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# Nominal Raise of Viva Naughton Reservoir, A Supplement to The Viva Naughton Enlargement Study, Level II, Phase II – Executive Summary



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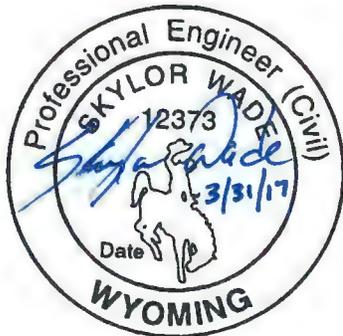
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**Western EcoSystems Technology, Inc.**  
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**Fugro Geospatial, Inc.**  
Rapid City, SD

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March 2017

This document is released under the authority of Skylor W. Wade, P.E. on March 31, 2017.



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Skylor W. Wade, P.E.  
Associate



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# 1.0 Introduction

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This report presents the results of the investigation of the nominal raise of Viva Naughton Reservoir, a supplement to the Viva Naughton Enlargement Study, Level II, Phase II (States West 2013), and provides a summary of the work completed and recommendations going forward.

## 1.1 PROJECT BACKGROUND

Wenck Associates, Inc. (Wenck), formerly States West Water Resources Corporation, was retained by the Wyoming Water Development Commission (WWDC) on March 13, 2014 as Amendment No. 8 to the Level II, Phase II study for the purpose to investigate the technical feasibility of a nominal raise (approximately 4,500 acre-feet) of Viva Naughton Reservoir based on the recommendations presented in Section 10 of the Viva Naughton Enlargement Study Level II, Phase II Final Report (States West, 2013). The tasks associated with the investigation of a nominal raise of Viva Naughton Reservoir consist of the following:

- Topographic Survey
- Reservoir Modeling and Operation
- Wetland and Sage Grouse Analysis
- Permitting and Environmental Compliance
- Geotechnical Investigation
- Flood Hydrology and Routing
- Preliminary Design

The following tasks have been completed and are documented in the final report:

1. LiDAR topographic survey and aerial images of the reservoir were completed along with a ground survey of the mudflats and wetlands on the north end of the reservoir.
2. The StateMod hydrologic model previously developed for the Hams Fork was updated through 2014. Firm yield of the proposed enlargement and shortages in the basin were estimated.
3. Completed an aquatic resource inventory and wetland functional value assessment.
4. Completed a detailed analysis of the timing and length of inundation as well as the depth of water for existing wetlands.
5. The Density and Disturbance Calculation Tool (DDCT) was updated based on the nominal raise of the reservoir and new guidance on calculating existing disturbances to determine the total surface disturbance and compliance with the Greater Sage-Grouse Executive Order.
6. Submitted a jurisdictional determination request to the U.S. Army Corps of Engineers (USACE).
7. Completed a geotechnical evaluation for a nominal raise of the reservoir based on existing information and developed a subsurface exploration plan to collect geotechnical data from the core, downstream shell and foundation to refine the seismic deformation analysis and support the design of raising the normal water surface elevation.
8. Submitted the proposed subsurface exploration plan to the Federal Energy Regulatory Commission (FERC) for review and approval.
9. Attended numerous meetings and conference calls with the WWDO, PacifiCorp, FERC and the Hams Fork Water Users Association (HFWUA) to discuss the project, water shortages in the basin, and future water demands for both the HFWUA and PacifiCorp.

At the conclusion of this study the project team had not yet obtained approval from FERC to conduct the subsurface exploration plan of Viva Naughton Dam. The subsurface exploration plan was submitted to FERC on March 7, 2016. Following discussions with WWDO, PacifiCorp, and the HFWUA, it was agreed the project would be concluded, the subsurface exploration plan would no longer be conducted, and PacifiCorp would start negotiations with the HFWUA to lease an additional 4,000 acre-feet of storage from Viva Naughton Reservoir. Given the lack of geotechnical data, the preliminary design for the nominal raise of Viva Naughton Reservoir was not advanced under this study, and there was no effort to update the flood hydrology and routing associated with an enlargement.

Since the June 7, 2007 execution of the Viva Naughton Enlargement, Level II, Phase II Study, future water demands in Viva Naughton Reservoir have changed. During the early 2000's PacifiCorp was interested in expanding the capacity of the Naughton Powerplant. This expansion would have involved additional water demands. Recent environmental regulations and PacifiCorp's long term plan to meet these regulations through coal to natural gas conversion and/or shutting down units, has reduced PacifiCorp's need for additional water storage. This has put PacifiCorp in a position to lease water to the HFWUA from the Viva Naughton Reservoir facility. Both parties have expressed a willingness to pursue a supplemental water use agreement which would allow the HFWUA to utilize an additional 4,000 acre-feet of water in lieu of an enlargement to Viva Naughton Reservoir.

HFWUA and PacifiCorp have been parties to a water use agreement (WUA) since the early 2000's, relating to the storage and release of water in Viva Naughton Reservoir. In its most current form, approved on April 5, 2013, the parties are allowed to extend the agreement for additional two year terms, not to exceed more than ten years from the Effective Date. On March 3, 2015, HFWUA and PacifiCorp agreed to extend the agreement two years with an expiration date of April 5, 2017. This agreement is included in the appendix of the final report. The water use agreement allows HFWUA to use up to 80 cubic feet per second (cfs) of direct flows in Hams Fork River released from Viva Naughton Reservoir commencing on May 1 and continuing through May 14 of each year. From May 15 through the end of runoff of each calendar year PacifiCorp will release up to 141 cfs from Viva Naughton Reservoir for use by HFWUA. HFWUA may request additional releases from the reservoir, but any additional releases come from an irrigation pool of 6,000 acre-feet. PacifiCorp holds the 6,000 acre-foot irrigation pool for the benefit of HFWUA which is available from May 1 through September 30 of each year. There is no carryover of the irrigation pool from year to year. Furthermore, the agreement calls for HFWUA to waive its rights to demand or otherwise call for any additional flows from the Hams Fork River or discharges from the Viva Naughton Reservoir over and above the minimum flows or irrigation pool. Negotiations are currently underway to extend this agreement an additional two years and, as stated, complete a separate agreement for the lease of an additional 4,000 acre-feet stored in Viva Naughton Reservoir. Initial discussions regarding the terms of the lease of 4,000 acre-feet are as follows:

1. Water would only be available in years where Viva Naughton Reservoir fills completely (elevation 7241.7 feet currently).
2. The cost of additional water is proposed at \$15/acre-foot.
3. The maximum amount of additional water that would be made available for purchase is 4,000 acre-feet.
4. No changes will be made to the current Water Use Agreement – the 6,000 acre-ft irrigation pool agreement remains unchanged.
5. Calls for purchased water will be made from HFWUA (not individuals) as per the current agreement.

6. Invoices/payments for purchased water will be worked through HFWUA (not individuals).
7. PacifiCorp's responsibility is to release water only – users must ensure their systems are capable of getting the water from the river.
8. Billing is based on point of discharge only – PacifiCorp's delivery point of purchased water is at the Viva Naughton Reservoir discharge point and not individual head gates.
9. There will be no carry-over from year-to-year (ends 9/30 each year).
10. HFWUA are responsible to monitor/enforce compliance within the water users.
11. Purchased water will be segregated and reported on the normal weekly report (produced by the Naughton plant).
12. Requests for releases of purchased water to be made via email with at least 24-hours advanced notice – normal work days only.
13. Either party can terminate the purchase agreement.
14. Initially, the trial period would be for 1-year with a possible 1-year extension. The trial period would be required to allow any unforeseen issues that may arise to be dealt with and incorporated into an updated written agreement.

## 2.0 Topographic Survey

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On June 2, 2015, Fugro Geospatial, Inc. completed aerial LiDAR acquisition and processing services as well as aerial imagery acquisition and processing of Viva Naughton Dam and Reservoir. 6" pixel resolution, color orthophotography and one foot contour data was developed from the LiDAR survey. This data is included in the working files DVD for the project. Ground control was provided by Crank Companies, Inc. out of Kemmerer, Wyoming. The LiDAR data was acquired when the reservoir was full and contours below the normal high water elevation could not be developed. These contours were needed to determine inundation tolerances of the wetlands; therefore, an additional ground survey of the wetlands and mud flats below the normal high water elevation was completed by Crank Companies in the fall of 2015 after the water surface elevation was below the existing wetlands. The survey data was used in conjunction with historic water surface elevations and wetland delineations to accurately assess the timing, length and depth of inundation of existing wetlands under normal high water conditions to determine inundation tolerances of the wetland species.

## 3.0 Reservoir Modeling and Operation

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The Hams Fork StateMod model developed in the Viva Naughton Enlargement, Level II Study (ECI 2004) analyzed the period from 1945 through 2002. This model was extended from 2003 through 2014. All changes were made directly to the input files and comments describing the changes were added in the file headers. The model is simple and static. The only dynamic dataset in the model is streamflow. Therefore, streamflow data was incorporated to update the model. Area-precipitation proration factors were calculated based on the natural flow gauge USGS 09223000 Hams Fork below Pole Creek near Frontier, WY and used to distribute natural flow to ungauged locations. Average annual precipitation was determined from 1981-2010 PRISM precipitation data.

### 3.1 BASELINE SHORTAGES

The baseline StateMod model does not reflect the water use agreement between PacifiCorp and the Hams Fork Water Users Association (HFWUA), whereby PacifiCorp makes available and releases some water from Viva Naughton Reservoir with certain conditions to the HFWUA in exchange for downstream senior water right holders to limit calls placed on the reservoir. Therefore, the baseline model is set with no storage available to irrigation demands. Municipal demands for Kemmerer are represented in the model. Baseline annual irrigation shortages for all ditches in the watershed average 4,100 acre-feet. Baseline annual irrigation shortages for the ditches below Viva Naughton Reservoir average 2,000 acre-feet. Annual municipal shortages average 234 acre-feet. July and August municipal shortages average 64 and 140 acre-feet respectively.

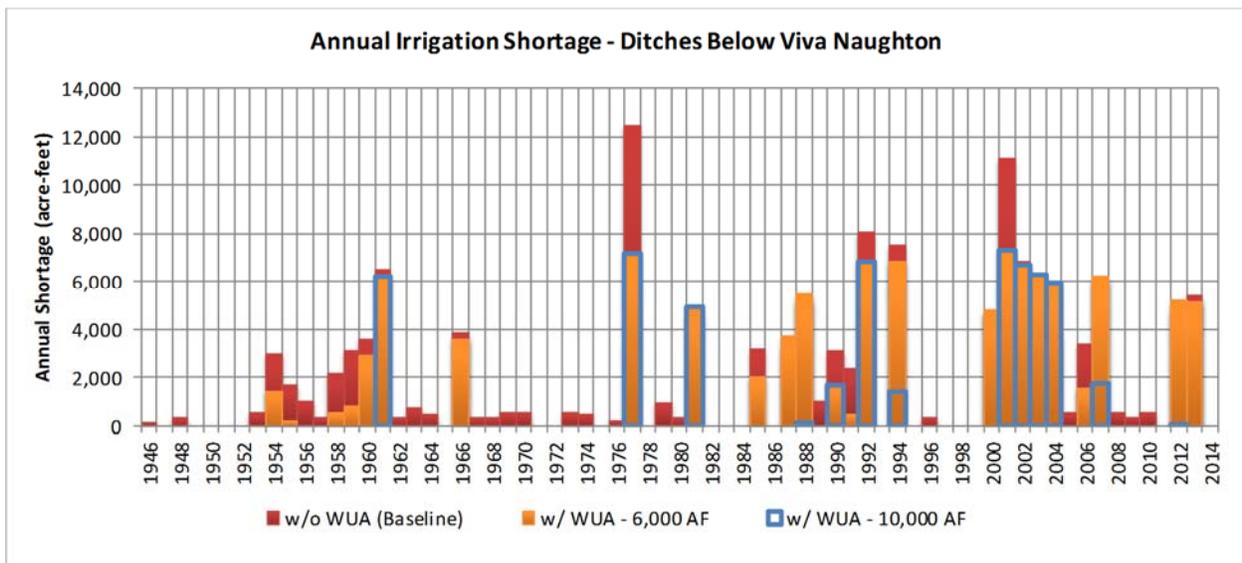
### 3.2 WATER USE AGREEMENT SCENARIO

As stated previously, a water use agreement is currently in place between PacifiCorp and the Hams Fork Water Users Association (HFWUA). With the agreement, the HFWUA agree to not place any calls on Viva Naughton Reservoir. In exchange for these restrictions and release limitations, the HFWUA receive 6,000 acre-feet of storage water in Viva Naughton Reservoir each water year.

A second temporary water use agreement is being discussed whereby an additional 4,000 acre-feet may be made available to the HFWUA only if Viva Naughton Reservoir fills that year. Again, as stated previously, details of this agreement are still being developed.

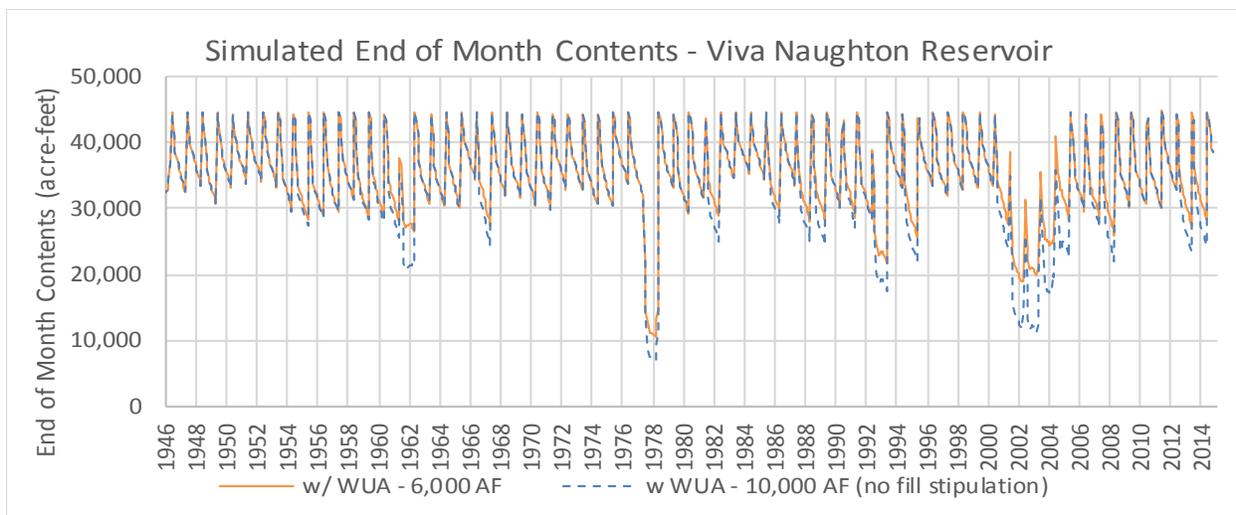
A scenario was developed in the StateMod model to simulate the existing water use agreement and the proposed second water use agreement. The limited releases in the existing agreement from May through June satisfy the downstream irrigation demands as they are set in the model. The downstream irrigation demands set in the model from July through September total 18,000 acre-feet which significantly exceeds the 6,000 and 10,000 acre-feet allocated in the existing and proposed water use agreements, respectively. In the model simulation, return flows help to make up some of the difference and Viva Naughton Reservoir is set to bypass inflow after filling due to the one fill rule. Shortages are eliminated in July under these water use agreement scenarios. It is assumed that inflow bypasses from Viva Naughton Reservoir in the period from July through September due to the one fill rule are not charged to the 6,000 acre-feet agreement allotment. If these bypasses were charged to the agreement allotment, then irrigation shortages in this period would increase. Model simulation indicates no municipal shortages occur under the existing water use agreement scenario. Annual irrigation shortages for all ditches in the watershed average 2,300 acre-feet and the ditches below Viva Naughton Reservoir average 1,500 acre-feet in the existing water use agreement scenario which allocates 6,000 acre-feet to the HFWUA. Annual irrigation

shortages for all ditches in the watershed average 1,600 acre-feet, and the ditches below Viva Naughton Reservoir average 820 acre-feet in the proposed scenario with the existing water use agreement plus an additional 4,000 acre-feet for a total of 10,000 acre-feet allocated to the HFWUA. This proposed scenario allocates the additional 4,000 acre-feet only if Viva Naughton Reservoir fills. The years the reservoir did not fill in the existing water use agreement scenario were noted and no further shortage reductions were assumed in these years in the proposed water use agreement scenario. Based on this analysis, the proposed water use agreement provides benefit beyond the existing water use agreement scenario in 16 years (**Figure 3-1**). If the additional 4,000 acre-feet were allocated regardless if the reservoir fills, then annual irrigation shortages for all ditches in the watershed would average 900 acre-feet and the ditches below Viva Naughton Reservoir would average 160 acre-feet and only eight years in the modeling period would have significant shortages.



**Figure 3-1: Annual Irrigation Shortage – Ditches Below Viva Naughton**

Simulated reservoir end of month contents are presented in **Figure 3-2** for the existing water use agreement scenario and the proposed water use agreement scenario without the stipulation that the reservoir must fill. The additional 4,000 acre-feet was made available regardless if the reservoir filled in this simulation of end of month contents. The model simulation indicates reservoir storage is not depleted under either scenario. Furthermore, it's worth noting a year-round industrial demand of 20 cfs was utilized in the modeling, which is quite conservative considering current PacifiCorp operations.



**Figure 3-2: Simulated End of Month Contents – Viva Naughton Reservoir**

### 3.3 VIVA NAUGHTON RESERVOIR ENLARGEMENT SCENARIO

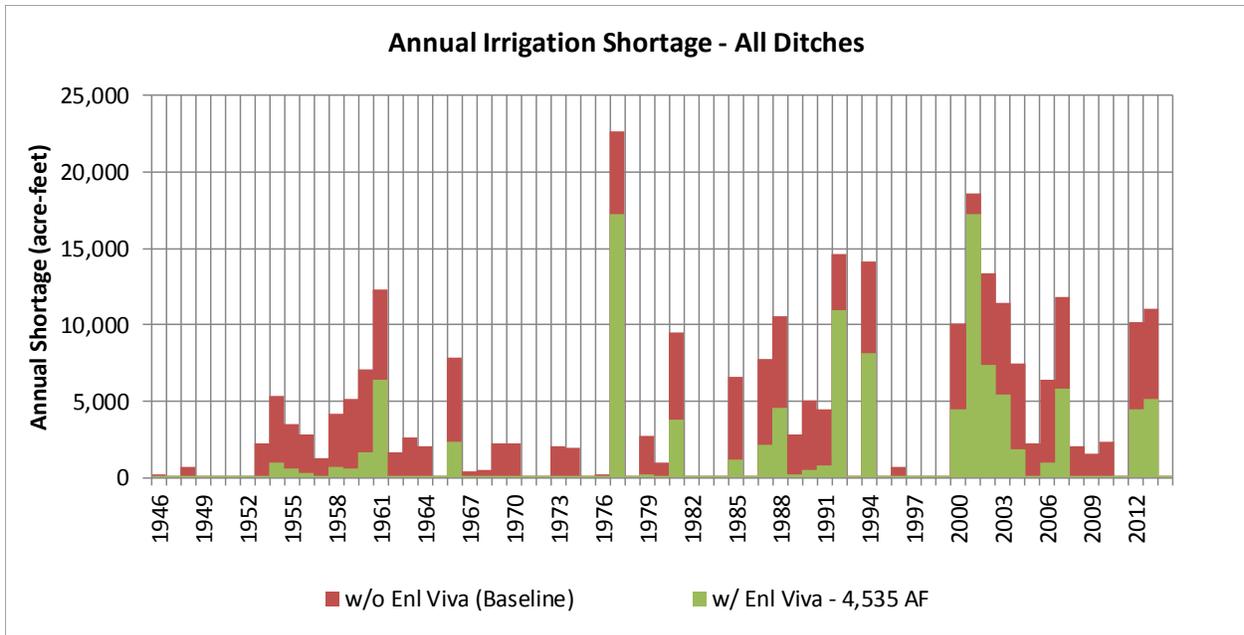
A proposed 4,535 acre-foot enlargement of Viva Naughton Reservoir for irrigation use was simulated in the model. The existing and proposed water use agreement conditions were not set in the model for this scenario. It was assumed that if the HFWUA constructed an enlargement they would no longer participate in the existing water use agreement, however; if the existing water use agreement remains in place with the enlargement scenario, then shortage reductions would be similar to the proposed water use agreement scenario.

#### 8 out of 10 Year Firm Yield

The 8 out of 10 year firm yield of a reservoir is determined by iteratively adjusting the specified release amount until the storage is depleted during 20 percent of the years of the modeling period (i.e. the specific amount of water a reservoir will be able to release in 80% of the modeled years). The firm yield analysis accounts for carry over storage and is a function of available water and capacity of the reservoir and is independent of irrigation shortages or actual demands. The firm yield is the specific amount of water that could be released from the reservoir given there is a potential use. A 4,535 acre-foot enlargement of Viva Naughton Reservoir could provide an 8 out of 10 year firm yield of 4,300 acre-feet.

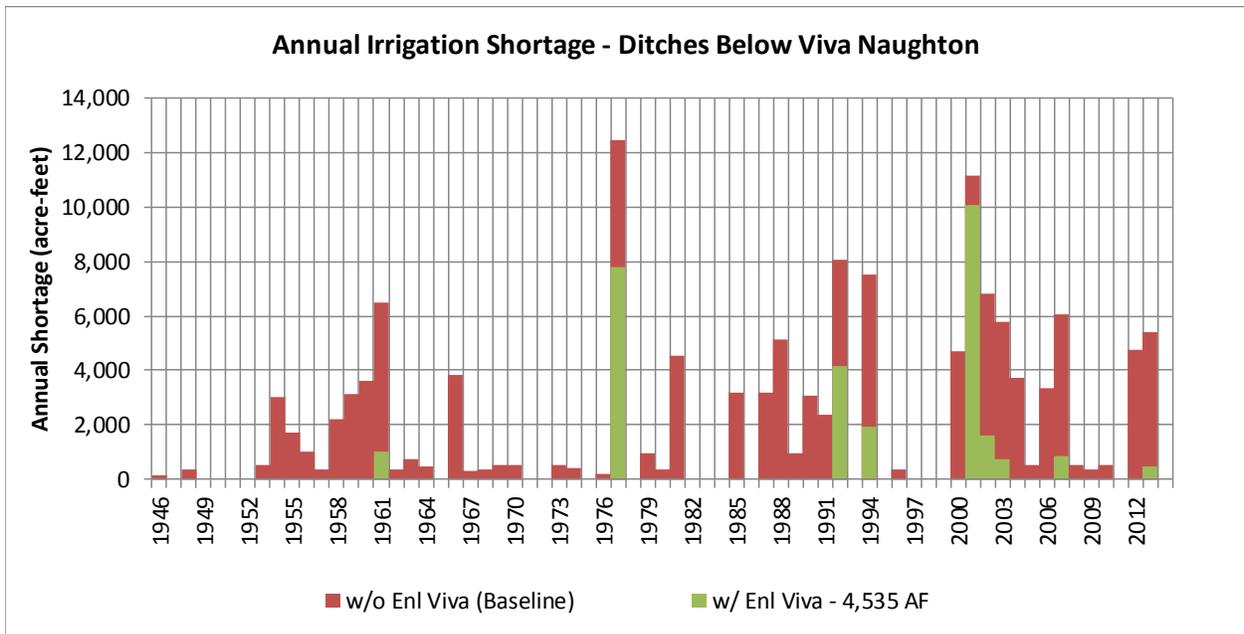
#### Shortage Reduction

The proposed 4,535 acre-foot enlargement was allocated to both downstream irrigation demands and upstream irrigation demands by exchange. Model simulation indicates average annual irrigation shortage could be reduced from 4,100 acre-feet to 1,700 acre-feet under this scenario (**Figure 3-3**).



**Figure 3-3: Annual Irrigation Shortage – All Ditches in Hams Fork Watershed**

Another scenario was analyzed where the enlargement account was only allocated to downstream irrigation demands. Model simulation indicates average annual irrigation shortage could be reduced from 2,000 acre-feet to 420 acre-feet under this scenario (**Figure 3-4**).



**Figure 3-4: Annual Irrigation Shortage – Ditches Below Viva Naughton**

## 4.0 Wetland Evaluation

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Western Ecosystems Technologies, Inc. (WEST) completed an aquatic resource inventory and wetland functional value assessment report for the Viva Naughton Reservoir enlargement project in Lincoln County, Wyoming. The current dam inundates an area up to an elevation of 7,242 feet. The proposed enlargement would result in the dam being raised three feet and the new inundation area would extend to 7,245 feet elevation. WEST quantified the acreage and functional value of wetlands that could possibly be impacted once the dam is raised.

### 4.1 AQUATIC RESOURCE INVENTORY

The aquatic resources inventory was conducted by reviewing color IR aerial photography, Google Earth photography, topographic maps, National Wetland Inventory (NWI) maps, the National Hydrology database, and previous reports, followed by a field investigation. The field investigation was conducted on September 2-3, 2014, by Greg Johnson, Luke Martinson, Kurt Flaig, and Elizabeth Lack, all wetland scientists at WEST. The field investigation included all areas between the existing reservoir pool at the time of the delineation and the proposed new high water elevation of 7,245 feet, which was roughly indicated on aerial photographs of the reservoir for use as a guide during the field survey.

#### 4.1.1 Wetlands

Viva Naughton Reservoir is situated in a valley with relatively steep slopes on the east and west sides. Very few wetlands occur along either the east or west sides of the reservoir where the slopes generally extend down to the water's edge. The vast majority of wetlands occur upstream of the reservoir in a relatively flat bench along the Hams Fork River. Forty-eight sample points were used to evaluate wetlands potentially impacted by raising the dam of Viva Naughton Reservoir (**Figure 4-1**). **Table 4-1** summarizes information for each wetland. The complete wetland report is presented in the appendix of the final report. In a letter dated October 18, 2016, PacifiCorp requested a jurisdictional determination from the U.S. Army Corps of Engineers (USACE) of the Viva Naughton Reservoir ordinary high water mark and wetlands so as to identify avoidance and minimization opportunities. To assist in the USACE analysis, end of month reservoir elevations from 1961 to September 2016, daily elevations from 1994 to October 2016, as well as the Aquatic Resources Inventory and Wetland Functional Value assessment completed by WEST were provided.

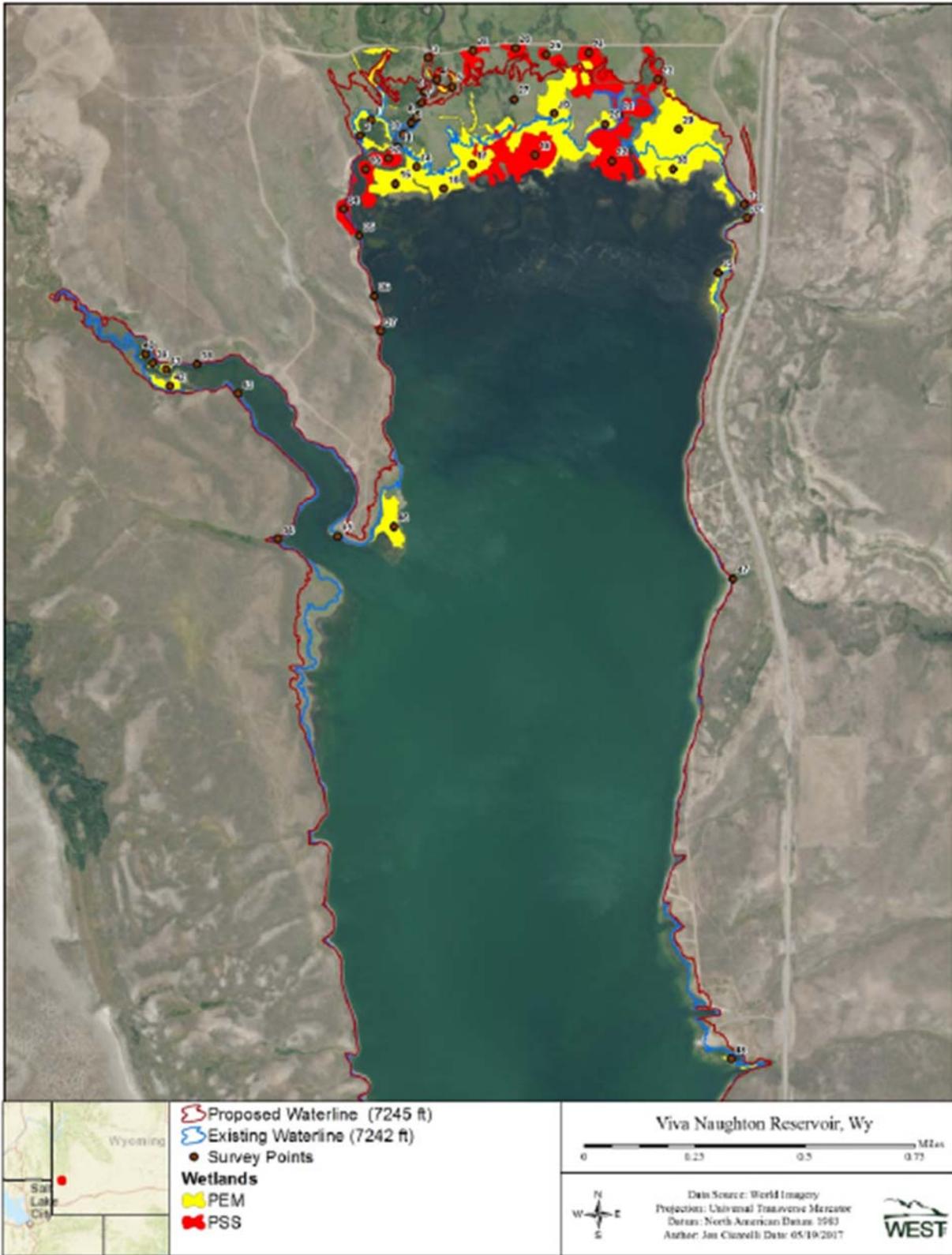


Figure 4-1: Location and type of wetlands at Viva Naughton Reservoir

**Table 4-1: Summary of Project Area Wetlands and Potential Impacts**

Wetland ID Number *	Description 	Potential impact (acres)
1-2, 14-17, 30-31	Palustrine emergent (PEM) wetlands below 7,242 feet in the upper end of Viva Naughton Reservoir.	NA
19-20, 29	PEM wetlands above 7,242 feet but below the proposed new elevation (7,245 feet) in the upper end of Viva Naughton Reservoir.	29.33
32-33, 38, 40-48	PEM wetland fringes along the existing Viva Naughton Reservoir shoreline above 7,242 feet but below the proposed new elevation (7,245 feet).	0.23
3-10	PEM wetland fringes along the Hams Fork River above elevation 7,242 feet but below the proposed new elevation (7,245 feet).	1.10
21, 27	Palustrine Scrub-Shrub (PSS) wetlands within secondary channels above 7,242 feet but below the proposed new elevation (7,245 feet) in the upper end of Viva Naughton Reservoir.	1.05
12-13, 18, 22	PSS wetlands below the existing 7,242 in the upper end of Viva Naughton Reservoir.	NA
23-26, 28	PSS wetlands above the existing 7,242 feet but below the proposed new elevation (7,245 feet) in the upper end of Viva Naughton Reservoir.	3.08
34-37, 39	PSS fringes along the existing Viva Naughton Reservoir shoreline above 7,242 feet but below the proposed new elevation (7,245 feet).	0.45
<b>Total</b>		<b>35.24</b>

\*See Attachment B

#### 4.2 WETLAND FUNCTIONAL VALUE ASSESSMENT

To assist with developing the wetland mitigation plan, a functional assessment was conducted for wetlands potentially impacted by enlarging the reservoir. As stated, forty-eight sample points were used to evaluate wetlands (**Figure 4-1**), and summarized in **Table 4-1**. Representative wetlands, for all types in the project area that may potentially be impacted, were evaluated to quantify their functions and values.

No federally listed species or sensitive species tied to streams or wetlands are likely to occur in the project area. The assessment considers all twelve functions and values (when applicable), which are rated as “low”, “moderate”, or “high” and scored on a scale of 0.1 (lowest) to 1 (highest) “functional points”. Functional points are summed and expressed as a percentage of the possible total. This percentage is then used in conjunction with other criteria to provide an overall wetland ranking from Category I through IV. Category I

wetlands are of exceptionally high quality and are generally rare to uncommon in the state or are important from a regulatory standpoint. Category II wetlands are more common than Category I wetlands and are those that provide habitat for sensitive plants or animals, function at very high levels for wildlife/fish habitat, are unique in a given region, or are assigned very high ratings for other functions or values. Category III wetlands are typically quite common, and less diverse, smaller, and more isolated than wetlands in a higher rated category (i.e., I or II). They can provide many functions and values, but are not primary habitat for federally-listed threatened or endangered species, are not unique or rare, or are not assigned a high rating for the other functions and values assessed. Category IV wetlands are generally small, isolated, and lack vegetative diversity. These sites provide little in the way of wildlife habitat and are often directly or indirectly disturbed.

#### **4.2.1 Functional Value Assessment Results**

All the wetlands within the project area were rated Category III. Based on results of the functional assessment, the total value of potentially impacted wetlands in the project area was 156.87 Functional Units.

#### **4.3 WETLAND INUNDATION ANALYSIS**

Some wetlands within the reservoir footprint would be seasonally submerged once the dam is raised. Wenck Associates (2016) prepared a detailed analysis of the timing and length of inundation as well as the depth of water for existing wetlands under normal high water conditions. Reservoir elevation data for a period of record of 19 years were used in the analysis. Based on a LiDAR topographic survey of the reservoir and maps of wetlands from the delineation, it was determined that the bottom elevation of the wetland complex was 7,238.0 feet. Using the bottom elevation of wetlands and the normal high water line of the reservoir, it was determined that existing wetlands between these two elevations were inundated at some point 17 years over the 19-year period of record. The median length of inundation of these wetlands was estimated to be 88 days for the 19-year period. The length of inundation varied among the 17 years from 24 to 170 days. The approximate depths of inundation also were examined. The average length of time that water was at or above the elevation of 7,238 feet was 88 days. For wetlands at the 7,238 foot elevation, the length of time that the maximum water depth was > 4 feet averaged 12 days. Maximum water depths of 3 feet occurred for an average of 36 days, while maximum water depths of 2 feet occurred for an average of 55 days and maximum water depths of 1 foot occurred for an average of 70 days. The analysis indicated that wetlands between 7,238 and 7,239 feet are, on average, inundated from May 13 through August 9. The length of inundation becomes shorter with increases in elevation. Wetlands at elevations of 7,242 to 7,243 feet would be inundated on average from June 14 through June 26.

WEST conducted a literature review to determine the inundation duration tolerances of the dominant plant species found in wetlands at the Viva Naughton Reservoir site. Most species appear tolerant of flooding for all or most of the growing season, particularly willows and sedges. Many grass species, especially Kentucky bluegrass (*Poa pratensis*) and tufted hairgrass (*Deschampsia caespitosa*), are likely to decline. Based on this information, it appears that wetlands that are flooded for 2 to 3 months during the growing season would continue to function as wetlands and maintain a dominance of hydrophytic species, although there may be slight shifts in species composition. Specifically, grasses are likely to decline and sedges and rushes are likely to increase in dominance. No change in willow composition is anticipated.

The literature indicates that dominant species in the wetlands along the margin of the reservoir would tolerate periodic flooding during times of raised normal high water levels. Existing wetlands at Viva Naughton Reservoir between 7,238 and 7,242 feet have persisted

despite an average of up to 88 days of inundation per year, including an average of 12 days per year inundated >4 feet of water. Based on analysis of existing wetlands in relation to past high water levels and a review of the literature, all of the wetlands at the upper end of the reservoir are likely to persist. No loss of PSS wetlands is expected. PEM wetlands also would likely persist, although some changes in species composition would likely occur (e.g., change from grass-dominated to sedge-dominated).

## 5.0 Permitting and Environmental Compliance

### 5.1 GREATER SAGE GROUSE HABITAT DISTURBANCE ANALYSIS

The Density and Disturbance Calculation Tool (DDCT) developed in the Viva Naughton Enlargement Study, Level II, Phase II (States West 2013) was updated based on new guidance for calculating existing disturbances, and a total surface disturbance associated with the reservoir enlargement was determined. The new guidance issued after the Phase II report was completed states existing reservoirs such as Viva Naughton Reservoir and Kemmerer Reservoir are not to be included as existing disturbances in the DDCT analysis. As shown in **Table 5-1**, new disturbances associated with the nominal water level raise would be approximately 65 acres. The additional disturbance areas would be within a core sage grouse habitat population, and the effects of the additional inundation would occur in June and July. The previous Phase II report determined the existing surface disturbances in the DDCT area to be approximately 3,832 acres; of which, approximately 1,558 acres were Viva Naughton Reservoir and Kemmerer Reservoir, and 2,274 acres were existing hayfields north of Viva Naughton Reservoir. Subtracting the existing reservoirs from the disturbance area results in a total existing disturbance of approximately 2,274 acres. The combined existing and proposed disturbance was approximately 2,339 acres. Compared to the total DDCT analysis area of 66,358 acres, the total disturbance represents 3.5% of the DDCT analysis area. This is less than the 5% disturbance threshold listed in the Governor's Executive Order.

**Table 5-1: Types and acres of disturbance within the Viva Naughton Reservoir Density and Disturbance Calculation Tool analysis area**

<b>Disturbance type</b>	<b>Acres</b>
<i>Proposed Disturbance</i>	
3' Raise of Viva Naughton Reservoir	65
<i>Existing Disturbance</i>	
Existing Reservoirs (Viva Naughton Reservoir, Kemmerer Reservoir)	1,558
Croplands	2,274
<b>Total disturbance</b>	<b>3,832</b>
<b>Total disturbance (minus existing Reservoirs)</b>	<b>2,339</b>
<b>Total area in DDCT</b>	<b>66,358</b>
<b>% disturbance in DDCT</b>	<b>3.5</b>

Based on the results of the DDCT analysis, the proposed Viva Naughton Reservoir enlargement will not significantly impact sage grouse habitat and mitigation for the species is not expected to be required.

### 5.2 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) COMPLIANCE

Depending on the extent of improvements to the dam embankment, spillways, power facilities and potential enlargement scenarios, the extent of NEPA review and Federal permitting requirements differ considerably. Prior to any proposed improvements to the dam and appurtenances and any proposed reservoir storage expansion, preliminary meetings with the Federal Energy Regulatory Commission (FERC) and the U.S. Army Corps of Engineers should be held to present the preferred alternative and other options that were considered. Written evaluations of NEPA and permitting requirements from these two agencies should be requested.

An enlargement of Viva Naughton Reservoir will likely require compliance with the provisions of NEPA. At this time, it appears that the Federal Energy Regulatory Commission (FERC) would be the Lead Federal Agency responsible for NEPA compliance. At a minimum, an Environmental Assessment (EA) will need to be prepared and depending on the extent of environmental impact (to be determined by FERC) an Environmental Impact Statement (EIS) may be required. FERC typically prepares an EA to support licensing decisions. An EIS is required for those actions determined by FERC staff to be a major federal action significantly affecting the quality of the human environment.

If construction of the dam and appurtenances below the Ordinary High Water Mark (OHWM) of the reservoir pool can be avoided, a 404 Permit issued by the U.S. Army Corps of Engineers (USACE) will not be needed. However, if work below the OHWM is necessary and the FERC determines an EIS is needed, the following discussion will be the appropriate course of action.

Cooperating agencies in the NEPA EIS process would likely include:

- The Wyoming Water Development Commission
- The U.S. Army Corps of Engineers
- The United States Environmental Protection Agency
- The Wyoming Department of Environmental Quality
- The Wyoming Game and Fish Department
- PacifiCorp

Other potential cooperating agencies could include:

- Lincoln County
- Local Conservation District(s)

A jurisdictional determination request was submitted to USACE. Should the WWDC decide to pursue construction of the project, more detailed permitting discussions with the FERC and the USACE are needed.

## 6.0 Geotechnical Investigation

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Based on recommendations from the Viva Naughton Enlargement Study, Level II, Phase II (States West 2013), RJH Consultants, Inc. (RJH) was retained to perform a geotechnical evaluation for raising the normal water surface of Viva Naughton Reservoir by three feet. In 2012, RJH performed preliminary slope stability and seismic deformation analyses to support the evaluation of raising the Viva Naughton Reservoir from (El.) 7242 to El. 7245. These preliminary analyses concluded the following:

- Raising the reservoir pool has a negligible impact on the computed static slope stability of the embankment.
- Raising the pool elevation will raise the water level to about 1 foot above the top of the core, which could result in water passing over the top of the core and could overwhelm the capacity of the chimney drain.
- Seismic induced settlement of the crest could be between 0.2 and 4.0 feet.

A more rigorous seismic deformation analyses required to raise the embankment crest elevation cannot be reliably performed without site specific geotechnical information for the core and shell materials. A subsurface exploration plan was developed and submitted to FERC for approval on March 7, 2016. At the conclusion of this study the project team had not yet obtained approval from FERC to conduct the subsurface exploration plan of Viva Naughton Dam. The proposed subsurface exploration plan would address the following recommendations from the Phase II report:

- Collect samples of the shell materials to perform grain size analysis, strength testing, and permeability testing.
- Collect samples of the foundation bedrock to perform laboratory strength testing.
- Confirm the elevation of the top of the core.
- Measure the shear wave velocities of the core and shell materials.
- Collect samples of the auxiliary spillway to evaluate the erodibility of the materials.

Data collected as part of the subsurface exploration would also be used to support evaluation of additional Potential Failure Modes (PFM) with regard to a potential increase in reservoir pool.

## 7.0 Project Summary and Conclusions

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The technical feasibility of a nominal raise (approximately 4,500 acre-feet) of Viva Naughton Reservoir was investigated based on the recommendations presented in Section 10 of the Viva Naughton Enlargement Study Level II, Phase II Final Report (States West, 2013). The tasks associated with the investigation of a nominal raise of Viva Naughton Reservoir consisted of the following:

- Topographic Survey
- Reservoir Modeling and Operation
- Wetland and Sage Grouse Analysis
- Permitting and Environmental Compliance
- Geotechnical Investigation
- Flood Hydrology and Routing
- Preliminary Design

The following tasks have been completed and are briefly summarized below. Further documentation is provided in the report:

1. LiDAR topographic survey and aerial images of the reservoir were completed along with a ground survey of the mudflats and wetlands on the north end of the reservoir.
2. The StateMod hydrologic model previously developed for the Hams Fork was updated through 2014. Firm yield of the proposed enlargement and shortages in the basin were estimated. The current and proposed water use agreements were simulated and their impacts on shortages were evaluated.
3. Completed an aquatic resource inventory and wetland functional value assessment. Potential wetland impacts totaled 35.24 acres. All the wetlands within the project area were rated Category III. Based on results of the functional assessment, the total value of potentially impacted wetlands in the project area was 156.87 Functional Units.
4. Completed a detailed analysis of the timing and length of inundation as well as the depth of water for existing wetlands. The literature indicates that dominant species in the wetlands along the margin of the reservoir would tolerate periodic flooding during times of normal high water levels. Existing wetlands at Viva Naughton Reservoir between 7,238 and 7,242 feet have persisted despite an average of up to 88 days of inundation per year, including an average of 12 days per year inundated greater than 4 feet of water. Based on analysis of existing wetlands in relation to past high water levels and a review of the literature, all of the wetlands at the upper end of the reservoir are likely to persist. No loss of PSS wetlands is expected. PEM wetlands also would likely persist, although some changes in species composition would likely occur (e.g., change from grass-dominated to sedge-dominated).
5. The Density and Disturbance Calculation Tool (DDCT) was updated based on the nominal raise of the reservoir and new guidance on calculating existing disturbances to determine the total surface disturbance and compliance with the Greater Sage-Grouse Executive Order. New disturbances associated with the proposed nominal water level raise would be approximately 65 acres. The additional disturbance areas would be within core sage grouse habitat, and the effects of the additional inundation

would occur in June and July. Based on the results of the DDCT analysis, the proposed Viva Naughton Reservoir enlargement would not significantly impact sage grouse habitat and mitigation for the species is not expected to be required.

6. Submitted a jurisdictional determination request to the U.S. Army Corps of Engineers (USACE).
7. Completed a geotechnical evaluation for a nominal raise of the reservoir based on existing information and developed a subsurface exploration plan to collect geotechnical data from the core, downstream shell and foundation to refine the seismic deformation analysis and support the design of raising the normal water surface elevation.
8. Submitted the proposed subsurface exploration plan to the Federal Energy Regulatory Commission (FERC) for review and approval.
9. Attended numerous meetings and conference calls with the WWDO, PacifiCorp, FERC and the Hams Fork Water Users Association (HFWUA) to discuss the project, water shortages in the basin, and future water demands for both the HFWUA and PacifiCorp.

At the conclusion of this study the project team had not yet obtained approval from FERC to conduct the subsurface exploration plan of Viva Naughton Dam. The subsurface exploration plan was submitted to FERC on March 7, 2016. Following discussions with WWDO, PacifiCorp, and the HFWUA, it was agreed the project would be concluded, the subsurface exploration plan would no longer be conducted, and PacifiCorp would start negotiations with the HFWUA to lease an additional 4,000 acre-feet of storage from Viva Naughton Reservoir. Given the lack of geotechnical data, the preliminary design for the nominal raise of Viva Naughton Reservoir was not advanced under this study, and there was no effort to update the flood hydrology and routing associated with an enlargement.

Since the June 7, 2007 execution of the Viva Naughton Enlargement, Level II, Phase II Study, future water demands in Viva Naughton Reservoir have changed. During the early 2000's PacifiCorp was interested in expanding the capacity of the Naughton Powerplant. This expansion would have involved additional water demands. Recent environmental regulations and PacifiCorp's long term plan to meet these regulations through coal to natural gas conversion and/or shutting down units, has reduced PacifiCorp's need for additional water storage. This has put PacifiCorp in a position to lease water to the HFWUA from the Viva Naughton Reservoir facility. Both parties have expressed a willingness to pursue a supplemental Water Use Agreement which would allow the HFWUA to utilize an additional 4,000 acre-feet of water in lieu of an enlargement to Viva Naughton Reservoir.

HFWUA and PacifiCorp have been parties to a water use agreement since the early 2000's, relating to the storage and release of water in Viva Naughton Reservoir. In its most current form, approved on April 5, 2013, the parties are allowed to extend the agreement for additional two year terms, not to exceed more than ten years from the Effective Date. On March 3, 2015, HFWUA and PacifiCorp agreed to extend the agreement two years with an expiration date of April 5, 2017. The water use agreement allows HFWUA to use up to 6,000 acre-feet from Viva Naughton Reservoir with stipulations. Negotiations are currently underway to extend this agreement an additional two years and complete a separate agreement for the lease of an additional 4,000 acre-feet stored in Viva Naughton Reservoir.

The potential advantages of leasing an additional 4,000 acre-feet over the nominal raise of Viva Naughton Reservoir include the following: Stored water is available immediately rather than waiting for permitting and construction of an enlargement (which during NEPA review, may not meet the purpose and need test with the availability of existing storage); the firm yield of the existing reservoir is very similar to that for an enlargement with a present day storage right; a reasonable rate will be set for leasing the water per acre-foot; there will be no operation and maintenance or loan reimbursement obligations; and the water users will have the flexibility to lease only the water needed from year to year. A potential disadvantage to the water use agreement is they are temporary with short terms and renewal periods and provide less certainty in regard to long term water supply; however, given the current outlook this may not be an issue.

Model simulation indicates the proposed water use agreement provides benefit to the HFWUA beyond the existing agreement scenario in 16 years. If the additional 4,000 acre-feet were allocated regardless if the reservoir fills, the HFWUA could benefit in all 25 years of need in the modeling period, reducing annual irrigation shortages below Viva Naughton Reservoir to an average of 160 acre-feet with only eight years in the modeling period having significant shortages. Model simulation indicates reservoir storage is never depleted for PacifiCorp under this scenario where the 4,000 acre-feet is available regardless if the reservoir fills. Given the current outlook related to future industrial water demands on Viva Naughton Reservoir and the willingness of both PacifiCorp and the HFWUA to pursue a supplemental water use agreement, it is recommended that the current Viva Naughton Enlargement Level II, Phase II Study be concluded.



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