Central Oregon Irrigation District
Juniper Ridge Phase II

A Project Associated With
North Unit Irrigation District
Water and Energy Conservation Initiative

Reclamation WaterSMART Water and Energy Efficiency Grant Proposal

January 2, 2013

Steve Johnson
District Manager
Central Oregon Irrigation District

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1.1. Executive Summary

Date: January 2, 2013
Applicant Name: Central Oregon Irrigation District
City/County/State: Redmond, Deschutes County, Oregon

This proposal is Juniper Ridge Phase II and is associated with the North Unit Energy and Water Conservation Initiative, a partnership between Central Oregon Irrigation District (COID), North Unit Irrigation District (NUID), and the Deschutes River Conservancy (DRC). COID proposes to pipe approximately one mile of its Pilot Butte canal and conserve 2,552 acre-feet (AF) of water from the Deschutes River. A water banking agreement will allocate a majority of the COID conserved water (2,000 acre-feet) to NUID lands currently supported by water that is pumped from the Crooked River. The Crooked River water rights displaced by the new water allocated from COID (2,000 acre-feet) will be transferred instream to support water quality and fish habitat improvements in the Crooked River. The remaining 552 acre-feet of conserved water will be restored permanently instream in the Deschutes River. COID will benefit from improved water management and increased hydropower generation at one of its existing Juniper Ridge Hydroelectric Facility. The project will provide benefits within all four Task Areas defined by the Bureau of Reclamation (Reclamation) in Funding Opportunity Announcement No. R13SF80003. The project will enhance irrigation conveyance efficiencies within COID, generate **2,000 acre-feet** of new Deschutes River water supply for farmers in NUID, **2,000 acre-feet** of new instream water rights in the lower Crooked River, and **552 acre-feet** of new instream water rights in the Deschutes River (Task A). The project **will conserve an estimated average 543,343 kilowatt hours of electricity**, and will **generate an additional 3,727,545 kilowatt hours/year of additional renewable energy** annually at its existing Juniper Ridge Hydroelectric Facility (Task B). The project will improve environmental conditions **by restoring 7.54 cfs of water rights to the lower Crooked River** for ESA listed Mid-Columbia steelhead trout in the lower Crooked River, addressing limiting factors of low flow and temperature. It will improve conditions in the middle Deschutes River by **restoring 1.7 cfs of water rights instream** (Task C). The project will utilize a **water banking agreement** to facilitate the reallocation of water from an agricultural water use to an environmental water use and the allocation of the conserved water in one irrigation district to existing agricultural uses in another irrigation district (Task D).

This project is the third phase of the North Unit Water and Energy Conservation Initiative. The Initiative will ultimately restore up to 22,500 acre-feet and protect up to 220 cfs in the lower Crooked River. It will reduce NUID annual pumping costs by over $300,000. Phase I, implemented in 2011-12 with support from a 2011 WaterSmart grant, restored 7,880 acre-feet to the lower Crooked River and reduced NUID pumping by 1,220,163 kilowatt hours. Phase II, implemented in 2012-13 with COID used the same water banking mechanism piloted in Phase I, but elevated the innovation by including a second irrigation district, thereby piloting inter-district transfers and generating additional renewable energy. Juniper Ridge Phase II (JR2) proposed here, is the third phase of the NUID Water and Energy Conservation initiative and the second to involve COID. This phase follows the precedent set in the first two projects to restore more water instream, conserve additional energy and generate additional renewable energy. JR2 is a

pipeline (penstock) extension of the original pipe constructed in 2010 for COID's Juniper Ridge Hydroelectric & Pipeline Project which was supported from a WaterSmart grant in 2009 and from the **American Recovery and Reinvestment Act**. That project permanently restored 8,319 acre feet to the Deschutes River and constructed a 5 MW conduit-exempt hydroelectric plant on COID's Pilot Butte Canal. The proposed JR2 project is expected to start in June 2013, with construction occurring in 2013-2014, and the water rights administrative process completed by March 2015.

1.2. Background Data

1.2.1. Area Maps, Project Map & Instream Restoration Reach Map

Figure 1. Irrigation Districts in the Deschutes Basin

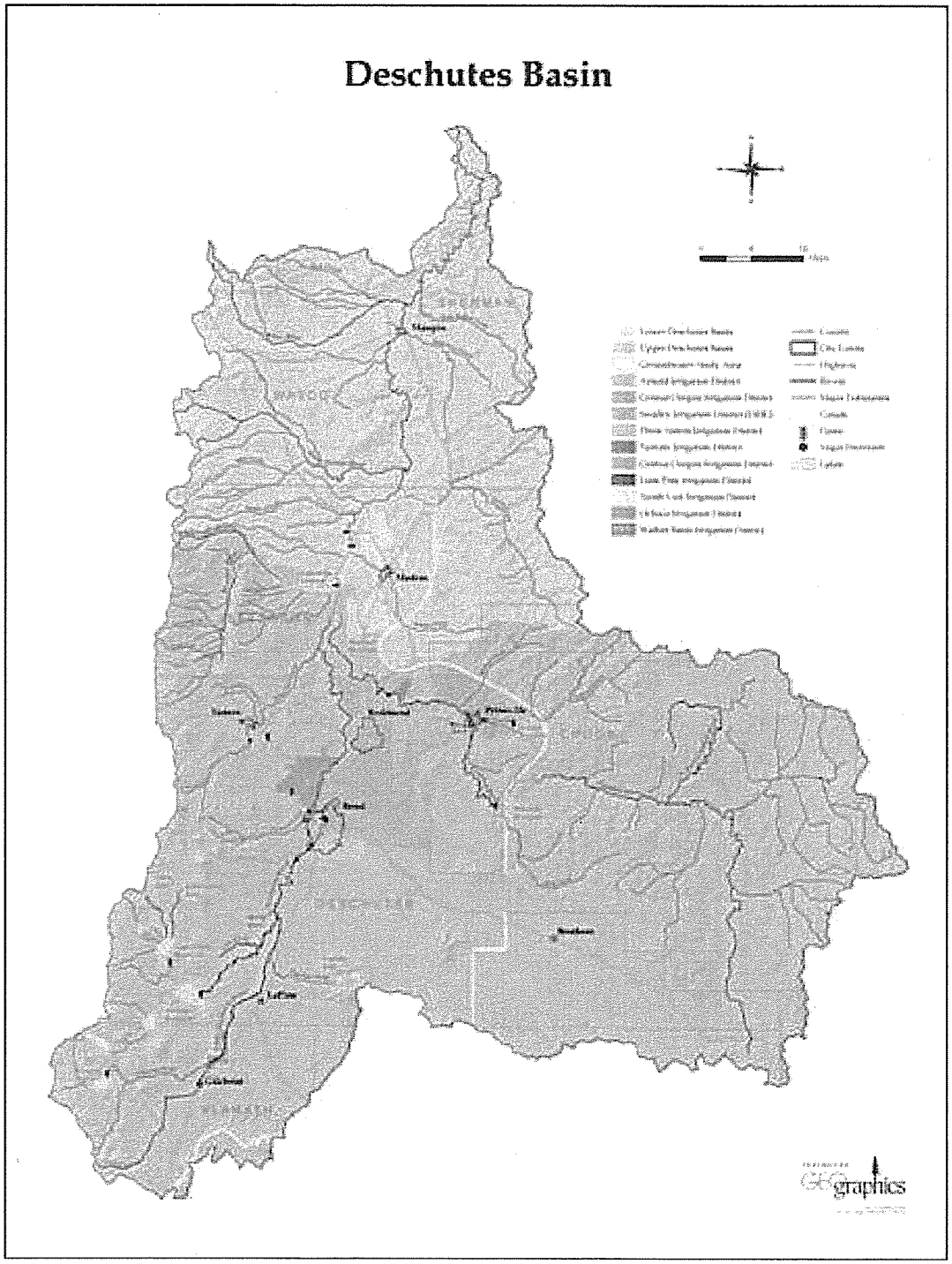


Figure 2. Project Map

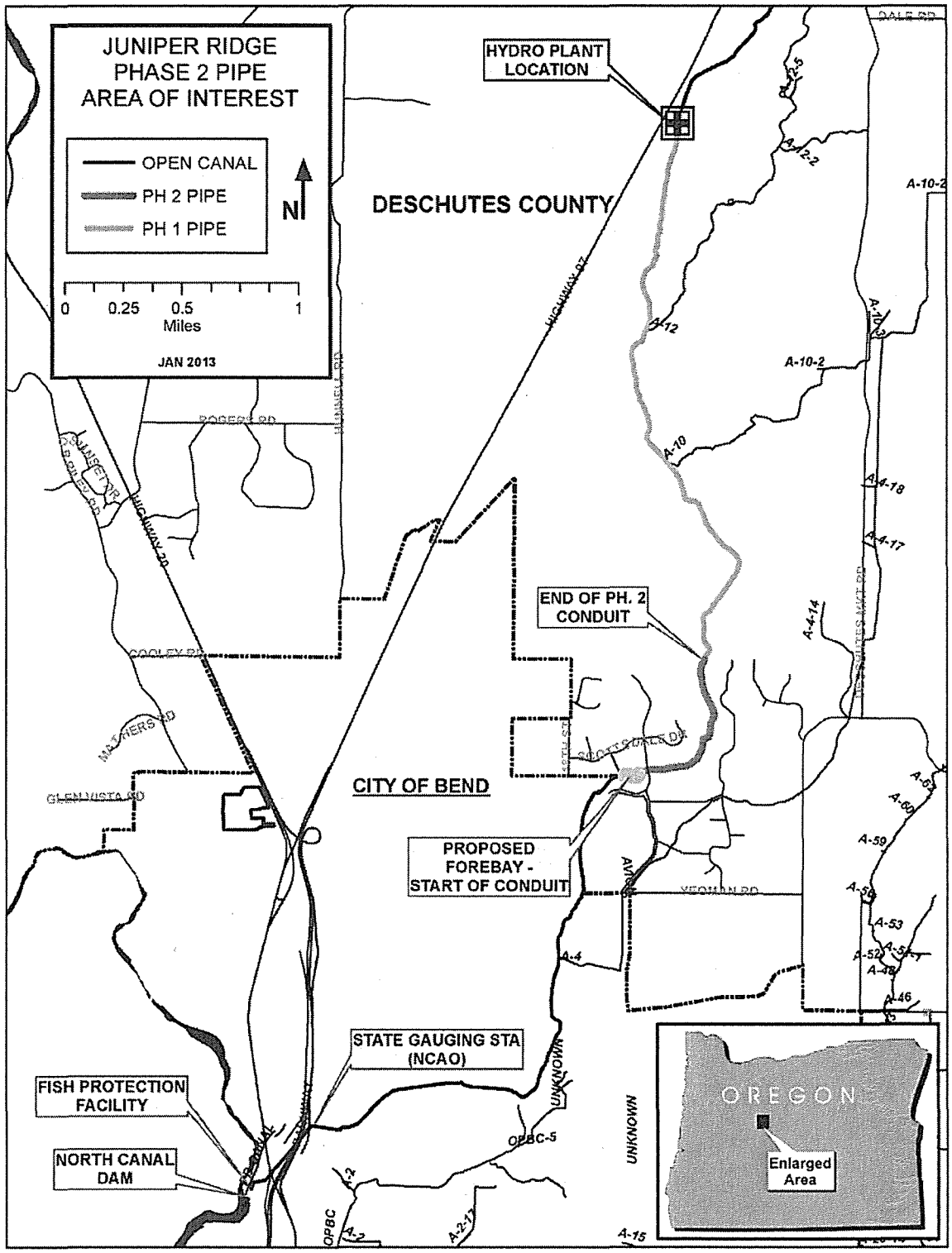


Figure 3. Aerial View, Project Map

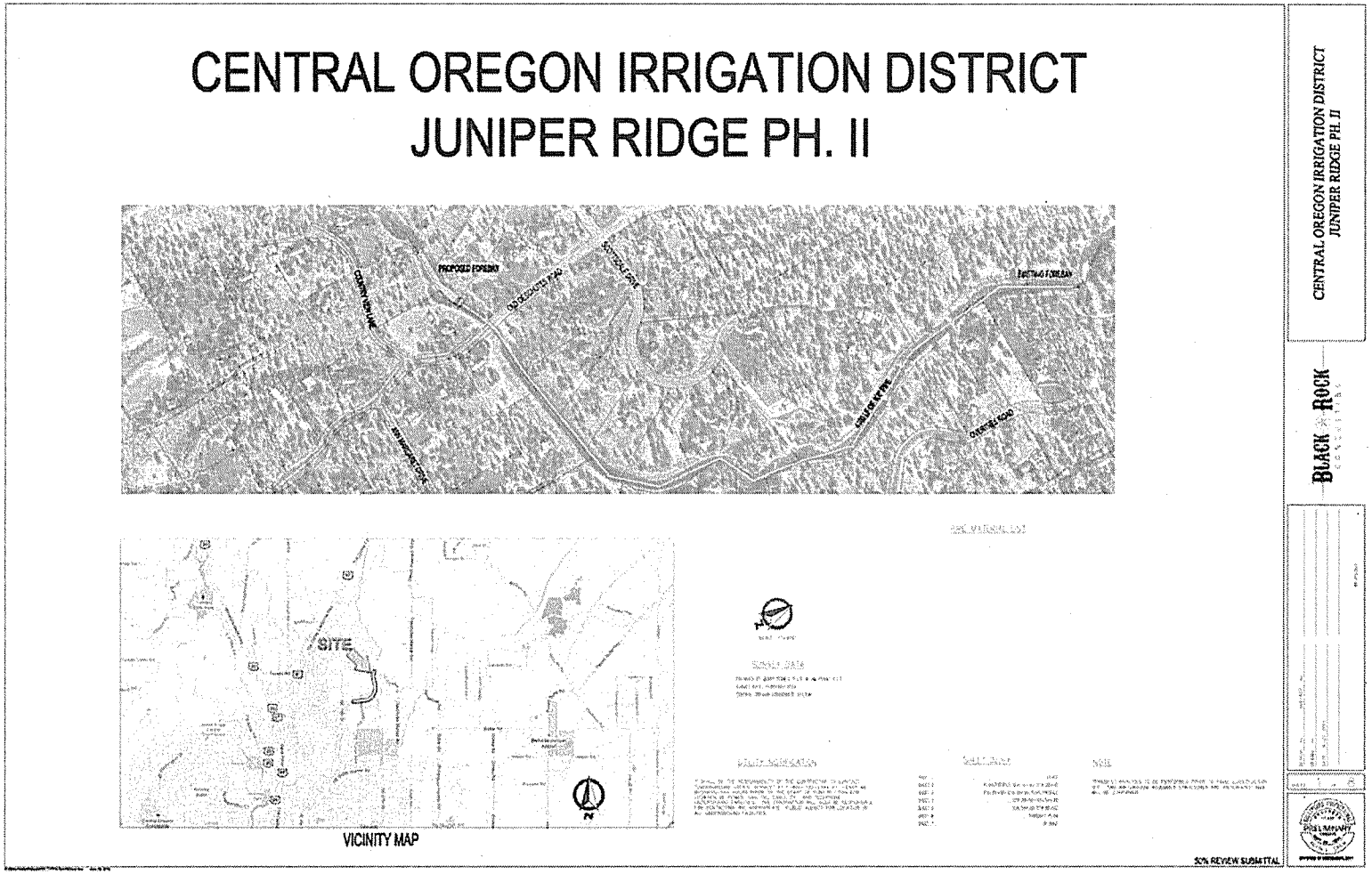
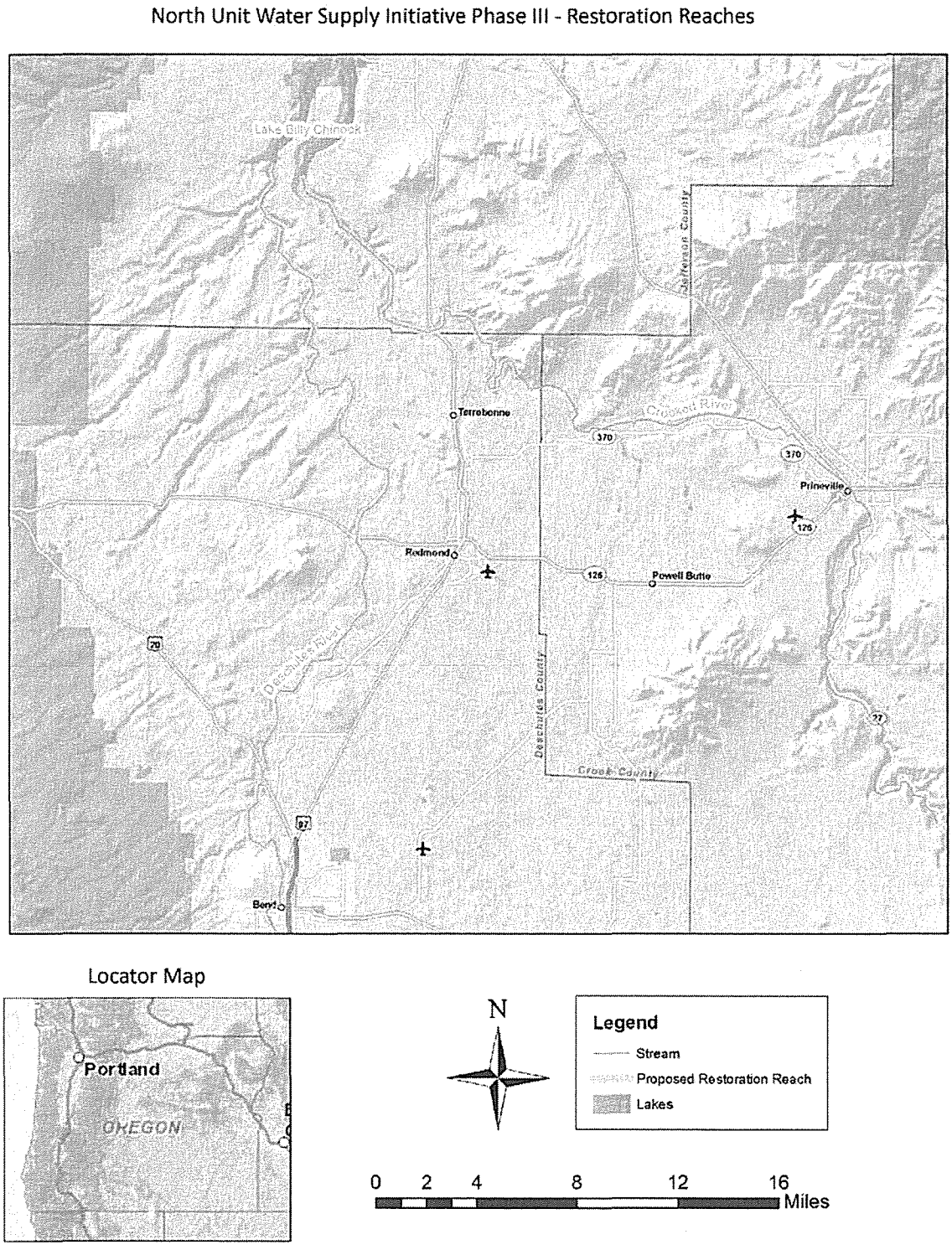


Figure 4. Instream Restoration Reach Map: Middle Deschutes & Lower Crooked Rivers



1.2.2. Deschutes Basin Water Management

Within the Deschutes Basin, eight irrigation districts serve the water needs of their patrons by diverting water from the Deschutes River and its tributaries. The districts are local governments formed under Oregon Revised Statutes Chapter 545. They are also political subdivisions of the state of Oregon and municipal corporations. The districts deliver water to over 150,000 acres of land through approximately 627 miles of canals and laterals.

The porous, volcanic soils of the Deschutes Basin cause a significant portion of the water that flows through irrigation canals to seep into the ground. Approximately 50% of the water that is diverted from the river is lost due to seepage from canals and cannot be used for irrigation. This means that the irrigation districts who manage these canals must divert twice the amount of water that they need to serve their patrons' needs for irrigation water.

Past water conservation efforts have reduced the amount of water diverted from the river; however, the river is still over-appropriated, meaning that more water is authorized to be diverted from the river than actually exists in the river. Irrigation districts in the basin have different needs based on the seniority of their water rights and their power usage. Senior irrigation districts, like Central Oregon Irrigation District (COID), are looking to increase operational efficiencies by piping open canals, but don't need additional water supply. They also have the potential to generate additional in-conduit power through altering conveyance routes. The junior irrigation district, North Unit Irrigation District (NUID), seeks to make its water supply more reliable, while reducing major energy costs associated with pumping Crooked River water. This project capitalizes on these different needs to maximize conservation and agricultural outcomes in the most cost-effective way possible. As such, the following provides background on both irrigation districts.

1.2.3. Central Oregon Irrigation District Infrastructure, Water Supply and Water Rights

At present, COID operates 2 main canals using water from the Deschutes River. The Central Oregon Canal serves the areas of Alfalfa, Bend, and Powell Butte; and the Pilot Butte Canal (PBC) serves the areas of Bend, Redmond, and Terrebonne. The PBC is mainly an unlined open canal running 42 miles in length itself, much of it running through heavily fractured basalt. There is a small section of the PBC through the city limits of Redmond that was piped in 2005 for a Highway 97 reroute. There is also a 2.5 mile section just north of Bend that was piped in 2009/2010 to conserve water and allow a 5 megawatt hydropower plant, known as the Juniper Ridge Hydropower Project, to be installed and operated at the end of this piped section. There are numerous laterals and sub-laterals that branch off of the main PBC throughout the entire system to serve its north area Bend, Redmond, and Terrebonne deliveries. There are 2 laterals in Terrebonne (H-14 and H-14-1) that were piped in 2005 to conserve water and more efficiently deliver water to those deliveries that these laterals serve. All of the conserved water from these two piping projects was marketed to and permanently transferred instream to the Middle Deschutes River through the DWA Water Bank.

COID's primary Deschutes River water right is described in Certificate 83571. It carries a priority date of October 31, 1900 for 978 cfs and December 2, 1907 for 392 cfs. Its primary use is for the irrigation of 43,440 acres, mostly alfalfa hay and forage with a small amount of field crops like potatoes and mint. Certificates 76685 and 76714 describe the right to store and use 50,000 acre-feet of water from Crane Prairie Reservoir as a supplemental water source. These rights carry a 1913 priority date. COID also holds three water rights certificates for hydropower use. Certificate 29582 describes the use of 90.0 cfs from the Deschutes River for energy generation with a priority date of 1892. Certificate 65215 describes the use of 640 cfs from the Deschutes River for energy generation at the Central Oregon siphon hydroelectric project with a priority date 1981. Certificate 82606 authorizes the use of existing water rights delivered through the North Canal for energy generation, subject to the existing conditions on those water rights. COID's primary water rights are senior and highly reliable. Generally, COID relies on stored water only in the shoulder seasons.

1.2.4. Central Oregon Irrigation District Energy Utilization

COID has two existing hydropower generation facilities as well as future planned facilities.

Siphon Power Project (FERC P-3571): The Siphon Power Project (SPP) is located 2 miles south of the city of Bend, Oregon. This facility is a 5.5 MW powerhouse that commenced commercial operation on October 16, 1989. The powerhouse draws water directly from the Deschutes River at river mile 170.9, generates hydro power from the water, and then returns the water back to the river. It operates on 640 cfs of water to generate an estimated 9,804 hp. The SPP has a FERC license issued September 29, 1987.

Juniper Ridge Hydropower Project (FERC P-13607): The Juniper Ridge powerhouse is located north of Bend, Oregon, on COID's Pilot Butte Canal near Deschutes Junction at Highway 97. This 5.0 MW facility commenced commercial operation on October 4, 2010. The powerhouse draws water directly from the PBC during the irrigation season (April – October) and winter stock runs (November – March), generates hydro power, and then returns the water back to the canal. It operates on 480 cfs of water to generate an estimated 7,909 hp. The Juniper Ridge project had a FERC conduit exemption issued March 11, 2009. The proposed project will increase hydropower generation at the Juniper Ridge facility.

COID is also underway pursuing the development of an additional in-canal hydro facility. This project is called the NC-2 Drop and will have a generation capacity of 400kW. This project is a joint venture with Natel Energy utilizing their SLH100 low head technology. Construction is anticipated in the winter of 2012-2013. Two additional in-canal sites have been deemed feasible and will be pursued after completion of the NC-2 Drop.

1.2.6 Central Oregon Irrigation District Bureau of Reclamation Partnership

COID has a long-standing relationship with Reclamation beginning with the Deschutes Project authorization and construction of Crane Prairie Reservoir in 1938, of which COID is the manager and operator, and interacts with local and regional Reclamation offices in that capacity.

COID has conducted several piping projects on its canals and laterals over the decades with Reclamation funds, and Water Conservation Field Services Program funds. The most recent piping projects in conjunction with Reclamation funds include the I-Lateral Piping Project, implemented in 2012-13, Juniper Ridge piping on the PBC north of Bend completed April 2010, the H-14 and H-14-1 laterals off the PBC in Terrebonne in 2005, and the C-1 lateral in Bend off the COC completed March 2009. The District has also been awarded Reclamation grants from the Water 2025 program in 2004, 2006, and 2008. The original grant in 2004 assisted COID and other basin stakeholders in creating a regional water planning body named the Deschutes Water Alliance. That same grant also provided for the formulation of a pilot water bank, now called the Deschutes Water Alliance Water Bank, that was and is still one of the few water banks in the country that facilitate permanent as well as temporary water transfers. The subsequent Water 2025 grants were for finalization of the water bank, and then for a basin-wide, multi-irrigation district field conservation study and installation of telemetry stations to better monitor the flows and losses of the canals and laterals throughout the District and basin. Another grant was issued to COID in 2007/2008 through a field technology improvements grant for field computers so that personnel including ditchriders and the District Watermaster are able to have access to COID maps and aerial photos while in the field, as well as their weir books and rotation schedules in electronic format. Water Conservation Field Services Program funds were also awarded to COID for the installation of ramp flumes throughout the District in 2005/2006, and for a water management and telemetry action plan from 2007 - 2009. In addition to COID receiving Reclamation funding for improvements to the District and to be able to conserve water through the DWA Water Bank, COID has also received Water 2025 funds in conjunction with the DRC, DWA, and DWA Water Bank for various projects related to the Deschutes Basin, water conservation, and water marketing.

A major COID project accomplished with financial assistance from Reclamation involved the replacement of an 800 cfs capacity 1.5 mile long wooden flume with a 10' diameter steel pipe in the early 1970s. This pipe became instrumental in not only providing for a much safer and secure facility for COID and its patrons, but also ended up becoming the backbone structure for the construction by COID of a 5.5 MW hydro-electric facility in the late 1980s. COID has owned and operated this facility under FERC license since 1989.

Another major COID project accomplished with financial assistance from Reclamation is the Juniper Ridge Hydropower & Piping Project briefly mentioned above. This project consisted of piping approximately 2.50 miles of the PBC with 9 foot diameter steel pipe and the installation of a hydropower plant consisting of one 5 MW turbine and generator at the north end of the pipe. The plant will produce 3.4 MWH of electricity at the start of its operations in the 2011 irrigation season. The plant will generate approximately 13 million kilowatt hours of renewable energy throughout each irrigation season. Through future phases of additional piping of the PBC, like the one proposed here, it is estimated that 10 cfs per mile (3,782 af per year) of additional piped canal will be conserved and permanently instreamed through the DWA Water Bank. A maximum of 4 additional miles added to the south end of this project is planned to be piped within the next 10 – 20 years. In addition to the conserved water created by the additional sections of pipe, more head will be captured for increased renewable energy through the hydropower plant up to 5 MWH. COID owns and operates this facility under a FERC conduit exemption.

1.2.5. North Unit Irrigation District Infrastructure, Water Supply and Water Rights

North Unit Irrigation District (NUID) utilizes water from the Crooked and Deschutes Rivers to serve approximately 59,000 acres of productive farmland. NUID lands are predominately in Jefferson County. Water is delivered through a network consisting of 65 miles of canals and 235 miles of laterals. Of the total area served, approximately 50,000 acres receive their primary supply from the Deschutes River and the remaining 9,000 acres receive deliveries from the Crooked River. A total of 850 landowners receive water from NUID. Principal crops produced by NUID farmers include irrigated pasture, hay, alfalfa, wheat, carrot seed, and grass seed. North Unit Irrigation District's 2003 Water Conservation Plan documents that on an average year, with an estimated 65% district-wide on-farm efficiency, supply averages 121,492 AF for a demand of 151,000 AF, signaling that additional irrigation water supply of approximately 29,400 AF would be necessary to meet the on-farm crop use for the total acres (Net Irrigation Requirement) (NUID, 2003).

Deschutes River Water Supply

Water from the Deschutes River is supplied by a diversion at river mile 160 that diverts water into the Main Canal. The canal was built in the mid 1940s by Reclamation and transferred to NUID to manage and operate shortly thereafter. The Main Canal is approximately 65 miles long, starting at the diversion dam and heading generally in a northerly direction before terminating just north of the town of Madras. The canal was built for a maximum capacity of 1000 cfs. Water diverted from the Deschutes River can be delivered by gravity and the district does not incur any pumping costs associated with these water rights.

In the late 1990s, NUID lined a portion of the Main Canal from near its diversion point in Bend (canal mile 0.5) to approximately canal mile 11.8. The bottom is lined with roller compacted concrete (RCC) and the sides are lined with shotcrete for the first 6.9 miles. From that point forward, only the bottom of the canal is lined with RCC. North Unit Irrigation District estimates 23,000 AF of water were saved by the project, which represents a 51% reduction in total seepage losses. The North Unit Water Conservation and Efficiency Phase I project being constructed in 2011-12, partially funded by a Reclamation Watersmart Grant, will line the unlined sides of the canal from canal mile 6.9 to 11.8, saving up to 7,880 AF of water.

North Unit Irrigation District's principal water right from the Deschutes River is described in Certificate 72279. It certificates the right to divert water from the Deschutes River, Wickiup Reservoir and Haystack Reservoir to irrigate 49,916 acres, with a priority date of February 28, 1913. The district is the junior water right holder on the Deschutes River and as such, relies more heavily on stored water than other irrigation districts in the basin. Based on historic averages of water diverted from the Deschutes River at Bend, roughly 30% of the water is from the district's natural flow water right and 70% is from stored water originating in Wickiup Reservoir. Wickiup Reservoir has a maximum capacity of 200,000 AF and reaches full fill in approximately seven out of ten years. In years that the reservoir does not fill, the district must employ a number of drought management strategies including additional supplemental pumping from the Crooked River, land fallowing, and deficit irrigation practices.

Crooked River Water Supply

In 1968, NUID constructed a pumping plant adjacent to and at the point where the Main Canal crosses the Crooked River. The primary purpose of the plant is to furnish a supplemental water supply, when needed, by pumping from the Crooked River and discharging into the Main Canal. However, the plant also provides a primary water supply to approximately 9,000 acres of land, which are spread throughout the district. The plant consists of nine vertical shaft pumps with a total capacity of 200 cubic feet per second at a total dynamic head of 150 feet. Each pump is powered by a 450-horsepower motor that pumps the water into a 60-inch steel-pipe discharge line 220 feet long. The power for the pumping plant is supplied under contract by the Central Electric Cooperative.

NUID uses water from the Crooked River under four water right certificates (cert. 72281, 72282, 72283, and 72284). Pumping water from the Crooked River canyon costs approximately $13 per acre foot in electricity charges due to the change in elevation between river and canal. Pumping costs can exceed $300,000 during a normal irrigation season and rates are expected to increase significantly in the future. Pumping costs are covered by assessing fees to farmers based on the number of acres of water rights they own. NUID's top priority is reducing these pumping costs.

1.2.6. North Unit Irrigation District Energy Utilization

North Unit's main energy usage is associated with the Crooked River Pumping Plant described above. It sources energy from Central Electric Cooperative and averages 3,982,912 kilowatt hours per year. The district is highly invested in reducing its pumping demand from the Crooked River, and is also actively assessing small hydropower opportunities on its canals. The district completed a feasibility study of five potential hydropower sites in 2009 and is in the process of conducting feasibility on an additional six sites. The district intends to move forwards with preliminary design of at least one hydropower project.

1.2.7. North Unit Bureau of Reclamation Partnership

North Unit Irrigation District has a long-standing relationship with the Reclamation as part of the Deschutes Project. The Deschutes Project includes Wickiup Reservoir, Haystack Dam and Reservoir, the North Unit Main Canal, and the Crooked River Pumping Plant. The Deschutes project was authorized by a finding of feasibility by the Secretary of the Interior dated September 24, 1937, approved by the President on November 1, 1937, pursuant to section 4 of the Act of June 25, 1910 (36 Stat. 836) and subsection B of section 4 of the Act of December 5, 1924 (43 Stat. 702). Construction of Haystack Dam and equalizing reservoir was authorized by act of the Congress on August 10, 1954, (68 Stat. 679, Public Law 83-573).

The District has participated in numerous water conservation projects with Reclamation's financial support. Recent projects are summarized below:

Completed

1995 – Lateral 52, installation of 12,500 feet of pipe to enclose an open canal. Reclamation Funding: $126,000

1998 – Lateral 51-4, demonstration high head pressure pipeline system, installation of 25,000 feet of pipe to enclose an open canal.

Reclamation Funding: $105,000

2002 – Lateral 58-1, pipe approximately 5 miles of open canal to save water and reduce soil erosion by decreasing canal seepage.
Reclamation Funding: $107,188

2003 – North Unit Small Pipelines 2003 – piping of various short sections of canals in the distribution system to prevent erosive destruction of the canal banks by livestock and to save water. The project included installation of three pipelines for a total of 6,291 feet.
Reclamation Funding: $38,000

2004 – Lateral 58, this project included 6,600 feet of pipe and abandon a section of lateral that passes through an industrial park. This piping project saved water and prevented soil erosion by decreasing canal seepage. Abandoning the section through the industrial park will kept runoff from parking lots and roofs from entering the irrigation system.
Reclamation Funding: $66,972

2004 – Lateral 51-1, piping approximately 3,500 feet of the distribution system to prevent seepage losses and soil erosion.
Reclamation Funding: $11,470

2005 – Automation and Telemetry Financial and Technical Assistance to install telemetry at Haystack Reservoir, 58 lateral turnout, 37–6 lateral and 58-11 lateral to conserve water and enhance water management through automation.
Reclamation Funding: $24,100

2005 – Water 2025 GIS and Aerial Imagery Consortium: Using Technology, Best Practices and Information System Management to Support Conservation Program Development and Implementation.
Reclamation Funding: $25,000

2006 – Lateral 58-3, pipe 1,800 feet to conserve water and enhance on farm irrigation efficiency.
Reclamation Funding: $20,017

2007 – Piping Laterals 53, 58-13 and 63-1. Upgrade 3 laterals from open ditch or leaking pipe to plastic pipe to conserve water, increase water use efficiency and enhance water management.
Reclamation Funding: $55,410

2007 – Water 2025 Challenge Grant, Telemetry & Action Plan. Partner with 5 other irrigation districts in Central Oregon to install flow measurement telemetry stations at 18 strategic locations across the
5 districts to measure the benefits of water conservation. Two sites were installed on the district.
Reclamation Funding: $8,818

2007 – Water 2025 Challenge Cost Share Program, Lateral 58-9 Pipeline Phase I – improve Lateral 58-9 by converting one half mile of open earth ditch to two parallel pipes to conserve water and thereby increase available water supplies associated with Reclamation's Deschutes River Project.
Reclamation Funding: $237,002

2008 – WCFSP Pipelines 41-6 Lateral and 43-7-1 Lateral (1425-08-FG-1L-1350) Convert sections of two earthen ditches to pipe to conserve water by reducing seepage and evaporation losses.
Reclamation Funding: $38,906

2009 – WCFSP Ramp Flume – Lateral 58 (09FG1U1421) Install an acoustic Doppler on Lateral 58 to for more accurate measure of water at the head end of the lateral to conserve an estimated 900 AF of water per year.
Reclamation Funding: $16,270

2009 – WCFSP Lateral 58-9 Piping Phase II (09FG1U1446) Install 22,000 feet of pipe to provide improved water management; eliminate soil erosion; pressurize a portion of the water delivery system and improve water quality.
Reclamation Funding: $318,663

2010 – Modernization of the Bend Diversion (R10AP1C006) NUID will replace and/or install at the headgate, river site, flow monitoring station and the canal site flow monitoring station SCADA Programmable Logic Controllers, river/gate position sensors, and cellular modem to communicate data.
Reclamation Funding: $31,016

2010 – Haystack Flow Measurement (R10AP1C052) – Install a Horizontal Acoustic Doppler Current Profiler within the district's easement near the base of Haystack Dam just downstream where the bypass chute and Haystack discharge come together.
Reclamation Funding: $10,899

2011-12- WaterSmart Grant: North Unit Irrigation District Energy and Conservation Initiative- Line approximately five miles of the sides of its Main Canal and conserve up to 7,880 acre-feet (AF) of water from the Deschutes River. The saved water is being used to irrigate lands currently supported by water that is pumped from the Crooked River. The Crooked River water rights displaced by the new water resulting from the lining project will be retired to support water quality and fish habitat improvements in the Crooked River. Reclamation Funding: $1,000,000

In Progress

2012-13- WaterSmart Grant: North Unit Irrigation District Energy and Conservation Initiative Phase II- Pipe approximately a mile of Central Oregon Irrigation District's I-lateral canal. Use a water banking agreement to transfer this water to NUID Crooked River lands and transfer the appurtenant Crooked River water rights instream, restoring 4.9 cfs to the Crooked River.

1.3. Technical Project Description

1.3.1 Project Background

Juniper Ridge Phase II is the third phase of the North Unit Water and Energy Conservation Initiative. The whole initiative will conserve 22,250 acre-feet of Deschutes River water rights in NUID and other districts. It will allocate the conserved Deschutes River water rights to 8,900 acres in NUID that currently receive primary irrigation water from the Crooked River. It will allocate the associated displaced Crooked River water rights permanently instream in the Crooked River.

NUID benefits by eliminating its need to pump water from the Crooked River. Other participating districts, like COID, benefit from improved infrastructure and increased hydropower generation. Increased flows in the Crooked River benefit the reintroduction of federally-listed mid-Columbia summer steelhead. The whole initiative will restore up to 220 cfs to the Crooked River and save on average 3,982,912 kWh of energy annually. The conserved water projects constructed to generate the water will improve district water management and, wherever possible, increase the generation of renewable energy from existing hydropower facilities.

Phase I of this project was implemented in 2011-12 with support from a 2011 Reclamation WaterSMART grant. Phase I lined five miles of NUID's main canal and utilized a water banking agreement to allocate 7,880 acre-feet of conserved Deschutes River water to 3,152 acres in NUID that historically received Crooked River water. Phase I allocated the 3,152 acres of associated Crooked River water rights instream in the Crooked River. The project saves NUID approximately 1,220,163 kWh of electricity, estimated at power costs of $64,290 to $93,564 annually. It restored up to 18.6 cfs to the lower Crooked River to benefit federally-listed mid-Columbia summer steelhead.

Phase II was implemented in 2011-12, with the support of a WaterSmart grant. It utilized the same water banking process but generated the conserved water through a piping project in Central Oregon Irrigation District (COID). This elevated the innovation of water management in the Deschutes Basin, allowing districts to cooperate to leverage the most cost-effective projects to meet the goals of the Initiative. This inter-district cooperation also allows districts with different needs to meet their particular goals. For example, COID does not need additional water supply, but benefits from the operational efficiencies of canal piping and from additional hydropower generation associated with conveying the water to NUID as well as improving flows in the Deschutes River. NUID benefits from putting the available conserved water on agricultural lands from which Crooked River rights can be transferred instream, saving energy costs and improving flows in the Crooked River. This approach allows NUID and partners to invest in the most cost-effective projects to reach the ultimate goal of eliminating the need to pump Crooked River primary rights, and leverages the more numerous conservation opportunities in the Deschutes sub-watershed to benefit reintroduced anadromous fish in the Crooked River. To date, the supply of Crooked River water rights available to be restored instream has been extremely limited. This project piloted the inter-district cooperation that facilitates the expansion of these opportunities. Phase II conserved 1,300 acre-feet of COID

water, reduced NUID pumping by approximately 191,178 kWh annually, and restored 4.9 cfs of water rights permanently to the lower Crooked River. Rerouting COID water to NUID generates an additional 318,638 kWh of renewable energy at two existing COID hydroelectric plants, creating approximately $27,249 in value.

The proposed Juniper Ridge Phase II project will follow the same model as Phase II of the North Unit Water and Energy Conservation Initiative:

- Construction of a COID canal piping project
- Implementation of a water banking agreement that uses Oregon's Allocation of Conserved Water Program to:
    - allocate COID conserved water to NUID lands currently served by Crooked River water rights, and
    - allocate the Crooked River water rights appurtenant to the NUID lands receiving COID conserved water permanently instream in a critically dewatered reach of the Crooked River
    - allocate a portion of the conserved water to be permanently protected instream in the middle Deschutes River

These components are further described below.

1.3.2 Juniper Ridge Phase II Piping Project

COID proposes to pipe 4,500 linear feet of the Pilot Butte Canal (PBC). The proposed pipe will connect on the upstream end of the existing 2.5 mile pipe that is connected to the Juniper Ridge Hydroelectric Facility. This will extend the total piping to almost 3.4 miles and increase the existing elevation drop to the hydro facility by 40'. The canal is a district-owned conveyance system with a federally-held 1891 right-of-way that allows construction and maintenance by COID. The PBC is located near Bend on the Deschutes River (approximately RM 170). Water is diverted through a radial gate and fish screen structure and travels through the open earth Pilot Butte Canal before reaching the new intake (forebay) of the installed pipe at canal mile 2.6. The proposed piping project is approximately 4,500' in length. Water conveyed through the Pilot Butte canal is described in water right certifcate 83571 with a priority date of 10/31/1900 and 12/02/1907.

Approximately half of all water diverted into the Pilot Butte Canal is lost to seepage through the sides and bottom of the canal. By replacing open earthen canals with enclosed pipelines, water seepage can be reduced to virtually zero. COID has worked with Black Rock Consulting, Inc. to quantify the amount of water that will be saved by analyzing pre-project water loss data. Measurements show that 4,500' of piping will result in a peak total of 7.85 cfs conserved.

Central Oregon Irrigation District is contracting with Kevin Crew of Black Rock Consulting for the final design of this piping project. The project will install 4,500 feet of welded, spiral wound, polyurethane coated and lined 108" diameter steel pipe, which will be buried and backfilled, and concrete forebay construction that will be constructed of reinforced concrete. The proposed design of the forebay, trashrack and catwalk system is consistent with the District's existing O&M systems. The intent of the forebay design is to match the retention capacity of the existing Juniper Ridge Phase I forebay to continue to provide acceptable control and wicket gate timing

at the power plant. Seeding and restoration is planned for areas disturbed during the course of construction.

Black Rock Consulting has conducted similar design work on other major irrigation projects in Central Oregon such as the COID Pilot Butte/Juniper Ridge Phase I piping, the COID I-Lateral piping project, the Tumalo Irrigation District Bend Feed Canal, and the Swalley Main Canal. Black Rock Consulting is a well established, experienced and reputable engineering firm. In addition to the project designs, biological assessments and cultural resource surveys of the canal have already been conducted and are ready to submit to satisfy the federal environmental and historical compliance.

1.3.3 Water Banking Agreement

Central Oregon Irrigation District, North Unit Irrigation District, and the Deschutes River Conservancy will execute a water banking agreement to allocate the conserved water generated by the project. It will allocate 2,000 acre-feet to lands that NUID currently irrigates with water from the Crooked River. Simultaneously, NUID will transfer instream a corresponding volume of water from the Crooked River, thereby increasing instream flows, enhancing water quality and improving habitat for native fish like redband trout, mid-Columbia steelhead and Chinook salmon. It will allocate the remainder of the conserved water, 552 acre-feet, to instream use in the middle Deschutes River to enhance fisheries and water quality. This agreement will facilitate: (1) the allocation of saved water to existing agricultural uses, and (2) the reallocation of water from agricultural uses to instream uses.

The water banking agreement will utilize existing tools under Oregon water law to accomplish the reallocation of the water. It will utilize Oregon's Conserved Water Statute, described in OAR 690-018-0010 to 690-018-0090 and ORS 537.455 to 537.500, to convey 2,000 acre-feet of COID conserved water to NUID lands currently served by Crooked River water. The new water right issued to NUID will maintain the same priority date as the conserved water. In turn, the Crooked River water rights appurtenant to those NUID lands receiving COID conserved water will be transferred to an instream use under Oregon water law and permanently protected in a critically dewatered reach of the Crooked River. The agreement will also allocate 552 acre-feet of conserved water to instream use in the middle Deschutes River. The DRC will partner with NUID and COID to submit a conserved water application for 2,552 acre-feet. The finalization of transferring conserved water to NUID lands will be concurrent with and contingent upon the instream transfer of Crooked River water rights. The resulting new water rights will be in the name of NUID, and will be conveyed to NUID through COID's Pilot Butte Canal. The new Crooked and Deschutes River instream water rights will be held by the State of Oregon. Both districts have Conserved Water Policies (as required by OAR 690-018-0025) that set forth the terms on which the districts implement Conserved Water Applications on behalf of district landowners. The proposed phase III project will use the same water banking structure piloted in Phases I and II, although this Phase will also protect a portion of the conserved water instream in the Deschutes River. State law and federal contracts have been reviewed to make sure they accommodate the proposed activities.

1.3.4 Project Summary

In summary, this project conserves 2,552 acre-feet through piping approximately a mile of the Pilot Butte canal. It allocates a small portion of that water to instream use in the Deschutes River. It allocates the majority of the water to existing agricultural uses in NUID, and transfers existing NUID Crooked River water rights permanently instream in the Crooked River. It restores 552 acre-feet, or 1.7 cfs to a dewatered reach of the Deschutes River. It restores 2,000 acre-feet, or 7.54[1] cfs, to a critically-dewatered reach of the Crooked River. The project saves an average of 545,343 kWh of energy annually in NUID, generates 3,727,545 kWh /yr in COID and improves water management in both districts. This project builds on the innovation and collaboration of water management in the Deschutes Basin and opens the door to additional inter-district projects that will ultimately restore up to 220 cfs to the Crooked River and eliminate NUID's need to pump primary water rights from the Crooked River.

1.4. Evaluation Criteria

1.4.1. Evaluation Criterion A: Water Conservation

Subcriterion No. 1—Water Conservation

Subcriterion No. A.1(a)—Quantifiable Water Savings

The project will conserve 2,552 AF on an annual basis and will be protected instream in perpetuity. The water that will be conserved currently seeps into the ground through the earthen sides and bottom of COID's Pilot Butte Canal and eventually enters the regional aquifer and discharges in the lower Deschutes River. A portion of conserved water will be allocated to restore 1.7 cfs instream in the Deschutes River. The majority of the conserved water will be allocated to NUID to meet existing irrigation needs. NUID will transfer a corresponding volume of water permanently instream to restore 7.54 cfs to the Crooked River.

Average Annual Water Supply

COID's average annual water supply in the Pilot Butte Canal is 120,000 acre-feet.

NUID's historic average annual supply of Crooked River primary water rights before the Initiative was 16,841 acre-feet. The Phase I project reduced this to 8,961 acre-feet. Phase II further reduces this to 7,661 acre-feet. The 2,000 acre-feet Deschutes River water conserved through the proposed Juniper Ridge Phase II piping project will replace 2,000 additional acre-feet of NUID Crooked River water rights, or 26% of the projected annual NUID Crooked River supply.

Where the Proposed Conserved Water Is Currently Going

As described above, the water that will be saved by this project currently seeps into the porous volcanic soil surrounding the Pilot Butte Canal. In general, water that leaks out of canals and laterals in Central Oregon enters the regional aquifer and ultimately discharges downstream in the Deschutes River and its tributaries near the confluence of the Deschutes, Crooked, and Metolious Rivers. Flows in the reach of the Deschutes River below this point of groundwater

[1] It should be noted that the 2,000 acre-feet, generated by 6.15 cfs of COID Deschutes water, equates to 7.54 cfs of NUID's Crooked River water supply, based on a different number of days in the seasons of use for those water sources.

return are not limited due to the magnitude of groundwater returns originating from percolating snowmelt in the Cascades. However, flows in the Deschutes and Crooked Rivers above this point become severely depleted due to the scale of irrigation withdrawals.

Proposed Use of Conserved Water Supply

The water conserved through this project will be allocated to two different places, using a water banking agreement and Oregon's Conserved Water Statute. A small portion of the conserved water, 552 acre-feet (1.7 cfs) will be protected instream in the middle Deschutes River to help improve water quality and fishery needs. The remainder of the water, 2,000 acre-feet, will be allocated to irrigated lands within NUID, and a corresponding volume of Crooked River water rights will be transferred instream (7.54 cfs). NUID currently irrigates these lands with water from the Crooked River, a tributary to the Deschutes River. The agreement will stipulate that 2,000 AF of water conserved from piping COID's Pilot Butte Canal will be used to replace NUID's existing water supply from the Crooked River. It will also stipulate that in return for being provided new gravity flow water from the Deschutes River, NUID will retire instream a corresponding volume of their Crooked River water right to help satisfy instream flow needs in the lower Crooked River. This arrangement will provide cost-relief to NUID farmers who currently have to pay to pump water from the lower Crooked River by providing them with new water rights that are delivered by gravity from the Deschutes River.

The District has established a lottery system to distribute the conserved water within the irrigation district. The lottery will give Crooked River water right holders first priority for new Deschutes River water rights. After NUID Phase II (implemented 2012-13) is finalized, approximately 7,661 acres will be irrigated from the Crooked River. These acres are dispersed geographically throughout NUID. The proposed project, JR2, will eliminate an additional 26% of NUID's remaining Crooked River water use, bringing it to 5,661 acres.

The approach described above was piloted in Phase I, which generated conserved water through lining 5 miles of NUID's Main Canal. Phase II included the additional innovation of transferring conserved water generated in another irrigation district. This proposed third phase, JR2, repeats this, continuing to demonstrate increased flexibility in the conserved water program, increasing the ability to leverage the most cost-effectiveness projects in the basin, and increasing opportunities to restore streamflow in critical reaches like the lower Crooked River.

Canal Lining/Piping

Estimated Average Annual Savings

Approximately half of all water diverted into the Pilot Butte Canal is lost to seepage through the sides and bottom of the canal. Replacing open earthen canals with enclosed pipelines reduces water seepage to virtually zero. Estimated average annual savings of 2,552 acre-feet are derived from estimated seepage losses described below.

Estimated Canal Seepage Losses

Losses in the Pilot Butte canal have been documented in the following studies:

- Upper Deschutes River Basin Water Conservation Study. 1997. Bureau of Reclamation and Oregon Water Resources Department.

- U.S. Bureau of Reclamation Water 2025 Challenge Grant Action Plan for Central Oregon Irrigation District, Ochoco Irrigation District and Swalley Irrigation District. Newton Consultants. 2009.
- Central Oregon Irrigation District Water Management Conservation Plan, Draft. 2011. COID.
- Seepage Loss Measurement, Pilot Butte Canal, 2010. Black Rock Consulting.

COID has aggressively measured seepage loss throughout the district as part of its water loss measurement program to assist in identifying prioritized seepage loss areas within the district. Numerous measurements were taken throughout the district using an acoustic Doppler profiler, price meter measuring equipment, as well as conventional cipoletti measuring weirs and associated pools/staff gauges. This program has been effective in providing COID the data to develop a prioritization of areas to study in more detail. One such identified high water loss areas was the subject area of Pilot Butte. COID installed, with Bureau assistance, two ramp flumes on the PBC that provided consistent full irrigation season measurement of water flows both below and above the proposed project area. See Appendix A: Seepage Loss Estimate for Juniper Ridge II Reach of the COID Pilot Butte Canal. The COID maintains a continuing program of seepage loss measurements that are intended to assist the District in identifying future conservation projects and to confirm seepage losses already mitigated.

Estimated Post-Project Seepage Losses

As described above, piping reduces seepage losses to zero. Applicants do not expect any post-project seepage losses in the project reach.

Anticipated Transit Loss Reductions

Transit loss reductions amount to 2,994 AF/mile.

Seepage Verification

Piping eliminates all seepage in the canal. COID uses ditch riders, weirs, and gages located at their point of diversions to verify all deliveries. Delivery records and legally reduced diversions will verify seepage reductions post project.

Materials Being Used

This project will use 108" spiral wound, polyurethane lined and coated steel pipe to pipe the Pilot Butte Canal. Similar pipe was used to successfully complete Juniper Ridge Phase I. Steel was selected not only to match the material used in the Phase I project , but due to its pressure handling capability. Other materials being used on the project are approximately 1,000 cubic yards of reinforced concrete (forebay), galvanized steel intake trash rack to mitigate debris floating in the canal, galvanized steel catwalk for operations staff access to the intake works and trash rack, locally imported backfill materials for the pipeline backfill, forebay structure backfill and upstream berms, and local native seed mix for restoration of disturbed surfaces. Forebay water surface elevation telemetry located at the existing Juniper Ridge Phase I forebay will be relocated to the new Phase II forebay and may require minor addional repeating equipment to relay the wireless signal from the forebay to the powerhouse. Galvanized steel chain-link safety fencing is also planned around the perimeter of the forebay to inhibit public access.

Subcriterion No.A.1(b)—Improved Water Management:

This project will result in the more efficient use of the 120,000 average annual acre-feet of water delivered down the Pilot Butte Canal: 2,552 acre-feet will be conserved and the remaining 117,448 acre-feet will be better managed, reducing transport time of water and operational and maintenance costs. This reflects approximately 2% of COID's deliveries down the Pilot Butte Canal (average 120,000 acre-feet) that will be better managed.

As discussed above, the project will save 2,552 acre-feet of water that currently seeps into the ground as canal transmission losses. It will transfer 2,000 acre-feet to NUID lands that currently rely on pumped water from the Crooked River for their water supply. The ultimate goal of this and future phases of the North Unit Water and Energy Conservation Initiative is to eliminate NUID's need to pump water from the Crooked River. Once achieved, 100% of NUID's primary water will stem from a single more reliable source resulting in more efficient, and cost effective water management.

Subcriterion No. A.2—Percentage of Total Supply:

This project will conserve 2,552 acre-feet in COID and allocate 2,000 acre-feet to lands in NUID that currently receive water from the Crooked River. NUID's associated Crooked River water rights will be converted to instream water rights in the Crooked River and maintain their existing priority date. NUID's average annual water supply for the Crooked River lands is 16,841 acre-feet. The Phase I and II projects implemented in 2011-12 and 2012-13 will reduce this to 7,661 acre-feet. The 2,000 acre-feet of conserved water generated in Phase III thus represents approximately 26% of NUID's Crooked River supply.

Subcriterion No. A.3—Reasonableness of Costs:

The estimated project cost is $6,531,133 to pipe 4,500 linear feet of the Pilot Butte Canal. Piping the Pilot Butte Canal will save a calculated volume of 2,552 AF of irrigation water annually from seepage losses. The expected life of the project is estimated conservatively to be 50 years based on extensive experience using polyethelene lined steel pipe domestically and abroad. Project reasonableness calculates to be $51.18 /(acre-feet x year). It should be noted that COID investing heavily in the project because of additional hydropower generation benefits.

$$\frac{\$6,531,133}{\text{(2552 acre-feet x 50 years)}}$$

1.4.2. Evaluation Criterion B: Energy-Water Nexus

Subcriterion No B. 1— Implementing Renewable Energy Projects Related to Water Management and Delivery

Amount of Energy Capacity

The COID owned and operated Juniper Ridge Hydropower Project will benefit from this proposal as well as future planned facilities that would benefit if completed.

Juniper Ridge Hydropower Project (FERC P-13607): The Juniper Ridge powerhouse is located north of Bend, Oregon, on COID's Pilot Butte Canal near Deschutes Junction at Highway 97. This 5.0 MW facility commenced commercial operation on October 4, 2010. The powerhouse draws water directly from the PBC during the irrigation season (April – October) and winter stock runs (November – March), generates hydro power, and then returns the water back to the canal. It operates on 480 cfs of water to generate an estimated 7,909 hp. The Juniper Ridge project had a FERC conduit exemption issued March 11, 2009.

COID is also underway pursuing the development of an additional in-canal hydro facility. This project is called the NC-2 Drop and will have a generation capacity of 400kW. This project is a joint venture with Natel Energy utilizing their SLH100 low head technology. Construction is anticipated in the winter of 2012-2013. Two additional in-canal sites have been deemed feasible and will be pursued after completion of the NC-2 Drop.

Amount of Energy Generation

The Juniper Ridge Hydroelectric Plant will generate an additional 3,727,545 kWh annually from this project as the penstock extension will capture an additional 40' of net head thereby optimizing the underutilized but available 5.0 MW capacity. The original planning and construction of the Juniper Ridge Hydro was purposefully intended to incorporate future piping upstream of the existing penstock without having to reconfigure the existing hydro facility, utility interconnection, utility power purchase agreement or FERC conduit exemption. The existing configuration operates at a peak operational generation capacity of 3.6 MW. Once completed, the proposed project will maximize generation to the facility's maximum capacity.

The calculation (Appendix B) of the additional generation utilized the initial index testing of the hydro facility in 2010 along with actual generation numbers from the entire year of 2011 and 2012.

Following this project, COID will still divert the conserved 7.85 cfs at the PBC diversion minus the permanent instreamed 1.7 cfs for Deschutes River instream flow restoration. The remaining 6.15 cfs of conserved water will run through COID's Juniper Ridge Power Plant and then be delivered to NUID at its current NUID spill near the Crooked River pumps.

Other Benefits

Renewable energy generated through COID's in conduit hydroelectric facilities will feed into the larger power grid, thereby reducing the demand to use non-renewable sources of energy in the Pacific Northwest. This has the potential to reduce greenhouse gas emissions and the reliance on flows in the Columbia dictated largely by dams and their associated hydroelectric facilities.

Additionally, conserved water resulting from the piping of COID's canal will ultimately reduce NUID's need to pump from the Crooked River resulting in an estimated savings of 543,343 kwh/year. The Crooked River pumping station is part of Reclamation's Deschutes River Project.

Subcriterion No. B.2—Increasing Energy Efficiency in Water Management

Energy Efficiencies from Project

In 1968, NUID constructed a pumping plant adjacent to and at the point where the Main Canal crosses the Crooked River. The primary purpose of the plant is to furnish a supplemental water supply, when needed, by pumping from the Crooked River and discharging into the Main Canal. However, the plant also provides a primary water supply to approximately 9,000 acres of land, which are spread throughout the district. The plant consists of nine vertical shaft pumps with a total capacity of 200 cubic feet per second at a total dynamic head of 150 feet. Each pump is powered by a 450-horsepower motor that pumps the water into a 60-inch steel-pipe discharge line 220 feet long. The power for the pumping plant is supplied under contract by the Central Electric Cooperative.

Prior to 2012, NUID pumped on average 3,982,912 kilowatt hours annually. Pumping water from the Crooked River canyon costs approximately $13 per acre-foot in electricity charges due to the change in elevation between river and canal. Pumping costs can exceed $350,000 during a normal irrigation season and rates are expected to increase significantly in the future. Pumping costs are covered by assessing fees to farmers based on the number of acres of water rights they own.

The proposed project will reduce the amount of water that NUID pumps from the Crooked River by 2,000 AF. On average, this reduction in pumping will conserve approximately 543,343 kilowatt hours of electricity. Average annual cost savings have been estimated at $29,449 at 2011 power rates. See Appendix C for a detailed analysis of energy savings estimates that was prepared for Phase I based on savings of 7,880 acre-feet. The estimates here used the equations established in that analysis to estimate cost and energy savings for 2,000 acre-feet.

Point of Diversion

This energy savings estimate originates from the NUID's point of diversion on the Crooked River.

Water Treatment

NUID does not treat this water for agricultural use so these calculations do not include any analysis of energy used to treat the water.

Renewable Energy Components Resulting in Minimal Energy Savings

This project does not include any renewable energy components resulting in minimal energy savings.

1.4.3. Evaluation Criterion C: Benefits to Endangered Species

This project will improve conditions for Endangered Species Act listed Middle Columbia Steelhead in the Crooked River, a tributary to Oregon's Deschutes River. Cascades Eastern

Slope Tributaries is a Major Population Group (MPG) of Middle Columbia Steelhead. Three Distinct Population Segments (DPS) of this MPG exist in Deschutes Basin: 1) Deschutes River West Side, 2) Deschutes River East Side, and 3) Crooked River (extinct).

Crooked River steelhead became extirpated following the development of Pelton Round Butte hydroelectric facility. The facility blocked downstream anadromous fish passage in the Deschutes River at its confluence with the Metolius and Crooked Rivers. NOAA's NOAA's Middle Columbia River Steelhead Distinct Population Segment ESA Recovery Plan (NOAA 2009: 7-17) describes restoring passage into the Crooked River above the Pelton Round Butte Dam complex as a key action to recover the Cascades Eastern Slope Tributaries Major Population Group (MPG) of Middle Columbia Steelhead.

As part of a FERC relicensing agreement completed in 2005, facilities co-managers Portland General Electric and the Confederated Tribes of the Warm Springs Reservation agreed to provide passage at and reintroduce anadromous fish above the Pelton Round Butte facility. They first reintroduced juvenile steelhead to the Crooked River in 2008 and will continue to release juvenile fish above the Pelton Round Butte project until they meet standards set out in the relicensing agreement.

Middle Columbia Steelhead, including Crooked River steelhead, are protected under the Endangered Species Act. When reintroduction is complete above the Pelton Round Butte project, the Crooked River population will extend the range of the species and contribute to the population numbers included in the Cascades Eastern Slope Tributaries MPG and help to meet recovery goals for the species. Adult steelhead returned to the lower Crooked River in 2012.

Adverse Affects on the Species by a Reclamation Project

As described elsewhere in this application, NUID is a major part of Reclamation's Deschutes Project. NUID's pumps water from the Crooked River at RM 27 at their Crooked River Pumping Plant, part of the Deschutes Project. NUID's pumps draw down stream flows in the Crooked River as low as 10 cfs, severely limiting conditions for resident and anadromous fish.

The Mid-Columbia Steelhead Distinct Population Segment Recovery Plan (NMFS 2009) lists degraded water quality in the Crooked River from RM 17 to RM 51 as a primary factor limiting steelhead recovery. This portion of the Crooked River is listed by Oregon DEQ as a 303(d) impaired stream for exceeding temperature, dissolved gas, and pH standards. Low stream flows resulting from pumping in the lower Crooked River contribute to elevated stream temperatures, turbidity, and low dissolved oxygen during the irrigation season.

Recovery Plan for Species

Oregon's *Conservation and Recovery Plan for Oregon Steelhead Populations in the Middle Columbia River Steelhead Distinct Population Segment* (ODFW 2010) documents recovery plans for steelhead in the Deschutes River and its tributaries. This plan is included as Appendix A of NOAA's *Middle Columbia River Steelhead Distinct Population Segment ESA Recovery Plan* (NOAA 2009).

Benefits of Proposed Project to the Status of the Species

The proposed project, Phase II of the NUID Water and Energy Conservation Initiative, will protect 7.54 cfs of instream water rights in the Crooked River downstream from NUID's pumps throughout the irrigation season. As a part of this entire initiative, NUID will legally condition their existing Crooked River irrigation water rights to protect new monthly minimum flows in addition to the new instream water rights created by each phase. Together, these new minimum flows and water rights will restore up to 220 cfs of stream flow upon completion of all phases of the initiative.

ODFW (2010) and NOAA (2009) highlight restoring a more natural hydrograph as a strategy for improving steelhead in the Crooked River. Actions associated with this strategy include implementing agricultural water conservation measures, improving irrigation conveyance and efficiency, and leasing or purchasing water rights and converting those rights to instream use (NOAA 2009: 7-21). The conservation project proposed here will satisfy many of the actions recommended in the Recovery Plan and will accelerate the recovery of listed fish species. This project phase, as well as the larger North Unit Water and Energy Conservation Initiative, is a critical piece to restoring streamflow in the lower Crooked River as other opportunities to do so are extremely limited. See Appendix D for attached letters of support from ODEQ and ODFW.

NOAA (2009) highlights improving degraded water quality (NOAA 2009: 7-21) as a strategy for improving steelhead in the Crooked River. Currently, high temperatures downstream from NUID's pumps create a seasonal thermal barrier to fish migration in the Crooked River. Modeling completed in 2011 by the Oregon Department of Environmental Quality (ODEQ) identified that low stream flows downstream from the Crooked River pumps contribute to increased stream temperatures. Their modeling demonstrated that decreased pumping will contribute to lowered river temperatures below NUID's pumps and decrease the magnitude of this thermal barrier.

1.4.4. Evaluation Criterion D: Water Marketing

An essential component of this project involves the use of water banking techniques to reallocate water from one water use to another and one irrigation district to another. Broadly speaking, water banking is a mechanism that facilitates the legal transfer and market exchange of various types of surface, groundwater, and storage entitlements. Banking facilitates the reallocation of water rights to alternate uses. This project will provide new supply of water while promoting conservation, regulatory compliance and reduced transaction costs associated with water transfers.

Estimate of the Amount of Water to Be Marketed

The proposed project will market a total of 2,552 acre-feet of COID Deschutes River. It will market 552 acre-feet to instream use in the Deschutes River. It will market 2,000 acre-feet to NUID for irrigation use. It will also market 2,000 acre-feet of NUID Crooked River water rights to environmental funders to be allocated for instream use. Marketing the conserved water in this way results in three points of beneficial impact from the saved water.

Market Mechanism

The NUID Water Supply Initiative created a new market for water rights in the Deschutes and Crooked Rivers. The Phase I NUID project has demonstrated the success of the proposed

approach. Phase II expanded the water marketing component by involving a second irrigation district in an inter-district transfer of water rights, expanding innovation and water management opportunities basin-wide. Phase III continues to build on this success in innovation, involving two irrigation districts and providing benefits in two instream reaches as well as for NUID farmers.

Number of Users and Types of Water Use

Phase III will conserve Deschutes River water through piping a portion of the Pilot Butte Canal in COID. It will allocate a portion of this water to instream use in the Deschutes River. The conserved water to approximately 65 district accounts in NUID that currently receive NUID water pumped from the Crooked River. This allocation will allow 2,000 acre-feet of NUID's Crooked River water rights to enter the market. Phase III will allocate these Crooked River water rights instream in the Crooked River. The transactions will meet new Deschutes River irrigation and new Deschutes and Crooked River environmental uses.

Legal Issues

These transactions will all occur under Oregon's Allocation of Conserved Water Program. COID, NUID, and the Deschutes River Conservancy developed this process in coordination with the Oregon Water Resources Department, the Oregon Department of Fish and Wildlife and the Oregon Department of Environmental Quality. They do not expect any state legal issues. Both COID and NUID have identified that this process aligns with their contracts with Reclamation. NUID does not expect any federal legal issues. NUID's recent Warren Act contract amendment will allow them to participate in this process:

> *The water supply available for irrigation of the lands within the project entitled to receive water and incidental stock and domestic uses and for instream purposes, including fish or wildlife purposes, to the extent that such use is required by Oregon State law in order for the District to engage in, or take advantage of, conserved water projects as authorized by Oregon State law, shall comprise all of the water within the rights, both natural flow and storage, acquired and appropriated, or to be acquired and appropriated, for the project for irrigation, stock and domestic uses, and for instream purposes as described above, that becomes available by the operation of the irrigation system, including natural flow rights out of the Crooked River held by the District. ***.*

The COID water to be marketed is live flow rights from the Deschutes River, not stored water from the Deschutes Project (Crane Prairie Reservoir). COID does not expect any federal legal issues.

Estimated Duration of Water Market

Applicant expects that the water market created through the NUID Water and Energy Conservation Initiative will be active for up to ten years. Phase III transactions should be complete within three years of the initiation of the project. Applicants expect future phases of this initiative to contribute to the market. All of the transactions under this market will be permanent.

1.4.5. Evaluation Criterion E: Other Contributions to Water Supply Sustainability

Making Water Available for a Specific Concern

Water Shortages

This project simultaneously increases the reliability of NUID's water supply, being the junior irrigation district in the basin, while marketing water to permanently restore instream flows to both improve water quality and fish habitat for ESA listed mid-Columbia steelhead trout as well as to improve water quality and fish habitat in the Deschutes River. NUID, the Crooked River and the Deschutes River have unmet water needs illustrated previously in this grant application. These needs, based on a 2011 climate change report specific to the Deschutes Basin (ClimateWise 2011), will only become increasingly acute with predicted climate variability and population growth in the basin.

Marketing to Other Users and Increasing Water Availability

The broader water management context of the Deschutes Basin is one of overallocated rivers, a recent reintroduction of an Endangered Species Act listed fish, an existing Endangered Species Act listed as threatened species (Bull Trout), and an expected ESA listing of the Oregon Spotted Frog, increasing municipal demand for water, and variability in the seniority and reliability of irrigation water rights. In addition, climate change forecasts estimate reduced snowpack and seasonal water availability. The partners in the Deschutes Basin have been working proactively to create a water management plan that identifies and implements a suite of projects that meet multiple demands and avoids potential water conflict. This project exemplifies the type of project that a broader basin-wide plan is being developed to support, piloting inter-district transactions, and breaking open a new set of opportunities in the basin that capitalize on the strengths/limitations of individual irrigation districts to meet agricultural and environmental needs.

Water Available to Indian Tribes

A description of important Native American Indian trust assets in the Deschutes River basin has been documented by the Confederated Tribes of the Warm Springs Reservation in Restoring Oregon's Deschutes River – Developing Partnerships and Economic Incentives to Improve Water Quality and Instream Flows (Environmental Defense Fund, 1995). The Tribes have identified that their paramount goal is to enhance Deschutes River tribal fisheries by increasing instream flows. This project will enhance instream flows and water quality and as such is expected to improve the condition of Native American trust assets in the region.

Promoting Collaboration

This project is widely supported by not only the two irrigation districts participating in the project, but also by the diverse interests represented on the DRC board and the Deschutes Water Alliance (DWA). Collaborative efforts in the basin gained momentum when the DWA was formed in 2004 by the Deschutes Basin Board of Control, the Deschutes River Conservancy, the Confederated Tribes of the Warm Springs Reservation, and the Central Oregon Cities Organization, with assistance from a Reclamation 2025 Challenge Grant, to plan for long term water resource management in the Deschutes Basin. The DWA was formed around the belief that it is possible to simultaneously meet new and existing demands for water in the Basin through the cooperation and voluntary participation of the key water suppliers and users in the basin.

The mission of the DWA contains the following three elements:

- Move stream flows toward a more natural hydrograph while securing and maintaining improved instream flows and water quality to support fish and wildlife
- Secure and maintain a reliable and affordable supply of water to sustain agriculture
- Secure a safe, affordable, and high quality water supply for urban communities

The DWA has been expanded to include all stakeholders in the basin and is working towards a long-term water management plan. It has become clear that instream flow needs cannot be fully met in the basin unless the needs of water-short irrigation districts are also addressed. While other Deschutes Basin irrigation districts have completed conservation projects and utilized Oregon's Conserved Water Statute to put water instream, North Unit, as the junior user, has had the challenge of seeking opportunities to firm up supply while benefiting the rivers. Prior to 2008, NUID's contract with Reclamation preventing them from moving conserved water instream. Changes in its contract with Reclamation in 2008 now allow them to move conserved water instream. By increasing the reliability of water and reducing NUID's energy costs while demonstrably restoring instream flows, the project serves as a model to promote and encourage the collaboration necessary to meet broader DWA goals for the basin. Projects like this will increase the district's ability to support and participate in increasingly creative projects to restore streamflow. The inter-district nature of the proposed project elevates the collaborative efforts even higher, allowing for more flexibility and creativity in meeting multiple goals. It will build cooperation and reduce the potential for conflicts that interrupt water supplies.

As discussed above, this project integrates water and energy conservation. Deschutes River water saved by COID piping projects replaces Crooked River water rights, allowing the Crooked River rights to be marketed to permanent instream use, obviating the need to pump that water for irrigation. The annual pumping costs on the Crooked River Pumping Plant average approximately 15% of NUID's annual operating budget, and create a significant burden to efficient operations. In addition, COID will benefit from producing additional renewable energy at its existing Juniper Ridge hydroelectric facility because the extended pipeline will capture an additional 40' of elevation head thereby optimizing existing capacity.

Irrigation districts and water conservation partners in the Deschutes Basin are actively looking to integrate water conservation projects with reduced energy demand and hydropower generation. This project will provide a strong example of the feasibility and multiple benefits of such projects.

Future On-Farm Improvements

This project is not expected to change on-farm conveyance and efficiencies.

Public Awareness of Water and Energy Conservation and Efficiency Efforts

A Local and National Example

This project will undoubtedly serve as an example of water and energy conservation within the local community and the state of Oregon. This demonstrates further success of coordinating water management between two districts to the benefit of each district and the environment. Previously funded Reclamation water/energy conservation projects in the Deschutes have

received national notoriety on the public and political stage, and it is anticipated that the project proposed here will receive similar attention. It should be noted that the Deschutes Basin was also selected as the test basin for the **Integrated Basin Scale Opportunity Assessment** being conducted by the US Department of Energy (DOE) under the Memorandum of Understanding signed by DOE and the Departments of the Interior and the Army. The effort is exploring opportunities for collaboration across entire river basins to increase generation and improve environmental conditions.

Increased Capability for Future Conservation
By demonstrating how collaboration between multiple districts can result in increased reliability for irrigation, decreased operational costs, increased hydroelectric revenue, and more water for our valued streams and river, this project will strengthen the path to future collaborative projects in the basin.

Water and Energy
This project simultaneously restores flows to the Crooked River and Deschutes Rivers while decreasing NUID energy consumption in the form of pumping and increasing COID renewable energy generation potential.

1.4.6. Evaluation Criterion F: Implementation and Results

Subcriterion No. 1—Project Planning

Studies completed over the last two decades have consistently highlighted conservation opportunities along COID's Pilot Butte Canal. The proposed COID Juniper Ridge Phase II piping project is identified in COID's Water Management Conservation Plan, (COID, Draft, 2011) and the U.S. Bureau of Reclamation Water 2025 Challenge Grant Action Plan for Central Oregon Irrigation District, Ochoco Irrigation District and Swalley Irrigation District (Newton Consultants, 2009). Reclamation's Upper Deschutes River Basin Water Conservation Study (1997) highlighted losses in the district, including the Pilot Butte Canal. In 2010, 2.5 miles of the Pilot Butte Canal was piped in conjunction with the installation of the Juniper Ridge Hydroelectric facility, supported in part by Reclamation funding. The project permanently restored 19.6 cfs of conserved water to the Deschutes River. This project is part of a planned continuation of piping 4 miles of the Pilot Butte Canal within the next ten years to reap additional conserved water (approximately 10 cfs/mile) and hydroelectric potential.

The Deschutes Water Alliance, a group of stakeholders focused on collaboratively meeting water needs in the upper Deschutes Basin, completed a series of regional water supply and demand studies in 2006 with support from a Water2025 grant. The Deschutes Water Alliance's Final Report on District Water Efficiency identified water conservation as the greatest opportunity for meeting new agricultural, municipal, and environmental water demands in the upper Deschutes Basin. It identified and prioritized piping in COID as a source of water to meet new demands. This project directly aligns with the goals of the Deschutes Water Alliance and the findings of their studies.

After Juniper Ridge Phase II of the Pilot Butte Canal was identified as a priority conservation project, COID contracted with Black Rock Consulting to produce the JR2 Seepage Mitigation Feasibility Study (Crew, 2010) to estimate the canal seepage and received feasibility grant funding from the Energy Trust of Oregon to generate complete preliminary (30%) design plans, estimated additional generation potential, and estimated designs for the project construction activities and costs This study provides feasibility and preliminary design for piping JR2 proposed here (included as Appendix E).

This project is consistent with Oregon's recently passed Integrated Water Resources Strategy. Piping Juniper Ridge Phase II of the Pilot Butte Canal meets both COID goals, North Unit Irrigation District's goals and the goals of a broad coalition of local, state, and federal basin stakeholders. Marketing the water to instream flow buyers such as the Pelton Water Fund, which has committed to investing in this project, meets the need for projects that restore flow in the lower Crooked River. The following assessments and action plans of the following agencies and organizations highlight the need to restore flow in the Crooked and Deschutes Rivers:

- US Bureau of Reclamation, Upper Deschutes River Basin Water Conservation Study (1997)
- Oregon Department of Fish and Wildlife, Crooked River Basin Plan (1996)
- Northwest Power and Conservation Council, Deschutes Subbasin Plan (2004)
- Upper Deschutes River Watershed Council, Upper Deschutes Watershed Assessment (2003)
- Crooked River Watershed Council, Crooked River Watershed Assessment/Action Plan (2003)
- Oregon Department of Agriculture, Upper Deschutes Agricultural Water Quality Management Area Plan (2002)
- Mid- Columbia River Steelhead (Oncorhynchus mykiss) Distinct Population Segment Recovery Plan (2009)

Subcriterion No. 2—Readiness to Proceed

Project Implementation

Design & Construction

Design for the project will be performed by Black Rock Consulting, an experienced local irrigation District, large diameter pipeline, and hydropower design firm.

The detailed design survey was completed in 2010 by Jerry C. Powell, PLS and James, D. Perry, PLS.

Design for the proposed 108" pipeline and forebay will be developed to a 60% (Preliminary Design) level and distributed to the District for review and comment. Final design will incorporate review comments. Final design drawings and specifications will be developed, stamped and signed by Kevin L. Crew, P.E. Bid documents will be prepared to accompany the project specifications.

The project will be bid through a competitive Design-Bid-Build process, standard in the industry. The lowest, responsive, responsible bidder will be awarded the contract for pipe procurement and construction of the project. Only a contractor, licensed in the State of Oregon, with experience on similar projects and properly bonded will be considered for the work.

Construction is anticipated starting in September, 2013 and ending in April, 2014. It is anticipated that pipe procurement will occur between September, 2013 and December, 2013. Clearing and grubbing will occur in October and November, 2013. Pipe installation will occur from December, 2013 through March, 2014. Forebay construction will occur from November, 2013 through March, 2014. Appurtenances to the project will occur throughout the course of the work. Substantial Completion will be in March, 2014 and Final Completion will be in early April, 2014.

Construction administration and field observation services will be performed by the design firm, Black Rock Consulting. This will consist of weekly project meetings, submittal reviews, addressing RFIs, any Change Orders, or other project documents, performing field observations, issuing Substantial and Final Completion documents, punch list, and attending final commissioning tests (as applicable). As with Juniper Ridge Phase I, it is also anticipated that the District will be routinely involved in project meetings and decisions. Additionally, the District will be involved with addressing public contacts.

Water Rights Process

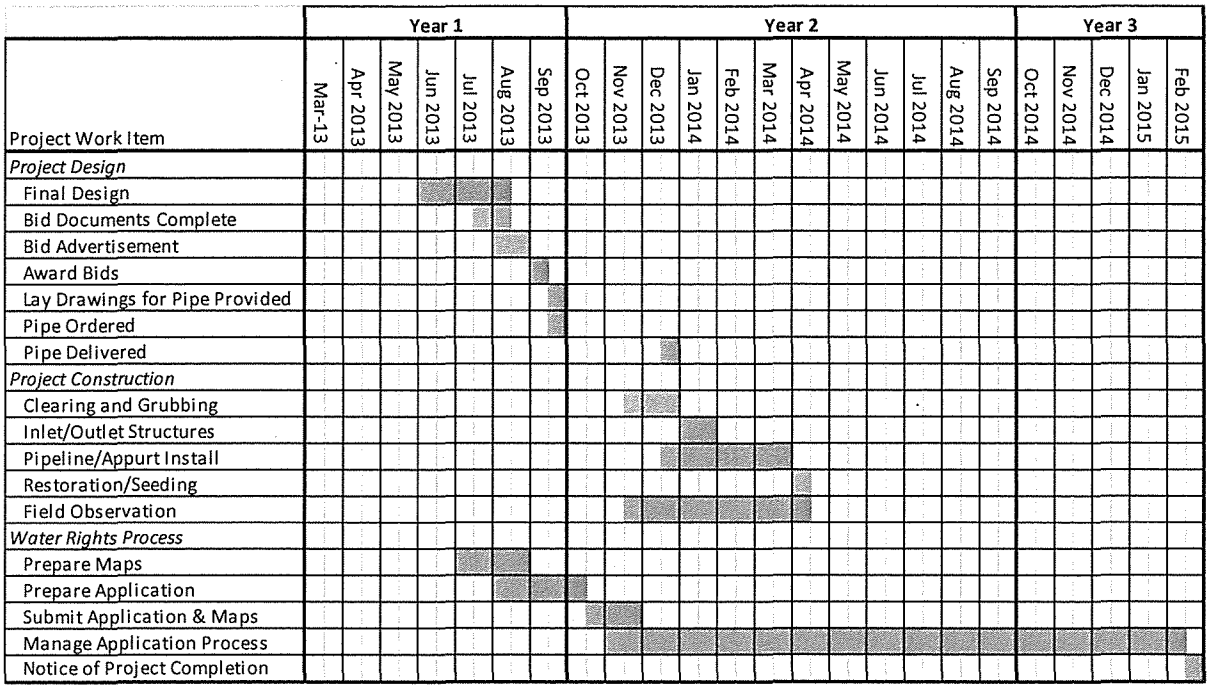
In 2013, NUID will meet with DRC to coordinate the development, preparation and submission of water rights maps for the affected lands. NUID has identified the affected lands through a lottery process. NUID successfully used this process in Phases I and II of the NUID Water and Energy Conservation Initiative. DRC will submit these maps with the final Application for the Allocation of Conserved Water.

COID, DRC and NUID and their representatives will meet in 2013 to initiate the development, preparation and submission of an Application for the Allocation of Conserved Water. The DRC will prepare the application following the process used in Phases I and II of the NUID Water and Energy Conservation Initiative. As previously, the DRC will coordinate with COID, NUID, the Oregon Water Resources Department and the Oregon Department of Fish and Wildlife during application preparation.

The DRC will facilitate the necessary agreements between COID, NUID, and project funders following the development of an application. Agreements will ensure that water deliveries occur as specified by NUID and COID. The DRC will submit the application for the Allocation of Conserved Water to OWRD in the fall of 2013.

The DRC will shepherd the application through the OWRD process. The DRC has extensive experience working with this process. COID will submit a Notice of Project Completion to OWRD as appropriate following the completion of project construction by March 2014. OWRD will issue a Final Order between 9 months and 15 months following submission of the application and pending a Notice of Project Completion.

Figure 2. Juniper Ridge Piping Project Phase II Schedule



Readiness Criteria

In addition to the project designs, biological assessments and cultural resource surveys of the canal have already been conducted and are ready to submit to satisfy the federal environmental and historical compliance. COID intends to apply to the Army Corps of Engineers for a fill and removal permit claiming an exemption for construction or maintenance of irrigation ditches under Army Corps of Engineers RGL 07-02. The Pilot Butte Canal is deemed a waterway of the U.S. COID was successful receiving the maintenance and construction exemption for the construction of the Juniper Ridge Hydroelectric & Pipeline project in 2009 and expects to receive the same exemption for JR2. No other permits are needed.

Available & Proven Design Criteria

COID and other districts in Central Oregon and around the country have had extensive successful experience using Steel pipe to pipe open earthen canals, resulting in demonstrable water savings. Black Rock Consulting follows industry standard design criteria for steel pipelines as provided for in ASCE 79, AWWA M-11, AWS D1.1, AWWA C-200 and associated national design standards.

Phases I and II demonstrated how the water banking agreement works to allocate conserved Deschutes River water to NUID Crooked River lands and NUID Crooked River water rights permanently instream, all approved measures under Oregon Water Law and federal Reclamation contracts.

Subcriterion No. 3—Performance Measures

Canal Piping

Deschutes River water saved through piping JR2 of the Pilot Butte Canal will be documented through inflow/outflow testing using existing gages and COID measuring capabilities upstream and downstream from the proposed piping project. As described in Section 1.4.1of this report, COID has adequately documented pre-project losses through this open reach of the Pilot Butte Canal using prior measurements. This project will reduce canal seepage. Post-project monitoring of the project will allow COID to evaluate post-project losses. Comparing pre- and post-project losses will allow COID to confirm the benefits of the canal piping project.

Water Markets – Water Marketing

As described earlier, this project will provide permanent instream flows to the Deschutes River and an alternate source of Deschutes River water rights for lands in NUID currently served by water pumped from the Crooked River and will restore a corresponding amount of water instream in the Crooked River. The Oregon Water Resources Department operates a stream flow gage downstream from NUID's diversion on the Crooked River. This gage will provide both pre-project and post-project stream flow data, allowing NUID to demonstrate benefits of water marketing to stream flows in the Crooked River. NUID will also track the number of acres that receive conserved water from the Deschutes River as a result of this project, demonstrating success of the agricultural transfers. The instream benefit to the Deschutes River will be monitored through Oregon Water Resources Department's extensive gaging system on the Deschutes.

Energy-Water Nexus – Increasing Energy Efficiency in Water Management

The proposed project will conserve an estimated 543,343 kilowatt hours of electricity every year in perpetuity. Energy savings will be documented by comparing pre and post project electricity use records provided by Central Electric Cooperative (CEC) to NUID. CEC provides monthly power bills to NUID that detail the district's electricity usage for that month and assesses a per kilowatt hour fee. NUID maintains a long-term record of these power bills and will use them as a baseline for quantifying actual post-project power savings. NUID will use the same records and methodology to quantify cost savings.

Energy-Water Nexus – Increasing Renewable Energy in Water Management

The proposed project will generate an additional 3,727,545 kilowatt hours of electricity every year in perpetuity at the existing COID Juniper Ridge hydropower facility. This estimate was calculated by using existing energy generation records for 2011 and 2012 along with the original index testing of the facility to calculate the generation produced by the increased elevation head from the penstock extension.

Benefits to Endangered Species

The proposed project will improve habitat conditions for ESA listed Mid-Columbia Steelhead and ESA listed Bull Trout by improving instream flows in the lower Crooked River. Specifically, the project will contribute an additional 2,000AF of flow to the lower 28 miles of the Crooked River each year from March to October. As described in 1.4.3 above, this project addresses key limiting factors identified in the Mid-Columbia Steelhead Distinct Population Segment Recovery Plan. Portland General Electric (PGE) and the Confederated Tribes of the Warm Springs Reservation (Tribes) are required as a stipulation of their federal license to operate the Pelton Round Butte Hydroelectric Project to monitor native fish populations (Hill and Quesada, 2009) in a portion of the upper Deschutes Basin that includes the lower 28 miles of the Crooked River. This monitoring

effort is described in Section 9 of *Recovery Strategies and Management Actions Oregon Mid-C Steelhead Recovery Plan* and is administered primarily by PGE. NUID will utilize data and reporting by PGE and the Tribes to determine, to the extent possible, the recovery rate of Mid-Columbia Steelhead in the lower Crooked River.

1.4.7. Evaluation Criterion G: Connection to Reclamation Project Activities

(1) How is the proposed project connected to Reclamation project activities?

Central Oregon Irrigation District is part of the Deschutes Project, and receives water from Crane Prairie Reservoir. North Unit Irrigation District is also a major part of Reclamation's Deschutes River Project. NUID Deschutes Project operations include Wickiup Reservoir, Haystack Dam and Reservoir, the North Unit Main Canal, and the Crooked River Pumping Plant.

(2) Does the applicant receive Reclamation project water?

Yes, COID receives water from Crane Prairie Reservoir, part of the Deschutes Project. NUID receives stored water from Wickiup Reservoir. Wickiup Reservoir is part of the Deschutes Project.

(3) Is the project on Reclamation project lands or involving Reclamation facilities?

Yes. The project involves NUID lands and the Crooked River pumps.

(4) Is the project in the same basin as a Reclamation project or activity?

Yes.

(5) Will the proposed work contribute water to a basin where a Reclamation project is located?

Yes. The Deschutes Basin includes both the Deschutes and Crooked River Projects.

1.5. References

BOR. 1997. Upper Deschutes River Basin Water Conservation Study, Special Report, Crook, Deschutes, and Jefferson Counties, Oregon: Bureau of Reclamation.

BOR. 2002. Canal-Lining Demonstration Project: Year 10 Final Report. Bureau of Reclemation

Carmichael, RW, BJ Taylor. 2010. Conservation and Recovery Plan for Oregon Steelhead Populations in the Middle Columbia River Steelhead Distinct Population Segment. Oregon Department of Fish and Wildlife. February 2010.

Crew, Kevin. 2010. Seepage Losses in the Juniper Ridge Phase II Reach of Central Oregon Irrigation District's Pilot Butte Canal. Bend, OR.

CRWC. 2003. Crooked River Watershed Assessment and Action Plan. Prineville, OR: Crooked River Watershed Council.

DEQ. 2002. 2002 303(d) List Database. Salem, OR: Department of Environmental Quality.

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Gannett, M.W., Lite, K.E., Morgan, D.S. and C.A. Collins. 2001. Ground-Water Hydrology of the Upper Deschutes Basin, Oregon. Water-Resources Investigations Report 00-4162. Portland, OR: USGS.

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Hill M, Quesada C. 2009. Native Fish Monitoring: Biological Component 2009 Annual Report and 2010 Work Plan. Portland General Electric Company. Portland, Oregon.

Newton Consultants. 2009. U.S. Bureau of Reclamation Water 2025 Challenge Grant Action Plan. Prepared for Central Oregon Irrigation District, Ochoco Irrigation District and Swalley Irrigation District. Bend, OR.

Newton Consultants. 2011.Report on Updated Costs and Schedule and Reductions in Power Costs for Proposed 4.9-Mile Sidewall Lining Project. Redmond, OR.

NFWF. 2007. Adaptive Management for ESA-Listed Salmon and Steelhead Recovery: Decision Framework and Monitoring Guidance http://www.nwr.noaa.gov/SalmonRecovery-Planning/ESA-Recovery-Plans/upload/Adaptive_Mngmnt.pdf.

NMFS. 2009. Mid- Columbia River Steelhead (Oncorhynchus mykiss) Distinct Population Segment Recovery Plan. Federal Register /Vol. 74, No. 188 /Wednesday, September 30, 2009

NUID. 2003. North Unit Irrigation District 5-Year Update: Water Management and Conservation Plan. Madras, Oregon.

NPCC. 2004. Deshutes Subbasin Plan. Portland, OR: Northwest Power and Conservation Council.

Tonsfeldt and Gray. 2010. Cultural Resource Inventory of a Segment of the Pilot Butte Canal, Juniper Ridge Piping Phase II. Deschutes County, OR.

ODFW. 1996. Crooked River Basin Plan. Prineville, OR: Oregon Department of Fish and Wildlife.

2. Environmental Compliance

(1) Will the project impact the surrounding environment (i.e., soil [dust], air, water [quality and quantity], animal habitat, etc.)?

This project will have minimal impacts on the surrounding environment. All work will occur within existing irrigation canals and the project sites will be accessed using existing access roads. Earth disturbing work, where required, will occur within existing irrigation canals.

(2) Are you aware of any species listed or proposed to be listed as a Federal endangered or threatened species, or designated Critical Habitat in the project area? If so, would they be affected by any activities associated with the proposed project?

No federally endangered or threatened species are known to exist in the project area. No designated Critical Habitat exists in the project area. The project will ultimately restore stream flow to the lower Crooked River, improving conditions for ESA listed steelhead trout. The lower Crooked River does not contain any designated Critical Habitat (WH Pacific, 2009).

(3) Are there wetlands or other surface waters inside the project boundaries that potentially fall under Federal Clean Water Act jurisdiction as "waters of the United States?" If so, please describe and estimate any impacts the project may have.

No wetlands or other surface waters that could fall under Clean Water Act jurisdiction exist in the project area. The project will ultimately reduce irrigation diversions from the Crooked River, likely improving water quality in the river.

(4) When was the water delivery system constructed?

The Central Oregon Irrigation District Pilot Butte Canal was completed in 1905. North Canal Dam and its connection to the Pilot Butte Canal were completed in 1912. Crane Prairie Reservoir was completed in 1940.

(5) Will the project result in any modification of or effects to, individual features of an irrigation system (e.g., headgates, canals, or flumes)? If so, state when those features were constructed and describe the nature and timing of any extensive alterations or modifications to those features completed previously.

This project will pipe 4,500 feet of the Pilot Butte Canal, constructed in 1905.. No extensive alterations or modifications have been made to the project area of the canal since original construction.

(6) Are any buildings, structures, or features in the irrigation district listed or eligible for listing on the National Register of Historic Places?

The Pilot Butte Canal has been determined eligible for nomination to the National Register of Historic Places, although is not currently listed. At some time in the future, the entire COID system could be proposed as an historic district.

(7) Are there any known archeological sites in the proposed project area?

No prehistoric or historic artifacts or features were located on the survey. The segment of the canal surveyed is considered an historic resource and will be documented on a Section106 Clearance form (Tonsfeldt and Gray, 2010).

(8) Will the project have a disproportionately high and adverse effect on low income or minority populations?

The project will not have a disproportionately high and adverse effect on low income or minority populations.

(9) Will the project limit access to and ceremonial use of Indian sacred sites or result in other impacts on tribal lands?

This project will not limit access to and ceremonial use of Indian sacred sites. COID does not expect this project to negatively affect tribal lands.

(10) Will the project contribute to the introduction, continued existence, or spread of noxious weeds or non-native invasive species known to occur in the area?

This project will not contribute to the spread of noxious weeds or non-native invasive species. Piping an open irrigation canal will limit invasive and non-native plant habitat along the canal, reducing the potential for invasive and non-native plant growth in the project area.

3. Required Permits or Approvals

3.1. Federal Permitting

The most significant federal approval necessary for construction of this project will be National Environmental Policy Act (NEPA) compliance. The biological assessment and cultural resource surveys of the canal were conducted in 2010 and are ready to submit to satisfy the federal environmental and historical compliance. Project partners will work with the Bureau of Reclamation to evaluate and satisfy NEPA compliance, modifying or generating any additional information as necessary. Reclamation has issued Categorical Exclusions for similar canal piping projects and for the NUID Energy and Water Conservation Initiative Phase I.

Currently, discussions are being held with Oregon SHPO regarding the additional piping of the Pilot Butte Canal. An initial report was filed with SHPO in 2010, and their original finding was

that the project would cause an adverse effect to the historical integrity of the canal. As this project has moved forward, COID has reopened discussions with SHPO, and we are now working on supplying an updated report with a clearer scope. The updated report will satisfy SHPO's need for COID to address the canal's historical integrity and concur with our findings of no adverse effect. (See Appendix F: email from Ian Johnson, Oregon SHPO Historian, for detailed information of his request and requirements).

A description of important Native American Indian trust assets in the Deschutes River basin has been documented by the Confederated Tribes of the Warm Springs Reservation in Restoring Oregon's Deschutes River – Developing Partnerships and Economic Incentives to Improve Water Quality and Instream Flows (Environmental Defense Fund, 1995). The Tribes have identified that their paramount goal is to enhance Deschutes River tribal fisheries by increasing instream flows. This project will enhance instream flows and water quality and as such is expected to improve the condition of Native American trust assets in the region.

Based on previous experience with satisfying federal NEPA and cultural resource requirements, NUID and COID are confident that necessary approvals can be secured prior to October 2013.

COID intends to apply to the Army Corps of Engineers (as discussed in subcriterion 2-Readiness to Proceed, Readiness Criteria) for a fill and removal permit claiming an exemption for construction or maintenance of irrigation ditches under Army Corps of Engineers RGL 07-02. The Pilot Butte Canal is deemed a waterway of the U.S. COID was successful receiving the maintenance and construction exemption for the construction of the Juniper Ridge Hydroelectric & Pipeline project in 2009 and expects to receive the same exemption for JR2. No other permits are needed.

3.2. State Permitting

No state permits are required.

3.3. Local Permitting

No local permits are required.

4. Funding Plan and Letters of Commitment

4.1. How Applicant Will Contribute to the Cost Share Requirement

COID and its funding partners will provide $5,031,166 in non-federal match to leverage Reclamation's $1,500,000 investment. Non-federal partners include Oregon Watershed Enhancement Board, Pelton Fund, Energy Trust of Oregon and a COID loan obtained through the Oregon Department of Environmental Quality's Clean Water State Revolving Fund. Non-federal partners and COID will provide $5,031,166 as described below (see Detailed Budget attachment). COID will fund, from its own resources, any funding deficiencies from non-federal partners and/or costs post-bid or construction in excess of those budgeted. In addition, there are significant additional in-kind personnel resources provided by COID, NUID, DRC and other project partners that are not reflected in the project budget. These amounts are not material to the

overall cost of the project but will be provided to the extent necessary for any administrative functions, full project completion, contractor oversight, and operational project function.

4.2. In-Kind Costs Incurred Before the Project Start Date

COID anticipates that this project, as funded by Reclamation, will start in the late spring/early summer of 2013 upon successful approval of all requested funding from Reclamation and other funding sources. Pre-construction work including surveys, road construction, final project design and related engineering, contractor bid process and water right mapping will commence before an anticipated Reclamation contract finalization of September 30, 2013.

4.3. Identify the Source and Amount of Funding Provided by Funding Partners

The Pelton Fund is a mitigation fund established as part of a 2005 FERC relicensing process for the Pelton Round Butte hydroelectric project on the Deschutes River. The Pelton Fund has invested approximately $6 million in stream flow and habitat restoration along the Deschutes River and its tributaries. The Pelton Fund has committed $500,000 to this project (see Appendix G).

The Oregon Watershed Enhancement Board invests in watershed restoration across Oregon. They have a strong history of investing in the Deschutes Basin and have already invested over $8 million in water conservation projects. The OWEB's Special Investments Partnership (SIP) has contributed significant funding to the first two phases of this project and we anticipate the OWEB SIP to commit $500,000 to this project. Based on feedback from OWEB staff, we believe the funding is highly likely and will be available to support this project in the fall of 2013.

COID anticipates securing $1.5 million from the Energy Trust of Oregon and plans to finance the remainder of the project costs ($2,531,166) through the Oregon Department of Environmental Quality (DEQ). DEQ manages the state funds associated with the Clean Water State Revolving Fund (CWSRF). COID has applied for $3,250,000 of CWSRF funds and anticipates approval by the end of March 2013. DEQ staff has verbally provided assurances to COID that a listing of Juniper Ridge Phase II will be published in the February ITP. DEQ staff assurances are based on the original Juniper Ridge Hydroelectric & Piping Project being an approved CWSRF project and consider JR2 to be an extension of that project.

The Energy Trust of Oregon (ETO) is a unique non-profit entity in Oregon which invests grant funds generated from utility customer billings for the construction of renewable energy generation projects. ETO was a funder in the original Juniper Ridge Hydroelectric & Piping Project and an application requesting $1,500,000 has been submitted by COID. The ETO approval process is already underway with a final determination on May 22, 2013 by the ETO Board of Directors. ETO staff has represented that they have considerable funding available in excess of any existing renewable energy generation projects, and the likelihood of approval is positive. (See Appendix D for Letter of Support).

4.4. Other Federal Funds

No federal funds have been requested or received from other sources.

4.5. Pending Funding Requests

There are OWEB and ETO funding requests pending, as discussed above. COID plans to obtain the balance of project financing through the Oregon Department of Environmental Quality's Clean Water State Revolving Fund. COID is committed (and has the available financial resources) to make up for any project cost differences if necessary (Appendix G).

4.6. Funding Summary

Table 1. Summary of non-federal and federal funding sources

Funding Sources	Funding Amount
Non-Federal Entities	
1. Oregon Watershed Enhancement Board	$ 500,000
2. Pelton Fund	$ 500,000
3. DEQ/CWSRF	$ 2,531,166
4. Energy Trust of Oregon	$ 1,500,000
Non-Federal Subtotal	*$ 5,031,166*
Other Federal Entities	
None	$ -
Other Federal Subtotal	$ -
Requested Reclamation Funding	*$ 1,500,000*
Total Project Funding	$ 6,531,166

Table 2. Funding Group II Funding Request

Funding Group II Request			
	Year 1 (FY2013)	Year 2 (FY 2014)	Year 3 (FY 2015)
Funding Request	750,000	750,000	

5. Letters of Project Support

Letters of support have been received from the following organizations (Appendix D)

- North Unit Irrigation District
- Deschutes River Conservancy
- Oregon Department of Fish and Wildlife
- Oregon Department of Environmental Quality
- Oregon State Parks
- Jefferson County Soil and Water Conservation District
- Crooked River Watershed Council
- Energy Trust of Oregon
- Portland General Electric and Confederated Tribes of the Warm Springs Reservation (Appendix G)

6. Official Resolutions

COID has passed an official Board Resolution specific to this project (Appendix H).

7. Budget Narrative

The assembled cost of the project has been estimated to be $6,531,166. This project estimate is based on 2013 costs and rates for survey, engineering and contractor professionals familiar with Central Oregon and the Pilot Butte Canal project reach, and the water rights transfer process. These costs were assembled with the intent for project implementation to begin approximately June 2013 with final project construction and completion by February 2014 and the water rights process continuing through March 2015.

The following sections outline the various budget items appearing in the project budget.

7.1. Salaries and Wages

None. COID, NUID and DRC will be contributing significant in-kind staff time to this project, but these costs were not reflected in this budget.

7.2. Fringe Benefits

None.

7.3. Travel

None

7.4. Equipment

None

7.5. Materials and Supplies

None

7.6. Contractual

7.7. Surveying

Surveying costs were estimated by Black Rock Consultants based on extensive local experience. They include all design, construction, and post-construction surveying costs.

7.8. Engineering

Engineering costs were estimated by Black Rock Consultants based on extensive prior experience. They include design, construction, and post-construction engineering costs. They also include project management costs. Please refer to the Detailed Budget for additional detail on engineering costs.

7.9. Construction

COID expects to have construction performed by a contractor selected through the public contracting process of the State of Oregon.

Construction – Salaries and Wages
The Cost Estimate included herein was developed with the concurrence (January, 2013) of Jack Robinson and Sons, Inc. a large local contractor that was responsible for the installation of the Juniper Ridge Phase I trench and pipeline. Jack Robinson and Sons, Inc. confirmed that given BOLI and Davis Bacon wage structures, that the costs shown cover estimated salaries and wages to perform the work. The forebay reinforced concrete construction estimate was developed in concurrence with Bend Concrete, a local concrete contractor with significant experience with similar installations in Central Oregon. Bend Concrete acknowledged the proposed State and Federal wage structure for the project.

Construction – Equipment
The cost Estimate included herein was developed with the concurrence (January, 2013) of Jack Robinson and Sons, Inc. a large local contractor that was responsible for the installation of the Juniper Ridge Phase I trench and pipeline. Jack Robnson and Sons, Inc. confirmed that given BOLI and Davis Bacon wage structures, that the costs shown cover estimated equipment and fuel expenses commensurate with the project scope. The forebay reinforced concrete construction estimate was developed in concurrence with Bend Concrete, a local concrete contractor with significant experience with similar installations in Central Oregon. Bend Concrete acknowledged that the equipment costs necessary for the forming, steel, tying, pouring and stripping are within the cost estimated.

Construction – Materials and Supplies
The cost Estimate included herein was developed with the concurrence (January, 2013) of Jack Robinson and Sons, Inc. a large local contractor that was responsible for the installation of the Juniper Ridge Phase I trench and pipeline. Jack Robnson and Sons, Inc. confirmed that the cost of the provision, hauling and placement of backfill materials was covered in the Cost Estimate. The forebay reinforced concrete construction estimate was developed in concurrence with Bend Concrete, a local concrete contractor with significant experience with similar installations in Central Oregon. Bend Concrete acknowledged that the concrete, steel and associated material costs were included in the Cost Estimate. Northwest Pipe was contacted regarding the current material and delivery costs for the proposed Steel Pipeline. The cost of manufacture and delivery of the steel pipeline was provided by Northwest Pipe and was included in the Cost Estimate from their quote with a markup as advised by Jack Robinson and Sons, Inc. for field welding, placement, and touch-up of the pipe.

7.10. Water Rights Process

Cost estimates for the water rights process include the technical and administrative costs associated with preparing, submitting, and finalizing an application under the Oregon Water Resources Department's Allocation of Conserved Water Program. State administrative fees are based on the number of water rights and rate of water rights to be conserved. Technical costs include water rights mapping and obtaining title reports for the water rights transfer. These costs are based on experiences with Phases I and II of the NUID Water Supply Initiative and similar projects. These actions are critical to the water banking components of this project, which are

more complex than traditional water rights change applications. Please refer to the Detailed Budget for additional detail on water rights process costs.

7.11. Environmental and Regulatory Compliance Costs

As described in the project application, applicant does not need to apply for any local and state permits for this project. With regards to federal permits, see section 3.1. COID has completed cultural resources surveys for this project location. Applicant anticipates that prior agreements and existing surveys will expedite the completion of these permits. Costs under this budget item will support this work, the submittal of existing surveys to the appropriate agencies, and obtaining necessary approvals. The construction and maintenance exemption to the Army Corps of Engineers Fill and Removal Permit Application will be managed and the effort completed with the applicants' own personnel and financial resources separate from the project budget.

7.12. Reporting

This line item includes costs to be incurred while reporting to Reclamation.

7.13. Other

None

7.14. Indirect Costs

None

7.15. Contingency

None

7.16. Total Cost

Table 4. Total Cost

Source	Amount	Proportion
Non-Federal	*$ 5,031,166*	0.77
Federal	*$ 1,500,000*	0.23
Total	*$ 6,531,166*	1

7.17. Detailed Project Budget

Please refer to the Detailed Budget accompanying this application.

Detailed Project Budget

Budget Item Description	$/Unit	Unit	Quantity	Recipient Funding	Reclamation Funding	Total Cost
Salaries and Wages (NUID)						
none						
Subtotal						
Fringe Benefits (NUID)						
none						
Subtotal						
Travel						
None						
Subtotal				$ -	$ -	$ -
Equipment						
None						
Subtotal				$ -	$ -	$ -
Supplies/Materials						
None						
Subtotal				$ -	$ -	$ -
Contractual/Construction						
Surveyor						
Construction Phase Services						
Construction Staking	$ 145.00	Hour	34	$ 4,930		$ 4,930.00
Mileage, stakes, lathe, paper, etc	$ 500.00	Per Project	1	$ 500		$ 500.00
Professional Engineer	$ 138.00	Hour	8	$ 1,104		$ 1,104.00
Geotechnical Engineer Intake Site Evaluation						
Professional Geotechnical Engineer	$ 135.00	Hour	40	$ 5,400		$ 5,400.00
Engineer						
Preliminary Design						
Professional Engineer (Civil/Structural)	$138.00	Hour	240	$ 33,120		$ 33,120.00
Engineering Technician	$80.00	Hour	180	$ 14,400		$ 14,400.00
Final Design Drawings & Specifications						
Professional Engineer (Civil/Structural)	$138.00	Hour	200	$ 27,600		$ 27,600.00
Engineering Technician	$80.00	Hour	160	$ 12,800		$ 12,800.00
Construction - Bid/Pre-Construction Assistance						
Professional Engineer	$138.00	Hour	80	$ 11,040		$ 11,040.00
Construction - Oversight and Field Observations						
Professional Engineer	$138.00	Hour	440	$ 60,720		$ 60,720.00
Construction Meetings						
Professional Engineer	$138.00	Hour	80	$ 11,040		$ 11,040.00
Completion - Record Drawings						
Professional Engineer	$138.00	Hour	10	$ 1,380		$ 1,380.00
Engineering Technician	$80.00	Hour	12	$ 960		$ 960.00
Index Testing Update						
Professioinal Engineer	$ 138.00	Hour	36	$ 4,968		$ 4,968.00
Reimbursable Expenses						
Mileage, Plotting,	$1,500.00	Per Project	1	$ 1,500		$ 1,500.00
CONSTRUCTION						
Mobilizatioin	10.00	% of		$ 569,282		$ 569,282.00
Earthwork and General Construction						
Clearing and Grubbing	$60,000.00	LS	1.00	$ 60,000		$ 60,000.00
Excavation, Backfill, Compaction Pipeline	$20.00	CY	50,000.00	$ 1,000,000		$ 1,000,000.00
Backfill Existing Forebay to Existing Grade	$16.50	CY	11,000.00	$ 181,500		$ 181,500.00
Scarify, Backrfill and Compact Berms Above For	$16.50	CY	10,000.00	$ 165,000		$ 165,000.00
Restoration/Seeding	$70,000.00	LS	1.00	$ 70,000		$ 70,000.00
Access Road Construction	$40,000.00	LS	1.00	$ 40,000		$ 40,000.00
Chain Link Fence with BW and Outriggers	$35.00	LF	850.00	$ 29,750		$ 29,750.00
Pipe (Steel)						
108" Dia. Pipe Including Welding and Delivery	$803.00	LF	4,100.00	$ 1,792,300	$ 1,500,000	$ 3,292,300.00
Pipe Appurtenances						
Conn. And Appurts. To Exist. 108" Steel Pipe	$10,000.00	LS	1.00	$ 10,000		$ 10,000.00
Furnish and Install Air/Vacuum Relief Assly	$60,000.00	EA	2.00	$ 120,000		$ 120,000.00
Furnish and Install Turnout Assemblies, Comple	$10,000.00	EA	3.00	$ 30,000		$ 30,000.00
Proposed Forebay						
Furnish and Install Reinforced Conc. Forebay	$482.00	CY	1,030.00	$ 496,460		$ 496,460.00
Backfill at Forebay	$20.00	CY	4,000.00	$ 80,000		$ 80,000.00
Relocate Existing Forebay Telemetry	$20,000.00	LS	1.00	$ 20,000		$ 20,000.00
Furnish and Install Forebay Trash Rack/Catwalk	$120,000.00	LS	1.00	$ 120,000		$ 120,000.00
F&I Forebay Misc. Appurts. And Safety Devices	$15,000.00	LS	1.00	$ 15,000		$ 15,000.00
WATER RIGHTS PROCESS						
Conserved Water Application Fees	1750	Application	1	$ 1,750	$ -	$ 1,750.00
Title Reports	200	Report	70	$ 14,000	$ -	$ 14,000.00
GIS Transfer Maps	150	Map	70	$ 10,500	$ -	$ 10,500.00
Gis Final Proof Maps	65	Map	70	$ 4,550		$ 4,550.00

Limited License Fees	300	License	1	$ 300	$ -	$ 300.00
Subtotal				**$ 5,021,854**	**$ 1,500,000**	**$ 6,521,854.00**
Environmental and Regulatory Compliance						
Professional Engineer	$ 138.00	Hour	24	$ 3,312		$ 3,312.00
Subtotal				**$ 3,312**		**$ 3,312.00**
Other						
Reporting	$ 3,000.00	Per Year	2	$ 6,000		$ 6,000.00
TOTAL PROJECT COSTS				**$ 5,031,166**	**$ 1,500,000**	**$ 6,531,166.00**

Appendix A

Seepage Losses in Juniper Ridge Phase II Reach of the Central Oregon Irrigation District Pilot Butte Canal

BLACK ROCK
CONSULTING

August 3, 2010

Mr. Steve Johnson, Manager
Central Oregon Irrigation District
1055 SW Lake Ct.
Redmond, OR 97756

SUBJECT: SEEPAGE LOSSES IN JUNIPER RIDGE PHASE II REACH OF THE CENTRAL OREGON IRRIGATION DISTRICT PILOT BUTTE CANAL

Dear Mr. Johnson:

Per your request, I have evaluated flow rate information at the State gauge and at the south ramp flume (located just above the Juniper Ridge hydroelectric power generation project forebay) as it relates to estimated water seepage losses in that entire reach of the Pilot Butte Canal. Based upon that information, I recommend that an estimated loss of 7.8-7.9 CFS be used for the proposed Juniper Ridge Phase II project area that will involve piping and concrete forebay construction sealing approximately 4,500 LF of canal reach.

Should you have any questions on this matter, please call me.

Sincerely,

BLACK ROCK CONSULTING

Kevin L. Crew, P.E.
Principal

20380 Halfway Road Suite #1
Bend, Oregon 97701
(541) 480-6257 (866) 591-1513 Fax

Appendix B

Production Estimate for Juniper Ridge Phase II

BLACK ROCK
CONSULTING

December 10, 2012

Mr. Steve Johnson, Manager
Central Oregon Irrigation District
1055 SW Lake Ct.
Redmond, OR 97756

SUBJECT: PRODUCTION ESTIMATE FOR JUNIPER RIDGE PHASE II

Dear Mr. Johnson:

Per your request, I have evaluated the increased production of the Juniper Ridge Hydroelectric Power Project given the addition of the Juniper Ridge Phase II improvements, lengthening the project to approximately 17,800-FT in total and increasing total gross head to approximately 159-FT. Attached are actual production records for Juniper Ridge Phase I for 2011 and 2012. 2012 has been adjusted with estimated production for October through December. These actual productions were averaged and used to adjust the 2009 production estimates for Juniper Ridge Phase II as indicated on the second attached spreadsheet.

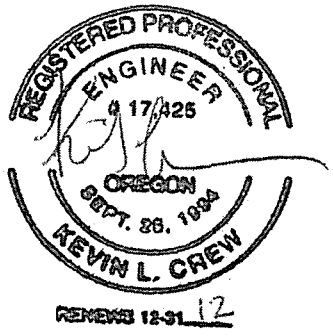
The resulting estimated production for the added Juniper Ridge Phase II increment is 3,727,545-kWh/yr based upon two years of averaged Juniper Ridge Phase I project operation.

Should you have any questions on this matter, please call me.

Sincerely,

BLACK ROCK CONSULTING

Kevin L. Crew, P.E.
Principal



20380 Halfway Road Suite #1
Bend, Oregon 97701
(541) 480-6257 (866) 591-1513 Fax

Juniper Ridge 2012 Power Production & Energy Payments

Month	Monthly kW-hrs	Yr to Date kW-hrs	Average kWs per Month YTD	Average kWs Yr to date	On-Peak kW-hrs	Off-Peak kW-hrs	On-Peak Rate ($)	Off-Peak Rate ($)	On-Peak Payment	Off-Peak Payment	Total Payment
January	65,280	65,280	88	7	48,586	16,694	$ 0.0768	$ 0.0586	$ 3,731.40	$ 978.27	$ 4,709.67
February	96,227	161,507	143	18	63,001	33,226	$ 0.0768	$ 0.0586	$ 4,838.48	$ 1,947.04	$ 6,785.52
March	98,421	259,928	132	30	64,629	33,792	$ 0.0768	$ 0.0586	$ 4,963.51	$ 1,980.21	$ 6,943.72
April	858,146	1,118,074	1,192	128	480,126	378,020	$ 0.0768	$ 0.0586	$ 36,873.68	$ 22,151.97	$ 59,025.65
May	2,280,660	3,398,734	3,065	388	1,270,140	1,010,520	$ 0.0768	$ 0.0586	$ 97,546.75	$ 59,216.47	$ 156,763.22
June	2,260,399	5,659,133	3,139	646	1,291,706	968,678	$ 0.0768	$ 0.0586	$ 99,203.02	$ 56,764.53	$ 155,967.55
July	2,450,865	8,109,998	3,294	926	1,325,489	1,125,056	$ 0.0768	$ 0.0586	$ 101,797.56	$ 65,928.28	$ 167,725.84
August	2,503,366	10,613,364	3,365	1,212	1,456,785	1,046,581	$ 0.0768	$ 0.0586	$ 111,881.09	$ 61,329.65	$ 173,210.73
September	2,208,302	12,821,666	3,067	1,464	1,174,993	1,033,309	$ 0.0768	$ 0.0586	$ 90,239.46	$ 60,551.91	$ 150,791.37
October	803,074	13,624,740	1,079	1,555	-	-	$ 0.0768	$ 0.0586	$ -	$ -	$ -
November	63,351	13,688,091	88	1,563	-	-	$ 0.0768	$ 0.0586	$ -	$ -	$ -
December	41,026	13,729,117	55	1,567	-	-	$ 0.0768	$ 0.0586	$ -	$ -	$ -
Totals		13,729,117	1,293	1,212	7,175,455	5,645,876			$ 551,074.94	$ 330,848.33	$ 881,923.28
	vs 2011 YTD	12,558,811			52.3%	41.1%	$ 0.0642				$ 803,362.93
		1,170,306			7,549,471	5,916,791					$ 78,560.34
					$ 579,799	$ 346,724	$ 926,523				

Juniper Ridge 2011 Power Production & Energy Payments

Month	Monthly kW-hrs	Yr to Date kW-hrs	Average kWs per Month	Average kWs Yr to date	On-Peak kW-hrs	Off-Peak kW-hrs	On-Peak Rate ($)	Off-Peak Rate ($)	On-Peak Payment	Off-Peak Payment	Total Payment
January	-	-	-	-	-	-	$ 0.0716	$ 0.0542	$ -	$ -	$ -
February	36,573	36,573	54	4	27,512	9,061	$ 0.0716	$ 0.0542	$ 1,969.86	$ 491.11	$ 2,460.97
March	83,965	120,538	113	14	50,496	33,469	$ 0.0716	$ 0.0542	$ 3,615.51	$ 1,814.02	$ 5,429.53
April	805,561	926,099	1,119	106	485,849	319,712	$ 0.0716	$ 0.0542	$ 34,786.79	$ 17,328.39	$ 52,115.18
May	2,200,712	3,126,811	2,958	357	1,186,144	1,014,568	$ 0.0716	$ 0.0542	$ 84,927.91	$ 54,989.59	$ 139,917.50
June	2,291,950	5,418,761	3,183	619	1,323,580	968,370	$ 0.0716	$ 0.0542	$ 94,768.33	$ 52,485.65	$ 147,253.98
July	2,439,029	7,857,790	3,278	897	1,312,213	1,126,816	$ 0.0716	$ 0.0542	$ 93,954.45	$ 61,073.43	$ 155,027.88
August	2,474,726	10,332,516	3,326	1,180	1,434,481	1,040,245	$ 0.0716	$ 0.0542	$ 102,708.84	$ 56,381.28	$ 159,090.12
September	2,226,295	12,558,811	3,092	1,434	1,230,034	996,261	$ 0.0716	$ 0.0542	$ 88,070.43	$ 53,997.35	$ 142,067.78
October	803,074	13,361,885	1,079	1,525	429,211	373,863	$ 0.0716	$ 0.0542	$ 30,731.51	$ 20,263.37	$ 50,994.88
November	63,351	13,425,236	88	1,533	44,587	18,764	$ 0.0716	$ 0.0542	$ 3,192.43	$ 1,017.01	$ 4,209.44
December	41,026	13,466,262	55	1,537	25,364	15,662	$ 0.0716	$ 0.0542	$ 1,816.06	$ 848.88	$ 2,664.94
Totals		13,466,262	1,529	1,180	7,549,471	5,916,791			$ 540,542.12	$ 320,690.07	$ 861,232.20
					56.1%	43.9%					

Juniper Ridge 2010 Power Production & Energy Payments

Month	Monthly kW-hrs	Yr to Date kW-hrs	Average kWs per Month	Average kWs Yr to date	On-Peak kW-hrs	Off-Peak kW-hrs	On-Peak Rate ($)	Off-Peak Rate ($)	On-Peak Payment	Off-Peak Payment	Total Payment
September	43,945	43,945	61	5	43,945	-	$ 0.03249	$ 0.02489	$ 1,427.77	$ -	$ 1,427.77
October	490,876	534,821	660	61	296,897	193,979	$ 0.06984	$ 0.05590	$ 20,734.34	$ 10,843.43	$ 31,577.77
November	10,639	545,460	355	62	6,954	3,685	$ 0.07210	$ 0.05590	$ 501.38	$ 205.99	$ 707.37
December	-	545,460	-	62	-	-	$ 0.07210	$ 0.05590	$ -	$ -	$ -
			-								
Totals		545,460	269	62	347,796	197,664			$ 22,663.50	$ 11,049.42	$ 33,712.91
					63.8%	36.2%					

ESTIMATED JUINIPER RIDGE HYDROELECTRIC POWER PROJECT OUTPUT
2009 INDEX TEST RESULTS - ADDED JUNIPER RIDGE HYDRO PHASE II PROJECT

Row No.	Days	Discharge	Generator Out put As Bid	Generator Out put 09292009	Generator Output JRII	Net Head Loss JR II	Net Head JRII	
		cfs	kW	kW	kW	FT		c=120
1	15	200	1,223	1,459	1,951	7	152.5	Minor=2'
2	5	225	1,505	1,726	2,274	8	151.5	c=120
3	5	250	1,800	1,990	2,588	9	150.1	Total Length
4	7	275	2,074	2,255	2,902	11	148.5	17,800'
5	5	300	2,340	2,518	3,221	12	147.2	
6	16	325	2,602	2,762	3,525	14	145.5	3463
7	17	350	2,782	3,008	3,815	16	143.8	3303.5
8	21	375	3,262	3,232	4,089	18	141.9	159.5
9	42	400	3,349	3,425	4,349	20	140	
10	53	425	3,605	3,609	4,579	22	137.9	
11	3	450	3,652	3,755	4,845	24	135.7	
12	0	475	4,028	3,870			159.5	
13	0	500		3,939				
14	189			13,771,309	17,546,448	3,775,139		

2011 ACTUAL POWER PRODUCTION JR PH I =	13,466,262	
2012 ACTUAL POWER PRODUCTION JR PH I=	13,729,117	(Assumed Production Oct-Dec)
AVERAGE=	13,597,690	
REVISED ESTIMATE OF JR II PRODUCTION =	**3,727,545**	(Prorated Decreased Estimate Based upon 2011/2012 Actual v. 2009 Estimated)

Appendix C

Report on Updated Costs and Schedule, & Reductions in Power Cost

REPORT ON UPDATED COSTS & SCHEDULE, & REDUCTIONS IN POWER COSTS

Including

QUANTIFIABLE WATER SAVINGS & INCREASED ENERGY EFFICIENCY

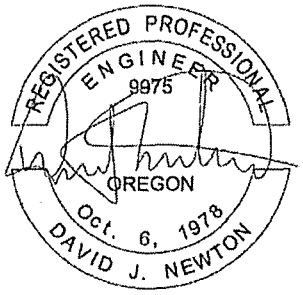
For

PROPOSED 4.9-MILE SIDEWALL LINING PROJECT

North Unit Irrigation District Main Canal

Deschutes County, Oregon

February 16, 2011



EXPIRES: 12/31/12

Prepared for:

Deschutes River Conservancy
700 NW Hill Street
Bend, Oregon 97701

Prepared by:

Newton Consultants, Inc.
P.O. Box 1728
Redmond, Oregon 97756

Project No. 960-232

REPORT ON UPDATED COSTS, & SCHEDULE, & REDUCTIONS IN POWER COSTS

Including

QUANTIFIABLE WATER SAVINGS & INCREASED ENERGY EFFICIENCY

For

PROPOSED 4.9-MILE SIDEWALL LINING PROJECT

North Unit Irrigation District Main Canal

Deschutes County, Oregon

February 16, 2011

PROJECT DESCRIPTION

The North Unit Irrigation District is a Bureau of Reclamation Project constructed in the mid-1940's to supply irrigation water to approximately 59,000 acres of cropland near Madras, Oregon. Most of the District's water supply is diverted by gravity from the Deschutes River at Bend, into the District's main canal. The main canal conveys water from the Bend diversion to farming areas north of Madras, over a total distance of about 65 miles. In addition, water for approximately 8,800 acres of cropland is pumped from the Crooked River.

The main canal was constructed by excavation into volcanic lava flows and ash deposits. In some reaches, canal construction included earth embankments. The canal is unlined, except for the recently lined sections described below. The volcanic materials are fractured and broken, resulting in high seepage losses. These high losses resulted in completion of two initial phases of canal lining.

Previous Lining Construction

At the present time, the bottom of the main canal is lined with roller compacted concrete (RCC) between canal mile 0.5 and 12.3. The sidewalls of the main canal are lined with shotcrete from mile 0.5 to mile 7.4. The bottom lining was completed in April 1997. The shotcrete sidewall lining was completed in April 1999.

The completed lining projects reduced seepage losses in the initial 11.8 mile canal reach by approximately 22,800 acre-feet per year (HDR Engineering, "Technical Memorandum, North Unit Irrigation District Main Canal Lining Feasibility Study", January 2006). Additional studies by HDR Engineering and more recently by a Technical Committee organized by the Deschutes River Conservancy indicate that an

additional 21,000 acre-feet of annual seepage losses still occur in the main canal reach from mile 0.5 to mile 25.75 where the canal crosses the Crooked River by aqueduct. Much of this additional seepage loss occurs in the initial reach of the canal, including sections within the previous lined reach.

Based on the previous lining results and additional seepage loss studies, the total losses in the 26-mile canal reach previous to any lining were on the order of 43,800 acre-feet per year. The average total annual volume of water conveyed through the main canal during recent years was found by the Technical Committee to be 162,000 acre-feet. These data indicate that seepage losses have been about 25 percent of the total canal flows in the initial 26-mile section of the main canal. Additional information on seepage losses and how they were determined is presented in the section "QUANTIFIABLE WATER SAVINGS" below.

Proposed Project

The proposed Project limits are confined to the inside the reach of main canal that was lined in 1996-97 and 1998-99. The Project limits within a canal reach of previously constructed liner suggest that a basis exists for an expedient NEPA and environmental compliance process for the proposed Project. In this regard, the HDR Technical Memorandum referenced above states "Areas immediately adjacent to the canal were checked for wetlands and waterways. There were none identified as indicated in the Wetland Reconnaissance report".

The proposed Project consists of lining the sidewalls of the North Unit Irrigation District's main canal between mile 7.4 and mile 12.3. As described above, the bottom of the canal was lined with roller compacted concrete during previous lining construction between mile 0.5 and 12.3. The proposed Project intends to line the sidewalls in the 4.9-mile long reach that was excluded during the previous lining work.

The proposed sidewall lining will be constructed with fiber-reinforced shotcrete, similar to shotcrete applications made on canal sidewall sections of the main canal during earlier lining work.

The existing sidewalls of the canal in the proposed Project section are sloped at approximately 2 horizontal to 1 vertical in most areas. Slopes in some local areas are steeper, approaching 1 horizontal to 1 vertical. The sidewall conditions include fractured basalt bedrock on the entire slope, shotrock boulder and large cobble-size materials on the entire slope, or bedrock and shotrock materials with earth embankment on the upper parts of the slope.

Previous sidewall lining included removal of existing materials, crushing of the materials, and replacing the materials on the sidewall. A layer of drainage material consisting of crushed rock was then placed on the reconstructed sidewall slope. This process resulted

in a relatively uniform slope and surface condition upon which at least 3 inches of shotcrete were applied.

QUANTIFIABLE WATER SAVINGS

Water Savings

Water savings resulting in a direct benefit of proposed project are quantified at approximately 7,880 acre-feet per year. This amount of water savings was determined from results of seepage loss analyses by HDR Engineering following previous lining installations in same canal reach of the proposed project and the most recent (2010) detailed analysis by a Technical Committee consisting of Newton Consultants, Inc. (Newton), Oregon Water Resources Department (OWRD) and Bob Main (retired OWRD region manager and active water resources consultant).

Previous Lining Installations

Lining was installed in the Main Canal between mile 0.5 and mile 12.3 in 1996-97 and 1998-99. The bottom of the Main Canal was lined with roller-compacted concrete from mile 0.5 to mile 12.3. The sidewalls of the Main Canal were lined with shotcrete from mile 0.5 to mile 7.4, leaving 4.9 miles of unlined sidewall proposed for lining under this Project.

HDR Seepage Loss Analysis

Reductions in seepage losses by the installed linings were measured by HDR Engineering during the 1999 irrigation season. Flow measurements were made on 3 occasions during the irrigation season. Measurement data were then extrapolated over the irrigation season using flow data from the Oregon Water Resources Department (OWRD) gage at mile 0.5 and the gage at mile 25.75 to arrive at a total annual loss of 18,410 acre-feet between these two gages. Further analysis utilizing the measurement data provided seepage loss estimates for lined sections of the main canal between mile 0.5 and 12.3. Although significant reduction in seepage resulted from the completed lining work, some seepage continues within the lined canal reach.

The analyses show that 1,872 acre-feet (10.2 percent of the total losses) occur in the lined canal reach between mile 0.5 and 7.4. This reach includes bottom and sidewall lining. The analyses also show that 13,224 acre-feet (71.8 percent of the total losses) occur in the lined canal reach between miles 0.5 to 12.3. This reach includes the 4.9-mile section with no sidewall lining. Seepage losses were estimated for the 4.9-mile project section by the Technical Committee.

Technical Committee Seepage Loss & Direct Benefit Analysis

The Technical Committee analysis of seepage losses conducted in 2010 was much more comprehensive and detailed than previous analyses. This analysis was based on canal flow data recorded for the years 2000, 2002 through 2007 and 2009 at the two existing flow gages referenced above. Flow data for these gages are available for each day of each month during the irrigation season between April and October. Detailed analysis of this data was conducted to calculate the average annual supply of water supplied to NUID through the main canal and to calculate seepage losses in cubic feet per second based on differences in flow at the two gages.

The average annual supply of water supplied to NUID through the main canal for the above periods of record based on this analysis is 162,000 acre-feet. The mean annual seepage loss in the canal reach between gages at mile 0.5 and 25.75 is estimated at 20,900 acre-feet. The median annual seepage loss for this same reach is 21,400 acre-feet. These losses were used in estimating the annual seepage loss of 7,880 acre-feet for the proposed sidewall lining between canal miles 7.4 and 12.3.

The average annual seepage loss of 7,880 acre-feet was calculated on the basis of the total losses for the entire canal reach between the flow gages at mile 0.5 and at mile 25.75, and the proportionate percentages of loss estimated in the lined sections of the canal between mile 0.5 and 12.3. Considering the detailed analysis of daily flow data for the years 2000, 2002 through 2007, and 2009, the total average annual seepage loss between the two gages was taken at 21,000 acre-feet. The seepage loss estimates by HDR for the lined sections of the canal and their percentage of the total estimated loss between the gages were then applied to the total annual loss of 21,000 estimated by the Technical Committee. This calculation is outlined below:

Seepage loss in lined section; mile 0.5 to 7.4: 10.2% X 21,000 = 2,142 AF/yr

Seepage loss in lined section; mile 0.5 to 12.3: 71.8% X 21,000 = 15,078 AF/yr

The next step was to isolate seepage losses in the canal section with the bottom lining and no sidewall lining between canal miles 7.4 to 12.3. The annual loss of 15,078 acre-feet calculated above is within the section between miles 0.5 and 12.3. The total annual loss between canal miles 7.4 and 12.3 is 12,936 acre-feet (15,078 af – 2,142 af).

The annual loss of 12,936 acre-feet in the project canal section is lost through the bottom and sidewalls of the canal. The canal bottom in this section is lined with RCC. The sidewalls are unlined. The next step is to calculate the amount of the 12,936 loss in project section that leaks through the canal sidewalls.

Calculation of Water Saved and Direct Project Benefit

Previous HDR analysis indicates that before canal lining, 43 percent of canal losses were through the canal bottom and 57 percent of the losses were through the canal sides. These percentages suggest that annual losses through the unlined canal sides are approximately 11,256 acre-feet. Lining the sidewalls with shotcrete will reduce this loss. Liner effectiveness in seepage reduction for concrete is estimated at 70 percent based on Reclamation liner feasibility studies in the Deschutes Basin. This indicates that approximately 30 percent of the water conveyed through this section of the canal after the sides are lined could leak. Therefore, it follows that 70 percent of the existing estimated seepage losses will be eliminated by the lining. On this basis, the direct benefit of the proposed project is 70% X 11,256 acre-feet = 7,880 acre-feet of reduced seepage loss.

Calculation of Percent of Total Water Supply to be Conserved

The total annual average volume of water supplied to the NUID through the main canal over the periods of record 2000, 2002 to 2007, and 2009 is 162,000 acre-feet. Based on the seepage reduction of 7,880 acre-feet, 4.9 percent of the total NUID water supply will be conserved by the proposed project.

PROJECT COST ESTIMATE

Estimated Cost and Basis

The assembled cost of the Project for surveying, engineering and construction has been estimated to be approximately $3,684,797.31. This Project estimate is based on 2011 costs and rates for survey, engineering and contractor professionals familiar with Central Oregon and the NUID main canal for the Project reach. These costs were assembled with the intent for Project implementation to begin approximately March of 2011 with final Project construction and completion by April 2012.

The Project cost estimates were developed in connection with review of previous NUID main canal lining from mile 0.5 to mile 12.3 documented in published U.S. Bureau of Reclamation reports and technical memorandums released by HDR, Inc. (HDR). The HDR memorandums provided summaries of likely design conditions that were helpful to provide potential design considerations for formulation of current 2011 Project cost estimates and will likely aid in reducing the overall cost of the proposed Project canal lining.

During research of previous NUID main canal lining activities, the former shotcrete canal lining contractor, Johnson Western Gunite Company (JWDC), was contacted to provide current cost estimates for the Project portion of the canal. This construction estimate from JWDC provided a basis to establish the reasonableness of Project construction and allow for Project benefit comparisons in the grant process. The cost estimates for the

survey and engineering is included in the following Table 1, with Table 2 presenting the estimated cost of construction.

Table 1. The following Table 1 presents the cost estimates for Project survey, engineering and construction management for project completion.

Budget Item Description	Computation		Recipient Funding	Reclamation Funding	Total Cost
	$/Hour	Quantity			
CONTRACTUAL/CONTRACTOR					
SURVEYOR					
Pre-Design Survey					
Field Delineate Survey Sites/Features	$145.00	16			$2,320.00
Survey Crew	$155.00	40			$6,200.00
Mapping	$110.00	16			$1,760.00
				Sub-Total	$10,280.00
Construction Phase Services					
Construction Coordination	$145.00	8			$1,160.00
Construction Staking Calculations	$110.00	16			$1,760.00
Construction Staking	$150.00	36			$5,400.00
				Sub-Total	$8,320.00
Record Drawings					
Field Crew	$150.00	36			$5,400.00
Mapping	$110.00	16			$1,760.00
				Sub-Total	$7,160.00
Reimbursable Expenses					
Mileage, Stakes, Lathe, Paper, etc.	$1,000.00	1			**$1,000.00**
				TOTAL	**$26,760.00**
ENGINEER					
Engineering Contract					
Principal Engineer/Geologist	$185.00	12			$2,220.00
Administrative Assistant	$57.00	4			$228.00
				Sub-Total	$2,448.00
Pre-Design Survey					
Senior Staff Engineer/Geologist	$100.00	16			$1,600.00
Senior Engineer/Geologist	$150.00	4			$600.00
				Sub-Total	$2,200.00
Preliminary Design					
Principal Engineer/Geologist	$185.00	15			$2,775.00
Senior Engineer/Geologist	$150.00	20			$3,000.00
Senior Staff Engineer/Geologist	$100.00	45			$4,500.00
Senior AutoCAD Technician	$88.00	60			$5,280.00
Engineering/Geological Technical	$80.00	20			$1,600.00
Administrative Assistant	$57.00	20			$1,140.00
				Sub-Total	$18,295.00

Final Design Drawings & Specifications					
Principal Engineer/Geologist	$185.00	10			$1,850.00
Senior Engineer/Geologist	$150.00	15			$2,250.00
Senior Staff Engineer/Geologist	$100.00	20			$2,000.00
Senior AutoCAD Technician	$88.00	80			$7,040.00
Engineering/Geological Technical	$80.00	10			$800.00
Administrative Assistant	$57.00	15			$855.00
				Sub-Total	$14,795.00
Construction Phase Services					
Permitting					
Principal Engineer/Geologist	$185.00	10			$1,850.00
Senior Engineer/Geologist	$150.00	8			$1,200.00
Senior Staff Engineer/Geologist	$100.00	25			$2,500.00
Administrative Assistant	$57.00	10			$570.00
				Sub-Total	$6,120.00
Bid Documents					
Principal Engineer/Geologist	$185.00	5			$925.00
Senior Engineer/Geologist	$150.00	15			$2,250.00
Senior Staff Engineer/Geologist	$100.00	20			$2,000.00
Administrative Assistant	$57.00	15			$855.00
				Sub-Total	$6,030.00
Bid/Pre-Construction Assistance					
Principal Engineer/Geologist	$185.00	5			$925.00
Senior Engineer/Geologist	$150.00	5			$750.00
Senior Staff Engineer/Geologist	$100.00	16			$1,600.00
Administrative Assistant	$57.00	5			$285.00
				Sub-Total	$3,560.00
Construction Oversight/Inspections					
Principal Engineer/Geologist	$185.00	10			$1,850.00
Senior Engineer/Geologist	$150.00	15			$2,250.00
Senior Staff Engineer/Geologist	$100.00	60			$6,000.00
Senior AutoCAD Technician	$88.00	30			$2,640.00
Engineering/Geologic Technician	$80.00	45			$3,600.00
Administrative Assistant	$57.00	15			$855.00
				Sub-Total	$17,195.00
Shotcrete Compression Testing					
Senior Staff Engineer/Geologist	$100.00	2			$200.00
Engineering/Geologic Technician (Lab)	$60.00	45			$2,700.00
Compression Testing (15 tests)	$15.00	15			$225.00
				Sub-Total	$3,125.00

Construction Management Phase					
Document Quantities Relative to Estimates					
Principal Engineer/Geologist	$185.00	9			$1,665.00
Senior Staff Engineer/Geologist	$100.00	18			$1,800.00
Administrative Assistant	$57.00	4.5			$256.50
				Sub-Total	$3,721.50
Project Progress Relative to Schedule					
Principal Engineer/Geologist	$185.00	9			$1,665.00
Senior Staff Engineer/Geologist	$100.00	18			$1,800.00
Administrative Assistant	$57.00	4.5			$256.50
				Sub-Total	$3,721.50
Project Progress and Potential Modifications					
Principal Engineer/Geologist	$185.00	9			$1,665.00
Senior Staff Engineer/Geologist	$100.00	27			$2,700.00
Administrative Assistant	$57.00	9			$513.00
				Sub-Total	$4,878.00
Review Changes Orders & Recommendations					
Principal Engineer/Geologist	$185.00	5			$925.00
Senior Staff Engineer/Geologist	$100.00	7.5			$750.00
Administrative Assistant	$57.00	5			$285.00
				Sub-Total	$1,960.00
Review/Approve/Dispute Contractor Invoices					
Principal Engineer/Geologist	$185.00	5			$925.00
Senior Staff Engineer/Geologist	$100.00	7.5			$750.00
Administrative Assistant	$57.00	2			$114.00
				Sub-Total	$1,789.00
Conduct Bi-weekly Contractor/Client Meetings					
Principal Engineer/Geologist	$185.00	27			$4,995.00
Senior Staff Engineer/Geologist	$100.00	27			$2,700.00
Administrative Assistant	$57.00	18			$1,026.00
				Sub-Total	$8,721.00
Construction Close Out, Punch List.					
Principal Engineer/Geologist	$185.00	8			$1,480.00
Senior Staff Engineer/Geologist	$100.00	16			$1,600.00
Administrative Assistant	$57.00	4			$228.00
				Sub-Total	$3,308.00

Project Completion Phase					
Record Drawings					
Principal Engineer/Geologist	$185.00	2			$370.00
Senior Engineer/Geologist	$150.00	5			$750.00
Senior Staff Engineer/Geologist	$100.00	10			$1,000.00
Senior AutoCAD Technician	$88.00	30			$2,640.00
Administrative Assistant	$57.00	4			$228.00
				Sub-Total	$4,618.00
Construction Oversight Report					
Principal Engineer/Geologist	$185.00	2			$370.00
Senior Engineer/Geologist	$150.00	4			$600.00
Senior Staff Engineer/Geologist	$100.00	12			$1,200.00
Senior AutoCAD Technician	$88.00	8			$704.00
Administrative Assistant	$57.00	6			$342.00
				Sub-Total	$3,216.00
Reimbursable Expenses					
Mileage, Plotting, Materials, etc.	$4,200.00	1			**$4,200.00**
				TOTAL	**$113,901.00**

Table 2. The following Table 2 presents the estimated cost for construction of the 4.9 mile section of NUID main canal sideling project, estimate provided by JWGC.

NORTH UNIT IRRIGATION DISTRICT							
Shotcrete Side Slope Budget Breakdown 2011							
Budget Description	**Amt**	**Unit**	**Cost**	**Sub-Total**	**Subsistence**	**Fuel**	**Total Costs**
Salaries and wages (includes benefits)			**10 hr day**				
Superintendent	120	Day	$870.00	$ 104,400.00	$ 7,200.00		$ 111,600.00
Shotcrete Foreman	90	Day	$800.00	$ 72,000.00	$ 5,400.00		$ 77,400.00
Gunite Laborer	630	Day	$780.00	$ 491,400.00	$ 37,800.00		$ 529,200.00
Pump Operator	90	Day	$840.00	$ 75,600.00	$ 5,400.00		$ 81,000.00
Equipment Operators Exc.	120	Day	$840.00	$ 100,800.00	$ 7,200.00		$ 108,000.00
Equipment Operators Watertruck.	90	Day	$840.00	$ 75,600.00	$ 5,400.00		$ 81,000.00
Grade Checker	180	Day	$780.00	$ 140,400.00	$ 10,800.00		$ 151,200.00
Mechanic	90	Day	$850.00	$ 76,500.00	$ 5,400.00		$ 81,900.00
Project Manager	15	Day	$1,800.00	$ 27,000.00	$ 900.00		$ 27,900.00
General Labor - support	180	Day	$780.00	$ 140,400.00	$ 10,800.00		$ 151,200.00
Equipment							
200 Class Excavator	180	Day	$195.00	$ 35,100.00		$14,400.00	$ 49,500.00
320L Excavator	180	Day	$400.00	$ 72,000.00		$14,400.00	$ 86,400.00
Watertruck	90	Day	$120.00	$ 10,800.00		$7,200.00	$ 18,000.00
Shotcrete Rig(pump,aircomp,truck)	90	Day	$1,350.00	$ 121,500.00		$7,200.00	$ 128,700.00
Skiploader	100	Day	$110.00	$ 11,000.00		$8,000.00	$ 19,000.00
Air Compressor	90	Day	$40.00	$ 3,600.00		$1,800.00	$ 5,400.00
Light Tower	180	Day	$25.00	$ 4,500.00		$3,600.00	$ 8,100.00
Pumps	30	Day	$25.00	$ 757.50		$606.00	$ 1,363.50
Backhoe 410D	60	Day	$125.00	$ 7,500.00		$4,800.00	$ 12,300.00
Utility Truck w/tools	180	Day	$175.00	$ 31,500.00		$14,400.00	$ 45,900.00

Transport	12	Day	$1,400.00	$ 16,800.00		$5,760.00	$ 22,560.00
Gator	180	Day	$25.00	$ 4,500.00		$3,600.00	$ 8,100.00
Pickups	270	Day	$95.00	$ 25,650.00		$21,600.00	$ 47,250.00
Construction Materials/Supplies		**Quantity**					
Shotcrete	8515	CY	$170.00	$1,447,550.00			$ 1,447,550.00
Crusher (Subcontractor)	38000	ton	$3.50	$ 133,000.00			$ 133,000.00
Washout - Rebound Removal	10	ea	$ 500.00				$ 500.00
Site Sanitary units	5	Mo	$ 1,200.00	$ 6,000.00			$ 6,000.00
Storage Containers	5	Mo	$ 375.00	$ 1,875.00			$ 1,875.00
Cure	575000	SF	$ 0.06	$ 34,500.00			$ 34,500.00
Cold Weather Protection - Blanket	191667	SF	$ 0.30	$ 57,500.00			$ 57,500.00
Engineering/Design & Project Support				-			
Mob/Demob	1	LS	$40,000.00	$ 40,000.00			$ 40,000.00
					Subsistence	Fuel	
Sub-Total Project Costs					**$ 96,300.00**	**$107,366.00**	**$ 3,573,898.50**
Contingency - none							$ -
Total Job Cost							**$ 3,573,898.50**
					Cost/SF		$ 6.22

Reasonableness of Cost

The estimated Project cost is $3,684,797.31 to shotcrete line the unlined sides of the NUID main canal from mile 7.4 to mile 12.3. The lining of the sides of the NUID main canal will save a calculated volume of 7,880 acre-feet of irrigation water annually from seepage losses. These seepage losses combined with the potential for electrical power savings in the range of $64,290 to $93,564 annually at 2010 power rates (additional savings would be approximately 8.8% greater with 2011 power and demand rates).

The expected life of the Project is estimated by the Bureau at 40 to 60 years, assuming and average design life of 50 years. The average design life of 50 years has been used to calculate the Project reasonableness below in Table 3:

Table 3. Project Reasonableness Calculation.

Cost Item	Cost in 2011 dollars
Survey	$26,760.00
Engineering	$84,802.00
Construction	$3,573,235.31
Total Project Cost	**$3,684,797.31**
Acre-Feet Conserved	**7,880**
Improvement Life (avg. years)	**50**
Total Project Cost/(Acre-Feet conserved x Improvement Life) = Reasonableness	
Reasonableness	**9.35**

READINESS TO PROCEED & PROJECT SCHEDULE

Readiness Criteria

The proposed Project is to be constructed within the limits of previously constructed canal lining projects. NEPA and environmental compliance requirements were addressed for these previous lining projects based on review of the above-referenced Technical Memorandum by HDR Engineering. Although the NEPA and environmental compliance requirements must be satisfied for the proposed Project, it appears that some expediency is reasonable in meeting these requirements based on the Project location inside the limits of previous construction and the previous NEPA and environment compliance considerations reflected in the Technical Memorandum.

Regulatory Elements of Project Implementation

No delays are expected from environmental compliance. The proposed Project is to be constructed within the limits of previous canal lining projects. NEPA and environmental compliance requirements were addressed for these previous lining projects based on review of the above-referenced Technical Memorandum by HDR Engineering. Although the NEPA and environmental compliance requirements must be satisfied for the proposed Project, it appears that some expediency is reasonable in meeting these requirements based on the Project location inside the limits of previous construction and the previous NEPA and environment compliance considerations reflected in the Technical Memorandum. Based on these conditions, no delays are expected to result from environmental compliance.

Project Schedule

The attached (in Appendix A) project schedule presents the key items of work and the estimated time frames for their start and completion. The proposed schedule is reasonable based on the *Readiness Criteria* summarized below.

Available & Proven Design Criteria

The Bureau of Reclamation conducted liner feasibility studies on different irrigation canals in Central Oregon in the 1990's and prepared reports on its findings relative to effectiveness and cost. These studies included consideration of roller compacted concrete and shotcrete liners, which were used in lining the sections of the North Unit Irrigation District main canal and reducing seepage losses between mile 0.5 and mile 12.3.

Previous bottom lining with RCC and sidewall lining with shotcrete in the initial sections of the main canal reduced annual seepage losses by approximately 22,800 acre-feet. The sidewall lining consisted of fiber-reinforced shotcrete, similar to that proposed for the Project.

Performance of the shotcrete sidewall lining in reducing seepage is good in terms of maintenance and effectiveness, which warrants continued use of a proven engineering design and construction process. Design and construction information is available from the previous lining projects within the same canal reaches for the proposed sidewall lining project. These factors will result in expedient development of construction drawings and specifications, and permitting, for timely Project development and implementation according to the schedule in Appendix A.

Project Implementation

Initial survey work will be completed during March and early April 2011 and will provide canal cross-sections at key sections of the Project for preliminary and final

design work. This work must be completed in the dry canal, previous to the irrigation season, beginning in early April. Costs for this work will be paid by others.

Design, construction and performance information exist for previous sidewall lining work completed in the same reaches of the main canal. Preliminary design work will compile this information into a basis for design, construction drawings and specifications to avoid regenerating design criteria and to be expeditious in project implementation.

Preliminary design products will be distributed for review and approval by the North Unit Irrigation District, Bureau of Reclamation and Deschutes River Conservancy. The preliminary design drawings and specifications will include their descriptive basis in the proven success in design, construction and performance of the previously constructed sidewall liners in the canal reaches containing the proposed Project.

Final design, construction drawings and specifications will be produced based on review results for the preliminary design products. These documents and bid documents will be completed to allow the bid process, award and start of construction no later than November 15, 2011.

Previous sidewall lining work included removal of existing sidewall materials (shotrock, rubble, earth, etc.), crushing of the removed material, and replacement of the crushed material to provide a uniform shape for the sidewall to receive a drainage blanket and overlying shotcrete. This approach provides control measures through a defined subgrade for better control of shotcrete quantities and for improving shotcrete performance.

Inspection work will be conducted periodically during the work by engineering company representatives. Inspections will be conducted on a base schedule of twice per week on average to observe the work, including sidewall subgrade preparation, placement of subgrade material to reduce potential for voids, and placement of shotcrete to the recommended minimum thickness. Shotcrete samples will be taken at approximate 500 cubic yard intervals and subjected to compression testing by a certified materials testing laboratory. The purpose of the tests is to determine if the shotcrete strength meets the minimum 28-day compressive strength (the minimum compressive strength for shotcrete in previous sidewall liners in the same reaches of the canal was 4,000 psi).

Survey control will be provided by canal centerline stationing. At completion of construction, record drawings of any changes documented during the work will be prepared. A report on construction inspections and shotcrete testing will also be prepared to document construction relative to the construction drawings and specifications.

PROJECT INCREASE IN ENERGY EFFICIENCY

North Unit Irrigation District (NUID) obtains its water from both the Deschutes River at a gravity diversion near Bend, Oregon, and by pumping from the Crooked River.

The following table (Table 4) represents the total amount of water that NUID diverted from the Deschutes River in the years 2006 through 2010. These total volumes were derived from flow gage data obtain from the Oregon Water Resources Department website (http://apps2.wrd.state.or.us/apps/sw/hydro_near_real_time/display_hydro_graph.aspx?station_nbr=14069000). The data provided by the website are in terms of mean daily flow rate in cubic feet per second (cfs). These data were converted to acre feet per day by multiplying the flow rate in cfs by 1.9835. The daily acre feet data were summed for each year to obtain the total annual volume in acre-feet.

Table 4. Total Annual Flow in Bend Diversion Canal.

Irrigation Season (April 1 thru October)	Total Annual Volume, Acre-Feet	Number of Days of Diversion
2006	156,562	186
2007	192,132	201
2008	189,824	203
2009	177,603	188
2010	168,034	190
2006-2010 Average	**176,831**	**194**

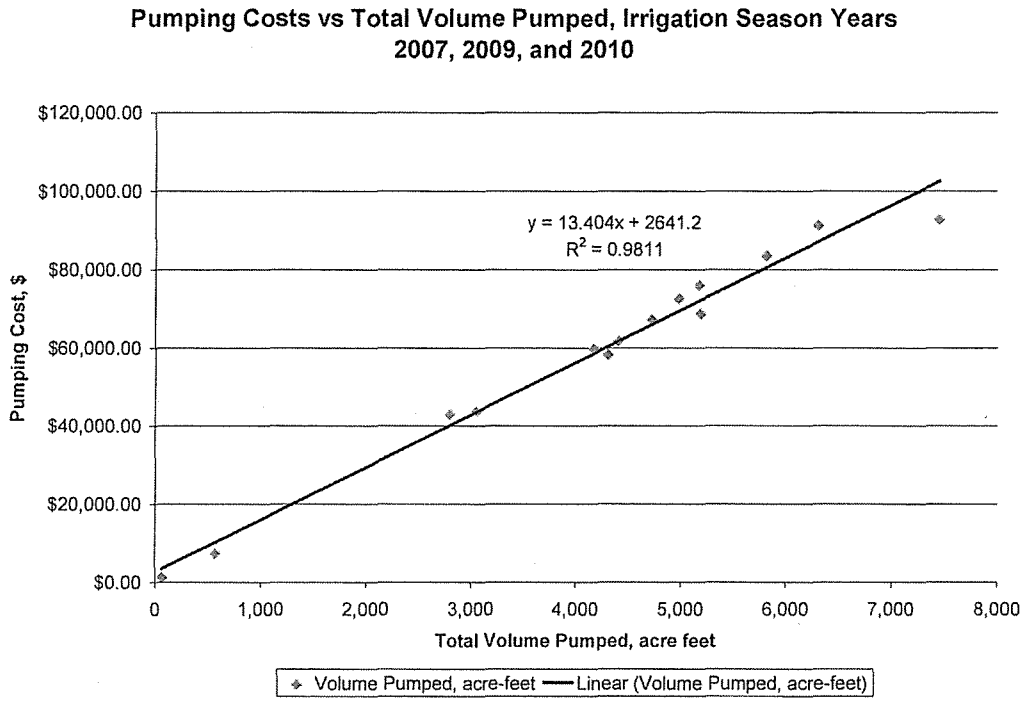
As indicated previously in this document, this canal sidewall lining project will reduce seepage by 7,880 acre feet per year. The average number of days when the canal is operating for the last 5 years is 194 days. Using 194 days and the total seepage of 7,880 acre feet, the average seepage rate is 20.5 cubic feet per second (cfs)

The water obtained from the Crooked River is pumped out of the river using a set of nine (9) pumps. The following table (Table 5) provides a summary of the pumping costs and volumes pumped for 2007, 2009, and 2010 by billing period. These years were selected because they represent a relatively broad range of number of days of pumping. The billing rate for all three years was the same. The bills and the pumping records for these years are in Appendix B and C. Below the table is a graph showing the relationship between pumping costs and the volumes pumped. The equation on the graph is derived from a least squares regression analysis computed by Microsoft EXCEL and represents the best fit relationship between the volume pumped and the associated cost. This

equation will be used to calculate potential cost savings by reduced pumping as a result of the proposed lining project. The R^2 value on the graph indicates how well the data fit the trend line represented by the least squares regression analysis. An R^2 value of 1.0 would be a perfect fit. The R^2 value on the graph of 0.9811 means the equation is a very good fit and the resulting equation should produce very good projections.

Table 5. Monthly Volume of Water Pumped from Crooked River Pump Station and Associated Electrical Costs.

Year	2007		2009		2010	
Total Days of Pumping	118		144		95	
Billing month	Volume Pumped, acre-feet	Amount Billed, $	Volume Pumped, acre-feet	Amount Billed, $	Volume Pumped, acre-feet	Amount Billed, $
June	6,311	$91,361.62	2,800	$43,088.32	572	$7,434.18
July	7,455	$92,808.01	4,310	$58,465.94	5,180	$76,114.87
August	4,176	$59,818.77	3,057	$43,899.02	5,817	$83,571.09
September	5,195	$68,824.65	4,986	$72,657.18	4,729	$67,286.36
October			4,413	$61,952.34	65	$1,387.52
Totals	**23,137**	**$312,813**	**19,566**	**$280,063**	**16,362**	**$235,794**



Although the graph above appears to show that there is an approximate linear relationship between costs and volume pumped, because the actual billings include a demand charge, the actual charges could be different from those projected from the equation stated on the graph.

The proposed lining project will save NUID pumping cost by reducing the amount of water that it needs to pump from the Crooked River. As previous noted above, the lining project will conserve 7,880 acre-feet per year. The amount of reduced pumping is a lesser amount of the total conserved water because the pumps do not operate over the same period of time that the canal operates. The pumping cost savings will be proportional to the ratio of pumping days to the days that the canal operates. The Table 4 above shows the average days per year that the canal operates: 194 days. Table 6 shows cost savings estimates for 2007, 2009, and 2010 by the reduction of pumping as the result of conserving water from this proposed project. These estimated costs are calculated by multiplying the estimated water savings from the liner project (7,880 acre-feet) by the days of pumping (P) for the given year divided by 194 days [7,880 x P/194]. This number is subtracted from the actual volume pumped in the given year. This gives the estimated volume of water (V) that would have been pumped had the liner been operational. This volume of water (V) is inserted into the equation on the graph to determine the estimated cost ($A) had the liner been in. [$A = (13.404 x V) + 2641.2]. The cost savings ($B) is determined by subtract $A from the actual cost for the given year.

Table 6. Estimated Cost Savings as a Result of Proposed Project.

Year (Total Days of Pumping)	Volume Actually Pumped, Acre-Feet	Volume Pumped Had Liner Been Functioning in 2007, Acre-Feet	Estimated Cost in 2007 Had Liner Been Functioning	Estimated Costs Savings in 2007 Had Liner Been Functioning
2007 (118)	23,137	18,344	$248,523	$64,290
2009 (144)	19,566	13,717	$186,499	$93,564
2010 (95)	16,362	12,504	$170,241	$65,553

For the years 2007, 2009, and 2010, the electricity charges were based primarily upon the amount of electricity used and the power demand charge. The cost of the amount of electricity is based upon the number of kilowatt hours consumed during the billing period. This rate for the three years is $0.050160 per kilowatt hour. The power demand is the total amount of electricity being used by a consumer at any one time. Demand varies from hour to hour, day to day and season to season. This usage, which is expressed in kilowatts (not kilowatt-hours), is called the "demand" on the system. Central Electric Cooperative monitors demand over a 15-minute period. The customer is charged for the highest 15-minute average recorded on the demand meter. After Central Electric reads the meter each month, demand is reset to zero and the meter starts over, recording the highest 15-minute average for the next billing period. The demand charge for these three years was $3 per kilowatt.

The rates referenced above will go up for the 2011 irrigation season to $0.0542 per kilowatt hour and $3.50 per kilowatt for the demand charge. Applying these new electricity rates to the amount of electricity billed in June through September, the 2011 costs will be about 8.8% higher assuming the same amount of electricity was used and the demand is the same. Using this same assumption, the savings in 2010 at 2011 rates would have been $71,331.

Relative to energy savings, the following graph shows the relationship between water volume pumped in acre-feet and kilowatt hours of electrical power consumed. The equation on the graph indicates the least squares regression analysis between the volumes pumped and kilowatt hours consumed.

Kilowatt-Hours Used vs Acre-Feet Pumped, Irrigation Seasons 2007, 2009, and 2010 North Unit Irrigation District Crooked River Pump Station

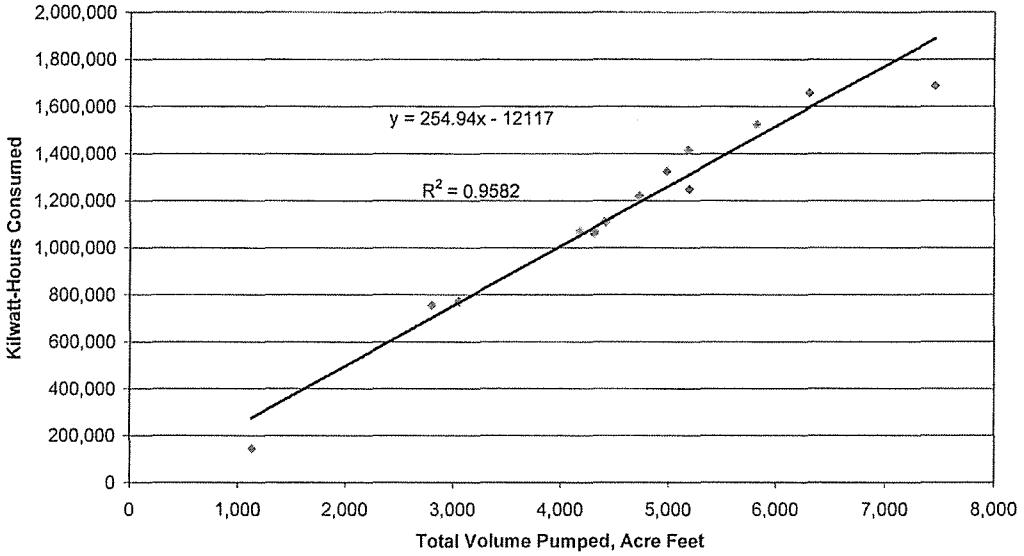


Table 7 computes the estimated reduction of kilowatts hours consumed had the liner been installed for the irrigations season of 2007, 2009, and 2010. The Kilowatt Hours Saved is calculated by subtracting the volume of water that would have been pumped with the liner from the actual volume pumped and inserting the remainder into the equation in the graph as X.

Table 7. Estimated Electricity Savings.

Year (Total Days of Pumping)	Volume Actually Pumped, Acre-Feet	Volume Pumped Had Liner Been Functioning, Acre-Feet	Kilowatts Hours Saved Had Liner Been Functioning
2007 (118)	23137	18344	1,209,808
2009 (144)	19566	13717	1,479,045
2010 (95)	16362	12504	971,636

This analysis demonstrates that the proposed Project will significantly reduce the cost for NUID to pump water from the Crooked River and will significantly increase the energy efficiency of water delivery from the Crooked River source.

The validity of this analysis is founded in reliable data obtained from actual electric power invoices from Central Electric Cooperative (CEC), discussion with CEC representatives in regard to rates, rate changes and demand charges, gage flow data for