Appendix A
Basic Services of Engineer
W.O. 15-10—Water Treatment Plant Chemical Building/Disinfection Improvements

Section 1. Engineer's Rights and Duties.

A. To furnish all labor, materials, equipment, supplies, and incidentals necessary to conduct and complete the Engineer's portion of the project as defined in the scope of work and to prepare and deliver to Billings all plans, specifications, bid documents, and other material as designated herein.

B. Ascertain such information as may have a bearing on the work from local units of government, utility companies, and private organizations and shall be authorized to procure information from other authorities besides Billings, but shall keep Billings advised as to the extent of these contacts and the results thereof.

C. Prepare and present such information as may be pertinent and necessary in order for Billings to pass critical judgment on the features of the work. The Engineer shall make changes, amendments or revisions in the detail of the work as may be required by Billings. When alternates are being considered, Billings shall have the right of selection.

D. Engineer's work shall be in accordance with the standards of sound engineering and present City, State, and National standards and policies currently in use.

E. Conform to the requirements of the Montana Code Annotated Title 18 "Public Contracts" and more particularly Sections 18-2-121 and 18-2-122, and all other codes of the State of Montana applicable to providing professional services including codes and standards nationally recognized.

F. The Engineer shall certify with the submission of final plans that the plans are in conformance with applicable sections of Title 69, Chapter 4, Part 5, of the Montana Code Annotated as pertaining to existing utilities.

G. To perform professional services in connection with the project and will serve as Billings' representative in those phases of the project to which this agreement applies.

H. Where Federal funds are involved, the necessary provisions to meet all requirements will be complied with and documents secured and placed in the bidding documents.

I. Submit an estimated progress schedule as to time and costs at the beginning of the work, and monthly progress reports thereafter until complete. The reports will include any problems, potential problems, and delays as foreseen by the Engineer. Reports will be submitted in a timely manner to permit prompt resolution of problems.

J. Contract administration duties will include review of contractor certified payrolls for wage rate compliance. Discrepancies in certified payrolls will be resolved with the Contractor. A signed Engineer's Payroll Check Sheet (included in the Standard Modifications to MPWSS) will be submitted as proof of this review with one copy of each payroll.

K. Name a Task Director who shall be the liaison between Billings and the Engineer. For this project the Task Director designated for the Engineer is Craig Habben working under the Principal-in-Charge, Amanda McInnis.

Section 2. Billings Rights and Duties.

A. To furnish all labor, materials, equipment, supplies, and incidentals necessary to conduct and complete Billings' portion of the project as designated in the scope of work.

B. Name a Task Director who shall be the liaison between the Engineer and Billings. For this project, the Task Director designated is Will Robbins, working under the City Engineer, Debi Meling.

Section 3. Scope of Work.

The project consists of engineering services for the design, bidding, construction, operation and maintenance manual, training and startup phases for the City of Billings Water Treatment Plant (WTP) Chemical Building/UV Improvements Project. The project is based on recommendations from the Water Treatment Facility Chemical Building and Disinfection Improvements – Chemical/Disinfection Systems Evaluation Report (HDR, 2014) for the chemical system and the City's preference to move forward with the ultraviolet (UV) disinfection system as well as chlorine upgrades and sodium hypochlorite provisions for a temporary system. The project also includes a second parallel filter effluent line from the Filter Building to the High Service Pump Station Transfer Pump Wetwell.

The scope of work is summarized below:

Chemical System

- Chemical Building
  - Locate all chemical facilities on the ground floor
  - Replace windows and doors
  - Perform minor repairs to building exterior
  - Provide exterior improvements to steps, landings and handrails
  - Replace boiler and accessories with new boiler and hot water heat system
  - Separate room drains and floor drains. Route floor drains to sewer collection system.
  - Replace 120 volt electrical system
  - Repair elevator
  - Provide adequate containment for all tanks
  - Remove unused piping, valves and equipment
- Bulk Chemical Building
  - Route sump pump discharge to sewer
  - Route chemical flush lines to new sump discharge line

- Chemicals
    - Remove equipment, piping, valves and tanks for carbon system, potassium permanganate, coagulant polymer, orthophosphate, caustic soda and ammonia.
    - PACL – continue use and replace all equipment, day tanks, valves and piping in the Chemical Building.
    - Chlorine – continue use. Expand chlorine feed room and provide improvements to monorail hoist system. Rearrange chlorinators in expanded room and reroute associated piping.
    - Filter Aid – continue use of dry filter aid. Locate all facilities on the ground floor. Replace all equipment, piping and valves.
    - Ferric Chloride – locate tote and metering pump on Ground Floor of Chemical Building.
    - Future Chemical/Piloting – provide a location for a chemical tote and metering pump location for experimenting with a future chemical or new blend of existing chemical.
    - Replace site piping and piping and valves at feed locations.

Disinfection System

- Chlorine
    - Continue current practice with the improvements described above. Also include piping to High Service Pump Station (HSPS) with feed point to adjust residual if needed.
    - Evaluate the need to dose chlorine following UV disinfection.
- Sodium Hypochlorite
    - Provide piping and valving that would allow for bulk sodium hypochlorite to be stored and fed from bulk tanks on the west side of the Bulk Chemical Building. No equipment would be provided at this time.
- UV
    - Provide a UV disinfection system on the discharge of the HSPS Transfer Pumps.
    - Evaluate UV reactor types to determine the most cost effective, reliable and maintainable system for Billings.
    - Pre-purchase UV system to provide a single design for the selected manufacturer.
    - Provide above ground building to house UV system. Building walls to be precast wall panels and roof to be precast hollow core panels.
    - Provide site piping to connect into existing Transfer Pump discharge piping. Evaluate and recommend level of redundancy of tie-in points.

Filter Effluent Waterline

- Route 60-inch pipe from stub-out south of the Filter Building to the east Transfer Pump Wetwell at HSPS.
- Repair landscaping and site to existing conditions.

Support Service

- Provide architectural design services:
    - Include repairs and improvements to Chemical Building.

    - Provide architecture of new UV Building to compliment existing plant architecture.
- Provide structural design services:
    - Include repairs and improvements to Chemical Building.
    - Provide structural services for new UV Building.
- Provide mechanical design services:
    - Include replacement of boiler system in Chemical Building with a hot water system.
    - Provide heating and ventilation of UV Building.
    - Provide plumbing systems for UV Building.
- Provide electrical design services:
    - Provide new 120 volt electrical in Chemical Building. Provide electrical to new Chemical System equipment.
    - Provide electrical system for new UV system and UV Building with appropriate reliability. Provide new Transformer T3-1 to serve 480 volt switchboard in the HSPS.
- Provide instrumentation and controls to support identified upgrades and new UV system.
- Provide bidding services
    - Bidding services based on pre-purchasing UV system and one construction bid package.
- Construction services
    - Provide construction services for Chemical System Improvements, new UV System and filter effluent waterline.
- Training, Startup and O&M assistance:
    - Coordinate training of new equipment with staff. Work with staff to develop protocol for operation of UV system including normal operation, backup operation and startup/operation on backup power.
    - Work with manufacturers and contractor to verify proper installation of chemical equipment and UV system. Verify new systems are functioning properly.
    - Develop electronic Operations Manual (eOM) for new UV system. Review and provide typical hard copies and electronic copy of equipment O&Ms.

DETAILED SCOPE OF SERVICES

The scope of services that will be utilized on the Water Treatment Plant Chemical Building/Disinfection Improvements is presented in the summaries for Tasks 100 through 600. The scope of services is organized as follows:

Task Series	Description
100	Project Initiation, Coordination and Management
200	Preliminary Design Phase
300	Final Design Phase
400	Bid Phase
500	Construction Phase
600	Training, Startup and eOM

TASK SERIES 100

101 – Project Initiation

The purpose of this task is to kick off the project externally and internally. A project management plan (PMP) and all the support paperwork will be developed for all team members to have available to understand the project, the project team and the project requirements. The PMP is updated with significant changes in the project. The project will be kicked off with the City with pertinent staff from the City and HDR to review the project components, schedule and the process for completing the design.

- Deliverables – Half day meeting with City, agenda and meeting minutes.

102 – Meetings with City Staff

During the preliminary design and final design phases of the project, key members of the Consultant design team will meet with the City staff to review the project. Meeting minutes will be prepared and distributed to all parties attending the meeting. Meetings will be approximately once a month with a review meeting at the completion of the draft Design Report, 60% Submittal and 95% Submittal. Ten total meetings are planned for design phase. Bidding and construction phase meetings are described elsewhere. Meetings to be held at the WTP Conference Room.

- Deliverables – Meeting minutes and decision log updated for each meeting

103 – Design, Bidding and Construction Services Project Management

As part of this task, the Engineer's Project Manager will lead coordination of the design team with the City as well as supervise the design team. Project Manager and Accountant will monitor project status, maintain project schedule and prepare financial documents.

- Deliverable – Monthly invoices

TASK SERIES 200 – PRELIMINARY DESIGN PHASE

This task series will further develop recommendations from the Chemical/Disinfection Evaluation as well as select a UV system for detailed design. The tasks associated with the preliminary design includes the following:

201 – Geotechnical Investigations

A soils consultant will perform geotechnical investigations to determine the structural design requirements and limitations for the UV Building and new waterlines.

- Deliverable – Geotechnical Report

202 – Perform Design Surveys

The overall scope is to provide topographic survey of the area from the Filter Building south to Belknap Ave and west to the clearwells. Survey will also include the area west and south of the Chemical Building for the new sump discharge to the sewer. The topographic survey will verify the location of structures and above ground appurtenances.

- The existing datum of the WTP will not be continued.
- The horizontal coordinates will be Montana coordinate system NAD 83 and the vertical will be NAVD 88.

- The existing control provided by the City will be verified.
- Control will be densified to accommodate topographic survey with robotic total station.
- City responsibility – provide utility locates and pertinent GPS information.

203 – Prepare Request for Qualifications (RFQ) Process for UV Equipment

Work with the City to identify reactors types and manufacturers that would be applicable for the Billings conditions. Prepare a RFQ for UV Systems and distribute to the potential manufacturers. Evaluate the qualifications received, call references, and create a shortlist of manufacturers.

- Deliverables – RFQ Package, Evaluation of qualifications received.

204 – Site Visits

Coordinate and travel with City personnel to evaluate existing UV systems on the City's shortlist. A maximum of four installations will be visited.

- Deliverables – Summary of observations from trip.

205 – Perform Procurement Process for UV Equipment

From the RFQ process and site visits, determine shortlist of manufacturers. Prepare procurement documents to send to shortlist of manufacturers. Documents to include front end specifications and technical specifications specific to purchasing UV equipment. Generic layout drawings, P&IDs and electrical one line drawings shall be included. Draft documents will be circulated to shortlisted bidders for review and comment. The bid form will incorporate a life cycle calculation that includes: capital cost, power cost, replacement costs and other future O&M costs. The bid documents shall include a prioritized preference factor on items important to the City and a detailed specification on warranty. HDR will distribute documents to shortlisted bidders, answer questions during bidding (a pre-bid meeting is not anticipated to be required), evaluate bids and supply the City with a recommendation for award. Services associated with a protest of award by a manufacturer is not included in the budget.

- Deliverables – Procurement Package, Addenda, Bid Recommendation.

206 – Montana Department of Environmental Quality (MDEQ) Coordination for UV Equipment

Coordinate with MDEQ and the selected manufacturer to obtain approval of recommended manufacturer from Procurement Bid.

- Deliverables – Support information for MDEQ review
- Assumptions – One trip to Helena for coordination meeting. The recommended UV manufacturer will be approved by MDEQ.

207 – UV Equipment Shop Drawings

HDR will receive, review and coordinate shop drawings with the selected and approved UV manufacturer.

208 - Develop a Lamp Break Response Plan

Develop a lamp break response plan that may be required for MDEQ approval for the project.

209 – Construction Cost Estimate
The estimated capital costs for the project will be updated from the Evaluation Report.

- Deliverable – Summary of Cost Estimate by facility.

210 – Prepare a Design Report
Prepare a design report that describes the project and the planned improvements. The report will include a section on construction sequencing and constructability. Preliminary drawings will be developed showing plan views of proposed improvements and key sections. A Building Information Management (BIM) 3D model will be used for the new UV Building. The Chemical System and Filter Effluent waterline will be produced in 2D. The cost estimate from the Evaluation will be updated as well as the project schedule. The report shall address DEQ design criteria.

- Deliverable – Draft Design Report (electronic copies of chapters as completed).
- Deliverable – BIM model to the City for review of basic layouts of UV facility at the 30% level.

211 – Review Design Report (30% Review)
Conduct internal reviews of Design Report. Incorporate review comments and submit to City for review. Conduct review meeting with the City.

- Deliverable – Draft Design Report (4 hard copies and one electronic copy).

212 – Finalize Design Report
Incorporate City review comments and finalize design report.

- Deliverable – Final Design Report (5 hard copies and one electronic copy).

213 – Internal Team Meetings
Regular conference calls will be conducted to coordinate between team members and to communicate information received from the City as well as obtain questions or decisions needed from the City.

TASK SERIES 300 – FINAL DESIGN
In this task, the Preliminary Design will be developed into more detailed engineered project elements. The design will be taken from the 30% Design Report level to 60% design level and then 95% level before being finalized for bid documents. The BIM model will be regularly shared with project staff and the City in digital format using Navisworks ™ reader software for model communication. Specifications will be prepared for 95% review and then finalized for bid. Specific tasks will include the following:

301 – Prepare 60% BIM Model and Drawings
The BIM models will be further developed for all disciplines providing structural sizing, equipment location, piping routing and major electrical facility location. Chemical System Improvements to be shown on 2D drawings utilizing photos as much as possible to indicate demolition and repairs. 2D site drawings, P&IDs drawings and electrical one-line drawings will be updated from preliminary design.

- Deliverable – See Task 302.

302 – Internal and External 60% Review

BIM models and 2D drawings will be reviewed internally by HDR. Review comments will be resolved and applicable comments incorporated in the City's review set. BIM model of the UV Building will be reviewed with City as well as the improvements developed on 2D drawings. City review comments will be resolved and applicable comments will be carried forward into the 95% design.

- Deliverables – BIM model and 2D drawings (4 half sized sets) for review. List of City review comments and how the comments were resolved.
- City responsibility – Provide one set of review comments.

303 – Prepare 95% BIM Model and Drawings

The BIM models for all disciplines will be fully developed showing details necessary for construction. Plan and section drawings will be extracted from the Building Information Model. Notes and additional details will be added to the drawings to complete the design. Existing facility 2D drawings will be further detailed. 2D site drawings, P&IDs drawings and 2D electrical drawings will be detailed for construction.

- Deliverable – See Task 305.

304 – Prepare Detailed Specifications

Final detailed specifications suitable for bidding and construction will be developed. These detailed specifications will be incorporated with the City's front-end documents.

- Deliverable – See Task 305.

305 – Internal and External 95% Review

BIM model, 2D drawings and specifications will be reviewed internally by HDR. Review comments will be resolved and applicable comments incorporated in the City's review set. BIM model will be reviewed with City as well as the 2D drawing set. Key components for the specifications will be reviewed with the City. City review comments will be resolved and applicable comments will be carried forward into the final bid set.

- Deliverables – BIM model, 2D drawing set and specifications for review. List of City review comments and how the comments were resolved.
- City responsibility – Provide one set of review comments.

306 – Finalize Design

Based on review comments, update BIM model and finalize 2D drawings and specifications.

- Deliverable – Bid Documents for advertisement. 4 sets (half-sized drawings) for the City and one set for each plan room.

307 – MDEQ Coordination for Construction Contract

HDR will coordinate all portions of the design with MDEQ to obtain a permit to construct. Any variances that will be needed will be requested from MDEQ.

- Deliverables – Two hard-copy review contract document sets to MDEQ and any variance requests.
- Assumptions – One trip to Helena.

308 – Building Permit
Assist the City in submitting building permit application.

- Deliverables – Building permit application and backup information.
- If necessary, any resubmittal information that may be required by Building Division.

309 – Construction Cost Estimate
The estimated capital costs for the project will be updated from the preliminary design.

- Deliverable – Summary of Cost Estimate by facility.

310 – Internal Team Meetings
Regular conference calls will be conducted to coordinate between team members and to communicate information received from the City as well as obtain questions or decisions needed from the City.

TASK SERIES 400 – BID PHASE

401 – Bidding Administrative Assistance
Produce and distribute bid documents to owner, prospective bidders and plan rooms. Answer bidder questions and prepare addenda as needed. Conduct pre-bid meeting. Attend Bid opening.

- Deliverable – Bid Documents, Advertisement, Pre-Bid Meeting Minutes and Addendums.

402 – Post-Bid Administrative Assistance
Receive, evaluate and tabulate bids. Assess completeness of bids. Review qualifications of bidders. Check references for two lowest bidders. Make recommendations to the City on award of contract.

- Deliverable – Summary of Bidder Qualifications and Recommendation of Award.

TASK SERIES 500 – CONSTRUCTION PHASE
Construction Phase scope of work is based on 52 week construction period, after which time only minor punch list items would need to be completed.

501 – Construction Initiation Services
The Consultant shall prepare construction contracts, conduct a preconstruction conference and prepare minutes summarizing the conference. The Consultant will provide the owner with three sets and the contractor one pdf of “Issue for Construction” plans and specifications.

502 – Office Assistance and Administration
During the construction phase of the project, the Consultant will provide office assistance to the City on the administration of the project. This effort will include review and preparation of change orders, shop drawing review, interpretation of drawings and specifications including answering requests for information (RFI), monitoring of compliance with procedure requirements on the project, coordinating with the contractor, evaluation of pay estimates, review for compliance of certified pay-rolls, and conducting weekly (or as needed) construction meetings.

503 – Field Services
The Consultant will provide half-time on-site construction observation services. A resident project representative will provide up to 1000 hours of construction observations and 500 hours of related tasks including travel to the plant. The resident project representative will monitor the project for compliance with contract documents.

504 – Construction Wrap-Up and Acceptance
Upon completion of the construction of the improvements, the Consultant will schedule and hold a final project walk-through and assist the City in the final wrap-up of the project, including preparing record drawings, preparation of a punch list, preparation of Certificate of Substantial Completion, information review and recommendation of final acceptance.

505 – Post-Construction Warranty Services
After final acceptance, the Consultant will provide warranty item consultation, assist in the eleven-month warranty inspection, and provide warranty follow-up.

TASK SERIES 600 – TRAINING, STARTUP AND ELECTRONIC OPERATIONS MANUAL PHASE (eOM)

601 – Training
Coordinate training of new equipment with manufacturers and the City. Work with staff to develop protocol for operation of UV system including normal operation, backup operation and startup/operation on backup power.

602 – Startup
Work with manufacturers and contractor to verify proper installation of chemical equipment and UV system. Coordinate startup of equipment with Contractor, manufacturer representative and the City. Verify new systems are functioning properly.

603 – eO&M
HDR will develop an Electronic Operations Manual (eOM) for the new UV Disinfection System. The eOM will provide the Owner's staff a graphical user interface to the information necessary to operate and maintain the plant facilities in an efficient and reliable manner. The eOM content will include facility and equipment descriptions, design criteria, process control narratives, design drawings, and vendor supplied equipment O&M manuals. The eOM will provide a permanent archive of the information. HDR will provide an eOM web site structure for the entire plant but will only provide content for the UV disinfection portion of the eOM at this time.

The eOM will be developed as a web application in the Microsoft ASP.net web environment and will function on the City's Windows-based server. The eOM will be internally accessible via Internet Explorer but will not be accessible by the general public. An HTML text editor will be embedded in the eOM web pages to enable easy text editing by City staff without having to know HTML. HDR owns the HTML editor enterprise license which allows FREE distribution provided the editor software is only used in HDR's eOM application. The recommended minimum hardware and software that the City will need to provide to host the eOM on the City server includes:

eOM Web Server Minimum Requirements

1. Microsoft Windows Server 2008 R2 Standard Edition or greater
2. 2 GHz dual/quad processor or better
3. 4 GB of RAM
4. 40 GB of hard drive space

eOM Client (End User) Machine - Software Minimum Requirements

1. Internet Explorer
2. Adobe Acrobat Reader
3. IIS (Internet Information Services 6.0 or higher)
4. Microsoft.NET Framework 3.5

Recommended Tools for Content Authors

1. Microsoft Office
2. Adobe Acrobat Standard - to modify new or scanned equipment O&M manuals in PDF format

The following items will be provided by the City:

1. Network server, network and personal computers, including standard Microsoft network software as described above.
2. Path to and necessary server space on the City's network server to host the eOM application.
3. Ancillary software on the City's computers necessary to run the eOM, including Microsoft Internet Explorer, Windows, and SQL Server.

A four hour kickoff workshop will be held to discuss general eOM content and the schedule for developing and implementing the eOM. The purpose of the workshop is to prepare a final web site map to illustrate the eOM layout and structure. HDR will prepare a draft web site map of the entire plant for review and comment prior to the workshop. The final web site map developed at the workshop will be emailed to City staff after the workshop for final approval. HDR will only prepare content for the UV disinfection portion of the eOM at this time.

The draft web site map will illustrate how and where the following will be organized:

1. The information structure, organization and level of detail.
2. How the navigation between each section will function.
3. What plant general reference information to include.
4. The unit process content detail to be provided.
5. How the equipment O&M manual hyperlinks will function.
6. An eOM content management guide.

The web site map will be developed in coordination with City staff, and will be specifically tailored to meet the requirements and needs of the plant staff.

- **Deliverables –** Meeting agenda and minutes for one four hour workshop.

- **Deliverables –** Draft eOM web site map prior to workshop.
- **Deliverables –** Final eOM web site map after the workshop for approval.

HDR will prepare the eOM manual structure for each unit process shown in the web site map but will provide content only for the UV disinfection section at this time. Example content definitions are shown in the following table. Note that content definitions for this project will be specific and customized to those sub-sections agreed upon and defined by the web site map developed with the plant staff.

Example Unit Process Content Pages	
Section	**Text**
Overview	This section will include the following narratives and photos: Purpose Theory Equipment List Equipment Photos with a Detailed Description
Process Flow Diagrams	Process flow diagrams to communicate the design intent to the plant staff. The diagrams will be created in Microsoft Visio and saved as PDF files. Both the Visio and PDF files will be included in the eOM. A total of 5 process flow diagrams are anticipated. In addition, HDR will incorporate the plant as-built drawings into the eOM Plant Reference section in PDF file format and provide hyperlinks to the drawings.
Design Criteria	Tabular listing of unit process sizes, loadings, and other design criteria.
Equipment	Hyperlinks to vendor supplied equipment manuals in PDF file format. Existing equipment O&M manuals that are only available in hard copy will be scanned into PDF files and hyperlinked within the eOM application
Controls	A description of manual and automatic equipment controls.
System Procedures	A list of general procedures for starting up and shutting down the process.
Troubleshooting	A compilation of both process and specific equipment troubleshooting guides.
Safety	General and process specific safety considerations.

HDR will provide the City with access to the draft eOM over the Internet for review approximately 30 days prior to startup of the unit process. Procurement of and hyperlinking to as-built equipment photographs will occur after startup and removal of all contractor equipment and materials. The draft eOM will be accessible by City staff as the unit process is started up. The final eOM will be delivered approximately 30 days following receipt of as-built drawings in PDF file format.

- **Deliverables –** Draft eOM accessible by plant staff via the Internet.
- **Deliverables –** Final eOM downloadable to City network server.

HDR will develop the draft and final eOM on an HDR server. Upon completion HDR will coordinate installation of the final eOM on the City's server with the City's information technology (IT) staff. The final eOM will be downloaded to the City's network server.

HDR will schedule a meeting with the plant staff, and facilitate two one-hour training sessions for the plant staff on how to use and maintain the eOM. The first one-hour training session will provide general instruction and use of the eOM. The second one-hour training session will provide instruction on how the plant staff can edit and revise the eOM.

- **Deliverables –** Coordinate with the City's IT staff to download and install final eOM.
- **Deliverables –** Provide two one-hour training sessions at plant to City O&M staff.