COLORADO
Colorado Water Conservation Board
Department of Natural Resources

1313 Sherman Street, Room 718
Denver, CO 80203

May 18, 2016

Trout Unlimited, Inc.
Attn: Mely Whiting, Legal Counsel
1777 N. Kent Street, Suite 100
Arlington, VA 22209

Trout Unlimited, Inc.
P.O. Box 1544
Pagosa Springs, Co 81147

RE: Notice to Proceed – WSRA Grant – POGG1 2016-900 – Windy Gap Reservoir Modification Project (Bypass Project) – Engineering

Dear Mely,

This letter is to inform you that the purchase order (POGG1) to assist in the above WSRA grant project was approved on May 18, 2016. The attachments will serve as your original grant contracting documents.

With the executed POGG1, you are now able to proceed with the project and invoice the State of Colorado for costs incurred through January 31, 2017. Please provide the project name, PO number, and basin when corresponding with or invoicing for your project. Upon receipt of your invoice(s), the State of Colorado will provide payment no later than 30 days after review and signed approval of the project manager.

If an extension to the project is necessary, a formal letter of request must be submitted to the project manager along with a proposed completion date **30 days** prior to the current expiration date. There will be no prior notice from the CWCB grant manager informing the grantee that the project is approaching its deadline, therefore the grantee must monitor the completion progress accordingly.

If you have any questions or concerns regarding the project, please contact Chris Sturm, Project Manager at 303-866-3441 x3236 or at chris.sturm@state.co.us. You can contact me at 303-866-3441 ext. 3250 for invoicing and payment disbursement questions.

Thank you.

Sincerely,

//s//

Doriann Vigil
Program Assistant II
O 303-866-3441 ext. 3250
1313 Sherman Street, Rm. 719
Denver, CO 80203
Dori.vigil@state.co.us / cwcb.state.co.us

cc: Chris Sturm, Project Manager
Attachments

STATE OF COLORADO
Department of Natural Resources

ORDER
Number: POGG1 PDAA 20160000000000000900
Date: 05/16/16
Description:
WSRA PDAA 2500 WINDY GAPRES MOD IN CO RIV BASIN
Effective Date: 05/18/16 Expiration Date: 01/31/17

BUYER
Buyer:
Email:

VENDOR
TROUT UNLIMITED INC
1777 N KENT ST
100
ARLINGTON, VA 22209-2133

Contact: Mely Whiting
Phone: 720-470-4758

**** IMPORTANT ****
The order number and line number must appear on all invoices, packing slips, cartons and correspondence

BILL TO
COLORADO WATER BOARD CONSERVATION
1313 SHERMAN STREET, ROOM 718
DENVER, CO 80203

SHIP TO
COLORADO WATER BOARD CONSERVATION
1313 SHERMAN STREET, ROOM 718
DENVER, CO 80203

SHIPPING INSTRUCTIONS
Delivery/Install Date:
F.O.B:
VENDOR INSTRUCTIONS:

Line Item	Commodity/Item Code	UOM	QTY	Unit Cost	Total Cost	MSDS Req.
1	G1000		0	0.00	$30,000.00	☐

Description: WSRA PDAA 2500 WINDY GAP RES MOD IN CO RIV BASIN

Service From: 05/18/16 Service To: 01/31/17

TERMS AND CONDITIONS
https://www.colorado.gov/osc/purchase-order-terms-conditions

DOCUMENT TOTAL = $30,000.00

BACKGROUND

This scope of work is based on conclusions and recommendations from the *Final Report, Windy Gap Reservoir Modification Study*[1] (Study) prepared for the Northern Colorado Water Conservancy District and Colorado Division Parks and Wildlife, dated February 2015 (Tetra Tech et al., 2015). In the Study Alternative 3 was identified as the alternative most likely to achieve the project objectives of providing benefit to the Colorado River, while being cost effective compared to the other alternatives. Alternative 3 separates the river from the reservoir with a new channel located through the southern half of the existing reservoir and a diversion structure to route flows from the river into the reservoir.

A preliminary scope of work was prepared and distributed to the TAT for review on May 8, 2015, after which a sub-group of the TAT met with the USACE to discuss permitting. We met with Rena Brand and Kiel Downing at the USACE office in Littleton and they provided guidance on the permit application. This amended scope of work includes services to prepare a 404 permit application in accordance with their guidance and suggestions and is outlined in Task IA.

OBJECTIVES

The purpose of this scope of work is to complete the assessment for Alternative 3 and prepare plans to a preliminary level of detail to facilitate review of the major design components of the project. This scope of work generally follows the tasks identified as 'Next Steps' in the Study with some minor modifications as noted below:

1. Evaluate the material in the reservoir for suitability in constructing the berm. Evaluate the need for a cut off wall in the berm.
2. Extend hydraulic analyses upstream of the railroad bridge to investigate bridge capacity and assess overtopping along the railroad. Assess and route the probable maximum flood (PMF) through the proposed river and modified reservoir.
3. Refine the channel cross section design to incorporate riffles, runs, pools and sinuosity; update and refine the hydraulic analysis for further balancing the high-water overflow with the required flows for sediment transport. In addition, assess the hydraulic conditions for Alternative 3 proposed channel alignment.
4. Collect additional data to verify and refine the inflowing sediment load rating curves.
5. Evaluate potential for utility conflicts. Determine power requirements for operating the diversion structure.
6. Develop preliminary plans, with grading and details. Refine grading as required to balance earthwork.
7. Prepare preliminary technical specifications (limited to materials and the selection of appurtenances only, as required to prepare preliminary opinion of probable costs).
8. Refine opinion of probable costs.
9. Consult with permitting agencies.

SCOPE OF WORK

Task 1A: Prepare 404 Permit Application

[1] Tetra Tech and HabiTech, Inc., 2015. *Final Report, Windy Gap Reservoir Modification Study*. Prepared for Colorado Division of Parks and Wildlife and Northern Colorado Water Conservancy District. Granby, Colorado, February 2015.

Consult with state and federal agencies
Tetra Tech will consult by phone with the USACE, USFWS and CPW prior to fieldwork. Consulting with the USACE will confirm wetland survey designs and the permitting process. USFWS and CPW will be consulted to confirm biological survey design, information on federally listed as threatened and endangered species as well as state species of concern. Communication will be maintained with the agencies to ensure the efficiency of the permitting process.

Field surveys
Existing information will be reviewed for documented wetlands and the preferred habitats for federally listed as threatened and endangered species as well as state species of concern with the potential to occur in the project prior to the field surveys. Tetra Tech will also prepare field survey maps, data sheets, photo logs, and health and safety protocols prior to field work.

Wetland Determination and Delineation
A wetland determination and delineation will be conducted for each of the locations listed following USACE guidelines. Wetlands will be delineated following the procedures in the *U.S.* Army *Corps of Engineers Wetlands Delineation Manual (1987)*. Included in this task will be a determination of the Ordinary High Water Mark (OHWM) for identifying the jurisdictional boundary of waters of the US. The OHWM and any wetlands found will be recorded with datasheets, photos and GPS data. This task is estimated to require a 2-day field effort, plus travel to and from the project area.

Biological Habitat Evaluation
During the field visit, a biological survey will be conducted to identify the general habitat characteristics and to identify potential federal or state listed threatened or endangered species in the area. This survey is part of the requirement for a USACE permit. The biological field survey will be conducted using meandering transects across the project area, focusing on areas of potential sensitive plant or animal habitat. This task will be conducted during the wetland delineation field survey and is included in that cost estimate.

Wetland and Biological Reports
Tetra Tech will provide two reports in support of the USACE permit application: Wetland Determination/Delineation OHWM Report and Biological Summary Report. The Wetland Determination/Delineation OHWM Report of the determination and delineation of wetlands within the project will be prepared after the field work is completed. The report will include a description of each wetland delineated including a recommended jurisdictional determination as well as a description of waterbody's encountered with a calculated OHWM. The report will include figures with the locations and sizes of each delineated wetland as well as photographic documentation of each wetland. The Biological Summary Report summarizing the general habitat conditions as well as the potential for impacts to federal or state listed as threatened or endangered species will be prepared upon completion of the field survey.

Cultural resource survey and report

Tetra Tech will conduct a site file search and literature review to determine if previously recorded cultural resources are present within the project area. The site file search will be conducted through the Colorado Historic Society Office of Archaeology and Historical Preservation (OAHP) Colorado Cultural Resource On-line Database (Compass), which includes records of all archaeological investigations that have been conducted and all cultural resources (prehistoric and historic archaeological sites) that have been previously recorded. Also included are records of properties listed on the National Register of Historic Places (NRHP). Tetra Tech will also review historic General Land Office (GLO) records and the Glenn R. Scott Historic Trail Maps to determine whether vestiges of trails, transportation routes, homesteads, or other historic resources may be present in the study corridor.

Following the completion of the site file search, Tetra Tech will conduct a pedestrian survey of the approximately 2.25 mile-long Project area corridor to determine if cultural resources are present and make recommendations of NRHP eligibility and mitigation measures. The pedestrian survey will be conducted in accordance with methods approved by the OAHP. The survey will consist of two staff archaeologists walking the Project area corridor spaced no more than 15 meters apart. Artifacts and archaeological features will be flagged, recorded, measured, photographed, and plotted via a sub-meter GPS recorder.

All potential cultural resource information will be documented on OAHP site forms and summarized in a report that will meet the report guidelines of the OAHP. For purposes of estimation this Scope of Work (SOW) is based upon the anticipation that the survey will require two staff archaeologists, and no more than two new cultural resources (sites and/or isolated finds) will be encountered. No subsurface testing or artifact collection is included in this task.

Following the completion of the above mentioned tasks, a Cultural Resources Inventory Report will be written to document each task's results, including all previously recorded sites, sites visible and identified on cartographic resources, and sites discovered during the pedestrian survey. The report will include results of the inventory and recommendations to avoid, minimize, and/or mitigate impacts to the cultural resources that are recommended as eligible for the NRHP. The report will follow OAHP's recommended format.

Permit Application

Upon completion of the field summary reports, a permit application will be prepared for submittal to the USACE. A meeting was held on May 27, 2015 to discuss permitting for this project. Rena Brand and Kiel Downing from the USACE, members of the Technical Advisory Team (project sponsors), and Peggy Bailey from Tetra Tech were present during the meeting. Ms. Brand and Mr. Downing were supportive of the project and under the preliminary design descriptions thought the project could be permitted under either a Nationwide Permit 27 (Aquatic Habitat Restoration, Establishment, and Enhancement Activities), Regional General Permit 12 (Aquatic Habitat Improvement for Stream Channels in Colorado) or a combination of the two. This cost estimate assumes the project will qualify for permitting under one of these options based on this initial preliminary discussion. The use of the nationwide permit will likely require the submittal of a Preconstruction Notification (PCN) in lieu of a permit application. A PCN includes the following items:

- Project description and purpose
- Quantity and type of dredged or fill material (determined with site plan development)
- Discussions on the direct and indirect effects caused by the activity
- Discussion of the cumulative impacts
- Design drawings

- Location maps
- Wetland delineation
- Cultural resource evaluation
- Threatened and endangered species review
- Explanations for compliance under each of the general conditions under the NWP

Assumptions: This scope assumes the USACE will issue a Nationwide Permit (NWP 27 and/or RGP 12) and mitigation will not be required. This scope also assumes a Biological Assessment will not be required.

Deliverables: A Wetland Determination/Delineation OHWM Report, a Biological Summary Report, a Cultural Resources Inventory Report, and the PCN all as described above will be prepared and submitted to the TAT for review. Final version will be included in the permit application submitted to USACE. We anticipate the USACE will submit the Biological Summary Report to the USFWS and CPW for review. Tetra Tech anticipates one round of review from the agencies prior to submittal of the final PCN.

Task I: Topographic and existing conditions mapping

Existing available topographic mapping developed for the previous Study will be utilized, coupled with additional GPS field surveys to extend the base mapping and bathymetric data. The surveyor will also look for existing property corners or rights-of-way monuments in the project area to help confirm property line information, however, a property boundary survey is not part of this scope of services.

We will coordinate with the utility companies that will likely have utilities within the project footprint to obtain their mapping information and incorporate this information into the project base map. Utility locates will also be requested. Survey crews will spend an estimated 5 days in the field collecting additional survey data including the following:

- Topographic data collection along the railroad bed and bathymetric surveys in the river upstream of the railroad bridge for use in the hydraulic analysis,
- Supplemental topographic and bathymetric data at the proposed diversion location for use in detailing the diversion structure,
- Supplemental topographic data downstream of the dam at the downstream tie-in locations,
- Additional survey data in the south floodplain for use in the channel design,
- Survey data at the gaging station to support the fish passage design, and
- Utility locates that are visible above ground, or below ground marked by the utility locator.

Assumptions: This task assumes permission can be obtained from the Railroad and adjacent property owners to access property to complete these surveys. In addition, we are assuming the river flow is low enough for the survey crew to wade and collect bathymetric data around the railroad bridge and immediately upstream of the measurement weir.

Deliverables: The deliverable for this task includes topographic base mapping, expanded and updated to include the additional surveys.

Task II. Channel design and hydraulic assessments

Proposed Channel
The channel will be developed to a preliminary design level which will include a grading plan with one (1) foot contours and site features. Working with the Colorado Parks and Wildlife, we will refine the channel alignment and cross sectional design; incorporate riffles, runs, pools and sinuosity; develop the grading and site plans and details for the tie-in locations (upstream at the confluence of Fraser and Colorado Rivers and the diversion structure and downstream below the dam where the new channel connects back to the Colorado River). This effort includes the preparation of typical details for cover and pool habitat, bank stabilization and revegetation. Plans and typical details will be submitted to the TAT (and CPW's TAT representatives) for review and comment. Plans and details will be revised based on feedback and input.

This task includes two meetings with CPW. The first meeting will be a work session to discuss plan details and establish objectives. The second meeting will be to review plans and discuss CPW comments. grading plans for

Hydraulic Analyses
Using the updated topographic information and river and reservoir grading plans (see Task IV), the proposed conditions hydraulic model (2-dimensional SRH-2D software) will be revised to reflect the configuration of Alternative 3. The proposed Alternative 3 conditions will be modeled over a range of flows and the results will be compared to the previous assessments for incipient motion. The hydraulic parameters of the proposed conditions river channel will be refined to ensure continuity between the existing river channel upstream and downstream of the project.
The 2-yr, 10-yr, 50-yr, 100-yr, 500-yr and PMF will be assessed and modeled through the proposed river channel, modified reservoir, and river channel downstream of the dam face to the County Road 578 Bridge. Additionally, the hydraulic conditions at the diversion structure, lateral weir, and at the confluence of the Fraser and Colorado Rivers will assessed for sediment continuity through the project and possible areas of sediment deposition.

Fish Passage Design
Prepare preliminary plans for fish passage at the gaging station. Develop base mapping from topographic surveys and prepare a preliminary plan and profile of the proposed passageway. Develop conceptual-level details.

Assumptions: This task assumes that CPW will provide general guidance on channel planform and habitat improvements for advancing the channel design. The channel design will be added/represented in the hydraulic model for the assessment of flooding, incipient motion and sediment transport.

Deliverables: A technical memorandum will be developed to document the design of the channel, and the results of the floodplain modeling. Mapping will also be prepared to show the 100-yr flood.

Task IIa. Verify and refine the inflowing sediment load rating curves

Sediment loading
Sediment sampling should be performed during spring runoff. Depending on the timing of implementation for the services described herein, the sediment sampling may not be possible until the spring of 2016. Sediment sampling informs on the total load of sediment moving through the system and with this information we are able to estimate the degradation that might occur at the diversion structure, which in turn, informs on the frequency of maintenance. Thus, depending on timing it is our suggestion that we move forward on the hydraulic analysis of Alternative 3, including incipient motion, the flood

events and bankfull design, and implement the sediment sampling and sediment analysis when conditions allow.

We propose to collect sediment samples from the cableway at the measuring weir, operated by Northern Colorado Water Conservancy District (with appropriate authorization and assuming the cable trolley can be outfitted with the USGS bedload and suspended load sampling reels). The County Road 57 Bridge (approx. 1.5 miles upstream) could be used as an alternative sediment sampling location if the cableway at the measuring weir cannot be used. Five or six measurements at medium to high flows should provide sufficient data to verify or supplement the 1980 Ward data used for the sediment transport analysis. In addition we will collect suspended sediment samples.

The results of the data collection will be compared to 1980 Ward data (used in the 2014 sediment transport study for Alternative 1) and either used to fill in the gaps in the Ward data or develop an updated sediment transport rating curve. This updated rating curve will be used to define the inflowing sediment load for the hydraulic analysis. The updated sediment transport rating curve developed from the bedload and suspended load sampling will be used to define the inflowing sediment load for the 2D modeling. The proposed Alternative 3 conditions will be modeled over a range of flows and the results will be compared to the previous assessments for both sediment transport.

Assumptions: This task assumes that sediment collection will be performed from either the cable at the measuring weir or upstream from the project at from the County Road 57 Bridge over the Fraser River.

Deliverables: Model results summary including a mapping and report.

Task III. Geotechnical assessments

The goal of the geotechnical assessment will be to evaluate the material in the reservoir for suitability in constructing the berm, the floodplain and the river channel; and to evaluate the need for a cutoff wall in/below the berm to address seepage issues.

Samples from the reservoir will be collected and analyzed for required soil properties (sieve analysis, hydrometer test, Atterberg limits, organic content, sulfates, chlorides and pH, standard Proctor, pinhole dispersion, permeability, unconfined compression, and direct shear and/or CU triaxial w/ pore pressure measurements (depending on soil props). Soil boring and subsurface field investigation will rely on published geologic mapping of the area, existing geologic/geotechnical investigations of the site, and other information that is available, particularly from the original Windy Gap design, to estimate the engineering properties of the foundation and embankment soils. This desk top analysis will be combined with gradation and testing of samples taken from the reservoir for further analysis.

Steady state and transient, finite element seepage models will be constructed using the SEEP/W module of Geostudio. A generalized maximum section will be constructed for high and low flow scenarios, with and without a slurry wall. Vertical and horizontal gradients will be calculated and results will be coupled with a SLOPE/W model to evaluate the berm performance under a range of conditions. Proposed slopes will be evaluated and minimum factors of safety will be calculated for end of construction, steady state, and rapid drawdown conditions, with and without pseudo-static loading.

Assumptions: For the purpose of this proposal we are assuming that the reservoir samples will be collected by the Subdistrict. We recommend a minimum of five samples, each approximately 5 gallons in volume, taken in appropriate and representative locations where sediment accumulation has occurred and

should be removed to restore storage. Subsurface borings and investigations will be based on existing available information as discussed above.

Deliverables: A report or technical memorandum will be prepared which will summarize the results of our literature review, present engineering properties of the soils used in our analyses including the input and output values for computer models, and present our opinions, conclusions and recommendations regarding the channel and berm from a geotechnical point of view. If appropriate, our report will present recommendations for additional investigations needed during subsequent design phases.

Task IV. Prepare preliminary site plans

A preliminary plan set will be developed to a level of sufficient detail to evaluate the major design features, identify issues for advancing to construction-level design and to develop a preliminary 'opinion of probable cost.' The plan set and design considerations will likely include the following:

Base Mapping
Base sheet mapping will be prepared at a scale of 1"=100' using the topographic surveys and mapping prepared for the original study. Base mapping will show existing features across the project site, including property lines (provided by the County GIS department), utility information, and dam facilities.

Demolition Plan
A plan sheet will be prepared showing the major site features and reservoir areas that will be removed as part of the project.

Site Plan
Prepare a site plan showing the proposed improvements including limits of river reconstruction, the diversion structure, limits of dam removal, the existing and proposed facilities and road right of way, lots and easements affected by the project, and the proposed maintenance road. Prepare a typical berm cross section and profile. Develop preliminary grading for the river, floodplain and berm with 2-foot contours and finish grade spot elevations for key elements of the proposed improvements. Finish grade will tie into existing contours around the proposed improvements. Include a preliminary layout plan for the utilities required to operate the proposed diversion structure and other utilities that are required to be relocated for the project.

Channel Layout Plan and Profile
Prepare a preliminary channel layout plan with planform geometry, habitat features and details. River profiles will also be set up for the new river alignment at 1"=100 horizontal and 1"=10' vertical. The river plan and profile sheets will show the vertical profile grade of the river thalweg and horizontal location of the river.

Reservoir Excavation Plans
Prepare a reservoir excavation plan with proposed contours for excavation in the existing reservoir. Run storage volume calculations and compare to storage requirements established in the Study. Prepare earthwork computations to evaluate cut-and-fill volumes and develop an implementation strategy to allow for staging the work including river diversions and dewatering dredged material. For purposes of this proposal, two revisions are included in order to allow for review by the Technical Advisory Team (TAT) and to develop a plan that best meets the goals of the project while balancing material requirements.

Access Road Plan and Profile

Develop a preliminary plan and profile for the access from US Highway 40 to the diversion structure location. Preliminary layout, profile and elevations will be provided as part of this task.

Assumptions: Two plan sets will be prepared. The first will be a draft-level plan set for review and comment from the TAT, permitting agencies and municipalities. The second will be final preliminary plans incorporating comments. No formal approvals from agencies or municipalities is anticipated for this work effort.

Deliverables: Twenty paper copies of the preliminary plan set as well as an electronic copy (pdf) for use in the reproduction of additional copies. A technical memorandum will also be prepared highlighting assumptions made in the development of the plan set and an outline of steps needed to proceed to final design and the preparation of construction drawings.

Task V. Prepare preliminary diversion structure plans

A preliminary plan set will be developed to evaluate the structural, mechanical and electrical design features of the diversion structure to a level of detail that will support a preliminary 'opinion of probable cost.' The design will include a layout plan, identification of equipment, and determination of power requirements. The plan set and design considerations will likely include the following:

Diversion Structure Layout
Prepare a plan sheet of the diversion structure with the lateral weir diversion, online weirs and the bridge crossing. The plan will show the foundation slab and wall layout for the diversion gate, sluice gates and the access bridge. Cross sections at the diversion gate, a typical sluice gate and access bridge will also be developed showing required wall and slab thicknesses. Foundation piles and wing walls will be shown if required. The drawings will be developed to a preliminary engineering level showing major concrete outlines and used to develop structural concrete quantities to refine the cost estimate. The lateral weir diversion structure will be designed for the PMF and seismic is assumed not to control.

Diversion and Sluice Gates Mechanical and Electrical Components
Mechanical and electrical equipment necessary for operation of the diversion and sluice gates will be located on a plan sheet of the diversion structure. Preliminary gate sizes and operator requirements will be established and costs will be derived from cut sheets from manufactures/suppliers. Layouts for mechanical equipment and fish screens (for optional installation if needed in the future) will be provided. The electrical layouts will include the basic power and controls interfacing requirements to establish construction costs.

Task VI. Prepare opinion of probable cost

A preliminary-level opinion of probable cost will be prepared to determine an approximate anticipated cost for construction. Cost estimates will be prepared using the preliminary designs, construction costs from past projects and other readily available cost information for construction of such facilities.

Assumptions: The opinion of probable costs will be based on unit prices estimates available from recent construction costs, and published data and sources.

Deliverables: A technical memorandum summarizing the opinion of probable costs.

Task VII. Meetings and coordination

This task includes time to coordinate efforts with the project team and meet with the TAT. We proposed three progress meetings be conducted with the TAT. The first meeting will be held following the completion of the site plan and reservoir excavation plan, completion of the updated hydraulic assessment, and completion of the geotechnical assessments. The second meeting will be held to review the draft plan set and opinion of probable cost. The final meeting will be held after the final plan set is completed.

This task also includes time to coordinate with Grand County to coordinate on requirements of a 1041 permit, and the Federal Emergency Management Agency (FEMA) to discuss floodplain regulations. Coordination with the State Engineers Office will be handled by the Subdistrict to identify requirements for modifying the dam.

Assumptions: The TAT meetings will be attended by a maximum of three project team members; the project manager, up to two other primary technical members and one junior engineer or support staff. The specific staffing will depend on the focus of the meeting. The meeting location will be in the Front Range, likely at the Tetra Tech Golden, Colorado office.

Deliverables: Schedule and conduct the TAT meeting. Prepare meeting notes and distribute to the TAT for review. Finalize the meeting notes.

SCHEDULE

The revised recommended sequence for implementing this work effort is to 1) prepare preliminary channel design and the Section 404 permit application, 2) develop base mapping and conduct the hydraulic assessment for the full range of flows including the PMF, 3) collect and assess the soil properties of the reservoir sediments and review Windy Gap geotechnical information, 4) prepare preliminary plans, and 5) prepare the opinion of probable costs.

This schedule assumes a start date by or before the fall of 2015. The sediment data collection and sediment transport analysis would be conducted in spring, 2016. Thus loading and discussions on maintenance and sediment removal would be done concurrently with the last several tasks as noted below.

Tasks	Start Date	Finish Date
IA - Prepare 404 Permit Application	August 1 2015	Nov 30 2016
I - Topographic and existing conditions mapping	completed Feb 2016	
II - Channel design and hydraulic assessments	April 30 2016	Nov 30 2016
II.A - Verify and refine the inflowing sediment load rating curves	May 31 2016	Aug 31 2016
III. Geotechnical assessments (preliminary)	completed Feb 2016	
IV. Prepare preliminary site plans	April 30 2016	Nov 30 2016
V. Prepare preliminary diversion structure plans	April 30 2016	Dec 31 2016
VI. Prepare opinion of probable cost	April 2016	Dec 31 2016
VII. Meetings and coordination	April 2016	Dec 31 2016
Final billing and close out project		Jan 31 2017

FEE SUMMARY

Tetra Tech staff and the entire Project Team are committed to completing this project expeditiously and within the proposed fee estimate. This estimate includes indirect costs for such things as survey equipment, travel, laboratory sampling, etc. A summary is provided below.

TASK	CWCB Contribution (WSRA)	total cost by task
TASK IA – 404 PERMIT APPLICATION*		**$ 32,652**
Develop preliminary proposed channel alignment and planform (with CPW) Wetland delineation and permit application ESA, historic/cultural/w etlands		
TASK I – TOPOGRAPHIC AND EXISTING CONDITIONS MAPPING		**$ 23,109**
Coordination for access, prep for field		
Call for locates, acquire available utility information Field surveys		
Update topography mapping		
TASK II – CHANNEL DESIGN AND HYDRAULIC ASSESSMENTS		**$ 70,700**
complete preliminary proposed channel alignment and planform (with CPW)		
Hydraulic analyses Conceptual fish passage design		
Task IIa-Verify and refine the inflowing sediment load rating curves		**$ 18,565**
TASK III - GEOTECHNICAL INVESTIGATIONS	**$ 10,000**	**$ 22,817**
Test material in reservoir		
Field borings along berm alignment Berm design for seepage		
TASK IV – DEVELOP PRELIMINARY DRAWING SET	**$ 10,000**	**$ 37,055**
Base mapping		
Draft-level *Site plan* *Grading and earthwork*		
Utility Plan		
Berm plan and profile		
Site plan for diversion Final preliminary plans **TASK V – DEVELOP PRELIMINARY DIVERSION STRUCTURE PLANS**	**$ 10,000**	**$ 127,821**
Bridge concept design		
Layout and structural design		
Prepare plans, sections, elevations Document analysis - bridge Gate Design		
Structure selction, loading		
concept design		
Mechanical and electrical drawings Document analysis - gates **TASK VI – OPINION OF PROBABLE COST, IMPLEMENTATION STRATEGIES**		**$ 12,834**
Quantities and unit price development; prepare opinion of probable cost		
Implementation strategies		
TASK VII – MEETINGS AND COORDINATION Meet and coordinate with agencies and municipalities		**$ 39,951**
Coordination and project management		
Project team meetings		
QAQC		
TAT meetings		
Total	$ 30,000	$ 385,504

KEY PROJECT TEAM MEMBERS

Peggy Bailey, PE
Project Manager

Peggy Bailey will serve as the project manager for the Windy Gap Reservoir Modification, Preliminary Design Services. Ms. Bailey served at Project Manager for the alternatives development for the Windy

Gap Modification study and as such is very familiar with the project, the objectives, stakeholders and design constraints. Ms. Bailey is a Senior Hydraulic Engineer and Project Manager in the Breckenridge office of Tetra Tech Inc. She has a diverse range of experience specializing in water resources, hydraulic engineering and civil design. Her primary expertise is in hydrology, hydraulics, aquatic restoration, site planning, and civil engineering. Ms. Bailey has assisted and overseen numerous projects involving river restoration, flood control, wetlands creation, hydraulic structures, stormwater runoff analysis, environmental and feasibility studies, comprehensive planning and engineering for multi-phase development, applications for permits, interfacing with municipalities, preparation of construction documents and construction observation.

Robert Mussetter, P.E, PhD
Hydraulic and Sediment Transport

Dr. Bob Mussetter will be responsible for aspects of the project involving hydraulic and sediment transport analysis. Dr. Mussetter has over 30 years of experience in river engineering and fluvial geomorphology in a wide variety of environments throughout the U.S. and internationally, Much of his work has involved eco-hydraulic analysis, the objective of which is to understand and quantify the linkages between hydraulic and sediment transport processes and aquatic habitat. He supported the Windy Gap Reservoir Modifications Study, specifically evaluating sediment transport. Dr. Mussetter is currently Project Manager for a long-term contract to support the California Department of Water Resources and the other members of the Restoration Team that includes the U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, CA Department of Fish and Game and other agencies and stakeholders to implement a settlement agreement to restore habitat for salmonids and other native fish species to a 150-mile reach of the San Joaquin River. He has also had significant involvement over the past two decades in efforts to recover the four endangered fish species in the Upper Colorado River basin, and has completed numerous other studies related to the linkage between hydraulic and sediment transport processes and instream and riparian habitat. It may also be of interest to the review panel that, early in his career, Dr. Mussetter designed the Fraser River measurement weir that is located at the head of the study reach.

Tom Wesche, PhD
Fisheries

Dr. Thomas A. Wesche, Professor Emeritus of Water Resources at the University of Wyoming and Principal Scientist with HabiTech, Inc. has 40 years of research and consulting experience in river ecology and restoration throughout the western U.S. Dr. Wesche is a Fisheries Professional Emeritus, certified by the American Fisheries Society, and a Professional Hydrologist, certified by the American Institute of Hydrology. Since 1973, he has authored numerous publications regarding trout stream ecology in the Rocky Mountain region, including the evaluation of salmonid habitat, stream flow – habitat relationships, and the influence of stream habitat quality on fish populations. He has also designed, permitted and provided oversight for many trout stream restoration projects. Dr. Wesche has worked with Peggy Bailey and Tetra Tech since 2007 on developing the Grand County Stream Management Plan, with primary responsibilities being the evaluation of aquatic habitat throughout Grand County, the development of environmental flow recommendations, and the identification of stream restoration needs. For the Windy Gap By-Pass Project, Dr. Wesche will continue to lead the aquatic community and habitat evaluation effort and will work closely with the other project scientists and engineers to develop and evaluate alternatives.

Chris Ansari
Biologist

Mr. Ansari has over 15 years of experience conducting biological resource surveys. Mr. Ansari served as the lead for Section 404 permitting projects and is proficient in USACE protocol wetland delineations having conducted delineations in Colorado, Wyoming, Idaho, Oregon, Nevada, Arizona, Virginia, and West Virginia. Mr. Ansari conducts biological surveys for threatened and endangered flora and fauna. His experience ranges across the western United States and includes serving as a biologist for the National Park Service as well as the U.S. Forest Service. Mr. Ansari has conducted wildlife surveys for the Mojave desert tortoise, Washington ground squirrel, 3-toed woodpecker, and burrowing owls in addition to presence/absence surveys for migratory birds and raptors. Mr. Ansari has conducted species specific surveys for the federally listed Ute ladies-tresses orchid (*Spiranthes diluvialis*) as well as rare plant habitat surveys in Wyoming, Idaho, Nevada, Arizona, and Oregon.

Stephen Anderson, M.A. R.P.A
Archaeologist

Mr. Anderson is a cultural resource specialist for projects in the Intermountain West, Southwest, Great Plains, Midwestern Plains, and the Pacific Northwest. Mr. Anderson has experience working on archaeological projects in Colorado, Wyoming, Montana, Oregon, Idaho, Alaska, Utah, Iowa, South Dakota, North Dakota, Arizona, California, Nevada, Texas, Illinois, Oklahoma, and Kansas. He is a Registered Professional Archaeologist (RPA) and is permitted as a Principal Investigator in eleven western and Midwestern states and/or federal agencies and meets the Secretary of Interior standards. Mr. Anderson has extensive experience working on Federal Energy Regulatory Commission (FERC), US Army Corps of Engineers (USACE), Bureau of Land Management (BLM), US Forest Service (USFS), National Park Service (NPS), Federal Emergency Management Agency (FEMA), and US Department of Agriculture (USDA) Rural Utility Service (RUS) projects. His responsibilities include developing cost estimates and scopes of work for archaeological proposals, conducting site file searches, pedestrian surveys, construction monitoring, recording of sites, obtainment of Smithsonian numbers, assessment of resources for eligibility for inclusion in the National Register of Historic Places, and the mitigation of sites for proposed undertakings. Additionally, he is responsible for the supervision and coordination of the Tetra Tech, Inc. western states survey/excavation crews, managing GIS data and plan map graphics for site forms and reports, and writing technical reports.

Chris Durloo, PE, LEED BD+C
Civil Engineering

Mr. Durloo is a civil engineer located in the Breckenridge office of Tetra Tech. He has over 18 years of project experience primarily focused in the mountain region of Colorado. Mr. Durloo has performed as Senior Engineer and Project Manager on many projects for private, governmental and commercial clients. Mr. Durloo has broad experience over various types of civil engineering projects including large scale earthwork and development sites, transportation and utility design. Mr. Durloo will be the civil engineering design lead for the Windy Gap Reservoir project including the design of grading plans, utilities, earthwork and project phasing requirements.

Erik Flickinger, P.E.
Mechanical Engineering

Erik Flickinger will provide mechanical engineering support for the specification of the gates and gate operators. Eric is experienced in the field of Mechanical Engineering providing conceptual and detail design services of flood protection, pump stations, water control gates, cranes, hoist and mechanical operating machinery. Eric has experience with multi-disciplinary design integration, design optimization through finite element analysis, designing large-scale mechanical systems, inspection and analysis of

existing mechanical machinery, retrofit of ageing mechanical systems, and developing detailed design documents.

Albert Barnes, P.E.
Electrical Engineering

Albert Barnes will provide electrical engineering for the controls and remote operation of the gates. Albert has experience in the planning, designing, managing, constructing, and commissioning of the electrical and controls portions of multi-discipline industrial projects. His experience includes defining project scope, writing design criteria, estimating capital and labor costs, project management, design calculations, permitting, reviewing budgets, writing specifications, reviewing construction bid documents, reviewing shop drawings, PLC programming, construction supervision, shop and site inspections, and commissioning.

Extensive design experience includes detailed drawings for power distribution including substations, motor controls including variable frequency drives, grounding, lighting, grounding, conduit and cable tray layout, instrumentation and panel layouts, schematics and wiring diagrams. He has provided electrical and controls leadership for design, bid, construction, and commissioning on numerous multi-million dollar projects.

Brian Twitchell, P.E.
Structural Engineering

Brian Twitchell will provide structural engineering for the diversion structure and Access Road Bridge. Brian has structural engineering experience that includes design and analysis of bridges, tunnels, retaining walls, locks, dams and other navigation and flood control structures. Brian specializes in design of hydraulic concrete structures using in-the-wet construction methods and has experience designing steel, concrete, prestressed concrete and post tensioned concrete structures. Brian’s analysis and design experience includes conceptual level through final plans and specifications. Brian is also experienced in providing engineering support during construction and performing construction inspection.

BACKGROUND

This scope of work is based on conclusions and recommendations from the *Final Report, Windy Gap Reservoir Modification Study*[1] (Study) prepared for the Northern Colorado Water Conservancy District and Colorado Division Parks and Wildlife, dated February 2015 (Tetra Tech et al., 2015). In the Study Alternative 3 was identified as the alternative most likely to achieve the project objectives of providing benefit to the Colorado River, while being cost effective compared to the other alternatives. Alternative 3 separates the river from the reservoir with a new channel located through the southern half of the existing reservoir and a diversion structure to route flows from the river into the reservoir.

A preliminary scope of work was prepared and distributed to the TAT for review on May 8, 2015, after which a sub-group of the TAT met with the USACE to discuss permitting. We met with Rena Brand and Kiel Downing at the USACE office in Littleton and they provided guidance on the permit application. This amended scope of work includes services to prepare a 404 permit application in accordance with their guidance and suggestions and is outlined in Task IA.

OBJECTIVES

The purpose of this scope of work is to complete the assessment for Alternative 3 and prepare plans to a preliminary level of detail to facilitate review of the major design components of the project. This scope of work generally follows the tasks identified as 'Next Steps' in the Study with some minor modifications as noted below:

1. Evaluate the material in the reservoir for suitability in constructing the berm. Evaluate the need for a cut off wall in the berm.
2. Extend hydraulic analyses upstream of the railroad bridge to investigate bridge capacity and assess overtopping along the railroad. Assess and route the probable maximum flood (PMF) through the proposed river and modified reservoir.
3. Refine the channel cross section design to incorporate riffles, runs, pools and sinuosity; update and refine the hydraulic analysis for further balancing the high-water overflow with the required flows for sediment transport. In addition, assess the hydraulic conditions for Alternative 3 proposed channel alignment.
4. Collect additional data to verify and refine the inflowing sediment load rating curves.
5. Evaluate potential for utility conflicts. Determine power requirements for operating the diversion structure.
6. Develop preliminary plans, with grading and details. Refine grading as required to balance earthwork.
7. Prepare preliminary technical specifications (limited to materials and the selection of appurtenances only, as required to prepare preliminary opinion of probable costs).
8. Refine opinion of probable costs.
9. Consult with permitting agencies.

SCOPE OF WORK

Task 1A: Prepare 404 Permit Application

[1] Tetra Tech and HabiTech, Inc., 2015. *Final Report, Windy Gap Reservoir Modification Study*. Prepared for Colorado Division of Parks and Wildlife and Northern Colorado Water Conservancy District. Granby, Colorado, February 2015.

Consult with state and federal agencies
Tetra Tech will consult by phone with the USACE, USFWS and CPW prior to fieldwork. Consulting with the USACE will confirm wetland survey designs and the permitting process. USFWS and CPW will be consulted to confirm biological survey design, information on federally listed as threatened and endangered species as well as state species of concern. Communication will be maintained with the agencies to ensure the efficiency of the permitting process.

Field surveys
Existing information will be reviewed for documented wetlands and the preferred habitats for federally listed as threatened and endangered species as well as state species of concern with the potential to occur in the project prior to the field surveys. Tetra Tech will also prepare field survey maps, data sheets, photo logs, and health and safety protocols prior to field work.

Wetland Determination and Delineation
A wetland determination and delineation will be conducted for each of the locations listed following USACE guidelines. Wetlands will be delineated following the procedures in the *U.S.* Army *Corps of Engineers Wetlands Delineation Manual (1987)*. Included in this task will be a determination of the Ordinary High Water Mark (OHWM) for identifying the jurisdictional boundary of waters of the US. The OHWM and any wetlands found will be recorded with datasheets, photos and GPS data. This task is estimated to require a 2-day field effort, plus travel to and from the project area.

Biological Habitat Evaluation
During the field visit, a biological survey will be conducted to identify the general habitat characteristics and to identify potential federal or state listed threatened or endangered species in the area. This survey is part of the requirement for a USACE permit. The biological field survey will be conducted using meandering transects across the project area, focusing on areas of potential sensitive plant or animal habitat. This task will be conducted during the wetland delineation field survey and is included in that cost estimate.

Wetland and Biological Reports
Tetra Tech will provide two reports in support of the USACE permit application: Wetland Determination/Delineation OHWM Report and Biological Summary Report. The Wetland Determination/Delineation OHWM Report of the determination and delineation of wetlands within the project will be prepared after the field work is completed. The report will include a description of each wetland delineated including a recommended jurisdictional determination as well as a description of waterbody's encountered with a calculated OHWM. The report will include figures with the locations and sizes of each delineated wetland as well as photographic documentation of each wetland. The Biological Summary Report summarizing the general habitat conditions as well as the potential for impacts to federal or state listed as threatened or endangered species will be prepared upon completion of the field survey.

Cultural resource survey and report

Tetra Tech will conduct a site file search and literature review to determine if previously recorded cultural resources are present within the project area. The site file search will be conducted through the Colorado Historic Society Office of Archaeology and Historical Preservation (OAHP) Colorado Cultural Resource On-line Database (Compass), which includes records of all archaeological investigations that have been conducted and all cultural resources (prehistoric and historic archaeological sites) that have been previously recorded. Also included are records of properties listed on the National Register of Historic Places (NRHP). Tetra Tech will also review historic General Land Office (GLO) records and the Glenn R. Scott Historic Trail Maps to determine whether vestiges of trails, transportation routes, homesteads, or other historic resources may be present in the study corridor.

Following the completion of the site file search, Tetra Tech will conduct a pedestrian survey of the approximately 2.25 mile-long Project area corridor to determine if cultural resources are present and make recommendations of NRHP eligibility and mitigation measures. The pedestrian survey will be conducted in accordance with methods approved by the OAHP. The survey will consist of two staff archaeologists walking the Project area corridor spaced no more than 15 meters apart. Artifacts and archaeological features will be flagged, recorded, measured, photographed, and plotted via a sub-meter GPS recorder.

All potential cultural resource information will be documented on OAHP site forms and summarized in a report that will meet the report guidelines of the OAHP. For purposes of estimation this Scope of Work (SOW) is based upon the anticipation that the survey will require two staff archaeologists, and no more than two new cultural resources (sites and/or isolated finds) will be encountered. No subsurface testing or artifact collection is included in this task.

Following the completion of the above mentioned tasks, a Cultural Resources Inventory Report will be written to document each task's results, including all previously recorded sites, sites visible and identified on cartographic resources, and sites discovered during the pedestrian survey. The report will include results of the inventory and recommendations to avoid, minimize, and/or mitigate impacts to the cultural resources that are recommended as eligible for the NRHP. The report will follow OAHP's recommended format.

Permit Application

Upon completion of the field summary reports, a permit application will be prepared for submittal to the USACE. A meeting was held on May 27, 2015 to discuss permitting for this project. Rena Brand and Kiel Downing from the USACE, members of the Technical Advisory Team (project sponsors), and Peggy Bailey from Tetra Tech were present during the meeting. Ms. Brand and Mr. Downing were supportive of the project and under the preliminary design descriptions thought the project could be permitted under either a Nationwide Permit 27 (Aquatic Habitat Restoration, Establishment, and Enhancement Activities), Regional General Permit 12 (Aquatic Habitat Improvement for Stream Channels in Colorado) or a combination of the two. This cost estimate assumes the project will qualify for permitting under one of these options based on this initial preliminary discussion. The use of the nationwide permit will likely require the submittal of a Preconstruction Notification (PCN) in lieu of a permit application. A PCN includes the following items:

- Project description and purpose
- Quantity and type of dredged or fill material (determined with site plan development)
- Discussions on the direct and indirect effects caused by the activity
- Discussion of the cumulative impacts
- Design drawings

- Location maps
- Wetland delineation
- Cultural resource evaluation
- Threatened and endangered species review
- Explanations for compliance under each of the general conditions under the NWP

Assumptions: This scope assumes the USACE will issue a Nationwide Permit (NWP 27 and/or RGP 12) and mitigation will not be required. This scope also assumes a Biological Assessment will not be required.

Deliverables: A Wetland Determination/Delineation OHWM Report, a Biological Summary Report, a Cultural Resources Inventory Report, and the PCN all as described above will be prepared and submitted to the TAT for review. Final version will be included in the permit application submitted to USACE. We anticipate the USACE will submit the Biological Summary Report to the USFWS and CPW for review. Tetra Tech anticipates one round of review from the agencies prior to submittal of the final PCN.

Task I: Topographic and existing conditions mapping

Existing available topographic mapping developed for the previous Study will be utilized, coupled with additional GPS field surveys to extend the base mapping and bathymetric data. The surveyor will also look for existing property corners or rights-of-way monuments in the project area to help confirm property line information, however, a property boundary survey is not part of this scope of services.

We will coordinate with the utility companies that will likely have utilities within the project footprint to obtain their mapping information and incorporate this information into the project base map. Utility locates will also be requested. Survey crews will spend an estimated 5 days in the field collecting additional survey data including the following:

- Topographic data collection along the railroad bed and bathymetric surveys in the river upstream of the railroad bridge for use in the hydraulic analysis,
- Supplemental topographic and bathymetric data at the proposed diversion location for use in detailing the diversion structure,
- Supplemental topographic data downstream of the dam at the downstream tie-in locations,
- Additional survey data in the south floodplain for use in the channel design,
- Survey data at the gaging station to support the fish passage design, and
- Utility locates that are visible above ground, or below ground marked by the utility locator.

Assumptions: This task assumes permission can be obtained from the Railroad and adjacent property owners to access property to complete these surveys. In addition, we are assuming the river flow is low enough for the survey crew to wade and collect bathymetric data around the railroad bridge and immediately upstream of the measurement weir.

Deliverables: The deliverable for this task includes topographic base mapping, expanded and updated to include the additional surveys.

Task II. Channel design and hydraulic assessments

Proposed Channel
The channel will be developed to a preliminary design level which will include a grading plan with one (1) foot contours and site features. Working with the Colorado Parks and Wildlife, we will refine the channel alignment and cross sectional design; incorporate riffles, runs, pools and sinuosity; develop the grading and site plans and details for the tie-in locations (upstream at the confluence of Fraser and Colorado Rivers and the diversion structure and downstream below the dam where the new channel connects back to the Colorado River). This effort includes the preparation of typical details for cover and pool habitat, bank stabilization and revegetation. Plans and typical details will be submitted to the TAT (and CPW's TAT representatives) for review and comment. Plans and details will be revised based on feedback and input.

This task includes two meetings with CPW. The first meeting will be a work session to discuss plan details and establish objectives. The second meeting will be to review plans and discuss CPW comments. grading plans for

Hydraulic Analyses
Using the updated topographic information and river and reservoir grading plans (see Task IV), the proposed conditions hydraulic model (2-dimensional SRH-2D software) will be revised to reflect the configuration of Alternative 3. The proposed Alternative 3 conditions will be modeled over a range of flows and the results will be compared to the previous assessments for incipient motion. The hydraulic parameters of the proposed conditions river channel will be refined to ensure continuity between the existing river channel upstream and downstream of the project.
The 2-yr, 10-yr, 50-yr, 100-yr, 500-yr and PMF will be assessed and modeled through the proposed river channel, modified reservoir, and river channel downstream of the dam face to the County Road 578 Bridge. Additionally, the hydraulic conditions at the diversion structure, lateral weir, and at the confluence of the Fraser and Colorado Rivers will assessed for sediment continuity through the project and possible areas of sediment deposition.

Fish Passage Design
Prepare preliminary plans for fish passage at the gaging station. Develop base mapping from topographic surveys and prepare a preliminary plan and profile of the proposed passageway. Develop conceptual-level details.

Assumptions: This task assumes that CPW will provide general guidance on channel planform and habitat improvements for advancing the channel design. The channel design will be added/represented in the hydraulic model for the assessment of flooding, incipient motion and sediment transport.

Deliverables: A technical memorandum will be developed to document the design of the channel, and the results of the floodplain modeling. Mapping will also be prepared to show the 100-yr flood.

Task IIa. Verify and refine the inflowing sediment load rating curves

Sediment loading
Sediment sampling should be performed during spring runoff. Depending on the timing of implementation for the services described herein, the sediment sampling may not be possible until the spring of 2016. Sediment sampling informs on the total load of sediment moving through the system and with this information we are able to estimate the degradation that might occur at the diversion structure, which in turn, informs on the frequency of maintenance. Thus, depending on timing it is our suggestion that we move forward on the hydraulic analysis of Alternative 3, including incipient motion, the flood

events and bankfull design, and implement the sediment sampling and sediment analysis when conditions allow.

We propose to collect sediment samples from the cableway at the measuring weir, operated by Northern Colorado Water Conservancy District (with appropriate authorization and assuming the cable trolley can be outfitted with the USGS bedload and suspended load sampling reels). The County Road 57 Bridge (approx. 1.5 miles upstream) could be used as an alternative sediment sampling location if the cableway at the measuring weir cannot be used. Five or six measurements at medium to high flows should provide sufficient data to verify or supplement the 1980 Ward data used for the sediment transport analysis. In addition we will collect suspended sediment samples.

The results of the data collection will be compared to 1980 Ward data (used in the 2014 sediment transport study for Alternative 1) and either used to fill in the gaps in the Ward data or develop an updated sediment transport rating curve. This updated rating curve will be used to define the inflowing sediment load for the hydraulic analysis. The updated sediment transport rating curve developed from the bedload and suspended load sampling will be used to define the inflowing sediment load for the 2D modeling. The proposed Alternative 3 conditions will be modeled over a range of flows and the results will be compared to the previous assessments for both sediment transport.

Assumptions: This task assumes that sediment collection will be performed from either the cable at the measuring weir or upstream from the project at from the County Road 57 Bridge over the Fraser River.

Deliverables: Model results summary including a mapping and report.

Task III. Geotechnical assessments

The goal of the geotechnical assessment will be to evaluate the material in the reservoir for suitability in constructing the berm, the floodplain and the river channel; and to evaluate the need for a cutoff wall in/below the berm to address seepage issues.

Samples from the reservoir will be collected and analyzed for required soil properties (sieve analysis, hydrometer test, Atterberg limits, organic content, sulfates, chlorides and pH, standard Proctor, pinhole dispersion, permeability, unconfined compression, and direct shear and/or CU triaxial w/ pore pressure measurements (depending on soil props). Soil boring and subsurface field investigation will rely on published geologic mapping of the area, existing geologic/geotechnical investigations of the site, and other information that is available, particularly from the original Windy Gap design, to estimate the engineering properties of the foundation and embankment soils. This desk top analysis will be combined with gradation and testing of samples taken from the reservoir for further analysis.

Steady state and transient, finite element seepage models will be constructed using the SEEP/W module of Geostudio. A generalized maximum section will be constructed for high and low flow scenarios, with and without a slurry wall. Vertical and horizontal gradients will be calculated and results will be coupled with a SLOPE/W model to evaluate the berm performance under a range of conditions. Proposed slopes will be evaluated and minimum factors of safety will be calculated for end of construction, steady state, and rapid drawdown conditions, with and without pseudo-static loading.

Assumptions: For the purpose of this proposal we are assuming that the reservoir samples will be collected by the Subdistrict. We recommend a minimum of five samples, each approximately 5 gallons in volume, taken in appropriate and representative locations where sediment accumulation has occurred and

should be removed to restore storage. Subsurface borings and investigations will be based on existing available information as discussed above.

Deliverables: A report or technical memorandum will be prepared which will summarize the results of our literature review, present engineering properties of the soils used in our analyses including the input and output values for computer models, and present our opinions, conclusions and recommendations regarding the channel and berm from a geotechnical point of view. If appropriate, our report will present recommendations for additional investigations needed during subsequent design phases.

Task IV. Prepare preliminary site plans

A preliminary plan set will be developed to a level of sufficient detail to evaluate the major design features, identify issues for advancing to construction-level design and to develop a preliminary 'opinion of probable cost.' The plan set and design considerations will likely include the following:

Base Mapping
Base sheet mapping will be prepared at a scale of 1"=100' using the topographic surveys and mapping prepared for the original study. Base mapping will show existing features across the project site, including property lines (provided by the County GIS department), utility information, and dam facilities.

Demolition Plan
A plan sheet will be prepared showing the major site features and reservoir areas that will be removed as part of the project.

Site Plan
Prepare a site plan showing the proposed improvements including limits of river reconstruction, the diversion structure, limits of dam removal, the existing and proposed facilities and road right of way, lots and easements affected by the project, and the proposed maintenance road. Prepare a typical berm cross section and profile. Develop preliminary grading for the river, floodplain and berm with 2-foot contours and finish grade spot elevations for key elements of the proposed improvements. Finish grade will tie into existing contours around the proposed improvements. Include a preliminary layout plan for the utilities required to operate the proposed diversion structure and other utilities that are required to be relocated for the project.

Channel Layout Plan and Profile
Prepare a preliminary channel layout plan with planform geometry, habitat features and details. River profiles will also be set up for the new river alignment at 1"=100 horizontal and 1"=10' vertical. The river plan and profile sheets will show the vertical profile grade of the river thalweg and horizontal location of the river.

Reservoir Excavation Plans
Prepare a reservoir excavation plan with proposed contours for excavation in the existing reservoir. Run storage volume calculations and compare to storage requirements established in the Study. Prepare earthwork computations to evaluate cut-and-fill volumes and develop an implementation strategy to allow for staging the work including river diversions and dewatering dredged material. For purposes of this proposal, two revisions are included in order to allow for review by the Technical Advisory Team (TAT) and to develop a plan that best meets the goals of the project while balancing material requirements.

Access Road Plan and Profile

Develop a preliminary plan and profile for the access from US Highway 40 to the diversion structure location. Preliminary layout, profile and elevations will be provided as part of this task.

Assumptions: Two plan sets will be prepared. The first will be a draft-level plan set for review and comment from the TAT, permitting agencies and municipalities. The second will be final preliminary plans incorporating comments. No formal approvals from agencies or municipalities is anticipated for this work effort.

Deliverables: Twenty paper copies of the preliminary plan set as well as an electronic copy (pdf) for use in the reproduction of additional copies. A technical memorandum will also be prepared highlighting assumptions made in the development of the plan set and an outline of steps needed to proceed to final design and the preparation of construction drawings.

Task V. Prepare preliminary diversion structure plans

A preliminary plan set will be developed to evaluate the structural, mechanical and electrical design features of the diversion structure to a level of detail that will support a preliminary 'opinion of probable cost.' The design will include a layout plan, identification of equipment, and determination of power requirements. The plan set and design considerations will likely include the following:

Diversion Structure Layout
Prepare a plan sheet of the diversion structure with the lateral weir diversion, online weirs and the bridge crossing. The plan will show the foundation slab and wall layout for the diversion gate, sluice gates and the access bridge. Cross sections at the diversion gate, a typical sluice gate and access bridge will also be developed showing required wall and slab thicknesses. Foundation piles and wing walls will be shown if required. The drawings will be developed to a preliminary engineering level showing major concrete outlines and used to develop structural concrete quantities to refine the cost estimate. The lateral weir diversion structure will be designed for the PMF and seismic is assumed not to control.

Diversion and Sluice Gates Mechanical and Electrical Components
Mechanical and electrical equipment necessary for operation of the diversion and sluice gates will be located on a plan sheet of the diversion structure. Preliminary gate sizes and operator requirements will be established and costs will be derived from cut sheets from manufactures/suppliers. Layouts for mechanical equipment and fish screens (for optional installation if needed in the future) will be provided. The electrical layouts will include the basic power and controls interfacing requirements to establish construction costs.

Task VI. Prepare opinion of probable cost

A preliminary-level opinion of probable cost will be prepared to determine an approximate anticipated cost for construction. Cost estimates will be prepared using the preliminary designs, construction costs from past projects and other readily available cost information for construction of such facilities.

Assumptions: The opinion of probable costs will be based on unit prices estimates available from recent construction costs, and published data and sources.

Deliverables: A technical memorandum summarizing the opinion of probable costs.

Task VII. Meetings and coordination

This task includes time to coordinate efforts with the project team and meet with the TAT. We proposed three progress meetings be conducted with the TAT. The first meeting will be held following the completion of the site plan and reservoir excavation plan, completion of the updated hydraulic assessment, and completion of the geotechnical assessments. The second meeting will be held to review the draft plan set and opinion of probable cost. The final meeting will be held after the final plan set is completed.

This task also includes time to coordinate with Grand County to coordinate on requirements of a 1041 permit, and the Federal Emergency Management Agency (FEMA) to discuss floodplain regulations. Coordination with the State Engineers Office will be handled by the Subdistrict to identify requirements for modifying the dam.

Assumptions: The TAT meetings will be attended by a maximum of three project team members; the project manager, up to two other primary technical members and one junior engineer or support staff. The specific staffing will depend on the focus of the meeting. The meeting location will be in the Front Range, likely at the Tetra Tech Golden, Colorado office.

Deliverables: Schedule and conduct the TAT meeting. Prepare meeting notes and distribute to the TAT for review. Finalize the meeting notes.

SCHEDULE

The revised recommended sequence for implementing this work effort is to 1) prepare preliminary channel design and the Section 404 permit application, 2) develop base mapping and conduct the hydraulic assessment for the full range of flows including the PMF, 3) collect and assess the soil properties of the reservoir sediments and review Windy Gap geotechnical information, 4) prepare preliminary plans, and 5) prepare the opinion of probable costs.

This schedule assumes a start date by or before the fall of 2015. The sediment data collection and sediment transport analysis would be conducted in spring, 2016. Thus loading and discussions on maintenance and sediment removal would be done concurrently with the last several tasks as noted below.

Tasks	Start Date	Finish Date
IA - Prepare 404 Permit Application	August 1 2015	Nov 30 2016
I - Topographic and existing conditions mapping	completed Feb 2016	
II - Channel design and hydraulic assessments	April 30 2016	Nov 30 2016
II.A - Verify and refine the inflowing sediment load rating curves	May 31 2016	Aug 31 2016
III. Geotechnical assessments (preliminary)	completed Feb 2016	
IV. Prepare preliminary site plans	April 30 2016	Nov 30 2016
V. Prepare preliminary diversion structure plans	April 30 2016	Dec 31 2016
VI. Prepare opinion of probable cost	April 2016	Dec 31 2016
VII. Meetings and coordination	April 2016	Dec 31 2016
Final billing and close out project		Jan 31 2017

FEE SUMMARY

Tetra Tech staff and the entire Project Team are committed to completing this project expeditiously and within the proposed fee estimate. This estimate includes indirect costs for such things as survey equipment, travel, laboratory sampling, etc. A summary is provided below.

TASK	CWCB Contribution (WSRA)	total cost by task
TASK IA – 404 PERMIT APPLICATION*		**$ 32,652**
Develop preliminary proposed channel alignment and planform (with CPW) Wetland delineation and permit application ESA, historic/cultural/w etlands		
TASK I – TOPOGRAPHIC AND EXISTING CONDITIONS MAPPING		**$ 23,109**
Coordination for access, prep for field		
Call for locates, acquire available utility information Field surveys		
Update topography mapping		
TASK II – CHANNEL DESIGN AND HYDRAULIC ASSESSMENTS		**$ 70,700**
complete preliminary proposed channel alignment and planform (with CPW)		
Hydraulic analyses Conceptual fish passage design		
Task IIa-Verify and refine the inflowing sediment load rating curves		**$ 18,565**
TASK III - GEOTECHNICAL INVESTIGATIONS	**$ 10,000**	**$ 22,817**
Test material in reservoir		
Field borings along berm alignment Berm design for seepage		
TASK IV – DEVELOP PRELIMINARY DRAWING SET	**$ 10,000**	**$ 37,055**
Base mapping		
Draft-level *Site plan* *Grading and earthwork*		
Utility Plan		
Berm plan and profile		
Site plan for diversion Final preliminary plans **TASK V – DEVELOP PRELIMINARY DIVERSION STRUCTURE PLANS**	**$ 10,000**	**$ 127,821**
Bridge concept design		
Layout and structural design		
Prepare plans, sections, elevations Document analysis - bridge Gate Design		
Structure selction, loading		
concept design		
Mechanical and electrical drawings Document analysis - gates **TASK VI – OPINION OF PROBABLE COST, IMPLEMENTATION STRATEGIES**		**$ 12,834**
Quantities and unit price development; prepare opinion of probable cost		
Implementation strategies		
TASK VII – MEETINGS AND COORDINATION Meet and coordinate with agencies and municipalities		**$ 39,951**
Coordination and project management		
Project team meetings		
QAQC		
TAT meetings		
Total	$ 30,000	$ 385,504

KEY PROJECT TEAM MEMBERS

Peggy Bailey, PE
Project Manager

Peggy Bailey will serve as the project manager for the Windy Gap Reservoir Modification, Preliminary Design Services. Ms. Bailey served at Project Manager for the alternatives development for the Windy

Gap Modification study and as such is very familiar with the project, the objectives, stakeholders and design constraints. Ms. Bailey is a Senior Hydraulic Engineer and Project Manager in the Breckenridge office of Tetra Tech Inc. She has a diverse range of experience specializing in water resources, hydraulic engineering and civil design. Her primary expertise is in hydrology, hydraulics, aquatic restoration, site planning, and civil engineering. Ms. Bailey has assisted and overseen numerous projects involving river restoration, flood control, wetlands creation, hydraulic structures, stormwater runoff analysis, environmental and feasibility studies, comprehensive planning and engineering for multi-phase development, applications for permits, interfacing with municipalities, preparation of construction documents and construction observation.

Robert Mussetter, P.E, PhD
Hydraulic and Sediment Transport

Dr. Bob Mussetter will be responsible for aspects of the project involving hydraulic and sediment transport analysis. Dr. Mussetter has over 30 years of experience in river engineering and fluvial geomorphology in a wide variety of environments throughout the U.S. and internationally, Much of his work has involved eco-hydraulic analysis, the objective of which is to understand and quantify the linkages between hydraulic and sediment transport processes and aquatic habitat. He supported the Windy Gap Reservoir Modifications Study, specifically evaluating sediment transport. Dr. Mussetter is currently Project Manager for a long-term contract to support the California Department of Water Resources and the other members of the Restoration Team that includes the U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, CA Department of Fish and Game and other agencies and stakeholders to implement a settlement agreement to restore habitat for salmonids and other native fish species to a 150-mile reach of the San Joaquin River. He has also had significant involvement over the past two decades in efforts to recover the four endangered fish species in the Upper Colorado River basin, and has completed numerous other studies related to the linkage between hydraulic and sediment transport processes and instream and riparian habitat. It may also be of interest to the review panel that, early in his career, Dr. Mussetter designed the Fraser River measurement weir that is located at the head of the study reach.

Tom Wesche, PhD
Fisheries

Dr. Thomas A. Wesche, Professor Emeritus of Water Resources at the University of Wyoming and Principal Scientist with HabiTech, Inc. has 40 years of research and consulting experience in river ecology and restoration throughout the western U.S. Dr. Wesche is a Fisheries Professional Emeritus, certified by the American Fisheries Society, and a Professional Hydrologist, certified by the American Institute of Hydrology. Since 1973, he has authored numerous publications regarding trout stream ecology in the Rocky Mountain region, including the evaluation of salmonid habitat, stream flow – habitat relationships, and the influence of stream habitat quality on fish populations. He has also designed, permitted and provided oversight for many trout stream restoration projects. Dr. Wesche has worked with Peggy Bailey and Tetra Tech since 2007 on developing the Grand County Stream Management Plan, with primary responsibilities being the evaluation of aquatic habitat throughout Grand County, the development of environmental flow recommendations, and the identification of stream restoration needs. For the Windy Gap By-Pass Project, Dr. Wesche will continue to lead the aquatic community and habitat evaluation effort and will work closely with the other project scientists and engineers to develop and evaluate alternatives.

Chris Ansari
Biologist

Mr. Ansari has over 15 years of experience conducting biological resource surveys. Mr. Ansari served as the lead for Section 404 permitting projects and is proficient in USACE protocol wetland delineations having conducted delineations in Colorado, Wyoming, Idaho, Oregon, Nevada, Arizona, Virginia, and West Virginia. Mr. Ansari conducts biological surveys for threatened and endangered flora and fauna. His experience ranges across the western United States and includes serving as a biologist for the National Park Service as well as the U.S. Forest Service. Mr. Ansari has conducted wildlife surveys for the Mojave desert tortoise, Washington ground squirrel, 3-toed woodpecker, and burrowing owls in addition to presence/absence surveys for migratory birds and raptors. Mr. Ansari has conducted species specific surveys for the federally listed Ute ladies-tresses orchid (*Spiranthes diluvialis*) as well as rare plant habitat surveys in Wyoming, Idaho, Nevada, Arizona, and Oregon.

Stephen Anderson, M.A. R.P.A
Archaeologist

Mr. Anderson is a cultural resource specialist for projects in the Intermountain West, Southwest, Great Plains, Midwestern Plains, and the Pacific Northwest. Mr. Anderson has experience working on archaeological projects in Colorado, Wyoming, Montana, Oregon, Idaho, Alaska, Utah, Iowa, South Dakota, North Dakota, Arizona, California, Nevada, Texas, Illinois, Oklahoma, and Kansas. He is a Registered Professional Archaeologist (RPA) and is permitted as a Principal Investigator in eleven western and Midwestern states and/or federal agencies and meets the Secretary of Interior standards. Mr. Anderson has extensive experience working on Federal Energy Regulatory Commission (FERC), US Army Corps of Engineers (USACE), Bureau of Land Management (BLM), US Forest Service (USFS), National Park Service (NPS), Federal Emergency Management Agency (FEMA), and US Department of Agriculture (USDA) Rural Utility Service (RUS) projects. His responsibilities include developing cost estimates and scopes of work for archaeological proposals, conducting site file searches, pedestrian surveys, construction monitoring, recording of sites, obtainment of Smithsonian numbers, assessment of resources for eligibility for inclusion in the National Register of Historic Places, and the mitigation of sites for proposed undertakings. Additionally, he is responsible for the supervision and coordination of the Tetra Tech, Inc. western states survey/excavation crews, managing GIS data and plan map graphics for site forms and reports, and writing technical reports.

Chris Durloo, PE, LEED BD+C
Civil Engineering

Mr. Durloo is a civil engineer located in the Breckenridge office of Tetra Tech. He has over 18 years of project experience primarily focused in the mountain region of Colorado. Mr. Durloo has performed as Senior Engineer and Project Manager on many projects for private, governmental and commercial clients. Mr. Durloo has broad experience over various types of civil engineering projects including large scale earthwork and development sites, transportation and utility design. Mr. Durloo will be the civil engineering design lead for the Windy Gap Reservoir project including the design of grading plans, utilities, earthwork and project phasing requirements.

Erik Flickinger, P.E.
Mechanical Engineering

Erik Flickinger will provide mechanical engineering support for the specification of the gates and gate operators. Eric is experienced in the field of Mechanical Engineering providing conceptual and detail design services of flood protection, pump stations, water control gates, cranes, hoist and mechanical operating machinery. Eric has experience with multi-disciplinary design integration, design optimization through finite element analysis, designing large-scale mechanical systems, inspection and analysis of

existing mechanical machinery, retrofit of ageing mechanical systems, and developing detailed design documents.

Albert Barnes, P.E.
Electrical Engineering

Albert Barnes will provide electrical engineering for the controls and remote operation of the gates. Albert has experience in the planning, designing, managing, constructing, and commissioning of the electrical and controls portions of multi-discipline industrial projects. His experience includes defining project scope, writing design criteria, estimating capital and labor costs, project management, design calculations, permitting, reviewing budgets, writing specifications, reviewing construction bid documents, reviewing shop drawings, PLC programming, construction supervision, shop and site inspections, and commissioning.

Extensive design experience includes detailed drawings for power distribution including substations, motor controls including variable frequency drives, grounding, lighting, grounding, conduit and cable tray layout, instrumentation and panel layouts, schematics and wiring diagrams. He has provided electrical and controls leadership for design, bid, construction, and commissioning on numerous multi-million dollar projects.

Brian Twitchell, P.E.
Structural Engineering

Brian Twitchell will provide structural engineering for the diversion structure and Access Road Bridge. Brian has structural engineering experience that includes design and analysis of bridges, tunnels, retaining walls, locks, dams and other navigation and flood control structures. Brian specializes in design of hydraulic concrete structures using in-the-wet construction methods and has experience designing steel, concrete, prestressed concrete and post tensioned concrete structures. Brian’s analysis and design experience includes conceptual level through final plans and specifications. Brian is also experienced in providing engineering support during construction and performing construction inspection.