OREGON
WATER RESOURCES DEPARTMENT

2019 SOLICITATION

FEASIBILITY STUDY GRANTS

GRANT APPLICATION

APPLICATION DEADLINE: BY 5:00PM ON NOVEMBER 13, 2019

Application must be received by this date and time

Send application electronically to: WRD_DL_feasibilitystudygrants@oregon.gov

Mail application to:

OREGON WATER RESOURCES DEPARTMENT
Attention: Grant Program Coordinator
725 Summer Street NE, Suite A
Salem, OR 97301

APPLICATION SUBMISSION INSTRUCTIONS

1. **When completing your application, use the** Application Instructions available at the OWRD Funding Opportunities, Applications, Forms, and Guidance webpage: https://www.oregon.gov/OWRD/programs/FundingOpportunities/Pages/default.aspx

2. Complete all sections in the spaces provided. An application must be submitted on the attached form provided by the Department. An explanation must accompany the application if any of the information required cannot be provided [OAR 690-600-0020(6)].

3. Please ensure that the Certification portion of Section II is signed with a live signature by the Applicant and, if applicable, the Co-Applicant.

4. Taking part in a Pre-Application Conference prior to applying is ***highly*** recommended. The pre-application conference request form is available on the OWRD Funding Opportunities Forms webpage. To learn more contact the Department.

5. Complete and sign the application checklist.

6. Electronic submission of application is the preferred method. You may scan a copy of the signed signature page and submit with your application if both documents are included in the same email.

7. If application is submitted in hard copy - use 8 ½" x 11" single sided, unstapled pages. Provide any attachments to the application on 8 ½" x 11" single-sided, unstapled pages.

8. Contact the Department at 503.986.0869 or WRD_DL_feasibilitystudygrants@oregon.gov if you have any questions.

FEASIBILITY STUDY GRANT APPLICATION CHECKLIST

Instructions: Use this checklist to ensure that your application is complete. An incomplete application will not be eligible for further review and consideration. This checklist must be completed and signed in order for your application to be considered complete.

SECTION A - Application

I. Study Information
- ☒ Study name and type(s) is complete and correct.
- ☒ The requested grant amount and previous Feasibility Study Grants for the study do not exceed $500,000.
- ☒ The requested grant amount does not exceed 50% of the Total Cost of the Study.

II. Applicant Information
- ☒ All applicant and co-applicant name(s) and contact information is complete and correct.
- ☒ Application is signed by Applicant/Authorized Person.
- ☐ Application is signed by Co-Applicant/Authorized Person *OR* there is no co-applicant.

Note: *If the project is awarded funding the co-applicant will be required to sign and be party to the grant agreement.*

III. Study Location
- ☒ All questions have been addressed.
- ☒ Site plan map is attached.

IV. Feasibility Study Summary
- ☒ A brief (4-5 sentence) summary of the feasibility study and goal is included.

V. Feasibility Study Grant Specifics
- ☒ All questions have been addressed.
- ☒ Study key tasks are identified.

VI. Feasibility Study Budget
- ☒ All key tasks and budget items follow the Department's Budget Procedures and Allowable Costs guidance available on the OWRD Funding Opportunities Forms webpage.
- ☒ All budget information is accurate and complete.
- ☒ Administrative costs do not exceed 10% of total Grant Request.
- ☒ Key tasks listed in budget match those identified in Questions 13 and 14.

VII. Match Funding Information
- ☒ Matching Funds total, at a minimum, 50% of the Total Cost of the Feasibility Study.
- ☒ Match fund letters, indicating pending or secured match, are attached and equal the amounts listed in VI. Feasibility Study Budget.

VIII. Storage-Specific Questions
- ☐ All questions have been addressed *OR* the application is not for a storage project.
- ☐ Minimum Storage Specific Study Requirements are met and are incorporated into the study and key tasks.

SECTION B - Application Attachments

Instructions: Use this checklist to ensure required attachments are included with your application. All attachments to the application must be numbered as well as included in this list. For all attachments ensure documentation meets any criteria identified in the application instructions, Storage-Specific Guidance, and Guidance on Budget Procedures and Allowable Costs. For "other" optional attachments in excess of the three spaces provided, include a supplemental list.

Required Attachments:

☒ Attachment 1 – Site map (Question 3)

☒ Attachment 2 – Signed Landowner Agreement Forms (Question 5) to verify that you have authorized access to the lands on which the study would occur.

☒ Attachment 3 – Documentation of matching funds (Question 19) includes the following:

a) Match documentation for all match fund sources listed in the match fund table.

b) Match fund documentation that clearly identifies the dollar amount and describes the work to be accomplished with the match.

☐ Attachment 4 *(Select Storage Projects Only: if you answered "yes" to any part of Question 19)* – Description of approach to address storage-specific requirements; see the Storage-Specific Study Requirements: Application Guidance for the minimum requirements.

Optional Attachments:

☒ Letters of support (Question 12): Attachment # **4**

☐ List and description of key tasks (Question 13): Attachment #

☐ Secured permits and regulatory approvals needed to implement the project (Question 15): Attachment #

☒ Other: Attachment # **5 additional maps, photos, graphs and tables**

☒ Other: Attachment # **6 copy of 2007 seepage analysis study**

☐ Other: Attachment #

All required items within Section A and B of the application checklist are completed and all identified criteria are addressed to the best of my knowledge.

Signature of Applicant/Authorized Person: Ken Diebel Date: 11/18/19

Print Name: KEN DIEBEL Title: EXEC. DIRECTOR

OREGON WATER RESOURCES DEPARTMENT

FEASIBILITY STUDY GRANTS
2019 GRANT APPLICATION

I. Study Information

Study Name: Drewsey Reclamation Ditch: Can We Pipe it?

Type of Feasibility Study:
- ☒ Water Conservation
- ☐ Reuse
- ☐ Storage (Above-Ground)
- ☐ Storage (Below-Ground)
- ☐ Storage (Other)

Requested Grant Amount (must be no more than 50% of Total Study Cost): $ 24,750

Total Cost of Feasibility Study: $ 57,060

Note: Request(s) may not exceed $500,000 per project.

II. Applicant Information

Applicant Name: Malheur Watershed Council	**Co-Applicant Name:**
Address: 710 SW 5th Ave	Address:
Ontario, OR 97914	
Phone: 541 881-1714	Phone:
Fax:	Fax:
Email: diebelk12@gmail.com	Email:

Principle Contact: Ken Diebel	**Fiscal Officer: Same**
Address: 32707 Old Mill Rd	Address:
Lebanon, OR 97355	
Phone: 541 910-4034	Phone:
Fax:	Fax:
Email: diebelk12@gmail.com	Email:

Certification: I certify that this application is a true and accurate representation of the proposed work for a project feasibility study and that I am authorized to sign as the Applicant or Co-Applicant. By the following signature, the Applicant and Co-Applicant (if applicable) certifies that they are aware of the requirements of an Oregon Water Resources Department grant, have read and agree to all conditions within the sample Feasibility Study Grant Agreement and are prepared to conduct the study if awarded.

Signature of Applicant/Authorized Person: Ken Diebel Date: 11/12/19

Print Name: Ken Diebel Title: Executive Director, Malheur Watershed Council

Signature of Co-Applicant/Authorized Person: _____ Date: _____

Print Name: _____ Title: _____

III. Feasibility Study Summary

1. Please provide a brief, 4-5 sentence summary of the feasibility study. This summary should include a brief description of the goal of the water conservation, reuse, or storage project being studied and the purpose of the study. Please refer to the Feasibility Study Grant Application Instructions for additional information on what to include in your study summary.

Our goal is to determine the feasibility of piping all or part of the Drewsey Reclamation Ditch to stop ditch losses, which in turn would require less water to be diverted from the Malheur River. The water saved would be protected in-stream to benefit aquatic habitat, listed fish species, and water quality. We are applying for funds to hire an engineer to complete a survey, conduct a water-loss analysis, develop: alternatives, cost estimates, water right investigation and a 60% design from the selected alternatives.

IV. Study Location

Instructions: Please answer the following questions about the location of the feasibility study and project being evaluated.

2. Please provide the following information about the study and project location.
   a. Latitude/Longitude (in decimal degrees): 43.816016/ -118.417276
   b. County: Harney
   c. Watershed/Basin (HUC 10 number): Upper Malheur River 17050116

3. Please attach a site plan map showing the following and label as Attachment #1:
   a. Feasibility study area boundaries
   b. Project area (if implemented)
   c. True north arrow
   d. Map title and legend
   e. Latitude and longitude
   f. Property boundaries
   g. Surface water bodies
   h. Sampling locations (if proposed)
   i. Points of Diversion and Place of Use, labeled for each water right (if applicable)

4. Check the box which best describes the properties involved in the proposed Feasibility Study.
   a. ☐This Feasibility Study will not impact or access lands. **See 6 b**
   b. ☒This Feasibility Study will impact or access lands. Complete the table below to identify any properties where access is required for the feasibility study or on which the study would occur.

      At this time, we are not certain of the pipeline route. Thus, we do not know which landowners we will need to contact. Once the potential route is selected, we will contact the affected landowners and obtain written permission to enter their property.

5. Attach a signed Landowner Agreement form for each property listed in Question #4 where access to the property is required or on which the Feasibility Study would occur. Attach Landowner

Agreement form(s) only for those properties involved in the Feasibility Study and label Attachment #2. (Landowner Agreement forms may be found on the Applications, Forms and Guidance webpage.)

a. Where a single landowner entity is the owner of record for multiple properties, one form may list the multiple properties owned by that entity.

b. For *public* lands attach the landowner form or other documented authorization from the federal or state government property owner allowing the feasibility study activities **or** documentation that demonstrates such authorization is being pursued.

6. Check the box which best describes the properties involved in future project Implementation. Identify any lands that would be impacted or accessed during future project implementation. Check all that apply and provide the requested information.

a. ☐The proposed project, if implemented, will only impact or access lands already identified in Question 4 (must have selected box b under question 4).

b. ☒The proposed project, if implemented, will likely impact or access lands during implementation, but those lands likely to be accessed or impacted have not been identified, OR this question is not applicable. If this box (6b) is checked, do not complete the table below.

At this time, we are not certain of the pipeline route. Thus, we do not know which landowners we will need to contact. Once the potential route or areas we need to survey are selected we will contact the affected landowners and obtain written permission to enter their property. Written permission will be obtained prior to conducting the drone survey as well.

c. ☐The proposed project, if implemented, is highly likely to impact or access additional lands during implementation. If this box (6c) is checked, complete the table below to identify any additional properties (those not already identified under question (4)) where access is required for future project implementation. *Add rows as needed. No Landowner Agreement forms are required for lands listed only under this question.*

V. Feasibility Study Specifics

Instructions: Please answer all questions in this section. As applications are expected to result in additional pages to complete this section, you may attach your responses on a separate document as long as you indicate the question numbers in your response.

Study Description, Needs, and Goals

7. Describe the feasibility study goal.

Our goal is to determine the feasibility of piping all or part of the Drewsey Reclamation Ditch. Currently the Ditch Company diverts more water than they use because of an estimated 30 to 50% loss through seepage and evaporation. They can divert up to 90 cfs into the ditch. However, over the course

of the 14-mile-long ditch there is a notable amount of lost water. Projecting the estimated loss to the maximum flow of 90 cfs in the canal, the potential seepage losses could be as high as 22.77 cfs.

Unlike an irrigation district the Cooperative itself does not have a water right. Each individual member has their own right. The priority dates for the members vary from 1881 to 1912. One of the tasks we need to complete before applying for construction funds is to research all water rights affected by the project and determine how an in-stream right would work in practice.

Maintaining the ditch is becoming more difficult. There is the possibility of bank failure, similar to what happened to the Smith Ditch in Baker County. A few years ago, that ditch failed and deposited tons of material in Baker City and into the Powder River. That event created a significant water quality problem adversely affecting fisheries and aquatic habitat. If the Drewsey Ditch were to fail the soil deposited into the river would be enormous and would cause great environmental damage.

A solution to address both problems is to pipe the most critical section(s) of the ditch where the most seepage occurs and the areas with the compromised banks. Unstable areas with the greatest seepage need to be identified and prioritized for piping.

Piping the ditch will solve many problems. First, it would leave more water in the river. If we eliminate ditch loss, irrigators will not have to divert as much into the canal to meet their irrigation needs. If successful in piping at least part of the ditch, the Ditch Company will protect this saved water under the Allocation of Conserved Water statutes or some other legal method. In order to meet the water rights of irrigators further down the current earthen ditch, excess water is conveyed into ditch at the diversion point to account for the seepage and evaporative loss further down the ditch line. Without this loss the Company won't have to divert as much from the river, more water is available for in-stream uses.

Keeping more water in the stream will benefit aquatic habitat in general but specifically help redband trout, a state sensitive species, and bull trout, a federally listed species. Historically, bull trout used this part of the river and redband are present for some part of their life cycle. Bull trout spawn in the cool headwaters in the upper tributaries of the Malheur River and migrate downstream to forage and overwinter in the larger Malheur River.

One of the main barriers to fish using the Malheur River more extensively are the high-water temperatures and erratic dissolved oxygen levels in the stream. Monitoring has shown temperatures can be as high as 80 degrees in the late summer at DEQ's Drewsey sampling site. In comparison for redband trout habitat, a seven-day-average maximum temperature standard of 68.0 degrees applies. In core cold water habitats, the temperature standard is 60.8 degrees. See the attached graph for visual depiction of the temperature regime of the Malheur River near Drewsey.

8. Describe how the proposed study would achieve the goal.

We are applying for funds to hire a contractor to deliver the following products:

- complete a drone and ground survey of the affected area,
- develop alternatives for pipeline routes,
    - recommend the shortest, and most stable feasible route.
- identify priority areas for piping based on
    - estimates of current water loss to seepage and evaporation,

        - identify areas where the greatest loss of water is currently occurring,
    - identify unstable areas,
    - estimate erosion from the spillways,
- develop a 60% design from the selected alternatives,
    - design will include recommendations and estimates of:
        - kinds of pipe, pipe sizes, lengths, pipe costs, installation methods and costs,
- facilitate stakeholder involvement by:
    - kick-off meeting with Board and affected landowners,
    - field day with Board and affected landowners,
    - present preliminary designs/estimates to Board, landowners, technical advisory agencies (ODA, DEQ, ODFW, USFWS, NRCS)
        - 15% design
        - 30% design
- conduct a water rights review of all the rights associated with the ditch,
    - Review will include:
        - priority dates,
        - appurtenancy (land where water is used),
        - existing turnout locations,
    - contractor is a certified water right examiner,

- investigate all the scenarios for the legal protection of saved water as an instream right.
    - determine how far the water can be protected,
        - determine affects to downstream users, and locations of downstream diversions.

9. Describe the identified water need (local, regional, or statewide). Please provide data or a narrative substantiating the need.

   Keeping more water in the stream will benefit aquatic habitat in general but specifically help redband trout, a state sensitive species, and bull trout, a federally listed species. Historically, bull trout used this part of the river for a least part of their life cycle and redband are present for some part of their life cycle. One of the main barriers to fish using the Malheur River more extensively are the high-water temperatures and erratic dissolved oxygen levels in the stream. The Northwest Power and Conservation Council's (NPCC) Malheur River Subbasin Plan (2004) prepared for the Malheur Watershed Council and Burns-Paiute Tribe (2004) identifies "strategies that assist in recovery of ESA-listed bull trout" as its number one priority (pg 94). It states these priorities should be implemented in the North Fork and Upper Malheur Watershed.

   Monitoring has shown temperatures can be as high as 80 degrees in the late summer at DEQ's Drewsey sampling site. In comparison for redband trout habitat, a seven-day-average maximum temperature standard of 68.0 degrees applies. In core cold water habitats, the temperature standard is 60.8 degrees. See the attached graph for visual depiction of the temperature regime of the Malheur River near Drewsey.

   Clearly the river in the Drewsey area has a temperature problem. Many factors affect stream temperatures, some natural and some human caused. DEQ considers human causes to include "excessive inputs of solar radiation due to the removal or reduction in stream side vegetation and

widening of channels. Water withdrawals, reservoirs, irrigation districts, and dam operations are considered nonpoint sources that influence the quantity and timing of heat delivery to downstream river reaches."

Decreases in stream flow in a natural channel can slow moving water and increase the time the water is exposed to solar radiation. In a practical sense having a greater volume of water in-stream means it takes more energy to heat it. Peak temperatures are decreased, and the rate of heating is slower if flows are higher.

ODFW and others have noted that water availability is a limiting factor in fish and aquatic habitat. The Oregon Conservation Strategy (2016) states:

"Where possible, maintain flow following the natural hydrological cycle. Improve irrigation efficiency. Lease water for instream use. In cooperative voluntary approaches that allow for purchase of instream water rights, prioritize use for agricultural purposes providing the greatest economic benefit."

Are flows too low in the Malheur River near Drewsey? At times yes. Flow data shows the river is dry or nearly so during the summer. This is not true every year, just during drought years. See the attached graphs for more details.

The Cooperative Board has other concerns about their open earth ditch. One is the possibility of bank failure similar to what happened with the Smith Ditch in Baker County a few years ago. The ditch failed and dumped enormous amounts of sediment into the Powder River and into Baker City itself. If this happened to the Drewsey Ditch the amount of sediment entering the Malheur River would be enormous.

Erosion is another concern. Currently, sediment is entering the river from 4 spillways from the ditch that are cutting into the hillside. Piping the ditch will reduce or eliminate these stability and erosion problems.

The Cooperative has taken an active role in improving conditions in the river for aquatic habitat. For example, about 5 years ago the Cooperative with the assistance of ODFW and others installed a new diversion and a screen. This has improved fish passage and the screen keeps fish out of the ditch.

In 2007, the Cooperative and the USFWS contracted with a consulting firm to estimate ditch losses. The consultant confirmed what the irrigators suspected, that ditch losses are high, 25 to 30% or even higher. The consultant's estimates were conservative for a variety of reasons. Mostly because it was difficult to separate out all the outside activities from what was occurring in the ditch. See the attached report.

Ranchers in the area have been proactive in improving the river as it runs through their property. Two habitat and bank stability projects were funded by OWEB (206-357) in 2008. By all reports the projects were successful. I have noted a substantial increase in riparian vegetation in the area since the early 2000's.

10. Please provide evidence that water is available to meet the above described need. Evidence can include regulatory and physical information regarding water availability.

The Ditch Company and the USFWS contracted with a consulting firm to estimate ditch losses in 2007. The consultant confirmed what the Ditch Company suspected, that ditch losses are high, 25 to 30%. Managers of the Ditch estimate that it could be as high as 50% loss. They can divert 90 cfs into the ditch, and over the course of the 14-mile-long ditch this is a notable amount of lost water. If one projects this percent loss to the projected maximum flow of 90 cfs in the canal, the potential seepage losses could be as high as 22.77 cfs.

The consultant's estimates were conservative for a variety of reasons. Mostly because it was difficult to separate out all the outside activities from what was occurring in the ditch. See the attached report.

11. Describe the level of community support and commitment associated with the study. This may include any collaborative water planning efforts undertaken to identify the project or study.

    Landowners in the Drewsey Valley have actively participated with many restoration efforts funded by the Oregon Watershed Enhancement Board (OWEB) over the last 15+ years. This project to pursue piping of the Drewsey Reclamation Ditch is the latest example of the dedication of local Drewsey Valley landowners to pursue restoration efforts.

    In 2018, a member of the Drewsey Ditch Reclamation Company (DDRC) made an initial contact to OWEB staff to inquire about the possibility of getting an OWEB grant to determine the feasibility of piping the ditch. The Council was contacted by the ditch company. A site visit in the summer of 2019 with MWC and an engineer occurred to obtain baseline information needed to develop a technical assistance application, which was submitted to OWEB in October 2019. If awarded, this grant will provide a portion of the funds needed to undertake this feasibility analysis.

    Landowners with DDRC were previously involved with a major restoration project that now provides fish passage on the Malheur River in Drewsey. This restoration effort was a needed first step before the possibility of piping the ditch can occur. In July 2008, OWEB granted Harney SWCD a $110,000 grant (208-5112) to install a fish-friendly diversion for the Drewsey Reclamation ditch. Landowners from DDRC actively participated with US Fish & Wildlife Service (USFWS), and Oregon Department of Fish & Wildlife (ODFW) to replace a large diversion dam. The Drewsey Reclamation ditch was unscreened, and its diversion dam a major barrier to upstream fish passage. Fixing this diversion was a critical step in restoring fish passage on upper Malheur River and helped realize the full benefit of past screening efforts in the basin. It was a key step in maintaining a bull trout migratory route between headwater streams and Warm Springs Reservoir.

    Over the last 13+ years, landowners in the Drewsey Valley have actively participated in many watershed restoration efforts to improve the watershed health of this drainage. These landowners have engaged with various agencies to implement a variety of projects. Several instream riparian restoration projects have been implemented in the Middle Fork and mainstem Malheur River. With the assistance of Harney SWCD, landowners were able to secure approximately $1.2 million in OWEB funding for 13 major restoration projects in the Drewsey Valley. Projects improving riparian areas; upland improvement through conifer reduction; sage-grouse habitat improvement; water quality enhancement and pasture improvement have been implemented throughout the Drewsey Valley watershed. These landowners have shown that they are committed to improving the environmental health of this basin.

12. Describe how implementation of the project could benefit and/or impact the community.

Harney County is the largest county in Oregon and bigger than eight US states. At over 10,000 square miles, it also has the lowest population density at .7/square miles. Harney County ranks near the bottom of all economic measures. Improving irrigation infrastructure helps creates jobs and improves many other aspects of the economy. This spending has a multiplying effect on local economies. Research of spending on infrastructure projects such as highway projects indicates that for every dollar spent on the highway project 1.5 to 3 times that is re-spent in the local economy. Workers buy food, pay rent, buy gas and so forth *(Highway Grants: Roads to prosperity? (Sylvain Leduc and Daniel Wilson, Federal Reserve Bank of San Francisco Economic Letter)).*

More specific to spending in the Oregon natural resources' sector, *Ecotrust (2011*) published a short paper about Oregon's restoration economy. They estimate that **90% of the money spent on restoration stays local**; for every $1 million spent on restoration 19 jobs are created.

When the restoration phase is implemented, and the ditch piped—either completely or in strategic sections—it will enable landowners to improve their irrigation delivery. Once fully implemented, the Drewsey Pipeline project will help address water supply needs by reducing the amount of water diverted and using the Allocation of Conserved Water Statutes. It adheres to OWRD's mission statement as it addresses Oregon's water supply needs. The pipe will help maintain the culture and custom of this farming and ranching community and achieves the triple bottom line- economy, ecosystem and maintaining the quality of life.

13. List letters of support (name and/or affiliation of sender). Attach copies of the letters to your application.

    Stephanie Page, Program Area Director
    Natural Resources and Pesticide Program
    Oregon Department of Agriculture

    Dave Banks, District Fish Biologist
    ODFW
    Burns, Oregon

    Drewsey Reclamation Cooperative
    Board of Directors

Study Key Tasks

14. Identify the study key tasks necessary to conduct the feasibility study using the following format and including as many tasks as necessary to complete the study. In the event that your study receives grant funding, the key tasks identified will be incorporated into your grant agreement as the "Statement of Work." Please note: Project management and administration are common functions within a specified key task and not separate key tasks themselves.

Task 1. Kick off meeting with Board Members

- Task schedule: May 2020
- Description of key task activities: Lay out tasks and deliverables for the Board
- Qualified personnel that will complete task: RSI Engineering Consultants. Engineering degrees and Professional Engineering license and 15 + years of experience

Resource Specialists Inc. has been conducting business since 2007, although individual staff members have been involved in restoration and agricultural efficiency work for many years prior to RSI incorporation. Our focus has been watershed restoration and agricultural viability in arid and semi-arid environments with our primary clients being Soil and Water Conservation Districts and Watershed Councils. We combine top-level education and technical knowledge with years of on-the-ground experience to provide outstanding results based on professional expertise and common sense. Since incorporation, RSI has designed and implemented over 60 major restoration projects, all of which were located in arid and semi-arid environments. These projects have ranged in complexity from single-user irrigation system design to large scale multi-phase active channel restorations.

Capabilities and Expertise

- *High Resolution Survey* – Proficient in multiple survey techniques including total station and RTK GPS.
- *CAD and GIS proficient* – Extensive experience across multiple CAD and GIS platforms including Civil3D, ArcGIS, Microstation, Global Mapper, and CFDesign.

- *Hydraulic Analysis* - Specializing in open channel, piped, and drainage modeling using existing software (CFD, HEC-RAS) and the development of specialized hydraulic modeling analysis techniques.
- *Hydrologic Analysis* – The project team has over 15 years of hydrology experience.
- *Habitat Restoration Design* - Focusing on aquatic species viability and productivity in flow limited systems.
- Certified Water Rights Examiner.

Malheur WSC staff, Dr. Ken Diebel, Ph.D. 25 + years of experience in:

- riparian and stream ecology/restoration, monitoring and policy,
- working with private landowners individually and in groups,
- budgeting and fiscal management of grants.

Task 2. Field Day with Board Members

- Task schedule: May 2020
- Description of key task activities: Discuss plans, water usage, take out points and places of use, alternative routes for the pipeline.
- Qualified personnel that will complete task: RSI Engineer and Malheur WSC

Task 3. Obtain written permission from landowners to access their property for the Drone survey.

- Task schedule: May 2020
- Description of key task activities: Talk with individual landowners and obtain written permission to access their property.
- Qualified personnel that will complete task: RSI Engineer and Malheur WSC

Task 4. Drone Survey

- Task schedule: June 2020
- Description of key task activities: Fly drone to develop surface map that will be used to develop alternative pipe routes. A drone flight of the project Area of Interest (AOI) (estimated to be 2,000 acres and 10 miles long) will be performed using a Futura fixed wing Unmanned Arial Vehicle (UAV) made by BAAM Tech. The UAV is equipped with a Sony A7Rii 42-megapixel digital camera fitted with a 28mm lens. The system is also equipped with a GNSS GPS receiver, which logs raw data enabling post processing corrections (PPK) of the image locations. Ground control points (GCPs) will be places along the project corridor as needed. The GCPs will be surveyed using RTK GPS to within 0.05-foot accuracy.
- Qualified personnel that will complete task: RSI Engineer

Task 5. Process data from drone survey

- Task schedule: June to August 2020
- Description of key task activities: Develop surface map that will be used to develop alternative pipe routes. The images will be processed using Agisoft PhotoScan Professional in order to produce an orthomosiac and a dense point cloud. Final resolution of the orthophoto will be ~0.1 ft. Ground points will be classified from the dense point cloud using an automated algorithm. The classified point cloud will be examined for consistency and edited as needed to eliminate spurious points. The output datasets will include orthorectified GeoTIFF image files and point cloud data (LAS/LAZ). Preliminary surfaces will be generated from the ground points and will be checked against RTK GPS check points taken within the project area.
- Qualified personnel that will complete task: RSI Engineer

Task 6. Identify priority areas for piping

- Task schedule: June to August 2020
- Description of key task activities: identify priority areas for piping based on:
    - estimates of current water use, loss to seepage and evaporation,
        - identify areas where the greatest loss of water is currently occurring,
    - identify unstable areas,
    - estimate erosion from the spillways,
- Qualified personnel that will complete task: RSI Engineer

Task 7. Meeting with Ditch Board Members and affected landowners.

- Task schedule: September 2020
- Description of key task activities: Present findings of survey and discuss alternate pipeline routes
- Qualified personnel that will complete task: Engineer and Malheur WSC

Task 8. Field Survey of Selected Route

- Task schedule: October 2020
- Description of key task activities: In-depth ground survey of selected pipeline route the proposed selected route will be surveyed using terrestrial RTK. The ground survey efforts will be minimal due to the previously conducted drone flight and surface. Efforts will be focused around turn-out locations, field verification and other key areas where high resolution survey is required
- Qualified personnel that will complete task: Engineer

Task 9. 15% Design level available to all stakeholders

- Task schedule: Nov 2020
- Description of key task activities: Check in with Board and tech advisors (DEQ, ODA, ODFW, USFWS, NRCS)
- Qualified personnel that will complete task: Engineer, WSC

Task 10. 30% Design Level

- Task schedule: Feb 2021
- Description of key task activities: Check in with Board and tech advisors (DEQ, ODA, ODFW, USFWS, NRCS)
- Qualified personnel that will complete task: Engineer, WSC

Task 11. 60% Design Level

- Task schedule: May 2021
- Description of key task activities: Check in with Board and tech advisors (ODFW, USFWS, NRCS). Design will include survey of pipeline route, priority areas for piping, estimates of water savings, pipe sizes and lengths, budgets and determine the need, if any, for permitting.
- Qualified personnel that will complete task: Engineer, Malheur WSC

Task 12. Water Right Investigation

- Task schedule: May 2021
- Description of key task activities: results of an investigation into water rights associated with the pipeline to determine feasibility of using conserved water right statutes, develop alternatives to determine the best way to legally protect the conserved water for in-stream uses.
- Qualified personnel that will complete task: Engineer, Malheur WSC

15. Study Task Scheduling – Estimated duration of feasibility study: May 2020 to May 2021

Place an "X" in the appropriate column to indicate when each task of the project would take place. Study tasks should match those listed as part of your response to the previous question.

Feasibility Study Key Tasks (Add additional rows as needed)	**Grant year**				**Grant year**				**Grant year**			
	2020				2021							
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Task 1. Kick off meeting with Board Members	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Task 2. Field Day with Board Members	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Task 3. Obtain written permission from landowners to access their property for the Drone survey.	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Task 4. Drone Survey	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Task 5. Process data from drone survey	☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
Task 6. Identify priority areas for piping	☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
Task 7. Meeting with Ditch Board Members and affected landowners.	☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
Task 8. Field Survey of Selected Route	☐	☐	☒	☒	☐	☐	☐	☐	☐	☐	☐	☐
Task 9. 15% Design level available to all stakeholders	☐	☐	☐	☒	☒	☐	☐	☐	☐	☐	☐	☐
Task 10. 30% Design Level	☐	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐	☐
Task 11. 60% Design Level	☐	☐	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐
Task 12. Water Right Investigation	☐	☐	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐

Permits and Regulatory Approvals

16. Identify any water rights required needed to complete the proposed Feasibility Study below. Check all of the following that apply and provide the information requested:
    a. ☒ No water rights are required to complete the proposed study.
    b. ☐ The proposed study requires a new water right or other water right transactions. If checked, list the transaction(s) required (e.g., new right, transfer, etc.):
    c. ☐ The applicant has legal access to a water right that will be used to conduct the study. The proposed study requires a water right, and the applicant holds or has been given permission to utilize the water right(s) for the proposed study. If checked, list all water rights required for the study in the table below, adding rows as needed. See the Application Instructions for further guidance, including how to find water right information.

Water Right Number (Include prefixes, if applicable, e.g., CW 12345)	Is this an application, permit, certificate, limited license, special or final order, transfer, decree, lease, or claim?	Tax Lot IDs within the Place of Use where water will be used to complete the study

17. Identify any water rights needed to implement the proposed Project below. Check all of the following that apply and provide the information requested:
    a. ☒ The applicant does not know what water rights or water right transactions are required for the project. That will be determined through this study or other effort at a future date.
    b. ☐ The proposed project requires a new water right or other water right transactions. If checked, list transaction(s) required (e.g., new right, transfer, etc.):
    c. ☐ The applicants holds the water right(s) required for the project. If checked, include list of rights in the table below, adding rows as needed. See the Application Instructions for further instruction, including how to find water right information.

Water Right Number (Include prefixes, if applicable, e.g., G 00010)	Is this an application, permit, certificate, limited license, special or final order, transfer, decree, lease, or claim?	Water Right Amount			Tax Lot IDs within the Place of Use where water will be used to implement the proposed project
		Max Volume (ac-ft)	Max Rate (cfs)	Duty (ac-ft/ac)	

18. Provide a list of any other permits and regulatory approvals needed to conduct the Feasibility Study and indicate the status of each in the table below. If permits/approvals are required, please submit copies of secured permits/approvals **or** describe efforts to secure permits/approvals including status. If no permits or authorizations are required for the study, provide an explanation:

    The study will only include surveying, water measurements, determinations of water losses, computer analysis, estimates of pipe size and lengths, budget development and investigations into current water rights. There should be no permits required for this work.

Study Permit/ Regulatory Approval	Status and Efforts To Date

19. Provide a list of the permits and regulatory approvals that you anticipate would be needed to implement the proposed project being studied. If permits/approvals are not required, please explain why and provide information regarding any agencies contacted to verify this determination:

Project Permit/Regulatory Approval *(add rows as needed)*
Department of State Lands Fill and Removal – possible wetland disturbances
ACOE Fill and Removal – possible wetland disturbances
DEQ 401 Water Quality Assurance – possible wetland disturbances
Cultural Review – possible wetland disturbances

VI. Feasibility Study Budget

Instructions: Please answer the following questions about the study budget using the tables provided.

20. Please provide an estimated line item budget for the proposed feasibility study. Examples include: Direct project specific costs, such as in-house staff salary, contractual services, and administrative costs. See the Department's Budget Procedures and Allowable Costs for further guidance.

OVERALL STUDY BUDGET Line Items	**Number of Units*** *(e.g. # of Hours)*	**Unit Cost** *(e.g. hourly rate)*	**In-Kind Match**	**Cash Match Funds**	**OWRD Grant Funds**	**Total Cost**
Staff Salary/Benefits						
Contractual/Consulting	480	95		21,850	23,750	45,600
Equipment (must be approved)						
Supplies						
Travel						
Other: Design review by Board	60	35	2,100			2,100
Design review by technical agencies	80	60	4,800			4,800
Administrative Costs**	114	40	1,375	2,185	1,000	4,560
		Total	**8,275**	**24,035**	**24,750**	**57,060**

** The "Unit" should be per "hour" or "day" – not per "project" or "contract." Units x Unit Costs = Total Cost*

*** Administrative Costs may not exceed 10% of the total funding requested from the Department*

21. Identify the budget for each key task below. Key tasks identified below should be the same as the key tasks identified in Questions 14 and 15.

Feasibility Study Key Tasks (Add additional rows as needed)	**In-Kind Match**	**Cash Match Funds**	**OWRD Grant Funds**	**Total Cost**
Kick off meeting/Field Tour with Board members (Tasks 1 and 2)	*700*	*950*		*1,650*
Drone Survey, water loss estimates and Data processing (Tasks 4, 5, and 6)		*9,600*	*9,600*	*19,200*
Meeting with Board members to discuss alternatives (Task 7)	*1400*	*950*		*2,350*
Field Survey of selected route (Task 8)		*2850*	*2850*	*5,700*
15% Design Check in with Tech Advisors and Board (Task 9)	*1600*		*2800*	*4,400*
30% Design Check in with Tech Advisors and Board (Task 10)	*1600*		*2800*	*4,400*
60% Design- finalize pipeline route and develop budget (Task 11)	*1600*	*5700*	*5700*	*13,000*
Water Right Investigations (Task 12)		*1800*		*1,800*
Administrative Costs (Tasks 1,2,3,7,9,10,11)	*1,375*	*2,185*	*1,000*	*4560*
Total	**8,275**	**24,035**	**24,750**	**57,060**

VII. Match Funding

Instructions: Please answer the following question regarding matching funds.

22. Please fill out the table below and attach the appropriate documentation for both the secured and pending match (add rows as needed). Keep in mind that applicants must demonstrate a minimum

dollar-for-dollar match. Please note that a failure to meet this requirement or to attach documentation will result in an incomplete application that will not be considered for funding.

For secured funding, you must *attach a letter of support or award* from the match funding source that specifically mentions the dollar amount identified for this study and as shown in the "Amount/Dollar Value" column in the table below.

For pending resources, *other written documentation showing a request* for the matching funds must accompany the application or documentation must identify the date on which a future funding application will be submitted, identify the funding program, and provide evidence that the project is eligible for the funding program identified.

Match Funding Source (if in-kind, briefly describe the nature of the contribution)	**Type (✓ One)**	**Status (✓ One)**	**Amount/ Dollar Value**	**Date Match Funds Available** *(Month/Year)*
OWEB Technical Assistance Grant Funding	☒cash ☐in-kind	☐secured ☒pending	24,035	May 2020
Ditch Company Board Participation in Alternative Pipeline Route Review and Selection	☐cash ☒in-kind	☐secured ☒pending	2,100	May 2020
Technical advisors review of design (DEQ, ODA, ODFW, USFWS, NRCS)	☐cash ☒in-kind	☐secured ☒pending	4800	May 2020
Malheur Watershed Council (Admin)	☐cash ☒in-kind	☐secured ☒pending	1,375	May 2020
	☐cash ☐in-kind	☐secured ☐pending		

VIII. Storage-Specific Questions

Instructions: If you indicated that your study is for a storage project, answer question 23 in this section. If your study is for above-ground storage, also answer question 24. Please refer to the document on Storage-Specific Study Requirements for guidance and information on completing this section, available on the OWRD Funding Opportunities, Applications, Forms, and Guidance webpage. If your study is for a water conservation or reuse project, skip this section.

23. Answer the following "Yes/No" questions about the storage project to be evaluated in the proposed study.

    A. Will the project divert more than 500 acre-feet of surface water annually? Yes ☐ No ☐

    B. Will the project impound surface water on a perennial stream? Yes ☐ No ☐

    C. Will the project divert water from a stream that supports sensitive, threatened or endangered species? Yes ☐ No ☐

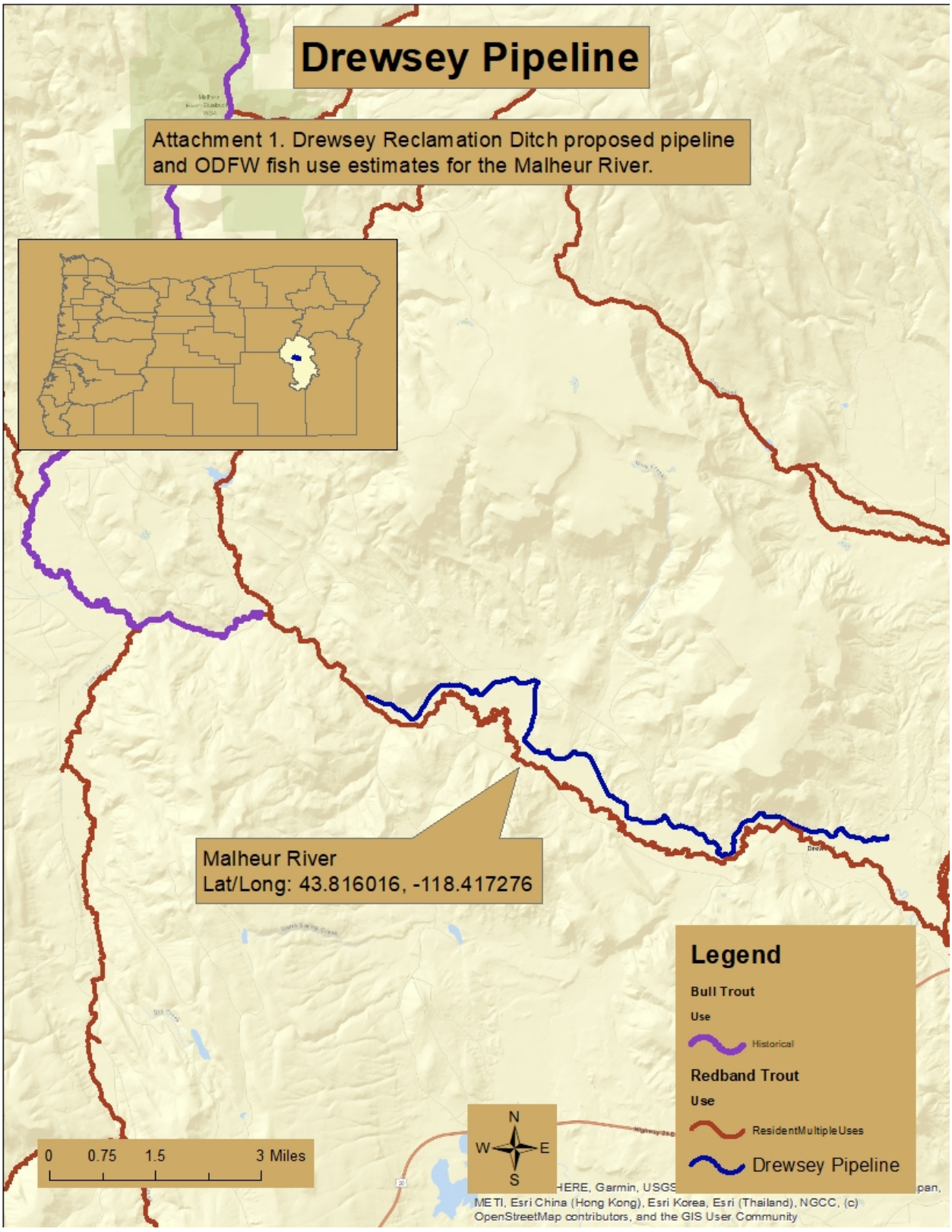
If you answered "yes" to any of the questions above, you are required to address the following analyses in your feasibility study. By signing this application, you are committing to include these required elements in your feasibility study.

If you answered "yes" to (A), (B), or (C) above, attach a description of how you intend to address the following required elements in your feasibility study (please refer to the document on Storage-Specific Study Requirements for guidance and a description of the minimum acceptable standards regarding these study requirements):

i. Analyses of by-pass, optimum peak, flushing and other ecological flows of the affected stream and the impact of the storage project on those flows.
ii. Comparative analyses of alternative means of supplying water, including but not limited to the costs and benefits of water conservation and efficiency alternatives and the extent to which long-term water supply needs may be met using those alternatives.
iii. Analyses of environmental harm or impacts from the proposed storage project.
iv. Evaluation of the need for and feasibility of using stored water to augment instream flows to conserve, maintain and enhance aquatic life, fish life and any other ecological values.
v. *For proposed storage projects for municipal use only* – For a proposed storage project that is for municipal use, analysis of local and regional water demand and the proposed storage project's relationship to existing and planned water supply projects.

24. **For Above-Ground Storage Only:** Describe whether or not the storage project would include provisions for using stored water to augment instream flows to conserve, maintain and enhance aquatic life, fish life or other ecological values. As per statute and rule, above-ground storage projects that include these provisions receive preference for funding over other storage projects.

Attachment 1



Attachment 2:

We are not certain which properties we will need to access. One of our tasks is to determine the most efficient route for the pipeline. Once we have an idea of the route, we will contact the landowners and get written permission to access their property.

Attachment 3:

Written documentation showing a request for the matching funds: We are showing the minimum requirements of $25,410. We expect to secure more if awarded this grant.

Gmail

Ken Diebel <diebelk12@gmail.com>

Online Technical Assistance Application for Drewsey Reclamation Ditch: Can We Pipe it?
1 message

oweb.grant.pgm@oregon.gov <oweb.grant.pgm@oregon.gov> Sat, Oct 26, 2019 at 3:53 PM
Reply-To: oweb.grant.pgm@oregon.gov
To: diebelk12@gmail.com

Congratulations Malheur WC! You have successfully submitted an Online Technical Assistance Application for Drewsey Reclamation Ditch: Can We Pipe it? on 10/26/2019 at 3:52 PM. Your application number will be assigned after the application deadline. You will be notified via email when your number is assigned and you can access your application on OGMS. If you would like to access and/or retain a copy of your application, please click the name of the application under the 'Submitted' applications section on the applications homepage and a PDF of the application will be generated for you.

Date Submitted: Oct 26, 2019

Funding program: OWEB Technical Assistance Grant

MENTON Coby * OWEB Wed, Nov 6, 12:28 PM (5 days ago)
to me

Hi Ken,

The project is eligible. If approved for funding by the OWEB Board is the question, that will be during the April 2020 Board meeting. The Board meeting is April 21 and 22. If you need an exact date, use April 22 for when OWEB funds would be available.

Coby Menton
OWEB
Region 5 Program Representative
Eastern Oregon
541-786-0061

OWEB Requested amount: $24,035

Drewsey Reclamation Cooperative
Board of Directors
In-kind = $2,100
See attached letter of support

710 SW 5th Ave.
Ontario, OR 97914

To whom it may concern:

The Malheur Watershed Council will contribute $1,375 of in-kind work as cost-share for the OWRD Feasibility Grant: Drewsey Reclamation Ditch: Can We Pipe It?

The work will consist of facilitating meetings, contacting landowners for permission to enter property, conducting outreach to the surrounding community, and fiscal management of the grant.

Sincerely,

Ken Diebel

Ken Diebel, Ph.D.
Executive Director
Malheur Watershed Council

Attachment #4 Support Letters

Oregon
Kate Brown, Governor

Department of Agriculture
635 Capitol St NE
Salem, OR 97301-2532

October 18, 2019

Malheur Watershed Council
710 SW 5th Ave
Ontario OR, 97914

Dear Mr. Diebel:

This letter is in support of the **Irrigation Drewsey Reclamation Ditch: Can We Pipe It?** project being proposed by the Malheur Watershed Council.

The Oregon Department of Agriculture's (ODAs) Water Quality Program supports the efforts of the Malheur Watershed Council and their partners to produce preliminary designs (60%) to pipe all or portions of the Drewsey Reclamation Ditch. Piping this ditch will improve water quantity and quality in the Malheur River. This project supports goals of the *Malheur River Basin Agricultural Water Quality Management Area Plan* to reduce potential groundwater pollution caused by seepage through the ditch and to reduce potential sedimentation to the Malheur River from the ditch, particularly should a portion of the ditch fail. Additionally, the proposed project lies within ODA's Strategic Implementation Area and complements the goals of this initiative.

The Oregon Department of Agriculture applauds the private landowners within the Drewsey Reclamation Ditch Cooperative, the Malheur Watershed Council, and all other partners for working together on this beneficial project.

Sincerely,

Stephanie Page

Stephanie Page, Program Area Director
Natural Resources and Pesticide Programs
(503) 986-4713
spage@oda.state.or.us

Oregon
Kate Brown, Governor

Department of Fish and Wildlife
Hines Office
Malheur Watershed District
237 Hwy 20 S.
PO Box 8
Hines, Oregon 97738
(541) 573-6582
FAX (541) 573-5306

November 7, 2019

OREGON WATER RESOURCES DEPARTMENT
Attention: Grant Program Coordinator
725 Summer Street NE, Suite A
Salem, OR 97301

Re: Drewsey Reclamation Ditch: Can We Pipe it?

To whom it may concern,

I am writing a letter to support the feasibility study proposed for the Drewsey Reclamation Ditch near Drewsey, Oregon. A completed pipeline project proposes to file for an in-stream water right for the Malheur River using the Conserved Waters statues under Oregon law. Approving funding for this study is the first step to improving in-stream conditions for state sensitive redband trout (*Oncorhynchus mykiss newberryi)* and other native fishes that historically used the Malheur River. I have worked with Mr. Ken Diebel, the project proponent, to implement projects that benefit landowners, aquatic ecosystems and fishes in eastern Oregon for 5 years. I know that he has the skills to work with the landowners and state agency staff to implement a project that will benefit ranchers, redband trout and the environment. I encourage you to approve funding for this study.

Sincerely,

David T. Banks

Dave Banks
Oregon Department of Fish and Wildlife
Malheur Watershed District
District Fish Biologist

November 12, 2019

DREWSEY RECLAMATION COOPERATIVE

To: 0regon Water Resources Department,

The Board of Directors of the Drewsey Reclamation Cooperative is in full support of conducting a feasibility study on the Drewsey reclamation ditch to determine the possibility of increasing the efficiency of irrigation water use and conserving spring and summer instream flow for the middle fork of the Malheur River.

The Drewsey Reclamation Cooperative is now working with partner, Malheur Watershed Council, in pulling together resources to cover the needs for producing a plan that will ultimately lead to a implementation project. This project will move the reclamation ditch toward a standard, which will serve the irrigators, the fish and wildlife, as well as the vision the people of Oregon have for high functioning waterways.

The Cooperative plans to contribute to the planning effort with in-kind cost-share of $2100.00. The contribution of the members will be as time spent in meetings with engineer and in reviewing designs.

Thank you for considering being a Partner in this important effort.

Board of Directors
Drewsey Reclamation District

Attachment #5 Additional Maps, Photos, Tables and Graphs


Drewsey Pipeline
Malheur River
Figure 1. Drewsey Reclamation Ditch proposed pipeline and ODFW fish use estimates for the Malheur River.
Legend
Bull Trout
Use
Historical
Redband Trout
Use
ResidentMultipleUses
Drewsey Pipeline
0
1
2
4 Miles
N
W
E
S

Figure 2 Drewsey Ditch in relation to the Malheur River.

Figure 3. Diversion structure and fish screen where water is diverted from the river into the ditch.

Figure 4. The Drewsey Ditch ends near the town of Drewsey.

Figure 5. One of the turnouts on the Drewsey Ditch that supplies water to fields below.

Figure 4-26. Water Temperature measurements made at U.S. Bureau of Reclamation flow gauges MADO located above Warm Springs Dam near Drewsey, Station WARO located below Warm Springs Dam, and MALO located at the 36th Street bridge in Ontario.

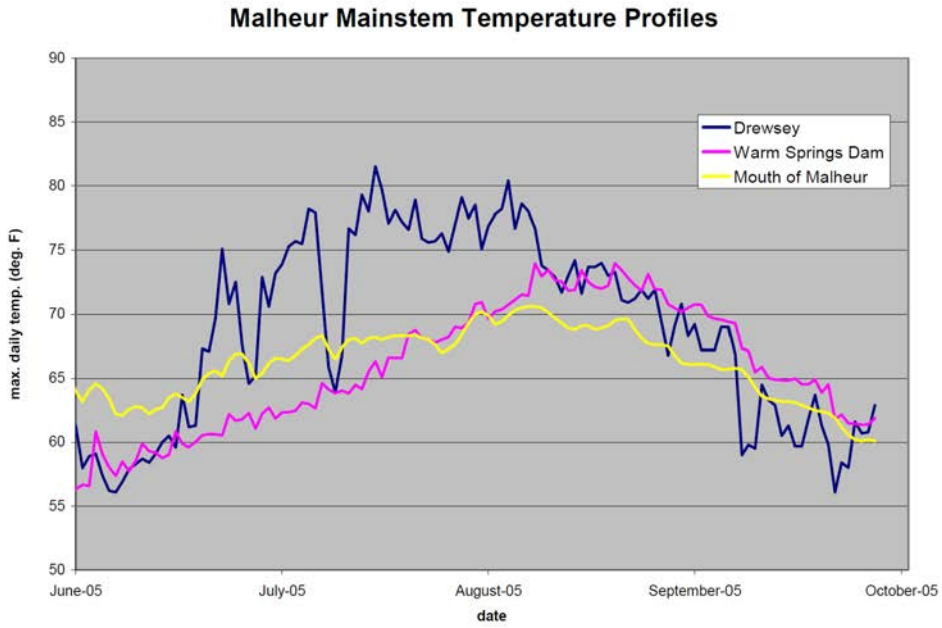


Figure 6. Stream temperatures of the Malheur River near Drewsey during the summer months. The temperature standard is 68 degrees for this reach.

Table 9-6. 7Q10 critical low flows (cfs) at various locations.

Period	Malheur River Near Drewsey	Malheur River below Warm Spring Reservoir	North Fork Malheur River above Beulah Reservoir
May 1 - Sept 30	0	0	29
Yearly	0	0	25
January	36	0	31
February	48	0	34
March	74	0	52
April	94	0	104
May	37	29	96
June	10	61	47
July	2	57	33
August	1	7	29
September	1	0	31
October	6	0	35
November	30	0	37
December	30	0	29
Data Source	USBR	USGS	USBR
Data Period	1927-2008	1909-2008	1914, 1936-2008

Figure 7. The 7Q10 is the lowest stream flow observed for seven consecutive days that would be expected to occur once in ten years. 7Q10s were calculated with DFLOW 3.1 (USEPA 2006).

Attachment #6 Copy of 2007 Seepage Analysis Study

NEWTON CONSULTANTS INC.
Earth, Water and Rock Specialists

521 SW 6th Street, Suite 100
Redmond, Oregon 97756
Phone: (541) 504-9960 FAX: (541) 504-9961

Memorandum

To:	John Stephenson Fish & Wildlife Biologist La Grande Field Office 20310 Empire Ave. Ste. A100 Bend, OR 97701	**Date:**	December 7, 2007
		From:	Mathias Perle.
		Project Name:	Drewsey Reclamation Ditch
Subject:	Seepage Analysis and Piping Feasibility	**Project No.:**	1064-101

PURPOSE

This memorandum presents results of seepage analysis and preliminary piping feasibility evaluation for the first two miles of the Drewsey Reclamation Ditch (Drewsey Ditch) from its main point of diversion on the Middle Fork of the Malheur River near Drewsey, Oregon in Harney County (See Figure 1.). Estimated seepage losses based on flow measurements and preliminary estimates of pipe size requirements and costs of piping are presented herein.

SUMMARY

Accurately measuring seepage losses in the Drewsey Ditch was made difficult by a number of factors. Most notably was the presence of the Miller Ditch located immediately uphill of the Drewsey Ditch. During field visits and flow rate measurements, signs of distinct seepage into the Drewsey Ditch from the Miller Ditch could be observed. These signs took a number of forms including: Surface water flowing out of seeps directly into the Drewsey Ditch and/or distinct changes in vegetation (i.e. willows and cattails) as compared to predominant surrounding Juniper and Sage.

The greatest losses in the Drewsey Ditch were measured between the headgate and check dam No. 4 shown in Figures 2 and 3. These measured seepage losses were approximately 25.3% of the measured total flow of 42.33 cubic feet per second (cfs). These losses are conservative, however, in that they very likely include inflow from seepage losses in the Miller Ditch. If one projects this percent loss to the projected maximum flow of 90 cfs in the canal, the potential seepage losses could be as high as 22.77 cfs. These seepage losses equate to potential savings over the course of 90 days of irrigation of approximately 4,058 acre-feet.

In an attempt to determine the contribution of the Miller Ditch seepage to Drewsey Ditch flows, we assumed that seepage losses in the Miller Ditch would be proportional to those in the Drewsey Ditch. Using this method, the estimated seepage losses were approximately 29.2% of total flow. If one projects this percent loss to the projected maximum flow of 90 cfs in the

canal, the potential seepage losses could be as high as 26.28 cfs. These seepage losses equate to potential savings over the course of 90 days of irrigation of approximately 4,683 acre-feet.

Two different potential piping options are presented below. Option 1 involves piping of the first 2.06 miles (10,858 feet) of the Drewsey Ditch, the entire length of the study reach. Option 2 involves piping the first 0.92 miles (4,882 feet) where the highest seepage losses were measured.

The estimated costs associated with piping Option 1 (the first 2 miles of canal) including, pipe costs, installation, engineering and a 10% contingency were $6,468,000. The cost per acre-foot of water conserved for Option 1 based on either 29.2% or 25.3% losses ranged from $1,381 to $1,594 per acre-foot of conserved water.

The estimated costs associated with piping Option 2 (the first 0.92 miles of canal) including, pipe costs, installation, engineering and a 10% contingency were $2,915,000. The cost per acre-foot of water conserved for Option 2 based on either 29.2% or 25.3% losses ranged from $622 to $718 per acre-foot of conserved water.

FINDINGS AND PRELIMINARY COST ESTIMATES

Seepage Loss Estimates

Flow rate measurements were conducted between October 9 and October 15 using a Global Water FP102 flow probe that measures flow velocity in feet per second (ft/sec). Measurements were taken both at concrete check dam facilities with rectangular control cross sectional areas and locations along the ditch where field observations indicated potential high seepage losses. Locations of the study reach and measurement sites are shown in Figures 2 through 4. A total of six measurements were made at check dams and three additional measurements were taken at locations along the ditch where field observations indicated potential high seepage losses.

It should be noted that flow rate measurements made in the concrete check dams are considered more accurate than those made in the uncontrolled sections. This can be explained by the fact that in concrete check dams, a uniform rectangular cross-section exists. In addition, these concrete check dams were anywhere from 4-5 feet long in the downstream direction. Taking flow rate measurements in the farthest downstream point in the concrete check dam increases the likelihood of laminar flow conditions in the check dam which in turn increase the accuracy of the flow rate measurement. This is true for all flow rate measurements except check dam No. 6 where the concrete check dam was only eight inches wide and therefore did not allow for uniform approach velocities and laminar flow.

Factors such as uncontrolled sections or conditions such as those seen in check dam No. 6 introduce an increased margin of error in flow rate measurements. Two successive flow rate measurements at check dam No. 6, for example, reveal flow rate measurements of 41.39 cfs and 38.68 cfs respectively, a difference of 2.71 cfs or 1,216 gpm.

As shown in Figure 1, a second irrigation ditch known as the Miller Ditch runs parallel to the Drewsey Ditch. The Miller Ditch is located directly uphill of the Drewsey Ditch. During field visits and flow rate measurements, signs of distinct seepage into the Drewsey Ditch from the Miller Ditch could be observed. These signs took a number of forms including: Surface water flowing out of seeps directly into the Drewsey Ditch and/or distinct changes in vegetation (i.e. willows and cattails) as compared to predominant surrounding Juniper and Sage.

Without any inflow or outflow into the Drewsey Ditch from points other than the headgate or open deliveries, one would assume that flow rates would consistently diminish due to seepage loss as one progressed down the Ditch. This, as can be seen in Table 1, is not the case. It is evident from the data that while losses may be occurring in the different measured sections, these losses are either attenuated or overridden by inflow from outside sources (i.e. Miller Ditch).

Table 1.

Measuring Station	Time	Total Flow Rate (cfs)	Cumulative Ditch Loss (cfs)	Ditch Loss Per Section (cfs)
Check Dam 1	8:40	42.33		
Un-controlled Point 1	9:35	35.58	6.74	-6.744
Check Dam 2	10:14	40.08	2.25	4.498
Un-controlled Point 2	10:54	38.31	4.01	-1.768
Check Dam 3	11:55	36.42	5.91	-1.897
Check Dam 4	13:04	31.60	10.73	-4.818
Check Dam 5	16:30	33.79	8.54	2.193
Un-controlled Point 3	14:45	34.76	7.56	0.972
Check Dam 6	15:15	41.39	0.94	6.627
Check Dam 6	16:00	38.68	3.64	3.921

It would appear that the greatest losses occur between check dam No. 1 and check dam No. 4 where losses reach 10.73 cfs or 25.3 % of total flow. Beyond check dam No. 4, flow rate measurements increase at the last three measuring points along the Drewsey Ditch.

Given these measurements and the distinct signs indicating that seepage from the Miller Ditch is likely contributing flows to the Drewsey Ditch, the following conclusions can be made:

1) Cumulative ditch loss numbers in the Drewsey Ditch are influenced by Miller Ditch seepage flows,

2) Given 1) above cumulative ditch loss numbers are conservative and would likely be greater if no inflow were occurring from the Miller Ditch.

If one assumes that seepage out of the Miller Ditch is relatively constant, then the increase in Drewsey Ditch flow rates beyond check dam No. 4 would appear to indicate that seepage losses from the Drewsey Ditch downstream of check dam No. 4 are relatively low. Downstream of check dam No. 4, Drewsey Ditch losses decrease sufficiently to show an increase in flow rate due to infiltration from the Miller Ditch. It is not possible however to

quantify the Drewsey Ditch seepage losses in these sections without knowing the proportion of seepage losses from the Miller Ditch contributing to the flow in the Drewsey Ditch.

Given the distinct potential for the Miller Ditch to influence flow rates in the Drewsey Ditch, three flow rate measurements along the Miller Ditch were taken to try and determine potential Miller Ditch seepage losses. Flow rate measurements in the Miller Ditch were performed in an uncontrolled setting with significant vegetation growth in the canal and very slow flow velocity conditions. These conditions contribute to measurement error. Results of flow rate measurements in the Miller Ditch and corresponding losses are shown below in Table 2. Given field observations of dry land upslope and no significant sources other than precipitation runoff (i.e. no upslope ditch or irrigation) could be contributing flows to the Miller Ditch, the fact that flows increase from uncontrolled point No. 2 to uncontrolled point No. 3 would indicate a significant amount of error.

Table 2.

Measuring Station	Sampling Time	Total Flow Rate (cfs)
Un-controlled Point 1	9:10	6.38
Un-controlled Point 2	17:00	5.43
Un-controlled Point 3	12:29	5.86

Because of inconclusive data in the Miller Ditch measured flow rates, a second method of estimating Miller Ditch losses was used. Very similar geologic seepage conditions were noted in the Miller Ditch as in the Drewsey Ditch. One could therefore assume that seepage losses in the Miller Ditch would be proportional to those in the Drewsey Ditch. Table 3 below applies the proportional losses in the Drewsey Ditch per section to the Miller Ditch based on a measured Miller Ditch flow rate of 6.38 cfs and adjusts the cumulative losses in the Drewsey Ditch accordingly.

Table 3.

Measuring Station	Time	Total Flow Rate (cfs)	Miller Ditch Proportional Loss (cfs)	Original Cumulative Ditch Loss (cfs)	Revised Cumulative Ditch Loss (cfs)
Check Dam 1	8:40	42.33			
Un-controlled Point 1	9:35	35.58	1.02	6.74	7.76
Check Dam 2	10:14	40.08	0.34	2.25	2.58
Un-controlled Point 2	10:54	38.31	0.61	4.01	4.62
Check Dam 3	11:55	36.42	0.89	5.91	6.80
Check Dam 4	13:04	31.60	1.62	10.73	12.35
Check Dam 5	16:30	33.79	NA	8.54	NA
Un-controlled Point 3	14:45	34.76	NA	7.56	NA
Check Dam 6	15:15	41.39	NA	0.94	NA
Check Dam 6	16:00	38.68	NA	3.64	NA

This method shows that seepage losses in the Drewsey Ditch between check dam No. 1 and check dam No. 4 could be as high as 12.35 cfs or 29.2% of total flow. Based on a projected maximum flow rate of 90 cfs and assuming similar proportional losses, seepage losses could be as high as 26.28 cfs based on extrapolated seepage loss numbers in Table 3. These seepage losses equate to potential savings over the course of 90 days of irrigation of approximately 4,683 acre-feet. Using the measured seepage losses of 25.3% in Table 2., the equivalent losses at a 90 cfs flow rate could be 22.77 cfs. These seepage losses equate to potential savings over the course of 90 days of irrigation of approximately 4,058 acre-feet.

It is not possible to quantitatively determine the seepage losses in the Drewsey Ditch downstream of check dam No. 4. On a qualitative and comparative level, it is safe to assume that losses between check dam No. 4 and check dam No. 6 are significantly lower than those noted between check dam No. 1 and check dam No. 4.

Piping Cost Estimates

Two separate potential piping options are presented below. Option 1 involves piping of the first 2.06 miles (10,858 feet) of the Drewsey Ditch, the entire length of the study reach. Option 2 involves piping the first 0.92 miles (4,858 feet) where the highest seepage losses were measured. Piping cost estimates were made based on the following assumptions:

1. The projected maximum flow that could move through the headgate into the Drewsey Ditch is 90 cfs.
2. Approximate number of irrigated acres being served by the Drewsey Ditch in the first two miles is 140 acres.
3. Based on a delivery flow rate of 1/40 of a cfs per acre, approximately 3.5 cfs of deliveries would occur in the first two miles thus effectively reducing the flow rate to 86.5 cfs at the end of the first two miles.

4. The total drop estimated from topographic and aerial maps over the first two miles of the Ditch is approximately 10 feet. The corresponding distance is approximately 10,858 feet or 2.06 miles
5. The total drop estimated from topographic and aerial maps between the headgate and check dam No. 4 is approximately 5 feet. The corresponding distance is approximately 4,858 feet or 0.92 miles.

OPTION 1:

Based on the above assumptions, we estimated a minimum pipe size of 63 inches would be needed to carry a projected maximum flow of 90 cfs. Estimated costs of pipe and installation costs are summarized below.

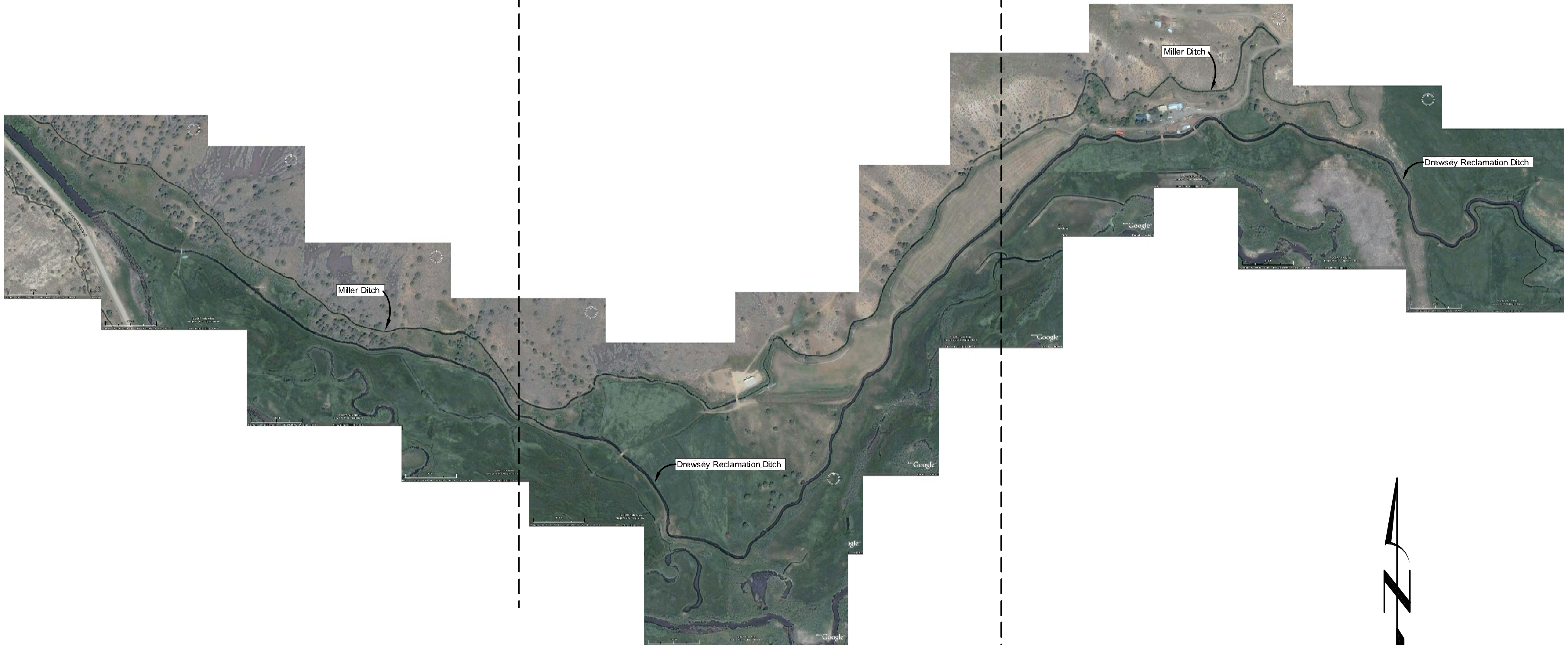
10,858 feet of 63 inch 51 psi HDPE Pipe	$	1,950,000
Installation cost for 63 inch pipe	$	3,900,000
CONSTRUCTION SUB-TOTAL:	**$**	**5,850,000**
ENGINEERING:	**$**	**30,000**
TOTAL PRELIMINARY ESTIMATED COST:	**$**	**5,880,000**
COST PER ACRE-FOOT OF CONSERVED WATER:	**$**	**1,256 to 1,449**
CONSTRUCTION CONTINGENCY (10%):	**$**	**588,000**
TOTAL ESTIMATE WITH CONTINGENCY:	**$**	**6,468,000**
COST PER ACRE-FOOT WITH CONTINGENCY:	**$**	**1,381 to 1,594**

OPTION 2:

Based on the above assumptions, we estimated a minimum pipe size of 63 inches would be needed to carry a projected maximum flow of 90 cfs. Estimated costs of pipe and installation costs are summarized below.

4,882 feet of 63 inch 51 psi HDPE Pipe	$	875,000
Installation cost for 63 inch pipe	$	1,750,000
CONSTRUCTION SUB-TOTAL:	**$**	**2,625,000**
ENGINEERING:	**$**	**25,000**
TOTAL PRELIMINARY ESTIMATED COST:	**$**	**2,650,000**
COST PER ACRE-FOOT OF CONSERVED WATER:	**$**	**566 to 653**
CONSTRUCTION CONTINGENCY (10%):	**$**	**265,000**
TOTAL ESTIMATE WITH CONTINGENCY:	**$**	**2,915,000**
COST PER ACRE-FOOT WITH CONTINGENCY:	**$**	**622 to 718**

See Figure 2 | See Figure 3 | See Figure 4



0' 750' 1,500'
SCALE: 1" = 750'

Vicinity Map

No Scale

Drewsey Ditch Project Site & Vicinity Map

Harney Silo & Water Conservation - Drewsey Reclamation Ditch
Drewsey, Harney County, Oregon

FIGURE 1

PROJECT NO. 1064-101

DATE: Nov 2007

DRAWN BY: S.Schenck

DESIGNED BY: M.Perle

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