OVID RESERVOIR

Ovid Reservoir

Comprehensive Feasibility Study

SB05-179 Analysis

December 2011

AG File No. 08-129

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CERTIFICATION

I hereby affirm that this Comprehensive Feasibility Report was prepared under my responsible charge, for the owners thereof, and to my knowledge is accurate and adheres to the applicable standards and rules provided by the State of Colorado, Department of Natural Resources, Division of Water Resources, Office of the State Engineer.

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EXECUTIVE SUMMARY

The Ovid Reservoir water right is a conditional storage right originally proposed by the Groundwater Appropriators of the South Platte (GASP). The water court application was filed in 1997 and was signed on September 5, 2002 (Case 98CW295) resulting in a conditional storage decree awarded to GASP for the project. GASP expended considerable legal, engineering, and land acquisition costs in moving the project forward.

GASP ceased to exist in 2003. In the meantime, water users within Water District 64 developed a business plan to acquire the Ovid Reservoir project from GASP in order to develop the project for local beneficial uses and to protect local water rights. This resulted in the creation of the District 64 Reservoir Company in November of 2006 by owners of water rights in Sedgwick and Logan Counties. The company was formed to purchase the water rights, engineering, legal documents and title to the land where the Ovid Reservoir is planned, in addition to other purposes relating to the provision of water supplies in the area. The company was formed as a non-profit mutual ditch and reservoir company by 75 shareholders, consisting of well owners, surface water users, recharge project owners, and other water users and local interests in the lower South Platte River. The company was capitalized through the sale of approximately $1,000,000 of company stock to be put towards purchasing the assets offered by GASP. Title to the Ovid Reservoir site, water right and related assets were acquired by the District 64 Reservoir Company on February 21, 2007.

Since incorporation in November of 2006, the District 64 Reservoir Company has pursued the development of the Ovid Reservoir water rights. The company entered into a contract with the Colorado Water Conservation Board (CWCB) on June 9, 2008 upon approval of a $176,000 grant by South Platte Basin Roundtable and CWCB as authorized by the Colorado General Assembly. The scope of work for this grant, titled "Ovid Reservoir Phase II Feasibility Study," seeks to further advance the Ovid Reservoir project through modeling of reservoir operations to consider current administration practices of the river and changing hydrology, review and revision of current preliminary engineering and infrastructure design, analysis of Julesburg Irrigation District and Peterson Ditch operations, and determination of operational alternatives and potential project beneficiaries.

The general concept of the reservoir is to construct an off-channel reservoir near the Colorado-Nebraska state line that can be used to augment well depletions, reregulate flows for fish and wildlife purposes, and to maximize the beneficial use of water in Colorado in a manner that is consistent with the South Platte River Compact. The appropriation date of Ovid Reservoir is June 30, 1998 with a conditional right to store 5,772 acre-feet of water including the right to fill and refill whenever water is physically available in priority. The existing Petersen Ditch (owned and operated by the Julesburg Irrigation District) is located within a half mile of the proposed reservoir site and is decreed to fill Ovid Reservoir at a rate of 184 cubic feet per second of time. The proposed reservoir would be located approximately one mile west of the town of Ovid, Colorado and would outlet through existing flood conveyance structures to the South Platte River approximately 12 miles west of the Colorado-Nebraska state line.

A detailed river basin model was prepared to evaluate the ability of the proposed reservoir to operate and divert under current river conditions and administration. The model is an Excel based spreadsheet that uses a time period of 2000-2010 with a daily time step sequence. This time period, although shorter than normally used, more accurately reflects the current river administration conditions on the lower end of the South Platte River and contains one of the worst droughts experienced in recent history. The results of the reservoir operations study showed that the Ovid Reservoir site can reliably fill and operate in almost every year and could refill in most years.

Preliminary engineering design of the reservoir calls for the creation of a constructed ring-dike (use of excavated dirt within the reservoir site to construct a fill dike around the perimeter of the reservoir). In addition, due to high permeability in the underlying aquifer, preliminary geotechnical engineering recommended the construction of a slurry wall (consisting of bentonite) trenched into the underlying bedrock layer, in order to contain stored water and to eliminate localized seep issues that could be potentially caused by the reservoir. This preliminary design was reviewed and updated based on identified changed conditions that warranted further consideration.

The project may include the reconstruction of the Peterson Ditch diversion structure on the South Platte River. The current structure is in disrepair and a winterized structure capable of diversion in freezing flows would make operations much simpler. This may also provide an added benefit to the Julesburg Irrigation District in having improved diversion capabilities for their system.

An alternate method of using alluvial groundwater wells to fill the reservoir was evaluated and resulted in the potential use of five to eight new wells to fill the reservoir. The evaluation and analysis identified the potential well field immediately adjacent to the South Platte River and due south of the reservoir. These wells could reliably pump water in most years and would extend the diversion season by virtue of allowing warm groundwater to be captured from the river, rather than experiencing icing conditions on the Petersen Ditch during cold winter months. In addition, it is possible to use both surface water and alluvial wells to fill the reservoir.

The study outlines numerous potential beneficial uses of Ovid Reservoir water supplies. The results of this study show that some of the benefits could provide statewide benefits which could warrant Colorado being a participant in the development of the project. In addition, this study identifies the potential for multiple project participants and regional benefits as a possible water supply for enhancing local and regional water management.

The grant supporting the “Ovid Reservoir Phase II Feasibility Study” was provided by the South Platte Basin Roundtable from the Water Supply Reserve Account. This grant was approved by CWCB on September, 1, 2007. This report constitutes the deliverable work product as approved in the grant proposal.

INTRODUCTION

PROJECT HISTORY

Ovid Reservoir is planned as an off-channel reservoir near the Colorado-Nebraska state line. The reservoir has a conditional water right to store 5,772 acre-feet of water including the right to fill and refill decreed by the Water Court for Water Division No. 1 on September 5, 2002 (Case 98CW295) with an appropriation date of June 30, 1998. The decreed uses are augmentation of well depletions junior to the compact and re-regulation of South Platte River flows for lawful purposes, including fish and wildlife purposes. Ovid Reservoir is decreed to fill at a rate of 184 cubic feet per second (cfs) through the existing Petersen Ditch (owned and operated by the Julesburg Irrigation District). The proposed reservoir would be located approximately one mile west of the Town of Ovid, Colorado and would outlet through existing flood conveyance structures to the South Platte River approximately 12 miles west of the Colorado-Nebraska state line.

The District 64 Reservoir Company (the "Company") was organized in November of 2006 to purchase Ovid Reservoir. The Company was formed as a non-profit mutual ditch and reservoir company by 75 shareholders, consisting of well owners, surface water users, recharge project owners, and other water users and local interests in the lower South Platte River.

Since incorporation in November of 2006, the District 64 Reservoir Company has diligently pursued the development of the Ovid Reservoir water rights. The Company entered into a contract with the Colorado Water Conservation Board (CWCB) on June 9, 2008 upon approval of a $176,000 grant by South Platte Basin Roundtable and CWCB as authorized by the Colorado General Assembly. The scope of work under this grant, titled "Ovid Reservoir Phase II Feasibility Study," includes modeling reservoir operations to consider current administration practices of the river and changing hydrology, review and revision of current preliminary engineering and infrastructure design, analysis of Julesburg Irrigation District and Petersen Ditch operations, and determination of operational alternatives and potential project beneficiaries. The Company filed an application with the Water Court for a finding of reasonable diligence in the development of the Ovid Reservoir water right in Case No. 08CW208.

As part of the analysis of Petersen Ditch operations, the Company studied alternative means to fill Ovid Reservoir and concluded that an alluvial well field along the South Platte, directly south of the reservoir and located adjacent to the river would be feasible. In December 2008, the Company filed an application in Water Court (Case No. 08CW312) to change the Ovid Reservoir water right to add these wells as alternate points of diversion for the proposed reservoir.

The projected beneficial uses for Ovid Reservoir are described starting on page 19, beneficial use demand estimates are described starting on page 29, and reservoir modeling scenarios are analyzed and described starting on page 34 of this report.

Location and Description of Property

The Ovid Reservoir dam site is located in the North ½ of Section 6, Township 11 North, Range 45 West, of the 6th P.M. The site is bordered by County Road 25 on the West, County Road 27 on the East, County Road 32 on the North and Highway 138 on the south (see Figure 1). The site is located immediately to the west of the Town of Ovid. The site consists partially of irrigated farmland and mostly of vacant pasture land. A residential home and several out buildings are located in the Northeast corner of the site. The properties around the site consist of irrigated farmland, vacant pasture lands and residential home sites.

Previous Owners

The project was originally conceived by The Groundwater Appropriators of the South Platte (GASP) as a part of its plan to augment well depletions from wells owned by GASP members. GASP authorized and developed engineering studies on the feasibility of the project. The project obtained a conditional decree.

Purpose of Basin Roundtable Study

Ovid Reservoir is strategically located in the lower river, and provides a number of opportunities to manage water supplies for augmentation, compact management, and other purposes.

The scope was outlined in a grant application made to the South Platte Basin Roundtable to pay for updating previous technical work, performing detailed water availability modeling and considering institutional and legal arrangements that may be necessary with other water agencies to move the project forward. If the project is determined to be feasible, funding for additional work may be sought to carry the project forward to completion; with the exception of actual construction funding. Sources and makeup of construction funds will be determined in subsequent analysis which may include grants or loans that could be obtained through a variety of sources including the CWCB construction loan program.

Summary of Previous Engineering Design

Preliminary design was done by Applegate Group. The previous design proposed a maximum dam height of 30 feet with a slurry wall foundation cutoff and clay core proposed for the seepage control. This would be classified as a high hazard dam. The upstream slope of the dam was proposed for 8H:1V; the downstream slope at a 3H:1V. No riprap was considered necessary with the 8:1 sloped embankments. The total above grade storage was estimated to be 5,700 ac-ft with an estimated potential below grade storage of 2,000 acre-feet for a total of 7,700 acre-feet. The normal water surface elevation set at 3,550 feet with five feet of freeboard for normal operations.

No consideration for remote control or sensing instrumentation was included in the preliminary design. Those parameters will be determined once policy decisions and end users are better defined. The project does include standard monitoring requirements for high hazard dams; crest and slope survey markers, toe drain outfall measuring weirs, open well piezometers, and reservoir staff gage.

Geotechnical Investigation

Previous geotechnical investigation was performed by Earth Engineering Consultants (EEC) in May and June of 2003, and by Joseph A. Cesare and Associates, Inc. (JAC) in September 2003. EEC performed a subsurface investigation consisting of preliminary test pits to evaluate soils for suitability for dam construction. During preliminary design JAC did additional exploration consisting of 50 drilled test holes ranging from 14 to 124 feet deep. Eleven piezometers were also installed as a result of that investigation, eight within the reservoir area and three along the west boundary of the Town of Ovid. JAC reviewed available geologic and hydrologic reports as well as the EEC investigation.

Topographically the site is divided north and south by an escarpment approximately 10 feet high. The lower southern portion is occupied by the current South Platte River alluvial floodplain. The higher northern portion is composed of an older alluvial terrace. The site generally consists of fine-grained clays and sands for the first four feet, underlain by sandy clay, potentially organic especially along the southern portion, ranging from 4 to 16 feet. Beneath this is 28 to 54 feet of sand. The bedrock consists of the Brule Formation and was encountered in 19 of the 50 test holes. The bedrock slopes from the north to the southwest corner and ranges from 34 to 70 feet deep in the southwest corner with a plasticity index of 12 on tested samples and an average depth of 55 feet.

Groundwater was encountered at depths of approximately 4 to 20 feet. On average, the piezometers have been measured about once a year since installation. The average recorded depths to water range from approximately 4 to 10 feet in the proposed reservoir area.

Dam Cutoff

The previous recommendation was to incorporate a slurry wall dam foundation cutoff. In the above grade dam sections a clay core would tie into the slurry wall. The use of a slurry wall might allow for below grade water storage. For this reason, recovery wells were considered in the preliminary design. Water stored within the sand alluvium below the reservoir would not be subject to evaporative losses.

The slurry wall cutoff may create some minor mounding and shadowing effects of the groundwater upgradient and downgradient of the reservoir. Concerns have been expressed on two basic subjects. The first is what impact the proposed reservoir would have on groundwater levels within the Town of Ovid. The concern being that the groundwater table elevations could potentially be raised with a reservoir containing water under 20 feet of head. This would be prevented by a slurry wall cutoff which would prevent reservoir seepage into the groundwater table. The second concern is what impact the proposed reservoir would have on wells that lie to the east of the reservoir. The concern being that these wells currently tap an ancient river bed that was once the South Platte River. These wells are very productive according to their owners. The fear is a slurry wall could block the path of groundwater flow sufficiently to reduce the well productivity. If further investigation shows a need for mitigation, a dewatering system along the north and west sides of the reservoir may be recommended to control high groundwater issues and to also pass groundwater flows around the perimeter of the slurry wall to feed the water supply for the wells.. The dewatering system would likely consist of installation of a French drain outside of the slurry wall at or near the current high groundwater elevation. Past history taken from gravel pits that were lined in an alluvial aquifer show that impacts are normally minor and easily mitigated. A groundwater model would be recommended at the time of final design as part of the submittal package for a dam safety permit.

Site Drainage
The site was analyzed for the 100-year storm event and the 2-year storm event. The 2-year storm event was based on County criteria. A ditch is proposed along the west side of the reservoir capable of conveying the 2-year storm event, 280 cubic feet per second (cfs). However, with the Town of Ovid in close proximity, the proposed ditch along the east side of the reservoir was designed to be capable of conveying the 100-year storm event, 840 cfs. The Sedgwick Sand Draws infrastructure was incorporated into the preliminary design to convey storm flows to the South Platte River. Approvals have been received to use this infrastructure in the Ovid Reservoir project.

Reservoir Infrastructure
The preliminary design incorporated use of the existing Peterson Ditch to deliver the water from the South Platte River to the reservoir. A new ditch and 42-inch siphon system was proposed to deliver the water from the Peterson Ditch into the reservoir. No ditch upgrades were considered during the preliminary design; however a new head gate diversion was considered necessary to divert flow to the reservoir. Preliminary recommendations for this new diversion structure involved use of a radial gate, but there are other options such as overshot gates that may prove to be a better alternate.

The reservoir inflow was designed for a maximum of 110 cfs, with a normal operation flow rate of 55-60 cfs. The emergency drawdown rates were based on State Engineer's Office criteria. The outlet works has an emergency capacity of 195 cfs with normal operation flow rates of 1-50 cfs expected.

The reservoir is off-channel which considerably lessens the size of the spillway. The preliminary design incorporates a concrete ogee crest spillway with a width of approximately 10 feet and a concrete chute to convey flows over the dam crest to a grass lined spillway channel at the toe of the dam. The outlet works system was preliminarily sized as a 42-inch concrete encased steel mortar lined pipe to meet mandatory emergency drawdown requirements. An 18-inch auxiliary outlet was also recommended to more efficiently and accurately release minor augmentation flows during normal operations.

Dam instrumentation will be required for public safety. With a high hazard dam classification, the dam would be required to have instrumentation such as pore pressure piezometers along the downstream side of the dam, slope movement indicators, and toe drain flow meters. Toe drains will have weirs to measure seepage flow rates through the dam embankment and foundation. The dam height is low enough that is it unlikely to require inclinometers.

PROJECT APPROACH

Changes in Rules and Regulations
The Ovid Reservoir was previously designed using the Colorado Dam Safety and Dam Construction Rules and Regulations dated September 30, 1988. Rules for Dam Safety and Dam Construction were updated in January 2007. This task consists of a review of the Rules for Dam Safety and Dam Construction updated in 2007 and requires identification of any regulatory changes that require design modification for approval by the State Engineer.

Dam Safety
The Colorado Dam Safety and Dam Construction Rules (Rules) were updated and improved during 2006 which resulted in the revised Rules effective January 1, 2007. The key changes to the Rules involved updating the technical requirements, hazard classification terminology, inflow design flood and hydrology requirements, spillway design capacity and seismic analysis.

The current preliminary design has been reviewed to determine if the Rule changes require modification of the design and to assure that the final design will meet the requirements of the current Rules and Regulations for Dam Safety and Dam Construction. A brief explanation of the key components of the assessment is provided below.

Plan Set Review
The plan set will require several modifications to meet the current Rules. The cover page will need to have the following added: Design Engineer title block, As Constructed block, State Engineer approval block, State Engineer file No. block, identification of the water division and water district. The plan set will also need to include the spillway and outlet discharge curves and reservoir area-capacity table. Final design will require additional design and detail to a level not currently complete. The current plan set could be considered somewhere between 70% and 80% complete as a plan set for construction.

Design Report
The Design Report is generally acceptable at this stage of the preliminary design. Of special note is that this structure is assumed to be a high hazard dam. A high hazard dam requires an Emergency Action Plan (EAP) with an inundation map. The Ovid Reservoir is a ring dike which means that the entire circumference of the structure is an above grade dam. An EAP will need to look at dam break models in multiple locations to determine the worst case scenario that the EAP must be built around.

Hydrology Report
The Hydrology Report is a requirement of the State Engineer. The current report addresses the contributing drainage basin and inflow design flood for spillway sizing. The spillway and outlet discharge calculations are included as necessary. The Hydrology Report is currently sufficient for the preliminary design. Additional study will be required to route surface flows around the reservoir. There is a series of three canals upstream of the reservoir that can artificially impact hydrology in varying degrees depending on time of year, the volume of overland flow, and irrigation water being diverted.

Geotechnical Requirements and Seismic Analysis
The geologic assessment is adequate. The foundation investigation is adequate. Additional laboratory testing is required for final design. The current stability analysis is adequate. The seismic analysis appears adequate for the preliminary design and will require additional documentation for final design. There may be some additional analysis required to consider liquefaction potential of the dam foundation.

Final Design
The current design report is generally adequate for preliminary design level according to the updated Colorado Dam Safety and Dam Construction Rules. Additional analysis and documentation

will be required for final design. The geotechnical data that has been collected will be reviewed for completeness and may require additional testing to meet the standard of care for final design.

Technology Enhancements

This project has been on the table since 1997. This 15-year time frame has seen considerable advances in technology with regard to water measurement and administration. The Ovid project is an ideal candidate for using this technology given the timing issues associated with river flows in the lower reach of the South Platte. This will include coordination with reservoir operations in conjunction with the reservoir modeling and operating procedures. The State of Colorado is requiring the installation of remote sensing and readout equipment to assist in river administration.

Telemetry and Control

The use of telemetry and remote sensing technology can assist in the daily measurement of inflows and outflows required in reservoir management. Whether the reservoir receives its inflows from the Peterson Ditch or the well field, the telemetry technology will measure daily inflows into the reservoir for transmittal to District 64 Reservoir Company staff to update accounting and to update Division Engineer's Office staff.

Telemetry technology can measure and transmit the actual volumes released from Ovid Reservoir each day for augmentation of irrigation wells or for volumes of water dedicated to other uses. The reservoir operations model can determine the timing of the augmentation releases and quantify the size of the release based on current reservoir supply. The daily transmittal of data helps to most efficiently track the volume of releases and help identify shortfalls or overages.

The water commissioners in Districts 1 and 64 use SCADA and telemetry to obtain real time pumping volumes from wells to determine daily lagged depletions and augmentation obligations. Water users in the lower South Platte also use this technology to record the daily volumes of surface water delivered to recharge sites or to measure the volume of water pumped each day from headgate wells, which are used to determine the daily volume of augmentation credit the river received to offset irrigation pumping depletions.

The well field may be used to fill the reservoir. Since Ovid Reservoir has a junior water right, the well field will be able to pump primarily during periods of no call during the winter months and infrequent no call periods during the irrigation season. This technology can allow the reservoir owners to coordinate efficiently with the Division Engineer's Office and water commissioner to maximize the volume pumped and diverted into the reservoir during the no call periods.

Infrastructure

Advances in technology have allowed for more effective infrastructure use and several options are available for consideration. The infrastructure relating to the proposed Ovid Reservoir includes a 42-inch siphon inlet from the Peterson Ditch, ogee crest spillway for emergency protection of the embankment, and a 42-inch outfall system for releases. The recommendations regarding this infrastructure remain unchanged from the previous feasibility report at this point. The determination of the project beneficiaries will likely result in some design changes. Updates pertaining to the diversion structure and gates on the Peterson Ditch are addressed in the next section.

Peterson Ditch and Diversion Alternatives

River Diversion Structure and Canal Headgate

The current diversion structure and ditch conveyance system for the Peterson Ditch was analyzed to determine feasibility of using the existing system to fill the Ovid Reservoir. During a site visit in October 2008, the river diversion and canal headgate structures were visited to analyze the current structure conditions. The river diversion structure is approximately 300 feet long and consists of an existing concrete and wood dam. Vertical concrete walls positioned approximately 30 feet apart span the width of the South Platte River and hold the wooden stop logs or check boards which can be removed to allow more water to pass the diversion and flow downstream. Pictures from the October 2008 site visit are included in Appendix B. Although functional, the diversion structure has significant vegetation growth along the dam, and the check boards are deteriorating and contain many leaks.

At the upstream end of the canal, approximately 350 feet from the diversion structure, the headgate to the Peterson Ditch currently consists of five 4-foot vertical sluice gates with concrete abutments. The sluice gates were replaced a few years ago.

Operations Policies

This project included an evaluation of changes necessary to operations policies to divert under cold weather conditions. This was considered as a risk management evaluation that considered possibilities of ditch freeze up disrupting diversions to the reservoir. Diversion records were obtained and evaluated and are included in Appendix A with a summary provided in Table 1 below. The Peterson Ditch typically operates during winter months to convey recharge water. The summary table below illustrates the monthly average flow and monthly maximum flow.

Applegate Group recently completed a winter operations study for canals in the Kearney, Nebraska area related to flow reregulation for endangered species purposes. The results of this study incorporated a review of existing ditch systems, many of which are in Eastern Colorado that also operate under winter conditions. The conclusions of this study are directly applicable to the issues associated with Ovid reservoir.

In 2008 the ditch experienced performance and conveyance issues regarding ice and freeze up downstream of the proposed Ovid Reservoir site. According to the Ditch Superintendent, the first three miles of the ditch does not experience problematic ice formation.

Preliminary Design

Peterson Ditch Diversion

Rubicon Gates are recommended for the canal head gate. Use of the Rubicon gates would allow the canal to be operated by automatic control for maintaining either constant flow or constant water elevation. Remote operation of the gates would be an option.

PICTURE 1: RUBICON GATES

Regarding the river diversion, a set of Obermeyer gates are recommended. The Obermeyer gates can be manufactured in various sizes, and different sizes can be strategically placed along the diversion alignment. Installation of Obermeyer gates would allow for debris to be flushed downstream of the diversion structure, and would also help manage silt buildup upstream of the diversion. This approach is being used on the Rio Grande River in Albuquerque, New Mexico for management of endangered species and sediment control.

Two good examples of projects in Colorado that use Obermeyer gates are the Empire Canal diversion near Kuner and the Bijou Canal diversion. Both were modernized in the past few years and have had very satisfactory operating conditions in winter weather. The Empire diversion has incorporated a wall heating system at the gates that prevents ice from forming on the concrete. To date it has worked very well.

PICTURE 2: OBERMEYER GATES

The operation of the diversion structure and the canal inlet would be coordinated by remote sensing which could set gate openings on either structure to optimize water elevations and/or maintain steady flow rates. Past experience has shown that being able to maintain steady flows for deliveries will result in less waste at the end of the system. A secondary benefit also accrues to other water rights due to the tighter control on diversions that can be maintained.

An alternate option to installing a new river diversion structure would be to rehabilitate the existing structure. The concrete piers could likely stay in place; some concrete patching may be necessary in areas. The wooden check boards could be replaced to minimize leaks that have occurred, along with the wooden catwalk. To help facilitate winter operations, bubblers could be installed along the diversion structure, or a portion of the structure. The check board sections with bubblers could still be manually operated during times when ice has formed on the surface of the river. Based on the work that Applegate Group recently completed on winter operations along the Platte River in Nebraska, we believe this would be a poor alternative that would result in considerable operations and maintenance expense.

Peterson Ditch Conveyance System

The feasibility of using the Peterson Ditch and improving ditch conveyance up to Ovid Reservoir was analyzed. The ditch conveys water approximately nine miles before it crosses County Road 25 near the Ovid Reservoir site (See Figure 2). It is decreed to convey 270 cfs and is a relatively flat ditch which allows for slower conveyance of water and less erosion. A review of the Peterson Ditch was also performed for the Preliminary Design Report. A topographic survey was completed and it was determined that the channel was approximately 18 feet wide at the bottom with 1:1 side slopes. The depth of the channel is approximately five feet with a longitudinal slope of 0.025 percent.

The preliminary design report states that the ditch is capable of carrying the Ovid Reservoir decreed amount of 184 cfs with one foot of freeboard at the proposed Ovid Reservoir Diversion location. It also states that there are sections of the ditch upstream of the Ovid Reservoir site that are limited to approximately 90 cfs according to Larry Frame, ditch superintendent.

During a site visit in October 2008, accessible portions of the ditch were driven to analyze the current ditch conditions. During the site visit the ditch appeared to be flowing nearly full. Pictures from the October 2008 site visit are included in Appendix C. Some embankment sections appeared to experience erosion, with near-vertical walls existing in areas. Approximately one-third of the ditch was observed during the site visit. Of the ditch sections observed, approximately 2% of the ditch could use embankment stabilization work.

The ditch conveys flows during the winter months to meet recharge requirements. Diversion records from 1950–2007 were reviewed to determine average and maximum monthly flows for Peterson Ditch (see Table 1 below). The complete diversion records illustrating total diversion per month for 1950-2007 obtained from the Colorado Decision Support System (CDSS) website is included in Appendix A. The ditch does not appear to have sufficient capacity to convey the decreed amount of 270 cfs.

Table 1. Peterson Ditch Diversion Records Summary

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Monthly Average Diversion (AF)	307	198	118	80	261	582	1050	1153	1733	1704	1179	512
Monthly Average Flow (cfs)	5.2	3.2	1.9	1.4	4.2	9.8	17.1	19.4	28.2	27.7	19.8	8.3
Monthly Maximum Flow (cfs)	58.0	49.5	42.4	19.1	49.2	39.7	61.6	54.5	74.9	71.1	59.9	46.5

The current condition of the ditch is functional for its current use. In general the existing ditch conveys flows in the range of 1-5 cfs during the winter months. If no upgrades were made to the ditch, it is thought that the ditch could convey the additional 55 cfs during the normal operating conditions during these winter months, with coordination to avoid conveying this additional flow during high flow days. The highest monthly maximum flow listed is 74 cfs; therefore, any day the ditch is conveying approximately 19 cfs or less, the additional flow could be conveyed to the Ovid Reservoir. The current ditch superintendent, Larry Frame, agreed with this conclusion.

We have analyzed for the option of stabilizing those sections of the ditch embankment that have shown evidence of erosion. All other infrastructure would be left as-is: road crossings, pivot system crossings, field drains, and pipe crossings. The eroded, near-vertical banks would be slightly excavated to allow for placement of bedding, riprap and grout. This was based on the estimated 2% of erosion areas observed during the site visit. An opinion of cost for this construction is discussed later in this report.

At some point in the future, it may become an option to consider increasing the ditch capacity for the nine miles leading up to the proposed Ovid Reservoir. This would minimize any risk of conveying the additional flow in the Peterson Ditch. This option would also involve increasing the capacity of the eight road crossings and analyzing current seepage conditions to consider benefits and risks of lining the ditch. At present it appears that there is excess capacity in the Peterson Ditch in enough time periods to allow the reservoir to fill reliably. Peterson ditch improvements are proposed to insure excess capacity exists within the ditch to allow filling of the reservoir. Please see Appendix D for a cost analysis of the proposed improvements to Peterson Ditch.

Peterson Ditch Alternatives

Well Field and Groundwater Modeling

An alternative water source for the proposed Ovid Reservoir is groundwater from the South Platte alluvium. The alluvium near the proposed reservoir consists of highly porous sand and gravel deposits up to 200 feet thick (Figure 3). Reported well yields in the area exceed 1,000 gpm. This area of the South Platte alluvial aquifer is highly permeable with transmissivities of up to 400,000 gpd/ft.

A groundwater flow model was developed to determine the feasibility of utilizing wells to fill the proposed reservoir. A model was created using USGS ModFlow. A grid was established of sufficient size to represent the hydrogeology of the area. Figure 4 shows the model grid boundary. For purposes of this model the following parameters were used:

- Constant base elevation of 100 feet
- Constant starting head of 0 feet
- Variable transmissivity using USGS mapping
- Pumping 5 wells with total annual yield of 5,800 acre-feet
- Model grid of 100 feet X 100 feet
- Specific Yield of 20%
- No flow boundaries on the west, northwest, and south of the model area
- General head boundaries on east and northeast

Several scenarios were performed based on pumping period, pumping rate and recharge. Model runs were done for 90- and 180-day pumping periods with river recharge and without recharge, and steady state. Presented in this report are the results of the 90-day model and the steady state model. The 90-day scenario is the shortest period and shows the greatest drawdown. Figures 5 and 6 show the drawdown after 90 days in each scenario.

A steady state model run was done to show the long-term affect of pumping. The steady state model shows drawdown that can be expected over time independent of the number of days pumped as long as the annual amount of water is pumped. The wells were pumped to reach a steady state condition assuming no recharge from the river or precipitation. The reasoning for this approach is to understand the worst case scenario. If the wells can pump at steady state without recharge then it's reasonable to expect better conditions, i.e. higher water levels when including recharge.

The modeling did not take into account any other influences, such as other pumping wells. This type of approach is called a "change model". In other words the model predicts the change in water level from the normal operating conditions.

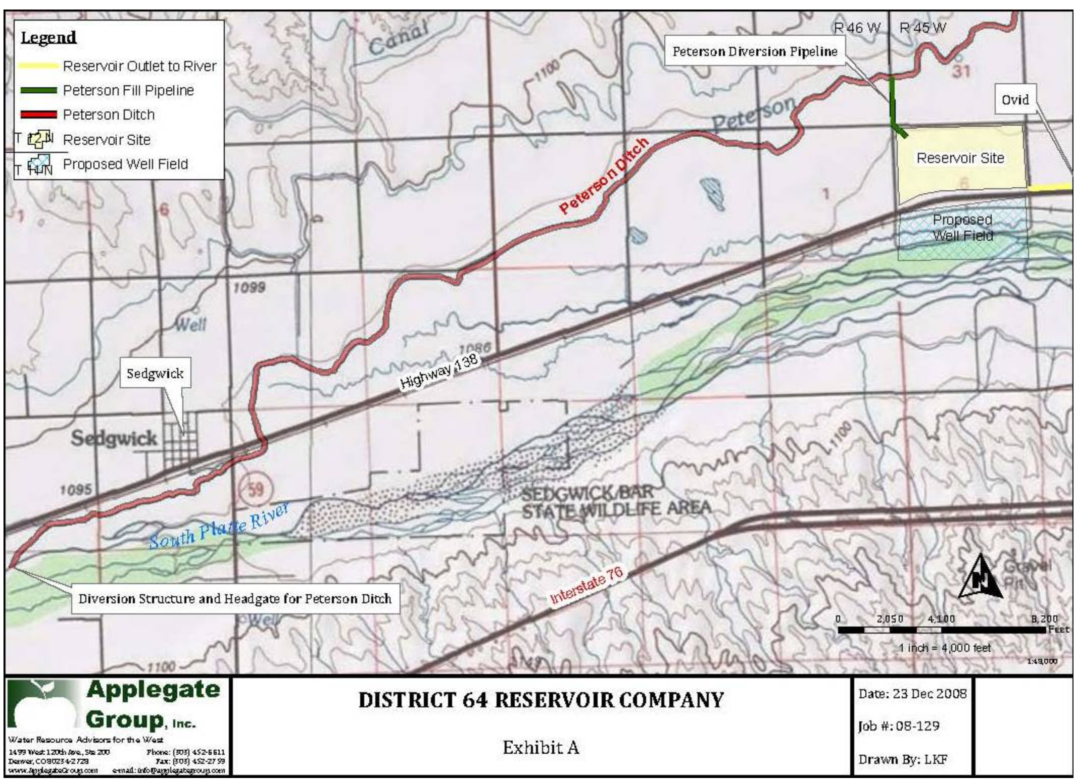
The results of the steady state model show that the maximum change in water level is 26 feet in the 90-day model with no river recharge and 20 feet in the steady state model. Figure 7 shows the contours of drawdown change for the steady state scenario.

Based on this worst case scenario of no river recharge, we are confident that wells in the alluvium can achieve rates even greater than those modeled. Based on the results of this model, well locations were specified for the proposed decree. In total, there are eight proposed well locations in the south half of Section 6, T.11 N, R 45 W. The maximum pumping rate for the proposed wells is 3,500 gpm per well. The well locations are shown on Figure 8. See the reservoir scenario modeling section below for reservoir fill results using only the well field.

Preliminary Design
The wells will be designed based on site specific data acquired from test holes. It is anticipated that the wells will be 16" in diameter with 40-60 feet of stainless steel wire wrapped screen, and 100-150 ft. in depth. The wells will be equipped with submersible pumps.

The test hole program would consist of drilling and logging 6-8 test holes. The data acquired will be utilized to prepare a final design for the wells and to determine the best locations for production wells. A preliminary cost estimate for test drilling and well cost on a per well basis is included in Appendix H.

Water Rights
Application was made to water court in December, 2008 on behalf of District 64 Reservoir Company, to allow the use of the wells to fill the proposed Ovid Reservoir. The application seeks a change of water right and plan of augmentation of the Peterson Ditch water right decreed in Case No. 98CW295. The change will allow diversion of said water right from the wells. As stated in the application, *"The Applicant will operate the Ovid Reservoir Well Field when Ovid Reservoir is in priority, and will replace injurious out-of-priority depletions from the use of the Ovid Reservoir Well Field by releasing water to the South Platte River from Ovid Reservoir. The locations of the Ovid Reservoir Well Field and Ovid Reservoir are shown below (in larger scale at the end of report) and incorporated by this reference. In addition, the Applicant may use any other water rights legally available to the Applicant that can be provided in the amount, time, and location required to replace out of priority depletions from the Ovid Reservoir Well Field."*



Generally, the wells will operate primarily during the non irrigation season. Due to the close proximity to the river, the depletions will occur quickly. Any lagged depletions that are not in-priority in the spring will be replaced by water in the reservoir by direct discharge. Based on call records from 2000-2007, the calling right is the Compact Call. In general the Compact Call comes on between the beginning of April and the end of May. The call comes off in mid-October, generally allowing Ovid Reservoir to fill November through March. It should be noted that well depletions should have a minor impact during a compact call and will be able to be replaced by releases from Ovid Reservoir. Also, by replacing these well depletions, it should generate minimal impact on the yield of the reservoir.

Preliminary Opinion of Probable Cost

The previous opinion of probable construction cost for the Ovid Reservoir and Dam has been updated to reflect inflation of construction costs. Modifications to the design were not recommended or thought necessary at this time. The opinions of cost are included in Appendix D. These opinions of cost may fluctuate in the current economy and are based on one snapshot in time. Preliminary opinions of long-term costs and benefits for each filling scenario were also analyzed. The comparison of costs to either make ditch improvements or use a well field includes commitments to some recurring annual costs. For example reservoir filling from the Peterson Ditch can be done with gravity while pumping a well field would incur energy costs. Below are four cost scenarios that are dependent on the mechanism used to fill the reservoir as well as the reservoir storage volume firm yield estimated. Each cost estimate scenario can be seen in detail in Appendix D.

A project of this size and complexity will probably take somewhere between 12 months to 18 months to complete once permits have been received and a notice to proceed is issued. This range is somewhat dependent on weather and can be greatly impacted by the contractor selected to do the work.

In each scenario analysis below, the term Reservoir Net Fill is used, this refers to the Current Year Fill volume, minus Reservoir shrink, plus the previous year end of storage volume.

Cost Scenario 1- Peterson Ditch Fill (5560 Ac-Ft)

For Cost Scenario 1, the Reservoir Net Fill firm yield was calculated for each of the seven beneficial use demand scenarios discussed in the beneficial use demand scenario modeling section below. The firm yield was calculated by averaging the Reservoir Net Fill amount from 2000-2009, for each scenario, and then averaging all seven scenario firm yields. Using this procedure, the firm yield for Cost Scenario 1 is estimated to be 5,560 acre-feet, or 97.5-percent of the modeled 5,770 acre-feet. Cost Scenario 1 includes the cost components discussed below:

Ovid Reservoir and Dam Construction

The previous opinion of probable construction cost for the Ovid Reservoir and Dam has been updated to reflect current construction costs. Modifications to the design were not recommended or thought necessary at this level of study. Earthwork and non-earthwork related cost changes were determined with input from local contractors, as well as information attained from R.S. Means, 2011. The current economy has been impacting construction project prices in Colorado. We have seen recent heavy construction projects receive bids that were 15% to 20% lower than estimated. The simple fact that there are a lot of Contractors looking for good work puts market pressure on prices. Depending on when this project actually goes to construction, there may be a significant cost savings to the owner compared to the construction estimates.

River Diversion and Ditch Headgate

A preliminary opinion of construction cost has been prepared for upgrading both the South Platte River diversion structure and the Peterson Ditch Headgate. The estimate was based on the information discussed in the *Peterson Ditch and Diversion Alternatives* section of this report. No permitting, electrical, or water diversion were included in this estimate.

Peterson Ditch Conveyance System

A preliminary opinion of construction cost has been prepared for implementing minimal upgrades to the Peterson Ditch system. Preliminary calculations were performed to stabilize sections of the ditch embankment with riprap, bedding, and grout. This was based on the field visit estimation that approximately 2% of the ditch showed evidence of erosion along the embankments. The earthwork and grading involved was based on the assumption that no material needs to be imported or exported, and that the material along the eroded sections can be graded to form a 3:1 slope along the embankment.

As seen in Appendix D, the Total Annualized 30-Year Cost per Acre-Foot including infrastructure costs, Operation and Maintenance costs, and 3-percent yearly interest, is estimated to be approximately $225; assuming a 5,560 acre-foot firm yield. Cost estimate details can be seen in Appendix D.

Cost Scenario 2- Well Field Fill Only (6,300 Ac-Ft)

For Cost Scenario 2, the Reservoir Net Fill firm yield was calculated for each of the seven beneficial use demand scenarios discussed in the beneficial use demand scenario modeling section below. The firm yield was calculated by averaging the Reservoir Net Fill amount from well field inflow only, from 2000-2009, for each scenario, and then averaging all seven scenario firm yields. Using this procedure, the firm yield is estimated to be 6,300 acre-feet, or 110-percent of the 5,770 acre-feet Peterson Ditch inflow also modeled. Cost Scenario 1 includes the cost components discussed below:

Ovid Reservoir and Dam Construction

The previous opinion of probable construction cost for the Ovid Reservoir and Dam has been updated to reflect current construction costs. Modifications to the design were not recommended or thought necessary at this level of study. Earthwork and non-earthwork related cost changes were determined with input from local contractors, as well as information attained from R.S. Means, 2011. The current economy has been impacting construction project prices in Colorado. We have seen recent heavy construction projects receive bids that were 15% to 20% lower than estimated. The simple fact that there are a lot of Contractors looking for good work puts market pressure on prices. Depending on when this project actually goes to construction, there may be a significant cost savings to the owner compared to the construction estimates.

Well Field

The preliminary design of the wells included 40-60 feet of stainless steel wire wrapped screen, and assumed the wells would be 16 inches in diameter and 100-150 feet in depth with submersible pumps. A test hole program was also included in the opinion of cost to further design the well field based on site specific data. This test hole program would consist of drilling and logging 6-8 test holes. Preliminary opinions of cost for the test hole drilling and construction, per well, were prepared.

It is estimated that it will cost approximately $2.32 per acre-foot to fill Ovid Reservoir with a firm yield of 6,300 acre-feet of water; including energy and demand charges. It should be noted that it was assumed each kilowatt utilized during the well field pumping has a cost of 15-cents for the first 300kWh, 11-cents for next 300 kWh, and 7.3-cents for the remaining 199,480 kWhs. The Cost per acre-foot values were attained from current data supplied by the Highline Electric Association in Ovid, CO.

As seen in Appendix D, the Total Annualized 30-Year Cost per acre-foot including infrastructure costs, Operation and Maintenance costs, well energy costs, and 3-percent yearly interest, is estimated to be approximately $175; assuming an 6,300 acre-foot firm yield. Cost estimate details can be seen in Appendix D.

Cost Scenario 3- Peterson Ditch Fill + Alluvial Well Withdrawal (7,560 Ac-Ft)

For Cost Scenario 3 the Reservoir Net Fill firm yield was calculated for each of the seven beneficial use demand scenarios discussed in the beneficial use demand scenario modeling section below. The firm yield was calculated by averaging the Reservoir Net Fill amount from the Peterson Ditch only, from 2000-2009, for each scenario, and then averaging all seven scenario firm yields. Using this procedure, the firm yield is estimated to be 5,560 acre-feet, or 97.5-percent of the 5,770 acre-feet Peterson Ditch inflow modeled. In addition, a firm yield of 2,000 acre-feet from the Alluvial wells was added to the 5,560 acre-feet firm yield from the Peterson Ditch modeled inflow; for a total firm yield of 7,560 acre-feet. Cost Scenario 3 includes the cost components discussed below:

Ovid Reservoir and Dam Construction

The previous opinion of probable construction cost for the Ovid Reservoir and Dam has been updated to reflect current construction costs. Modifications to the design were not recommended or thought necessary at this level of study. Earthwork and non-earthwork related cost changes were determined with input from local contractors, as well as information attained from R.S. Means, 2011. The current economy has been impacting construction projects prices in Colorado. We have seen recent heavy construction projects receive bids that were 15% to 20% lower than estimated. The simple fact that there are a lot of Contractors looking for good work puts market pressure on prices. Depending on when this project actually goes to construction, there may be a significant cost savings to the owner compared to the construction estimates.

River Diversion and Ditch Headgate

A preliminary opinion of construction cost has been prepared for upgrading both the South Platte River diversion structure and the Peterson Ditch Headgate. The estimate was based on the information discussed in the *Peterson Ditch and Diversion Alternatives* section of this report. No permitting, electrical, or water diversion were included in this estimate.

Peterson Ditch Conveyance System

A preliminary opinion of construction cost has been prepared for implementing minimal upgrades to the Peterson Ditch system. Preliminary calculations were performed to stabilize sections of the ditch embankment with riprap, bedding, and grout. This was based on the field visit estimation that approximately 2% of the ditch showed evidence of erosion along the embankments. The earthwork and grading involved was based on the assumption that no material needs to be imported or exported, and that the material along the eroded sections can be graded to form a 3:1 slope along the embankment.

Slurry Wall Alluvial Wells

The use of a slurry wall surrounding the reservoir might allow for below grade water storage of 2,000 acre-feet. This storage amount was estimated from groundwater modeling and is considered to be a conservative estimate. For this reason, recovery wells were considered in the preliminary design. Water stored within the sand alluvium below the reservoir would not be subject to evaporative losses. However, the current water decree for storage does not recognize this alluvial storage and at present it is not being pursued as a part of the project. However, for comparison purposes, a cost analysis for the alluvial wells have been included in order to compare costs given future utilization of the wells.

It is estimated that it will cost approximately 96-cents per acre-foot to utilize the alluvial wells to pump the additional estimated 2,000 acre-feet of water contained below grade within the slurry wall alluvium. It should be noted that it was assumed each kilowatt utilized during the well field pumping has a cost of 15-cents for the first 300kWh, 11-cents for next 300 kWh, and 7.3-cents for the remaining 25,240 kWhs. The Cost per acre-foot values were attained from current data supplied by the Highline Electric Association in Ovid, CO.

As seen in Appendix D, the Total Annualized 30-Year Cost per acre-foot including infrastructure costs, Operation and Maintenance costs, well energy costs, and 3-percent yearly interest, is estimated to be approximately $168; assuming an 7,560 acre-foot firm yield. Cost estimate details can be seen in Appendix D.

Cost Scenario 4- Well Field Fill + Alluvial Well Withdrawal (8,300 Ac-Ft)

For Cost Scenario 4 the Reservoir Net Fill firm yield was calculated for each of the seven beneficial use demand scenarios discussed in the beneficial use demand scenario modeling section below. The firm yield was calculated by averaging the Reservoir Net Fill amount from the Well Field, from 2000-2009, for each scenario, and then averaging all seven scenario firm yields. Using this procedure, the firm yield is estimated to be 6,300 acre-feet, or 110-percent of the 5,770 acre-feet Peterson Ditch fill modeled. In additional, a firm yield of 2,000 acre-feet from the Alluvial wells was added to the 6,300 acre-feet firm yield from the Well Field modeled inflow; for a total firm yield of 8,300 acre-feet. Cost Scenario 4 includes the cost components discussed below.

Ovid Reservoir and Dam Construction

The previous opinion of probable construction cost for the Ovid Reservoir and Dam has been updated to reflect current construction costs. Modifications to the design were not recommended or thought necessary at this level of study. Earthwork and non-earthwork related cost changes were determined with input from local contractors, as well as information attained from R.S. Means, 2011. The current economy has been impacting construction projects prices in Colorado. We have seen recent heavy construction projects receive bids that were 15% to 20% lower than estimated. The simple fact that there are a lot of Contractors looking for good work puts market pressure on prices. Depending on when this project actually goes to construction, there may be a significant cost savings to the owner compared to the construction estimates.

Well Field
A preliminary opinion of construction cost has been prepared for this filling alternative (Appendix D). The preliminary design of the wells included 40-60 feet of stainless steel wire wrapped screen, and assumed the wells would be 16 inches in diameter and 100-150 feet in depth with submersible pumps. A test hole program was also included in the opinion of cost to further design the well field based on site specific data. This test hole program would consist of drilling and logging 6-8 test holes. Preliminary opinions of cost for the test hole drilling and construction, per well, were prepared.

It is estimated that it will cost approximately $2.32 per acre-foot to fill Ovid Reservoir with a firm yield of 6,300 acre-feet of water; including energy and demand charges. It should be noted that it was assumed each kilowatt utilized during the well field pumping has a cost of 15-cents for the first 300kWh, 11-cents for next 300 kWh, and 7.3-cents for the remaining 199,480 kWhs. The Cost per acre-foot values were attained from current data supplied by the Highline Electric Association in Ovid, CO.

Slurry Wall Alluvial Wells
The use of a slurry wall surrounding the reservoir might allow for below grade water storage of 2,000 acre-feet. This storage amount was estimated from groundwater modeling and is considered to be a conservative estimate. For this reason, recovery wells were considered in the preliminary design. Water stored within the sand alluvium below the reservoir would not be subject to evaporative losses. However, the current water decree for storage does not recognize this alluvial storage and at present it is not being pursued as a part of the project. However, for comparison purposes, a cost analysis for the alluvial wells have been included in order to compare costs given future utilization of the wells.

It is estimated that it will cost approximately 96-cents per acre-foot to utilize the alluvial wells to pump the additional estimated 2,000 acre-feet of water contained below grade within the slurry wall alluvium. It should be noted that it was assumed each kilowatt utilized during the well field pumping has a cost of 15-cents for the first 300kWh, 11-cents for next 300 kWh, and 7.3-cents for the remaining 25,240 kWhs. The Cost per acre-foot values were attained from current data supplied by the Highline Electric Association in Ovid, CO.

As seen in Appendix D, the Total Annualized 30-Year Cost per Acre-Foot including infrastructure costs, Operation and Maintenance costs, well energy costs, and 3-percent yearly interest, is estimated to be approximately $134; assuming an 8,300 acre-foot firm yield. Cost estimate details can be seen in Appendix D.

Additional Notes
Utilizing Peterson Ditch and the well field to fill Ovid Reservoir, as well as utilize the alluvial wells for a total acre-feet firm yield of 8,300, produces a Total Annualized 30-Year Cost per acre-foot of approximately $158.

Facilities Operations and Maintenance
Preliminary opinions of long term costs and benefits for each filling scenario were analyzed as seen in Appendix D. Annual maintenance should be relatively minor for the first ten years. Weed mowing, minor shoreline repair after wind storms, grading the dam crest road, servicing and

exercising valves should be the primary maintenance functions. There will be some on-going monitoring costs for collecting and reporting the instrumentation data from the dam. As the facilities get progressively older, some additional maintenance could include concrete repair, flushing of toe drains, shoreline repair, servicing of valves and remote sensing equipment.
A rough rule of thumb for annualized maintenance expenses based on capital construction costs is to use 1% to 1.5% for budgeting purposes.

PROJECTED BENEFICIAL USES

DISTRICT 64 NEEDS EVALUATION

The Ovid Reservoir was evaluated for potential uses both allowed under its current conditional decree and uses requiring potential changes in the decreed water rights for the project. Based on the Statewide Water Supply Investigation, the potential uses were categorized under Consumptive and Non-Consumptive needs as identified in the SWSI report. It should be noted that there is sufficient need for use by existing water users within District 64 but other benefits of the project have warranted the initial identification of both existing and new consumptive and non-consumptive water demands that may utilize the project as a beneficial water supply.

CONSUMPTIVE USES

EXISTING BASIS OF APPROPRIATION

The District 64 Reservoir Company has established needs for this water supply. Each category below includes the existing consumptive uses planned for the conditional water right pertaining to Ovid Reservoir.

AGRICULTURE

Augmentation Water for Existing Uses

Existing and new irrigated agriculture lands could benefit from water supplies provided by Ovid Reservoir for augmentation. The primary value of the reservoir via augmentation comes from the ability to make exact releases in time, location and quantity to potentially unsatisfied senior surface water rights near the reservoir including the South Reservation, Peterson, Liddle, and Carlson ditches in Sedgwick County and to maximize the beneficial use of water in Colorado in a manner that complies with the requirements of the South Platte River Compact.

Existing Irrigation

The augmentation water needed for agricultural wells in District 64 is primarily covered by managed groundwater recharge and is often sufficient in average and wet years. However, alluvial augmentation wells, reservoir water and direct flow water rights are often times needed during dry years to fully augment agricultural wells as a back-up supply to recharge. In addition, during wet and sometimes average years, high groundwater tables in District 64 may continue to impact the use of managed groundwater recharge in certain areas. Ovid Reservoir could be used as a source of augmentation during desirable times of the year for existing agricultural wells in the lower portions of District 64.

In addition, there are many new recharge projects in the lower reach of the South Platte River that are currently operating to meet augmentation requirements. Many of these projects only get credit for the accretions to the stream that cover their well depletions, the remainder being excesses to the river or unusable due to groundwater timing. Ovid Reservoir could store available excess accretions with the proper legal agreements in place. The stored accretion credits could then be released or retimed to benefit future demands. There are also numerous groundwater recharge projects in the lower South Platte that currently provide accretion credits for beneficial uses. These recharge projects are junior water rights that may see some time periods in years where they are unable to divert. There may also be time periods where recharge has to be curtailed due to high groundwater tables which could cut short the ability to build up accretion credits coming back to the river. Ovid could be able to provide supplemental supplies to extend or alter recharge delivery time periods for optimum beneficial use. Please see the Augmentation of Existing Wells discussion under the Beneficial Use Demand section below for estimated monthly water demand data.

Supplemental Surface Water for Existing Irrigation

In addition to using Ovid Reservoir for augmentation of alluvial agricultural wells, the reservoir has potential to operate as a supplemental storage supply for existing irrigation within Sedgwick County.

Existing Surface Irrigation

Ovid Reservoir could provide a supplemental water supply to existing irrigation projects that use surface water supplies. In some cases it may be used as a drought supply or a re-regulation / efficiency improvement supply. One potential example of such use would be as a supplemental supply for the Julesburg Irrigation District (JID). The location of the proposed reservoir is ideal for irrigators under JID. The reservoir as proposed would be fed by the Peterson Ditch which is a JID structure. The reservoir could under certain operating conditions be pumped back into the Peterson Ditch to supply supplemental water to the lower end of the JID system as a drought supply or to provide efficiency improvements within the system. Please see the Irrigation Supplement discussion under the Beneficial Use Demand section below for estimated monthly water demand data.

MUNICIPAL AND INDUSTRIAL

Augmentation Water for Existing Uses

Existing Municipal and Industrial

Currently the towns of Julesburg, Ovid and Sedgwick are within close vicinity of the proposed Ovid Reservoir site. These towns all rely on local augmentation plans which primarily use managed groundwater recharge to augment well depletions under the same type of operations as augmenting existing agriculture irrigation wells. Similar to agricultural wells, Ovid Reservoir could be used as a source of augmentation during desirable times of the year for existing municipal wells in the lower portions of District 64.

Supply for Augmented Deficit Irrigation and Other Alternative Agriculture Transfer Projects

There are many projects currently analyzing the use of Alternative Transfer Methods (ATM) for agriculture to lease water supplies to municipal water providers to allow irrigated agriculture to remain in production. Deficit irrigation projects are being considered in the lower South Platte region, which look at producing crops with less water. This concept proposes that a portion of the conserved water can then be used for municipal use and extensive research projects are currently studying the potential water savings from such deficit irrigation. One of the primary concerns with deficit irrigation is the need to augment or replace the return flows generated from the historic irrigation practices in order to prevent injury to other water rights. Certainty for ATM projects and the protection of existing water rights would be efficiently served by storage water that can be released on demand. Ovid Reservoir could serve as a source of supply to keep return flow patterns whole, allowing deficit irrigation and/or other alternative transfer method projects to be implemented in the lower reaches of the South Platte River.

POTENTIAL FUTURE OVID RESERVOIR USES

The water rights for Ovid Reservoir are based on the demand for water by District 64 Reservoir Company shareholders for the decreed purposes for the Ovid Reservoir water rights. However, as the result of the interest in Ovid Reservoir on the part of the Colorado Water Conservation Board and others, the scope of this Study is broader and includes an assessment of other potential benefits of Ovid Reservoir. These other benefits include each category below of new or possible future consumptive uses of water stored in Ovid Reservoir. This list is not considered exhaustive.

Supplemental Surface Water for New Irrigation

In addition to using Ovid Reservoir for augmentation of alluvial agricultural wells, the reservoir has potential to operate as a supplemental storage supply for new irrigation within Sedgwick County.

New Surface Irrigation

As mentioned under the augmentation section above, the economic viability of agriculture has shown a marked upswing in the past few years. One clear sign of health has been the marked decrease in farm subsidy payouts over the past few years. Grain prices have increased well past the tipping point. This will bring an incentive to plant more land to meet the increased farm commodity demands that exist. Ovid Reservoir is in an area that could potentially bring additional lands under irrigation by District 64 Reservoir Company shareholders and could provide supplemental storage water for such lands. Agriculture in the lower reaches of the South Platte River is very viable economically. Food and energy production is making the preservation and expansion of irrigated agriculture more important than ever. Ovid Reservoir could provide a water supply for new lands coming under irrigation solely by District 64 Reservoir Company shareholders. The fact that it can fill reliably makes it a valuable asset for new lands. Please see the New Irrigation discussion under the Beneficial Use Demand section below for estimated monthly water demand data.

MUNICIPAL AND INDUSTRIAL

This provides opportunity for local M&I water supplies for future uses. Possible uses could include municipal water supplies for future growth and industrial supplies for new development. It is anticipated that potential energy, mineral and renewable energy projects in the area may be beneficiaries. This report assumes that both the existing and potential future municipal and industrial demands will be served by alluvial groundwater wells and therefore would require a water supply for augmenting the depletions from such wells. The following existing and future municipal and industrial needs could potentially benefit from water supplied by Ovid Reservoir.

Augmentation Water for New Uses

New Municipal

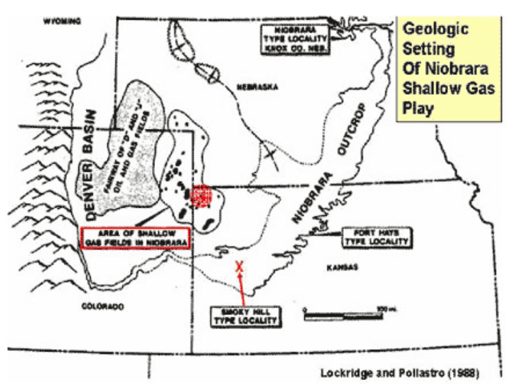
New water demands for future growth in existing towns such as Julesburg, Ovid and Sedgwick could be potentially supplied by Ovid Reservoir as an augmentation source for such demands. In addition, portions of the new municipal water demands further upstream in Water District 64 could be augmented by Ovid Reservoir if coupled with minor infrastructure and exchange of available water supplies past upstream dry-up points. Please see the New Municipal discussion under the Beneficial Use Demand section below for estimated monthly water demand data.

New Industrial

Increasing national demands for energy, mineral and renewable energy development warrants the need for local water supplies to offset the water demands on these highly consumptive industries should local industry become reality. Potential future industry needs for water supplies from Ovid Reservoir are as follows:

Energy Development

New energy development by means of co-generation (coal-fired and natural gas) power plant could be a viable consumptive beneficial use for Ovid Reservoir. It has been estimated that a co-generation plant utilizing both coal and natural gas will be approximately the same size and have the same water demands as a coal-fired plant utilizing coal only.



LOCATION OF OIL AND GAS RESOURCES

Other potential energy demands could come from gas fields located in the Niobrara formation in the northeast corner of Colorado. Augmentation water for well development is a critical component to meeting these energy demands, which could be potentially supplied by Ovid Reservoir. Please see the Energy discussion under the Beneficial Use Demand section below for estimated monthly water demand data.

Mineral Development

Mineral development of sand and gravel reserves in the region is a potential source of demand for Ovid Reservoir. The reserves that remove gravel from the valley fill aquifer of the South Platte River will expose groundwater which requires augmentation by Colorado law. During the course of extraction, many gravel pits use Substitute Water Supply Plans to cover consumptive uses such as lake evaporation, dust control, moisture loss in produced materials and production losses from washed products. After reclamation is completed any exposed water that is hydraulically connected to the groundwater table has to be permanently augmented. All of these demands could be met on a year round basis by Ovid Reservoir. For every acre of exposed groundwater, approximately three acre-feet of water would need to be replaced due to evaporation.

Temporary Substitute Water Supply Plans for Commercial and Industrial Construction Projects

The current administration of the South Platte River has many temporary substitute water supply plans. It is anticipated that in the future there will be many more proposed. Ovid Reservoir could provide a temporary supply for proposed new temporary construction projects. Projects that are going through water court and have a need of backup or alternate supplies to adequately protect water rights could rely on Ovid for that substitute supply.

REGIONAL AND SOUTH PLATTE BASIN WATER SUPPLY GAP

Recent Statewide and South Platte Basin Roundtable discussions and needs assessments have taken place concerning existing and future water supply shortages across the State of Colorado and more specifically within the South Platte basin. The Colorado Water Conservation Board and the South Platte Basin Roundtable have identified a "status-quo" gap between municipal water supplies and demand of 410,000 ac-ft by the year 2050 for the South Platte basin. CWCB and the SPBRT have also identified an estimated future agricultural water supply gap of 274,000 ac-ft in the South Platte Basin and a potential loss of 40% of irrigated agricultural acres in the South Platte Basin to meet the existing and future M&I water supply gap in the basin. The impending future gap between water supplies and demands within the South Platte Basin along with existing and future local and regional water supply shortages have prompted water users and planners to develop solutions to meeting water supply shortages.

One of the potential solutions to Statewide and South Platte Basin water supply shortages is to develop alternative transfer methods (ATMs) to the permanent dry-up of irrigated agriculture. There are numerous types of ATMs as defined by CWCB in their SWSI 2010 Report such as: lease/fallowing agreements, interruptible supply agreements, deficit irrigation practices, changing cropping types, water banking, and purchase and leaseback agreements. In addition, there are potential variations of such programs that could benefit the water supplies of both existing agricultural water demands and future municipal and industrial demands. One of the key issues involved with making such a program work is the distribution or transport of water supplies from areas with available water supplies to areas upstream on the river with water demands. The construction of large pumping plants and pipelines become extremely expensive and cost prohibitive due to varying water availability and low water quality near the point of diversion. The use of river exchanges to move available water from downstream to upstream can be a viable alternative to large-scale infrastructure but can be limited due to drying river points and water availability. However, strategically located infrastructure such as pumping plants, storage reservoirs and other augmentation sources can significantly enhance the ability to move and re-time available water supplies to upstream water demands. Due to the proposed location of the Ovid Reservoir and the nearby senior surface rights of the South Reservation, Peterson, Liddle and Carlson ditches, the proposed project could serve as a water supply project to enhance regional exchanges and allow water users in District 64 to optimize the use of their existing water supplies in meeting existing and future regional water supply shortages. Examples of potential use for the project are listed below.

Integration into Lower South Platte Water Cooperative or Other Similar Concepts

Over the past three years, a group of water users and water professionals have been discussing the possibility of organizing a water cooperative in the area of Water Districts 1 and 64 in the lower South Platte River, to create a mechanism for moving augmentation credits from plans with excess credits into plans with replacement deficits. Preliminary review of recent augmentation accounting indicated that there may be somewhere between 15,000 and 30,000 acre feet per year of excess credits from existing augmentation plans available, and recent river conditions indicate that this amount will likely increase over time. During discussions with various water users, it also became apparent that some groups were interested in leasing percentages of excess augmentation water along with other potentially available water to municipal and industrial end users. It appears that there are two types of groups potential looking to lease water: 1) those who are interested in leasing only excess augmentation credits locally to primarily agricultural end users and 2) those who would like to lease water both locally to agriculture end users and lease water further west for municipal and industrial end users.

Steering committee members of the water co-op have met with numerous ditch and reservoir companies, irrigation districts, augmentation groups and conservancy districts to discuss whether there was sufficient interest in organizing the co-op. The response was generally quite positive, with some questions and issues raised. Feedback from the initial round of meetings made it clear that the success of the co-op will be directly related to two key issues:

- The organizational structure chosen to govern and operate the co-op must be fair, open and transparent; and
- The operational plan for the co-op must be able to function within the existing system of water rights decrees, and be done so that no injury to existing water rights occurs.

In response to water user questions, feedback and direction in addition to further needed analysis, the steering committee has successfully requested funding from the Colorado Water Conservation Board grant programs. The first grant was applied for and awarded through the South Platte Basin Roundtable and Statewide Water Supply Reserve Account program to focus on analyzing the organizational structure for a potential water cooperative. The second grant was applied for and warded through the CWCB Alternative Agriculture Transfer Methods Grant program to primarily analyze the operational planning for a potential water cooperative.

In general the concept of exchanging, retiming and leasing water is being studied in depth by the steering committee and consultants involved with the water cooperative. Preliminary analysis has shown that the development of local and regional infrastructure such as storage reservoirs, pumping stations and recharge facilities can vastly improve the yield and efficiency of the water cooperative concept. The implementation of Ovid Reservoir could feasibly be integrated into the water cooperative project to provide improvements to water supply exchanges, allowing water users within all of District 64 to benefit from exchanging, leasing and retiming available water supplies in order to optimize their water supplies in addressing local and regional water supply shortages.

Preliminary analysis by Brown and Caldwell (engineering consultants for Lower South Platte Water Cooperative) showed a diminishing ability to exchange water within District 64 primarily below the Harmony Ditch in the lower reaches of District 64 (see Exhibit B). This same analysis also highlighted the potential for improvements to exchanging available water by installing infrastructure improvements such as pumping stations at critical “bottlenecks” or dry-up points in the river coupled with downstream augmentation sources to replace potential “out-of-priority” depletions from such operations. Ovid Reservoir could be utilized as a potential augmentation source to replace downstream depletions from upstream exchange operations.

NON-CONSUMPTIVE USES

POTENTIAL FUTURE USES OF OVID RESERVOIR FOR NON-CONSUMPTIVE DEMANDS

As previously stated, District 64 Reservoir Company needs already exist for the water in Ovid Reservoir. The interest in the reservoir has identified potential non-consumptive benefits which might benefit from participation in the reservoir project. Each category below includes the potential non-consumptive uses of the conditional water right for Ovid Reservoir.

ENVIRONMENTAL AND RECREATIONAL

The South Platte Basin Roundtable did a comprehensive needs-assessment of existing non-consumptive uses for the entire reach of the South Platte River. Non-Consumptive needs are generally related more to the environment and recreation. There are multiple needs in the lower part of the South Platte River that are related to wildlife and recreational uses. Ovid Reservoir could provide water supplies associated with environmental and recreational uses, enhance or augment the many recharge projects developed to create or improve seasonal wetlands, and provide in-stream supplemental water supply.

Augmentation Supply for Existing Seasonal Wetlands

Ovid Reservoir could provide supplemental water to firm up the water supplies for existing wetland projects by making releases in times when the wetlands need water and the water rights provided may not be adequate. Please see the Wetlands discussion under the Beneficial Use Demand section below for estimated monthly water demand data.

This analysis did not consider the ability for individual groups to finance the construction and operations of the reservoir. By combining various groups together under seven separate scenarios, future economic and organizational consideration will determine the overall and individual economic feasibility of the project.

OTHER NON-CONSUMPTIVE BENEFITS

Compact Compliance Efficiency Improvements

The South Platte River Compact (Compact) between the States of Colorado and Nebraska was signed by Commissioners for both States on April 27th, 1923, providing for the permanent and equitable distribution of the waters of the South Platte River. The Compact has several Articles and paragraphs detailing the terms and conditions of the agreement between the two States; however, the primary obligation by the State of Colorado is defined in Article IV Paragraph 2. Article IV, Paragraph 2 of the Compact states: *Between the first day of April and the fifteenth day of October of each year, Colorado shall not permit diversions from the Lower Section of the river, to supply Colorado appropriations having adjudicated dates of priority subsequent to the fourteenth day of June, 1897, to an extent that will diminish the flow of the river at the Interstate Station, on any day, below a mean flow of 120 cubic feet of water per second of time, except as limited in paragraph three (3) of this Article.* Paragraph 3 of the same Article states: *Nebraska shall not be entitled to receive and Colorado shall not be required to deliver, on any day, any part of the flow of the river to pass the Interstate Station, as provided by paragraph two (2) of this Article, not then necessary for beneficial use by those entitled to divert water from said river within Nebraska.*

Historically there have been numerous times when water users and the State of Colorado would benefit from the ability to fulfill compact requirements to the State of Nebraska. As South Platte River flows begin to diminish in late spring and early summer the ability for Colorado (within Water District 64) to supply 120 cfs of flow at the state line diminishes as well. Consequently during such times from April 1st through October 15th when river flow at the state line falls below 120 cfs, water users within Water District 64 are required to curtail diversions and/or replace out-of-priority depletions junior to June 14th, 1897. Managed releases by the State of Colorado Division of Water Resources from Ovid Reservoir could potentially be used as an exchange source to allow existing and/or new water rights to divert during times that they otherwise may not have been able to due to compact requirements at the state line. There are multiple benefits from these management practices to the State of Colorado and South Platte water users which include but are not limited to allowing extended junior recharge diversions, requiring of less augmentation replacement water, and extending “free river” days within Water District 64.

Ovid Reservoir could provide additional water for the benefit of Colorado in what could be called "Compact Compliance Efficiency Regulation". The current administration of water rights from Balzac down to the State line is based on maintaining the 120 cfs flow when legally required to do so. The State water commissioners currently estimate when flows at Balzac are dropping enough that they know an impact on flows will be felt at the State line sufficient to fall below the compact requirements. Based on this, they curtail upstream water uses earlier than when the stream flow falls below 120 cfs because of the lag time in getting flows to the State line. Ovid is only 12 miles above the State line and could start making early releases that would quickly make up the deficit and allow Colorado water users the benefit of extra time to continue making diversions before they are curtailed.

Augmentation Supply for New and Existing Seasonal Wetlands

Ducks Unlimited has been very proactive in the development of new wetlands habitat along the Lower South Platte. They have been working in cooperation with agricultural interests to identify lands that could support wetlands habitat. These projects require reliable water supplies that work within the priority system. Ovid Reservoir could provide supplemental water to firm up the water supplies for these projects by making releases in times when the wetlands need water and the water rights provided may not be adequate. It would also provide some indirect benefits to South Platte flows at the State Line from retimed return flows accruing back to the stream. Please see the Wetlands discussion under the Beneficial Use Demand section below for estimated monthly water demand data.

This analysis did not consider the ability for individual groups to finance the construction and operations of the reservoir. By combining various groups together under seven separate scenarios, future economic and organizational consideration will determine the overall and individual economic feasibility of the project.

Fish hatchery Development

The development of a warm water fish hatchery may also be a potential use of water supply from Ovid Reservoir. There have been preliminary discussions held with the Colorado Division of Parks and Wildlife (DOW) regarding fish hatchery development. The conclusions reached were that at the present time, given priorities and budgets, that is would not immediately rise to the top as a project. However, the idea for a hatchery appeared technically feasible and the funding and policy issues could change in the future. The location would be close enough to the State line that indirect benefits from operations of the hatchery could also benefit South Platte flows at the State line. Please see the Hatchery discussion under the Beneficial Use Demand section below for estimated monthly water demand data.

In-Stream Supply for Threatened and Endangered Fish

The reservoir could also potentially be used to supplement flows for a warm water stream to benefit minnows that have been identified along the South Platte by the DOW. The ability to make releases and provide controls could benefit research of these species. Colorado has been proactive in trying to keep species from being listed as endangered and the Tamarack Project has also been used to a small degree for this purpose, but the results to date have mostly been centered around minnows living in some of the local ponds. Given that these species were assumed to exist in the native stream, it would seem appropriate to have a project that more closely duplicates those conditions for purposes of research. Again, those operational non-consumptive flows could also provide some indirect benefits to flows at the State line.

OTHER NON-CONSUMPTIVE BENEFITS

Low Head Hydroelectric Generation

Ovid Reservoir could potentially reregulate as much as 10,400 ± acre-feet of water a year based on a fill and refill. The releases would be made through and outlet works back to the South Platte River. The technology in turbines has progressed significantly in the area of lower head units. It may be feasible to fit the outlet works of the reservoir with a small turbine and sell generated power to help as a source of revenue to pay for the project. This end use would not require any changes in decrees because the actual end use is something other than power and the electric production is ancillary to the final purpose. A recent study that was completed by Applegate Group for the Colorado Department of Agriculture evaluated the feasibility of using existing agricultural irrigation systems for purpose of power generation. These results indicate that there is significant potential in Colorado that warrants considering the installation of turbines when certain criteria are met.

PROJECTED BENEFICIAL USE NOTES

Please see the Reservoir Modeling Scenarios section below for Ovid Reservoir operation modeling results. The modeling scenarios below were determined by grouping various beneficial use demands by trial and error in order to produce a realistic Ovid Reservoir beneficial use schedule. Each scenario discusses scenario modeling results as well as realistic scenario feasibility.

BENEFICIAL USE DEMAND

LIMITATIONS

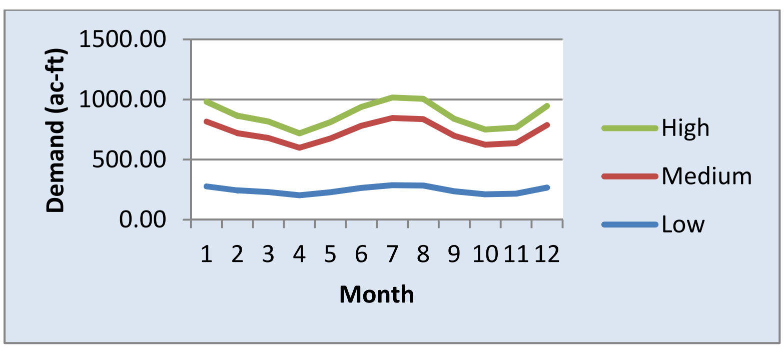
The following Ovid Reservoir beneficial-use water demand estimates are useful in quantifying realistic scenarios for how and when stored water in the proposed Ovid Reservoir could be put to beneficial-use. All data used for creating the following water demand curves was conservatively purposed to match operating conditions near the proposed Ovid Reservoir location, in Ovid, Colorado. It is important to note however, that there is a degree of uncertainty involved in the demand estimates for each beneficial-use below. For the purpose of this beneficial-use water-demand analysis, each water demand should be considered a rough estimate. The estimates found here within will be used to model estimates of reservoir release timing, depending on variations of beneficial-use combinations. See Appendix E for the Beneficial Use Demand figures mentioned in each beneficial use section below.

This analysis did not consider the ability for individual groups to finance the construction and operations of the reservoir. By combining various groups together under seven separate scenarios, future economic and organizational consideration will determine the overall and individual economic feasibility of the project.

ENERGY

Energy water demand estimates in acre-feet per month were attained from the "Statewide Water Supply Initiative 2010 South Platte Basin Report (SWSI Report)," Table 4-6 titled "Estimated Thermoelectric Power Generation Water Demands." The low demand illustrated in Figure-1 below from Appendix E, was assumed to be data from year 2008, the medium and high demands also in Figure-1, were assumed to be the estimated water demands for thermoelectric power generation in year 2050. It is important to note that the energy demand estimates used were from Morgan County, Colorado. The Pawnee Power Generating Plant is a coal-fired power plant located in Brush, CO in Morgan County. It has been estimated that if a co-generation power plant were to be constructed within Sedgwick County, that the size and energy output would be similar to that of the Pawnee Plant (505 megawatts per year). The Pawnee Plant produces approximately 505 megawatts per year with a water demand of 11.7 ac-ft per megawatt. The distribution curve of the plotted water demand values was generated by monthly electricity demands attained from the U.S. Energy Information Administration. For the purpose of this analysis, and in order to create a realistic demand curve, 50-percent of the energy water demands were utilized.

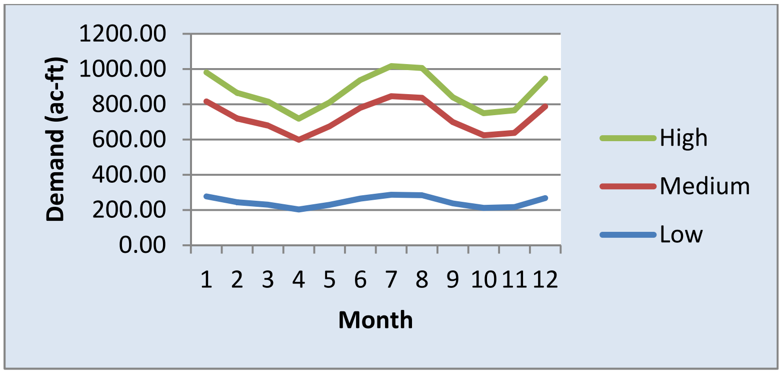
Figure 1: Energy 50% – Co-Generation Power Plant



WETLAND

Demand data estimates for Figure-2 below and in Appendix E were attained from typical standing water wetland, Net Evaporation values. The distribution of the demand data used in this analysis is simply the typical Net Evaporation observed month to month. Low, medium, and high water demands that could potentially be needed for a wetland project within Sedgwick County are essentially estimates of water demand for a range of common wetland acreages, provided by Ducks Unlimited.

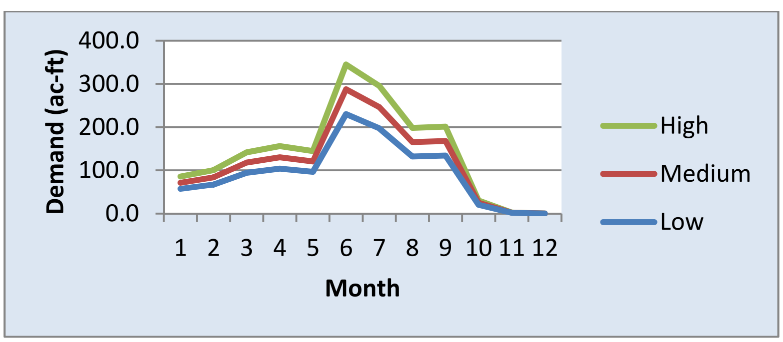
Figure 2: Wetland



HATCHERY

The Wray Fish Hatchery is a warm water hatchery in Wray, Colorado and was the source of demand data for the fish hatchery beneficial-use analysis. Information obtained from the Wray Hatchery estimated that a monthly distribution curve for monthly water demands would follow a pan evaporation curve from the proposed location of a future hatchery in Sedgwick County (Figure-3). For the purpose of this demand analysis, pan evaporation data from the Northern Colorado Water Conservancy District's weather station in Ovid, Colorado was used to estimate the distribution of monthly water demand. Average water demand was attained from the Wray hatchery; low and high demand was calculated by adjusting the average demand by twenty percent. Please reference Figure-3 below and in Appendix E for plots of each calculated water demand mentioned above. This analysis did not consider the ability for individual groups to finance the construction and operations of the reservoir. By combining various groups together under seven separate scenarios, future economic and organizational consideration will determine the overall and individual economic feasibility of the project.

Figure 3: Hatchery



IRRIGATION SUPPLEMENT

"Irrigation Supplementation" as an Ovid Reservoir beneficial-use takes into account two aspects of attaining the water needed to irrigate a crop in Sedgwick County, as a Julesburg Irrigation District (JID) shareholder. First, JID delivers a certain volume of water to the shareholder per year, per acre of irrigated land, depending on the amount of water divertible into its system in a given year. For the purpose of this analysis, it was assumed the range of deliverable water by JID ranges from four-tenths of an acre-foot per acre to slightly more than one acre-foot per acre. Second, the irrigator has an irrigation requirement per acre, depending on the crop being irrigated, that must be met in order to fully mature a crop. According to an official at JID, the total estimated irrigated acres under the JID system is 22,500. The difference between the water delivery quota by JID and the actual water need of the irrigated crop is considered in this analysis as the irrigation supplementation. In other words, the monthly demand depicted in Figure-4 and Figure-5, below and in Appendix E, is the amount of water the irrigator needs in addition to the water delivered by JID, to irrigate their crop. The dry year, average year, and wet year designations within the two figures assume that JID deliveries vary depending on divertible water available, therefore creating a higher or lower need for supplement water. Figure-4 and Figure-5 assume a water need of two acre-feet per acre. Figure-4 assumes 20-percent of JID's acres are supplemented by Ovid Reservoir and Figure-5 assumes only 10-percent of JID's acres are supplemented by Ovid Reservoir. The distribution of demand in Figure-4 and Figure-5 was estimated by analysis of historical monthly diversions by JID from the South Platte River.

Figure 4: Irrigation Supplement – 20% JID Acres

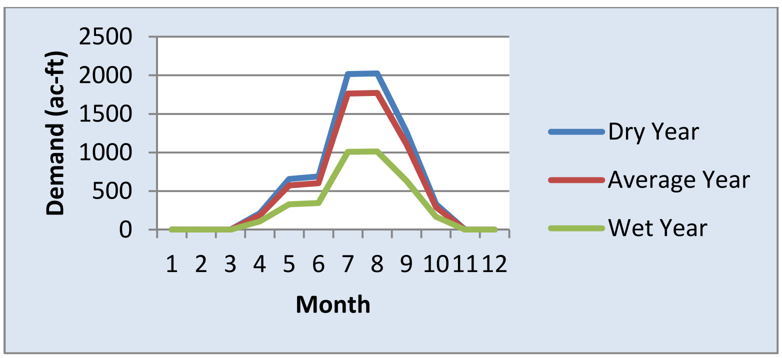
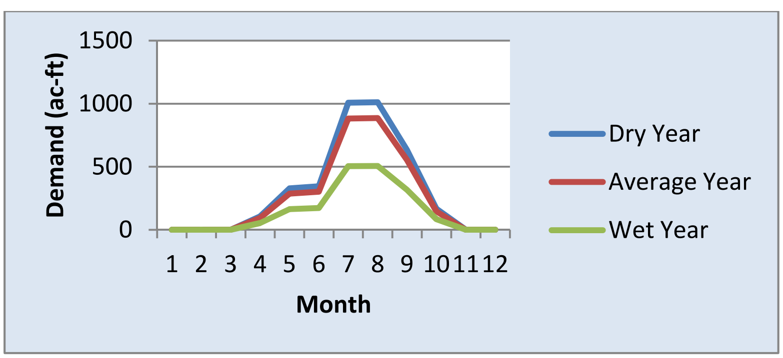


Figure 5: Irrigation Supplement – 10% JID Acres

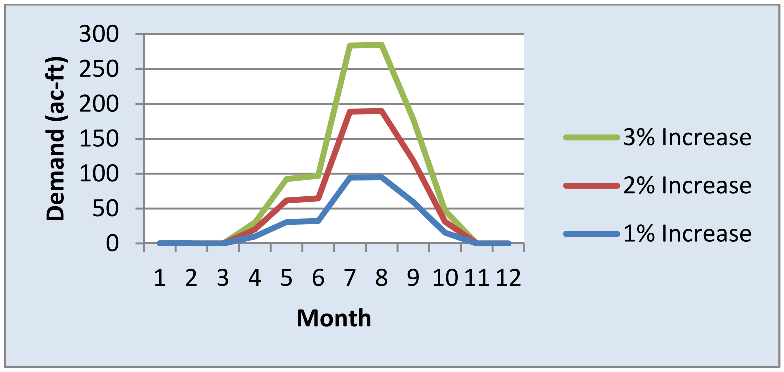


New Irrigation

Under the "Irrigation Supplement" section above, it was assumed either 10-percent or 20-percent of JID's 22,500 shareholder acres were supplemented by Ovid Reservoir. The beneficial-use titled "New Irrigation" is the estimated monthly water demand generated from the area of additional irrigated land that could be irrigated if Ovid Reservoir was constructed, and additional augmentation water was available. This possible additional irrigated land is a basis for calculating potential new surface acres by District 64 Reservoir shareholders. The percent increase in irrigated acreage, from a base of 22,500 acres, was calculated as one percent, two percent, and three percent

(Figure-6 below and in Appendix E). The water need for each of the three calculated acreage increases was assumed to be one and one-half acre-feet per acre. The distribution curve of the new irrigation water demand estimates was calculated from historical monthly diversions by JID from the South Platte River.

Figure 6: New Irrigation



AUGMENTATION OF EXISTING WELLS – SEDGWICK COUNTY/LOGAN COUNTY

Monthly augmentation, including recharge and depletion data, during augmentation year 2008 for District 64 was used to create Figure-7 below and in Appendix E. The District 64 recharge accretions minus depletions data for augmentation year 2008, that make up Figure-7, was attained from Table 5-3 within the "Colorado Corn Growers Association report on the Lower South Platte CO-OP." Entities within District 64 whose augmentation data was included in this analysis includes the Lower South Platte Water Conservancy District, Sedgwick County Well Users, Dinsdale, Harmony, and Condon. Excess recharge credits were calculated in April, May, and June for the above water authorities in the amount of approximately 2,640 acre-feet. These recharge excesses could be stored and released in July, August, September, and part of October to cover available depletions (Figure-7). It was assumed that from mid- October through March, no augmentation from Ovid Reservoir would be needed due to lack of calls on the South Platte River. The low and high demand values in Figure-7 were calculated by adjusting the average (medium) augmentation demand by 25 percent. The remaining water entities in Table 5-3 mentioned above are within Logan County and directly affect the Harmony Ditch when it is calling. It was estimated that Ovid Reservoir could cover five-percent, ten-percent, and twenty-percent (as low, medium, and high percentages, respectively) of Logan County's augmentation deficits via exchange and infrastructure pumping to the Harmony Ditch. Only deficits occurring in April through mid-October could potentially be covered by Ovid Reservoir. Figure-8 illustrates the estimated low, medium, and high augmentation of existing wells within Logan County, via exchange.

Figure 7: Augmentation of Existing Wells – Sedgwick County

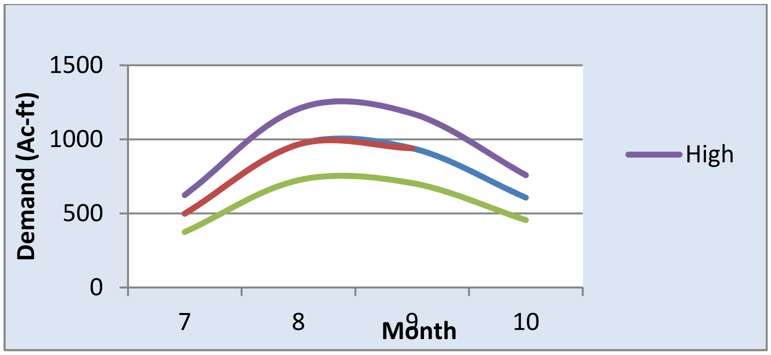
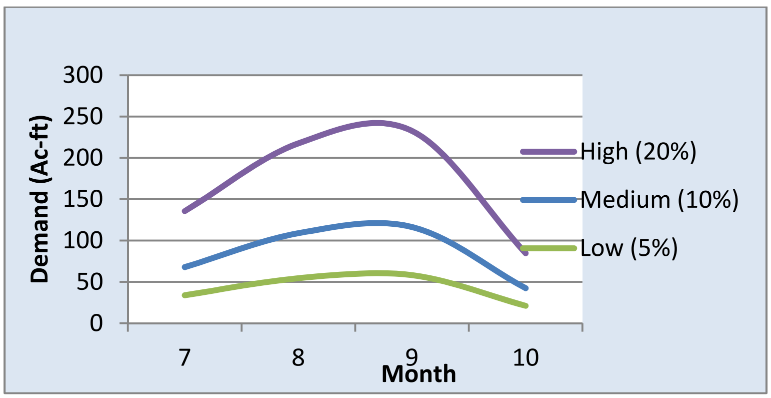


Figure 8: Augmentation of Existing Wells – Potential Logan County Deficit Coverage (Via Exchange)



NEW MUNICIPAL

The "New Municipal" proposed beneficial-use for Ovid Reservoir is simply the low, medium, and high estimated municipal water demands forecasted for year 2050 in Sedgwick County, Colorado. It should be noted that in order to calculate the excess water needed to meet the forecasted water demands for year 2050, the 2008 municipal water demand for Sedgwick County was assumed to be water that currently is in use; therefore, the 2008 water demand was subtracted from the forecasted year 2050 water demands. The same calculation was made for Logan County as well, however it was estimated that Ovid Reservoir could cover Logan County new municipal water demands via exchange at five-percent, ten-percent, and twenty-percent of the medium, year 2050 demand. Although the municipal water demand was calculated, it should be emphasized that the municipal needs in Logan County could be covered via a water exchange agreement only, if needed. Municipal water demand data was attained from Table 4-3 from the SWSI Report. Figure-9 and Figure-10, below and in Appendix E, illustrate the excess water demand needs for Sedgwick and Logan counties, respectively. The municipal water demand distribution curve was calculated from monthly municipal water needs illustrated in the Aurora, Colorado Water Demand Management Study from March, 2008.

Figure 9: New Municipal – Sedgwick County

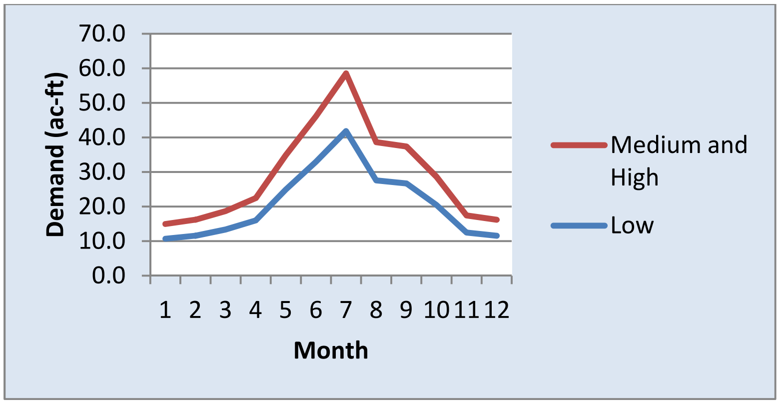
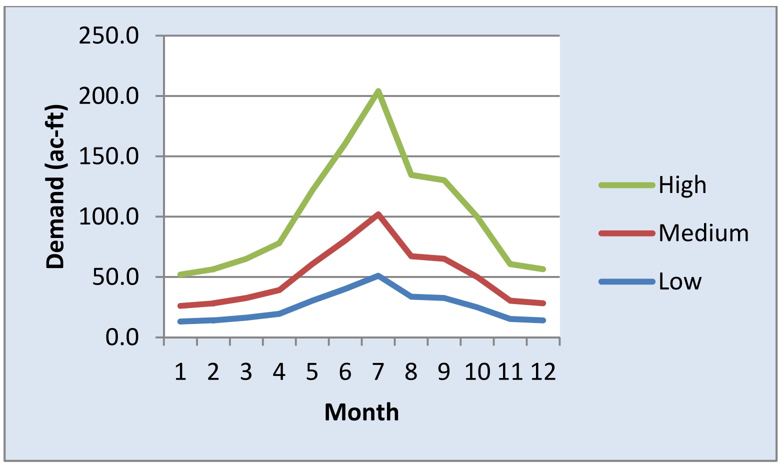


Figure 10: New Municipal – Logan County (Via Exchange)



RESERVOIR MODELING SCENARIOS

Following is a descriptive summary of the Ovid Reservoir beneficial-use water demand scenarios formulated to estimate realistic reservoir releases. Each beneficial-use water demand scenario is comprised of one or more beneficial uses which include estimated monthly water demands for each beneficial-use. The intended purpose of each modeling scenario is to evaluate Ovid Reservoir's ability to meet the needed, timed releases, for each respective reservoir usage scenario. The reservoir model used to model each scenario was designed specifically for Ovid Reservoir and includes capacities and conditions critical to operating the proposed Ovid Reservoir in Ovid, Colorado.

The modeling time period used was from 2000 to 2010 using daily time steps. Consideration was given to using a longer time period such as 30 years of record. The use of earlier data would have skewed results simply because the administration of the lower South Platte River was different in earlier years and would not be representative of how water is currently administered. The shorter time step also has the worst drought on record in the data so yield estimates for reservoir diversions should be considered worst case. The reservoir was modeled to subordinate to junior recharge water rights. This is a policy decision that was made by the District 64 Reservoir Company to respect the capital that has been invested to develop recharge projects for well augmentation. The data used included the daily gage records and call records from the Division of Water Resources and weather station data from the Northern Colorado Water Conservancy District Ovid Weather Station.

This analysis did not consider the ability for individual groups to finance the construction and operations of the reservoir. By combining various groups together under seven separate scenarios, future economic and organizational consideration will determine the overall and individual economic feasibility of the project.

Reservoir capacities used include the following: Maximum reservoir fill, dead storage, maximum fill rate, minimum fill rate, canal loss, outlet capacity, and river loss. Reservoir fill conditions include: River call percentage, minimum temperature at which to fill, average temperature required in order to fill, Peterson Ditch maximum diversion, flow below Peterson, total state line flow, and compensated state line flow (used in the event of needed excess water above state line flow requirement). Please see Table-8 for detailed capacities and conditions utilized. It should be noted that the augmentation demand amount for non-compact months (January, February, March, October 16-31, November and December) is equal to zero. Also, the compact call operates through October 15th, therefore the water demand calculated for the month of October includes half of October's demand.

The Peterson Ditch fill method is considered to be the primary means of filling Ovid Reservoir, hence the reason in-depth modeling and results analysis is provided herein. Later in this report, filling Ovid Reservoir by way of the well field was also analyzed. The well field analysis represents an alternative reservoir fill option.

Table 8: Reservoir Capacities and Fill Conditions

Capacities		***Fill Conditions***			***Values in CFS***
Maximum Fill Ac/ft	**5770**	Call % <=	**0**	Peterson Max Diversion =	**120**
Dead Storage Ac/ft	**500**	Min Temp >	**0**	Flow Below Peterson >	**15**
Max. Fill Rate CFS	**100**	Avg Temp >	**15**	Total State Line Flow >	**120**
Min. Fill Rate CFS	**20**	***Allocation %***		Compensated State Line Value	**125**
Canal Loss	**5.00%**	Augmentation	**100.0%**		
Outlet Capacity CFS	**100**	Compact Man	**0.0%**		
River Loss	**5.00%**				

Column-E in Table-1 through Table-7 calculates the total annual augmentation credits for potential storage and release from Ovid Reservoir. These values are calculated by determining the maximum storage volume available in Ovid Reservoir for the months in which excess District 64 augmentation credits are available (April-June), and then determining the minimum value between available storage and available excess augmentation credits; the total augmentation credits available for potential release is then summed from April through June, for each year of study (2000-2009). For the purpose of this analysis, it was assumed that 50-percent of the District 64 excess augmentation credits were available to potentially store and release from Ovid Reservoir.

See Appendix E for the Beneficial Use Demand figures referenced in each scenario below; see Appendix F for the Reservoir Modeling Scenario tables mentioned below.

The Table 9 summary table below illustrates the daily water demand per month required for each scenario.

Table 9: Water Demand Summary Table

	Monthly Water Demand (Ac-Ft)						
Month	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	19.9	7.5	3.8	6.1	11.3	6.2	31.2
5	21.8	8.1	11.2	7.0	19.3	18.5	41.1
6	26.0	15.5	12.2	13.5	27.7	20.1	53.7
7	27.3	33.2	34.5	34.2	49.5	56.9	95.1
8	27.0	45.2	34.7	47.9	45.2	57.1	106.9
9	23.3	45.6	22.4	46.2	32.9	37.0	91.3
10	40.3	49.0	11.4	46.0	19.9	18.8	100.7
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SCENARIO-1

Scenario-1 models the energy/power generation beneficial-use only (Figure-1, Appendix E). It is important to note that the average estimated water demand from Figure -1 was utilized in the analysis discussed below. The total daily releases from year 2000 through year 2009 from the reservoir under Scenario-1, equals 26,450 acre-feet. The daily demand estimated for the time period of year 2000 through year 2009, equals 34,092 acre-feet. Daily demand is the amount of water, from year 2000 through year 2009, that is estimated to be needed on a daily basis in order to meet the need of a power generating plant located in Sedgwick County. This demand does not take into account the operational requirements of the proposed Ovid Reservoir; it does however take into account the minimum state-line flow at the Nebraska/Colorado border. The total daily water shortage observed, in order to meet the estimated Scenario-1 water demand, taking into account minimum state-line flow requirements, equals 7,643 acre-feet, from year 2000 through year 2009. The total remaining water shortage from year 2000 through 2009, after utilizing stored augmentation credits, is estimated to be 4,684 acre-feet (Column F, Table-1. In order to meet the water demands for Scenario-1 on a daily basis for a similar period of record as was used for historic record for the reservoir model (2000-2009), additional water will be needed in excess of what Ovid Reservoir can supply, in the estimated amount of 4,684 acre-feet. Having analyzed the water demand associated with Scenario-1, it can be concluded that in all but dry years (seven out of the ten years of study), Ovid Reservoir would be able to cover 100-percent of the daily water demand without using stored augmentation credits from Sedgwick County (Column-D, Table-1). In eight of the ten years of study, Ovid Reservoir could cover daily demand shortages using stored District 64 excess augmentation credits. The two remaining years in which there is a shortage of water, creates a situation where additional sources of water will be needed to cover a portion of the daily demands for Scenario-1.

Table 1: Scenario 1 – 50% Energy/Power Generation Sedgwick County

Scenario Modeling Summary Table						
Scenario 1						
Year	Reservoir Net Fill (Fill-Shrink+ Previous Years End Storage) (ac-ft) (A)	Release (ac-ft) (B)	Daily Water Demand (ac-ft) (Footnote 1) (C)	Total Daily Water Shortage (ac-ft) (C-B) (D)	Total Annual Aug. Credits for Potential Storage and Release (ac-ft) (Footnote 2) (E)	Remaining Water Shortage (After Aug. Credit Release) (ac-ft) (D-E) (F)
2000	5,711	3,546	3,546	0	502	0
2001	8,164	2,416	2,416	0	497	0
2002	4,933	4,459	4,773	314	1,235	0
2003	1,643	1,534	4,675	3,141	1,322	1,819
2004	1,001	811	4,998	4,187	1,322	2,865
2005	8,218	2,682	2,682	0	670	0
2006	5,012	4,458	4,458	0	820	0
2007	6,919	3,076	3,076	0	395	0
2008	7,671	3,251	3,251	0	798	0
2009	5,986	216	216	0	344	0
Total:	**55,258**	**26,450**	**34,092**	**7,643**	**7,905**	**4,684**
Average:	**5,526**	**2,645**	**3,409**	**764**	**790**	**468**

See Footnotes following Table-7.

SCENARIO-2

Scenario-2 models the augmentation of existing wells in Sedgwick and Logan County (via exchange), New Municipal uses for both Sedgwick and Logan County (via exchange), and Wetland and Hatchery demands in Sedgwick County (Figures 7, 8, 9, 10, 2, 3 respectively, Appendix E). It is important to note that the average estimated water demand from the figures listed above were combined and utilized in the analysis discussed below. The total daily releases from year 2000 through year 2009 from the reservoir under Scenario-2, equals 30,887 acre-feet. The total daily demand estimated for the time period of year 2000 through year 2009, equals 41,088 acre-feet. The total daily water shortage observed, in order to meet the estimated Scenario-2 water demand, taking into account minimum state-line flow requirements, equals 10,201 acre-feet, from year 2000 through year 2009. The remaining water shortage from year 2000 through 2009, after utilizing stored augmentation credits, is estimated to be 3,114 acre-feet (Column-F, Table-2). In order to meet the water demands for Scenario-2 on a daily basis for a similar period of record as was used for historic record for the reservoir model (2000-2009), additional water will be needed in excess of what Ovid Reservoir can supply, in the estimated amount of 3,114 acre-feet. Having analyzed the water demand associated with Scenario-2, it can be concluded that in all but dry years (six out of the ten years of study), Ovid Reservoir would be able to cover 100-percent of the daily water demand without using stored augmentation credits from Sedgwick County and Logan County (Via Exchange) (Column-D, Table-2). In eight of the ten years of study, Ovid Reservoir could cover daily demand shortages using stored District 64 excess augmentation credits. The two remaining years in which there is a shortage of water, creates a situation where addition sources of water will be needed to cover a portion of the daily demands for Scenario-2.

Table 2: Scenario 2 – Aug.(All), New Munic.(All), Wetlands, Hatchery

Scenario Modeling Summary Table Scenario 2						
Year	Reservoir Net Fill (Fill-Shrink+ Previous Years End Storage) (ac-ft) (A)	Release (ac-ft) (B)	Daily Water Demand (ac-ft) (Footnote 1) (C)	Total Daily Water Shortage (ac-ft) (C-B) (D)	Total Annual Aug. Credits for Potential Storage and Release (ac-ft) (Footnote 2) (E)	Remaining Water Shortage (After Aug. Credit Release) (ac-ft) (D-E) (F)
2000	5,582	4,483	4,483	0	665	0
2001	8,648	3,199	3,199	0	290	0
2002	4,911	4,454	5,370	916	1,445	0
2003	1,611	1,417	5,334	3,917	2,725	1,192
2004	1,079	780	5,427	4,646	2,725	1,921
2005	7,885	3,640	3,640	0	399	0
2006	4,987	4,536	5,258	722	1,022	0
2007	6,862	4,513	4,513	0	336	0
2008	7,643	3,784	3,784	0	819	0
2009	5,850	80	80	0	335	0
Total:	**55,059**	**30,887**	**41,088**	**10,201**	**10,761**	**3,114**
Average:	**5,506**	**3,089**	**4,109**	**1,020**	**1,076**	**311**

See Footnotes following Table-7.

SCENARIO-3

Scenario-3 models the 10-percent irrigation supplement within Sedgwick County and the new irrigation water demand (Figures 5 & 6 respectively, Appendix E). It is important to note that the average estimated water demand from the figures listed above were combined and utilized in the analysis discussed below. The total daily releases from year 2000 through year 2009 from the reservoir under Scenario-3, equals 24,797 acre-feet. The total daily demand estimated for the time period of year 2000 through year 2009, equals 29,469 acre-feet. The average total daily water shortage observed, in order to meet the estimated Scenario-3 water demand, taking into account minimum state-line flow requirements, equals 4,672 acre-feet, from year 2000 through year 2009. This total daily water shortage was observed to occur only in extremely dry years, where the Net Reservoir Fill (Column-A, Table-3) was far below average. The remaining water shortage, seen only in extremely dry years, from year 2000 through 2009, after utilizing stored augmentation credits, is estimated to be 2,028 acre-feet (Column-F, Table-3). In order to meet the water demands for Scenario-3 on a daily basis in extremely dry years, for a similar period of record as was used for historic record for the reservoir model (2000-2009), additional water will be needed in excess of what Ovid Reservoir can supply, in the estimated amount of 2,028 acre-feet per year. Having analyzed the water demand associated with Scenario-3, it can be concluded that in all but dry years, Ovid Reservoir would be able to cover 100-percent of the daily water demand without using stored augmentation credits from District 64 (Column-D, Table-3).

Table 3: Scenario 3 – Irr. Supp. 10%, New Irr.

Scenario Modeling Summary Table						
Scenario 3						
Year	Reservoir Net Fill (Fill-Shrink+ Previous Years End Storage) (ac-ft) (A)	Release (ac-ft) (B)	Daily Water Demand (ac-ft) (Footnote 1) (C)	Total Daily Water Shortage (ac-ft) (C-B) (D)	Total Annual Aug. Credits for Potential Storage and Release (ac-ft) (Footnote 2) (E)	Remaining Water Shortage (After Aug. Credit Release) (ac-ft) (D-E) (F)
2000	5,602	3,230	3,230	0	429	0
2001	8,214	2,466	2,466	0	279	0
2002	4,900	3,762	3,762	0	944	0
2003	2,253	1,989	3,672	1,683	1,322	361
2004	1,146	819	3,808	2,989	1,322	1,667
2005	7,876	2,716	2,716	0	474	0
2006	4,974	3,702	3,702	0	804	0
2007	6,820	3,015	3,015	0	286	0
2008	7,630	2,993	2,993	0	619	0
2009	5,875	105	105	0	388	0
Total:	**55,288**	**24,797**	**29,469**	**4,672**	**6,867**	**2,028**
Average:	**5,529**	**2,480**	**2,947**	**467**	**687**	**203**

See Footnotes following Table-7.

SCENARIO-4

Scenario-4 models Augmentation of existing wells for Sedgwick and Logan Counties (via exchange), New Irrigation in Sedgwick County, and Wetland and Hatchery demands from Sedgwick and Logan Counties (via exchange) (Figures 7, 8, 6, 2, & 3 respectively, Appendix E). It is important to note that the average estimated water demand from the figures listed above were combined and utilized in the analysis discussed below. The total daily releases from year 2000 through year 2009 from the reservoir under Scenario-4, equals 31,119 acre-feet. The daily demand estimated for the time period of year 2000 through year 2009, equals 41,214 acre-feet. The total daily water shortage observed, in order to meet the estimated Scenario-4 water demand, taking into account minimum state-line flow requirements, equals 10,096 acre-feet, from year 2000 through year 2009. This total daily water shortage was observed to occur only in dry years, where the Net Reservoir Fill (Column-A, Table-4) was below average. The remaining water shortage, seen only in dry years, from year 2000 through 2009, after utilizing stored augmentation credits, is estimated to be 3,058 acre-feet (Table-4). In order to meet the water demands for Scenario-4 on a daily basis in dry years, for a similar period of record as was used for historic record for the reservoir model (2000-2009), additional water will be needed in excess of what Ovid Reservoir can supply, in the estimated average amount of 3,058 acre-feet per year. Having analyzed the water demand associated with Scenario-4, it can be concluded that in all but dry years (six out of the ten years of study), Ovid Reservoir would be able to cover 100-percent of the daily water demand without using stored augmentation credits from Sedgwick County (Column-D, Table-4). In eight of the ten years of study, Ovid Reservoir could cover daily demand shortages using stored District 64 excess augmentation credits. The two remaining years in which there is a shortage of water, creates a situation where addition sources of water will be needed to cover a portion of the daily demands for Scenario-4.

Table 4: Scenario 4 – Aug.(All), New Irr., Wetlands, Hatchery

Scenario Modeling Summary Table						
Scenario 4						
Year	Reservoir Net Fill (Fill-Shrink+ Previous Years End Storage) (ac-ft) (A)	Release (ac-ft) (B)	Daily Water Demand (ac-ft) (Footnote 1) (C)	Total Daily Water Shortage (ac-ft) (C-B) (D)	Total Annual Aug. Credits for Potential Storage and Release (ac-ft) (Footnote 2) (E)	Remaining Water Shortage (After Aug. Credit Release) (ac-ft) (D-E) (F)
2000	5,572	4,510	4,510	0	658	0
2001	8,640	3,265	3,265	0	259	0
2002	4,908	4,454	5,334	880	1,362	0
2003	1,606	1,401	5,301	3,900	2,725	1,175
2004	1,089	768	5,375	4,607	2,725	1,882
2005	7,850	3,723	3,723	0	358	0
2006	4,984	4,536	5,243	708	986	0
2007	6,864	4,589	4,589	0	307	0
2008	7,639	3,804	3,804	0	793	0
2009	5,839	69	69	0	314	0
Total:	**54,991**	**31,119**	**41,214**	**10,096**	**10,486**	**3,058**
Average:	**5,499**	**3,112**	**4,121**	**1,010**	**1,049**	**306**

See Footnotes following Table-7.

SCENARIO-5

Scenario-5 models the 10-percent Irrigation Supplement within Sedgwick County, New Irrigation water demand, New Municipal demand for Sedgwick and Logan Counties(via exchange), and Wetland and Hatchery demand for Sedgwick and Logan Counties (via exchange) (Figures 5, 6, 9, 10, 2, & 3 respectively, Appendix E). It is important to note that the average estimated water demand from the figures listed above were combined and utilized in the analysis discussed below. The total daily releases from year 2000 through year 2009 from the reservoir under Scenario-5, equals 32,787 acre-feet. The total daily demand estimated for the time period of year 2000 through year 2009, equals 44,542 acre-feet. The total daily water shortage observed, in order to meet the estimated Scenario-5 water demand, taking into account minimum state-line flow requirements, equals 11,754 acre-feet, from year 2000 through year 2009. This total daily water shortage was observed to occur only in dry years, where the Net Reservoir Fill (Column-A, Table-5) was below average. The remaining water shortage, seen only in dry years from year 2000 through 2009, after utilizing stored augmentation credits, is estimated to be 4,001 acre-feet (Column-F, Table-5). In order to meet the water demands for Scenario-5 on a daily basis in dry years, for a similar period of record as was used for historic record for the reservoir model (2000-2009), additional water will be needed in excess of what Ovid Reservoir can supply, in the estimated amount of 4,001 acre-feet per year. Having analyzed the water demand associated with Scenario-5, it can be concluded that in all but dry years (six out of the ten years of study), Ovid Reservoir would be able to cover 100-percent of the daily water demand without using stored augmentation credits from District 64 (Column-D, Table-5). However, dry years in which there is a shortage of water, creates a situation where District 64 augmentation credits as well as other addition sources of water, will be needed to cover a portion of the daily demands for Scenario-5 (Column-F, Table-5).

Table 5: Scenario 5 – Irr. Supp. 10%, New Irr., New Munic. (All), Wetlands, Hatchery

Scenario Modeling Summary Table						
Scenario 5						
Year	Reservoir Net Fill (Fill-Shrink+ Previous Years End Storage) (ac-ft) (A)	Release (ac-ft) (B)	Daily Water Demand (ac-ft) (Footnote 1) (C)	Total Daily Water Shortage (ac-ft) (C-B) (D)	Total Annual Aug. Credits for Potential Storage and Release (ac-ft) (Footnote 2) (E)	Remaining Water Shortage (After Aug. Credit Release) (ac-ft) (D-E) (F)
2000	5,713	4,861	4,861	0	744	0
2001	8,744	3,564	3,564	0	515	0
2002	4,946	4,558	5,826	1,268	1,874	0
2003	1,554	1,432	5,701	4,268	2,725	1,543
2004	1,012	786	5,969	5,183	2,725	2,458
2005	8,114	3,910	3,910	0	568	0
2006	5,024	4,620	5,654	1,035	1,366	0
2007	6,900	4,303	4,303	0	398	0
2008	7,674	4,568	4,568	0	1,053	0
2009	5,955	185	185	0	291	0
Total:	**55,635**	**32,787**	**44,542**	**11,754**	**12,258**	**4,001**
Average:	**5,564**	**3,279**	**4,454**	**1,175**	**1,226**	**400**

See Footnotes following Table-7.

SCENARIO-6

Scenario-6 models the 50-percent Irrigation Supplement within Sedgwick County (Figure-4, Appendix E). It is important to note that the average estimated water demand from the figure listed above was utilized in the analysis discussed below. The total daily releases from year 2000 through year 2009 from the reservoir under Scenario-6, equals 35,036 acre-feet. The total daily demand estimated for the time period of year 2000 through year 2009, equals 48,537 acre-feet. The total daily water shortage observed, in order to meet the estimated Scenario-6 water demand, taking into account minimum state-line flow requirements, equals 13,501 acre-feet, from year 2000 through year 2009. This total daily water shortage was observed to occur in all but the wettest year within the study period (Column-D, Table-6). The remaining water shortage from year 2000 through 2009, after utilizing stored augmentation credits, is estimated to be 8,798 acre-feet (Column-F, Table-6). Having analyzed the water demand associated with Scenario-6, it can be concluded that in four out of the ten years of study, Ovid Reservoir would need additional sources of water to meet a portion the demand of Scenario-6.

Table 6: Scenario 6 – Irr. Supp. 20%

Scenario Modeling Summary Table						
Scenario 6						
Year	Reservoir Net Fill (Fill-Shrink+ Previous Years End Storage) (ac-ft) (A)	Release (ac-ft) (B)	Daily Water Demand (ac-ft) (Footnote 1) (C)	Total Daily Water Shortage (ac-ft) (C-B) (D)	Total Annual Aug. Credits for Potential Storage and Release (ac-ft) (Footnote 2) (E)	Remaining Water Shortage (After Aug. Credit Release) (ac-ft) (D-E) (F)
2000	5,708	5,134	5,320	185	479	0
2001	8,741	4,062	4,062	0	424	0
2002	4,941	4,568	6,196	1,628	988	639
2003	1,536	1,394	6,048	4,654	1,322	3,332
2004	1,030	781	6,272	5,491	1,322	4,169
2005	8,040	4,474	4,474	0	516	0
2006	5,018	4,633	6,098	1,465	806	658
2007	6,885	4,888	4,966	78	322	0
2008	7,667	4,930	4,930	0	776	0
2009	5,943	173	173	0	272	0
Total:	**55,509**	**35,036**	**48,537**	**13,501**	**7,228**	**8,798**
Average:	**5,551**	**3,504**	**4,854**	**1,350**	**723**	**880**

See Footnotes following Table-7.

SCENARIO-7

Scenario-7 models the Augmentation of existing wells in Sedgwick and Logan County (via exchange), New Municipal uses for both Sedgwick and Logan County (via exchange), Wetland and Hatchery demands in Sedgwick County, 10-percent Irrigation Supplement within Sedgwick County, New Irrigation water demand in Sedgwick County, and energy/power generation in Sedgwick County (Figures 7, 8, 9, 10, 2, 3, 5, 1, 6 respectively, Appendix E). It is important to note that the average estimated water demand from the figures listed above were combined and utilized in the analysis discussed below. The total daily releases from year 2000 through year 2009 from the reservoir under Scenario-7, equals 40,395 acre-feet. The daily demand estimated for the time period of year 2000 through year 2009, equals 104,649 acre-feet. The total daily water shortage observed, in order to meet the estimated Scenario-7 water demand, taking into account minimum state-line flow requirements, equals 64,255 acre-feet, from year 2000 through year 2009. This total daily water shortage was observed to occur in all but the wettest year within the study period (Column-D, Table-7). The remaining water shortage from year 2000 through 2009, after utilizing stored augmentation credits, is estimated to be 50,151 acre-feet (Column-F, Table-7). Having analyzed the water demand associated with Scenario-7, it can be concluded that in all but extremely wet years (nine out of the ten years of study), the demands would need additional sources of water to meet the demand of Scenario-7.

Table 7: Scenario 7 – All Scenarios Except Irr. Supp. 20%

Scenario Modeling Summary Table						
Scenario 7						
Year	Reservoir Net Fill (Fill-Shrink+ Previous Years End Storage) (ac-ft) (A)	Release (ac-ft) (B)	Daily Water Demand (ac-ft) (Footnote 1) (C)	Total Daily Water Shortage (ac-ft) (C-B) (D)	Total Annual Aug. Credits for Potential Storage and Release (ac-ft) (Footnote 2) (E)	Remaining Water Shortage (After Aug. Credit Release) (ac-ft) (D-E) (F)
2000	5,924	5,406	11,259	5,853	896	4,957
2001	8,949	6,117	8,082	1,964	910	1,054
2002	5,002	4,774	13,905	9,131	2,233	6,898
2003	1,409	1,372	13,681	12,309	2,725	9,584
2004	959	800	14,233	13,433	2,725	10,708
2005	8,737	6,128	9,037	2,910	913	1,996
2006	5,097	4,847	13,419	8,571	1,627	6,945
2007	7,080	5,225	10,605	5,380	572	4,808
2008	7,757	5,324	10,028	4,704	1,502	3,201
2009	6,171	401	401	0	371	0
Total:	**57,085**	**40,395**	**104,649**	**64,255**	**14,475**	**50,151**
Average:	**5,709**	**4,039**	**10,465**	**6,425**	**1,448**	**5,015**

Footnotes:

1.) Daily Water Demand was calculated by summing each day's water demand only on days when the Compensated Stateline Flow was less than that specified in the model.

2.) Total Annual Augmentation Credits for Potential Storage and Release was calculated by first determining how much storage was available in the reservoir in each month that excess District 64 augmentation credits were available (April-June)(Table 5-3 (Exhibit C), Colorado Corn Growers Association report on the Lower South Platte CO-OP Via Brown and Caldwell). Next, depending on which Scenario was being analyzed, 50-percent of the available augmentation credits, for each respective county (Sedgwick and Logan), was determined; the minimum value between available reservoir storage and available augmentation credits was then used as the applicable Total Annual Augmentation Credit for Potential Storage and Release.

Well Field Fill Reservoir Model

For each modeled Peterson Ditch reservoir fill scenario above, modeling results were also run for the fill scenario in which the reservoir is filled via the well field only. Below are the reservoir capacities and fill conditions for the purpose of modeling reservoir fill via the well field only, as well as the summary table illustrating the water shortage via the reservoir model for both the Peterson Ditch fill and the well field only fill.

Table 10: Well Field Fill Only - Reservoir Capacities and Fill Conditions

Capacities		*Fill Conditions*			*Values in CFS*
Maximum Fill Ac/ft	5770	Call % <=	0	Peterson Max Diversion =	120
Dead Storage Ac/ft	500	Min Temp >	-40	Flow Below Peterson >	0
Max. Fill Rate CFS	62.4	Avg Temp >	-20	Total State Line Flow >	120
Min. Fill Rate CFS	7.8	*Allocation %*		Compensated State Line Value	125
Canal Loss	0.00%	Augmentation	100.0%		
Outlet Capacity CFS	100	Compact Man	0.0%		
River Loss	5.00%				

Table 11: Daily Water Shortage Comparison

	Daily Water Shortage (Ac-Ft)						
Reservoir Fill Option	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**	**Scenario 6**	**Scenario 7**
Peterson Ditch	7,643	10,201	7,672	10,096	11,754	13,501	64,255
Well Field	587	2,731	0	2,635	4,069	5,796	56,469

As seen in the daily water shortage Table 11 above, the daily water shortages to satisfy daily demand for each scenario is greatly reduced if filling the reservoir with the well field only. Although the maximum fill rate into the reservoir is considerably lower than if filling with Peterson Ditch (100 cfs), fill volume into the reservoir is increased because there is no canal loss. Also, the number of days in which the reservoir is able to fill is increased as well by lowering the temperature at which reservoir fill takes place, and by lowering the flow below Peterson Ditch required in order to fill.

CONCLUSION NOTES

In Scenario-1 through Scenario-6, significant water shortages are seen only in year 2003 and year 2004, after available District 64 excess augmentation credits have been released. In these years, Net Reservoir Fill in Column-A was much lower than the other years of study. These shortages are predicted to decrease during dry years due to a projected increase in return flows due to the full augmentation of wells in water districts 1 and 64. Therefore, the reservoir may yield an increase in Net Reservoir storage to cover demands for these six scenarios. Overall, Ovid Reservoir could be operated to supply nearly all of the beneficial uses demands in six out of the seven modeled scenarios.

CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations were arrived to as a result of the studies incorporated into this project.

1. The Ovid Reservoir project is technically feasible to construct at the decreed location. The estimated construction cost for the project is approximately $20,000,000; based on 2011 construction dollars. The annual capital cost for the reservoir equates to approximately $170 per acre-foot looking at the estimated firm yields.
2. The District 64 Reservoir Company has established demands and uses for beneficial use of the water by their shareholders.
3. The previous engineering design was reviewed for feasibility and potential changes. The design approach would not change appreciably. An earth embankment dam using on-site material with a slurry wall cutoff still appears to be the most cost effective alternate. Some advances in technology may allow for better control and measurement for both inlet and outlet structures. The final set of end users will dictate the level and type of control needed.
4. The basin scenario modeling that was done for the time period between 2000 and 2009 shows that the reservoir could reliably fill in most years. The analysis apportioned diverted water to District 64 demands and other potential demands. In Scenario-1 through Scenario-6, significant water shortages are seen only in year 2003 and year 2004, after available District 64 excess augmentation credits have been released. In these years, Net Reservoir

Fill was much lower than the other years of study. These shortages are predicted to decrease during dry years due to a projected increase in return flows due to the full augmentation of wells in water Districts 1 and 64. Therefore, the reservoir may yield an increase in Net Reservoir storage to cover demands for these six scenarios. Ovid Reservoir could be operated to supply nearly all of the beneficial uses demands in six out of the seven modeled scenarios.

5. The Peterson Ditch or a well field could both serve the proposed Ovid site. The Peterson Ditch is flat in gradient, but could feasibly be operated in the winter months. The diversion structure on the South Platte River would require modernization to accommodate winter operations. The estimated cost for modernization is $135,025. A well field would have increased costs of pumping, but could divert reliably in extreme cold when ditch operations could not function.
6. The Ovid Reservoir location and the decreed uses give it extraordinary flexibility in meeting a wide range of potential demands. A list of potential uses is outlined in the report. It is not represented as exhaustive and the potential exists for other uses to come to the forefront that may not be anticipated now. The modeling results showed that a wide range of demands could be met. Demand curves for various uses were based on industry data and projections made by the State of Colorado in the State Water Supply Investigation.
7. The reservoir could be of benefit to the Julesburg Irrigation District for multiple purposes. These uses could include augmentation water, supplemental water for recharge, and alternate supply for maintenance operations at the head gate. Ovid Reservoir could also provide some operational efficiencies for other JID ditches besides the Peterson. There have been preliminary discussions with JID; however, there are no formal agreements that have been reached with JID for Ovid Reservoir.
8. Reservoir fill firm yields from 5,560 acre-feet to 8,300 acre-feet were used to estimate Total Annualized 30- Year Cost per Acre-Foot values from $134 to $225 (Appendix D).
9. As discussed in the well field alternative fill section above, filling Ovid Reservoir with inflow from the well field significantly reduces water shortage for each beneficial use demand scenario. The pumping of warm groundwater opens up more time periods where the reservoir can physically divert water that is legally available.
10. Utilizing a well field to fill the reservoir in addition to recovery wells provided the best cost per ac-ft due to the ability to fill during cold winter conditions at a steady rate and the ability to recover additional water contained within the confined slurry-wall created aquifer. However, the Peterson ditch reservoir fill option is still very feasible depending on fill conditions.
11. Future diligence needs to proceed between interested parties to determine funding options and agreements for Ovid Reservoir.
12. Each reservoir fill and recovery option is subject to factors that may affect the overall feasibility of each option. Additional study will be required such as: groundwater modeling, easement and river access analysis, and conveyance options for delivery to the reservoir.

Printed: December 23, 2008 by LKF
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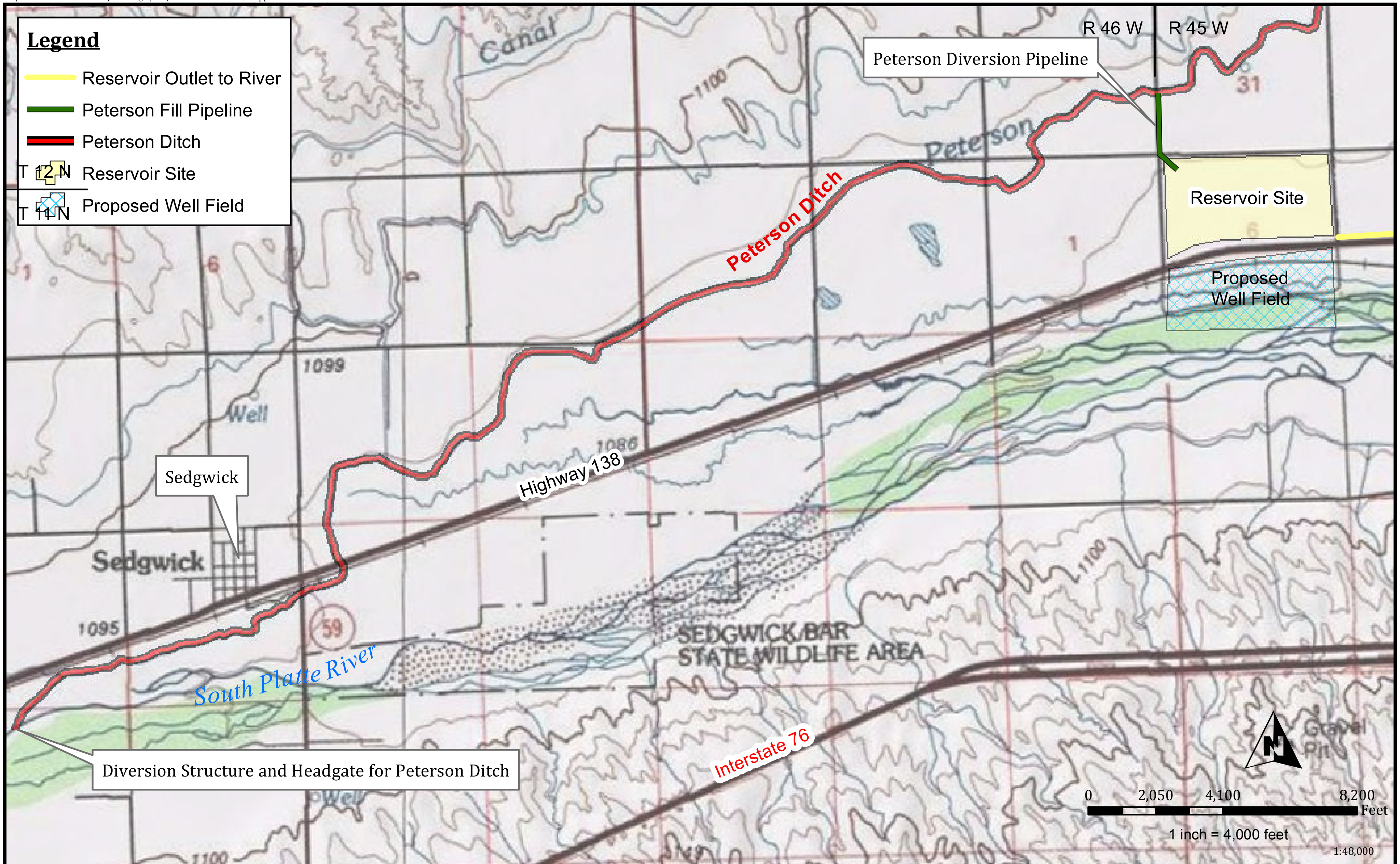

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DISTRICT 64 RESERVOIR COMPANY

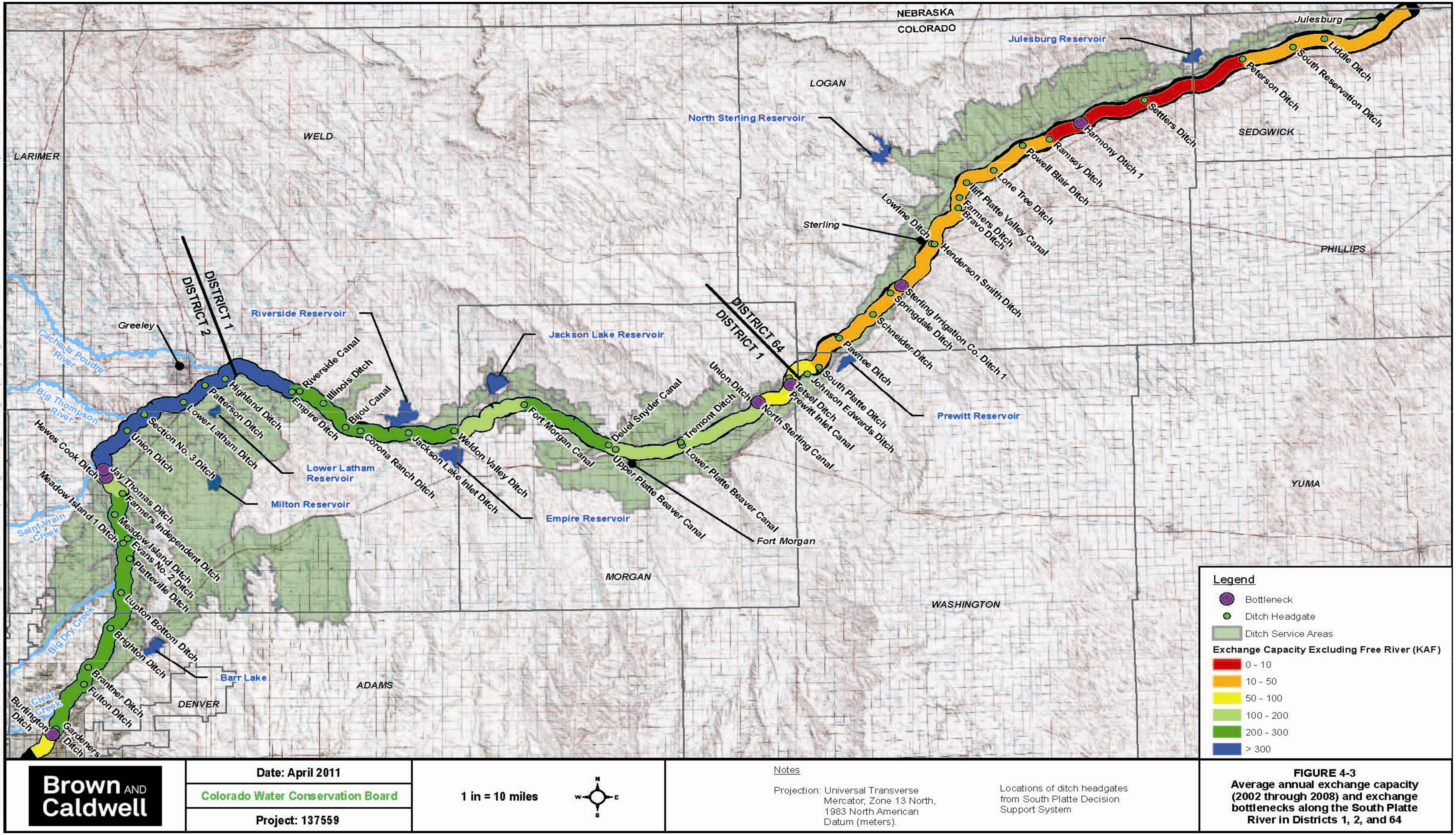
Exhibit A

Date: 23 Dec 2008

Job #: 08-129

Drawn By: LKF

Exhibit B: Brown and Caldwell Map



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April 18, 2011
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Exhibit C: Brown and Caldwell Table

Table 5-3. Calculation of recharge accretions minus depletions (net effects) for augmentation year 2008

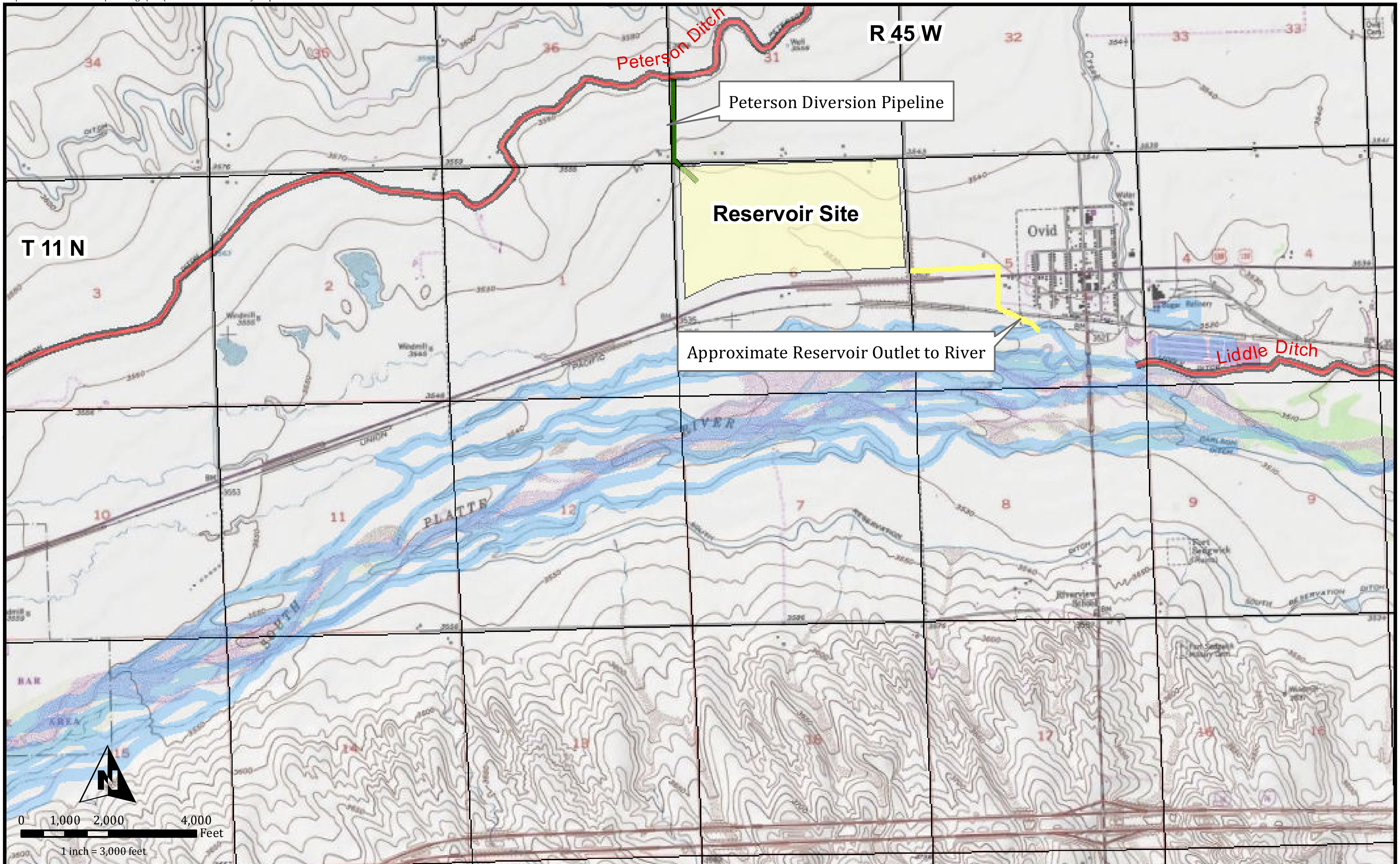
District 1 Augmentation Plan	2008									2009			Total
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	
LP&B	406	354	249	151	108	132	87	158	86	111	92	154	2,088
Pioneer	271	409	214	79	-7	36	138	285	219	166	124	237	2,170
Wind	0	-3	-3	-3	-3	-2	0	-3	-3	-3	-3	-3	-27
UP&B	1,417	653	192	188	302	370	933	579	248	186	236	1,502	6,806
English Feedlot	2	2	2	2	2	1	1	0	2	0	1	6	20
Pinneo Feedlot	29	28	29	30	32	33	35	38	37	34	32	31	389
City of Brush	0	0	0	0	0	0	0	19	18	15	13	15	79
Badger Beaver	0	0	0	0	0	0	0	0	0	0	0	0	0
D&S	72	57	47	41	86	57	43	38	88	80	48	49	706
T&M Livestock	0	0	0	1	7	2	2	2	2	2	2	0	20
Riverside	27	36	26	24	31	44	39	32	17	14	21	33	343
FMRICO	485	467	420	331	425	386	373	377	323	202	138	323	4,248
PSCO	-269	0	-5	5	-54	0	-592	-655	-644	-243	-410	-137	-3,002
City of Ft. Morgan	-4	-12	-30	-48	-50	-47	-46	-35	-29	-22	-17	-20	-359
MCQWD	0	0	1	1	1	1	1	-1	1	-1	-1	-1	1
Ft. Morgan Farms	-56	-57	-55	-57	-58	-57	-61	-60	-63	-63	-56	-52	-694
Jensen Teague	-92	-142	-132	-140	-128	-128	-92	-233	-257	-393	-299	-311	-2,347
Bijou	-322	-338	-424	-499	-558	-552	-535	-474	-516	-551	-585	-541	-5,895
Groves Farms	-47	-31	-56	-69	-93	-92	-90	-63	-84	-48	-42	-37	-751
OWW	22	22	21	21	18	14	12	9	8	6	2	3	158
Goodrich	72	75	73	76	77	75	77	75	77	76	68	75	896
Subtotal	192	-307	-200	-439	1,426	1,929	1,429	533	119	-101	0	268	4,849
[1]Total	192	0	0	0	1,426	1,929	1,429	533	119	0	0	268	5,897

District 64 Augmentation Plan	2008									2009			Total
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	
LSPWCD	166	204	241	121	65	20	1	-245	-243	-227	-146	-520	-563
SCWU	13	2	-196	-612	-681	-591	-480	-451	-464	-331	-243	-170	-4,204
Dinsdale	107	69	61	-193	-340	-305	-192	-440	-507	-599	-459	-480	-3,278
Harmony	289	192	162	141	108	109	121	124	131	132	119	252	1,881
Condon	544	513	277	44	-118	-173	-57	64	-35	-12	1	384	1,432
LLWU	131	399	587	275	73	-165	-76	-151	-1,755	-2,513	-2,292	-1,070	-6,557
Harris	51	16	-27	-37	-10	-11	-27	-5	-8	-3	0	14	-46
Hurst	82	-49	-95	-210	-192	-165	-58	26	54	114	149	155	-189
North Sterling	75	307	364	280	212	169	144	120	101	86	75	78	2,011
Lowline	106	79	44	0	0	16	72	83	41	36	108	171	756
LWU	459	277	-194	-667	-931	-819	-590	-447	-350	-110	85	488	-2,799
PWU	162	155	124	62	52	67	89	107	103	90	73	74	1,158
City of Sterling	-39	-302	-418	-480	-363	-324	-68	35	0	0	0	2	-1,957
SPDWU	153	150	109	91	74	67	86	103	128	138	141	56	1,296
Vandemoer	37	42	27	12	2	7	16	15	17	28	29	40	270
Quint	0	0	0	0	0	0	-7	-17	-14	38	-9	-6	-14
Valley View	-2	-1	-3	-3	-3	-4	-3	-3	-3	-4	-3	-3	-35
FL Gill	0	0	0	-1	-2	-1	-1	-1	0	0	0	-1	-6
Subtotal	2,334	2,052	1,062	-1,176	-2,053	-2,103	-1,029	-1,081	-2,805	-3,136	-2,374	-536	-10,844
[1]Total	2,334	2,052	1,062	0	0	0	0	0	0	0	0	0	5,448

[1]Negative values were removed from totals to account for other sources of augmentation supply that are used by augmentation plans to prevent the occurrence of negative net effects

FIGURES

Printed: July 3, 2008 by JMD
N:\08129 Ovid Reservoir\Drawings\GIS\Ovid Reservoir Vicinity Map.mxd



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www.ApplegateGroup.com
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Fax: (303) 452-2759
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OVID RESERVOIR

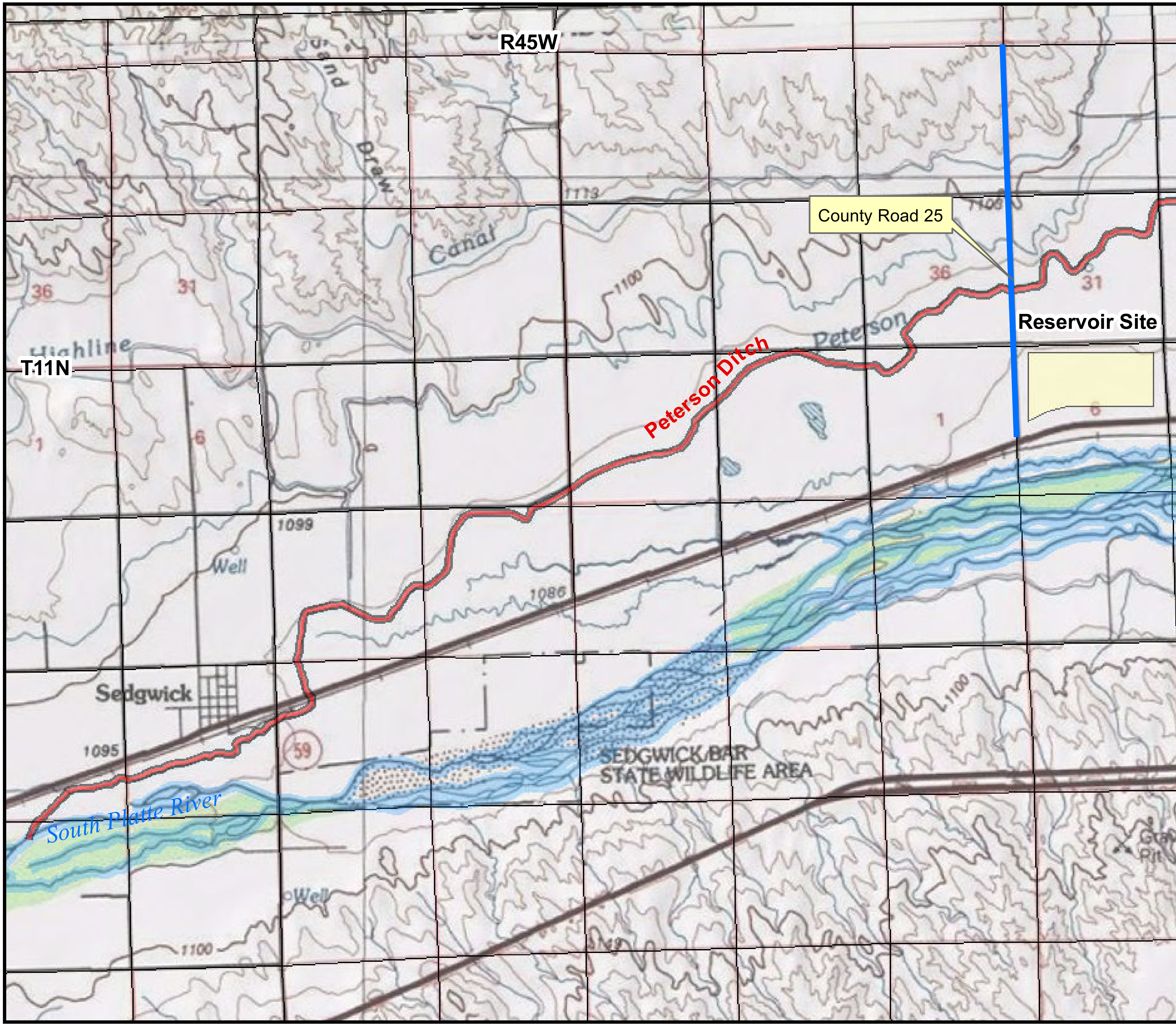
Vicinity Map

Date: 3 Jul 2009

Job #: 08-129

Drawn By: JMD

Figure: 1 Of: 8



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OVID RESERVOIR

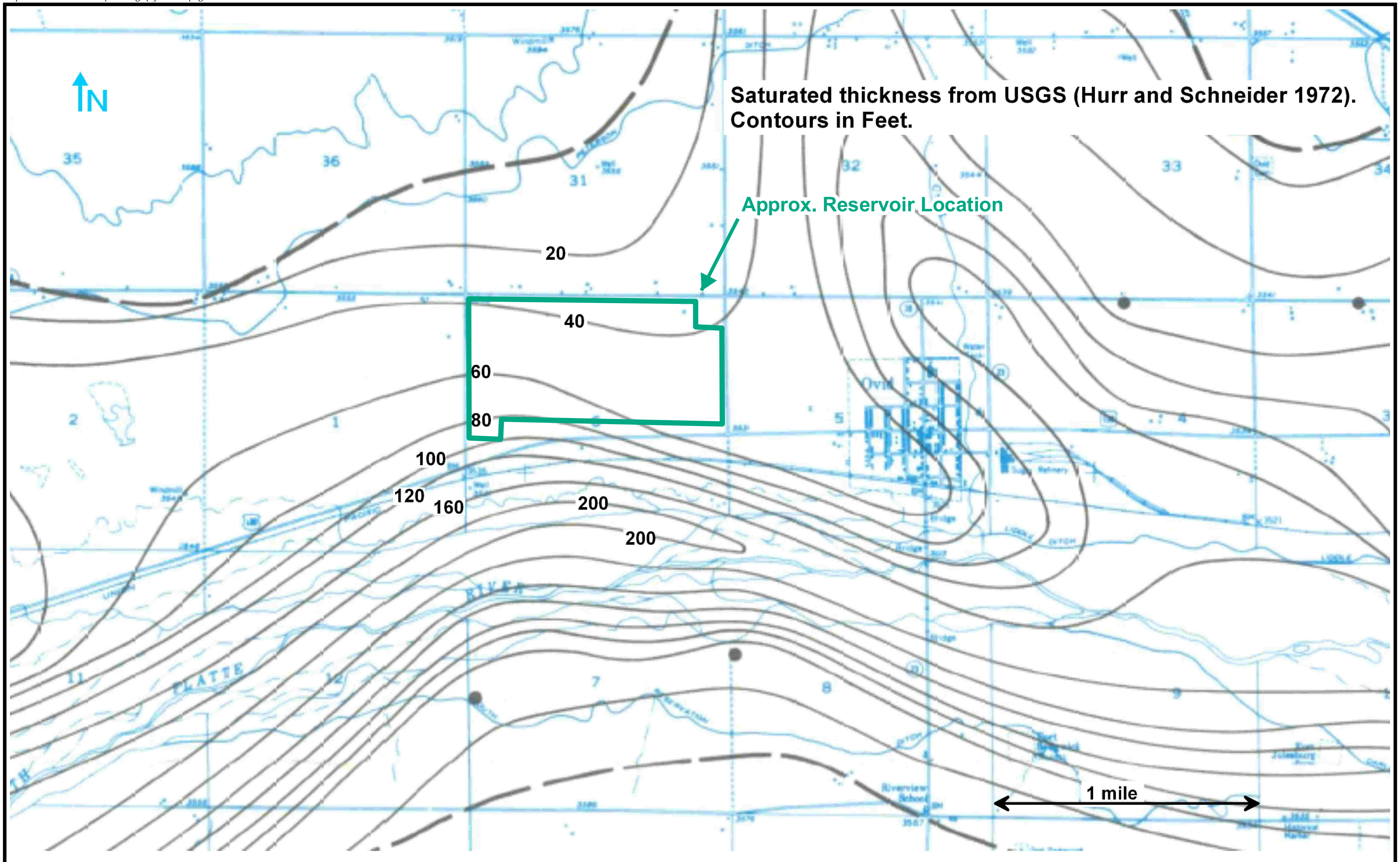
Peterson Ditch Conveyance

No.	Rev. Date	Revision Description

Date: 3 Jul 2008
Job #: 08-129
Drawn By: JMD

Figure: **2**
Of: 8

Printed: March 3, 2009 by JMD
N:\08129 Ovid Reservoir\Drawings\By Others\Figure 3 - Saturated Thickness.mxd



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OVID RESERVOIR

Saturated Thickness

Date: 3 Mar 2009

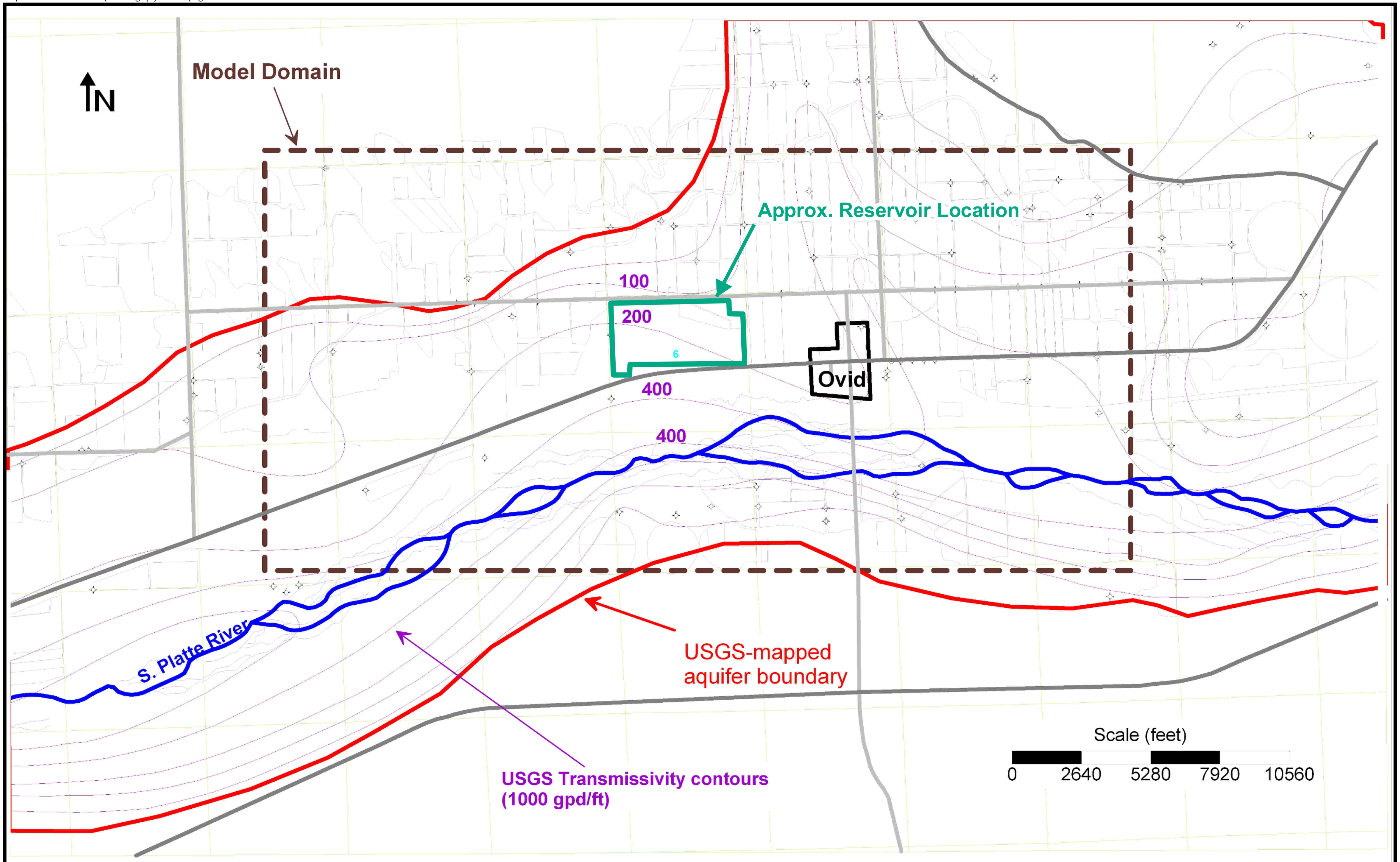
Job #: 08-129

Drawn By: CM

Figure: 3

Of: 8

Printed: March 3, 2009 by JMD
N:\08129 Ovid Reservoir\Drawings\By Others\Figure 4 - Model Area.mxd



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OVID RESERVOIR

Groundwater Model Area

Date: 3 Mar 2009

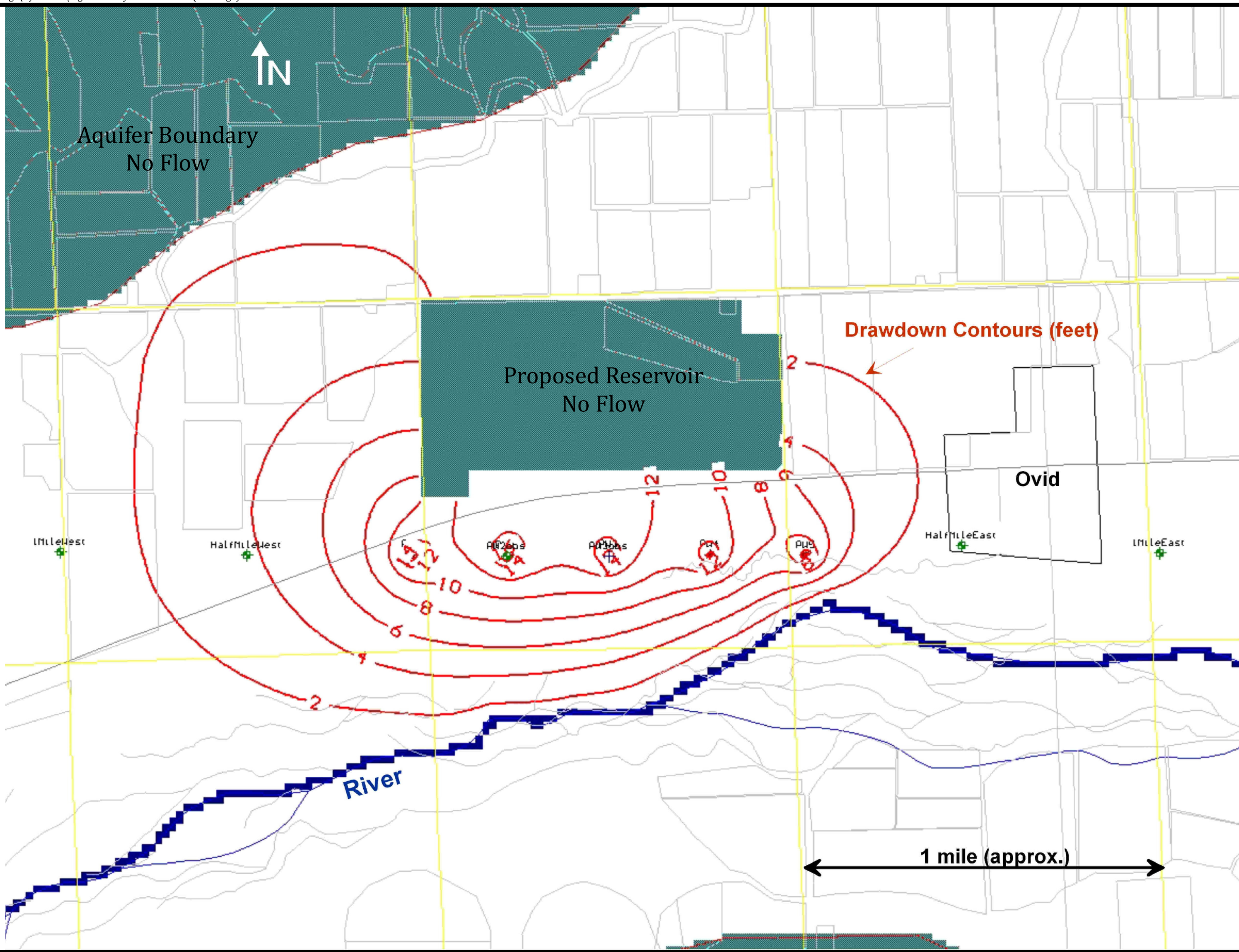
Job #: 08-129

Drawn By: CM

Figure: 4

Of: 8

Printed: March 3, 2009 by JMD
N:\08129 Ovid Reservoir\Drawings\By Others\Figure 5 - Day 90 Drawdown (Recharge).mxd



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OVID RESERVOIR

Day 90 Drawdown (With River Recharge)

Date: 3 Mar 2009

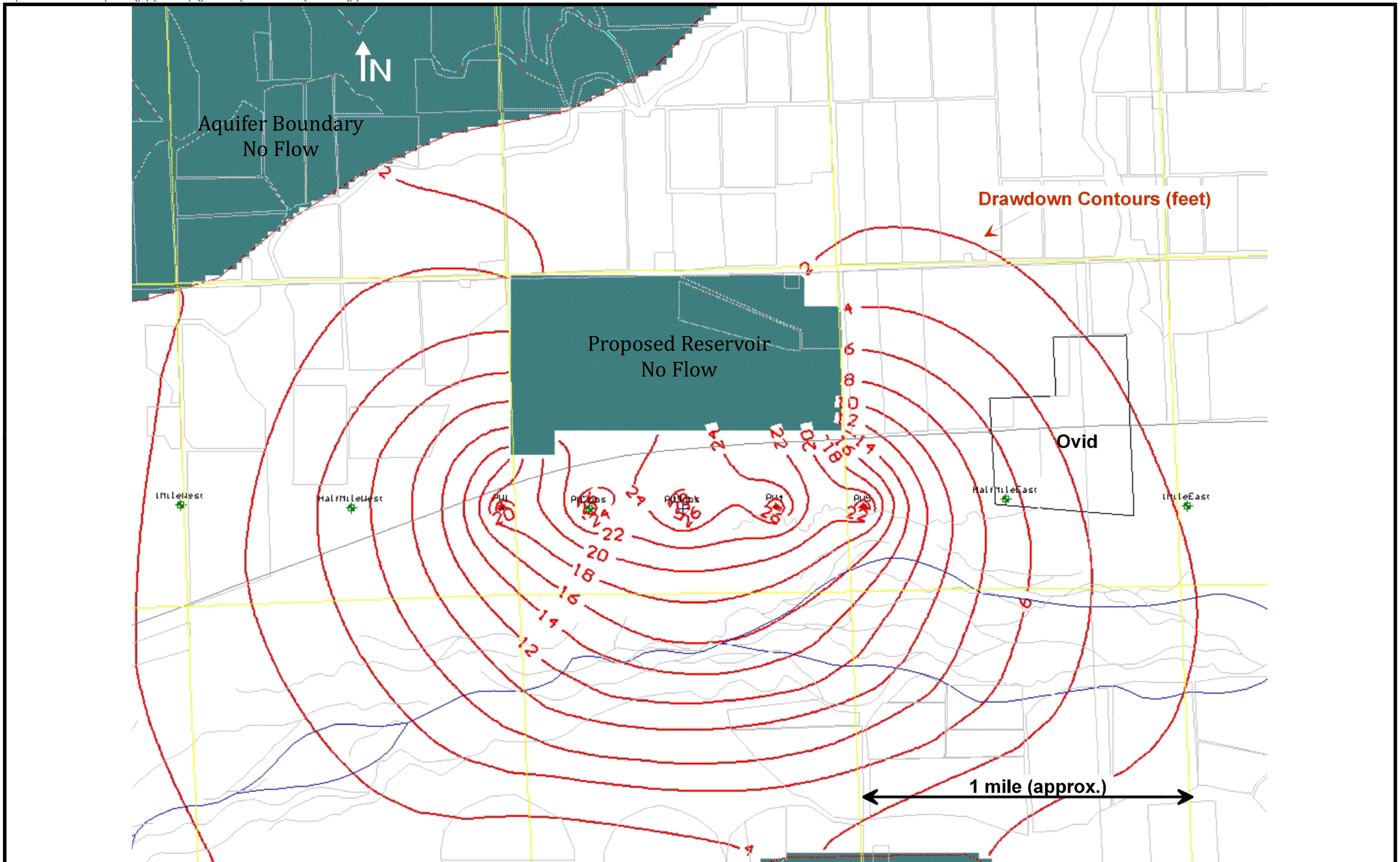
Job #: 08-129

Drawn By: CM

Figure: 5

Of: 8

Printed: March 3, 2009 by JMD
N:\08129 Ovid Reservoir\Drawings\By Others\Figure 6 - Day 90 Drawdown (No Recharge).mxd



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OVID RESERVOIR

Day 90 Drawdown (No River Recharge)

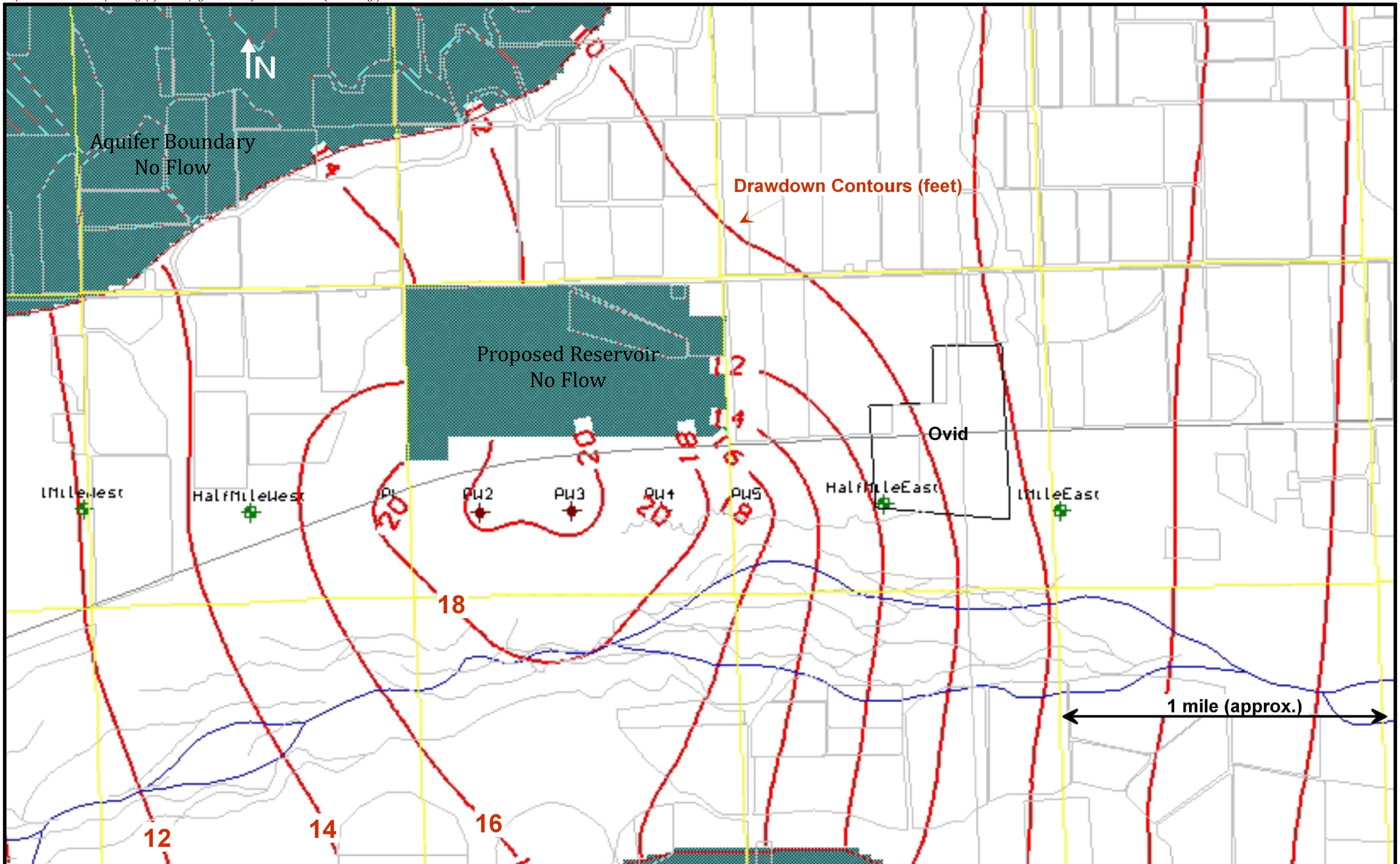
Date: 3 Mar 2009

Job #: 08-129

Drawn By: CM

Figure: 6 Of: 8

Printed: March 3, 2009 by JMD
N:\08129 Ovid Reservoir\Drawings\By Others\Figure 7 - Steady State Drawdown (No Recharge).mxd



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OVID RESERVOIR

Steady State Drawdown (No River Recharge)

Date: 3 Mar 2009

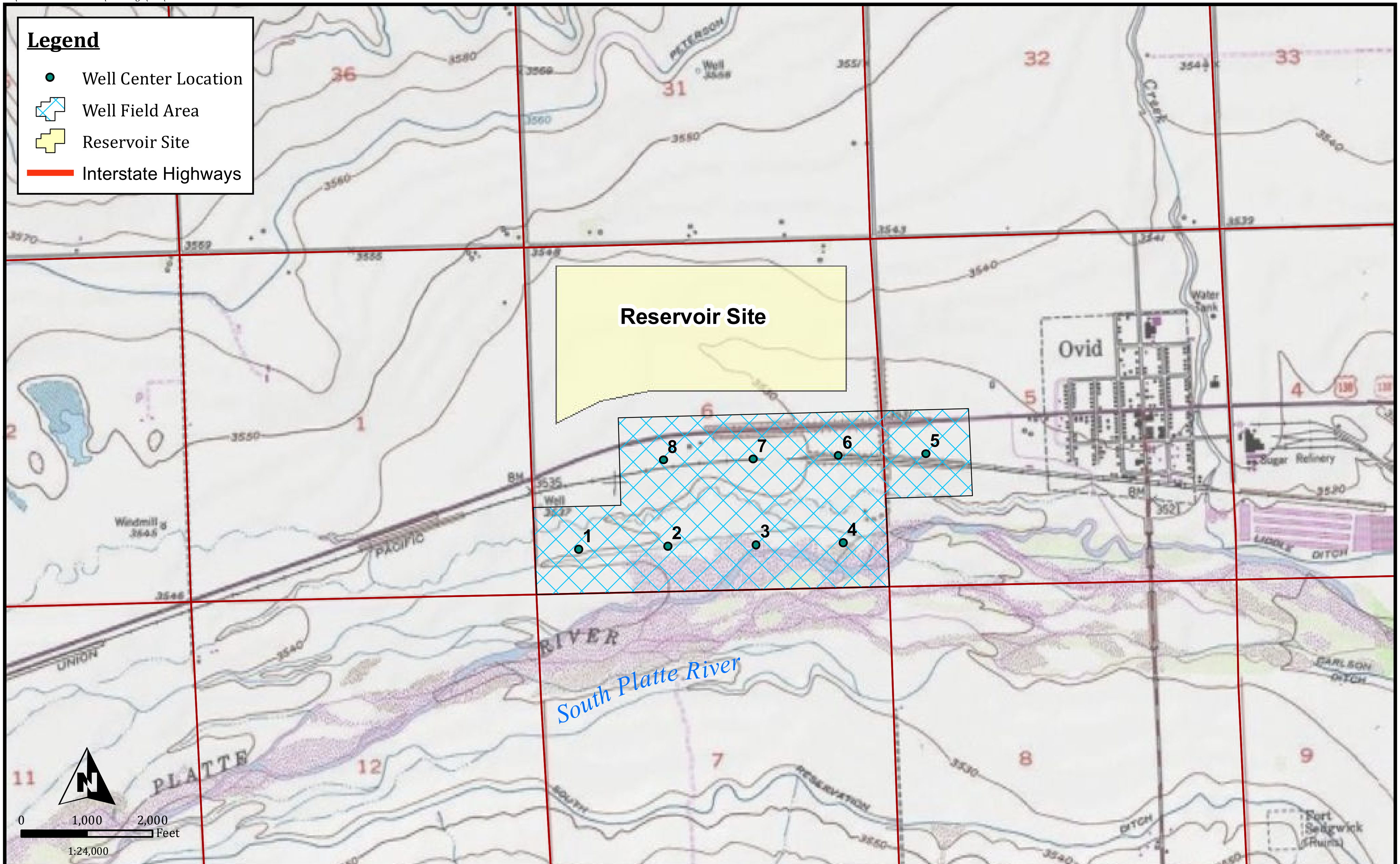
Job #: 08-129

Drawn By: CM

Figure: 7

Of: 8

Printed: February 4, 2009 by JMD
N:\08129 Ovid Reservoir\Drawings\GIS\Ovid Well Field Location.mxd



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OVID RESERVOIR

Proposed Well Field Location

Date: 4 Feb 2009

Job #: 08-129

Drawn By: JMD

Figure: 8 Of: 8

APPENDIX A

Peterson Ditch Diversion Records (1950-2009)

Structure Name: **PETERSON DITCH** **Water District:** **64** **Structure ID Number:** **504**

Source: SOUTH PLATTE RIVER

Location:	Q10	Q40	Q160	Section	Twnshp	Range	PM
	NW	NE	NW	24	11N	47W	S

Distance From Section From N/S Line: From E/W Line:

UTM Coordinates (NAD 83): Northing (UTM 4533197 Easting (UTM x): 706321 Spotted from PLSS distances from section lines

Latitude/Longitude (decimal degrees): 40.923867 -102.549686

Water Rights Summary:							
	Total Decreed Rate(s) (CFS):	Absolute:	271.0000	Conditional:	301.8000	AP/EX:	0.0000
	Total Decreed Volume(s) (AF):	Absolute:	0.0000	Conditional:	0.0000	AP/EX:	0.0000

Water Rights -- Transactions

Case Number	Adjudication Date	Appropriation Date	Administration Number	Order Number	Priority Number	Decreed Amount	Adjudication Type	Uses	Action Comment
CA0944	1907-10-26	1895-03-01	17846.16496	0		164.0000 C	S	1	205A-I COURT RECORD ASP B25124 JULESBURG
91CW0121	1911-01-05	1897-10-11	17846.17451	0		350.0000 C	S,AB	1	ABAN 01/06/1997
CA0944	1911-01-05	1897-10-11	17846.17451	0		350.0000 C	S	1	231, 205A-I COURT RECORD ASP B25124 JULESBURG
W7161	1972-12-31	1926-10-01	44559.28032	0		50.0000 C	S	4	GREAT WESTERN SUGAR
90CW0182	1990-12-31	1989-05-02	51134.50891	0		25.0000 C	S	AR	LOWER SO PLATTE RECHARGE PROJECT
90CW0182	1990-12-31	1989-05-02	51134.50891	0		40.0000 C	S,C	12348AR	LOWER SO PLATTE RECHARGE PROJECT 97CW385
97CW0385	1990-12-31	1989-05-02	51134.50891	0		10.0000 C	S,CA	12348AR	MADE ABS 02/24/1999
98CW0295	1998-12-31	1998-06-30	54237.00000	0		184.0000 C	S,C	0	STORAGE IN OVID RES
02CW0320	2002-12-31	2002-12-31	55882.00000	0		116.0000 C	O,C,EX	12379RW	EXCH FM LOWER SOUTH PLATTE AUG REACH
03CW0209	2003-12-31	2003-04-30	56002.00000	0		22.0000 C	S	AR	
03CW0209	2003-12-31	2003-04-30	56002.00000	0		30.0000 C	S,C,EX	12379AR	EXCH OF EXCESS REP WTR
03CW0209	2003-12-31	2003-04-30	56002.00000	0		87.8000 C	S,C	AR	

Water Rights -- Net Amounts

Adjudication Date	Appropriation Date	Administration Number	Order Number	Priority/Case Number	Rate (CFS) Absolute	Rate (CFS) Conditional	Rate (CFS) AP/EX	Volume (Acre-Feet) Absolute	Volume (Acre-Feet) Conditional	Volume (Acre-Feet) AP/EX
1907-10-26	1895-03-01	17846.16496	0	CA0944	164.0000	0	0	0	0	0
1972-12-31	1926-10-01	44559.28032	0	W7161	50.0000	0	0	0	0	0
1990-12-31	1989-05-02	51134.50891	0	90CW0182	35.0000	30.0000	0	0	0	0
1998-12-31	1998-06-30	54237.00000	0	98CW0295	0	184.0000	0	0	0	0
2002-12-31	2002-12-31	55882.00000	0	02CW0320	0	0	116.0000	0	0	0
2003-12-31	2003-04-30	56002.00000	0	03CW0209	22.0000	87.8000	30.0000	0	0	0

Irrigated Acres Summary -- Totals From Various Sources

GIS Total (Acres):	6415.027	Reported:	2005
Diversion Comments Total (Acres):	8648	Reported:	2007
Structure Total (Acres):		Reported:	

Irrigated Acres From GIS Data

Year	Land Use	Acres Flood	Acres Furrow	Acres Sprinkler	Acres Drip	Acres Groundwater	Acres Total
1956	***Year Total***	6709.68	0	0	0	2249.63	6709.68
1956	ALFALFA	680.68	0	0	0	258.55	680.68
1956	CORN	3275.62	0	0	0	1161.76	3275.62
1956	DRY_BEANS	218.20	0	0	0	137.18	218.20
1956	GRASS_PASTURE	323.57	0	0	0	7.13	323.57
1956	SMALL_GRAINS	19.64	0	0	0	0	19.64
1956	SUGAR_BEETS	2191.97	0	0	0	685.01	2191.97
1976	***Year Total***	6640.95	0	181.83	0	3145.69	6822.78
1976	ALFALFA	710.92	0	0	0	258.09	710.92
1976	CORN	3315.15	0	48.51	0	1738.58	3363.66
1976	DRY_BEANS	217.79	0	0	0	161.00	217.79
1976	GRASS_PASTURE	322.96	0	0	0	7.11	322.96
1976	SMALL_GRAINS	19.60	0	0	0	0	19.60
1976	SUGAR_BEETS	2054.51	0	133.33	0	980.90	2187.84
1987	***Year Total***	6447.10	0	112.11	0	2836.37	6559.21
1987	ALFALFA	64.62	0	0	0	0	64.62
1987	CORN	4575.15	0	112.11	0	2174.92	4687.27
1987	DRY_BEANS	1074.60	0	0	0	486.75	1074.60
1987	GRASS_PASTURE	262.85	0	0	0	75.81	262.85
1987	SMALL_GRAINS	334.58	0	0	0	50.82	334.58
1987	SUGAR_BEETS	135.29	0	0	0	48.07	135.29
2001	***Year Total***	6223.55	0	253.75	0	2820.73	6477.30
2001	ALFALFA	288.51	0	0	0	32.18	288.51
2001	CORN	5398.02	0	253.75	0	2665.85	5651.77
2001	DRY_BEANS	458.18	0	0	0	118.36	458.18
2001	SMALL_GRAINS	62.50	0	0	0	4.34	62.50
2001	SUGAR_BEETS	16.35	0	0	0	0	16.35
2005	***Year Total***	5092.59	0	1322.43	0	2821.86	6415.03
2005	ALFALFA	353.37	0	0	0	48.53	353.37
2005	CORN	3866.03	0	1192.90	0	2422.14	5058.93
2005	DRY_BEANS	405.27	0	64.04	0	157.32	469.31
2005	SMALL_GRAINS	373.00	0	0	0	95.47	373.00
2005	SUGAR_BEETS	94.92	0	65.50	0	98.40	160.42

Year	FDU	LDU	DWC	Maxq & Day	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Total
1950	1950-03-17	1950-10-07	179	103 06-22	0	0	0	0	1022	1922	2614	2787	2079	1500	2458	347	14727
1951	1950-11-07	1951-10-13	128	95 08-08	149	0	0	0	766	1519	496	0	895	3366	841	764	8795
1952	1952-05-02	1952-10-04	135	103 06-15	0	0	0	0	0	0	722	3243	1855	2045	2021	167	10052
1953	1953-04-22	1953-10-10	172	88 08-04	0	0	0	0	0	625	1712	1494	1795	2142	990	292	9049
1954	1954-04-07	1954-10-30	123	31 05-06	0	0	0	0	0	906	1230	397	0	0	319	702	3554
1955	1954-11-07	1955-10-31	143	36 04-18	415	0	0	0	270	1418	601	1093	387	0	0	952	5135
1956	1955-11-01	1956-10-31	136	81 08-05	248	0	0	0	278	1006	278	571	329	1196	0	599	4505
1957	1956-11-01	1957-10-05	154	95 07-30	173	0	0	99	692	504	760	1299	3080	3299	2344	117	12367
1958	1958-05-04	1958-09-26	110	74 07-31	0	0	0	0	0	0	789	1204	1496	1837	1194	0	6520
1959	1959-04-22	1959-10-03	127	47 06-15	0	0	0	0	0	575	1222	1583	797	248	448	65	4939
1960	1960-04-17	1960-10-15	107	48 07-06	0	0	0	0	0	902	1271	980	803	32	56	545	4590
1961	1961-04-28	1961-09-09	72	100 06-30	0	0	0	0	0	139	430	883	1837	1751	664	0	5705
1962	1962-04-24	1962-09-29	108	80 07-24	0	0	0	0	0	488	607	307	2531	1845	2269	0	8047
1963	1963-04-20	1963-10-10	115	42 05-05	0	0	0	0	0	672	994	458	12	313	746	284	3479
1964	1964-05-12	1964-10-31	41	30 06-04	0	0	0	0	0	0	343	454	79	0	0	63	940
1965	1964-11-01	1965-09-17	81	70 08-03	258	0	0	0	0	484	34	42	0	2339	1142	0	4298
1966	1966-05-01	1966-09-27	105	26 09-27	0	0	0	0	0	0	742	506	149	530	627	0	2553
1967	1967-03-26	1967-10-14	153	42 07-15	0	0	0	0	200	1025	474	0	1460	1882	1682	833	7557
1968	1968-04-10	1968-10-05	124	48 06-24	0	0	0	0	0	849	462	1238	79	492	700	99	3919
1969	1969-04-15	1969-09-24	115	60 07-08	0	0	0	0	0	444	99	103	2850	1390	655	0	5542
1970	1970-05-09	1970-10-09	129	59 05-09	0	0	0	0	0	0	1285	222	2344	1248	744	357	6200
1971	1971-06-10	1971-10-22	89	30 07-08	0	0	0	0	0	0	0	480	1277	38	397	208	2400
1972	1972-04-03	1972-09-29	117	37 08-29	0	0	0	0	0	1051	738	706	0	244	421	0	3160
1973	1973-06-18	1973-09-21	90	76 07-19	0	0	0	0	0	0	0	224	3749	2624	641	0	7238
1974	1974-04-29	1974-10-15	98	110 05-10	0	0	0	0	0	167	3666	1585	16	0	1267	278	6978
1975	1975-05-01	1975-08-25	75	70 05-13	0	0	0	0	0	0	2208	496	2398	538	0	0	5639
1976	1976-04-05	1976-09-27	57	28 06-15	0	0	0	0	0	109	373	549	0	0	109	0	1141
1977	1977-05-12	1977-09-27	102	50 07-30	0	0	0	0	0	0	807	1428	331	823	706	0	4096
1978	1978-04-08	1978-10-26	89	40 06-24	0	0	0	0	0	998	516	764	0	0	0	436	2713
1979	1979-04-23	1979-09-12	143	88 08-02	0	0	0	0	0	159	1216	1599	3412	4007	1603	0	11994
1980	1980-05-26	1980-10-31	152	94 07-02	0	0	0	0	0	0	428	2507	3658	1472	2598	1906	12569
1981	1980-11-01	1981-10-31	244	60 11-06	3451	2947	2521	1139	0	444	1434	1194	1443	1793	658	190	17215
1982	1981-11-01	1982-10-07	285	51 07-10	1904	1968	1230	754	0	377	1275	1200	1961	2113	1598	278	14657
1983	1983-06-01	1983-10-31	116	60 08-03	0	0	0	0	0	0	0	298	2525	3049	1573	1091	8535
1984	1983-11-01	1984-10-31	184	75 06-25	1031	0	0	0	0	0	387	1742	2467	3186	1765	1313	11891
1985	1984-11-01	1985-09-24	225	70 07-06	1309	1353	305	0	0	742	1367	2382	2356	2075	1486	0	13375
1986	1986-05-07	1986-09-30	147	88 07-08	0	0	0	0	0	0	1289	2339	4455	4151	2027	0	14261
1987	1987-04-28	1987-09-30	111	110 07-01	0	0	0	0	0	155	309	1755	4360	2932	1218	0	10730
1988	1988-05-10	1988-09-27	121	103 06-20	0	0	0	0	0	0	829	2482	3227	2355	2031	0	10924
1989	1989-04-28	1989-09-10	125	95 08-04	0	0	0	0	0	264	1930	2250	1802	2567	952	0	9764
1990	1990-05-14	1990-10-03	143	96 08-10	0	0	0	0	0	0	1166	1856	2086	3355	3566	119	12149
1991	1991-04-09	1991-10-07	143	75 08-14	0	0	0	0	0	257	1515	607	2599	2711	1765	278	9731
1992	1991-11-21	1992-10-31	226	85 07-12	201	180	1	64	335	68	1182	214	2993	2295	426	572	8532
1993	1993-05-12	1993-10-22	164	58	0	0	0	0	0	0	1163	2008	2510	2034	1331	835	9881
1994	1994-04-19	1994-10-31	191	42	0	0	0	0	0	323	817	1658	1118	912	587	786	6199
1995	1994-11-01	1995-10-16	185	101	181	0	0	0	0	76	503	301	3082	4228	2912	339	11623
1996	1996-02-23	1996-10-31	216	82 08-28	0	0	0	62	152	121	762	186	2122	2506	467	187	6565
1997	1996-11-01	1997-10-31	218	96 07-10	147	26	0	0	98	578	1341	181	2841	3574	2161	123	11070
1998	1997-11-01	1998-10-05	194	101 08-10	167	0	0	0	0	1485	1344	2039	3085	3550	974	34	12677
1999	1999-01-16	1999-10-15	263	88	0	0	157	262	232	571	1019	1153	3748	2214	1498	155	11010
2000	1999-11-23	2000-10-31	236	54 04-26	61	0	42	137	173	716	1486	1236	89	240	1117	1165	6462
2001	2000-11-01	2001-10-31	263	86	216	49	0	0	922	1842	2782	2438	3088	3006	2767	2765	19875
2002	2001-11-01	2002-10-31	258	65	1387	0	0	0	629	2361	1823	1407	2012	1695	900	1013	13225

2003	2002-11-01	2003-10-31	202	47	10-18	1833	1548	271	0	1559	390	995	1547	69	0	205	1688	10105
2004	2003-11-01	2004-10-31	283	79	10-15	1444	1056	0	443	1782	1470	968	1552	713	767	1320	1744	13258
2005	2004-12-01	2005-10-31	232	90	04-14	0	1095	0	714	1518	2281	2054	0	2169	1996	1807	1667	15303
2006	2005-11-01	2006-10-31	305	66	03-13	1930	717	2310	954	2926	2000	1728	867	0	221	1406	1867	16926
2007	2006-11-01	2007-10-31	291	71		1302	522	0	0	1568	1297	2293	2801	1896	2091	2225	2501	18497
			Minimum	26		0	0	0	0	0	0	0	0	0	0	0	0	940
			Maximum:	110		3451	2947	2521	1139	2926	2361	3666	3243	4455	4228	3566	2765	19875
			Average	70		307	198	118	80	261	582	1050	1153	1733	1704	1179	512	8877

58.00 years with diversion records

Notes: The average considers all years with diversion records, even if no water is diverted.

The above summary lists total monthly diversions.

* = Infrequent Diversion Record. All other values are derived from daily records.

Average values include infrequent data if infrequent data are the only data for the year.

Diversion Comments

IYR	NUC Code	Acres Irrigated	Comment
1950		8648	
1951		8648	
1952		8648	
1953		8648	
1954		8648	
1955		8640	
1956		8648	
1957		8648	
1958		8648	
1959		8648	
1960		8648	
1961		8648	
1962		8648	
1963		8648	
1964		8648	
1965		8648	
1966		8648	
1967		8648	
1968		8648	
1969		8648	
1970		8648	
1971		8648	
1972		8648	
1973		8648	
1974		8648	
1975		8648	
1976		8648	
1977		8648	
1978		8648	
1979		8648	
1980		8648	
1981		10003	
1982		8648	
1983		8448	
1984		8648	
1985		8648	
1986		8	
1987		8648	
1988		8648	
1989		8648	
1990		8648	
1991		8648	
1992	Water available, but not taken	8648	
1993	Water available, but not taken	8648	
1994		8648	
1995		8648	
1996		8648	
1997		8648	
1998		8648	
1999		8648	IRR
2000		8648	IRR

2001	8648	IRR
2002	8648	IRR
2003	8648	IRR
2004	8648	IRR
2005	8648	IRR
2006	8648	IRR
2007	8648	IRR

Note: Diversion comments and reservoir comments may be shown for a structure, if both are available.

APPENDIX B

Peterson Ditch Diversion Structure and Headgate Photos

South Platte River diversion structure

Peterson Ditch inlet to head gate

South Platte River diversion structure

Concrete piers and wooden stop logs

South Platte River diversion structure

Looking downstream of river diversion structure

Looking down at wooden stop logs

South Platte River diversion structure

Peterson Ditch inlet to head gate

Ditch channel upstream of head gate structure

Peterson Ditch head gate structure

Peterson Ditch head gate structure


Looking downstream of head gate structure


Looking upstream at head gate structure


Looking downstream at head gate structure


Drop structure downstream of ditch head gate


South embankment downstream of drop structure


Looking downstream of drop structure

Looking downstream of drop structure

Looking upstream at drop structure

APPENDIX C

Peterson Ditch Photos


Directly north of reservoir site


CR-25, looking west


West of CR-25


CR-25, looking east


Pivot system crossing


Pivot system crossing


Field drains in the north embankment


Erosion along the north embankment


Looking back at CR-32 crossing


House along south embankment south of CR-32


Seepage


Near vertical walls along north embankment


Near vertical walls along north embankment


Short vertical-wall section along south embankment


Incoming field drain with erosion


Near vertical wall & seepage along north embankment


Section changes (CR-30) – less vegetation, 20+ ft wide


Erosion


Looking South at Highway-138


Looking North at Highway-138


Looking South at railroad south of Highway-138


South of railroad


Prior bank stabilization just south of railroad


Looking East from CR-15


Looking West from CR-15

APPENDIX D

Ovid Reservoir Opinion of Cost Scenarios

Scenario 1: Peterson Ditch Fill (5,560 Ac-Ft)

Scenario 1: Peterson Ditch Fill (5560 Ac-Ft)

Applegate Group, Inc.

1499 W. 120th Ave. Suite 200
Denver, CO 80234
Phone: (303) 452-6611
Fax: (303) 452-2759

Job No. :	08-129
By:	CAG
Date:	12/6/2011
Project:	Ovid Reservoir
Client:	District 64 Reservoir Co.

Ovid Dam and Reservoir Infrastructure

No.	Item	Units	Quantity	Unit Cost	Total Cost
STARTUP					
1	MOBILIZATION	LS	1	$ 640,000.00	$ 640,000.00
2	BONDS AND INSURANCE	LS	1	$ 64,000.00	$ 64,000.00
				Subtotal	$ 704,000.00

No.	Item	Units	Quantity	Unit Cost	Total Cost
SITE PREPARATION					
3	CLEARING AND STRIPPING RESERVOIR SITE AND STOCKPILING STRIPPING	AC	300	$ 1,280.00	$ 384,000.00
4	SITE EROSION CONTROL	LS	1	$ 64,000.00	$ 64,000.00
				Subtotal	$ 448,000.00

No.	Item	Units	Quantity	Unit Cost	Total Cost
INLET WORKS					
5	RELOCATE PETERSON DITCH DURING CONSTRUCTION	LS	1	$ 12,800.00	$ 12,800.00
6	RELOCATE EXISTING HEADGATE	LS	1	$ 2,560.00	$ 2,560.00
7	RELOCATE/RECONSTRUCT EXISTING IRRIGATION CULVERT/PIPE	LS	1	$ 3,840.00	$ 3,840.00
8	CONCRETE DIVERSION STRUCTURE	LS	1	$ 25,600.00	$ 25,600.00
9	4'x15' LAYDOWN/CREST GATE	LS	1	$ 48,640.00	$ 48,640.00
10	4'x6' RADIAL GATE	LS	1	$ 17,920.00	$ 17,920.00
11	CONCRETE LATERAL DITCH AND FLUME	CY	42	$ 640.00	$ 26,880.00
12	SIPHON CONCRETE INLET STRUCTURE	LS	1	$ 12,800.00	$ 12,800.00
13	SIPHON INLET TRASHRACK	LS	1	$ 6,400.00	$ 6,400.00
14	42" HDPE SDR 32.5 PIPE	LF	2250	$ 166.40	$ 374,400.00
15	MANHOLE/INSPECTION TEE	EA	4	$ 6,784.00	$ 27,136.00
16	42" HDPE SDR 26 45 DEGREE BEND	EA	3	$ 1,696.00	$ 5,088.00
17	THRUST/ANCHOR WALL	EA	6	$ 6,400.00	$ 38,400.00
18	12" HDPE SDR26 PIPE	LF	70	$ 35.20	$ 2,464.00
19	SIPHON CONCRETE OUTLET HEAD WALL	LS	1	$ 3,840.00	$ 3,840.00
20	RUNDOWN CHANNEL RIPRAP	CY	1250	$ 85.76	$ 107,200.00
21	RUNDOWN CHANNEL BEDDING	CY	625	$ 53.76	$ 33,600.00
				Subtotal	$ 749,568.00

No.	Item	Units	Quantity	Unit Cost	Total Cost
DAM EMBANKMENT					
22	SLURRY WALL	LF	15050	$ 204.80	$ 3,082,240.00
23	OVEREXCAVATION OF DOWNSTREAM TOE	CY	120600	$ 1.54	$ 185,241.60
24	ZONE I (CORE) FILL	CY	300000	$ 2.44	$ 733,440.00
25	ZONE II FILL	CY	1193975	$ 2.44	$ 2,919,030.08
26	FILTER DRAIN	CY	40000	$ 25.60	$ 1,024,000.00
27	ACCESS ROADS TO DAM EMBANKMENT	CY	25000	$ 2.56	$ 64,000.00
28	TOE DRAIN PIPING AND FILTER	LF	15165	$ 44.80	$ 679,392.00
29	TOE DRAIN MANHOLES	EA	42	$ 4,260.00	$ 178,920.00
30	TOE DRAIN OUTLET WEIR BOXES	EA	6	$ 640.00	$ 3,840.00
31	TOPSOIL DOWNSTREAM FACE OF DAM EMBANKMENT AND DISTURBED AREAS	CY	18000	$ 2.37	$ 42,660.00
32	TOPSOIL UPSTREAM FACE (8:1 SLOPE)	CY	183775	$ 2.37	$ 435,546.75
33	ROADBASE DAM CREST ROAD	SY	15050	$ 17.43	$ 262,375.68
34	DAM INSTRUMENTATION	LS	1	$ 211,200.00	$ 211,200.00
				Subtotal	$ 9,821,886.11

No.	Item	Units	Quantity	Unit Cost	Total Cost
OUTLET WORKS					
35	42" STEEL OUTLET PIPE DELIVERED AND INSTALLED INCLUDING CONCRETE ENCASMENT	LF	410	$ 704.00	$ 288,640.00
36	OUTLET PIPE MUD MAT	CY	100	$ 256.00	$ 25,600.00
37	OUTLET CHANNEL GRADING	CY	10000	$ 3.00	$ 30,000.00
38	OUTLET WORKS SAND COLLAR	CY	300	$ 51.20	$ 15,360.00
39	CONCRETE INTAKE STRUCTURE WITH ALL APPURTENANCES	LS	1	$ 12,800.00	$ 12,800.00
40	INTAKE TRASH RACK DELIVERED AND INSTALLED	LS	1	$ 6,400.00	$ 6,400.00
41	42" x 42" GATE DELIVERED AND INSTALLED ON INTAKE STRUCTURE WITH ALL APURTENANCES	LS	1	$ 28,761.60	$ 28,761.60
42	DAM CREST OUTLET CONTROL STRUCURE	LS	1	$ 19,200.00	$ 19,200.00
43	GATE OPERATOR AND STEM	LF	240	$ 128.00	$ 30,720.00
44	3" STEEL AIR VENT PIPE	LF	240	$ 13.76	$ 3,302.40
45	STAFF GAGE	LS	1	$ 34,560.00	$ 34,560.00
46	VALVE HOUSE - CONCRETE STRUCTURE	CY	75	$ 704.00	$ 52,800.00
47	VALVE HOUSE - HARDWARE	LF	1	$ 6,400.00	$ 6,400.00
48	VALVE HOUSE - MANIFOLD FITTINGS	LS	1	$ 6,400.00	$ 6,400.00
49	VALVE HOUSE - 42" STEEL PIPE	LF	60	$ 192.00	$ 11,520.00
50	VALVE HOUSE - 18" STEEL PIPE	LF	50	$ 64.00	$ 3,200.00
51	VALVE HOUSE - 42" BUTTERFLY VALVE	LS	1	$ 20,480.00	$ 20,480.00
52	VALVE HOUSE - 42" INSPECTION TEE	LS	1	$ 10,240.00	$ 10,240.00
53	VALVE HOUSE - 42" DRESSER COUPLING	LS	1	$ 10,240.00	$ 10,240.00
54	VALVE HOUSE - 18" CONE VALVE	LS	1	$ 51,200.00	$ 51,200.00
55	VALVE HOUSE - 18" DRESSER COUPLING	LS	1	$ 6,400.00	$ 6,400.00
56	VALVE HOUSE - METER AND PROBES	LS	1	$ 3,968.00	$ 3,968.00
57	VALVE HOUSE - ELECTRICAL SERVICE	LS	1	$ 6,400.00	$ 6,400.00
58	CONCRETE OUTLET BAFFLE STRUCTURE	LS	1	$ 38,400.00	$ 38,400.00
				Subtotal	$ 722,992.00

No.	Item	Units	Quantity	Unit Cost	Total Cost
SPILLWAY					
63	CONCRETE OGEE SPILLWAY STRUCTURE	CY	20	$ 768.00	$ 15,360.00
64	CONCRETE SPILLWAY CHANNEL	CY	110	$ 640.00	$ 70,400.00
65	STILLING BASIN CONCRETE	CY	10	$ 640.00	$ 6,400.00
66	STILLING BASIN RIPRAP	CY	50	$ 57.60	$ 2,880.00
67	STILLING BASIN BEDDING	CY	25	$ 44.80	$ 1,120.00
68	STILLING BASIN OUTLET RIPRAP	CY	270	$ 83.20	$ 22,464.00
69	STILLING BASIN OUTLET BEDDING	CY	135	$ 44.80	$ 6,048.00
70	SPILLWAY CHANNEL CROSSING - 6' x 12' CONCRETE BOX CULVERT	LF	12	$ 812.80	$ 9,753.60
				Subtotal	$ 134,425.60

No.	Item	Units	Quantity	Unit Cost	Total Cost
MISCELLANEOUS					
71	DAM SITE SEEDING AND MULCHING	AC	50	$ 1,000.00	$ 50,000.00
72	2 - 4' x 8' CONCRETE BOX CULVERTS AT CR27	LF	60	$ 1,044.48	$ 62,668.80
73	DRAINAGE CHANNEL EXCAVATION AND GRADING	CY	85400	$ 3.00	$ 256,200.00
74	DRAINAGE CHANNEL GROUTED RIPRAP @ DROP STRUCTURES	CY	470	$ 156.16	$ 73,395.20
75	DRAINAGE CHANNEL NON-GROUTED RIPRAP @ DROP STRUCTURES	CY	320	$ 124.16	$ 39,731.20
76	DRAINAGE CHANNEL BEDDING AT DROP STRUCTURES	CY	400	$ 44.80	$ 17,920.00
77	RIPRAP AT BRIDGE CROSSINGS	CY	600	$ 80.13	$ 48,076.80
78	RIPRAP BEDDING AT BRIDGE CROSSINGS	CY	300	$ 44.80	$ 13,440.00
79	SAND DRAWS CHANNEL MAINTENANCE	LF	3000	$ 19.20	$ 57,600.00
				Subtotal	$ 569,032.00

Obermeyer Gate Diversion Structure for South Platte River					
No.	Item	Units	Quantity	Unit Cost	Total Cost
1	Obermeyer Gates (installed)	EA	1	$ 700,000.00	$ 700,000.00
2	Foundation	CY	820	$ 750.00	$ 615,000.00
3	SCADA	EA	1	$ 100,000.00	$ 100,000.00
4	Excavation and Grading	CY	740	$ 2.05	$ 1,517.00
	Subtotal				$ 1,416,517.00
	10% Demo and Removal				$ 141,651.70
	30% Contingency				$ 424,955.10
	10% Contractor Mobilization Cost				$ 141,651.70
	7% Geotechnical Engineering				$ 99,156.19
	7% Field Surveying				$ 99,156.19
	10% Engineering Fees				$ 141,651.70
	Total				**$ 2,464,739.58**

* Estimate does not include power hookup, permitting, and water control during construction.

Rubicon Gate Structure for Peterson Ditch Headgate					
No.	Item	Units	Quantity	Unit Cost	Total Cost
1	Rubicon Gates (installed)	EA	2	$ 25,000.00	$ 50,000.00
2	Foundation	CY	240	$ 750.00	$ 180,000.00
3	SCADA	EA	1	$ 100,000.00	$ 100,000.00
4	Excavation and Grading	CY	200	$ 2.05	$ 410.00
	Subtotal				$ 330,410.00
	10% Demo and Removal				$ 33,041.00
	30% Contingency				$ 84,000.00
	10% Contractor Mobilization Cost				$ 33,041.00
	7% Geotechnical Engineering				$ 23,128.70
	7% Field Surveying				$ 23,128.70
	10% Engineering Fees				$ 33,041.00
	Total				**$ 559,790.40**

* Estimate does not include power hookup, permitting, and water control during construction.

COST SUMMARY		
	TOTAL INFRASTRUCURE COST	$ 16,174,433.69
	CONTINGENCY (15%)	$ 2,426,165.05
	ENGINEERING FINAL DESIGN/PERMITTING/BIDDING/ASBUILTS	$ 1,132,210.36
	CONSTRUCTION MANAGEMENT/OBSERVATION (10%)	$ 1,617,443.37
	Total Cost	**$ 21,350,252.47**
	Total Infrastructure Cost Per Acre foot (5560 ac-ft)	**$ 3,839.97**
	Annualized 30-Year Cost Per Acre-Foot (5560 ac-ft Firm Yield)	**$ 128.00**
	Operations and Maintenance Per Year (1% of Infrastructure)	**$ 161,744.34**
	Total Annualized 30-Year Cost Per Acre-Foot (Incl. O&M)(5560 ac-ft Firm Yield)	**$ 225.00**
	Yearly Loan Payment (30 Years, 3% Interest)	**$ 1,089,274.07**

Scenario 2: Well Field Fill (6,300 Ac-Ft)

Scenario 2: Well Field Fill (6300 Ac-Ft)

Applegate Group, Inc.
1499 W. 120th Ave. Suite 200
Denver, CO 80234
Phone: (303) 452-6611
Fax: (303) 452-2759

Job No. :	08-129
By:	CAG
Date:	12/6/2011
Project:	Ovid Reservoir
Client:	District 64 Reservoir Co.

Ovid Dam and Reservoir Infrastructure

No.	Item	Units	Quantity	Unit Cost	Total Cost
	STARTUP				
1	MOBILIZATION	LS	1	$ 640,000.00	$ 640,000.00
2	BONDS AND INSURANCE	LS	1	$ 64,000.00	$ 64,000.00
				Subtotal	$ 704,000.00

No.	Item	Units	Quantity	Unit Cost	Total Cost
	SITE PREPARATION				
3	CLEARING AND STRIPPING RESERVOIR SITE AND STOCKPILING STRIPPING	AC	300	$ 1,280.00	$ 384,000.00
4	SITE EROSION CONTROL	LS	1	$ 64,000.00	$ 64,000.00
				Subtotal	$ 448,000.00

No.	Item	Units	Quantity	Unit Cost	Total Cost
	DAM EMBANKMENT				
22	SLURRY WALL	LF	15050	$ 204.80	$ 3,082,240.00
23	OVEREXCAVATION OF DOWNSTREAM TOE	CY	120600	$ 1.54	$ 185,241.60
24	ZONE I (CORE) FILL	CY	300000	$ 2.44	$ 733,440.00
25	ZONE II FILL	CY	1193975	$ 2.44	$ 2,919,030.08
26	FILTER DRAIN	CY	40000	$ 25.60	$ 1,024,000.00
27	ACCESS ROADS TO DAM EMBANKMENT	CY	25000	$ 2.56	$ 64,000.00
28	TOE DRAIN PIPING AND FILTER	LF	15165	$ 44.80	$ 679,392.00
29	TOE DRAIN MANHOLES	EA	42	$ 4,260.00	$ 178,920.00
30	TOE DRAIN OUTLET WEIR BOXES	EA	6	$ 640.00	$ 3,840.00
31	TOPSOIL DOWNSTREAM FACE OF DAM EMBANKMENT AND DISTURBED AREAS	CY	18000	$ 2.37	$ 42,660.00
32	TOPSOIL UPSTREAM FACE (8:1 SLOPE)	CY	183775	$ 2.37	$ 435,546.75
33	ROADBASE DAM CREST ROAD	SY	15050	$ 17.43	$ 262,375.68
34	DAM INSTRUMENTATION	LS	1	$ 211,200.00	$ 211,200.00
				Subtotal	$ 9,821,886.11

No.	Item	Units	Quantity	Unit Cost		Total Cost	
OUTLET WORKS							
35	42" STEEL OUTLET PIPE DELIVERED AND INSTALLED INCLUDING CONCRETE ENCASMENT	LF	410	$	704.00	$	288,640.00
36	OUTLET PIPE MUD MAT	CY	100	$	256.00	$	25,600.00
37	OUTLET CHANNEL GRADING	CY	10000	$	3.00	$	30,000.00
38	OUTLET WORKS SAND COLLAR	CY	300	$	51.20	$	15,360.00
39	CONCRETE INTAKE STRUCTURE WITH ALL APPURTENANCES	LS	1	$	12,800.00	$	12,800.00
40	INTAKE TRASH RACK DELIVERED AND INSTALLED	LS	1	$	6,400.00	$	6,400.00
41	42" x 42" GATE DELIVERED AND INSTALLED ON INTAKE STRUCTURE WITH ALL APURTENANCES	LS	1	$	28,761.60	$	28,761.60
42	DAM CREST OUTLET CONTROL STRUCURE	LS	1	$	19,200.00	$	19,200.00
43	GATE OPERATOR AND STEM	LF	240	$	128.00	$	30,720.00
44	3" STEEL AIR VENT PIPE	LF	240	$	13.76	$	3,302.40
45	STAFF GAGE	LS	1	$	34,560.00	$	34,560.00
46	VALVE HOUSE - CONCRETE STRUCTURE	CY	75	$	704.00	$	52,800.00
47	VALVE HOUSE - HARDWARE	LF	1	$	6,400.00	$	6,400.00
48	VALVE HOUSE - MANIFOLD FITTINGS	LS	1	$	6,400.00	$	6,400.00
49	VALVE HOUSE - 42" STEEL PIPE	LF	60	$	192.00	$	11,520.00
50	VALVE HOUSE - 18" STEEL PIPE	LF	50	$	64.00	$	3,200.00
51	VALVE HOUSE - 42" BUTTERFLY VALVE	LS	1	$	20,480.00	$	20,480.00
52	VALVE HOUSE - 42" INSPECTION TEE	LS	1	$	10,240.00	$	10,240.00
53	VALVE HOUSE - 42" DRESSER COUPLING	LS	1	$	10,240.00	$	10,240.00
54	VALVE HOUSE - 18" CONE VALVE	LS	1	$	51,200.00	$	51,200.00
55	VALVE HOUSE - 18" DRESSER COUPLING	LS	1	$	6,400.00	$	6,400.00
56	VALVE HOUSE - METER AND PROBES	LS	1	$	3,968.00	$	3,968.00
57	VALVE HOUSE - ELECTRICAL SERVICE	LS	1	$	6,400.00	$	6,400.00
58	CONCRETE OUTLET BAFFLE STRUCTURE	LS	1	$	38,400.00	$	38,400.00
				Subtotal		$	722,992.00

No.	Item	Units	Quantity	Unit Cost		Total Cost	
SPILLWAY							
63	CONCRETE OGEE SPILLWAY STRUCTURE	CY	20	$	768.00	$	15,360.00
64	CONCRETE SPILLWAY CHANNEL	CY	110	$	640.00	$	70,400.00
65	STILLING BASIN CONCRETE	CY	10	$	640.00	$	6,400.00
66	STILLING BASIN RIPRAP	CY	50	$	57.60	$	2,880.00
67	STILLING BASIN BEDDING	CY	25	$	44.80	$	1,120.00
68	STILLING BASIN OUTLET RIPRAP	CY	270	$	83.20	$	22,464.00
69	STILLING BASIN OUTLET BEDDING	CY	135	$	44.80	$	6,048.00
70	SPILLWAY CHANNEL CROSSING - 6' x 12' CONCRETE BOX CULVERT	LF	12	$	812.80	$	9,753.60
				Subtotal		$	134,425.60

No.	Item	Units	Quantity	Unit Cost	Total Cost
	MISCELLANEOUS				
71	DAM SITE SEEDING AND MULCHING	AC	50	$ 1,000.00	$ 50,000.00
72	2 - 4' x 8' CONCRETE BOX CULVERTS AT CR27	LF	60	$ 1,044.48	$ 62,668.80
73	DRAINAGE CHANNEL EXCAVATION AND GRADING	CY	85400	$ 3.00	$ 256,200.00
74	DRAINAGE CHANNEL GROUTED RIPRAP @ DROP STRUCTURES	CY	470	$ 156.16	$ 73,395.20
75	DRAINAGE CHANNEL NON-GROUTED RIPRAP @ DROP STRUCTURES	CY	320	$ 124.16	$ 39,731.20
76	DRAINAGE CHANNEL BEDDING AT DROP STRUCTURES	CY	400	$ 44.80	$ 17,920.00
77	RIPRAP AT BRIDGE CROSSINGS	CY	600	$ 80.13	$ 48,076.80
78	RIPRAP BEDDING AT BRIDGE CROSSINGS	CY	300	$ 44.80	$ 13,440.00
79	SAND DRAWS CHANNEL MAINTENANCE	LF	3000	$ 19.20	$ 57,600.00
				Subtotal	$ 569,032.00

Well Field Alternative to filling with Peterson Ditch

No.	Item	Units	Quantity	Unit Cost	Total Cost
	Test Hole Program				
1	Drill and log 6-8 test holes	EA	1	$ 18,000.00	$ 18,000.00
2	Test hole supervision and management	EA	1	$ 8,000.00	$ 8,000.00
				Subtotal	$ 26,000.00

No.	Item	Units	Quantity	Unit Cost	Total Cost
	Well Construction (per well)				
1	Drilling and completion	EA	8	$ 45,000.00	$ 360,000.00
2	Pumping equipment	EA	8	$ 20,000.00	$ 160,000.00
3	Pumping controls	EA	8	$ 5,000.00	$ 40,000.00
4	Engineering design, well site supervision	EA	8	$ 12,000.00	$ 96,000.00
				Subtotal	$ 656,000.00

No.	Item	Units	Quantity	Unit Cost	Total Cost
Pumping Costs Per 6300 Ac-Ft Fill					
1	First 300 kWh	kWh	300	$ 0.15	$ 45.00
2	Second 300 kWh	kWh	300	$ 0.11	$ 33.00
3	Remaining kWh	kWh	199480	$ 0.07	$ 14,562.04
				Subtotal	$ 14,640.04

No.	Item	Units	Quantity	Unit Cost	Total Cost
Well House, Pumps and Manifold System					
1	48" Pressure PVC Pipe	LF	2000	$ 210.50	$ 421,000.00
2	18" Pressure PVC Pipe	LF	6600	$ 35.65	$ 235,290.00
3	Valves and Fittings	LS	1	$ 35,000.00	$ 35,000.00
				Subtotal	$ 691,290.00
	Subtotal				$ 1,373,290.00

COST SUMMARY		
	TOTAL INFRASTRUCURE COST	$ 13,773,625.71
	CONTINGENCY (15%)	$ 2,466,043.86
	ENGINEERING FINAL DESIGN/PERMITTING/BIDDING/ASBUILTS	$ 964,153.80
	CONSTRUCTION MANAGEMENT/OBSERVATION (10%)	$ 1,377,362.57
	Total Cost	**$ 18,581,185.94**
	Total Infrastructure Cost Per Acre foot (6300 ac-ft)	**$ 2,949.39**
	Total Well Field Pumping Cost Per Acre foot (6300 ac-ft)	**$ 2.32**
	Annualized 30-Year Cost Per Acre-Foot (6300 ac-ft Firm Yield)	**$ 98.31**
	Operations and Maintenance Per Year (1% of Infrastructure)	**$ 152,376.30**
	Total Annualized 30-Year Cost Per Acre-Foot (Incl. O&M)(6300 ac-ft Firm Yield)	**$ 174.66**
	Yearly Loan Payment (30 Years, 3% Interest)	**$ 947,998.34**

Scenario 3: Peterson Ditch Fill + Reservoir Alluvial Well Withdrawl (7,560 Ac-Ft)

Scenario 3: Peterson Ditch Fill + Reservoir Alluvial Well Withdrawl (7560 Ac-Ft)

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Job No. :	08-129
By:	CAG
Date:	12/6/2011
Project:	Ovid Reservoir
Client:	District 64 Reservoir Co.

Ovid Dam and Reservoir Infrastructure

No.	Item	Units	Quantity	Unit Cost	Total Cost
STARTUP					
1	MOBILIZATION	LS	1	$ 640,000.00	$ 640,000.00
2	BONDS AND INSURANCE	LS	1	$ 64,000.00	$ 64,000.00
				Subtotal	$ 704,000.00

No.	Item	Units	Quantity	Unit Cost	Total Cost
SITE PREPARATION					
3	CLEARING AND STRIPPING RESERVOIR SITE AND STOCKPILING STRIPPING	AC	300	$ 1,280.00	$ 384,000.00
4	SITE EROSION CONTROL	LS	1	$ 64,000.00	$ 64,000.00
				Subtotal	$ 448,000.00

No.	Item	Units	Quantity	Unit Cost	Total Cost
INLET WORKS					
5	RELOCATE PETERSON DITCH DURING CONSTRUCTION	LS	1	$ 12,800.00	$ 12,800.00
6	RELOCATE EXISTING HEADGATE	LS	1	$ 2,560.00	$ 2,560.00
7	RELOCATE/RECONSTRUCT EXISTING IRRIGATION CULVERT/PIPE	LS	1	$ 3,840.00	$ 3,840.00
8	CONCRETE DIVERSION STRUCTURE	LS	1	$ 25,600.00	$ 25,600.00
9	4'x15' LAYDOWN/CREST GATE	LS	1	$ 48,640.00	$ 48,640.00
10	4'x6' RADIAL GATE	LS	1	$ 17,920.00	$ 17,920.00
11	CONCRETE LATERAL DITCH AND FLUME	CY	42	$ 640.00	$ 26,880.00
12	SIPHON CONCRETE INLET STRUCTURE	LS	1	$ 12,800.00	$ 12,800.00
13	SIPHON INLET TRASHRACK	LS	1	$ 6,400.00	$ 6,400.00
14	42" HDPE SDR 32.5 PIPE	LF	2250	$ 166.40	$ 374,400.00
15	MANHOLE/INSPECTION TEE	EA	4	$ 6,784.00	$ 27,136.00
16	42" HDPE SDR 26 45 DEGREE BEND	EA	3	$ 1,696.00	$ 5,088.00
17	THRUST/ANCHOR WALL	EA	6	$ 6,400.00	$ 38,400.00
18	12" HDPE SDR26 PIPE	LF	70	$ 35.20	$ 2,464.00
19	SIPHON CONCRETE OUTLET HEAD WALL	LS	1	$ 3,840.00	$ 3,840.00
20	RUNDOWN CHANNEL RIPRAP	CY	1250	$ 85.76	$ 107,200.00
21	RUNDOWN CHANNEL BEDDING	CY	625	$ 53.76	$ 33,600.00
				Subtotal	$ 749,568.00

No.	Item	Units	Quantity	Unit Cost	Total Cost
DAM EMBANKMENT					
22	SLURRY WALL	LF	15050	$ 204.80	$ 3,082,240.00
23	OVEREXCAVATION OF DOWNSTREAM TOE	CY	120600	$ 1.54	$ 185,241.60
24	ZONE I (CORE) FILL	CY	300000	$ 2.44	$ 733,440.00
25	ZONE II FILL	CY	1193975	$ 2.44	$ 2,919,030.08
26	FILTER DRAIN	CY	40000	$ 25.60	$ 1,024,000.00
27	ACCESS ROADS TO DAM EMBANKMENT	CY	25000	$ 2.56	$ 64,000.00
28	TOE DRAIN PIPING AND FILTER	LF	15165	$ 44.80	$ 679,392.00
29	TOE DRAIN MANHOLES	EA	42	$ 4,260.00	$ 178,920.00
30	TOE DRAIN OUTLET WEIR BOXES	EA	6	$ 640.00	$ 3,840.00
31	TOPSOIL DOWNSTREAM FACE OF DAM EMBANKMENT AND DISTURBED AREAS	CY	18000	$ 2.37	$ 42,660.00
32	TOPSOIL UPSTREAM FACE (8:1 SLOPE)	CY	183775	$ 2.37	$ 435,546.75
33	ROADBASE DAM CREST ROAD	SY	15050	$ 17.43	$ 262,375.68
34	DAM INSTRUMENTATION	LS	1	$ 211,200.00	$ 211,200.00
				Subtotal	$ 9,821,886.11

No.	Item	Units	Quantity	Unit Cost	Total Cost
OUTLET WORKS					
35	42" STEEL OUTLET PIPE DELIVERED AND INSTALLED INCLUDING CONCRETE ENCASMENT	LF	410	$ 704.00	$ 288,640.00
36	OUTLET PIPE MUD MAT	CY	100	$ 256.00	$ 25,600.00
37	OUTLET CHANNEL GRADING	CY	10000	$ 3.00	$ 30,000.00
38	OUTLET WORKS SAND COLLAR	CY	300	$ 51.20	$ 15,360.00
39	CONCRETE INTAKE STRUCTURE WITH ALL APPURTENANCES	LS	1	$ 12,800.00	$ 12,800.00
40	INTAKE TRASH RACK DELIVERED AND INSTALLED	LS	1	$ 6,400.00	$ 6,400.00
41	42" x 42" GATE DELIVERED AND INSTALLED ON INTAKE STRUCTURE WITH ALL APURTENANCES	LS	1	$ 28,761.60	$ 28,761.60
42	DAM CREST OUTLET CONTROL STRUCURE	LS	1	$ 19,200.00	$ 19,200.00
43	GATE OPERATOR AND STEM	LF	240	$ 128.00	$ 30,720.00
44	3" STEEL AIR VENT PIPE	LF	240	$ 13.76	$ 3,302.40
45	STAFF GAGE	LS	1	$ 34,560.00	$ 34,560.00
46	VALVE HOUSE - CONCRETE STRUCTURE	CY	75	$ 704.00	$ 52,800.00
47	VALVE HOUSE - HARDWARE	LF	1	$ 6,400.00	$ 6,400.00
48	VALVE HOUSE - MANIFOLD FITTINGS	LS	1	$ 6,400.00	$ 6,400.00
49	VALVE HOUSE - 42" STEEL PIPE	LF	60	$ 192.00	$ 11,520.00
50	VALVE HOUSE - 18" STEEL PIPE	LF	50	$ 64.00	$ 3,200.00
51	VALVE HOUSE - 42" BUTTERFLY VALVE	LS	1	$ 20,480.00	$ 20,480.00
52	VALVE HOUSE - 42" INSPECTION TEE	LS	1	$ 10,240.00	$ 10,240.00
53	VALVE HOUSE - 42" DRESSER COUPLING	LS	1	$ 10,240.00	$ 10,240.00
54	VALVE HOUSE - 18" CONE VALVE	LS	1	$ 51,200.00	$ 51,200.00
55	VALVE HOUSE - 18" DRESSER COUPLING	LS	1	$ 6,400.00	$ 6,400.00
56	VALVE HOUSE - METER AND PROBES	LS	1	$ 3,968.00	$ 3,968.00
57	VALVE HOUSE - ELECTRICAL SERVICE	LS	1	$ 6,400.00	$ 6,400.00
58	CONCRETE OUTLET BAFFLE STRUCTURE	LS	1	$ 38,400.00	$ 38,400.00
				Subtotal	$ 722,992.00

No.	Item	Units	Quantity	Unit Cost	Total Cost
ALLUVIAL WELLS					
59	1500 GPM PUMPS INSTALLED WITH CASING	EA	4	$ 768.00	$ 3,072.00
60	12" PVC WELL OUTLET PIPE	LF	2900	$ 29.75	$ 86,275.00
61	24" PVC WELL OUTLET PIPE	LF	3100	$ 51.40	$ 159,340.00
62	PVC WELL OUTLET PIPE FITTINGS	EA	15	$ 57.60	$ 864.00
				Subtotal	$ 249,551.00

No.	Item	Units	Quantity	Unit Cost	Total Cost
Pumping Costs - 2000 Ac-Ft Discharge from Slurry					
1	First 300 kWh	kWh	300	$ 0.15	$ 45.00
2	Second 300 kWh	kWh	300	$ 0.11	$ 33.00
3	Remaining kWh	kWh	25240	$ 0.07	$ 1,842.52
				Subtotal	$ 1,920.52

No.	Item	Units	Quantity	Unit Cost	Total Cost
SPILLWAY					
63	CONCRETE OGEE SPILLWAY STRUCTURE	CY	20	$ 768.00	$ 15,360.00
64	CONCRETE SPILLWAY CHANNEL	CY	110	$ 640.00	$ 70,400.00
65	STILLING BASIN CONCRETE	CY	10	$ 640.00	$ 6,400.00
66	STILLING BASIN RIPRAP	CY	50	$ 57.60	$ 2,880.00
67	STILLING BASIN BEDDING	CY	25	$ 44.80	$ 1,120.00
68	STILLING BASIN OUTLET RIPRAP	CY	270	$ 83.20	$ 22,464.00
69	STILLING BASIN OUTLET BEDDING	CY	135	$ 44.80	$ 6,048.00
70	SPILLWAY CHANNEL CROSSING - 6' x 12' CONCRETE BOX CULVERT	LF	12	$ 812.80	$ 9,753.60
				Subtotal	$ 134,425.60

No.	Item	Units	Quantity	Unit Cost	Total Cost
MISCELLANEOUS					
71	DAM SITE SEEDING AND MULCHING	AC	50	$ 1,000.00	$ 50,000.00
72	2 - 4' x 8' CONCRETE BOX CULVERTS AT CR27	LF	60	$ 1,044.48	$ 62,668.80
73	DRAINAGE CHANNEL EXCAVATION AND GRADING	CY	85400	$ 3.00	$ 256,200.00
74	DRAINAGE CHANNEL GROUTED RIPRAP @ DROP STRUCTURES	CY	470	$ 156.16	$ 73,395.20
75	DRAINAGE CHANNEL NON-GROUTED RIPRAP @ DROP STRUCTURES	CY	320	$ 124.16	$ 39,731.20
76	DRAINAGE CHANNEL BEDDING AT DROP STRUCTURES	CY	400	$ 44.80	$ 17,920.00
77	RIPRAP AT BRIDGE CROSSINGS	CY	600	$ 80.13	$ 48,076.80
78	RIPRAP BEDDING AT BRIDGE CROSSINGS	CY	300	$ 44.80	$ 13,440.00
79	SAND DRAWS CHANNEL MAINTENANCE	LF	3000	$ 19.20	$ 57,600.00
				Subtotal	$ 569,032.00

Obermeyer Gate Diversion Structure for South Platte River					
No.	Item	Units	Quantity	Unit Cost	Total Cost
1	Obermeyer Gates (installed)	EA	1	$ 700,000.00	$ 700,000.00
2	Foundation	CY	820	$ 750.00	$ 615,000.00
3	SCADA	EA	1	$ 100,000.00	$ 100,000.00
4	Excavation and Grading	CY	740	$ 2.05	$ 1,517.00
	Subtotal				$ 1,416,517.00
	10% Demo and Removal				$ 141,651.70
	30% Contingency				$ 424,955.10
	10% Contractor Mobilization Cost				$ 141,651.70
	7% Geotechnical Engineering				$ 99,156.19
	7% Field Surveying				$ 99,156.19
	10% Engineering Fees				$ 141,651.70
	Total				**$ 2,464,739.58**

* Estimate does not include power hookup, permitting, and water control during construction.

Rubicon Gate Structure for Peterson Ditch Headgate					
No.	Item	Units	Quantity	Unit Cost	Total Cost
1	Rubicon Gates (installed)	EA	2	$ 25,000.00	$ 50,000.00
2	Foundation	CY	240	$ 750.00	$ 180,000.00
3	SCADA	EA	1	$ 100,000.00	$ 100,000.00
4	Excavation and Grading	CY	200	$ 2.05	$ 410.00
	Subtotal				$ 330,410.00
	10% Demo and Removal				$ 33,041.00
	30% Contingency				$ 84,000.00
	10% Contractor Mobilization Cost				$ 33,041.00
	7% Geotechnical Engineering				$ 23,128.70
	7% Field Surveying				$ 23,128.70
	10% Engineering Fees				$ 33,041.00
	Total				**$ 559,790.40**

* Estimate does not include power hookup, permitting, and water control during construction.

COST SUMMARY		
	TOTAL INFRASTRUCURE COST	$ 16,423,984.69
	CONTINGENCY (15%)	$ 2,463,597.70
	ENGINEERING FINAL DESIGN/PERMITTING/BIDDING/ASBUILTS	$ 1,149,678.93
	CONSTRUCTION MANAGEMENT/OBSERVATION (10%)	$ 1,642,398.47
	Total Cost	**$ 21,679,659.79**
	Total Infrastructure Cost Per Acre foot (7560ac-ft)	**$ 2,867.68**
	Total Alluvial Well Pumping Cost Per Acre foot (2000 ac-ft)	**$ 0.96**
	Annualized 30-Year Cost Per Acre-Foot (7560 ac-ft Firm Yield)	**$ 95.59**
	Operations and Maintenance Per Year (1% of Infrastructure)	**$ 166,160.37**
	Total Annualized 30-Year Cost Per Acre-Foot (Incl. O&M)(7560 ac-ft Firm Yield)	**$ 168.29**
	Yearly Loan Payment (30 Years, 3% Interest)	**$ 1,106,080.18**

Scenario 4: Well Field Fill + Reservoir Alluvial Well Withdrawl (8300 Ac-Ft)

Scenario 4: Well Field Fill + Reservoir Alluvial Well Withdrawl (8300 Ac-Ft)

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Job No. :	08-129
By:	CAG
Date:	12/6/2011
Project:	Ovid Reservoir
Client:	District 64 Reservoir Co.

Ovid Dam and Reservoir Infrastructure

No.	Item	Units	Quantity	Unit Cost	Total Cost
STARTUP					
1	MOBILIZATION	LS	1	$ 640,000.00	$ 640,000.00
2	BONDS AND INSURANCE	LS	1	$ 64,000.00	$ 64,000.00
				Subtotal	$ 704,000.00

No.	Item	Units	Quantity	Unit Cost	Total Cost
SITE PREPARATION					
3	CLEARING AND STRIPPING RESERVOIR SITE AND STOCKPILING STRIPPING	AC	300	$ 1,280.00	$ 384,000.00
4	SITE EROSION CONTROL	LS	1	$ 64,000.00	$ 64,000.00
				Subtotal	$ 448,000.00

No.	Item	Units	Quantity	Unit Cost	Total Cost
DAM EMBANKMENT					
22	SLURRY WALL	LF	15050	$ 204.80	$ 3,082,240.00
23	OVEREXCAVATION OF DOWNSTREAM TOE	CY	120600	$ 1.54	$ 185,241.60
24	ZONE I (CORE) FILL	CY	300000	$ 2.44	$ 733,440.00
25	ZONE II FILL	CY	1193975	$ 2.44	$ 2,919,030.08
26	FILTER DRAIN	CY	40000	$ 25.60	$ 1,024,000.00
27	ACCESS ROADS TO DAM EMBANKMENT	CY	25000	$ 2.56	$ 64,000.00
28	TOE DRAIN PIPING AND FILTER	LF	15165	$ 44.80	$ 679,392.00
29	TOE DRAIN MANHOLES	EA	42	$ 4,260.00	$ 178,920.00
30	TOE DRAIN OUTLET WEIR BOXES	EA	6	$ 640.00	$ 3,840.00
31	TOPSOIL DOWNSTREAM FACE OF DAM EMBANKMENT AND DISTURBED AREAS	CY	18000	$ 2.37	$ 42,660.00
32	TOPSOIL UPSTREAM FACE (8:1 SLOPE)	CY	183775	$ 2.37	$ 435,546.75
33	ROADBASE DAM CREST ROAD	SY	15050	$ 17.43	$ 262,375.68
34	DAM INSTRUMENTATION	LS	1	$ 211,200.00	$ 211,200.00
				Subtotal	$ 9,821,886.11

No.	Item	Units	Quantity	Unit Cost		Total Cost	
OUTLET WORKS							
35	42" STEEL OUTLET PIPE DELIVERED AND INSTALLED INCLUDING CONCRETE ENCASMENT	LF	410	$	704.00	$	288,640.00
36	OUTLET PIPE MUD MAT	CY	100	$	256.00	$	25,600.00
37	OUTLET CHANNEL GRADING	CY	10000	$	3.00	$	30,000.00
38	OUTLET WORKS SAND COLLAR	CY	300	$	51.20	$	15,360.00
39	CONCRETE INTAKE STRUCTURE WITH ALL APPURTENANCES	LS	1	$	12,800.00	$	12,800.00
40	INTAKE TRASH RACK DELIVERED AND INSTALLED	LS	1	$	6,400.00	$	6,400.00
41	42" x 42" GATE DELIVERED AND INSTALLED ON INTAKE STRUCTURE WITH ALL APURTENANCES	LS	1	$	28,761.60	$	28,761.60
42	DAM CREST OUTLET CONTROL STRUCURE	LS	1	$	19,200.00	$	19,200.00
43	GATE OPERATOR AND STEM	LF	240	$	128.00	$	30,720.00
44	3" STEEL AIR VENT PIPE	LF	240	$	13.76	$	3,302.40
45	STAFF GAGE	LS	1	$	34,560.00	$	34,560.00
46	VALVE HOUSE - CONCRETE STRUCTURE	CY	75	$	704.00	$	52,800.00
47	VALVE HOUSE - HARDWARE	LF	1	$	6,400.00	$	6,400.00
48	VALVE HOUSE - MANIFOLD FITTINGS	LS	1	$	6,400.00	$	6,400.00
49	VALVE HOUSE - 42" STEEL PIPE	LF	60	$	192.00	$	11,520.00
50	VALVE HOUSE - 18" STEEL PIPE	LF	50	$	64.00	$	3,200.00
51	VALVE HOUSE - 42" BUTTERFLY VALVE	LS	1	$	20,480.00	$	20,480.00
52	VALVE HOUSE - 42" INSPECTION TEE	LS	1	$	10,240.00	$	10,240.00
53	VALVE HOUSE - 42" DRESSER COUPLING	LS	1	$	10,240.00	$	10,240.00
54	VALVE HOUSE - 18" CONE VALVE	LS	1	$	51,200.00	$	51,200.00
55	VALVE HOUSE - 18" DRESSER COUPLING	LS	1	$	6,400.00	$	6,400.00
56	VALVE HOUSE - METER AND PROBES	LS	1	$	3,968.00	$	3,968.00
57	VALVE HOUSE - ELECTRICAL SERVICE	LS	1	$	6,400.00	$	6,400.00
58	CONCRETE OUTLET BAFFLE STRUCTURE	LS	1	$	38,400.00	$	38,400.00
				Subtotal		$	722,992.00

No.	Item	Units	Quantity	Unit Cost		Total Cost	
ALLUVIAL WELLS							
59	1500 GPM PUMPS INSTALLED WITH CASING	EA	4	$	-	$	-
60	12" PVC WELL OUTLET PIPE	LF	2900	$	29.75	$	86,275.00
61	24" PVC WELL OUTLET PIPE	LF	3100	$	51.40	$	159,340.00
62	PVC WELL OUTLET PIPE FITTINGS	EA	15	$	640.00	$	9,600.00
				Subtotal		$	255,215.00

No.	Item	Units	Quantity	Unit Cost	Total Cost
Alluvial Well Pumping Costs - 2000 Ac-Ft Discharge from Slurry					
1	First 300 kWh	kWh	300	$ 0.15	$ 45.00
2	Second 300 kWh	kWh	300	$ 0.11	$ 33.00
3	Remaining kWh	kWh	25240	$ 0.07	$ 1,842.52
				Subtotal	$ 1,920.52
1	STILLING BASIN BEDDING	CY	25	$ 44.80	$ 1,120.00
2	STILLING BASIN OUTLET RIPRAP	CY	270	$ 83.20	$ 22,464.00
3	STILLING BASIN OUTLET BEDDING	CY	135	$ 44.80	$ 6,048.00
4	SPILLWAY CHANNEL CROSSING - 6' x 12' CONCRETE BOX CULVERT	LF	12	$ 812.80	$ 9,753.60
				Subtotal	$ 43,148.64

No.	Item	Units	Quantity	Unit Cost	Total Cost
MISCELLANEOUS					
71	DAM SITE SEEDING AND MULCHING	AC	50	$ 1,000.00	$ 50,000.00
72	2 - 4' x 8' CONCRETE BOX CULVERTS AT CR27	LF	60	$ 1,044.48	$ 62,668.80
73	DRAINAGE CHANNEL EXCAVATION AND GRADING	CY	85400	$ 3.00	$ 256,200.00
74	DRAINAGE CHANNEL GROUTED RIPRAP @ DROP STRUCTURES	CY	470	$ 156.16	$ 73,395.20
75	DRAINAGE CHANNEL NON-GROUTED RIPRAP @	CY	320	$ 124.16	$ 39,731.20
76	DRAINAGE CHANNEL BEDDING AT DROP	CY	400	$ 44.80	$ 17,920.00
77	RIPRAP AT BRIDGE CROSSINGS	CY	600	$ 80.13	$ 48,076.80
78	RIPRAP BEDDING AT BRIDGE CROSSINGS	CY	300	$ 44.80	$ 13,440.00
79	SAND DRAWS CHANNEL MAINTENANCE	LF	3000	$ 19.20	$ 57,600.00
				Subtotal	$ 569,032.00

Well Field Alternative to filling with Peterson Ditch					
No.	Item	Units	Quantity	Unit Cost	Total Cost
Test Hole Program					
1	Drill and log 6-8 test holes	EA	1	$ 18,000.00	$ 18,000.00
2	Test hole supervision and management	EA	1	$ 8,000.00	$ 8,000.00
				Subtotal	$ 26,000.00
No.	Item	Units	Quantity	Unit Cost	Total Cost
Well Construction (per well)					
1	Drilling and completion	EA	8	$ 45,000.00	$ 360,000.00
2	Pumping equipment	EA	8	$ 20,000.00	$ 160,000.00
3	Pumping controls	EA	8	$ 5,000.00	$ 40,000.00
4	Engineering design, well site supervision	EA	8	$ 12,000.00	$ 96,000.00
				Subtotal	$ 656,000.00
No.	Item	Units	Quantity	Unit Cost	Total Cost
Pumping Costs Per 6300 Ac-Ft Fill					
1	First 300 kWh	kWh	300	$ 0.15	$ 45.00
2	Second 300 kWh	kWh	300	$ 0.11	$ 33.00
3	Remaining kWh	kWh	199480	$ 0.07	$ 14,562.04
				Subtotal	$ 14,640.04
No.	Item	Units	Quantity	Unit Cost	Total Cost
Well House, Pumps and Manifold System					
1	48" Pressure PVC Pipe	LF	2000	$ 210.50	$ 421,000.00
2	18" Pressure PVC Pipe	LF	6600	$ 35.65	$ 235,290.00
3	Valves and Fittings	LS	1	$ 35,000.00	$ 35,000.00
				Subtotal	$ 691,290.00
	Subtotal				$ 1,373,290.00

COST SUMMARY		
	TOTAL INFRASTRUCURE COST	$ 13,937,563.75
	CONTINGENCY (15%)	$ 2,490,634.56
	ENGINEERING FINAL DESIGN/PERMITTING/BIDDING/ASBUILTS	$ 975,629.46
	CONSTRUCTION MANAGEMENT/OBSERVATION (10%)	$ 1,393,756.38
	Total Cost	**$ 18,797,584.15**
	Total Infrastructure Cost Per Acre foot (8300 ac-ft)	**$ 2,264.77**
	Total Well Field Pumping Cost Per Acre foot (6300 ac-ft)	**$ 2.32**
	Total Alluvial Well Pumping Cost Per Acre foot (2000 ac-ft)	**$ 0.96**
	Total Pumping Cost (Well Field + Alluvial) Per Acre foot (8300 ac-ft)	**$ 3.28**
	Annualized 30-Year Cost Per Acre-Foot (8300 ac-ft Firm Yield)	**$ 75.49**
	Operations and Maintenance Per Year (1% of Infrastructure)	**$ 155,936.20**
	Total Annualized 30-Year Cost Per Acre-Foot (Incl. O&M)(8300 ac-ft Firm Yield)	**$ 134.33**
	Yearly Loan Payment (30 Years, 3% Interest)	**$ 959,038.82**

APPENDIX E

Beneficial Use Demand Figures

Figure 1: Energy 50% – Co-Generation Power Plant

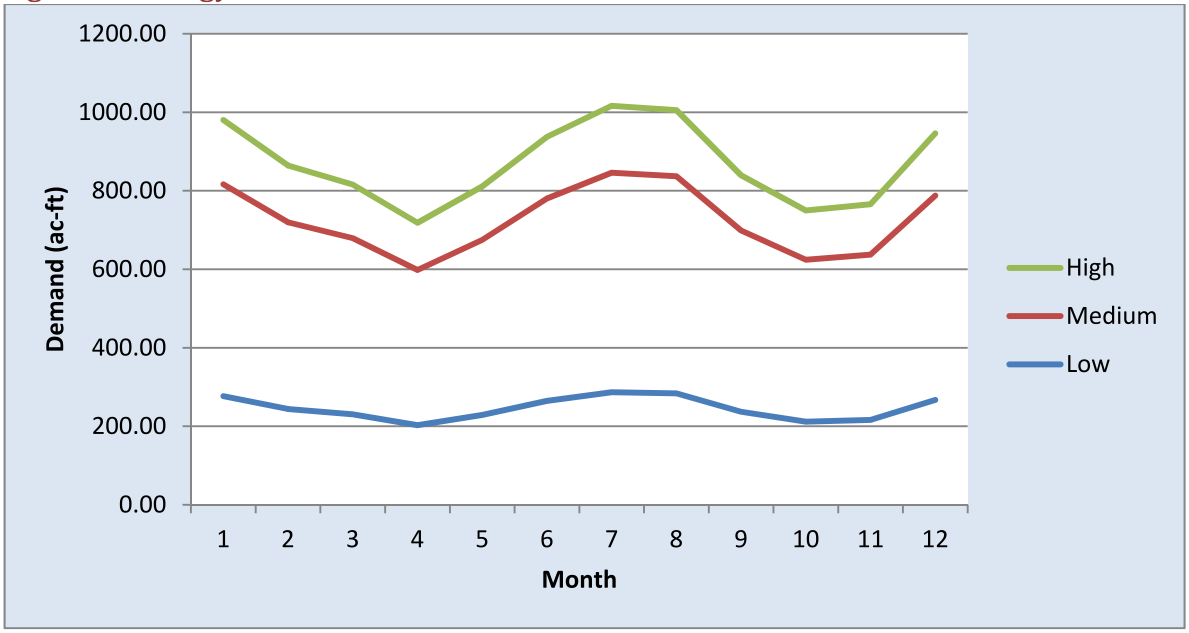


Figure 2: Wetland

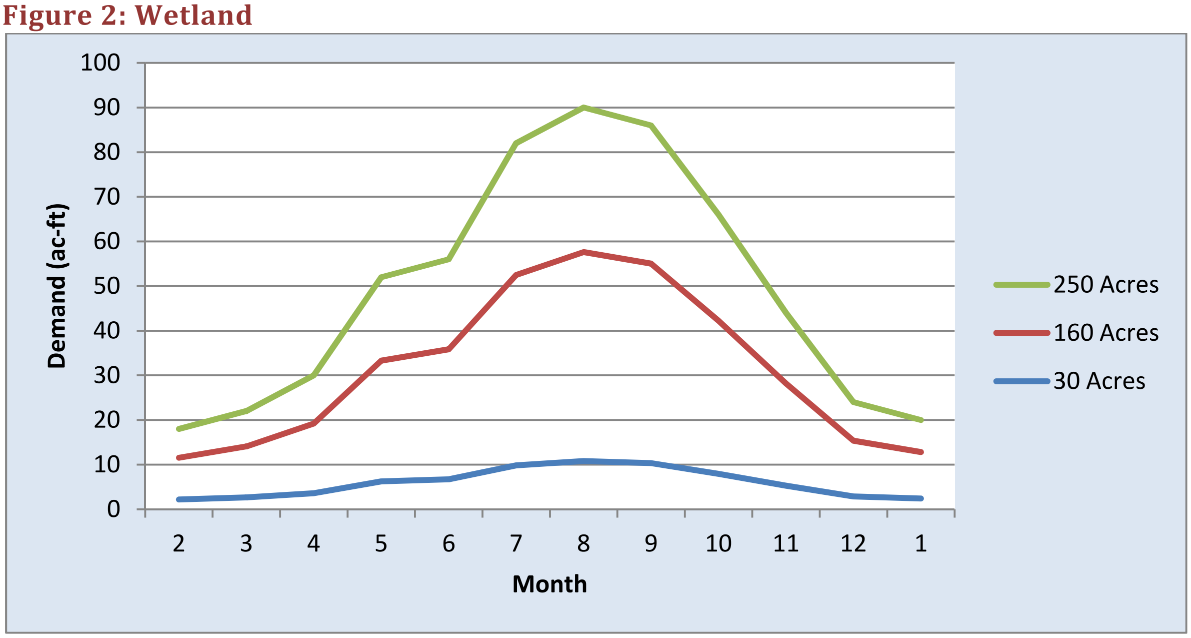


Figure 3: Hatchery

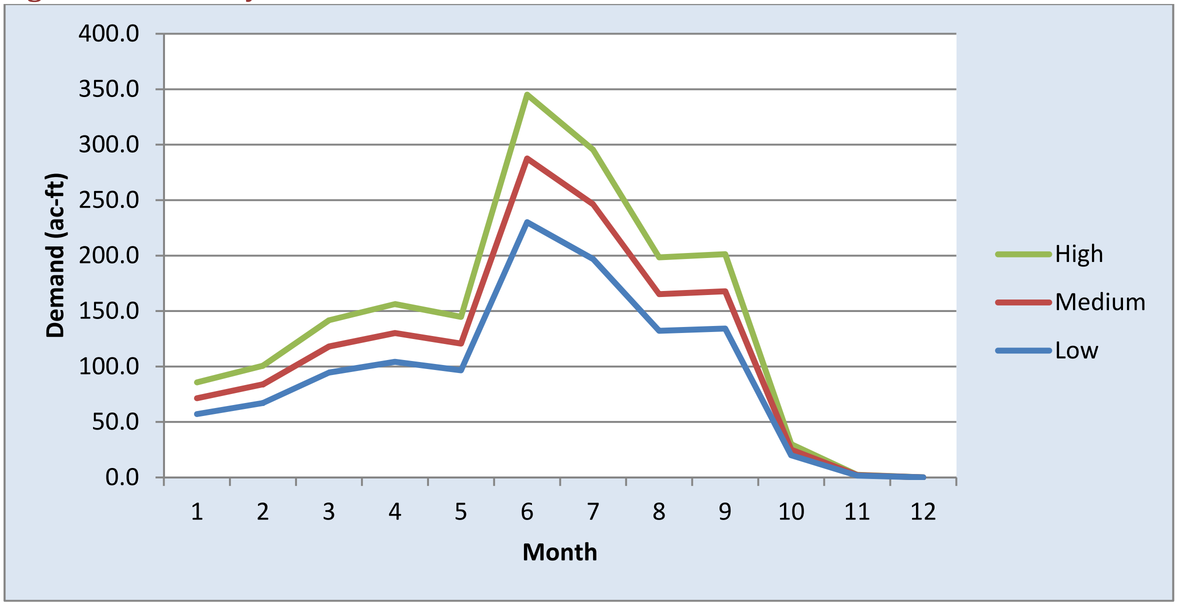


Figure 4: Irrigation Supplement – 20% JID Acres

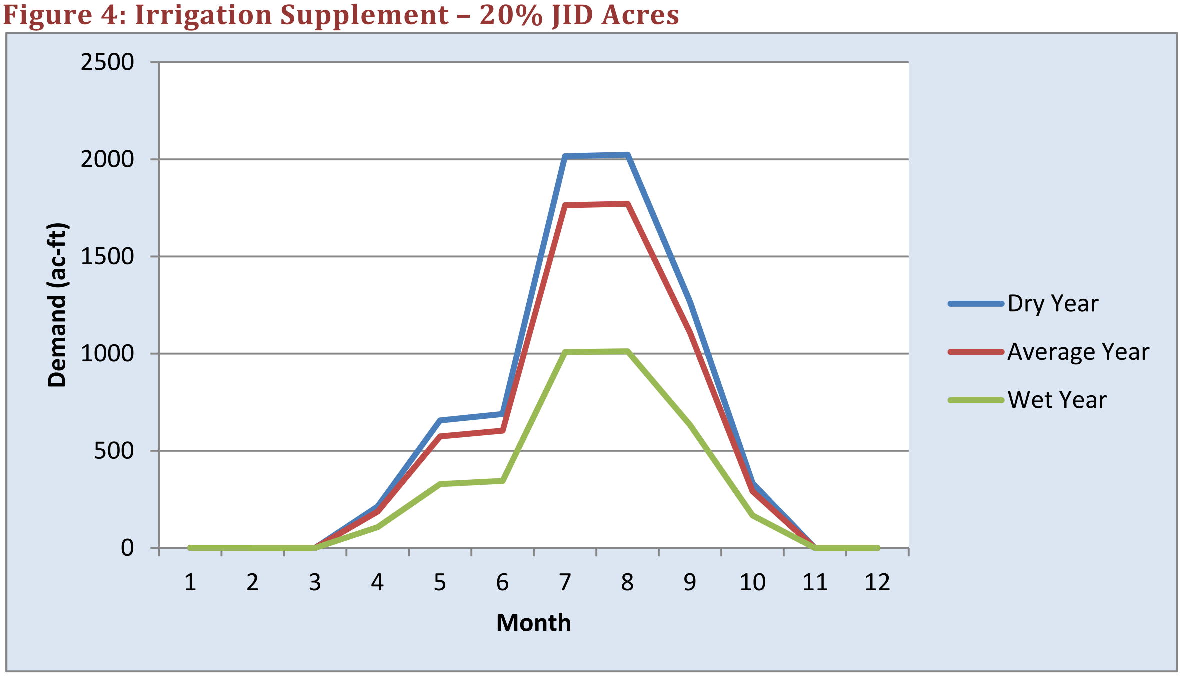


Figure 5: Irrigation Supplement – 10% JID Acres

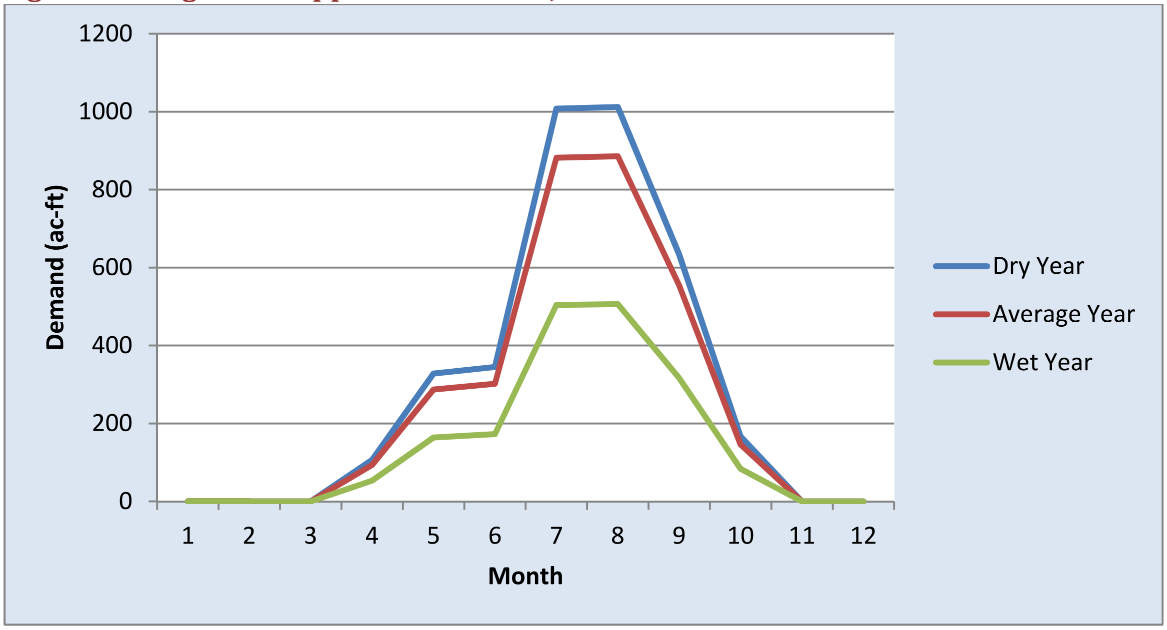


Figure 6: New Irrigation

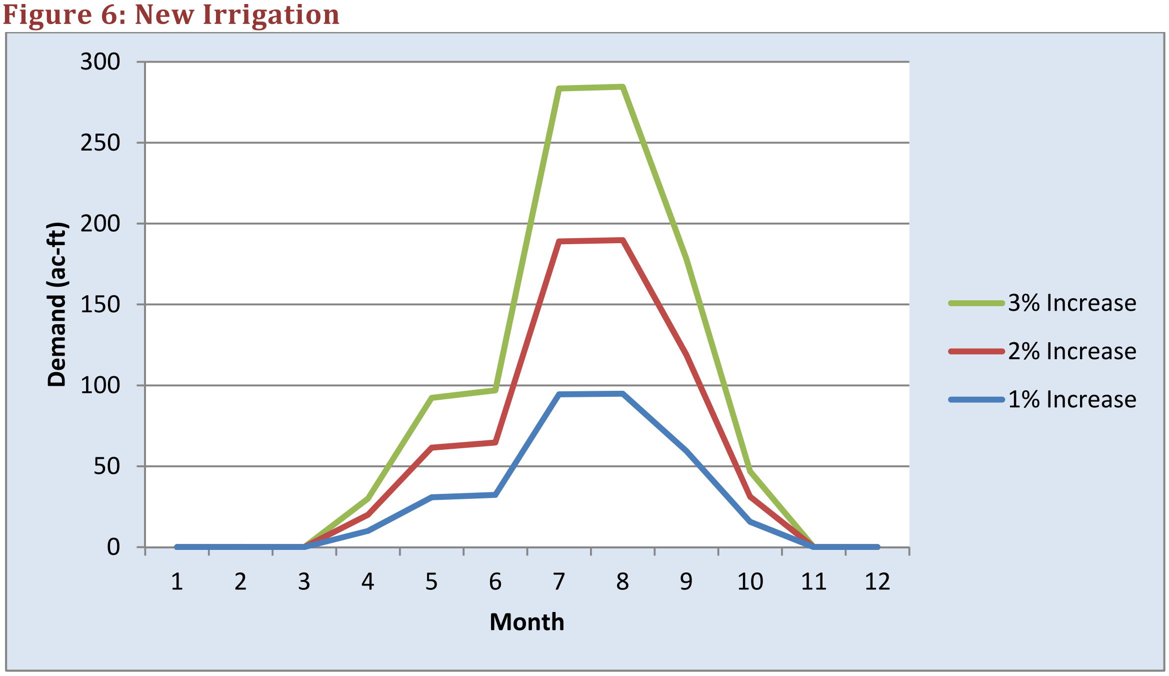


Figure 7: Augmentation of Existing Wells – Sedgwick County

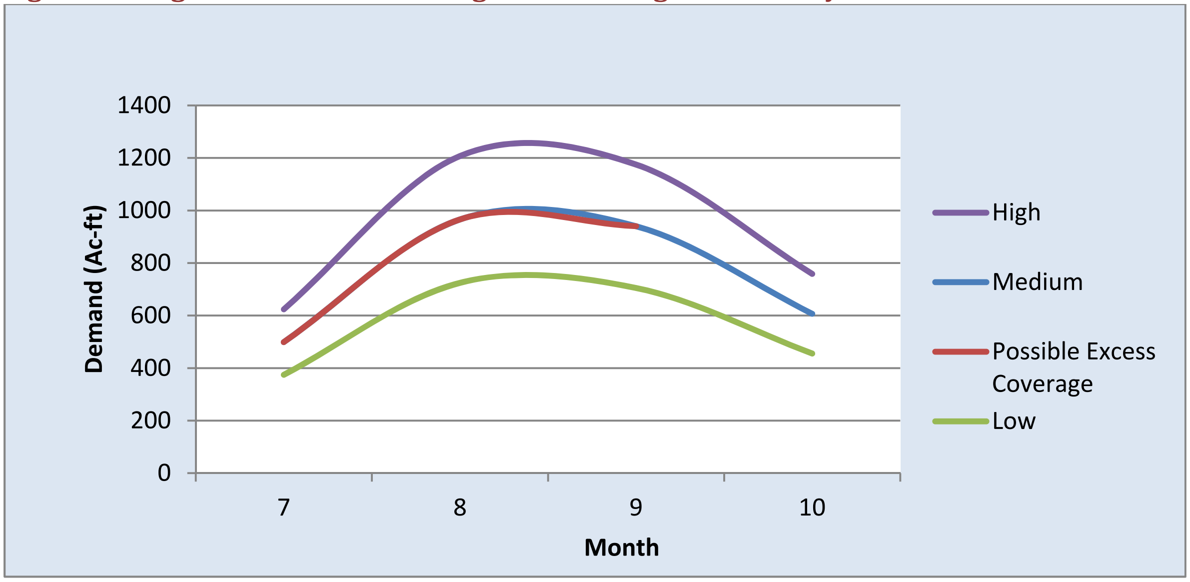


Figure 8: Augmentation of Existing Wells – Potential Logan County Deficit Coverage (Via Exchange)

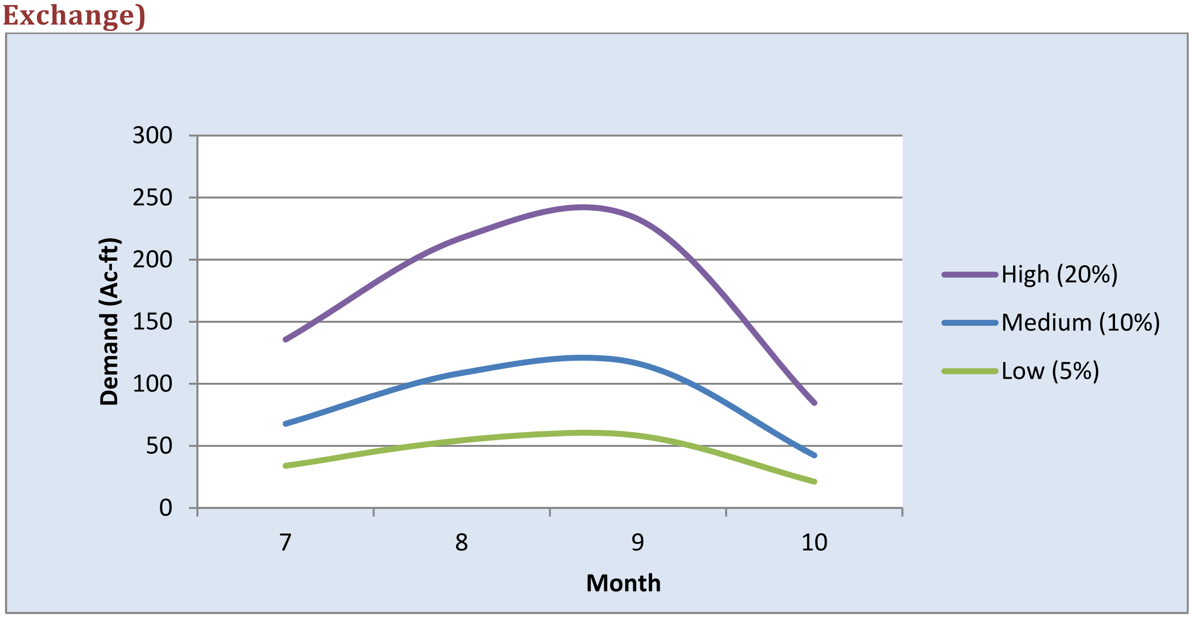


Figure 9: New Municipal – Sedgwick County

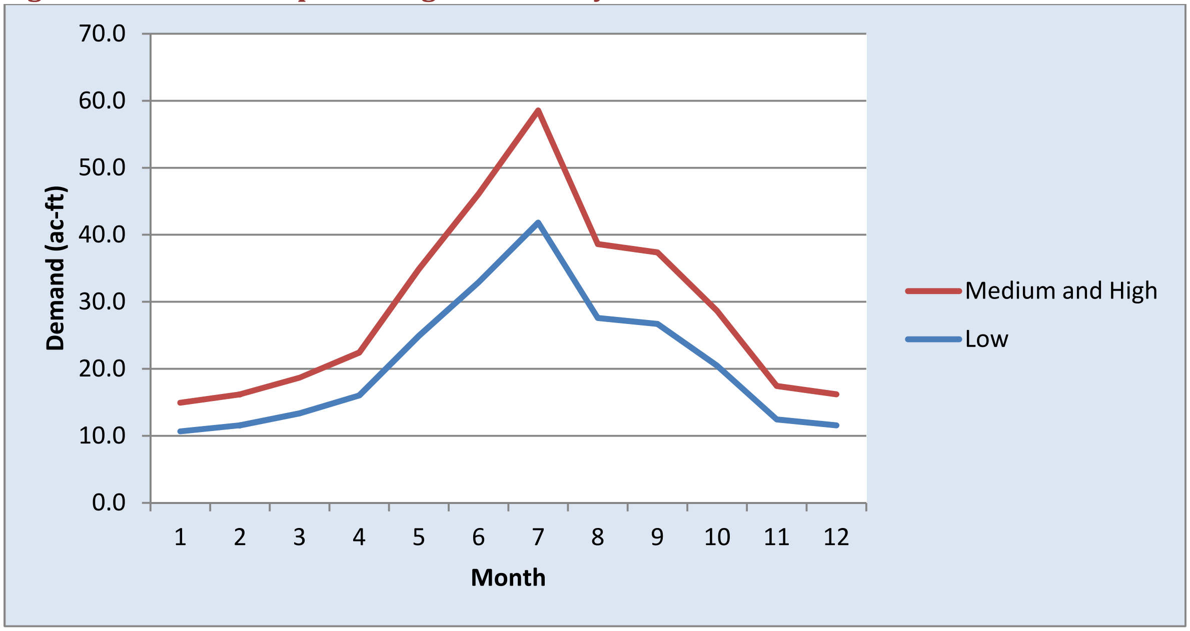
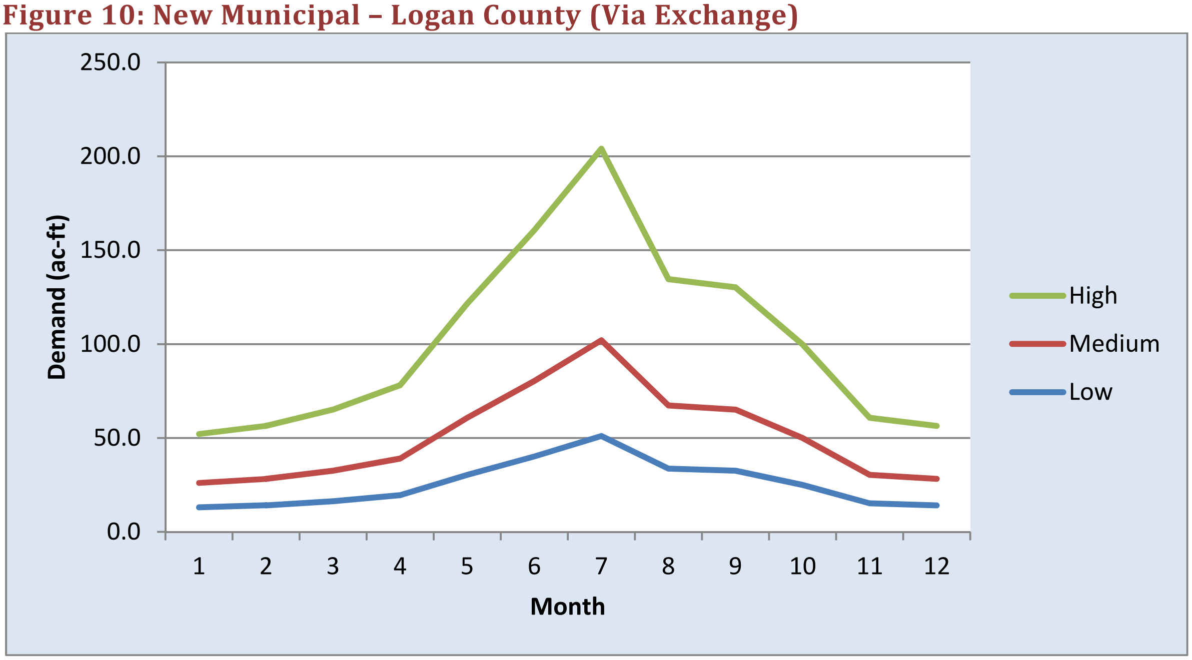


Figure 10: New Municipal – Logan County (Via Exchange)



APPENDIX F

Reservoir Modeling Scenario Tables

Table 1: Scenario 1 – 50% Energy/Power Generation Sedgwick County

Scenario Modeling Summary Table						
Scenario 1						
Year	Reservoir Net Fill (Fill-Shrink+ Previous Years End Storage) (ac-ft) (A)	Release (ac-ft) (B)	Daily Water Demand (ac-ft) (Footnote 1) (C)	Total Daily Water Shortage (ac-ft) (C-B) (D)	Total Annual Aug. Credits for Potential Storage and Release (ac-ft) (Footnote 2) (E)	Remaining Water Shortage (After Aug. Credit Release) (ac-ft) (D-E) (F)
2000	5,711	3,546	3,546	0	502	0
2001	8,164	2,416	2,416	0	497	0
2002	4,933	4,459	4,773	314	1,235	0
2003	1,643	1,534	4,675	3,141	1,322	1,819
2004	1,001	811	4,998	4,187	1,322	2,865
2005	8,218	2,682	2,682	0	670	0
2006	5,012	4,458	4,458	0	820	0
2007	6,919	3,076	3,076	0	395	0
2008	7,671	3,251	3,251	0	798	0
2009	5,986	216	216	0	344	0
Total:	**55,258**	**26,450**	**34,092**	**7,643**	**7,905**	**4,684**
Average:	**5,526**	**2,645**	**3,409**	**764**	**790**	**468**

See Footnotes following Table-7.

Table 2: Scenario 2 – Aug.(All), New Munic.(All), Wetlands, Hatchery

Scenario Modeling Summary Table						
Scenario 2						
Year	Reservoir Net Fill (Fill-Shrink+ Previous Years End Storage) (ac-ft) (A)	Release (ac-ft) (B)	Daily Water Demand (ac-ft) (Footnote 1) (C)	Total Daily Water Shortage (ac-ft) (C-B) (D)	Total Annual Aug. Credits for Potential Storage and Release (ac-ft) (Footnote 2) (E)	Remaining Water Shortage (After Aug. Credit Release) (ac-ft) (D-E) (F)
2000	5,582	4,483	4,483	0	665	0
2001	8,648	3,199	3,199	0	290	0
2002	4,911	4,454	5,370	916	1,445	0
2003	1,611	1,417	5,334	3,917	2,725	1,192
2004	1,079	780	5,427	4,646	2,725	1,921
2005	7,885	3,640	3,640	0	399	0
2006	4,987	4,536	5,258	722	1,022	0
2007	6,862	4,513	4,513	0	336	0
2008	7,643	3,784	3,784	0	819	0
2009	5,850	80	80	0	335	0
Total:	**55,059**	**30,887**	**41,088**	**10,201**	**10,761**	**3,114**
Average:	**5,506**	**3,089**	**4,109**	**1,020**	**1,076**	**311**

See Footnotes following Table-7.

Table 3: Scenario 3 – Irr. Supp. 10%, New Irr.

Scenario Modeling Summary Table						
Scenario 3						
Year	Reservoir Net Fill (Fill-Shrink+ Previous Years End Storage) (ac-ft) (A)	Release (ac-ft) (B)	Daily Water Demand (ac-ft) (Footnote 1) (C)	Total Daily Water Shortage (ac-ft) (C-B) (D)	Total Annual Aug. Credits for Potential Storage and Release (ac-ft) (Footnote 2) (E)	Remaining Water Shortage (After Aug. Credit Release) (ac-ft) (D-E) (F)
2000	5,602	3,230	3,230	0	429	0
2001	8,214	2,466	2,466	0	279	0
2002	4,900	3,762	3,762	0	944	0
2003	2,253	1,989	3,672	1,683	1,322	361
2004	1,146	819	3,808	2,989	1,322	1,667
2005	7,876	2,716	2,716	0	474	0
2006	4,974	3,702	3,702	0	804	0
2007	6,820	3,015	3,015	0	286	0
2008	7,630	2,993	2,993	0	619	0
2009	5,875	105	105	0	388	0
Total:	**55,288**	**24,797**	**29,469**	**4,672**	**6,867**	**2,028**
Average:	**5,529**	**2,480**	**2,947**	**467**	**687**	**203**

See Footnotes following Table-7.

Table 4: Scenario 4 – Aug.(All), New Irr., Wetlands, Hatchery

Scenario Modeling Summary Table						
Scenario 4						
Year	Reservoir Net Fill (Fill-Shrink+ Previous Years End Storage) (ac-ft) (A)	Release (ac-ft) (B)	Daily Water Demand (ac-ft) (Footnote 1) (C)	Total Daily Water Shortage (ac-ft) (C-B) (D)	Total Annual Aug. Credits for Potential Storage and Release (ac-ft) (Footnote 2) (E)	Remaining Water Shortage (After Aug. Credit Release) (ac-ft) (D-E) (F)
2000	5,572	4,510	4,510	0	658	0
2001	8,640	3,265	3,265	0	259	0
2002	4,908	4,454	5,334	880	1,362	0
2003	1,606	1,401	5,301	3,900	2,725	1,175
2004	1,089	768	5,375	4,607	2,725	1,882
2005	7,850	3,723	3,723	0	358	0
2006	4,984	4,536	5,243	708	986	0
2007	6,864	4,589	4,589	0	307	0
2008	7,639	3,804	3,804	0	793	0
2009	5,839	69	69	0	314	0
Total:	**54,991**	**31,119**	**41,214**	**10,096**	**10,486**	**3,058**
Average:	**5,499**	**3,112**	**4,121**	**1,010**	**1,049**	**306**

See Footnotes following Table-7.

Table 5: Scenario 5 – Irr. Supp. 10%, New Irr., New Munic. (All), Wetlands, Hatchery

Scenario Modeling Summary Table						
Scenario 5						
Year	Reservoir Net Fill (Fill-Shrink+ Previous Years End Storage) (ac-ft) (A)	Release (ac-ft) (B)	Daily Water Demand (ac-ft) (Footnote 1) (C)	Total Daily Water Shortage (ac-ft) (C-B) (D)	Total Annual Aug. Credits for Potential Storage and Release (ac-ft) (Footnote 2) (E)	Remaining Water Shortage (After Aug. Credit Release) (ac-ft) (D-E) (F)
2000	5,713	4,861	4,861	0	744	0
2001	8,744	3,564	3,564	0	515	0
2002	4,946	4,558	5,826	1,268	1,874	0
2003	1,554	1,432	5,701	4,268	2,725	1,543
2004	1,012	786	5,969	5,183	2,725	2,458
2005	8,114	3,910	3,910	0	568	0
2006	5,024	4,620	5,654	1,035	1,366	0
2007	6,900	4,303	4,303	0	398	0
2008	7,674	4,568	4,568	0	1,053	0
2009	5,955	185	185	0	291	0
Total:	**55,635**	**32,787**	**44,542**	**11,754**	**12,258**	**4,001**
Average:	**5,564**	**3,279**	**4,454**	**1,175**	**1,226**	**400**

See Footnotes following Table-7.

Table 6: Scenario 6 – Irr. Supp. 20%

Scenario Modeling Summary Table						
Scenario 6						
Year	Reservoir Net Fill (Fill-Shrink+ Previous Years End Storage) (ac-ft) (A)	Release (ac-ft) (B)	Daily Water Demand (ac-ft) (Footnote 1) (C)	Total Daily Water Shortage (ac-ft) (C-B) (D)	Total Annual Aug. Credits for Potential Storage and Release (ac-ft) (Footnote 2) (E)	Remaining Water Shortage (After Aug. Credit Release) (ac-ft) (D-E) (F)
2000	5,708	5,134	5,320	185	479	0
2001	8,741	4,062	4,062	0	424	0
2002	4,941	4,568	6,196	1,628	988	639
2003	1,536	1,394	6,048	4,654	1,322	3,332
2004	1,030	781	6,272	5,491	1,322	4,169
2005	8,040	4,474	4,474	0	516	0
2006	5,018	4,633	6,098	1,465	806	658
2007	6,885	4,888	4,966	78	322	0
2008	7,667	4,930	4,930	0	776	0
2009	5,943	173	173	0	272	0
Total:	**55,509**	**35,036**	**48,537**	**13,501**	**7,228**	**8,798**
Average:	**5,551**	**3,504**	**4,854**	**1,350**	**723**	**880**

See Footnotes following Table-7.

Table 7: Scenario 7 – All Scenarios Except Irr. Supp. 20%

Scenario Modeling Summary Table						
Scenario 7						
Year	Reservoir Net Fill (Fill-Shrink+ Previous Years End Storage) (ac-ft) (A)	Release (ac-ft) (B)	Daily Water Demand (ac-ft) (Footnote 1) (C)	Total Daily Water Shortage (ac-ft) (C-B) (D)	Total Annual Aug. Credits for Potential Storage and Release (ac-ft) (Footnote 2) (E)	Remaining Water Shortage (After Aug. Credit Release) (ac-ft) (D-E) (F)
2000	5,924	5,406	11,259	5,853	896	4,957
2001	8,949	6,117	8,082	1,964	910	1,054
2002	5,002	4,774	13,905	9,131	2,233	6,898
2003	1,409	1,372	13,681	12,309	2,725	9,584
2004	959	800	14,233	13,433	2,725	10,708
2005	8,737	6,128	9,037	2,910	913	1,996
2006	5,097	4,847	13,419	8,571	1,627	6,945
2007	7,080	5,225	10,605	5,380	572	4,808
2008	7,757	5,324	10,028	4,704	1,502	3,201
2009	6,171	401	401	0	371	0
Total:	**57,085**	**40,395**	**104,649**	**64,255**	**14,475**	**50,151**
Average:	**5,709**	**4,039**	**10,465**	**6,425**	**1,448**	**5,015**

Footnotes:

1.) Daily Water Demand was calculated by summing each day's water demand only on days when the Compensated Stateline Flow was less than that specified in the model.

2.) Total Annual Augmentation Credits for Potential Storage and Release was calculated by first determining how much storage was available in the reservoir in each month that excess District 64 augmentation credits were available (April-June)(Table 5-3, Colorado Corn Growers Association report on the Lower South Platte CO-OP). Next, depending on which Scenario was being analyzed, 50-percent of the available augmentation credits, for each respective county (Sedgwick and Logan), was determined; the minimum value between available reservoir storage and available augmentation credits was then used as the applicable Total Annual Augmentation Credit for Potential Storage and Release.

Table 8: Reservoir Capacities and Fill Conditions

Capacities		***Fill Conditions***			***Values in CFS***
Maximum Fill Ac/ft	**5770**	Call % <=	**0**	Peterson Max Diversion =	**120**
Dead Storage Ac/ft	**500**	Min Temp >	**0**	Flow Below Peterson >	**15**
Max. Fill Rate CFS	**100**	Avg Temp >	**15**	Total State Line Flow >	**120**
Min. Fill Rate CFS	**20**	***Allocation %***		Compensated State Line Value	**125**
Canal Loss	**5.00%**	Augmentation	**100.0%**		
Outlet Capacity CFS	**100**	Compact Man	**0.0%**		
River Loss	**5.00%**				