reservoir. A review of the data suggests that the changes in surface area are not as large as might be expected because: (1) the volume versus surface-area relationships tend to become less sensitive to changes in volume when these reservoirs are relatively full (e.g., in May and June) – in North Sterling Reservoir, for example, a 16% change in volume when it is close to full results in only an 8% change in surface area (approximately); and (2) some portion of water leased by the Program would have already been evacuated from the reservoirs in these months anyway for delivery to existing (historic) uses. In other words, much but not all of the May and June Program releases represent a "new" impact on the reservoirs.

It should be noted that the monthly storage records for these reservoirs are not complete for the entire 1947-1994 period. Therefore some subjective judgment was involved in estimating missing values and/or choosing which years to ignore for averaging purposes.

2. Modeling the Effects of First-Increment Water Development in Colorado

After consulting with the states of Nebraska and Colorado and other Program participants, the U.S. Fish and Wildlife Service (FWS) decided to model the effects of First-Increment water development in the South Platte River basin of Colorado by adjusting monthly inflows at the Julesburg, Colorado gauge for OpStudy model runs. OpStudy is a monthly time-step model. As such it does not directly model daily changes in central Platte flows. However the OpStudy model does generate a synthetic series of daily flows based on historic daily flows (PREISO, 2005). Increasing the inflow at Julesburg in any month has the effect of proportionally increasing all simulated daily flows during that month; decreasing monthly Julesburg inflow has the opposite effect.

The following sections describe how changes to monthly inflows at the Julesburg, Colorado stream gage were estimated to represent the likely effects of First-Increment water development in Colorado.

2.1 Future Water Development in Colorado’s South Platte Basin

Colorado's Plan for Future Depletions describes anticipated trends of water supply development in the South Platte Basin of Colorado during the first increment of the Program. Among the basin characteristics and anticipated trends described in that Plan are the following:

- As of the effective date of the Cooperative Agreement (1997), population in Colorado's South Platte Basin was estimated at 2,662,279 (Northern region[2] 701,470; Central region 1,766,207; and Southern region 194,602).

- The gross per-capita water requirement in the South Platte Basin is assumed to be 0.27 acre-feet/year.

- Of water supplied in the basin, 35% consumptive use is assumed for municipal purposes, 45% is assumed for agricultural irrigation purposes.

- Six sources of water supply are anticipated to serve population increase in the basin, in the approximate proportions shown below:

Source	**Northern Region**	**Central Region**	**Southern Region**	**Accretive or (Depletive) Effect**
New Transbasin Imports	40%	30%	20%	64%
Nontributary Groundwater	0%	10%	50%	68%
Ag. to Urban Conversion	35%	5%	0%	10%
Conservation	5%	15%	10%	0%
Wastewater Exchange/Reuse	10%	25%	10%	(41%)
Native South Platte Flows	10%	15%	10%	(27%)

- Monthly transit loss per-mile factors for the South Platte River are tentatively assumed to be those set forth in the table below (however, these values may be updated at a later date):

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
.02%	.02%	.05%	.1%	.3%	.45%	.5%	.5%	.5%	.4%	.1%	.02%

- The cumulative effect of Colorado's population growth and new water supply development on the South Platte River at Julesburg for any annual period is expected to be a mix of net accretions during the fall, winter and spring period, and seasonal

[2] The Northern Region consists of Boulder, Weld, Larimer, Washington, Morgan, Sedgwick, Logan, and Phillips counties; the Central Region of Denver, Jefferson, Adams, Clear Creek, Gilpin, and Park counties; and the Southern Region of Arapahoe, Douglas, and Elbert counties.

depletions in the late-spring to mid-summer period, resulting in an estimated total seasonal net depletive effect on an order of magnitude of less than 1,800 af/yr for each 100,000 additional people in the South Platte River Basin in Colorado.

Colorado's Plan for Future Depletions anticipates using the Tamarack re-regulation project near the Nebraska state line to re-regulate a portion of the anticipated net accretions such that they return to the river during periods of net depletions. The intent of this reregulation is to ensure that, on average, there will be no net new depletions to South Platte River flows at Julesburg in any month of the year as a result of new water-related activities, as described in the Colorado Plan.

2.2 Modeling the Effects of Future Development

2.2.1 Basic Assumptions and Issues of Concern

For all modeling described in this document, FWS assumed that the basic assumptions described above hold true through the First Increment of the Program, with the possible exception of the assumed mix and distribution of the six sources of water supply. FWS further assumed a net growth in basin population of 1.1 million between 1997 and 2020, approximately the end of the first increment (**Appendix B**). A key assumption of our modeling is that Colorado will honor their commitment to avoid creating any net new depletions to South Platte River flows at Julesburg in any month of the year on an average long-term basis.

While FWS is interested in maintaining *average annual* and *average monthly* flows in the South Platte River at pre-1997 levels to help achieve Program objectives, the Service is also interested in minimizing reductions in the *magnitude and frequency of high flows* in the South Platte River. This is because high flows in the South Platte are, under current conditions, frequently important contributors to high flows occurring in the central Platte River. High flows in the central Platte, in turn, are potentially important agents of habitat formation, sediment mobilization, vegetative scour, spawning cues for fish, and other physical effects important to river health and the maintenance of desirable species habitat conditions (e.g., Murphy et al, 2003; NRC, 2005).

For this reason, negotiations over an acceptable *Plan for Future Depletions* in Colorado included consideration of the potential to adversely effect the highest ("peak") South Platte flows due to new water supply development. Of the six water supply sources described in Colorado's Plan, two are likely to adversely affect peak flows: (1) native South Platte flow development and (2) wastewater exchange/reuse. In the first case, new dams and diversions will capture a portion of the remaining native basin runoff that is not already appropriated for other uses. Because the South Platte basin is already heavily appropriated, this capture predominantly would occur during the months of April through July of relatively wet years. In the second case, increased consumption of legally re-usable return flows will reduce the water supply to downstream South Platte reservoirs, which are then likely to divert more water during high-flow periods.

To address the above concerns, Colorado agreed that ESA coverage provided to Colorado projects under the Program would be limited with respect to the magnitude of new water supplies derived from the above two sources, as described in their *Plan for Future Depletions*:

> "New water related activities would not be covered by this plan if the average annual water supply to serve Colorado's population increase from "Wastewater Exchange/Reuse" and "Native South Platte Flows" exceeds 98,010 acre feet during the February through July period as described below. The 98,010 acre-feet figure represents gross water deliveries (supplies) to meet new demands for an average hydrologic year, and is not a consumptive use or diversion limitation. In analyzing proposed new water related activities that have supplies derived from the storage of native South Platte flows or wastewater exchange or reuse, only those supplies resulting from diversions to storage or exchange/reuse during the period from February through July will be counted toward the 98,010 acre-feet. In the event that a new water related activity is not covered by Colorado's plan pursuant to this subsection I.H.3, Colorado and the activity's proponent can consider amendments that will allow Colorado's Plan to provide ESA compliance for the activity as provided in Section E of the Program document."

The period of February through July is specified because FWS identified these as the months of greatest concern from its perspective of potential impacts to the Program target species. Because high flows in the central Platte River attributable in large part to South Platte contributions almost never occur outside of these months, and because Colorado anticipates that their mix of water supply development projects will result in net accretions to South Platte flows during the remainder of the year, FWS agreed to this February-July method of characterizing coverage under Colorado's Plan.

2.2.2 Hydrosphere Analysis

In 2003 the Platte River EIS Office contracted with Hydrosphere Resource Consultants of Boulder, Colorado, to quantify likely impacts of native South Platte flow development and wastewater exchange/re-use on South Platte River peak flows.

Hydrosphere's "worst-case" assessment (2003a), which was later scaled down to evaluate a more realistic First-Increment scenario (2003b) examined five hypothetical water supply components of South Platte basin water development, as described below. Hydrosphere believes these are representative of the kinds of projects that are most likely to be developed during a first increment. It should be noted that Hydrosphere adopted a number of assumptions that err on the side of over-estimating impacts to high flows.

(1) A major on-stream reservoir on the South Platte River upstream of Denver.

This reservoir was modeled as having a capacity of 400,000 acre-feet. However, annual deliveries to water users were limited to a first-increment "firm yield" of only about 7,329 acre-feet* over the modeled 48-year period. A worst-case assumption was made that this reservoir captures only native runoff.

(2) An expanded Northern Integrated Supply Project involving a major on-stream reservoir on the Cache La Poudre River.

The model assumed cumulative new upper Poudre River storage of 220,000 acre-feet. This Project was assumed capable of diverting from both the main stem and the North Fork of the Poudre. The analysis assumed a combined Poudre/South Platte confluence diversion leading to a large off-stream reservoir. Average deliveries to users provided by this water supply component were roughly 20,000 to 25,000 acre-feet/year.

(3) A major diversion and pumpback project on the South Platte River below Greeley, serving metro Denver area providers.

This was assumed to serve metro Denver and involve diversion of unappropriated water and re-usable return flows (RRFs). For this source, plus the source described under Item #5 below, the total assumed diversion capacity was about 161 cfs*, at a location on the South Platte just below Kersey. The assumption was made that all diverted water was regulated in off-stream storage.

(4) Development of multiple reservoirs on South Platte tributaries.

This component represented a collection of relatively small new reservoirs or reservoir expansion projects that could cumulatively reduce peak flows at and below Kersey in a significant manner. The example projects included in this component included:

- An expanded Gross Reservoir storing water on South Boulder Creek;
- An enlargement of Button Rock Reservoir storing water on North St. Vrain Creek;
- Reuter-Hess Reservoir storing water from Cherry Creek (currently proposed by the Parker Water & Sanitation District);
- An enlargement of Standley Lake storing water from Clear Creek; and
- Dispersed gravel pit storage along the South Platte and the lower portions of the major South Platte tributaries.

First-increment demands met by this component were assumed to be about 3.8%* of the historical gaged flow at Kersey.

(5) Reuse to extinction of historically unused RRFs from the metro Denver area.

Hydrosphere simulated the effects of re-using the unused RRFs generated by Metro Denver-area providers that historically occurred during the 1947-1994 hydrologic period. This had an immediate effect on flows during days of diversion. This was also modeled as causing major downstream agricultural storage reservoirs – Empire,

* The asterisked values under this section are 121/350 of the value used in the original 350KAF annual supply analysis by Hydrosphere. See discussion of the 121,000 acre-foot figure in **Appendix C**.

Jackson, Riverside, Prewitt, North Sterling and Julesburg – to often fill longer into the spring runoff period, thereby reducing many high spring flows.

Details of Hydrosphere's modeling methodology for these components is provided in Hydrosphere 2003a and 2003b.

Because the OpStudy Model is based on an evaluation of Platte River flows from 1947 through 1994, Hydrosphere used this time period for their analysis of likely impacts to flows. A key product of Hydrosphere's analysis was a spreadsheet providing estimates of daily reductions in flow in the South Platte River at Julesburg, Colorado resulting from implementation of the above suite of water development activities. Hydrosphere was not asked to nor did they model return flows nor the accretive effects of other water development activities in the basin (such as accretions from transbasin imports). These effects on monthly flows were considered later by FWS as described below.

2.2.3 FWS Analysis

As already described, a decision was made to assess the effects on the central and lower Platte River in Nebraska for the EIS by adjusting monthly inflows to the OpStudy Model at the Julesburg, Colorado gage (i.e., model inflow) location. To create a new dataset of modified monthly inflows, FWS followed these steps:

(1) Hydrosphere's daily estimates of reductions in flow at Julesburg due to native flow development and reuse of reusable return flows were aggregated into monthly reductions, January 1947 to December 1994 (see **Appendix D, Table 2**). Present Condition (adjusted baseline) monthly flows (**Appendix D, Table 1**) were adjusted downward by these amounts.

(2) All monthly flows were then adjusted *upwards* in recognition of Colorado's commitment to maintain or increase long-term average flows at Julesburg in each month of the year. This reflects the expectation that a host of water development activities will occur that were not modeled by Hydrosphere but will be accretive to South Platte flows, and also that Colorado has committed to re-regulating these accretions to maintain average flows in all months of the year at Julesburg.

Based on an assumed population growth of 1.1 million, and using the "Illustrative Tool"[3] provided by Colorado, FWS estimated average annual monthly pre-reregulation accretions (August through April) and depletions (May through July) to streamflow at Julesburg at the end of the first increment, as described in Appendix D.

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[3] Colorado's "Illustrative Tool" is a spreadsheet that was developed to estimate the aggregate monthly accretive/depletive effect of various water development scenarios in the South Platte River basin. Variables that may be changed in this spreadsheet model include population growth, the mix of six water supply sources, the accretive/depletive effects of each water supply source, and per-mile transit losses applied to both accretions and depletions. The spreadsheet model aggregates these variables by basin region (Northern, Central, Southern). The tool used for the FWS analysis is dated 9/11/1998.

Colorado commits to replacing seasonal depletions to flow on an average annual basis through re-regulation of accretions. Thus FWS assumed that 48-year average monthly flows in May, June and July will not change under the modeled scenario; only the distribution of flows over these years will change (*i.e.*, flows will generally be higher than the Present Condition in low-flow years, and lower in high-flow years). Monthly flows in the remaining nine months of the year will increase somewhat, on average, but will also be reduced in year-to-year variability.

For each of the 12 months, FWS added a constant volume of flow in all 48 years over the modeled period to address Colorado's projection of no net depletions in May-July (on average), and of accretions to flow in the months of August through April (on average).

The product of the above steps was a new table of monthly inflows for the South Platte River at Julesburg for the OpStudy Model. This table is **Appendix D, Table 5**.

2.2.4 Limitations, Qualifiers, and Disclaimers

In hindsight, a more elegant and straightforward method of estimating monthly changes to South Platte River flows at Julesburg might have been implemented had that been the specific identified objective when Hydrosphere was first tasked, in 2003, with evaluating potential impacts of "peak flow development" in Colorado.

In fact, the nature of the analysis described shifted over time as discussions between FWS and the state of Colorado regarding potential species effects shifted focus. FWS believes that the analysis described here represents the best simulation of likely effects on central Platte River flows possible given the datasets, analyses, and models available to us at this time.

Various assumptions have been folded into this analysis that err on the side of over-estimating, rather than under-estimating, likely reductions to flows at Julesburg in high-flow months during the first increment of the Program. Therefore negative effects (if any) on central Platte target species due to the peak flow impacts of new water development in Colorado during the First Increment are not likely to be any greater than those identified using this analysis, provided that the assumptions and commitments described in Program documents remain valid throughout this period.

3. Modeling the Effects of Tamarack I, II, and III

The “Tamarack Plan” refers to a program proposed by the State of Colorado (and, to some extent, already implemented) to re-regulate flows in the lower South Platte River upstream from the Colorado/Nebraska state line. The intent of this project is to divert water from the south Platte River via ditches and/or alluvial aquifer wells into recharge basins in sandy upland areas during periods when flows exceed critical in-stream needs.

By properly distributing the diverted water to properly-located recharge basins, this is expected to have the effect of maximizing return flows to the south Platte River during periods when instream flow augmentation is particularly desired (*e.g*., April through September).

Tamarack Phases I and III are intended to achieve the goal of reducing shortages to target flows in the central Platte River, relative to current conditions, using the approach described above. Tamarack Phases I and III were not modeled as a element of the South Platte River EIS Model. Rather, these two projects were modeled within the Central Platte OpStudy Model using the SDFView stream accretion/depletion software developed by Colorado State University. Details of the Tamarack Plan modeling in OpStudy is provided in Section 4.13 of PREISO, 2005.

Tamarack Phase II would operate in a similar manner, however its intent would not be to reduce shortages to Program target flows *per se*, but rather to help ensure that long-term average flows in the South Platte River at the Colorado/Nebraska state line are not depleted in any month of the year due to population-driven changes in water supply and water use for which Colorado is responsible under *Colorado's Plan for Future Depletions*. Thus, Tamarack II was not modeled as an element of the South Platte River EIS Model, either. Rather, it was assumed that Tamarack II will be successfully implemented to achieve the objective described above as part of the First-Increment evaluation described in the previous section of this document.

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APPENDIX A

Estimates of Changes in South Platte Reservoir Surface Areas Under the Colorado Water Leasing Scenarios

Estimated changes in reservoir surface areas under the FEIS Water-leasing Scenario #1

Source: Don Anderson, USFWS, 7/8/2005
Source data spreadsheet:
WaterLeasingReservoirImpacts.xls

	Riverside Reservoir			
	Average end-of-month surface acres			
	May	Jun	July	Aug
Historic average	3,541	3,426	2,741	1,914
Water Leasing Alternative Changes:				
min	**-122**	**-134**	**-110**	**-73**
avg	**-81**	**-109**	**-77**	**-32**
max	**0**	**0**	**0**	**0**
Percent change under avg condition	-2.3%	-3.2%	-2.8%	-1.7%

	Empire Reservoir			
	Average end-of-month surface acres			
	May	Jun	July	Aug
Historic average	2,689	2,616	2,062	1,491
Water Leasing Alternative Changes:				
min	**-89**	**-101**	**-101**	**-89**
avg	**-55**	**-75**	**-55**	**-22**
max	**13**	**-51**	**-38**	**0**
Percent change under avg condition	-2.0%	-2.9%	-2.6%	-1.5%

	Jackson Reservoir			
	Average end-of-month surface acres			
	May	Jun	July	Aug
Historic average	2,306	2,277	2,112	1,851
Water Leasing Alternative Changes:				
min	**-101**	**-107**	**-77**	**-254**
avg	**-34**	**-65**	**-63**	**-30**
max	**6**	**0**	**0**	**0**
Percent change under avg condition	-1.5%	-2.9%	-3.0%	-1.6%

	Prewitt Reservoir			
	Average end-of-month surface acres			
	May	Jun	July	Aug
Historic average	2,084	2,042	1,737	1,315
Water Leasing Alternative Changes:				

	May	Jun	July	Aug
min	**-203**	**-243**	**-421**	**-71**
avg	**-113**	**-152**	**-119**	**-28**
max	**10**	**0**	**0**	**0**
Percent change under avg condition	-5.4%	-7.4%	-6.8%	-2.1%

N Sterling Reservoir

	Average end-of-month surface acres			
	May	Jun	July	Aug
Historic average	2,546	2,425	2,037	1,425
Water Leasing Alternative Changes:				
min	**-312**	**-328**	**-264**	**-185**
avg	**-186**	**-256**	**-208**	**-111**
max	**11**	**0**	**0**	**0**
Percent change under avg condition	-7.3%	-10.6%	-10.2%	-7.8%

Julesburg Reservoir

	Average end-of-month surface acres			
	May	Jun	July	Aug
Historic average	1,439	1,416	1,206	982
Water Leasing Alternative Changes:				
min	**-123**	**-128**	**-98**	**-650**
avg	**-75**	**-105**	**-67**	**-33**
max	**4**	**0**	**0**	**0**
Percent change under avg condition	-5.2%	-7.4%	-5.6%	-3.4%

APPENDIX B

South Platte River Basin Population Estimates/Projections (2003) (population in thousands)

Year	**CWCB** [4]	**CDLA** [5]	**CIRES** [6]	**Colorado FDP** [7]
1990		2,251,6	2,425.3	
1995				2,662.3 [8]
2000	2,968.5	2,957.8	3,000.0 [7]	2,915.3 [9]
2005		3,218.0		
2010		3,508.5		
2015		3,802.8		
2020	**4,167** [10]	**4,100.6**	**3,900.0** [11]	**3,692.8**
2025		4,412.4		
2030	4,766.2			
Estimated increase, 1997-2020	**> 1,198**	**> 1,142**	**> 900**	**1,031**

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4 Colorado Water Conservation Board, *South Platte River Basin Water Use, Growth & Water Demand Projections*, March 2002, page 1. Colorado population only.

5 Colorado Department of Local Affairs. These figures approximate the South Platte basin by summing CDLA's projections for the Denver-Boulder-Greeley region + Fort Collins MSA + Clear Creek, Gilpin, and Park Counties + Region 1 Eastern Plains. Colorado population only.

6 Cooperative Institute for Research in Environmental Studies, cires.colorado.edu/wwa/landuse/demog2.html. "Total estimated population, South Platte Basin counties in Colorado, Wyoming, and Nebraska."

7 Colorado's Future Depletion Plan, 1998. From the "Illustrative Tool" that was distributed with the Plan, dated September 11, 1998. Colorado's population only.

8 This estimate is for 1997.

9 This estimate is for 2002.

10 Linear interpolation from the year 2000 and 2030 estimates.

11 Approximate value, estimated from points on a graph.

APPENDIX C

Description of the “121 KAF Scenario” (98 KAF February-July Scenario) of Colorado Peak Flow Development

Origin of 121 KAF Figure

Colorado's Plan for Future Depletions states that:

> *New water related activities would not be covered by this plan if the average annual water supply to serve Colorado’s population increase from 'Wastewater Exchange/Reuse' and 'Native South Platte Flows' exceeds 98,010 acre feet during the February through July period.*

Hydrosphere's analysis of potential peak flow impacts (2003a, 2003b) suggests that approximately 81% of supplies coming from these sources would be captured in this February-through-July period, with the remainder captured in August through January. Because Hydrosphere's analysis had been scaled down from their "worst-case" scenario on the basis of estimated *annual* water supplies provided by these sources, the 98,000 acre-foot figure was equated to 121,000 acre-feet on an *average annual basis* for the sake of utilizing Hydrosphere's results.

In order to analyze potential impacts to peak flows during the first increment of Platte River Recovery Program, USFWS assumed a population growth of 1,100,000 in the South Platte Basin of Colorado from 1997 to 2020 (approximately the end of the first increment). See Appendix A.

According to Colorado’s *Plan for Future Depletions* and Illustrative Tool (9/11/1998), this additional population represents a demand for approximately **297,000 acre-feet** of additional water deliveries in the “average hydrologic year” (equivalent to 0.27 acre-feet per capita). Colorado anticipates that this demand will be met through six different categories of water supply development:

1. New trans-basin diversions
2. Non-tributary groundwater
3. Agricultural to municipal conversions
4. Conservation
5. Re-use of reusable return flows
6. Native South Platte storage

For the “121 KAF Scenario” (equivalent to a "98 KAF February-July Scenario"), we assumed that approximately 121,000 acre-feet (41%) of this 297,000 total will, in the average hydrologic year, be supplied by native South Platte storage development plus re-use of reusable return flows. We assumed the remaining 176,000 AF is provided by the four other sources, as follows:

New trans-basin diversions	56,500 AF (19%)	
Non-tributary groundwater	47,500 AF (16%)	**175,600 AF of total**
Agricultural to municipal conversions	40,000 AF (13%)	(59%)
Conservation	31,600 AF (11%)	
Re-use of reusable return flows	64,600 AF (22%)	**121,400 AF of total**
Native South Platte storage	56,800 AF (19%)	(41%)
	297,000 AF (100%)	

It is worth noting that the above mix of water supply sources relies more heavily on the latter two sources than is "initially assumed" under *Colorado's Plan for Future Depletions*. Using Colorado's Illustrative Tool, FWS estimates that Colorado's "initial assumptions" result in only 86,000 AF (29%) of this annual total coming from these two sources, with the remaining 211,000 AF (71%) provided by the remaining four sources. For this EIS evaluation, FWS intentionally selected the more extreme scenario described above for analysis; if the development of these two water supply sources affecting peak flows turns to be less than assumed in this analysis, then adverse effects to peak flows will also be correspondingly less.

What 98 KAF Does & Does Not Represent

Again, 98,000 acre-feet of this 121,000 acre-foot supply is estimated to be captured in the months of February through July. The 121,000 and 98,000 acre-foot figures represent **gross water supplies to meet new demands** in the average hydrologic year.

- ***It is not a consumptive use value***. Colorado estimates that, in the average year, approximately 35% of new water supplied for municipal and industrial uses will be consumptively used in Colorado. (35 percent of 98,000 is roughly 34,000 acre-feet).
- ***It is not a "reduction in peak flows" value***. Reductions to February-July peak flows in the central Platte River would be substantially less than 98,000 acre-feet in the average year under this scenario. Peak flow reductions are limited by the timing of diversions providing this water supply, by transit losses and downstream diversions, by other factors attenuating peak flows downstream, and by accretions to flows from various basin activities.
- ***It does provide a basis for "scaling down" Hydrosphere's initial (July 2003) analysis of peak flow impacts***. That analysis assumed more than 350,000 acre-feet of supply provided by these two sources (as detailed in Hydrosphere's report of July 21, 2003). Hydrosphere's methods of scaling-down their analysis to correspond to 121 KAF of annual supply are detailed in their memo of August 21, 2003.

APPENDIX D

FWS Adjustments to Monthly Inflows at Julesburg for the OpStudy Model

Hydrosphere's analysis evaluated only the effects of diversion and storage associated with native South Platte flow development and re-use of legally reusable return flows on daily flows, including peak flows. Hydrosphere's analysis did *not* consider the return-flow effects associated with these sources, nor the accretive effects of other anticipated South Platte water development activities. By itself, the Hydrosphere analysis provides good information on likely reductions in South Platte flows during days of high flow, but little information about overall flow impacts during other times or on a monthly basis.

To develop a modified monthly time series of Julesburg flows, FWS began by aggregating Hydrosphere's daily estimates of reductions in flow at Julesburg into monthly reductions, January 1947 to December 1994 (**Table 2**), and adjusting Present Condition flows at Julesburg downward by these amounts. This had the effect of changing the 48-year pattern of flows in any given month as conceptually illustrated in Figure 1:

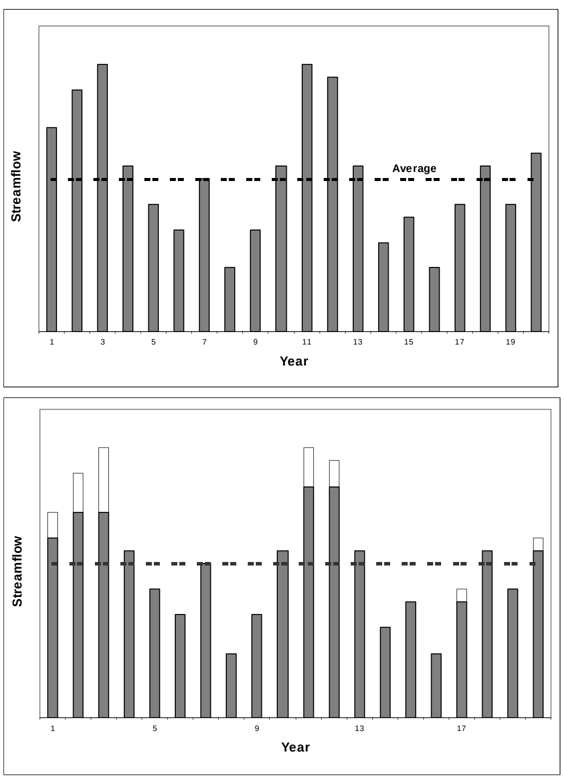
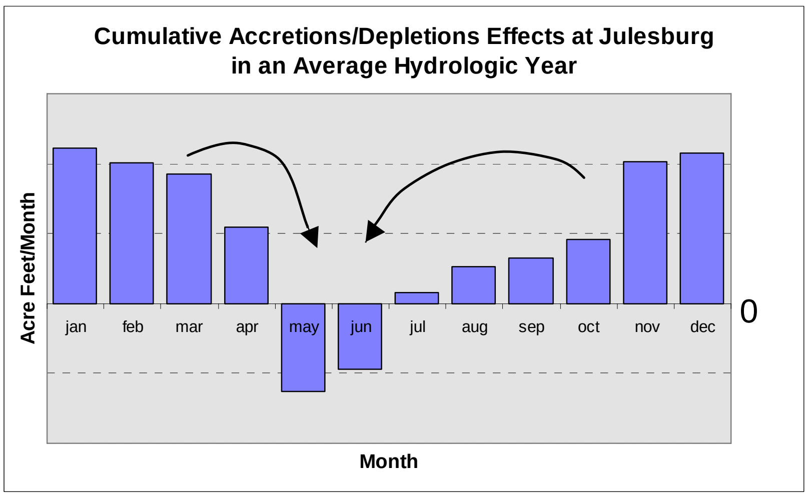


Figure 1. Conceptual illustration of the first adjustment made to monthly flows reflecting only reductions in high flows associated with water supply development. The figure on the left illustrates "Present Condition" flows for one specific month (e.g., May) over a period of 20 years. The figure on the right illustrates how flows in some of these months would be substantially reduced considering only reductions in high flows represented in the Hydrosphere analysis. Making the adjustment shown in the

right figure reduces the long-term average flow for this month below the Present-Condition average (dashed line).

However, Colorado anticipates maintaining or increasing long-term average flows in the South Platte River at Julesburg in every month of the year during the first increment. Therefore, the reduced monthly flows as shown in Table 2 need to be adjusted upwards to reflect this commitment.

Colorado's Illustrative Tool provides a means of estimating average net monthly and annual impacts on flow at Julesburg under an assumed mix of the six water supply sources serving an assumed increase in population. Conceptually, under currently-assumed water supply mixes in an "average hydrologic year", the pattern of net accretions and depletions looks something like this:



Colorado's *Plan for Future Depletions* envisions replacing the seasonal (e.g., May-June) depletions with re-regulated accretions (arrows on above graph). To the extent that net accretions exceed the volume needed to fill the seasonal depletive "hole" that is created, they will also increase the average annual streamflow at Julesburg.

FWS assumed the following mix of new water supply sources under the 121 KAF annual (98 KAF February-July) scenario described in Appendix B. This scenario assumes a population growth of 1,100,000 in the basin (1997 through 2020), with a distribution of 32%/ 45%/ 23% in the Northern, Central, and Southern regions respectively. Shaded boxes indicate the percentages FWS changed from Colorado's "initial assumptions" in order to represent this scenario. This scenario results in 121,000 acre-feet (41%) of supply provided by these two sources in the "average hydrologic year":

	North	Central	South
Trans-basin imports	27%	18%	10%
Non-tributary water	0%	10%	50%

Agricultural conversion	35%	5%	0%
Conservation	5%	15%	10%
Water re-use	15%	30%	15%
Native S. Platte development	18%	22%	15%
TOTAL	100%	100%	100%

<u>What net accretive/depletive patterns are anticipated under the above scenario?</u>

According to Colorado's Illustrative Tool, and applying the tentative per-mile transit losses proposed by Colorado, the following pattern of net accretions and depletions is anticipated at Julesburg in the "average hydrologic year" under the above scenario:

(Acre--Feet Per Month)

Seasonal Accretions/Depletions	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec	total
"New" Transbasin Imports	3067	2883	2540	2105	1367	1119	940	1159	969	1246	2627	2743	22,766
Nontributary Groundwater	1455	1448	1458	1945	1691	1067	967	975	774	1114	1814	1812	16,519
In-basin Agricultural Conversion	78	78	74	171	361	222	176	176	176	84	68	78	1,740
Conservation	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Reuse	(63)	(63)	(130)	(742)	(2500)	(1105)	(2172)	(1955)	(815)	(446)	(56)	(63)	(10,108)
Native South Platte Flow Development	4972	4007	3900	(304)	(12160)	(9856)	(491)	1185	1414	1709	4178	4735	3,289
Total Accretions/Depletions	9,509	8,353	7,842	3,174	(11,242)	(8,552)	(580)	1,539	2,519	3,706	8,632	9,306	34,206
Net accretions after depletions offset*	**5,959**	**5,235**	**4,915**	**1,989**	**0**	**0**	**0**	**965**	**1,579**	**2,323**	**5,410**	**5,832**	**34,206**

* These values were estimated by FWS, not the Illustrative Tool. An equal percentage was taken from each month of accretions (37.3%) to offset the corresponding May-June-July depletions.

We adjusted all monthly streamflows at Julesburg upwards in two steps as follows:

1. First, for each of the 12 months, FWS added a fixed amount of flow in all 48 years so that the 48-year average in each month was the same as the Present Condition average. This reflects Colorado's commitment to maintain long-term average monthly flows.

2. Second, for the nine months showing projected net accretions, FWS used the final row of numbers in the above table (representing net accretions after depletions are offset) to additionally adjust all 48 years of values upwards. This reflects the anticipated effect of net accretions occurring in these months.

Conceptually, the effect of the above two steps is illustrated by the black portion of the bars in Figure 2:

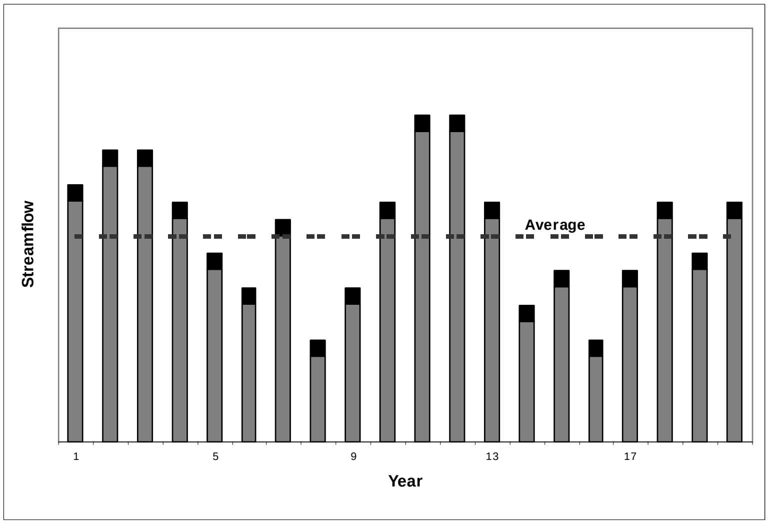


Figure 2. Conceptual illustration of the second adjustment made to monthly flows to account for commitments/expectations that long-term average flows will be maintained at Present Condition levels or increased in each month. The black cap on each bar represents the constant value added back in to each month to bring the long-term average back to the original Present Condition average (dashed line), or the original Present Condition average plus the additional accretion to flows expected in that month.

Such that the final effect on assumed monthly flows at Julesburg, before vs. after all these adjustments are made, would look something like Figure 3:

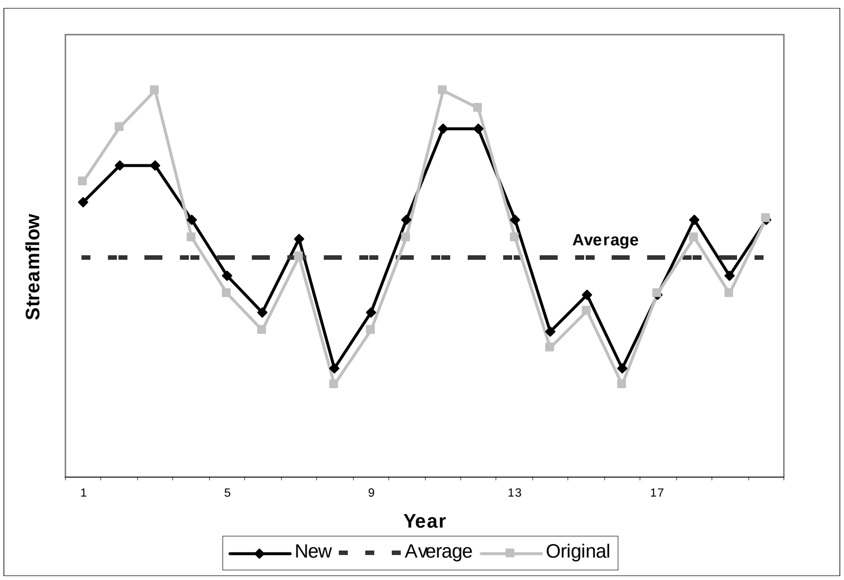


Figure 3. Conceptual illustration showing the combined effect of the two adjustments. For these 20 example years, the long-term average flow (dashed line) has been maintained or increased at the level of Present Condition flows during this month (light line), but the distribution of flows has changed (dark line). In general, the highest-flow months see reductions as a result of the capture of high flows for new South Platte water supplies when they are available, while the lower-flow months see increases as a result of a modified quantity and timing of return flows and/or the re-regulation of flows at the Tamarack site.

That is, the 48-year average flow at Julesburg for every month of the year is the same as or greater in the modeled scenario than the average flow under the Present Condition. However the distribution of these flows has changed, reflecting a reduction in many high-flow months, and increased flows in many low-flow months. The overall effect is to reduce year-to-year variability in monthly flows.

The cumulative adjustments to monthly flows are shown in **Table 4**. **Table 5** is the adjusted table of monthly flows at Julesburg used to represent this scenario in the Platte EIS model.

Table 1. Present Condition (adjusted historic) Inflows, South Platte at Julesburg (KAF)

2) SOUTH PLATTE RIVER NEAR JULESBURG - ADJUSTED HISTORIC INFLOWS in KAF (HYDROSPHERE:6/26/2000)

	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**TOTAL KAF**
1947	6.4	10.4	1	7.1	7.4	207.5	149.7	6.4	7.1	18.9	21.3	43.8	487
1948	46.2	81.3	84.1	22.4	7.4	7.3	36.5	2.5	14.2	6.2	23.1	36	367.1
1949	39.6	66	22.3	20.9	7.4	372.4	94.3	7.3	24.4	13.3	15.9	20	703.7
1950	42.4	47.3	35.9	8.9	4.2	2.4	4.5	8.6	7.1	6.6	13.6	19.9	201.4
1951	27	36.5	17.9	13.3	7.6	22.7	26	38.3	32.8	32.9	23.7	43.9	322.5
1952	52.4	60.6	54.8	51.8	104.8	82.3	9.9	14	8.2	4.7	9.1	36.3	488.8
1953	40.1	36.8	19.6	26.6	7.4	3	4.1	4.1	2.4	3.6	6	13.4	166.9
1954	11.9	16	14.8	6.7	4.6	2.5	1.6	2.4	1.6	1.9	1.9	4.4	70.3
1955	3.8	7.1	9.5	4.8	5.7	7.1	5	1.4	1.2	3.1	3.9	4.6	57.2
1956	3.5	5.1	6	2.8	2	2.7	1.6	1.6	0.4	2.1	11.4	6.9	46
1957	3.6	4.8	4.4	19.6	136.9	167.7	63.1	42.1	30.3	38.5	40.3	46.7	598.1
1958	78	63.9	52.9	40.4	249.3	123.8	24.1	3.7	4.9	10	24.6	41.5	717.2
1959	38	35.7	32.9	55.8	59.3	22.4	2.9	2.7	2	18.2	39.3	40.8	350
1960	42.9	42	41.4	27.2	30.2	13.5	10.4	9.1	15.5	3.6	17.5	34	287.4
1961	35.5	36.2	13.4	19.4	44.3	168.8	13	18.3	39.7	83.3	87.2	96.4	655.5
1962	101.4	98.8	77.8	24.6	39.2	104.2	8.1	27.2	13	16	35.8	36.3	582.4
1963	34.7	51.5	53.9	7.6	7.4	7.1	9.4	8.7	11.4	17	19.1	32.9	260.7
1964	32.4	19.1	12.5	11	7.4	7.5	11.1	2.5	2.4	1.5	2.7	4.2	114.4
1965	5.2	5.1	5.3	3.9	4	293.1	100.7	101.7	48.2	67.9	63.3	63.9	762.3
1966	53.9	80.7	49.1	25.7	20.4	26.6	16	4.8	7.1	5.9	10.6	23.1	323.8
1967	23.7	22.8	7	3.1	7.4	107.4	96.4	13.2	27.9	13.4	22.6	30	374.8
1968	51.8	45.9	35.5	26.3	16.6	42.2	5.2	77.2	23	14.4	41.8	38.8	418.5
1969	40.1	36.6	25.5	14.1	170	243.7	77.6	3.1	3.8	30.1	62.4	78.1	785.1
1970	116.5	90.1	47	116.3	134.4	236.2	47.2	14.7	30.6	30.5	49.9	44.5	957.9
1971	55.6	68	57.5	44	147.4	103.9	6.6	3.6	25.6	18.3	39.3	39.8	609.7
1972	39.1	53.6	34.8	7.1	7.4	7.1	3.7	2.7	16.8	4.8	16.4	37.7	231.3
1973	54.2	63.3	48.6	72.8	463.8	242.8	7.4	19.2	57.6	78.8	72.2	58.9	1239.7
1974	88.4	73.3	58.8	38.2	7.4	38.4	3.4	3.3	27.6	4.3	16.9	29.6	389.6
1975	44	46.8	16.9	26.7	21.9	110.5	4.8	4.8	18.7	8.7	34.4	47.8	386
1976	58.1	47.1	37	7.1	15.5	7.1	2.9	2.8	2.9	3.7	2.9	3.3	190.5
1977	15.3	25.4	26.2	17	8	27	2.5	5.1	6.8	5.7	5.8	7.8	152.6
1978	7.3	10.2	9.1	4.1	7.4	65.2	5.5	3.7	4.6	3.6	4.1	3.4	128.2
1979	7.6	43.2	23.4	17.4	68.7	315.7	28.5	38.2	39.6	17.1	46.5	70.4	716.1
1980	87.9	104.2	83.4	99.2	605.9	299.2	12.7	2.3	26.5	6.7	25.7	41.9	1395.6
1981	54.6	36.6	23.3	29.2	27.6	48.5	5.9	4.5	2.3	5.8	5.4	11	254.7
1982	8.3	17.7	9.8	7.1	9.1	23.2	25.5	3.9	19	8.1	12.9	46.4	191.1
1983	93.2	78.5	72.9	151.7	435.4	742.2	312.5	66.6	64.8	71.2	56.6	56.2	2201.7
1984	86.9	99.7	65	138.3	355.7	182.5	25.7	48.1	101	136.6	106.5	82.5	1428.5
1985	84.3	96.1	45.6	9.9	119.5	72.9	7.4	7.4	33.8	50	13.5	46	586.4
1986	70.5	52.6	21.6	90.1	24.3	176.5	6.8	4.9	51.6	25.7	29.4	47.3	601.3
1987	51.6	44.5	82.6	50.2	204	134	23.5	6.4	31.5	10.8	14.1	15.2	668.6
1988	51.1	81.3	43.4	15.2	35.9	35.9	3.9	3.1	10	6.9	6.7	19.6	313.1
1989	41.8	32.7	23.2	10	4	7.1	1.8	3.3	25.1	6.1	4.4	1	160.6
1990	47.8	33	43.9	49.7	7.4	7.1	1.9	4.8	7.1	7.1	17.8	29.8	257.6
1991	47.8	46.1	33.1	26.5	7.4	58.7	3.1	3.7	14.2	15.1	5.9	12.1	273.5
1992	40.7	49.7	49.3	37.6	3.2	40.4	13.5	13.1	45.8	32.8	15.4	47.6	389.2
1993	54.5	50.6	58.2	36.4	8.6	24.3	4.2	3.6	43.7	40.1	17.8	33.7	375.6
1994	46.2	45.7	32.2	16.5	7.4	7.1	6.9	2.8	1	6.4	0.5	1	173.8
Mean	***45.2***	***47.9***	***35.9***	***32.5***	***76.8***	***105.2***	***27.9***	***14.1***	***21.6***	***21.2***	***25.4***	***34.0***	***487.8***

Table 2. Cumulative monthly reductions in daily flows attributable to the development of native South Platte supplies and use of legally re-usable return flows only, as modeled by Hydrosphere (AF).

Monthly Total Reductions in Flow at Julesburg (AF) **121 KAF Scenario**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Index Column	31	59	90	120	151	181	212	243	273	304	334
1947	2800	2689	7611	7410	5356	42918	54471	3603	347	3964	5116	7278
1948	7107	10359	8941	7359	11353	11682	3060	258	0	0	0	670
1949	8325	8208	783	767	2088	35575	20837	145	0	0	0	0
1950	0	0	4045	4384	0	0	0	0	0	0	0	0
1951	361	434	337	50	0	0	0	0	0	0	0	0
1952	1456	7018	6544	6022	7169	12328	0	0	0	0	0	0
1953	361	293	204	2768	1943	0	0	0	0	0	0	0
1954	0	0	0	79	0	0	0	0	0	0	0	0
1955	258	337	0	0	0	0	0	0	0	0	0	0
1956	258	192	30	0	0	0	0	0	0	0	0	0
1957	1856	494	30	492	21635	17607	5608	0	0	0	0	0
1958	9227	10540	10030	9560	27215	40558	2136	0	0	0	0	0
1959	258	50	2572	6177	4745	0	0	0	0	0	0	0
1960	1469	4192	6252	8208	7212	3024	0	0	0	0	0	0
1961	155	349	482	1747	5420	2007	0	0	0	0	0	0
1962	6929	7991	7900	7934	1225	5596	299	0	0	0	0	0
1963	2276	5106	5705	313	0	0	0	0	0	0	0	0
1964	103	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	22797	13072	29642	6272	15501	14026	10690
1966	7906	5652	2931	1801	408	744	149	0	0	0	0	0
1967	103	111	702	115	0	7125	11121	514	0	0	0	0
1968	3964	292	3173	3986	488	0	0	0	0	0	0	0
1969	516	99	668	758	43854	60942	15925	149	0	0	0	0
1970	6165	5945	6213	14690	77044	78935	11137	0	0	0	0	0
1971	6276	6623	6849	11031	41629	18164	123	0	0	0	0	0
1972	5925	6720	6354	1848	442	2350	0	0	0	0	0	0
1973	20792	7968	7079	10621	87143	83451	5707	3569	4549	20120	10125	8422
1974	9276	6899	8204	11729	3468	1931	0	0	0	0	0	0
1975	14059	10841	2635	9118	0	25119	1945	0	0	0	0	0
1976	11460	6593	10460	0	0	0	0	0	0	0	0	0
1977	4720	1662	5527	2395	0	0	0	0	0	0	0	0
1978	2054	1007	0	0	0	0	0	0	0	0	0	0
1979	5927	14173	597	0	0	0	0	0	0	0	0	0
1980	16362	19148	18085	46357	115262	89118	6294	0	0	0	0	0
1981	16033	5703	4963	11579	1690	21260	0	0	0	0	0	0
1982	5788	7145	274	71	250	349	13316	0	0	0	0	0
1983	19701	7482	14991	31199	85013	48758	25519	16132	9312	9606	13447	14993
1984	10353	9955	9536	25061	35434	21319	5191	11428	16737	28341	18928	11973
1985	10460	7710	6100	896	23056	17595	3875	224	0	0	0	0
1986	8503	7617	1305	19776	7403	15039	954	0	0	0	0	0
1987	15097	17462	12110	13465	46404	18904	1533	0	0	0	0	0
1988	15410	19542	12981	15099	11053	9844	0	0	0	0	0	0
1989	16461	16794	8791	736	36	0	0	0	0	0	0	0
1990	18537	14468	11515	28660	1682	1678	0	0	0	0	0	0
1991	19211	13992	7295	3272	36	30195	0	0	0	0	0	0
1992	28486	26824	24161	25535	34	0	1168	0	0	0	0	0
1993	16939	19243	20369	21773	222	1612	0	0	0	0	0	0
1994	15574	15434	11242	4168	0	0	0	0	0	0	0	0
Mean	***7818***	***7112***	***5970***	***7896***	***14113***	***15594***	***4238***	***1368***	***775***	***1615***	***1284***	***1126***

Table 3. Net change in monthly flows after flows added back in to account for return flows, accretions, and re-regulation that ensures no decrease in average flows in any month of the year at Julesburg (AF).

Peak flow effects (AF) re-distributed to result in no 48-year average change in flow in any given month (Tamarack II)
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Positive values accretions, negative values depletions. Assumption Tam II can offset this magnitude; addn'l net accretions need to be added in)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1947	5018	4423	-1640	486	8757	-27324	-50233	-2235	428	-2349	-3832	-6152
1948	711	-3248	-2971	537	2760	3912	1179	1110	775	1615	1284	455
1949	-507	-1096	5187	7129	12025	-19981	-16599	1223	775	1615	1284	1126
1950	7818	7112	1925	3512	14113	15594	4238	1368	775	1615	1284	1126
1951	7457	6677	5633	7846	14113	15594	4238	1368	775	1615	1284	1126
1952	6362	94	-574	1874	6944	3266	4238	1368	775	1615	1284	1126
1953	7457	6818	5766	5128	12169	15594	4238	1368	775	1615	1284	1126
1954	7818	7112	5970	7817	14113	15594	4238	1368	775	1615	1284	1126
1955	7560	6774	5970	7896	14113	15594	4238	1368	775	1615	1284	1126
1956	7560	6919	5941	7896	14113	15594	4238	1368	775	1615	1284	1126
1957	5962	6618	5941	7404	-7522	-2013	-1370	1368	775	1615	1284	1126
1958	-1409	-3428	-4060	-1664	-13102	-24964	2103	1368	775	1615	1284	1126
1959	7560	7062	3398	1719	9367	15594	4238	1368	775	1615	1284	1126
1960	6348	2920	-282	-312	6901	12570	4238	1368	775	1615	1284	1126
1961	7663	6763	5488	6149	8693	13587	4238	1368	775	1615	1284	1126
1962	889	-880	-1930	-38	12887	9998	3939	1368	775	1615	1284	1126
1963	5541	2005	265	7583	14113	15594	4238	1368	775	1615	1284	1126
1964	7715	7112	5970	7896	14113	15594	4238	1368	775	1615	1284	1126
1965	7818	7112	5970	7896	14113	-7202	-8834	-28274	-5497	-13886	-12742	-9565
1966	-88	1460	3039	6095	13704	14851	4090	1368	775	1615	1284	1126
1967	7715	7001	5268	7781	14113	8469	-6882	854	775	1615	1284	1126
1968	3854	6820	2798	3910	13625	15594	4238	1368	775	1615	1284	1126
1969	7302	7012	5302	7139	-29741	-45347	-11687	1219	775	1615	1284	1126
1970	1653	1167	-242	-6794	-62931	-63341	-6898	1368	775	1615	1284	1126
1971	1542	488	-879	-3135	-27516	-2570	4115	1368	775	1615	1284	1126
1972	1893	391	-383	6048	13671	13244	4238	1368	775	1615	1284	1126
1973	-12974	-856	-1109	-2725	-73030	-67856	-1469	-2201	-3774	-18504	-8841	-7296
1974	-1459	213	-2233	-3833	10644	13663	4238	1368	775	1615	1284	1126
1975	-6242	-3729	3335	-1222	14113	-9524	2293	1368	775	1615	1284	1126
1976	-3642	518	-4490	7896	14113	15594	4238	1368	775	1615	1284	1126
1977	3098	5450	444	5501	14113	15594	4238	1368	775	1615	1284	1126
1978	5763	6104	5970	7896	14113	15594	4238	1368	775	1615	1284	1126
1979	1891	-7061	5373	7896	14113	15594	4238	1368	775	1615	1284	1126
1980	-8544	-12036	-12115	-38461	-101149	-73524	-2056	1368	775	1615	1284	1126
1981	-8215	1408	1007	-3683	12423	-5666	4238	1368	775	1615	1284	1126
1982	2029	-33	5697	7825	13863	15245	-9078	1368	775	1615	1284	1126
1983	-11883	-370	-9021	-23302	-70900	-33164	-21281	-14764	-8537	-7990	-12163	-13868
1984	-2535	-2843	-3566	-17165	-21322	-5725	-953	-10060	-15961	-26726	-17644	-10848
1985	-2642	-598	-129	7000	-8944	-2001	364	1144	775	1615	1284	1126
1986	-685	-505	4666	-11880	6710	555	3285	1368	775	1615	1284	1126
1987	-7279	-10351	-6140	-5569	-32291	-3310	2705	1368	775	1615	1284	1126
1988	-7592	-12431	-7010	-7203	3059	5751	4238	1368	775	1615	1284	1126
1989	-8643	-9682	-2820	7160	14077	15594	4238	1368	775	1615	1284	1126
1990	-10719	-7356	-5545	-20764	12431	13917	4238	1368	775	1615	1284	1126
1991	-11393	-6880	-1325	4624	14077	-14601	4238	1368	775	1615	1284	1126
1992	-20668	-19712	-18191	-17639	14079	15594	3070	1368	775	1615	1284	1126
1993	-9121	-12131	-14399	-13877	13891	13982	4238	1368	775	1615	1284	1126
1994	-7757	-8322	-5271	3728	14113	15594	4238	1368	775	1615	1284	1126
Mean	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Table 4. Modeled monthly net change from Present Condition (AF).

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1947	10,977	9,658	3,274	2,475	8,757	(27,324)	(50,233)	(1,271)	2,007	(26)	1,578	(320)
1948	6,670	1,987	1,944	2,526	2,760	3,912	1,179	2,075	2,354	3,938	6,694	6,287
1949	5,453	4,139	10,102	9,118	12,025	(19,981)	(16,599)	2,188	2,354	3,938	6,694	6,958
1950	13,777	12,347	6,840	5,501	14,113	15,594	4,238	2,332	2,354	3,938	6,694	6,958
1951	13,416	11,912	10,548	9,836	14,113	15,594	4,238	2,332	2,354	3,938	6,694	6,958
1952	12,322	5,329	4,341	3,863	6,944	3,266	4,238	2,332	2,354	3,938	6,694	6,958
1953	13,416	12,053	10,681	7,117	12,169	15,594	4,238	2,332	2,354	3,938	6,694	6,958
1954	13,777	12,347	10,885	9,806	14,113	15,594	4,238	2,332	2,354	3,938	6,694	6,958
1955	13,519	12,009	10,885	9,885	14,113	15,594	4,238	2,332	2,354	3,938	6,694	6,958
1956	13,519	12,154	10,855	9,885	14,113	15,594	4,238	2,332	2,354	3,938	6,694	6,958
1957	11,921	11,853	10,855	9,393	(7,522)	(2,013)	(1,370)	2,332	2,354	3,938	6,694	6,958
1958	4,550	1,807	855	325	(13,102)	(24,964)	2,103	2,332	2,354	3,938	6,694	6,958
1959	13,519	12,297	8,313	3,708	9,367	15,594	4,238	2,332	2,354	3,938	6,694	6,958
1960	12,308	8,154	4,633	1,678	6,901	12,570	4,238	2,332	2,354	3,938	6,694	6,958
1961	13,623	11,998	10,403	8,138	8,693	13,587	4,238	2,332	2,354	3,938	6,694	6,958
1962	6,849	4,355	2,985	1,951	12,887	9,998	3,939	2,332	2,354	3,938	6,694	6,958
1963	11,501	7,240	5,180	9,572	14,113	15,594	4,238	2,332	2,354	3,938	6,694	6,958
1964	13,674	12,347	10,885	9,885	14,113	15,594	4,238	2,332	2,354	3,938	6,694	6,958
1965	13,777	12,347	10,885	9,885	14,113	(7,202)	(8,834)	(27,309)	(3,918)	(11,563)	(7,332)	(3,733)
1966	5,871	6,695	7,954	8,085	13,704	14,851	4,090	2,332	2,354	3,938	6,694	6,958
1967	13,674	12,235	10,183	9,770	14,113	8,469	(6,882)	1,819	2,354	3,938	6,694	6,958
1968	9,813	12,055	7,712	5,899	13,625	15,594	4,238	2,332	2,354	3,938	6,694	6,958
1969	13,262	12,247	10,217	9,128	(29,741)	(45,347)	(11,687)	2,184	2,354	3,938	6,694	6,958
1970	7,612	6,401	4,672	(4,805)	(62,931)	(63,341)	(6,898)	2,332	2,354	3,938	6,694	6,958
1971	7,501	5,723	4,036	(1,146)	(27,516)	(2,570)	4,115	2,332	2,354	3,938	6,694	6,958
1972	7,852	5,626	4,532	8,037	13,671	13,244	4,238	2,332	2,354	3,938	6,694	6,958
1973	(7,014)	4,379	3,806	(736)	(73,030)	(67,856)	(1,469)	(1,237)	(2,195)	(16,182)	(3,431)	(1,464)
1974	4,501	5,448	2,681	(1,844)	10,644	13,663	4,238	2,332	2,354	3,938	6,694	6,958
1975	(282)	1,505	8,250	767	14,113	(9,524)	2,293	2,332	2,354	3,938	6,694	6,958
1976	2,318	5,753	425	9,885	14,113	15,594	4,238	2,332	2,354	3,938	6,694	6,958
1977	9,058	10,685	5,358	7,490	14,113	15,594	4,238	2,332	2,354	3,938	6,694	6,958
1978	11,723	11,339	10,885	9,885	14,113	15,594	4,238	2,332	2,354	3,938	6,694	6,958
1979	7,850	(1,826)	10,288	9,885	14,113	15,594	4,238	2,332	2,354	3,938	6,694	6,958
1980	(2,584)	(6,801)	(7,200)	(36,471)	(101,149)	(73,524)	(2,056)	2,332	2,354	3,938	6,694	6,958
1981	(2,255)	6,643	5,922	(1,693)	12,423	(5,666)	4,238	2,332	2,354	3,938	6,694	6,958
1982	7,989	5,202	10,611	9,814	13,863	15,245	(9,078)	2,332	2,354	3,938	6,694	6,958
1983	(5,924)	4,865	(4,106)	(21,313)	(70,900)	(33,164)	(21,281)	(13,799)	(6,958)	(5,668)	(6,753)	(8,036)
1984	3,424	2,392	1,349	(15,176)	(21,322)	(5,725)	(953)	(9,096)	(14,382)	(24,403)	(12,234)	(5,016)
1985	3,317	4,637	4,785	8,989	(8,944)	(2,001)	364	2,108	2,354	3,938	6,694	6,958
1986	5,274	4,730	9,580	(9,891)	6,710	555	3,285	2,332	2,354	3,938	6,694	6,958
1987	(1,319)	(5,116)	(1,225)	(3,579)	(32,291)	(3,310)	2,705	2,332	2,354	3,938	6,694	6,958
1988	(1,633)	(7,196)	(2,096)	(5,213)	3,059	5,751	4,238	2,332	2,354	3,938	6,694	6,958
1989	(2,684)	(4,448)	2,094	9,150	14,077	15,594	4,238	2,332	2,354	3,938	6,694	6,958
1990	(4,760)	(2,121)	(630)	(18,775)	12,431	13,917	4,238	2,332	2,354	3,938	6,694	6,958
1991	(5,434)	(1,646)	3,590	6,613	14,077	(14,601)	4,238	2,332	2,354	3,938	6,694	6,958
1992	(14,709)	(14,478)	(13,276)	(15,650)	14,079	15,594	3,070	2,332	2,354	3,938	6,694	6,958
1993	(3,162)	(6,897)	(9,484)	(11,888)	13,891	13,982	4,238	2,332	2,354	3,938	6,694	6,958
1994	(1,797)	(3,087)	(357)	5,717	14,113	15,594	4,238	2,332	2,354	3,938	6,694	6,958
Mean	***5959***	***5235***	***4915***	***1989***	***0***	***0***	***0***	***965***	***1579***	***2323***	***5410***	***5832***

Table 5. Modeled monthly inflows at Julesburg incorporating first-increment Colorado development and re-regulation of accretions (KAF).

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New Monthly Julesburg inflow file (KAF)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
1947	17.4	20.1	4.3	9.6	16.2	180.2	99.5	5.1	9.1	18.9	22.9	43.5	446.6
1948	52.9	83.3	86.0	24.9	10.2	11.2	37.7	4.6	16.6	10.1	29.8	42.3	409.5
1949	45.1	70.1	32.4	30.0	19.4	352.4	77.7	9.5	26.8	17.2	22.6	27.0	730.2
1950	56.2	59.6	42.7	14.4	18.3	18.0	8.7	10.9	9.5	10.5	20.3	26.9	296.1
1951	40.4	48.4	28.4	23.1	21.7	38.3	30.2	40.6	35.2	36.8	30.4	50.9	424.5
1952	64.7	65.9	59.1	55.7	111.7	85.6	14.1	16.3	10.6	8.6	15.8	43.3	551.5
1953	53.5	48.9	30.3	33.7	19.6	18.6	8.3	6.4	4.8	7.5	12.7	20.4	264.6
1954	25.7	28.3	25.7	16.5	18.7	18.1	5.8	4.7	4.0	5.8	8.6	11.4	173.3
1955	17.3	19.1	20.4	14.7	19.8	22.7	9.2	3.7	3.6	7.0	10.6	11.6	159.7
1956	17.0	17.3	16.9	12.7	16.1	18.3	5.8	3.9	2.8	6.0	18.1	13.9	148.7
1957	15.5	16.7	15.3	29.0	129.4	165.7	61.7	44.4	32.7	42.4	47.0	53.7	653.4
1958	82.6	65.7	53.8	40.7	236.2	98.8	26.2	6.0	7.3	13.9	31.3	48.5	711.0
1959	51.5	48.0	41.2	59.5	68.7	38.0	7.1	5.0	4.4	22.1	46.0	47.8	439.3
1960	55.2	50.2	46.0	28.9	37.1	26.1	14.6	11.4	17.9	7.5	24.2	41.0	360.1
1961	49.1	48.2	23.8	27.5	53.0	182.4	17.2	20.6	42.1	87.2	93.9	103.4	748.5
1962	108.2	103.2	80.8	26.6	52.1	114.2	12.0	29.5	15.4	19.9	42.5	43.3	647.6
1963	46.2	58.7	59.1	17.2	21.5	22.7	13.6	11.0	13.8	20.9	25.8	39.9	350.4
1964	46.1	31.4	23.4	20.9	21.5	23.1	15.3	4.8	4.8	5.4	9.4	11.2	217.3
1965	19.0	17.4	16.2	13.8	18.1	285.9	91.9	74.4	44.3	56.3	56.0	60.2	753.4
1966	59.8	87.4	57.1	33.8	34.1	41.5	20.1	7.1	9.5	9.8	17.3	30.1	407.4
1967	37.4	35.0	17.2	12.9	21.5	115.9	89.5	15.0	30.3	17.3	29.3	37.0	458.2
1968	61.6	58.0	43.2	32.2	30.2	57.8	9.4	79.5	25.4	18.3	48.5	45.8	509.9
1969	53.4	48.8	35.7	23.2	140.3	198.4	65.9	5.3	6.2	34.0	69.1	85.1	765.3
1970	124.1	96.5	51.7	111.5	71.5	172.9	40.3	17.0	33.0	34.4	56.6	51.5	860.9
1971	63.1	73.7	61.5	42.9	119.9	101.3	10.7	5.9	28.0	22.2	46.0	46.8	622.0
1972	47.0	59.2	39.3	15.1	21.1	20.3	7.9	5.0	19.2	8.7	23.1	44.7	310.7
1973	47.2	67.7	52.4	72.1	390.8	174.9	5.9	18.0	55.4	62.6	68.8	57.4	1073.2
1974	92.9	78.7	61.5	36.4	18.0	52.1	7.6	5.6	30.0	8.2	23.6	36.6	451.2
1975	43.7	48.3	25.1	27.5	36.0	101.0	7.1	7.1	21.1	12.6	41.1	54.8	425.4
1976	60.4	52.9	37.4	17.0	29.6	22.7	7.1	5.1	5.3	7.6	9.6	10.3	265.0
1977	24.4	36.1	31.6	24.5	22.1	42.6	6.7	7.4	9.2	9.6	12.5	14.8	241.4
1978	19.0	21.5	20.0	14.0	21.5	80.8	9.7	6.0	7.0	7.5	10.8	10.4	228.3
1979	15.5	41.4	33.7	27.3	82.8	331.3	32.7	40.5	42.0	21.0	53.2	77.4	798.7
1980	85.3	97.4	76.2	62.7	504.8	225.7	10.6	4.6	28.9	10.6	32.4	48.9	1188.1
1981	52.3	43.2	29.2	27.5	40.0	42.8	10.1	6.8	4.7	9.7	12.1	18.0	296.6
1982	16.3	22.9	20.4	16.9	23.0	38.4	16.4	6.2	21.4	12.0	19.6	53.4	266.9
1983	87.3	83.4	68.8	130.4	364.5	709.0	291.2	52.8	57.8	65.5	49.8	48.2	2008.8
1984	90.3	102.1	66.3	123.1	334.4	176.8	24.7	39.0	86.6	112.2	94.3	77.5	1327.4
1985	87.6	100.7	50.4	18.9	110.6	70.9	7.8	9.5	36.2	53.9	20.2	53.0	619.6
1986	75.8	57.3	31.2	80.2	31.0	177.1	10.1	7.2	54.0	29.6	36.1	54.3	643.8
1987	50.3	39.4	81.4	46.6	171.7	130.7	26.2	8.7	33.9	14.7	20.8	22.2	646.5
1988	49.5	74.1	41.3	10.0	39.0	41.7	8.1	5.4	12.4	10.8	13.4	26.6	332.2
1989	39.1	28.3	25.3	19.1	18.1	22.7	6.0	5.6	27.5	10.0	11.1	8.0	220.8
1990	43.0	30.9	43.3	30.9	19.8	21.0	6.1	7.1	9.5	11.0	24.5	36.8	284.0
1991	42.4	44.5	36.7	33.1	21.5	44.1	7.3	6.0	16.6	19.0	12.6	19.1	302.8
1992	26.0	35.2	36.0	22.0	17.3	56.0	16.6	15.4	48.2	36.7	22.1	54.6	386.0
1993	51.3	43.7	48.7	24.5	22.5	38.3	8.4	5.9	46.1	44.0	24.5	40.7	398.7
1994	44.4	42.6	31.8	22.2	21.5	22.7	11.1	5.1	3.4	10.3	7.2	8.0	230.4
Mean	***51.1***	***53.2***	***40.8***	***34.5***	***76.8***	***105.2***	***27.9***	***15.1***	***23.2***	***23.5***	***30.8***	***39.8***	***522.0***