COLORADO HEALTHY RIVERS FUND

Uncompahgre River Restoration – City of Montrose

Final Report

Prepared for:
Colorado Healthy Rivers Fund Grants
Attn: Chris Sturm

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City of Montrose
Grant Amount: $500,000
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INTRODUCTION

The proposed project was to complete Phase 1 of 3 for river restoration improvements on 0.65 miles (3,400 feet) of the Uncompahgre River traversing through Montrose (Phases 2 and 3 account for an additional 5,300 feet of improvements to be constructed at a future date). For many years, the value of the Uncompahgre River as an economic, recreational, and natural asset was not realized. Activities in and along the river drastically changed the quality of the river and led to many undesired consequences. A variety of land use practices, flow modifications, and encroachments have resulted in an overly wide channel, bank stabilization issues, and a lack of stable aquatic and riparian habitat. Approximately 2,850 linear feet of the project area was also currently experiencing lateral bank retreat. Aerial imagery indicates the river's channel has moved by approximately 400 feet over the past 50+ years mostly in response to gravel mining activities that had historically taken place in the river.

The Uncompahgre River through Montrose consists of both channelized, relatively stable reaches of about 60 to 70 feet wide and meandering, dynamic reaches of up to 500 feet in width. Existing fish habitat is marginal throughout most of the Project Area and some portions of the River were experiencing lateral bank retreat on the order of several feet per year. Flow through the project area primarily consists of contributions from the Gunnison Tunnel/South Canal, releases from Ridgway Reservoir, and tributary stormwater flows. The Ridgway Reservoir provides for relatively consistent flows on the river between April and September.

The pre-project condition of the river varied in response to historic and current land uses. Development within the valley and floodplain constrictions along the river have each affected the river by altered flows, flood elevations, and patterns, changed mineral content, impacted channel structure, and reduced permeability and vegetated cover of the drainages within the watershed. The Uncompahgre Valley Water Users Association completed the Gunnison Tunnel in 1909 which supports 575 miles of irrigation canals and laterals to irrigate agricultural lands in the Uncompahgre Valley. The effect of the agricultural system irrigating the Mancos shale soils is increased pH, salinity and specifically selenium levels in water bodies, creeks, ditches, and the River. Additionally, Ridgway Reservoir, completed in 1987, regulates flows from the Uncompahgre headwaters. The regulation removes some flooding which could affect the adjacent vegetation and sediment/nutrient loading. The reservoir potentially settles out heavy metals and other contaminants leached from mining operations upstream and releases significantly cooler water, which is a benefit to native fish, offsetting the warming effect caused by loss of much of the canopy along the corridor which had historically shaded the river.

The purpose of this project was to address the above-described issues, improve access and recreation within and adjacent to the river, and create a highly functional ecosystem that greatly benefits the community. The project re-established a resilient channel alignment, created an active channel width balanced with flow and sediment load, connected the river to its floodplain, created a stable riparian zone adjacent to the channel, improved fish and other aquatic habitat, stabilized the river banks, and enhanced angling access opportunities made available through a recent 42-acre land donation. Property along the stretch of the river where improvements will take place has never been open to the public before this project.

BACKGROUND

The Project was multi-objective and aimed to address ecosystem restoration through rebalancing the physical environment with the flow alterations. Specifically, the goal of the Improvement Project was to improve aquatic and riparian habitat while reducing geomorphic and future flood risk considering the flow alterations. The following stakeholders formed an advisory committee and assisted in directing the Improvement Project.

- City of Montrose
- Colorado Parks and Wildlife (CPW)
- Colorado Outdoors, LLC
- FORU - Friends of the River Uncompahgre (Local River Advocacy Group)
- Montrose Urban Renewal Authority (MURA)
- Telluride Outdoors (Local Outfitter)
- Trout Unlimited

The Committee defined the following goals as part of the project inception:

- Design/construct river improvements in such a manner as to maintain a natural, user friendly, and inviting feel for the River system (i.e., use natural materials wherever possible, no concrete structures).
- Design/construct river improvements in such a manner as to maintain functionality during both high and low flows to the extent practical.
- Stabilize river banks where necessary to prevent lateral retreat.
- Avoid adverse impacts to neighboring properties along the River.
- Avoid causing a rise in floodplain elevations on the Uncompahgre River.
- Improve fish habitat through the Project area by adding new habitat, enhancing existing habitat, and performing channel reconstruction necessary to produce a sustainable (no stocking) catch-and-release, artificial flies, and lures only trout fishery to the extent practicable.
- Design/construct river improvements in such a way as to allow boaters to pass through the project area with relative ease while not encouraging whitewater surfing.

Upon more detailed analysis and design development, specific, quantifiable goals were established based upon the initial concept principles and guidelines. With these broad goals, specific objectives for the Project Reach were more clearly defined. The objectives for the Project Reach were defined by the following seven specific objectives:

1. Re-establish appropriate channel dimension, pattern, profile for existing stream flows
2. Floodplain connectivity
3. Bed form diversity
4. Establish a riparian habitat corridor
5. Reclaim natural riparian and upland natural vegetation communities and lands
6. Flood resiliency
7. Fish Communities-Habitat Availability

The design, completed by Ecological Resource Consultants, Inc. (ERC), was based on detailed evaluation of stream corridor conditions, including the critical parameters of flow, sediment loading and historic channel evolution. Flows in the Uncompahgre through Montrose are highly altered due to irrigation and trans-basin diversions from the Gunnison Tunnel. These flows were evaluated and have been factored into the bankfull channel and connection of flood flows to the floodplain. Review of past channel conditions, sediment deposition and stream alignments were also very influential in the design plans. The stream has taken on dramatically different alignments through the project area over the past 60 years. Most of the alignment changes can be tied directly to flow alterations and historic encroachments or mining activities in the floodplain.

Channel evolution was evaluated and used to define meander wave lengths, amplitude and bend radii which are appropriate for the flow and sediment load. Hydraulic evaluations were performed to define channel geometries and ensure the constructed system will interact with its floodplain in a manner which sustains the riparian corridor and uses the natural floodplain function. Evaluation of existing vegetation was helpful in defining the native species which will be utilized to create the large riparian/floodplain terraces which are part of this project.

A variety of current and past land-use practices (i.e, gravel mining, agriculture, urban development, bridges, flow alterations, and encroachment) impacted the Project Reach causing a system that was out of balance and generally unstable as observed by an overly wide and shallow channel, excessive bank erosion and lack of suitable aquatic habitat. Within the Project Reach, approximately two-thirds of the river contained what CPW considers marginal fish habitat; the remainder was generally devoid of optimal fish habitat. Aerial imagery indicates the river's channel has moved approximately 400 feet over the past 50 years.

FLOW REGIME

River flow through the Project Reach consists primarily of contributions from the Gunnison Tunnel/South Canal, releases from Ridgway Reservoir, and tributary stormwater flows. This altered flow regime represents the primary contributing factor to the existing degraded conditions of the system. The nearest USGS stream gage is located approximately 15 miles upstream of the Project Reach near Colona, Colorado. However, this gage is situated upstream of the South Canal's contributions (up to 1,150 CFS) with multiple irrigation canal diversions (taking up to 700 CFS) between the gauge and project area. As a result of these contributions and diversions, flow measurements at this gauge are not directly representative of flows through the project area.

To account for the contribution of flow from the South Canal and reduction in flow resulting from the various diversions, the expected flow at the Project Reach was calculated by taking discharge measurements at the Colona Gauge, adding contributions from the South Canal, and subtracting major diversion flows between the Colona gauge and Project Reach. Flow records taken from the United States Geological Survey and the Colorado Division of Water Resources were used for these calculations.

A hydrograph showing the calculated flow at the Project Reach dating back to 1991 is included as **Figure 1**. As shown in the figure, flows at the Project Reach are drastically higher and prolonged than natural

conditions during the irrigation season (April through October) as a result of contributions from the South Canal and spring runoff/stormwater contributions that join downstream of Ridgway Reservoir. The River flows during the early irrigation season average around 450 cfs and taper down to 200 cfs by the late irrigation season. In the off-irrigation season, flows average around 75 cfs, however often become extremely lower. Over the period dating back to 1991, the typical irrigation season highs have varied between 300 cfs in drought years to as high as 1,200 cfs in abundant years.

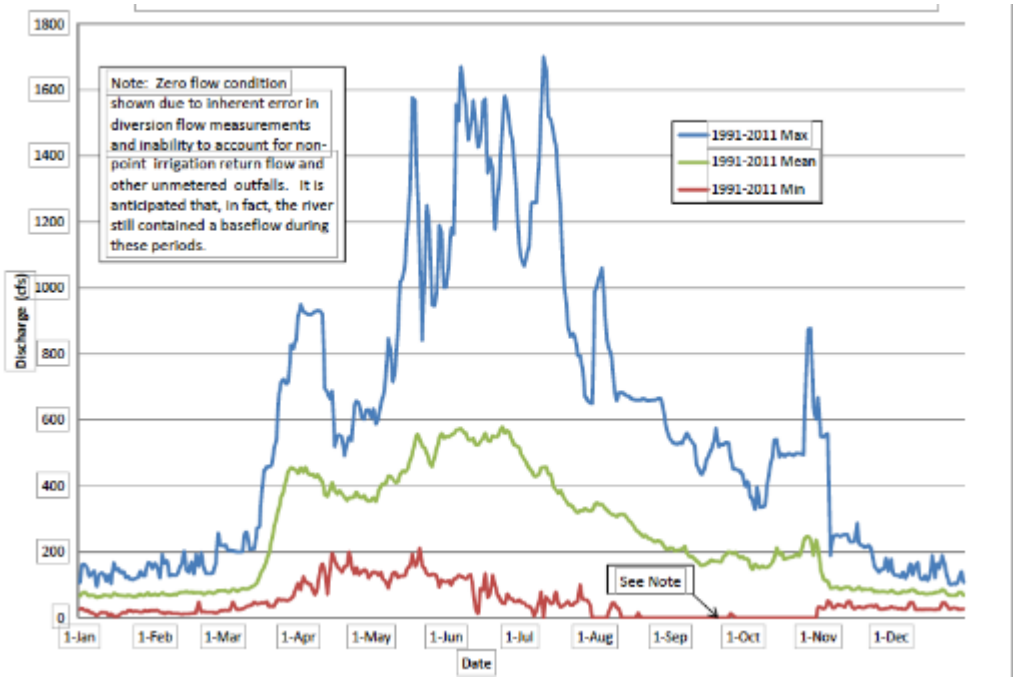

Figure 1 *Uncompahgre River Flow Stats at Main Street Bridge*

CHANNEL PLANFORM

An evaluation of historical channel planforms was conducted as part of evaluating existing conditions. Review of historic photos suggest that the River has been unstable and prone to migration through the years as depicted in the different channel alignments that are presented in **Figure 2**.

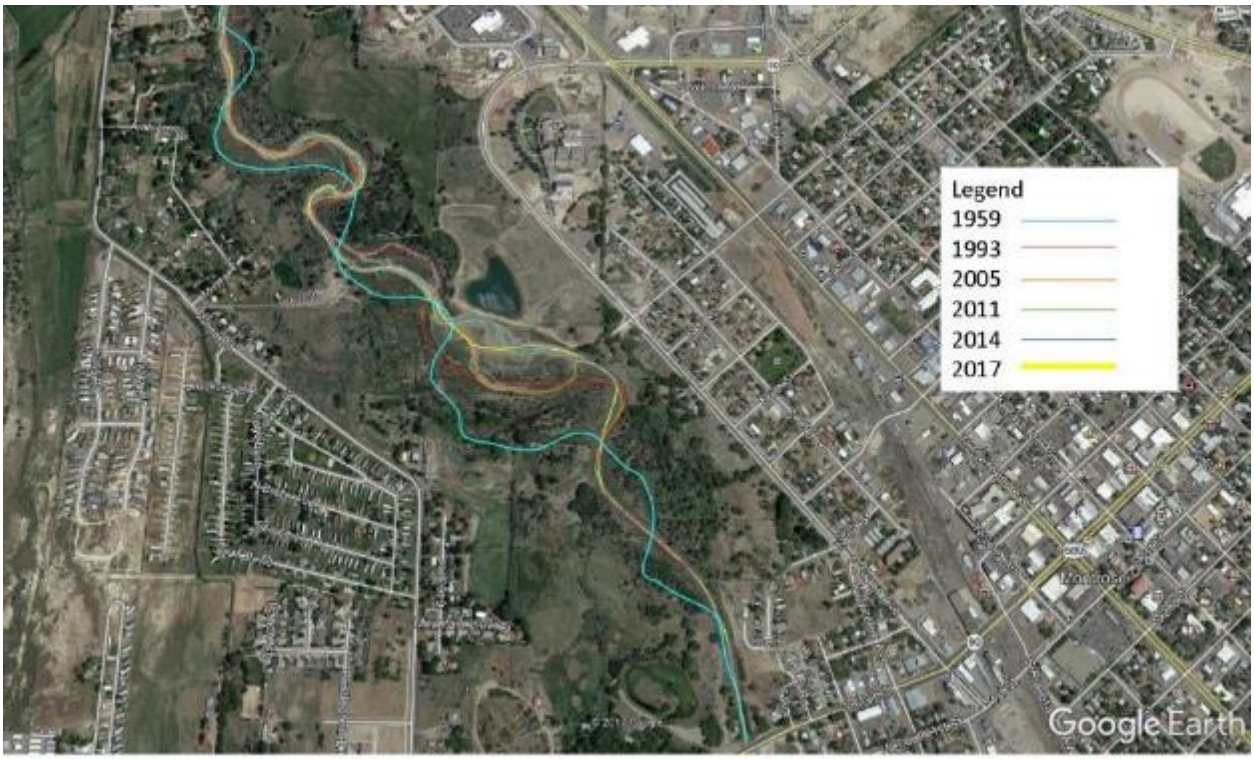

Figure 2 *Comparison of Recent Channel Alignments*

What was evident from historic photos is at times when the River was stable for an extended period, the River through the Project Reach took the form of what would be considered more typical of an ecological reference condition, with a distinct narrow main channel, a more uniform meandering channel planform (higher sinuosity, larger meander radii and wavelengths), numerous smaller side channel and a well-vegetated floodplain. During periods of instability the Project Reach form deviates from a more typical ecological reference condition, with extremely wide bankfull width and an irregular meander channel planform (straighten sections, tight meander radii and wavelengths).

Figure 3 *1959 Aerial Illustrating a Relatively Stable Planform*

Over time, the altered and regulated hydrography coupled with regional anthropogenic impacts, the Project Reach has experienced periods of high instability. Pre-restoration the Project Reach was highly unstable with sections of the River experiencing significant bank erosion causing the channel to widen and straighten which further reduced sediment transport capacity and encouraged additional deposition. **Figures 4** from 2014 shows how the River had recently straightened, become extremely wide and riparian bank vegetation is lacking.

Figure 4 *Recent Channel Migration with Loss of Riparian Areas*

In order to better understand current instability in relation to the desired or reference conditions for the Project Reach, ERC evaluate conditions from the earlier available aerial photo (1959) to determine channel characteristics.

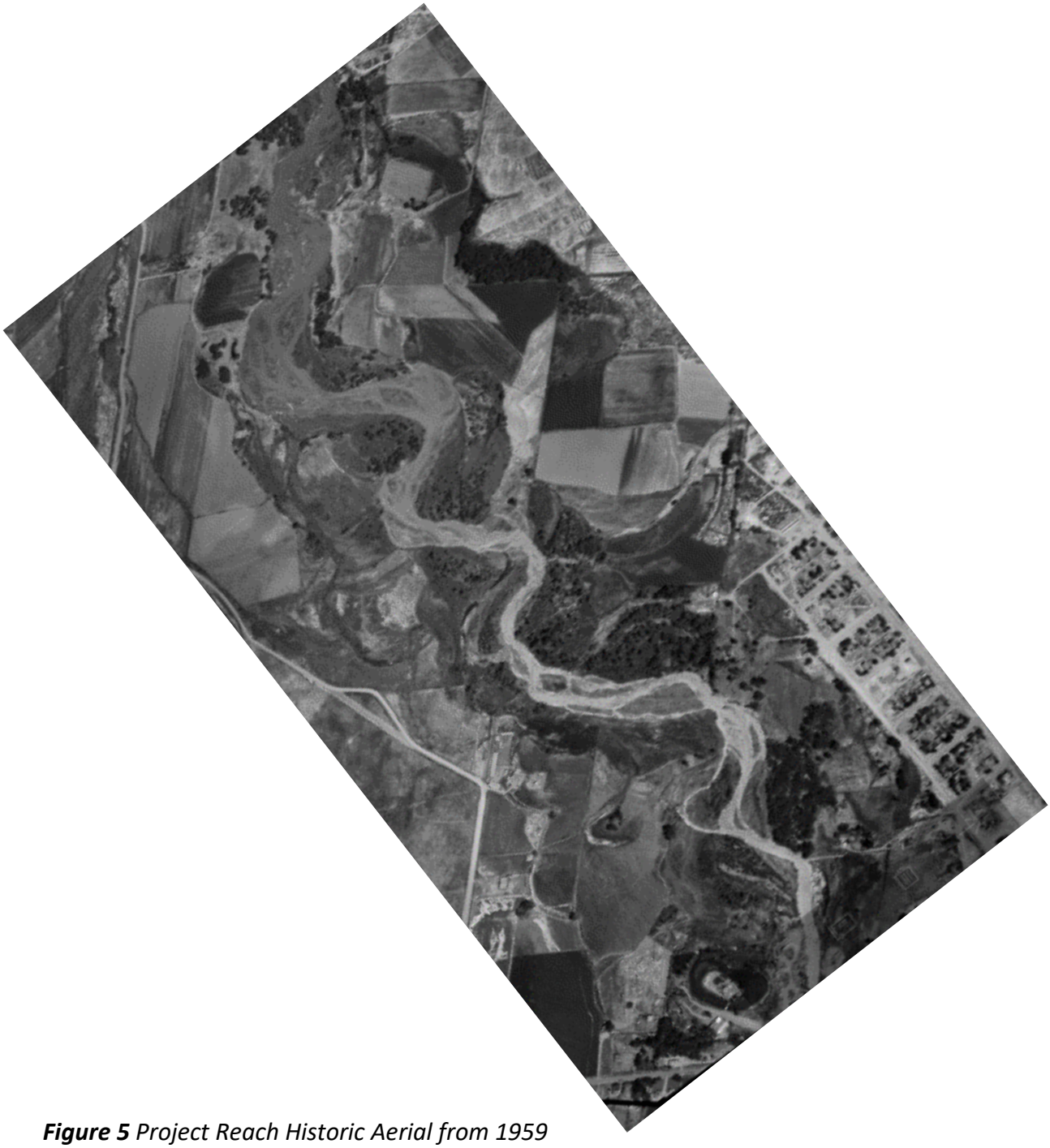

Figure 5 *Project Reach Historic Aerial from 1959*

Some important geomorphological observations were made from this 1959 image when direct land impacts were minimal and helped inform the design:

- The channel included sections with a predominant main channel plus prevalent side channels in upstream locations and was braided downstream
- A very similar meander wavelength and amplitude pattern is observed
- Tight meander radii did not exist
- Evidence of recent and historic channel migration exist.

Some major differences from the unimpacted and current conditions are wave amplitude and meander radii. As the 2014 image shows, the wave amplitude has been greatly reduced and small meander radii exist. These conditions contribute to the overall instability of the system.

A summary of some of the pre-project channel characteristics is given in **Table 1** with values are derived for River extents identified in **Figure 6** below.

Table 1 *Pre-Project Channel Characteristics*

Category	Value
Valley Length (ft)	3,427
Stream Length (ft)	4,873
Stream Sinuosity	1.42
Minimum Meander Radius (ft)	85
Meander Wavelength (ft)	790
Meander Amplitude (ft)	225

Figure 6 *River Extents for Geomorphologic Comparison*

Photos 1 (left) and 2 (right) provide examples of the unstable with channel widenning and lateral instability (bank erosion).

Photos 3 (left) and 4 (right) provide example of a section within the Project Reach that exhibits a wide channel bottom with limited channel diversity and instream aquatic habitat under typical high summer flow conditions.

Photos 5 (left) and 6 (right) provide example of a section within the Project Reach that exhibits the unstable condition with bank erosion and channel widening.

CHANNEL MORPHOLOGY

Reference geomorphologic conditions for the Project Reach were derived using both regime equations and an assessment of conditions observed from the 1959 aerial image when land impacts were minimal as a means of verification. Most geomorphologic equations for channel geometry relate to bankfull flow conditions. Due to uncertainty in bankfull flows, our assessment determined the appropriate bankfull channel width using two approaches. First channel width was measured in riffle sections where the channel is currently stable. Widths were measured at six riffle sections downstream of the Project Reach where the channel is stable and has been stable in recent history were identified using aerial images. The range of bankfull channel widths measured from these sites was 58 feet to 71 feet with mean and median values of 64 feet and 63 feet respectively. Secondly bankfull width was estimated based on flow recurrence intervals. For gravel and cobble channels, which the River through the Project Reach is, bankfull flow can be reasonably approximated as the flow with a recurrence interval of 1.5-2 years. ERC determined peak annual flows for the 22-year period of 1991 – 2011 provided by the City and generated a recurrence interval plot – see **Figure 7**. Flow data suggests that the bankfull flow is on the order of 770 – 890 cfs based on flow intervals.

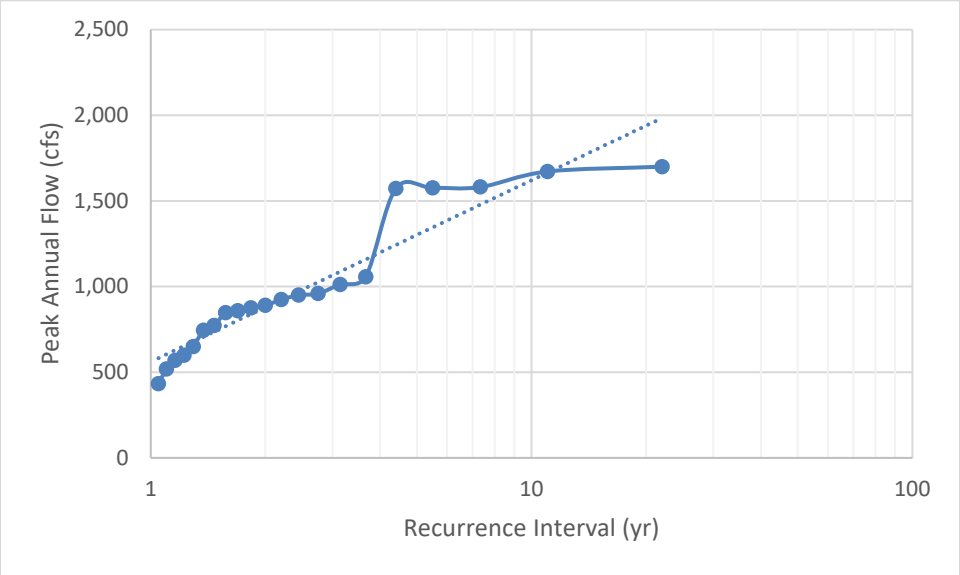

Figure 7 *Peak Annual Flows (1991 – 2011)*

Based on hydraulic geometry for Colorado gravel-bed rivers with thin bank vegetation, bankfull channel width can be estimated from bankfull flow (Andrews 1984). For a bankfull flow of 800 cfs, bankfull channel width is approximately 70 feet, which compares will with measured values.

Using an approximate bankfull channel width of 65, ERC estimated minimum meander radii, meander wavelength and wave amplitude (Williams 1986). Using these regime equations ERC estimated the reference geometries for the channel. Reference data from regime equations, values measured using the 1959 aerial and existing conditions are compared in **Table 2**.

Table 2 *Reference and Pre-Project Channel Geometric Parameters*

Parameter	Reference Value from Williams 1986	Reference Values from 1959 Image	Pre-Project Conditions
Minimum Meander Radius (ft)	156	380	85
Meander Wavelength (ft)	805	1,300	790
Meander Amplitude (ft)	460	500	225

As expected, reference values from regime equations and the 1959 image do not provide the exact same result but are similar. Comparing results from these two different reference standards to pre-project conditions shows that current meander wavelengths are similar to reference standards. Minimum meander radii and amplitudes, however, are approximately half or less than reference conditions. These parameters were indicators of current instability. The low meander radii of pre-project conditions led to erosion and bank retreat. The low meander wavelength suggests that stream energy was too high which can cause lateral and vertical instability.

NATIVE VEGETATION COMMUNITY TYPES

Existing land use and vegetation cover types were evaluated regionally along the Uncompahgre River corridor using mapping from the U.S. Geological Survey (USGS) Southwest Regional Gap Analysis Project (SRGAP 2020). Natural vegetation cover types within the floodplain of the river are primarily classified as Rocky Mountain Lower Montane-Foothill Riparian Woodland and Shrubland and to a lesser degree Intermountain Basins Greasewood Flat. The Rocky Mountain Lower Montane-Foothill Riparian Woodland and Shrubland vegetation community type is most characteristic of habitats regionally and thus would be considered the reference standard or ideal natural community for the project area.

The Rocky Mountain Lower Montane-Foothill Riparian Woodland and Shrubland ecological system is found throughout the Rocky Mountain and Colorado Plateau regions within a broad elevational range from approximately 900 to 2800 m. This system often occurs as a mosaic of multiple communities that are tree-dominated with a diverse shrub component. It is dependent on a natural hydrologic regime, especially annual to episodic flooding. Occurrences are found within the flood zone of rivers, on islands, sand or cobble bars, and immediate streambanks. It can form large, wide occurrences on mid-channel islands in larger rivers or narrow bands on small, rocky canyon tributaries and well-drained benches. It is also typically found in backwater channels and other perennially wet but less scoured sites, such as floodplains, swales and irrigation ditches. In some locations, occurrences extend into moderately high intermountain basins where the adjacent vegetation is sage steppe. Dominant trees may include Acer negundo, Populus angustifolia, *Populus deltoides, Populus fremontii, Pseudotsuga menziesii, Picea pungens, Salix amygdaloides,* or *Juniperus scopulorum*. Dominant shrubs include *Acer glabrum, Alnus incana, Betula occidentalis, Cornus sericea, Crataegus rivularis, Forestiera pubescens, Prunus virginiana, Rhus trilobata, Salix monticola, Salix drummondiana, Salix exigua, Salix irrorata, Salix lucida, Shepherdia argentea,* or *Symphoricarpos* spp. Exotic trees of *Elaeagnus angustifolia* and *Tamarix* spp. are common in some stands. Generally, the upland vegetation surrounding this riparian system is different and

ranges from grasslands to forests. In the Wyoming Basins, the high-elevation Populus angustifolia-dominated rivers are included here, including along the North Platte, Sweetwater, and Laramie rivers. In these situations, Populus angustifolia is extending down into the sage steppe zone of the basins. (NatureServe 2020).

Within the Project Reach, the reference standard communities would occur on low terraces and along the immediate streambanks of the Uncompahgre River through the riparian zone within the floodplain. The unconfined, active stream channel would frequently inundate vegetation through the riparian zone and active floodplain forming a complexity of habitats which support a variety of plant communities. The riparian zone vegetation community would be dominated by open to moderately open tree canopy of cottonwood (25-50% cover) with thickets of narrowleaf willow in the mid-story. A dense herbaceous understory layer comprised of graminoids would be present along portions the streambanks above the ordinary high water mark. The presence of narrowleaf willow indicates that the water table is relatively high and the community floods at least occasionally (NatureServe 2020. **Figure 8** depicts the examples of a properly functioning and structurally diverse riparian community along the Uncompahgre River considered as an ecological reference and target plant community for the Design Plan.

Figure 8 *Ecological Reference (red circle) and Target Plant Communities*

METHODS

A natural based restoration approach was taken for improvements. The guiding principle of the natural restoration approach was that the restored stream system should mimic a natural channel in appearance and function. Restoring the natural form and function within the stream system allows lost ecological balance to be restored. Like a natural channel, restoration was approached with a design that allowed the stream to migrate in response to flow and sediment loads but is intended to maintain its basic form without significant aggradation or degradation. This approach, rather than a structural

approach to restoration, was of the utmost importance to this project so the restored resources functions holistically with existing resources and fits with the overall characteristics of the River system.

Restoration focused on developing an appropriately sized channel to convey typical and bankfull flow events, promote floodplain interaction and establish native riparian and upland vegetation communities to follow the determined ecological reference conditions.

CHANNEL MORPHOLOGY

A key element of the proposed channel design was creating a meandering pattern that is in balance with the natural function of the stream. This type of stream system is naturally dominated by repeating riffle-bend-pool complexes and point bars**.** Riffles are the steeper sections of the stream and generally located upstream from larger channel bends. Riffles are characterized by larger substrate material and swift flows. Pools are located downstream of riffles and are typically at or near the more pronounced bends in the stream. The higher flow velocity of the riffle sections provide energy required to continually scour the pools maintaining quality pool habitat. Glides are located between pools and riffles and generally have a mild adverse slope leading from the end of a pool up to the start of the next riffle. Glides have a well-defined thalweg that contain flow to a defined channel during low flow periods.

The natural channel form for the Project Reach included meanders with radii, wave amplitudes and wavelengths that promote stability. These along with other design characteristics of the restored stream are summarized as follows.

Table 3 *Restored Channel Characteristics*

Category	Proposed Channel
Valley Length in Main Segment (ft)	3,427
Channel Length in Main Segment (ft)	4,950
Sinuosity	1.44
Bankfull Flow	800 cfs
Ave Bankfull Width*	63 feet
Ave Bankfull Depth*	2.25 feet
Pool Spacing	460 feet (7.3 x bankfull width)
Width/Depth Ratio*	28
Minimum Meander Radius (ft)	200
Meander Wavelength (ft)	1,200
Meander Amplitude (ft)	420
*measured at riffle beginning	

NATIVE VEGETATION COMMUNITIES

The Design mimicked the Rocky Mountain Lower Montane-Foothill Riparian Woodland and Shrubland vegetation community type that is the most characteristic habitat regionally and was considered the reference standard or ideal natural community for the Project Reach. The Design Plan focused first on establishing a deeply rooted and dense groundcover dominated by native riparian herbaceous and woody species that are typical to the region. The intent was to quickly establish a groundcover to stabilize soil, minimize establishment of invasive species and promote long-term successional development. To facilitate complete ground coverage and seed bank development the entire riparian zone was seeded with the specialized Riparian Seed Mix with locally native species that germinate rapidly and provide complete groundcover tolerant of a wide variety of hydrologic conditions. Second, riparian shrub plantings were placed. This vegetation was primarily placed along outside bends of the new channel to provide bank stability and increase biomass and structural habitat for the fishery and terrestrial wildlife. Additionally, the shrub plantings were intended to provide increased biomass to the stream (leaf-litter), overhead cover (shading) and increases bug life (terrestrial and aquatic, such as caddis).

The riparian habitat is designed to interact with local groundwater (within 1 to 2 feet of the surface) as well as seasonal overbank flooding. The channel design utilized near surface moisture to the riparian zone from groundwater and stream flows through much of the growing season. Portions of the riparian zone is anticipated to develop wetland characteristics however it was not designated as wetland creation nor compensatory wetland mitigation.

The design/built plans that were implemented are presented in **Appendix A**.

COLORADO WATER CONSERVATION BOARD FUNDING USE

Funding from the CWCB for the project totaled $500,000 which equates to a little less than 1/3 of the roughly $1.6 million project. Specific project elements that were implemented using funds from CWCB are summarized below.

- Stream Excavation – CWCB funds contributed $312,500 to this task. This task entailed excavating the new channel alignment, screening, and sorting materials for placement in the channel and backfilling area that were converted to riparian zones.
- Riffle/Pool Features (Main and Side Channels) – CWCB funds contributed $34,750 to this task. This task included constructing seven (7) riffle/pool sequences on the main channel and 11 sequences in the side channels.
- Bank Stabilization (Types A, B, C and D) – CWCB funds contributed $81,250 to this task. Work accomplished as part of this task included 5,775 linear feet of bank stabilization of different forms. Type A and B bank stabilization included a structural rock wall where needed to protect infrastructure. Type C was a cobble toe and Type D was a rootwad type stabilization. All stabilization types included seeding, erosion control fabric and revegetation.
- Revegetation of Riparian Areas – CWCB contributed $62,500 to this task. Approximately six (6) acres of new riparian habitat was created. All riparian area creation included backfill to achieve desired elevations, installation of a minimum of six inches of planting soil, seeding, soil amendments and hydromulching.

RESULTS

The completed project resulted in the following benefits:

- Creation of 3,300 linear feet of the Uncompahgre River that mimics the geometry of a geomorphologically stable stream
- Establishment of seven large riffle/pool/glide sequences within the main river
- Creation of a total of nearly 2,300 linear feet of side channels as part of three different segments
- Development of 12 riffle/pool/glide sequences within the side channels
- Created multiple formal and informal backwater habitat areas to benefit habitat
- Stabilized 5,775 feet of stream banks using an assortment of rock features, rootwads, native cobble and intensive riparian plantings
- Regraded the channel to create six acres of riparian habitat that was directly connected to the channel as part of its floodplain. All created riparian areas were revegetated to increase habitat
- Installed over 3,600 containerized native shrubs

Photos of completed work are included in **Appendix B**.

CONCLUSIONS AND DISCUSSION

The restoration project was able to be completed as intended. No modifications to the original design intent were required. Minor modifications that were included and the reason for the changes are summarized below.

- Base Mapping – high flows in the time after initial plans were developed resulted in shifts to the river. Additional bank stabilization was completed to address areas as needed and design elevations were revised to match tie-in points. Additional excavated material was removed from site rather than originally planned to compensate for topographic changes.
- Main Channel Alignment – it was determined that a slight realignment of the main channel from approximately station 41+00 to 46+00 allowed a berm to be removed which resulted in increased floodplain connectivity.
- Side Channel #2 – a slight revision to the alignment of side channel #2 occurred to take advantage of existing stable bank sections and preserve riparian vegetation.
- Micro Habitat Features – Additional boulder and log habitat structures were added based on availability of materials.
- Side Channel #3 – Extensive subgrade excavation was necessary in side channel #3 due to organic material encountered. This material was over excavated and a gravel/cobble mix substrate was placed.
- Backwater Areas – the extent and location of backwater areas were revised in the field to better match localized elevations and hydrology. The backwater originally planned adjacent to side channel #3 was eliminated given its elevation relative to the channel.

- Bank Stabilization – Minor revisions to the extent and type of bank stabilization used in locations occurred to best fit topography and observed stabilization needs.
- Additional Plantings – Additional native vegetation was incorporated.

Constructed improvements allowed the project objectives of restoring the natural form/function of the degraded and highly unstable section of river to be accomplished. Aquatic habitat diversity and floodplain connectivity were achieved throughout.

The City plans to monitor the physical conditions of the channel as well as the development of revegetation. Components of the monitoring plan include:

- Annual visual inspection of the project area to ensure project is operating as intended and to check for unintended erosion.
- Assessment of vegetation to track establishment trends and address invasive species as appropriate.
- Annual Aerial photo documentation of improvements to monitor changes and development over time.

Given that the goal of the project was to work with processes of fluvial geomorphology and create a channel and riparian floodplain that is stable for flows and sediment, minimal if any direct maintenance of the stream is anticipated. Given that the design intended to replicate a natural stream system and, excluding the hard armored Type A and B bank stabilization areas, the design allowed for natural channel migration, it is expected that there will be some evolution as the constructed channel adjusts. These types of natural adjustments include minor bank erosion, sediment deposition, aggradation, movement of micro habitat features and adjustment of existing vegetation due to the altered channel locations. Vegetation establishment is the area where some more active management may be necessary. Development of weeds will be monitored and may require mitigation to assist with the establishment of the native riparian zone. Once the native vegetation has fully established the need for further long-term care will be further reduced. If excessive erosion or channel migration are observed above what would be expected of a natural system, these issues will be addressed by the City of Montrose using hired contractors or in-house crews, depending on the scale of the issue.

Given the amount of use that the area is expected to receive from anglers and recreationalists, it is expected that some human related impacts may occur. Social trails, areas of localized erosion and use concentration areas are likely to develop as the community utilizes the improved natural areas. The City will monitor these areas for impacts that could have an impact on the overall system function and block off areas contributing to erosion as appropriate.

The completed project has obvious potential for continued work. The segment of the Uncompahgre River downstream from work completed in 2020/2021 is degraded and unstable. We believe that continuing the concepts that were successfully implemented this past year would further benefit the overall riverine system.

LESSONS LEARNED

The restoration work showed that in the project reach the gravels and cobbles in the sizes needed for the work could be generated by screening and selectively sorting the alluvial material within the channel. This was expected in the design and was verified through the construction process. This lesson is helpful as it will allow the City to consider further restoration having confidence that native material could be used thereby greatly reducing the amount of expensive rock import that might otherwise be required. While all project settings are different, the City believes this lesson may have applications at many other potential river restoration projects around the state.

Another lesson learned is the benefit of securing rock and logs for the project. The City was able to provide a small portion of the habitat rocks and a local source was identified for the logs used for stabilization and habitat. As a result of having this material available, additional logs and rock above what was originally contemplated were able to be incorporated into the project. This will benefit the ultimate ecological function of the system. Much of the wood that was incorporated into the project was not the large diameter rootwad members that are often specified in stream restoration design. Despite variability in the wood used, it was able to be incorporated in a manner that provided stability, aquatic and terrestrial habitat that benefits to the overall system.

The most significant lessons learned throughout the project were the benefit of using an experienced team and a design/build process. Originally the City did not intend to utilize a true design/build process. Rather the design and permitting portions of the project were awarded. When the design was substantially complete the City issued a RFQ for the contractor with the idea that the hired contractor would work with the designer from that point forward to complete remaining design efforts and build the project. This process of hiring the contractor independent of the designer introduced potential issues where the designer and contractor had different experiences and visions that were not always compatible. The City was able to identify these conflicts before hiring the contractors and revised its contracting approach. Following a failed procurement attempt under the design-bid-build model, the City ultimately rebid the project as a “true” design/build project requiring designers and contractors to submit joint submittals before ultimately hiring a design/built “team”. While this worked well and the selected team was able to deliver the project, having to rebid the work as a design/build project impacted timing and costs. From a timing standpoint the project was delayed a year due to the extra process involved. Additional costs were incurred by having multiple bidding processes. It is the City’s recommendation that particularly for more involved restoration work, stream projects be pursued as design/build from the beginning.

ACTUAL EXPENSE BUDGET

A copy of actual project expenses are included in Appendix C.

Appendices

Appendix A – Design Plans
Appendix B – Site Photos
Appendix C – Project Expense Worksheets

Appendix A – Design Plans

Appendix B – Site Photos

CITY OF MONTROSE

UNCOMPAHGRE RIVER IMPROVEMENT PROJECT

OCTOBER 2020

LOCATION MAP:

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15	NOTES & PLANTING TABLES

REV	DATE	DESCRIPTION
C	10/12/20	ISSUED FOR CONSTRUCTION
B	08/27/20	ISSUED FOR REVIEW
A	06/15/20	ISSUED FOR REVIEW

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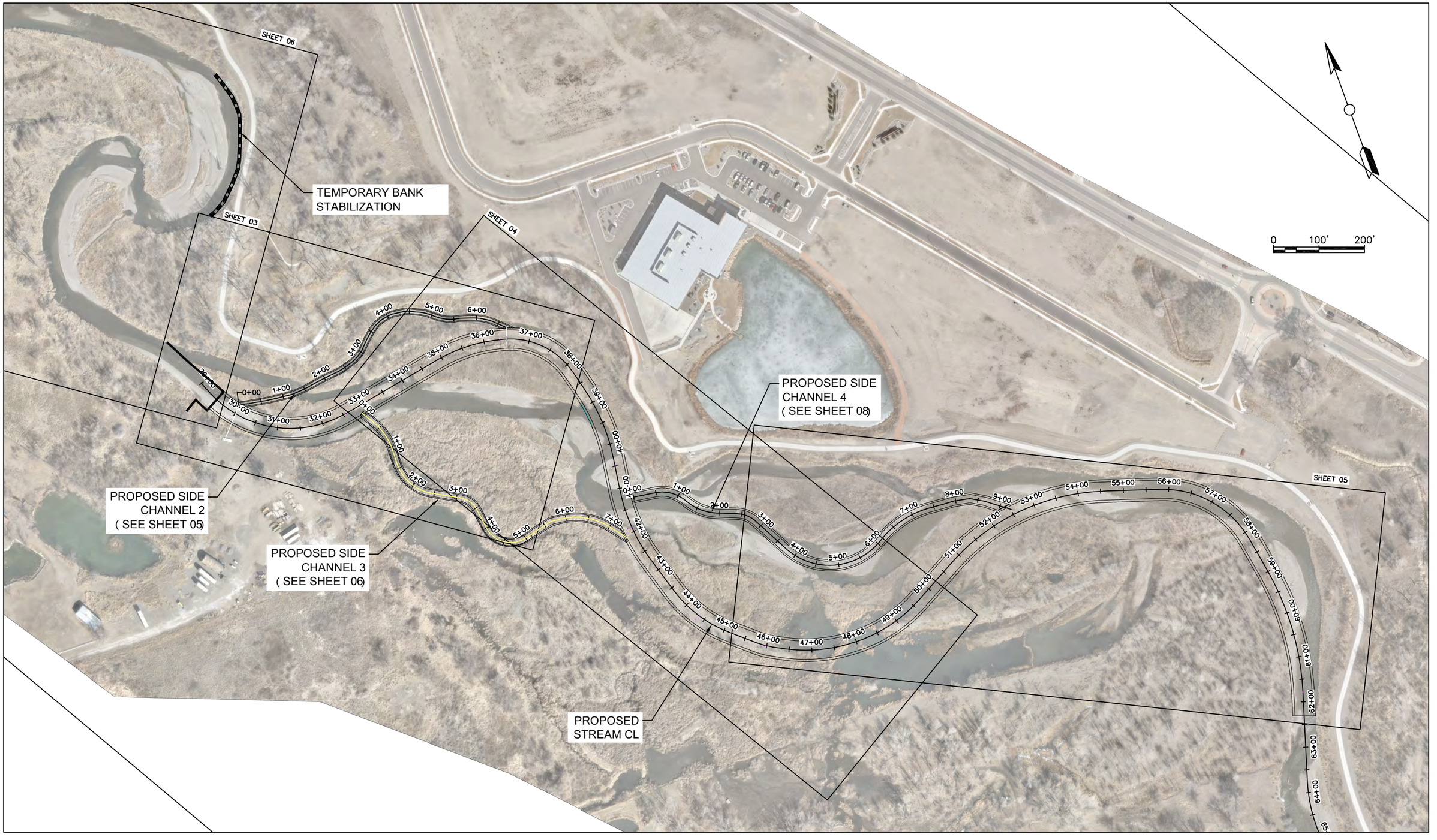
ECOLOGICAL RESOURCES CONSULTANTS, INC
225 UNION BLVD. SUITE 325
LAKEWOOD, CO 80228

CLIENT: CITY OF MONTROSE

PROJECT: UNCOMPAGHRE RIVER IMPROVEMENT

TITLE: COVER SHEET

SHEET: 01



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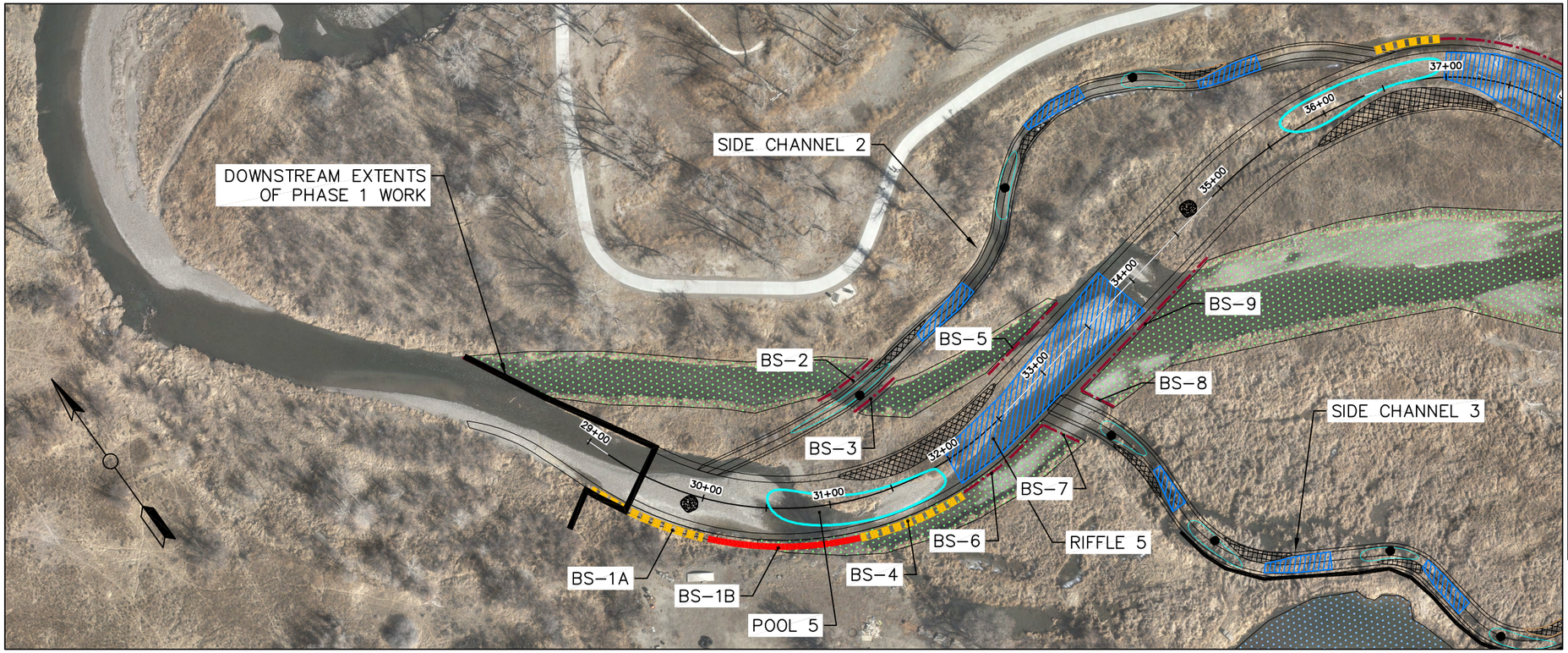
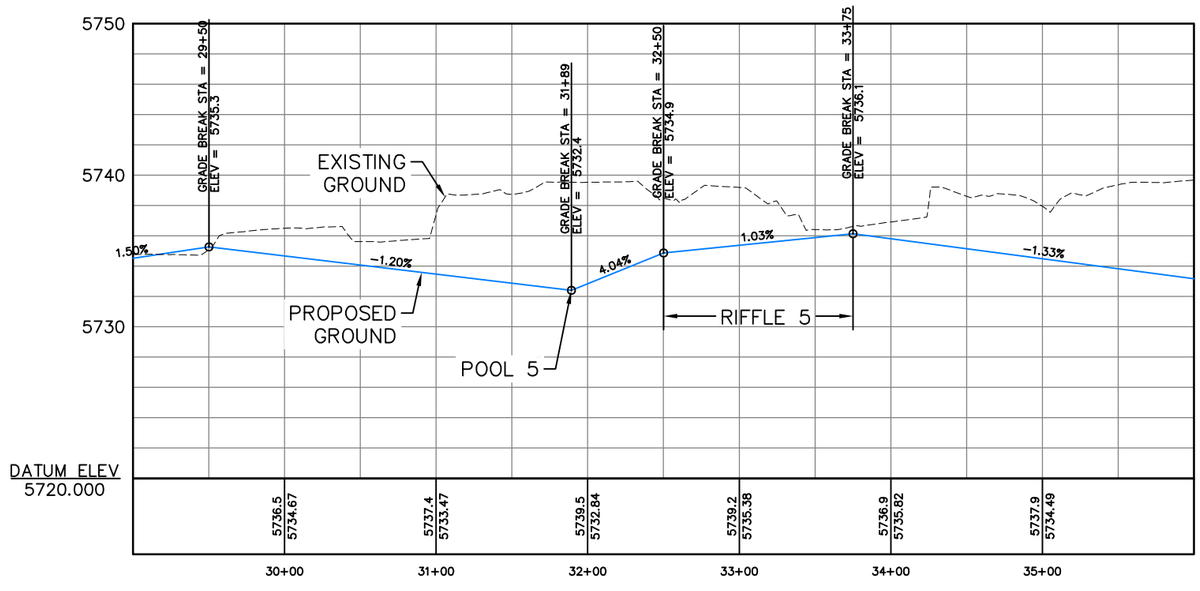
PREPARED BY	CLIENT	PROJECT	TITLE	SHEET
ECOLOGICAL RESOURCES CONSULTANTS, INC 225 UNION BLVD. SUITE 325 LAKEWOOD, CO 80228	CITY OF MONTROSE	UNCOMPAGHRE RIVER IMPROVEMENT	OVERALL SITE PLAN	02



LEGEND:

- RIFFLE
- POINT BAR
- POOL
- REARING BACKWATER HABITAT
- BACKFILL AND REVEGETATION
- HABITAT CLUSTERS
- TYPE A STABILIZATION - HIGH WALL
- TYPE B STABILIZATION - SHORT WALL W/ VEGETATION OVERBANK
- TYPE C STABILIZATION - COBBLE W/ VEGETATION OVERBANK
- TYPE D STABILIZATION - ROOTWARD INSTALLATION

0 50' 100'



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LAKEWOOD, CO 80228

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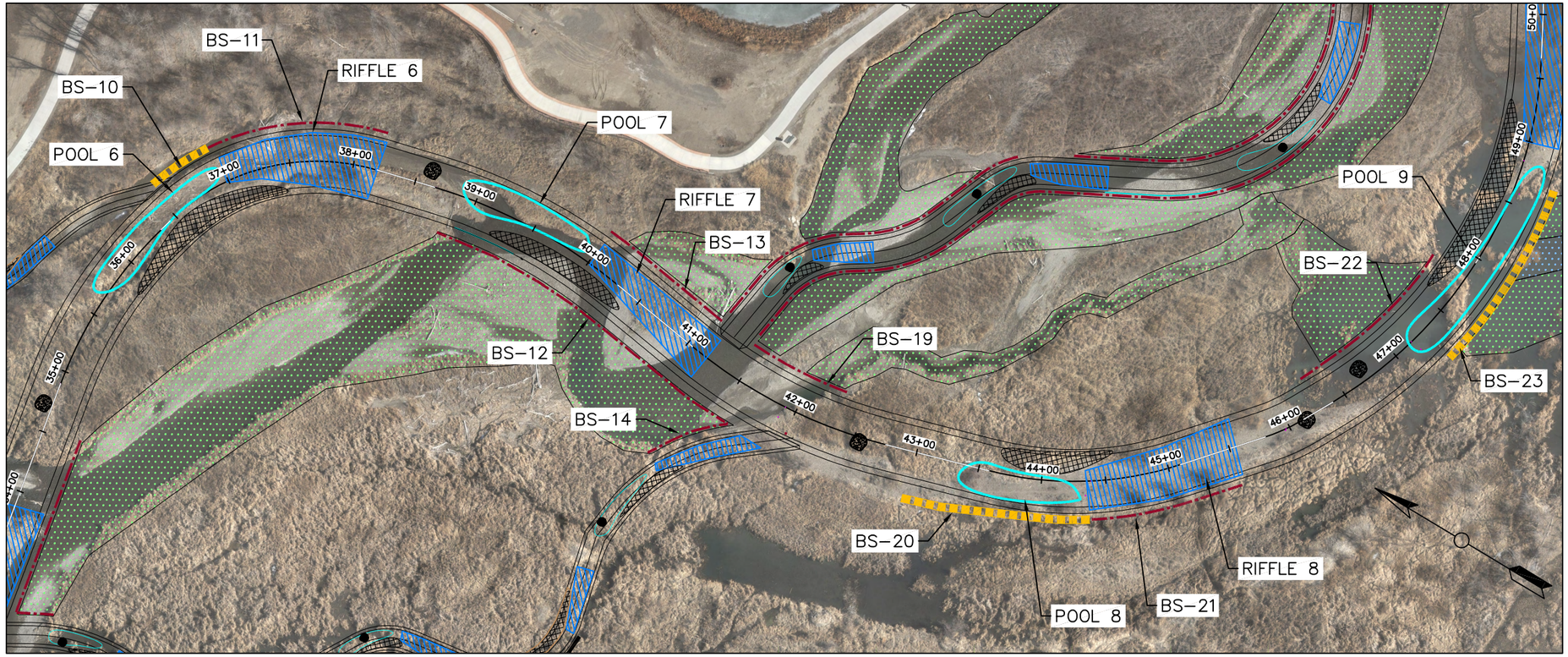
PROJECT: UNCOMPAGHRE RIVER IMPROVEMENT

TITLE: PLAN AND PROFILE (SHEET 1)

SHEET: 03



LEGEND:

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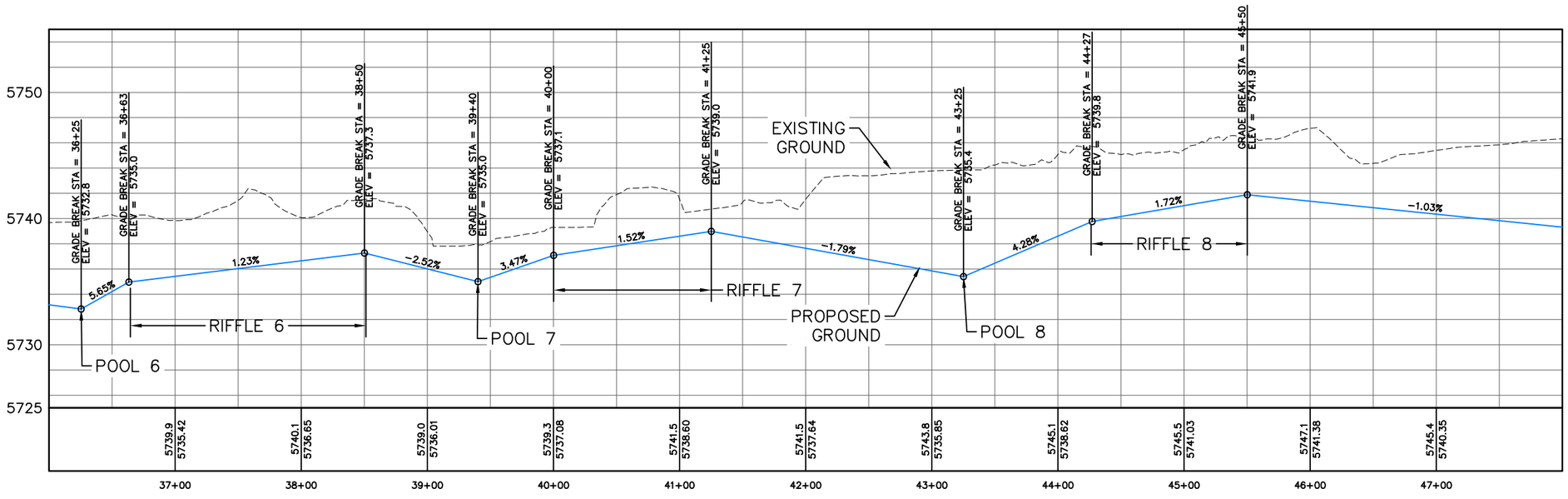
0 50' 100'



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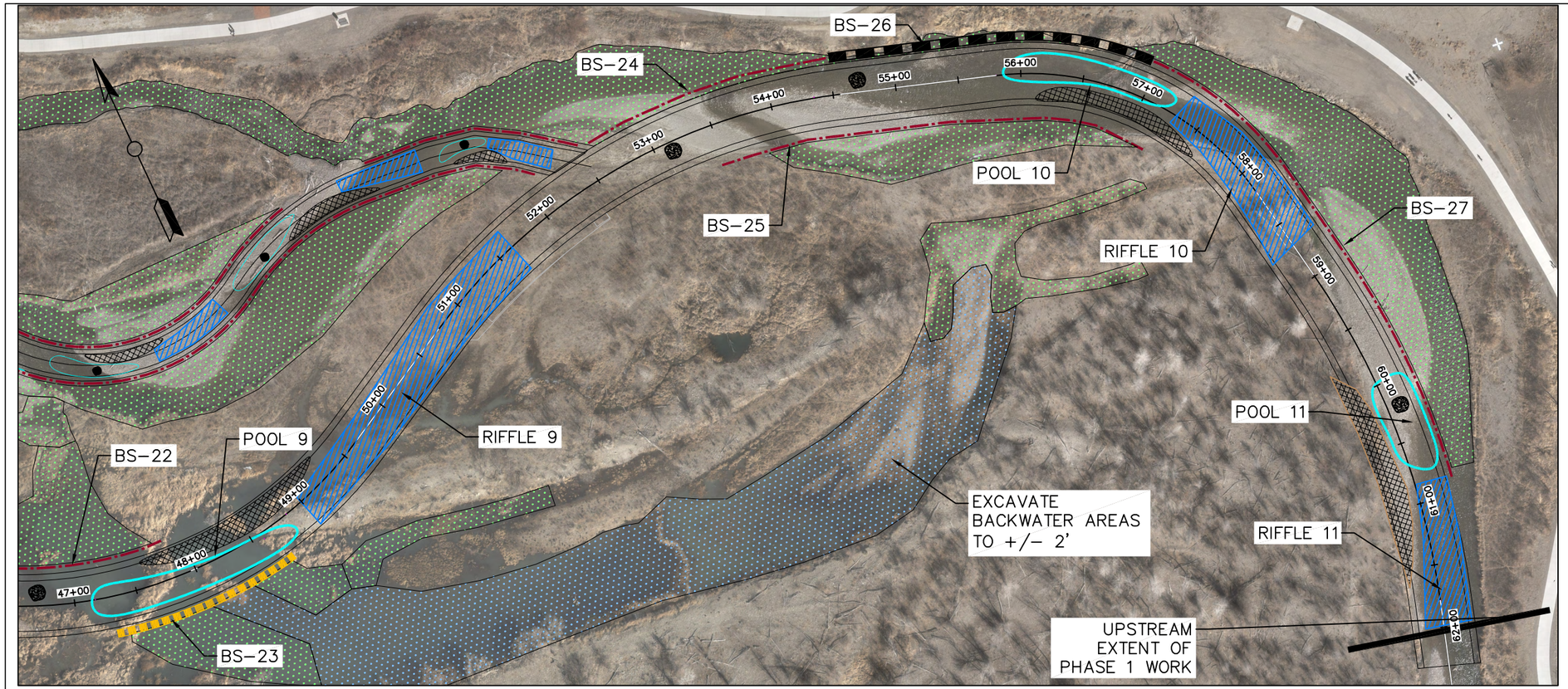
CLIENT
CITY OF MONTROSE

PROJECT
UNCOMPAGHRE RIVER IMPROVEMENT

TITLE
PLAN AND PROFILE (SHEET 2)

SHEET
04



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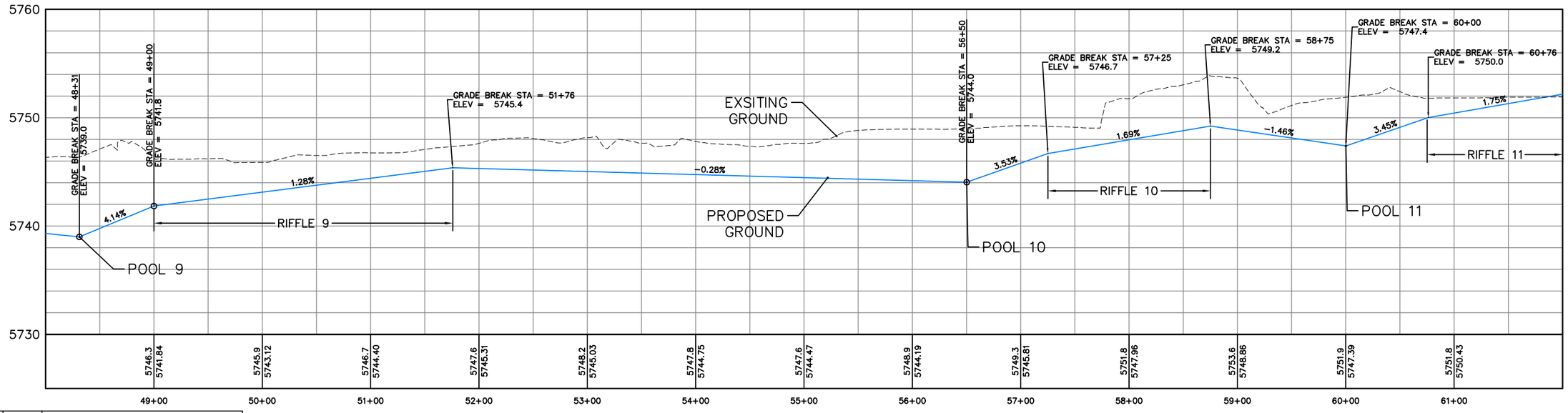

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CLIENT: CITY OF MONTROSE

PROJECT: UNCOMPAGHRE RIVER IMPROVEMENT

TITLE: PLAN AND PROFILE (SHEET 3)

SHEET: 05

LEGEND:

- RIFFLE
- POINT BAR
- POOL
- REARING BACKWATER HABITAT
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- HABITAT CLUSTERS
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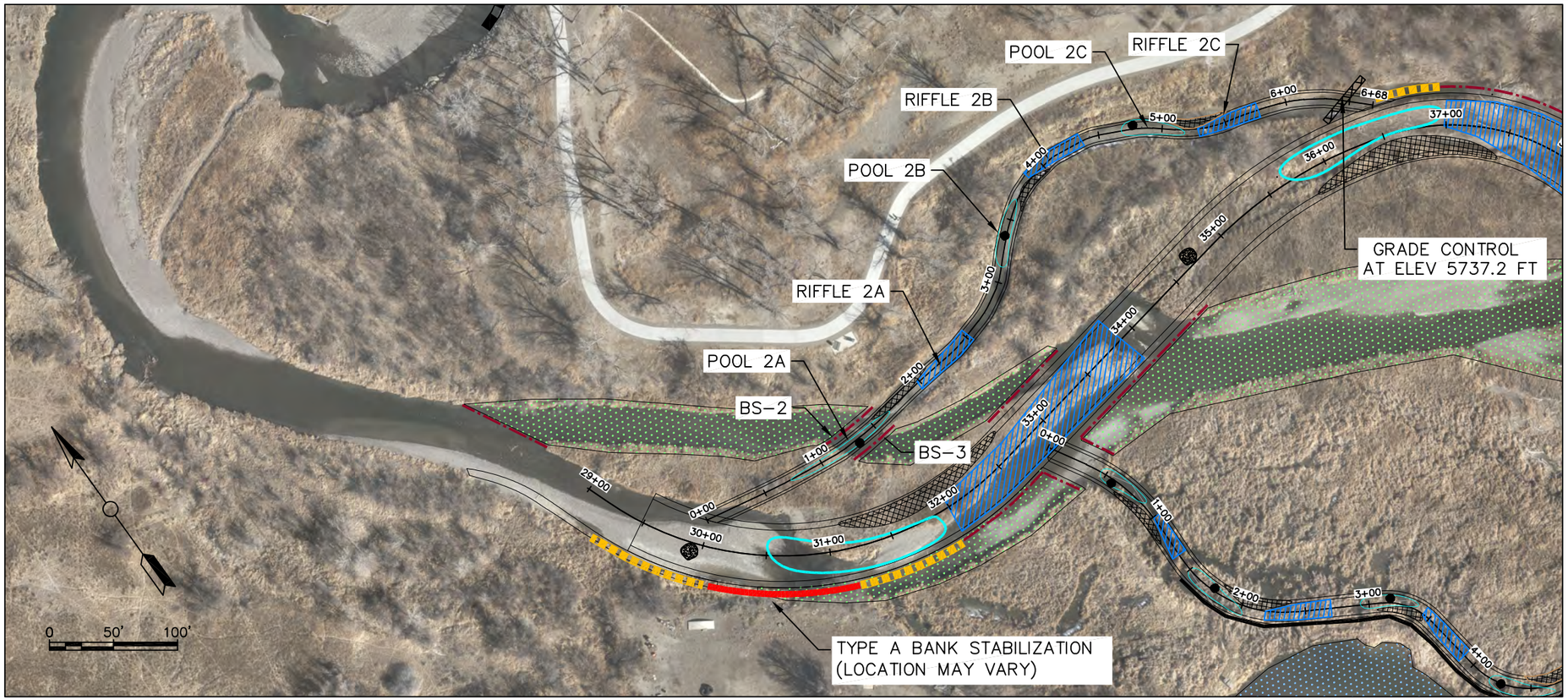
PROJECT: UNCOMPAGHRE RIVER IMPROVEMENT

TITLE: PLAN (SIDE CHANNEL 1)

SHEET: 06



LEGEND:

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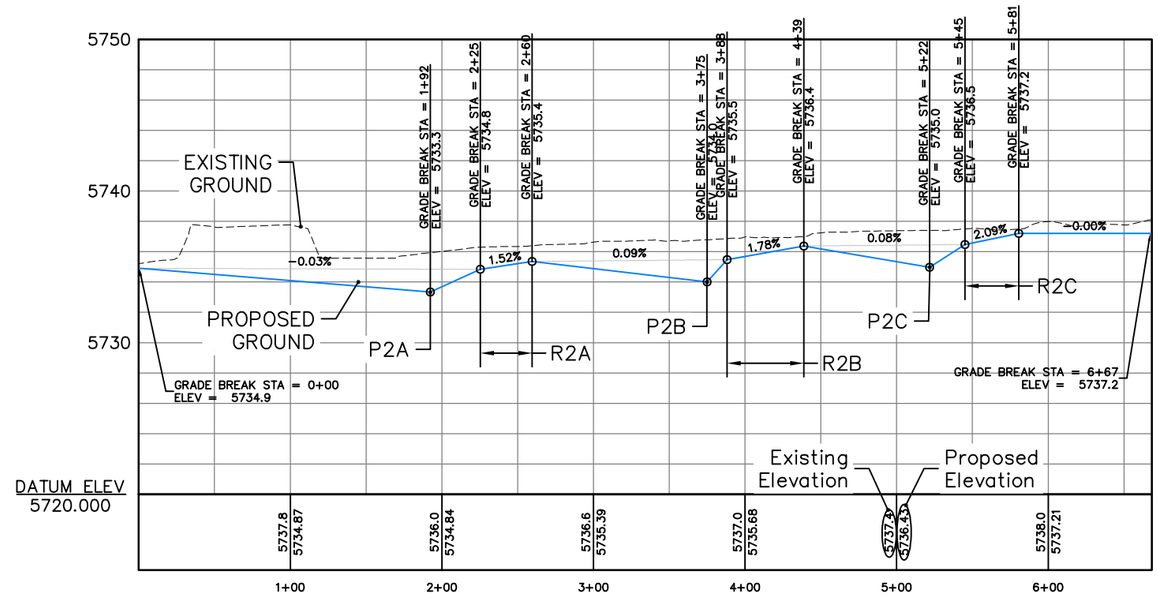

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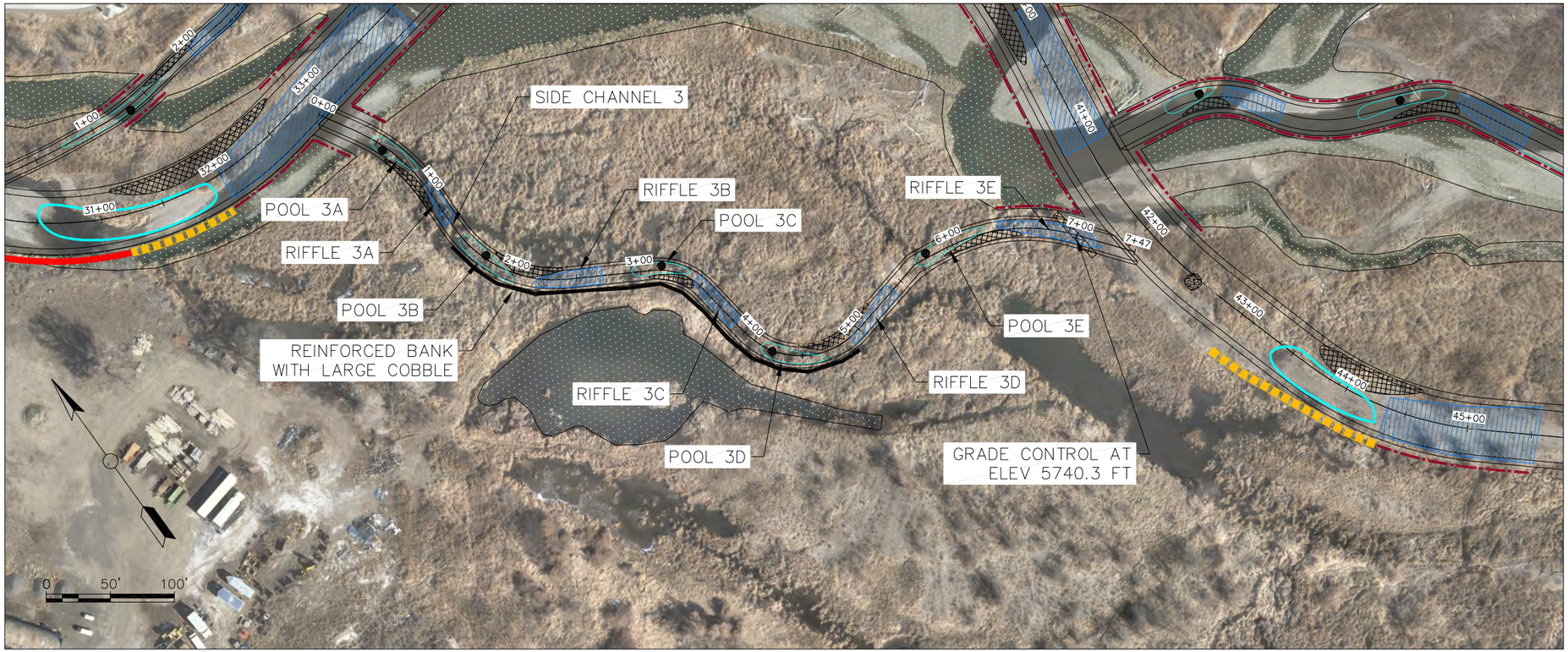
CLIENT
CITY OF MONTROSE

PROJECT
UNCOMPAGHRE RIVER IMPROVEMENT

TITLE
PLAN AND PROFILE (SIDE CHANNEL 2)

SHEET
07



LEGEND:

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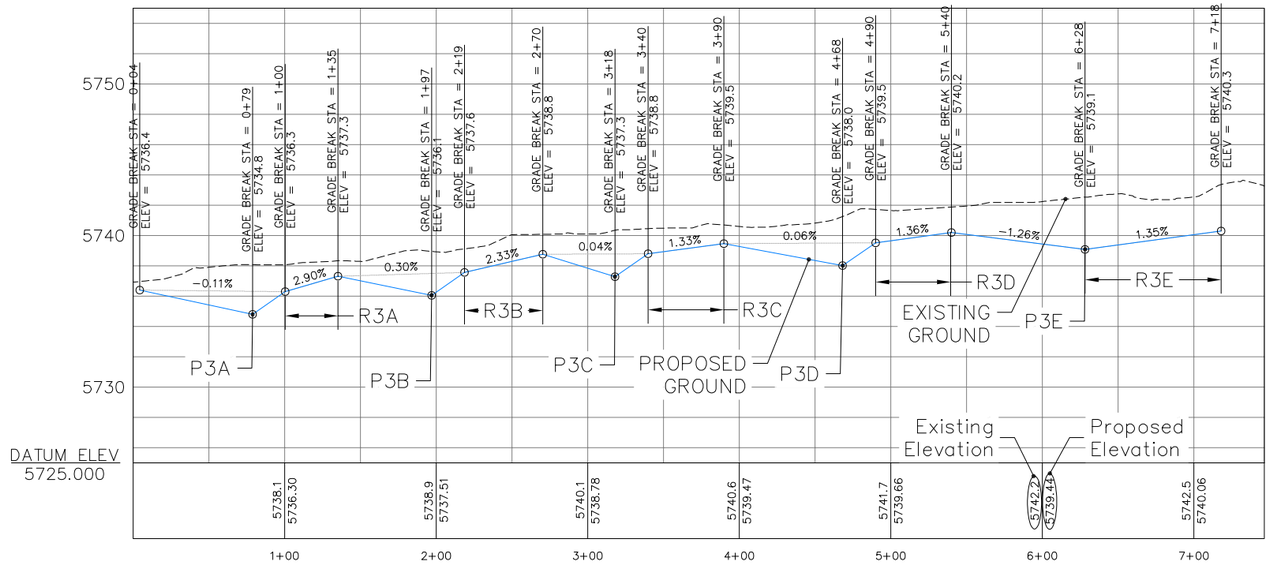

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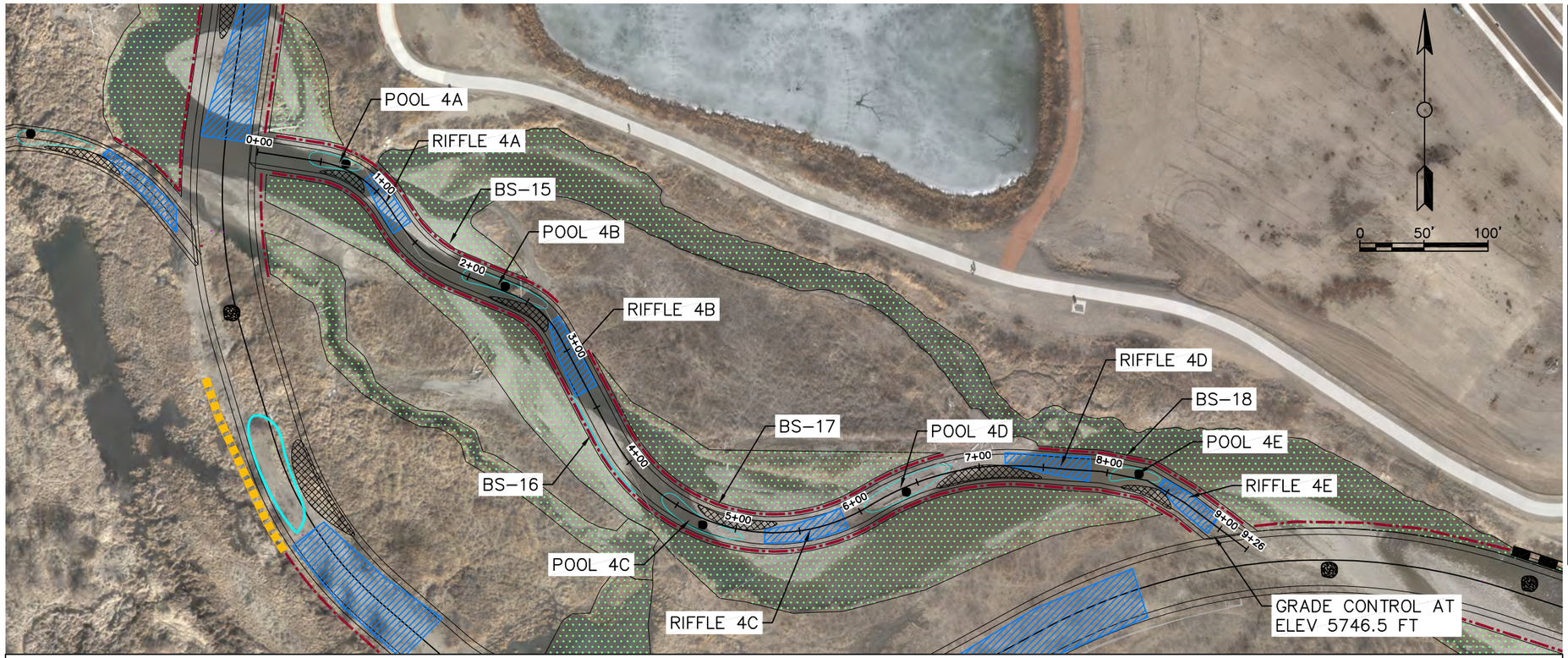
PROJECT: UNCOMPAGHRE RIVER IMPROVEMENT

TITLE: PLAN AND PROFILE (SIDE CHANNEL 3)

SHEET: 08



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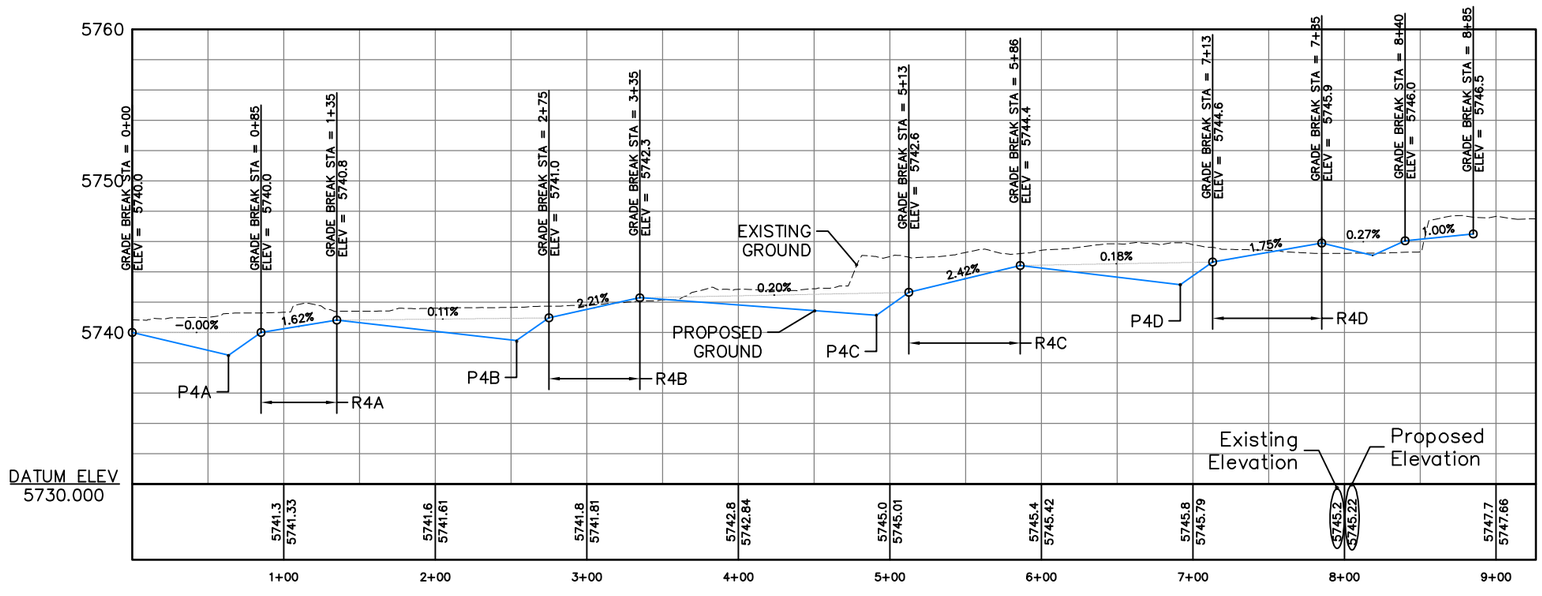

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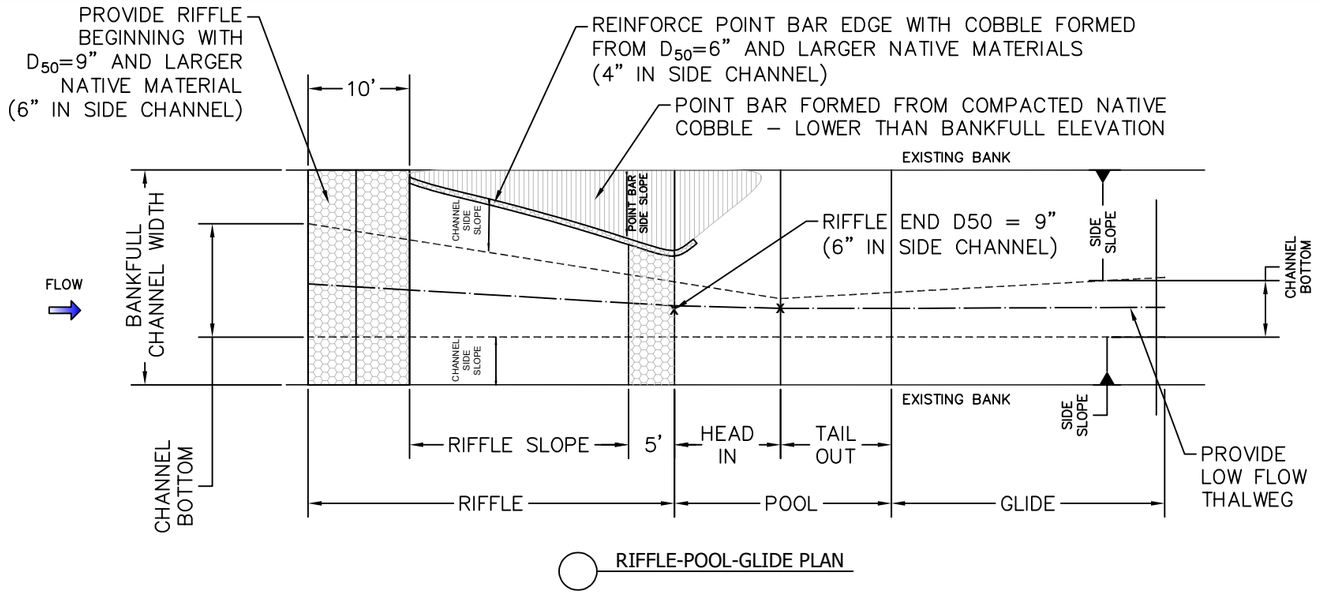
CITY OF MONTROSE

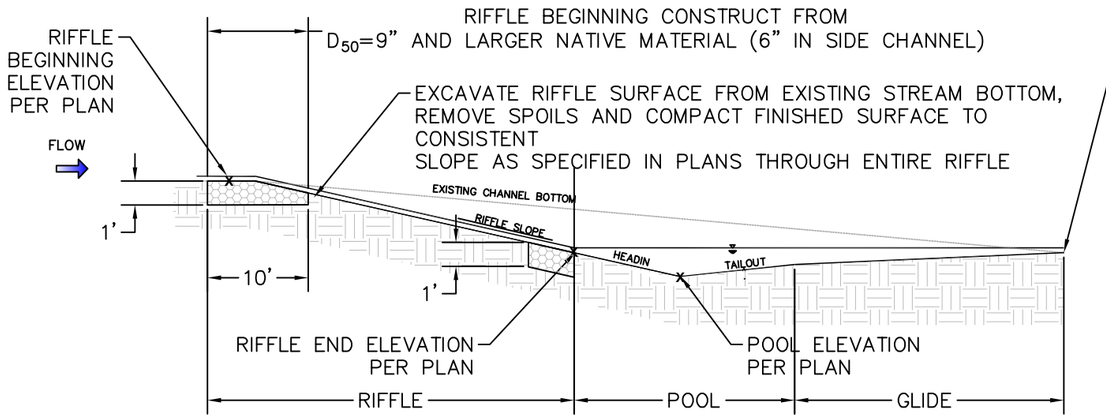
PROJECT
UNCOMPAGHRE RIVER IMPROVEMENT

TITLE
PLAN AND PROFILE (SIDE CHANNEL 4)

SHEET
09



RIFFLE-POOL-GLIDE PLAN

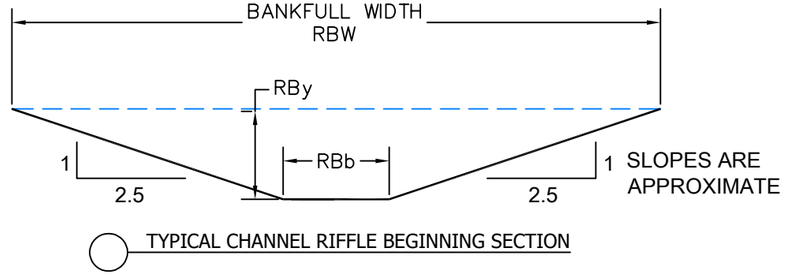


RIFFLE-POOL-GLIDE PROFILE

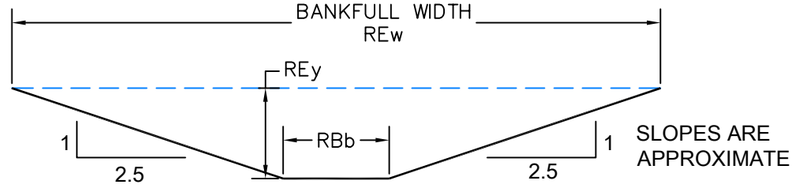
GRADE CHANNEL BOTTOM TO MATCH GRADE OF DOWNSTREAM RIFFLE BEGINNING

NOTES:

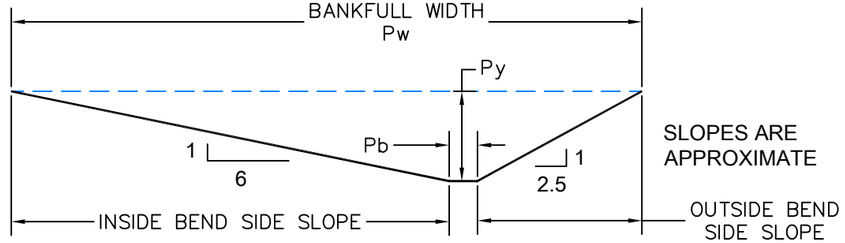
1. MEANDERING LOW FLOW THALWEG TO BE CONSTRUCTED IN ALL AREAS.
2. FINISHED RIFFLE SURFACE MATERIAL D50 = 6". (4" IN SIDE CHANNEL)



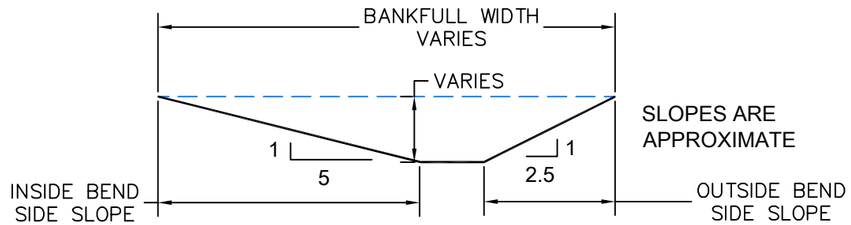
TYPICAL CHANNEL RIFFLE BEGINNING SECTION



TYPICAL CHANNEL RIFFLE END SECTION



TYPICAL CHANNEL - POOL SECTION



TYPICAL CHANNEL - MIDDLE OF GLIDE

Channel Geometry Table

Sequence	RBw (ft)	RBy (ft)	RBb (ft)	REw (ft)	REy (ft)	REb (ft)	Pw (ft)	Py (ft)	Pb (ft)
Riffle/Pool 5	51	2.3	40	45	2.5	35	56	4.5	5
Riffle/Pool 6	52	2.3	40	47	2.5	35	57	4.5	5
Riffle/Pool 7	46	2.2	35	40	2.4	30	51	4.5	5
Riffle/Pool 8	46	2.2	35	40	2.4	30	51	4.5	5
Riffle/Pool 9	46	2.1	35	40	2.3	30	51	4.5	5
Riffle/Pool 10	56	2.3	45	50	2.5	40	61	4.5	5
Riffle/Pool 11	51	2.3	40	45	2.5	35	56	4.5	5
Side Channel 2	20	1	15	18	1.2	12	18	3.5	3
Side Channel 3	20	1	15	18	1.2	12	18	3.5	3
Side Channel 4	26	1.1	20	23	1.3	16	24	3.5	3

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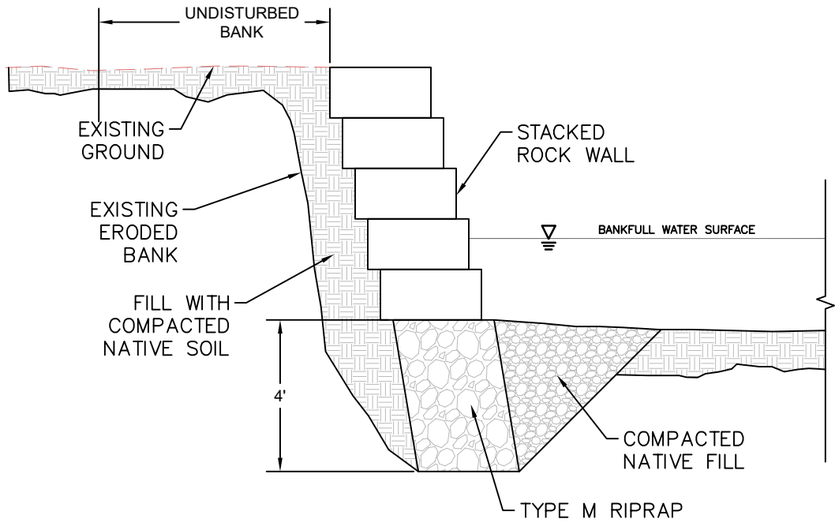
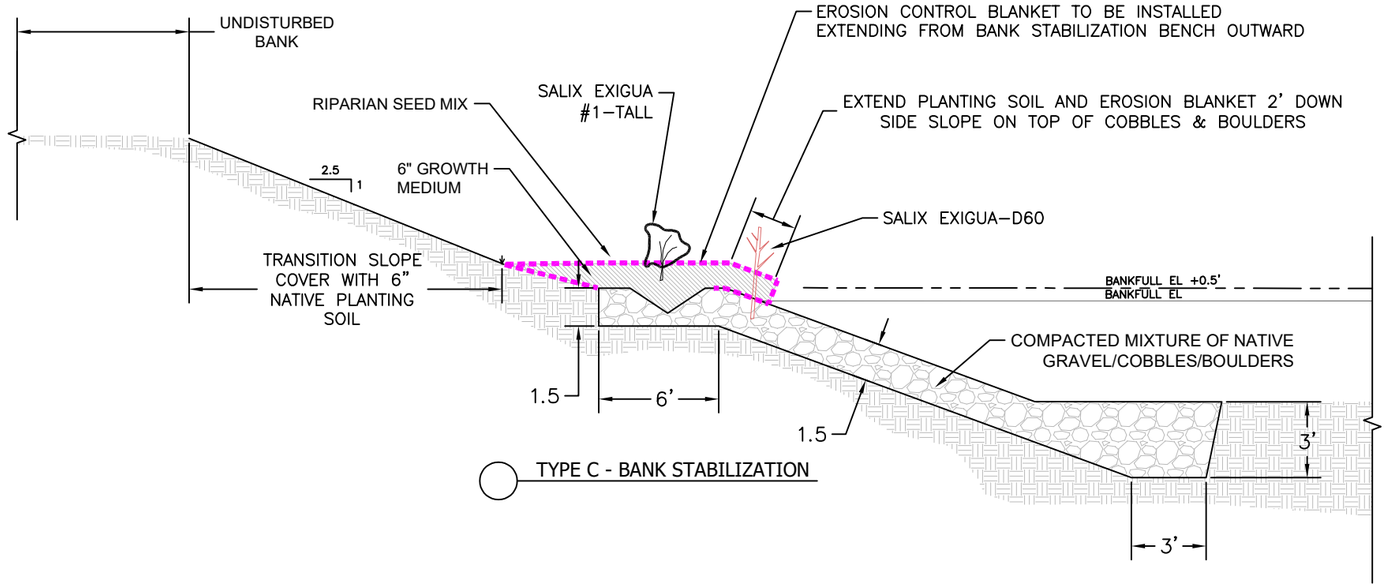
TITLE: SECTIONS AND DETAILS

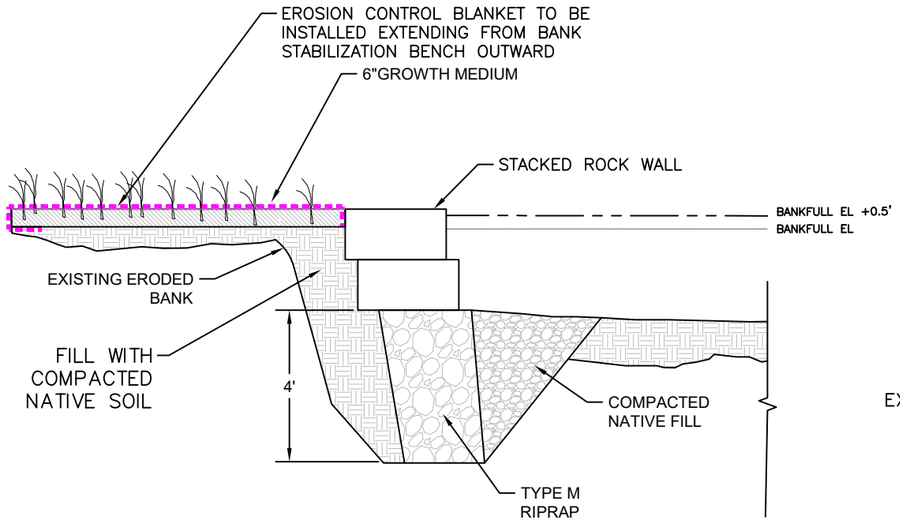
SHEET: 10



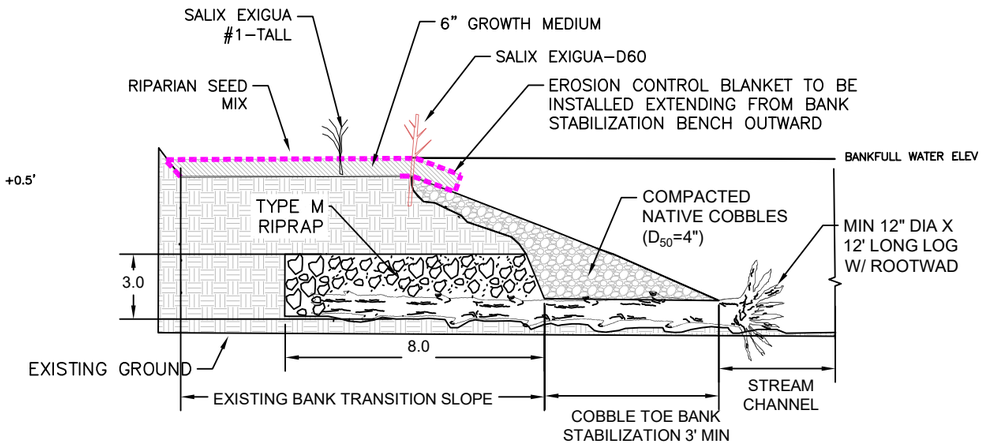
TYPE A - BANK STABILIZATION



TYPE C - BANK STABILIZATION



TYPE B - BANK STABILIZATION



TYPE D - BANK STABILIZATION

BANK STABILIZATION LAYOUT TABLE

ID	TYPE	CHANNEL	DS STA	UP STA	LENGTH (FT)
BS-A	B	SIDE 1	650	1000	350
BS-1A	D	MAIN	2935	3035	100
BS-1B	A	MAIN	3035	3125	90
BS-2	D	SIDE 2	100	175	75
BS-3	C	SIDE 2	125	175	50
BS-4	C	MAIN	3125	3200	75
BS-5	C	MAIN	3275	3350	75
BS-6	C	MAIN	3200	3275	75
BS-7	C	SIDE 3	0	50	50
BS-8	C	SIDE 3	0	50	50
BS-9	C	MAIN	3300	3450	150
BS-10	D	MAIN	3650	3700	50
BS-11	C	MAIN	3700	3825	125
BS-12	C	MAIN	3850	4175	325
BS-13	C	MAIN	4000	4100	100
BS-14	C	SIDE 3	650	700	50
BS-15	C	SIDE 4	0	275	275
BS-15	C	SIDE 4	0	900	900
BS-17	C	SIDE 4	300	675	375
BS-18	C	SIDE 4	750	900	150
BS-19	C	MAIN	4150	4225	75
BS-20	D	MAIN	4300	4450	150
BS-21	C	MAIN	4450	4550	100
BS-22	C	MAIN	4625	4800	175
BS-23	D	MAIN	4725	4875	150
BS-24	C	MAIN	5250	5450	200
BS-25	C	MAIN	5350	5725	375
BS-26	B	MAIN	5450	5700	250
BS-27	C	MAIN	5700	6100	400
					5365

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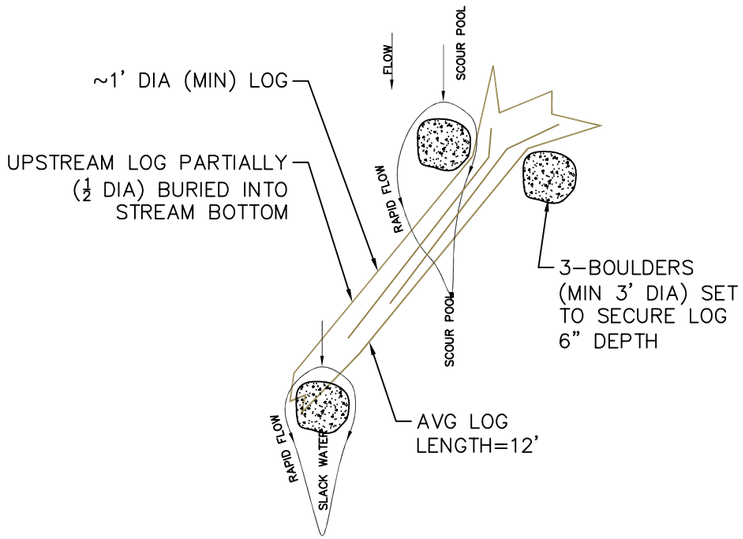
TITLE: SECTIONS AND DETAILS

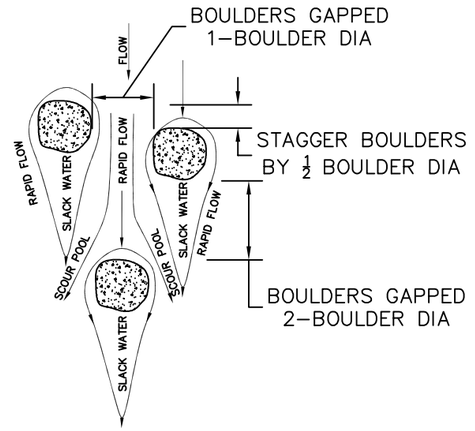
SHEET: 11



INSTREAM LOG/ROOT WAD (ILRW)

ILRW NOTES:

1. FURNISH 3' MIN DIA ROUNDED BOULDER
2. TOP OF ALL BOULDERS AND LOG WILL BE SET BELOW THE BANKFULL FLOW ELEVATION
3. CREATE SCOUR HOLE IN RAPID FLOW PATH AREAS
4. BOULDERS AND LOG SHOULD BE SET TOWARDS STREAM CENTER MAINTAINING 5' SPACE FROM BANK EDGE
5. ALL LOGS SALVAGED ON SITE FROM CITY SUPPLY
6. LOCATION OF ILRW TO BE DETERMINED IN THE FIELD BY ERC



BOULDER CLUSTERS (BC)

BC NOTES:

1. FURNISH 3' MIN ROUNDED BOULDERS
2. TOP OF ALL BOULDERS WILL BE SET BELOW THE BANKFULL FLOW ELEVATION
3. CREATE SCOUR HOLE IN RAPID FLOW PATH AREAS
4. BOULDERS SHOULD BE SET TOWARDS STREAM CENTER MAINTAINING 5' SPACE FROM BANK EDGE AS DIRECTED BY ERC
5. LOCATION OF BC TO BE DETERMINED IN THE FIELD BY ERC

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TITLE: SECTIONS AND DETAILS

SHEET: 12

Main Channel					
ID	Station (ft)	Elevation (ft)	Bankfull Elevation (ft)	Feature	Grade
Match Existing					
P5	3189	5732.4		Right Pool	-1.2%
RE5	3250	5734.9	5737.4	Riffle End	4.0%
RB5	3375	5736.2	5738.5	Riffle Beginning	1.0%
P6	3625	5732.8	5738.5	Left Pool	-1.3%
RE6	3663	5735.0	5737.5	Riffle End	5.7%
RB6	3850	5737.3	5739.6	Riffle Beginning	1.2%
P7	3940	5735.0	5739.6	Right Pool	-2.5%
RE7	4000	5737.1	5739.5	Riffle End	3.5%
RB7	4125	5739.0	5741.2	Riffle Beginning	1.5%
P8	4325	5735.4	5742.2	Left Pool	-1.8%
RE8	4427	5739.8	5742.2	Riffle End	4.3%
RB8	4550	5741.9	5744.1	Riffle Beginning	1.7%
P9	4831	5739.0	5744.1	Left Pool	-1.0%
RE9	4900	5741.8	5744.1	Riffle End	4.1%
RB9	5176	5745.4	5747.5	Riffle Beginning	1.3%
P10	5650	5744.1	5749.2	Right Pool	-0.3%
RE10	5725	5746.7	5749.2	Riffle End	3.5%
RB10	5875	5749.2	5751.5	Riffle Beginning	1.7%
P11	6000	5747.4	5752.5	Right Pool	-1.5%
RE11	6076	5750.0	5752.5	Riffle End	3.5%
RB11	6200	5752.2	5754.5	Riffle Beginning	1.8%
Match Existing					

MAIN CHANNEL ELEVATIONS

Side Channel 2					
ID	Station (ft)	Elevation (ft)	Bankfull Elevation (ft)	Feature	Grade
Match Main	0	5734.9			-
P2A	192	5733.3	5736.0	Left Pool	-0.8%
RE2A	225	5734.8	5736.0	Riffle End	4.6%
RB2A	260	5735.4	5736.4	Riffle Beginning	1.5%
P2B	375	5734.0	5736.7	Right Pool	-1.2%
RE2B	388	5735.5	5736.7	Riffle End	11.2%
RB2B	439	5736.4	5737.4	Riffle Beginning	1.8%
P2C	522	5735.0	5737.4	Left Pool	-1.7%
RE2C	545	5736.5	5737.7	Riffle End	6.5%
RB2C	581	5737.2	5738.2	Riffle Beginning	2.1%
Match Main	667	5737.2			0.0%

SIDE CHANNEL 2 ELEVATIONS

Side Channel 3					
ID	Station (ft)	Elevation (ft)	Bankfull Elevation (ft)	Feature	Grade
Match Main	0	5736.4			-
P3A	79	5734.8	5737.5	Right Pool	-2.2%
RE3A	100	5736.3	5737.5	Riffle End	7.0%
RB3A	135	5737.3	5738.3	Riffle Beginning	2.9%
P3B	197	5736.1	5738.8	Left Pool	-2.0%
RE3B	219	5737.6	5738.8	Riffle End	6.9%
RB3B	270	5738.8	5739.8	Riffle Beginning	2.3%
P3C	318	5737.3	5740.0	Right Pool	-3.1%
RE3C	340	5738.8	5740.0	Riffle End	6.9%
RB3C	390	5739.5	5740.5	Riffle Beginning	1.3%
P3D	468	5738.0	5740.7	Left Pool	-1.9%
RE3D	490	5739.5	5740.7	Riffle End	6.9%
RB3D	540	5740.2	5741.2	Riffle Beginning	1.4%
P3E	628	5739.1	5741.2	Right Pool	-1.3%
Match Main	718	5740.3			1.4%

SIDE CHANNEL 3 ELEVATIONS

Side Channel 4					
ID	Station (ft)	Elevation (ft)	Bankfull Elevation (ft)	Feature	Grade
Match Main	0	5740.0			-
P4A	64	5738.5	5741.3	Left Pool	-2.4%
RE4A	85	5740.0	5741.3	Riffle End	7.0%
RB4A	135	5740.8	5741.9	Riffle Beginning	1.6%
P4B	254	5739.5	5742.3	Right Pool	-1.1%
RE4B	275	5741.0	5742.3	Riffle End	7.0%
RB4B	335	5742.3	5743.4	Riffle Beginning	2.2%
P4C	491	5741.1	5743.9	Left Pool	-0.7%
RE4C	513	5742.6	5743.9	Riffle End	7.0%
RB4C	586	5744.4	5745.5	Riffle Beginning	2.4%
P4D	692	5743.1	5745.9	Right Pool	-1.2%
RE4D	713	5744.6	5745.9	Riffle End	7.0%
RB4D	785	5745.9	5747.0	Riffle Beginning	1.8%
Match Main	885	5746.5		Riffle Beginning	1.0%

SIDE CHANNEL 4 ELEVATIONS

REV	DATE	DESCRIPTION
C	10/12/20	ISSUED FOR CONSTRUCTION
B	08/27/20	ISSUED FOR REVIEW
A	06/15/20	ISSUED FOR REVIEW

PREPARED BY
ECOLOGICAL RESOURCES CONSULTANTS, INC
225 UNION BLVD. SUITE 325
LAKEWOOD, CO 80228

CLIENT: CITY OF MONTROSE

PROJECT: UNCOMPAGHRE RIVER IMPROVEMENT

TITLE: DESIGN ELEVATIONS

SHEET: 13

NOTES AND SPECIFICATIONS

A. GENERAL

A.1. THIS PLAN HAS BEEN PREPARED ON BEHALF OF THE CITY OF MONTROSE.

A.2. THIS PLAN HAS BEEN PREPARED AS A DESIGN-BUILD PROJECT BY ECOLOGICAL RESOURCE CONSULTANTS, INC. (ERC) AND NARANJO CIVIL CONSTRUCTORS (NARANJO). ONLY KEY DESIGN ELEMENTS AND SPECIFICATIONS ARE PROVIDED. THE PLAN DOES NOT CONTAIN SUFFICIENT DETAIL FOR CONSTRUCTION FROM AN UNSUPERVISED OR INDEPENDENT CONSTRUCTION GROUP. ALL DESIGN LAYOUT, CONTROL DATUM AND PROPOSED ELEVATIONS WILL REQUIRE VERIFICATION BY ERC/NARANJO.

A.3. EVERY EFFORT SHALL BE MADE DURING CONSTRUCTION ACTIVITY TO MINIMIZE DISTURBANCE TO THE UNCOMPAHGRE RIVER (RIVER) FISHERY AND ENVIRONMENT.

A.4. THIS PLAN IS SUBJECT TO US ARMY CORPS OF ENGINEERS, CITY OF MONTROSE, COLORADO PARKS AND WILDLIFE (CPW) AND OTHER AGENCY REVIEW AND APPROVALS. ALL WORK SHALL COMPLY WITH SPECIFICATIONS OF ALL APPROVALS.

A.5. CPW SHALL BE CONTACTED PRIOR TO CONSTRUCTION TO CONFIRM ANY SEASONAL CONSTRUCTION RESTRICTIONS FOR WORK IN THE RIVER.

A.6. PER STANDARD CPW BEST MANAGEMENT PRACTICES, ALL HEAVY EQUIPMENT WORKING IN THE RIVER OR AROUND WATER SHALL BE CLEANED PRIOR TO SITE MOBILIZATION TO PREVENT THE SPREAD OF EXOTIC OR DESTRUCTIVE AQUATIC NUISANCES AND TERRESTRIAL WEED SPECIES. ALL MUD AND DEBRIS SHALL BE REMOVED FROM EQUIPMENT AND PARTS (TRACKS, TURRETS, BUCKETS, TEETH, ETC.) BY HAND SCRAPING AND POWER WASHING. SPRAY/SOAK EQUIPMENT WITH A QUANTERNARY AMMONIUM COMPOUNDS "QAC", QUAT 128 OR SPARQUAT 256. KEEP EQUIPMENT MOIST FOR AT LEAST 10 MINUTES.

A.7. ALL CONSTRUCTION EQUIPMENT WORKING IN OR NEAR THE WATER SHALL BE SAFE, CLEAN AND IN EXCEPTIONAL OPERATIONAL CONDITION. ALL EQUIPMENT SHALL BE INSPECTED DAILY FOR ANY POTENTIAL SPILLS/LEAKS OR MECHANICAL PROBLEMS PRIOR TO WORKING IN THE WATER. ALL EQUIPMENT SHALL BE CLEANED OF ANY EXCESS GREASES/OILS AND DIRT DAILY PRIOR TO WATER ENTRY. HIGH PRESSURE WASHING OF CONSTRUCTION EQUIPMENT MAY BE NECESSARY DAILY AND MUST BE PERFORMED ONSITE IN A PRE-APPROVED LOCATION.

A.8. UTILITY LOCATES SHALL BE ESTABLISHED THROUGHOUT THE PROJECT AREA A MINIMUM OF FIVE DAYS PRIOR TO CONSTRUCTION START DATE AND UPDATED DURING THE PROJECT AS NEEDED. UTILITY NOTIFICATION CENTER OF COLORADO 1-800-922-1987 OR 811.

A.9. ANY LAND DISTURBANCE AND IN PARTICULAR THE PROPOSED PROJECT ACTIVITIES INEVITABLY CREATES CONDITIONS FOR INCREASED SUSCEPTIBILITY OF WEED INFESTATION ESPECIALLY WITH KNOWN EXISTING ESTABLISHED POPULATIONS OF WEEDS WITHIN THE PROJECT AREA. IT IS HIGHLY RECOMMENDED AS PART OF THIS PROJECT TO IMPLEMENT A PROJECT SPECIFIC ADAPTIVE WEED MANAGEMENT PLAN.

B. PROJECT INITIATION

B.1. ERC/NARANJO SHALL FIELD FLAG, STAKE AND/OR ROPE-OFF THE LIMITS OF DISTURBANCE WITHIN THE PROJECT AREA PRIOR TO COMMENCEMENT OF CONSTRUCTION AS NECESSARY. MARKERS SHALL BE MAINTAINED UNTIL CONSTRUCTION IS COMPLETED.

B.2. PLANT MATERIAL TO BE SALVAGED SHALL BE CLEARLY IDENTIFIED BY ERC/NARANJO PRIOR TO CLEARING AND GRUBBING. SUCH PLANT MATERIAL IDENTIFIED FOR SALVAGE SHALL BE REMOVED AND STORED PRIOR TO CLEARING AND GRUBBING. AN EXCAVATOR SHALL BE USED TO COLLECT PLANT MATERIAL IN A MANNER WHICH PRESERVES THE ROOTBALL. SALVAGED PLANT MATERIAL SHALL BE TEMPORARILY STORED AND MAINTAINED ON SITE.

B.3. AS PART OF THE INITIAL PROJECT CLEARING AND GRUBBING, EXOTIC/NON-NATIVE/NOXIOUS PLANTS WILL NEED TO BE REMOVED AS DIRECTED TO PREVENT UNWANTED SPREAD. ERC WILL IDENTIFY IN THE FIELD LOCATIONS FORM PLANT REMOVAL THAT WILL REQUIRE EXCAVATION AND TRANSPORTING TO A SEPARATE LOCATION THAN TOPSOIL AND MATERIAL SALVAGE AREAS. PROPER DISPOSAL WILL BE REQUIRED.

B.4. ALL SURFACE OBJECTS, TREES, STUMPS, ROOTS, AND OTHER PROTRUDING OBSTRUCTIONS NOT DESIGNATED TO REMAIN SHALL BE CLEARED AND GRUBBED AS REQUIRED. SMALLER BRANCHES AND TREES SHALL BE STRIPPED, STOCKPILED AND DISPOSED OF AS REQUIRED. LARGER DIAMETER LOGS AND ROOTWADS CAN BE INCORPORATED AS NON-STRUCTURE HABITAT FEATURES WITHIN THE STREAM, RIPARIAN FRINGE AS DETERMINED BY ERC/TEZAK. ANY SUCH HABITAT FEATURES SHALL BE APPROPRIATELY LOCATED AND ADEQUATELY SECURED/ANCHORED AS DIRECTED BY ERC/TEZAK.

C. SEDIMENT CONTROL

C.1 APPROPRIATE MEASURES TO PREVENT AND MINIMIZE DEGRADATION TO ON-SITE AND OFF-SITE WATERWAYS SHALL BE IMPLEMENTED DURING CONSTRUCTION ACTIVITIES. SPECIFICALLY THE FOLLOWING MEASURES SHALL BE IMPLEMENTED TO MINIMIZE TO THE MAXIMUM EXTENT FEASIBLE SUSPENDED SEDIMENTS AND TURBIDITY: (A) A DOWNSTREAM SEDIMENT DAM CONSTRUCTED FROM CLEAN COBBLE, ROCK OR RIPRAP SHALL BE INSTALLED ACROSS THE RIVER BELOW ALL CONSTRUCTION ACTIVITIES. THE SEDIMENT DAM SHALL BE INSPECTED AND MAINTAINED AS REQUIRED. (B) EMERGENCY LEAK/SPILL CONTAINMENT AND CLEANUP SUPPLIES MUST BE STORED ONSITE PRIOR TO THE PRESENCE OF ANY CONSTRUCTION EQUIPMENT WORKING IN FLOWING WATER. LEAK/SPILL CONTAINMENT BOOMS OR SIMILAR MUST BE INSTALLED DOWNSTREAM OF ALL CONSTRUCTION EQUIPMENT. THE EMERGENCY LEAK/SPILL CONTAINMENT SUPPLIES MUST BE ADEQUATE TO CONTAIN POTENTIAL LEAK OR SPILL FROM CONSTRUCTION EQUIPMENT ONSITE. ALL SITE EMPLOYEES MUST HAVE KNOWLEDGE OF EMERGENCY LEAK/SPILL RESPONSE MEASURES.

C.2. ALL MEASURES AS OUTLINED IN ANY PROJECT COLORADO STORMWATER DISCHARGE PERMIT SHALL BE IMPLEMENTED, ROUTINELY INSPECTED AND MAINTAINED DURING THE PROJECT AS REQUIRED. FINAL STABILIZATION REQUIREMENTS FOR STORMWATER CONSTRUCTION PERMIT TERMINATION SHALL BE TRANSFERRED AND BECOME RESPONSIBILITY OF THE CITY OF MONTROSE UPON APPROVED IMPLEMENTATION OF THE SITE RECLAMATION.

REV	DATE	DESCRIPTION
C	10/12/20	ISSUED FOR CONSTRUCTION
B	08/27/20	ISSUED FOR REVIEW
A	06/15/20	ISSUED FOR REVIEW

PREPARED BY
ECOLOGICAL RESOURCES CONSULTANTS, INC
225 UNION BLVD. SUITE 325
LAKEWOOD, CO 80228

CLIENT: CITY OF MONTROSE

PROJECT: UNCOMPAGHRE RIVER IMPROVEMENT

TITLE: NOTES

SHEET: 14

NOTES AND SPECIFICATIONS

GROWTH MEDIUM

D.1. ALL DESIGNATED UPLAND AND RIPARIAN RECLAMATION AREAS REQUIRE THE PLACEMENT OF GROWTH MEDIUM WITH A MINIMUM DEPTH OF 0.5'.

D.2. GROWTH MEDIUM SHALL GENERALLY CONSIST OF ON-SITE PROCESSED FINE-GRAINED MINERAL SOIL SCREENED/CRUSHED TO 3/4" MINUS. AS MUCH AS POSSIBLE, MINERAL SOILS SHALL BE FREE OF ANY OBVIOUS WEEDS. MINERAL SOIL SHALL BE MIXED WITH 5% BLEND BY VOLUME OF UNSCREENED COMPOST AS DETERMINED APPROPRIATE. MINERAL SOIL AND COMPOST SHALL BE THOROUGHLY MIXED PRIOR TO SURFACE APPLICATION.

D.3. PRIOR TO DISTRIBUTION, GROWTH MEDIUM SHALL BE ANALYZED TO ENSURE ALL NUTRIENT PARAMETERS ARE WITHIN ACCEPTABLE RANGES AS APPROVED BY ERC. SOIL NUTRIENT TESTING WILL BE REQUIRED.

D.4 GROWTH MEDIUM SHALL BE EVENLY DISTRIBUTED OVER COMPLETED SUBGRADE AND LIGHTLY TRACK COMPACTED WITH ON SITE EQUIPMENT TO SPECIFIED DEPTHS AND BE FREE OF CLODS.

E. SEEDING

E.1. PRIOR TO SEEDING, SOIL AMENDMENTS SHALL BE APPLIED TO THE FINISHED GROWTH MEDIUM SURFACE. SOIL AMENDMENTS SHALL INCLUDE 2000 POUNDS PER ACRE OF BIOSOL FORTE, 200 POUNDS PER ACRE OF HUMATES AND 60 POUNDS PER ACRE OF MYCORRHIZAE. FINAL APPLICATION RATES OF SOIL AMENDMENTS WILL BE DETERMINED UPON FINAL GROWTH MEDIUM NUTRIENT TESTING. UPON APPLICATION OF AMENDMENTS THE SOIL SURFACE SHALL BE DISCED OR HARROWED TO A MAXIMUM DEPTH OF 0.25' THOROUGHLY MIXING GROWTH MEDIUM AND AMENDMENTS PRODUCING A SMOOTH AND LOOSE SURFACE.

E.2. SEED SHALL BE SUPPLIED AS SPECIFIED IN THE SEED TABLES AND APPROVED BY ERC. ALL SEED SHALL BE MIXED IN ORDER TO OBTAIN THE SPECIFIED MIXTURE AND APPLICATION RATE. NO SPECIES SUBSTITUTION SHALL BE PERMITTED WITHOUT PRIOR APPROVAL OF ERC.

E.3. ALL SEED SHALL CONFORM TO ALL CURRENT STATE AND FEDERAL REGULATION AND SHALL BE SUBJECT TO THE TESTING PROVISIONS OF THE ASSOCIATION OF OFFICIAL SEED ANALYSTS. ALL SEED AND SEED MIXES SHALL BE FURNISHED IN BAGS OR CONTAINERS CLEARLY LABELED BY SPECIFIED SEED MIX TYPE AND SHOW THE NAME, ADDRESS OF THE SUPPLIER, THE COMMON, SCIENTIFIC AND VARIETY NAME OF THE SEED, THE LOT NUMBER, POINT OF ORIGIN, NET WEIGHT, PERCENT OF WEED CONTENT AND THE GUARANTEED PERCENTAGE OR PURITY AND GERMINATION. SEED TAGS SHALL BE RETAINED BY ERC. ALL SEED SHALL BE GUARANTEED FOR PURITY AND GERMINATION, FREE OF NOXIOUS WEED SEED AND SUPPLIED ON A PURE LIVE SEED (PLS) BASIS. SEED SHALL BE PROPERLY STORED DURING REVEGETATION EFFORTS TO PREVENT ANY EXPOSURE TO MOISTURE AND/OR CONTAMINANTS.

E.4. ALL SEED IS TO BE DRILLED ONE-QUARTER (1/4) INCH TO ONE-HALF (1/2) INCH INTO THE SOIL AT THE SPECIFIED PURE LIVE SEED (PLS) PER ACRE RATE WITH A MECHANICAL GRASS DRILL WITH DEPTH BANDS AND AN AGITATOR IN THE SEED BOX. ROWS SHALL BE SPACED NOT MORE THAN SEVEN (7) INCHES APART. DRILL ONE-HALF (1/2) OF THE REQUIRED PLS PER ACRE IN ONE COMPASS DIRECTION, AND THEN DRILL THE REMAINING HALF OF THE REQUIRED PLS PER ACRE IN A DIRECTION NINETY DEGREES (90°) TO THE FIRST HALF.

E.5. ALL SEEDING IS INTENDED TO BE CONDUCTED UPON COMPLETION OF THE EXCAVATION WORK ANTICIPATED TO OCCUR BETWEEN FEBRUARY AND MARCH. SEEDING SHOULD NOT OCCUR DURING FROZEN SOIL CONDITIONS.

E.6. ALL SEEDED AREAS SHALL BE STABILIZED AS DESIGNATED IN THE PLANS WITH EROSION CONTROL BLANKET OR WITH HYDROMULCH. HYDROMULCH SHALL CONSIST OF ORGANIC WOOD FIBER MULCH AND TACKIFIER HYDROLOGICALLY APPLIED APPLIED AT 2000 POUNDS PER ACRE. ALL HYDRO-MULCH SHALL ALSO INCLUDE A MULCH TACKIFER CONSISTING OF ORGANIC, NON-TOXIC, FREE-FLOWING, NON-CORROSIVE MATERIAL. HYDRO-MULCH SHALL COVER ALL SEEDED AREAS WITH A UNIFORM SURFACE LAYER. SEEDING SHALL NOT OCCUR AS PART OF HYDRO-MULCH APPLICATIONS.

F. WILLOW TRANSPLANTS

F.1. WILLOW CLUMPS SHALL BE HARVESTED ON SITE AND TRANSPLANTED WHERE FEASIBLE. TRANSPLANTS SHALL BE IDENTIFIED DURING INITIAL CONSTRUCTION EFFORTS AND TRANSPLANT LOCATIONS DETERMINED IN THE FIELD BY ERC. WILLOW CLUMPS SHALL BE HARVESTED WITH AN EXCAVATOR SALVAGING THE ENTIRE ROOT BALL (INCLUDING ANY SOIL/COBBLE) AND MOVED DIRECTLY TO TRANSPLANT LOCATION. PRIOR TO SALVAGE, THE ABOVE GROUND PORTION EACH SHRUB SHALL BE TRIMMED TO A HEIGHT OF 2'. TRANSPLANT LOCATIONS MAY WILL BE FIELD DEFINED BY ERC AT DESIGNATED LOCATIONS WITH APPROPRIATE HYDROLOGY. SALVAGED WILLOW CLUMP ROOT BALLS SHALL REMAIN MOIST DURING TRANSPLANT.

Riparian Seed Mix					
Scientific Name	**Common Name**	**Seasonality**	**% of Mix**	**LBS/PLS per Acre**	**LBS/PLS Required**
Beckmannia syzigachne	American sloughgrass	Cool	15	5.4	32.4
Carex nebrascensis	Nebraska sedge	Cool	5	0.8	4.8
Carex utriculata	Northwest territory sedge	Cool	5	1	6
Elymus canadensis	Canada wildrye	Cool	10	7.6	45.6
Elymus trachycaulus	Slender wheatgrass	Cool	10	5.8	34.8
Glyceria striata	Fowl managrass	Cool	15	7.3	43.8
Juncus arcticus spp littoralis	Mountain rush	Cool	5	0.1	0.6
Panicum virgatum	Switchgrass	Warm	15	0	0
Schoenoplectus punges	Three-square bulrush	Cool	5	1.1	6.6
Sporobolus airodes	Alkali sacaton	Warm	15	0.7	4.2
		Total	**100**	**29.8**	**178.8**
Notes:					
Quantity assumes 200 seeds per square foot broadcast seeded. Reduce by 25% for drill seeding.					
Quantity based on a total of 6 acres of Riparian Seeding.					
Final species composition and rates subject to availability.					

Upland Seed Mix					
Scientific Name	**Common Name**	**Seasonality**	**% of Mix**	**LBS/PLS per Acre**	**LBS/PLS Required**
Achnatherum hymenoides	indian ricegrass	Cool	20	12.4	74.4
Bouteloua curtipendula	side-oats grama	Warm	5	2.3	13.8
Elymus canadensis	Canada wildrye	Cool	5	15.2	91.2
Elymus elymoides	bottlebrush squireltail	Warm	20	9.1	54.6
Hesperostipa comata	meedle-and-thread	Cool	5	3.8	22.8
Koeleria macrantha	prairie Junegrass	Cool	20	0.8	4.8
Pascopyrum smithii	western wheatgrass	Cool	25	19.8	118.8
		Total	**100**	**63.4**	**380.4**
Notes:					
Quantity assumes 200 seeds per square foot broadcast seeded. Reduce by 25% for drill seeding.					
Quantity based on a total of 6 acres of Riparian Seeding.					
Final species composition and rates subject to availability.					

BANK STABILIZATION LAYOUT TABLE

ID	TYPE	CHANNEL	DS STA	UP STA	LENGTH (FT)	Size / Spacing	#1 Tall / 5	D-60 / 1.5
BS-A	B	SIDE 1	650	1000	350			
BS-1	A	MAIN	2925	3125	200			
BS-2	D	SIDE 2	100	175	75		15	50
BS-3	C	SIDE 2	125	175	50		10	33
BS-4	C	MAIN	3125	3200	75		15	50
BS-5	C	MAIN	3275	3350	75		15	50
BS-6	C	MAIN	3200	3275	75		15	50
BS-7	C	SIDE 3	0	50	50		10	33
BS-8	C	SIDE 3	0	50	50		10	33
BS-9	C	MAIN	3300	3450	150		30	100
BS-10	D	MAIN	3650	3700	50		10	33
BS-11	C	MAIN	3700	3825	125		25	83
BS-12	C	MAIN	3850	4175	325		65	217
BS-13	C	MAIN	4000	4100	100		20	67
BS-14	C	SIDE 3	650	700	50		10	33
BS-15	C	SIDE 4	0	275	275		55	183
BS-16	C	SIDE 4	0	900	900		180	600
BS-17	C	SIDE 4	300	675	375		75	250
BS-18	C	SIDE 4	750	900	150		30	100
BS-19	C	MAIN	4150	4225	75		15	50
BS-20	D	MAIN	4200	4450	250		50	167
BS-21	C	MAIN	4450	4550	100		20	67
BS-22	C	MAIN	4625	4800	175		35	117
BS-23	C	MAIN	4725	4875	150		30	100
BS-24	D	MAIN	5250	5450	200		40	133
BS-25	C	MAIN	5350	5725	375		75	250
BS-26	B	MAIN	5450	5700	250			
BS-27	C	MAIN	5700	6100	400		80	267
					5475		935	3116

REV	DATE	DESCRIPTION
C	10/12/20	ISSUED FOR CONSTRUCTION
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A	06/15/20	ISSUED FOR REVIEW

PREPARED BY
ECOLOGICAL RESOURCES CONSULTANTS, INC
225 UNION BLVD. SUITE 325
LAKEWOOD, CO 80228

CLIENT: CITY OF MONTROSE

PROJECT: UNCOMPAGHRE RIVER IMPROVEMENT

TITLE: NOTES & PLANTING TABLES

Constructed Riffle

Constructed Pool

Glide

Micro Habitat Feature

Backwater

Rock Wall Stabilization (foreground) and Log Stabilization (background)

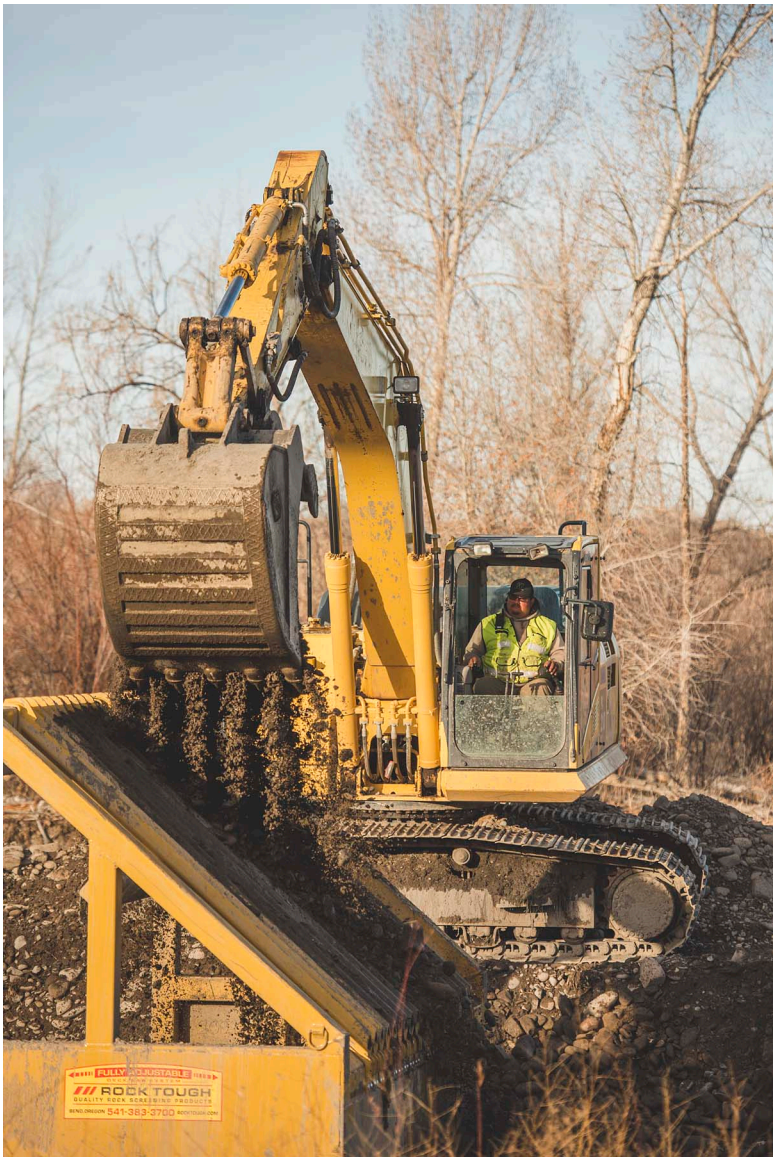
Micro Habitat

Bank Stabilization

Rock Wall Stabilization

Constructed Backwater

Natural Channel Form



Screening Materials

Tracked Haul Trucks

Seeding

Reclamation Seeding

Hydromulching

Installed Blanket

Blanket Installation

Smaller Potted Material

Terrace Grading with Seeding and Fabric

Fabric for Stabilization

Rootwad Stabilization with Plantings

Bank Stabilization with Habitat Features

Side Channel

Native and Rock Wall Stabilization along Glide

Overbank Grading and Stabilization with Habitat Features

Micro Habitat Features and Log Stabilization

Created Side Channel

Created Side Channel

5 Gallon Willows

5 Gallons Installed

Bank Stabilization with Roots and Vegetation

Appendix C – Project Expense Worksheets

TABLE 1
Uncompahgre River Improvements Project
Summary of Expenditures - REIMBURSEMENT 2 ONLY

Vendor	Work Element	Invoice Number	Invoice Date	Check Number	Check Date	Amount Paid
Ecological Resource Consultants	Design-Build Pay App 13	11193	3/8/2021	125853	3/11/2021	$126,860.53
	Design-Build Retainage Release	11195	3/8/2021	126000	3/25/2021	$71,760.71
					TOTALS	**$198,621.24**

TABLE 2
Uncompahgre River Improvements Project
Summary of Expenditures - PROJECT TOTAL

Vendor	Work Element	Invoice Number	Invoice Date	Check Number	Check Date	Amount Paid
Ecological Resource Consultants	Design-Build Pay App 1	10115	4/6/2020	122511	4/16/2020	$15,369.35
	Design-Build Pay App 2	10200	5/5/2020	122673	5/12/2020	$11,517.50
	Design-Build Pay App 3	10299	6/3/2020	123072	6/18/2020	$35,181.89
	Design-Build Pay App 4	10201	5/5/2020	123207	7/9/2020	$5,873.00
	Design-Build Pay App 5	10378	7/6/2020			$13,434.00
	Design-Build Pay App 6	10564	9/3/2020	123896	9/17/2020	$1,327.50
	Design-Build Pay App 7	10605	10/2/2020	124151	10/8/2020	$2,832.00
	Design-Build Pay App 8	10723	11/3/2020	124607	11/12/2020	$16,162.50
	Design-Build Pay App 9	10802	11/5/2020			$119,813.43
	Design-Build Pay App 10	10895	12/4/2020	124964	12/10/2020	$521,422.89
	Design-Build Pay App 11	10990	1/7/2021	125296	1/14/2021	$371,414.16
	Design-Build Pay App 12	11040	2/3/2021	125487	2/4/2021	$273,942.28
	Design-Build Pay App 13	11193	3/8/2021	125853	3/11/2021	$126,860.53
	Design-Build Retainage Release	11195	3/8/2021	126000	3/25/2021	$71,760.71
					TOTALS	**$1,586,911.74**

Invoice to: Colorado Water Conservation Board
1313 Sherman St. Rm. 721
Denver, Co 80203

Project Name: Uncompahgre River Improvement Project

Grantee: City of Montrose
Address: P.O. Box 790, 433 S. 1st St.
Montrose, CO 81401
Phone No.: (970) 497-8531

CWCB Contract or Purchase Order No.: CMS 163687 / CTGG1 2021-2185

Grant Amount: $500,000

Date of Invoice: 31-Mar-21

Task	Description	CWCB WSRF Funds (Total Grant Amount)	CWCB CWRP Funds (Total Grant Amount)	Previously Invoiced WSRF	Previously Invoiced CWRP	Current Invoice WSRF Funds	Current Invoice CWRP Funds	Percent Complete
1	Stream Excavation - Cut to Fill	$ 62,500.00	$ 250,000.00	$ 53,750.00	$ 215,000.00	$ 8,750.00	$ 35,000.00	100.0%
2	Riffle/Pool Features, Main Channel	$ 6,250.00	$ 25,000.00	$ 5,375.00	$ 21,500.00	$ 875.00	$ 3,500.00	100.0%
3	Riffle/Pool Features, Side Channel	$ 2,500.00	$ 10,000.00	$ 2,150.00	$ 8,600.00	$ 350.00	$ 1,400.00	100.0%
4	Fine Grading at Backwater Areas	$ -	$ -	$ -	$ -	$ -	$ -	#DIV/0!
5	Grade Controls at Side Channels and Backwater Areas	$ -	$ -	$ -	$ -	$ -	$ -	#DIV/0!
6	Type A Bank Stabilization	$ 5,000.00	$ 20,000.00	$ 4,300.00	$ 17,200.00	$ 700.00	$ 2,800.00	100.0%
7	Type B Bank Stabilization	$ 6,250.00	$ 25,000.00	$ 5,375.00	$ 21,500.00	$ 875.00	$ 3,500.00	100.0%
8	Type C Bank Stabilization	$ 3,750.00	$ 15,000.00	$ 3,225.00	$ 12,900.00	$ 525.00	$ 2,100.00	100.0%
9	Type D Bank Stabilization	$ 1,250.00	$ 5,000.00	$ 1,075.00	$ 4,300.00	$ 175.00	$ 700.00	100.0%
10	Micro Habitat Features	$ -	$ -	$ -	$ -	$ -	$ -	#DIV/0!
11	Vegetation of Riparian Areas	$ 12,500.00	$ 50,000.00	$ 10,750.00	$ 43,000.00	$ 1,750.00	$ 7,000.00	100.0%
12	Mob/Demobilization	$ -	$ -	$ -	$ -	$ -	$ -	#DIV/0!
13	Water Control	$ -	$ -	$ -	$ -	$ -	$ -	#DIV/0!
14	Erosion Control and Reclamation	$ -	$ -	$ -	$ -	$ -	$ -	#DIV/0!
15	Construction Oversight	$ -	$ -	$ -	$ -	$ -	$ -	#DIV/0!
	TOTALS	**$ 100,000.00**	**$ 400,000.00**	**$ 86,000.00**	**$ 344,000.00**	**$ 14,000.00**	**$ 56,000.00**	

Total Invoiced CWRP **400,000.00**

Total Invoiced WSRF **100,000.00**

Submitted by: Scott Murphy

Title: City Engineer

Signature: