GROUNDWATER RESTORATION PLAN FOR THE BUTTE-SILVER BOW DOMESTIC WATER SYSTEM

PREPARED FOR:

STATE OF MONTANA
NATURAL RESOURCE DAMAGE PROGRAM

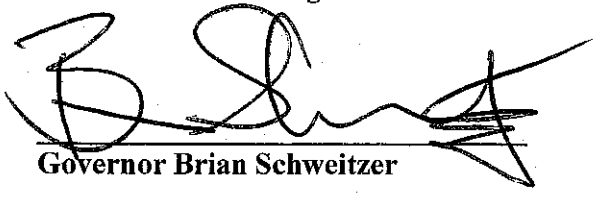
1301 EAST LOCKEY
P.O. BOX 201425
HELENA, MT 59620-1425

BY

THE CITY AND COUNTY OF BUTTE-SILVER BOW

OCTOBER 2012

I hereby approve of this final document, along with the associated final response to comments on the August 2012 draft version of this document:



Governor Brian Schweitzer

10 - 19 - 2012

Date

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Groundwater Restoration Plan

for the

Butte Silver Bow Domestic Water System

Prepared for

Montana Department of Justice
Natural Resource Damage Program
Groundwater Restoration Program

Prepared by
The City and County of Butte-Silver Bow

Final Version
October 4th, 2012

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1.0 Introduction

It has long been recognized that the deposition of wastes in the city of Butte from mining and mineral-processing operations has resulted in injury to groundwater resources and the surface water of Silver Bow Creek. Injury to groundwater has been demonstrated by the occurrence of concentrations of heavy metals (including cadmium, zinc, iron, lead, copper, arsenic, mercury and sulfate) that exceed drinking water standards in the alluvial aquifer.

In turn, surface water and streambed contamination to Silver Bow Creek has resulted from the discharge of contaminated surface runoff. In the past, surface runoff from storms and snowmelt carried hazardous substances from hundreds of dispersed waste source sites to Silver Bow Creek through surface drainages and the Butte storm water collection system.

The loss of this groundwater and surface water source has required the citizens of Butte to assume responsibility for a vast and extensive water supply, treatment and distribution system that relies upon raw water supplies considerable distance from the customer base. Moreover, the infrastructure for this system was put in place nearly a century ago and is in dire need of replacement and upgrades.

For over a century, the Butte water supply systems were owned and managed by private corporations whose primary objective was to supply water to the burgeoning mining industry. Drinking water supply and safety was a secondary concern. In the early 1990's, the water supply and distribution systems came under public ownership as part of the Consolidated City and County of Butte-Silver. Immediate improvements were completed in the mid 1990's to mitigate the "boil" order and associated health problems that were being experienced by the citizens of Butte. These improvements were applied in much the manner of a triage unit and were very limited in nature consisting of two minimal treatment plants, (Big Hole and Moulton) and two new storage tanks (Colorado Hill and West Side). Unfortunately, the cash settlement in acquiring the system fell far short of making the necessary improvements and upgrades to this century old system. This was further compounded by the fact that the original owners and operators were severely remiss in preventative maintenance and capital replacement.

Over the past two decades, Butte Silver Bow Water Utilities Division (BSB) has been responsible to operate the water system as an enterprise account and capital improvements have been limited to those funded through external sources, most notably, the Montana State Department of Justice Natural Resource Damage Program (NRDP) and from capital reserves supported by the rate payers. *To date, approximately $35.5 million has been invested by NRDP and $44.5 million by rate payers with current estimates totaling over $125 million of capital investment yet remaining to restore this water system.*

The Butte water system is a very complex water system given the pumping from very remote distances, blending of water supplies, challenging source water quality, and deteriorating infrastructure dating back to early mining days. BSB's domestic water system is comprised of the surface water resources of the Big Hole River (including South Fork Reservoir), Basin Creek and Moulton Watersheds. Surface water treatment plants provide treatment for the

Moulton and Big Hole supplies, while Basin Creek has historically operated under a filtration waiver with only chlorine disinfection. These sources are pumped and flow by gravity for great distances to storage tanks located at various locations within Butte. From these storage tanks, distribution systems, consisting of nine different pressure zones controlled by pumps and pressure reducing valves, provide domestic water supply and fire protection to approximately 12,800 residential and commercial customers. In addition to these inherent challenges, new Federal Safe Drinking Water Act regulations continue to ramp into effect and are now immediately impacting the compliance status of the Butte Water System.

In 2008, BSB completed a Water Master Plan that identified many of the deficiencies and critical elements that needed replaced. Since completion of the 2008 Water Master Plan, the Stage 2 Disinfection Byproduct Rule (Stage 2 DBPR) has come into effect for the Butte water system. In October of 2010, the Montana Department of Environmental Quality (DEQ) revoked the filtration waiver on the Basin Creek Reservoir. Additionally, DEQ reclassified the Big Hole Water Treatment Plant from a "direct" to "conventional" water treatment plant in 2010 requiring even more stringent treatment requirements.

Revocation of the filtration waiver for Basin Creek Reservoir means, in short, the community of Butte must build a new treatment plant for this source water. Reclassification of the Big Hole Water Treatment Plant to a "conventional" facility mandates more stringent treatment at this facility, thereby, requiring major modifications to the facility to meet the additional treatment objectives. BSB maintains compliance with the Stage 2 DBPR requirements within its Big Hole and Moulton Treatment plants, albeit, at the sacrifice of plant capacities. Both plants suffer over 50% reduction in treatment capacity due to the ever increasing presence of Total Organic Carbon (TOC) in raw water sources. Removal of TOC's is a requirement for DBPR control and is accomplished through enhanced coagulation. This is turn results in less treatment capacity due to the formation of sludge containing the TOC's that must be removed from the treated water stream. Without proper technology and equipment, this sludge formation fouls or plugs the existing treatment processes and reduces their production capacity significantly.

Over the past three years, considerable study has been given to these problems resulting in a 2012 Amendment to the 2008 Water Master Plan. Through this effort, Butte-Silver Bow County has charted a course for the future for their domestic water system. This new path of direction has been documented in a 2012 amendment to the 2008 Water Master Plan and is the genesis of BSB's Groundwater Restoration Program.

This plan requires significant capital investment. It cannot be achieved through traditional rate payer financing as the revenue generated through the provision of water service is barely adequate to provide for the operation of the system and cannot finance the capital replacement investment. As a result, BSB is pursuing funds beyond those collected directly from the users to make up for deep deficits between available funds and the cost of replacement of the existing aging infrastructure. BSB's Groundwater Restoration Plan requests the entire balance of Butte's share of the NRD Groundwater Restoration Program, approximately $30.1 million, and will address the continued repair and replacement of existing treatment, transmission, storage, and distribution system components.

2.0 BSB's Groundwater Restoration Plan

The sum total of costs required to complete the required improvements to the BSB Domestic Water System is estimated at $125 million as documented in the 2012 Water Master Plan Update. These improvements include water treatment, transmission, storage and distribution infrastructure upgrades. It is understood and recognized that BSB's limit of the current NRD Groundwater Restoration Program is estimated at approximately $30.1 million. As can be determined, the remaining financial needs are well in excess of this amount. It is the intent of this Groundwater Restoration Plan to demonstrate BSB's critical need for their entire amount of the Groundwater Restoration Program immediately and BSB recognizes that additional funding will need to be sought from local, state and federal programs and through other grant applications, loans, bonding and rate increases for the additional $90 to $100 million needed to address the critical needs of BSB's water system.

For this Groundwater Restoration Plan, BSB has selected nine components from the 2012 Master Plan for replacement or repair based upon their criticality. These nine components listed in this Groundwater Restoration Plan have been identified as priorities within the 2012 Amendment to the Water Master Plan. Each of the components are unique and can proceed without delay into construction. Moreover, should additional funding be availed in the future, all the projects contemplated within this grant application are complimentary and requirements of the overall plan and are/will not be sacrificed when other improvements are made to the system in future years. A summary of the nine components is provided in Table One.

It is imperative to understand that these improvements do not provide for an adequate water supply to satisfy current peak demand or to provide for any future growth potential. These components are simply to replace existing infrastructure to a level sufficient to meet current demands and severe water restrictions will be required during the irrigation season to ensure adequate fire flow and pressure are available during peak demand times.

Table One: Groundwater Restoration Plan Components
Summary of Financial Request from Groundwater Restoration Program

#	Item	2012 Master Plan Item #	$$$ (Millions)
1	Big Hole WTP Improvements for TOC Removal	2	9.00
2	Big Hole Finished Water Transmission Main I-15 to Rocker Tank	23	7.20
3	Moulton WTP Solids Handling	37	0.20
4	South Butte Water Supply to include water storage tank, pumps, transmission mains, Pressure Reducing Valve and Vault and associated improvements to supply treated water	4, 5, 12, 6, 41, 8, & 15	13.70
	Totals		**30.10**

As noted, this Groundwater Restoration Plan does not result in achieving BSB's need for 20 million gallons per day of treated water capacity simply because there is not sufficient funding available. Moreover, this Groundwater Restoration Plan does not address any distribution replacement or meter installation. Since the late 1990's BSB has pursued and aggressive program of replacing aged and leaking water distribution lines on the "Hill" (above Front Street). This effort has been very successful in reducing water consumption and improving service to Uptown Butte. However, little or no replacement has been accomplished on the "Flats". The amount of distribution pipe replacement remaining on the "Flats" is considerable. Approximately 130 miles of distribution pipeline exists in the area known as the "Flats". The majority of this pipeline is from 50 to 80 years in age and nearly 90 miles of the 130 total miles is 6 inch or smaller in diameter and has extensive leak history.

Given a conservative approach of just replacing those lines which are 6-inch and smaller results in over 88 miles of pipeline replacement. This is a significant undertaking and will require major financial obligations. Given the quantity of mains in need of renewal, the needed replacements will be an ongoing process for many years with the pace of replacement tied directly to the level of funding resources allocated to this purpose. Possible sources of funding for this replacement program include the issuance of additional bonds upon the anticipated payoff of current Butte Water System debt. This debt payoff will free up substantial bonding capacity of the water system and enable additional borrowing while minimizing the potential necessary rate increase for annual loan payments for the same. The level of borrowing and associated user rates will be a function of how aggressive the replacement program proceeds. Based on BSB's experience over the past decade, distribution pipeline replacement in urban areas costs approximately $1 million per mile of pipeline replaced. Considering the amount of old pipe in the ground in need of replacement, this could take several decades to replace the entire system in need of rehabilitation. Completion of the work in larger pieces and a shorter overall time frame increases the financial resources needed.

Lastly, a new Basin Creek Water Treatment Plant is required to be designed and constructed. Improvements are needed to the West Side Transmission Main and associated pump stations to be able to convey water from the Colorado Hill Tank to the West Side and High Service Tanks and pressure zones. The two Basin Creek dams are considered high hazard dams by the Montana Department of Natural Resources and Conservation and have significant deficiencies and safety concerns that must be addressed. Considerable work yet remains on the distribution system replacement on "the Hill" and additional storage and transmission mains are needed in the South Butte area. The 2012 Amendment to the Master Plan summarizes these needs and the financial requirements that exceed $125 million.

With this grant in the amount of $30.1 million, a funding shortfall between **$90 to 100 million** remains for the Butte Domestic Water System over the next 10 to 20 years as noted in the 2012 Amendment. BSB will continue to aggressively pursue all avenues for funding including additional NRD Grants, other grant programs, and rate payer financed loans.

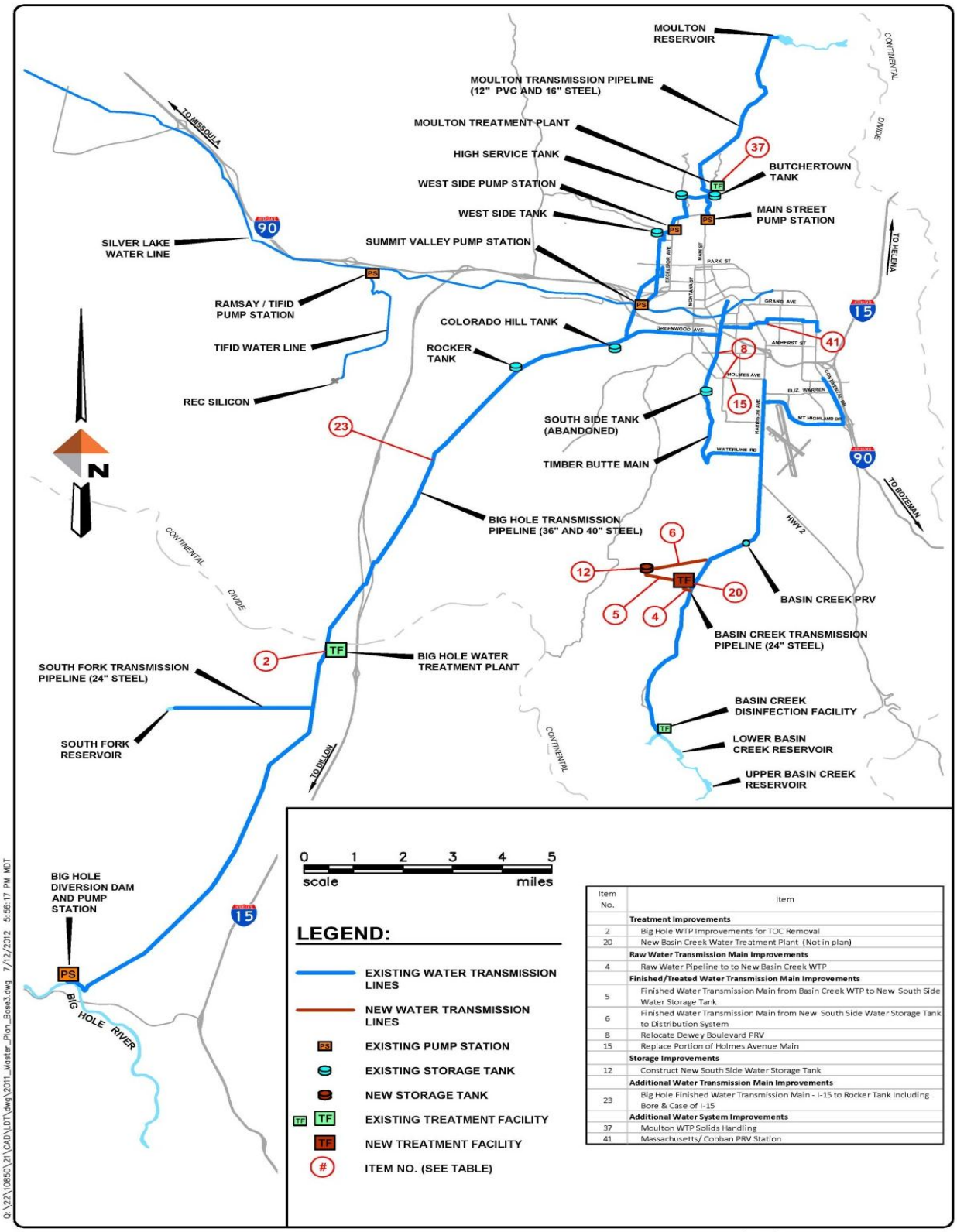
Table 1 and the following Figure 1 provide for an overview and summary of BSB's Groundwater Restoration Plan and the components that are anticipated to be repaired, replaced or rehabilitated. In Figure 1, various capital improvements are noted in red text and line work, whilst the existing infrastructure is shown in blue line work. Various items are identified by numbers that correspond to a brief description in the legend. The item numbers are not consecutive due to alternative selection as documented in the 2012 Butte Water Master Plan Update. It bears noting that BSB has aggressively pursued the plans outlined and has already taken significant steps towards getting this work underway. Most notably, BSB has:

1) Raised their water rates in the Fall of 2011 by 10% with intentions of continuing with a 10% per year increase for the next four years with a total rate increase planned of 50%.

2) Entered into a State Revolving Fund contract in the fall of 2011 to secure approximately $4.8 million dollars in loan funding to complete the study, evaluation, engineering, design and permitting services required to begin advertising for construction contracts as soon as NRD Groundwater Funding is availed.

3) Completed jar testing, pilot testing and technology selection and validation for treatment of Total Organic Carbon (TOC) compounds in its raw water supplies.

4) Completed an amendment to the 2008 Water Master Plan to reflect the proposed adaptation of the Butte Water System and to address the rapidly declining water quality issues surrounding the Basin Creek, Moulton and Big Hole Systems.



Item No.	Item
	Treatment Improvements
2	Big Hole WTP Improvements for TOC Removal
20	New Basin Creek Water Treatment Plant (Not in plan)
	Raw Water Transmission Main Improvements
4	Raw Water Pipeline to to New Basin Creek WTP
	Finished/Treated Water Transmission Main Improvements
5	Finished Water Transmission Main from Basin Creek WTP to New South Side Water Storage Tank
6	Finished Water Transmission Main from New South Side Water Storage Tank to Distribution System
8	Relocate Dewey Boulevard PRV
15	Replace Portion of Holmes Avenue Main
	Storage Improvements
12	Construct New South Side Water Storage Tank
	Additional Water Transmission Main Improvements
23	Big Hole Finished Water Transmission Main - I-15 to Rocker Tank Including Bore & Case of I-15
	Additional Water System Improvements
37	Moulton WTP Solids Handling
41	Massachusetts/ Cobban PRV Station

BUTTE - SILVER BOW
GROUNDWATER RESTORATION PLAN

NATURAL RESOURCE DAMAGE PROGRAM

FIGURE 1

DOWL HKM

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2.1 Component Description

The following sub-articles provide a description of the type and locations of each of the nine components to be implemented within the overall framework of the BSB Groundwater Restoration Plan.

2.1.1 Big Hole WTP Improvements for TOC Removal

This component is for the construction of a new building addition at the BHWTP that would house new flocculation and sedimentation equipment and new chemical mixing capabilities for the express purpose of removing Total Organic Carbon (TOC) from the raw water source. Additionally, new solids handling equipment would be added to prevent the additional sedimentation process sludge from overloading the existing lagoons at the site. This additional treatment technology at the BHWTP is necessary to achieve Total Organic Carbon removal, improve the filtration capacity through replacement of filter media and upgrades to the pumping system to be able to receive and treat the full water right capacity of the Big Hole River of 13.8 MGD, and the intermittent additional flow from the South Fork Reservoir such that the throughput capacity of the Big Hole Water Treatment plant will be 16 million gallons per day pending source water supply availability.

This component includes the surveying, mapping, design and creation of plan and profile sheets, details and material specifications required for public bidding and construction of the new building addition, installation of the flocculation and sedimentation equipment and the sludge handling equipment. Additionally, this scope includes acquiring appropriate approvals of the plans and specifications resulting in a final set of bid documents. BSB would then advertise for public bids for the procurement and construction of all the improvements by a contractor.

2.1.2 Big Hole Finished Water Transmission Main I-15 to Rocker Tank

Beginning in 2007, BSB embarked on an annual pipe replacement program for the raw and finished water transmission main from the Big Hole River near Divide to the Big Hole Water Treatment plant near Feely and from the WTP to the Colorado Hill Tank. This pipeline is the major artery for the Butte water system. Approximately 40,000 feet remains to be replaced, beginning approximately 2 miles north of the Big Hole Water Treatment Plant, near the confluence of the existing alignment and I-15 and continuing east to the Rocker Water Storage Tank.

This component includes the surveying, mapping, design and creation of plan and profile sheets, details and material specifications required for construction of the remaining 40,000 feet of transmission main. Additionally, this scope includes acquiring appropriate approvals of the plans and specifications resulting in a final set of bid documents. BSB would then advertise for public bids for the procurement of the pipeline materials and installation of the pipeline would be accomplished by BSB crews.

2.1.3 Moulton WTP Solids Handling

Minor modifications are needed to the Moulton Water Treatment Plant's solids handling equipment to enable continued use of this facility as a treated water supply. The improvements include installation of a screw press for the plate settler sludge and conveying the press effluent to the recirculation basin for recycle to the raw water influent. This upgrade to the solids handling capability of the water treatment plant is needed to manage the increased solids production expected from the switch to alum as the primary coagulant to reduce the Total Organic Carbon concentrations experienced in the raw water.

This new equipment installation at the Moulton Water Treatment Plant will include sludge dewatering and handling facilities to be able to accommodate Total Organic Carbon removal from the Moulton raw water supply and achieve a throughput capacity at this plant of approximately 1 to 1.5 million gallons per day pending source water supply availability.

This component includes the surveying, mapping, design and creation of plan and profile sheets, details and material specifications required for public bidding and installation of the screw press system. Additionally, this scope includes acquiring DEQ approval of the plans and specifications resulting in a final set of bid documents. BSB would then advertise for public bids for the procurement and construction of all the improvements by a contractor.

The following elements 2.1.4 through 2.1.9 are collectively known as the South Butte Water Supply when referenced as a series of improvements required to enable conveyance, storage and distribution of treated water supplies to the South Side Pressure Zone which has been historically served by the Basin Creek Supply. Herein, is a more detailed description of the various subcomponents of the overall South Butte Water Supply Improvements.

2.1.4 Water Transmission Main for South Side Pressure Zone

To enable the conveyance and storage of treated water supplies from the Colorado Hill Tank to the South Side Pressure Zone in the near term and to support a future Basin Creek Water Treatment plant, water transmission main is required to connect existing transmission mains to a proposed water storage tank located in South Butte. This new tank and pump station is needed to provide adequate pressure and storage volume for consumption and fire protection. This component is the transmission supply line to the proposed new storage tank (Item 2.1.5).

This component includes the surveying, mapping, design and creation of plan and profile sheets, details and material specifications required for construction of approximately 1,000 feet of transmission main. Additionally, this scope includes acquiring appropriate approvals of the plans and specifications resulting in a final set of bid documents. BSB would then advertise for public bids for the procurement of the pipeline materials and installation of the pipeline would be accomplished by BSB crews.

2.1.5 South Side Water Storage Tank and Pump Station

A new water storage tank and pump station is required in South Butte to provide the required pressure for fire protection and domestic consumption. The tank volume needs to satisfy the DEQ requirement for storage equivalent to average (summertime) day plus an allowance for fire suppression. Three separate building complexes in south Butte have fire demands of 6,000 – 6,500 gpm according to the Insurance Services Office (ISO). According the Uniform Fire Code, these fire flows require a minimum duration of 4 hours. This equates to a fire storage of approximately 1.6 MG (6,500 gpm x 4 hrs x 60 min./hr = 1.6 MG). The required tank volume is then 4.8 MG (average summertime day) plus 1.6 MG fire suppression equal to 6.4 MG storage. In addition, a pumping station will be required to convey water to this new storage tank from the future Basin Creek Water Treatment Plant.

This component includes the surveying, mapping, design, details and material specifications required for public bidding and construction of the new water storage tank. Additionally, this scope includes acquiring DEQ approval of the plans and specifications resulting in a final set of bid documents. BSB would then advertise for public bids for the procurement and construction of all the improvements by a contractor.

2.1.6 Water Transmission Main from South Side Water Storage Tank to Distribution System

The water stored in the proposed South Side Water Storage Tank (Item 2.1.5) needs to be conveyed and connected back to the Basin Creek Transmission Main. The connection to the Basin Creek Transmission Main will occur at an isolated connection to the existing Basin Creek Transmission Line upstream of the existing Basin Creek Pressure Reducing Valve to regulate pressure and flow into the South Butte Pressure Zone. This new section of finished water transmission main will be connected at the boundaries of the new storage tank and extend to the existing transmission main.

This component includes the surveying, mapping, design and creation of plan and profile sheets, details and material specifications required for construction of the estimated 5,000 feet of transmission main. Additionally, this scope includes acquiring appropriate approvals of the plans and specifications resulting in a final set of bid documents. BSB would then advertise for public bids for the procurement of the pipeline materials and installation of the pipeline would be accomplished by BSB crews.

2.1.7 New Massachusetts/Cobban Pressure Reducing Valve and Vault

This component is for the replacement of the manual isolation valve located at the intersection of Massachusetts and Cobban Streets. This manual valve allows water to flow from the 24-inch on Cobban Street into the 20-inch on Massachusetts and Harrison Avenue, however it is a manual valve and can only be periodically adjusted. A new flow controlled pressure reducing/sustaining valve is needed to be able to better regulate water into the South Side Pressure Zone to improve water pressure and flow patterns in the South Side Pressure Zone.

This component includes the PRV vault and valve installation at this intersection and approximately 50 feet of 16-inch water line to connect from the respective transmission mains to the automated flow controlled Pressure Reducing/Sustaining Valve and Vault. This subtask will consist of designing, seeking appropriate permits and authorizations and advertising for public bids for the procurement and construction by a contractor.

2.1.8 Relocate Dewey Blvd Pressure Reducing Valve and Vault to Holmes Avenue

The existing Dewey Boulevard PRV station is planned to be relocated to Holmes Avenue. Since initial installation of the Dewey PRV in 1993, changes to the water demand patterns in south Butte have resulted in lost effectiveness of the PRV to supplement flows in the South Side pressure zone from the Colorado Hill pressure zone. Construction of the 20-inch main from Harrison Avenue along Mount Highland Drive over to Continental Drive in the mid 1990's as a result of increased demands in the Country Club and Continental Drive neighborhoods has resulted in more demand on the Dewey Boulevard PRV. However, the ability of the Dewey PRV to convey water to the South Side pressure zone is limited by the roughly 5,000 feet of 12-inch main between the PRV and the primary South Side transmission main on Harrison Avenue. Relocating the PRV to Holmes Avenue, to take advantage of the new 24-inch diameter main on Holmes Avenue to Harrison Avenue, provides significant pressure improvements during peak system demands. This subtask includes the PRV vault and valves installation on Holmes Avenue and approximately 500 feet of 20-inch water line to connect to Timber Butte Main.

This component will consist of designing, seeking appropriate permits and authorizations and advertising for public bids for the procurement and construction by a contractor.

2.1.9 Replace section of Holmes Avenue for new PRV Vault

The existing 4,200 feet of 20-inch pipeline that is located in Holmes Avenue is very old Calamine pipeline that has a significant leak history with over 20 leaks in the past three years. This line will provide critical service as it will be one of two major conveyance lines to distribute water from the Colorado Hill supply into the South Side Pressure Zone through a pressure reducing valve. This subtask includes replacement of a portion of this 20-inch pipeline with a new 24-inch pipeline to accommodate the relocation of the PRV vault from Dewey Boulevard.

This subtask will consist of designing, seeking appropriate permits and authorizations and advertising for public bids for the procurement of the required pipelines, valves and appurtenances. BSB crews will complete the installation of this portion of pipeline.

2.2 Component Benefits

2.2.1 Big Hole WTP Improvements for TOC Removal

Based upon the extensive water quality and pilot plant testing of options for TOC removal and reduction of disinfection byproducts formation, the preferred alternative for improvements to the Big Hole Water Treatment Plant include continued utilization of the existing facility along with expansion of the pretreatment facilities to allow for "enhanced coagulation". Through this approach, the Big Hole Plant Improvements would consist of a stand-alone new flocculation/sedimentation and solids handling facility located in a separate and new building just to the south of the existing plant and would result in the plant capacity of 16 MGD at raw water quality TOC values up to 15 mg/liter. It should be noted that the "Pilot Plant Report" focuses on a 20 MGD capacity plant, however the pretreatment technology identified as the preferred alternative would work equally well with a 16 MGD. The improvements would also include installing variable frequency drives on the high service pumps to improve electrical consumption efficiency and replacing the filter media in the four existing filter beds.

2.2.2 Big Hole Finished Water Transmission Main I-15 to Rocker Tank

The Big Hole Transmission Main will always represent a critical link in the infrastructure required to deliver water to the Butte Water System. Therefore, the continued replacement of the remaining sections of this old transmission main must continue. The sense of priority comes from the leak history and critical nature of this transmission main. Should a catastrophic failure occur, forcing the pipeline to be out of service for extended period, Butte would have serious problems satisfying the demands of the system.

2.2.3 Moulton WTP Solids Handling

The Moulton WTP is similarly struggling, like the Big Hole WTP, to treat their respective raw water sources that are high in TOC and resulting in violations of the Stage 2 DBPR. Further, the overall reliable yield of this water supply is estimated at an average of approximately 100 million gallons per year or 0.274 MGD. Therefore, the cost per thousand gallons of treated water from this facility is very high compared to the Big Hole River Water Supply.

In two separate reports, several alternatives were considered for future use of this Moulton Water Supply System. The report titled "*Water Supply Alternatives Analysis Report – Summit Valley Pump Station and West Side Transmission Main vs Moulton Water Supply"; (i.e. "West Side Transmission Main Report");* March of 2011, provided a life cycle cost comparison of perpetuating use of the Moulton Water Supply versus replacing the water supply with water pumped from the Big Hole Water Supply System. The net result was the determination of the very high cost per thousand gallons of treated water from Moulton versus from the other treated water source, and the results supported eventual abandonment of the Moulton Supply as part of the overall treated water supply to the Butte Water System.

However, the most pressing need for water from the Moulton Water Supply System is during the peak water demand months. As an alternative to complete abandonment of this facility, an interim option of utilizing this facility as a "peaking plant" during the peak summer demand months became apparent. Therefore, in an additional, separate report, the implications of utilizing this facility during the peak months were developed. Given the peak demand periods last approximately four months, the reliable yield of the watershed of 100 MGY was spread over approximately 120 days resulting in an average daily supply of approximately 830,000 gpd and a design peak day of 1.5 MGD to supplement the Big Hole River Supply during the peak demands.

Therefore, the options of completing "interim improvements" to this facility to assist with the enhanced coagulation treatment and resulting additional solids management were developed in the report *"Moulton WTP Sedimentation Sludge and Filter Backwash Evaluation Report"*; (i.e. "Moulton Sludge and Backwash Report"); November 2011. The options for management of the backwash water, sedimentation tank solids discharge, recycle flows, and solids dewatering were considered in this report.

2.2.4 through 2.2.9 South Butte Water Supply

This is comprised of a series of components as noted below that all are related beneficially to providing water to the South Side Pressure Zone.

2.2.4 Water Transmission Main for South Side Pressure Zone

2.2.5 New South Side Water Storage Tank and Pump Station

2.2.6 Water Transmission Main from South Side Water Storage Tank to Distribution System

2.2.7 New Massachusetts/Cobban Pressure Reducing Valve and Vault

2.2.8 Relocate Dewey Blvd Pressure Reducing Valve and Vault to Holmes Avenue

2.2.9 Replace section of Holmes Avenue for new PRV Vault

As noted, the DEQ has revoked the filtration waiver for the Basin Creek Water Supply, meaning BSB must treat this water supply to meet surface water treatment standards or cease use of this supply by February 18, 2012 for potable water purposes. In consideration of major improvements required at the Big Hole Water Treatment plant to address the Stage 2 DBPR, major capital improvement requirements to the water transmission systems, and reassessment of the projected water system demands, the options for supply of treated water to South Butte were further considered.

The options evaluated in detail for supply of treated water to South Butte included the following:

- **Construct New Water Treatment Plant to Treat Basin Creek Reservoir Water**
- **Convey Silver Lake Water to the Big Hole WTP & Expand the Big Hole WTP**
- **Construct New Silver Lake WTP Near REC Silicon West of Butte**

In addition to these alternatives, the possibility of delivering raw water from Basin Creek to the Big Hole WTP or construction of a new 20 MGD water treatment plant at Colorado Hill were also considered at a cursory level. These alternatives for pumping Basin Creek water to the Big Hole WTP would include either construction of a pump station below Basin Creek Dam to pump water over the hill to the Big Hole WTP or a gravity pipeline beginning at a new diversion structure on Fish Creek well above the upper Basin Creek Reservoir. The Colorado Hill WTP option would include pumping water from Basin Creek to a new water treatment plant at Colorado Hill where Big Hole River raw water would also be treated, and the Big Hole WTP would be abandoned. The technical feasibility, permitting challenges, and enormous cost of these options resulted in no further evaluation of these options at this time.

BSB has selected the option of constructing a new water treatment plant to treat Basin Creek Raw Water supplies. However, BSB's current financial ability does not allow for the construction of this treatment plant until the current revenue bonds are paid off and can be replaced with new bonds in 2015 that would generate funding amounts sufficient to construct this new plant estimated at $17 million. In order to continue to provide water to the South Butte Pressure Zone, BSB plans to construct a new water storage tank (South Side Water Storage Tank – Item 2.2.5) that would be supplied by water from the Colorado Hill Storage tank via the Big Hole supply. This new tank and associate pump station are necessary to provide the required pressure for fire protection and domestic consumption in the South Side Pressure Zone (the "Flats"). The tank volume needs to satisfy the DEQ requirement for storage equivalent to average (summertime) day plus an allowance for fire suppression. This tank would be supplied by water from the Colorado Hill Tank via existing and new transmission mains (Item 2.2.4 and Item 2.2.6) and would allow for water service supply and pressure to be provided, albeit, at reduced volumes and pressure during high demand periods for the interim period until such time as a Basin Creek Water Treatment Plant could be financed and constructed. The water transmission mains, pump station and the new storage tank would also remain required elements to support a new water treatment plant in the future.

This series of components also includes the improvements to the Massachusetts/Cobban isolation valve including replacing the manual valve with an automated pressure reducing valve and vault, and relocating the pressure reducing value in Dewey Boulevard to Holmes Avenue and associated pipeline replacement to improve the flow and pressure supplies within the South Butte Pressure Zone. These improvements are required as a result of the change in hydraulic gradelines, flow capacities and demands that will occur with the new Basin Creek WTP and associated South Butte Water Storage Reservoir.

2.3 Component Costs

BSB has developed a priority listing of components, estimated total project costs and timelines for completion as noted throughout this grant application. It is our full intention to proceed as stated, however BSB reserves the right to amend or modify certain portions of these projects as necessary should circumstances arise including emergency failures of systems prior to their scheduled replacement, budgetary constraints due to volatile construction pricing or changes in regulations or project requirements. BSB will endeavor to communicate fully with the NRD through systematic project reviews and progress reporting as well as note any modifications or alterations in the plan as outlined.

The Budget Summary Form and the Budget Detail form are provided below. In summary, the total cost for the Improvements to the Butte-Silver Bow Domestic Water System is for the entire balance of BSB's share of the Groundwater Restoration Program estimated at $30.1 million.

BSB Groundwater Restoration Plan		Budget Summary Form				
		UCFRB Groundwater Restoration	Matching Funds			Total
Expense Category			Cash	In-Kind	Subtotal	
1	Salaries and Wages					
2	Fringe Benefits					
3	Contracted Services	$30,100,000	$4,800,000 (1)	$0	$4,800,000	$34,900,000
4	Supplies and Materials					
5	Communications					
6	Travel					
7	Rent and Utilities					
8	Equipment					
9	Miscellaneous					
10	Other					
Total		$30,100,000	$4,800,000	$0	$4,800,000	$34,900,000

(1) This cash match provided by BSB comprises the State Revolving Fund Loan that has been secured as described in Section 2.0 Paragraph 2) on page 5

(2) Moreover, BSB Public Water Division will construct the following various components (2, 4, 6, and 9) as noted in Section 2.1.

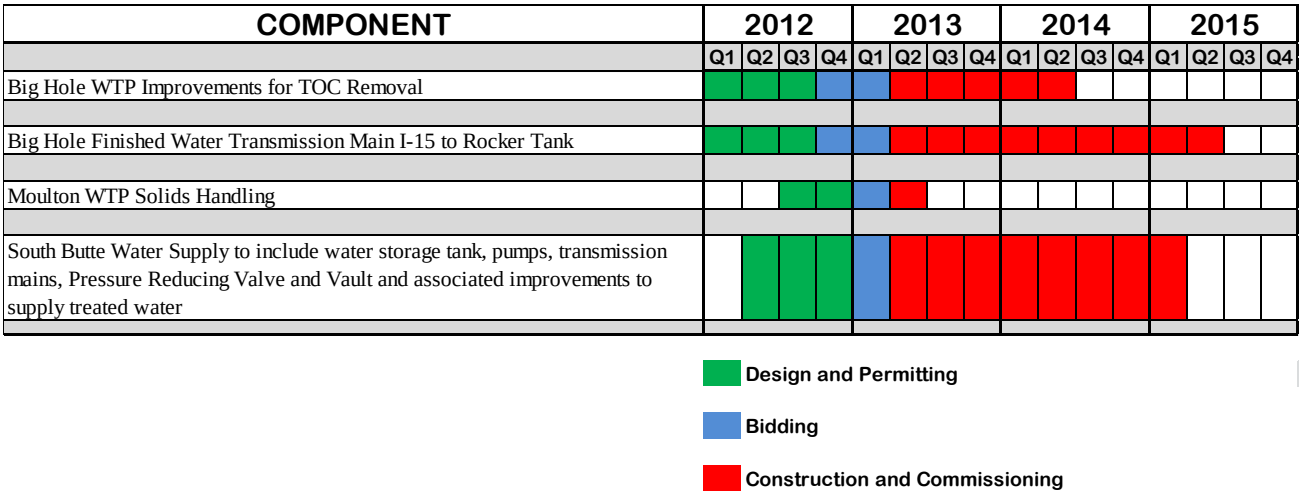
Salaries, Wages and Fringe Benefits: The BSB Groundwater Restoration Plan will not have a cost component for BSB salaries, wages or fringe benefits.

Contracted Services: The BSB Groundwater Restoration Plan requires two major components for contracted services. One component of contracted services is for the engineering design and construction oversight for the various elements. The second component of the project is for the contracted services for the actual construction of the various elements.

Supplies, Materials, Communications, Travel, Rent, Utilities, Equipment and Miscellaneous: The BSB Groundwater Restoration Plan will not have a cost component for any of the listed chart of accounts.

2.4 Component Timeline

BSB anticipates completing the various components as outlined in the project schedule below:



2.5 Component Monitoring

Monitoring activities that are specific to each component include oversight of the design phase services, construction phase, and project completion and commissioning. In each of the components, Butte Silver Bow Utility Division personnel will oversee and provide input to the consulting engineering firm. The consulting engineer performs the professional design services including structural, mechanical, civil and site, electrical and process controls required to develop a final set of design documents, specifications, drawings, and details for component. The consulting engineer will also prepare design reports and draft operations and maintenance manuals for review and approval by BSB prior to submitting to MDEQ for approval. These plan sheets and specifications are used for the bidding process and during actual construction. The Water Division personnel will work with the consulting engineer during this process and review the designs once complete. The consulting engineer then submits the designs to the appropriate local, state and federal agencies for approval and or authorization to proceed.

Once the project components have been designed, accepted by Butte-Silver and approved and/or authorized by the respective agencies, the consulting engineer will prepare a bid package that contains plans, specifications, general conditions, and a contract. The project is advertised in the legal notices of the newspaper and sealed bids are received and publically opened for review by the Council of Commissioners. The Public Works Department personnel, in conjunction with the consulting engineer, reviews all bids submitted. The Department prepares a recommendation for award of a contract for construction and presents this recommendation to the Council of Commissioners. The Council awards the project and a contract is executed between the general contractor and Butte-Silver Bow.

During the construction phase, the Public Works Department personnel and the Consulting Engineer oversee the contractor throughout the construction phase of the project. The oversight is intended to assure that the contractor builds the project in conformance with the approved plans and specifications. The consulting engineer will review all pay requests submitted by the Contractor for completeness and accuracy. The consulting engineer will make recommendations to the Public Works Department regarding the pay estimates.

Once the project is constructed, the Consulting Engineer will assemble all contractor furnished submittals, operations and maintenance manuals and provide BSB with a complete set of operations and maintenance manuals, list of recommended spare parts and operating and maintenance schedules and incorporates this information into final record drawings that document the work completed during the construction

Consistent with the provisions of the 2012 Final UCFRB Restoration Process Plan, BSB will provide for NRDP review of design documents for consistency with the scope of work and budget for projects covered by, and any changes or amendments to, an approved Groundwater Restoration Plan.

2.6 Component Analysis

Butte is at significant cross roads in determining the future of their water systems. Various options exist as a path forward, however each requires significant amounts of capital to invest in new infrastructure. System reliability, capacity and quality of the finished product are tantamount in any option development and evaluation. Studies have shown that Butte will require the ability to treat and deliver 20 million gallons per day during peak months that usually occur in June through August.

As noted, considerable study and evaluation has been given to this problem since 2008. As a result, an all-encompassing view was taken of the entire Butte water system, its assets, its current condition and capabilities and its future demands and requirements. A plan has slowly evolved over the study period that provides the following benefits:

1. Provide for a raw water supply for domestic use of 20 MGD.

2. Provide for a treated capacity of 20 MGD.

3. Provide adequate fire protection and satisfy peak flow and pressure demands.

4. For the first time ever, ensure that all rate payers serviced by the Butte Water System are provided treated and disinfected drinking water.

BSB contracted with DOWL HKM to prepare an amendment to the 2008 Water Master Plan in 2011. The 2012 Amendment to the Master Plan included the following components:

a) Chapter I – Executive Summary
b) Chapter IV – Alternatives Evaluation
c) Chapter V – Selection and Description of Preferred Alternatives
d) Chapter VI – Project Implementation
e) Appendices A through F

All of the reports are contained within the overall Water Master Plan – 2012 Update approved and adopted by the Butte Silver Bow Chief Executive and Council of Commissioners on April 4th, 2012. The documents are all available electronically at a FTP site hosted by DOWL HKM and are available by accessing the FTP site as follows:

FTP Site Address: ftp://BSBWaterUser:Wat3rUs3r@ftpa.dowlhkm.com
User Name: BSBWaterUser
User Password: Wat3rUs3r

The following Table Two provides for a summary review of how the nine individual components outlined in this Groundwater Restoration Plan compare with the prioritization of improvements as listed in the Water Master Plan – 2012 Update.

Table Two: Comparison of Water Master Plan – 2012 Update and Groundwater Restoration Plan Components

Priority 1 Improvements and Components Identified in 2012 Master Plan Update	2012 Master Plan #	Included in Groundwater Grant Application	Comments and Explanations
1A – South Butte Filtered Water Supply			
Timber Butte and Holmes Avenue Main Replacement	15	Partial Request	Identified as a Priority 1 Improvement in Master Plan, however only portion of Holmes Avenue included in Grant Application due to Budget Constraints
New South Butte Water Storage Tank and Pump Station	12	Yes	Identified as a Priority 1 Improvement in Master Plan and Included in Grant Application
New Foothills Booster Station	19	No	Not included in Grant Application Due to Budget Constraints.
New South Butte Transmission Main	6	No	Not included in Grant Application Due to Budget Constraints.
Relocate Dewey Blvd Pressure Reducing Valve and Vault	8	Yes	Identified as a Priority 1 Improvement in Master Plan and Included in Grant Application
Colorado Hill Tank Yard Piping Improvements	7	No	Not included in Grant Application Due to Budget Constraints.
1B - Big Hole Water Treatment Plant Improvements	2	Yes	Identified as a Priority 1 Improvement in Master Plan and Included in Grant Application
1C – Basin Creek Water Treatment Plant Improvements			
Basin Creek Water Treatment Plant (BCWTP)	20	No	Not included in Grant Application Due to Budget Constraints.
Basin Creek Raw Water Transmission Main to BCWTP	4	Yes	Identified as a Priority 1 Improvement in Master Plan and Included in Grant Application
Finished Water Main from BCWTP to South Butte Water Tank	5	Yes	Identified as a Priority 1 Improvement in Master Plan and Included in Grant Application
Finished Water Main from South Butte Water Tank to Distribution System	6	Yes	Identified as a Priority 1 Improvement in Master Plan and Included in Grant Application
1D - Big Hole Transmission Main Replacement			
Big Hole Raw Water Transmission Main River to Top of the Hill	36	No	Not included in Grant Application Due to Budget Constraints.
Big Hole Finished Water Transmission Main I-15 to Rocker Tank	23	Yes	Identified as a Priority 1 Improvement in Master Plan and Included in Grant Application
1E – Pressure Reducing Valves and Meter Upgrades ***(Includes Massachusetts and Cobban PRV)***	41	Partial Request	Identified as a Priority 1 Improvement in Master Plan, however only Mass/Cobban PRV included in Grant Application due to Budget Constraints
1F - Moulton Water Treatment Plant Improvements	37	Yes	Identified as a Priority 1 Improvement in Master Plan and Included in Grant Application
1G – On-Going Individual Service Metering Program	42	No	Not included in Grant Application Due to Budget Constraints.
1H – Upper and Lower Basin Creek Dam Improvements	10 & 11	No	Not included in Grant Application Due to Budget Constraints.
1I – Reconnect of Colorado Hill Pressure Zone at Front Street	39	No	Not included in Grant Application Due to Budget Constraints.
1J – Waterline Road Transmission Main Replacement	38	No	Not included in Grant Application Due to Budget Constraints.
1K – Complete Replacement of Distribution "Orphans" on Hill	40	No	Not included in Grant Application Due to Budget Constraints.

As can be seen by Table Two, BSB's Groundwater Restoration Plan was limited to only those items that were identified as Priority 1 Improvements in the Water Master Plan – 2012 Update (green shade). In fact, major components identified as Priority 1 Improvements including rehabilitation of the Basin Creek Dams, improvements to Colorado Hill Tank, any distribution system replacement including the Waterline Road Main, ongoing individual service metering and any new treatment plant are **not** included in the grant application due to budget constraints (red shade). These components remain as critical needs and Priority 1 Improvements, however, will have to be funded through other means. The priorities have **not** been changed from the 2012 Update to the Master Plan as adopted by the Council of Commissioners and Chief Executive in April of 2012.

2.6.1 Legal Criteria

A summary of the legal criteria analysis of the projects collectively has been prepared using the NRD Evaluation Criteria specified in Section 6.0 of the Final Upper Clark Fork River Basin Interim Restoration Process Plan dated May of 2012. The eight Evaluation Criteria include:

1) Technical Feasibility
2) Relationship of Expected Costs to Expected Benefits
3) Cost Effectiveness
4) Results of Response Actions
5) Adverse Environmental Impacts
6) Recovery Period and Potential for Natural Recovery
7) Federal, State, and Tribal Policies, Rules and Laws
8) Resource of Special Interest to the Tribes and DOI.

2.6.1.1 TECHNICAL FEASIBILITY

BSB has evaluated the technical feasibility of the nine proposed components of the BSB Groundwater Restoration Plan through the efforts of registered professional engineers, past practices, and standards of the public water supply industry. In addition, EPA and the Montana Department of Environmental Quality regulate and authorize any improvement to a public water supply through the Clean Water Act. The feasibility of all nine components is well documented and proven through standards of the industry.

Groundwater Restoration Plan Components 2.2.1 and 2.2.3 - Water Treatment Plant Improvements

A project was initiated in early 2011 to determine how the BHWTP could produce water that would comply with regulatory requirements particularly related to DBPs. During the initial parts of the project up to May 2011, different technologies that could provide reduction of DBPs were evaluated. The technologies evaluated were:

1) Alternative Disinfection:
    a. Ozone,
    b. Ultraviolet light,
    c. Chloramines, and
    d. Chlorine dioxide

2) Enhanced coagulation to remove precursors of the DBPs including different technologies for removing the floc formed by enhanced coagulation such as:
    a. Plate settlers,
    b. Dissolved Air Floatation, and
    c. Actiflo®

3) Lime softening to remove DBP precursors

4) Magnetic Ion Exchange (MIEX) to remove DBP precursors

5) Use of Activated Carbon in various forms to remove DBP precursors and/or remove DBPs after formation

6) Oxidation of DBP precursors with ozone

7) Use of nanofiltration (NF) to remove DBP precursors

Following the evaluation of these options, enhanced coagulation with plate settlers was determined to be the most cost effective option. Jar tests and other bench-scale studies were performed to determine what dose rates of different coagulants would be required to reduce DBPs in the BSB distribution system to levels below regulatory limits.

From late May 2011 to mid-August 2011, a pilot test program was performed to continuously treat water at the Big Hole Water Treatment Plant to demonstrate the enhanced coagulation process at the BHWTP. The pilot test program studied the effects of different chemicals and dose rates for coagulation and the benefits of adding ozone to the treatment process. In addition, the study evaluated different filter media configurations to determine how to best increase filtration capacity at the plant.

The pilot tests demonstrated that, in conjunction with sedimentation and filtration, both alum and ferric chloride coagulants were able to reduce HAA5 concentrations in the treated water to less than 48 µg/L (80% of the regulatory limit of 60 µg/L). Both of these primary coagulants were also able to reduce TOC by more than the target amount, but in general, ferric chloride was found to be more effective than alum at meeting the treatment goals. Due to the relatively high coagulant doses required to remove TOC, both alum and ferric chloride will produce significant amounts of solids and will require that the pH of the water at the coagulation point and in the finished water be adjusted by adding caustic soda. Therefore, the pilot tests studied other proprietary coagulant chemicals, which may be able to produce fewer solids and require less caustic soda for pH control. The pilot tests showed that these proprietary coagulant chemicals will not be sufficient to meet treatment goals during seasonal periods of elevated TOC in the raw water. They could be used in the winter months when raw water TOC concentrations are low; however, BSB has indicated that they would prefer to limit the number of different coagulants used at the plant, so the continued use of proprietary coagulants will not be pursued further. The pilot test found that ozone is not currently required to meet treatment objectives at the plant, as enhanced coagulation alone is able to reduce HAA5s and remove sufficient amounts of TOC.

Component 2.2.1 of this grant application proposes to construct a new building addition at the BHWTP that would house new flocculation and sedimentation equipment and new chemical mixing capabilities for the express purpose of removing Total Organic Carbon (TOC) from the raw water source. Additionally, new solids handling equipment would be added to prevent the additional sedimentation process sludge from overloading the existing lagoons at the site.

Component 2.2.3 of this grant application proposes minor modifications to the Moulton Water Treatment Plant's solids handling equipment to enable continued intermittent use of this facility as an emergency water supply. The improvements include construction of a screw press for dewatering the plate settler sludge and conveying the filter effluent to the recirculation basin for recycle to the raw water influent. This upgrade to the solids handling capability of the water treatment plant is needed to manage the increased solids production expected from the switch to alum as the primary coagulant for enhance coagulation and TOC removal.

Groundwater Restoration Plan Component 2.2.2 – Big Hole Finished Water Transmission Main I-15 to Rocker Tank

Beginning in 2007, BSB has aggressively pursued the replacement of this very critical piece of infrastructure that conveys treated or finished water from the Big Hole Water Treatment plant onto the Colorado Hill Tank. This pipeline is the major artery for the Butte water system. BSB has replaced the entire section of the raw water transmission main from the Big Hole River near Divide to the Big Hole Water Treatment plant near Feely with exception of the initial 2,500 feet at the Big Hole Pump Station Complex. This stretch was not replaced pending the decisions on the dam and new pump station component locations.

BSB is currently installing the next segment (nominally 20,000 feet) of pipeline replacement utilizing the NRD program funding from the 2010 grant cycle. With completion of this portion, approximately 40,000 feet remains to be replaced, beginning approximately 2 miles north of the Big Hole Water Treatment Plant, near the confluence of the existing alignment and I-15 north and east to the Rocker Water Storage Tank.

To date, BSB crews have installed nearly 65,000 feet of 36-inch ductile iron pipeline or nearly two thirds of the total pipeline scheduled for replacement. The technical feasibility of replacing this line, the design and construction standards and procedures, materials selection and installation practices are well documented

Groundwater Restoration Plan Components 2.2.4 to 2.2.9 – South Butte Water Supply

These six components all are related beneficially to providing water to the South Side Pressure Zone.

2.2.4 Water Transmission Main for South Side Pressure Zone

2.2.5 New South Side Water Storage Tank and Pump Station

2.2.6 Water Transmission Main from South Side Water Storage Tank to Distribution System

2.2.7 New Massachusetts/Cobban Pressure Reducing Valve and Vault

2.2.8 Relocate Dewey Blvd Pressure Reducing Valve and Vault to Holmes Avenue

2.2.9 Replace section of Holmes Avenue for new PRV Vault

Since completion of the 2008 Water Master Plan, the Stage 2 Disinfection Byproduct Rule (Stage 2 DBPR) has come into effect for the Butte water system. Additionally, the Montana Department of Environmental Quality (DEQ) revoked the filtration waiver on the system's major source supply of Basin Creek Reservoir in October of 2010 and lastly, DEQ reclassified the Big Hole Water Treatment Plant from a "direct" to "conventional" water plant. BSB maintains compliance with the Stage 2 DBPR requirements within its Big Hole and Moulton Treatment plants, albeit, at the sacrifice of plant capacities. Both plants suffer over 50% reduction in treatment capacity due to the ever increasing presence of Total Organic Carbon (TOC) in raw water sources. Removal of TOC's is a requirement for DBPR control and is accomplishing

through enhanced coagulation. This is turn results in less treatment capacity due to the formation of sludge containing the TOC's that must be removed from the treated water stream.

Revocation of the filtration waiver for Basin Creek Reservoir means, in short, BSB must treat this water supply to meet surface water treatment standards or cease use of this supply by February 18, 2012 for potable water purposes to supply the South Side Pressure Zone (i.e. "South Butte").

The now-known implications of these regulations along with the need to reprioritize the capital improvement requirements to best utilize the available financial resources while minimizing the ultimate impact to the water system rate payers prompted the need to develop a 2012 update to the Water Master Plan for Butte Silver Bow.

The primary objective of this master plan update was to evaluate options to address revocation of the filtration waiver for the Basin Creek Supply and identify the best option for providing a supply of treated water to the South Side Pressure Zone ("South Butte") historically served by the Basin Creek water source. Numerous options were considered with three primary options evaluated in detail in this master plan update. One option is construction of an additional water treatment facility to treat water from Basin Creek Reservoir. The second option is conveying water from the Silver Lake Water System to the existing Big Hole Water Treatment Plant for treatment and subsequent delivery to Butte through the existing infrastructure. The third option is construction of a new water treatment plant west of Butte to treat water from the Silver Lake Water System and convey the treated water to the Colorado Hill Tank primarily through the existing finished water transmission main. All three options were technically viable and given full consideration across a wide spectrum of evaluation criteria including:

1. Capital Costs
2. Annual O&M Costs
3. Life Cycle Costs
4. Operations and Maintenance Requirements
5. Impacts to Existing Facilities
6. Redundancy/Reliability
7. Health and Safety
8. Regulatory Concerns
9. Future Demands
10. Energy Requirements
11. Constructability
12. Environmental Impacts
13. Funding Eligibility/Access

In June of 2012, the BSB Chief Executive selected the option of constructing the required improvements to result in treated the raw water supplies provided for by the Basin Creek Watershed. This decision was made with recognition that other sources of funding will need to be developed to address the financial requirements of that decision and as such, the critical elements as noted in this Groundwater Restoration Plan (Components 2.2.4 through 2.2.9) were determined to be included in the Groundwater Restoration Plan. This is because all six of these components are a requirement to restore water service to the South Side Pressure Zone (South Butte) and are not dependent upon other improvements. Each of the components can proceed without delay into construction. Moreover, should additional funding be availed in the future, all six components are complimentary and requirements of the overall plan and are/will not be sacrificed when other improvements are made to the system in future years.

2.6.1.2 RELATIONSHIP OF EXPECTED COST TO EXPECTED BENEFITS

The operational purpose of the overall Butte Water System continues to transition from an industrial water supply system with the secondary purpose of providing drinking water to a system with the first and foremost priority of providing safe and reliable potable water supply for the residential, commercial, institutional and industrial community of Butte. Tied directly to this shift in operational philosophy is the responsibility for the long term reliability of the system both in the physical operational sense as well as the long term financial support of the system. The financial source of support for a municipal water system is ultimately the rate payer. The revenue generated through the provision of water service must be adequate to provide for the overall sustainability of the system. In reality, most systems pursue and utilize funds beyond those collected directly from the users to make up for deep deficits between available funds and the increasing cost of replacement of the existing aging infrastructure.

The sum total of costs required to bring the BSB Domestic Water System Improvements is estimated at $125 million as documented in the 2012 Water Master Plan Update. These improvements include water treatment, transmission, storage and distribution infrastructure upgrades. It is understood and recognized that the limit of the current NRD Groundwater Restoration Program is estimated at approximately $30.1 million. As can be determined from this grant application, the remaining financial needs are well in excess of this amount. It is the intent of this grant to demonstrate BSB's critical need for the entire amount of the Groundwater Restoration Program immediately and BSB recognizes that additional funding will need to be sought from local, state and federal programs and through other grant applications, loans, bonding and rate increases for the additional $90 to $100 million needed to address the critical needs of BSB's water system.

For this grant request, BSB has identified nine components shown in Table One and Figure One whose replacement will ensure, for the first time ever, that all rate payers serviced by the Butte Water System are provided filtered and disinfected drinking water. As noted previously, BSB overall goals for its water system require financial support well in excess of their NRD Groundwater Restoration allocation. This means that BSB has and will continue to seek funding elsewhere including through additional assessment to its rate payers until the full restoration of the domestic water system can be realized. The nine components included in this Groundwater Restoration Plan are considered as having the highest priority and will provide the most significant and immediate benefit to the customer base.

2.6.1.3. COST EFFECTIVENESS

The development of alternatives or potential solutions was/is provided by the 2012 Water Master Plan Update. Various alternatives have been vetted through the development of the Chapters IV and V of that document and through meetings with various local, state and federal agency representatives and the general public. Various alternatives were screened for many of the proposed improvements resulting in selection of the preferred alternatives in each case. There are really only two alternatives to evaluate; No Action or Proceed with the strategies as developed in the Master Plan Update.

No Action Alternative

The "No Action" alternative is not viable, due to the condition of the existing infrastructure within the BSB Domestic Water System and the water quality violations that currently are being experienced due to deteriorating raw water supply quality. As noted throughout this grant application, the majority of the existing infrastructure has significant deficiencies and risk of catastrophic failure is highly probable given the age and condition of the infrastructure. In addition, the treatment, storage and delivery infrastructure and ongoing operations cannot be sustained if these issues are not addressed. In short, the entire water system is in danger of failing in the near future.

Proceed with the Developments as Outlined in the Master Plan

As noted, since No Action alternative is not an option, then the action to be taken is to immediately begin with the plans as outlined in the 2012 Water Master Plan Update to include installing the most cost effective treatment technology in the Big Hole and Moulton Water Treatment Plants to comply with the Stage 2 Disinfection Byproduct Rule (Stage 2 DBPR) and to install the required infrastructure to address the loss of the filtration waiver on the Basin Creek Reservoir supply through the construction of transmission lines and a storage tank as part of the overall plan to provide for filtration treatment of the Basin Creek Raw Water Supply.

The selected and piloted alternative using enhanced coagulation was deemed the most practical and economical treatment technique for reducing TOC and resulting disinfection byproduct formation from chlorination of the treated water. This is primarily because the majority of the existing infrastructure at both the Big Hole and Moulton Treatment Plants would remain in place and in use, with additional pretreatment processes added ahead of the existing filtration infrastructure within the existing facilities.

Three options were evaluated in detail for supply of treated water to South Butte. The following Tables Three and Four summarize the infrastructure requirements and associated costs of the South Butte Filtered Water Supply Alternatives. The comparisons reflected in the tables are representative of the total selected design capacity of the overall Butte Water System of 20 MGD. As can be seen in Tables Three and Four, the initial capital costs and the 25-year life cycle estimates for all three alternatives were evaluated in the detail in the 2012 Water Master Plan Update and are well within a reasonable margin of error (< 5%)

given the level of detail for which each of the options has been developed (i.e. conceptual with minimal level of design).

Based on the 2012 Water Master Plan Update, BSB initially pursued Alternative 3 (New Silver Lake WTP), however, as a result of public comment indicating a greater likelihood of funding and concerns with potential loss of the Basin Creek water right by abandonment, BSB opted to pursue Alternative 1 (New Basin Creek WTP).

Table Three: Capital Cost Comparison of South Butte Filtered Water Supply Alternatives

Item No.	Item	Estimated Cost (millions)					
		Alternative 1 New Basin Creek WTP		Alternative 2 Convey Silver Lake Water to BHWTP		Alternative 3 New Silver Lake WTP	
		Low Range	High Range	Low Range	High Range	Low Range	High Range
	Treatment Improvements						
1	Basin Creek WTP (7 MGD Capacity)	$15.08	$18.03				
2	Big Hole WTP Improvements for TOC Removal (13 MGD Capacity)	$7.97	$9.75			$7.97	$9.75
13	Big Hole WTP Improvements for TOC Removal (20 MGD Capacity)			$16.00	$19.56		
20	Water Treatment Plant at TIFID w/ High Service Pumps to Colorado Hill Tank (7 MGD Capacity)					$13.72	$16.76
	Raw Water Transmission Main Improvements						
3	Replace Basin Creek Raw Water Transmission Main (27,000-ft)	$4.02	$4.92				
4	Construct 5,800-ft of 24-inch Raw Water Pipeline from Upstream of Basin Creek PRV to Basin Creek WTP	$1.04	$1.27				
14	Construct 36,000-ft of 24-inch Raw Water Pipeline - REC to Big Hole WTP			$6.16	$7.53		
21	Construct 1,500-ft of 24-inch Raw Water Pipeline - REC to New TIFID WTP					$0.32	$0.40
	Finished/Treated Water Transmission Main Improvements						
5	Construct 8,200-ft of 24-inch Finished Water Pipeline from Basin Creek WTP to New Tank	$1.41	$1.72				
6	Construct 17,100-ft of 24-inch Finished Water Pipeline from New Basin Creek Tank to Distribution System	$2.95	$3.61	$2.95	$3.61	$2.95	$3.61
7	Colorado Hill Tank Yard Piping Improvements	$0.84	$1.03	$0.84	$1.03	$0.84	$1.03
8	Relocate Dewey Boulevard PRV	$0.27	$0.33	$0.27	$0.33	$0.27	$0.33
15	Replace Timber Butte Transmission Main from 36-inch at Lexington to New Basin Creek Tank (17,100-ft)			$4.08	$4.98	$4.08	$4.98
9	Replace Timber Butte Transmission Main from 36-inch at Lexington to old South Side Storage Tank on Timber Butte	$2.04	$2.49				
22	Construct 6,800-ft of 24-inch Finished Water Pipeline from New TIFID WTP to BHTM at I-15 Crossing					$1.40	$1.71
	Dam/Reservoir Improvements						
10	Rehabilitate Upper Basin Creek Dam	$1.06	$1.29	$1.06	$1.29	$1.06	$1.29
11	Rehabilitate Lower Basin Creek Dam	$3.41	$4.17	$3.41	$4.17	$3.41	$4.17
	Storage Improvements						
12	Construct New Water Storage Tank	$6.28	$7.67	$6.28	$7.67	$6.28	$7.67
	Pump Station Improvements						
17	TIFID Pump Station modifications			$0.83	$1.01	$0.83	$1.01
18	New REC Pump Station			$1.80	$2.20		
19	New Timber Butte Booster Station			$0.58	$0.71	$0.58	$0.71
	Additional Transmission Main Improvements						
23	Big Hole Finished Water Transmission Main - I-15 to Rocker Tank Including Bore & Case of I-15 (32,000-ft)	$5.98	$7.31	$5.98	$7.31	$5.98	$7.31
36	Big Hole Raw Water Transmission Main - PS to Top of Hill (2,300-ft)	$1.20	$1.47	$1.20	$1.47	$1.20	$1.47
	Total Estimated Cost =	**$53.55**	**$65.06**	**$51.44**	**$62.87**	**$50.89**	**$62.20**

Table Four: Life Cycle Cost Comparison of South Butte Filtered Water Supply Alternatives (20 MGD Overall System Design Demand)

Item	Estimated Cost (millions)		
	Alternative 1 New Basin Creek WTP	**Alternative 2 Convey Silver Lake Water to Big Hole WTP**	**Alternative 3 New Silver Lake WTP**
Capital Costs	$53.55 - $65.06	$51.44 - $62.87	$50.89 - $62.20
Annual O&M Cost	$0.82	$0.79	$0.78
25-Year Life Cycle Cost (1)	$66.2	$63.8	$63.5

(1) The mid-range of the estimated capital cost range was included in the life cycle cost comparison.

2.6.1.4 RESULTS OF SUPERFUND RESPONSE ACTIONS

It has long been recognized that the deposition of wastes in the city of Butte from mining and mineral-processing operations has resulted in injury to groundwater resources and the surface water of Silver Bow Creek. Injury to groundwater has been demonstrated by the occurrence of concentrations of heavy metals (including cadmium, zinc, iron, lead, copper, arsenic, mercury and sulfate) that exceed drinking water standards in the alluvial aquifer. In turn, surface water and streambed contamination to Silver Bow Creek has resulted from the discharge of contaminated surface runoff. In the past, surface runoff from storms and snowmelt carried hazardous substances from hundreds of dispersed waste source sites to Silver Bow Creek through surface drainages and the Butte storm water collection system.

The loss of this groundwater and surface water source has required the citizens of Butte to assume responsibility for a vast and extensive water supply, treatment and distribution system that relies upon raw water supplies considerable distance from the customer base. Moreover, the infrastructure for this system was put in place nearly a century ago and is in dire need of replacement and upgrades.

While various response actions are both contemplated and being implemented for the Butte Superfund site, these actions will not restore the groundwater resources lost to Butte for municipal water supply. In the absence of an effectual restoration response for this extensive groundwater contamination, BSB is left with "replacement" – i.e., maximizing use of its existing water resources, conserving them and extending their availability wherever possible. The proposed Groundwater Restoration Plan projects are consistent with that goal.

The Groundwater Restoration Plan projects will proceed independently of ongoing or planned CERCLA response actions relative to the Butte Superfund sites. The project will not impact other remediation or response actions. As part of its institutional controls relative to Superfund, BSB has a Development Permit System (DPS) to assure safe management of hazardous materials disturbed by construction.

2.6.1.5 ADVERSE ENVIRONMENTAL IMPACTS

This section itemizes the anticipated effects to the physical and human environment during and after construction of the proposed projects. References consulted to assess potential environmental impacts and suitable mitigation if required include the Montana Natural Resource Information System database (www.nris.state.mt.us), the National Historic Register (www.nr.nps.gov), Federal Emergency Management Agency (FEMA) floodplain maps, and construction experience by BSB with similar domestic water system improvements within its urban areas over the past nine years.

Impacts to the physical environment resulting from the proposed project include both short term transient impacts associated with the construction, and long term environmental benefits resulting from completion. No construction in or adjacent to waterways is involved for the water treatment improvements or the proposed transmission main and water storage tank. The components involve a combination of underground construction and vertical construction, however, in both cases upon completion, the ground surface will be restored to pre-project elevations and conditions.

No identified wetlands or watercourses will be traversed or disturbed by the various components. Likewise no Threatened or Endangered Species will be impacted and no impacts are anticipated with any historic properties and districts currently listed in the National Historic Register. No archeological sites of significance are known to exist within the limits of the proposed activities for each of the components. The locations are urban and have been disturbed previously on several occasions for water treatment plant construction, pipe line installations, road improvements and excavation of underground utilities. Should any potentially significant archeological findings be encountered during the course of project construction, work will be halted to allow assessment of such findings by qualified personnel, with full involvement of the State Historic Preservation Office.

Following construction, the component sites and corridors will be fully restored to the pre-project condition including and seeding and mulching on disturbed areas. Construction impacts to soil and surface water resources will be mitigated by use of erosion control measures (strategic soil stockpiling and silt fencing) around excavated areas to prevent sediment transport. Such construction measures will concentrate on prevention of siltation in the adjoining waterways. During construction, construction site storm water management permit from MDEQ will be required and enforced since the area of disturbances will exceed the one-acre exemption.

Potential transient impacts to human health and safety during construction will be effectively mitigated by proper fencing and signage at the work site to prohibit access and protect the public against hazards. Blasting is not anticipated to be necessary for any of the expected excavation. Transient air quality and noise impacts due to operation of construction machinery will be attenuated by dust and noise control standards and proper operation and maintenance of equipment. State of Montana air quality standards for fugitive dust emissions govern such releases, and will be enforced. Noise impacts may cause localized disturbance, but can be minimized by limiting equipment operation to traditional work hours.

Construction work will be executed in full compliance with OSHA standards, including designation of the job sites as "hard hat areas," and trench excavation and other work place safety conforming to applicable requirements. The Construction Contractor to assure adequate barriers and protection for the public are provided during and after work hours and will be required to have a jobsite safety plan. The Construction Contractor will be assigned contractual responsibility for all job site safety and regulatory compliance.

Protection of public (sanitary) health during construction, specifically isolation and replacement of existing water mains and storage tanks, will be provided by adherence to MDEQ Circular DEQ1 and Montana Public Works Standard Specifications requirements for thorough disinfection and bacteriological testing of new water lines, treatment facilities and storage tanks. Adherence to these standards and requirements will be legally required in the construction contract.

2.6.1.6 RECOVERY PERIOD AND POTENTIAL FOR NATURAL RECOVERY

Because of cost and "technical infeasibility" limitations, EPA opted to cap large areas of mining wastes in the Butte Superfund area and allow groundwater contamination to remain without direct remedial action. While surface reclamation should reduce infiltration through the waste material, the large expanse of contamination continues to impact groundwater resources. Natural recovery of contaminated water resources has been discounted, due partly to the magnitude of the problem. This results in an irreversible loss for Butte, and limits availability of potable water resources to meet the existing and future needs of its residents. Prospects for natural recovery of contaminated groundwater resources are improbable, as addressed above. The prospects and time frame for natural recovery are not affected by this project. In lieu, the project promotes efficient utilization of Butte's existing surface water sources as an alternative to natural recovery.

2.6.1.7 FEDERAL, STATE, AND TRIBAL POLICIES, RULES AND LAWS

Multiple regulatory approvals and permits will be required. The agencies to be contacted include the following:

a. State Department of Fish, Wildlife and Parks (MTFWP)
b. Department of Natural Resources and Conservation (DNRC)
c. State Historic Preservation Office (SHPO)
d. National Resource Conservation Service (NRCS)
e. Montana Department of Environmental Quality (Stormwater Permitting)
f. Montana Department of Transportation (Encroachment Permits)

Public involvement and agency coordination activities which will lead into the application and acquisition of a variety of permits including:

a. Montana Floodplain and Floodway Management Act. (SP124 Permit). This permit is obtained from the Floodplain Management Section of the Department of Natural Resources and Conservation. This permit is required for all construction within the 100 year floodplain.

b. Storm Water Discharge Permit Authorization. Required for any construction project that will have a discharge of storm water into surface waters. Obtained from the Montana Department of Environmental Quality.

c. MPDES General Permit for Discharges Associated with Construction Dewatering for any construction project that will have a construction dewatering discharge into surface waters. Obtained from the Montana Department of Environmental Quality.

d. Public Water Supply Authorization obtained from the Montana Department of Environmental Quality.

e. Since this is a Butte-Silver Bow project, all appropriate local government personnel will be contacted.

BSB has the legal authority to enter into a binding contract with the State of Montana to authorize funding for the proposed project and will comply with all applicable state and federal laws and regulations in the completion of this project. MDEQ jurisdiction over public water systems will require approval of design plans and specifications by that agency for all main replacements and central water system improvements. A Professional Engineer licensed by the State of Montana must be in "responsible charge" of preparation of central system improvements design. Following completion of construction, the Engineer must also file with MDEQ a "Certification of Completion in Accordance with Approved Plans and Specifications". Railroad or state/federal highway crossings will be permitted as required by the appropriate agencies.

Other than concurrence by the NRD Program that the Engineer's completed design plans conform to the project scope under this Groundwater Restoration Plan, no other permitting or approvals are anticipated to be required for the project. BSB will enter into a grant contract with the NRD Program if/as required for its Groundwater Allocation funds, and abide by the conditions therein. No other ramifications of the proposed project to laws, rules, policies, or Consent Decree requirements are anticipated.

2.6.1.8 RESOURCES OF SPECIAL INTEREST TO THE TRIBES AND DOI

There are no known Tribal cultural resources to special interest to the Tribes or DOI in the vicinity of the proposed components. The proposed projects are confined to urban residential and commercial corridors previously disturbed by construction activities. No Tribal lands, nor any wildlife, wetland, or riparian habitats are present. Therefore, it is anticipated that this project will have no adverse impacts on resources related to Tribal Nations, or the Department of Interior - U.S. Fish and Wildlife Service. BSB acknowledges that appropriate actions and consultation with Tribes and/or the Department of Interior will be required if any unanticipated Resources of Special Interest relative to these entities are encountered in the course of executing the project.