Somerset Diversion Improvement Study - North Fork of the Gunnison River Corridor Project
Final Report

Submitted to
Colorado Water Conservation Board
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Submitted by
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Acronyms List

BLM-UFO – Bureau of Land Management – Uncompahgre Field Office
cfs – Cubic Feet per Second
CPW – Colorado Parks and Wildlife Division
CWCB – Colorado Water Conservation Board
CWWL – Crane Associates and Western Water & Land
DCD – Delta Conservation District
GPS – Global Positioning System
NFR – North Fork of the Gunnison River
PAT – Public Access Team
PKC – Paonia Kayak Club
RFP – Request for Proposal
SDSD – Somerset Diversion Stake Downstream
SDSP – Somerset Diversion Stake Pump
SDSU – Somerset Diversion Stake Upstream
SDWD – Somerset Domestic Waterworks District
SOW – Statement of Work
TU – Trout Unlimited
WSCC – Western Slope Conservation Center

Table of Contents

Section 1 Project Executive Summary

The Somerset Diversion Improvement project provides multiple potential benefits to the North Fork of the Gunnison River (NFR). The exact location of this project is just upstream of Somerset, Colorado as shown in Figure 1, area view and Figure 2 close up of the diversion area.

Figure 1 –Diversion Area View

The consumptive use portion of the study addressed improvements for the municipal and industrial diversion at Somerset. The municipal water diversion is for the Somerset Domestic Waterworks District (SDWD) that provides domestic water to the Gunnison County Town of Somerset. The industrial water diversion is for the Oxbow Mining's Elk Creek Mine.

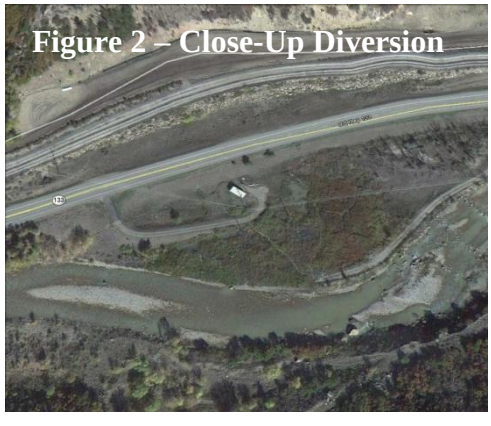


Figure 2 – Close-Up Diversion

The non-consumptive portion of the study developed the potential of public access points for boating and fishing, and improved habitat in the river reach around the diversion with improved safety for both boating and fishing.

Obtaining a preliminary design is critical to the SDWD's ongoing long-term system maintenance planning. Implementing the resultant engineering design could save substantial thousands of dollars annual in water system maintenance costs. There also would be improved domestic and industrial water quality.

The project developed three alternatives for an improved diversion preliminary design improving low-flow diversion performance, eliminating direct water pumping from the river, and reduced sediment infiltration through the diversion. Reduced sediment infiltration will reduce operational cost for both Oxbow and SDWD. The three alternatives are:

- Alternative 1 provides a surface intake to supply pump station water and restores the reach with a combination of drops and pools. Alternative 1 is based on restoring and reinforcing the series of sills previously constructed that are currently in a disorganized state.
- Alternative 2 provides a similar surface intake to supply pump station water but restores the reach to a continuous single-thread riffle through the project reach.
- Alternative 3 provides a hybrid of Alternatives 1 and 2. Alternative 3 promotes a new intake and single thread river, but relies on small drops and pools in lieu of a continuous riffle to restore the river.

The project also developed multiple public access potentials with the three major landowners in the project reach of the river.

This project final report contains the details for all efforts completed during this project.

Section 2 Problem Background

2.1 Consumptive Use

The consumptive part of this project focuses on the diversion of municipal and industrial water.

The Somerset diversion is currently operated by Oxbow Mining LLC – Elk Creek Mine. See Figures 1, 2, and 3. This diversion provides industrial water for the mine and the municipal water for the town of Somerset via the Somerset Domestic Waterworks District (SDWD). Currently, the diversion can only meet the needs of both the town and the mine by using in-river pumps during low-flow periods. Additional, the filtration system that removes sediment is old and inefficient. The resulting high sediment filled water requires significant maintenance.

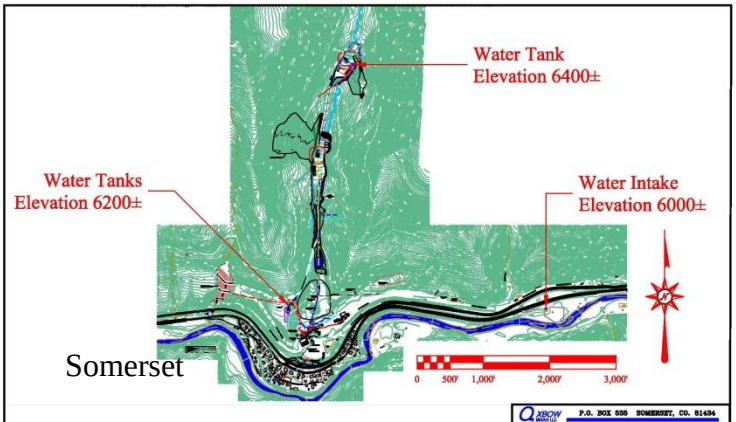


Figure 3 – Somerset Diversion Water Intake Location

As the cessation of mining operations nears, SDWD prepares to take over the operation of the complete water system. Obtaining this preliminary design is critical to the SDWD's ongoing long-term system maintenance planning. Implementing the resultant engineering design could save thousands of dollars annual in maintenance costs and improve the water quality utilized domestically over the long term and for the shorter term industrial use.

2.2 Non-consumptive Use

The non-consumptive use part of this project focused on improved riparian habitat improvement, boater and fisher safety, and public access.

This stretch of the NFR has a variable boating season of 1-9 weeks of higher flows (1000+ cfs) and benefits from extended flows down to the 256 cfs that are delivered to the Fire Mountain Canal below Somerset, Colorado. These lower flows last through the irrigation season that can end in August.

Fishing on the North Fork is limited by access; however, is considered excellent for trout. Legal access to the 20 mile stretch of the NFR from Paonia Reservoir to the Town of Paonia is limited to the State Park below the Paonia Reservoir dam and the River Park in Paonia.

Section 3 Task Results

The efforts and results from the three tasks completed are detailed in the following subsections.

3.1 TASK 1 –Preliminary Design and Public Access Requirements

3.1.1 Diversion Requirements

The initial effort of Task 1 was to assemble the key stakeholders to define all the requirements that must be incorporated into the preliminary design of an improved diversion. All key stakeholders names and contact information is in Appendix A.

The first individual stakeholder meetings were held with SDWD (February 11, 2014) and Oxbow (February 17, 2014). These two stakeholders are the owners of the diversion water rights. Each has their own requirements for the diversion and long-term operations. The group stakeholder meeting was held on March 10, 2014. Attendee list for each of these meetings is in Table 1.

Table 1 Stakeholder Meetings and Attendees

Meeting	Date	Attendee	Organization
SDWD	11-Feb-14	Terry Commander	SDWD
		Bill Sterns	SDWD
		Mike Drake	DCD
		Ralph D'Alessandro	DCD
Oxbow	17-Feb-14	Mike Ludlow	Oxbow
		Jim Kiger	Oxbow
		Mike Drake	DCD
		Ralph D'Alessandro	DCD
All Stakeholders	10-Mar-14	Mike Drake	DCD
		Ralph D'Alessandro	DCD
		Jim Kiger	Oxbow
		Mike Ludlow	Oxbow
		Chuck Shelden	Oxbow
		Tom Glor	Bear Ranch
		Rob Thurman	Oxbow
		Terry Commander	SDWD
		Eric Gardunic	CPW
		Dave Graf	CPW
		Kirk Madariaga	CPW
		Neal Schwieterman	PKC

The results of these meetings led to the following diversion requirements that were placed in the Statement of Work (SOW) used in the Request for Proposal (RFP) developed for the diversion preliminary design bidding process (See Section 3.2 for details). The preliminary diversion design effort will utilize the requirements to insure:

- Full diversion of water rights at all flow levels
- Fish and boater passage through/around the diversion
- Improved river and riparian area wildlife habitat, and bank and river channel stability
- Reduced sediment loading in diverted water before pumping
- Reduced long-term maintenance
- Survival of a 100 year flood on the designed structure
- Limited impact on the surrounding floodplain
- Optimum pumping operations to move the water from the diversion to the water treatment plant 200 feet above the river and approximately a half mile away.

3.1.2 Public Access – Plan Development

The second effort under Task 1 was to develop a plan to enhance public access to the North Fork of the Gunnison River over the river reach from the base of the Paonia Reservoir downstream to the Gunnison County/Delta County line.

Our Public Access Team (PAT) included DCD, SDWD, WSCC, CPW, TU, and PKC. Our team consists of a Colorado State Department, two Colorado special districts, and three nonprofit organizations. Our team members provided proven strengths and experience in gaining improved public access to both private and government owned lands, including conservation and access easements, donation of land, and direct purchase of land. All three of the major landowners made positive comments about the strength of our team.

This effort required:

- Defining the land ownership along the river
- Talking with the major landowners to define the processes required to move forward with potential projects to increase public access to the river
- Potential Sites Identification

3.1.3 Public Access – Land Ownership

Defining the land ownership along the NFR was readily available from the Gunnison County GIS mapping that is available on the Gunnison County website. (http://www.gunnisoncounty.org/325/Interactive-Maps)

Meetings with the GIS Department, the County Records Department, and the County Economic and Community Development Department at the County Building in Gunnison, Colorado provided the information verification/validation of the information provided on the interactive maps. A sample of the interactive information available is shown in Figure 4. From the GIS web information, one can obtain the GPS points that define the outline of any of the properties. All information obtained is contained in Appendix B.

3.1.4 Public Access – Landowner Meetings

Once landownership was defined, it was easy to see that there were three major river access landowners – BLM, MCC, and Oxbow. Before the landowner meetings started, our Team made the following decisions:

- Our approach would be to develop a partnership with the individual landowner for improved public access
- An independent meeting with each of the three major landowners would be held

- Access types under consideration would range from walk-in only access to drive-in access with parking, raft/kayak launching, and picnic areas

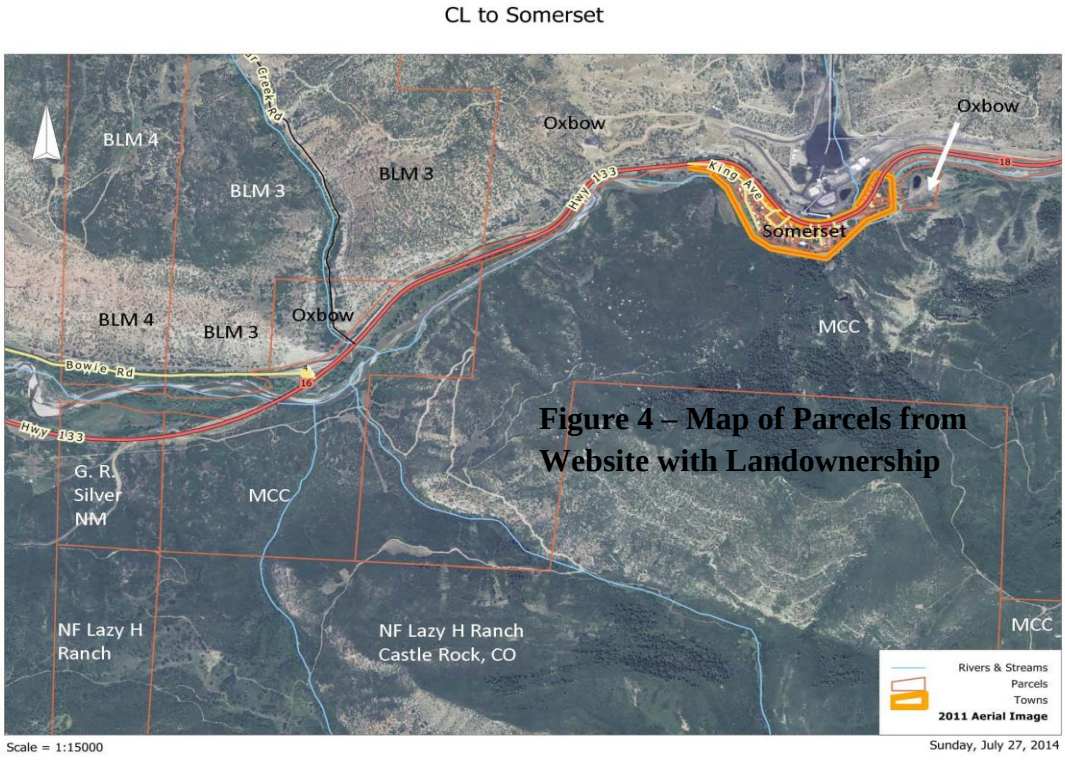


Figure 4 – Map of Parcels from Website with Landownership

The first public access meeting was held August 22, 2014 with the BLM at the Montrose Field Office. The attendees are listed in Table 2.

Table 2 – Attendees BLM Public Access Meeting	
Barb Sharrow	BLM-UFO
Julie Jackson	BLM-UFO
Jedd Sondergard	BLM-UFO
Mike Drake	DCD
Cary Denison	TU
Eric Gardunic	CPW
Neal Schwieterman	PKC

BLM found our team's plan to enhance public access to the NFR though developing a partnership with BLM very interesting. In our plan, the partnership with BLM would focus on BLM NFR property public access improvements projects.

BLM explained that a partnership agreement would be defined for each individual project. The BLM process to develop each individual project consists of the following steps:

- Step 1 – The Group interested in supporting the improvement project would draft a site specific proposal for public access improvement for a specific BLM property. The proposal should include:
  - Exact improvements to be made, including such items as entrance to property (vehicle and/or walking-in), parking, camping, picnic area, boat ramps, etc.
  - All supporting partners
  - Potential funding sources
  - Estimated increase in usage

- Step 2 – Project Group would initiate conversations with the BLM to get initial feedback and suggests for improvements on the proposal from BLM
- Step 3 – The final proposal would be submitted to BLM
- Step 4 – With the submittal of the final proposal, the BLM will start their official review process required for BLM to decide on accepting the project
- Step 5 – BLM will come back with official comments on the proposal and required changes needed for BLM to accept the project.
- Step 6 – BLM and the Project Group agree on proposal modification and the BLM accepts the project
- Step 7 – The Project Group secures funding and starts project implementation and coordination with BLM

The second public access meeting was held December 1, 2014 with the Mountain Coal Company (MCC) at 10 AM. The people in attendance are listed in Table 3.

Table 3 – Attendees MCC Public Access Meeting	
Kathy Welt	MCC
Weston Norris	MCC
Mike Drake	DCD
Ralph D'Alessandro	DCD
David Graf	CPW
George Osborn	TU

MCC thought that the team's plan to enhance public access to the NFR though developing landowner partnerships was interesting. We briefly discussed our meeting with the BLM. From that discussion, MCC started a discussion noting specific properties/areas where they thought potential projects might be developed. Any area near current or future coal mining operations would not available for project development.

Our discussion with MCC about their process for developing a specific project resulted in the following steps being defined:

- Step 1 – The Group interested in supporting the improvement project would draft a site specific proposal for public access improvement for a specific MCC property. The proposal should include:
    - Exact improvements to be made, including such items as entrance to property (vehicle and/or walking-in), parking, camping, picnic area, boat ramps, etc.
    - All supporting partners
    - Potential funding sources
    - Estimated increase in usage
- Step 2 – Project Group would initiate conversations with the MCC to get initial feedback and suggests for improvements on the proposal from MCC
- Step 3 – The final proposal would be submitted to MCC
- Step 4 – With the submittal of the final proposal, the MCC will start their official review process required for MCC to decide on accepting the project
- Step 5 – MCC will come back with official comments on the proposal and required changes needed for MCC to accept the project.
- Step 6 – MCC and the Project Group agree on proposal modification and the BLM accepts the project
- Step 7 – The Project Group secures funding and starts project implementation and coordination with MCC

Although the basic process looks identical to the BLM process, the options available and opportunities for funding any project with a private landowner would be significantly different than the ones used in developing projects with the BLM.

The third public access meeting was held December 1, 2014 with Oxbow at 1:30 PM. The people in attendance are listed in Table 4.

Table 4 – Attendees Oxbow Public Access Meeting	
Mike Ludlow	Oxbow
Mike Drake	DCD
Ralph D'Alessandro	DCD
David Graf	CPW
George Osborn	TU

We briefly discussed our meeting with the BLM and MCC. From that discussion, we started a discussion noting specific properties/areas where Oxbow thought potential projects might be developed. However, Oxbow was much less optimistic than MCC about the potential of company land being developed into a public assess point. Any area near current or future coal mining operations would not be available for project development.

Our discussion with Oxbow about their process for developing a specific project resulted in the same process steps as defined during the meeting with MCC.

3.1.4 Public Access – Preliminary Sites Identification

The Table 5 presents several potential river access sites, defined by the PAT, for each of the three major landowners. Note that these are preliminary sites identification and no detailed discussions with the landowners about any of these sites have occurred. The PAT will have to have additional meetings to determine exact usage and location priorities before additional access development actions occur.

Table 5 Potential River Access Site Examples		
Site Number	Landowner	GPS Locator
BLM #1	BLM	N 38° 55’ 10.21”; W 107° 29’ 45.87”
BLM #2	BLM	N 38° 56’ 20.53”; W 107° 22’ 09.44”
MCC #1	MCC	N 38° 55’ 21.71”; W 107° 29’ 08.82”
MCC #2	MCC	N 38° 55’ 47.62”; W 107° 25’ 13.55”
Oxbow #1	Oxbow	N 38° 55’ 43.72”; W 107° 27’ 19.60”
Oxbow #2	Oxbow	N 38° 55’ 54.05”; W 107° 24’ 47.48”
Oxbow #3	Oxbow	N 38° 55’ 45.79”; W 107° 25’ 23.52”

BLM #1 is located just east of the intersection of Bowie Road and CO RT 133, along Bowie Road. See Figure 5. There are two separate BLM parcels included in this location. The primary

Figure 5 – BLM #1 Along Bowie Road, downstream of Fire Mountain Canal takeout

access for this location would be for walk-in fishing access. Potential improvements include several safe access paths from the road to the river and limited parking along Bowie Road.

BLM #2 is located along CO RT133 and the Kebler Pass Road. See Figure 6. Potential

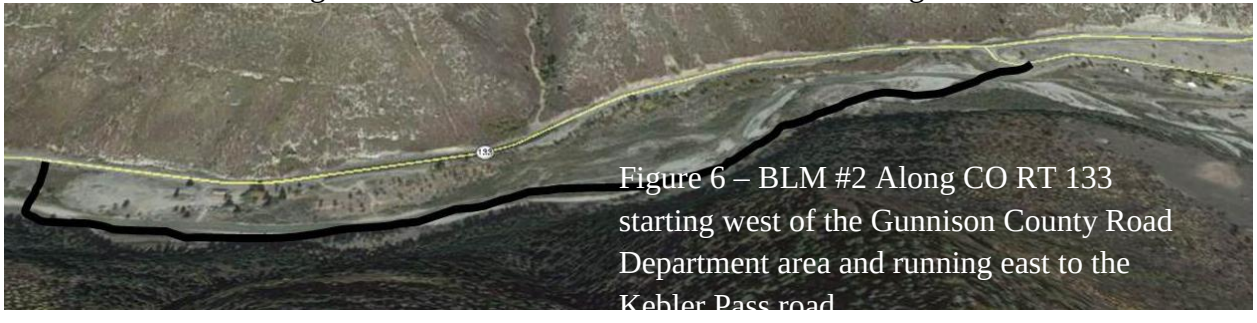


Figure 6 – BLM #2 Along CO RT 133 starting west of the Gunnison County Road Department area and running east to the Kebler Pass road

improvements for this location include Raft/Kayak launch site, parking lot, picnic area, fishing access paths.

MCC #1 is located along CO RT 133 on the north side of the road. See Figure 7. Potential improvements include walk-in fishing access, small parking lot and small picnic area.

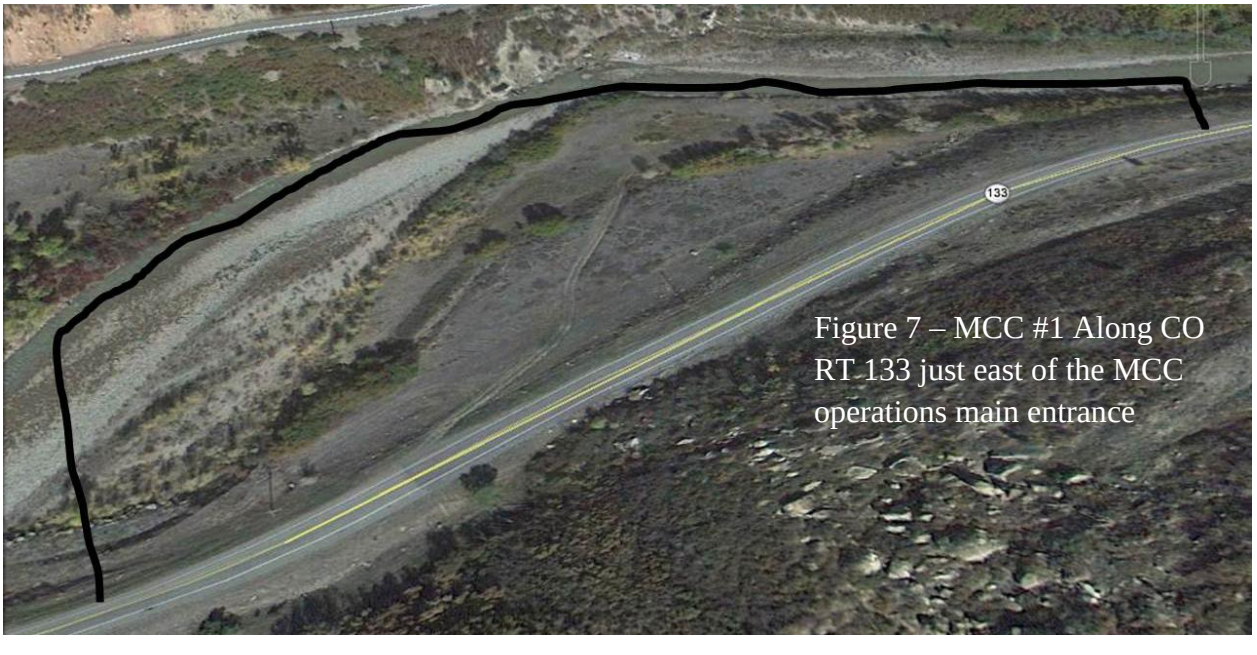


Figure 7 – MCC #1 Along CO RT 133 just east of the MCC operations main entrance

MCC #2 is located along the south side CO RT-133, just west of Somerset Colorado and across from Bowie Road. See Figure 8. Potential site improvements include raft/kayak launch/takeout site, parking lot, picnic area, and fishing access.

Figure 8 – MCC #2 Along CO RT 133 just west of Somerset Colorado and across from Bowie Rd

Oxbow #1 is located along and south of CO RT-133 in the area of the current pump house. See Figure 9. One required improvement would be to fence the critical areas around the pump house. Potential site improvements include walk-in fishing access, small parking lot and picnic area.

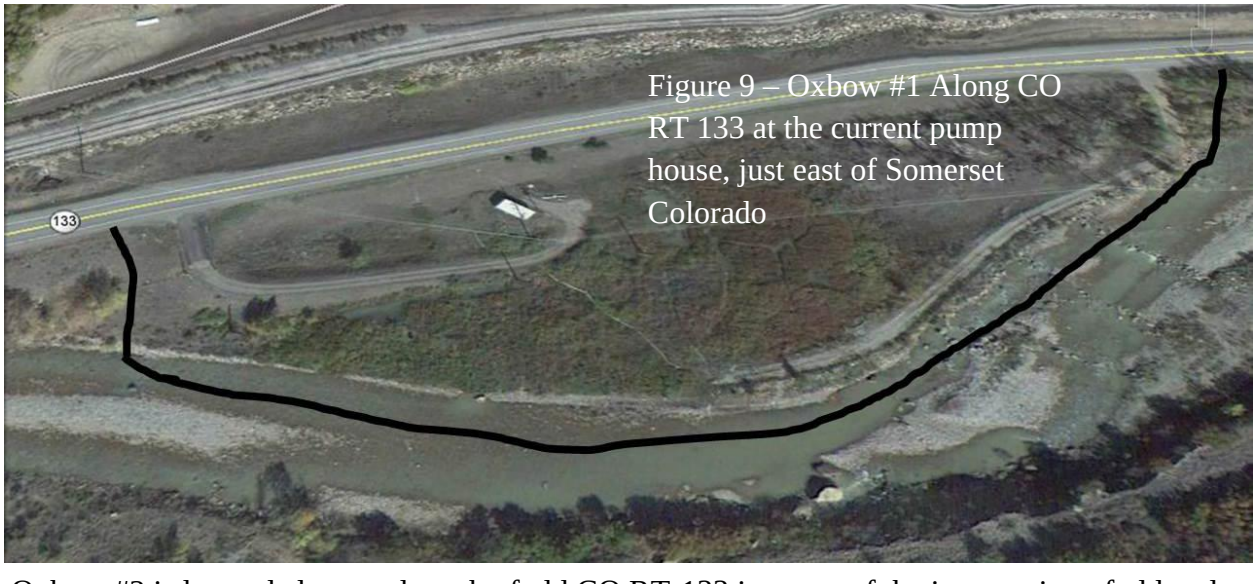


Figure 9 – Oxbow #1 Along CO RT 133 at the current pump house, just east of Somerset Colorado

Oxbow #2 is located along and south of old CO RT-133 just east of the intersection of old and new RT-133. See Figure 10. Potential site improvements include raft/kayak launch/takeout site, walk-in fishing access, parking lot and picnic area.

Oxbow #3 is located along and south of old CO RT-133. See Figure 11. This location is approximately X miles from the intersection of old and new RT-133. Potential site improvements include raft/kayak launch/takeout site, walk-in fishing access, parking lot and picnic area.

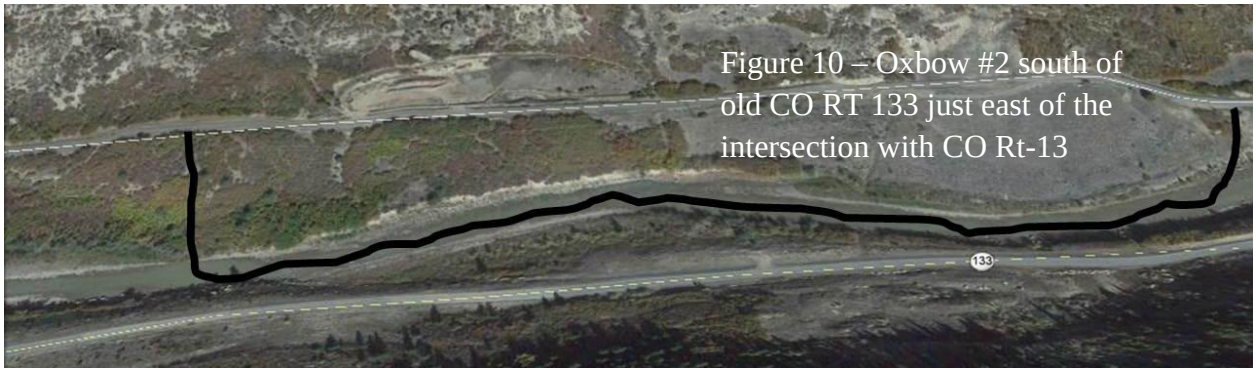


Figure 10 – Oxbow #2 south of old CO RT 133 just east of the intersection with CO Rt-13

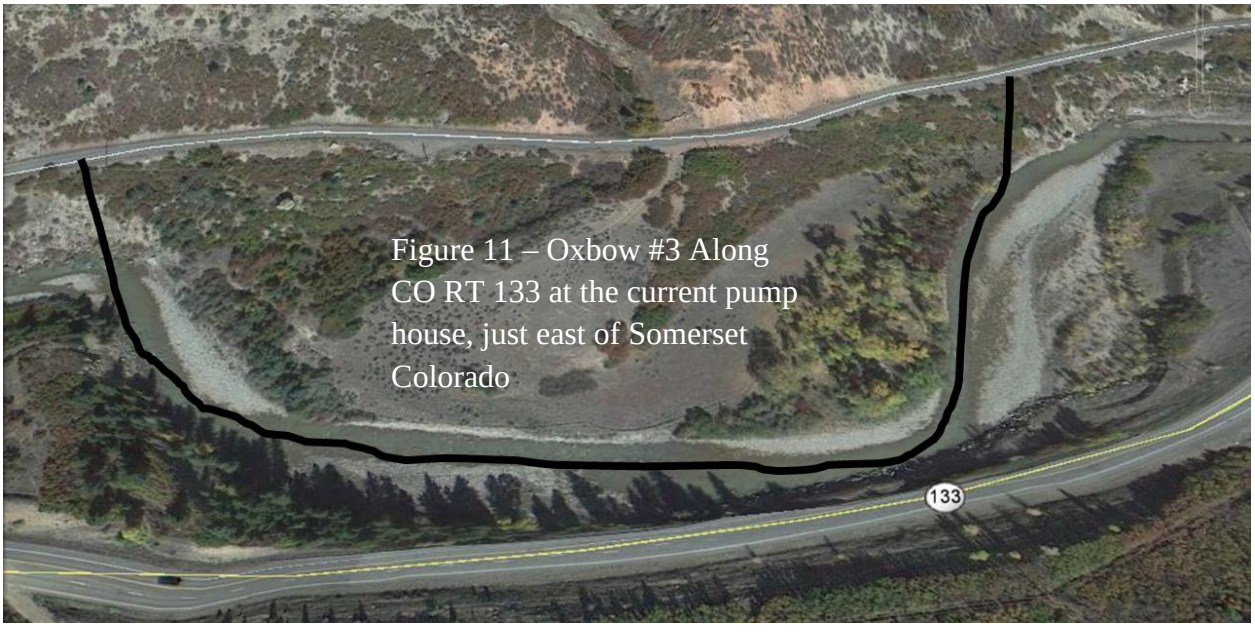


Figure 11 – Oxbow #3 Along CO RT 133 at the current pump house, just east of Somerset Colorado

Several of the potential sites for public access presents a steep downhill approach to the river. CPW has developed a way to turn this steep approach into a benefit using what we will call a raft slide with steps. Figures 12 and 13 show the implementation of a raft slide on the Blue River. This example is just upstream of the Trough Road Bridge, in the Kremmling, Colorado area.

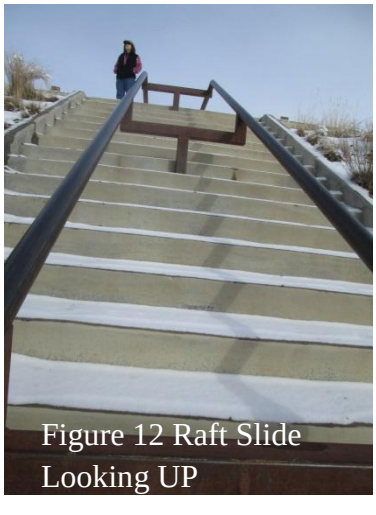


Figure 12 Raft Slide Looking UP

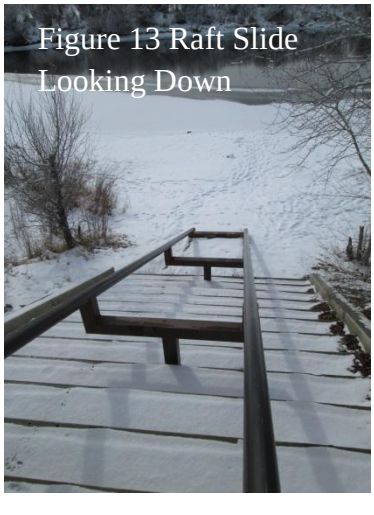


Figure 13 Raft Slide Looking Down

3.2 TASK 2 – Preliminary Design Development

Task 2 was completed through the execution of the following two efforts:

- Completing a competitive procurement for the preliminary design effort
- Completing the preliminary design engineering effort

3.2.1 – Competitive Procurement

The Request for Proposal (RFP) package was developed from the information obtained in Task 1 and included all necessary requirements from DCD's contract with CWCB. The RFP package included the following documents:

- Invitation to Bid
- DCD Bid Instructions
- Preliminary Design Statement of Work (SOW)
- Past Performance Information Sheet
- Sample Contract

The entire RFP package is contained in Appendix C.

Five companies with known expertise in the required areas were set the RFP package. The companies were Buckhorn Geotech, McLaughlin Water Engineers (a Division of Merrick and Company), Crane Associates, FlyWater Inc., and Western Water and Land Inc.

A bidder's conference was held at the DCD offices in Delta Colorado on April 9, 2014. The attendees at this meeting are presented in Table 6. The meeting included a review of the RFP, with a question and answer session. After the meeting, there was a site visit at the diversion point on the North Fork. At that time, Oxbow employees joined the meeting and gave a tour of the pump house and the adjacent river area, and answered question on the current operation of the water diversion process.

Table 6 – Attendees Bidder's Conference

Mike Drake	DCD
Ralph D'Alessandro	DCD
Beth Karberg	DCD
Jeff Crane	Crane Associates
Nancy Lamm	Buckhorn Geotech
Bruce Smith	Western Water & Land
Arron Asqith	Merrick-McLaughlin

After the bidder's conference, Buckhorn Geotech contacted DCD and stated that they would not be submitting a proposal.

Two proposals were received on the due date of May 2, 2014. One proposal was submitted by the team of Crane Associates and Western Water & Land (CWWL). The other proposal was submitted by Merrick-McLaughlin.

The proposals were reviewed by three DCD people using the Delphi method as explained in the instruction to offerers (See Appendix C for details). In the technical portion of the evaluation both bidders scored well, with Merrick-McLaughlin somewhat higher than CWWL in the independent review by all three reviewers. In the past performance, Merrick-McLaughlin was scored significantly higher than CWWL. Merrick-McLaughlin also was the low cost bidder. Therefore, from a low risk/high value standpoint, the contract was awarded to Merrick-McLaughlin on May 14, 2014.

3.2.2 Preliminary Design Engineering

The steps completed to develop the preliminary design are detailed in the following paragraphs.

River Flow Measurements – The initial step in the preliminary design effort was the collection of river flow measurements. This step actually began before the award of the award of the contract for the preliminary design. As a result of the Bidder's Conference, two of the potential bidders suggested that DCD start collection river flow measurements as the snow melt run-off started.

DCD started collecting river staff gage measurements on May 3, 2014. Three staff gages were placed in the river. Each gage was marked at one inch intervals from the top of the gage. The gages were pounded into the coble of the river bed and anchored with rocks at the bed level.

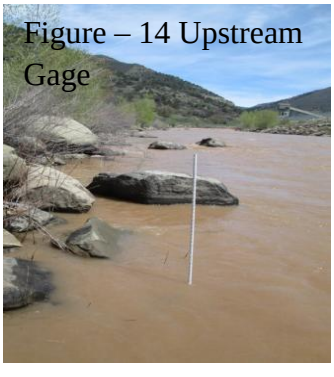


Figure – 14 Upstream Gage

The three gages were place as follows. One staff gage was placed near the upstream and downstream end of the river reach under consideration, and a gage was placed at the location of the current river pump site. The upstream gage was identified as SDSU. SDSU details are – gage placed downstream of the upstream river model point; GPS location N 38° 55.763' W 107° 27.184, as shown in Figure 14. The pump location gage was identified as SDSP. SDSP details are – gage placed just downstream of the pumps; GPS location N 38° 55.691' W 107° 27.341, as shown in Figure 15. The downstream gage was identified as SDSD. SDSD details are – gage placed about 10 yards upstream of the downstream river model point; GPS location N 38° 55.692' W 107° 27.362, as shown in Figure 16.

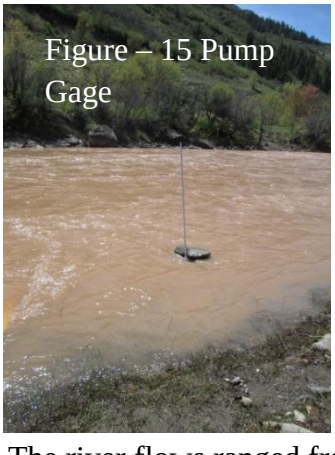


Figure – 15 Pump Gage

The first measurement set was taken on May 3rd with the last measurement set taken on July 2nd. There were a total of 12 measurement set recorded. The river flows ranged from 586 cfs to 2,697 cfs during the collection of the data. The data set for each measurement set included the date and time of day, and the distance in inches from the top mark on the stake to the water level. A sample of the data is shown in Table 7. All of the data collected is contained in Appendix D.

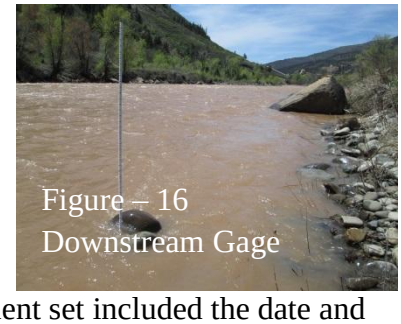


Figure – 16 Downstream Gage

Table 7 – Sample of Gage Data			
Date	Location	Time	Inches
5/3/14	SDSP	1:04 PM	41 5/8
5/3/14	SDSD	1:18 PM	37 1/8
5/3/14	SDSU	1:40 PM	34 7/8

Kickoff Meeting – The second design effort was the Design Kickoff meeting held at the DCD office on July 22, 2014. The attendees at this meeting are listed in Table 8. The purpose of the Kickoff meeting was to insure that the stakeholders and the MWE Team were all in agreement of the project scope, schedule, objectives, and diversion design requirements. During these discussions the following objectives and design criteria were agreed upon:

Table 8 – Kickoff Attendees	
Mike Drake	DCD

Beth Karberg	DCD
Arron Asqith	Merrick-McLaughlin
Quinn Connell	Merrick-McLaughlin
Neal Schwieterman	Paonia Kayak Club
Terry Commander	SDWD
Mike Ludlow	Oxbow
Tom Glor	Bear Ranch

- Ensure full diversion of water rights at all flow levels,
- Ensure fish and boater passage through/around diversion,
- Reduce sediment loading in diverted water before pumping,
- Reduce long-term maintenance,
- Survive 100-yr flood with improvements,
- Minimize impact to surrounding floodplain, and
- Optimize pumping operations from pump station to water tank

Also, all stages of the diversion design effort the following key issues were considered at:

- The Waterworks District would like to eliminate the initial pumping (river to wet well) with the proposed design.
- The group would like the final configuration to equally benefit fishing and boating recreation with boating/passage improvements to encourage low hazard normal river use and not necessarily provide a destination park and play experience.
- Where possible, the group would like to introduce natural elements into the design, minimizing straight lines or obvious man made elements where possible.
- The project area is currently on private property. Development of access will not be initiated until this analysis/design is completed.

Evaluation Of Existing Site And Diversion – The third design effort was Merrick-McLaughlin completing a topographic and bathymetric survey of the site and river bottom from July 22 through July 24, 2014. Surveying was completed using a Leica Total Station. Monuments or other control points on established datums, such as NAVD 88 and NGS 83 could not be located in the immediate project area. As a result, the survey was tied to the vertical datum used by the Oxbow Mine, LLC. Full topographic survey extended downstream of the pump station 500 feet and upstream 1000 feet. River cross sections were also collected 1,000 feet and 2,000 feet downstream of the pump station. The most downstream cross section corresponds to Cross Section Z, as identified in the Flood Insurance Study, Gunnison County, Colorado and Incorporated Areas, FIS Number 08051CV000A, May 16, 2013. The measured hydraulic drop in the North Fork from the east entrance road to the west entrance road at the time of surveying was 9.9 feet with an overall channel slope 0.83%.

In the past, multiple loose rock sills were constructed in the river to raise local groundwater and aide with infiltration gallery production. Since construction, the sills have gradually lost shape during high flows from saltation and local scour processes. During the survey, inspection of the site was also completed. In the current state, water is spread out across the sills, resulting in shallow flow in spaces between boulders. The shallow nature of the flow and numerous small gaps limits boat passage through the diversion site at low flows. In addition, local scour around the larger boulders allows underflow creating voids that are foot entrapment hazards for fisherman and waders. At intermediate boating flows, less than 1,000 cfs, gaps between boulders present pinning hazards for boaters. It also was noted that banks on both sides of the river have degraded to a near vertical condition as a result of the unstable condition of the reach. It is opined that this vertical condition is the result of a combination of channel degradation due to

sediment stripping by Paonia Reservoir and higher flows being directed into banks by the series of installed sills. The resulting condition is near vertical banks that can no longer support riparian habitat or wetland vegetation needed to keep topsoil in place and provide shaded shelter for fish and other aquatic species.

Preliminary Design Analysis and Draft Design Review Meeting – The completion of flow measurements, the Kickoff meeting, and the evaluation of the existing site and diversion delivered the required data to start the preliminary design effort. This effort was the detailed design and analysis that resulted in the Draft Preliminary Diversion Design, which was then reviewed by the project stakeholders at the Draft Preliminary Design Review Meeting.

The Draft Preliminary Diversion Design effort developed in two alterative designs.

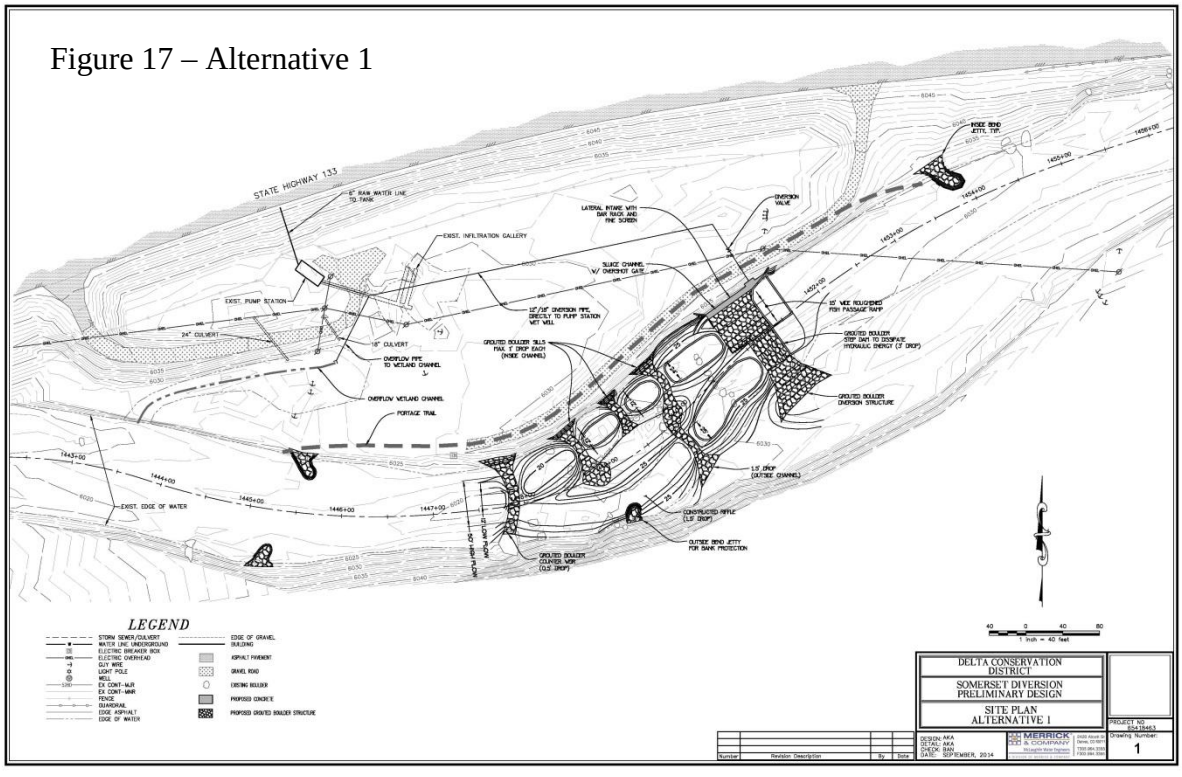
Alternative 1 restores and reinforces the multiple sill project previously constructed to locally raise groundwater at the diversion location. The following are short descriptions of the design elements included in Alternative #1:

- Intake/Diversion Orientation – The intake/diversion structure is proposed on the outside of a bend, parallel to the river bank and oriented to provide sweeping flow across the intake bar rack to reduce pinning of floating debris.
- Bar Rack – New sloped bar rack along intake structure for exclusion of large floating debris.
- Sluice Channel with Overshot Gate – A concrete channel, parallel to river flow is proposed to sluice sediment downstream while allowing lateral intake of water. An overshot gate within the channel can be raised during periods of low flow and drought to ensure a pool for water diversion. During high flow, the gate will be lowered to promote sediment sluicing.
- Existing and New Sills – Boulders from the existing loose rock sills will be reused. New sills will be constructed at similar elevation to existing sills, however, the new sills will include appropriate cutoffs and grout for stability during a 100-yr design flood.
- Fish Passage – A roughened channel (rock ramp) using boulders to provide fish passage at the grouted boulder diversion structure. Other sills will use a combination of boulders and low drops to allow upstream fish passage.
- Stepped Dam – Grouted boulder steps at the dam will improve stability and reduce hazards along the toe of the dam.
- Jetties – Boulder jetties upstream, downstream, and within the project reach will be constructed to turn the river flow, provide a take-out for river users, and protect the bank.
- Portage Trail – A trail and signage to encourage portage around the intake and diversion dam is included on the north bank.

This alternative provides a combination of small drops and pools to distribute the grade in the reach and is depicted in Figure 17.

Alternative 2 represents a return of the river reach to a single thread, matching the overall river gradient and mimicking the river width and riparian and wetland terraces bordering the river upstream and downstream of the project site. Similar to Alternative 1, a combination fish ramp/boat passage and lateral diversion structure is proposed at the upstream end of the project reach. The drop is reduced to 2 feet in this alternative to further promote fish passage and low hazard boat passage. In lieu of multiple sills, a series of jetties on the outside of the river bend shift the river north and provide an opportunity to re-establish the outside bend terrace that has

Figure 17 – Alternative 1



long since vanished as a result of sediment transport and scour. The following are short descriptions of the design elements included in Alternative #2:

- Intake/Diversion Orientation – The intake/diversion structure is proposed on the outside of a bend, parallel to the river bank and oriented to provide sweeping flow across the intake bar rack to reduce pinning of floating debris.
- Bar Rack – New sloped bar rack along intake structure for exclusion of large floating debris.
- Sluice Channel with Overshot Gate – A concrete channel, parallel to river flow is proposed to sluice sediment downstream while allowing lateral intake of water. An overshot gate within the channel can be raised during periods of low flow and drought to ensure a pool for water diversion. During high flow, the gate will be lowered to promote sediment sluicing.
- Existing and New Sills – Boulders from the existing loose rock sills will be reused. One new grouted boulder diversion sill will be constructed at the upstream end of the project reach. The new sill will be constructed at a similar elevation to the upper existing sill; however, it will include appropriate cutoffs and grout for stability during a 100-yr design flood.
- Fish Passage – A roughened channel (rock ramp) using boulders to provide fish passage at the grouted boulder diversion structure. The remainder of the reach will be restored with a continuous riffle, easily meeting fish passage criteria.
- Jetties and Boulder Clusters – Boulder jetties upstream, downstream and within the project reach will be constructed to turn the river flow, provide a take-out for river users, protect the bank and establish riparian/wetland terraces. In addition, large single boulders or boulder clusters are provide to provide intermediate resting and feeding areas within the riffle.
- Portage Trail – A trail and signage to encourage portage around the intake and diversion dam is included on the north bank.

This alternative uses a combination of a single drop/sill and constructed riffle to distribute the drop within the reach and is depicted in Figure 18. One primary goal of Alternative 2 is to restore the river to a more natural condition, prior to loose boulder sill installation and subsequent destabilization of the reach. Similar to reaches upstream and downstream, it is planned to add large individual boulders or boulder clusters to provide variety in the riffle, and feeding/resting zones for fish.

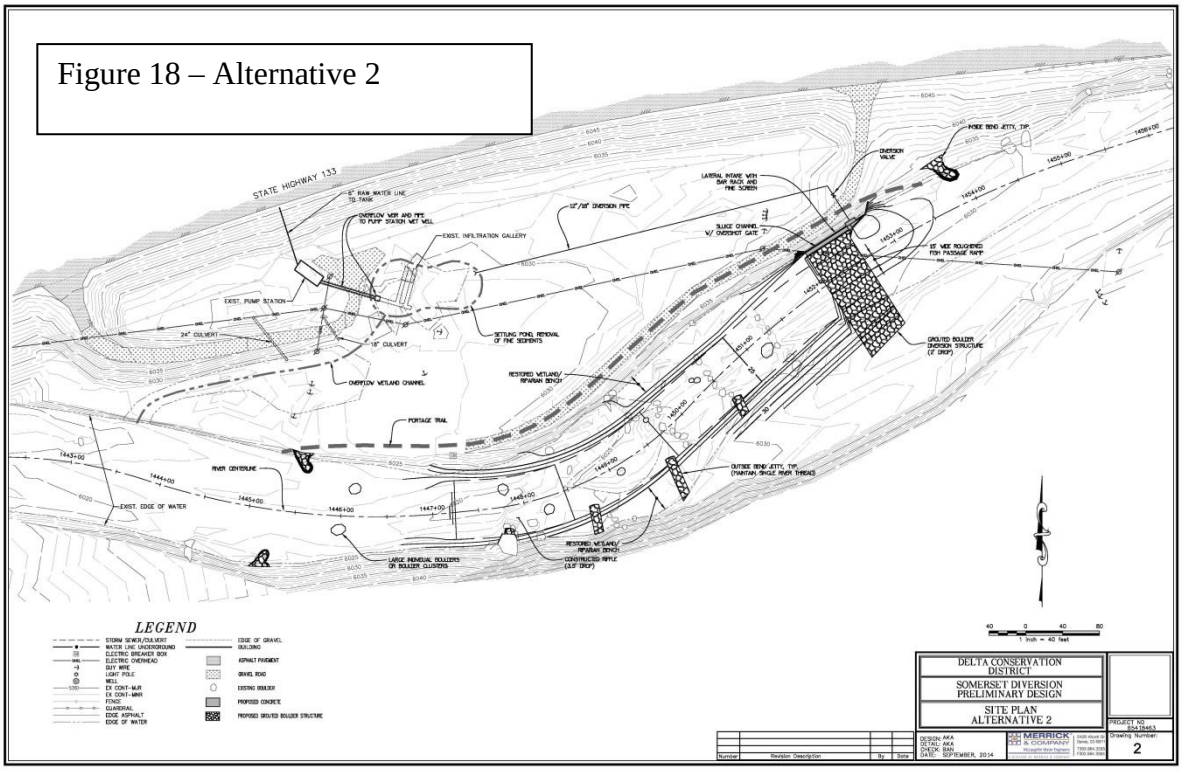


Figure 18 – Alternative 2

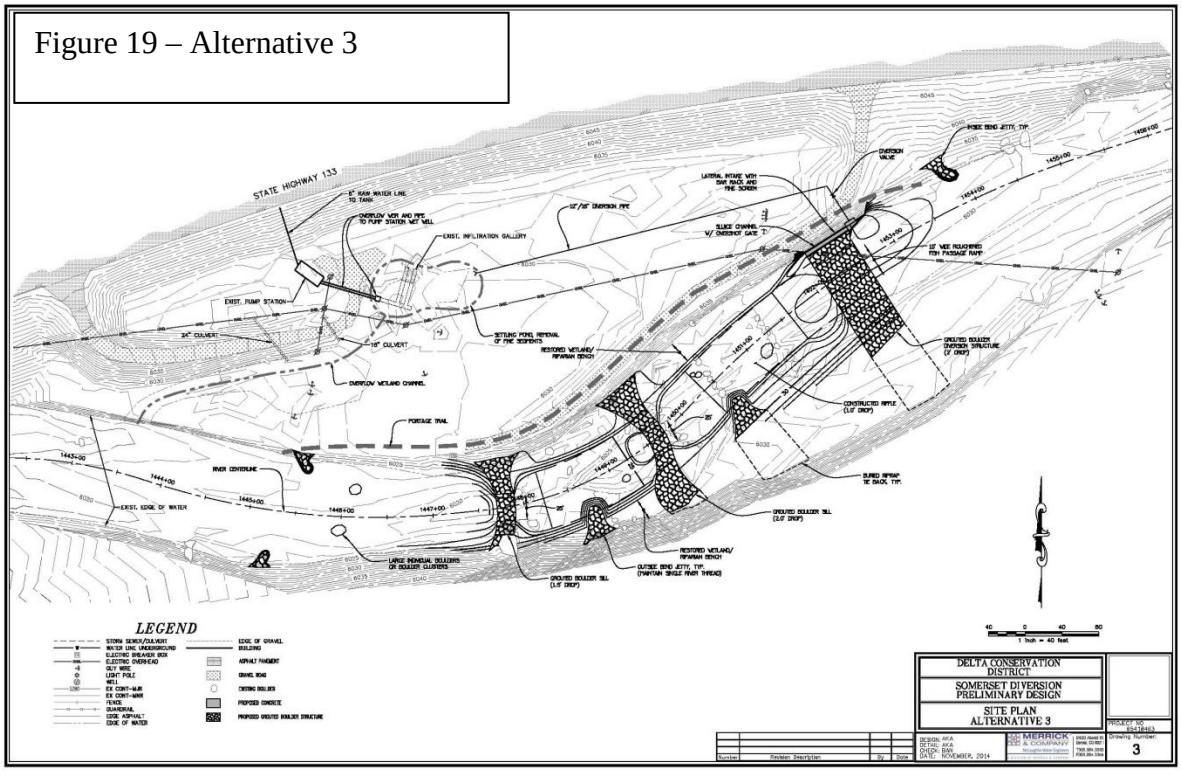
The Preliminary Design Review meeting resulting in the following suggestions to be reviewed and included into the Final Preliminary Design report:

- The costs presented did not include on shore (land) work that should be included in the final report.
- Most group member preferred the single thread river option.
- Alternative 2 fish passage River velocities and depths were preferred.
- The group would like to explore a third alternative that blends Alternatives 1 and 2 – small drops and a single thread for restoration of the river.
- Follow up with the County is needed to further define needed floodplain development permitting for the site.
- The team would like an estimate of construction duration included in the report.
- There is concern that construction of the diversion at the proposed location may cause the need to apply for a change in point of diversion.

Final Preliminary Design Report – The Draft Final Preliminary Design Report was reviewed by the stakeholders and small corrections and additions were requested. The Final Preliminary Design Report was received on January 15, 2015. The Final Preliminary Diversion Design Report, including the details of all analysis completed, is contained in Appendix E. Two key points within this report are given in the following paragraphs.

Stakeholders Preferred Alternative – The Stakeholders prefer a single thread river design. CPW and TU prefer Alternative 2, from an overall fish prospective. The rest of the stakeholder team prefers Alternative 3 (See Figure 19 and 20) from a boating and fishing prospective. See Appendix F for the statement supporting Alternative 2, along with concerns and required analysis that would be have to be completed for CPW and TU to support Alternative 3.

Figure 19 – Alternative 3



Floodplain Modification Process – The proposed alternatives modify the existing 100-yr water surface elevations by as much as 1.2 feet at some cross sections. The project lies within Zone A of the Flood Insurance Rate Map (FIRM) and will be constructed in the floodplain and floodway. In development of final design, a standard Gunnison County floodplain development permit application (available on the County website) will be required. Currently, the County floodplain regulations limit the post project base flood elevation rise to 0.5 feet. There are two approaches may be taken during final design development. These include:

1. Modification of design to achieve a 0.5 feet or less rise, followed by standard floodplain development permit application.
2. Request for a variance to the regulations as the only adjacent structure potentially impacted would be the existing pump station.

Note that the pump station finished floor elevation is approximately 2 feet above the current 100 year water surface elevation.

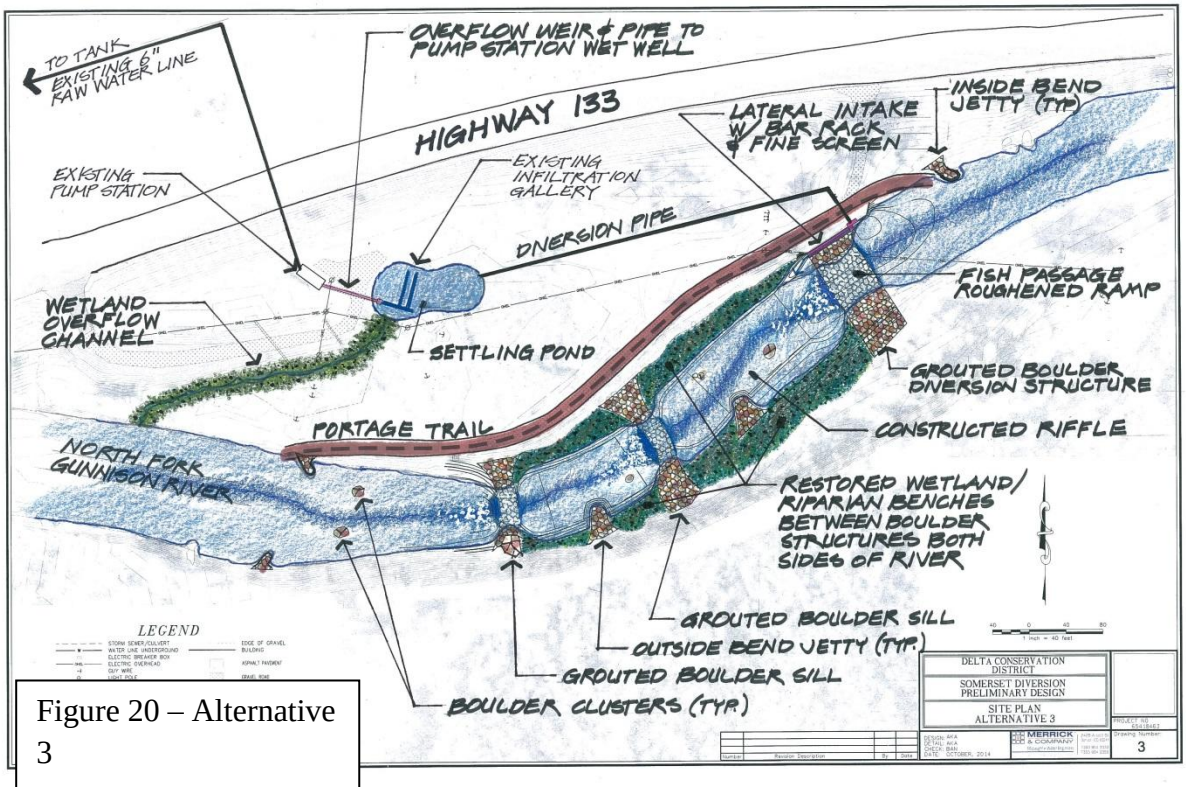


Figure 20 – Alternative 3

The County reviews floodplain development applications on a case by case basis and does not have specific criteria related to diversion structures. As a result, the design engineer for the final project will need to prepare a report detailing the proposed impacts to the floodplain. An initial project meeting will be held with the County to discuss options and requirements for the project.

3.3 TASK 3 – Final Report

This document is the Final Report for the Somerset Diversion Improvement Study -North Fork of the Gunnison River Corridor Project. The effort to develop, compile, and review the Final Report started on October 23, 2014. The report was completed and sent to CWCB on December 2, 2014.

Section 4 Project Conclusions

The following conclusions are based on both data collected and the analysis completed for this project:

1. Three alternative concepts were developed. All concepts achieved the primary design objectives including:
   - Ensure full diversion of water rights at all flow levels,
   - Ensure fish and boater passage through/around diversion,
   - Reduce sediment loading in diverted water before pumping,
   - Reduce long-term maintenance,
   - Survive 100-yr flood with improvements,
   - Minimize impact to surrounding floodplain, and
   - Reducing water system maintenance and increasing water quality.
2. The three concepts, as developed, have been validated with preliminary design analysis. Alternatives 1 and 2 have been modeled using one-dimensional and two-dimensional

modeling techniques. Since Alternative 3 is a combination of Alternatives 1 and 2, addition analysis wasn't necessary.

3. Alternatives 1 and 3 support multi-use recreational objectives for the project reach, maximizing benefits for both fisherman and boaters and will encourage tourism.
4. The majority of stakeholders prefer Alternative 3 because the design returns the river to a single thread and provides an opportunity for riparian terrace restoration, and encourages tourism.
5. Alternative 2 is preferred by CPW and TU, from a fish perspective. However, Alternative 3 could be acceptable if fish requirements are completely met (See Appendix F).
6. The three major landowners for this section of the NFR basically agreed that our PAT's plan to enhance public access to the NFR though developing landowner partnerships was a good approach to gaining more public access to the NFR.
7. There is a high probability that public access projects can be developed with the BLM and MCC.

Section 5 Project Recommendations

The following recommendations are based on the data collected and the analysis completed:

1. Alternative 3 is the recommended as the basis for future design phases and funding requests.
2. During final design the following will be required:
    - Stability design will be required, including scour depths, channel degradation and aggradation, and armoring sizes/types.
    - A standard floodplain development permit application (available on the Gunnison County website) will be required.
    - The preliminary design indicates a 1.2 foot increase while the current floodplain regulations limit the post project base flood elevation rise to 0.5 feet. Two potential resolution approaches are:
        1. Modification of design to achieve a 0.5 feet or less rise, followed by standard floodplain development permit application.
        2. Request for a variance to the regulations as the only adjacent structure potentially impacted would be the existing pump station. Note that the pump station finished floor elevation is approximately 2 feet above the 100-yr water surface elevation.
    - The County reviews floodplain development applications on a case by case basis and does not have specific criteria related to diversion structures. As a result, the design engineer for the final project will need to prepare a report detailing the proposed impacts to the floodplain. It is highly recommended that an initial project meeting with the County is held to discuss options and requirements for the project.
    - Safety recommendation – the CWCB low hazard design criteria be used as a basis for further development of the design.
    - 2D modeling results indicate that some design revisions will be required to ensure compliance with fish passage criteria.
    - Determination of needed property and access for operation and maintenance of the diversion improvements is required.
    - Tie project survey to NAVD 88 (vertical datum) and NGS State Plane Coordinates (horizontal control).
3. Public access projects should be developed for BLM and MCC lands and funding these projects should be pursued.

Appendix A - Key Stakeholder Contact List

Name	Affiliation	Address	Phone	E-mail
Ralph D'Alessandro	DCD	690 Industrial Blvd. Delta, CO 81416	(970) 314-5355	rdinca@yahoo.com
Mike Drake	DCD	PO Box 1534 Paonia, CO 81428	(970) 527-4535	mldht1@live.com
Beth Karberg	DCD	690 Industrial Blvd. Delta, CO 81416	(790) 498-9460	deltaconservationd@gmail.com
Aaron Asquith	MWE/Merritt	2420 Alcott Street Denver, Colorado 80211	(303) 800-9030	Aaron.Asquith@merrick.com
Terry Commander	SDWD			tcommander@wildblue.net
Bill Sterns	SDWD		(970) 929-6366	
Eric Gardunic	CPW	2300 S. Townsend Ave., Montrose, CO 81401	(970) 250-5842	Eric.Gardunio@state.co.us
Dave Graf	CPW	711 Independent Ave., Grand Junction, CO 81505	(970) 255-6142	david.graf@state.co.us
Barb Sharrow	BLM-UFO		(970) 240-5313	bsharrow@blm.gov
Julie Jackson	BLM-UFO		(970) 240-5310	jmjackson@blm.gov
Jedd Sondergard	BLM-UFO		(970) 240-5342	jsondergard@blm.gov
Cary Denison	Trout Unlimited			cdenison@tu.org
Neal Schwieterman	Paonia Kayak Club		(970) 527-9188	mambomamba@paonia.com
Sarah Sauter	Western Slope Conservation Center			sarah@theconservationcenter.com
Jim Kiger	Oxbow			jim.kiger@oxbow.com
Mike Ludlow	Oxbow			mike.ludlow@oxbow.com
Chuck Shelden	Oxbow			
Rob Thurman	Oxbow			
Tom Glor	Bear Ranch			tom.glor@flcrsi.com

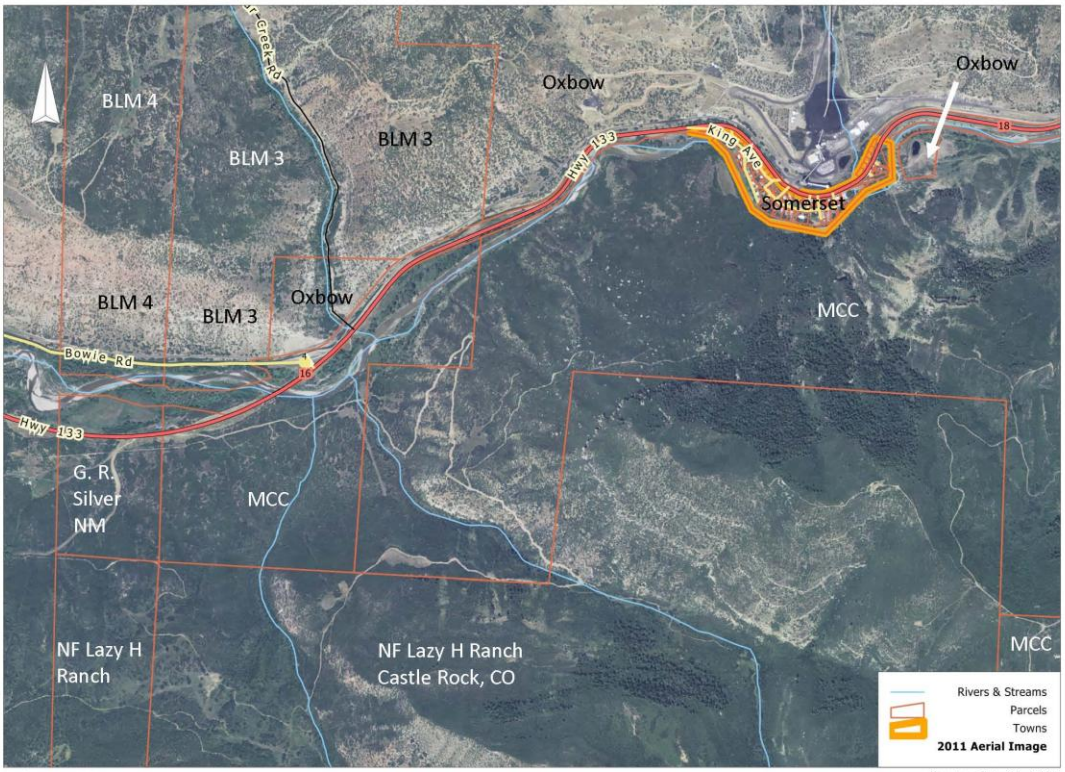
Name	Affiliation	Address	Phone	E-mail
Kathleen Welt	MCC	PO Box 591, 5174 Highway 133, Somerset, CO 81434	(970) 929-2283	kwelt@archcoal.com
Weston Norris	MCC	PO Box 591, 5174 Highway 133, Somerset, CO 81434	(970) 929-2333	wnorris@archcoal.com

Appendix B – GIS Landowner Information

The following table illustrates the value of the GIS information available. The GIS points listed in the table provide the corner points for all the BLM owned parcels in this reach of the river.

Landowner Parcel no.	1	2	3	4	5	6	7	8	9	10	11	12
BLM 3187000 00004	38°56.3 107°30.44	38°56.289 107°29.717	38°55.153 107°29.778	38°55.17 107°30.042								
BLM 3185000 00003	38°56.059 107°29.727	38°56.058 107°29.183	38°55.84 107°29.207	38°55.841 107°28.946	38°55.493 107°28.975	38°55.414 107°29.184	38°55.413 107°29.503	38°55.213 107°29.513	38°55.206 107°29.563	38°55.175 107°29.507	38°55.142 107°29.627	38°55.153 107°29.778
BLM 3185000 00014	38°55.719 107°25.216	38°55.737 107°24.694	38°55.842 107°24.696	38°55.872 107°24.548	38°55.893 107°24.492	38°55.948 107°24.44	38°55.558 107°24.44	38°55.498 107°24.943	38°55.502 107°25.212			
BLM 3185000 00021	38°55.979 107°24.393	38°56.053 107°24.236	38°56.088 107°24.083	38°56..084 107°23.913	38°56.129 107°23.731	38°56.229 107°23.338	38°56.013 107°23.332	38°56.005 107°23.603	38°55.561 107°23.600	38°55.560 107°23.880	38°55.995 107°23.883	
BLM 3185000 00018	38°56.314 107°22.805	38°56.293 107°22.656	38°56.284 107°22.585	38°56.232 107°22.583	38°56.232 107°22.446	38°56.282 107°22.446	38°56.319 107°22.283	38°56.38 107°22.188	38°56.469 107°21.903	38°56.473 107°21.78	38°56.391 107°21.503	38°56.381 107°21.908
18 row #2	13 - 38°56.175 107°21.901	14 - 38°56.177 107°22.805										

CL to Somerset



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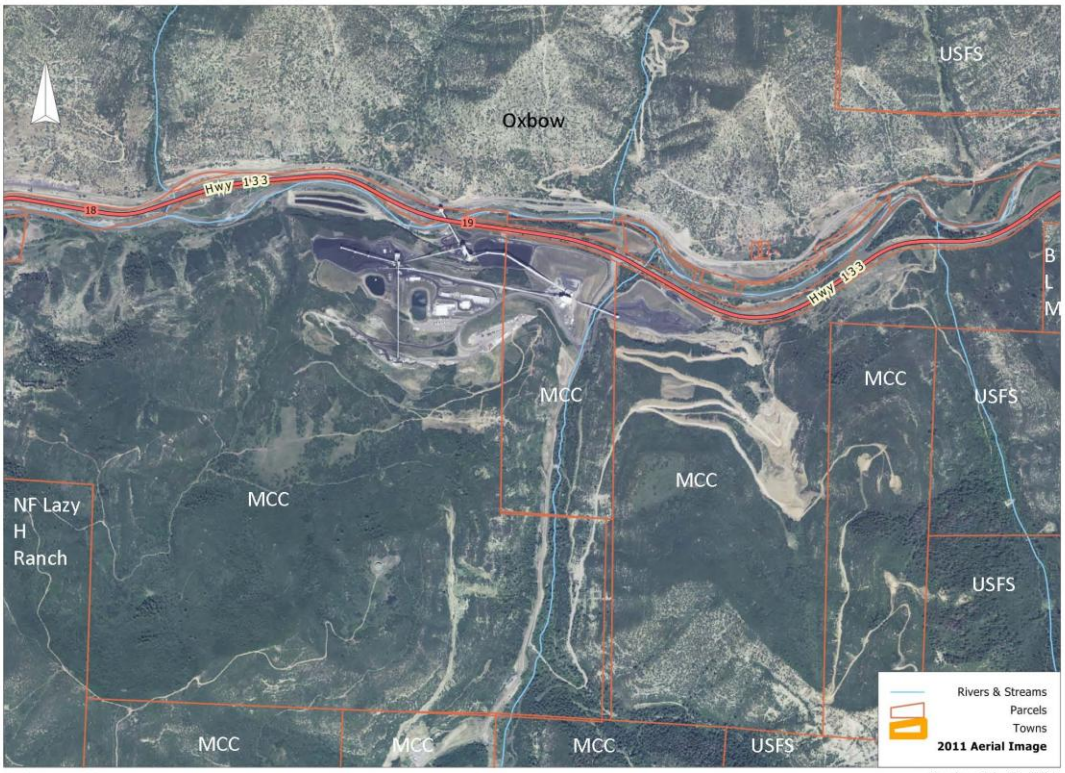
Sunday, July 27, 2014

Somerset US 1



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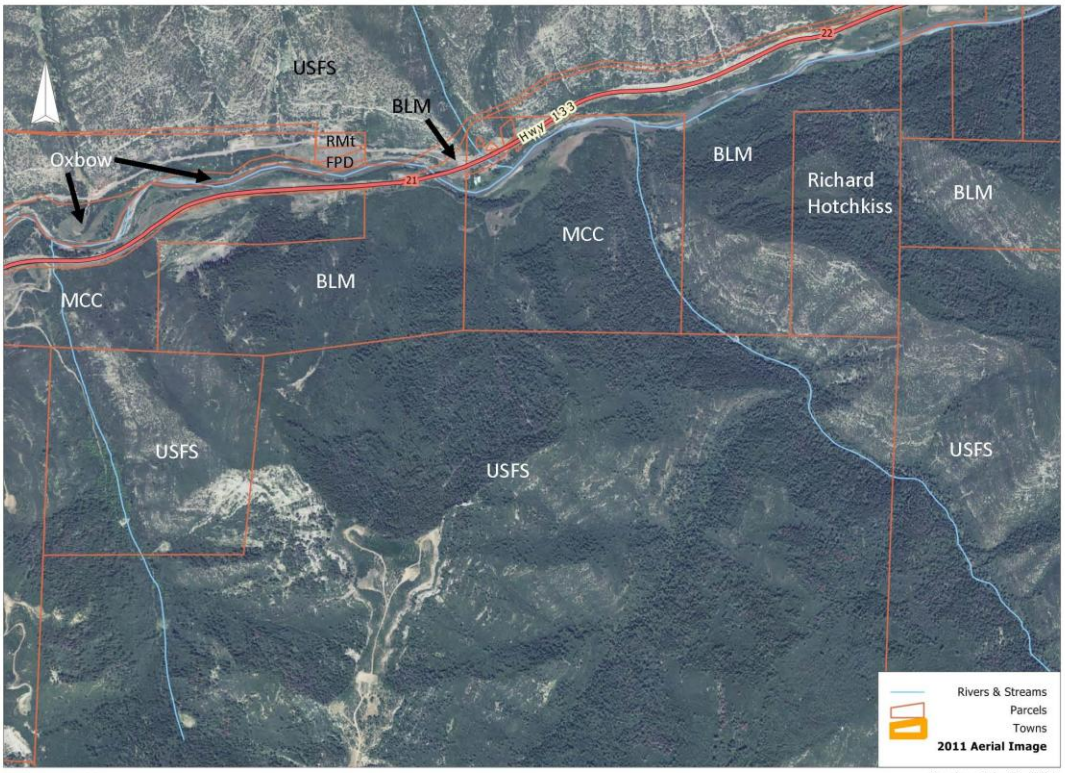
Somerset US 2



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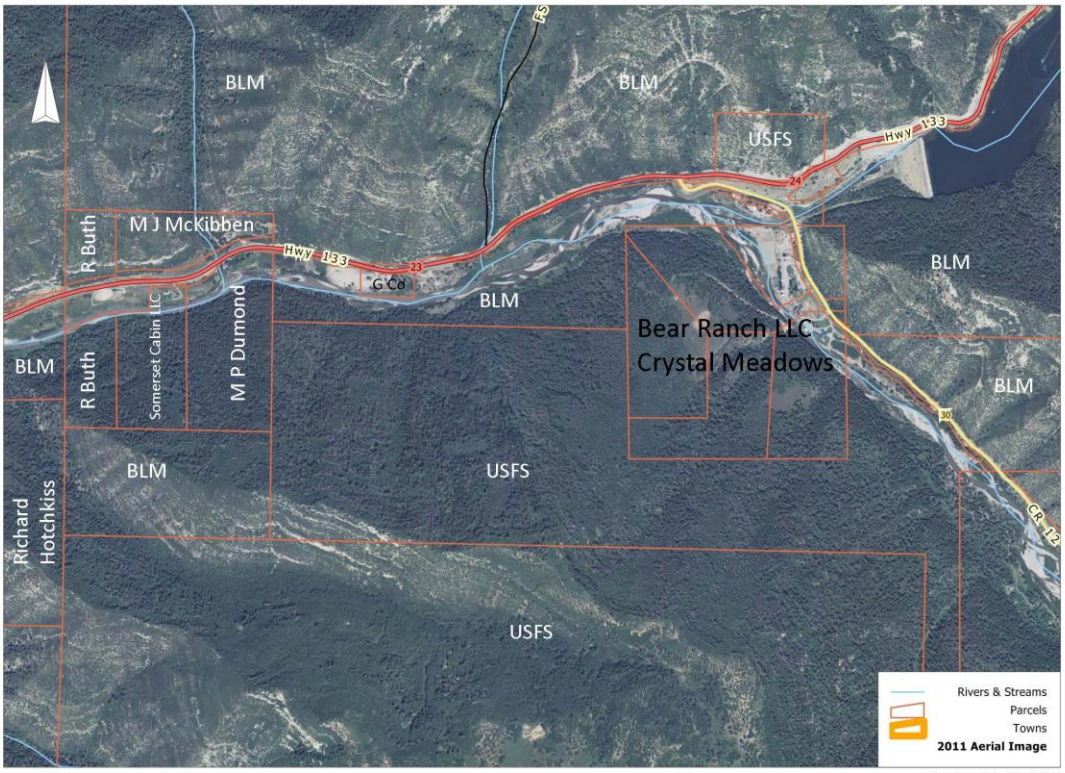
Sunday, July 27, 2014

Somerset US 3



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Sunday, July 27, 2014

Appendix C – RFP Package

Delta Conservation District
INVITATION TO BID
Solicitation **NO. DCD2014-SD-R-001**

Delta Conservation District (DCD) is soliciting sealed bids to provide engineering services for the Somerset Diversion Preliminary Design for the Somerset water diversion, located on the North Fork of the Gunnison River in Gunnison County, Colorado. **Bids must be received at the DCD office at 690 Industrial Blvd; Delta, CO 81416 not later than 4:00 PM Thursday, May 2, 2014**, at which time the bid opportunity will close. Bids received after this time will not be considered.

On April 9, 2014 at 12:30 PM, there will be a bid meeting at the DCD office. A site visit will follow the meeting. Offerors are not required to attend the meeting to bid the project. Anyone wishing to join a teleconference of the meeting must email DCD at the email addresses given below by April 7, 2014. The teleconference numbers will be sent in a response to your email request.

All bids must be submitted in compliance with the instructions to the offerors and the enclosed Bid Forms. The preferred delivery for bid packages is electronic. Bid packages can be delivered electronically to David Cary at david.carey@co.nacdnet.net and Mike Drake at mldht1@live.com. Electronic submissions must arrive no later than the same closing time as non-electronic submissions. Non-electronic submissions can be printed material with original signature pages, or on CD or other electronic storage device. In all cases of submission, other than printed versions, original signature pages or scanned copies of the original signature pages must accompany the submission. Bid packages delivered though the mail, UPS/FEDX, or by hand should be placed in a sealed envelope addressed to DCD. Inside the outer envelope, a second envelope should be clearly labeled or marked "Somerset Diversion Preliminary Design" and bearing the name and address of the submitting entity. If DCD staff is unavailable for acceptance of hand delivered packages, the bid packages may be delivered in person to the NRCS Field Office at the above address.

Questions regarding this invitation to bid may be directed to Mike Drake, DCD Project Manager at Email mldht1@live.com; phone (970) 527-4535 or cell (801) 710-83762.

DCD reserves the right to accept or reject any and all bids, in whole or in part, in the best interest of the project.

Solicitation **NO. DCD2014-SD-R-001**

Somerset Diversion Preliminary Design
Instructions to the Offerors

I. Attachments

Information provided with these instructions includes:

- Statement of Work (SOW)
- Past Performance Information Sheet (PPIS) template
- Proposal preparation and evaluation process information
- Sample contract

II. Proposal Marking

The proposal package shall include completed forms, technical proposal, cost proposal, completed sample contract, and three completed PPISs. All documents in the proposal package shall be marked on each page with the following:

- Competition Sensitive
- The solicitation number
- The offeror's company Name

Proposal package shall be submitted in a sealed package clearly labeled with the words "Somerset Diversion Preliminary Design Competition Sensitive" on the front/outside of the package.

III. Signature Requirements:

Required signatures must be provided by company authorized agents and the signature must be witnessed.

IV. Contractor Requirements

The contractor shall provide all equipment, labor, materials and supplies necessary to complete the work.

V. Contract Award

Award of a contract shall be awarded at the earliest possible date with an executed contract with the winning bidder. DCD at its sole and absolute discretion will fairly evaluate all proposals submitted based on the evaluation criteria defined. DCD reserves the right to reject any and all bids found to not meet the minimum requirements defined. To receive an official debrief, losing bidders must request a debrief within three working days of notification.

VI. Required Information Upon Award

The contractor to whom award is made shall provide the following information to DCD prior to the award of the contract:

- Standard Accord Certificate(s) of Insurance. (Contractual Liability Type)
  1) Workers Compensation Insurance
  2) Public Liability and Property Damage Insurance with DCD, Somerset Domestic Waterworks District, Ox Bow – West Elk Mine added to the policy
  3) Automobile Bodily Injury and Property Damage Insurance
  4) Performance Bond (100% of the contract amount)

VII. Work Completion

The work shall be completed no later than 90 days from the award of the contract signified by the receipt of a Notice to Proceed delivered in writing to the bidders legal mailing address.

VIII. Payment Schedule

The winning bidder can bill DCD monthly for expenses incurred. Payment will be made within five days after DCD receives funds from the sponsoring agencies. CWCB states that they will pay DCD invoices within 45 days of receiving the invoice.

DCD will withhold 10% of the total bid until the final report is accepted and approved. The final payment shall be made to the contractor by DCD no later than five days after receiving final payment from the sponsors.

IX. Proposal Volume

The proposal will consist of three sections, which are:

- Section 1 – Technical
- Section 2 – Past Performance
- Section 3 – Cost

The Technical Section will address the technical proposal criteria and present resumes of key personnel to be used in the program.

The Past Performance Section will present relevant corporate experience to the proposal evaluation criteria for two past projects using the provided Past Performance Information Sheets (PPIS).

The Cost Section will present the bid price and back up data that supports that price. Cost data to be included are:

- An program labor breakout for labor hours and per hour fully loaded costs by labor category
- Travel costs, including number of trips, people per trip, length of trip, and reason for trip
- Itemization of other direct cost items and cost

X. Proposal Page limits

The Technical Section is limited to 15 pages. Identify up to five key personnel and their roles in the program. Include resumes for these key personnel in an appendix to the technical proposal. The resumes will not count against the total page count. The Past Performance Section is limited

to a two page company introduction and two Past Performance Information Sheets (PPISs). Each PPIS is limited to three pages. The offerors must use the PPIS form provided.

XI. Proposal Evaluation Criteria

Evaluation Factor 1 – Technical and Management Approach to Somerset Diversion Preliminary Design completion

A. Subfactor 1 – Overall technical approach
B. Subfactor 2 – Detailed technical approach to Tasks 3.2 and 3.3
C. Subfactor 3 – Overall program management approach
D. Subfactor 4 – Project management plan, including subcontractor management if required

Evaluation Factor 2 – Relevant past performance

A. Two past performance write ups.
B. Relevance evaluation based on scope, cost, and technical similarity and complexity of past performance as compared to this project.
C. Performance risk based on relevancy, success, and on-time/within budget performance.

Evaluation Factor 3 – Cost

XII. Proposal evaluation process

Evaluation factors 1 and 2 equally important, with factor 3 of less importance. The Delphi method will be used to rank the proposals. The subfactors for evaluation factors 1 and 2 will be scored between one and five. The weighted subfactor score will be calculated by multiplying the subfactor score by the weighing value assigned to that subfactor. The evaluation factors 1 and 2 scores will be the average of the weighted subfactor scores. The weighted score for evaluation factors 1 and 2 will be the evaluation score multiplied by the appropriate weighting factor. The weighted score for evaluation factor 3 will be the score for evaluation factor 3 multiplied by the appropriate weighting factor. Cost scoring will range from 5 for the lowest bid to 1 for the highest bid. The proposal cost also will be evaluated for reasonableness. The total proposal score will be the sum of the weight evaluation factor scores. All weighting factors are shown in Table below.

Evaluation Factor	Weight Factor
1 Technical	8
• SF 1	8
• SF2	8
• SF3	9
• SF4	7
2 Past Performance	10
• PP1	10
• PP2	10
3 Cost	4

Statement of Work (SOW)

For

Somerset Diversion Preliminary Design Project

February 10, 2014

Prepared by:

Delta Conservation District
690 Industrial Blvd.
Delta, Colorado 81416
(970) 874 5735 X

Table of Contents

ACRONYM LIST

CAD	Computer Aided Drawings
DAC	Days After Contract
DCD	Delta Conservation District
IPT	Integrated Project Team
NFR	North Fork River
OSHA	Occupational Safety and Health Administration
PDF	Adobe Data File
POP	Period of Performance
PR	Purchase Request
SDWD	Somerset Domestic Waterworks District
SOW	Statement of Work

INTRODUCTION

1.1 Purpose

The purpose of this effort is to complete a preliminary design for an operationally improved Somerset Diversion design including transport of the water from the river up to the raw water storage tank 200 feet above the river. Additional, the diversion design will incorporated improved boat and fish passage, and improved river and riparian habitat in the area of the diversion. The starting point for the preliminary design will be the current water diversion operations.

1.2 Scope

The Contractor shall provide all personnel necessary to perform project management, logistics, engineering, and technical drawings required for the completion of the preliminary design. Tasks shall include, but are not limited to: completing the preliminary design, participation on the Integrated Project Team (IPT) and related activities, briefing preparation and presentation, project planning and scheduling, project risk management, defining and analyzing problems, defining problem solutions, providing recommendations, and writing reports. The preliminary design effort will evaluate requirements for:

- Diversion structure requirements to insure full diversion of water rights at all flow levels
- Diversion structure requirement to insure fish and boater passage through/around the diversion
- River and riparian area requirements to improve wildlife habitat and improve bank and river channel stability
- Reduced sediment loading in diverted water before pumping
- Reduced long-term maintenance
- Survival of a 100 year flood on the designed structure
- Impact on the surrounding floodplain
- Optimum pumping operations to move the water from the diversion to the water treatment plant 200 feet above the river and approximately a half mile away.

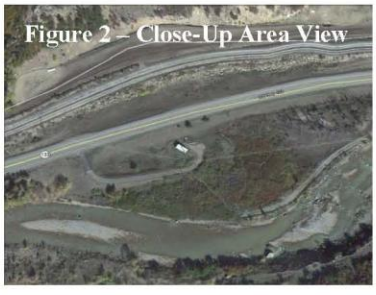
The contractor should propose any additional requirements that are deemed necessary to successfully achieve the purpose of this project. The preliminary design process will incorporate the latest analysis technologies that have been proven successful in the design and evaluation of boat and fish passage dam modifications.

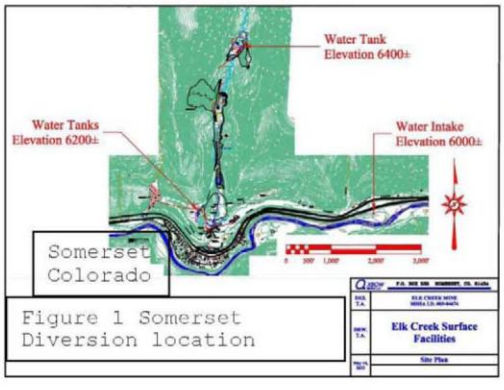
Figure 1 – Area View

1.3 The Somerset Diversion Preliminary Design Project Background

The location of the current Somerset water diversion operations is shown large scale in Figure 1 and close up in Figure 2. The Somerset diversion currently is owned and operated by Oxbow Mining LLC – Elk Creek Mine. See Figure 3. However, the ownership and operation is in the process of being transferred to the Somerset Domestic Waterworks District (SDWD).

This diversion provides industrial water for the mine and provides the municipal water for the town of Somerset via the Somerset Domestic Waterworks District. There is no direct diversion of water from the river to the gallery. The old system was to collect subsurface water in the gallery. That system eventually didn't supply sufficient water. At that point a direct pump from the river to the gallery was implemented. Currently, to insure sufficient water for mine operations, a second pump is used to pump water to the gallery or directly to the pump house to supplement the water being pumped to the raw water storage tank. There has always been difficulty diverting the required water during low flow periods and the sediment filtration problems are significant. The water is currently pumped directly out of the river and into the water system. Due to the elevation of the raw water tank, water must be pumped from the river level 200 feet up in elevation to the water processing facility and the first storage tank.





The total water decree is for 1.8 CFS from the North Fork of the Gunnison River.

This stretch of the North Fork River (NFR) has a variable boating season of 1-9 weeks of higher flows (1000+ cfs) and benefits from extended flows down to the 256 cfs that are delivered to the Fire Mountain Canal below Somerset, Colorado. These lower flows last through the irrigation season typically into September or even October. Fishing on the NFR is limited by access; however, is considered excellent for trout.

DCD has established partnerships and an IPT with the key stakeholders in this project, who are given in Attachment I. The key stakeholders have supported the planning and development of the project because of the project's multiple benefits.

In 2012, DCD began meeting with the key stakeholders to develop an agreed-upon set of project requirements. These meetings resulted in the definition of the critical requirements/objectives that the diversion will have to meet. Obtaining this agreement on the modification requirements resulted in solid support for the project from the key stakeholders.

This contractual statement of work addresses the preliminary design project.

REFERENCE DOCUMENTS

All reference documents are contained in Attachment II. These documents include photos of the diversion area, the diversion degrees, operations and maintenance manuals for the transfer

system. Note that the focus of the design effort is to improve the water delivery system from the river to the raw water storage.

CONTRACTOR TASKING / REQUIREMENTS

The contractor shall provide engineering/technical services required to complete the following tasks, and interact with DCD and IPT members involved in the support of the Somerset Diversion project.

3.1 Kick-off Meeting

The purpose of the Kick-off meeting is to insure that the contractor and all the key stakeholders agree and understand the requirements.

The Contractor shall support the Preliminary Design Kick-off meeting. Beyond participation, this task shall include supporting DCD in the development of the agenda, reviewing preliminary design criteria and suggesting modifications and additions, completing meeting minutes, detailing action items, and finalizing design criteria developed during the meeting. The Kick-off meeting shall be completed within two weeks of the award of the contract.

3.2 Site Inspection and Survey

The contractor shall complete a site inspection and survey to acquire all necessary site data required for the completion of the preliminary design. The field survey should cover the length of project and to include floodplain elevations beyond the river banks, particularly in areas where increased flood elevations could impact adjacent properties.

3.3 Develop Draft Preliminary Design

The contractor shall complete the draft preliminary design for the Somerset Diversion. The contractor shall consider all design criteria and information, and address all issues resulting from the Kick-off meeting and site inspection. The design shall consider requirements for diversion, fish and boat passage, river and riparian habitat improvement, long-term maintenance, flood plain, and 100 year flood survival. The preliminary design process will incorporate the latest analysis technologies that have been proven successful in designs of similar diversions.

3.4 Draft Preliminary Design Review

The contractor shall present the detailed results of the draft preliminary design efforts at the Preliminary Design Review. This review will be held at the DCD office in Delta, Colorado. The contractor shall provide the presentation and supporting detailed information to DCD five business days prior to the scheduled review meeting. Immediately upon receiving the review information, DCD will submit the information to the IPT so that the information can be evaluated prior to the review meeting. The IPT will provide feedback and recommendations at the review meeting on needed changes and improvements to be addressed before the final preliminary design is complete.

3.5 Preliminary Design Iteration

The contractor shall evaluate and develop a solution for all issues/problems defined during the draft final design review and complete the preliminary design.

The contractor shall produce drawings and specifications required. The preliminary design report will be part of the final design bid package. DCD will be responsible for the final design bid process.

3.6 Preliminary Design and Report Review

The contractor shall present the final design and final report at a review meeting held at the DCD office in Delta, Colorado. The contractor shall provide the presentation and supporting detailed information and the draft final report to DCD one week prior to the scheduled review meeting. Immediately upon receiving the review information, DCD will submit the information to the IPT so that the information can be evaluated prior to the review meeting. The IPT will provide feedback and recommendations at the review meeting on needed minor changes/improvements to be addressed before final submission.

DELIVERY SCHEDULE AND PERIOD OF PERFORMANCE

4.1 Period of Performance (POP)

The POP for this task shall be twelve weeks following contract award.

4.2 Delivery Schedule

The following deliverables are required for this project:

1. Kick-off Meeting Minutes and Action Items – due one week after the Kick-off meeting
2. Presentation Materials (Section 3.4 – Draft Final Design Review, Section 3.6 – Final Design and Report Review) – due five business days before meeting
3. Monthly Status Reports – due monthly ten business days after the end date of the reporting period
4. Final Report – due two weeks after the final design and report review meeting.

Documentation deliverables shall be delivered in electronic format. Both Microsoft Office and PDF format are acceptable. CAD data must be submitted in both the format for the specific CAD system used to develop the data and a universal format accepted by commercially available CAD systems. The contractor must get approval from the DCD Program Manager for any variant in deliverable formatting.

4.2.1 Kick-off Meeting Minutes and Action Items

The contractor shall work with DCD to compile and complete the minutes from the Kick-off meeting that will include the listing of action items and assigned responsibilities.

4.2.2 Monthly Status Report

The Contractor shall submit monthly status reports no later than the 10^{th} business day after the end of the reporting period. The Monthly Status Reports shall be on company letterhead and accompanied by the month's invoice. The Monthly Status Report shall include, but is not limited to, the following information:

a) Contract Number
b) Narrative review of work accomplished during the reporting period
c) Description of any major issues/problems identified and proposed solutions
d) Description of any travel
e) Detailed accounting of expenditures

f) Anticipated work activity for the next reporting period

4.2.3 Draft Final Design Review, and Final Design and Report Review
The contractor shall develop presentation materials for both review meetings using Microsoft PowerPoint. The presentation material will cover all topics to be covered in the meeting and will be provided to DCD no less than five business days before the meeting date.

4.2.4 Final Report
The Final Report shall completely document all the work completed and data generated, including design drawings and specifications, in the development of the preliminary design of the Improved Somerset Diversion. The Draft Final Report shall be submitted with the presentation materials for the Preliminary Design and Report Review meeting no less than five business days before the meeting date.

4.3 DCD Inspection and Acceptance of Deliverables
The DCD Program Manager will have the right to accept, or reject and require correction of any deficiencies found in deliverables.

For monthly deliverables, the Contractor shall be notified in writing through email by the DCD Program Manager of the acceptance or rejection, including if necessary, specific reasons why the deliverable was rejected, within five business days of receipt of the deliverable. The Contractor shall have five business days to correct the rejected deliverable and resubmit for re-inspection.

For the Final Report, the contractor shall receive comments on the draft final report during the Final Preliminary Design and Report Review meeting. DCD will notify the contractor within one week of receipt of the Final Report of acceptance or rejection. If rejection notice is sent, the notice will include precise details on the cause of rejection. The contractor shall have ten business days from receipt of the rejection notice to correct and resubmit the Final Report.

SPECIAL CONSIDERATIONS

5.1 Access to Facilities and Property
Access to the land around the Somerset Diversion is limited. The Contractor shall provide an estimated plan of required access/usage dates and times for the complete preliminary design effort as part of the proposal to DCD. That plan will be finalized and presented at the Kick-off meeting. If access is required before the Kick-Off meeting, then access will be approved at the award of the contract. Revisions to this plan must be submitted to DCD at least ten business days prior to any deviation from the submitted plan.

5.2 DCD Program and Contract Management
The DCD Program Manager will provide DCD's Program and Contract Manager for this contract.

The Program Manager will provide the contractor access to all technical data required to perform the project. Only the Program Manager has authority to review and approve contract deliverables.

Responsibility for contracting activities rests solely with DCD's Program Manager, as the contracting officer. No conversation, recommendations, or direction, whether given directly by, or implied by any DCD personnel, that will affect the scope, schedule, or price of the program covered by this SOW, shall be acted upon by the contractor unless specifically approved in writing by the DCD Contracting Officer.

5.3 Safety and Liability Requirements

5.3.1 General Safety Requirements

The contractor shall comply with all safety provisions, e.g., technical specifications, technical publications, Federal Occupational Safety and Health Standards (Title 29 CFR. Part 1910). If there is no applicable Occupational Safety and Health Administration (OSHA) standard, use other applicable nationally recognized sources of safety, health, and fire prevention standards in the completion of the work requirements of this contract.

5.3.2 Liability Requirements

The contractor shall add DCD, Somerset Domestic Waterworks District, Ox Bow – West Elk Mine to the coverage list on their liability insurance.

TRAVEL REQUIREMENTS:

The contractor may be required to travel to support the objectives of this contract. The contractor shall obtain written approval from the DCD Program Manager three (3) business days in advance of traveling. At a minimum, requests for travel shall include the travel dates, expected duration, origin and destination, purpose, travel cost estimates, and the names of the personnel traveling. The contractor is responsible for making all necessary travel arrangements.

ATTACHMENT I – Project Lead and Partners

DCD is the lead organization for the proposed project. DCD has established partnerships and an Integrated Project Team (IPT) with the key project stakeholders to participate and support the project. The following list includes the project stakeholders who have been involved in the planning to date:

- Oxbow LLC – Elk Creek Mine,
- Somerset Domestic Waterworks District,
- Gunnison Basin Roundtable,
- Colorado River Water Conservation District,
- Colorado Division of Parks and Wildlife,
- Trout Unlimited,
- Gunnison County,
- Delta Conservation District,
- The Western Slope Conservation District

These key stakeholders have been involved in the planning and development of the project and are supportive of this project because of the multiple benefits the project affords.

ATTACHMENT II – Reference Documents

- Water supply operational summary
- Somerset Water Treatment Improvement Project
- Fish Requirements
- Boating Requirements
- Water Rights
- Water agreements with SDWD and Mine

dfgsfdg

Water Supply Summary

Oxbow Mining, LLC. Elk Creek Mine Water Supply Summary

1. Oxbow holds two 0.9 cfs water rights for a total of 1.8 cfs or 808 gpm.

2. The # 1 flood pump supplies 200 gpm water via 4" flex line 100 feet from the river to the infiltration gallery. (~6,035' elevation)

3. The #2 flood pump supplies 200 gpm water via 4" flex line 100 feet direct to pond/gallery and with optional 2" flex line direct to pumphouse wet well.

4. Wet well consists of a 6-foot diameter x 20-foot long vertical corrugated metal pipe (CMP).

5. Wet well is connected to a 4-foot diameter x 100-foot long, perforated horizontal CMP buried at a depth of approximately 15 feet. The 12 guage pipe is perforated with 3/8 inch diameter holes on 4-inch centers.

6. Two, 4-foot diameter, 40-foot long perforated sections of pipe were added to the end of the original 100-foot section, perpendicular to the eastern trend, spaced approximately 10 feet apart.

7. Excavations around the gallery pipes were backfilled with washed gravel material.

8. Twin Vertical Turbine pumps are installed in the wet well.

9. When one pump runs, capacity is approximatey 300 gpm

10 When two pumps operate, capacity is approximately 370 gpm

11. Raw water pumped water flows through a 6" cast iron pipe north under the Colorado Highway 133 and Union Pacific RxR tracks and turns west at the mine secondary back entrance road.

12. Raw water then flows west approximately ¾ mile through a 6" HDPE water line and terminates at the 200,000 gallon raw water storage tank (~6,235' elevation).

13. Raw water pumps will further transfer water to additional mine storage (@ 600 gpm) or water will gravity feed to the nearby potable water treatment building where it is filtered, chlorinated for the mine and Town of Somerset potable water needs. (PWSID #CO 0126718).

14. Two Culligan MT-60 Water Filtration systems are available in the water treatment building and will filter up to 85 gpm of finished water. During high, raw water turbidity, flows are slowed to <50 gpm.

15. Finished, chlorinated, potable water is stored in the 144,000 gallon storage tank located next to the filtration building.

Date: March 19, 2014

Western Water & Land, Inc.
743 Horizon Court Suite 365
Grand Junction, CO 81506

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JOB NO. _____
DATE _____
COMPUTED BY _____
CHECKED BY _____

PROJECT _____
SUBJECT _____

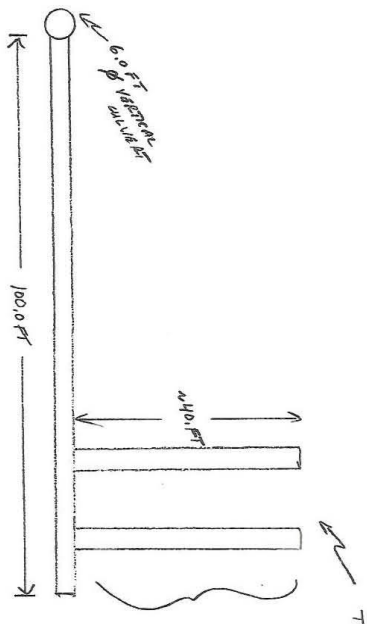

FIGURE 2: PLAN VIEW
GENERAL EXISTING INFILTRATION GALLERY

1/3

Western Water & Land, Inc.
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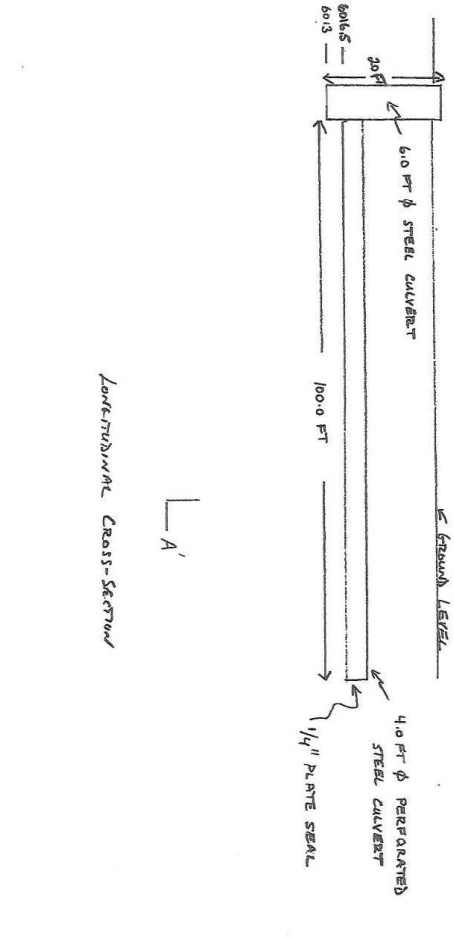

FIGURE 3:
GENERAL CROSS-SECTION
EXISTING INFILTRATION GALLERY

Western Water & Land, Inc.
743 Horizon Court Suite 365
Grand Junction, CO 81506

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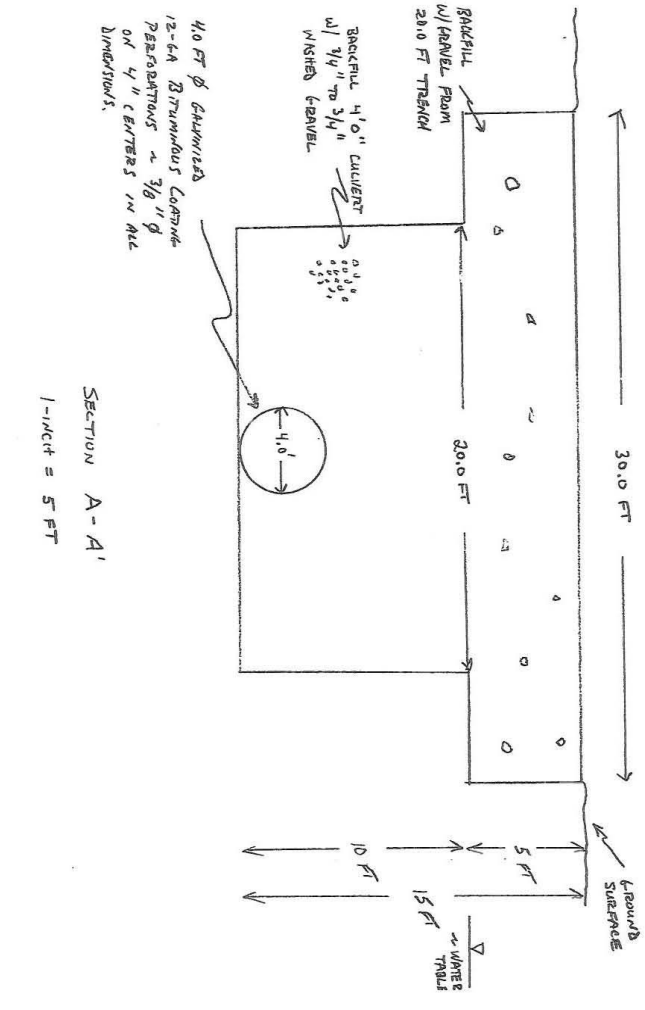


SECTION A-A'
1-INCH = 5 FT

Figure 4:
GENERAL CROSS-SECTION
EXISTING INFILTRATION GALLERY
(TO BE DEMOLISHED)

5/13

OXBOW - SURFACE WATER

Water Pumped from the North Fork of the Gunnison River

Date	Meter Reading Gallons	Pumped To Raw Tank Gallons	Town Meter Reading Gallons	Used by Town Gallons	Used by Mine Gallons
1-Nov-08	600,507,000	8,170,600		221,900	7,948,700
1-Dec-08	607,013,400	6,506,400		175,650	6,330,750
1-Jan-09	613,698,700	6,685,300		190,050	6,495,250
1-Feb-09	622,004,400	8,305,700		189,750	8,115,950
1-Mar-09	631,719,200	9,714,800		152,200	9,562,600
1-Apr-09	640,043,200	8,324,000		159,650	8,164,350
4-May-09	647,040,000	6,996,800		188,800	6,808,000
5-Jun-09	652,234,000	5,194,000		300,100	4,893,900
1-Jul-09	657,223,400	4,989,400		410,950	4,578,450
1-Aug-09	669,245,888	12,022,488		449,165	11,573,323
4-Sep-09	680,606,900	11,361,012		445,250	10,915,762
2-Oct-09	690,611,000	10,004,100		318,870	9,685,230
29-Oct-09	694,842,100	4,231,100		269,730	3,961,370
3-Dec-09	704,330,900	9,488,800		140,000	9,348,800
1-Jan-10	711,550,800	7,219,900		100,000	7,119,900
1-Feb-10	720,184,500	8,633,700		100,000	8,533,700
3-Mar-10	727,020,500	6,836,000		100,000	6,736,000
1-Apr-10	735,837,200	8,816,700		100,000	8,716,700
3-May-10	746,259,000	10,421,800		195,330	10,226,470
1-Jun-10	756,997,400	10,738,400		285,020	10,453,380
1-Jul-10	763,649,700	6,652,300		302,050	6,350,250
1-Aug-10	771,535,200	7,885,500		451,000	7,434,500
1-Sep-10	780,798,500	9,263,300		462,800	8,800,500
1-Oct-10	791,355,900	10,557,400		337,350	10,220,050
1-Nov-10	803,073,100	11,717,200		307,900	11,409,300
1-Dec-10	814,726,500	11,653,400		189,900	11,463,500
1-Jan-11	828,408,600	13,682,100		144,000	13,538,100
1-Feb-11	838,880,000	10,471,400		156,300	10,315,100
1-Mar-11	848,235,750	9,355,750		154,700	9,201,050
1-Apr-11	857,617,500	9,381,750		146,900	9,234,850
1-May-11	870,248,300	12,630,800		205,150	12,425,650
1-Jun-11	880,300,000	10,051,700		387,600	9,664,100
1-Jul-11	893,400,000	13,100,000		452,250	12,647,750
1-Aug-11	907,576,700	14,176,700		243,650	13,933,050
1-Sep-11	920,717,500	13,140,800		346,200	12,794,600
1-Oct-11	934,493,200	13,775,700		365,500	13,410,200
1-Nov-11	945,408,000	10,914,800		334,250	10,580,550
1-Dec-11	953,509,000	8,101,000		145,650	7,955,350
1-Jan-12	960,879,200	7,370,200		96,500	7,273,700
1-Feb-12				89,800	
1-Mar-12				116,200	
1-Apr-12	985,318,600	24,439,400		107,400	24,126,000
1-May-12	999,697,000	14,378,400		136,750	14,241,650
1-Jun-12	1,011,158,500	11,461,500		391,450	11,070,050
1-Jul-12	1,023,736,800	12,578,300		594,900	11,983,400
1-Aug-12	1,034,980,900	11,244,100		455,500	10,788,600
1-Sep-12	1,047,761,000	12,780,100		485,000	12,295,100
1-Oct-12	1,056,409,200	8,648,200		315,200	8,333,000
1-Nov-12	1,070,347,800	13,938,600		104,050	13,834,550
01-Dec-12	1,086,730,000	16,382,200		109,542	16,272,658
01-Jan-13	1,095,371,500	8,641,500		115,242	8,526,258
01-Feb-13	1,099,045,100	3,673,600		276,945	3,396,655
01-Mar-13	1,101,767,700	2,722,600		101,685	2,620,915
01-Apr-13	1,106,087,900	4,320,200		176,871	4,143,329
01-May-13	1,106,087,900	No reading			
5-Jun-13	1,117,223,300	11,135,400		142,760	10,992,640
8-Jul-13	1,123,951,900	6,728,600		253,850	6,474,750
5-Aug-13	1,128,530,300	4,578,400		303,419	4,274,981
1-Sep-13	1,130,461,400	1,931,100		232,195	1,698,905
1-Oct-13	1,132,492,000	2,030,600		155,700	1,874,900
1-Nov-13	1,139,330,100	6,838,100		155,700	6,682,400
1-Dec-13	1,144,503,500	5,173,400		71,700	5,101,700
1-Jan-14	1,145,804,000	1,300,500		76,155	1,224,345
1-Feb-14	1,146,654,250	850,250		185,920	664,330
1-Mar-14	1,147,615,200	960,950			960,950

ENGINEERING DESIGN AND CAPACITY REPORT: SOMERSET WATER DISTRICT WATER TREATMENT IMPROVEMENT PROJECT

Prepared for

Oxbow Mining, LLC
P.O. Box 535
Somerset, CO 81434

WWL Project No. 10602.01

December 19, 2002

Western Water & Land, Inc.
743 Horizon Court, Suite 330
Grand Junction, CO 81506

1.0 Introduction

This design capacity engineering report, as required by Colorado Department of Public Health and Environment (CDPHE) Water Quality Control Division (WQCD), addresses the scope of water treatment improvements as proposed by Oxbow Mining, L.L.C. (OMLLC) for the Somerset Water District (Public Water System ID No. 126718), located in Somerset, Colorado. OMLLC holds both domestic and industrial-use water rights on the North Fork of the Gunnison River and serves as the pubic water supplier for the unincorporated town of Somerset. Somerset is located approximately 8 miles east of the town of Paonia on Colorado Highway 133 (Figure 1).

1.1 Project Purpose

The purpose of the water treatment improvement project is to continue to supply potable water to the residents of Somerset and employees of OMLLC per Colorado Primary Drinking Water Regulations (C.R.S. 25-1-107). The following section describes the background and subsequent need for the water treatment improvement project.

1.2 Report Organization

This report presents the documentation requirements for demonstrating capacity as outlined in the "New Water System Capacity Planning Manual" (Capacity Manual) prepared and made available by the WQCD. The Capacity Manual outlines technical, managerial, and financial elements required for an application for construction approval for a new or improvement of a public water treatment system.

The report presents a compilation of the technical, managerial, and financial elements of the project. Technical information, including the engineering design report and associated drawings, is presented in the following sections. These narrative sections are modeled after the outline provided in the Capacity Manual. The narrative report summarizes the purpose, need, alternatives considered, and a description of the proposed treatment process.

The documentation requirements for demonstrating capacity include several forms provided by the WQCD. These forms include County and Local Health Approval, Flood Plain Certificate, Inventory Form, and Chemical Analysis. The financial and managerial information, and the

state-required forms, with exception of the chemical analysis forms, are presented in Appendix A. The chemical analysis forms and additional water quality data are presented in Appendix G.

1.3 Background

Historically, the original and subsequent operators of the underground coal mine (Somerset Mine) located near the small community of Somerset, Colorado have provided treated domestic water to residents of the Somerset community. Water was originally supplied directly from the North Fork of the Gunnison River (North Fork) and was later supplied from an infiltration gallery located on the alluvial terrace adjacent to the North Fork. OMLLC purchased and began operation of the mine in 1991. Mining operations over the last 3 years have focused on longwall mining in the Sanborn Creek Mine. The Sanborn Creek Mine is scheduled to close in the first quarter of 2003 when longwall mining operations shift to the new Elk Creek Mine that adjoins the existing surface facilities.

As part of a state (CDPHE -WQCD) water treatment inspection on August 8, 2000, the state requested that a microscopic particulate analysis (MPA) be conducted for the water being pumped from the infiltration gallery. The results of the MPA test, conducted in November 2000, indicated influence of surface water. This resulted in notification from the state (letter of December 20, 2000) to improve the water treatment process such that the threat from influence of surface-water pathogens (bacteria, viruses, and protozoans) is adequately mitigated.

2.0 Engineering Report Submittals

2.1 Service Area

The water supply service area includes the unincorporated town of Somerset and adjoining OMLLC coal mine facility (Figure 1). Somerset has 54 water taps and approximately 100 residents, whereas the mine employs 240 people. The estimated per capita consumption rate for town residents is 210 gallons during the winter and 480 gallons during the summer. Use of water by the mine in 2002 was estimated to be between 117,000 and 200,000 gallons per day (winter and summer). OMLLC uses water for domestic (showers, etc.), mining (coal mining and processing), and industrial (dust suppression) purposes.

The town of Somerset is not expected to grow in population due to limited open space in the narrow mountain valley, lack of utility infrastructure, and the local socio-economic conditions. Even though OMLLC is in the process of moving the longwall coal mining activities to the new mine in the Elk

Creek drainage, mine management does not expect a significant increase in the number of employees at the facility. However, the longwall mining process in the Elk Creek Mine is estimated to require significant amounts of water during short periods of time. OMLLC estimates that 200 to 600 gallons per minute (gpm) may be needed over periods of several hours. In anticipation of this water requirement, OMLLC constructed a new 200,000 gallon mine-water storage tank near the Elk Creek mine ventilation shafts in 2002.

The water supply and distribution system for OMLLC and Somerset is not connected to any other water treatment plant or distribution systems in the area. The closest water supply and distribution systems are the West Elk Mine system located approximately two miles east of Somerset, and the town of Paonia system, located approximately 8 miles west of Somerset.

2.2 Analysis of Existing Treatment Facilities

The early mining companies that originally developed the coal mining operations on this property acquired water rights from the North Fork to support mining operations and also to support potable uses for the mine and the town of Somerset (originally part of the mine property). As the town property changed ownership over the years, it has been the responsibility of the mining operator to continue the practice of supplying potable water to residents of Somerset.

In the 1960's, an infiltration gallery was constructed to provide a more high-yielding and reliable groundwater supply source. The gallery was constructed on a small alluvial plain adjacent to the North Fork approximately 0.6 mile upstream (east) of the main mine site. The gallery is located approximately 200 feet from the north bank of the North Fork. It consists of a 6-foot diameter, 20-foot long vertical corrugated metal pipe (CMP) connected to a 4-foot diameter, 100-foot long, perforated horizontal CMP at a depth of approximately 15 feet. Several years later, two 4-foot diameter, 40-foot long, perforated sections of pipe were added to the original 100-foot long section perpendicular to its eastern trend. The excavation around the gallery pipes was backfilled with washed gravel aggregate.

Water collected in the gallery is pumped from the infiltration gallery pump house to a 200,000-gallon water storage tank through a 6-inch diameter pipeline which also serves as the water supply pipeline to the Sanborn Creek Mine. The original 200,000-gallon water storage tank (separate from the new Elk Creek mine tank) is located near the main mine surface buildings above the town at an elevation of approximately 6,200 feet (approximately 170 feet above the

infiltration gallery and pump house). Domestic water is supplied to Somerset by way of a pipeline from the water storage tank. The storage tank also supplies water to underground mining operations when the gallery pump is not operating. The gallery pump operates depending on the water levels in the storage tank and within the gallery sump.

The gallery successfully supplied alluvial groundwater to the mine and the town of Somerset for a number of years; however, yield of the gallery began to decrease with time. The decreasing yield was probably related to several factors including a decrease in river stage due to upstream regulation from dam construction, stream incising, and/or gradual collapse and failure of the gallery piping. As a result, direct surface recharge of the gallery alluvium was initiated in approximately 1995 by pumping water from the North Fork and allowing it to recharge the gallery through the surficial gravel fill materials.

Under normal conditions, a submersible river pump constantly supplies surficial recharge water from the North Fork, and the gallery pump cycles on and off depending on water levels in the storage tank. Water levels in the gallery sump rarely influence the pump's operation because water levels do not drop to the automatic shut-off level. Water treatment consists of injection of chlorine gas into the gallery sump for disinfection purposes.

As mentioned in Section 2.1, OMLLC recently constructed an additional 200,000 gallon storage tank in the Elk Creek Mine area to be used exclusively for industrial mine water storage. The Elk Creek Mine water tank is plumbed to the original primary 200,000 gallon water tank. Therefore, the primary tank will supply water to the new mine water tank.

In August 2001, it was noted that treated water was turbid after a major storm event. An examination of the infiltration gallery surface revealed at least one location that indicated the occurrence of "preferential or pipe flow" of the surface recharge water through the infiltration media. As documented in a notice from the state, the results of the state-required MPA test indicated the influence of surface water, which is likely attributed to such preferential flow.

2.3 Analysis of Source Selection

Although OMLLC maintains water rights from the North Fork, both surface water and groundwater were considered as potential sources of water supply for the project.

The potential groundwater sources considered were groundwater within the alluvial deposits underlying and surrounding the infiltration gallery facility, and potential groundwater in colluvial deposits in the Elk Creek drainage. Groundwater sources in the Elk Creek drainage were considered inadequate and the option was rejected. A "test well" installed by OMLLC in the early stages of supply assessment indicated a static depth to water of 6 feet below ground surface. The well was shown to yield a sustained production rate of 50 gpm based on continuous pumping for 8 ½ hours (see Appendix F). However, the river pump was supplying at least 100 gpm over the gallery during the informal pumping test. Because the test well was within approximately 100 feet of the infiltration gallery, the test was not considered representative of actual aquifer water levels or yield. Follow-up monitoring of water levels in the gallery pumping sump (vertical pipe) while pumping the gallery and shutting off the river pump, indicated that a more probable groundwater level was approximately 11 to 13 feet below ground surface.

A 2-D groundwater flow model was constructed and several simulations were conducted to investigate the feasibility of groundwater production by way of a well field on the alluvial plain deposits. Hydraulic parameters were estimated based on general physical characteristics of alluvial material and descriptions of alluvial materials from the test well bore log. Details of this work are presented in the "Water Supply and Treatment Alternatives Evaluation" report (Appendix D). With a hydraulic conductivity of 28.3 feet/day ($1x10^{-2}$ centimeters/second), the simulations showed that a well field of 6 pumping wells would only yield 130 gpm. In the case of a hydraulic conductivity of 283.5 feet/day ($1x10^{-1}$ centimeters/second), the well field would produce a total of 300 gpm. Other preliminary groundwater options are discussed in the Water Supply and Treatment Alternatives Evaluation report (Appendix D). However, the uncertainty associated with natural groundwater levels, heterogeneity of alluvial material type (e.g. percentages of silt, sand, gravel, etc.), alluvial material thickness, suitable hydraulic parameters, and the inability (wells and testing would interfere with the current gallery pumping schedule) and expense to acquire these data negated the option for an alluvial well field groundwater source.

Because of OMLLC's decreed water rights, the only viable surface water source considered was the North Fork. OMLLC holds two 0.9 cubic feet per second (cfs) surface water rights on the North Fork for municipal and mining use. This is equivalent to approximately 808 gpm. This surface water source has been used as the main water supply source for at least 5 years in supplementing water to the infiltration gallery. Barring severe drought situations, the North Fork

water right is OMLLC's most reliable water source in the long term. In addition, OMLLC has purchased augmentation water from the Fire Mountain Water District. This water provides a right to 2.83 acre-feet stored in East Beckwith Reservoir No. 1 to be used when a call on the river is in effect. The water rights certification information, a water rights summary and copies of OMLLC's water rights decrees are presented in Appendix B.

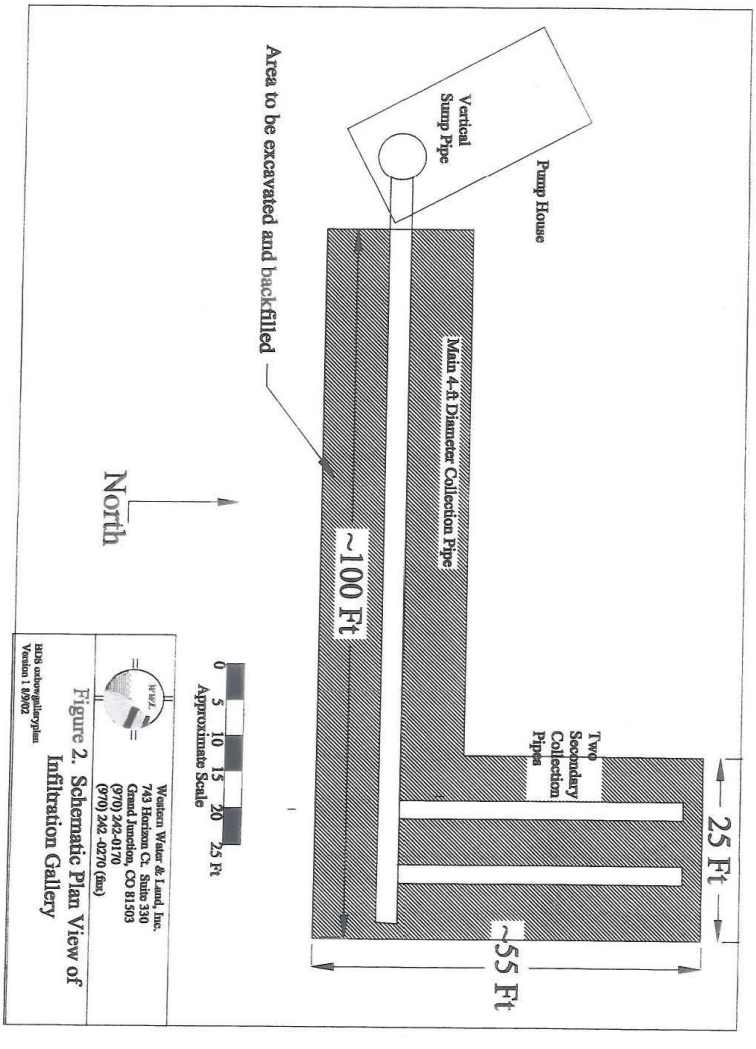
2.4 Analysis of Treatment Alternatives

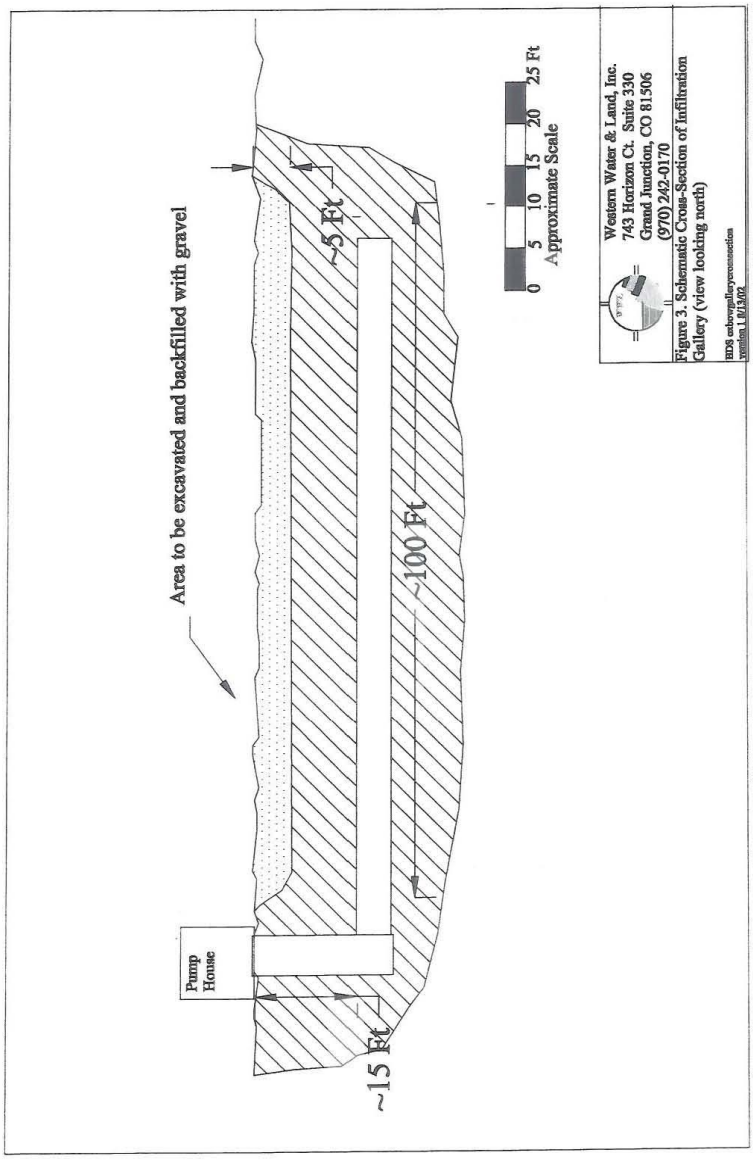
In early January 2002, OMLLC completed the planned tasks through the water supply and treatment alternatives analysis. The study indicated a number of possible water supply and treatment alternatives. The estimated cost of conventional treatment systems for a 90 gallon per minute (gpm) flow rate ranged from $471,000 to $606,000. After preparation of the Water Supply and Treatment Alternatives Evaluation report, an additional alternative was researched and defined and is presented in Addendum 1 to the report (Appendix D). It was also recommended that continued use of the gallery as the water supply structure would require refurbishment of the upper infiltration media to reduce the occurrence of preferential flow paths.

The original conceptual plan for construction of a water treatment improvement system called for installation of the equipment adjacent to the existing infiltration gallery and pump house, located on the alluvial plain of the North Fork of the Gunnison River. As part of the engineering design report, OMLLC conducted a thorough flood plain analysis of the alluvial plain area. The "Report on 100-Year Flood Limit Study", presented in Appendix C, indicates that the 100-year flood event will inundate the ground surface up to base of the foundation of the pump house.

To minimize risk to the water treatment system, OMLLC proposes to install the water treatment improvement system on the north side of Highway 133 at the interface of the mountain slope and the main access road to the Sanborn Creek Mine portal. The proposed plan is presented in Figure 2. Construction of the water treatment improvement system in this area also has the advantages of an existing and permitted discharge basin, ease of access, and better facility security. However, construction in this area is not possible until mining in the Sanborn Creek Mine is completed in the first quarter of 2003.

An analysis of treatment alternatives is provided in the Water Supply and Treatment Alternatives Evaluation report and Addendum 1 of the same report in Appendix D.


Vertical Sump Pipe
Pump House
Area to be excavated and backfilled
Main 4-ft Diameter Collection Pipe
Two Secondary Collection Pipes
~100 Ft
25 Ft
~55 Ft
North
0 5 10 15 20 25 Ft
Approximate Scale
Western Water & Land, Inc.
743 Horizon Ct. Suite 330
Grand Junction, CO 81503
(970) 242-0176
(970) 242 -0270 (fax)
Figure 2. Schematic Plan View of
Infiltration Gallery
H:\26 colony\gallery.plan
Version 1 8/5/02


Area to be excavated and backfilled with gravel
~5 Ft
~100 Ft
~15 Ft
Pump House
0 5 10 15 20 25 Ft
Approximate Scale
Western Water & Land, Inc.
743 Horizon Ct. Suite 330
Grand Junction, CO 81506
(970) 242-0170
Figure 3. Schematic Cross-Section of Infiltration Gallery (view looking north)

Fish Considerations

The fish of concern are a variety of trout species found in the North Fork of the Gunnison River. The fish barrier, passage and entrainment guidelines are applicable.

Boating Considerations

The present pump diversion appears to be about 200ft (+ or -) downstream from an older diversion point at a very deteriorated drop structure. One thought might be to move the diversion upstream above the old drop structure to enable gravity diversion into a short ditch at the foot of Hwy 133 leading directly to the existing infiltration gallery. The rule of thumb is within 200ft of the decreed location is allowed without a change of point of diversion application which is also not much of a headache.

As a boating/fishing component, the series of older broken down drop structures could be rebuilt/replaced with new ones that span the river making nice waves for surfing at higher water and channelize the low flows (Fire Mountain decree from the Paonia reservoir of approximately 250 cfs) into a single low flow channel that ensures the decreed diversion and meanders back and forth about the right or north channel making good aeration and eddy lines for both boating and fishing. An alternate consideration could be a separate more challenging boating channel and a fish ladder. With a 250 cfs low flow, kayakers could float around Somerset and take out above the Fire Mountain diversion.

Water Rights

WATER RIGHTS

All water and water rights, ditch and ditch rights, wells and well rights, reservoir and reservoir rights, well permits, augmentation plans, water agreements and leases, and other rights in or to the use of water of whatever kind or nature owned by Somerset Mining Company, including but not limited to the following:

A. Somerset Mine Well. Permit No. 23700-F under Water Decree No. 79CW86 dated July 26, 1979, appropriating 200 G.P.M., of water for industrial purposes, from the following point of diversion:

Township 13 South. Range 90 West, 6th P.M.

Section 8: SW1/4 SE1/4

B. Somerset Water Supply System.

1. Municipal Priority No. J-91 under Water Decree dated August 16, 1936, as amended by Amended Ruling of Water Referee dated November 13, 1973, in the name of United States Steel Corporation, appropriating an amount not to exceed .90 c.f.s. of water from the North Fork of the Gunnison River for municipal and mining purposes, from the following point of diversion:

Township 13 South, Range 90 West 6th P.M.

Section 9: A point on the North bank of the North Fork of the Gunnison River whence the SW1/4 corner of Section 9 bears South 65 degrees 20' West, 1820 feet.

2. Municipal and Mine Priority No. J-329 under Water Decree dated December 16, 1948, as amended by Amended Ruling of Water Referee dated November 13, 1973, in the name of United States Steel Corporation, appropriating an amount not to exceed .90 c.f.s. of water from the North Fork of the Gunnison River for municipal and mining purposes, from the following point of diversion:

Township 13 South. Range 90 West, 6th P.M.

Section 9: A point on the North bank of the North Fork of the Gunnison River whence the SW1/4 corner of Section 9 bears South 65 degrees 20' West, 1820 feet.

3. All rights in, to and under the Finding, Ruling and Decree of the District Court for Water Division No, 4 entered in Case No 93CW97 on December 8, 1994.

11112808

SDWD and Mine Agreement

5/29/62

THIS AGREEMENT made and entered into as of the 1st day of January, 1962, by and between COLUMBIA-GENEVA STEEL DIVISION, UNITED STATES STEEL CORPORATION, hereinafter called "Columbia", and the SOMERSET DOMESTIC WATERWORKS DISTRICT, hereinafter called the "District",

WITNESSETH:

WHEREAS Columbia owns and operates Somerset Mine in the vicinity of Somerset, Colorado; and

WHEREAS Columbia is the owner of a water supply needed for the operation of said Mine, having its source in the Gunnison River, and of a water system in and near the Village of Somerset; and

WHEREAS the District is in need of a supply of water in Order that it may furnish water for domestic purposes to the inhabitants of Somerset, and would like to purchase the same from Columbia's Gunnison River supply, and to have conveyed to it that portion of the distribution system lying within the Village of Somerset; and

WHEREAS Columbia is willing to sell water to the District for resale to the residents of the Somerset area, and to quitclaim to the District its interest in and to that portion of the distribution system lying within the Village limits;

NOW, THEREFORE, in consideration of the mutual promises hereinafter contained, the parties hereto agree as follows:

1. Columbia agrees promptly to convey, transfer and quit-claim to the District its interest in and to, all water pipes and pipelines, distribution lines, service llnes, hydrants, connections, and all other waterhandling faoilities and accessories located within the platted townsite of Somerset, as shown in red color on drawing AR8-16 dated 10-13-61 which is attached hereto marked "A" and made a part hereof, Columbia further agrees promptly to assign and transfer to the District the right to enter upon the property of

-1-

the residents of the area served by the District for the purpose of operating, inspecting, maintaining, repairing, removing, relocating and replacing pipes and other water facilities, all as reserved to Columbia by deeds heretofore delivered to the residents. The transfers provided for in this paragraph shall be accomplished by Columbia's execution and delivery of instruments in the form of Exhibits B and C, attached hereto and made a part hereof, which the parties have initialed for identification.

2. Columbia agrees to sell and deliver to the District, and the District agrees to take, use and pay for, such quantity of water as the District may require to meet the domestic needs of the residents of Somerset area; provided, however, that Columbia will not be required to supply water in excess of a total of 75 gallons per minute. In case of emergencies, such as fire, Columbia will try to supply all the water possible. The water to be sold and delivered to the District hereunder shall be of substantially the same quality as that used by Columbia for its own operations and purposes.

3. Delivery of water by Columbia to the District hereunder shall, subject to paragraph 11 hereof, be made at the point of interconnection of facilities to be retained by Columbia and of facilities to be conveyed to the District, the point being located on the main water line Just north of the Denver & Rio Grande Western Railroad Company right of way and being designated "Proposed Meter and Valve Box" on drawing AR8-16. Columbia shall install and maintain a meter at this point on the water line. Columbia, at its own expense, shall maintain the pipeline and pump, tank and other facilities necessary to deliver the water to this point. The District shall maintain the water distribution system to be conveyed to it beyond this point, and, at its expense, shall procure, furnish, install, operate and maintain all facilities, rights of way and easements required to receive, apply, and utilize the water delivered hereunder. Any responsibility for improvement in the quality of the water over and above the standard of quality hereinabove provided for shall be the District's and not Columbia's.

4. It is recognized by the parties that the meter referred to in paragraph 3 will not have been installed on the water line by January 1, 1962, the effective date of this agreement. Pending installation of said meter, Columbia will furnish such quantity of water as the District may require to meet the domestic needs of the residents of the Somerset area at the monthly rate of $256.00. Beginning with the first complete month following installation of said meter, water shall be sold to the District hereunder at the rate of twenty-six cents (26¢) per 1,000 gallons of water furnished. If owners of other kinds of establishments of a sort not listed above and not presently found in the District as now constituted should request the District to furnish them with water, a charge proportionate to their consumption shall be made,

5. Bills for water delivered shall be rendered by Columbia to the District monthly and shall be due and payable on receipt thereof by the District.

6. In case the Consumer Price Index, as published by the Bureau of Labor Statistics, United States Department of Labor. During the term of this Agreement, shall rise to a point higher than the Consumer Price Index as of January, *1962*, the charge to the District for water sold hereunder may be increased proportionately. Increases in the cost of water permitted under this paragraph shall not be made more frequently than once a year and shall be prospective only in their application.

7. Columbia shall exercise reasonable care and diligence to furnish such water to the District as provided for herein, but the parties recognize that Columbia cannot guarantee the sufficiency of its source of supply, and Columbia shall not be required to acquire additional water rights or other sources of supply 1n order to meet its obligations hereunder. Columbia shall not be liable for any failure, interruption or shortage of water, or any loss or damage resulting therefrom occasioned in whole or 1n part by causes beyond the reasonable control of Columbia.

8. Columbia shall furnish, inspect, test and repair, and keep in repair, all meters and other instruments which may be required to measure the water delivered to the District hereunder. The District shall have the right at any time to test and Inspect any such meters and instruments.

9. The District shall not assign any interest herein to any party without the written consent of Columbia first had and obtained.

10. The term of this agreement shall be for seven years from and after the effective date hereof, and shall continue thereafter from year to year unless terminated by either party hereto upon 6 months' written notice. The charges provided for herein and all other matters relating to the furnishing of water to the District shall be renegotiated between Columbia and the District at any time after December 31, 1968, upon 60 days' advance notice by either party.

11. It is recognized that five residences each located outside the Village of Somerset and remote from the District's distribution system will require water. The residences are readily accessible from Columbia's main water line, however, and Columbia agrees to install water meters for these residences and to deliver water to the District, for ultimate use of the occupants, to points on its water line where 5 separate meters shall be installed. The charge for water furnished these residences shall be as outlined In paragraph 4. Installation of these meters shall be at Columbia's expense. The occupants' consumption shall be measured by Columbia, and the quantity of water consumed shall be taken into consideration in determining the maximum amount of water required to be furnished by Columbia.

12. The parties recognize that Columbia acquired coal lands near Somerset to insure itself of coking coal for its steelmaking operations in Utah; that the coal found in the vicinity of Somerset is particularly adaptable for this purpose; and that Columbia intends to continue to conduct mining operations at Somerset for the foreseeable future, subject; only to interruptions which are characteristic

of all such operations, as for example, inclement weather, lack of demand and labor disturbances, none of which appear to be imminent. Notwithstanding paragraph 10, the parties recognize that if for any reason or any time Columbia decides to terminate its operations and abandon the mining area adjacent to the Village of Somerset, Columbia will be relieved of its obligations hereunder. In such event, Columbia agrees that the water supply will be handled as follows;

(a) Columbia will give the settling pond, pumps, filters, chlorinating system, tanks and pipelines to the District at no charge.

(b) Columbia will make available to the District, at no charge to the District, such water from its Gunnison River supply as necessary to meet the reasonable domestic needs of the District; provided, however, the parties recognize that Columbia cannot guarantee the sufficiency of its source of supply, and Columbia shall not be required to acquire additional water rights or other sources of supply to meet thj.8 obligation. In the event Columbia sells, assigns or transfers Somerset Mine to some other operator, or enters into an operating agreement with another whereby the latter operates said Somerset Mine with Columbia remaining as owner, Columbia shall assign this agreement to such new operator who shall be entitled to its benefits and bound by its obligations.

13. Any notice which is provided or permitted to be given to either party hereunder shall be deemed to have been given or made 48 hours after such notice has been deposited in the United States mail postage prepaid and addressed to Columbia at 120 Montgomery Street, San Francisco, California, or to the District at Somerset, Colorado, as the situation may require. Said addresses may be changed by either party by notice in writing given to the other party.

14. Columbia 1s not a public utility or service company and by entering into this Agreement is not holding itself out or undertaking to furnish water to the public or to the individual

residents or inhabitants of the Village of Somerset or its vicinity and nothing in this agreement shall in any way be construed to place Columbia under the duties, rights, or obligations of a public service company. Should the Public Utility Commission or any similar body assert any jurisdiction over Columbia, Columbia shall have the option of performing under this Agreement or not performing, in whole or in part, as it shall deem best, without any liability on account of any action taken in the premises.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the first day of January, 1962.

UNITED STATES STEEL CORPORATION

By /S/ D.E. Rice
Vice President
Columbia-Geneva Steel Division

SOMERSET DOMESTIC WATERWORKS DISTRICT

By /S/ Pete Tullio
President

ATTACHMENT III – Pictures

Pump House Pictures

View from Pumps

Pump House control panels

Picture of a pipe feeding water directly to pump house cistern from river to provide the additional needed water during peak mining operations that can't the galley system currently can't provide.

Pond feeding water to the galley system. Note the pipe bringing water from the river to the pond. See diagrams on pages 41 and 42 to get a detailed view of the pump house cistern and the gallery.

Picture of white pipe bring water from the river to the pond and the red pipe bring water directly to the pump house cistern. Picture is from the pond looking toward the river.

Picture of the pipes to the pond and pump house from the river side.

Picture of the two pipes coming from the two pumps in the river.

Picture of pump house from the location of the current river pumps.

Picture of starting at the most upstream position progressing downstream to current pump location.


Note arrow points to pump in river. See next picture for detailed view

Arrow points to pump.

Looking up stream from pump house. Road is on the left side of picture. Arrow points to the most upstream picture shown on page 48.

Arrow points to pump house.

PAST PERFORMANCE INFORMATION SHEET
Instructions

This Instruction Sheet describes the information to be provided when submitting contracts for your Past Performance Volume. You will provide the information requested in this form for each contract/program being described. Comments shall be frank and concise regarding your performance on the contracts you identify. Provide a separate completed form for each contract/program submitted. There is no need to reformat the Submittal Sheets; they should be submitted as is and without changes. You do not need to submit this Instruction Sheet with your Submittal Sheets. You only need to submit the information found on the Submittal page 3 for each submitted contract. The limit of past efforts submitted is three. The length of each submission is limited to three pages. The Submittal Sheet currently has one page, but as information is entered, the pages can expand to the three page limit. Past performance submissions will be evaluated for relevancy based on how similar work on the prior contract coincides with the requirements of this acquisition as outlined in the instructions to offerors.

The following are instructions related to the sections found on page 3:

A. Offeror: Provide information for your company. For large, multi-functional companies, limit the references to work done by the division, group or unit that plans to perform the proposed work.

B. Program Title: Title used to describe the contract/effort.

C. Contract Specifics:
1. *Contracting Agency or Customer*: The party who awarded the contract.
2. *Contract Number:* If information is provided relevant to task order type contracts, offerors must provide specific task order numbers, in addition to the basic contract number.
3. *Contract Role* refers to your role on the contract (i.e. Prime Contractor or Subcontractor) and any comments you feel are necessary to clarify your role.
4. *Contract type* refers to the different pricing arrangements including Firm Fixed Price, Time & Materials, etc.
5. *Original Contract $ Value* is the original amount awarded.
6. *Current Contract $ Value* is the current or final amount.
7. *Reasons for Contract Value changes*: If the amounts in 5 and 6 above are different, provide a brief description of the reasons behind the changes.
8. *Period of Performance* should include the original period of performance, options, and any extensions.
9. *Original Completion Date* is the date associated with the original period of performance.
10. *Current schedule* refers to the current estimated completion date – any changes in the original period of performance (e.g. exercise of options, increases in scope, delays, etc.).

11. *How Many Times Changes* refers to the number of modifications were made to the original contract that increased the schedule.
12. *Primary Causes of Change*: Describe any changes in the Period of Performance.

D. Primary Customer Points of Contact: (For Government contracts provide current information on all three individuals. For commercial contracts provide points of contact fulfilling these same roles.) It is the contractor's responsibility to ensure all data is current and accurate. Provide the following for each Point of Contact: Name, Address, Telephone, e-mail (if available)

E. Unique considerations: Address any technical (or other) area about this contract/program considered unique that should be considered when evaluating the past performance.

F. Key Personnel: Specify, by name, any key individual(s) from your company who participated in the work outlined in this Past Performance Information Sheet and are proposed to support this acquisition.

G: Brief Program Description: Describe briefly the work performed. Keep in mind the relevancy of the work performed on the submitted contract to this acquisition.

H. Relevancy to Subfactors: For each of the applicable proposal evaluation factors and subfactors, illustrate how your performance on this program applies to those Subfactors/Factors. Relevancy of the submitted contract to these Subfactors/Factors are a major part of your past performance evaluation.

PAST PERFORMANCE INFORMATION Sheet

A. Offeror: Name (Company/Division): _____
CAGE Code: _____ DUNS Number: _____
B. Program Title: _____
C. Contract Specifics:
1. Contracting Agency or Customer_____
2. Contract Number_____
3. Contract Role and Comments: ___ Prime or ___ Subcontractor

4. Contract Type:_____
5. Original Contract $ Value _____
6. Current Contract $ Value _____
7. Reasons for Contract Value changes:

8. Period of Performance_____
9. Original Completion Date:_____10. Current Schedule:_____
11. How Many Times Changed:_____
12. Primary Causes of Change:

D. Primary Customer Points of Contact:

	Program Manager/Technical POC	Administrative POC	Contracting Officer
Name			
Office			
Address			
Telephone			
e-mail			

E. Unique considerations:

F. Key Personnel:

G. Brief Program Description:

H. Relevancy to Subfactors:
1. Subfactor One and Two: Technical Approach

2. Subfactor Three and Four: Program Management Approach

Somerset Diversion Preliminary Design

Solicitation **NO. DCD2014-SD-R-001**

Sample Contract

In compliance with the DCD RFP package, the undersigned proposes to complete the Preliminary Design for the Somerset Diversion at the cost of $_____.

This contract document, and therefore the contractual requirements, includes the following RFP package documents:

- Statement of Work (SOW),
- CWCB contract clauses
- Instructions to offerors

The undersigned agrees to all requirements stipulated in this contract.

Bidder's Firm Name and Address: _____

_____

_____

_____ _____

Witness Signature Title

Contractor Federal Identification Number: _____

DCD Contract award approved by:

_____

Signature Title Date

Appendix D – Somerset Diversion River Flow Measurements

SDSP = Gage placed just downstream of the pumps; GPS location N 38° 55.691’ W 107° 27.341

SDSD = Gage placed about 10 yards upstream of the downstream river model point; GPS location N 38° 55.692’ W 107° 27.362

SDSU = Gage placed downstream of the upstream river model point; GPS location N 38° 55.763’ W 107° 27.184

Measurements = distance in inches from the top mark on the stake to the water level

Date	Location	Time	Measurement
5/3/14	SDSP	1:04 PM	41 5/8
5/3/14	SDSD	1:18 PM	37 1/8
5/3/14	SDSU	1:40 PM	34 7/8
5/6/14	SDSP	7:59 AM	29 1/2
5/6/14	SDSD	7:55 AM	25 5/8
5/6/14	SDSU	8:11 AM	20
5/13/14	SDSP	3:19 PM	37 1/2
5/13/14	SDSD	3:21 PM	33 3/4
5/13/14	SDSU	3:27 PM	32 1/10
5/19/14	SDSP	8:55 AM	35
5/19/14	SDSD	8:58 AM	30 7/10
5/19/14	SDSU	9:06 AM	27 1/4
5/25/14	SDSP	9:46 AM	30
5/25/14	SDSD	9:48 AM	27 1/2
5/25/14	Rock	9:53 AM	Periodic topping
5/25/14	SDSU	9:56 AM	22 2/10
5/28/14	SDSP	3:53 PM	29 2/10
5/28/14	SDSD	3:55 PM	25 4/10
5/28/14	Rock	3:59 PM	Topped
5/28/14	SDSU	4:02 PM	20 9/10
5/30/14	SDSP	10:15 AM	23
5/30/14	SDSD	10:18 AM	20 8/10
5/30/14	Rock	10:23 AM	topped
5/30/14	SDSU	10:27 AM	14 1/2
6/3/14	SDSP	9:04 AM	15 3/4
6/3/14	SDSD	9:06 AM	17 2/5
6/3/14	Rock	9:09 AM	
6/3/14	SDSU	9:14 AM	9 3/4
6/8/14	SDSP	11:32 AM	?
6/8/14	SDSD	11:35 AM	24 1/2
6/8/14	Rock	11:41 AM	
6/8/14	SDSU	11:45 AM	18 3/4
6/19/14	SDSP	10:30 AM	?
6/19/14	SDSD	10:32 AM	35 1/2
6/19/14	Rock	10:35 AM	

6/19/14	SDSU	10:39 AM	31 2/5
6/25/14	SDSP	10:47 AM	?
6/25/14	SDSD	10:50 AM	?
6/25/14	Rock	10:54 AM	
6/25/14	SDSU	10:57 AM	33
7/2/14	SDSP	2:29 PM	2.2 inches from water line on gage to bottom of river
7/2/14	SDSD	2:29 PM	7.4 WL to bottom
7/2/14	Rock	2:29 PM	
7/2/14	SDSU	2:29 PM	35. 8; or 8 wl to b

Appendix E –Preliminary Design Report

SOMERSET DIVERSION
PRELIMINARY DESIGN REPORT

PREPARED FOR:

DELTA CONSERVATION DISTRICT

Prepared by:

MERRICK® & COMPANY
McLaughlin Water Engineers
A Division of Merrick & Company

Aaron Asquith, Colorado P.E. 36602

January 2015

Merrick Project No. 65418463

SOMERSET DIVERSION

PRELIMINARY DESIGN REPORT

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APPENDIX B. 2D MODELING – 400 CFS

APPENDIX C. 2D FIGURES – 1,000 CFS

APPENDIX D. DETAILED COST ESTIMATES

1.0 INTRODUCTION

Merrick & Company has completed preliminary designs for modifications to the Somerset Diversion. Objectives for the design identified by the Delta Conservation District and Project Stakeholders are as follow:

1. Ensure full diversion of water rights at all flow levels,
2. Ensure fish and boater passage through/around diversion,
3. Reduce sediment loading in diverted water before pumping,
4. Reduce long-term maintenance,
5. Survive 100-yr flood,
6. Minimize impact to surrounding floodplain, and
7. Optimize pumping operations from pump station to water tank.

The Project Stakeholders include:

1. Oxbow LLC – Elk Creek Mine
2. Somerset Domestic Waterworks District
3. Gunnison Basin Roundtable
4. Colorado River Water Conservation District
5. Colorado Division of Parks and Wildlife
6. Trout Unlimited
7. Gunnison County
8. Delta Conservation District
9. Western Slope Conservation District

1.1 KICKOFF MEETING

A project kickoff meeting was held on July 22, 2014 to discuss project schedule and scope as well as refine project objectives. Primary discussion points included the following:

1. The Waterworks District would like to eliminate the initial pumping (river to wet well) with the proposed design.
2. The group would like the final configuration to equally benefit fishing and boating recreation with boating/passage improvements to encourage low hazard normal river use and not necessarily provide a destination park and play experience.
3. Where possible, the group would like to introduce natural elements into the design, minimizing straight lines or obvious man made elements where possible.
4. The project area is currently on private property. Development of access will not be initiated until this analysis/design is completed.

1.2 PRELIMINARY DESIGN REVIEW MEETING

A draft preliminary design report was provided to the Integrated Project Team on September 29, 2014. Design Alternatives were presented and discussed on October 6, 2014. Primary discussion points included the following:

1. The costs presented did not include on shore (land) work. The cost for that work should be included in the final report.
2. Most group member preferred the single thread river option.
3. River velocities and depths for fish passage were preferred for Alternative 2.
4. The group would like to explore a third alternative that blends small drops and a single thread for restoration of the river.
5. Follow up with the County is needed to further define needed floodplain development permitting for the site.
6. The team would like an estimate of construction duration included in the report.
7. There is concern that construction of the diversion at the proposed location may cause the need to apply for a change in point of diversion.

2.0 SCOPE

The scope of this project is further divided into tasks as follow:

1. Kick-off meeting
2. Site Inspection and Survey
3. Draft Preliminary Design
4. Draft Preliminary Design Review
5. Preliminary Design Iteration
6. Preliminary Design and Report Review

3.0 BACKGROUND

The Somerset Diversion is located on the North Fork of the Gunnison River approximately 0.6 miles upstream of Somerset, CO in Gunnison County. In the 1960's, an infiltration gallery was constructed to provide a reliable groundwater source for coal mining operations and potable water supply to mine workers and the Town of Somerset. The Oxbow Mine maintains the responsibility of supplying potable water to the Town's residents. The water supply system has been periodically improved since the original infiltration gallery construction. The original gallery, consisting of a 6-feet diameter, 20-feet long vertical corrugated metal pipe and 4-feet diameter, 100-feet long horizontal pipe was expanded with the addition of two 4-feet diameter 40-feet long perpendicular pipes at the eastern end of the gallery. An existing pump station housing twin 50 hp vertical turbine pumps delivers water via a 6" water line to a 200,000 gallon water storage tank

located near the main mine surface buildings. A second 200,000 gallon water storage tank was constructed by the mine in 2002 to address the long wall mining process at the Elk Creek Mine.

Mining has ceased and significantly reduced water demand. In addition, the existing infiltration gallery has deteriorated and can no longer adequately flood the wet well to allow pumping at the decreed diversion rate of 1.8 cfs for sustained periods. As a result, the mine is currently operating two trash pumps that sit in the river. One discharges into the infiltration gallery and the other one discharges directly to the wet well during periods of high demand. The result is the diversion and pumping of sediment laden water to the raw water storage tank. While the sediment laden water is not reported to have caused damage to the vertical turbine pumps, it does cause sediment buildup in the tank, leading to regular maintenance cleanings. In addition, during periods of turbid river flow, additional backwash cycles are required at the water treatment plant.

The Fire Mountain Ditch Company has been working with the USBR to address sedimentation of Paonia Reservoir upstream. Since completed, the reservoir capacity has been steadily decreasing due to sediment inflow from its tributaries. It is our understanding that sediment is being discharged from the reservoir to the North Fork equal to the rate of sediment inflow to preserve current storage volume. Although there are currently other sources of sediment load to the Gunnison River, most notably Coal and Anthracite Creeks, this discharge has increased sediment in the river at the Somerset Diversion.

3.1 EVALUATION OF EXISTING SITE AND DIVERSION

Merrick & Company completed a topographic and bathymetric survey of the site and river bottom from July 22 through July 24, 2014. Surveying was completed using a Leica Total Station. Monuments or other control points on established datums, such as NAVD 88 and NGS 83 could not be located in the immediate project area. As a result, the survey was tied to the vertical datum used by the Oxbow Mine, LLC. Full topographic survey extended downstream of the pump station 500 feet and upstream 1000 feet. River cross sections were also collected 1,000 feet upstream and 2,000 feet downstream of the pump station. The most downstream cross section corresponds to Cross Section Z, as identified in the Flood Insurance Study, Gunnison County, Colorado and Incorporated Areas, FIS Number 08051CV000A, May 16, 2013. The measured hydraulic drop in the North Fork from the east entrance road to the west entrance road at the time of surveying was 9.9 feet with an overall channel slope 0.83%.

Based on conversations with the project team, multiple loose rock sills were constructed in the river to raise local groundwater and aide with infiltration gallery production. Since construction, the sills have gradually lost shape during high flows from saltation and local scour processes. In the current state, water is spread out across the sills, resulting in shallow flow in spaces between boulders. The shallow nature of the flow and numerous small gaps limits boat passage through the diversion site at low flows. In addition, local scour around the larger boulders allows

underflow through voids that are foot entrapment hazards for fisherman and waders. At intermediate boating flows, less than 1,000 cfs, gaps between boulders are a pinning hazards for boaters. It was also noted that banks on both sides of the river have degraded to a near vertical condition as a result of the unstable condition of the reach. It is opined that this vertical condition is the result of a combination of channel degradation due to sediment stripping by Paoina reservoir and higher flows being directed into banks by the series of installed sills. The resulting condition is near vertical banks that can no longer support riparian habitat or wetland vegetation needed to keep topsoil in place and provide shaded shelter for fish and other aquatic species.

4.0 ALTERNATIVE DEVELOPMENT

Two initial alternative concepts were developed for in river improvements. Following the preliminary design report review, a third alternative was developed for the site. Alternative 1 provides a surface intake to supply pump station water and restores the reach with a combination of drops and pools. Alternative 1 is based on restoring and reinforcing the series of sills previously constructed that are currently in a disorganized state. Alternative 2 provides a similar surface intake to supply pump station water but restores the reach to a continuous single-thread riffle through the project reach. Alternative 3 provides a hybrid of Alternatives 1 and 2. Alternative 3 promotes a new intake and single thread river, but relies on small drops and pools in lieu of a continuous riffle to restore the river. The three alternatives are further described below and are depicted on Drawings 1, 2 and 3, attached in Appendix A.

4.1 ALTERNATIVE NO. 1 – DROP POOL RIVER RESTORATION

Alternative No. 1 restores and reinforces the multiple sill project previous constructed to locally raise groundwater at the diversion location. This alternative provides a combination of small drops and pools to distribute the grade in the reach. The alternative is depicted on the attached Drawing 1. The surface water diversion occurs at the upper drop structure. A combination roughened fish passage/boat chute (low flows) and a roughened step dam that is activated during higher flows is integrated with the diversion. The proposed diversion is a lateral takeout with a sediment sluice channel. A bar rack is proposed to protect the intake from debris and large cobbles while the sluice channel, combined with a fine screen, would reduce diversion of granular sediment.

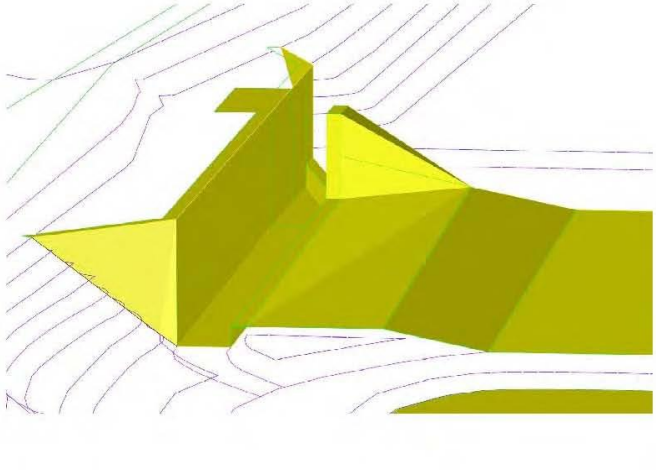


Figure 1: Isometric View of Lateral Diversion and Sluice Channel

The existing bifurcated channel through the bend remains intact and is reinforced by reconstructed sills. On the inside path, three drops of approximately 1 foot each provide navigable drops, passable by upstream migrating trout, and intermediate resting pools. Along the outside bank, one larger 1.5 feet drop is coupled with a 200 feet long riffle to distribute the grade in the reach. The two channels are combined just upstream of the pump station at a counter weir with 0.5 feet of hydraulic drop. The counter weir provides a dual function, including distributing a portion of the existing drop as well as providing protection of the improvements from additional head cutting downstream of the reach.

The following are short descriptions of the design elements included in Alternative No. 1:

- ***Intake/Diversion Orientation*** – *The intake/diversion structure is proposed on the outside of a bend, parallel to the river bank and oriented to provide sweeping flow across the intake bar rack to reduce pinning of floating debris.*
- ***Bar Rack*** – *New sloped bar rack along intake structure for exclusion of large floating debris.*
- ***Sluice Channel with Overshot Gate*** – *A concrete channel, parallel to river flow is proposed to sluice sediment downstream while allowing lateral intake of water. An overshot gate within the channel can be raised during periods of low flow and drought to ensure a pool for water diversion. During high flow, the gate will be lowered to promote sediment sluicing.*

- ***Existing and New Sills*** – *Boulders from the existing loose rock sills will be reused. New sills will be constructed at similar elevation to existing sills, however, the new sills will include appropriate cutoffs and grout for stability during a 100-yr design flood.*
- ***Fish Passage*** – *A roughened channel (rock ramp) using boulders to provide fish passage at the grouted boulder diversion structure. Other sills will use a combination of boulders and low drops to allow upstream fish passage.*
- ***Stepped Dam*** – *Grouted boulder steps at the dam will improve stability and reduce hazards along the toe of the dam.*
- ***Jetties*** – *Boulder jetties upstream, downstream, and within the project reach will be constructed to turn the river flow, provide a take-out for river users, and protect the bank.*
- ***Portage Trail*** – *A trail and signage to encourage portage around the intake and diversion dam is included on the north bank.*

4.2 ALTERNATIVE NO. 2 – RIFFLE AND TERRACE RESTORATION

Alternative 2 represents a return of the river reach to a single thread, matching the overall river gradient and mimicking the river width and riparian and wetland terraces bordering the river upstream and downstream of the project site. This alternative uses a combination of a single drop/sill and constructed riffle to distribute the drop within the reach. Similar to Alternative 1, a combination fish ramp/boat passage and lateral diversion structure is proposed at the upstream end of the project reach. The drop is reduced to 2 feet in this alternative to further promote fish passage and low hazard boat passage. In lieu of multiple sills, a series of jetties on the outside of the river bend shift the river north and provide an opportunity to re-establish the outside bend terrace that has long since vanished as a result of sediment transport and scour. It is anticipated that existing boulders will be reused for the project and native river bed material will be stripped, stockpiled and replaced after grading to reform a natural armoring layer in the extended riffle.

Photo 1: Riffle River Section Upstream of Project Reach

Note that one primary goal of Alternative 2, depicted on Drawing 2, is to restore the river to a more natural condition, prior to loose boulder sill installation and subsequent destabilization of the reach. Similar to reaches upstream and downstream, it is planned to add large individual boulders or boulder clusters to provide variability in the riffle, and feeding/resting zones for fish.

The following are short descriptions of the design elements included in Alternative No. 2:

- ***Intake/Diversion Orientation*** – *The intake/diversion structure is proposed on the outside of a bend, parallel to the river bank and oriented to provide sweeping flow across the intake bar rack to reduce pinning of floating debris.*
- ***Bar Rack*** – *New sloped bar rack along intake structure for exclusion of large floating debris.*
- ***Sluice Channel with Overshot Gate*** – *A concrete channel, parallel to river flow is proposed to sluice sediment downstream while allowing lateral intake of water. An overshot gate within the channel can be raised during periods of low flow and drought to ensure a pool for water diversion. During high flow, the gate will be lowered to promote sediment sluicing.*
- ***Existing and New Sills*** – *Boulders from the existing loose rock sills will be reused. One new grouted boulder diversion sill will be constructed at the upstream end of the project reach. The new sill will be constructed at a similar elevation to the upper existing sill; however, it will include appropriate cutoffs and grout for stability during a 100-yr design flood.*
- ***Fish Passage*** – *A roughened channel (rock ramp) using boulders to provide fish passage at the grouted boulder diversion structure. The remainder of the reach will be restored with a continuous riffle, meeting fish passage criteria.*

- ***Jetties and Boulder Clusters*** *– Boulder jetties upstream, downstream and within the project reach will be constructed to turn the river flow, provide a take-out for river users, protect the bank and establish riparian/wetland terraces. In addition, large single boulders or boulder clusters are provided for intermediate resting and feeding areas within the riffle.*
- ***Portage Trail*** *– A trail and signage to encourage portage around the intake and diversion dam is included on the north bank.*

4.3 ALTERNATIVE NO. 3 – SINGLE THREAD DROP POOL RIVER RESTORATION

Alternative 3 also returns the river to a single thread. Three sills are proposed with crests at elevations to match the overall river gradient and mimick the river width upstream and downstream of the site. Similarly to Alternative 2, wetland and riparian terraces are provided through the restored reach. The upstream sill is a combination fish ramp/boat passage integrated with a lateral diversion structure. The two downstream sills provide small drops suitable for play boating for intermediate skill level users. Because sill crests are proposed to match the overall river gradient, the project relies on local scour to maintain small pools at the sills where standing waves or holes would form. This approach allows shoulders of the sills to be graded at shallow slopes, providing upstream roughened fish passage at either side of the hydraulic.

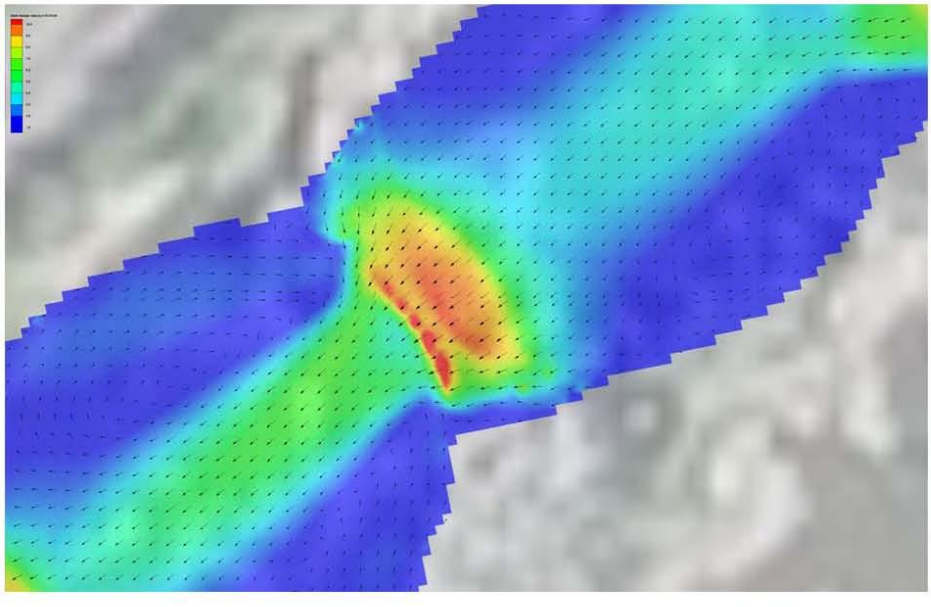


Figure 2: 2D Modeling of Low Drop Sill – Note Low velocities (1 – 5 FT/SEC) at Sides

The following are short descriptions of the design elements included in Alternative No. 3:

- ***Intake/Diversion Orientation*** *– The intake/diversion structure is proposed on the outside of a bend, parallel to the river bank and oriented to provide sweeping flow across the intake bar rack to reduce pinning of floating debris.*
- ***Bar Rack*** *– New sloped bar rack along intake structure for exclusion of large floating debris.*
- ***Sluice Channel with Overshot Gate*** *– A concrete channel, parallel to river flow is proposed to sluice sediment downstream while allowing lateral intake of water. An overshot gate within the channel can be raised during periods of low flow and drought to ensure a pool for water diversion. During high flow, the gate will be lowered to promote sediment sluicing.*
- ***Existing and New Sills*** *– Boulders from the existing loose rock sills will be reused. New sills will be constructed with crests to match the overall river gradient. The new sills will include appropriate cutoffs and grout for stability during a 100-yr design flood.*
- ***Fish Passage*** *– A roughened channel (rock ramp) using boulders to provide fish passage at the grouted boulder diversion structure. Other sills will use a combination of boulders and low drops to allow upstream fish passage while providing a recreational experience.*
- ***Jetties and Boulder Clusters*** *– Boulder jetties upstream, downstream and within the project reach will be constructed to turn the river flow, provide a take-out for river users, protect the bank and establish riparian/wetland terraces. In addition, large single boulders or boulder clusters are provided for intermediate resting and feeding areas within the riffle.*
- ***Portage Trail*** *– A trail and signage to encourage portage around the intake and diversion dam is included on the north bank.*

5.0 HYDROLOGY

In preparation of this design, we obtained the Flood Insurance Study for the North Fork. The study, titled "Flood Insurance Study – Gunnison County, Colorado and Incorporated Areas" completed detailed floodplain mapping on the North Fork upstream to a cross section 2,000 feet west of the diversion pump station. The most upstream cross section was duplicated with the survey effort for this project; however, unavailable NGS bench marks in the area did not allow matching of the 2 datums. Review of the study indicates the following flood series flows for the North Fork at the Somerset Gage.

Event Frequency (Yrs)	Flow (cfs)
10	5,600
50	8,000
100	9,200
500	11,300

Table 1 – North Fork Gunnison River Flood Series from Flood Insurance Study

6.0 HYDRAULIC ANALYSIS

Mr. Mike Drake (Delta Conservation District) recorded water surface elevations at three locations within the project reach. Data was collected periodically from May 3, 2014 to July 2, 2014 during flows ranging from 586 cfs to 2,697 cfs. In addition, water surface elevations were measured at the time of survey (flow of 275 cfs). Initially, a one dimensional hydraulic model (HEC-RAS) was built for the project reach. Roughness values were selected based on field observations of the reach. Using measured water surface elevations, roughness values were adjusted to provide a best fit (modeled to measured data) over the range of flows. The resulting one dimensional model has a maximum difference from measured results of 0.27 feet, with an average difference of 0.12 feet. Note that differences in predicted values were both above and below the measured water surface elevations.

Results from the one-dimensional model were used to setup two-dimensional modeling. Existing conditions and Alternatives 1 and 2 were 2D modeled using TUFLOW with pre- and post-processing, using SMS v11.0. Two flows were evaluated in the existing proposed conditions 2D hydraulic models: 400 cfs and 1,000 cfs. In all models, the diverted flow to the pump station was ignored, as it represented a very small portion of the river flow (0.45% and 0.18%). The overshot gate was modeled in the down condition. Both alternatives provided promising intake conditions that would result in minimal floating debris accumulations and intake of sediment.

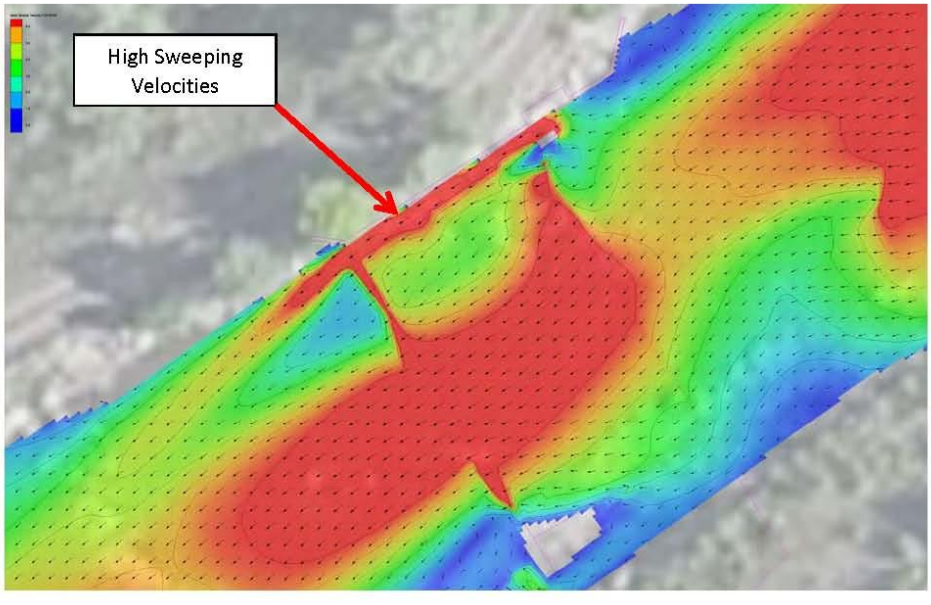


Figure 3: 2D Hydraulic Results at Intake – 1,000 cfs

Results from the 2D modeling effort are provided in the attached Appendices. Appendix B includes results at 400 cfs and Appendix C includes results at 1,000 cfs.

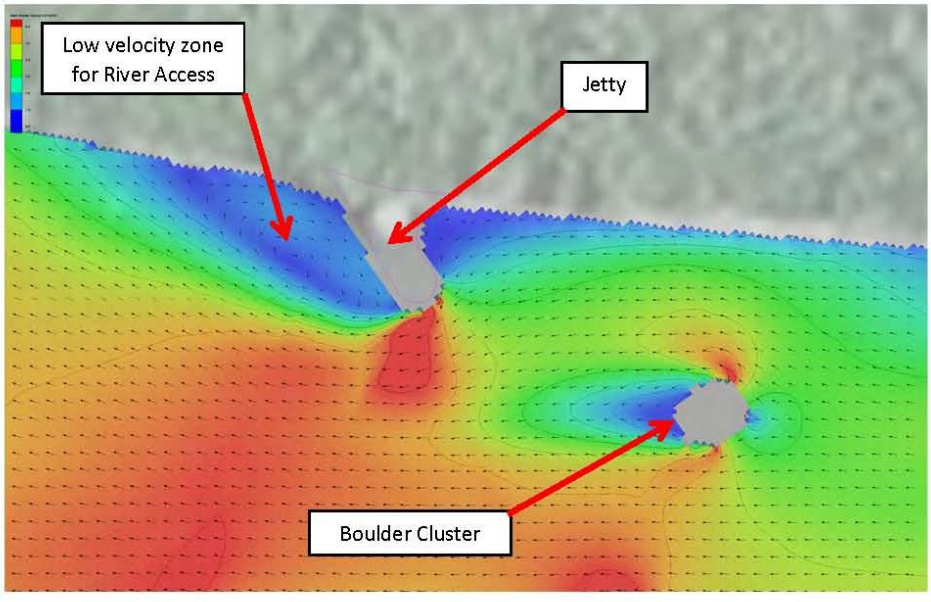


Figure 4: 2D Hydraulic Results at Jetty and Boulder Cluster

6.1 STABILITY

In-river structures must resist river forces. Riprap, loose boulders and grouted boulders will be used to resist tractive forces, shear stresses, and impact forces. Subsurface cutoffs are required to reduce piping and uplift pressures on structures. Scour protection using sloped grouted boulders and buried riprap is needed along the toe of the diversion structure and sills, and at the sediment trough. Grouted boulder jetty structures, riprap and vegetation will be used for bank/channel stabilization. Stability design including scour depths, channel degradation and aggradation, and armoring sizes/types was not completed for this phase but will be required during final design.

6.2 FLOOD CONVEYANCE

The Federal Emergency Management Agency (FEMA) has mapped the reach but not performed a detailed flood study of the project reach. Alternatives 1 and 2 have been modeled using HEC-RAS (1-Dimensional Model approved by FEMA) to determine impacts to the 100-yr water surface elevations in the reach. To determine impacts, a base model was created from collected cross section survey data. Drawing M0, attached in Appendix A, depicts the locations of cross sections

used in the modeling effort. After an existing conditions model was completed it was then modified to represent proposed conditions for Alternatives 1 and 2. Water surface profiles from the modeling efforts are attached in Appendix A, following Drawing MO. Table 2 represents the existing conditions versus proposed conditions modeling results.

Cross Section	Existing Conditions Water Surface (Feet)	Alternative 1 Water Surface (Feet)	Water Surface Difference (Feet)	Alternative 2 Water Surface (Feet)	Eater Surface Difference (Feet)
145637.9	6038.32	6038.26	-0.06	6038.27	-0.05
145545.7	6038.61	6038.54	-0.07	6038.55	-0.06
145458.5	6037.07	6037.80	0.73	6037.81	0.74
145376.2	6036.54	6036.86	0.32	6036.86	0.32
145290.1	6035.81	6035.81	0.00	6035.85	0.04
145215.6	6034.87	6036.08	1.21	6034.29	-0.58
145129.3	6034.01	6034.73	0.72	6033.18	-0.83
145049.2	6033.13	6033.34	0.21	6032.40	-0.73
144988.6	6032.48	6032.80	0.32	6032.98	0.50
144948.2	6032.53	6032.97	0.44	6032.86	0.33
144855.6	6032.45	6032.60	0.15	6032.67	0.22
144777.7	6030.89	6031.33	0.44	6031.37	0.48
144688.7	6029.35	6030.28	0.93	6030.59	1.24
144613.2	6029.39	6030.27	0.88	6030.10	0.71
144544.0	6029.31	6029.18	-0.13	6029.18	-0.13
144459.6	6028.72	6028.72	0.00	6028.72	0.00
144391.8	6027.59	6027.59	0.00	6027.59	0.00
144320.1	6026.06	6026.06	0.00	6026.06	0.00
144245.6	6026.49	6026.49	0.00	6026.49	0.00
143645.0	6022.53	6022.53	0.00	6022.53	0.00
142740.0	6015.22	6015.55	0.33	6015.22	0.00

Table 2 – 100-yr Modeling Results - North Fork Existing Conditions and Alternatives 1 and 2

As can be seen from the table, the proposed alternatives modify the existing 100-yr water surface elevations by as much as 1.2 feet at some cross sections. In preparation of this report we have contacted Gunnison County Planning to determine required floodplain permitting associated with the project and the potential water surface increase as a result of the project. The project lies within Zone A of the Flood Insurance Rate Map (FIRM) and will be constructed in the floodplain

and floodway. In development of final design, a standard floodplain development permit application (available on the County website) will be required. Currently, the County floodplain regulations limit the post project base flood elevation rise to 0.5 feet. We believe two approaches may be taken during final design development. These include:

1. Modification of design to achieve a 0.5 feet or less rise, followed by standard floodplain development permit application.
2. Request for a variance to the regulations as the only adjacent structure potentially impacted would be the existing pump station. Note that the pump station finished floor elevation is approximately 2 feet above the 100-yr water surface elevation.

The County reviews floodplain development applications on a case by case basis and does not have specific criteria related to diversion structures. As a result, the design engineer for the final project will need to prepare a report detailing the proposed impacts to the floodplain. It is highly recommended that an initial project meeting with the County is held to discuss options and requirements for the project.

6.3 FISH PASSAGE

Two applicable sources were identified by document research to determine fish passage criteria for target species, adult trout. *Washington Department of Fisheries and Wildlife (WADFW) Fish Passage Design at Road Culverts Design Manual* provides required hydraulic conditions, water depth and velocity, for passage of an adult Rainbow Trout (>6-inches). *The United States Army Corps of Engineers Fish Passage Development and Evaluation Program Fisheries Handbook* by Milo C. Bell (1991) lists swimming capabilities for many fish species including trout. Fish passage criteria from these sources are summarized below:

Fish Passage Criteria (WADFW)

- Minimum Depth: 0.8 feet
- Maximum Velocity: 4 feet/second

Brown Trout Swimming Capabilities (USACE – Milo Bell)

- Sustained Swim Speed: 7 feet/second
- Darting Swim Speed: 12 feet/second

Additionally, existing hydraulic conditions in the river upstream and downstream of the project reach were evaluated to determine current fish passage conditions. To demonstrate that a continual path from downstream to upstream was available for fish passage, the following criteria were applied to the 2D model results:

- Depth: 0.8 feet, and
- Velocity: < 7 feet/second

Based on document research and existing river conditions, Merrick used the following fish passage criteria for the preliminary design.

Fish Passage Criteria

- **Minimum Depth: 0.8 feet**
- **Maximum Velocity: 7 feet/second**
- **Fish Passage Flow Range: 400 cfs – 1000 cfs**

A roughened channel/rock ramp fishway design is proposed for the diversion structure. The channel is trapezoidal with a 15 foot wide bottom, 18-inches deep, 4:1 side slopes, and longitudinal slope of 6%. Boulders are placed in the channel invert and on side slopes to create hydraulic roughness and slower velocities. A conservative Manning's roughness value of 0.08 was used for hydraulic analysis in the two-dimensional modeling based on recommendations from *Reclamation Managing Water in the West Rock Ramp Design Guidelines, U.S. Department of the Interior Bureau of Reclamation, September 2007* and a HEC-RAS model analysis conducted by Merrick. Relative roughness due to boulder obstructions in the fishway was evaluated by developing two hydraulic models with the same geometries (cross section, slope, length) and boundary conditions. Boulders were added to the channel cross sections in one model. The channel roughness of the other model (without boulder obstructions) was increased until the energy grade lines were equal, representing a relative channel roughness that included boulder obstructions. Two channel slopes were evaluated; 2% low gradient and 10% high gradient. Results indicate channel roughness is sensitive to channel slope (see Figures Below).

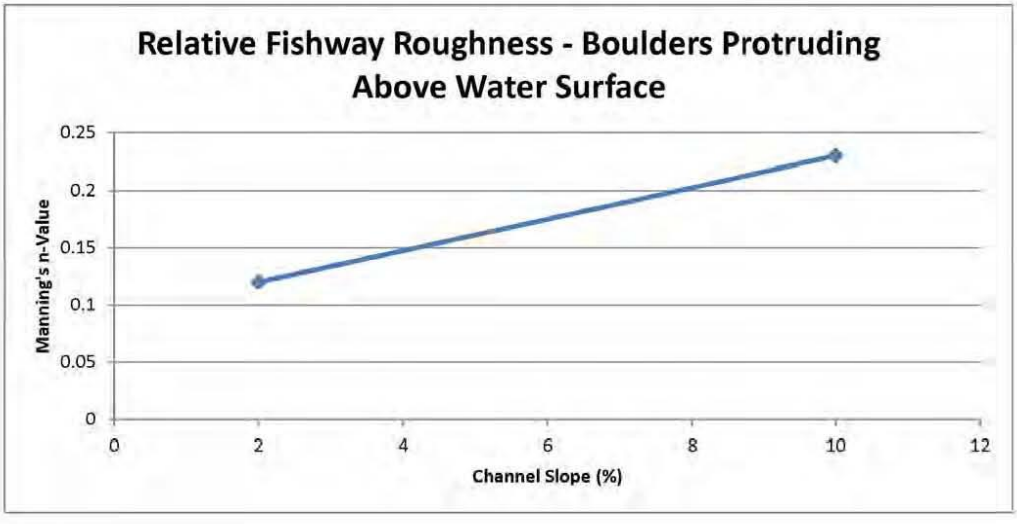


Figure 5 – Results of Merrick Analysis of Fishway Channel Roughness (HEC-RAS)

It is important to note that these roughness results are for hydraulic conditions where the boulders extend above the surface of the water. Lower roughness values are expected once overtopping occurs. In conclusion, the Manning's roughness value of 0.08 used for fishway design is within recommended ranges for rock ramps with boulder obstructions by the USBR and is slightly conservative according to the Merrick analysis.

7.0 SAFETY

Although the improvements for this project are not intended primarily for boating recreation use, Merrick recommends that in-river improvements be designed per the guidelines for recreational structures in the "Colorado Floodplain and Stormwater Criteria Manual" by the Colorado State Water Conservation Board (CWCB). This guideline states that the primary objective for planning, design and construction is *"structures be designed and constructed so that they are predictable and without hidden or unobvious hazards to responsible users"*. Low hazard design elements are included in the concept designs:

- Portage Trail – Ability for river users to exit the water upstream of the diversion and walk around or "scout" the structure,
- Dam Hazard Mitigation – Low slope or stepped dam face to reduce the "reverse roller" hydraulic that develops at the toe of the dam at some flows & boulder placement to reduce foot and hand entrapment hazards, and

- Signage – install signage upstream and at the dam site to provide the public with information on responsible usage, potential hazards and portage/access.

Merrick & Company recommends that the CWCB criteria be used as a basis for further development of the design.

8.0 INTAKE OPERATIONS

Sluicing is proposed to improve sediment and debris exclusion at the intake. An overshot gate at the dam crest will improve sweeping velocities across the bar rack and move large sediments such as cobbles downstream away from the intake. The proposed overshot gate is similar to an air bladder gate system as manufactured by Obermeyer Hydro, Inc. Summary of proposed sluicing operations follows:

- Overshot Gate Sluicing:
  - Operated in the fully Up or fully Down position
  - Open during higher river flows >400 cfs
  - Closed below river flows ≤ 400 cfs
  - Do not allow overtopping of gate for safety reasons

9.0 OVERSHOT GATE SYSTEM

An overshot gate is proposed for sluicing sediment at the intake diversion dam. The gate is connected to the river bottom by a hinge that allows a panel to be raised and lowered. Compressed air fills a reinforced rubber bladder under the gate panel to raise the gate. Conversely, air is released from the bladder to lower the gate panel. The gate is intended to be in the fully up or fully down position depending on sediment sluicing needs and river flow. Controls can be configured to automate the gate movement by water level, time, or other parameters.

Merrick has used a similar gate system on past projects. Obermeyer Hydro, Inc. of Fort Collins, Colorado is a leading manufacturer of these systems. They have been installed on small and large rivers all over the world and have been exposed to harsh river conditions including ice flows, large debris and high flood flows. The following figures are of a recent Merrick project on an irrigation diversion dam in Boise, Idaho.

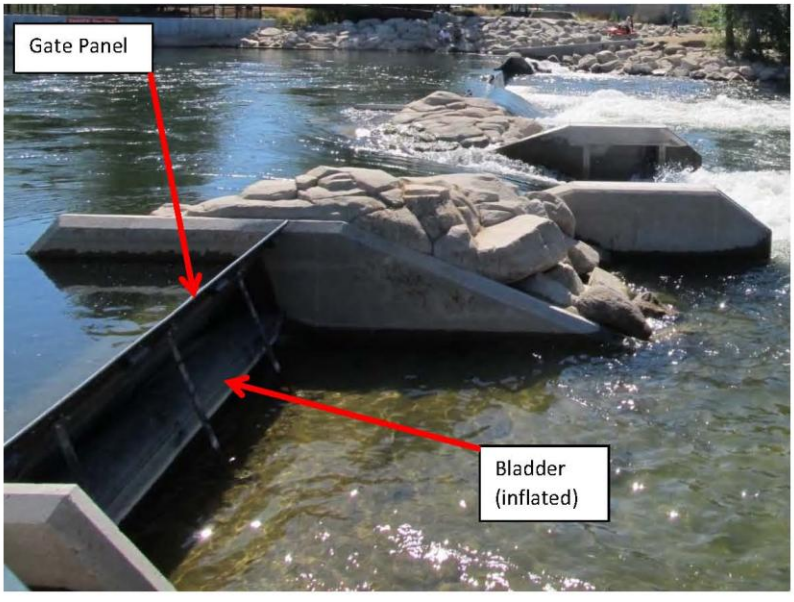


Figure 6 – Overshot Gate in "Up" Position at Thurman Mill Diversion Boise River, ID

These types of gates are generally low in maintenance over the project life. The gate incorporates a stainless steel hinge assembly with thick rubber hinge seal. Side seals are also constructed of a rubber j-bulb shape held in place with a removable – bolt-on plate. Gate panels are high density steel, treated to withstand corrosion and erosive forces of flowing sediment laden water. The bladder is a reinforced vulcanized rubber that is highly puncture resistant. At the proposed installation, stop logs would be included upstream of the gate to allow dewatering and full inspection on an annual basis. During inspection, seals along the bottom and sides should be inspected over the full length to determine if abnormal wear or tearing has occurred. In addition, the bladder would be inflated and observed for pressure loss or punctures. Seals can be replaced without gate removal if necessary although in this installation, minor leakage will not likely impact diversion operations. If installed correctly and without vandalism, it is likely that the gate system will last 10+ years without maintenance.

Figure 7 – Overshot Gate in "Down" Position at Thurman Mill Diversion Boise River, ID

10.0 POST-DIVERSION ALTERNATIVES (LAND WORK)

Based on discussions with project stakeholders the major concerns regarding pump station operation include:

1. Handling fine sediments (currently entrained by the river trash pump) that settle in the 200,000 raw water storage tank.
2. Inadequate water supply causing pump shut off when both pumps operate.

The proposed alternatives screen/remove sediments over 0.5 mm in diameter, which is a typical particle size passable by a vertical turbine pump without severe damage. The remaining granular sediment (< 0.5 mm) and colloidal sediment (clay particles) are much more difficult to remove.

Following diversion, water is routed to the existing pump station from where it is pumped to a 200,000 gallon raw water storage tank. Two alternatives to deliver water from the diversion to the pump station were evaluated as part of this project. Alternative A is a direct piping option from the diversion and is depicted on the Alternative 1 Site Plan. The alternative proposes to carry diverted water through a 12" or 18" pipe approximately 450 feet to a splitter structure. The splitter structure would be designed to maintain a constant water surface elevation and flooding of the wet well. From the splitter structure water would be piped directly to the pump station wet

well, or if diversion rates are higher than the needed by the pump station, excess water would be returned via a constructed wetland channel to the river.

Alternative B provides the opportunity to settle fine sediments in a pond prior to pumping to the raw water tank. As shown in the Alternative 2 and 3 Site Plans, diverted water is carried for approximately 430 feet to a 5 feet deep settling pond. Diverted water would then pass over a weir structure and flow by gravity to the existing pump station wet well. The pond would be equipped with a spillway to allow flows in excess of pumping rates to be returned to the river via a constructed wetlands channel. This project offers the benefit of sediment removal near the diversion, in lieu of removal through period raw water tank cleaning. Either alternative is an improvement over the existing system as the need for double pumping (river to wet well and wet well to tank) is reduced.

11.0 LAND EASEMENTS AND OWNERSHIP

Proposed improvements are to be constructed on and adjacent to private property. Under all alternatives, proposed river restoration will improve the channel reach and improve fishing and boating recreation. In addition, it is prudent and appropriate to provide portage around in-river structures so they may be scouted or bypassed by in-river users. Determination of needed property and access for operation and maintenance of the diversion improvements is outside the scope of work for this project; however, it is recommended that development of access parallels further design development and funding requests for the project.

12.0 COSTS AND ESTIMATED CONSTRUCTION SCHEDULE

For cost estimation, quantities of work were estimated from the concept drawings and unit costs were estimated for this report. Unit costs were prepared from average unit costs of recent project bids with similar scope and from manufacturer supplied data. A breakdown of cost estimates is provided in Appendix D for Alternatives 1 through 3 (River Work) and Alternatives A and B (Land Work). A summary of estimates of probable construction costs is provided in Table 3.

River Work	**Estimated Cost**
Alternative 1 – Drop Pool River Restoration	$1,400,000
Alternative 2 – Riffle and Terrace Restoration	$990,000
Alternative 3 – Single Thread Drop Pool River Restoration	$1,350,000
Land Work	**Estimated Cost**
Alternative A – Direct Pipe Option	$130,000
Alternative B – Settling Pond Option	$160,000

Table 3 – Cost Estimates Summary

As can be seen from Table 3, the range of estimated costs for the project, river plus land work, is **$1,120,000** to **$1,560,000**.

A larger project, the Hartland Dam Modifications, was completed in Fall 2011/Winter 2012. The project was approximately twice the estimated cost of the proposed Somerset Diversion Project. The Hartland Project started in September and required 4.5 months for completion. Based on that schedule and similar project complexities, it is estimated that this project could be completed in 3 months and could start earlier, possibly August, as the required bypass flow rate is much less on the North Fork than the main stem of the Gunnison.

13.0 CONCLUSIONS AND RECOMMENDATIONS

Three alternative concepts were developed for this report and are presented herein. All concepts address primary design objectives including:

1. Ensure full diversion of water rights at all flow levels,
2. Ensure fish and boater passage through/around diversion,
3. Reduce sediment loading in diverted water before pumping,
4. Reduce long-term maintenance,
5. Survive 100-yr flood with improvements,
6. Minimize impact to surrounding floodplain, and
7. Optimize pumping operations from pump station to water tank.

The concepts, as developed, have been validated with preliminary design analysis and Alternatives 1 and 2 have been modeled using one-dimensional and two-dimensional modeling techniques. Based on 2D modeling, results indicate that some final design revisions and modeling will be required to ensure compliance with fish passage criteria. In addition, both designs modeled indicated a rise in the 100-yr water surface elevation in the project reach.

Alternatives 1 and 3 support multi-use recreational objectives for the project reach, maximizing benefits for both fisherman and boaters. Of the two, Alternative 3 is more desired by Project Stakeholders as it returns the river to a single thread and provides an opportunity for riparian terrace restoration. With Alternative 3, a local amenity will be provided that will benefit residents in the valley and encourage visitation, although on a small scale. For these reasons, Alternative 3 is the recommended as the basis for future design phases and funding requests. A rendering of Alternative 3 has been included in Appendix A. While the preliminary design appropriate to move forward has been completed, several key items, in addition to finalization of Contact Documents, will need to be considered in future phases of work. These include:

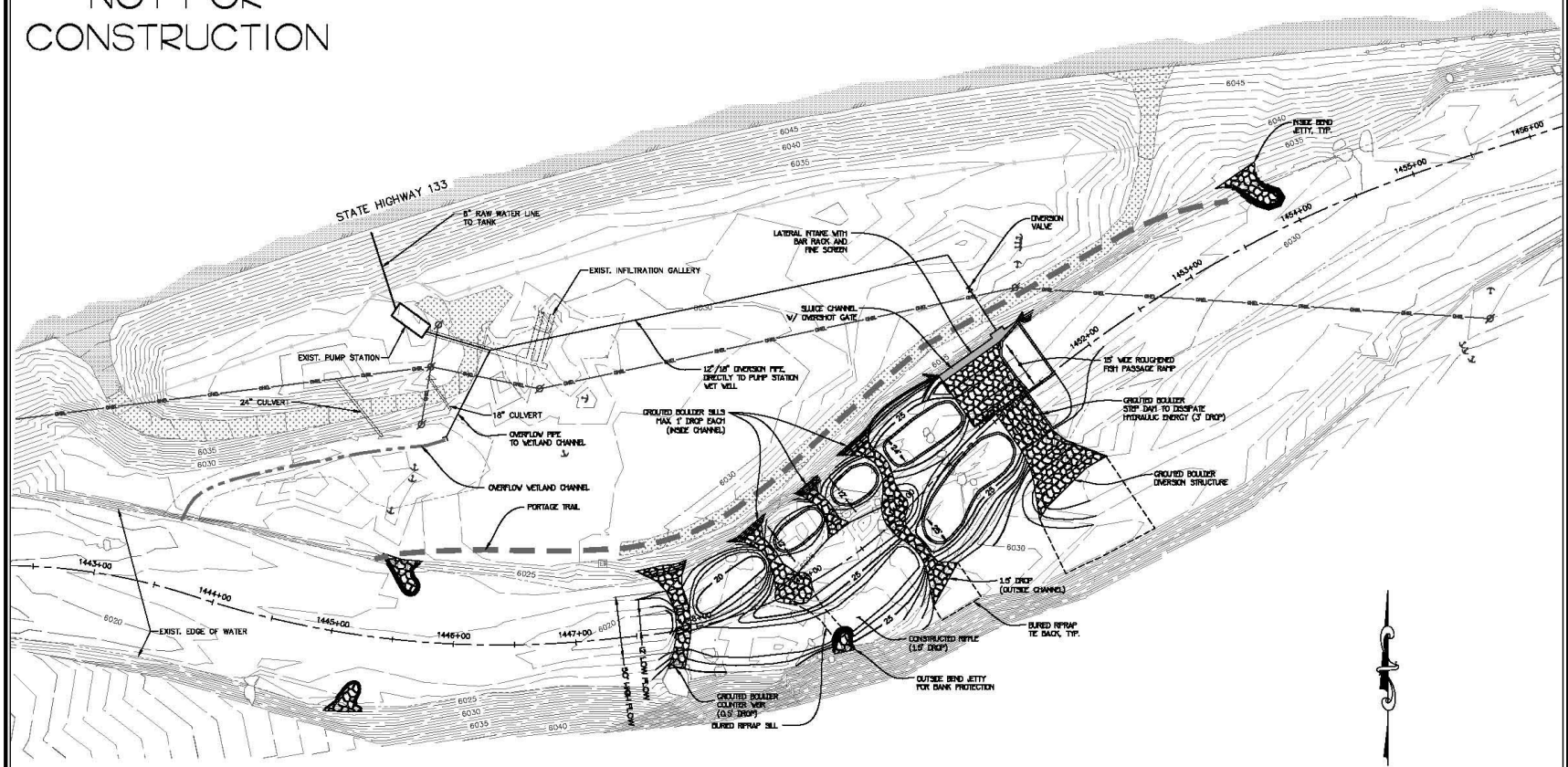
1. Property boundary surveying and development of land purchase agreements and/or easements for maintenance and operation.

2. Tie project survey to NAVD 88 (vertical datum) and NGS State Plane Coordinates (horizontal control).
3. Refine specific design items, including grouted boulder sill slopes and roughness elements, to achieve fish passage criteria.
4. Prepare and submit a floodplain development application to Gunnison County.
5. Evaluate the presence of wetland and Waters of the U.S. and submit a USACE 404 Permit Application prior to construction.

Appendix A

Preliminary Design Drawings, Rendering, and 1D Modeling Figures

NOT FOR CONSTRUCTION



LEGEND

- STORM SEWER/CULVERT
- WATER LINE UNDERGROUND
- ELECTRIC BREAKER BOX
- ELECTRIC OVERHEAD
- GUY WIRE
- LIGHT POLE
- WELL
- EX CONT-MJR
- EX CONT-MNR
- FENCE
- GUARDRAIL
- EDGE ASPHALT
- EDGE OF WATER
- EDGE OF GRAVEL
- BUILDING
- ASPHALT PAVEMENT
- GRAVEL ROAD
- EXISTING BOULDER
- PROPOSED CONCRETE
- PROPOSED GROUTED BOULDER STRUCTURE

40 0 40 80
1 Inch = 40 feet

DELTA CONSERVATION DISTRICT

SOMERSET DIVERSION PRELIMINARY DESIGN

SITE PLAN ALTERNATIVE 1

PROJECT NO 65418463

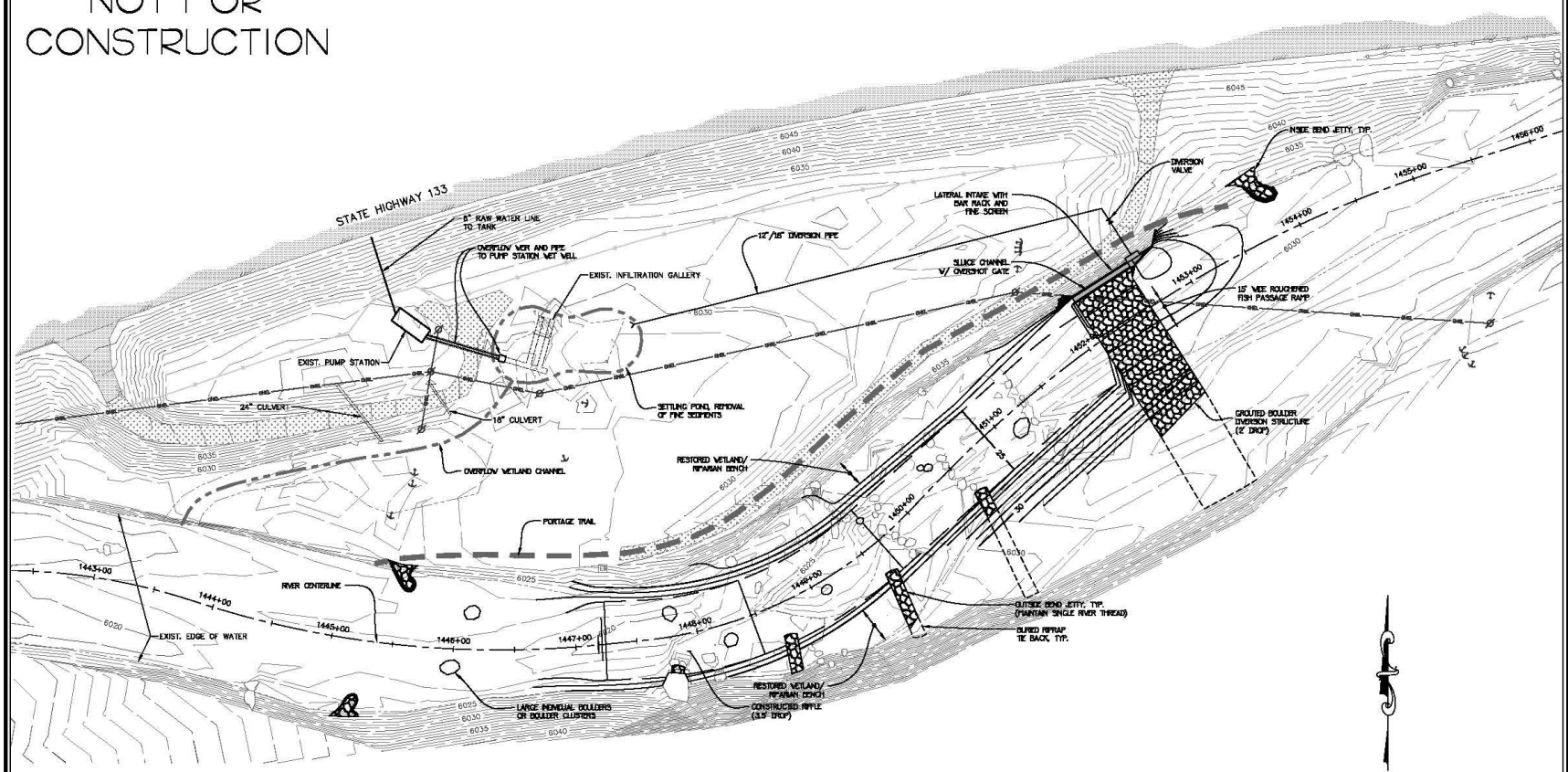
Drawing Number: 1

Number	Revision Description	By	Date

DESIGN: AKA
DETAIL: AKA
CHECK: BAN
DATE: NOVEMBER, 2014

MERRICK & COMPANY
Mclaughlin Water Engineers

NOT FOR CONSTRUCTION



LEGEND

- STORM SEWER/CULVERT
- WATER LINE UNDERGROUND
- ELECTRIC BREAKER BOX
- ELECTRIC OVERHEAD
- GUY WIRE
- LIGHT POLE
- WELL
- 5280 EX CONT-MJR
- EX CONT-MNR
- FENCE
- GUARDRAIL
- EDGE ASPHALT
- EDGE OF WATER
- EDGE OF GRAVEL
- BUILDING
- ASPHALT PAVEMENT
- GRAVEL ROAD
- EXISTING BOULDER
- PROPOSED CONCRETE
- PROPOSED GROUTED BOULDER STRUCTURE

40 0 40 80
1 Inch = 40 feet

DELTA CONSERVATION DISTRICT

SOMERSET DIVERSION PRELIMINARY DESIGN

SITE PLAN ALTERNATIVE 2

PROJECT NO 65418463

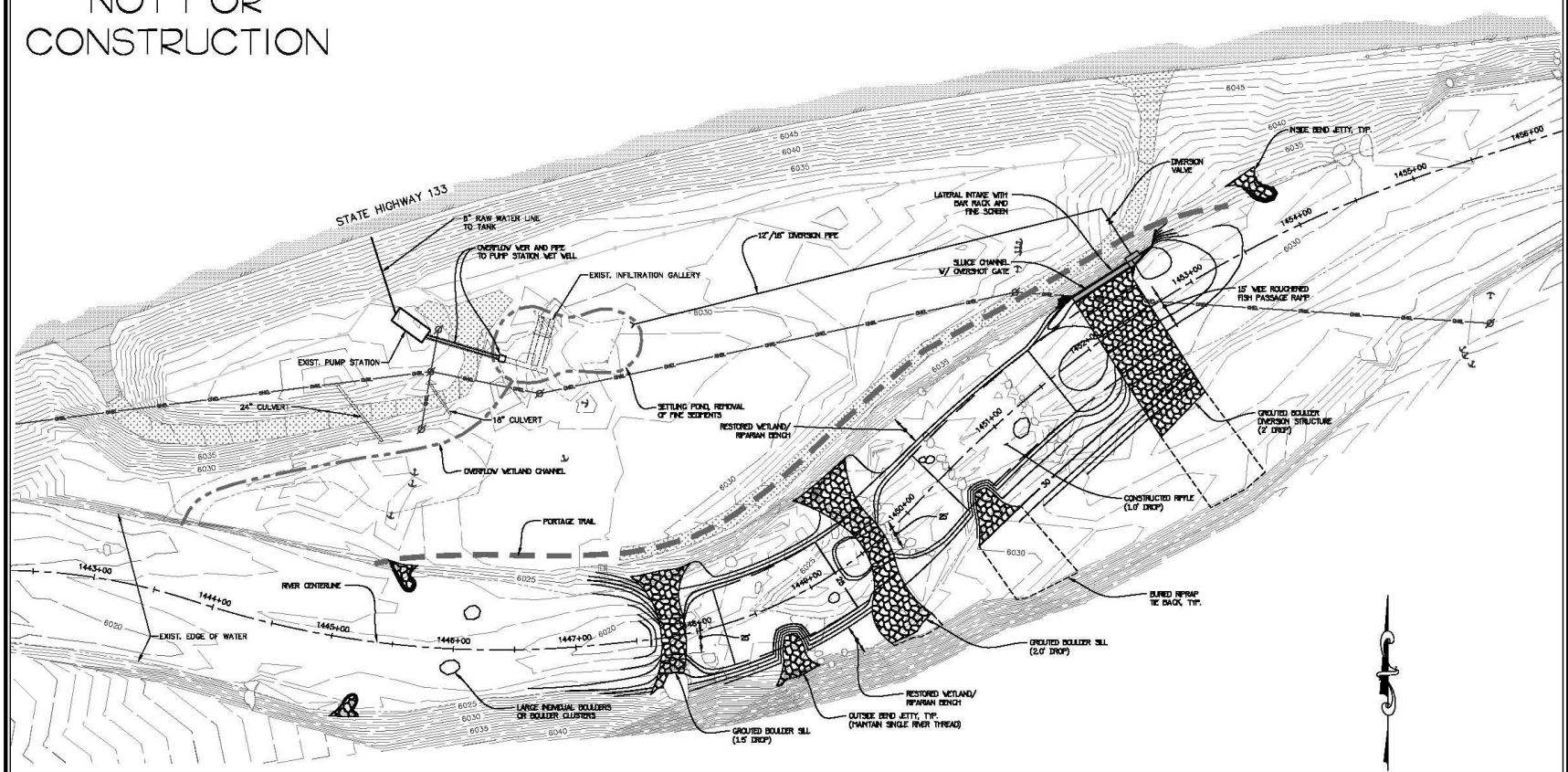
Drawing Number: 2

Number	Revision Description	By	Date

DESIGN: AKA
DETAIL: AKA
CHECK: BAN
DATE: NOVEMBER, 2014

MERRICK & COMPANY
Mclaughlin Water Engineers

NOT FOR CONSTRUCTION



LEGEND

- STORM SEWER/CULVERT
- WATER LINE UNDERGROUND
- ELECTRIC BREAKER BOX
- ELECTRIC OVERHEAD
- GUY WIRE
- LIGHT POLE
- WELL
- EX CONT-MJR
- EX CONT-MNR
- FENCE
- GUARDRAIL
- EDGE ASPHALT
- EDGE OF WATER
- EDGE OF GRAVEL
- BUILDING
- ASPHALT PAVEMENT
- GRAVEL ROAD
- EXISTING BOULDER
- PROPOSED CONCRETE
- PROPOSED GROUTED BOULDER STRUCTURE

40 0 40 80
1 Inch = 40 feet

DELTA CONSERVATION DISTRICT

SOMERSET DIVERSION PRELIMINARY DESIGN

SITE PLAN ALTERNATIVE 3

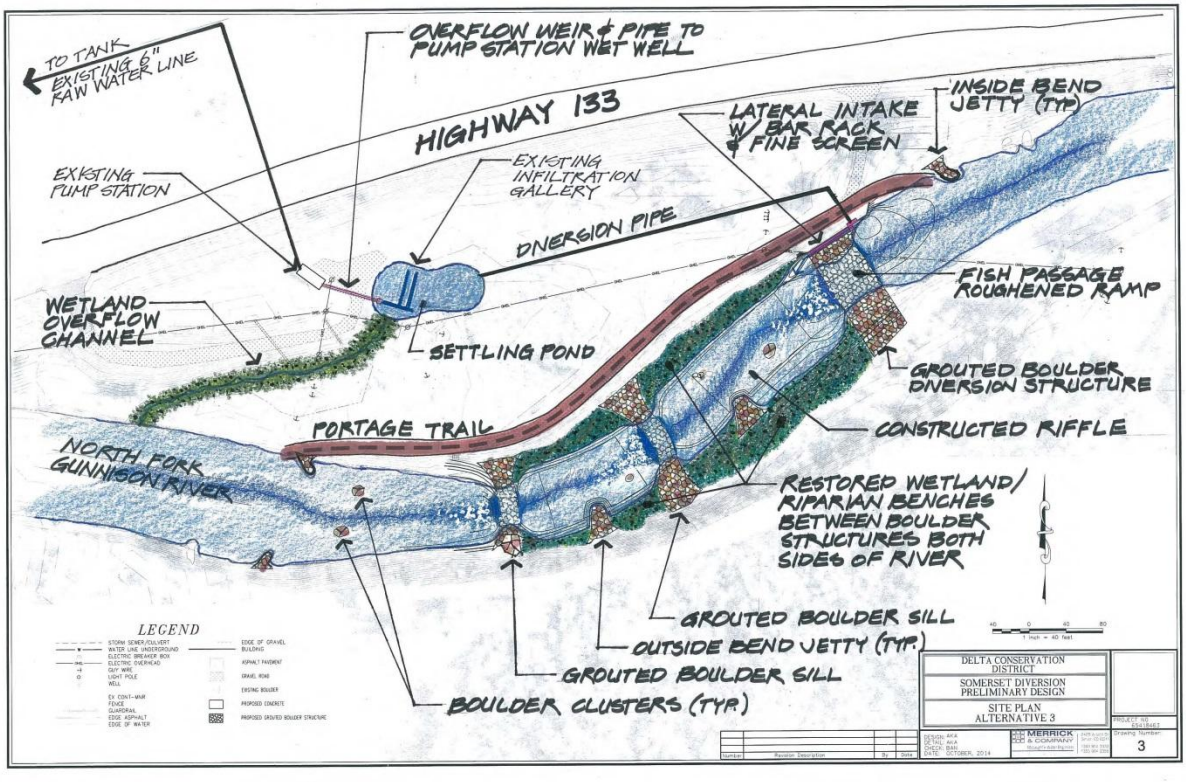
PROJECT NO 65418463

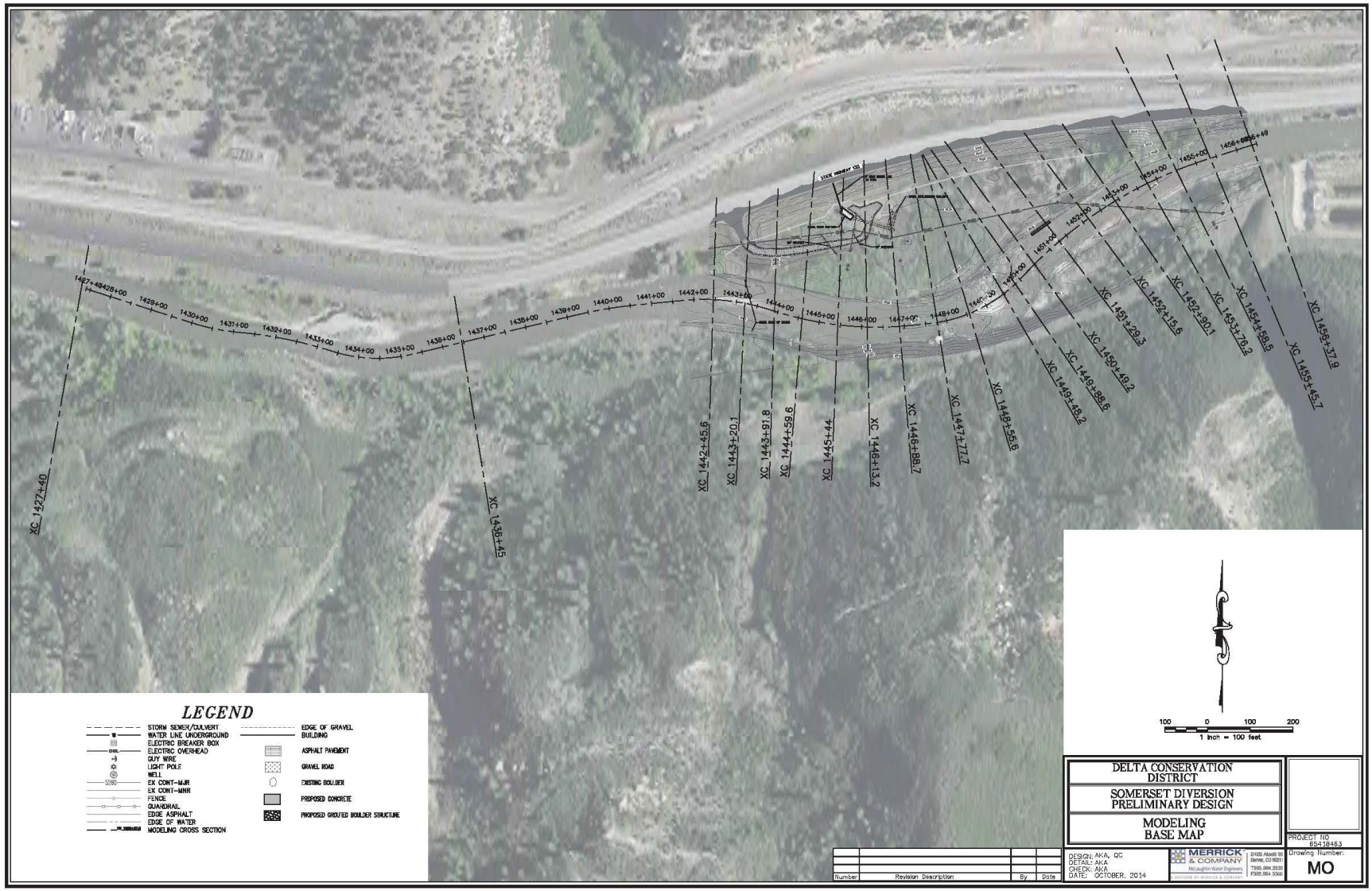
Drawing Number: 3

Number	Revision Description	By	Date

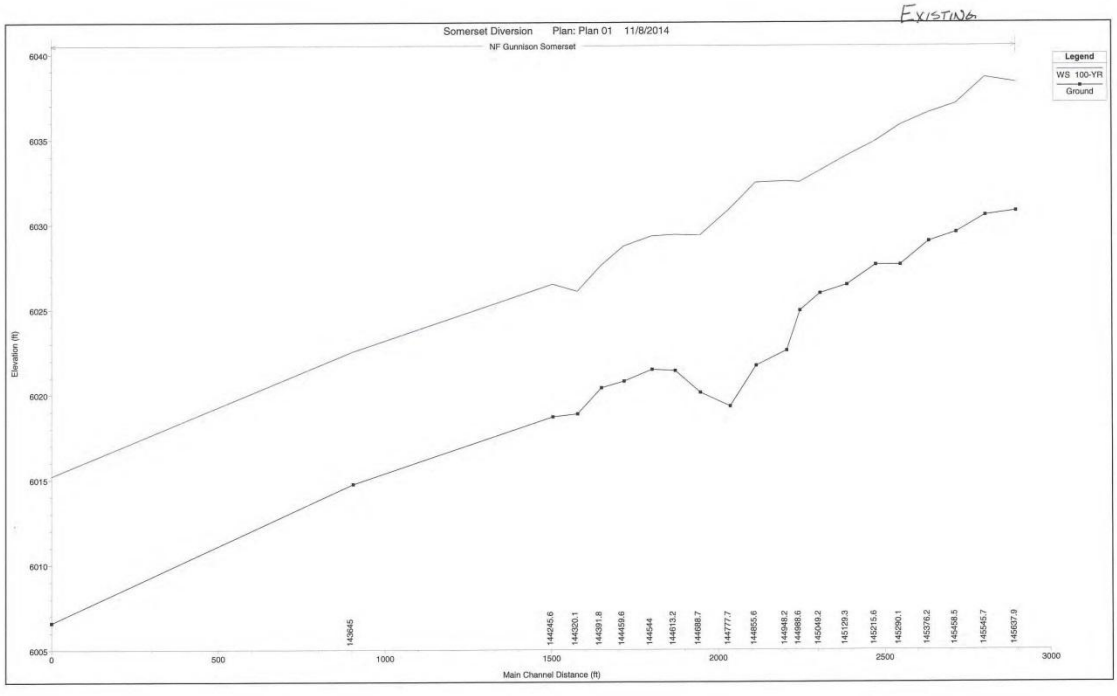
DESIGN: AKA
DETAIL: AKA
CHECK: BAH
DATE: NOVEMBER, 2014

MERRICK & COMPANY
Mclaughlin Water Engineers

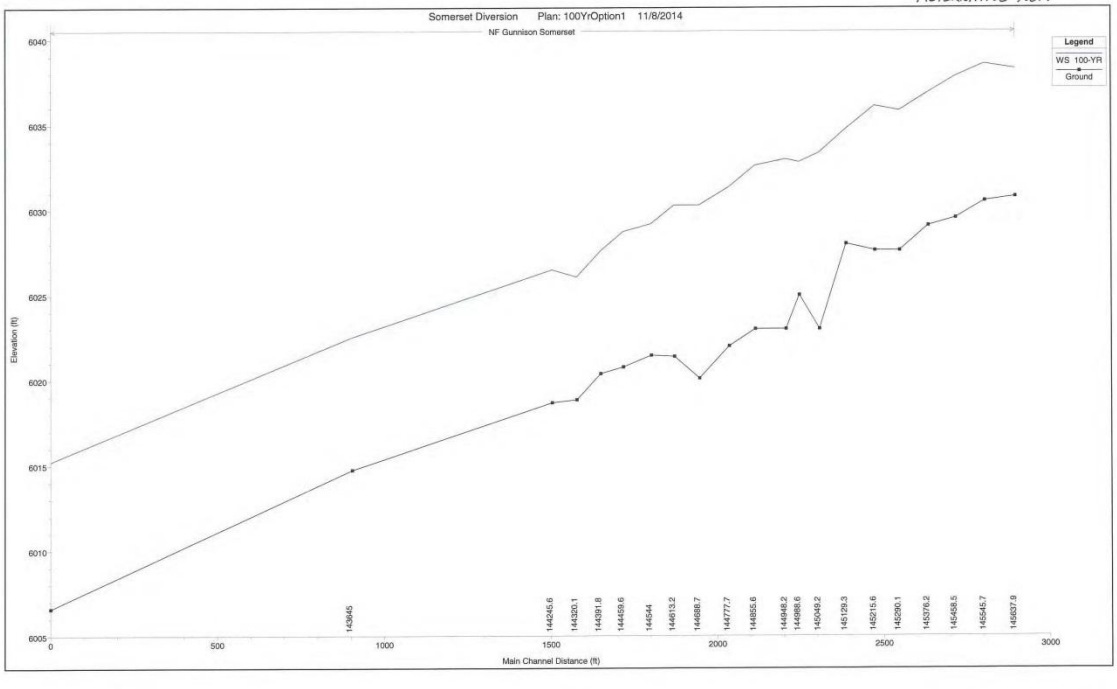

TO TANK
EXISTING 6" RAW WATER LINE
OVERFLOW WEIR & PIPE TO PUMP STATION WET WELL
HIGHWAY 133
LATERAL INTAKE W/ BAR RACK & FINE SCREEN
INSIDE BEND JETTY (TYP)
EXISTING PUMP STATION
EXISTING INFILTRATION GALLERY
DIVERSION PIPE
FISH PASSAGE ROUGHENED RAMP
WETLAND OVERFLOW CHANNEL
SETTLING POND
GROUTED BOULDER DIVERSION STRUCTURE
PORTAGE TRAIL
CONSTRUCTED RIFFLE
NORTH FORK GUNNISON RIVER
RESTORED WETLAND/ RIPARIAN BENCHES BETWEEN BOULDER STRUCTURES BOTH SIDES OF RIVER
GROUTED BOULDER SILL
OUTSIDE BEND JETTY (TYP.)
GROUTED BOULDER SILL
BOULDER CLUSTERS (TYP.)
LEGEND
1 Inch = 40 feet
DELTA CONSERVATION DISTRICT
SOMERSET DIVERSION PRELIMINARY DESIGN
SITE PLAN ALTERNATIVE 3
MERRICK & COMPANY
Drawing Number: 3


LEGEND
STORM SEWER/CULVERT
WATER LINE UNDERGROUND
ELECTRIC BREAKER BOX
ELECTRIC OVERHEAD
GUY WIRE
LIGHT POLE
WELL
EX CONT-MJR
EX CONT-MNR
FENCE
GUARDRAIL
EDGE ASPHALT
EDGE OF WATER
MODELING CROSS SECTION
EDGE OF GRAVEL
BUILDING
ASPHALT PAVEMENT
GRAVEL ROAD
EXISTING BOULDER
PROPOSED CONCRETE
PROPOSED GROUTED BOULDER STRUCTURE
XC 1427+40
XC 1436+45
XC 1442+45.6
XC 1443+20.1
XC 1443+91.8
XC 1444+59.6
XC 1445+44
XC 1446+13.2
XC 1446+88.7
XC 1447+77.7
XC 1448+55.9
XC 1449+43.2
XC 1449+88.6
XC 1450+49.2
XC 1451+29.3
XC 1452+15.6
XC 1452+90.1
XC 1453+76.2
XC 1454+58.9
XC 1455+45.7
XC 1456+37.9
100 0 100 200
1 inch = 100 feet
DELTA CONSERVATION DISTRICT
SOMERSET DIVERSION PRELIMINARY DESIGN
MODELING BASE MAP
PROJECT NO 65418463
Drawing Number: MO
DESIGN: AKA, QC
DETAIL: AKA
CHECK: AKA
DATE: OCTOBER, 2014
MERRICK & COMPANY
Number
Revision Description
By
Date

EXISTING



ALTERNATIVE No. 1



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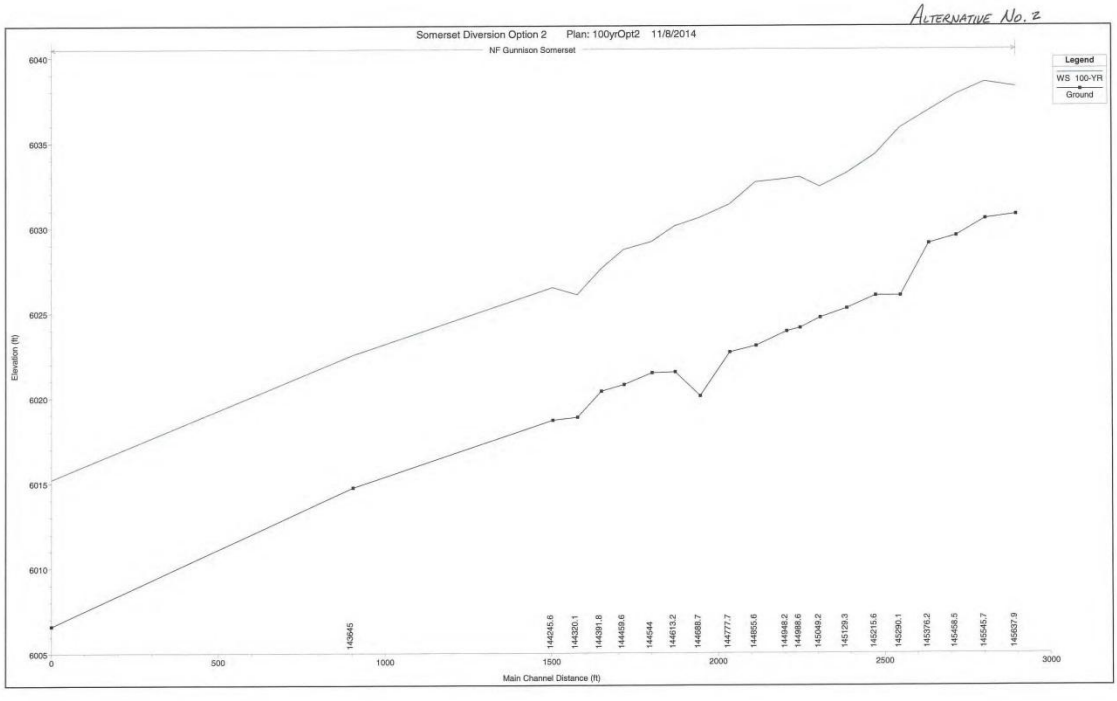

Appendix B

2D Modeling – 400 cfs

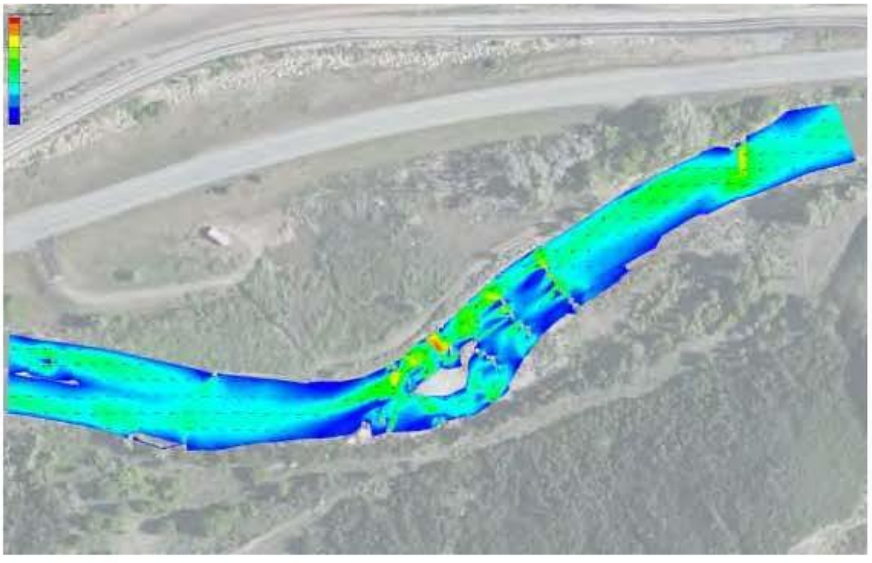

Figure B1: Existing Conditions – 400 cfs

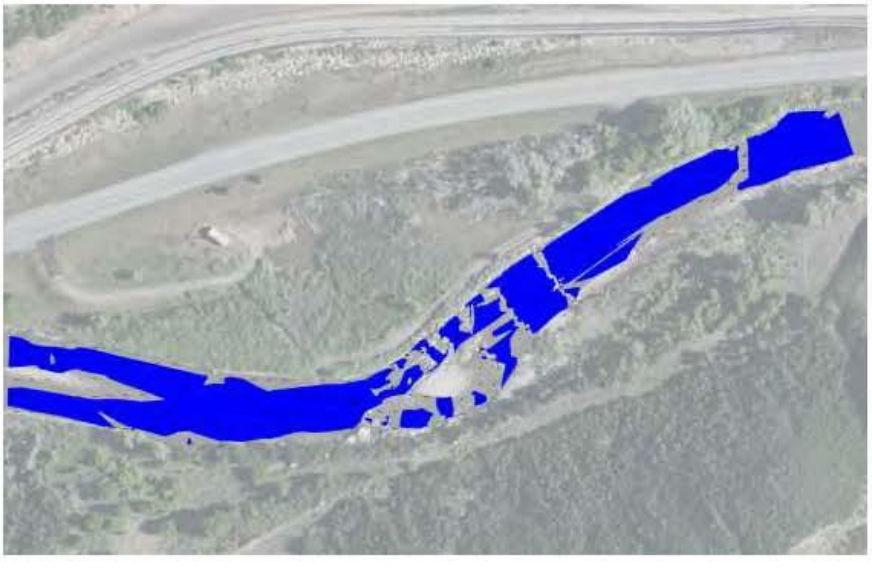

Figure B2: Fish Passage Routes - Existing Conditions – 400 cfs – Depth > 0.8, Velocity < 6.0

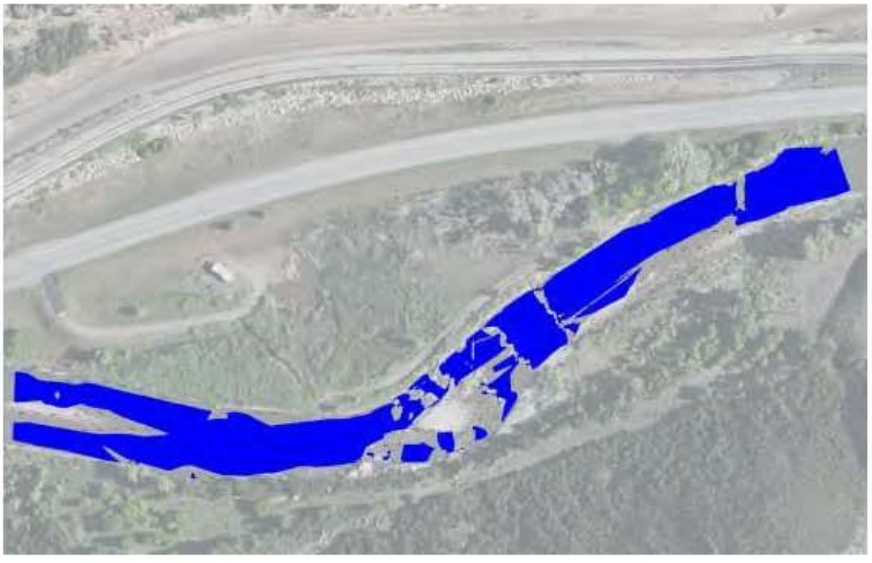

Figure B3: Fish Passage Routes – 400 cfs – Existing Conditions – Depth > 0.8, Velocity < 7.0

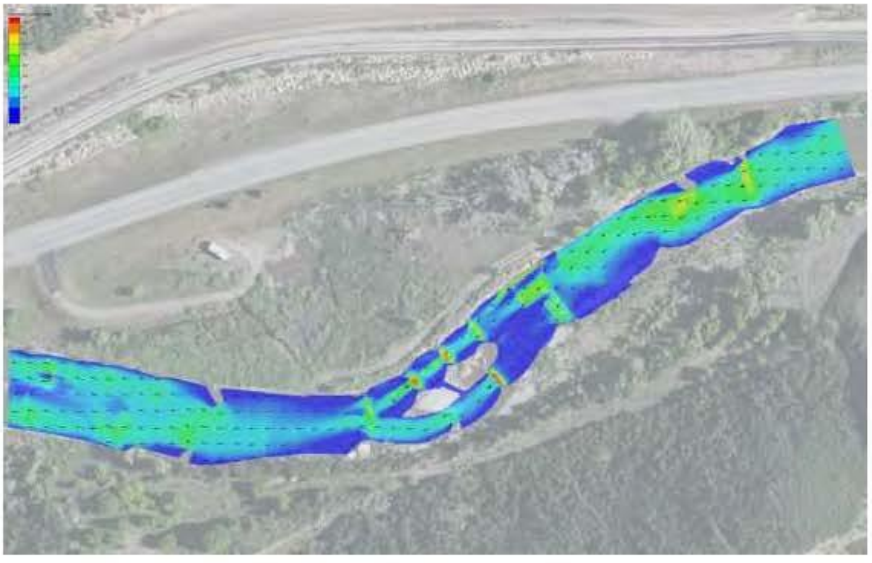

Figure B4: Alternative 1 – Proposed Conditions – 400 cfs

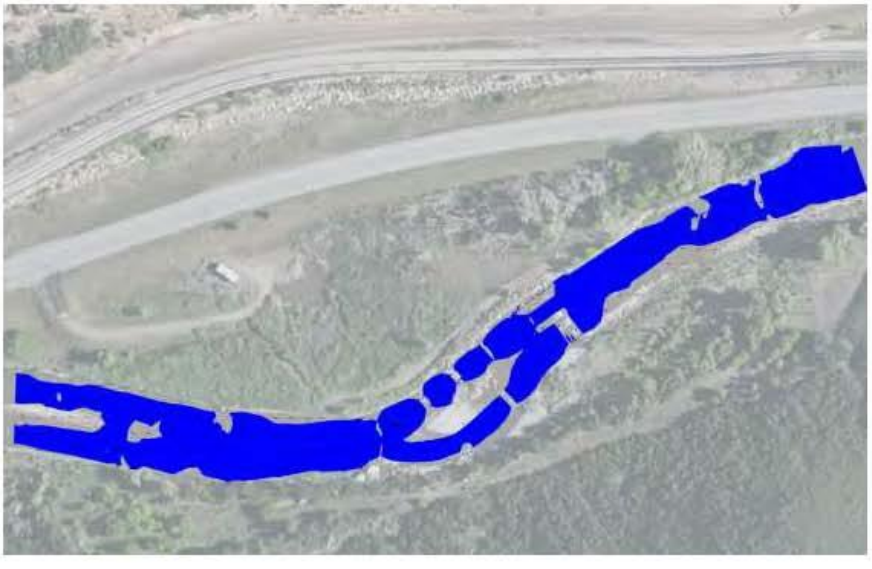

Figure B5: Fish Passage Routes - Alternative 1 – Proposed Conditions - 400 cfs

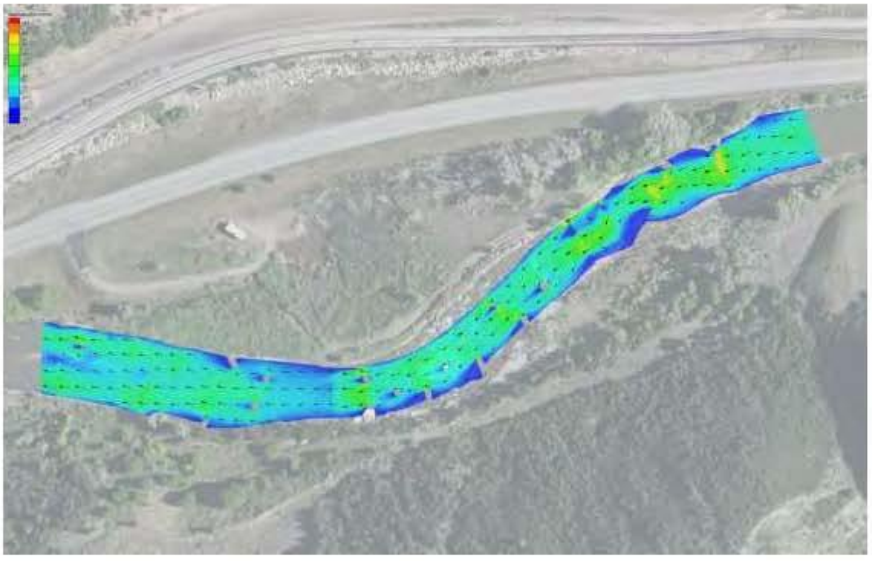

Figure B6: Alternative 2 – Proposed Conditions – 400 cfs

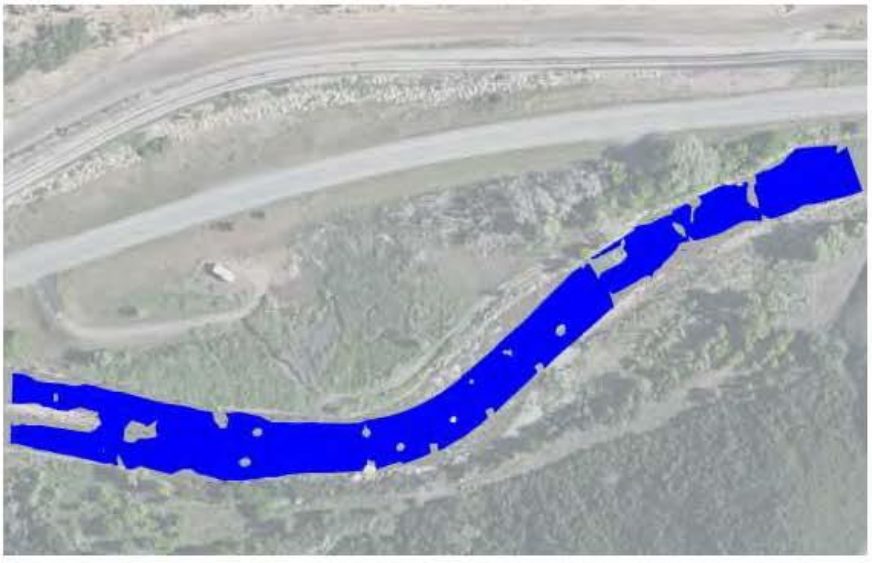

Figure B7: Fish Passage Routes – Alternative 2 - Proposed Conditions – 400 cfs

Appendix C

2D Figures – 1,000 cfs

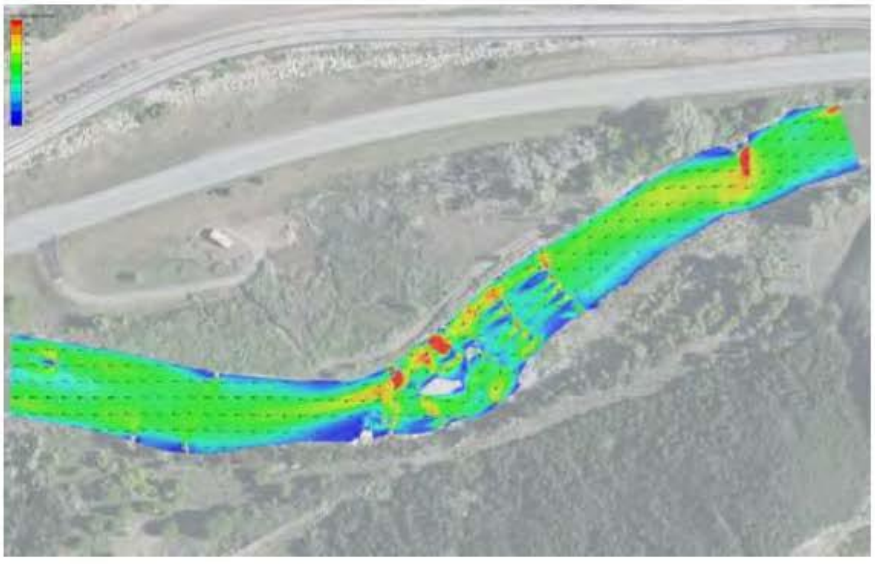

Figure C1: Existing Conditions – 1,000 cfs

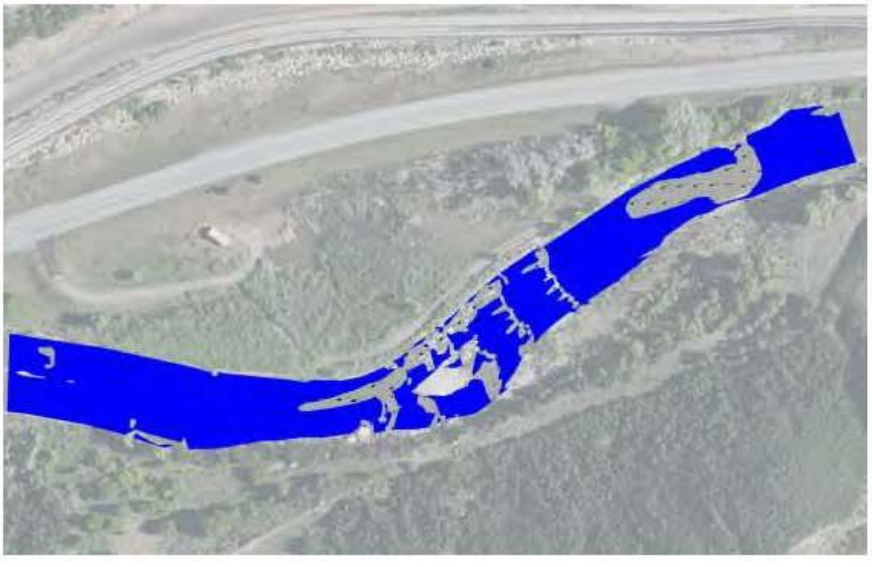

Figure C2: Fish Passage Routes– Existing Conditions – 1,000 cfs - Depth > 0.8, Velocity < 6.0

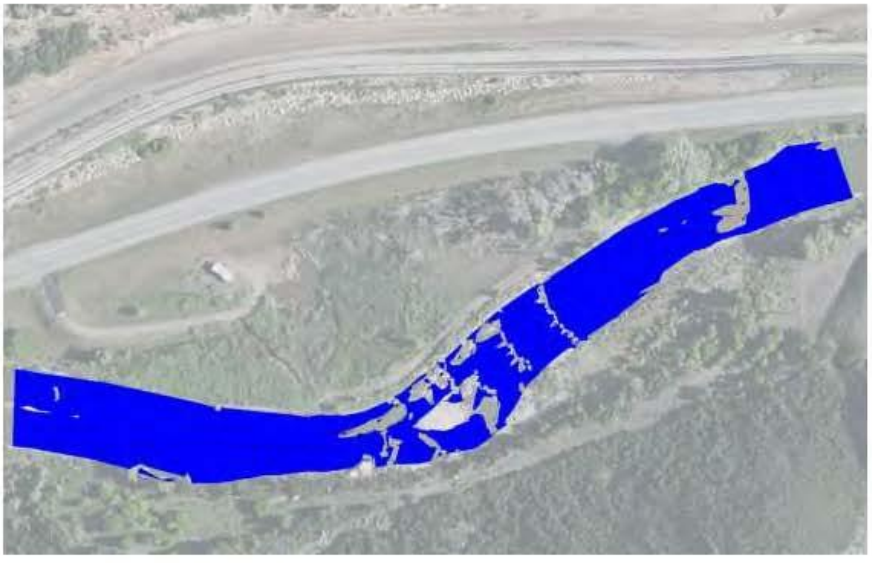

Figure C3: Fish Passage Routes – 1 Existing Conditions – 1,000 cfs - Depth > 0.8, Velocity < 7.0

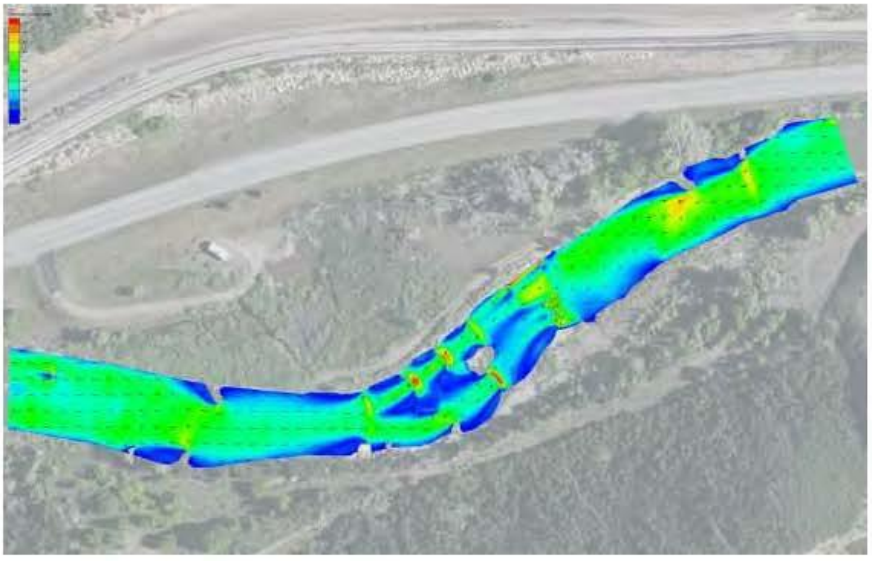

Figure C4: Alternative 1 – Proposed Conditions – 1,000 cfs

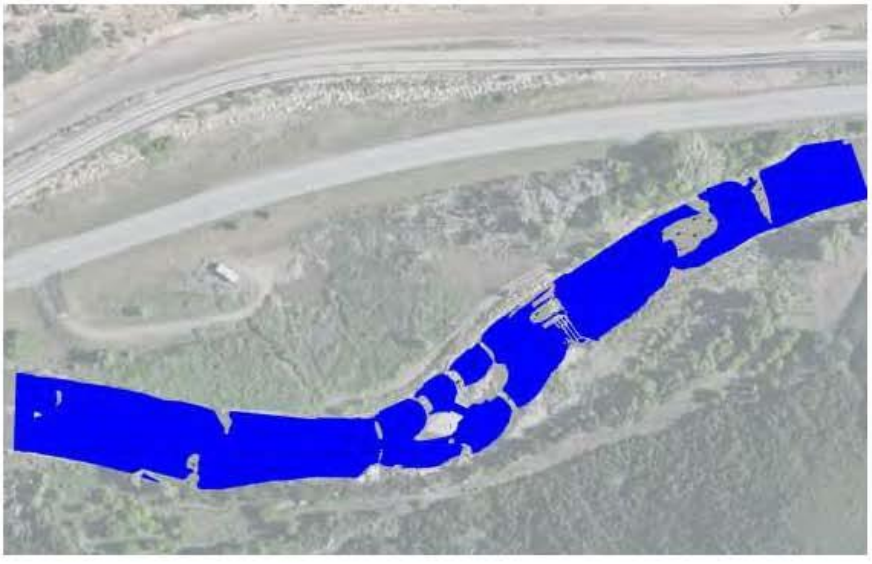

Figure C5: Alternative 1 - Fish Passage Routes – Proposed Conditions - 1,000 cfs

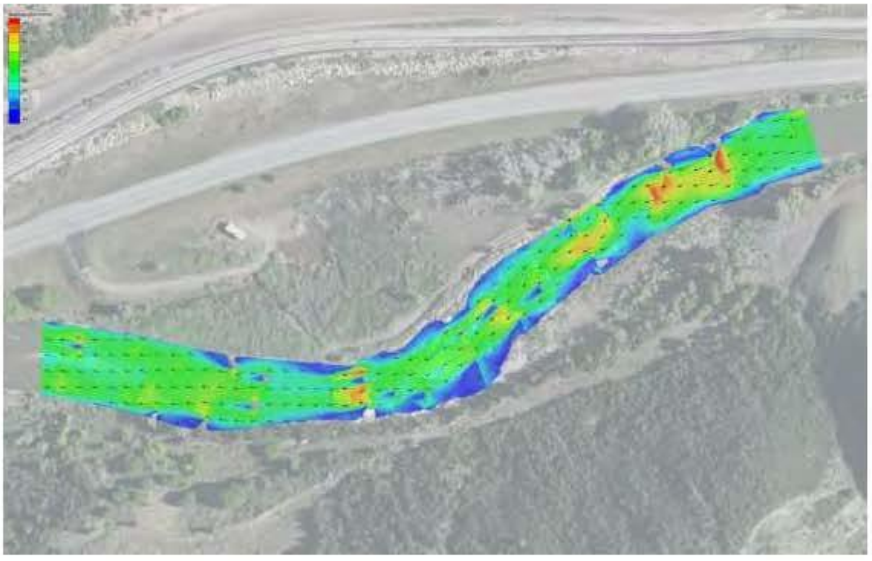

Figure C6: Alternative 2 – Proposed Conditions – 1,000 cfs

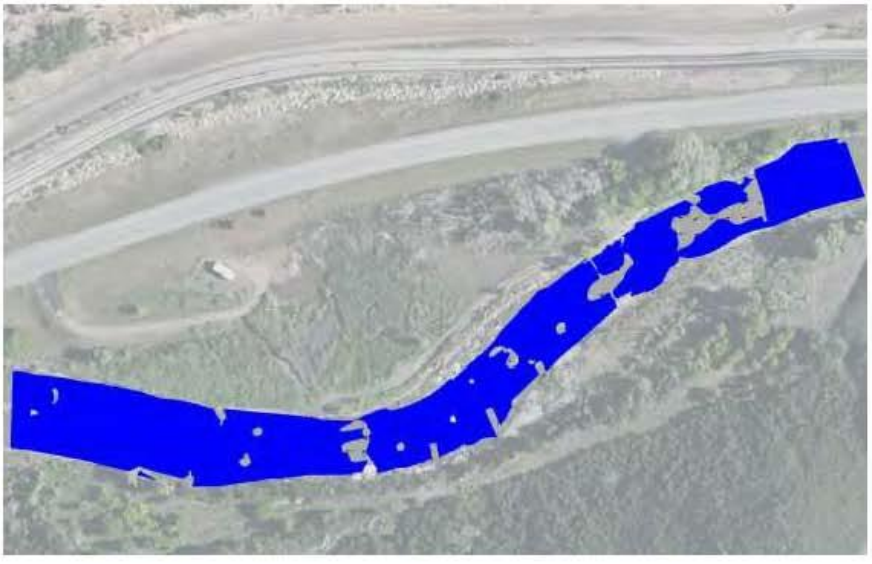

Figure C7: Alternative 2 - Fish Passage Routes – Proposed Conditions – 1,000 cfs

Appendix D

Detailed Cost Estimates

MERRICK & COMPANY
McLaughlin Water Engineers
A Division of Merrick & Company

Delta Conservation District
Somerset Diversion Preliminary Design
Engineer's Opinion of Probable Costs
ALTERNATIVE #1
November 2014

Item	Quantity	Unit	Cost($)/Unit	Cost ($)
General Site Costs				
Mobilization	1	LS	$50,000	$50,000
Dewatering	1	LS	$100,000	$100,000
Subtotal				$150,000
25% Contingency				$37,500
Subtotal				**$187,500**
Intake Structure				
Excavation and Backfill	50	c.y.	$13	$650
Concrete Walls and Slabs	85	c.y.	$800	$68,000
Bar Rack	140	s.f.	$20	$2,800
Fine Screen	20	s.f.	$50	$1,000
Overshot Gate	1	ea.	$15,000	$15,000
Subtotal				$87,450
25% Contingency				$21,863
Subtotal				**$110,000**
Jetties				
Imported and Placed Boulders (24" to 48")	210	c.y.	$125	$26,250
Grout	74	c.y.	$250	$18,500
Subtotal				$44,750
25% Contingency				$11,188
Subtotal				**$56,000**

Grouted Boulder Sills/Diversion

Imported and Placed Boulders (24" to 48")	1,665	c.y.	$125	$208,125
Reused On-site Boulders (24" to 48")	130	c.y.	$70	$9,100
Grout	630	c.y.	$250	$157,500
Cutoff Walls (assume 12 ft deep)	6,010	s.f.	$45	$270,450
Subtotal				$645,175
25% Contingency				$161,294
Subtotal				**$807,000**

Miscellaneous

Portage Trail	300	l.f.	$12	$3,600
Riffle Construction	675	c.y.	$20	$13,500
Pool Excavation and Haul Off	800.0	c.y.	$20	$16,000
Seeding, Planting and Restoration	0.5	acre	$20,000	$10,000
Subtotal				$43,100
25% Contingency				$10,775
Subtotal				**$54,000**

Final Design Engineering (15%) **$182,175**

TOTAL ***$1,397,000***

Assumptions

1. Prices shown are for budgetary planning purposes only.

MERRICK & COMPANY
McLaughlin Water Engineers
A Division of Merrick & Company

Delta Conservation District
Somerset Diversion Preliminary Design
Engineer's Opinion of Probable Costs
ALTERNATIVE #2
November 2014

Item	Quantity	Unit	Cost($)/Unit	Cost ($)
General Site Costs				
Mobilization	1	LS	$50,000	$50,000
Dewatering	1	LS	$100,000	$100,000
Subtotal				$150,000
25% Contingency				$37,500
Subtotal				**$187,500**
Intake Structure				
Excavation and Backfill	50	c.y.	$13	$650
Concrete Walls and Slabs	85	c.y.	$800	$68,000
Bar Rack	140	s.f.	$20	$2,800
Fine Screen	20	s.f.	$50	$1,000
Overshot Gate	1	ea.	$15,000	$15,000
Subtotal				$87,450
25% Contingency				$21,863
Subtotal				**$110,000**
Jetties				
Imported and Placed Boulders (24" to 48")	450	c.y.	$125	$56,250
Grout	160	c.y.	$250	$40,000
Subtotal				$96,250
25% Contingency				$24,063
Subtotal				**$121,000**

Grouted Boulder Sills/Diversion

Imported and Placed Boulders (24" to 48")	740	c.y.	$125	$92,500
Reused On-site Boulders (24" to 48")	130	c.y.	$70	$9,100
Grout	300	c.y.	$250	$75,000
Cutoff Walls (assume 12 ft deep)	1,440	s.f.	$45	$64,800
Subtotal				$241,400
25% Contingency				$60,350
Subtotal				**$302,000**

Miscellaneous

Portage Trail	300	l.f.	$12	$3,600
Riffle Construction	2,940	c.y.	$20	$58,800
Import Topsoil	600.0	c.y.	$45	$27,000
Seeding, Planting and Restoration	0.5	acre	$40,000.0	$20,000
Subtotal				$109,400
25% Contingency				$27,350
Subtotal				**$137,000**

Final Design Engineering (15%) **$128,625**

TOTAL ***$986,000***

Assumptions

1. Prices shown are for budgetary planning purposes only.

MERRICK & COMPANY
McLaughlin Water Engineers
A Division of Merrick & Company

Delta Conservation District
Somerset Diversion Preliminary Design
Engineer's Opinion of Probable Costs
ALTERNATIVE #3
November 2014

Item	Quantity	Unit	Cost($)/Unit	Cost ($)
General Site Costs				
Mobilization	1	LS	$50,000	$50,000
Dewatering	1	LS	$100,000	$100,000
Subtotal				$150,000
25% Contingency				$37,500
Subtotal				**$187,500**
Intake Structure				
Excavation and Backfill	50	c.y.	$13	$650
Concrete Walls and Slabs	85	c.y.	$800	$68,000
Bar Rack	140	s.f.	$20	$2,800
Fine Screen	20	s.f.	$50	$1,000
Overshot Gate	1	ea.	$15,000	$15,000
Subtotal				$87,450
25% Contingency				$21,863
Subtotal				**$110,000**
Jetties				
Imported and Placed Boulders (24" to 48")	232	c.y.	$125	$29,000
Grout	81	c.y.	$250	$20,250
Subtotal				$49,250
25% Contingency				$12,313
Subtotal				**$62,000**

Grouted Boulder Sills/Diversion

Imported and Placed Boulders (24" to 48")	1,789	c.y.	$125	$223,625
Reused On-site Boulders (24" to 48")	130	c.y.	$70	$9,100
Grout	670	c.y.	$250	$167,500
Cutoff Walls (assume 12 ft deep)	4,224	s.f.	$45	$190,080
Subtotal				$590,305
25% Contingency				$147,576
Subtotal				**$738,000**

Miscellaneous

Portage Trail	300	l.f.	$12	$3,600
Riffle Construction	590	c.y.	$20	$11,800
Import Topsoil	600.0	c.y.	$45	$27,000
Seeding, Planting and Restoration	0.5	acre	$40,000.0	$20,000
Subtotal				$62,400
25% Contingency				$15,600
Subtotal				**$78,000**

Final Design Engineering (15%) **$176,325**

TOTAL ***$1,352,000***

Assumptions

1. Prices shown are for budgetary planning purposes only.

MERRICK & COMPANY
McLaughlin Water Engineers
A Division of Merrick & Company

Delta Conservation District
Somerset Diversion Preliminary Design
Engineer's Opinion of Probable Costs
Land Work
November 2014

Direct Piping Option

Item	Quantity	Unit	Cost($)/Unit	Cost ($)
General Site Costs				
Mobilization	1	LS	$5,000	$5,000
Dewatering	1	LS	$10,000	$10,000
Subtotal				$15,000
25% Contingency				$3,750
Subtotal				**$18,750**
Piping Work				
12"/18" Pipe	585	l.f.	$75	$43,875
12"/18" Valve	1	ea.	$3,000	$3,000
Splitter Structure	1	LS	$5,000	$5,000
Connect to Exist. Pump Station	1	LS	$5,000	$5,000
Demo Interfering Gallery Pipes	1	LS	$10,000	$10,000
Construct Wetlands Channel	230	l.f.	$35	$8,050
Subtotal				$74,925
25% Contingency				$18,731
Subtotal				**$94,000**
Final Design Engineering (15%)				**$16,913**
TOTAL				***$130,000***

Settling Pond Option

Item	Quantity	Unit	Cost($)/Unit	Cost ($)
General Site Costs				
Mobilization	1	LS	$5,000	$5,000
Dewatering	1	LS	$10,000	$10,000
Subtotal				$15,000
25% Contingency				$3,750
Subtotal				**$18,750**
Piping/Pond Work				
12"/18" Pipe	430	l.f.	$75	$32,250
12"/18" Valve	1	ea.	$3,000	$3,000
Pond Excavation and Haul Off	1,100	c.y.	$25	$27,500
Weir Box	1	LS	$10,000	$10,000
Connect to Exist. Pump Station	1	LS	$5,000	$5,000
Demo Interfering Gallery Pipes	1	LS	$10,000	$10,000
Construct Wetlands Channel	230	l.f.	$35	$8,050
Subtotal				$95,800
25% Contingency				$23,950
Subtotal				**$120,000**
Final Design Engineering (15%)				**$20,813**
TOTAL				***$160,000***

Assumptions

1. Prices shown are for budgetary planning purposes only.

Appendix F – Alternative 2 Support Statement and Concerns

From a fisheries perspective, Alternative number 2 is by far the preferred alternative. It adequately meets the goals of this project by creating a functional water diversion structure that allows both boater and fish passage, while maintaining a channel that is reflective of the natural channel of the N. Fork Gunnison.

I am not enthusiastic about the three grouted drop structures that are proposed in Alternative number 3, as they will have detrimental impacts to the fishery in the N. Fork. These structures appear to have been added to allow for the addition of play boating, which I was not aware of having been a stated goal of the project. Such grouted structures are known to negatively impact riverine fisheries in three ways: they limit fish passage due to high velocities, they reduce the amount of inhabitable fish habitat within the altered reach, and they reduce the aquatic invertebrate production within the stretch of river.

The high velocities within the tongue of these types of structures typically exceed the swimming capabilities of fish, especially at low flows when the entire volume of the river is confined to the grouted drop structure. Although the proposed design describes the use of boulders to allow upstream fish passage and shows some low velocity zones adjacent to the drop structure, I am concerned that these boulders will not be accessible during low flow conditions where these types of grouted drop structures are most limiting to fish passage. We have seen issues with these types of designs throughout the state. Would it be possible to run the Merrick fish-passage analysis for Alternative number 3 at low flows to see what predicted fish passage would look like? In such an analysis, would the Manning's n value be adjusted to reflect the low roughness, grouted surface? If these structures are preferred, we would recommend making adjacent fish passage structures that would be inundated and passable at all flow conditions.

In multiple kayak parks throughout the state, CPW has observed significant declines in fish abundance and biomass. This is due to the high and variable flow conditions that result from the accelerated water that is produced as a necessity for creating play-waves. Essentially, the conditions within pools downstream of grouted drop structures are too tumultuous for fish to inhabit in normal numbers.

Finally, grouted drop structures reduce the aquatic invertebrate production from the section of stream in which they are installed. Aquatic invertebrates utilize the interstitial spaces between cobbles in the stream bed for habitat, and the highest zones of invertebrate densities are within riffles. Grouted drop structures eliminate these invertebrate production zones by changing the natural riffle drops in a river to grouted drops causing drastic reductions in overall biomass within the reach of river. The impacts of this reduced biomass can affect fish populations well downstream of the drop structures by eliminating inflows of invertebrates from upstream.

In summation, CPW does not support Alternative number 3. If this alternative is pursued, we would like to see the Merrick analysis for this design for the entire reach, and would recommend installing fish passage channels adjacent to the grouted drops.

We greatly prefer Alternative number 2. Thanks! Eric Gardunio; Area Aquatic Biologist