1. Administrative Details

Proposal Name: PTCWSD Water Systems Improvement Project

by Agency: Power Teton County Water and Sewer District

Locations: MT

Date Submitted: 08/21/2018

Confirmation Number: 7981ad20-b1d3-4967-ae1b-7ed757b853a8

Supporting Documents

File Name	Date Uploaded
PTCWSD WRRDA letter of application 8-20-2018.pdf	08/21/2018
PTCWSD PER Water Improvment Project 1 of 3 8-20-18.pdf	08/21/2018
PTCWSD Map.pdf	08/21/2018
PTCWSD WRRDA funding committment 8-20-18.pdf	08/21/2018
Senator Daines PTCWSD LOS.pdf	08/21/2018
Senator Tester 2018-08-20 Power Teton Water.pdf	08/21/2018
Power Water Letter of Support 2018-HD17.pdf	08/21/2018
MT DEQ POWER TETON COUNTY WATER DIST.PDF	08/21/2018
NCMEDD PTCWSD WRRDA letter of support 082018.pdf	08/21/2018
MTDOC PowerTetonWRRDASupporLtr.pdf	08/21/2018
PTCWSD PER Water Improvment Project 3 of 3 82018.pdf	08/21/2018
PTCWSD PER Water Improvment Project 2 of 3 82018.pdf	08/21/2018

2. Provide the name of the primary sponsor and all non-Federal interests that have contributed or are expected to contribute toward the non-Federal share of the proposed feasibility study or modification.

Sponsor	**Letter of Support**
Power Teton County Water and Sewer District(Primary)	Reliable infrastructure is the cornerstone to any communit y, especially in rural areas. The project will allow the PTC WSD to provide quality drinking water to current users at an affordable cost. The population of the community is 179 and projections have indicated an increase of double within the next 20 years. In addition to the school, fire protection and suppression is a key component of the service provided. The requested funds will be used for a Water Systems Impr ovement project. The project will abandon the current raw water intake at Muddy Creek and the existing water treat ment. Routine testing of the raw water has shown high lev els of e.coli bacteria. This concentration will force the Dist rict to make additional changes to their water treatment, p rimarily the installation of a UV disinfection system. Ther e is currently no source water protection plan, watershed s urvey or emergency spill response plan for Muddy Creek up stream of the diversion dam. Any contamination of the cr eek, including animal carcasses, or activities such as spring runoff, snow melt and agricultural activities, may force the complete shutdown of the Water Treatment Plant until th e issue is remedied. The current preferred alternative for th e PTCWSD is shallow ground wells that will be drilled on t he Fairfield Bench and connected to the existing water dist ribution system. A chlorination system will be added for t reatment of the well water. The completion of this project will allow the District to provide quality drinking water to the users of the system at all times during the year. We ar e working with Sweetgrass Development as well as TD&H Engineering, our firm contracted for the project, to secure f unding and move forward. The District has received suppo rt from Teton County, area legislators and a large number of members of the community.

3. State if this proposal is for a feasibility study, a modification to an authorized USACE feasibility study or a modification to an authorized USACE project. If it is a proposal for a modification, provide the authorized water resources development feasibility study or project name.

[x] Modification to an Authorized USACE Project : Power Teton County Water and Sewer District

4. Clearly articulate the specific project purpose(s) of the proposed study or modification. Demonstrate that the proposal is related to USACE mission and authorities and specifically address why additional or new authorization is needed.

The Power-Teton County Water & Sewer District (PTCWSD) was created in 1969, consisting of a water tre atment plant (WTP) and distribution system. The population of the unincorporated town of Power is 179, 9 6 active users, 86 are residential. PTCWSD diverts raw water from the surface water source, Muddy Creek, drawing approximately 14 million gallons annually. The water right does not allow diverting of water if Mu ddy Creek flows are below the Montana Department of Natural Resource and Conservation rates. PTCWSD does not have a source water protection plan or watershed survey, putting the source at increased risk of con tamination. Testing of raw water has shown high levels of E.coli bacteria, which will require extensive and in credibly expensive upgrades to the WTP. The solids entering the plant have caused corrosion of piping and valves, clogging of the pumps, treatment train failures, as well as corroded the intake pipe and clogged the ra w water pumps. The diversion dam has been damaged; an ice jam in 2017 forced a shutdown for nearly 24 h ours. The WTP does not have sufficient capacity to meet current or projected max day demand with 100% r edundancy, as required by the State of Montana. The proposed project will replace the existing surface wate r treatment system with groundwater wells to meet regulatory requirements. The PER identifies a new gro und water source as the most viable, affordable solution, for ratepayers. The project fits perfectly within the Corps mission "is to provide vital public engineering services in peace and war to strengthen our Nation's sec urity, energize the economy, and reduce risks from disasters." Due to the proximity to Great Falls, Power is expecting to double in size over the next 20-years. A new water source will reduce the risk from any disaster s affecting the water supply. Without a more dependable water source, Power's school and fire suppression c apability are in jeopardy, but the survival of the community itself is as stake.

5. To the extent practicable, provide an estimate of the total cost, and the Federal and non-Federal share of those costs, of the proposed study and, separately, an estimate of the cost of construction or modification.

	Federal	**Non-Federal**	**Total**
Study	$0	$0	$0
Construction	$1,970,000	$657,000	$2,627,000

Explanation (if necessary)

The Power Teton County Water and Sewer District is applying for state and federal funding, grants and loa ns to complete the project. They are currently debt servicing $278,000 from the last project that was compl eted in 2008. The total identified project cost is $2,627,000. Based on an assumed "worst case" financial stra tegy presented in Chapter 6.0 of the PER, impacts to user rates are expected to result in a $54.22 per month increase, for a total of $154.22 per EDU per month user rate. The rate increase includes an estimated annual operating budget of approximately $30,600, a mixture of grants and loans to complete the funding package. Funding in any form has not yet been secured for the project. Applications to the State of Montana have been submitted in the amount of $500,000 and $125,000 respectively. These are highly competitive program s that will be difficult to obtain funding, given the number of users and the infrastructure economy in Monta na. WRRDA funding would assist with the completing of the funding package and allow the PTCWSD to move forward with the project. State funding notification should be received in Spring of 2019. The fundin g strategy anticipates application submission to the following agencies: MT Dept. of Commerce Treasure State Endowment Program (application submitted, competitive process) $500,000 MT Dept. of Natural Res ources & Conservation Renewable Resource Grant & Loan (app submitted, competitive process) $125,000 M ontana Dept. of Commerce Community Development Block Grant (Teton County applicant, submission Nov ember 2018) $450,000 U.S. Army Corps of Engineers Water Resources Development Act: 1,970,000 Monta na State Revolving loan fund

6. To the extent practicable, describe the anticipated monetary and nonmonetary benefits of the proposal including benefits to the protection of human life and property; improvement to transportation; the national economy; the environment; or the national security interests of the United States.

Health and security is of the utmost importance to the District. The distribution, storage, and treatment sys tems pose a significant threat to the safety community. Should a break in the single main distribution syste m occur, residents would be without water; fire suppression capabilities would be diminished. The current st orage tank does not provide sufficient volume to meet current and projected water demands. In order to pro vide the residents of Power with adequate potable water and fire suppression, additional water storage is req uired. The largest threat is the existing treatment plant and source water. Ice jams have recently damaged t he diversion structure. This not only caused staff to enter the frozen creek to repair the intake structure, but could also halt raw water intake for nearly 24 hours. Employees are forced to enter the raw water sump regu larly to manually clean it, which is unsafe and a strain on the limited resources. High TOC and turbidity ha ve been reported in the raw water. Recent samples have indicated high concentrations of E. coli. A water sh ed survey has not been completed and a source water protection plan has not been developed. At the time of the PER, a truck entered Muddy Creek upstream of the diversion dam. The vehicle was reportedly hauling f uel in at least one canister. This forced the District to shut down the WTP until clean up could be competed. Train derailments and vehicle accidents have reportedly happened on more than one occasion in the past. T he District must purchase water from the BLM in Canyon Ferry to be released into the Missouri River the fo llowing year. The District is also restricted as to when they are able to divert water, depending on the time of year and the flow rate in Muddy Creek. The community is expected to double in size over the course of th e next 20-years. The increased demand will put a severe strain on the existing facilities. The current system is not adequate for the expected growth.

7. Does local support exist? If 'Yes', describe the local support for the proposal.

[x] Yes

Local Support Description

Teton County has conducted community needs assessment in anticipation for submission of grant proposals on behalf of the District. Numerous letters have been provided to the District for support of the project and are attached. State and federal officials also support the project.

8. Does the primary sponsor named in (2.) above have the financial ability to provide for the required cost share?

[x] Yes

Primary Sponsor Letter of Support

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PTCWSD WRRDA letter of application 8-20-2018.pdf

POWER – TETON COUNTY WATER & SEWER DISTRICT

P. O. Box 176
Power, Montana 59468

August 20, 2018

U.S. Army Corps of Engineers
441 G Street NW
Washington, DC 20314-1000

RE: Power-Teton County Water & Sewer District

Dear Selection committee,

Please accept this letter of request for $1.97 million in funding for the Power-Teton County Water and Sewer District from the U.S. Army Corps of Engineers Water Resource Reform and Development Act. The Power-Teton County Water & Sewer District (PTCWSD) serves as the governing body for the infrastructure needs for the community of Power, Montana. The unincorporated community of Power is located within Teton County, approximately 20 miles north of Great Falls, Montana along the Interstate 15 corridor. Power supports a K-12 school, with a total of 105 students enrolled, 32 in high school.

Reliable infrastructure is the cornerstone to any community, especially in rural areas. The proposed project will allow the PTCWSD to provide quality drinking water to its current users at an affordable cost. The population of the community is 171, according to the 2015 American Community Survey. The PTCWSD provides water to most of the citizens, through residential connections. Population projections have indicated Power could see an increase in population within the next 20 years. The completion of this project will allow for that growth by providing the essential service of quality drinking water. In addition to the school, fire protection and suppression is a key component of the service provided. Multiple businesses and a large agricultural base are dependent on the District as well, for a clean, sustainable water source. Should a water outage occur, the devastation to the community would be insurmountable, the community may not recover.

The Power-Teton County Water & Sewer District is a small district with limited resources and manpower. All grant funds will allow the District to complete this important project at an affordable rate to the users. The grant funding for this project will be used for all facets of the project. These include:

- Construction costs associated with drilling and installing the shallow wells and the connection to the current distribution system;
- Engineering costs associated with the design and inspection during construction;
- Administration of the project

The requested funds will be used for a Water Systems Improvement project. The project will abandon the current raw water intake at Muddy Creek and the existing water treatment. The current raw water source for the District is Muddy Creek. As the name implies, Muddy Creek has a very high concentration of silt and sediment. In addition, routine testing of the raw water has shown high levels of e.coli bacteria. This concentration will force the District to make additional changes to their water treatment, primarily the installation of a UV disinfection system. The UV system is not only very costly to install, energy costs for the operation will increase significantly. The nature of the creek is causing extensive damage to the current water treatment plant and associated equipment. In addition to the quality of raw water, the Creek is also in danger of significant contamination. There is currently no source water protection plan, watershed survey or emergency spill response plan for Muddy Creek upstream of the diversion dam. Any contamination of the creek, including animal carcasses, or activities such as spring runoff, snow melt and agricultural activities, may force the complete shutdown of the Water Treatment Plant until the issue is remedied.

The current preferred alternative for the PTCWSD is shallow ground wells that will be drilled on the Fairfield Bench and connected to the existing water distribution system. A chlorination system will be added for treatment of the well water. The District will also negotiate for new water rights from the Montana Department of Natural

Resources and Conservation. The completion of this project will allow the District to provide quality drinking water to the users of the system at all times during the year.

The Power WSD has maintained the current system on a very slim budget. Any grant funds received will allow the District to complete the proposed project, operate the new system, and plan for future necessary improvements within the constraints of the current budget. Additionally, based on engineering estimates, the cost to operate and maintain the proposed system will decrease.

We are working with Sweetgrass Development as well as TD&H Engineering, our firm contracted for the project, to secure funding and move forward. The District has received support from Teton County, area legislatures and a large number of members of the community. Public meetings held to discuss the project were well attended. Copies of the letters of support received as part of applications to other funding sources are available, if needed.

Thank you for your time and consideration. We look forward to working with our local, state and federal partners for completion of the project. Please contact me at the information below, should you have questions.

Sincerely,

Ross H. Fitzgerald
Chairman/President
Power-Teton County Water & Sewer District
406-788-1443
rhfitz@3rivers.net

CC: Sweetgrass Development
CC: TD&H

Additional Proposal Information

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PTCWSD PER Water Improvment Project 1 of 3 8-20-18.pdf

1800 River Drive North
Great Falls, MT 59401

406.761.3010
tdhengineering.com

PRELIMINARY ENGINEERING REPORT

POWER-TETON COUNTY WATER & SEWER DISTRICT
POWER, MT

CLIENT

Power-Teton County
Water & Sewer District
PO Box 176
Power, MT 59468

ENGINEER

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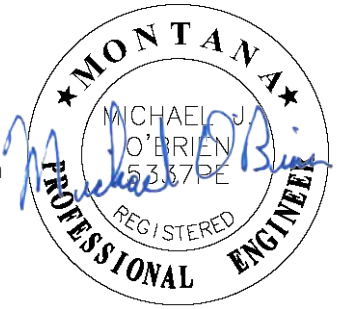

JOB NO. 17-258

MAY 2018

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Appendix 6 A Power CDP Target Rates

Appendix 7 A Resolution to Adopt the PER

Acronym List

ACS	American Communities Survey
AIS	American Iron and Steel Institute
BMP	Best Management Practices
BNSF	Burlington Northern Santa Fe
CCD	Census County Division
CDBG	Community Development Block Grant.
CDP	Census Designated Place
cf	Cubic feet
cfs	Cubic feet per second
DBP	Disinfection By-Products
DEQ	Montana Department of Environmental Quality
DNRC	Department of Natural Resources and Conservation
EPA	US Environmental Protection Agency
EDU	Equivalent Dwelling Unit
FEMA	Federal Emergency Management Agency
FWP	Fish Wildlife and Parks
FWS	US Fish and Wildlife Service
gpd	Gallons per day
gpcd	Gallons per capita day
GWIC	Groundwater Information Center
HAA5	Haloacetic Acids
IESWAR	Interim Enhanced Surface Water Treatment Rule
ISO	Insurance Service Office
LF	Linear Feet
LMI	Low and Moderate Income

MCL	Maximum Contaminant Level
MDOC	Montana Department of Commerce
MHI	Median Household Income
MNHP	Montana Natural Heritage Program
MPWSS	Montana Public Works Standard Specification
MRC	Maximum Recording Limit
MSCA	Montana Salinity Control Association
NCMRWA	North Central Montana Regional Water Authority
NOI	Notice of Intent
NFIP	National Flood Insurance Program
NRCS	Natural Resources Conservation Service
NWI	National Wetland Inventory
O&M	Operations and Maintenance
psi	Pounds per square inch
PER	Preliminary Engineering Report
PVC	Polyvinyl Chloride
RD	Rural Development
RO	Reverse Osmosis
RRGL	Renewable Resource Grant and Loan
SCADA	Supervisory Control and Data Acquisition
SDW	Safe Drinking Water Act
SDWA	Safe Drinking Water Act Amendments
SHPO	State Historical Preservation Office
SRF	State Revolving Fund
SWPP	Storm Water Pollution Prevention Plan
TD&H	Thomas, Dean & Hoskins, Inc.

TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TSEP	Treasure State Endowment Program
TTHM	Total Trihalomethanes
USGS	United States Geological Survey
WRDA	Water Resources Development Act
WTP	Water Treatment Plant

0.0 EXECUTIVE SUMMARY

A. PURPOSE

The following Preliminary Engineering Report (PER) for the Power-Teton County Water and Sewer District addresses the necessary planning and engineering required to comply with state and federal public water system standards. Properly functioning water source, treatment, distribution, and storage system are necessary to provide, clean, safe water for both domestic purposes and fire protection. Sections and subsections included in the subsequent chapters include information required in the October 2017 General Outline of a Preliminary Engineering Report found in the Uniform Application for Montana Public Facility Projects.

Through the PER process, the most beneficial and efficient water system improvements can be determined. An analysis of the water supply, treatment, storage, and distribution systems was completed to identify cost effective improvements which will comply with federal and state regulations and meet the goals of the District's 20-year planning period, ending in 2040. Life-cycle costs are evaluated in terms of construction and operating costs. These costs are used in conjunction with social and environmental considerations for those alternatives which are considered feasible for the current funding cycle. The PER includes an analysis of those alternatives considered to be technologically and politically feasible to the Power-Teton County Water and Sewer District.

The water system is owned and operated by:

Power-Teton County Water and Sewer District
PO Box 176
Power, MT 59468

B. SCOPE OF WORK

The scope of work in this PER includes:

- Project population and water demands;
- Evaluate the water source;
- Evaluate the water treatment system;
- Evaluate the water storage capacity and existing tank condition;
- Evaluate the distribution system deficiencies;
- Develop new alternatives to reflect current infrastructure conditions or City priorities;
- Evaluate the viable alternatives;
- Prepare cost estimates for each alternative including capital and O&M costs;
- Develop project priorities and recommended improvements;
- Prepare a funding and implementation plan for proposed project;
- Present findings to District and to public at multiple workshops and public hearings.

C. EXISTING SYSTEM

The public water system currently serves the Power-Teton County Water and Sewer District. The District has 96 active EDUs, 86 of which are residential. Due to the District's proximity to Great Falls, and the recent growth experienced by the City of Great Falls, the District is expecting to double in size over the next 20-years. This equates to an average annual growth rate of 2.88%.

The PER evaluates the condition and capacity of the existing water system, including water source, treatment, distribution, and storage systems, to determine immediate and long-term needs to the twenty-year planning periods.

The Power-Teton County Water & Sewer District was created in 1969 and consisted of a water treatment plant and a distribution system. The District diverted raw water from the nearby surface water source, Muddy Creek. A recent three-phased project lasting from 2003 to 2008 included a new WTP, a new finished water storage tank, and improvements to the water distribution system. The system draws approximately 14,000,000 gallons (40 acre-feet) from Muddy Creek annually.

A number of deficiencies have been identified with the existing system. Based on available records, an average of 46.7% of the water produced in the last three years is unaccounted for. These losses are considered high for a recently replaced water distribution system. Because the entire distribution system went through a recent rehabilitation project, the water mains are not the expected cause of the water losses. The galvanized service connections are believed to be the main source of unaccounted for water. The distribution system has a dead end main at the southern end of Rainbow Avenue and a single water main under the BSNF Railroad, connecting the east and west sections of the District. These deficiencies decrease the reliability and efficiency of the distribution system. Furthermore, the existing storage tank does not have sufficient volume to meet regulatory requirements.

The District's raw water source and water treatment plant are considered the most pressing issues facing the small District. The current water right does not allow the District to divert water if flows in Muddy Creek are below DNRC defined flow rates. Furthermore, there is no source water protection plan or watershed survey, putting the District's water source at increased risk of contamination. Additionally, the silts naturally present in Muddy Creek enter the existing plant. The WTP includes a large settling and storage pond; however, the basins have not been used in years for maintenance issues. The solids entering the plant have caused corrosion of piping and valves, clogging of the pumps, and frequent treatment train failures. The District has also experienced a variety of problems with the raw water intake. The silts and sediments have corroded the 12-inch ductile iron intake pipe and clogged the raw water pumps. The diversion dam has also been damaged on several times; most recently, an ice jam collided with the structure in the winter of 2017, forcing the District to shut the treatment plant down for nearly 24 hours. Finally, the treatment does not have sufficient capacity to meet current or projected max day demand with 100% redundancy, as required by DEQ.

D. ALTERNATIVES CONSIDERED

Several alternatives were included in the PER as possible solutions to the issues facing the District. The considered alternatives include.

1. Treatment Alternatives

- Alternative T-1-No Action
- Alternative T-2: Upgrade Existing WTP
- Alternative T-3: Connect to NCMRWA
- Alternative T-4: Connect to City of Great Falls
- Alternative T-5: Connect to Tri-County Water
- Alternative T-6: Shallow Ground Water Wells

- Alternative T-7: Deep Ground Water Wells

2. Storage Alternatives

- Alternative S-1-No Action
- Alternative S-2: New 60,000-Gallon Water Storage Tank
- Alternative S-3: New 210,00-Gallon Water Storage Tank

3. Distribution Alternatives

- Alternative D-1-No Action
- Alternative D-2: New Service Connections
- Alternative D-3: New Looping Water Main

E. SUMMARY OF RECOMMENDED IMPROVEMENTS

The alternative selected for improvements to the Power-Teton County Water and Sewer District will be phased. Evaluation of the existing system and conversations with District staff indicate the most pressing issues are associated with the water source and treatment plant. The selected treatment system alternative is included in Phase I. Should the District have sufficient funding after Phase I is completed, Phase II improvements may be pursed and included upgrades to the storage and distribution system. Selected improvements are as follows:

- Phase I- Alternative T-6: Shallow Ground Water Wells
- Phase II- Alternative S-2: New 60,000-Gallon Water Storage Tank
- Phase II- Alternative D-3: New Looping Water Main

1. Project Cost Summary

The total identified project cost for Phase I is $2,627,000. Based on an assumed "worst case" financial strategy presented in Chapter 6.0, impacts to user rates are expected to result in a $54.22 per month increase, for a total of $154.22 per EDU per month user rate. The rate increase includes an estimated annual operating budget of approximately $30,600, a total grant award of $1,219,250 and $1,407,750 in RD loans. The District has plans to submit for a WRDA and CDBG grant; however, WRDA grants are difficult to procure and the current Census data indicated the District does not qualify for CDBG. An income survey is being conducted to verify. Should the District receive these additional grants, the required loan amount and impact to user rates will decrease.

The funding strategy anticipates grant and loan funding from the following agencies:

- TSPE
- RD
- RRGL

F. AKNOWLEDGEMENTS

TD&H Engineering would like to acknowledge the efforts and assistance of the District in preparing this Preliminary Engineering Report. Ms. Karol Walker, Mr. Gene Walker, and Mr. Ross Fitzgerald were especially instrumental in providing background information, context, and input during the PER process. Their cooperation, understanding, and direction guided the recommendations in this report. Finally, the community of Power has displayed concern and interest in the PER process and in the proposed treatment and water source improvements project. The District has been proactive in continuing to address the deficiencies in the water system while minimizing the financial impacts to the rate payers.

1.0 PROJECT PLANNING

The Power-Teton County Water and Sewer District serves the community of Power, MT. The following sections describe the service area in detail.

A. LOCATION

Power is an unincorporated community in Teton County, located along Intersate-15. The community is in North Central Montana, approximately 25 miles northwest of Great Falls and 100 miles south of the Canadian Border. The majority of the community is in Township 23 North, Range 1 West, Sections 25 and 26, at a latitude and longitude of 47.716° and -111.686°, respectively.

The District is roughly 2.5 square miles with a water distribution system located throughout. The existing water treatment plant (WTP) is roughly 1.5 miles west of the District, on Muddy Creek; a 150,000-gallon welded steel finished water storage tank is 0.75 miles northeast of the District. Property information from the Montana Cadastral service is provided in Appendix 1-A. Figure 1-1 presents the District boundary and planning area that was considered in this study. Figure 1-2 is a United States Geological Survey (USGS) topographic map of the District.

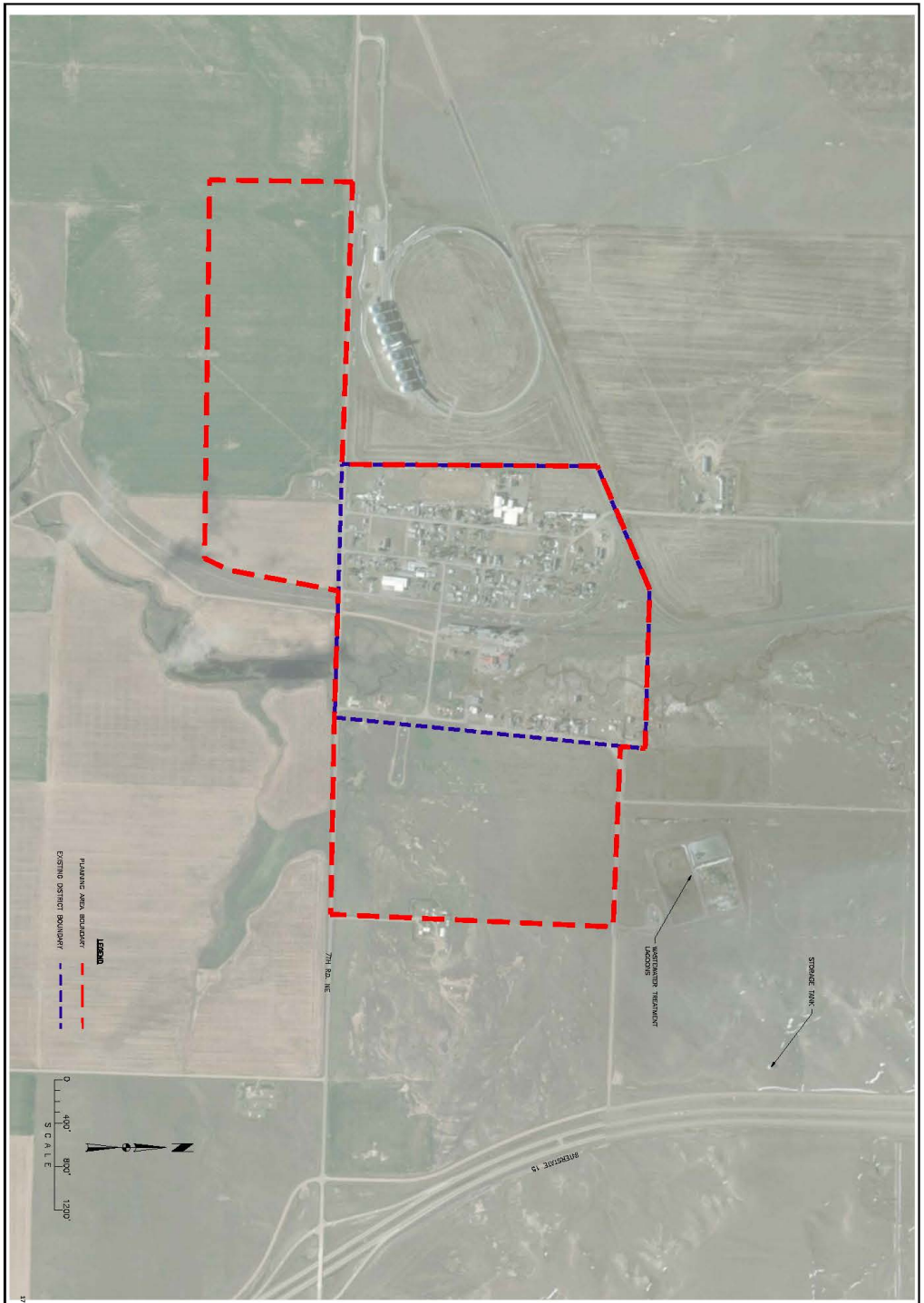
B. ENVIRONMENTAL RESOURCES PRESENT

The environmental resources present in the vicinity of the Power-Teton County Water and Sewer District are discussed below and include land resources, floodplains, wetlands, agricultural lands, endangered animal and plant species, historic sites, and socio-economic/environmental justice issues. The Uniform Environmental Checklist addressing the following resources has been completed and is included in Appendix 1-B. Environmental documentation for the following topics is provided in Appendix 1-C; agency correspondences are available in Appendix 1-D.

1. Land Resources

The area surrounding the community of Power is characterized as agricultural land on relatively flat terrain. The elevation of Power is roughly 3,700 feet above sea level. The Natural Resources Conservation Service (NRCS) Web Soil Survey was consulted regarding soil types in the project area. Web Soil Surveys are included with the Uniform Environmental Checklist in Appendix 1-B. According to the survey, the soil in the District consist primarily of silty clay loam.

As shown in Figure 1-2, WTP and finished water storage tank are both located outside the District and planning area boundary. According to the Web Soil Survey, a majority the soils around the water treatment plant are a silty clay; the finished water storage tank is constructed on the Neldore-Bascovy-Rock outcrop complex.



POWER TETON COUNTY WATER AND SEWER DISTRICT
POWER, MONTANA

PLANNING BOUNDARY

17-258 PL ANNING BOUNDARY.DWG
FIGURE 1-1

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QUALITY CHECK: NMR
DATE: 2/28/2018
JOB NO.: 17-258
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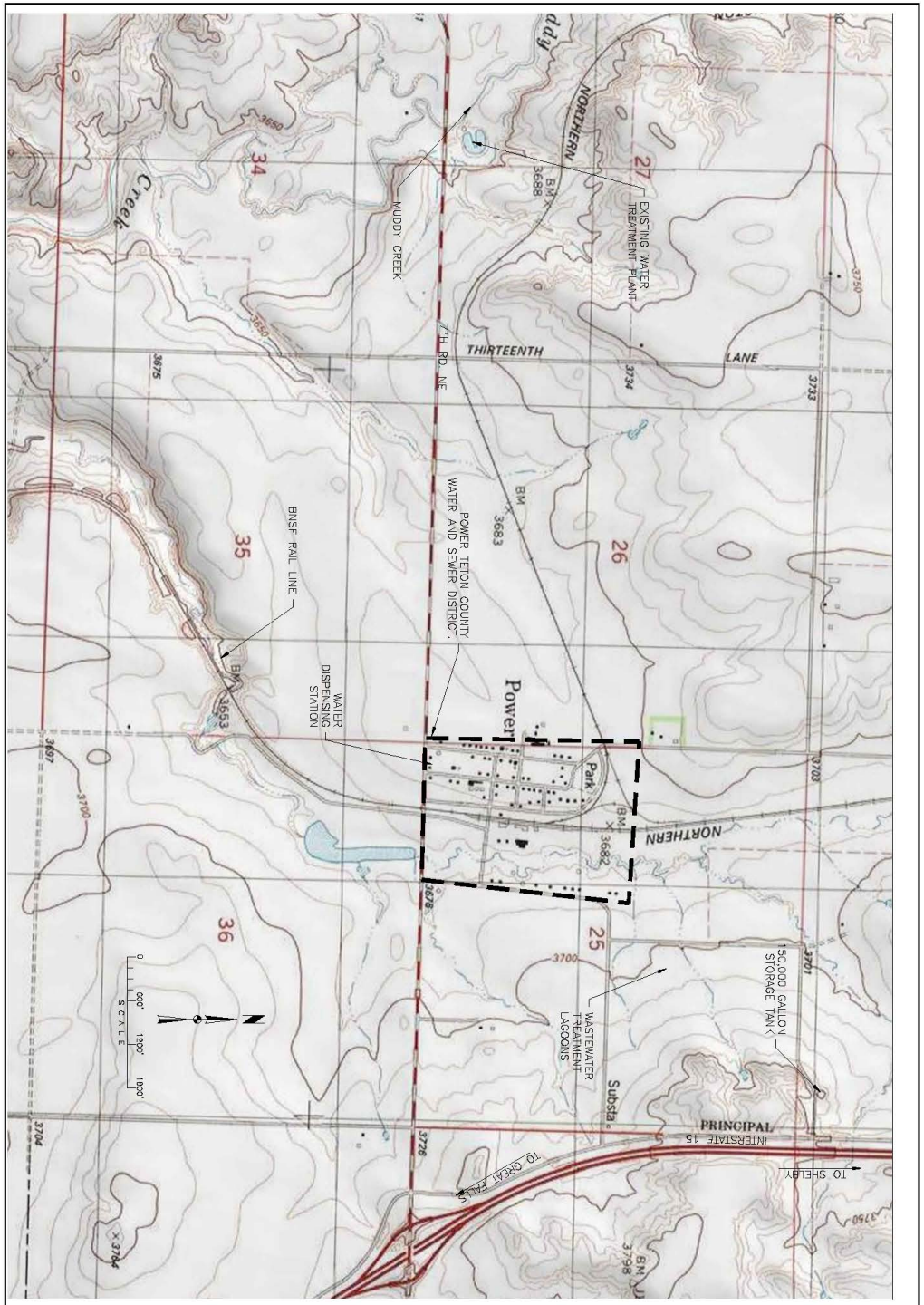

POWER TETON COUNTY WATER AND SEWER DISTRICT
POWER, MONTANA

USGS MAP

FIGURE 1-2
17-258 FIGURE 1-2.DWG

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DESIGNED BY: NMR
QUALITY CHECK: DJG
DATE: 2/26/2018
JOB NO.: 17-258
F.E.N.: 1080XX

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2. Floodplains

The Power-Teton County Water and Sewer District has not been mapped through the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program (NFIP). Attempts were made to contact the Teton County Flood Plain Administrator. The Department of Natural Resources and Conservation (DNRC) responded to our request for information in a letter dated February 6, 2018, available in Appendix 1-D. The DNRC stated that the area surrounding the proposed project is currently classified as Zone D. The response letter clarifies, "The Zone D designation is used for area where there are possible but undetermined flood hazards, as no analysis of the floodplain has been conducted." All proposed improvements will be designed and constructed to prevent changes to the floodplain.

3. Wetlands

A letter has been sent to the Fish Wildlife and Parks (FWP) requesting comment on the proposed improvements to the Power-Teton County Water and Sewer District. The request letter is included in Appendix 1-D. Additionally, a query of the US Fish and Wildlife Service's (FWS) National Wetlands Inventory (NWI) was performed; the results are in included in Appendix 1-C. Most of the surrounding area is not considered wetland. However, the area directly south of the District is mapped as a freshwater pond, and various locations surrounding the community have small portion considered freshwater emergent. Any proposed improvements will be designed to avoid impacts surrounding wetlands.

4. Agricultural Lands

Much of the area surrounding the community of Power is considered agricultural lands. According to the NRCS Web Soil Survey, the Power-Teton County Water and Sewer District consists of areas of prime farmland if irrigated, farmland of statewide importance, and not prime farmland. The reports indicating farmland classification are included in Appendix 1-C.

5. Endangered Animal and Plant Species

A letter requesting information on the area surrounding the Power-Teton County Water and Sewer District was sent to the FWS as well as the FWP. Correspondence are included in Appendix 1-D. The FWS maintains a list of threatened, candidate, and endangered species that may reside within each county. A copy the list is included in Appendix 1-C. The species of interest and their status in Teton County are as follows:

- Grizzly Bear — Listed Threatened
- Canada Lynx — Listed Threatened, Designated Critical Habitat
- Red Knot — Listed Threatened
- Piping Plover — Listed Threatened, Designated Critical Habitat
- Wolverine — Proposed
- Whitebark Pine — Candidate

A query of the Montana Natural Heritage Program (MNHP) website provided a list of animal and plant species of concern, potential species of concern, and special status species. A copy of the query is provided in Appendix 1-C. There are no plant species of concern, potential species of concern, and special status species listed in the area. Additionally, no animal potential species of concern, and special status species are listed. The horned grebe is the only animal species of concern found in the area.

6. Historic Sites

The State Historic Preservation Office (SHPO) was contacted regarding the proposed project. A copy of the file search request form and response are available in Appendix 1-D. According to Mr. Damon Murdo, Cultural Records Manager for the State Historic Preservation Office, there are a few cultural sites in the area. Additionally, a number of cultural resource inventories have been performed. However, Mr. Murdo writes, "As long as the project will be occurring within previously disturbed ground, and there is no disturbance or alteration to structures over fifty years of age we feel that there is a low likelihood cultural properties will be impacted." Based on the Historical Society's evaluation, a cultural inventory is not required at this time. Should cultural resources be encountered, SHPO will be contacted for further assistance.

7. Socio-economic/Environmental Justice Issues.

The proposed project will benefit all users equally. This project is located in a low-income community. According to the 2015 American Community Survey, 31.58% of the Power Census Designated Place's (CDP) population is considered low and moderate income and 15.5% are below the poverty level. Census and TSEP target rate information is available in Appendix 6. Grant and low interest loans will be used to offset impacts to the District's rate payers.

C. POPULATION TRENDS

Population data from the United States Census Bureau is available for Teton County, the Dutton-Power Census County Division (CCD), and the Power CDP. Population data is provided in Appendix 1-E. Figure 1-3 illustrates the census boundaries.

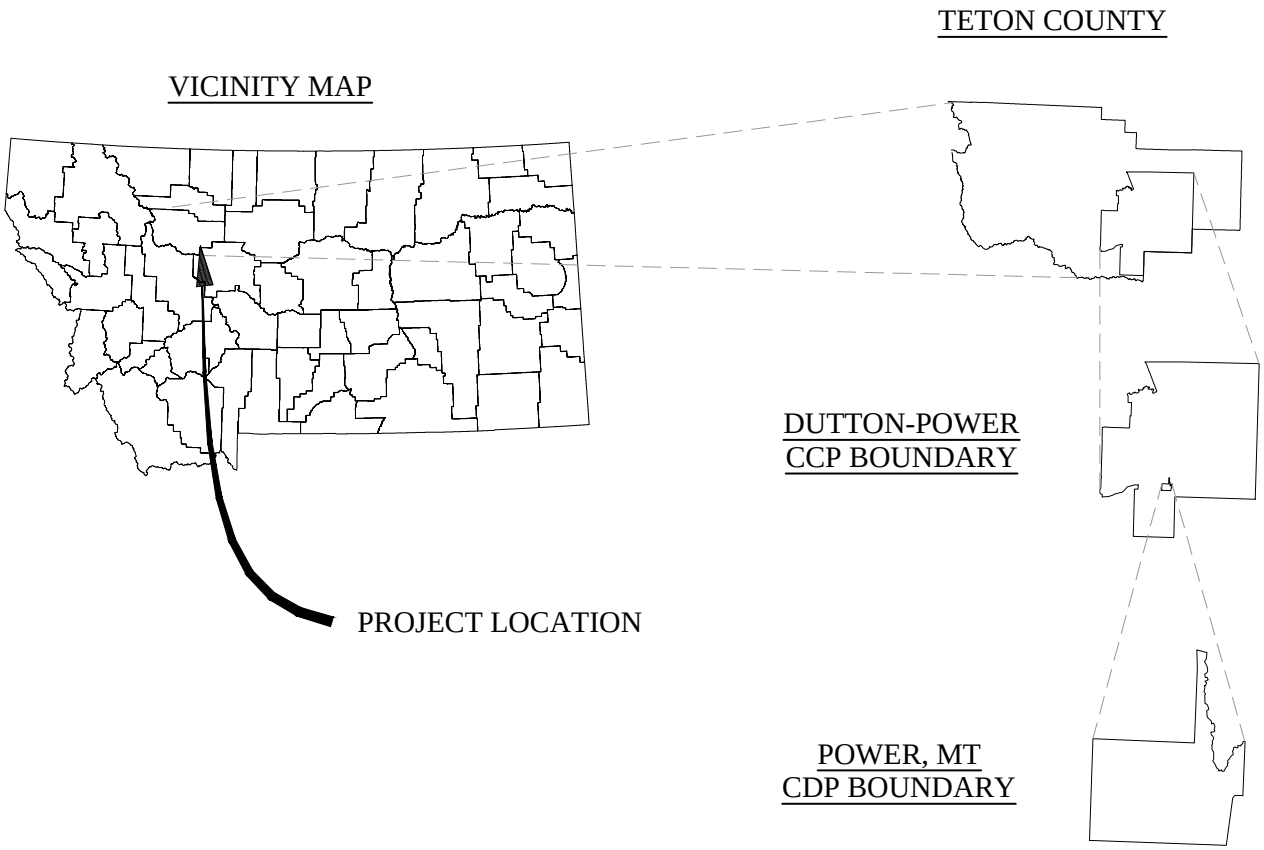
Population records from 1970 to 2010 were reference for both Teton County and the Dutton-Power CCD. The Power CDP consists of 1.5 square miles in eastern Teton County and population data is available from 2000 to 2010. Table 1-1 presents the historical population data.

Table 1-1 Historic Population Data						
Year	Teton County		Dutton-Power CCD		Power CDP	
	Population	% Annual Growth	Population	% Annual Growth	Population	% Annual Growth
1970	6,116	--	1298	--	--	--
1980	6,491	0.60%	1198	-0.80%	--	--
1990	6,271	-0.34%	1,262	0.52%	--	--
2000	6,445	0.27%	1,220	-0.34%	171	--
2010	6,073	-0.59%	1,118	-0.87%	179	0.46%
2015(1)	6,074	0.00%	1,279	1.35%	174	-0.28%

(1) Information provided by the 2015 American Communities Survey (ACS)

Conversations with District staff indicate historic population trends are not likely representative of future growth. The City of Great Falls has been expanding quickly to the northeast and south. Because of the District's proximity to Great Falls, Montana, it is believed the District will see rapid growth in coming years. The District is expected to provide water supply for an additional 180 persons by the year 2040. This equates to an average annual growth rate of 2.82 %. Table 1-2 presents the 20-year population projections.

Table 1-2 Population Projections		
Year	Annual Growth Rate	Population Estimates
2015	2.82%	179
2020	2.82%	206
2030	2.82%	272
2040	2.82%	359



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POWER-TETON COUNTY WATER AND SEWER DISTRICT
POWER, MT

POPULATION AREA MAP

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DESIGNED BY:	NMR
QUALITY CHECK:	MJO
DATE:	2018-01-10
JOB NO.	17-258
CAD NO.	17-258 FIGURE 2.3

FIGURE
1-3

J:\2017\17-258 Power-Teton County Water and Sewer District PER\CADD\CIV\L17-258 FIGURE 2.3.dwg, 3/4/2018 10:40:13 PM, nmr

D. COMMUNITY ENGAGEMENT

Two advertised public hearings were held at the Power Senior Center to discuss the proposed improvements. Public notices and meeting minutes are included in Appendix 1-F.

The first hearing was held March 13, 2018; advertisements were posted throughout the community. The primary purpose of this initial public hearing was to discuss deficiencies in the District's existing system and provide possible solutions. Meeting attendees included District board members, TD&H staff, Sweetgrass Development staff, and 7 members of the community. Feedback from community members regarding a preferred solution was encouraged. The majority of the public comment included concerns regarding an increase in user rates and questions about the water quality of the Fairfield Bench's shallow aquifer.

The second public hearing was held April 10, 2018. The hearing was advertised through both posted flyers in the community and an advertisement that ran twice in the Teton County Newspaper, *The Choteau Ancatha*. Attendees included members of the Board, a representative from TD&H Engineering, Sweetgrass Development staff, and a number of community members. The main purpose of this hearing was to discuss possible environmental impacts of the proposed improvements. The public was given two weeks to review the Uniform Environmental Checklist prior to the meeting. No comments were received regarding environmental concerns.

The community of Power has shown an overwhelming level of support for the proposed project. Senator Llew Jones of Senate District 9 provided a letter of support on April 24, 2018 stating:

"A dependable water source is of the utmost importance to any community. The Power-Teton County Water and Sewer District is a small District with limited resources and man-power. These grants and low interest loans would go a long way in providing potable water and fire protection to the community of Power, Montana."

Representative Ross Fitzgerald demonstrated his support as well in a letter dated April 30, 2018. The letter states:

"A new water source and treatment system is vital for the District to continue to provide clean, reliable water to the community. I am in full and unequivocal support of this PER and application for grant and low interest loans."

Additionally, 39 community members have provided letters expressing their support for the project. Copies of all support letters are provided in Appendix 1-G.

2.0 EXISTING FACILITIES

The following Chapter describes the Power-Teton County Water and Sewer District's water system. The analysis includes both existing infrastructure and financial status.

A. LOCATION MAP

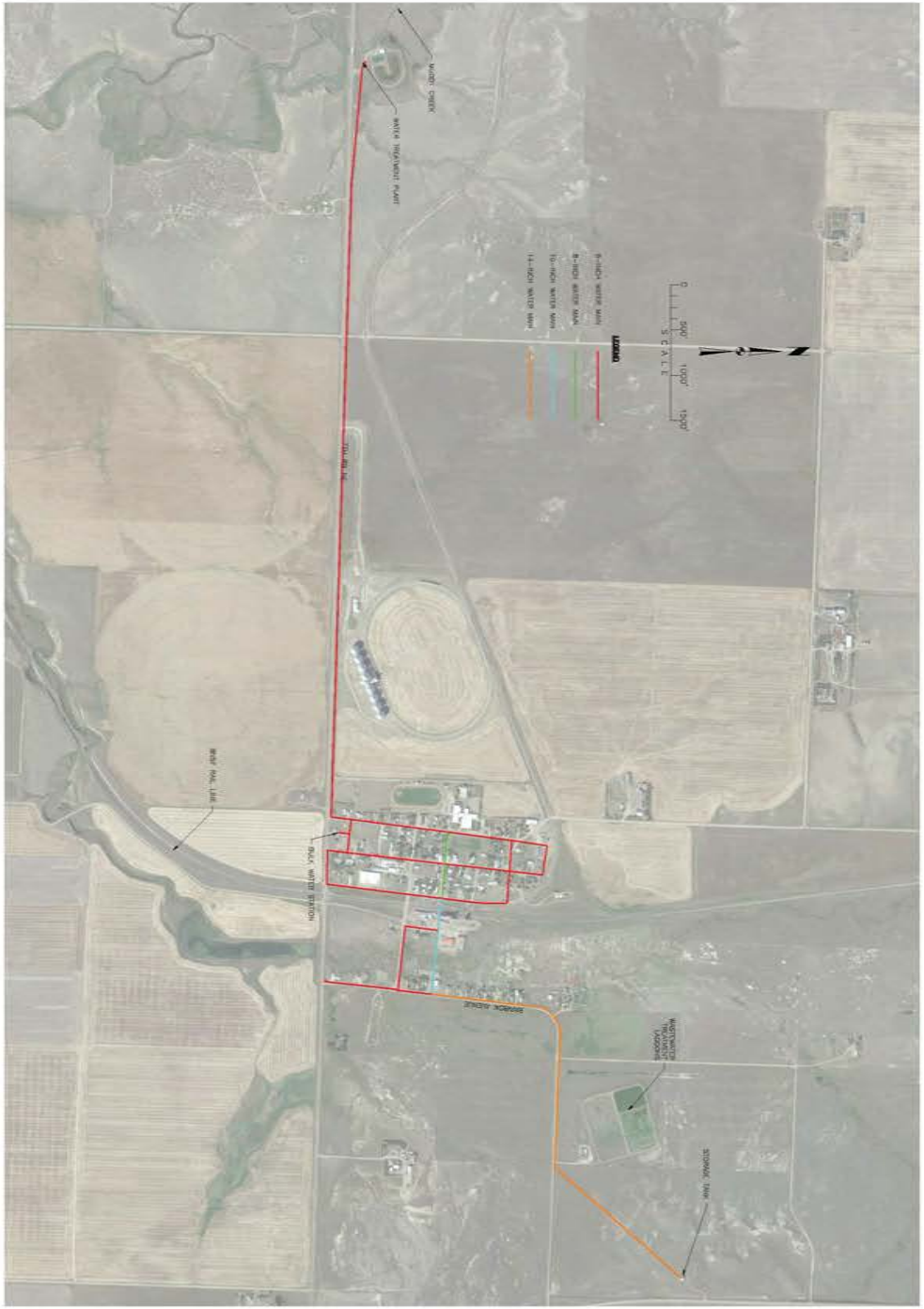
The District covers roughly 160 acres within Teton County, Montana. The water distribution system consists of PVC mains ranging in size from 6- to 14-inch. A 6-inch PVC transmission main conveys treated water from the WTP to the distribution system; a 14-inch PVC transmission main connects the distribution system to a 150,000-gallon finished water storage tank. The District and planning area boundaries were presented in Figure 1-1. Figures 2-1 illustrate the District's complete water system; Figure 2-2 presents a detailed look at the distribution system. Photographs from the WTP, taken during a January 2018 site visit, are provided in Appendix 2-A.

B. HISTORY

The Power-Teton County Water & Sewer District was created in 1969 and included a WTP and a water distribution system. The District originally obtained its raw water from Muddy Creek. Over the past nearly 5 decades, several improvements have been made. These included the additional of a 50,000-gallon concrete storage tank and booster pump station in 1977.

A recent three-phased project lasting from 2003 to 2008 included a new WTP, a new finished water storage tank, and improvements to the water distribution system. The new WTP, which retains Muddy Creek as its water source, draws approximately 14,000,000 gallons per year (40 acre-feet). A new 150,000-gallon welded steel storage tank was constructed northeast of the District. Improvements to the distribution system were also completed throughout the District and included upsizing all mains to provide fire protection and developments to the bulk water station.

Sanitary Surveys conducted by the Montana Department of Environmental Quality (DEQ) indicated the District has not been in violation of state requirements since before 2007. Copies of the past two Sanitary Surveys are provided in Appendix 2-B. However, a number of deficiencies have been identified with the existing system. Suspended solids present in Muddy Creek enter the existing plant and settle in the raw water sump, forcing the operators to spend excessive time and effort to maintain the system. The WTP does include large settling ponds. Due to issues discussed later in this chapter, the ponds are no longer used. Additionally, calculated water losses are extremely high for a recently replaced distribution system. The service connections are believed to be leaking, wasting the limited water supply in the area. These issues will be discussed in greater detail in the sections to follow.



POWER-TETON COUNTY WATER AND SEWER DISTRICT PER
POWER, MONTANA

COMPLETE WATER SYSTEM MAP

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DESIGNED BY: NMR
QUALITY CHECK: DJD
DATE: 02-28-2018
JOB NO.: 17-258
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17-258 FIGURE 2.1DWG
SHEET 2-1

POWER-TETON COUNTY WATER AND SEWER DISTRICT PER
POWER, MONTANA

WATER DISTRIBUTION SYSTEM

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DESIGNED BY: CDF
QUALITY CHECK: DO
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FILE NUMBER:

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SHEET 2.2
17-258 FIGURE 2.2.DWG

C. CONDITION OF EXISTING FACILITIES

The following sections describe each component of the Power-Teton County Water and Sewer District's water system. The DEQ completed sanitary surveys in 2012 and 2015; these are included in Appendix 2-B.

1. Demand

a. Water Records

The District supplied monthly water production, bulk water sales, backwash water, and water usage records from 2015 to 2017. Water production data is measured at the WTP year-round and reported to DEQ. Measurements are taken at the finished water pumps in the WTP. Water required for sludge blow down is diverted from water at the finished water storage tank. As such, sludge blown down water is included in the District's meter water production and must be considered when discussing system demands. The District does not keep records regarding frequency or volume of sludge blow down. The yearly volume of sludge blowdown water was estimated based on conversations with District staff and the system's O&M manual. Water usage records were obtained from individual meters. Each service connection in the District is equipped with a meter; however, meter readings are not taken in the winter months. As with most communities, Power's water usage decreases significantly during the winter. A flat rate is applied to all users from October to February. In the summer months, users pay a flat monthly rate for the first 20,000 gallons. Additional charges are incurred for usage over 20,000 gallons. Bulk water sales from the bulk water station are recorded as yearly revenue. The current charge rate from the station is $0.75 per 100 gallons; this was used to estimate the yearly volume of water sold at the station. Backwash water records were also provided. Backwash water is diverted from the clearwell, upstream of the District's water production meter. Therefore, the backwash water volume is not considered when calculating system demands. Raw water records are included in Appendix 2-C. The available water records and estimated water usage are summarized below in Table 2-1.

Table 2-1
Water Records Summary

Year	Water Production (gallons)	Sludge Blow Down Water (gallons)	Metered Sales (gallons)	Bulk Water Sales (gallons)
2015	15,900,000	2,067,000	5,301,775	215,067
2016	15,430,000	2,005,900	5,447,192	209,667
2017	12,860,000	1,671,800	5,575,500	249,333

b. Unaccounted for Water

Unaccounted for water is determined by comparing the amount of water produced against the amount of water sold. It can result from a combination of factors including leakage, meter inaccuracies, unmetered hydrant flow, unmetered connections, maintenance flushing of pipelines, or unmetered park irrigation. Unaccounted for water for the Power-Teton County Water and Sewer District was calculated using the following equation:

$$\%\ Unaccounted\ for\ Water = \left[1 - \frac{Sales\ (gal) + Bulk\ Water\ \ (gal) + Backwash\ \ (gal)}{Water\ Production\ (gal)}\right] * 100\%$$

Table 2-2 summarizes the yearly percent unaccounted for water for 2015 to 2017. It is estimated that the District saw an average of 46.7% unaccounted-for water, with a maximum of 51.2% in 2015. Conversations with District staff indicate minimal water is lost to fire hydrant usage or maintenance flushing. Additionally, there are no unmetered customers or parks in the District. The suspected cause of the extremely high amount of water loss is leakage from the service lines. Although the distribution system has been recently replaced and is unlikely leaking, issues with the service connections have been reported. Given many of the District's meters are within the building, and downstream of the service connections, this could significantly impact unaccounted for water. The existing service connections are discussed in detail later in this Chapter.

Table 2-2
Unaccounted For Water

Year	Percent Water Loss (%)
2015	51.2%
2016	50.1%
2017	38.8%
Average	46.7%

Discussions with the District have suggested the monthly manual meter reading procedures likely introduce some error in the monthly water use values, particularly regarding Power High School's water service. Additionally, meter readings are not taken in the winter months. Because of these reasons, coupled with the lack of sludge blow down water records on volume and frequency, it is suggested the District gather additional data in the future to more precisely assess water production, sales and backwash data.

c. Existing Water Demand

To ensure appropriately conservative designs throughout this Preliminary Engineering Report (PER), existing water demand has been estimated using recorded water production rather than water usage data. After the large quantity of unaccounted-for water recently became evident, the District has begun preliminary discussions on repairing leaking services. Should the community find a solution to the large amounts of expected leakage, the water production rate will decrease. It is considered to be too speculative to assume that the existing trends will change in the future. Additionally, the District is planning to grow significantly in the coming years. Although new infrastructure to serve new residents will likely not have the same leaking present as the existing system, this growth will likely be accompanied by new parks, businesses, and more frequent O&M procedures such as hydrant flushing and exercising valves. These activities will increase the net volume of water required of the District to serve the new areas. It was therefore decided that the current system's water production should be used to predict water needs for future growth areas.

Total water production rates were divided by 365 days to calculate the average day

water production in gallons per day (gpd). Population was based on 2015 American Communities Survey (ACS) and a 0.5% annual growth rate to estimate 2016 and 2017 populations. As shown in Table 2-3, this methodology estimates the average water production for the Power-Teton Water and Sewer District at 224 gallons per capita per day (gpcd).

Table 2-3
Existing Water Demands

Year	Total Water Production (gallons)	Average Production Rate (gpd)	Estimated Population[1] (persons)	Production Rate (gpcd)
2015	15,900,000	43,562	179	243
2016	15,430,000	42,274	180	235
2017	12,860,000	35,233	181	195
			Average	**224**

(1) Population estimates based on 2015 ACS and 0.5% annual population growth

This production rate was compared against reported production rates from Montana communities, summarized in Table 2-4. Production rates ranged from 102 gpcd in Belgrade, MT to 250 gpcd for Malta, MT. Brady, MT is similar to Power in both size and location and reported a production rate of 226 gpcd; this is comparable to the calculated average of 224 gpcd for the District. Based on this comparison, a water production rate of 224 gpcd is considered appropriately conservative for the planning purposes of this PER.

Table 2-4
Montana Community Production Rate

Community	Population	Production Rate (gpcd)
Malta, MT	1,997	250
Brady, MT	173	226
Neihart, MT	136	103
Belgrade, MT	8,776	102
Libby, MT	3,076	122

d. Peaking Factors

Peaking factors were calculated from water production flow data provided by the District and reported to the DEQ. Raw data collected from 2015 to 2017 is provided in Appendix 2-C. The provided data was utilized in this analysis. The average day flow rate ranged from 42,158 gpd in 2016 to 43,434 gpd in 2015 and averaged 42,632 gpd for 2015 to 2017. Yearly max month and max day flow rates were calculated. Peaking factors for max month and max day were calculated for each year by dividing the maximum flow rate by the 3-year average day flow rate of 42,632 gpd. The District does not have flow records at small enough intervals to allow for peak hour or peak instantaneous flows. Detailed calculations are provided in Appendix 2-C; results are summarized in Table 2-5.

Table 2-5 Power District - Peaking Factors					
Year	3-year Average Day Flow Rate (gpd)	Maximum Month		Maximum Day	
		Flow (gpd)	Peaking Factor	Flow (gpd)	Peaking Factor
2015	42,632	100,000	2.35	120,000	2.81
2016	42,632	66,452	1.56	90,000	2.11
2017	42,632	72,258	1.69	90,000	2.11
Average		**79,570**	**1.87**	**100,000**	**2.35**

To provide a comparison, peaking factors may be estimated through published literature. Water Resource Engineering, Second Edition, by David A. Chin, provides typical values for water system peaking factors. These values are presented below in Table 2-6.

Table 2-6 Typical Peaking Factors			
	Minimum Value	Typical Value	Maximum Value
Maximum Month	1.10	1.20	1.50
Maximum Day	1.50	1.80	3.00
Maximum Hour	2.00	3.25	4.00

For further comparison, peaking factors from similar Montana communities were evaluated. Table 2-7 provides peaking factors from Malta, Brady, Neihart and Belgrade, Montana.

Table 2-7 Montana Community Peaking Factors			
Community	Peak Hour	Maximum Day	Maximum Month
Malta, MT	6.18	3.90	*
Brady, MT	*	4.25	*
Neihart, MT	*	3.25	*
Belgrade, MT	3.19	2.31	*

*Not Reported

Due to the unaccounted-for water and the wide range of values reported for similar Montana communities, the typical peaking factors reported in referenced literate and summarized in Table 2-6 will be utilized throughout this PER. The calculated peaking factors from Table 2-5 correspond most closely to the maximum values in in Table 2-6. Additionally, smaller communities tend to have larger peaking factors. For these reasons, the maximum values from Table 2-6 will be referenced for design flows.

e. Future Demands

Future demands are based on historic water production and the predicted population growth rate. As a conservative method, the total average per capita usage (224 gpcd) is multiplied by the projected population to predict the future average day demand. As discussed in Chapter 1, the District is expecting the community of Power to average 2.82% annual grown for the next 20 years; this equates to a design population of 359 people in 2040. The projected maximum month, day, and hour demand are determined by multiplying the peaking factors discussed in the previous section by the future average day demand. Projected future demands are summarized below in Table 2-8.

Table 2-8
Future Demands

Per Capita Demand	224	gpcd
2040 Population	359	persons
Average Day Demand	80,416	gpd
Max Hour Demand	321,664	gpd
Max Day Demand	241,248	gpd
Max Month Demand	120,624	gpd

f. Design Demands

Table 2-9 summarizes demands based on previous sections and recommended peaking factors.

Table 2-9
Design Demands

Current Conditions		
Population	185	persons
Average Day	41,400	gpd
Max Hour	165,800	gpd
Max Day	124,300	gpd
Max Month	62,200	gpd
20-year Design Conditions		
Population	359	persons
Average Day	80,400	gpd
Max Hour	321,700	gpd
Max Day	241,200	gpd
Max Month	120,600	gpd

* Rounded to the nearest 100 gpd

2. Water Supply

The Power-Teton County Water and Sewer District's water source is Muddy Creek. Muddy Creek is fed largely by irrigation flows from the Greenfield Irrigation District. A diversion dam was constructed on Muddy Creek, approximately 1.5 miles west of the District. This dam directs a portion of the creek's flow into the existing treatment plant. The District has a Provisional Water Right for diversion of water from Muddy Creek.

Table 2-10 provides a summary of the District's Water Right. Detailed Water Rights information is provided in Appendix 2-D.

Table 2-10 Water Rights			
Owner	**Water Rights Number**	**Flow Rate (gpm)**	**Source**
POWER - TETON COUNTY WATER & SEWER DISTRICT	41K 30049120	70	Muddy Creek

a. Condition

The raw water from Muddy Creek is high in organic content and turbidity, particularly during spring runoff, winter thaws, and large storm events. This is illustrated below in the photograph of the backwash water in the WTP, taken January 2018.

The most recent sanitary survey, available in Appendix 2-B, classified the Muddy Creek Water Shed as largely agricultural with no source water protection plan or emergency spill response plan. In order to better protect the District's water source, a watershed survey and watershed protection plan were strongly recommended. Activities such as runoff, snow melt and agricultural practices have a large impact on the water quality of Muddy Creek. Additionally, District staff have described a number of isolated incidents that have occurred in recent years that have seriously impact Muddy Creek's water quality. These occurrences have included things such as train derailment and the presence of animal carcasses in the Creek. Most recently, on May 6, 2018, a vehicle went off the road and became submerged in the creek upstream of the diversion dam. The vehicle was carrying at least one canister of fuel, in addition to the fuel present in the gas tank. This incident affected the water quality in Muddy Creek so significantly, the WTP was forced to shut down until clean up can be completed. At the time this PER was printed, cleanup had not been completed and the District was unable to divert raw water. The survey also noted total organic carbon (TOC) concentrations steadily increasing over time and predicted a continued increase in organic matter present in the source water. Moreover, the survey noted the existing intake is not protected from contamination and suggests multiple intakes and varying elevations.

According to the plant operators, the high concentration of silts and sediments in source water have caused significant maintenance problems within the WTP. Pre-sedimentation basins have been constructed upstream of the WTP to prevent most of the suspended solids from entering the plant. However, the basins are rarely used due to maintenance issues such as difficulty cleaning and poor drainage. As such, a large quantity of solids enter the treatment facility and settle out in the raw water sump, forcing the operators to enter the sump periodically to dig out the sediments by hand. Additionally, the copper and ductile iron pipe, fittings, and valves throughout the plant have corroded as a result of the high suspended solids concentration. Finally, the raw water pumps often experience clogging from silts present. Issues with the existing treatment plant will be discussed in greater detail later in this Chapter.

b. Capacity

Muddy Creek flow rates at the water treatment plant have not been recorded, but a U.S Geological Survey (USGS) gauging station exists on Muddy Creek at Vaughn, Montana, Gauging Station 06088500. This station is located approximately 14.5 miles downstream and additional stream flow enters upstream of the station, inflating measured flow rates. However, site specific information is not available at this time. Chart 2-1 summarizes recorded flow rates at Station 06088500, raw flow data is available in Appendix 2-E.

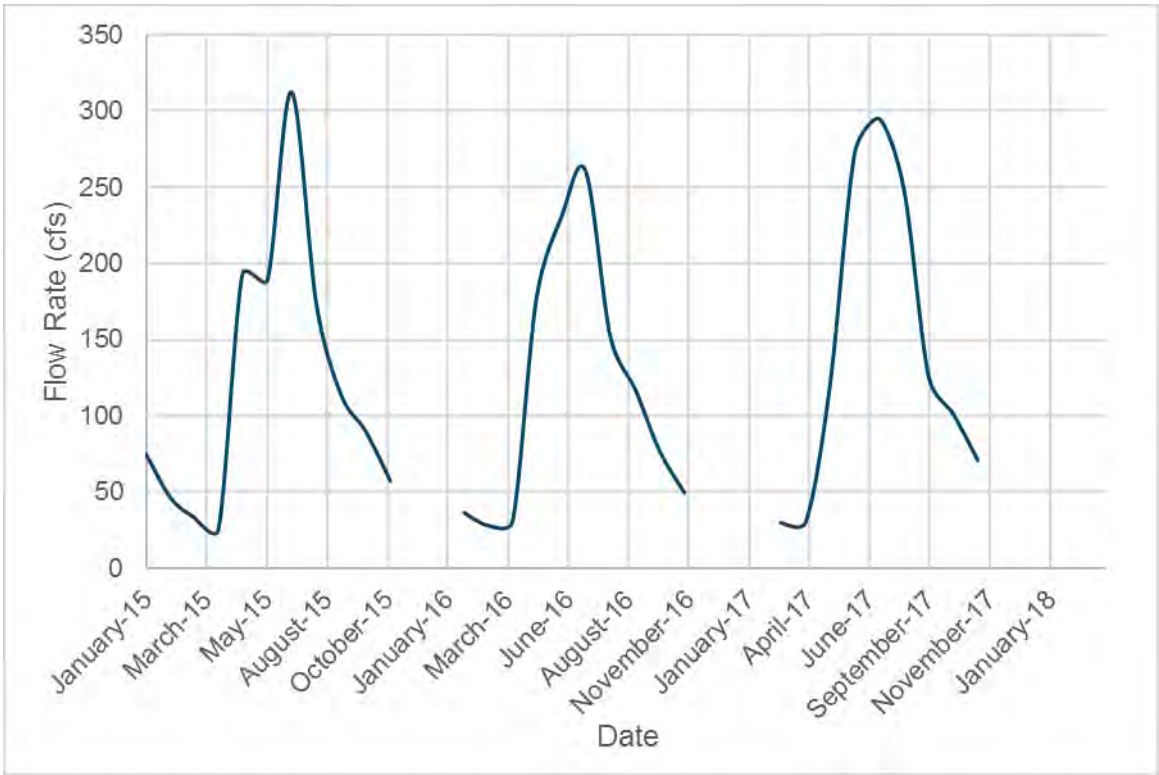


Chart 2-1: Muddy Creek at Vaughn: Historic Monthly Average USGS Flow Rates

Circular DEQ-1 requires the quantity of water at the source be adequate to meet or exceed the design maximum day demand for the service area as well as provide a reasonable surplus for anticipated growth. As presented in the previous section, the current maximum day demand is 124,300 gpd or 0.192 cfs; the design maximum

day demand is projected to be 241,200 gpd or 0.373 cfs. As shown in Chart 2-1, flows in Muddy Creek are more than adequate to serve the District; with minimum monthly average flow rates around 20 cfs in the winter months and exceeding 300 cfs in the summer months.

Although the Muddy Creek provides sufficient flows to meet the District's current and future demands, significant restrictions are detailed in the District's Provisional Water Right. In the General Abstract for the Power-Teton County Water and Sewer District's provisional permit, published by the DNRC on January 12, 2018, the maximum flow the District is permitted to divert is 70 gpm or 100,800 gpd. This does not meet DEQ-1 requirement that the source water must be sufficient to exceed maximum day demand, as the current max day demand it 124,300 gpd. As the District grows in the coming years, the current Water Right will become increasingly inadequate. The 20-year design max day demand is 241,200 gpd, over twice the flow allowed by District's Water Right.

Furthermore, all water diverted from Muddy Creek by the District in a given year must be purchased via a Water Service Contract from the U.S. Bureau of Reclamation's Water Reserve in Canyon Ferry Reservoir for release into the Missouri River the following year. The District has also been directed to contact the US FWS when water is diverted from Muddy Creek, as a portion of creek flows are diverted to the Benton Lake National Wildlife Refuge

Finally, water may not be diverted if measured flows in Muddy Creek are below values reported in Table 2-11.

Table 2-11
Existing Water Right Diversion Restrictions

Time Period	Minimum Muddy Creek Flow (cfs)
April 6-May 15	47.55
May 16-June 21	48.84
August 1-September 30	48.84
October 1-October 15	47.55
October 16-October 31	40.65

Using flow data obtained from the USGS gauging station at Vaugh, MT, at a minimum the District was unable to divert water from Muddy Creek for 26, 27, and 37 days in 2015, 2016, and 2017, respectively. Detailed analysis and raw gauging station data are provided in Appendix 2-E.

3. Water Treatment

The District's existing WTP was constructed in 2004 and consists of two conventional filtration treatment trains. A concrete diversion dam, constructed in 1970 with the original treatment plant, diverts raw water to a perforated pipe in the bed of Muddy Creek. Raw water then flows by gravity to the WTP through a 12-inch ductile iron pipe to a raw water wet well located in the southeast corner of the treatment plant. From there, raw water is sent directly to the treatment trains or to the pre-sedimentation basins by the two raw water pumps. Another pump is included in the wet well to transfer raw water to the large storage

basin east of the plant. This pump is also utilized to supply the fire fill line and provide fire protection. A second wet well is included adjacent to the raw water wet well. This wet well can be utilized to transport raw water from the small pre-sedimentation basin or the large storage basin directly to the treatment trains and includes 2 raw water pumps with 50 gpm capacities.

The WTP includes two treatment trains to provide redundancy to the treatment process, as required by DEQ. Each of the two treatment trains has rapid mixers for injecting ferric chloride, alum, and/or polymer into the feed water before entering the flocculators. The pH can be adjusted with the use of hypochlorite acid or caustic. Flocculation is aided by variable speed mixers before entering sedimentation. Tube settlers are used for removing the floc prior to filtration. Each filtration basin consists of 37 inches of anthracite and garnet sand on top of 16 inches of support gravel. Finished water from the clearwell is used as backwash water for cleaning the filter material.

From the treatment trains, water flows through a carbon filter. Next, calcium hypochlorite is added for disinfection before the water is conveyed to an above ground, insulated 30,000-gallon clearwell south of the treatment building. Finally, two 50-gpm high service pumps are used to transport finished water to the distribution system. Backwash is controlled by time, high turbidity, or high pressure and head loss. The treatment trains are able to operate simultaneously, provided one is not undergoing backwash.

The plant is controlled by water levels in the clearwell. The treatment trains are automatically controlled by a level transducer; the raw water and backwash pumps are automatically controlled by the plant control system. An alarm system is included to alert the operators to high or low tank levels, power outages, or backwash failure.

A waste pond has been constructed west of the treatment plant. Wastewater from the sedimentation and backwash process is discharged to the waste pond. From there, the water is conveyed to surrounding wetlands where evapotranspiration and infiltration ultimately dispose of the wastewater.

a. Condition

Conversations with District staff indicate the existing WTP is suffering from numerous operational issues. The main cause of these issues is believed to be the high organic content and silty nature of the source water, as previously discussed.

The WTP includes a smaller pre-sedimentation basin to help mitigate issues associated with the high sediment concentration in Muddy Creek and a larger storage pond intended to store water during low flow conditions. However, the basins have not been used in recent years. The pre-sedimentation basin is designed to be flushed by a fire truck periodically. Fire truck flushing is done to direct sediment to a drain, which does not function properly. Additionally, the local fire department has recently switched to foam fire suppression. As such, the Department no longer has a fire truck capable of flushing the basin. Ultimately, the District has determined the raw water sump is easier to use and more efficient to clean and maintain. The pre-sedimentation pond is not currently utilized. The larger storage pond is also not used as it allows for the buildup of organic carbon in the water creating the potential for increased disinfection by-products. Rather, water is pumped directly from the raw water sump to the treatment trains. This forces the operators to enter the sump to clean out accumulated sediment and trash. Occasionally, operators are able to

use a trash pump in the cleaning process; more often, the sediment is too dense and requires manual removal. It is also worth noting that the bottom of the basins are not easily accessed. Animals have entered and clogged the drain in the past as well as damaged the PVC liner.

Conversations with the District have indicated the existing clearwell and backwash pond are also in need of repair. The backwash pond is unlined and difficult to maintain. The clearwell is an insulated tank located next to the treatment plant. The most recent Sanitary Survey performed by the DEQ reported that the inspector was unable to fully inspect the clearwell, particularly the roof, for fear of damaging the insulation.

The high silt and sediment concentration in the source water has caused a number of issues within the WTP. The solids shown in the photograph below were cleaned from the flash mixer but are present throughout many components in the WTP. These solids have caused valves and piping throughout the plant to corrode and leak. This is particularly true regarding the solenoid valves in the treatment trains. Additionally, check valve failures have allowed finished water to run backwards when another pump is running.

The District has also experienced a number of issues with the existing diversion dam. Most recently, an ice jam damaged the dam in the winter of 2017; this incident left the community of Power without a water source for nearly 24-hours while District staff was forced to enter the freezing creek and repair the structure. Additionally, the existing ductile iron pipe from the diversion dam to the treatment plant has deteriorated significantly over time due to the poor water quality in Muddy Creek. These issues, coupled with the frequent clogging of raw water pumps has resulted in regular intake issues.

Finally, issues with the existing treatment trains have been reported. According to the current plant operators, the treatment trains are very temperamental and frequently fail. Maintenance issues with the treatment trains have also been reported; when cleaning one of the trains, sludge build up will often be simply transferred to the other train.

The District has worked tirelessly to maintain this system. The 2015 sanitary survey, prepared by the DEQ, stated:

"The Power-Teton County Water District is well operated and maintained. The dedication of the operator is to be commended…The overall facility is very well managed and maintained. The management is very proactively maintaining the technical sustainability of the system."

However, the poor source water quality is causing significant corrosion and maintenance issues with the treatment system, beyond the operators control.

b. Capacity

Circular DEQ-1 requires all water treatment plants have 100% redundancy. The Power-Teton County Water and Sewer District's WTP was designed for an average day flow rate of 66,000 gpd. Each treatment train is capable of treating 46 gpm.

The existing plant has shown to be sufficient to meet the current District demand, however the District has had to run both trains simultaneously. Sanitary Surveys completed by the DEQ in 2012 and 2015 indicate the District has not had any violations in water quality prior to 2007; Sanitary Surveys are provided in Appendix 2-B. The current average day demand for the District is estimated at 41,400 gpd. The average day demand after the 20-year design period is projected at 80,400 gpd. In order to provide the required 100% redundancy, the WTP would need the capacity to treat 156,400 gpd. This is more than 20,000 gpd greater than the capacity of the current system.

Although the current WTP has the capacity to provide for the District's current average day water needs, the system is unable to produce enough treated water to meet the current max day demand, 124,300 gpd. The treatment system will become progressively inadequate as the population increases. At a total capacity of 132,480 gpd, the system will not be able sustain a design average day or max day demands of 80,40 gpd and 241,200 gpd, respectively.

c. Treatment

As with any public water system, the Power-Teton County Water and Sewer District has a number of regulatory requirements detailed in the 1974 Safe Drinking Water Act (SDW) and its subsequent amendments. Several of the requirements that currently affect, or could affect the District in the future, are discussed below. Water quality data is provided in Appendix 2-F.

<u>Interim Enhanced Surface Water Treatment Rule (IESWAR)</u>

The 1996 Safe Drinking Water Act Amendments (SDWA) required US Environmental Protection Agency (EPA) to develop rules to strengthen system protection against microbial contaminants. As a result, the IESWAR was promulgated in 1998. As part of this rule unfiltered surface water supply systems must comply with updated watershed control requirements that add *Cryptosporidium* as a pathogen of concern. The rule initially only applied to systems serving more than 10,000 people. The rule places new or additional requirements on turbidity, disinfection requirements, and disinfection byproducts.

Long Term Enhanced Surface Water Treatment Rules, LT-1 and LT-2

LT-1 was finalized in 2002 and became effective in January 2005. This rule extends the requirements of the IESWAR to systems with less than 10,000 in population. The rule added requirements on turbidity and disinfection.

LT-2 was finalized in January of 2006. In general, this rule requires systems to monitor for *Cryptosporidium* in their source water supply. A proposed sampling schedule was to be submitted along with a notice to the EPA or the State of an unfiltered system's intent to provide at least 3-log treatment for Cryptosporidium by July 1, 2008. *E. coli* may be monitored instead of *Cryptosporidium* but the system must notify EPA or the State of their intent to monitor *E. coli*. Systems were mandated to begin 12 or 24 months of *Cryptosporidium* source water monitoring by April 2010. Public systems must install and operate additional treatment in accordance with their mean *Cryptosporidium* level by September 30, 2014.

The Power-Teton County Water and Sewer District samples for *E. coli* in their source water. The District provided results from October 23, 2017 to April 10, 2018. These results are summarized below in Table 2-12. According to the EPA's Fact Sheet of LT2 source water monitoring, available in Appendix 2-F, for filter system serving less than 10,000 people, the EPA requires *E. coli* samples at least once every two weeks for a 12-month period. For systems with a flowing water source, like Power, if the mean annual *E. coli* concentration is greater than 50 *E. coli* per 100 ml, the system will be required to monitor *Cryptosporidium*.

Table 2-12
LT2 Tests: *E. coli*

Date	*E. coli*/100 ml
10/23/2017	15.6
11/6/2017	59.0
11/20/2017	60.0
12/4/2017	29.2
12/18/2017	61.3
1/2/2018	172.2
1/16/2018	209.8
1/29/2018	920.8
2/14/2018	12.1
3/14/2018	37.9
3/13/2018	123.0
3/26/2018	93.0
4/10/2018	157.6
Average	**150.1**

As shown in Table 2-12, the average sampled *E. coli* exceeds 50 *E. coli* per 100 ml. Should this trend continue, the District will be required to sample for *Cryptosporidium*. The *Cryptosporidium* samples will dictate if additional treatment and disinfection is required. The District will be placed into an EPA defined "bin" based on measured *Cryptosporidium* concentrations; these measured concentrations define the required *Cryptosporidium* treatment and are detailed in the Fact Sheet included in Appendix 2-

F. Given the high concentrations of *E. coli*, it is possible the District will be required to add additional disinfection in the future. UV disinfection is a common addition in this situation and is effective against *Cryptosporidium*.

Disinfection By-Product Rules

Disinfection By-Product Rule Stage 1 is the first of a staged set of rules that will reduce the allowable levels of disinfection byproducts (DBP) in drinking water. The rule establishes seven new standards. The rule became effective for systems with less than 10,000 people in January of 2004.

Disinfection By-Product Rule Stage 2 increases public health protection by increasing monitoring requirements and reducing the allowable concentrations of DBPs total trihalomethanes (TTHMs) and Haloacetic Acids (HAA5). Due to the high levels of TOC in Power's source water, the District is considered high risk for DBP. Disinfection By-Product Rule Stage 2 set the Maximum Contaminant Level (MCL) at 80 µg/l for TTHM and 60 µg/l for HAA5. The fact sheet is provided in Appendix 2-F.

A summary of the TTHMs and HAA5 concentrations is provided in Table 2-13. Detailed water quality data is provided in Appendix 2-F.

Table 2-13
DPB Test Results

Date	TTHM (µg/l)	HAA5 (µg/l)
Aug-14	39	27
Aug-15	51	39
Aug-16	49	24
Aug-17	27	17

Lead and Copper

Lead and copper are contaminants that can dissolve in water as it flows through the distribution system, service lines, and household fixtures. SDW regulations require monitoring of lead and copper throughout the distribution system. If lead levels exceed 0.015 mg/L or copper levels exceed 1.3 mg/L, action must be taken to control these contaminants.

Water samples were taken in August 2014 from various locations within the distribution system. Test results for lead ranged from <0.001 mg/L to 0.002 mg/L, and copper results ranged from <0.01 mg/L to 0.11 mg/L. These results are below the Maximum Recording Limit (MRL) for both contaminants.

Other Rules

The SDW and its Amendments include a wide variety of rules regarding various other contaminants. A description of all the rules is beyond the scope of this report.

4. Water Distribution

The distribution system was completely replaced during a three-phase project from 2003

to 2008. Approximately 8,300 LF of 6-inch PVC connects the distribution system to the existing treatment plant. The distribution system consists of a matrix of PVC pipe ranging in size from 6-inch to 10-inch. Roughly 12,550 LF of PVC water main is included throughout the Power-Teton County Water and Sewer District's distribution system. Finally, the distribution system is connected to a 150,000-gallon storage tank by approximately 5,000 LF of 14-inch PVC. Figures 2-1 and 2-2, included earlier in this chapter, illustrate the existing distribution system. Table 2-14 summarizes approximate pipe quantities.

Table 2-14
Existing System Pipe Quantities

Size	Length (LF)
6-inch	19,000
8-inch	750
10-inch	1,100
14-inch	5,000

a. Condition

As previously mentioned, the District's distribution system went through a complete rehabilitation project from 2003 to 2008. New PVC piping was reportedly installed throughout the community in accordance with DEQ requirements, Montana Public Works Standard Specifications (MPWSS), and generally accepted engineering practices. Due to the recent construction, it is believed that the current system is in good condition and free of leaks. Moreover, the clay soils in the area would cause significant leaks to surface, allowing for quick remediation. The large percentage of unaccounted-for water previously discussed is most likely a result of the galvanized service connections. Because the connection experience smaller flow rates when compared to the larger mains, the volume of water leaking in a single area would be minimal, allowing the water time to infiltrate rather than surface.

A number of deficiencies do exist throughout the distribution system. Most notably the dead end and lack of redundancy reduce the reliability of the system. A single 10-inch water main travels under the railroad tracks and connects the east and west potions to the District. Should that main fail, the eastern half would be disconnected from the WTP; the western half of the District would also be isolated from the water storage tank. A second main under the railroad track is necessary to further ensure potable water is continuously available to the entire District. Finally, a dead end exists in the system on the southern edge of Rainbow Avenue. Circular DEQ-1, Section 8.2.4.a states:

"To provide increased reliability and reduce head loss, dead ends must be minimized by using appropriate tie-ins whenever practical."

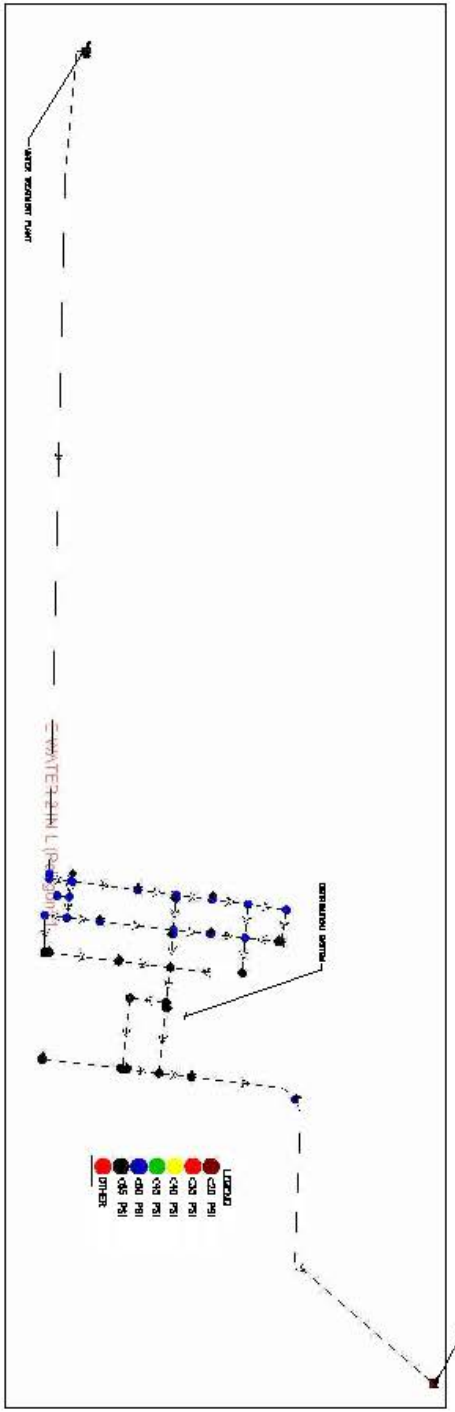
By connecting the existing 6-inch water main along Rainbow Avenue to the rest of the distribution system, the reliability and water pressures of the system in that portion of the District would increase.

b. Capacity

A hydraulic analysis was completed using WaterCAD by Bentley Systems. The model

was created based on available Record Drawing and conversation with District staff. The limits of the WaterCAD model are presented in Figure 2-3. Detailed model reports are provided in Appendix 2-G.

The hydraulic model consisted of a steady state hydraulic simulation. Four scenarios were evaluated representing average day and max hour demands for both existing and estimated design demands for the year 2040. Predicted water pressures throughout the system for each scenario are presented in Table 2-15.



POWER-TETON COUNTY WATER AND SEWER DISTRICT PER
POWER, MONTANA

WATERCAD MODEL LIMITS

FIGURE 2-3 FIG 2-3.DWG

DRAWN BY: NMR
DESIGNED BY: NMR
QUALITY CHECK: MJO
DATE: 03-2018
JOB NO.: 17-258
FILENAME: 17-258.DWG

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REV	DATE	REVISION

NOT FOR CONSTRUCTION

Table 2-15 Modeled Distribution System Pressures				
WaterCAD Junction	Residual Pressure (psi)			
	Existing Average Day Demand	Existing Max Hour Demand	Design Average Day Demand	Design Max Hour Demand
J-1	52	52	52	52
J-2	55	55	55	55
J-3	52	52	52	52
J-5	53	53	53	53
J-6	53	53	53	53
J-7	53	53	53	53
J-8	47	47	47	47
J-9	47	47	47	47
J-10	48	48	58	48
J-11	56	56	56	56
J-12	50	50	50	50
J-13	48	48	48	48
J-14	53	53	53	53
J-15	49	49	49	49
J-16	51	51	51	51
J-17	53	53	53	53
J-18	53	53	53	53
J-19	49	49	59	49
J-20	53	53	53	53
J-21	51	51	51	51
J-22	47	47	47	47
J-23	48	48	48	48
J-24	47	47	47	48
J-25	48	48	48	48
J-26	48	48	48	48
J-27	47	47	47	47
J-28	47	49	49	49
J-29	47	49	49	49
J-30	51	51	51	51
J-31	49	48	48	48
J-32	50	50	50	49
J-34	53	53	53	53
J-35	49	49	49	49
J-36	57	47	47	47
J-37	58	48	48	48
J-38	53	53	53	53
J-40	53	53	53	53
J-41	55	55	55	55
J-43	69	68	68	68

Circular DEQ-1 mandates normal working water pressure within public distribution systems must remain above 35 psi. As shown in Table 2-15, the Power-Teton County Water and Sewer District's distribution system maintains working pressures for the existing average day and max hour demands both existing and with a minimum modeled pressure of 47 psi. Similarly, the design max hour and average day demands produced a minimum system pressure of 47 psi, showing the existing Distribution has sufficient capacity to handle the design demands.

5. Water Meters

All water services are metered. WTP water production is metered.

6. Services

Power property owners are responsible for their water service lines within the boundaries of their property, up to the curb stop. Service lines from the mains to the curb stops have been replaced during past construction projects. As mentioned previously in this PER, the service lines are suspected of significant leaking, contributing to the District's high percentage of unaccounted for water. Many service lines have recently been replaced within the District. The photographs provided below were taken from the most recent corroded service connection replacement. As shown, large holes are present in multiple locations along the connection, allowing ample opportunity for leakage.

7. Fire Protection

As part of the most recent improvements to the distribution system, fire hydrants were installed throughout the District and all distribution mains were upsized to 6-inches or greater. This was reportedly done in accordance with Circular DEQ-1 requirements for systems that provide fire suppression. Additionally, DEQ requires that fire flows, when fire protection is provided, meet the recommendations of the fire protection agency in which the water system exists, or in the absence of such a recommendation, the fire code adopted by the State of Montana. The fire flow must not cause pressures to fall below 20 psi at any locations in the system.

The Insurance Service Office (ISO) recommends minimum fire flows based on the factors such as the type and condition of the fire suppression system, the degree of training to the Fire Department, and if the Fire Department is a full-time or volunteer service. Additionally, ISO considers the type of buildings in the vicinity. Typically, ISO recommends 500 to 1,500 gpm for residential areas and 2,000 to 5,000 gpm for commercial areas such as schools. For the purpose of this evaluation, the required fire flow for the Power-Teton County Water and Sewer District is assumed to be 1,000 gpm for 60 mins. The two fire hydrants nearest the school are assigned an estimated fire flow of 2,000 gpm for 60 min.

The previously discussed WaterCAD model was utilized to estimate system pressures under fire flow conditions. Per DEQ-1 requirements, system pressure must remain above 20 psi for all flow conditions, including fire flows. Table 2-16 provide available fire flow to each hydrant and the resulting system pressure. Detailed WaterCAD results are included in Appendix 2-G.

Table 2-16
Fire Flow Model Results

Hydrant	Required Flow (gpm)	Available Fire Flow (gpm)	Minimum System Pressure (psi)
H-01	1,000	1,757	20
H-02	1,000	1,973	20
H-03	1,000	1,745	20
H-04	1,000	1,888	20
H-05	1,000	1,745	20
H-06	1,000	2,453	20
H-07	1,000	1,555	20
H-08(1)	2,000	1,738	20
H-09(1)	2,000	1,814	20
H-10	1,000	2,207	20
H-11	1,000	2,459	20
H-12	1,000	3,000	29
H-13	1,000	1,122	20
H-14	1,000	3,000	35

(1) Hydrants H-08 and H-09 are located nearest Power High School

As shown in Table 2-16, the existing distribution system provides reasonable fire flow while maintaining adequate system pressure for all residential hydrants. The two hydrants nearest Power High School were assigned a fire flow demand of 2,000 gpm, in accordance with typical ISO recommendations. The school was not evaluated in detail to confirm this assumed fire demand is adequate for the particular building. Modeled results indicate the maximum flow available to each hydrant is only 1,738 gpm and 1,814 gpm while maintaining a minimum pressure of 20 psi throughout the system. This is slightly less than the typically recommended flows.

8. Water Storage

As part of the recent improvements to the Power-Teton County Water and Sewer District, a 150,000-gallon welded steel storage tank was constructed roughly 0.75 miles northeast of the District. The storage tank is 30 feet in diameter and 30 feet high and connected to the distribution system by a single 14-inch PVC transmission main.

a. Condition

No issues have been reported from the storage tank. Conversations with District staff and recent DEQ Sanitary Surveys indicate the storage tank is in good condition and operating as designed.

b. Capacity

Circular DEQ-1 requires the volume of all finished water storage tanks connected to systems that provide fire protection be greater than or equal to the average day demand for 24 hours plus the fire flow demand. As defined previously, the current average day demand for the district is and the 41,400 gpd and the maximum fire flow demand is estimated at 2,000 gpm for 60 min. Based on the following equation, the District currently needs 161,400 gallons of storage. The 20-year design average day demand is 80,400 gpd. This results in a future required storage volume of 200,400 gallons.

$$Current\ Required\ Storage = (41{,}400\ gpd * 1\ day) + (2{,}000\ gpm * 60\ \mathrm{min})$$
$$= 161{,}400\ gallons$$

Based on this analysis, the existing 150,000-gallon storage tank does not have sufficient capacity of service the Power-Teton County Water and Sewer District under current or design conditions.

D. FINANCIAL STATUS OF EXISTING FACILITY

1. History of Revenues and Expenditures

Financial records were provided by the District. Table 2-17 summarizes the incomes and expenditures for the 2014-2016. Details of the District's profits and loses can be found in Appendix 2-H.

Table 2-17 Revenues and Expenditures			
Income			
	2014	**2015**	**2016**
Operating Revenue	$50,590	$50,336	$50,615
Non-Operating Revenue	$69,183	$71,398	$74,737
Total Revenue	$119,773	$121,734	$125,352
Expenditures			
	2014	**2015**	**2016**
Operating Expenditures	$46,013	$47,038	$43,718
Non-Operating Expenditures	$10,287	$7,960	$8,839
Total Expenditures	$56,300	$54,998	$52,557
Net			
	2014	**2015**	**2016**
Net Operating Income	$4,577	$3,298	$6,897
Net Non-Operating Income	$58,896	$63,438	$65,898
Total Net Income	**$63,473**	**$66,736**	**$72,795**

Multiple loans were taken out to fund Phases I and II of the 2003-2008 water system improvements. Phase III was funded exclusively through grants. Phase I was originally funded, in part, by a $400,000 loan at 2.75% interest from the State Revolving Fund (SRF) drinking water program. This loan was refinanced in 2014 at a 2.00% interest rate. Phase II received $375,000 SRF loan at 2.75% in 2005. This loan was refinanced in 2014 with an interest rate of 2.25%. Table 2-18 summarizes the Districts outstanding loans. Detailed amortization schedules are included in Appendix 2-H.

Table 2-18 Outstanding Loans					
Description	**Loan Amount**	**Interest Rate**	**Date of Funding**	**Payoff Date**	**Outstanding Balance**
SRF Loan 1	$216,000	2.00%	3/18/2014	7/1/2023	$130,000
SRF Loan 2	$247,000	2.25%	3/18/2014	7/1/2025	$169,000
				Total	**$299,000**

Finally, at the end of 2016, the District has $310,964 in cash or cash equivalents. Conversations with operational staff indicated that as of May 4, 2018, the District had $323,608 in savings. This includes an operational checking account with roughly $48,000. Funding is held primarily at Dutton State Bank and includes savings accounts, checking accounts, and CDs. A small portion of the District's funds are held in various banks and credit unions in the area.

2. Rate Schedules

The Power-Teton County Water and Sewer District has 89 residential services and 1 commercial service. Three of the residential services are disconnected Each residential service is a ¾-inch service and defined by the District as 1 equivalent dwelling unit

(EDU). The single commercial service is a 2-inch service that feeds Power High School and is considered 10 EDUs. The District charges $13.00 per month for sewer services. For the water system, the users pay $26.00 per month up to 20,000 gallons; users pay an additional $0.30/100 gallons for 20,000 to 40,0000 gallons, $0.50/100 gallons for 40,000 to 60,000 gallons, and an additional $0.70/100 gallons for usage over 60,000 gallons. Finally, $61.00 per month is charged for loan repayment.

3. Annual Operating and Maintenance Costs

The District provided financial records from 2013 to 2016. From these records, provided in Appendix 2-H, annual operations and maintenance cost were determined. Although the District's annual budget includes roughly $100,000 for depreciation, conversations with District staff indicate this value is not included in the current user rates as no yearly payment is required. As such depreciation has not been included in the annual O&M budget Table 2-19 summarizes these costs.

Table 2-19
Operations and Maintenance Budget

Operating Expenses	FY 2013	FY 2014	FY 2015	FY 2016	Average Operating Expenses
Accounting & Auditing	$625	$660	$675	$700	$665
Bank Service Charges	---	$19	---	---	$19
Chemicals	$5,018	$6,015	$6,741	$6,128	$5,976
Dues/Certifications/Training	$425	$425	$425	$425	$425
Easement & Water Assessment	$183	$196	$211	$227	$204
Fees (Permits, Service, Recording)	$756	$920	$768	$774	$805
Insurance & Bonding	$1,779	$1,813	$1,846	$1,995	$1,858
Payroll Expense	$10,451	$11,285	$11,232	$11,692	$11,165
Postage & Office	$1,534	$655	$834	$980	$1,001
Professional Fees	$249	$9,026	$1,000	---	$3,425
Repairs	$1,514	$1,539	$8,980	$7,490	$4,881
Supplies	$57	$1,296	$2,672	$1,642	$1,417
Testing Water	$1,938	$1,849	$2,076	$1,994	$1,964
Truck Expenses	$1,380	$1,282	$1,235	$752	$1,162
Utilities	$7,212	$9,033	$8,343	$8,919	$8,377
Total Operating Expenses	**$33,121**	**$46,013**	**$47,038**	**$43,718**	**$42,473**

E. WATER/ENERGY/WASTE AUDITS

A comparison of the plant production water verses the individual metered sold water was made for this PER and is discussed earlier in this section. Other than this information, no water/energy audits have been conducted.

3.0 NEED FOR PROJECT

The following Chapter details the Power-Teton County Water and Sewer District's need for improvements to their existing water system. This project will assist the Power-Teton County Water and Sewer District in prioritizing capital projects as well as managing limited resources and budgets. The needs for the project are discussed below in terms of health, sanitation and security, infrastructure age, and system growth.

A. HEALTH, SANITATION AND SECURITY

Health, sanitation, and security is of the utmost importance to the District. Currently, the existing distribution, storage, and treatment systems each pose a significant threat to the safety and well-being of the community.

1. Distribution System

As a whole, the existing distribution system is operating as designed and is able to maintain DEQ mandated minimum pressures. However, a single distribution main connects the east and west portions of the District. The District is bisected by a Burlington Northern Santa Fe (BNSF) railroad. A 10-inch PVC water main travels east-west along 4th Street and has been bored under the rail line. Should this main fail, the eastern section of the District would be disconnected from the WTP and the western portion would be isolated from the storage tank. Depending on the severity of the main break and the time required to repair the fractured link, the residents east of the railroad tracks may be without water for an extended period of time. Without a constant source of potable water, significant issues regard human health, hygiene, and sanitation would arise. Furthmore, fire protection would no longer be supplied to that portion of the District; creating obvious safety hazards. The lack of redundancy in the system poses a serious risk to the health and safety of the residents and the security of the existing distribution system.

Additionally, a dead end exists on the southern end of Rainbow Avenue. Circular DEQ-1 strongly recommends the number of dead ends in a system be decreased to the greatest extent possible. The addition of a looping main to eliminate the existing dead end would greatly improve the reliability and efficiency of the system. This is particularly critical given that the fire hydrant present near the dead end is the only fire suppression available to the area. Eliminating the dead end will also decrease the age of the finished water within the distribution system. This will improve the quality of water in the system and decrease the risk of water borne pathogens.

2. Storage

The District's current storage tank does not provide sufficient volume to meet current and projected water demands. Circular DEQ-1 mandates enough finished water storage must be provided for fire flows plus 24 hours of average day demand. The lack of available finished water storage may hinder fire suppression efforts and pose a significant risk to public safety. In order to provide the residents of Power with adequate potable water and fire suppression, additional water storage is required.

3. Treatment and Water Source

The largest threat to the health, sanitation, and security of the District's water system is the existing treatment plant and source water. As detailed in Chapter 2, there are concerns regarding the quality of the District's source water, Muddy Creek. The high silt and sediment concentration in Muddy Creek have caused a number of serious operational and maintenance issues within the WTP. Ice jams have recently damaged the diversion structure. This not only caused District staff to enter the frozen creek to repair the intake structure, but also deprived the District of raw water intake for nearly 24 hours. The sedimentation basins are no longer usable due to concerns with the existing liner and drain. The inadequacy of the basins is allowing a large quantity of sediment to enter the treatment plant. District employees are forced to enter the raw water sump regularly to manually clean it. This is both unsafe for the operators, and a strain on the District's limited manpower and resources. Additionally, the silts are clogging pumps and corroding the ductile iron and copper pipes, fittings, and valves throughout the WTP. Clogged pumps and corroded pipes have resulted in leaks, valve failures and pump failures. Most notably, the reliability of solenoid valves of the treatment trains has significantly decreased, causing the treatment trains to become extremely temperamental.

Muddy Creek is considered an unreliable source for the community. High TOC and turbidity have been reported in the raw water. Recent samples taken by the District have indicated high concentions of *E. coli*. Furthermore, a water shed survey has not been completed and a source water protection plan has not been developed. At the time of writing this report, a truck entered Muddy Creek upstream of the diversion dam. The vehicle was reportedly hauling fuel in at least 1 canister. This foced the District to shut down the WTP until clean up could be competed. Train derailments and vehicle accidents have reportedly happened on more then 1 occasion in the past. The poor water quality and unrealiable nature of the District's source water can have a significant negative impact of the District's ability to supply the community with clean, safe drinking water.

The District's Provisional Water Rights were also discussed in Chapter 2. The District must purchase water from the BLM in Canyon Ferry to be relieased into the Missouri River the following year. The District is also restricted as to when they are able to divert water, depending on the time of year and the flow rate in Muddy Creek. Moreover, the corrosion occurring in the 12-inch ductile iron intake pipe and clogging in the raw water pumps is causing significant intake issues for the District. Finally, the District's current water right allow them to divert no more than 70 gpm; this is not a sufficient water supply to provide for the current maximum day demand, as required by DEQ-1.

A reliable water treatment plant and water source are crucial for the District to continue providing clean, healthy water to the community of Power.

B. AGING INFRASTRUCTURE

1. Distribution System

Although the public distribution system was replaced in a recent rehabilitation project, the service connection located on private property are corroded and leaking. The large volume of unaccounted for water is believed to be result these

connections. Replacement of each service would substantially increase both the efficiency of the system and cost saving for the small District.

2. Treatment and Water Source

Similar to the water distribution system, the WTP went through a recent rehabilitation project. However, the poor source water quality has caused the treatment system to deteriorate at an accelerated pace. As mentioned previously, the existing piping, valves, and pumps have corroded due to high solids concentrations in the raw water. This is causing leaks, pump failures, and treatment train failures throughout the water treatment plant. The efficiency of the system has significantly decreased as a result, wasting limited resouces and money. Additional workloads have been placed on the plant operators who work tirelessly to maintain a failing system. Improvements to the source water and treatment plant are required to provide the District with an effective and manageable water system.

C. REASONABLE GROWTH

As discussed in Chapter 1, the District is expecting significant growth over the design life of all proposed improvements. The community is expected to double in size over the course of the next 20-years due to its proximity to Great Falls. The increased demand will put a severe strain on the existing facilities. The finished water storage tank is believed to be undersized for the current population. The problems with the source water and treatment plant will be further perpetuated with the expected growth.

4.0 ALTERNATIVES CONSIDERED

The primary objective of this PER is to select the most appropriate alternative for solving the problems facing the Power-Teton County Water and Sewer District's water supply, treatment, distribution, and storage systems. Several potential solutions are developed and evaluated in this Chapter. The selected alternative must be the most feasible method of meeting applicable criteria and public health requirements throughout the project's design life.

Alternatives considered for this project are presented below. A description of each alternative and the rationale for inclusion as a viable option are discussed. Where alternatives are excluded from further consideration, justification for elimination is provided. If an alternative appears to be feasible, it is analyzed in accordance with all required information identified in the *2017 Uniform Application for Montana Public Facility Projects*.

A. WATER SOURCE/TREATMENT ALTERNATIVES

1. Alternative T-1: No Action

In this alternative, the water treatment plant will operate as it does currently. Benefits to this alternative include no immediate construction activities or capital costs. As detailed in Chapter 2, significant issues are present throughout the existing treatment plant. The elevated silt and sediment concentrations present in the source water have caused fittings, valves, and pipes to fail. This significantly impacts water and energy efficiency within the plant. The large O&M effort required to maintain the treatment system coupled with the decreased efficiency is putting undue stress on the small District. For these reasons, the No Action Alternative is not considered a viable option and will not be discussed further.

2. Alternative T-2: Upgrade Existing Treatment Plant

a. Description

This alternative entails rehabilitating the existing WTP; the corroded, deteriorated, and inadequate components of the existing WTP will be repaired or replaced.

A number of deficiencies within the District's existing treatment plant and water source were detailed throughout Chapter 2. Two conventional filtration treatment trains are included in the treatment plant. Each train has a design capacity of 46 gpm. Due to DEQ-1's requirement for 100% redundancy in water systems, the existing system has a 66,000 gpd capacity. The existing max day demand is 124,300 gpd; the design max day demand is 241,200 gpd. The existing treatment trains do not have capacity to provide for current max day demands while providing 100% redundancy and will become increasing inadequate as the District's population increases. Replacement of the treatment trains is included in this alternative to increase the capacity of the system.

Issues with TSS and TOC were noted throughout the provided sanitary surveys and discussions with District staff. This alterative include replacing the conventional filtration trains with a membrane filtration system. Membrane filtration involves passing the raw water through a thin layer of semi-permeable material to filter solid impurities. There are a number of membrane filtration options, including microfiltration, ultrafiltration, nanofiltration, and reverse osmosis. Ultrafiltration is proposed as part of this alternative. Pore sizes for ultrafiltration systems range

from 0.02 to 0.1 microns with operating pressures of 30 to 100 psi. Ultrafiltration systems have shown to be very efficient at removing suspended solids, turbidity, and coagulated organic matter. Given the poor water quality of Muddy Creek, this is believed to be the most beneficial system. Additionally, high removal rate of particulate metals, as well as microbial and viral pathogens have been reported. Ultrafiltration treatment trains are considered low-pressure systems when compared to other membrane filtration systems. Advantageous to ultrafiltration, when compared to convention clarification, include consistent treated water quality, simple automation, a small footprint, and smaller required backwash water volume. Given the limited resources and manpower available to the District, a simpler, automated system with fewer operational requirements is considered to be the most beneficial. Manufacture's literature is provided in Appendix 4-A.

A pilot test was performed in 2001 to test membrane filtration efficiency on raw water directly form Muddy Creek. According to the 2001 study Muddy Creek's water quality was too high in TSS for the membrane filtration system to performed effectively. The high turbidity and TSS concentration in the source water can mitigated with the use of the pre-sedimentation basin at the WTP. However, as detailed in Chapter 2, this basin is rarely used due to a number of O&M issues. Alternative T-2 includes retrofitting the basin to allow for more efficient solids settling, as well as more efficient O&M procedures. The basin will be cleaned of all sediment and debris. The existing PVC liner will be removed and the pond will be graded to facilitate more efficient drainage. A check dam will be constructed near the pond's inlets; this will slow the raw water as it enters the ponds and facilitate more efficient solids settling. The basin will be lined with a concrete slab to allow for mechanical cleaning. This will also prevent burrowing animals from damaging the new structure. Finally, a new outlet structure will be constructed allow for more efficient draining and to prevent small animal from entering the drain. The large storage basin north and east of the existing WTP will be abandoned. Conversations with District staff have indicated this basin is rarely operated, and will not likely be utilized with improvements.

The poor source water quality has caused the copper and ductile iron piping and fittings within the treatment plant to corrode and leak. Therefore, all ductile iron and copper pipes and fittings are to be replaced with this alternative. This includes approximately 352 LF of copper and 195 LF of ductile iron piping. Additionally, replacement of all check valves and solenoid valves within the plant is included. The elevated solids concentrations and chemical residue has caused the pumps throughout the plant to clog and experience frequent failures. The five raw water pumps within the plant and two finished water pumps are to be replaced with this alternative.

The District's recent source water samples have shown high concentrations of *E. coli*, as discussed in Chapter 2. This may trigger the DEQ to required UV disinfection as part of the District's treatment train. Alternative T-2 includes a UV disinfection system. UV systems utilize radiation to lyse the cell walls of the bacteria. Typical system use radiation lamps placed in a regulated flow stream. Either open channel or closed conduit units are available. Product literature for an open channel system is included in Appendix 4-A.

Issues with the existing diversion structure were originally presented in Chapter 2. Ice jams have damaged the structure in the past, causing District staff to enter the

frozen creek; a single intake is included in the dam, while multiple intake at varying elevations is recommended. Finally, the 12-inch ductile iron intake pipe is corroded and causes significant intake issues. This alternative includes the replacement of the 12-inch intake, roughly 130 LF. A new diversion dam is also included in this alternative. The diversion dam will be cast-in-place concrete and include two intake pipes and varying elevations.

Issues with both the clearwell and backwash pond were discussed in the existing facilities review. The most recent DEQ sanitary surveys detailed deficiencies with the clear well including spray on insulation and an inadequate access hatch. DEQ staff was unable to fully inspect the clearwell due to fear of damaging the structure. A new clearwell is included in this alternative. Conversations with District staff suggest the backwash pond needs to be upgraded. This alternative entails constructing a new inlet structure and lining the pond with HDPE liner.

Finally, the District's Provisional Water Right will be reevaluated with Alternative T-2. A more reliable water source is crucial for the District as the community continues to grow. The existing water right includes significant restrictions regarding when the District is able to divert raw water. The US FWS is to be contacted whenever the District diverts water, as a portion of Muddy Creek is diverted to Benton Lake Wildlife Refuge. Additionally, the water right allows for a maximum diversion of 70 gpm (100,800 gpd). This is not sufficient to provide for the current of design maximum day flows. The Havre Regional Office of the DNRC was contacted regarding the District's existing Water Right. According to DNRC staff, Muddy Creek is located in the Upper Missouri River Basin. This is a legislatively closed basin, meaning the DNRC is unable to appropriate additional water rights for surface water. Water will therefore have to be purchased from an existing water right.

b. Design Criteria

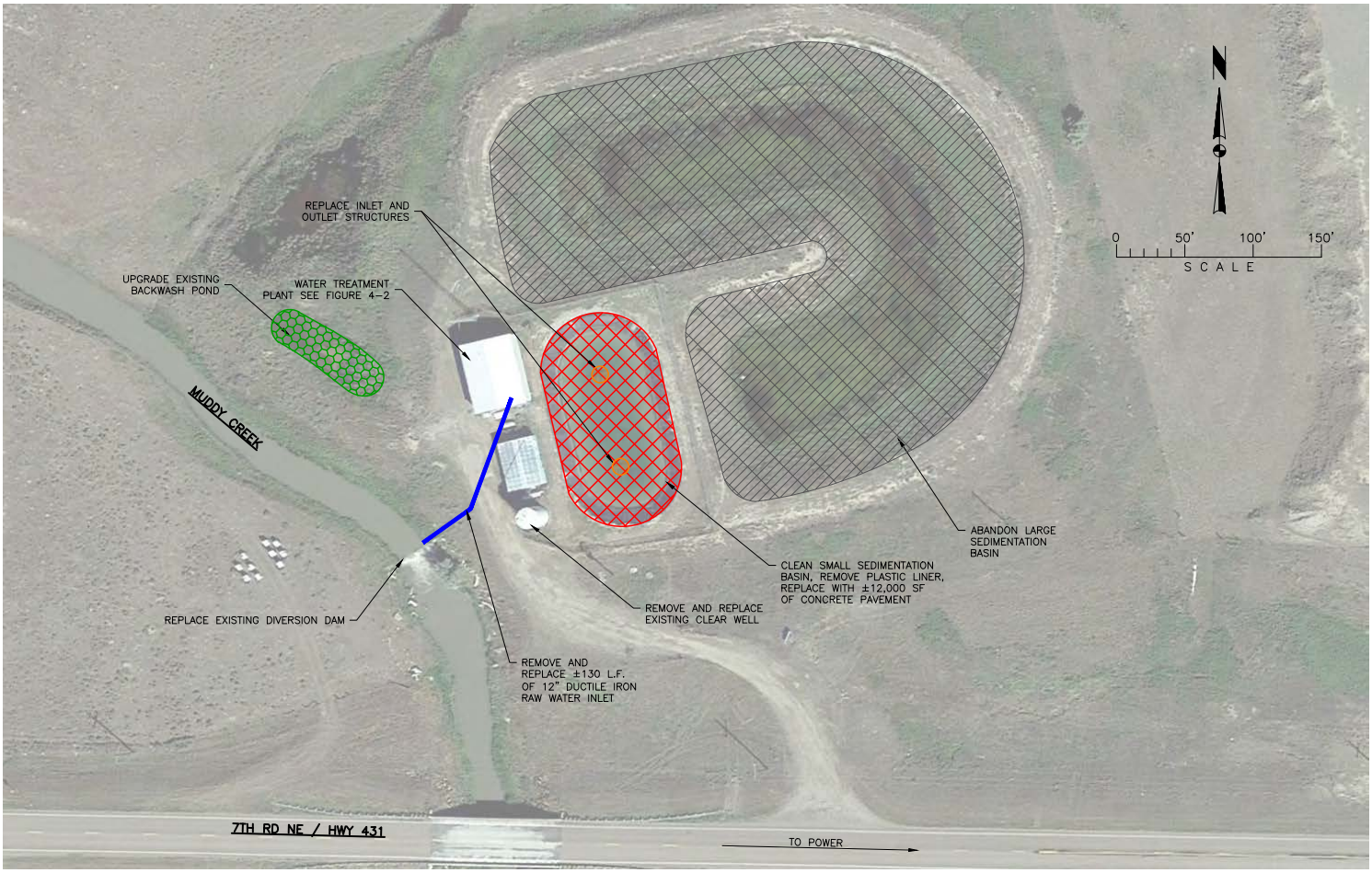
Final design will be in accordance with requirements specified in Circular DEQ-1, Montana Public Works Standard Specifications (MPWSS), and generally accepted engineering practices. Water treatment regulations are detailed in Chapter 7 of Circular DEQ-1. Standard treatment system requirements include 100% redundancy in the system and capacity to handle the design max day flow rate.

c. Map

Improvements to the site, including modifications to the sedimentation basin, backwash pond, clearwell and intake pipe and illustrated in Figure 4-1. Proposed modifications within the treatment plant are provided in Figure 4-2.

d. Environmental Impacts

Environmental impacts for this alternative would be minimal. Construction of this alternative would take place inside the existing WTP's footprint. Stormwater best management practices (BMP) would be implemented to prevent pollutants from entering Muddy Creek. Additionally, significant shoring and dewatering may be required in the stream bed during the replacement of existing intake pipe and diversion dam. This may have potential negative impacts to aquatic life. However, these would be expected to resolve quickly.



NOT FOR CONSTRUCTION

POWER TETON COUNTY WATER AND SEWER DISTRICT
POWER, MONTANA

ALTERNATIVE T-2

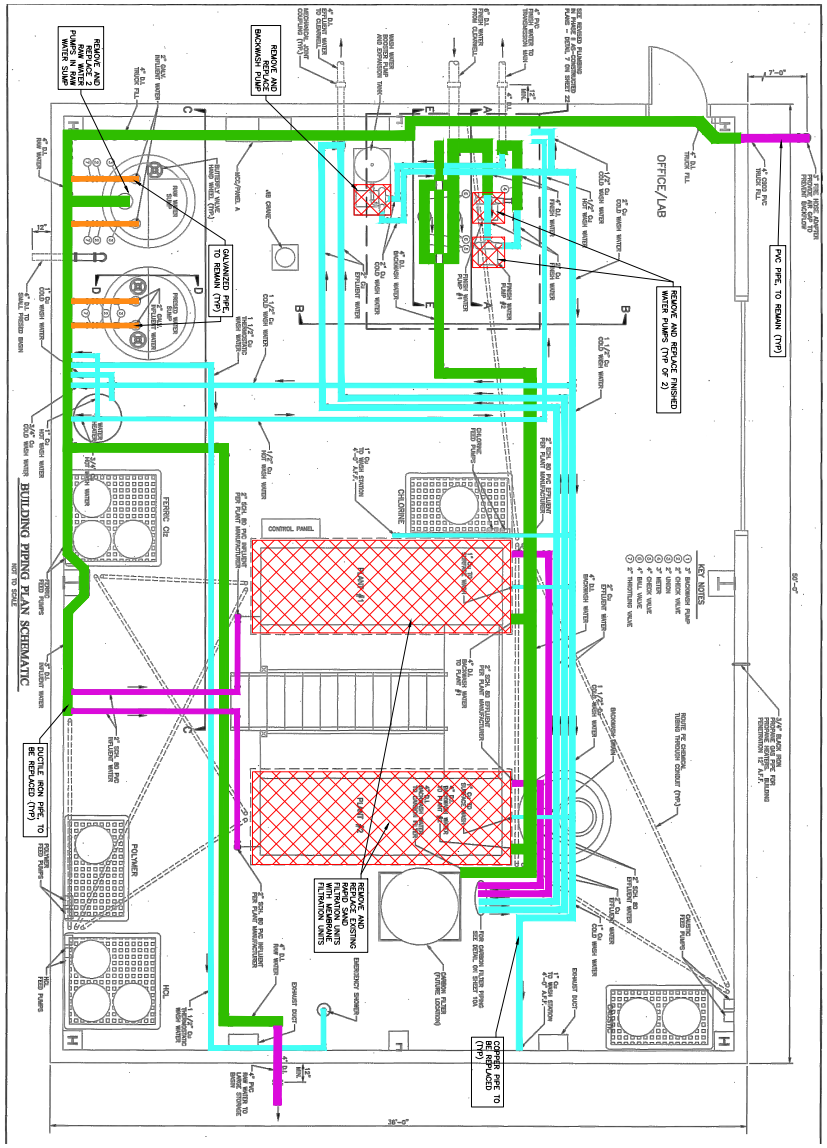
SITE IMPROVEMENTS

TD&H Engineering
406.761.3010 • tdhengineering.com
1800 RIVER DR. NO. • GREAT FALLS, MONTANA 59401

DRAWN BY:	CDF
DESIGNED BY:	NMR
QUALITY CHECK:	MJO
DATE:	2018-04-19
JOB NO.	17-258
CAD NO.	17-258 FIGURE 4.1

FIGURE
4-1

J:\2017\17-258 Power-Teton County Water and Sewer District PER\CADD\CIVIL\17-258 FIGURE 4.1.dwg, 5/7/2018 9:59:25 PM, nmr



POWER TETON COUNTY WATER AND SEWER DISTRICT
POWER, MONTANA

ALTERNATIVE T-2

WATER TREATMENT PLANT IMPROVEMENTS

FIGURE 4.2

17-258 FIGURE 4.2.DWG

DRAWN BY: CDF
DESIGNED BY: NMR
QUALITY CHECK: DJO
DATE: 2018-04-03
JOB NO.: 17-258
E.B.NO.: XX

TD&H Engineering
406.761.3010 • tdhengineering.com
1800 RIVER DR. NO. • GREAT FALLS, MONTANA 59401

REV	DATE	REVISION

NOT FOR CONSTRUCTION

e. Land Requirements

No additional land would be required for this alternative. All improvements would be constructed within the footprint of the existing system.

f. Potential Construction Problems

The existing water treatment plant would continue to run as the proposed upgrades are constructed. Careful planning and coordination between the contractor and operators would be required to ensure that the District may continue to provide the community with a reliable water source. Additionally, significant shoring and dewatering would be required in Muddy Creek. Construction within a State Water requires multiple agency permits and an approved Joint Application.

g. Sustainability Consideration

1. *Water and Energy Efficiency*
The proposed improvement would reduce water loss through leaking pipes, fittings, and valves within the plant. Replacement of inadequate pumps and treatment trains would increase the energy efficiency of the system.

2. *Green Infrastructure.*
A *Storm Water Pollution Prevention Plan* (SWPPP) would be required prior to construction to mitigate storm water runoff from disturbed areas. Additionally, BMPs would be required to prevent pollution entering the creek.

3. *Other*
There are no other anticipated sustainability considerations with regards to this alternative. Upgrades to the plant would allow it to operate more efficiently. The District's current O&M practices will remain applicable to the upgraded system.

h. Cost Estimate

Planning level capital costs and operations budgets are presented in Tables 4-1 and 4-2, respectively. Construction cost estimates were based on unit prices from similar public projects and information from equipment suppliers. A new supervisory control and data acquisition (SCADA) system is also included in this alternative. Given the large quantity of ductile iron pipe, gate valves and pumps included in this alternative, an additional 5% of the construction cost was included to ensure compliance with American Iron and Steel Institute's (AIS) regulations. It is believed a 10% contingency is sufficient for this project; 25% was also included for administrative, legal, and engineering fees. The total estimated construction cost for Alternative T-2 is $1,919,000 with a salvage value present worth of $503,000. A real discount rate of 0.2%, as defined in Appendix C of OMB Circular A-94, was used to calculate the present worth of the salvage value. Detailed cost estimates and calculations for Alternative T-2 are provided in Appendix 4-A.

The District's existing O&M budget, presented in Chapter 1, was used as a reference to estimate O&M costs for Alternative T-2. Although the District's annual budget includes roughly $100,000 for depreciation, conversations with District staff indicate this value is not included in the current user rates as no yearly payment is required. As such depreciation has not been included in the proposed annual O&M

budget for Alternative T-2. Modifications to the budget are indicated in Table 4-2 and include an added line item for short lived asset reserves and an increase in insurance and bonding based on the new equipment.

Table 4-1
Construction Cost Estimate
Treatment Alternative T-2: Upgrade Water Treatment Plant

Item	Quantity	Units	Unit Cost	Cost	Salvage Value[1]
Mobilization	5	%		$63,289	$0
Remove and Replace 12-inch DI Raw Water Pipe and Fittings	130	LF	$225	$29,250	$14,625
Remove and Replace Copper Piping and Fittings	325	LF	$160	$52,000	$26,000
Remove and Replace DI Pipe and Fittings	195	LF	$140	$27,300	$13,650
Remove and Replace Raw Water Pumps	2	EA	$9,000	$18,000	$0
Remove and Replace Raw Water Pumps	2	EA	$9,000	$18,000	$0
Remove and Replace Raw Water Pumps	1	EA	$9,000	$9,000	$0
Remove and Replace Finished Water Piping	2	EA	$9,000	$18,000	$0
Remove and Replace Clear Well Tank	1	LS	$120,000	$120,000	$60,000
Replace Diversion Dam	1	EA	$30,000	$30,000	$22,500
Demo Existing Pond Liner	12,000	SF	$1	$12,000	$0
Demo Existing Rapid Filtration Treatment Trains	2	EA	$10,000	$20,000	$0
Demo Existing Carbon Tank	1	LS	$10,000	$10,000	$0
Install New Concrete Sediment Pond Liner	1,300	SY	$100	$130,000	$65,000
Install New Concrete Sediment Pond Inlet/Outlet Structures	2	EA	$3,500	$7,000	$3,500
Install New Ultrafiltration Membrane System	2	EA	$150,000	$300,000	$75,000
Upgrade Backwash Water Ponds	1	LS	$250,000	$250,000	$125,000
Install new SCADA/PLC System	1	LS	$50,000	$50,000	$12,500
Connect to Existing 6-inch PVC Transmission Main	1	EA	$1,500	$1,500	$750
New UV Disinfection System	1	LS	$140,000	$140,000	$105,000
Layout and Construction Staking	1	LS	$10,000	$10,000	$0
Exploratory Excavation	8	HR	$150	$1,200	$0

Table 4-1 Construction Cost Estimate Treatment Alternative T-2: Upgrade Water Treatment Plant					
Construction Materials Testing	1	%		$12,533	$0
Construction Estimates				**$1,329,100**	**$523,500**
AIS Compliance-Materials and Project Management			5%	$66,455	
Contingency			10%	$139,556	
Administrative, Engineering, and Legal			25%	$383,778	
Total (rounded to the nearest $1000)				**$1,919,000**	**$503,000**
[1] Salvage Value PW Factor @0.2% for 20 years					

Table 4-2 Annual Operations and Maintenance Costs Treatment Alternative T-2: Upgrade Water Treatment Plant				
Description	**Quantity**	**Unit**	**Unit Cost**	**Cost**
Accounting & Auditing	1	LS	$700	$700
Bank Service Charges	1	LS	$0	$0
Chemicals	1	LS	$6,128	$6,128
Dues/Certifications/Training	1	LS	$425	$425
Easement & Water Assessment	1	LS	$227	$227
Fees (Permits, Service, Recording)	1	LS	$774	$774
Insurance & Bonding	1	LS	$2,195	$2,195
Payroll Expense	1	LS	$11,692	$11,692
Postage & Office	1	LS	$980	$980
Professional Fees	1	LS	$0	$0
Repairs	1	LS	$5,618	$5,618
Short Lived Asset Reserves	1	LS	$3,300	$3,300
Supplies	1	LS	$1,642	$1,642
Testing Water	1	LS	$1,994	$1,994
Truck Expenses	1	LS	$752	$752
Utilities	1	LS	$8,919	$8,919
Total Annual Operating and Maintenance Costs (rounded to the nearest $100)				**$45,300**
Real Interest Rate	0.2%			
Present Worth for 20 Years @ 0.2% (rounded to the nearest $100)				**$887,300**
[1] Shading represents expense adjusted to reflect O&M cost specific to Alternative				

3. Alternative T-3: Connect to North Central Montana Regional Water Authority's Water System (NCMRWA)

a. Description

Alternative T-3 entails the Power-Teton County Water and Sewer District connecting to the North Central Montana Regional Water Authority (NCMRWA). A new transmission main is included in this alternative to connect District to the existing NCMRWA system. The NCMRWA has discussed the option of providing water to the District; however, Power is outside the established service area and is not currently a member. Water authority projects are subsidized by federal funds. Unless the District joins the Authority, it is not eligible for federal funds. For preliminary planning purposes, it is assumed that the District will remain outside the NCMRWA's service area. Should the District be included in the Authority in the future, the required transmission main would be bought and owned by the NCMRWA.

At the time of writing this report, the closest connection to the NCMRWA is Brady, Montana, roughly 23 miles north of Power. However, Dutton, MT has expressed interest in joining the Authority and is roughly 9 miles north of the District. However, no immediate plan to connect Dutton to the water system have been finalized. The transmission main constructed from Conrad to Brady was sized with sufficient capacity to serve the Town of Dutton. A hydraulic analysis, performed by the NCMRWA, indicates the line is adequately sized to serve Power, but the existing booster pump would have to be upsized. This would likely require a new booster station and surge tank.

The NCMRWA treats its water at the Conrad water treatment plant. This system is not sized to provide water for the Power-Teton County Water and Sewer District. Upgrades to Conrad's treatment plant are required prior to the District connecting to the NCMRWA's.

This alternative requires the transmission main from Brady to Dutton be completed at an accelerated schedule and upgrades to the Conrad WTP. Assuming both these projects can be completed in the coming years, a roughly 9-mile transmission main can be constructed from Dutton to Power. The proposed alignment follows Interstate-15 and will remain east of the BNSF rail line to avoid construction within BNSF property. The line connects to the District's system near the existing finished water storage tank. The new main will be jack and bored under MT HWY 221; additionally, 6 rural roads will need to be crossed along the alignment. A new booster pump station and surge tank are included near the Town of Dutton. Because this would be a consecutive system, a new water sampling station is required near the connection point. The district would be required to monitor water quality issues such as chlorine residuals to maintain primary water quality standards.

b. Design Criteria

This alternative will be constructed in accordance with requirements specified in Circular DEQ-1. Additionally, MPWSS and generally accepted engineering practices will be followed. Chapter 8 of DEQ-1 details standards for construction of new transmission mains. The regulatory requirements include, but are not limited to:

- All pipes and fittings must conform to the latest standards issued by AWWA and ANSI/NSF
- Water pressures must remain above 35 psi under normal conditions and may not fall below 20 psi for all flow types, including fire flow.
- Maximum working normal pressure should be roughly 60 to 80 psi.
- Air relief valves are to be included at high points in the transmission main, to remove accumulated air.
- A minimum of five feet of cover must be provided for underwater crossings.

c. Map

The proposed alignment is presented in Figure 4-3. Final alignment will depend on land availability.

d. Environmental Impacts

Environmental impacts are expected to be short-term during construction. Proposed improvements would require a number of drainage swale crossings. BMPs would be implemented during construction to minimize impacts. An approved Joint Application Permit will be required prior to construction within any stream beds. After construction, impacted surfaces not covered in a hard surface would be revegetated.

e. Land Requirements

Easements would be required along the entire alignment. Final alignment and design would be dependent on land availability. Depending on the location of a new booster station and surge tank, a small amount of land may need to be purchased.

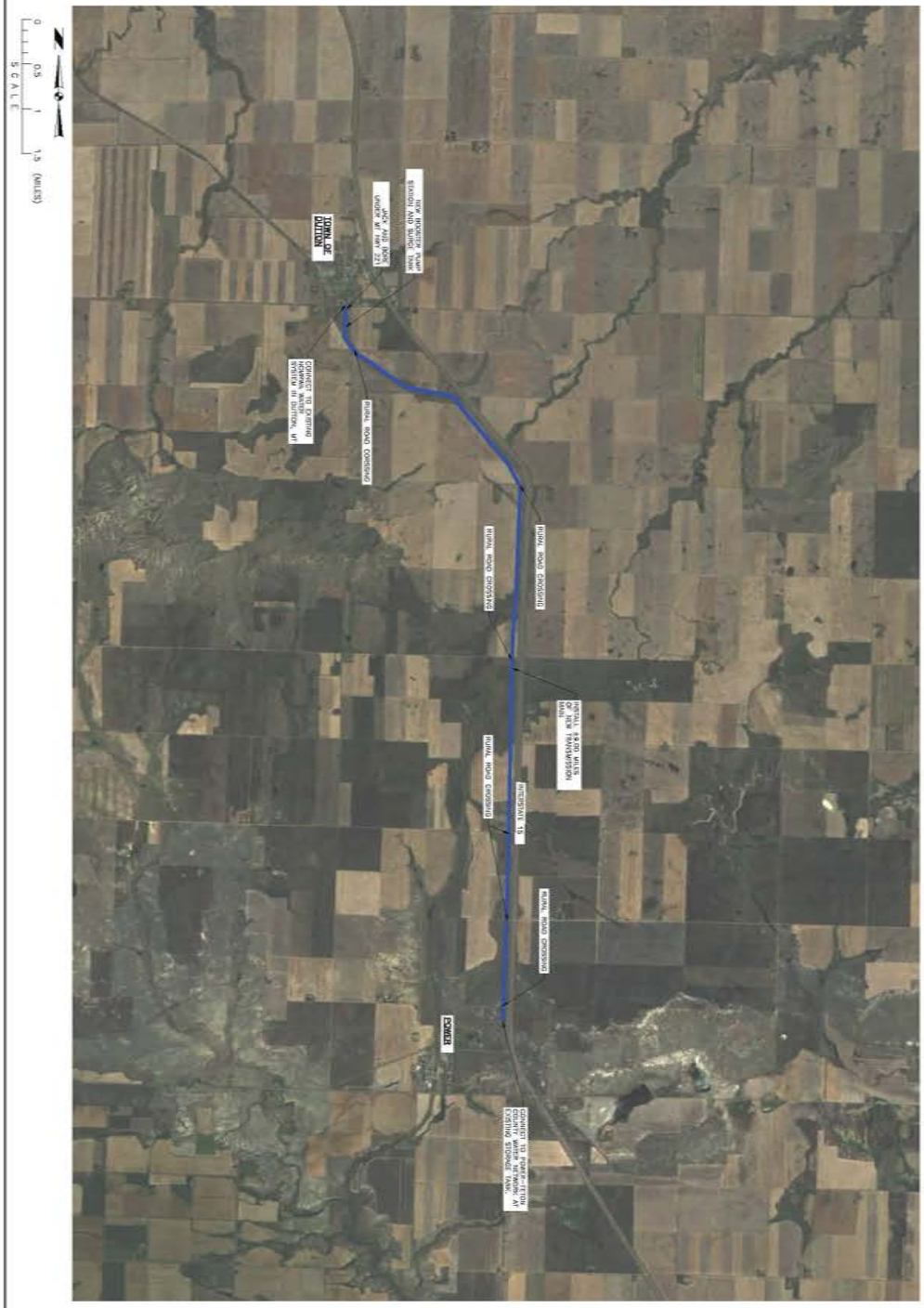
f. Potential Construction Problems

Minimal construction issues are anticipated for this alternative. The proposed alignment includes a number of irrigation ditches, swales, and other water way crossings that will need to be crossed during installation. A Joint Application for Proposed Work in Montana's Streams, Floodplains, and Other Water Bodies would be necessary for any work that impacts wetlands, streams, or drainage swales. This alternative would be completely independent of the existing treatment plant. As such, the existing WTP may continue to operate as the new transmission main is constructed.

g. Sustainability Consideration

1. *Water and Energy Efficiency*
   As with all viable alternatives, water and energy efficiency would be increase significantly with Alternative T-3. The failing and corroded pumps, pipes and valves in the existing treatment plant would no longer be in operation. This would decrease or eliminate wasted water and energy from leaking pipes and failing pumps.

2. *Green Infrastructure.*
   A SWPPP would be required prior to construction to reduce the amount of storm water runoff from disturbed areas of the project.



POWER TETON COUNTY WATER AND SEWER DISTRICT
POWER, MONTANA

ALTERNATIVE T-3

CONNECT NCMRWA WATER SYSTEM

DRAWN BY: CDF
DESIGNED BY: NMR
QUALITY CHECK: DJO
DATE: 2018-05-23
JOB NO.: 17-258
FILE NO.: XX

TD&H Engineering
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FIGURE 4-3
17-258 FIG T3-T5.DWG

3. *Other*

There are no other anticipated sustainability considerations with regards to this alternative. The new mains should require minimal maintenance; valves would need to be exercised annually. The surge tank would require cleaning and painting approximately once every five years. The booster pumps would require periodic replacement. Routine maintenance for the booster station would be a yearly requirement, but should be minor in scope.

h. Cost Estimate

Planning level capital costs and operations budgets are presented in Tables 4-3 and 4-4, respectively. Construction cost estimates were based unit prices from similar public projects and conversation with suppliers. A number of gate valves and ductile iron fittings would likely be required throughout the alignment. Because of this, along with the booster station and bulk water station, an additional 5% of the construction cost was included to ensure compliance with AIS regulations.

The cost of pipe material would have a large impact on final construction costs. It is beyond the scope of this PER to compare all aspects of various pipe materials. Many issues with regard to pipe material selection are subjective and commonly left up to engineering judgment. Factors such as pipe durability, pipe longevity, ease of installation, and many other considerations effect final pipe section.

In addition, the pipe material market is volatile. The price of hydrocarbons and steel greatly impact the cost of plastic and metals based products. Any conclusions drawn today as to the least expensive pipe material may be incorrect in six months to a year. Materials selection is something that is best left to the design engineer or possibly market competition through alternative bidding at the time of final design and construction. This PER will provide an adequately conservative budget to ensure sufficient funds are available for final design and construction.

Due to the remaining questions regarding Conrad's WTP and the construction of the transmission main from Brady, MT to Dutton, MT, a contingency of 15% has been assigned to this alternative; 25% was also included for administrative, legal, and engineering fees. The total estimated construction cost for Alternative T-3 is $6,991,000 with a salvage value of $1,881,000. A real discount rate of 0.2%, as defined in Appendix C of OMB Circular A-94, was used to calculate the present worth of the salvage value. Detailed cost estimates and calculations for Alternative T-3 are provided in Appendix 4-B.

The District's existing O&M budget, presented in Chapter 1, was used as a reference to estimate O&M costs for Alternative T-3. Modifications to the budget are indicated in Table 4-4 and include an added line item for short lived asset reserves. Additionally, budget was provided for easements and utilities. The largest budgetary increase was associated with fees; conversations with NCMRWA members indicated the Authority charges $3.25 per 1,000 gallons with an additional $7,500 for maintenance. Assuming an average day flow of 75,000 gpd, these fees sum to roughly $96,500 per year. Although the District's annual budget includes roughly $100,000 for depreciation, conversations with District staff indicate this value is not included in the current user rates as no yearly payment is

required. As such depreciation has not been included in the proposed annual O&M budget for Alternative T-3.

Table 4-3 Construction Cost Estimate Treatment Alternative T-3: Connect to the NCMRWA's Water System					
Item	**Quantity**	**Units**	**Unit Cost**	**Cost**	**Salvage Value[1]**
Mobilization	5	%		$220,570	$0
Connect to NCRWA Main	1	LS	$15,000	$15,000	$0
Transmission Main and Fittings	48,000	LF	$80	$3,840,000	$1,920,000
Booster Pump Station and Surge Tank	1	EA	$100,000	$100,000	$25,000
Jack & Bore Under MT Highway 221	1	LS	$75,000	$75,000	$0
Rural Roads Crossings	6	LS	$50,000	$300,000	$0
Connect to District Water Main	1	LS	$1,500	$1,500	$0
New Water Sampling Station	1	EA	$25,000	$25,000	$12,500
Layout and Construction Staking	1	LS	$10,000	$10,000	$0
Exploratory Excavation	8	HR	$150	$1,200	$0
Construction Materials Testing	1	%		$43,700	$0
Construction Estimate				**$4,631,970**	**$1,957,500**
AIS Compliance-Materials and Project Management			5%	$231,599	
Contingency			15%	$729,535	
Administrative, Legal, & Engineering			25%	$1,398,276	
Total (rounded to the nearest thousand)				**$6,991,000**	**$1,881,000**

[1] Salvage Value PW Factor @0.2% for 20 years

Table 4-4 Annual Operations and Maintenance Costs Treatment Alternative T-3: Connect to the NCMRWA's Water System				
Description	**Quantity**	**Unit**	**Unit Cost**	**Cost**
Accounting & Auditing	1	LS	$700	$700
Bank Service Charges	1	LS	$0	$0
Chemicals	1	LS	$4,596	$4,596
Dues/Certifications/Training	1	LS	$425	$425
Easement & Water Assessment	1	LS	$454	$454
Fees (Permits, Service, Recording)	1	LS	$96,500	$96,500
Insurance & Bonding	1	LS	$998	$998
Payroll Expense	1	LS	$5,846	$5,846
Postage & Office	1	LS	$980	$980
Professional Fees	1	LS	$0	$0
Repairs	1	LS	$3,745	$3,745
Short Lived Asset Reserves	1	LS	$1,400	$1,400
Supplies	1	LS	$1,642	$1,642
Testing Water	1	LS	$1,994	$1,994
Truck Expenses	1	LS	$752	$752
Utilities	1	LS	$10,000	$10,000
Total Annual Operating and Maintenance Costs (rounded to the nearest $100)				**$130,000**
Real Interest Rate	0.2%			
Present Worth for 20 Years @ 0.2% (rounded to the nearest $100)				**$2,546,200**
[1] Shading indicated expense adjusted to reflect O&M cost specific to Alternative				

4. Alternative T-4: Connect to City of Great Falls' Water System

a. Description

Similar to Alternative T-3, this alternative involves connecting the Power-Teton County Water and Sewer District to an existing water system, the City of Great Falls. The City of Great Falls diverts raw water from the Missouri River at two intake points. Water is treated through conventional filtration with flocculation basins and clarifiers upstream of the filtration units. Roughly 23.25-miles of new transmission main is included in this project. The new main would connect the District's distribution system to the northwestern edge of the City's system. In addition, two new booster stations will be needed to provide the required pressures within the main. As with Alternative T-3, this alternative will require the new transmission main to be constructed in the existing stream beds. Additionally, the new main will be bored under both Interstate-15 and MT HWY 89. A number of rural road crossing will be required. The proposed alignment remains east of the BNSF rail line to avoid construction within BNSF property. Similar to Alternative T-3, a new water monitoring station is included to ensure primary drinking water standards are met. This is required because this would be a consecutive system.

b. Design Criteria

This alternative will be constructed in accordance with requirements specified in Circular DEQ-1. Additionally, MPWSS and generally accepted engineering practices will be followed. Chapter 8 of DEQ-1 details standards for construction of new transmission mains. The regulatory requirements include, but are not limited to:

- All pipes and fittings must conform to the latest standards issued by AWWA and ANSI/NSF
- Water pressures must remain about 35 psi under normal conditions and may not fall below 20 psi for all flow types, including fire flow.
- Maximum working normal pressure should be roughly 60 to 80 psi.
- Air relief valves are to be included at high points in the transmission main, to remove accumulated air.
- A minimum of five feet of cover must be provided for underwater crossings.

c. Map

The proposed alignment for Alternative T-4 is presented in Figure 4-4.

d. Environmental Impacts

Environmental impacts for Alternative T-4 would be similar that the impacts associated with alternative T-3. Minor, short term impacts would be anticipated during construction. The proposed transmission main would cross a number of drainage swales. BMPs would be required during construction to minimize the construction impacts. After construction, all disturbed areas would be returned to its natural state. An approved Joint Application Permit would be required prior to construction within any stream beds.

e. Land Requirements

Easements would need to be procured for the length of the proposed alignment. Depending on the location of a new booster stations and surge tanks, a small amount of land may need to be purchased. Final design would be dependent on land availability.

f. Potential Construction Problems

Construction problems would be minimal for this alternative. The proposed alignment would cross several small waterways, including streams and irrigation ditches. A Joint Application for Proposed Work in Montana's Streams, Floodplains, and Other Water Bodies would be required for any work that impacts wetlands, streams, or drainage swales. This alternative would be completely independent of the existing treatment plant. As such, the existing WTP can continue to operate as the new transmission main is constructed.

POWER TETON COUNTY WATER AND SEWER DISTRICT
POWER, MONTANA

ALTERNATIVE T-4

CONNECT TO CITY OF GREAT FALLS WATER SYSTEM

FIGURE 4-4

17-258 FIG T3-T5.DWG

DRAWN BY: CDF
DESIGNED BY: NMR
QUALITY CHECK: DJO
DATE: 2018-3-22
JOB NO.: 17-258
F.B. LOC: XX

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g. Sustainability Consideration

1. *Water and Energy Efficiency*
   As with all viable alternatives, water and energy efficiency would increase significantly. The failing and corroded pumps, pipes, and valves in the existing treatment will no longer be in operation. This is expected to decrease wasted water and energy from leaking pipes and failing pumps.

2. *Green Infrastructure.*
   A SWPPP would be required prior to construction to reduce the amount of storm water runoff.

3. *Other*
   There are no other anticipated sustainability considerations with regard to this alternative. The new transmission should require minimal maintenance. Valves would need to be exercised annually. Routine maintenance for the booster stations would be a yearly requirement, but should be minor in scope.

h. Cost Estimate

Planning level capital costs and operations budgets are presented in Tables 4-5 and 4-6, respectively. Construction cost estimates are based on unit prices from similar public projects and conversation with suppliers. A number of gate valves and ductile iron fittings would likely be required throughout the alignment. Because of this, along with the booster station and bulk water station, an additional 5% of the construction cost was included to ensure compliance with AIS regulations.

Much like Alternative T-3, the estimated construction cost of Alternative T-4 is highly dependent on the cost of pipe materials. The pipe market is considered volatile and difficult to predict years in advance. Construction costs presented in Table 4-5 are believed to be appropriately conservative. A decision on pipe material will be made during final design.

It is believed a 15% contingency is necessary for this project due to the length of the required transmission main and the unpredictability of pipe material costs; 25% was also included for administrative, legal, and engineering fees. The total estimated construction cost for Alternative T-4 is $16,916,000 with a salvage value of $4,788,000. A real discount rate of 0.2%, as defined in Appendix C of OMB Circular A-94, was used to calculate the present worth of the salvage value. Detailed cost estimates and calculations for Alternative T-4 are provided in Appendix 4-C.

Table 4-5 Construction Cost Estimate Treatment Alternative T-4: Connect to the City of Great Falls Water System					
Item	**Quantity**	**Units**	**Unit Cost**	**Cost**	**Salvage Value[1]**
Mobilization	5	%		$533,670	$0
Connect to City of Great Falls Main	1	LS	$15,000	$15,000	$0
Transmission Main and Fittings	123,000	LF	$80	$9,840,000	$4,920,000
Booster Pump Stations	2	LS	$100,000	$200,000	$50,000
Jack and Bore Under Interstate-15	1	LS	$100,000	$100,000	$0
Jack and Bore Under My HWY 89	1	EA	$75,000	$75,000	$0
Rural Roads Crossings	6	LS	$50,000	$300,000	$0
Connect to District Water Main	1	LS	$1,500	$1,500	$0
New Water Sampling Station	1	EA	$25,000	$25,000	$12.,500
Layout and Construction Staking	1	LS	$10,000	$10,000	$0
Exploratory Excavation	8	HR	$150	$1,200	$0
Construction Materials Testing	1	%		$105,700	$0
Construction Estimate				**$11,207,070**	**$4,982,500**
AIS Compliance-Materials and Project Management			5%	$560,354	
Contingency			15%	$1,765,114	
Administrative, Legal, & Engineering			25%	$3,383,134	
Total (rounded to the nearest thousand)				**$16,916,000**	**$4,788,000**
[1]Salvage Value PW Factor @ 0.2% for 20 years					

The District's existing O&M budget, presented in Chapter 1, was used as a reference to estimate O&M costs for Alternative T-4. Modifications to the budget are indicated in Table 4-6 and include an added line item for short lived asset reserves. Additional budget was provided for easements and utilities. The largest

budgetary increase was associated with fees; conversations with the City of Great Falls indicated users are charge $2.46 per 100 cf of water sold for sales over 300 cf. Assuming an average day flow of 75,000 gpd, these fees sum to roughly $90,000 per year. Although the District's annual budget includes roughly $100,000 for depreciation, conversations with District staff indicate this value is not included in the current user rates as no yearly payment is required. As such depreciation has not been included in the proposed annual O&M budget for Alternative T-4.

Table 4-6
Annual Operations and Maintenance Costs
Treatment Alternative T-4: Connect to the City of Great Falls Water System

Description	Quantity	Unit	Unit Cost	Cost
Accounting & Auditing	1	LS	$700	$700
Bank Service Charges	1	LS	$0	$0
Chemicals	1	LS	$4,956	$4,956
Dues/Certifications/Training	1	LS	$425	$425
Easement & Water Assessment	1	LS	$454	$454
Fees (Permits, Service, Recording)	1	LS	$97,500	$97,500
Insurance & Bonding	1	LS	$998	$998
Payroll Expense	1	LS	$5,846	$5,846
Postage & Office	1	LS	$980	$980
Professional Fees	1	LS	$0	$0
Repairs	1	LS	$3,745	$3,745
Short Lived Asset Reserves	1	LS	$1,400	$1,400
Supplies	1	LS	$1,642	$1,642
Testing Water	1	LS	$1,994	$1,994
Truck Expenses	1	LS	$752	$752
Utilities	1	LS	$22,298	$22,298
Total Annual Operating and Maintenance Costs (rounded to the nearest $100)				**$143,300**
Real Interest Rate	0.2%			
Present Worth for 20 Years @ 0.2% (rounded to the nearest $100)				**$2,806,700**

[1]Expense adjusted to reflect O&M cost specific to Alternative

5. Alternative T-5: Connect to Tri-County Water District Water System

Much like Alternative T-3 and T-4, Alternative T-5 involves connecting the Power-Teton County Water and Sewer District's water system to an existing water supply. The existing WTP will be demolished with this alternative and a new transmission main will be constructed to connect the District's distribution system to the Tri-County Water system. Tri-County has a series of infiltration galleries to collect shallow groundwater. Roughly eight miles of transmission main are needed to connect Power to the Tri-County System. A new booster station and surge tank will also be necessary to maintain sufficient pressure within the line. Tri-County currently has a chlorine injection system to treat its water. If Power were to connect to this system, the chlorine injection equipment and pumps would have to be upgraded. At the time of writing this

report, the Tri-County system is at capacity for both its pumping system and water rights.

There is currently a 4-inch Tri-County water main that crosses the existing 14-inch Power transmission main to the finished water storage tank. Hydraulic analysis, performed by the Tri-County Water System, indicates the Tri-County distribution system upstream of this crossing cannot supply Power's needs because of increased friction losses. In addition, the District chairperson, Mr. Adam Dahlman, has stated Tri-County District is reaching the limit of its water right maximum flow rate and maximum volume. For these reasons, Alternative T-5 is not considered a viable option and will not be discussed further.

6. Alternative T-6: Shallow Ground Water Wells

a. Description

Alternative T-6 involves digging or drilling shallow municipal wells for the District. Shallow ground water is available both east and west of Muddy Creek. The Fairfield Bench (Greenfields Bench) is west of Muddy Creek. This bench is an erosion surface that indicates catastrophic formation as the unusually flat planation surface is cut at a slight angle to the bedding, with a gradual slope down to the east toward Muddy Creek. An important aquifer is hosted in gravel that caps the erosion surface cut into less permeable sedimentary bedrock. Little or no evidence of glaciation is found on the bench. Shallow ground water is also present in unconsolidated sediments in and around Power, east of Muddy Creek. These sediments appear to be predominantly influenced by glacial depositional processes and range in texture from sand to clay or diamict ("till"). There does not appear to be any communication between the aquifers on either side of Muddy Creek.

Advantages of shallow aquifers generally include low initial cost, low operating costs, and good supply. The most productive aquifers are usually unconfined aquifers hosted in gravels or sands. One of the most serious disadvantages of shallow aquifers is susceptibility to drought and contamination.

The shallow aquifer on which the Fairfield Bench is sited has been used for many years for domestic water. Information available from the Ground Water Information Center (GWIC), a service of the Montana Bureau of Mines and Geology (MBMG), indicates the ground water is hosted in sand or subjacent sedimentary bedrock. Well depths ranged from 30 to 71 feet. GWIC well logs are provided in Appendix 4-D.

The Fairfield/Greenfields aquifer is the most important local aquifer. This aquifer is just southeast of the District's existing transmission main, on the opposite side of Muddy Creek. Water is hosted in the catastrophically-deposited sheet gravels. Production is good, with some wells listed in excess of 100 gpm, or more than 144,000 gpd. Although the bench has many water wells, supply has not historically been a problem. There is a large drop in water levels over the winter that indicates a large portion of recharge is artificial and a response to flows through the Greenfields Irrigation District system. As irrigation has moved from flood methods to sprinkling, the amount of artificial recharge has begun to diminish. Of potentially greater concern is the likelihood that agricultural chemicals or high nutrient levels will contaminate ground water by leaching through the permeable soils and into

the shallow aquifer. This has been investigated by the Montana Department of Agriculture, and while detectable levels of pesticides and nutrients are sometimes present in the water, all were below water quality standards. Nitrogen (nitrate plus nitrite) was near one-half the maximum contaminant level (MCL), while herbicides and insecticides were well below half the MCLs. Based on water quality data available from the GWIC database, wells at the east end of the bench near Power produces Class I or Class II water for total dissolved solids (TDS). Table 4-7 summarizes groundwater classification based on TDS. The Fairfield/Greenfields aquifer appears to be the most promising potential ground water source for this project.

Table 4-7
Total Dissolved Solids

Water Class	TDS (mg/L)
I	0 - 1,000
II	1,000 - 2,500
III	2,500 - 15,000
IV	>15,000

Water quality for many shallow ground water monitoring wells installed by the Montana Salinity Control Association (MSCA) in the northeast part of the Muddy Creek watershed, immediately upstream of the Power WTP, encountered Class III and Class IV waters. Both water quantity and quality appear to be inferior to the Power and Fairfield/Greenfields aquifers. At this time, the Muddy Creek Water Shed appears to be the least ideal location for municipal wells. However, final well placement will be decided during final design and contingent upon land availability as well and water quality and quantity tests.

A new pump station and transmission main are included in this alternative to convey the groundwater to the distribution system. A detailed hydraulic analysis will be completed during final design to size the finished water pumps and transmission main. These calculations will be largely based on location of the new municipal wells. Preliminary hydraulic analysis indicates a 6-inch main will be sufficient. The existing water treatment will be demolished; the existing treatment building will be available to be used as a treatment facility, should water treatment be necessary. Chlorination equipment is included in the Alternative to comply with water quality standards.

Finally, this alternative requires the District to apply for a new water right. As previously mentioned, Power is in the Upper Missouri River Basin, which is a legislatively closed basin. Conversations with the Havre Regional Office of the DNRC suggested that new water rights in this basin are possible, but difficult to obtain. A detailed hydrogeologic analysis is required to assess the interaction between ground water and surface water. This modeling is beyond the scope of this project and will be completed during final design.

b. Design Criteria

Per DEQ-1, well yields must be sufficient to supply the District with max day flow with the largest source out of service. The design max day demand is 241,200

gpd, or 167.5 gpm. At least two wells would be needed to meet DEQ-1 100% redundancy requirements and to produce the required flow, depending on the results of aquifer testing. Based on preliminary GWIC well log investigations, as many of 3 wells may be required. To provide a conservative design, 3 wells are included in this alternative.

The hydrogeology of the site selected for shallow ground water wells dictates the design. The most likely location for extraction would be on the east end of the Fairfield (Greenfields) Bench south of the existing Power WTP. The actual location should be chosen based on the bedrock surface; selecting a location on a bedrock of higher elevation could jeopardize the water supply during low ground water periods.

If reliable water is quite shallow but soil permeability is only moderate, an infiltration gallery, gallery well, or radial collector well may be a suitable alternative. The Tri-County Water District uses two trenched infiltration galleries at depths of 20 to 22 feet, which is the top of bedrock at that location. If depressions in the erosional surface require greater depth and the soil permeability is quite high, ordinary vertical wells would be a better choice than an infiltration gallery. The texture of the unconsolidated sediments and their permeabilities can be evaluated by drilling and constructing ground water monitoring or test wells. Aquifer testing data are input into ground water modeling software to calculate permeability and the zone of influence. These results are also used to evaluate possible impacts to surface water, which is necessary for water rights.

A sand or gravel pack should be designed based on the properties of the materials encountered. While the filter pack will not keep dissolved constituents out of the well, it will filter particulates. This is important for pump life and to reduce the treatment required downstream. The preliminary design assumes chlorination will be the only water treatment required, as the DEQ requires chlorination of any public water well shallower than 25 feet. Detailed water quality data, beyond the scope of this PER, will be required during final design to define required treatment. Requirements detailed in DEQ-1, section 3.2 include, but are not limited to:

- Total ground water source capacity must meet or exceed design max day demands, with the largest producing well out of service.
- Sufficient auxiliary power must be provided to meet average day demand when power failure would result in cessation of the minimum essential service.
- Wells must have unperforated casing to a minimum depth of 25 feet or full time microbial treatment must be provided.
- Full time microbial treatment is required when the seasonal high-water level is within 25 feet of the ground surface.
- Permanent steel casing pipe must be in accordance with ARM 36.21.640 and have joints in accordance with ARM 36.21.642.
- Screens must be constructed of materials resistant to damage by chemical action of groundwater or cleaning operations.
- Every well must be developed in accordance with ARM 36.21.653.

The amount of head required to lift the water from wells or an infiltration gallery to near the surface and thence via a pipe to the treatment plant will determine the size of pump required. To provide adequate redundancy, at least two pumps are

required. To comply with DEQ-1 standards, a regular working pressure of 35 psi must be maintained throughout the distribution system and 20 psi must be maintained under all conditions including fire flow. A WaterCAD analysis was conducted for this Alternative, results are provided in Appendix 4-D. According to this analysis, a 6-inch PVC transmission main and a finished water pump with a design point of 168 gpm at 50 feet of total dynamic head (TDH) will be sufficient to maintain required pressures, with no notable impacts on fire flow of max day pressures. WaterCAD results are available for review in Appendix 4-D.

DEQ-1 mandates standby power in section 2.6 of the circular, stating "dedicated standby power is required... Alternatives to dedicated standby power may be considered with proper justification". Emergency power will be supplied to the wells with a backup generator.

c. Map

Figures 4-5 and 4-6 illustrate possible well locations east and west of Muddy Creek. As discussed above, the aquifer directly upstream of the existing WTP is believed to have poor water quality and is not ideal for a municipal well. As such, a figure illustrating a possible well location upstream is not provided. Final well location will be determined during final design and based upon land availability and a hydrogeologic investigation.

d. Environmental Impacts

Minor, short-term environmental impacts would be expected during construction. BMPs would be incorporated to mitigate stormwater runoff. The primary environmental impact after construction will be to water resources. If the aquifer interacts with surface water, and extraction at the proposed rate affects surface water, then flows in Muddy Creek may be reduced. If a reduction in surface water occurs, it is expected to be minor and likely restricted by the water rights. More testing is required prior to final design.

e. Land Requirements

The amount of land required depends on aquifer properties. For vertical wells, the well spacing will be dictated by the aquifer properties. The wells should be spaced greater than the radius of influence, and the radius of influence is not presently known. However, vertical wells would require a smaller amount of land than infiltration galleries. As a first approximation, roughly 5 acres will be required for each well, 15 acres total. The District may choose to negotiate an easement for this property; however, a land purchase is suggested to prevent access issues in the future.

f. Potential Construction Problems

Coarse gravel lacking in fine sands provides the best properties for transmitting large amounts of ground water, but these properties also make the soil cohesion less. This makes trenching difficult due to the need to lay slopes back. Drilling in gravel can also be difficult and requires larger rigs designed for these conditions. Such equipment is readily available, but costs are higher than for smaller rigs in easier soil conditions. In particular, casing must be advanced for vertical well construction, then retracted as the filter pack is placed to expose the well screen and filter to the formation. Wells built without using this process are prone to silting

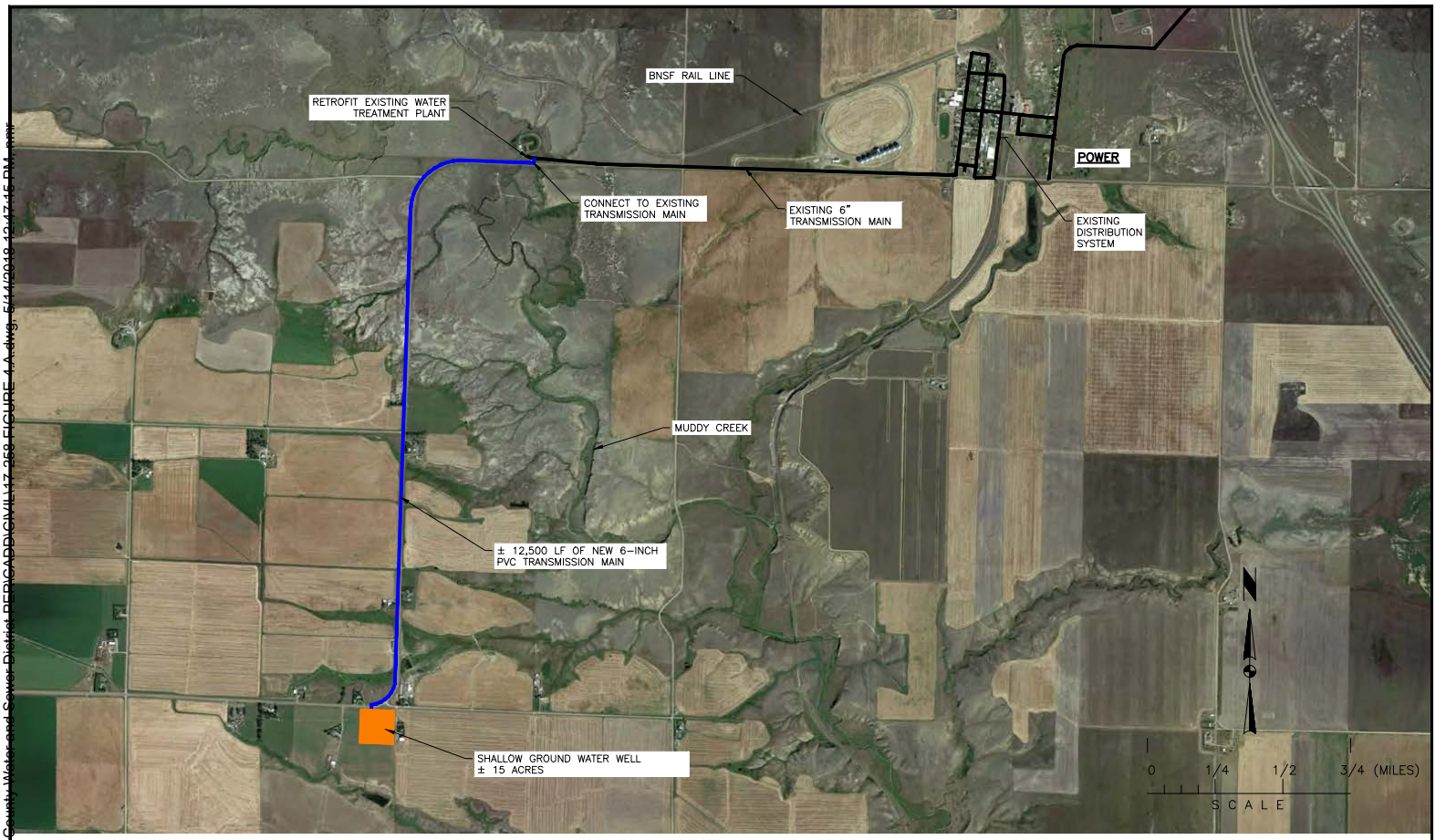
in, shortened pump life from sand, and loss of capacity with time. Given the District's recent problems with silts and sediments in their source water, every effort would be taken to prevent silting in the proposed system.

g. Sustainability Consideration

1. *Water and Energy Efficiency*
   One of the advantages of shallow wells is the relatively low head required to pump the water to the distribution system. This will increase the energy efficiency when compared to other alternatives. Ground water extraction will not exceed the water right obtained and will not jeopardize the health of the aquifer. Various agencies are involved in managing the water that contributes to the aquifer as well as water extraction in the area.

2. *Green Infrastructure*
   A SWPPP will be required prior to construction to reduce the amount of storm water runoff from disturbed areas of the project. This alternative will also rely on filtering and disinfection properties naturally present in the soils. This will likely result in fewer required chemicals.

3. *Other*
   Properly designed, constructed, and maintained water wells serve communities significantly longer than the proposed 20-year design like of this project. Poorly designed and constructed wells, especially if not adequately maintained, can quickly lose their efficiency and sometimes become unusable after a short period of time. For a slight increase in initial cost, a reliable well with a much lower lifecycle cost can be provided. Other system components, such as pumps and valves, are more easily accessed and replaced, but lifecycle cost analysis is still an important consideration.



NOT FOR CONSTRUCTION

POWER TETON COUNTY WATER AND SEWER DISTRICT
POWER, MONTANA

ALTERNATIVE T-6A

SHALLOW GROUND WATER WELLS, WEST SIDE OF MUDDY CREEK

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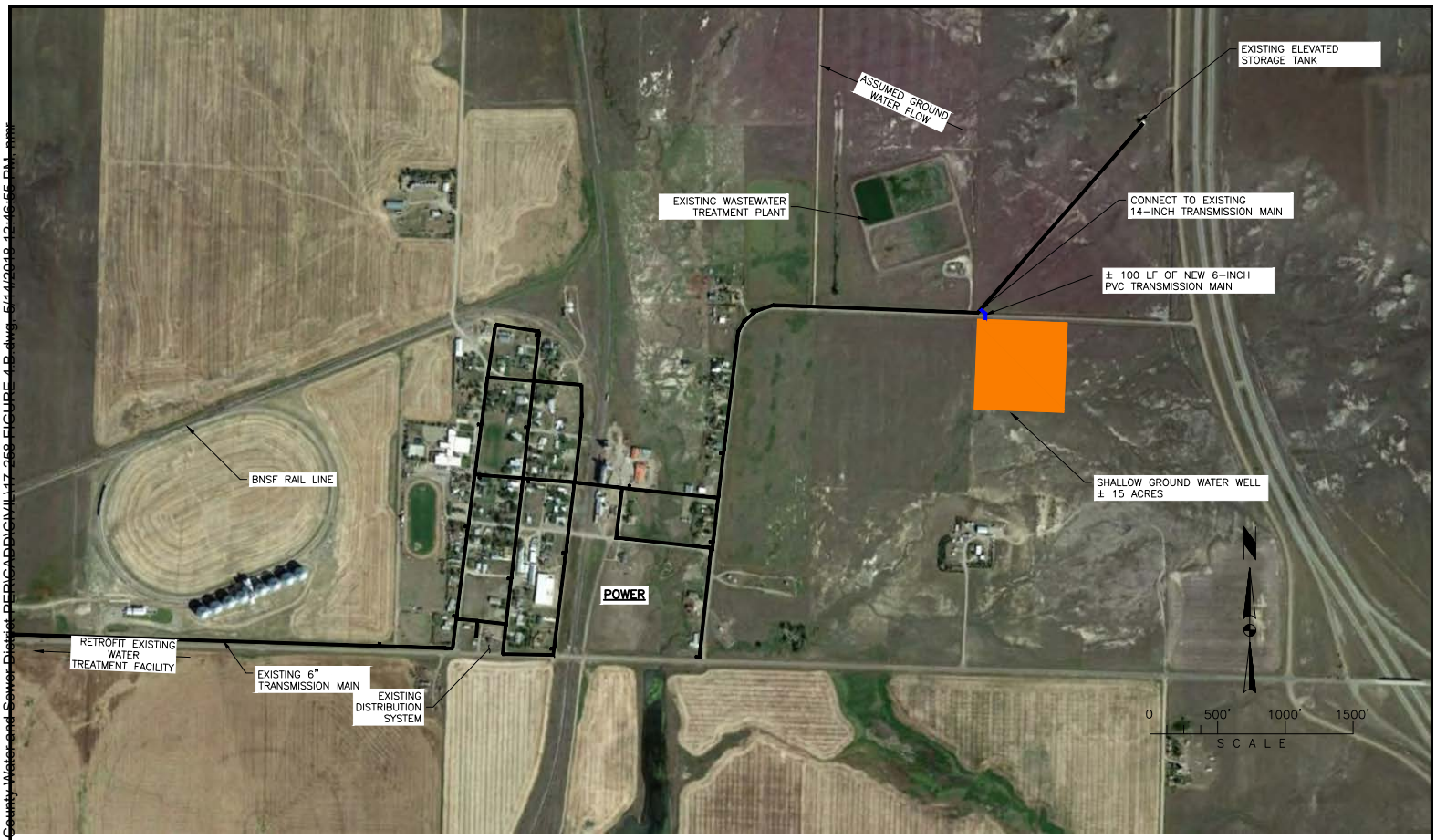
DRAWN BY:	CDF
DESIGNED BY:	NMR
QUALITY CHECK:	MJO
DATE:	2018-03-22
JOB NO.	17-258
CAD NO.	17-258 FIGURE 4.A

FIGURE
4-5

J:\2017\17-258 Power Teton County Water and Sewer District PER\CADD\CIVIL\17-258 FIGURE 4.A.dwg, 5/11/2018 10:47:15 PM, nmr



NOT FOR CONSTRUCTION

POWER TETON COUNTY WATER AND SEWER DISTRICT
POWER, MONTANA

ALTERNATIVE T-6B

SHALLOW GROUND WATER WELLS, EAST SIDE OF MUDDY CREEK

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DRAWN BY:	CDF
DESIGNED BY:	NMR
QUALITY CHECK:	MJO
DATE:	2018-03-22
JOB NO.	17-258
CAD NO.	17-258 FIGURE 4.B

FIGURE
4-6

J:\2017\17-258 Power Teton County Water and Sewer District PER\CADD\CIV\17-258 FIGURE 4B.dwg 5/11/2018 12:16:55 PM mmr

h. Cost Estimate

Planning level capital costs and operations budgets are presented in Tables 4-8 and 4-9, respectively. Two proposed well locations were presented in Figures 4-5 and 4-6; however, cost estimates have been based on Figure 4-5 as a municipal well west of Muddy Creek will likely require a longer transmission main. This was done to ensure an appropriately conservative cost estimate.

Construction cost estimates were based unit prices from similar public projects and conversation with suppliers. A number of gate valves and ductile iron fittings would likely be required throughout the alignment. Additionally, the two shallow wells will likely include steel well casings. Because of this, along with the bulk water station, an additional 5% of the construction cost was included to ensure compliance with AIS regulations. A new SCADA system has been included. This is expected to be a less complex system than one required for a surface water treatment facility. Groundwater water sources are inherently unpredictable due to the unknown and changing conditions of aquifers. For this reason, a 15% contingency believed to be warranted. Additionally, 25% was also included for administrative, legal, and engineering fees. The total estimated construction cost for Alternative T-6 is $2,627,000 with a salvage value of $964,000. A real discount rate of 0.2%, as defined in Appendix C of OMB Circular A-94, was used to calculate the present worth of the salvage value. Detailed cost estimates and calculations for Alternative T-6 are provided in Appendix 4-D.

The District's existing O&M budget, presented in Chapter 1, was used as a reference to estimate O&M costs for Alternative T-6. Modifications to the budget are indicated in Table 4-9 and include an added line item for short lived asset reserves. Although the District's annual budget includes roughly $100,000 for depreciation, conversations with District staff indicate this value is not included in the current user rates as no yearly payment is required. As such depreciation has not been included in the proposed annual O&M budget for Alternative T-6.

Table 4-8 Construction Cost Estimate Treatment Alternative T-6 Shallow Ground Water Well					
Item	**Quantity**	**Units**	**Unit Cost**	**Cost**	**Salvage Value[1]**
Mobilization	5	%		$81,595	$0
Land Purchase	15	ACRES	$8,000	$120,000	$60,000
Well Installation	3	EA	$35,000	$105,000	$52,500
Pump House	1	LS	$75,000	$75,000	$37,500
Install New Pumps	2	EA	$9,000	$18,000	$4,500
Emergency Backup Generator	1	LS	$55,000	$55,000	$27,500
New 6-inch PVC Water Main and Fittings	12,500	LF	$80	$1,000,000	$750,000
Road/Creek Directional Drilling	1	LS	$100,000	$100,000	$50,000
Connect to Existing Distribution System	1	EA	$1,500	$1,500	$750
Install new SCADA/PLC System	1	LS	$30,000	$30,000	$15,000
Demo Existing Treatment Plant Equipment	1	LS	$75,000	$75,000	$0
Chlorination Equipment	1	LS	$10,000	$20,000	$5,000
Temporary Erosion Protection	1	LS	$5,000	$5,000	$0
Layout and Construction Staking	1	LS	$10,000	$10,000	$0
Exploratory Excavation	8	HR	$150.00	$1,200	$0
Construction Materials Testing	1	%		$16,200	$0
			Construction Estimate	**$1,713,495**	**$1,002,750**
Water Rights Negotiations					
Water Rights	1	LS	$60,000	$60,000	
Bedrock Surface Investigation	1	LS	$11,000	$11,000	
Hydrogeologic Survey	1	LS	$8,500	$8,500	
			Subtotal	**$1,792,995**	
AIS Compliance-Materials and Project Management			5%	$89,650	
Contingency			15%	$282,400	
Administrative, Legal, & Engineering			25%	$541,260	
Total (rounded to the nearest thousand)				**$2,627,000**	**$964,000**

[1] Salvage Value PW Factor @ 0.2% for 20 years

Table 4-9 Annual Operations and Maintenance Costs Treatment Alternative T-6 Shallow Ground Water				
Description	**Quantity**	**Unit**	**Unit Cost**	**Cost**
Accounting & Auditing	1	LS	$700	$700
Bank Service Charges	1	LS	$0	$0
Chemicals	1	LS	$1,532	$1,532
Dues/Certifications/Training	1	LS	$425	$425
Easement & Water Assessment	1	LS	$227	$227
Fees (Permits, Service, Recording)	1	LS	$774	$774
Insurance & Bonding	1	LS	$2,195	$2,195
Payroll Expense	1	LS	$11,692	$11,692
Postage & Office	1	LS	$980	$980
Professional Fees	1	LS	$0	$0
Repairs	1	LS	$3,000	$3,000
Short Lived Assets	1	LS	$1,800	$1,800
Supplies	1	LS	$1,642	$1,642
Testing Water	1	LS	$1,994	$1,994
Truck Expenses	1	LS	$752	$752
Utilities	1	LS	$2,900	$2,900
Total Annual Operating and Maintenance Costs (rounded to the nearest $100)				**$30,600**
Real Interest Rate	0.2%			
Present Worth for 20 Years @ 0.2% (rounded to the nearest $100)				**$600,000**
[1] **Shading indicates e**xpenses adjusted to reflect O&M cost specific to Alternative				

7. Alternative T-7: Deep Ground Water Wells

a. Description

Alternative T-7 involves drilling deep ground water wells for the District's municipal wells. Water is available in sandstone strata beneath the land surrounding Power. In particular, the Sunburst Sandstone member of the Kootenai Formation is a known aquifer that can provide substantial amounts of water. It has a high degree of reliability, since this relatively deep aquifer is unlikely to be impacted by drought or by surface contamination. Driller logs indicate that in at least some of these wells, ground water was encountered well below the static water level obtained in the wells, indicating artesian conditions. Artesian conditions suggest less vulnerability to drought than many shallow aquifers experience, and the cap of 10 to 30 feet of clay soil indicated on the logs also suggests less vulnerability to contamination. The sand beneath the clay provides a permeable medium for ground water migration, and well yields for the small domestic wells ranged from 5 gpm to over 60 gpm. Hydrofracturing (fracking), will likely increase well yields. Water produced is likely to be Class II or Class III for TDS, and some form of treatment may be needed to achieve primary drinking water standards and to produce the desired quality of water.

The Kootenai Formation consists primarily of fine-grained clastic rocks, especially claystone, that act as aquitards. Sandstone strata isolated by the fine-grained aquitards act as aquifers. There may be some water quality differences between these various zones. Similar lithologies are present in the shallower Blackleaf Formation, and a shallower well may be a possibility. However, it is more prudent to anticipate completing the well in the deeper Kootenai.

An advantage of this alternative includes the flexibility in well location and minimal required land acquisition when compare to Alternative T-6.

For this alternative, the existing WTP equipment will be demolished; the existing building will be retained for any required treatment equipment. This alternative assumes the Kootenai aquifer produces poor water quality. Should this alternative be selected for final design a detailed water quality analysis will be required. A reverse osmosis (RO) system is suggested in this preliminary planning stage. The new RO system can be housed in the existing WTP building. RO systems contain a semi-permeable membrane with pore sizes less than 0.001 microns. RO systems are able to remove nearly all inorganic contaminants, pesticides, and bacteria with low effluent concentration possible. However, RO system often require pretreatment and can be susceptible to fouling. RO system requires disposal of the treatment wastewater. The existing WTP has a number of basins that can be upgraded to act as a total retention waste pond. Improvements to the ponds, including new HDPE liner and inlet structures are included in this alternative.

A new water right will need to be negotiated with the DNRC. Unlike Alternative T-6, this alternative will not affect nearby surface water. As such, the water right negotiations will likely be significantly less complicated.

b. Design Criteria

The design max day demand is 241,200 gpd, or 167.5 gpm. Per DEQ-1, well yields must be sufficient to supply the District with max day flow with the largest well out of service. In general, wells completed in the Kootenai sandstones produce between 30 gpm to 60 gpm; however, it would be possible to obtain significantly more if suitable fractures are encountered. A larger diameter well would potentially provide some increase in production and would significantly increase well reliability by facilitating cleaning and providing more cooling for the well pump. A stainless-steel well screen and sand pack would significantly extend the well life and efficiency and would permit periodic brushing and acid washing. A minimum well size of 8 inches would permit sleeving of the well in the future if needed to extend well life.

Requirements for municipal groundwater wells, detailed in DEQ-1, section 3.2 include, but are not limited to:

- Total ground water source capacity must meet or exceed design max day demands, with the largest producing well out of service.
- Sufficient auxiliary power must be provided to meet average day demand when power failure would result in cessation of the minimum essential service.

- Permanent steel casing pipe must be in accordance with ARM 36.21.640 and have joints in accordance with ARM 36.21.642.
- Screens must be constructed of materials resistant to damage by chemical action of groundwater or cleaning operations.
- Every well must be developed in accordance with ARM 36.21.653.

Production zones that only provide 15 to 25 gpm would not provide enough water for the Power water system. Activities such as hydrofracturing ("fracking") will be required to enhance production. Directional drilling with multiple screens may also provide the required well yields.

Finally, DEQ-1 mandates standby power in section 2.6 of the circular, stating "dedicated standby power is required…. Alternatives to dedicated standby power may be considered with proper justification". Emergency power will be supplied to the wells with a backup generator.

c. Map

The Kootenai aquifer (or aquifers) occupy the entire area under Power and can be encountered by drilling at nearly any convenient location. A map illustrating possible well locations is shown on Figure 4-7.

d. Environmental Impacts

Environmental impacts with this alternative are expected to be low due to a small footprint and the use of a deep ground water resource. Minor, short-term impacts associated with dust and noise would be expected during construction. If treatment is necessary, especially if it involves reverse osmosis, effluent or solid waste may be generated that would require disposal.

e. Land Requirements

Land requirements would be limited to two separate locations, roughly 1 acre each in area. This would provide sufficient area for a drilling rig and well service truck to access the wellhead. As with Alternative T-6, land purchase is recommended over an easement to prevent access issues in the future. Final design would be dependent on land availability.

f. Potential Construction Problems

Drilling wells to a depth of approximately one thousand feet through Marias River Formation, Blackleaf Formation, and Kootenai strata is relatively straightforward. Of greater concern is the degree to which water treatment may be necessary. This could negate the advantage for system resiliency if multiple wells had to be plumbed to a central treatment plant. Small, wellhead treatment systems would only be suitable if minor treatment (e.g. a single substance) is needed and if this could be provided using reliable, low-maintenance equipment.

g. Sustainability Consideration

1. *Water and Energy Efficiency*

   The ground water hosted in the Kootenai Formation is regionally extensive and not highly utilized. It is an abundant resource and relatively insulated from year-to-year fluctuations in recharge.

   From limited well logs, a reasonable estimate for depth to water would be 800 feet. The deep well option therefore requires significantly more pumping energy than the shallow option. To some extent, this could be partially offset if wells could be distributed throughout the system, but if more sophisticated treatment is needed for the anticipated Class III water, then all the produced water will need to be treated at the water treatment plant.

2. *Green Infrastructure*

   A SWPPP will be required prior to construction to reduce the amount of storm water runoff from disturbed areas of the project. This alternative will also rely on filtering and disinfection properties naturally present in the soils. This will likely result in fewer required chemicals.

3. *Other*

   The benefits of proper well design, construction, and maintenance as described for the shallow well option apply to an even greater degree to the deep well option. For example, a stainless-steel well screen that costs far more than a PVC well screen can be brushed and acid washed multiple times during the life of the well to maintain production and extend the life of the well. While very difficult to place, a well-placed sand or gravel pack around the screen can contribute to stable ground water production.

POWER-TETON COUNTY WATER AND SEWER DISTRICT
POWER, MONTANA

ALTERNATIVE T-7

DEEP GROUND WATER WELLS

17-258 FIGURE 4.C.DWG
FIGURE 4-7

DRAWN BY: CDF
DESIGNED BY: NMR
QUALITY CHECK: DJO
DATE: 2018-05-22
JOB NO.: 17-258
E-BUSINESS:

TD&H Engineering
406.761.3010 • tdhengineering.com
1800 RIVER DR. NO. • GREAT FALLS, MONTANA 59401

REV	DATE	REVISION

NOT FOR CONSTRUCTION

h. Cost Estimate

Planning level capital costs and operations budgets are presented in Tables 4-10 and 4-11, respectively. Due to the unpredictable nature of groundwater sources, it is unknown at this time how many wells well be required. It is considered appropriately conservative to assume, with fracking, well yields will average between 75 gpm and 100 gpm. Four wells will are believed to be sufficient. Construction cost estimates are based on unit prices from similar public projects and information from equipment suppliers. A number of gate valves and ductile iron fittings would likely be required throughout the alignment. Additionally, the wells will likely include steel well casings. Because of this, along with the bulk water station, an additional 5% of the construction cost was included to ensure compliance with AIS regulations. Due to the inherent unpredictability of groundwater sources, a 15% contingency has been applied; 25% was also included for administrative, legal, and engineering fees. The total estimated construction cost for Alternative T-7 is $3,061,000 with a salvage value of $896,000. A real discount rate of 0.2%, as defined in Appendix C of OMB Circular A-94, was used to calculate the present worth of the salvage value. Detailed cost estimates and calculations for Alternative T-7 are provided in Appendix 4-E.

The District's existing O&M budget, presented in Chapter 1, was used as a reference to estimate O&M costs for Alternative T-6. Modifications to the budget are indicated in Table 4-11 and include an added line item for short lived asset reserves. Modifications to the budget result in a decreased annual cost, when compared to the District's 2016 costs. Although the District's annual budget includes roughly $100,000 for depreciation, conversations with District staff indicate this value is not included in the current user rates as no yearly payment is required. As such depreciation has not been included in the proposed annual O&M budget for Alternative T-7.

Table 4-10 Power Teton - County Water & Sewer District Preliminary Engineering Report Construction Cost Estimate Treatment Alternative T-7 Deep Ground Water Wells					
Item	**Quantity**	**Units**	**Unit Cost**	**Cost**	**Salvage Value[1]**
Mobilization	5	%		$95,280	$0
Land Purchase	8.0	ACRES	$7,000	$64,000	$0
Well Installation	4	LS	$200,000	$800,000	$400,000
Pump House	1	LS	$75,000	$75,000	$37,500
Install New Pump	4	EA	$8,000	$32,000	$16,000
Emergency Backup Generator	1	LS	$55,000	$55,000	$27,500
New 6-inch PVC Water Main and Fittings	3,100	LF	$80	$248,000	$186,000
New RO Treatment System	1	LS	$500,000	$500,000	$250,000
Surface Restoration	300	SY	$50	$15,000	$0
Connect to Existing Distribution System	1	EA	$1,500	$1,500	$375
Install new SCADA/PLC System	1	LS	$30,000	$30,000	$15,000
Demo Existing Treatment Plant Equipment	1	LS	$50,000	$50,000	$0
Temporary Erosion Protection	1	LS	$5,000	$5,000	$0
Layout and Construction Staking	1	LS	$10,000	$10,000	$0
Exploratory Excavation	8	HR	$150	$1,200	$0
Construction Materials Testing	1	%		$17,900	$0
			Construction Estimate	**$2,000,880**	**$932,375**
Water Rights Negotiations					
Water Rights	1	LS	$60,000	$60,000	
Bedrock Surface Investigation	1	LS	$11,000	$11,000	
Hydrogeologic Survey	1	LS	$8,500	$8,500	
			Subtotal	**$2,080,380**	
AIS Compliance-Materials and Project Management			5%	$104,019	
Contingency			15%	$327,660	
Administrative, Legal, & Engineering			25%	$628,015	
Total (rounded to the nearest thousand)				**$3,061,000**	**$896,000**
[1]Salvage Value PW Factor @ 0.2% for 20 years					

Table 4-11 Annual Operations and Maintenance Costs Treatment Alternative T-7 Deep Ground Water Wells				
Description	**Est. Qty.**	**Unit**	**Est. U/C**	**Est. Cost**
Accounting & Auditing	1	LS	$700	$700
Bank Service Charges	1	LS	$0	$0
Chemicals	1	LS	$1,532	$1,532
Dues/Certifications/Training	1	LS	$425	$425
Easement & Water Assessment	1	LS	$227	$227
Fees (Permits, Service, Recording)	1	LS	$774	$774
Insurance & Bonding	1	LS	$2,195	$2,195
Payroll Expense	1	LS	$11,692	$11,692
Postage & Office	1	LS	$980	$980
Professional Fees	1	LS	$0	$0
Repairs	1	LS	$3,000	$3,000
Short Lived Assets	1	LS	$3,600	$3,600
Supplies	1	LS	$1,642	$1,642
Testing Water	1	LS	$1,994	$1,994
Truck Expenses	1	LS	$752	$752
Utilities	1	LS	$5,000	$5,000
Total Annual Operating and Maintenance Costs (rounded to the nearest $100)				**$34,500**
Real Interest Rate	0.2%			
Present Worth for 20 Years @ 0.2% (rounded to the nearest $100)				**$676,000**
[1] Shading indicates expense adjusted to reflect O&M cost specific to Alternative.				

B. WATER STORAGE ALTERNATIVES

1. Alternative S-1: No Action

This alternative entails leaving the existing storage system unchanged; the District's 150,000-gallon finished water storage tank is to remain the sole source of storage in Alternative S-1. As discussed in Chapter 2, the available storage is not able to provide enough water for 24 hours of the current or design average day demand plus required fire flows. As such, the system does not meet regulatory requirements specified in Circular DEQ-1. Should the WTP plant fail, the finished water stored in the tank would be the Districts only source of potable water. Inadequate finished water storage poses a significant threat to the safety and security of the District. For this reason, Alternative S-1 is not considered a viable alternative and will not be discussed further.

2. Alternative S-2: New 60,000-Gallon Water Storage Tank

a. Description

As previously discussed, the Power-Teton County Water and Sewer District does not have adequate water storage to meet domestic and fire demands. Per DEQ standards, 161,400 gallons of storage is currently needed to serve the community of Power, and 200,400 gallons will be required for the projected 20-year design

demand. These calculations were provided in Chapter 2 of this PER. Currently, the District has 150,000 gallons of finished water storage. Constructing a new 60,000-gallon storage tank near the existing 150,000-gallon tank will provide the District with a total of 210,000 gallons of finished water storage. This will be sufficient volume to meet the District's projected 20-year demands.

The new 60,000-gallon tank will be constructed similarly to the existing 150,000-gallon storage tank, complete with overflow piping and PVC subdrain. The finished floor elevation will be approximately 3,785 feet and the surrounding area will be graded away from the tank to provided adequate drainage.

Three types of tanks were considered for this alternative; cast-in place concrete, welded steel, and bolted steel. The capital costs associated with concrete tanks is expected to be considerably higher due to the necessary frame work, reinforcing steel bars and availability of concrete supplier. A specialized concrete crew would be required to for the forming of the tank. Additionally, construction times would be longer due to the concrete required cure time. Bolted Steel tanks would be the most cost effective. These tanks have shorter life spans and are only expected to last 60 years. Welded steel is considered to be the most advantageous for the District, as the existing storage tank is a welded steel tank. Maintaining a similar construction allows O&M procedures and replacement parts to be consistent between the two tanks.

If this alternative is implemented and significant reductions in unaccounted for water are achieved throughout the distribution system, there may be a need for increasing chlorination feed rates. Larger storage volumes can cause longer detention times within the tank. Reductions in water loss would also increase the water age. Depending the District's treatment system and disinfection requirements, chlorine feed rates may need to be increased to maintain residuals. However, the incremental increase in water age and subsequent increase in chlorine feed rate changes the potential for DBP formation. It seems unlikely that DBP formation would be significantly increased as a result of somewhat longer water age. Nonetheless, if DBP levels are determined to be a future risk, one option to mitigate that risk would be to modify the disinfectant to use chloramination. This can be done by adding ammonia to the feed in combination with chlorine. Additionally, if the District changes its source water as detailed in the treatment system alternatives, TOC concentrations will likely decrease, decreasing the likelihood of DBPs. DBP formation should be evaluated as part of the final design.

b. Design Criteria

The design of a new storage tank will be in accordance with DEQ Circular 1. DEQ-1 requires all finished water storage tanks meet following criteria:

- Have sufficient volume to provide 24 hours of average day demand plus fire flow.
- DEQ requires that in addition to fire demands, the system must be able to provide a minimum residual pressure of 20 psi at all points in the system.

c. Map

A map with the location of the existing and proposed water storage tank is provided in Figure 4-8.

d. Environmental Impacts

Minor, short-term impacts associated with dust and noise would be expected during construction. Land would have to be cleared and excavated for the new tank and a small disinfection building. Once construction is complete, any disturbed ground would be required to be revegetated to native species. Impacts to the environment are anticipated to be minimal.

e. Land Requirements

The District currently owns the nearly 2.5-acre parcel that the current storage tank sits on. Construction of a second tank could feasibly take place on the same parcel. No additional land would be required for this alternative.

f. Potential Construction Problems

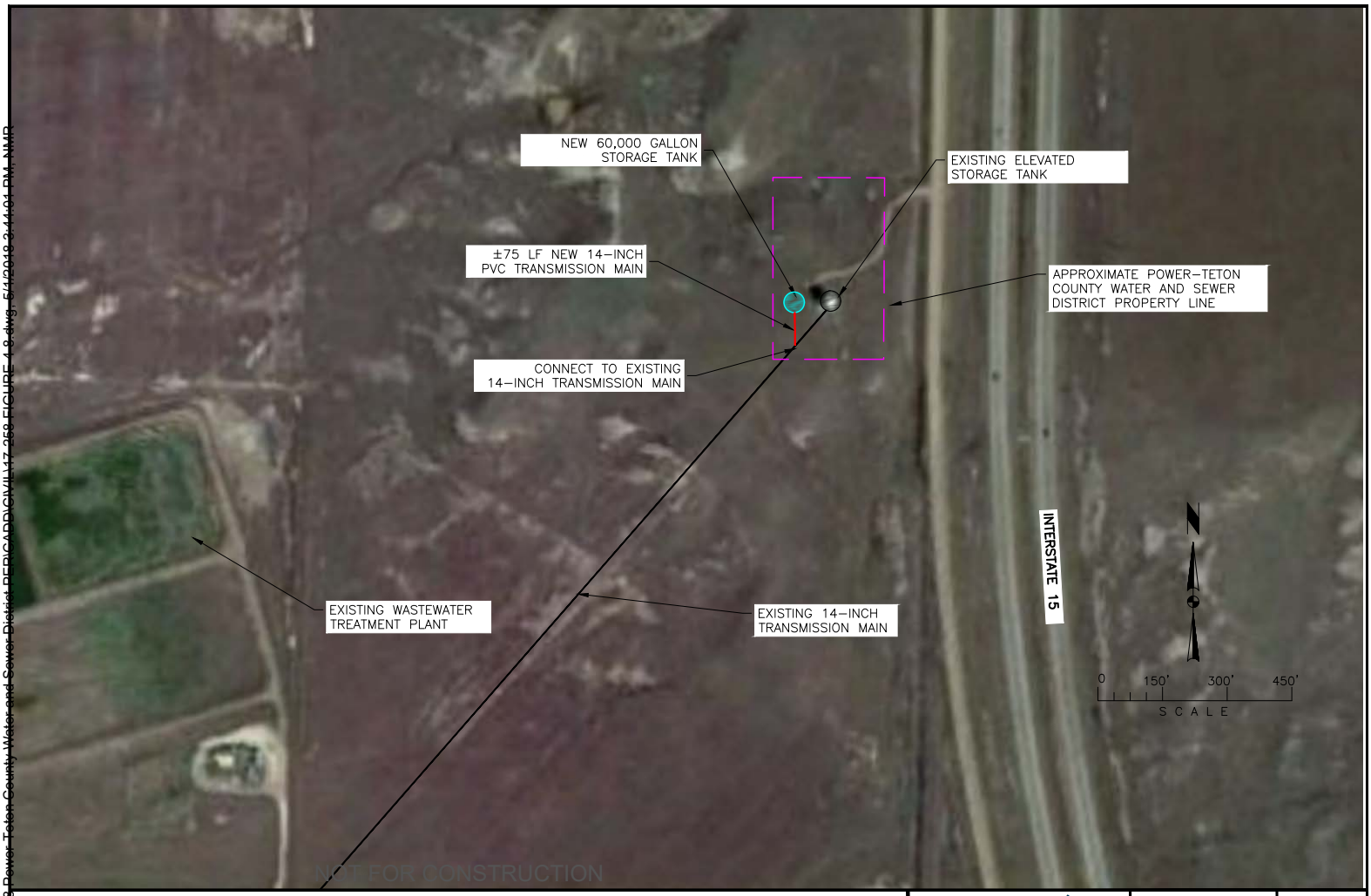
No significant construction problems would be expected. Construction of the new water storage tank would be completely independent of the existing system, as such the water system may function as normal throughout construction. Additionally, there is sufficient land available near the existing storage tank. The land in the area is relatively flat terrain with clayey soils.

g. Sustainability Considerations

1. *Water and Energy Efficiency*
   Water from the proposed tank will flow throughout the distribution system. There will be minimal electrical needs for the tank and potential disinfection building. This alternative is very energy efficient.

2. *Green Infrastructure*
   Green infrastructure with regard to storm water considerations is not applicable to this alternative.

3. *Other*
   The proposed tank will require routine maintenance such as inspecting and cleaning every five years.



POWER TETON COUNTY WATER AND SEWER DISTRICT
POWER, MONTANA

ALTERNATIVE S-2

NEW 60,000 GALLON FINISHED WATER STORAGE TANK

TD&H Engineering
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DRAWN BY:	NMR
DESIGNED BY:	NMR
QUALITY CHECK:	MJO
DATE:	2018-03-22
JOB NO.	17-258
CAD NO.	17-258 FIGURE 4-8

FIGURE
4-8

J:\2017\17-258 Power Teton County Water and Sewer District PER\CADD\CIVIL\17-258 FIGURE 4-8.dwg 5/1/2018 2:44:01 PM NMR

h. Cost Estimate

Planning level capital costs and operations budgets are presented in Tables 4-12 and 4-13, respectively. Construction cost estimates are based unit prices from similar public projects and conversation with suppliers. Due to the large quantity of steel required for a welded steel storage tank, an additional 5% of the construction cost was included to ensure compliance with AIS regulations. It is believed a 10% contingency is sufficient for this project; 25% was also included for administrative, legal, and engineering fees. The total estimated construction cost for Alternative S-2 is $572,000 with a salvage value of $56,000. A real discount rate of 0.2%, as defined in Appendix C of OMB Circular A-94, was used to calculate the present worth of the salvage value. Detailed cost estimates and calculations for Alternative S-2 are provided in Appendix 4-F.

The District's existing O&M budget, presented in Chapter 1, was used as a reference to estimate O&M costs for Alternative S-2. Modifications to the budget are indicated in Table 4-13 and include an added line item for short lived asset reserves. The major item associated with short lived assets for this alternative is tank accessories including ladder and hatches. Although the District's annual budget includes roughly $100,000 for depreciation, conversations with District staff indicate this value is not included in the current user rates as no yearly payment is required. As such depreciation has not been included in the proposed annual O&M budget for Alternative S-2.

Table 4-12
Construction Cost Estimate
Water Storage Alternative S-2 New 60,000 Gallon Water Storage Tank

Item	Quantity	Units	Unit Cost	Cost	Salvage Value[1]
Mobilization	5	%		$18,852	$0
Earth Work-Site Grading	1	LS	$155,000	$155,000	$0
Foundation and Footings	1	LS	$95,000	$95,000	$23,750
Site Fencing	1	LS	$1,600	$1,600	$800
14" PVC	75	LF	$80	$6,000	$3,000
14" Gate Valve	1	EA	$4,500	$4,500	$2,250
60,000 Gallon Welded Steel Tank	1	EA	$110,000	$110,000	$27,500
Exploratory Excavation	8	HR	$150	$1,200	$0
Construction Materials Testing	1	%		$3,733	$0
Construction Estimate				**$395,885**	**$57,300**
AIS Compliance-Materials and Project Management			5%	$19,794	
Contingency			10%	$41,567	
Administrative, Legal, & Engineering			25%	$114,312	
Total (rounded to the nearest thousand)				**$572,000**	**$56,000**

[1]Salvage Value PW Factor @ 0.2% for 20 years

Table 4-13 Annual Operations and Maintenance Costs Storage Alternative S-2 New 60,000 Gallon Storage Tank				
Description	**Quantity**	**Unit**	**Unit Cost**	**Cost**
Accounting & Auditing	1	LS	$700	$700
Bank Service Charges	1	LS	$0	$0
Chemicals	1	LS	$6,128	$6,128
Dues/Certifications/Training	1	LS	$425	$425
Easement & Water Assessment	1	LS	$227	$227
Fees (Permits, Service, Recording)	1	LS	$774	$774
Insurance & Bonding	1	LS	$2,100	$2,100
Payroll Expense	1	LS	$11,692	$11,692
Postage & Office	1	LS	$980	$980
Professional Fees	1	LS	$0	$0
Repairs	1	LS	$8,980	$8,980
Short Lived Assets	1	LS	$900	$900
Supplies	1	LS	$1,642	$1,642
Testing Water	1	LS	$1,994	$1,994
Truck Expenses	1	LS	$752	$752
Utilities	1	LS	$8,919	$8,919
Total Annual Operating and Maintenance Costs (rounded to the nearest $100)				**$46,200**
Real Interest Rate	0.2%			
Present Worth for 20 Years @ 0.2% (rounded to the nearest $100)				**$905,000**
[1] Shading indicated expense adjusted to reflect O&M cost specific to Alternative.				

The O&M budget presented in Table 4-13 has been based on provided financial records and includes required O&M for the water and sewer systems. Based on the operating revenue, the water system is roughly 66% of the total District. Furthermore, the finished water storage tanks require minimal O&M; for the purpose of this PER, it is assumed the storage tank requires 10% of the water systems O&M. Therefor the annual O&M cost of the water storage tank is $5,300 ($46,200*0.66*0.1=$3,000). Present worth is estimated at $59,700, assuming 20 years at 0.2% real interest rate.

3. Alternative S-3: New 210,000-Gallon Storage Tank

This alternative includes demolishing the existing 150,000-gallon welded steel storage tank and constructing new 210,000-gallon finished storage tank. The new tank will provide sufficient volume to serve the 20-year design demands projected for the community. However, the existing tank was constructed 2005 and no issues regarding the condition and functionality of the tank have been reported. It would be considered

a waste of time and resources to demolish a relatively new storage tank that is considered to be in good condition. For this reason, Alternative S-3 is not considered a feasible option and will not be discussed further.

C. DISTRIBUTION SYSTEM ALTERNATIVES

1. Alternative D-1: No Action

Alternative D-1 will allow the existing distribution to continue without improvement. As discussed in Chapter 2, the existing distribution system was constructed in 2008 and is considered to be in generally good condition. However, a few inadequacies are present within the system, most notably, the dead end, lack of redundancy, and leaking service connections. The dead end along Rainbow Avenue and single main to connect the east and west portions of the District significantly decrease the reliability of the distribution system. Dead ends can increase water age within the distribution system, and the single main feeding the fire hydrant along Rainbow Ave is the sole source of fire protection and potable water for the section of the District. Additionally, the main traveling along 4th street under the BNSF rail line is the only connection between the two halves of the District. Should either of these mains fail, entire portions of the District will be without water until the main can be repaired. Moreover, the District is experiencing a large percentage of unaccounted-for water. This is most likely due to the leaking and corroded service connections. This drastically impacts the water and energy efficiency of the entire system, wasting the limited resources of the District. For these reasons, Alternative D-1: No Action is not considered a viable option and will not be discussed further.

2. Alternative D-2: New Service Connections

Alternative D-2 includes replacement of all service connections within the District. This is expected to considerably decrease the amount of unaccounted-for water the District is currently reporting. In turn, the water and energy efficiency of the water system will increase, saving the District both time and money. Conversations with the District staff and users at a recent public hearing indicated the community of Power would prefer to correct this deficiency with its manpower and resources rather than apply for grant and low interest loans. As such, this alternative will not be discussed further within this PER.

3. Alternative D-3: New Looping Water Main

a. Description

Alterative D-3 includes the construction of a looping main along the southern edge of the District. This will provide multiple benefits for the water system. First, the proposed main will eliminate the dead end located on the end of Rainbow Ave. Second, the second main will be bored under the BNSF rail line. The purpose of these improvements is to provide redundancy to the system and increase the reliability of the system. As discussed previously, should the single main under the railroad ever fail, the eastern section the District will be isolated from the WTP and the western half will have no connection to the finished water storage tank. Depending on the severity of the main break and the amount of time required for repair, water users could go for an extended period of time without potable water or fire protection. Additionally, the existing dead end at the southern end of Rainbow Avenue decreases the reliability of the distribution system in that area

and may increase water age. This increases the risk of pathogens in the water.

A new 6-inch main along 7th Rd NE, connecting Rainbow Avenue to Hill Avenue, will eliminate both of these concerns. Roughly 1,100 LF of 6-inch PVC will be required; the main will need to be bored under the BNSF rail road and two connections to the existing system will be included at Hill Avenue and Rainbow Avenue.

b. Design Criteria

To comply with DEQ-1 design standards, a working pressure of 35 psi would have to be maintained throughout the distribution system and 20 psi would be required at all times including fire flows. Additionally, all mains providing fire flow must be at least 6-inches in diameter. The WaterCAD model of the District's water system was modified to include Alternative D-2. Table 4-14 summarizes the modeled pressures at the junctions surrounding the proposed main assuming max day design demand; Table 4-15 provides fire flow results for the surrounding hydrants. Detailed results are provided in Appendix 4-G. As illustrated in Table 4-14, a 6-inch water main will be sufficient to maintain DEQ standards. In addition to DEQ standards, Alternative D-3 would be designed and constructed in accordance with MPWSS and generally accepted engineering practices.

Table 4-14
Modeled Distribution System Working Pressures
Alternative D-3: New Looping Water Main

Junction	Location	Working Pressure (psi)
J-14	Rainbow Ave and 7th Rd NE	53
J-38	Rainbow Ave and 7th Rd NE	53
J-40	Hill Ave and 7th Rd NE	53
J-20	Hill Ave and 7th Rd NE	53
J-29	Central Ave and 7th Rd NE	49
J-18	Hill Ave and 2nd Street	53
J-1	Hill Ave and 4th Street	52
J-5	Rainbow Ave and 3rd Street	53

Table 4-15
Modeled Fire Flows
Alternative D-3: New Looping Water Main

Hydrant	Location	Available Fire Flow (gpm)	Minimum Pressure (psi)
H-13	Rainbow Ave and 7th Rd NE	3,000	32
H-05	Hill Ave and 7th Rd NE	2,059	20
H-06	Rainbow Ave and 3rd Street	2,596	20
H-04	Hill Ave and 2nd Street	1,975	20

c. Map

The alignment for the looping main in relation to the existing distribution system is presented in Figure 4-9.

d. Environmental Impacts

Minor, short term environmental impacts associated with dust and noise during construction would be unavoidable. However, these can be easily mitigated with properly planned and scheduled construction practices.

e. Land Requirements

The new main would be installed within the footprint of the existing street. An easement from BNSF would be required to bore the new main under the rail line.

f. Potential Construction Problems

No significant construction problems would be expected to impact the project. All disturbed land would be rehabilitated as part of the improvements. Additionally, utility crossing would be safely shored and protected from damage.

g. Sustainability Considerations

1. *Water and Energy Efficiency*

   Water from the proposed tank will flow throughout the distribution system. There will be minimal electrical needs for the tank and potential disinfection building. This alternative is very energy efficient.

2. *Green Infrastructure*

   Green infrastructure with regard to storm water considerations is not applicable to this alternative.

3. *Other*

   No significant changes to the District's current O&M procedures would be expected as a result of this alternative.

POWER-TETON COUNTY WATER AND SEWER DISTRICT PER
POWER, MONTANA

ALTERNATIVE D-3

NEW LOOPING WATER MAIN

DRAWN BY: CDF
DESIGNED BY: NMR
QUALITY CHECK: DJO
DATE: 03-22-2018
JOB NO.: 17-258
FILENAME: XXX

TD&H Engineering
406.761.3010 • tdhengineering.com
1800 RIVER DR. NO. • GREAT FALLS, MONTANA 59401

REV	DATE	REVISION

NOT FOR CONSTRUCTION

FIGURE 4-9
17-258 FIGURE 4.XWG

h. Cost Estimate

Planning level capital costs and operations budgets are presented in Tables 4-15 and 4-16, respectively. Construction cost estimates are based unit prices from similar public projects and conversation with suppliers. An additional 2.5% of the construction cost was included to provides to meet AIS standards for the gate vales and steel fitting required in the project. It is believed a 10% contingency is sufficient for this project; 25% was also included for administrative, legal, and engineering fees. The total estimated construction cost for Alternative D-3 is $303,000 with a salvage value of $68,000. A real discount rate of 0.2%, as defined in Appendix C of OMB Circular A-94, was used to calculate the present worth of the salvage value. Detailed cost estimates and calculations for Alternative S-2 are provided in Appendix 4-G.

The District's existing O&M budget, presented in Chapter 1, was used as a reference to estimate O&M costs for Alternative D-3. Modifications to the budget are indicated in Table 4-17. Minor impacts to O&M are expected to result for Alternative D-3 and include yearly fees for easements due to work within BNSF property. Although the District's annual budget includes roughly $100,000 for depreciation, conversations with District staff indicate this value is not included in the current user rates as no yearly payment is required. As such depreciation has not been included in the proposed annual O&M budget for Alternative D-3.

Table 4-16 Construction Cost Estimate Alternative D-3 New Looping Main					
Item	**Quantity**	**Units**	**Unit Cost**	**Cost**	**Salvage Value[1]**
Mobilization	5	%		$10,225	$0
Connect to Existing Main	2	EA	$1,750	$3,500	$2,625
6-inch PVC	1,080	LF	$80	$86,400	$64,800
6-inch Gate Valve	2	EA	$2,000	$4,000	$3,000
Utility Crossing	1	LS	$3,000	$3,000	$0
Jack and Bore Under BNSF Railroad	1	EA	$90,000	$90,000	$0
Ground Surface Restoration	1	LS	$5,000	$5,000	$0
Layout and Construction Staking	1	LS	$10,000	$10,000	$0
Exploratory Excavation	4	HR	$150	$600	$0
Construction Materials Testing	1	%		$2,000	$0
Construction Estimate				**$214,725**	**$70,425**
AIS Compliance-Materials and Project Management			2.5%	$5,368	
Contingency			10%	$22,009	
Administrative, Legal, & Engineering			25%	$60,526	
Total (rounded to the nearest thousand)				**$303,000**	**$68,000**

[1] Salvage Value PW Factor @0.2% for 20 years.

Table 4-17 Power Teton-County Water & Sewer District Preliminary Engineering Report Annual Operations and Maintenance Costs Alternative D-3: New Looping Water Main				
Description	**Quantity**	**Unit**	**Unit Cost**	**Cost**
Accounting & Auditing	1	LS	$700	$700
Bank Service Charges	1	LS	$0	$0
Chemicals	1	LS	$61,128	$61,128
Dues/Certifications/Training	1	LS	$425	$425
Easement & Water Assessment	1	LS	$454	$454
Fees (Permits, Service, Recording)	1	LS	$774	$774
Insurance & Bonding	1	LS	$1,995	$1,995
Payroll Expense	1	LS	$11,692	$11,692
Postage & Office	1	LS	$980	$980
Professional Fees	1	LS	$0	$0
Repairs	1	LS	$7,490	$7,490
Short Lived Asset Reserves	1	LS	$0	$0
Supplies	1	LS	$1,642	$1,642
Testing Water	1	LS	$1,994	$1,994
Truck Expenses	1	LS	$752	$752
Utilities	1	LS	$8,919	$8,919
Total Annual Operating and Maintenance Costs (rounded to the nearest $100)				**$43,900**
Real Interest Rate	0.2%			
Present Worth for 20 Years @ 0.2% (rounded to the nearest $100)				**$859,900**
[1] Shading indicates expense adjusted to reflect O&M cost specific to Alternative				

The O&M budget presented in Table 4-17 has been based on provided financial records and includes required O&M for the water and sewer systems. Based on the operating revenue, the water system is roughly 66% of the total District. Furthermore, the distribution system requires minimal O&M when compared to the treatment system; for the purpose of this PER, it is assumed the storage tank requires 25% of the water systems O&M. Therefor the annual O&M cost of the water storage tank is $5,300 ($43,900*0.66*0.25=$7,200). Present worth is estimated at $141,900, assuming 20 years at 0.2% real interest rate.

5.0 SELECTION OF AN ALTERNATIVE

Each technically feasible alternative presented in Chapter 4 was evaluated to select the most beneficial alternative to the Power-Teton County Water and Sewer District. The viable alternatives are evaluated below based on an organized and systematic approach. This methodology ensures a consistent and unbiased means of selecting the most beneficial alternative for the District. Each alternative was evaluated by applying consistent criteria. These criteria include life cycle cost, technical and logistical feasibility, operation and maintenance complexity, public health and safety, environmental impacts, and public acceptance. Each viable option was ranked within a decision matrix. The alternative selection process is presented in the following sections for water source and treatment alternative, water storage alternatives, and distribution system alternatives. Options chosen for further consideration from this method will be discussed in greater detail in *Chapter 6.0-Proposed Project.*

A. WATER SOURCE/TREATMENT ALTERNATIVES

Seven water source and treatment alternatives were discussed previously in Chapter 4. Alternative T-1: No Action and T-5: Connect to Tri-County Water District were not considered to be feasible. Alternative T-1 did not provide a solution to the District's most pressing concerns and The Tri-County Water District indicated the system does not have the capacity to supply sufficient water to the community of Power. Therefore, these two alternatives have been eliminated from further consideration. The following sections compares the remaining alternatives with respect to the above-mentioned criterion. Each alternative was given a score with lower scores representing the most desirable Alternative. Scores for each criterion were summed together in the decision matrix; the lowest total score indicates the most advantageous project for the District.

1. Life Cycle Cost Analysis

A comparison on the net present value for the five-remaining water source and treatment system alternatives is presented in Table 5-1. A low net present value is desired as such Alternative T-6, T-2, T-7, T-3, and T-4 are ranked 1, 2, 3, 4, and 5, respectively.

Table 5-1 Water Source and Treatment Alternative Life Cycle Cost Analysis				
Alternative	**Present Worth of O&M Cost(1)**	**Capital Costs**	**Present Worth of Salvage Value**	**Net Present Value**
T-2: Upgrade WTP	$877,300	$1,919,000	$503,000	$2,303,300
T-3: Connect to NCMRWA	$2,546,200	$6,991,000	$1,881,000	$7,656,200
T-4: Connect to City of Great Falls	$2,806,700	$16,916,000	$4,788,000	$14,934,700
T-6: Shallow Ground Water Wells	$600,000	$2,627,000	$964,000	$2,263,000
T-7: Deep Groundwater Wells	$676,000	$3,061,000	$896,000	$2,841,000

Note: Interest Rate=0.2%, Term=20 years

2. Non-Monetary Factors

The alternative analysis includes consideration of non-monetary factors such as technical and logistical feasibility, operation and maintenance complexity, public health and safety, environmental impacts, and public acceptance. The following discussion evaluates the remaining alternatives with respect to each criterion. Each water source and treatment alternative has been ranked 1-5 for each criterion, with 1 indicating the most desirable option.

a. Technical and Logistical Feasibility

Technical and logistical feasibility considers factors such as permitting requirements, land acquisition and technical practicability of the project. The five remaining alternatives are all considered to be technically feasible. Preliminary designs apply typical industry standards and meet applicable design requirements. The proposed treatment options are designed with sufficient capacity to provide reliable treatment and disposal for the Power-Teton County Water and Sewer District during the 20-year design life.

Alternative T-2 is considered the most technically and logistically feasible option. This alternative will not require any land acquisition or easements and discussions with the DNRC and other agencies regarding the Districts Water Rights would be minimal when compared to other options. For these reasons, Alternative T-2 has been ranked 1 in terms of technical and logistical feasibility.

Alternatives T-3 and T-4 both require negotiations with other water systems to purchase finished water. Moreover, these alternatives will require a number of easements along the alignment of the necessary transmission main. Land may also need to be purchased for the required booster station. Because Alternative T-3 is contingent on an accelerated schedule for a new NCMRWA transmission

main from Brady to Dutton and an upgrade of the Conrad WTP it is considered less feasible than Alternative T-4.

Alternatives T-6 and T-7 will both require land acquisition for the well sites and easements along the transmission mains. However, Alternative T-7 will require less land and a shorter transmission main. A new water right is required for both well alternatives, Alternative T-6's required water right is expected to be more complex as the shallow ground water is more likely to affect surface water when compared to a deep aquifer. For these reasons Alternative T-7 is considered more feasible than Alternative T-6.

In general, new wells are believed to be the more technically and logistically feasible alternatives as neither will require the large number easements expected with Alternative T-3 and T-4. Additionally, Alternatives T-6 and T-7 will not require negotiations with existing systems. As such Alternative T-7, T-6, T-4 and T-3 are ranked 2, 3, 4, and 5, respectively, for technical and logistical feasibility.

b. Operations and Maintenance Complexity

The Power-Teton County Water and Sewer District is a small district with limited resources and man power. The complexities of any operations and maintenance procedures must be evaluated with respect to the available staffing and associated technical expertise available to the District. An ideal alternative will minimize O&M complexities to avoid unnecessary strain.

Alternatives T-3 and T-4 are believed to be the most ideal in terms of O&M complexity, as connecting to an existing water system will drastically decrease the required manpower and resources for treatment. Because Alternative T-3 will required 1 booster station and 2 booster stations are believed to be needed for Alternative T-4, Alternatives T-3 and T-4 are ranked as 1 and 2, respectively, with respect to O&M complexity.

It is believed that upgrading the existing WTP will involve the most complex O&M procedures of all alternatives. This alternative does very little to address the poor water quality of Muddy Creek. Therefore, continued corrosion and clogging are expected. Additionally, the District's most recent *E. coli* sampling suggests UV disinfection may be required in the future, further complicating the District's maintenance plan. Therefore, Alternative T-2 has received a ranking of 5 for operations and maintenance complexity.

Maintenance required for the two well options will likely be minimal when compared to the existing WTP. Typical maintenance activities such as brushing and acid washing well screens will be required. Due to the depth of wells associated with the deep well option and the likelihood of required treatment, Alternative T-7 is considered less desirable with respect to O&M complexity and has received a score of 4; Alternative T-6 has been ranked a 3.

c. Public Health and Safety

The purpose of the improvements to the water source and treatment system is to provide better quality finished water to the District. A reliable potable water source is of the utmost importance to any community's health and safety. All feasible alternatives have been designed to provide an ideal outcome and are considered equal with regards to public health and safety. Each treatment alternative has been given a rank of 1.

d. Environmental Impacts

Each alternative is expected to impact the surrounding environment during construction. These environmental impacts are expected to be minor and short-term. However, the long transmission mains required for Alternative T-3 and T-4 would cause the greatest disruption. Alternatives T-3 and T-4 have been ranked 4 and 5, respectively, as the required transmission main to connect to the City of Great Falls' system is significantly longer than required to connect to the NCMRWA.

Alternatives T-6 and T-7 involve a ground water source while Alternative T-2 retains the existing surface water source. Diverting water from surface water has negative impacts on aquatic life. For this reason, Alternative T-2 has received a rank of 3 for environmental impacts. The shallow wells included in Alternative T-6 will likely have some impact on surface water and aquatic life; these effects are expected to be minimal. No impacts to surface are anticipated to result from the deep well included in Alternative T-7. As such, Alternative T-7 receives ranking of 1 for environmental impacts; Alternative T-6 and T-2 receive scores of 2 and 3, respectively.

e. Public Acceptance

Conversations with District staff and community members have indicated the least desirable solution is Alternative T-2, as upgrading the existing WTP would not fix the poor water quality of the source water, which is considered to be the main problem with the District's water source. It is expected that a high O&M effort from the District would still be required due to the high solids concentration in the source water. For this reason, Alternative T-2 has received a rank of 5 in regard to public acceptance.

The District has also expressed a desire to remain independent and not reliant on another system; as such, Alternatives T-3 and T-4 are not considered an ideal solution. Because the NCMRWA is a smaller network that would require a shorter transmission main, Alternative T-3 is considered more beneficial than Alternative T-4, however. Alternatives T-3 and T-4 have been ranked 3 and 4, respectively.

The two well alternatives, Alternative T-6 and T-7, are considered the most ideal by the public. Due to the net present value associated with Alternative T-6 and the higher expected water quality, Alternative T-6 has been given a rank of 1 and Alternative T-7 has been ranked 2 with respect to public acceptance.

3. Alternative Ranking Matrix

Both the non-monetary factors and life cycle costs were compared in an organized and systematic method. A scoring structure was implemented to impartially compare the treatment alternatives. The alternatives were ranked 1-5 for each of the criterion. The lowest overall score indicates the most desirable option. The alternative scoring is presented in Table 5-2. As shown in the below table, **Alternative T-6: Shallow Ground Water Wells is considered the most ideal source water and treatment alternative.**

Table 5-2
Water Source and Treatment Alternative
Decision Ranking Matrix

Alt.	Life Cycle Cost	Technical and Logistical Feasibility	O&M Complexity	Public Health and Safety	Environmental Impacts	Public Acceptance	Total	Ranking
T-2	2	1	5	1	3	5	**17**	**3**
T-3	4	5	1	1	4	3	**18**	**4**
T-4	5	4	2	1	5	4	**21**	**5**
T-6	1	3	3	1	2	1	**11**	**1**
T-7	3	2	4	1	1	2	**13**	**2**

B. WATER STORAGE ALTERNATIVES

Three water storage alternatives were presented in Chapter 4; two have been eliminated from consideration. Alternative S-1: No Action does not provide a solution to the Districts insufficient water storage volume and Alternative S-3: New 210,000-gallon storage tank involved demolishing the existing water storage tank. Although Alternative S-3 does provide a solution to the lack of finished water storage volume, demolishing the existing tank is considered a waste of time and effort, as the tank is believed to be in good condition. The remain Alternative S-2: New 60,000-gallon storage tank is evaluated with regard to both life cycle cost and non-monetary factors.

1. Life Cycle Cost Analysis

A comparison on the net present value for the remaining water storage alternatives is presented in Table 5-3.

Table 5-3 Water Storage Alternative Life Cycle Cost Analysis				
Alternative	**Present Worth of O&M Cost(1)**	**Capital Costs**	**Present Worth of Salvage Value**	**Net Present Value**
S-2: New 60,000-Gallon Storage Tank	$59,700	$572,000	$56,000	$575,700

Note: Interest Rate=0.2%, Term=20 years

2. Non-Monetary Factors

The alternative analysis includes consideration of non-monetary factors such as technical and logistical feasibility, operation and maintenance complexity, public health and safety, environmental impacts, and public acceptance. The following discussion evaluates Alternative S-2 with respect to each criterion.

a. Technical and Logistical Feasibility

The second storage tank proposed in Alternative S-2 will be constructed near the existing finished water storage on property owned by the District. As such, land acquisition or easement negations will not be necessary. DEQ approval of plans and specs will be required prior to construction, as with any public water system project. No unusual or complicated permits are expected to be needed to the Alternative S-2.

b. Operations and Maintenance Complexity

Minor changes to the District's current O&M would result from Alternative S-2. The proposed tank will be constructed of welded steel, similar to the existing tank. As such, O&M procedures and replacement parts such as ladders and access hatches will be similar between the two. Depending on the volume and resulting water age, additional chemical may be required to maintain acceptable finished water quality.

c. Public Health and Safety

The purpose of this alternative is to provide the District with enough finished water storage to provide for 24-hours of average day demand plus the recommended fire flow. Without the proposed improvements the community of Power will have a less reliable potable water supply and fire protection system. Additional finished water storage will improve public health and safety for the District.

d. Environmental Impacts

Environmental impacts of an additional storage tank are expected to be minimal. Dust and noise during construction in expected, but can be easily mitigated with

proper construction planning and scheduling. A small area of land disturbance will be needed to the tank and transmission main.

e. Public Acceptance

In general, community members and District staff consider the insufficient finished water storage to be a minor problem when compared to the inadequacies of the existing treatment system and water source. Additional water storage was presented and discussed at each public hearing. Any comments received in regard to the District's water storage expressed a desire to prioritize improvements to the WTP and water source over the storage system.

C. DISTRIBUTION SYSTEM ALTERNATIVES

Three possible distribution system alternatives were presented in Chapter 4. Alternative D-1: No Action was eliminated for consideration as it does not provide a solution to the District current problems. Conversations with District staff and the community of Power suggest the community would prefer to address the leaking service connection without financial assistance; Alternative D-2: New Service Connections was not formally considered in this PER. Alternative D-3: New Looping Water Main remains the only viable distribution system alternative and is discussed in regard to both life cycle cost and non-monetary factors below.

1. Life Cycle Cost Analysis

A comparison on the net present value for the remaining distribution system alternatives is presented in Table 5-4.

Table 5-4
Distribution System Alternative
Life Cycle Cost Analysis

Alternative	Present Worth of O&M Cost(1)	Capital Costs	Present Worth of Salvage Value	Net Present Value
D-3: New Looping Main	$141,900	$303,000	$69,000	$376,900

Note: Interest Rate=0.2%, Term=20 years

2. Non-Monetary Factors

The alternative analysis includes consideration of non-monetary factors such as technical and logistical feasibility, operation and maintenance complexity, public health and safety, environmental impacts, and public acceptance. The following discussion evaluates Alternative D-3 with respect to each criterion.

a. Technical and Logistical Feasibility

The new main included in Alternative D-3 will be constructed along 7th Rd NE in Power. No land acquisition or easement negotiations will be required. As with all public water projects, DEQ approval will be required prior to design. No unusual permits will be required.

b. Operations and Maintenance Complexity

No new O&M procedures will be required of the District as a result to Alternative D-3.

c. Public Health and Safety

Alternative D-3 will provide redundancy to the distribution system and eliminate the dead end at the end of Rainbow Avenue. This will increase the reliability of the system and decrease the likelihood of sections of the District being isolated or separated for the WTP or the storage tank. Ultimately, Alternative D-3 will have a positive impact on public health and safety.

d. Environmental Impact

Environmental impacts associated with Alternative D-3 are expected to be minimal. Minor, short-term impacts associated with dust and noise are expected during construction. Once construction is complete, no impacts to the environment would be expected.

e. Public Acceptance

Similar to additional water storage, the community of Power considers the deficiencies present in the distribution system to be minor in comparison to the problems in the WTP. The consensus at each public hearing was to prioritize improvements to the WTP and water source over improvements to the distribution system.

6.0 PROPOSED PROJECT

A. PRELIMINARY PROJECT DESIGN

As a result of project cost relative to available funding and associated debt service requirements, it is recommended the selected improvements be constructed in multiple phases. Due to the severity of the District's water source and treatment issues, it is recommended to prioritize the water source and treatment over the distribution system and storage improvements. The proposed phasing is as follows:

Phase I-Alternative T-6: Shallow Ground Water Wells
Phase II- Alternative S-2: New 60,000 Gallon Storage Tank
Phase II- Alternative D-3: New Looping Main.

1. Source Water and Treatment

   Projected 20-year system demands are summarized in Chapter 2, Tables 2-8 and 2-9. Proposed improvements include abandoning the existing treatment plant and surface water source. New shallow ground water wells will be drilled near the District. These improvements have been designed to eliminate the existing concerns with source water, decrease required O&M tasks, and provide the community of Power with reliable, clean water for both fire suppression and drinking water. The new water source and required treatment will be in accordance with DEQ Guidelines set forth in DEQ-1: Standards for Waterworks, MPWSS, and generally accepted engineering principles. Requirements detailed in DEQ-1, section 3.2 include, but are not limited to:

   - Total ground water source capacity must meet or exceed design max day demands, with the largest producing well out of service.
   - Sufficient auxiliary power must be provided to meet average day demand when power failure would result in cessation of the minimum essential service.
   - Wells must have unperforated casing to a minimum depth of 25 feet or full time microbial treatment must be provided.
   - Full time microbial treatment is required when the seasonal high-water level is within 25 feet of the ground surface.
   - Permanent steel casing pipe must be in accordance with ARM 36.21.640 and have joints in accordance with ARM 36.21.642.
   - Screens must be constructed of materials resistant to damage by chemical action of groundwater or cleaning operations.
   - Every well must be developed in accordance with ARM 36.21.653.

   A new pump house and transmission main are also included in the proposed improvements. Transmission main and piping sizing will be done to ensure a minimum working pressure of 35 psi is maintained throughout the distribution system; 20 psi will be maintained under all conditions, including fire flow. Preliminary hydraulic modeling indicates a 6-inch PVC transmission main and a pump capable of providing 168 gpm at 50 feet of TDH will be sufficient. Restoration of disturbed asphalt pavement, gravel roads, and landscaping will also be included throughout the alignment of the required transmission main.

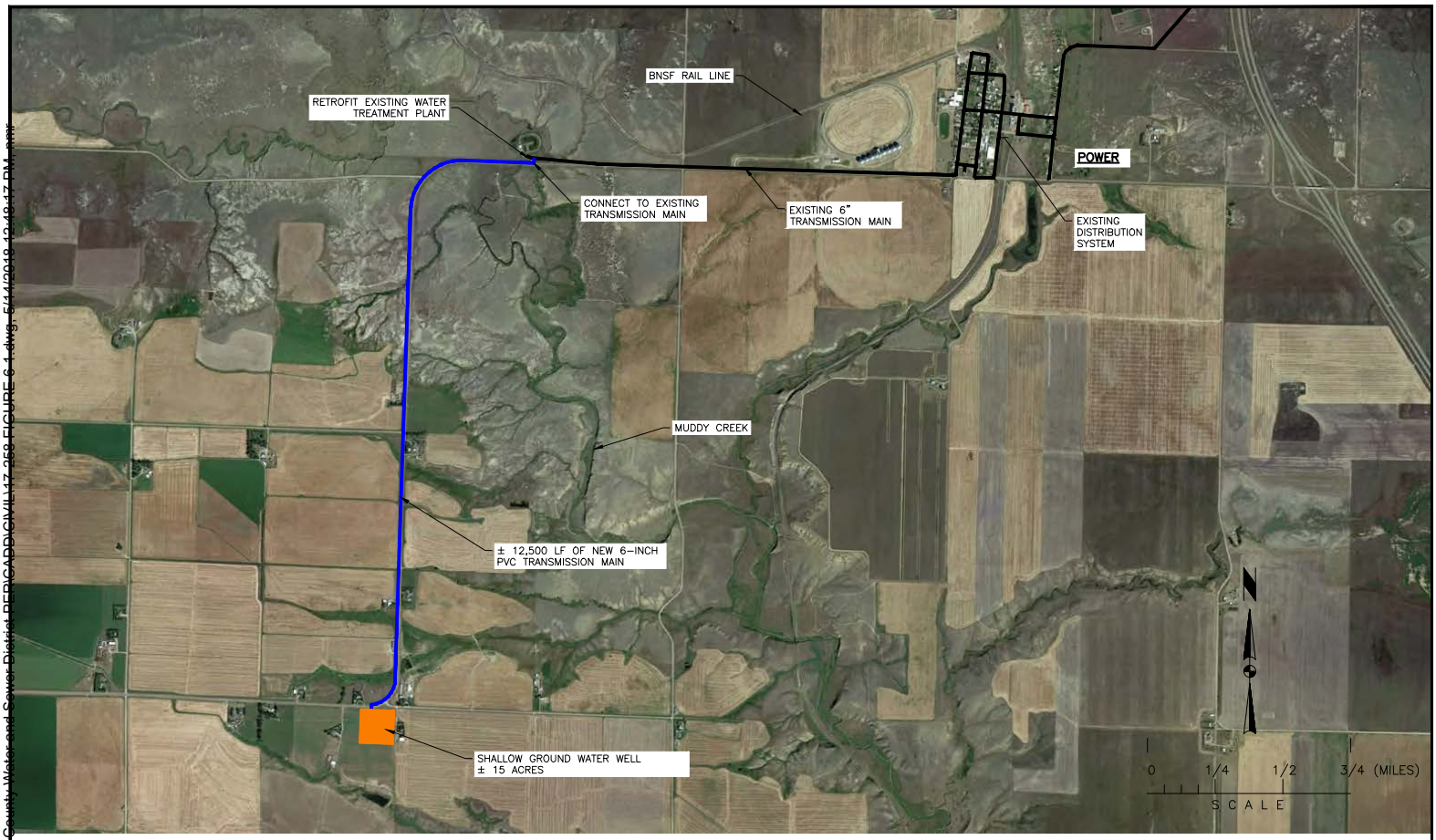
Figures 6-1 and 6-2 illustrate possible shallow groundwater well locations near Power, MT. Final design well be dependent on land availability and a detailed hydrogeological investigation.

2. Storage

The District's current and projected 20-year storage requirements are detailed in Chapter 2, Section C.8. The proposed improvements to the District's finished water storage have been designed to provide sufficient storage for 24-hours of average day demand plus recommended fire flows, per DEQ-1. A new 60,000 gallon welded steel finished water storage tank will be constructed near the existing 150,000 gallon welded steel storage tank, on land currently owned by the District. The new finished water storage tank will be in accordance with DEQ Guidelines set forth in DEQ-1: Standards for Waterworks, MPWSS, and generally accepted engineering principles. Figure 6-3 displays the new finished water storage tank in relation to the District's existing water system.

3. Distribution

As discussed in Chapter 2, Section C.4, the District's current distribution system is considered to be in generally good condition. The proposed improvements include a looping main to connect the dead end at the south end Rainbow Avenue with the rest of the distribution system. This main will also serve as a second main under the BNSF railroad tracks. This project has been selected as it provides redundancy and increases the reliability of the system. A hydraulic analysis of the system indicated a 6-inch PVC water main will provide sufficient water pressure to maintain a working pressure greater than 35 psi throughout the distribution system. A minimum pressure of 20 psi can be maintained with all flow conditions, including fire flow. Restoration of disturbed asphalt pavement, gravel roads, and landscaping will also be included. The new looping water main will be in accordance with DEQ Guidelines set forth in DEQ-1: Standards for Waterworks, MPWSS, and generally accepted engineering principles. Figures 6-4 illustrates the new water main in relation to the existing distribution system.



NOT FOR CONSTRUCTION

POWER TETON COUNTY WATER AND SEWER DISTRICT
POWER, MONTANA

SELECTED WATER SOURCE AND TREATMENT IMPROVEMENT

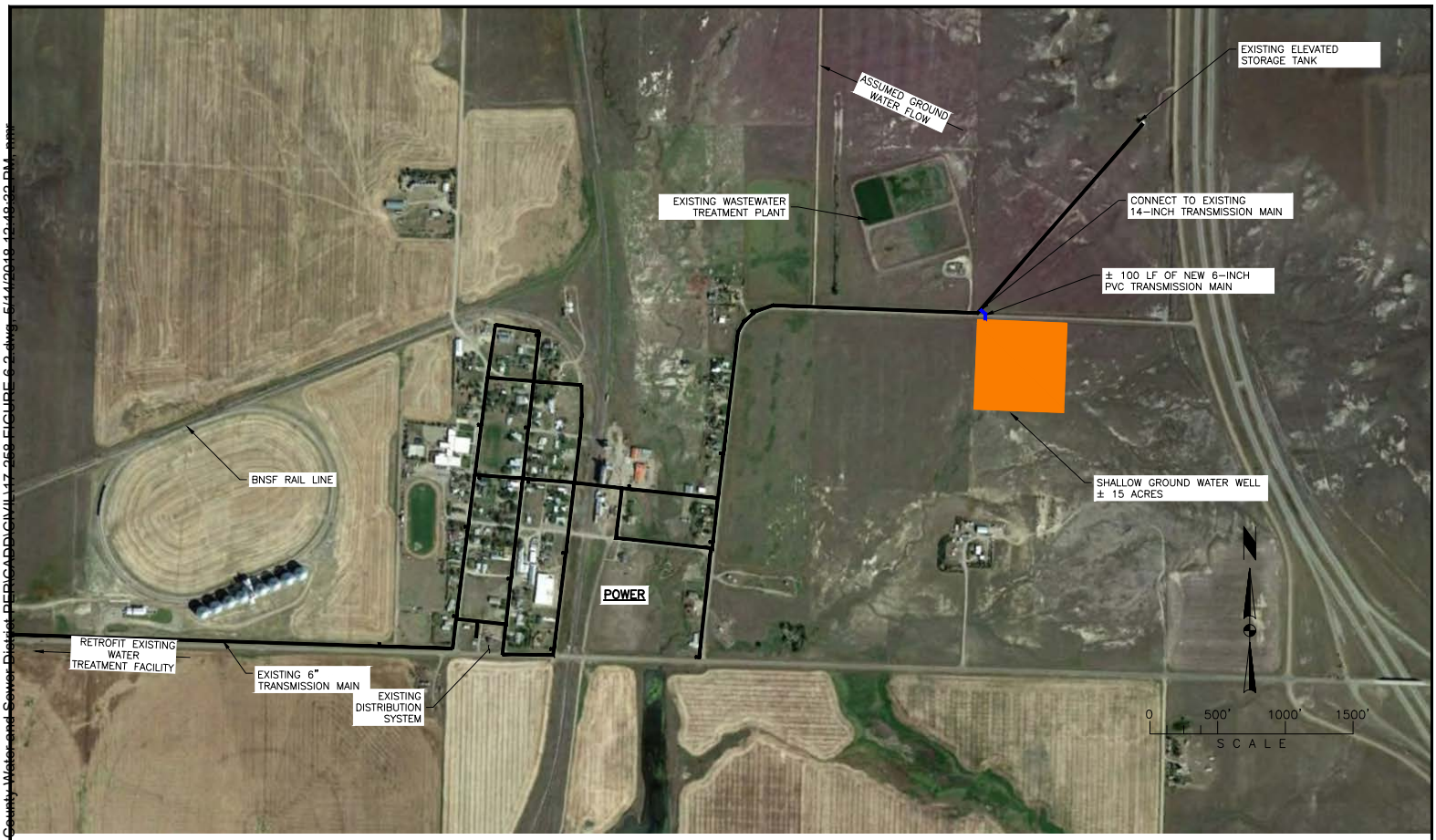
POSSIBLE LOCATION A

TD&H Engineering
406.761.3010 • tdhengineering.com
1800 RIVER DR. NO. • GREAT FALLS, MONTANA 59401

DRAWN BY:	CDF
DESIGNED BY:	NMR
QUALITY CHECK:	MJO
DATE:	2018-03-22
JOB NO.	17-258
CAD NO.	17-258 FIGURE 6-1

FIGURE
6-1

J:\2017\17-258 Power Teton County Water and Sewer District PER\CADD\CIVIL\17-258 FIGURE 6-1.dwg, 5/11/2018 12:49:17 PM, nmr



NOT FOR CONSTRUCTION

POWER TETON COUNTY WATER AND SEWER DISTRICT
POWER, MONTANA

SELECTED WATER SOURCE AND TREATMENT ALTERNATIVE

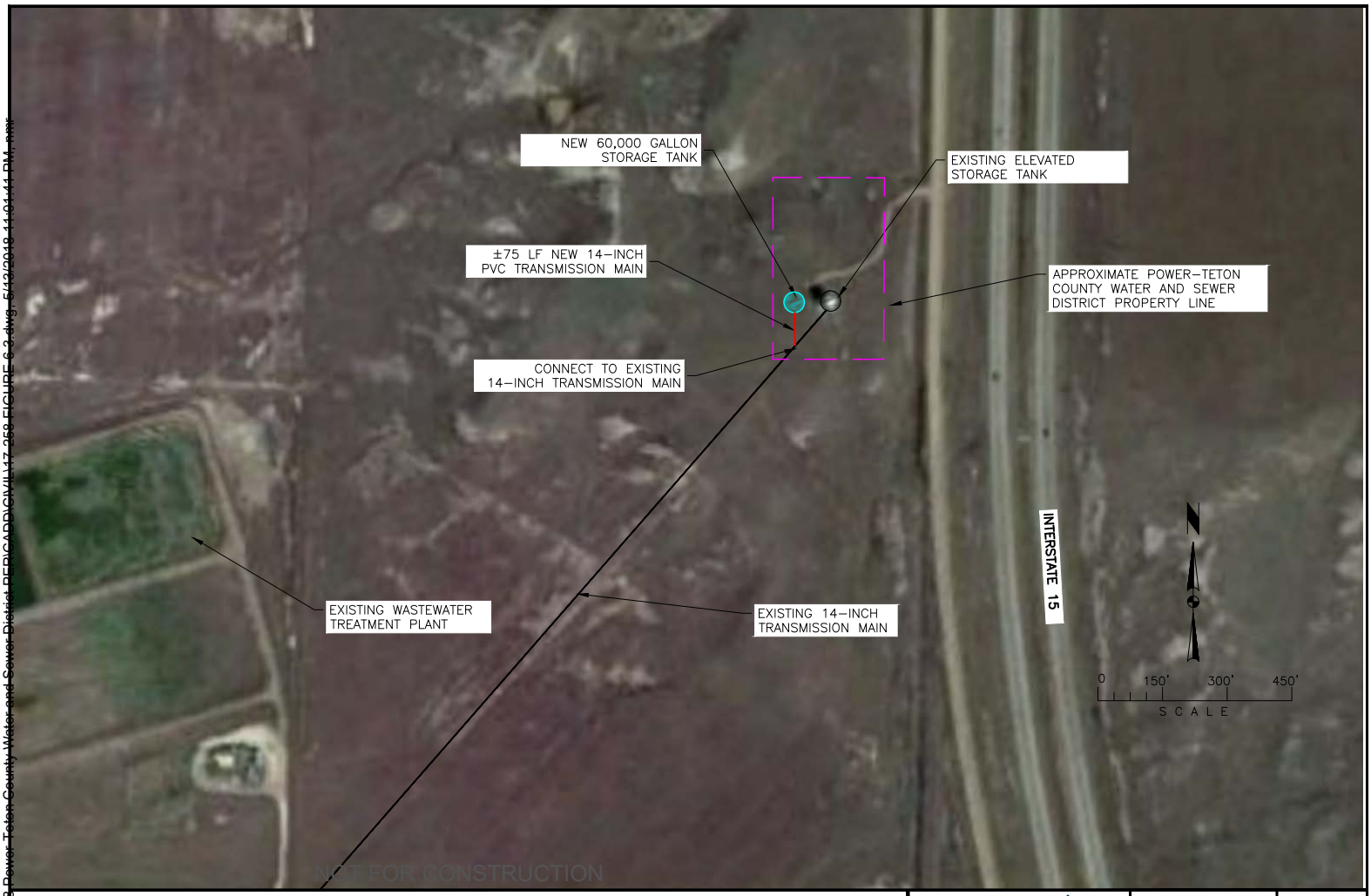
POSSIBLE LOCATION B

TD&H Engineering
406.761.3010 • tdhengineering.com
1800 RIVER DR. NO. • GREAT FALLS, MONTANA 59401

DRAWN BY:	CDF
DESIGNED BY:	NMR
QUALITY CHECK:	MJO
DATE:	2018-03-22
JOB NO.	17-258
CAD NO.	17-258 FIGURE 6-2

FIGURE
6-2

J:\2017\17-258 Power Teton County Water and Sewer District PER\CADD\CIVIL\17-258 FIGURE 6-2.dwg 5/11/2018 12:49:22 PM mmf



POWER TETON COUNTY WATER AND SEWER DISTRICT
POWER, MONTANA

SELECTED STORAGE SYSTEM IMPROVEMENTS

TD&H Engineering
406.761.3010 • tdhengineering.com
1800 RIVER DR. NO. • GREAT FALLS, MONTANA 59401

DRAWN BY:	NMR
DESIGNED BY:	NMR
QUALITY CHECK:	MJO
DATE:	2018-03-22
JOB NO.	17-258
CAD NO.	17-258 FIGURE 6-3

FIGURE
6-3

J:\2017\17-258 Power Teton County Water and Sewer District PER\CADD\CIVIL\17-258 FIGURE 6-3.dwg 5/12/2018 11:01:11 PM mmr

POWER-TETON COUNTY WATER AND SEWER DISTRICT PER
POWER, MONTANA

SELECTED DISTRIBUTION SYSTEM IMPROVEMENTS

DRAWN BY: CDF
DESIGNED BY: NMR
QUALITY CHECK: DJS
DATE: 03-22-2018
JOB NO.: 17-258
FILENAME: XXX

TD&H Engineering
406.761.3010 • tdhengineering.com
1800 RIVER DR. NO. • GREAT FALLS, MONTANA 59401

REV	DATE	REVISION

NOT FOR CONSTRUCTION

17-258 FIGURE 6-4.DWG
FIGURE 6-4

B. PROJECT SCHEDULE

Table 6-1 presents the proposed implementation schedule for the water source and treatment improvements.

Table 6-1
Proposed Implementation Schedule

Task	Estimated Completion Date
Submit Draft PER	April 2018
Submit Final PER	May 2018
DNRC Grant Application	May 2018
Conduct Income Survey	June 2018
TSEP Grant Application	June 2018
CDBG Grant Application	July 2018
WRDA Grant Application[(1)]	July 2018
RD Funding Application	July 2018
Funding Secured	May 2019
Start Engineering Design	July 2019
Preliminary Construction Plans and Specification Complete	August 2019
Agency Comments on Construction Plans and Specifications	October 2019
Final Construction Plans and Specifications Complete	November 2019
Advertise for Construction Bids	December 2019
Award Construction Contract	February 2020
Begin Construction	May 2020
Construction Complete	September 2020
One-Year Warranty Inspection	September 2021

[(1)] An application to CDBG will be submitted only if the income survey shows the District's LMI is greater than 51%

The implementation schedule for Phase II activities will be similar to those identified in Phase I. The 2018 PER will be reference for any Phase II funding applications; thus preparation of future PER will be unnecessary, an amendment to the 2018 PER will suffice. Should the District choose to move forward with Phase II after construction of Phase I is complete, grant application will be submitted in April and May with other tasks scheduled similarly to what is detailed in Table 6-1.

C. PERMITS, APPROVALS & ENVIRONMENTAL

The proposed improvements to the Power-Teton County Water and Sewer District's water source and treatment will require several permits and agency coordination. Depending on the final location of the shallow ground water wells, a Joint Application for Proposed Work in Streams, Lakes and Wetlands in Montana will likely be necessary. This application covers the SPA 124 Permit, Section 404 Permit, and 318 Authorization. A Storm Water Pollution

Prevention plan (SWPPP) and Notice of Intent (NOI) are anticipated. Finally, DEQ plan and specification approvals, approval from funding agencies, and Power-Teton County Water and Sewer District's approval of plan and specification will be required prior to construction.

A major concern with the proposed project is the application for a new water right. The DNRC Havre Regional Office was contacted in April 2018 in regard to a new water right. DNRC staff explained the Upper Missouri River Basin is a legislatively closed basin. In order for the District to be granted a new water right, a hydrogeologic analysis proving the ground water used by the District will not decrease surface water flows will be required. The DNRC did warn that this will be a long and potentially complex process, but is entirely possible.

Letters regarding environmental issues were sent to the following agencies requesting comments on the proposed project:

- United States Army Corp of Engineers
- Bureau of Land Management
- Department of Environmental Quality Permitting and Compliance Division
- Department of Natural Resources and Conservation
- United States Environmental Protection Agency
- US Fish and Wildlife Service
- Natural Resources Conservation Service
- Montana Fish, Wildlife and Parks
- State Historic Preservation Office

A copy of these letters as well as any responses from the environmental agencies is included in Appendix 1-D.

D. SUSTAINABILITY CONSIDERATIONS

1. Water and Energy Efficiency

One of the advantages of shallow wells is the relatively low head required to pump the water to the distribution system. This will increase the energy efficiency when compared to other alternatives. Ground water extraction will not exceed the water right obtained and will not jeopardize the health of the aquifer. Various agencies are involved in managing the water that contributes to the aquifer as well as water extraction in the area.

2. Green Infrastructure

A SWPPP will be required prior to construction to reduce the amount of storm water runoff from disturbed areas of the project. This alternative will also rely on filtering and disinfection properties naturally present in the soils. This will likely result in fewer required chemicals.

3. Other

Properly designed, constructed, and maintained water wells serve communities significantly longer than the proposed 20-year design like of this project. Poorly designed and constructed wells, especially if not adequately maintained, can quickly

lose their efficiency and sometimes become unusable after a short period of time. For a slight increase in initial cost, a reliable well with a much lower lifecycle cost can be provided. Other system components, such as pumps and valves, are more easily accessed and replaced, but lifecycle cost analysis is still an important consideration.

E. TOTAL PROJECT COST ESTIMATE

The total project cost for Phase I is estimated at $2,627,000 including contingency, AIS compliance, and administrative, legal, and engineering costs. Table 6-2 presents the breakdown of the administrative, legal, and engineering costs for Phase I of the proposed improvements. Costs were prepared assuming a four-month construction duration. Land acquisition and fees associated with water right negotiations are included in the overall construction cost.

Table 6-2
Project Cost Summary

Construction		
Description	**Percent of Cost**	**Total Cost**
Shallow Groundwater Wells		$1,792,995
AIS Compliance	5%	$89,650
Construction Contingency	15%	$282,400
Subtotal Construction Cost		*$2,165,045*
Administrative, Engineering and Legal		
Description	**Percent of Cost**	**Total Cost**
Personnel	0.175%	$3,300
Office Cost	0.050%	$950
Grant Administration	1.650%	$31,000
Travel and Training	0.050%	$950
Legal Services	0.395%	$7,400
Bond Services	0.790%	$14,855
Audit Costs and LGS Fees	0.700%	$13,200
Review and Loan Fees	0.185%	$3,500
Interim Interest	0.160%	$3,000
One Year's Insurance	0.200%	$3,800
Final Engineering	9.800%	$185,000
Resident Project Representative Services	10.400%	$195,000
Subtotal Administrative, Engineering & Legal		$461,955
Total Project Cost		**$2,627,000**

Phase II consists of a new 60,000-gallon storage tank and a 6-inch looping water main. Phase II project cost summary will be included in future applications to grant and low interest loans and amendments to this PER.

F. ANNUAL OPERATING BUDGET

1. Income

The Power-Teton County Water and Sewer District is working with its representatives in congress to procure a Water Resources Development Act (WRDA) grant to help pay for the proposed improvements. Additionally, an income survey of the District is begin conducted to verify the District's eligibility status for the Community Development Block Grant (CDBG). Because the likelihood of procuring these two grants is still unknown, they have been excluded from the proposed funding packing. The proposed project is estimated to cost $2,627,000. The District currently plans to apply for a Rural Development (RD) grant and loan package. Should the District receive either WRDA or CDBG funding, the required loan amount will decrease.

User rates must be raised in order to fund the proposed improvements as well as address the Treasure State Endowment Program (TSEP) target rates. Target rates are based on the median household income (MHI) for the community, recently published at $59,286. Target rates for the Power-Teton County Water and Sewer District are $113.63 per EDU. To fund the proposed improvements and provide the required debt service, the District will be forced to increase user rates to $154.22 per EDU. Additional funding related discussion are included later in this chapter.

The District currently has 96 total EDUs, with 86 active residential hookups. The currently charges a flat rate of $100.00 per EDU per month for water, sewer and debt services. Additionally, charges are applied for water usage over 20,000 gallons in the summer months. Average operating revenue for the past 3 years equals $50,514. Although an increase in population is projected for this planning document, no immediate service connections are anticipated and therefore, projected EDUs will correspond to the current number. The proposed new user rates to fund Phase I are $154.22 per EDU per month. The potential income if rates are raised to fund the Phase I improvements will be $14,805 per month or $177,661 annually.

2. Annual O&M Costs

The proposed operations and maintenance budget for Phase I is presented in Table 6-3. The Phase II O&M budget will be finalized and proposed in future PER Amendments.

Table 6-3 Annual Operations and Maintenance Budget				
Description	**Quantity**	**Unit**	**Unit Cost**	**Estimated Cost**
Accounting & Auditing	1	LS	$700	$700
Bank Service Charges	1	LS	$0	$0
Chemicals	1	LS	$1,532	$1,532
Dues/Certifications/Training	1	LS	$425	$425
Easement & Water Assessment	1	LS	$227	$227
Fees (Permits, Service, Recording)	1	LS	$774	$774
Insurance & Bonding	1	LS	$2,195	$2,195
Payroll Expense	1	LS	$11,692	$11,692
Postage & Office	1	LS	$980	$980
Professional Fees	1	LS	$0	$0
Repairs	1	LS	$3,000	$3,000
Short Lived Assets	1	LS	$1,800	$1,800
Supplies	1	LS	$1,642	$1,642
Testing Water	1	LS	$1,994	$1,994
Truck Expenses	1	LS	$752	$752
Utilities	1	LS	$2,900	$2,900
Total Annual Operating and Maintenance Costs (rounded to the nearest $100)				**$30,600**

3. Debt Repayment

The District is currently repaying two State Revolving fund (SRF) Drinking Water Program loans on their water system. The loans were refinanced in 2014; information on the loans is included in Table 6-4.

Table 6-4 Outstanding Loans					
Description	**Loan Amount**	**Interest Rate**	**Date Of Funding**	**Payoff Date**	**Outstanding Balance**
SRF Loan 1	$216,000	2.00%	3/18/2014	7/1/2023	$130,000
SRF Loan 2	$247,000	2.25%	3/18/2014	7/1/2025	$169,000
				Total	**$299,000**

The loan payments total approximately $70,272 per year or $61.00 per EDU per month on the principal, interest, and required debt reserves.

4. Reserves

At the end of 2016, the District has $310,964 in cash or cash equivalents. Conversations with operational staff indicated that as of May 4, 2018, the District had

$323,608 in savings. This includes an operational checking account with roughly $48,000. The majority of the funding is held at Dutton State Bank and includes savings accounts, checking accounts, and CDs. Some portions of the District's reserves is held in various banks and credit unions.

a. Debt Service Reserves

To provide the small District with the most financial aid possible, TSEP, (Renewable Resource Grant and Loan (RRGL), WRDA, Rural Development (RD) and CDBG grant applications will all be submitted, provided the results of the upcoming income survey qualify the District for CDBG. Should the District receive funding from all of the aforementioned agency, a loan may not be required to fund the project. However, a conservative funding package has been assumed and is detailed in the following sections. Because WDRA funding is not guaranteed to be available and presently, the District does not qualify for CDBG, the funding package includes only TSEP, RRGL, and RD grants with an RD loan.

The RD Loan will require a revenue bond be passed by the District. The revenue bond requires a debt service and coverage of 110%. This results in an annual debt service of $76,788 annually; of which $6,981 is the annual debt service reserve.

b. Short-Lived Asset Reserve

Table 6-5 provides the recommended short-lived assets budgeting for Phase I. The total recommended reserve amount has been added to the annual O&M budget.

Table 6-5
Short-Lived Asset Reserves

Asset	Projected Repair/Replacement[1]	Replacement Cost	Annual Reserve
Finished Water Pump	2030	$18,000	$1,800
Total Short-Lived Asset Budget (rounded to nearest $100)			**$1,800**

1. Short-lived assets addressed through planning period. Projected replacement at or longer than 20 years are not included in the total budget.

G. FUNDING STRATEGY

The following provides a general discussion of the grant and loan funds available, as well as the proposed funding strategy. As previously mentioned, applications for TSEP, RRGL, RD, CDBG and WRDA grant funding will be submitted to the proposed improvements. However, due to the unpredictable nature of the WRDA grant and the District's currently unknown CDBG eligibility status, these funding options are not included in the proposed funding strategy. A 40-year RD loan is included at a 3.875% interest rate. Should the District receive either CDBG or WRDA, the loan component would drastically decrease.

The Montana Department of Commerce (MDOC) which encompasses the TSEP and CDBG Programs require a community have their rates at a minimum of their published target rates to apply for grant money. The target rates are based on the community's Median Household Income (MHI), determined by the Census Bureau. This information for the Power CDP is provided in Appendix 6. The Power CDP MHI is listed at $59,286. Because the District is a water and sewer district, the combined water and sewer target rate must be met to qualify for funding. Combined water and sewer target rates are calculated 2.3% of the monthly household include, calculated as follows:

($59,286/12)*0.023=$113.63

The above formula sets the combined water and sewer target rate for Power at $113.63 per EDU per month. Currently, the Districts users pay $26.00 per EDU per month for first 20,000 gallons of water, $13.00 per EDU per month for sewer and $61.00 per EDU per month for debt services. The total combined rate for the Power-Teton County Water and Sewer District is $100.00 per EDU per month. In order to be eligible for the minimum TSPE grant of $500,000, the District must raise their user rates to $113.63. The proposed funding strategy will increase user rates beyond the MDOC target rates while addressing the most serious issues facing the District's water system. Details regarding typical funding sources follow:

1. Montana Renewable Resource Grant and Loan Program (RRGL) - Department of Natural Resources and Conservation (DNRC)

   The Montana legislature established the RRGL Program to enhance Montana's renewable resources. The program is administered by the Resource Development Bureau of the DNRC. Funds are appropriated directly through the legislature based on recommendations from DNRC. The grant funding limits are $125,000. The loan amount limit is the maximum amount that can be borrowed by the local government and repaid by issuing bonds. This grant option is included in the proposed finding package.

2. Treasure State Endowment Program (TSEP)

   This State-funded program is administered by the MDCO. The funding is derived from a portion of the interest from the Coal Tax Trust Fund. The TSEP program provides matching grants for qualifying projects for up to $750,000. In order to qualify for the maximum grant of $750,000 the applicant's user rates must be 150% of the community's target rate upon completion of the proposed project. If the user rates are projected to be between 125% and 150% of the target rate the applicant may apply for a maximum grant of $625,000. Applicant's whose user rates are under 125% of the target rate can apply for a maximum of $500,000.

   TSEP also requires that a project grant request may not exceed $20,000 per benefited household. Only full-time occupied residential properties at the time the application is submitted will be counted as benefited households; undeveloped vacant lots, vacation rentals or second homes that are not the primary residence of the owners, are not counted as benefited households. To qualify as full-time occupied residential owners, the owners or residents must live in the residence at least six months out of the year. According to the MDOC Power has 74 occupied residences; if awarded a grant for $625,000, the District would receive $8,445 per benefited household. The proposed funding package requires user rates to be

$154.22. A local match of 50% of the project is required. Cash, grants or other loans can qualify as matching funds.

Applications for the TSEP program are accepted every other year by the MDOC and submitted to the legislature for review and approval for funding. The applications are accepted in July of the year before the next legislative session (even numbered years). The District will be eligible for $625,000 from TSEP, given the proposed funding strategy.

3. Community Development Block Grant (CDBG) Program

Montana's CDBG program is a federally funded competitive grant program designed to help communities of less than 50,000 people and must benefit low and moderate income (LMI) persons. These funds are most often used in combination with other federal, state or local funds to improve infrastructure such as water and wastewater facilities. The maximum grant awarded for a public facility project is $450,000. MDOC shows 74 households in the District with an LMI of 31.58% which does not meet CDBG's requirements of 51% LMI for a community, thus Power is not currently eligible for a CDBG grant.

At the time of this PER, the District is planning to conduct an income survey to determine if they would be eligible for a CDBG grant. The boundary of their CDP is much larger than the boundary of their existing users. If an income survey results in an LMI of 51% or greater, the District will pursue a CDBG grant.

4. State Revolving Fund Loan (SRF)

This fund was initiated by the Montana legislature for water and wastewater projects using federal seed money. This program provides at or below market interest rates to qualifying entities. The loans are funded using capitalization grants from EPA and are matched with state issued general obligation bonds.

In order to be eligible for this type of funding, the project must be added to the SRF Project Priority List and Intended Use Plan. This annual process to identify projects that need and are eligible for SRF funds begins in July. Early notification by the applicant is important to get on the priority list. A project remains on the list until it has been completed, regardless of the funding sources used to finance the project.

The SRF loans have a current rate of 3% for a loan of up to twenty years. The revenue bond requires debt service and coverage of 125%. Loan amounts are limited to the borrower's ability to pay and the amount of SRF funds available. Conversation's with District board members indicate an RD loan is more suited for the District's current financial needs. As such SRF is not being pursued to fund the proposed improvements.

5. U. S. Department of Agriculture Rural Development

The U.S. Department of Agriculture Rural Development (RD) program provides grants and loans to communities of less than 10,000 people. These loans may be used to construct, repair, improve, expand, or modify rural water distribution and treatment facilities. Priority is given to communities of less than 5,500 in population.

Funds are available for up to 75% of the eligible facility costs. Eligible communities are those that are unable to obtain financing at reasonable rates and terms elsewhere. The maximum term of RD loans is 40 years or the useful life of the facility, whichever is less. All loans must be secured. Bonds or notes pledging taxes, assessments, or revenues may be accepted as security if they meet statutory requirements. Grants are only available if they are required to reduce the rates to a target level commensurate with the amounts residents in other similar communities pay. This rate is typically set at one percent of the median income. For the purposes of the funding strategy for Power, a 25/75 grant/loan split was used to calculate future rates.

Rural Development has an open application cycle; applications may be received and funded at any time during the year. Each project is given a priority score based on income, population, health and other considerations. The applicants with the highest priority points are selected to proceed with the application process.

6. Water Resources Development Act (WRDA)

WRDA is a congressional law where the federal government undertakes projects which construct or maintain water resources and infrastructure. This work is managed through the Army Corp of Engineers. Army Corp projects are typically authorized every two years by Congress and funded annually in appropriations bills.

7. Funding Strategy

A summary of the project funding for the recommended improvements is:

Amount	**Funding Agency**
$625,000	TSEP Grant
$125,000	RRGL Grant
$469,250	RD Grant
$1,407,750	RD Loan
$2,627,000	**Total**

The following table shows the user rates if the recommended alternatives are implemented. The proposed strategy excludes funding from CDBG and WRDA and assumes a 25/75 grant/loan split for RD.

Table 6-6 User Rate Calculations Estimated Project Costs		
	Total Project Cost	$2,627,000
Funding Contributions		
TSEP Grant	24%	$625,000
RRGL Grant	5%	$125,000
RD Grant	18%	$469,250
RD Loan	54%	$1,407,750
Sum Total	*100%*	*$2,627,000*
RD Loan Amortization		
Present Loan Amount		$1,407,750
Annual Interest Rate		3.875%
Loan Term		40 years
Number of Payments per Year		$1
Interest per Period		3.875%
Payment Per Period		$69,807
Debt Service Reserve and Coverage		1.10
Total Payment Per Period		$76,788
Annual Debt Service Reserves and Coverage		$6,981
Monthly Debt Service from Project		$6,399
Monthly per EDU Increase from Project		$67
O&M Costs		
Estimated New Annual O&M Costs		$30,600
Additional Annual Expenses (Existing Debt, etc.)		$70,272
Sum Total		$100,872
New Annual O&M Cost per EDU		$1,051
New Monthly O&M Cost per EDU		$87.56
Estimated User Rates		
New Monthly User Rate (O&M plus Debt Service)		**$154.22**
Proposed Monthly Rate Increase		$54.22
New Monthly Income		$14,805
New Annual Income		$177,661

7.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the alternative evaluation, estimated project costs, and associated user rates, a phased approach is recommended in this report. In order to minimize the significant financial burden placed upon the community as a result of a comprehensive water system project, water source and treatment improvements have been prioritized and included in Phase I. A second phase may occur upon completion of Phase I, provided the District has the financial standing to proceed. Water source and treatment improvements have been prioritized as those issues are considered the most pressing.

Primary Phase I activities include new shallow ground water wells, pump house, transmission main, and chlorination equipment. Phase II improvements will include new 60,000-gallon finished water storage tank and looping main.

Project budgets including administrative, legal, engineer, and other applicable cost as well as funding scenarios and scheduling are described in Chapter 6.0. The estimated construction cost for Phase I improvements is $2,627,000 and final user rates are recommended at $154.22 per month per EDU. This is a $54.22 increase from currently user rates. Recommended user rates are based on successfully securing several grants, including TSEP, RRGL, and RD. An incoming survey is currently being conducted, should the results show the District has a LMI greater than 51%, CDBG funding will be pursued. A WRDA grant is also being pursued. However, due to the unpredictable nature of WRDA grants, it has not been included in the proposed funding package. If adequate grants are not secured, the project will not likely be implemented as recommended.

The District Board formally approved the 2018 Power-Teton County Water and Sewer District Preliminary Engineering Report at the May 8, 2018 District Board meeting. An executed copy of Resolution # 2018-03 is included in Appendix 7.

8.0 REFERENCES

1. 2017 Uniform Preliminary Engineering Report for Montana Public Facilities Projects

2. City of Great Falls Montana, Water Treatment Plant, April 29, 2018

3. Department of Environmental Quality (DEQ), Circular 1: Standards for Water Works

4. DEQ PWSS Bureau, Power-Teton Co Water District Water Quality Data

5. DEQ Sanitary Survey Inspection of Power Teton County Water District PWSID:MT0000311, 2012 and 2015.

6. Department of Natural Resource and Conservation

7. Montana Cadastral Service, Property Records

8. Montana Bureau of Mines and Geology, Ground Water Information Center Well Logs

9. Montana Department of Agriculture, Groundwater Monitoring for Pesticides and Nitrates in Greenfield Bench, Montana; Summary and Findings, 1992-2015

10. Montana Department of Environmental Quality

11. Montana Fish Wildlife and Parks

12. Montana Natural Heritage Program

13. Montana Salinity Project, DEQ 319 Contract 21179

14. Montana Public Works Standard Specification

15. Montana State Historic Preservation Office

16. Montana Department of Commerce

17. OpenLine: The Open Channel UV Disinfection System. Data Sheet and Specifications.

18. Power-Teton County Water and Sewer District, Loan Amortization Schedule

19. Power-Teton County Water and Sewer District, Audit Reports 2011-2016

20. Power-Teton County Water and Sewer District, Individual Meter Readings

21. Power-Teton County Water and Sewer District, 2000 Water System Preliminary Engineering Report. Damschen-Entranco

22. Power-Teton County Water and Sewer District, Water System Improvements, Phase I and II. Operations and Maintenance Manual. April 2007. Great West Engineering.

23. Power-Teton County Water and Sewer District, Phase III Water System Improvements Construction Plans. August 25,2008. Great West Engineering.

24. Power-Teton County Water and Sewer District, Phase II Water System Improvements Construction Plans. January 2005. Damschen-Entranco.

25. Power-Teton County Water and Sewer District, Phase I Water System Improvements Construction Plans. March 2007. Great West Engineering.

26. State of Montana, Department of Natural Resources and Conservation, General Abstract, 41K 30049120 Provisional Permit. January 12, 2018.

27. US Army Corps of Engineers.

28. Us Census Bureau 2010 Census Designated Place, Census and Economic Information Center

29. US Fish and Wildlife Service, Endangered, Threatened, Proposed and Candidate Species

30. US Fish and Wildlife Service, National Wetland Inventory

31. USDA Natural Resources Conservation Service We Soil Survey

32. USGS Gaugin Station 0608850 Flow Data

33. USGS Topographic Maps

34. WesTech Ultrafiltration Systems, Versatile Membrane Solutions for Potable and Process Water Treatment

Map Document

(This is as uploaded, a blank page will show if nothing was submitted)

PTCWSD Map.pdf

POWER TETON COUNTY WATER AND SEWER DISTRICT
POWER, MONTANA

PLANNING BOUNDARY

FIGURE 1-1

17-258 PLANNING BOUNDRY.DWG

DRAWN BY: NMR
DESIGNED BY: NMR
QUALITY CHECK: MJO
DATE: 2018-02-08
JOB NO. 17-258
FILE:DBOOK

TD&H Engineering
406.761.3010 • tdhengineering.com
1800 RIVER DR. NO. • GREAT FALLS, MONTANA 59401

REV	DATE	REVISION

NOT FOR CONSTRUCTION

Additional Proposal Information

(This is as uploaded, a blank page will show if nothing was submitted)

PTCWSD WRRDA funding committment 8-20-18.pdf

POWER – TETON COUNTY WATER & SEWER DISTRICT

P. O. Box 176
Power, Montana 59468

August 20, 2018

U.S. Army Corps of Engineers
441 G Street NW
Washington, DC 20314-1000

RE: Power-Teton County Water & Sewer District

Commitment of Non-Federal Share

Please accept this letter of commitment for the non-federal share of the $1.97 million request in funding for the Power-Teton County Water and Sewer District from the U.S. Army Corps of Engineers Water Resources Development Act. The Power-Teton County Water & Sewer District (PTCWSD) commits to providing 25% , ($657,000) of the total amount of the project. The total amount identified for completing of the project is $2,627,000.

Federal Share:	**$1,970,000**
Non-Federal Share:	**$657,000**
Total Project Cost	**$2,627,000**

The Power-Teton County Water & Sewer District is a small district with limited resources and manpower. All grant funds will allow the District to complete this important project at an affordable rate to the users. The grant funding for this project will be used for all facets of the project. These include:

- Construction costs associated with drilling and installing the shallow wells and the connection to the current distribution system;
- Engineering costs associated with the design and inspection during construction;
- Administration of the project

We are working with Sweetgrass Development as well as TD&H Engineering, our firm contracted for the project, to secure funding and move forward. The District has received support from Teton County, area legislators and a large number of members of the community. Public meetings held to discuss the project were well attended. Copies of the letters of support received as part of applications to other funding sources are available, if needed.

Thank you for your time and consideration. We look forward to working with our local, state and federal partners for completion of the project. Please contact me at the information below, should you have questions.

Sincerely,

Ross H. Fitzgerald
Chairman/President
Power-Teton County Water & Sewer District
406-788-1443
rhfitz@3rivers.net

CC: Sweetgrass Development
CC: TD&H

Additional Proposal Information

(This is as uploaded, a blank page will show if nothing was submitted)

Senator Daines PTCWSD LOS.pdf

STEVE DAINES
MONTANA

320 HART SENATE OFFICE BUILDING
WASHINGTON, DC 20510
(202) 224-2651

United States Senate

COMMITTEES
AGRICULTURE, NUTRITION AND FORESTRY
APPROPRIATIONS
ENERGY AND NATURAL RESOURCES
HOMELAND SECURITY AND GOVERNMENTAL AFFAIRS
INDIAN AFFAIRS

August 20, 2018

U.S. Army Corps of Engineers
441 G Street NW
Washington, DC 20314-1000

To Whom It May Concern:

I am writing to you in support of the Power-Teton County Water and Sewer Districts (PTCWSD) application for U.S. Army Corp of Engineer Water Resource Development Act funding for their Water Systems Improvement project.

As a community of 171 people, Power, Montana, like many other rural communities, face issues when it comes to reliable infrastructure. Currently, the raw water source for the PTCWSD contains high concentrations of silt and sediment while routine testing of raw water has shown high levels of e.coli bacteria. Additionally, if a water outage were to occur, there would be an extremely hard and devastating impact to the community, as it has a large agricultural base.

If this application is successful, funds will be used to abandon the current raw water intake at Muddy Creek and the existing water treatment. Specifically, funding will be used for construction costs associated with drilling and installing the shallow wells and the connection to the current distribution system, engineering costs associated with design and inspection, and administration of the project. I support this project, as PTCWSD users deserve clean, high-quality drinking water at an affordable cost.

I trust you will give this application fair and thoughtful consideration.

Sincerely,

Steve Daines
United States Senator

Additional Proposal Information

(This is as uploaded, a blank page will show if nothing was submitted)

Senator Tester 2018-08-20 Power Teton Water.pdf

JON TESTER
MONTANA

COMMITTEES:
APPROPRIATIONS
BANKING
COMMERCE
INDIAN AFFAIRS
VETERANS' AFFAIRS

United States Senate

SENATE HART BUILDING
SUITE 311
WASHINGTON, DC 20510
202-224-2644

INTERNET:
tester.senate.gov/contact

August 20, 2018

Lieutenant General Todd T. Semonite
US Army Corps of Engineers
441 G Street NW.
Washington, DC 20314-1000.

Dear General Semonite:

I write in support of the Power-Teton County Water and Sewer District's (PTCWSD) application for a Water Resources Development Act grant. The PTCWSD serves as the governing body for the infrastructure needs of the community of Power, Montana. The unincorporated community of Power is located within Teton County. Power supports a K-12 school, with a total of 105 students enrolled. The PTCWSD is a small district with limited resources and staff.

The proposed project will allow the PTCWSD to provide clean drinking water to its current and future users at an affordable cost. The PTCWSD provides water to most of its 171 citizens through residential connections. Population projections have indicated Power may increase in population within the next 20 years. The completion of this project will allow for that growth by providing the essential service of quality drinking water. In addition to the school, fire protection and suppression is a key component of the service provided. Multiple businesses and a large agricultural base are also dependent on the District for a clean, sustainable water source. All grant funds will allow the District to complete this important project at an affordable rate to the users.

Thank you for your attention to this application. If I can provide any additional information, do not hesitate to contact me. Please inform my office of the eventual decision on this application.

Sincerely,

Jon Tester
United States Senator

BOZEMAN (406) 586-4450 | BUTTE (406) 723-3277 | GLENDIVE (406) 365-2391 | GREAT FALLS (406) 452-9585 | HELENA (406) 449-5401 | KALISPELL (406) 257-3360
BILLINGS (406) 252-0550 | MISSOULA (406) 728-3003

Additional Proposal Information

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Power Water Letter of Support 2018-HD17.pdf

The Big Sky Country

MONTANA HOUSE OF REPRESENTATIVES

REPRESENTATIVE ROSS H. FITZGERALD
HOUSE DISTRICT 17

HELENA ADDRESS:
CAPITOL BUILDING
PO BOX 200400
HELENA MT 59620-0400
PHONE: (406) 444-4800

HOME ADDRESS:
451 1ST ROAD NE
FAIRFIELD MT 59436
PHONE: (406) 467-2032
MOBILE: (406) 788-1443
EMAIL: rep.ross.fitzgerald@mt.gov

U.S. Army Corps of Engineers
441 G Street NW
Washington, DC 20314-1000

August 15, 2018

RE: Power-Teton County Water & Sewer District

Dear Selection Committee,

Please accept this letter of request for $1.97 million in funding for the Power-Teton County Water and Sewer District from the U.S. Army Corps of Engineers Water Resources Development Act. The Power-Teton County Water & Sewer District (PTCWSD) serves as the governing body for the infrastructure needs for the community of Power, Montana. The unincorporated community of Power is located within Teton County, approximately 20 miles north of Great Falls, Montana along the Interstate 15 corridor.

Reliable infrastructure is the cornerstone to any community, especially in rural areas. The proposed project will allow the PTCWSD to provide quality drinking water to its current users at an affordable cost. The population of the community is 171, according to the 2015 American Community Survey. Providing safe reliable water is an essential service of any community. In addition, fire protection and suppression is a key component of the service provided. Multiple businesses and a large agricultural base are dependent on the District as well, for a clean, sustainable water source. Should a water outage occur, the devastation to the community would be insurmountable, the community may not recover.

The requested funds will be used for a Water Systems Improvement project. The project will abandon the current raw water intake at Muddy Creek and the existing water treatment. The current raw water source for the District is Muddy Creek. As the name implies, Muddy Creek has a very high concentration of silt and sediment. In addition, routine testing of the raw water has shown high levels of e.coli bacteria. This concentration will force the District to make additional changes to their water treatment, primarily the installation of a UV disinfection system. The UV system is not only very costly to install, energy costs for the operation will increase significantly. The nature of the creek is causing extensive damage to the current water treatment plant and associated equipment. In addition to the quality of raw water, the Creek is also in danger of significant contamination.

The current preferred alternative for the PTCWSD is shallow ground wells that will be drilled on the Fairfield Bench and connected to the existing water distribution system. A chlorination system will be added for treatment of the well water. The District will also negotiate for new water rights from the Montana Department of Natural Resources and Conservation. The completion of this project will allow the District to provide quality drinking water to the users of the system at all times during the year.

The Power WSD has maintained the current system on a very slim budget. Any grant funds received will allow the District to complete the proposed project, operate the new system, and plan for future necessary improvement. Additionally, based on engineering estimates, the cost to operate and maintain the proposed system will decrease. We are working with Sweetgrass Development as well as TD&H Engineering, the firm contracted for the project, to secure funding and move forward. The PTCWSD will be able to provide required match and is seeking funding from non-federal sources, on the state level, to accomplish those goals.

Thank you for your time and consideration. We look forward to working with our local, state and federal partners for completion of the project. Please contact me at the information below, should you have questions.

Respectfully,

Ross H. Fitzgerald

ROSS H. FITZGERALD

Additional Proposal Information

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MT DEQ POWER TETON COUNTY WATER DIST.PDF

DEQ
Montana Department
of Environmental Quality

August 17, 2018

U.S. Army Corps of Engineers
441 G Street NW
Washington, DC 20314-1000

RE: Power-Teton County Water & Sewer District

Dear Selection committee,

Please accept this letter of support for $1.97 million in funding for the Power-Teton County Water and Sewer District from the U.S. Army Corps of Engineers Water Resources Development Act. The Power-Teton County Water & Sewer District (PTCWSD) serves as the governing body for the infrastructure needs for the community of Power, Montana. The unincorporated community of Power is located within Teton County, approximately 20 miles north of Great Falls, Montana along the Interstate 15 corridor.

The Power-Teton County Water District public water supply serves a total of 167 people through 85 connections. The source is surface water, Muddy Creek, which is treated via 30+ year old surface water treatment plant. Water quality sampling has shown a need for additional treatment for cryptosporidium. This will certainly require capital investment in new infrastructure as well as an increase in operational expenses.

When considering these factors, a new source could mean less operational costs, manpower requirements, and monitoring obligations. For this small town, a new water source would help ensure that they can continue to provide safe, affordable drinking water to the community.

The current preferred alternative for the PTCWSD is for shallow ground wells that will be drilled on the Fairfield Bench and connected to the existing water distribution system. A chlorination system will be added for treatment of the well water. The District will need to apply for and get approval from the Montana Department of Natural Resources and Conservation for new water rights and/or changes to existing water rights.

Please let me know if you have questions.

Sincerely,

Tim Davis
Administrator
Water Quality Division

Additional Proposal Information

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NCMEDD PTCWSD WRRDA letter of support 082018.pdf

SWEETGRASS DEVELOPMENT
SERVING NORTH CENTRAL MONTANA – CASCADE, GLACIER, PONDERA, TETON AND TOOLE COUNTIES

August 20, 2018

U.S. Army Corps of Engineers
441 G Street NW
Washington, DC 20314-1000

RE: Power-Teton County Water & Sewer District

Dear Selection committee,

Sweetgrass Development is comprised of a five county region in North Central Montana. The organization is an Economic Development District with designation through the U.S. EDA as well as a CRDC through the State of Montana. The mission and objectives of the organization are to assist the governments and citizens in each county and the Blackfeet Nation, achieve their economic goals, while preserving their distinct cultures and way of life.

Please accept this letter of support for the Power Water and Sewer District's Army Corps of Engineers Water Resources Reform and Development Act grant application. Power is an unincorporated town located off of Interstate 15, within Teton County. The district is applying for funding to make improvements on the existing water source. Muddy Creek, the current raw water source, is high in silts and sediment concentration. This is causing significant operations and maintenance issues within the treatment plant, increasing the cost exponentially for the small community. The current Water Right includes diversion restrictions, based on the flows rates in Muddy Creek. The proposed improvements include a new water right for the District, 2 new shallow municipal wells, demolition of the existing treatment plant, roughly 12,500 LF of new 6-inch transmission main and connection to the District's existing distribution system. These improvements will create a sustainable, quality water source for years to come.

Sweetgrass Development is committed to improving the quality of life in the counties of Cascade, Glacier, Pondera, Teton and Toole through comprehensive and coordinated efforts of the citizens and local decision makers. This project supports the mission statement of Sweetgrass Development and is desperately needed to improve the quality of life of citizens in our area. Thank you in advance for your time and consideration of this application.

Sincerely,

Tony Sitzmann
President
Sweetgrass Development

521 1st Avenue Northwest Great Falls, MT 59404
Phone 406-727-5173 Fax 406-454-6903
www.sweetgrassdevelopment.org

Additional Proposal Information

(This is as uploaded, a blank page will show if nothing was submitted)

MTDOC PowerTetonWRRDASupporLtr.pdf

PAM HAXBY-COTE
DIRECTOR

MONTANA
DEPARTMENT OF COMMERCE

STEVE BULLOCK
GOVERNOR

August 17, 2018

U.S. Army Corps of Engineers
441 G Street NW
Washington, DC 20314-1000

RE: Power-Teton County Water & Sewer District

Dear Selection committee,

The Montana Department of Commerce works with statewide and local partners, private industry and small businesses to enhance and sustain economic prosperity in Montana.

Commerce supports all Montana communities in addressing their infrastructure needs and is committed to addressing infrastructure public health and safety needs.

Commerce supports efforts to ensure that infrastructure improvements are affordable, with support from federal, state and other funding sources.

Thank you for your time and consideration. Please contact me at the information below, should you have questions.

Sincerely,

Pam Haxby-Coté

PAM HAXBY-COTE
Director, Montana Department of Commerce

COMMERCE.MT.GOV | COMDEV.MT.GOV
301 S. PARK AVE. | PO BOX 200523 - COMMUNITY DEVELOPMENT DIVISION | HELENA, MT 59620-0523
P: 406.841.2770 | F: 406.841.2771 | TDD: 406.841.2702

Additional Proposal Information

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PTCWSD PER Water Improvment Project 3 of 3 82018.pdf

APPENDIX 2 - D

Water Rights Information

4

Form No. 600 R2/2010

APPLICATION FOR
BENEFICIAL WATER USE PERMIT
Use for ground water in excess of 35 gpm or 10 acre-feet per year
and for all surface water.

Use one application for each source of supply or each development. Check all appropriate boxes and fill in each blank. If more space is needed, attach properly labeled additional information. To avoid processing delays, submit all required information.

FILING FEE

$800.00	Inside a Basin Closure Area, Controlled Ground Water Area, or Compact Area all ground water in excess of 35 gpm or 10 acre-feet per year and for all surface water.
$600.00	Outside of a Basin Closure Area, Controlled Ground Water Area, or Compact all ground water in excess of 35 gpm or 10 acre-feet per year and for all surface water.
$200.00	In a Controlled Ground Water Area - ground water appropriation less than 35 gpm and 10 acre-feet per year.

RECEIVED
AUG 25 2010
Montana DNRC
Havre Unit Office

FOR DEPARTMENT USE ONLY

Application # 30049120 Basin 41K

Priority Date _____

Time 10:35 (AM) PM

Rec'd By Terri L Peterson

Fee Rec'd $ 800.00 Check # 4539
HUW 110 3687

Refund _____ Date _____

1. **NAME OF APPLICANT** Power - Teton County Water & Sewer District FO # 298296

Mailing address PO Box 176

City or Town Power State MT Zip 59468

Phone 406-463-2351 Email Address _____

2. **SOURCE OF WATER SUPPLY**

☐ Well Estimated Depth in Feet _____ ☐ Developed Spring Name _____

☐ Lake Name _____ Tributary to _____

☑ Stream Name Muddy Creek

☐ Unnamed Source - Tributary to _____

☐ Closed Basin (A closed basin results when water drains into a depression, lake, etc. from which water escapes only by evaporation.)

☐ Other _____

3. **POINT OF DIVERSION** Describe the location to the nearest 10 acres.

(a) ____ 1/4 SE 1/4 SW 1/4 Sec 27 Twp 23N N/S Rge 1W E/W County Teton

Lot ____ Block ____ Tract No. ____ Subdivision Name ____

Government Lot ____ Latitude ____ Longitude ____

(b) ____ 1/4 ____ 1/4 ____ 1/4 Sec ____ Twp ____ N/S Rge ____ E/W County ____

Lot ____ Block ____ Tract No. ____ Subdivision Name ____

Government Lot ____ Latitude ____ Longitude ____

4. **MEANS OF DIVERSION**

☐ Headgate

☐ Pipeline (description) _____

☐ Dam (Complete item 5)

☐ Pit (Complete item 5)

☐ Other _____

☑ Pump

70 total ✓ Rated Capacity (GPM or CFS)

2 - 5 HP pump ✓ Horsepower

161' Lift in Feet

Describe your plans for measuring your water use: Have an existing flow gauge in-line of pipe

WORK COPY

5. **RESERVOIR** Check the boxes that pe... to reservoirs greater than 0.10 acre-feet. See formu... below for computing capacity.

☐ Proposed New Capacity _____ acre-feet, Name (if any) _____

☐ Existing Reservoir Water Right # _____

Existing Reservoir Capacity _____ acre-feet, Name (if any) _____

Proposed Enlarged Reservoir Capacity _____ acre-feet

☐ Annual volume of water that will evaporate from the reservoir surface. _____ Acre-feet. Deviations from the acceptable standards in ARM 36.12.116(1) require supporting information.

☐ Drainage device will be installed

☐ Reservoir located on the source

☐ Reservoir located away from the source

Location of impoundment structure (dam or pit): Describe the location where the pit or dam crosses the source.

_____ 1/4 _____ 1/4 _____ 1/4 Sec. _____ Twp _____ N/S Rge _____ E/W County _____

PIT: surface area _____ acres X maximum depth _____ feet X 0.5 = _____ capacity in acre-feet

DAM: surface area _____ acres X maximum depth _____ feet X 0.4 = _____ capacity in acre-feet

Explain the conveyance means to and from the reservoir and any losses that may occur with that conveyance.

_____

_____

6. **PERIOD OF DIVERSION** The period during the year when the water will be diverted, impounded, or withdrawn from the source.

(month/day) 01/01 to (month/day) 12/31

7. **PROPOSED BENEFICIAL USE** Check the boxes that pertain to your development.

☑ Domestic Number of Homes to be Supplied 83 and 1 school

☐ Lawn & Garden Maximum size in acres _____

☐ Stock Maximum Number and Type _____

☐ Industrial ☐ Mining ☑ Municipal ☐ Power

☐ Wetland ☐ Fish ☐ Wildlife ☐ Recreation

☐ Irrigation

O Sprinkler (type) _____ O Contour Ditch O Border Dike

O Waterspreading / Spreader Dike

O Other _____

O Crop to be grown: _____

☐ Other Purpose _____

8. **SUPPLEMENTAL WATER RIGHTS**

☐ If this application is to provide supplemental water to another water right, provide the number of the water right that is being supplemented.

_____

☐ Explain why supplemental water is needed and how the water rights will be collectively operated. _____

_____

_____

WORK COPY

9a. PLACE OF USE

(a) Geocode of the place of use (17 digits) _____

If there are multiple places of use, list the geocode for each parcel on an attached sheet. The geocodes can be found at the County Clerk and Recorders Office or by visiting http://gis.mt.gov/.

(b) Irrigation / Lawn & Garden

County _____ Subdivision Name _____

____ Acres ____ Lot ____ Block ____ 1/4 ____ 1/4 ____ 1/4 Sec ____ Twp ____ N/S Rge ____ E/W

____ Acres ____ Lot ____ Block ____ 1/4 ____ 1/4 ____ 1/4 Sec ____ Twp ____ N/S Rge ____ E/W

____ Acres ____ Lot ____ Block ____ 1/4 ____ 1/4 ____ 1/4 Sec ____ Twp ____ N/S Rge ____ E/W

____ Acres ____ Lot ____ Block ____ 1/4 ____ 1/4 ____ 1/4 Sec ____ Twp ____ N/S Rge ____ E/W

____ Acres ____ Lot ____ Block ____ 1/4 ____ 1/4 ____ 1/4 Sec ____ Twp ____ N/S Rge ____ E/W

____ Total Acres

9b. PLACE OF USE

(c) Non-Irrigation

(i) Purpose of Use Town of Power water supply Place of use same as Point of Diversion, **CHECK** ☐

____ 1/4 ____ 1/4 SW 1/4 Sec 25 Twp 23N N/S Rge 1W E/W County Teton

Lot ____ Block ____ Tract # ____ Government Lot ____

(ii) Purpose of Use ____ Place of use same as Point of Diversion, **CHECK** ☐

____ 1/4 ____ 1/4 ____ 1/4 Sec ____ Twp ____ N/S Rge ____ E/W County ____

Lot ____ Block ____ Tract # ____ Government Lot ____

10. FLOW RATE, VOLUME, PURPOSE OF USE, AND PERIOD OF USE

20 (cfs/gpm) up to 40 acre-feet for domestic purpose (month/day) 01/01 to (month/day) 12/31

____ (cfs/gpm) up to ____ acre-feet for ____ purpose (month/day) ____ to (month/day) ____

____ (cfs/gpm) up to ____ acre-feet for ____ purpose (month/day) ____ to (month/day) ____

Total Amount Requested 20 (cfs/gpm) up to 40 acre-feet per year

11. GENERAL PROJECT PLAN & PROPOSED COMPLETION PERIOD

What year will the project completed and all of the water put to beneficial use? now

Explain why this amount of time is requested. Include information about the cost, magnitude, complexity, or any other reason for the time period requested. The Town of Power has historically used a Bureau of Reclamation water use permit. Since this is not best way to hold Power's water right for long-term, are now pursuing own water right.

Generally identify what will be completed and how much water will be put to use during each year until the project is completed. Project is already completed and using Bureau of Reclamation water use for Town of Power - have documentation since 1988 showing high water use of 37 Acre-feet in 2009

WORK COPY

12. LOCATION MAP Must be included

A map showing the following items must accompany this application. A USDA aerial photo or USGS topographic map must be used.

a) Section Corners and Numbers
b) Township and Range Numbers
c) Point of Diversion
d) Place of Use (Subdivision, Irrigated Acres, Stock Tanks, etc.)
e) Location of Ditch, Pipeline, etc.

13. REMARKS (Provide any additional information to explain the proposed appropriation.)

This water system has been using water from Muddy Creek at Power since March 1970 through a Reclamation right and is now requesting own water right

14. CONTACT PERSON Who should we contact with questions about this application?

☐ Check, if same as applicant ☐ Check, if contact is an attorney

Name of Contact Gene & Karol Walker Title Managers

Mailing address PO Box 176

City or Town Power State MT Zip 59468

Phone 406-463-2351 Email address gkwalker@3rivers.net

NOTE: If a contact person is identified as an attorney, all communication will be sent only to the attorney unless the attorney provides written instruction to the contrary. If a contact person is identified as a consultant, employee, or lessee, the individual filing the water right form or objection form will receive all correspondence and a copy may be sent to the contact person.

15. AFFIDAVIT

I affirm the information provided for this application is to the best of my knowledge true and correct. I also affirm I have possessory interest or the written consent of the person with the possessory interest, in the property where the water is to be put to beneficial use and if applicable, exclusive property rights in the groundwater development or the written consent of the person with those rights.

Applicant's Signature Ross H. Fitzgerald, PRESIDENT Date 23 August - 2010

Date

State of Montana
County of Teton

Signed or acknowledged before me on August 23, 2010 by ~~Kelly~~ Ross H. Fitzgerald

Notary's Signature

Notary's Name (Printed) Kelly McInerney

Notary public for the State of Montana

Residing at Fairfield Montana

My commission expires July 31, 2013

KELLY McINERNEY
NOTARY PUBLIC for the
State of Montana
Residing at Fairfield, Montana
My Commission Expires
July 31, 2013

Affix Notarial Seal/Stamp Above

WORK COPY

PE..MIT APPLICATION INFOR..ATION

On a separate attachment provide the following information. Attachments must be labeled individually as shown in the sections below. (ie: Physical Surface Water Availability A.1.a) If a section is not applicable, label the section as Not Applicable or NA. Conclusions, calculations, references, data, and assumptions used must be included in the application materials. Round flow rate, volume, and reservoir size to tenths.

The applicable addendums must be completed and attached. Check if one or more of the following are included.

- ☐ **Aquifer Testing Addendum** – submit with ground water applications
- ☐ **Basin Closure Addendum** - Submit for legislative and administrative basin closures
- ☐ **Basin Closure Area - Mitigation Addendum** – Submit for ground water application located in legislative and administrative basin closures
- ☐ **Basin Closure Area - Historic Beneficial Use Addendum** – Submit for ground water application located in legislative and administrative basin closures and the applicant has determined the net depletion will not result in adverse affect

Section A. Attachments must make specific reference to the section item shown.

PHYSICAL SURFACE WATER AVAILABILITY – ARM 36.12.1702

A.1. ☐ STREAMFLOW GAGING STATION RECORDS ARE AVAILABLE – GAGING STATION RECORDS ARE REQUIRED IF THEY ARE AVAILABLE. ALL BOXES MUST BE CHECKED AND INFORMATION PROVIDED.

A.1.a ☐ Provide the median of the monthly average flow rates and volumes for the stream gaging station period during each proposed month of diversion; and

A.1.b ☐ Provide a legible copy or excerpt of the data used, data source, and study or report(s) used in documenting water availability in the source of supply; and

A.1.c ☐ Provide all conclusions, calculations, data, and assumptions used in estimating water availability.

A.2. ☐ STREAMFLOW GAGING STATION RECORDS ARE NOT AVAILABLE, HOWEVER LOW FLOW MEASUREMENTS WERE MADE. AT LEAST ONE MEASUREMENT MUST BE COLLECTED DURING THE LOWEST FLOW PERIOD

A.2.a ☐ Provide a table of stream flow measurement(s) taken at or directly upstream of the proposed point of diversion. The table must include the flow rate measured; the date of measurement; a description of the weather conditions, including sky conditions, whether it is raining or snowing, general wind conditions, and the temperature; the type of measurement device used; and the legal land description showing where the measurement was taken..

A.2.b ☐ Using the measured flows from A.2.a above and accepted methods and statistical techniques for estimating surface water flow rates and volumes, estimate the median monthly flow rates for the water source at the proposed point of diversion. Provide all conclusions, calculations, data, and assumptions used in estimating water availability.

A.2.c ☐ If flow measurements could not be taken (such as for an on-stream reservoir), explain why and provide a drainage basin analysis to show the volume of water available during the proposed period of diversion. Provide all conclusions, calculations, data, and assumptions used in estimating water availability.

Section B. Attachments must make specific reference to the section item shown.

PHYSICAL GROUND WATER AVAILABILITY – ARM 36.12.1703

Note: The aquifer testing rule requirements in ARM 36.12.121 must be followed.

B.1. ☐ Provide the calculated zone of influence. Include the transmissivity, storage coefficient and appropriate analytical model determined from an aquifer test; hydraulic gradient determined from water level measurements or published water level maps; drawdown cutoff of 0.01 feet; and apply Darcy's law.

B.2. ☐ Provide the ground water flow rate through the zone of influence.

Section C. Attachments must make specific reference to the section item shown.

EXISTING LEGAL DEMANDS – ARM 36.12.1704

C.1. ☐ Provide abstracts or an existing legal demands index (found on the NRIS - DNRC Water Right Query System) on the surface water or ground water source of supply and its tributaries that may be affected by the proposed appropriation.

C.2. ☐ If your source is ground water that flows through the zone of influence and contributes water to a surface

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water reach , provide a ... or an existing legal demands index (fc ... the NRIS - DNRC Water Right Query System) of the surface water rights that are hydraulically connected.

Section D. Attachments must make specific reference to the section item shown.

PHYSICAL & LEGAL DEMAND COMPARISON – ARM 36.12.1705

D.1. ☐ Provide a comparison of the physical water available and the legal demands on the source and its downstream tributaries. Example comparison: The amount of water is physically available minus the amount of legal demands for the water = amount of water available for applicant's use.

D.2. ☐ If the amount of water available is less than the amount needed by the applicant, explain the current water use on the sources and why water can be considered available for the applicant's use.

Section E. Attachments must make specific reference to the section item shown.

ADVERSE EFFECT – ARM 36.12.1706

Surface Water

E.1. ☐ Explain the potential affect to senior downstream water rights.

E.2. ☐ Explain the rate and timing of depletions from the surface water source of supply and its downstream tributaries and the effect that will have on other surface water rights. Explain and document return flow that may occur from the project. (Return flow is that part of a diverted flow which is applied to a beneficial use and is not consumed and returns underground to its original source or another source of water, and to which other water users are entitled to a continuation of, as part of their water right. Return flow is not wastewater.)

Ground Water

E.3. ☐ Based on a model to simulate drawdown resulting from 5 years of pumping at the proposed rate and volume, calculate how water levels in wells of senior water rights will be lowered and describe the resulting affects on available water column remaining in those wells.

E.4. ☐ Explain the rate, timing, and location of depletions from surface water reaches that receive ground water that flows through the zone of influence and describe the affect on senior surface water rights.

Applicant's Plan

E.5. ☐ Explain how the applicant plans to divert, operate, and use water during times of water shortage so that senior water rights will be satisfied. Explain why the plan is reasonable and believable.

Section F. Attachments must make specific reference to the section item shown.

ADEQUATE DIVERSION MEANS AND OPERATION – ARM 36.12.1707

F.1. ☐ Describe how the proposed system will be operated, from point of diversion through the place of use and on through the discharge of water, if any.

F.2. ☐ Provide design plans and specifications for the diversion and conveyance facilities and the equipment used to put the water to beneficial use, including the proposed flow rate and volume design capacity; the expected overall efficiency, including diversion, conveyance, and system efficiencies; the proposed diversion schedule, such as number and timing of irrigation sets; and system design, construction, or operation features which are intended to reduce or eliminate adverse effects on other water rights.

F.3. ☐ For a well, provide information about the observed drawdown extended throughout the period of diversion; describe the compared height of the water column above the pump; and explain if the water supply can be sustained in the proposed amount and throughout the period of diversion.

Section G. Attachments must make specific reference to the section item shown.

BENEFICIAL USE – ARM 36.12.1801

G.1. ☐ Explain how the water use benefits the applicant, other persons, or the public.

G.2. ☐ Explain why the requested flow rate and volume is the amount needed to sustain each purpose.

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WATER RESOURCES OFFICES

BILLINGS: AIRPORT INDUSTRIAL PARK, 1371 RIMTOP DR., BILLINGS MT 59105-1978
PHONE: 406-247-4415 FAX: 406-247-4416
SERVING: Big Horn, Carbon, Carter, Custer, Fallon, Powder River, Prairie, Rosebud, Stillwater, Sweet Grass, Treasure, and Yellowstone Counties

BOZEMAN: 2273 BOOT HILL COURT, SUITE 110, BOZEMAN MT 59715
PHONE: 406-586-3136 FAX: 406-587-9726
SERVING: Gallatin, Madison, and Park Counties

GLASGOW: 222 6TH STREET SOUTH, PO BOX 1269, GLASGOW MT 59230-1269
PHONE: 406-228-2561 FAX: 406-228-8706
SERVING: Daniels, Dawson, Garfield, McCone, Phillips, Richland, Roosevelt, Sheridan, Valley, and Wibaux Counties

HAVRE: 210 6TH AVENUE, PO BOX 1828, HAVRE MT 59501-1828
PHONE: 406-265-5516 FAX: 406-265-2225
SERVING: Blaine, Chouteau, Glacier, Hill, Liberty, Pondera, Teton, and Toole Counties

HELENA: 1424 9TH AVE., PO BOX 201601, HELENA MT 59620-1601
PHONE: 406-444-6999 FAX: 406-444-9317
SERVING: Beaverhead, Broadwater, Deer Lodge, Jefferson, Lewis and Clark, Powell, and Silver Bow Counties

KALISPELL: 655 TIMBERWOLF PAKWY, SUITE 4, KALISPELL MT 59901-1215
PHONE: 406-752-2288 FAX: 406-752-2843
SERVING: Flathead, Lake, Lincoln, and Sanders Counties

LEWISTOWN: 613 NORTHEAST MAIN ST., SUITE E, LEWISTOWN MT 59457-2020
PHONE: 406-538-7459 FAX: 406-538-7089
SERVING: Cascade, Fergus, Golden Valley, Judith Basin, Meagher, Musselshell, Petroleum, and Wheatland Counties

MISSOULA: 1610 S 3RD ST WEST, SUITE 103, PO BOX 5004, MISSOULA MT 59806-5004
PHONE: 406-721-4284 FAX: 406-542-1496
SERVING: Granite, Mineral, Missoula, and Ravalli Counties

MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION
Water Resources Division - Water Rights Bureau
WEBSITE: **http://dnrc.mt.gov/wrd/**
EXISTING LEGAL DEMANDS INDEX: **http://nris.mt.gov/dnrc/waterrights/default.aspx**

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APPLICATION FOR BENEFICIAL WATER USE PERMIT
BASIN CLOSURE AREA ADDENDUM
§§ 85-2-360, 85-2-361, 85-2-362, 85-2-363, MCA
ARM 36.12.120

This addendum must be completed and the required information attached to a permit application if the point of diversion is located within a basin closure area.

On a separate attachment provide the following information. Attachments must be labeled as shown in the sections below. (i.e: BCA.3.a) If a section is not applicable, label the section as Not Applicable or NA. Conclusions, calculations, references, data, and assumptions used must be included in the application materials.

BCA.1 BASIN CLOSURE AREA – Identify in which basin closure area this application is located.

- ☒ Upper Missouri River Basin (41A, 41B, 41C, 41D, 41E, 41F, 41G, 41H, 41I, 41J, 41K, 41QJ, 41U)
- ☐ Jefferson (41G) & Madison Rivers (41F)
- ☐ Teton River Basin (41O)
- ☐ Upper Clark Fork (76G, 76GJ, 76E, 76F)
- ☐ Bitterroot River (76H)
- ☐ Grant Creek (Missoula County)
- ☐ Houle Creek (Missoula County)
- ☐ Rock Creek (Carbon County)
- ☐ Sharrott Creek (Ravalli County)
- ☐ Sixmile Creek (Missoula County)
- ☐ Towhead Gulch (Lewis & Clark County)
- ☐ Truman Creek (Flathead County)
- ☐ Walker Creek (Flathead County)
- ☐ Willow Creek (Ravalli County)

BCA.2 BASIN CLOSURE EXCEPTION – ARM 36.12.120 - Identify how this application meets the basin closure exceptions.

- ☐ Application is to appropriate ground water and applicant will comply with 85-2-360, MCA
- ☐ Application is to appropriate water for a nonconsumptive use
- ☐ Application is to appropriate surface water for a domestic use
- ☐ Application is to appropriate surface water for stock use
- ☒ Application is to appropriate surface water by or for a municipality
- ☐ Application is to store water during high spring flows
- ☐ Application is from the Forest Service for a state water reservation
- ☐ Application is to appropriate surface water to conduct response actions related to natural resource restoration.
- ☐ Other (explain) _____

Section 3. Attachments must make specific reference to the section item shown.

N/A

BCA.3 GROUND WATER APPLICATIONS – Hydrogeologic Assessment

Hydrogeologic Environment

BCA.3.a ☐ Identify the geology, including stratigraphy and structure in the area of estimated effect.

BCA.3.b ☐ Identify, at a minimum, the parameters of the aquifer system within the area of estimated effect for the following.

- **BCA 3.b.1** ☐ the lateral and vertical extent of the aquifer
- **BCA 3.b.2** ☐ whether the aquifer is confined or unconfined
- **BCA 3.b.3** ☐ the effective hydraulic conductivity of the aquifer
- **BCA 3.b.4** ☐ transmissivity and storage coefficient related to the aquifer
- **BCA 3.b.5** ☐ estimated flow direction of ground water and rate of movement

Area of Effect

The area of effect required by statute is limited to the boundaries of drainage basin subdivisions, however an applicant may choose to broaden the boundaries.

BCA.3.c ☐ Identify and provide a map of the estimated area of ground water that will be affected.

BCA.3.d ☐ Provide a map of the points of diversion of surface and ground water appropriation rights on record with the department which are located within the area of effect.

BCA.3.e ☐ Provide a list of the surface water appropriation rights and groundwater rights on record with the department that are located within the area of effect.

NOTE: If the applicant determines later in the permit process that a mitigation plan is needed and the plan requires a water right change application, the deadlines placed on that change application will be the same as the subject permit.

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Net Depletion Analysis

The net depletion analysis must include, but is not limited to the following requirements.

BCA.3.f ❑ Identify the total predicted net depletion of surface water.

BCA.3.g ❑ Provide evidence addressing the hydraulic connection between the source aquifer and all surface water.

BCA.3.h ❑ Provide evidence of propagation of drawdown from pumping a proposed well or other groundwater diversion and volume, rate, timing, and location of any resulting surface water effects.

BCA.3.i ❑ Provide a comparison of the proposed flow rate and period of diversion to similar types of existing water uses.

BCA.3.j ❑ Provide estimates of the monthly volume of water consumed by a proposed project through evaporation, evapotranspiration, and all other forms of consumption associated with the proposed project.

BCA.3.k ❑ Provide estimates of water lost through conveyance and whether any lost amounts are lost to the system through evaporation or other means or whether those amounts are returned to the system through percolation or other means.

BCA.3.l ❑ Provide an assessment of potential return flows to a source aquifer or surface water source and the volume, rate, timing, and location of return flows. In addition to ARM 36.12.101 (56) and for the purposes of 85-2-361, MCA, return flows includes but is not limited to any treated wastewater if the treated wastewater will be used as part of an aquifer recharge plan

BCA.3.m ❑ Identify the volume, rate, timing, and locations of accretions to surface water that is not consumed and subsequently returns to surface water.

BCA.3.n ❑ Provide a water balance table that describes the monthly and total annual water balance for the proposal.

Water Quality Report

BCA.3.o ❑ Identify the location of existing documented hazards that could be affected or exacerbated by the proposed project, such as areas of subsidence and describe a plan to mitigate any conditions or impacts.

BCA.3.p ❑ Provide a copy of the relevant DEQ discharge permit if the applicant is proposing to use sewage from a system requiring a water quality permit for the purposes of aquifer recharge or plans to use sewage from a system requiring a water quality permit as a return flow to minimize the amount of water necessary to offset adverse effects resulting from net depletion of surface water through an aquifer recharge plan.

BCA.3.q ❑ Describe any water treatment method that will be used at the time of any type of injection or introduction of water to the aquifer.

Adverse Effect

An applicant must determine the net depletion created by the proposed appropriation and whether the net depletion will result in an adverse affect created by the appropriation.

BCA.3.r ❑ Net depletion will result in adverse affect. Identify the amount of net depletion that will result in adverse effect.

BCA.3.r.1 ❑ The applicant is submitting an Application to Change a Water Right application to mitigate the adverse effect created. A Mitigation Addendum must be submitted with this permit application.

BCA.3.r.2 ❑ The applicant is not submitting a change application, however the applicant is submitting an alternative mitigation plan. A Mitigation Addendum must be submitted with this permit application.

BCA.3.s ❑ Net depletion will not result in adverse effect. Explain why the predicted net depletion of surface water will not result in adverse effect. The applicant must complete the *Historic Beneficial Use of Existing Water Rights Addendum.*

NOTE: If the applicant determines later in the permit process that a mitigation plan is needed and the plan requires a water right change application, the deadlines placed on that change application will be the same as the subject permit.

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Form No. 600B R8/03

CRITERIA ADDENDUM
APPLICATION FOR BENEFICIAL WATER USE PERMIT
FOR APPROPRIATIONS GREATER THAN 5.5 CFS AND 4,000 AC-FT

Section 85-2-311(3), MCA, provides the Department shall approve a water use permit for an appropriation of greater than 5.5 CFS and 4,000 AC-FT of water of water if the applicant proves by clear and convincing evidence the criteria listed below are met.

The information requested by this supplement together with the application is necessary for the Department to process an application. It is the applicant's responsibility to provide credible, relevant, and factual information upon which the Department may rely to support the issuance of a provisional permit.

It is your responsibility to obtain any necessary easement or right-of-way. If public lands are involved, such as State of Montana or BLM, contact the appropriate agency. The water right may need to be in their name.

BASIN CLOSURE AREAS: There are several closed basins in Montana. Within these basins, additional criteria must be met before a permit can be issued. Check with the local Regional Office to determine if your diversion is located within a closed basin.

WATER QUALITY CRITERIA: If a party files a valid objection containing substantial credible information establishing to the satisfaction of the Department that the water quality criteria, as applicable, may not be met, the applicant will be required to prove the following: 1) the water quality of an appropriator will not be adversely affected; 2) the proposed use will be substantially in accordance with the classification of water set for the source of supply pursuant to 75-5-301(1); or 3) the ability of a discharge permit holder to satisfy effluent limitations of a permit issued in accordance with Title 75, chapter 5, part 4, will not be adversely affected.

OUT-OF-STATE: For out-of-state water use, an applicant must also prove by clear and convincing evidence the criteria in ' 85-2-311(4).

ON A SEPARATE ATTACHMENT PROVIDE CLEAR AND CONVINCING EVIDENCE PROVING:

1. Information to prove there is water physically available at the proposed point of diversion in the amount you seek to appropriate;
2. Information or data to prove water is legally available during the period and in the amount you request;
3. Information to prove the proposed use of water will not adversely affect a prior appropriator using an existing water right, a certificate, a permit, or a state water reservation. Include how you plan to exercise and control your project to ensure prior appropriators will be satisfied.
4. Describe the proposed means of diversion, construction, and operation of the diversion works you intend to use and present evidence to prove the means of diversion, construction and operation are adequate;
5. Information and data to prove the proposed use is a beneficial use of water and the flow rate and volume requested is reasonable; and
6. Show the proposed appropriation is a reasonable use based on consideration of the following:
   a. describe the existing demands on the State water supply as well as projected demands of water for future beneficial purposes including municipal water supplies, irrigation systems, and minimum streamflows for the protection of existing water rights and aquatic life;
   b. describe the benefits of the proposed use to the applicant and the State of Montana;
   c. describe the effects on the quantity and quality of water for existing uses in the source of supply;
   d. describe the availability and the feasibility of using low-quality water (meaning not potable for human consumption) for the purpose for which the application has been made;
   e. describe the effect on private property rights by any creation of or contribution to saline seep; and
   f. the probable significant adverse environmental impacts of the proposed use of water.

If the water applied for is to be appropriated in excess of that which will be solely used by the applicant or if it will be marketed by the applicant to other users, information detailing the following is required: a) each person who will use the water and the amount of water each person will use; b) the proposed place of use of all water by each person; c) the nature of the relationship between the applicant and each person using the water; and d) each firm contractual agreement for the specified amount of water for each person using the water.

PROJECT PLAN & TIME LINE: Once you receive your permit when will you begin construction? Provide a detailed project plan and time line for purchasing and installing equipment, the anticipated completion date, and a description of when and how much water will be put to beneficial use.

The completion date is the time by which the diversion works will be operating and the permitted water used to the fullest extent planned.

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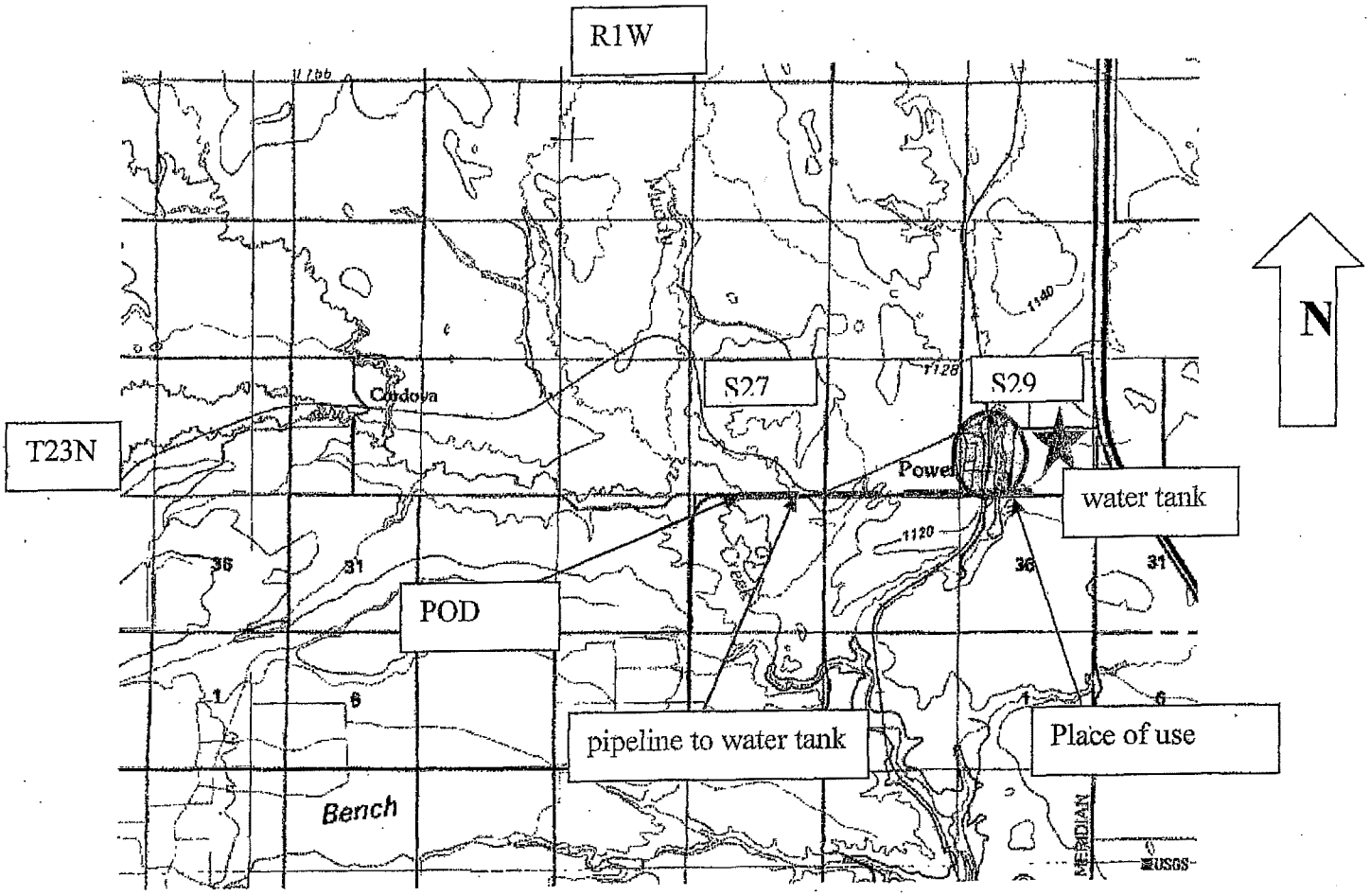
Attach #1



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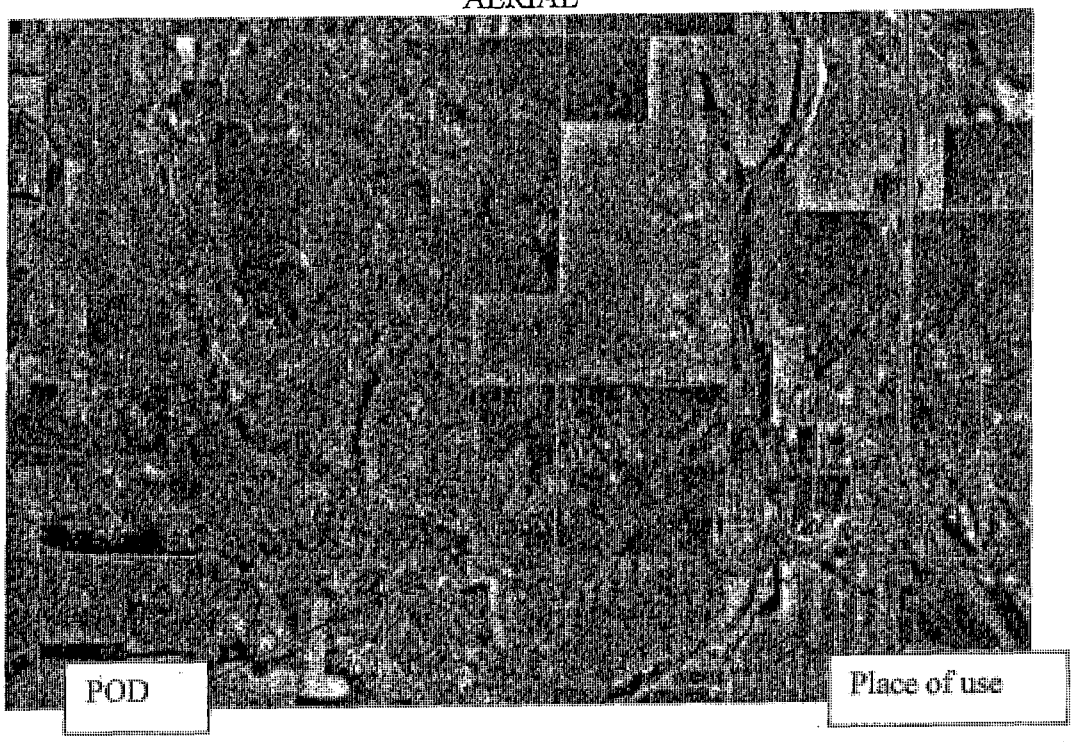

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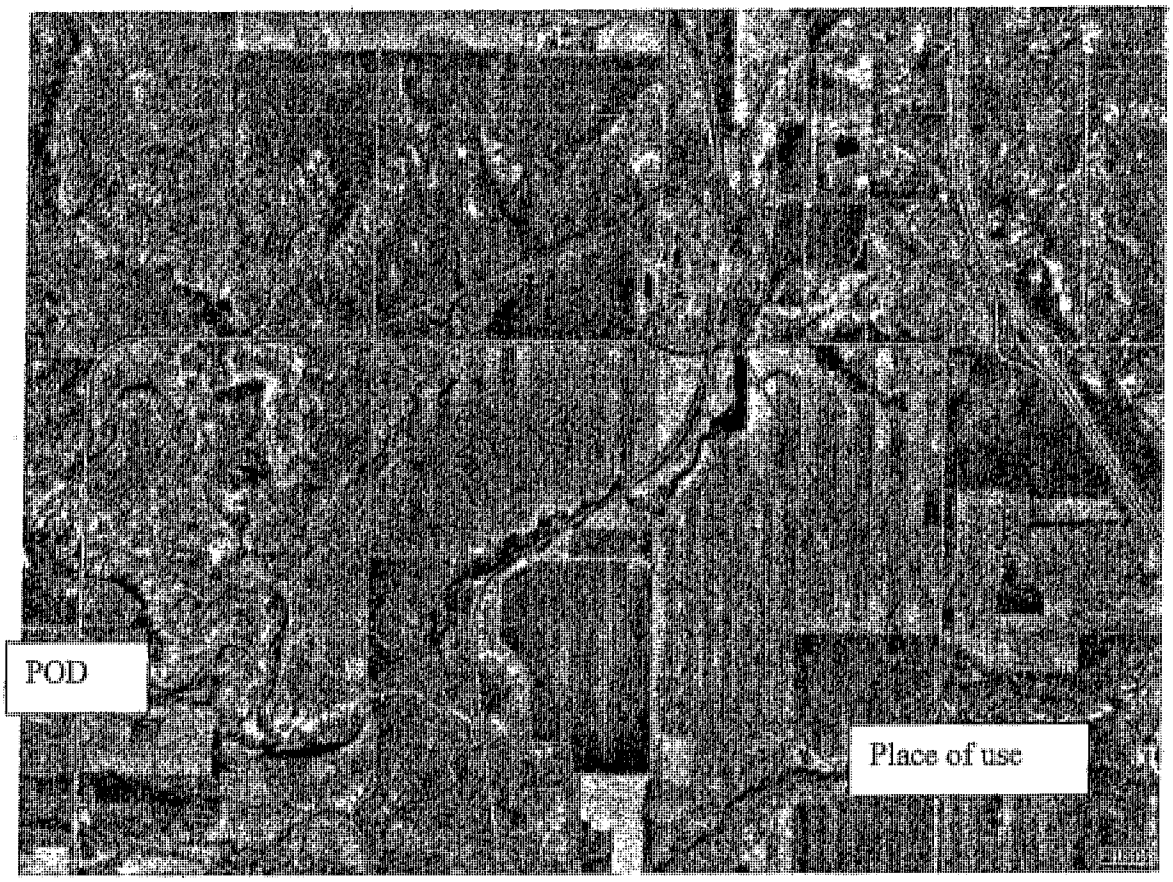

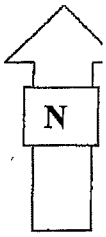

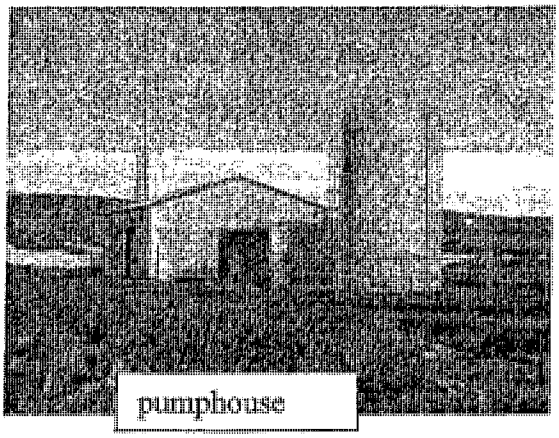

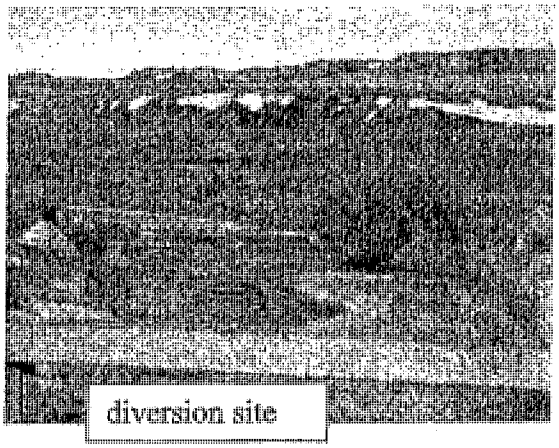

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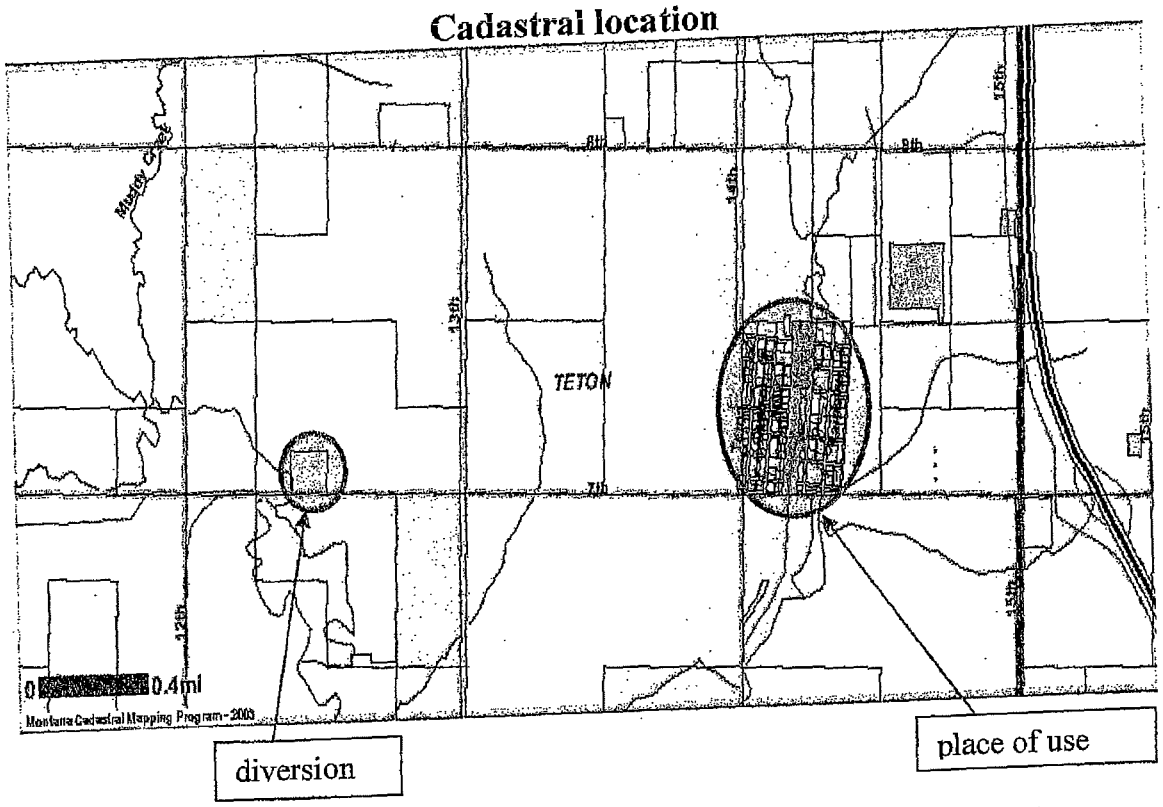
Cadastral location



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Section A.1. – Surface Water Availability <u>with gauge</u>

The following information should justify the availability of water. Attached are three flow data reports compiled by:

Kim Hershberger, Montana State University Extension Water Quality
PO Box 173120
806 Leon Johnson Hall
MSU
Bozeman, MT 59717
Business # 406-994-5685

Kim Hershberger's method is to measure actual flows several times per year using a current meter and then establishing a rating curve. The rating curve is used with continuous height recorders, either Aqurod or TruTrack. Recorders are downloaded approximately monthly and then tabulated at end of year for hourly, daily, monthly and yearly averages.

Per flow data gathered by MSU at Power (AFTER POWER USEAGE), monthly median flow and volume available is:

Month	Requested flow rate (cfs)	Monthly median flow (cfs)	Monthly volume Ac/ft)
January	20.20	5.00 (est)	10
February	20.20	5.00 (est)	10
March	20.20	5.00 (est)	10
April	20.20	10.56	627
May	20.20	29.95	1,782
June	20.20	31.52	1,875
July	20.20	54.06	3,217
August	20.20	13.56	807
September	20.20	17.29	1,029
October	20.20	20.35	1,211
November	20.20	5.00 (est)	10
December	20.20	5.00 (est)	10

- At Vaughn volume DOES NOT include water right # 188174 (U.S. Fish & Wildlife Service/Benton Lake) because it is not used during entire irrigation season. When used, most other water right holders are required to shut off during that period.

On the map below, monitoring site where the stream measurements were taken are at #9. Diversion point is approximately 1 mile upstream of monitoring site

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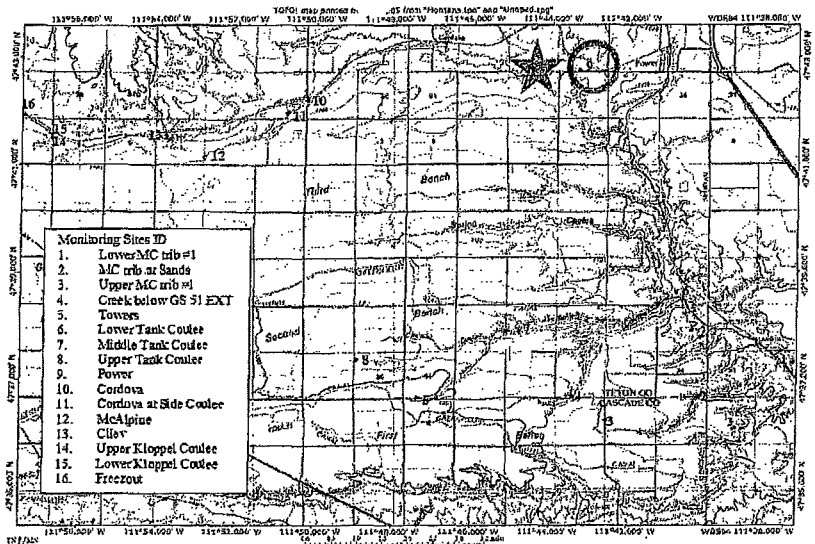

Figure 1. Muddy Creek Follow-up monitoring sites.

Section B – Ground Water - not applicable

Section C.1. – Existing Legal Demands

Attached Table 1 is a water rights chart that includes a volume in acre/feet column acquired from DNRC Water Rights query system. If water right did not have volume, estimated for irrigation at 2 acre/feet x number of acres and livestock at 100 acre/feet.

The column labeled "water rights subtotals (cfs)" shows the flow needed to meet the current demands of these water rights at three specific locations: Muddy Creek @ Power, Muddy Creek near Vaughn also known as Gordan, and Muddy Creek @ Vaughn. The next column labeled "estimated flows (cfs)" shows estimated flows using USGS gauge stations with data on web site: http://waterdata.usgs.gov/mt/nwis/current?type=flow&group_key=basin_cd&search_site_no_station_nm=.. At the Muddy Creek @ Power site, the estimated flows exceed the water rights subtotals by 538% (35 CFS/6.5 CFS). At the Muddy Creek near Vaughn also known as Gordan site the estimated flows exceed the water rights subtotals 286%. At the Muddy Creek @ Vaughn site the estimated flows exceed the water rights subtotals 1,940%.

Section D – Physical & Legal Demand Comparison

40 acre feet - M.M. DNRC

This water right application is requesting ~~2.23 cfs~~ 20.20 and a total of ~~276.8 acre/feet (2 ac/ft per acre)~~. The following table shows that the median flow rate at Power and Vaughn will not infringe upon the senior water rights downstream. Please also refer to Table #1 for flow and current water rights data. **This is after Power historic usage of water from Muddy Creek above the gauge.**

Month	Requested flow rate (cfs)	Monthly median flow (cfs) at Power	Senior water rights (cfs) at Power	Monthly median flow (cfs) at Vaughn	Senior water rights (cfs) at Vaughn
January	20.20	5.0	6.5	5.0	66.68
February	20.20	5.0	6.5	5.0	66.68

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March	20.20	5.0	6.5	5.0	66.68
April	20.20	3.92	6.5	28.9	66.68
May	20.20	29.95	6.5	175.4	66.68
June	20.20	31.52	6.5	259.6	66.68
July	20.20	54.06	6.5	309.6	66.68
August	20.20	13.56	6.5	175.9	66.68
Sept	20.20	17.29	6.5	86.3	66.68
October	20.20	20.35	6.5	49.0	66.68
November	20.20	5.0	6.5	5.0	66.68
December	20.20	5.0	6.5	5.0	66.68

Section E. Adverse Effect

The community water system is designed to supply water to 83 households at rate of 1 AF/YR per household. The water will be used from January 1 to December 31 time period.

The method by which the operator determines if such a condition exists will be by direct communication with immediate downstream senior water right holders AND utilizing the following United States Geological Service (USGS) website.
http://waterdata.usgs.gov/mt/nwis/current/?type=dailystagedischarge&group_key=basin_cd
The operator will go to this website (via the internet) and click on the number 06088500 Muddy Creek at Vaughn. This site will show the current flow in CFS. If this flow drops below the necessary flow of 150 cfs per an agreement made with PPL MT, DNRC and SRWG for new water rights on Muddy Creek, the operator will then stop diversion. The operator will begin each irrigation season in May checking this website daily and then switch to weekly once it is determined that adversely affecting other senior water rights is unlikely.

Section F. Adequate diversion

The diversion has been in use since 1970 and continues to adequately meet current demands. See attachment #3 for past water use.

Section G. Beneficial Use

DNRC estimated single household demand of 1 AF/YR was used. See attachment #3 for past water use.

SEDIMENT REDUCTION

A reduction of flow in tributaries or a reduction in the flow fluctuations in Muddy Creek could significantly reduce sediment loads transported Power to Vaughn. Research findings and outcomes of this investigation suggest that dynamic fluctuations in flow are a more significant contributor to sediment than are sustained flows. Operational practices to minimize dynamic fluctuations would likely result in reduced sediment transport.

Although this single irrigation project, by diverting 20.20 CFS, will not by itself solve the erosion problem, by combining it with other current and future water projects it will have a cumulative effect on reducing the overabundance and fluctuations of water flows. This is then a win-win situation for the landowners along the Muddy Creek and the public's interest in the ecological health of the Muddy Creek.

- MSU Report Overall Recommendations

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The overall theme of the Muddy Creek project was to define flow and sediment sources within Muddy Creek. While this project was never intended to be a five- year study at the start, data collection which started off on more of the watershed scale basis lead to smaller focus areas where there was some question as to what was happening. In the first couple of years of the study it was determined that the majority of flow in Muddy Creek was sourced from tributaries originating within GID boundaries, while the majority of sediment was sourced in Muddy Creek proper from Gordon down to Vaughn. From this point the focus of the project began to shift to Muddy Creek tributaries, as this was an area where it was felt management changes were feasible and could make an impact on the big picture in Muddy Creek. Over the years, different tributaries were intensively monitored where there were questions and unknowns about the sources of flow and sediment. Areas where focus was directed included the section of Muddy Creek above Power, the entire reach of Muddy Creek tributary #1, the section of Tank Coulee above the Upper Tank Coulee gauging station, Tank Coulee from the Lower Tank Coulee gauging station to the Middle Tank Coulee gauging station, and the section of Muddy Creek from Power to Cordova.

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Flow and current water rights numbers table for water right application **TABLE #1**

Site name	site/water right #	Flow rate (gpm)	Flow Rate (cfs)	Volume (Ac/ft)	water rights subtotals (cfs)	estimated flows (cfs)	comments
Muddy Creek @ Power	SRWG/MSU					35.00	2001, 2002, 2005, 2006 flow data
	g104362 - IR	3100	6.89	660			Teton CD right (Andrews)
	p31657 - IR	294	0.65	99			
	w188174 - FW		50.00	14,600			normally not used in irrigation season
	p11979 - IR		0.53	8			
	g11928 - SP	345	0.77	80			
	p24693 - NS	450	1.00	100			
	W208749 - IR	1750	3.90	205			
	P4458 - IR	224	0.50	108			
	p13743 - IR	500	1.11	23			
	g200181 - IR	600	1.33	131			
Muddy Creek near Vaughn also known as Gordon	USGS #06088300				66.68	191.00	1968 to 2001 water years
	W123550 - IR	460	1.02	40			
	w200174 - IR		5.00	291			
	w210532 - IR	1200	2.67	100			
	W210464 - ST			100			
	w210461 - IR	60	0.13	28			
	W199367 - ST			100			
	P20614 - IR	300	0.66	46			
	P11611 - IR		1.35	116			
	W209851 - IR	119	0.27	15			
	p45401 - IR	130	0.29	9			

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Muddy Creek @ Vaughn	USGS #06088500					11.39	221.00	1925 – 2001 water years

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Power's Past Water Consumption

Attachment #3

metered water for Power Water Treatment Plant

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Jan	400,000	450,000	450,000	520,000	450,000	610,000	520,000	580,000	570,000	510,000	430,000	530,000
Feb	450,000	480,000	460,000	460,000	470,000	510,000	510,000	530,000	550,000	430,000	420,000	520,000
Mar	540,000	570,000	530,000	500,000	680,000	570,000	570,000	670,000	590,000	560,000	470,000	600,000
Apr	600,000	550,000	600,000	540,000	920,000	560,000	630,000	600,000	600,000	500,000	740,000	690,000
May	660,000	660,000	730,000	680,000	1.390,000	880,000	990,000	690,000	630,000	840,000	1,260,000	840,000
Jun	1,400,000	1,090,000	1,210,000	1,200,000	1,000,000	870,000	1,490,000	890,000	960,000	980,000	650,000	1,160,000
Jul	1,440,000	1,390,000	1,530,000	1,610,000	670,000	630,000	1,800,000	1,140,000	1,740,000	1,300,000	1,500,000	1,590,000
Aug	1,710,000	1,300,000	1,220,000	1,570,000	1,270,000	870,000	1,360,000	1,400,000	1,590,000	1,380,000	1,480,000	1,260,000
Sep	650,000	560,000	1,250,000	880,000	300,000	660,000	1,170,000	850,000	930,000	1,040,000	1,180,000	810,000
Oct	650,000	510,000	660,000	690,000	460,000	570,000	700,000	610,000	630,000	610,000	620,000	500,000
Nov	450,000	470,000	500,000	450,000	440,000	560,000	540,000	620,000	570,000	410,000	440,000	430,000
Dec	430,000	540,000	520,000	430,000	520,000	530,000	590,000	530,000	510,000	430,000	460,000	480,000
Yr/ Total	9,380,000	8,570,000	9,660,000	9,530,000	7,180,000	7,820,000	10,870,000	9,110,000	9,870,000	8,990,000	9,650,000	9,410,000
Acre/ft	28.7	26.3	29.6	29.2	22.0	23.9	33.3	27.9	30.2	27.5	29.6	28.8

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Jan	500,000	510,000	580,000	510,000	520,000	470,000	480,000	560,000	560,000	610,000	990,000
Feb	460,000	460,000	510,000	470,000	450,000	410,000	450,000	510,000	480,000	630,000	950,000
Mar	500,000	530,000	620,000	520,000	550,000	480,000	470,000	560,000	540,000	700,000	930,000
Apr	650,000	550,000	640,000	570,000	690,000	550,000	550,000	630,000	600,000	730,000	1,170,000
May	1,340,000	1,250,000	1,090,000	760,000	860,000	890,000	1,220,000	910,000	660,000	1,080,000	1,380,000
Jun	970,000	1,110,000	980,000	1,100,000	760,000	670,000	940,000	1,440,000	960,000	1,480,000	1,670,000
Jul	1,700,000	1,160,000	1,460,000	1,410,000	1,450,000	1,610,000	1,740,000	2,180,000	1,580,000	1,830.00	0
Aug	1,480,000	1,260,000	1,010,000	1,140,000	940,000	1,360,000	1,270,000	1,680,000	1,530,000	1,610,000	0
Sep	850,000	950,000	880,000	730,000	650,000	820,000	880,000	830,000	700,000	1,460,000	0
Oct	490,000	620,000	570,000	580,000	490,000	510,000	700,000	610,000	640,000	820,000	0
Nov	500,000	620,000	480,000	490,000	430,000	760,000	570,000	530,000	530,000	900,000	0
Dec	480,000	640,000	490,000	490,000	490,000	450,000	530,000	450,000	620,000	930,000	0
B Wash	0	0	0	0	500,000	1,080,000	1,080,000	1,080,000	1,080,000	1,080,000	500,000
Yr/Total	9,920,000	9,660,000	9,310,000	8,770,000	8,780,000	10,060,000	10,880,000	11,970,000	10,480,000	12,031,830	7,590,000.0
Acre/ft	30.4	29.6	28.5	26.9	26.9	30.8	33.3	36.7	32.1	36.9	23.2

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MUDDY CREEK FOLLOWUP PROJECT - 2005

Final Report

J. W. Bauder, Professor, and Kim Hershberger, Water Quality Associate
Department of Land Resources and Environmental Sciences
Montana State University Extension Water Quality

Overview/Preface

Muddy Creek, located in North Central Montana near Great Falls, is a tributary of the Sun River. Muddy Creek is 42 miles long and accumulates flow from a 314 square mile drainage area. The Greenfield's Irrigation District (GID) irrigates approximately 50,000 acres that fall within the Muddy Creek drainage. Reportedly, the implementation of irrigation projects in the 1920's significantly increased flows in Muddy Creek, and it appears that these increased flows have resulted in erosion of stream banks and increased sediment loads delivered to the Sun River.

Substantial improvements have been made in decreasing sediment loads and stream bank erosion in Muddy Creek. Yet, Muddy Creek and the Sun River below Muddy Creek are still considered impaired by the Montana Department of Environmental Quality and are listed on the Montana 303(d) list. Muddy Creek and the Sun River below Muddy Creek are both unable to meet their designated uses, mostly due to excessive sediment loads, fluctuating flows, and fisheries habitat modification.

In 2002 and 2003, Montana State University-Bozeman was contracted to complete a study on the sources and amounts of flow and sediment within Muddy Creek and to determine relationships between Muddy Creek and tributary discharges and sediment. Sediment and flow were monitored at 13 locations along the Muddy Creek channel, at confluences of tributaries to Muddy Creek, and up gradient from tributary confluences with Muddy Creek. The study revealed that flow within Muddy Creek at Vaughn was influenced the greatest by inflows of water originating from tributaries within the GID boundary. During this same time period, the majority of sediment measured at Vaughn originated in the reach of Muddy Creek between Muddy Creek tributary #1 and Vaughn. This study helped to pinpoint areas where follow-up is needed to completely understand the sediment and flow patterns in Muddy Creek and the tributaries. Those areas are as follows:

- Additional data is needed to understand flows in Muddy Creek above Power. In the 2002/2003 study, data gathered at the Power monitoring station indicated that there was a significant increase in flow in Muddy Creek at Power coincident with the initiation of GID irrigation deliveries. Correspondingly, flows at Power reflect a significant decrease when GID discontinued irrigation deliveries. It appears that either operational spills, canal over runs, or farm field irrigation return flow contribute significantly to flows in Muddy Creek at some location upstream from the Power monitoring station.

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- A detailed assessment is needed of MC#1 and Tank Coulee, both tributaries of Muddy Creek. In the previous study, data gathered showed very significant increases in both flow and sediment from the upper to lower portions of the drainages of these two tributaries. During the 2003 irrigation season, flow volume in Tank Coulee increased 2,771 acre-feet and sediment load increased by 481 tons between the upper and middle portions of Tank Coulee. Correspondingly, flow increased 3,850 acre-feet between the middle and lower portions of Tank Coulee and sediment increased by 1,322 tons during the same time period. Flow within MC#1 increased 1,851 acre-feet and sediment increased by 776 tons between the upper and lower portions of this drainage. The factors contributing to increases in both flow and sediment in these tributaries are not understood.

In an effort to address these issues, the Sun River Watershed Group contracted with Montana State University Extension Water Quality to define and quantify surface (and where possible groundwater) sources contributing flows and sediment to Muddy Creek tributary #1, Tank Coulee, and Muddy Creek above Power.

Approach

With the guidance of GID staff and the Sun River watershed coordinator, sixteen sites were selected for monitoring (Figure 1). At each of these sites an aquarod or tru-track was installed in a stilling well. Aquarods and tru-tracks log water level and water temperature on a continuous basis. Aquarods and tru-tracks used in this project were set to record stream height every 30 minutes. Additionally, staff gauges were installed at many of these sampling sites.

After initial installation of equipment, each sampling site was visited once before the onset of irrigation season, twice a month during the irrigation season, and once following the irrigation season. Flow was measured during these visits using a Marsh-McBirney Model 2000 Flo-Mate portable flowmeter. Flow measurements made with the flow meter were correlated with aquarod and tru-track stage height measurements to develop rating curves for the water level measurements logged by the aquarods and tru-tracks at each gauging station. In addition, sediment samples were collected at all of the sites bimonthly. Sediment samples were then transported back to Montana State University for analysis. Flow and sediment data were organized for each gauging station and subsequently used to determine instantaneous flow, time-dependent flow, and average daily flow and daily sediment in tons for each monitoring site for the 2005 irrigation season. Efforts were undertaken to define relationships between flow rate (cfs) and sediment concentration (mg/L) at each gauging station. Data collected prior to and after the specific period when water was reportedly being diverted for irrigation purposes (the irrigation season) was used solely for calibration purposes and was not included in the calculations of irrigation-season-related flow or sediment. Where appropriate, these data were reported and identified accordingly.

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This project can be divided into three portions: 1. Muddy Creek tributary #1 (MC#1), 2. Tank Coulee, and 3. above Power. On August 4, 2004, the Sun River Watershed coordinator and an MSU water quality associate walked the entire stretch of MC#1. All identifiable sources of water (seeps, tributaries, overland flows, etc.) were noted and located with a handheld GPS unit. This information helped with the location of monitoring sites on MC#1. Three monitoring sites were located on MC#1, two on MC#1 proper (Lower MC trib #1 and Upper MC trib #1) and one on a trib to MC#1 (MC trib at Sands). Notes from this scoping trip are included in the appendix.

Five sites were located within the Tank Coulee watershed. Three monitoring sites were located on Tank Coulee (Upper, Middle, and Lower Tank Coulee). The additional sites were located on tributaries to Tank Coulee (Creek below GS 51 EXT, Towers).

With additional guidance from Montana Fish, Wildlife, and Parks, eight monitoring sites were installed to understand flow and sediment above Power.

GID turned water out into canals on May 14, 2005 and discontinued diversions August 20, 2005. The 2005 irrigation season was thus determined to run from May 14th – August 20th and all flow and sediment calculations were made for this period of time. Note: unless otherwise stated, all flow and sediment load values reported in figures and tables included in this report apply to the period of May 14 through August 20, 2005. Data collected and presented for periods outside of these dates was used solely for calibration, determination of baseline conditions, or for illustration purposes. Data collected prior to or after the defined irrigation season (which is defined as the period of diversion or shortly after diversion was discontinued) is identified as such in the accompanying figures and tables.

Observations and Measurements

Calculations made were total flow (acre ft), total sediment (tons), sediment concentration (tons/acre ft), and average flow rate (cfs) for the irrigation season, that being the period from May 14 through August 20, 2005 (Table 1). Rating curves, flow x sediment concentration curves, and regressions for each gauging and monitoring station are included within the Appendix. Figure 2 presents a composite flow diagram of all flow and sediment determinations made along with GID reported spills and gains and losses in flow and sediment calculated between reaches within the study area.

Table 1. Total Flow and Total Sediment for Big Coulee and Duck Creek for 2005 – Irrigation Season (May 14 – August 20)

Station	Source	Total Flow (acre feet)	Total Sediment (tons)	Sediment (tons/acre ft)	Average Flow Rate (cfs)
Muddy Creek Tributary #1					
LMC#1	Aquarod	2,817	1,142	0.41	14
UMC#1	GID	1,059	17	0.02	4
MC @ Sands	Tru-track	501	14	0.03	3

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Tank Coulee					
LTC	Aquarod	9,911	1,253	0.13	51
MTC	Aquarod	5,231	177	0.04	27
UTC	Aquarod	3,181	69	0.02	16
Creek below GS 51 EXT	Tru-track	2,315	63	0.03	12
Towers	Tru-track	545	0	0	3
Above Power					
Power	Estimate	6,212	637	0.10	32
Cordova	Aquarod	3,761	625	0.17	19
Cordova at Side Coulee	Estimate	3,169	419	0.13	16
McAlpine	Aquarod	2,485	10	0.00	12
Cliev*	Tru-Track	1,910	83	0.04	10
Upper Kloppel Coulee	Tru-Track	1,232	12	0.01	6
Lower Kloppel Coulee	Tru-Track **	695	7	0.01	4
Freezout	Tru-Track ***	1,247	66	0.05	4

*Cliev – Due to equipment failure, flows are estimated from 8/8 – 8/20.
**Lower Kloppel Coulee – Due to equipment failure, flows are estimated from 5/14-6/2.
***Freezout – Due to equipment failure, flows were estimated from 7/27–8/8.

Flow Patterns

Figure 3 depicts average daily flows measured at the three stations located in the MC#1 drainage. Flow at Upper MC#1 (blue line) is directly in response to GID releases down MC#1. Water only flows past this station during the irrigation season. Flow at the Lower MC#1 (pink line) station tracks the flow in Upper MC#1, but with a definite increase. Some of this increase in flow between these two stations is attributable to the tributary to MC#1, identified as MC trib at Sands (green line). Additionally, figure 2 shows that there are several GID spills that contribute to flows measured at MC#1. The remaining balance of flow measured at LMC#1 is likely attributable to the many seeps and drainages found along the MC#1 drainage, and documented during a walk along the drainage in August, 2004. There is progressive increase in flows found at LMC#1 throughout the irrigation season. This indicates progressively increasing contributions of water from surface runoff, return flows, and drainage water resulting from deep seepage.

Figure 4 is a plot of the average daily flows within the Tank Coulee drainage. Flows within Upper Tank Coulee (UTC) (green line), Middle Tank Coulee (MTC) (blue line), and Lower Tank Coulee (pink line) somewhat track each other. A large rainfall event is evident by the spike at all stations during June 2. According to the agrimet station located near Fairfield, 3.21 inches of precipitation was received between June 1-5.

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A total of 5.52 inches of precipitation was received throughout the irrigation season. Of the two tributaries that contribute flow to Tank Coulee, Towers (red line) remains relatively stable with only very low flows throughout the season, but the tributary identified as Creek below GS 51 EXT does contribute a significant amount of flow to the system, and helps explain the increase in flow between MTC (blue line) and LTC (pink line). Additionally, as depicted in figure 2, GID reports a spill between UTC and MTC and a spill between MTC and LTC.

Figure 5 depicts daily flows measured or estimated at and above the Power gauging station. A large portion of flows had to be estimated at these stations due to equipment related problems. Monitoring stations are listed within the legend in the order they appear going upstream from Power. Cordova at Side Coulee (light blue line) and McAlpine (pink line) represent a single tributary (top and end) that discharges into Muddy Creek just above the Cordova station. Differences in flow between these two stations (1,134 acft – from figure 2) are a result of several small springs and runoff water coming in. Likewise, there is an increase in flow between Power (green line) and Cordova (navy blue line). GID doesn't report any spill water between these two stations. Figure 2 shows a calculation of 2,451 acft gain in flow between Power and Cordova during the irrigation season. Figure 2 indicates a loss of 1,967 acre feet of water between Cliev and Cordova, despite inflows of 418 acft from spill GM77, 584 acft from spill GM72, and 3,169 acft from Cordova at Coulee. One irrigator is known to be pumping 814 gallons/minute continuously throughout the irrigation season (353 acft). Between Lower Kloppel Coulee (brown line), which is identified as the beginning of Muddy Creek, and Cliev (purple line) there is a significant increase in flow.

With the assistance from GID management, efforts were undertaken to partition monitored flows for each flow segment of this project for: 1) operational spills and wasteway contributions, 2) baseflow (a source of perennial flow), and 3) farm field sources, consisting of return flows, fields spills, and seepage. Data collected were used to develop Table 2.

Table 2. Summary - 2005 Flow Sources and Contributions to MC tributary #1, Tank Coulee and Muddy Creek above Power for May 14 – August 20, 2005. All values reported in acre feet.

Tributary/ Source	**Operational spills/ wasteways**	**Baseflow**	**Tribs**	**Farm field sources – return flows, seepage**	**Diversion Losses**	**Total gauged flow**
MC#1	1,642	567	501	107	none	2,817
Tank Coulee	224	897	2,860	5,930	none	9,911
Above Power	1,631	1,882	3,169	1,497	1,967	6,212

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Sediment Patterns

Sediment amounts (loads) at the monitoring stations along Muddy Creek and tributaries were determined by applying daily flow data to sediment concentration correlations as functions of flow for each gauging and monitoring site. Flows x sediment curves were developed for each monitoring site (see Appendix tables). Combining daily flow velocities with associated sediment concentrations provided a mechanism for calculating sediment loads as a function of time. These amounts were then accumulated for the irrigation season. Figure 2 depicts flow and sediment recorded at each station during the irrigation season in order along the stream channel. Boxes between stations show gains and losses in flow and sediment. Gains and losses in flow are identified in red and with + symbols for gains and – symbols for losses. Gains in sediment are identified in brown and with + symbols (there were no losses).

A total of 1,142 tons of sediment was contributed from Muddy Creek tributary #1 to Muddy Creek. Of that, 1,111 tons of sediment was gained between the upper and lower portions. Flow measured at LMC#1 had the largest sediment concentrations per acre foot of water – 0.41 tons/acre foot. During the 2004 scoping walk, several high sloping erosive banks were identified which could of definitely contributed to the sediment loads measured.

Tank Coulee contributed 1,253 tons of sediment to Muddy Creek. Figure 2 shows the majority of sediment was sourced between the Middle Tank Coulee gauge and the Lower Tank Coulee gauge. This sediment gain coincides with a relatively large flow addition between these two gauging stations.

Figure 2 shows that 637 tons of sediment passed by the Muddy Creek at Power gauging station. The largest gains in sediment above Power were not measured within the Muddy Creek channel, but in the tributary reach between McAlpine and Cordova at Side Coulee. GID reports that there is a significant amount of runoff water and springs coming in between these two stations. Insignificant amounts of sediment are gained between the Cordova and Power gauging stations. The largest source of sediment within Muddy Creek proper above Power is found between the Cliev and Cordova gauging stations. Table 1 shows that Cordova averaged 0.17 tons of sediment/acre foot of water during the irrigation season. 409 tons of sediment was gained between these two stations.

A look back at the 2003 study completed by MSU shows that sediment loads were less in 2005 in Tank Coulee and in Muddy Creek at Power. Yet, sediment loads measured at Muddy Creek tributary #1 were significantly greater.

Summary

Flow and sediment were monitored at sixteen sites within three portions of the Muddy Creek drainage – Muddy Creek tributary #1, Tank Coulee, and above Power.

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Three stations were monitored throughout Muddy Creek tributary #1. Gauged flow at LMC#1 was portioned out into several categories – baseflow, operational spills, farm field wastes, and tributary flows. All gains in flow within MC#1 are understood. 1,142 tons of sediment were measured at the LMC#1 gauging station. Notes from the August 2004 scoping trip identify several key areas where sediment was likely sourced, and areas where work could easily be done to reduce sediment loads.

On Tank Coulee, two new gauges were installed in addition to the gauges previously in place during the 2003 study. The gauge at Creek below GS 51 EXT helped to explain part of the large increases in flow between Middle and Lower Tank Coulee. The study also found that a large portion of the sediment measured in Tank Coulee is sourced between the MTC and LTC gauging stations. Any efforts to reduce sediment loads should be focused on this area of Tank Coulee.

Seven stations located at and above Power helped identify flow and sediment sources. A large portion of flow and sediment coming into Power is sourced from a tributary just upstream of Cordova, identified in this study as Cordova at Side Coulee and McAlpine. From this study it is apparent that sediment loads at the headworks of Muddy Creek are very small.

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STATE OF MONTANA
DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION
1424 9TH AVENUE P.O.BOX 201601 HELENA, MONTANA 59620-1601

GENERAL ABSTRACT

Water Right Number: 41K 30049120 PROVISIONAL PERMIT
Version: 1 -- ORIGINAL RIGHT
Version Status: ACTIVE

Owners: POWER - TETON COUNTY WATER & SEWER DISTRICT
PO BOX 176
POWER, MT 59468

Priority Date: AUGUST 25, 2010 at 10:35 A.M.

Enforceable Priority Date: AUGUST 25, 2010 at 10:35 A.M.

Purpose (use): MUNICIPAL

Maximum Flow Rate: 70.00 GPM

Maximum Volume: 40.00 AC-FT

Source Name: MUDDY CREEK

Source Type: SURFACE WATER

Point of Diversion and Means of Diversion:

ID	Govt Lot	Qtr Sec	Sec	Twp	Rge	County
1		SESW	27	23N	1W	TETON

Period of Diversion: JANUARY 1 TO DECEMBER 31
Diversion Means: PUMP

Period of Diversion: PERIOD OF DIVERSION /MUDDY CREEK TRIGGER FLOWS
THE APPROPRIATOR MAY ONLY DIVERT WATER DURING THE PERIOD OF APRIL 6 - JUNE 21 AND AUGUST 1 - NOVEMBER 15 WHEN EITHER: (1) FLOWS AT THE APPROPRIATOR'S POINT OF DIVERSION EXCEED THE FOLLOWING MINIMUM FLOWS:

47.55 CFS APRIL 6 - MAY 15;
48.84 CFS MAY 15 - JUNE 21;
48.84 CFS AUGUST 1 - SEPTEMBER 30;
47.55 CFS OCTOBER 1 - OCTOBER 15;
40.65 CFS OCTOBER 16 - OCTOBER 31;

OR, (2) THE APPROPRIATOR OBTAINS CONFIRMATION FROM USFWS THAT IT IS NOT DIVERTING WATER FROM MUDDY CREEK PURSUANT TO STATEMENT OF CLAIM NO. 41K 188174 00. THE APPROPRIATOR SHALL MEASURE FLOWS IN MUDDY CREEK AT THE APPROPRIATORS POINT OF DIVERSION USING A MEASUREMENT DEVICE APPROVED BY THE DEPARTMENT. THE APPROPRIATOR MAY USE THE CURRENT AQUAROD STREAM FLOW RECORDER LOCATED ON MUDDY CREEK NEAR POWER (MCP) UPON CONFIRMATION BY THE DEPARTMENT IT IS CAPABLE OF MEASURING FLOWS IN EXCESS OF 49 CFS. IF THE DEPARTMENT DETERMINES THE MCP MEASUREMENT DEVICE IS INADEQUATE, THE APPROPRIATOR SHALL INSTALL A MEASUREMENT DEVICE APPROVED BY THE DEPARTMENT. THE APPROPRIATOR SHALL NOT DIVERT WATER PURSUANT TO SUBPART (1) OF THIS CONDITION UNTIL A MEASURING DEVICE HAS BEEN APPROVED BY THE DEPARTMENT. THE APPROPRIATOR SHALL KEEP A DAILY RECORD OF FLOWS AT THE POINT OF DIVERSION AND DIVERTED FLOW RATE WHEN DIVERTING WATER PURSUANT TO SUBPART (1) OF THIS CONDITION. APPROPRIATOR SHALL KEEP A RECORD OF THE NAME OF THE INDIVIDUAL AT THE USFWS CONTACTED AND DATES FOR WHICH CONFIRMATION WAS OBTAINED THAT THE USFWS WOULD NOT BE DIVERTING WATER FROM MUDDY CREEK PURSUANT TO STATEMENT OFCLAIM NO. 41K 188174 00 WHEN THE APPROPRIATOR IS DIVERTING WATER PURSUANT TO SUBPART (2) OF THIS CONDITION. RECORDS SHALL BE SUBMITTED BY NOVEMBER 30 OF EACH YEAR AND UPON REQUEST AT OTHER TIMES DURING THE YEAR. FAILURE TO SUBMIT RECORDS MAY BE CAUSE FOR REVOCATION OF THE AUTHORIZATION. THE RECORDS MUST BE SENT TO THE HAVRE WATER RESOURCES REGIONAL OFFICE.

Purpose (Use): MUNICIPAL
Volume: 40.00 AC-FT
Period of Use: JANUARY 1 to DECEMBER 31

Place of Use:

ID	Acres	Govt Lot	Qtr Sec	Sec	Twp	Rge	County
1			SW	25	23N	1W	TETON

Remarks:

IMPORTANT INFORMATION

PRIOR TO COMMENCING DIVERSIONS UNDER THIS PERMIT THE APPROPRIATOR SHALL MAKE PROVISION TO MITIGATE ADVERSE EFFECT TO SURFACE WATER RIGHTS BY REPLACING THE FULL VOLUME OF NET DEPLETION OF THE APPROPRIATION. THE APPROPRIATOR SHALL REPLACE AN EQUIVALENT AMOUNT OF WATER TO THE MAINSTEM OF THE MISSOURI RIVER ABOVE RAINBOW DAM IN THE FOLLOWING MANNER; THE APPROPRIATOR SHALL MITIGATE DEPLETIONS TO SURFACE WATER AND PROVIDE FOR LEGAL AVAILABILITY OF SURFACE WATER UNDER THIS PERMIT THROUGH THE PURCHASE OF A U.S. BUREAU OF RECLAMATION (BOR) WATER SERVICE CONTRACT FROM CANYON FERRY RESERVOIR. THE VOLUME OF WATER STATED ON THE CONTRACT MUST BE EQUAL TO THE VOLUME THAT POWER - TETON DIVERTS FROM MUDDY CREEK ON AN ANNUAL BASIS. DELIVERIES OF WATER UNDER SUCH CONTRACT MUST BE COMMENCED THE CALENDAR YEAR AFTER DIVERSIONS UNDER THIS PERMIT COMMENCE. APPROPRIATORS CONTRACT WITH THE BOR MAY PROVIDE THAT IN THE CALENDAR YEARS SUBSEQUENT TO THE FIRST CALENDAR YEAR IN WHICH WATER IS TO BE PUT TO BENEFICIAL USE, THE CONTRACT VOLUME DELIVERED MAY BE EQUAL TO BUT NOT LESS THAN THE VOLUME OF WATER ACTUALLY DIVERTED BY THE APPROPRIATOR IN THE PREVIOUS CALENDAR YEAR. A DELIVERY SCHEDULE ALLOWED BY THE BOR AND WHICH RESULTS IN THE FULL REPLACEMENT OF THE PRIOR CALENDAR YEARS DIVERSION VOLUME DURING THE FOLLOWING CALENDAR YEAR SHALL BE DEEMED SUFFICIENT UNDER THIS PERMIT. APPROPRIATOR SHALL SUBMIT TO THE HAVRE REGIONAL OFFICE WITH ITS WATER MEASUREMENT RECORDS ON NOVEMBER 30 OF EACH YEAR PROOF OF THE WATER SERVICE CONTRACT WITH BOR AS DESCRIBED ABOVE. DIVERSION UNDER THIS PERMIT MUST STOP IF ANY PART OF THE REQUIRED MITIGATION CEASES.

WATER MEASUREMENT INFORMATION

THE APPROPRIATOR SHALL INSTALL A DEPARTMENT APPROVED IN-LINE FLOW METER IN THE DELIVERY LINE OF THE DIVERSION ASSOCIATED WITH THIS WATER RIGHT. THE LOCATION OF THE FLOW METER MUST BE APPROVED BY THE DEPARTMENT. WATER MUST NOT BE DIVERTED UNTIL THE REQUIRED MEASURING DEVICE IS IN PLACE AND OPERATING. THE APPROPRIATOR SHALL KEEP A WRITTEN DAILY RECORD OF THE FLOW RATE AND VOLUME OF ALL WATER DIVERTED, INCLUDING THE PERIOD OF TIME. RECORDS SHALL BE SUBMITTED BY NOVEMBER 30 OF EACH YEAR AND UPON REQUEST AT OTHER TIMES DURING THE YEAR. FAILURE TO SUBMIT RECORDS MAY BE CAUSE FOR REVOCATION OF THE AUTHORIZATION. THE RECORDS MUST BE SENT TO THE HAVRE WATER RESOURCES REGIONAL OFFICE. THE APPROPRIATOR SHALL MAINTAIN THE MEASURING DEVICE SO IT ALWAYS OPERATES PROPERLY AND MEASURES THE FLOW RATE AND VOLUME ACCURATELY.