

Exhibit A

City of Madison, WI Starkweather Creek Coagulant Treatment / Phosphorus Removal Facility Phase II: Final Design, Permitting, Bidding, Construction Phase and Startup Professional Services

Introduction

The City of Madison (City) and Brown and Caldwell (BC) completed a feasibility level study for the coagulant treatment of wet weather flow from Starkweather Creek. The purpose of the treatment is to remove phosphorus from stormwater. The coagulant stormwater treatment concept consists of the following primary components:

1. Divert wet-weather flows via a pump station from Starkweather Creek to an off-line coagulant treatment system.
2. Inject coagulant into the diverted water at an offline location.
3. Conduct rapid and thorough mixing of the coagulant with the diverted water.
4. Allow the precipitates (floc containing phosphorus, sediment and other pollutants) to settle out in an offline pond.
5. Discharge the treated water from the settling pond to the stream via an existing side-channel.

BC developed a conceptual design for the facility under a Phase I study (see March 31, 2016 report). This study was amended based on additional analyses conducted in the fall of 2016 (see February 14, 2017 Technical Memo). As amended, the conceptual treatment system would consist of the following elements:

1. Inflow diversion structure with retractable gate and screening system to minimize trash / floatables entering the diversion.
2. Replacement of two existing CMP pipes at an abandoned railroad spur crossing the creek with box culverts and pneumatic weirs or retractable gates.
3. Install and grout 18-inch pipe in third existing CMP pipe at the abandoned railroad spur crossing the creek.
4. Treatment system inflow conveyance via a 48-inch RCP to a pump station.
5. A subsurface inlet pump station consisting of four 25-cfs submersible axial flow tube pumps equipped with variable frequency drives (VFDs) in conjunction with a wet well to accommodate the expected range of flows to the settling pond (maximum treatment flow rate ~ 100 cfs).
6. A rapid mix chamber with coagulant injection system just downstream from the pump station.
7. Modify the existing quarry pond with:
 - a. Normal pool elevation approximately 848 feet.
 - b. Flat pond bottom at a depth of approximately 23 feet.
 - c. Treated discharge to the pond at a depth of approximately 20 feet below normal pool elevation.
 - d. Pond overflow weir to return treated water back to channel.
8. An on-site building for bulk coagulant storage of coagulant, and housing of necessary maintenance equipment and system controls.

9. Telemetry for treatment system's remote monitoring and control.
10. Site grading to include the settling pond, access and maintenance drive, operations area, and bike trail. Construction will minimize or avoid impacts to FEMA mapped floodway.
11. Project site three-phase electrical service to treatment system, inlet control gates, stream crossing culvert gates, controls / storage building, and water pumping station.

Figure 1 attached to this scope of work identifies the project limits and the main elements included in the project.

Comprehensive / Overall Assumptions

Overall assumptions for performance of the scope of work and associated budget are provided below. Additional task-specific assumptions are included in the individual task descriptions.

1. **Scope Basis.** This scope of work is based on the conceptual system as described in the Phase I final Deliverable: *"Phase I Feasibility Analysis: Use of Coagulant for Phosphorus Treatment at Starkweather Creek, Madison WI"* (March 31, 2016) and the Amendment 4 Technical Memorandum (February 14, 2017). Should the City require a design direction different than described in the above referenced documents, an amendment may be required. The Facility does not need to achieve typical municipal WWTP requirements for facility life and materials. The Facility components will need to meet applicable codes as of December 31, 2017, including safety requirements, but will be designed in a manner to minimize design and construction costs while achieving performance and permitting requirements.
2. **Project Bid Packages.** It is assumed the City desires three bid packages. Two of the bid packages as described below will be developed by the City using design deliverables prepared by BC:
 - a. **Bid Set #1: Civil / Site Work:** land clearing, demolition, earthwork, stormwater diversion pipe, access and maintenance drive, operation's area, bike trail and structural components of: 1) stream culverts, 2) system diversion, 3) pump station, 4) mixing chamber, and 5) pond outlet structures, 6) lighting for access road and operations area.
 - b. **Bid Set #2: Treatment System:** The remaining portions of the project not listed under 2.a. above. These components include: the building and slab foundation, the non-structural components of: 1) the stream diversion structure, 2) weirs associated with the culverts in creek, 3) water depth and flow rate measurement instruments, 4) coagulant injection system, 5) rapid mix system, 6) the controls / storage building (including: mechanical, electrical, controls, telemetry, coagulant storage tanks and associated electronics), 7) water pump station, 8) floc discharge piping, 9) floc dewatering / polymer feed system, 10) electrical service, and 11) miscellaneous site lighting and appurtenances immediately associated with the building and pump station.

A third bid package will be fully prepared by the City for the portion of the bike trail not designed by BC for the bike bridge crossing of the Milwaukee Street Tributary. BC will not have any design responsibilities related to the third bid package.

3. Criteria:

- a. **Decisions.** Design decisions will primarily be reached in a workshop setting, without detailed technical memoranda. Major decisions for equipment selections will be carried forward from the pre-design phase. All other design decisions will be expedited between BC and City staff using workshops and direct communications. All decisions will be documented in a decision log.
- b. **Design Review.** Design deliverable milestone reviews will be streamlined where cost-effective by using structured review meetings.

- c. City Comments. The City project manager will compile and reconcile City staff comments on all BC deliverables. All project reviews and comment periods will be limited to 10 working days.
 - d. Funding. The documents will not require addressing any special funding provisions.
 - e. Specifications/Details. Preparation of contract design drawings and specifications will be based on the use of standard BC document protocols, CAD standards, technical specification formats, and special provisions required for the project. The City will provide and prepare the General Conditions, standard contract and other front-end documents. All specifications will be prepared in Microsoft Word format.
4. **Design Deliverables**. The major design deliverables will be as follows:
- a. Intermediate Designs
 - i. 30% concept drawings will be developed and discussed with the City for design issues. The concept drawings will only be prepared for the civil portion of the project and layout of the related structures of the treatment system. No structural, mechanical, electrical, or other components will be shown on the 30% concept drawings).
 - ii. 60% plans: suitable for government permitting requirements and draft special provisions and technical specifications. Cost estimates to be provided.
 - iii. 90% plans: final reviews and verifications, special provisions, and technical specifications. Cost estimates to be provided.
 - b. Final Plan set (100% plans for construction bidding)
 - i. Plan sheets setup for 22" x 34" size. Civil grading plan sheets will be setup at a 1 inch equals 20-foot scale, and other civil design portions will be setup at a suitable scale for the project. Plan sheets for other project disciplines will be setup for 22" x 34" and the scale will be chosen to appropriately display design information. Plan sheet will be printed and delivered at a 11" x 17" hard copy size.
 - ii. Three (3) sets hard copy.
 - iii. Electronic delivery shall be in PDF and CAD format (Civil 3D and Revit).
 - iv. Special Provisions and Technical Specifications.
 - v. City incorporates technical specifications into bid package.
5. **Work Completed by Others**. Services to be conducted by others, under direct agreement with the City, and not budgeted under this scope of work includes:
- a. Site Survey.
 - b. Geotechnical Investigation.
 - c. Wetland Delineation.
 - d. Site Environmental Assessments (Phase I, or other environmental services).
 - e. Design of bike trail outside of project limits, bike trail bridge and abutments crossing Milwaukee Street Tributary.
 - f. Landscape plan.
 - g. Public involvement activities except as noted under Task 120.
6. **Construction Phase Related Services**. Limited bidding, construction, and start-up phase services are included in this scope document. These services may be further defined and budgeted as an amendment to this agreement, once the design is 60 percent complete.

7. **Project Duration and Completion Date:** The level of effort is based on an eighteen (18) month design period and a twelve (12) month construction phase. Budgets are based on the assumption that all work will be completed by December 31, 2018.
8. **Site Environmental Conditions.** The design scope and budget assumes that there are no environmental remediation requirements at the project site.
9. **Project Related Travel.** At selected points during the design and construction phases of the project it will be important for selected BC staff to conduct a site visit either to observe existing conditions, to confirm construction quality, or to conduct system startup and training tasks. Reasonable, limited travel expenses shall be reimbursable to BC through this agreement. The table immediately below lists the out of town site visits / travel that shall be reimbursable under this contract. Out of town travel in addition to those identified in the table below are not budgeted.

Task / Expertise	Design Phase	Construction Phase	Startup, Training, O&M	Total
Coagulant Treatment	2	3	2	7
Pump Station	1	1	0	2
Structural	1	0	0	1
Mechanical	0	1	0	1
Electrical / SCADA	0	2	0	2
Instrumentation & Controls	0	2	0	2
TOTAL:	4	9	2	15

Task Descriptions

Specific tasks to be performed under this scope of work are summarized in the work breakdown table below. Following the table are detailed descriptions of each task.

Phase	Task #	Task Description
Project Management	100	<u>Project Management; and Related Coordination</u>
	110	Project Management
	120	Design Phase Coordination Meetings and Workshops
	130	Coordination with Other City Professional Service Providers
Pre-Design Activities	200	<u>Pre-Design Activities</u>
	211	Establish Detailed Design Criteria for Treatment
	212	System Hydrologic and Hydraulic Modeling
	213	Groundwater Assessment
Detailed Design	300/400/500	<u>Detailed Design Tasks</u>
	310/410/510	Civil and Site Work Design
	320/420/520	Process-Mechanical and Rapid-Mix Design
	330/430/530	Pump Station, In-Stream Gate(s); and System Inlet Diversion Gate Design
	340/440/540	Structural Design
	350/450/550	Architectural Design
	360/460/560	Electrical / SCADA Design
	370/470/570	Instrumentation and Controls Design
	380/480/580	Building Mechanical Design
	390/490/590	Document Preparation
591	Opinion of Probable Construction Cost	
Agency Permitting	600	<u>Agency Permitting and Regulatory Compliance</u>
	610	Federal, State, County, and City Permitting
	620	CLOMR and LOMR (FEMA) – E. Branch Starkweather Creek
	625	CLOMR and LOMR (FEMA) – Milwaukee Street Tributary
	630	System Performance Monitoring Design
640	Environmental Assessment Preparation	
Other Services	700	<u>Construction and Post-Construction Services</u>
	710	Bidding Phase Assistance – Bid Set #1 (Civil / Site)
	715	Bidding Phase Assistance – Bid Set #2 (Process / Mechanical/Electrical)
	720	Construction Phase Services – Bid Set #1 (Civil / Site)
	725	Construction Phase Services – Bid Set #2 (Process / Mechanical/Electrical)
730	System Startup, Training, and O&M Services	

Task 100 – Project Management and Related Coordination

Provide overall project coordination and management as described in subtasks below.

Task 110 – Project Management

Objective. To provide management, direction, coordination, and control of work associated with project schedule, budget, technical quality, and monthly progress reports and invoices for the project.

Approach. This task includes the following activities:

1. Maintain critical-path schedule.



2. Prepare monthly project status reports for submittal with progress payment invoices. Progress reports will identify budget status, progress status, activities of the previous month, and up-coming activities.
3. Coordinate project team.
4. Manage in-house budget and schedule.
5. Procure, supervise, and coordinate the activities of architectural subconsultant.
6. Coordinate QA/QC process

Products.

1. Monthly progress reports and invoices
2. Monthly schedule update.
3. Subconsultant contracts

City's Responsibilities. Review monthly progress reports and schedules and process invoices.

Assumptions: Project management effort is based on an 18-month design period and a 12-month construction period.

Task 120 – Design Phase Coordination Meetings and Workshops

Objective. To provide a regular forum for receipt, exchange, response, and documentation of project management, planning, and design related issues during the project.

Activities. This task includes the following coordination meetings:

1. Kick-off meeting between City staff and design team including four BC Team members to review major design elements, schedule, and key issues.
2. Up to eighteen (18) monthly conference calls during the design phase between BC and City to review project status, schedule, contract issues, and other project management related issues during permitting and design. Participants on the call may vary depending upon the stage of the project; however, the Consultant's PM and the City's PM will be regular attendees.
3. Three (3), four (4)-hour workshops at the City with BC Team members to discuss specific detailed design issues. BC Team members attending a workshop may vary depending on the topic under discussion. Attendance may include BC staff member(s) on a conference call / web connection.
4. Assist City in preparation and conducting one (1) public information meeting. BC will prepare PowerPoint slides and up to three (3) poster-size hard copy drawings based on CAD design products available from work conducted under Tasks 300 / 400 / 500 series. BC will budget two staff to attend the public information meeting.

Products.

1. Agenda to be distributed prior to the kick-off meeting and each design review workshop.
2. Meeting notes for each meeting and design review workshop.
3. Materials as identified under #4 above.

Assumptions

1. The City is responsible for all logistics, scheduling, and room arrangements for the public information meeting.
2. No renderings are included in the products for the public information meeting.

Task 130 - Coordination with Other City Other Professional Service Providers



Objective. This task covers work necessary to communicate and coordinate with, project related consultants that are under direct contract with the City.

Approach. BC will provide project background information and project data requirements to parties contracted with the City. Under this task, the BC will provide required information to guide others conducting the following work:

1. Field survey: BC will provide direction to the field survey regarding extent of survey boundary, coordinate and topographic requirements, natural and structural features to be surveyed, format for survey deliverables, and other requirements necessary for the design work described in this scope of work.
2. Wetland field delineations: BC will provide maps / drawings showing the limits of the project and land disturbing activities, approximate location of proposed subsurface infrastructure and above ground structures, and roadways.
3. Geotechnical / groundwater monitoring: BC will provide a map showing the approximate location of geotechnical bore locations and groundwater monitoring well locations. BC will provide requirements for soil testing, soil logs, soil classification (Unified Soil Classification System), and groundwater measurements (quality and gradient measurements). Furthermore, BC will review and analyze the reports provided by the geotechnical firm.

Assumptions:

1. The Consultant will budget up to two (2) site visits with the City's professional service providers.
2. BC is not conducting the field tasks or responsible for the quality of work conducted by the other professional services under contract with the City.
3. Findings and recommendations of Other Professionals Service Providers can be relied upon by BC without verification.

Products.

The Consultant will document correspondence with other professionals as part of the project communication log.

Task 200 - Pre-Design Activities

Task 211 – Establish Detailed Design Criteria for Treatment

Objective. Establish design criteria for the primary treatment system components including: system inlet / diversion structure as related to aquatic life and regulatory issues; coagulant storage tanks; coagulant metering pumps; coagulant flow rate and volume measurement; coagulant injection and rapid mixing; water depth and flow rate measurement; influent and effluent water quality monitoring; settling pond configuration; floc dredging and dewatering; polymer feed for floc dewatering; and treatment system operations logic.

Approach. The overall project objective is to treat approximately 3,500 acre-feet of stormwater from Starkweather Creek and remove approximately 1,660 pounds of total phosphorus during an average rainfall year. BC will develop project design criteria to meet these objectives based on the evaluation phase, previous jar testing results, and additional analyses and modeling completed during this phase of work.

Of particular note:

1. BC will conduct one (1) meeting with the City and WDNR to clarify the system inlet / diversion structure's design requirements for agency acceptance.



2. BC will conduct an analysis for the feasibility of a centrifuge floc dewatering system as compared to the currently proposed filter bag dewatering system. The analysis will provide an opinion of technical feasibility and a conceptual cost comparison to the dewatering filter bag approach.

Products. Brief Technical Memorandum summarizing the selected detailed design criteria, results of the system inlet design conditions, and the centrifuge feasibility assessment.

Assumptions:

1. The maximum water flow rate to be treated is approximately 100 cubic feet per second.
2. Liquid Aluminum Chlorohydrate (~12.4 percent aluminum) is the selected coagulant.
3. The expected coagulant dose is 4-5 milligrams of aluminum per liter of water.
4. The existing quarry pit will be modified and used for floc settling.
5. The system will not operate during winter months.
6. Wet floc will need to be removed from the bottom of the floc settling pond approximately once per every year or two depending upon the rain patterns, phosphorus concentration in the raw water, and other factors.
7. One (1) four (4) hour meeting will be held with the WDNR and City to clarify design needs for the inlet / diversion structure.

Task 212 - System Hydrologic and Hydraulic Modeling

Objective. A watershed-wide hydrologic and hydraulic model was created during the feasibility study. This model generated runoff volumes from the watershed and routed volumes to and through the East Branch of Starkweather Creek. This information was used to preliminarily size the conceptual inlet and outlet structures of the treatment system. This task includes refining the feasibility level hydrologic and hydraulic modeling to include the project design elements: structures, piping, pump station, and settling pond. The purpose of the modeling is to: 1) predict the annual runoff volume that can be treated by the system under various annual rainfall conditions, and 2) evaluate treatment system hydraulics: flows, treatment volumes, and treatment conveyance design parameters (size, slope, materials, etc.).

Approach. The following steps will be conducted under this task:

1. Perform expert review of the PC SWMM and XP SWMM models from a design level perspective and refine models based on the final design elements and configuration.
2. Use refined model to analyze the hydraulics of coagulant treatment system as design level efforts are conducted.
3. Determine treated water volume during various annual rainfall conditions and pump operation scenarios.
4. Verify residence time of the settling pond during various pump operation scenarios.

Products. H&H model of final design, technical memo describing model inputs, assumptions, and results. The model results will guide design criteria of the coagulant treatment system such as conveyance system size and elevations: gate, weir, and pump operations; and settling pond grading and operating water levels.

Assumptions:

1. The identical rainfall files used in the previous phase of the project will remain in use for this phase.

2. Model calibration to in-stream measurements (stage or discharge) is not included in this scope of work. Some comparisons to in-stream measured stages may be performed if field data is available.

Task 213 – Groundwater Assessment

Objective. Asses the likely flow interaction between the local shallow groundwater and the proposed pond under the concepts as recommended under the Amendment 4 Technical Memo.

Approach. The following steps will be conducted under this task:

1. Perform expert review of available file data on the site’s soil, and groundwater information. Data sources will include NRCS and Dane County soil information, Wisconsin Geological and Natural History Survey (WGNHS)’ and U.S. Geological Survey (USGS) data.
2. The existing data will be augmented with the site data collected from wells installed by the city in 2017 at, and near the project site.

Products. A technical memo will be prepared summarizing the analysis and professional opinion on likely groundwater flow interaction and estimated flow rates between the proposed pond and the site’s shallow groundwater under predicted pond water surface elevations.

Assumptions:

1. The site information gathered in 2017 will include well logs, and groundwater level elevation measurements from the wells.
2. All groundwater related field data will be collected by others and provided to BC at no cost under this contract.
3. No site visits or field investigations will be conducted by BC under this task.

Task 300 / 400 / 500 Series – Detailed Design Tasks

The Task 300 / 400 / 500 series tasks are for the effort required to advance the design from the preliminary design level to final design, ready for bidding of the project. This will be accomplished by dividing the detailed design into the following steps:

- Phase 300: A 30 percent design level review of figures showing the proposed civil and structural features in a meeting with City and BC staff. The project’s 30 percent design will include the civil components as follows: floc settling pond; stormwater diversion pipe; access and maintenance drive; stream culverts; diversion structure; pump station footprint; building footprint; mixing chamber; pond inlet and outlet structures/pipe; bike trail; and operations storage area.
The 30 percent design will not include plan sheets for structural, mechanical, electrical, controls, architectural, or other project components. These components will be described in text and conceptually shown on simple flow chart(s). No formal submittal to the city will be prepared.
- Phase 400: 60% design submittal of all design components of the system.
- Phase 500: 90% and Final Documents for bid package of all design components of the system.

After addressing comments from the 90% submittal, Final Documents will be developed and submitted to the City for bidding of the project. City’s comments will be incorporated into the Final Documents.

Assumptions. The following assumptions are made for this task:

1. The detailed scope assumes that decisions logged in the previous design phase will be followed in the subsequent design. Decisions that are changed or altered substantially will be addressed by amendment if necessary.

2. Documents for review by the City will be supplied only in electronic format (PDF).
3. Civil/Site-work drawings will be in AutoCAD Civil 3D v 2017 in accordance with Brown and Caldwell CAD Standards. The remaining drawings in the set will be done using AutoDesk Revit 2017.
4. BC equipment naming and numbering system will be used.
5. Land surveying services to be provided by a City surveyor or another surveyor under direct contract with the City.
6. Wetland field delineation to be provided by others under separate agreement with the City.
7. Geotechnical field services to be provided by others under separate agreement with the City.

Task 310/410 / 510 – Civil and Site Work Design

Objective. To design general and civil site work up to and including final drawings and specifications for bidding of the project.

Approach. This task consists of work necessary for completion of the general, civil, and site design included in this project. Civil drawings and specifications will be based on known identified buried utilities, site survey data, field delineated and located wetlands, engineering calculations, existing geotechnical information, and geotechnical information collected in the field under a separate contract. This task also includes design of maintenance access roadways, roadway crossings over channels interior to the site, settling pond inlet and outlet structures, diversion inlet screening, conveyance pipeline, excavation / grading plan for settling pond, site grading, site drainage for building(s) and roadways, “operational area” (snow disposal / dewatering tubes area), bike trail along access road from Milwaukee Street and extending to limits of the project area (see Figure 1) , and construction erosion control plan.

Products. General and Civil drawings and specifications will be submitted with the milestone submittals. A preliminary drawing list is provided in Exhibit D Drawing List. General drawings will include title sheet and vicinity maps, drawing index, general symbols, legends, and abbreviations.

Civil drawings will include the following:

1. Site demolition and clearing and grubbing plans, site plan, survey control, horizontal layout (northing/easting format),
2. Construction site erosion control plans, including construction notes and details,
3. Outlet structure including pond outlet channel, maintenance road crossing, and related items,
4. Maintenance access roads/driveways/parking,
5. Grading plans for site, settling pond, and floc and sediment dewatering tube (operations) area including cross-sections for each, and general excavated material stockpiles grading.
6. Site details, site drainage, and
7. Site electrical and lighting for access road and operations area,
8. Bike/pedestrian trail designed to AASHTO standards.

Assumptions:

1. The Civil / Site design plans and specifications will use City Standard Specifications and Bid set items.
2. It is assumed that the pump station for pond inflow will be located at the north side of the pond, and that the pond outlet structure will be located at the south side of the pond near the existing outlet channel.
3. The Bid Set #1 plan set will reference the City’s standard details wherever possible. No details will be shown on the plan sets, if standard details are available through the City.



4. No new site grading plan sheets will be included in Bid Set #2. Grading needs under Bid Set #2 will reference existing plan sheets from Bid Set #1.
5. The project limits are confined to the area shown on Figure 1.
6. The pond and surrounding areas will include a maximum side slope above the normal water surface of 4:1 (no retaining walls are included in the scope of work). The pond will include a 10' wide safety shelf and maximum slopes of 3:1 below the normal water surface.
7. All areas of the site will be stabilized and restored using City of Madison standard grass or prairie seed mixes. Separate landscaping plan sheets will not be prepared. Appropriate notes regarding site restoration will be included on other plan sheets.
8. The City of Madison will provide design of site lighting and security monitoring systems for the access road (from Milwaukee Street to the site) and operations area (east of the pond). Brown and Caldwell will incorporate the design into drawings and provide to City for review. The City will provide a "redline" mark-up of conceptual (30-percent) design drawings to show the site lighting and monitoring system design. The "redlines" will be incorporated with subsequent submittals. Site lighting and security monitoring system plan sheets will not be stamped and/or approved by Brown and Caldwell.
9. All project site lighting information will be included in Bid Set #1.
10. Sanitary sewer and potable water service will not be provided to the site.
11. Access road crossings of existing "dead-end" channels within the project area will not require bridges. Where these channels are crossed, they will be filled and a small (24-inches or smaller) culvert may be included to facilitate local drainage.
12. The alignment of the bike trail will be provided by the City. The bike trail alignment will not cross Starkweather Creek. Crossings of existing abandoned channels will not require bridges or culverts. The City will provide review and support for the design of the bike trail to ensure it complies with City design standards.
13. A portable, diesel powered dredge will be used for removing floc from the settling pond. A launch area for the dredge will be provided.
14. The access road, parking and turnaround areas near the building, will be asphalt. The operations area will consist of compacted gravel. Paving and pavement striping plans will not be prepared.
15. The City will provide bike trail (asphalt and base course thickness), access road (asphalt and base course thickness), and operations area (base course thickness). Information provided will include pavement cross section details, asphalt mix design and specifications or reference to applicable specifications (such as WisDOT).
16. On-site storm water management will be required only for proposed impervious areas directly associated with the pump station, storage / controls building, and operations area. Storm water associated with the access road and bike trail from Milwaukee Street to the project site will be treated with drainage swales. The access road, bike trail, and operations areas surrounding the pond will be drained into the pond. The bike trail north of the project site will be exempt from storm water management requirements because of the disconnected nature of the trail.

Task 320/420 / 520 – Process Mechanical and Rapid Mix Design

Objective. The purpose of this task is to prepare process and instrumentation documents, mechanical design calculations, drawings, and specifications for bidding of the project.

Approach. This task includes final process design, equipment sizing and selection for each process area, process piping layout, and the preparation of mechanical plan view, mechanical sections, and specifications.



Also, included under this task is rapid-mix equipment, process treatment design of chemical coagulation and settling to remove phosphorus from Starkweather Creek flows.

Products. P&ID drawings and mechanical drawings and specifications will be submitted with the milestone submittals as detailed in the preliminary drawing list provided in Exhibit D.

Assumptions. The following assumptions are made for this task:

1. Pipe supports will be designed by the contractor.

Task 330/430/530 – Pump Station, In-Stream Gate(s); and System Inlet Diversion Gate Design

Objective. The purpose of this task is to prepare process and instrumentation documents, mechanical design calculations, drawings, and specifications for bidding of the pumping station and other mechanical portions of the project exclusive of the mixing chamber. The mechanical portions of the project included under this task are:

1. In-stream actuated motorized gate(s) or inflatable weir(s) at the re-constructed railroad spur crossing culverts.
2. System diversion structure actuated motorized gate.
3. Pump station.

Approach. This task includes final pumping station design including final pump sizing, the preparation of mechanical plans and sections, and specifications. Plan sheets included under this task are identified in Exhibit D Drawing List.

Products. Plans and specifications.

Assumptions. The following assumptions are made for this task:

1. Pump station will be a simple lift (no force main) with four variable speed pumps.
2. Pump(s) speed will be controlled based on wet well level to deliver up to 100 cfs into the pond.
3. Pump(s) will be axial flow, submersible, tube type, with a formed suction inlet.
4. Pump controls will be located in the chemical storage / controls building. There will not be a separate building, or enclosure, specifically for the pump station.
5. A pneumatically actuated spillway gate, (similar to those manufactured by Obermeyer), will be installed at the culverts to divert flow to the intake structure. A motor driven slide gate will be considered as an alternative to the pneumatic spillway gate.
6. The intake structure will be 40 to 50 feet long with a mechanically cleaned screen and a motor actuated fabricated slide gate to route flow to the pumping station.
7. A back-up power source will not be provided for the pump station or other components of the system (weirs, gates, etc.).
8. The pond's outlet weir will be at a fixed elevation and not movable.

Task 340/440/540 – Structural Design

Objective. The purpose of this task is to provide analysis and design calculations, drawings, and specifications for structural portions of the project.

Approach. The design will be done in accordance with applicable codes (as of December 31, 2017) and standards and will be coordinated with Architectural and other disciplines. The identified structural components of the project are listed below.

1. Double-cell precast concrete box culvert crossing of Starkweather Creek at existing abandoned railroad crossing.
2. Cast-in-place reinforced concrete diversion intake structure.
3. Below grade cast-in-place reinforced concrete pump station.
4. Below grade precast concrete rapid mixing chamber.
5. Storage and controls building. Single story masonry building with metal roof deck with steel beam roof system, and shallow cast-in-place concrete foundation.
6. Settling pond outlet structure including precast single cell concrete box culvert with cast-in-place concrete wingwalls.

Products. Structural drawings and specifications will be included with the 60 percent and 90 percent submittals as detailed in the preliminary drawing list provided in Exhibit D. The structural design will be coordinated with the other design components defined in this scope of work.

Assumptions. The following assumptions are made for this task:

1. Precast concrete structures will be used at the Starkweather Creek box culvert, settling pond outlet structure culvert, and rapid mixing chamber. Precast structures will be designed and supplied by others.
2. For the rapid-mixing chamber structural drawings will not be produced. This structure will only be shown on Civil and Mechanical drawings.
3. Soil borings with foundation and subgrade recommendations at each structure location will be provided by others. Soil borings will extend a minimum of 20 feet and terminate at firm subgrade. Coordination between the structural engineer and geotechnical engineer will take place prior to the investigation and after receipt of report.
4. Structural design will be in accordance with the International Building Code as adopted and amended by the State of Wisconsin.
5. A site inspection of the existing abandoned railroad crossing and other site features will be conducted by the lead structural engineer. Site inspection will determine if leaving the west bank of the culvert and existing CMP is structurally feasible or not.
6. Soils at the structural locations will not require unusual structural design requirements. Deep foundations such as piles or piers will not be required.

Task 350/450/550 – Architectural Design

Objective. Provide necessary architectural services for the proposed building such that the building meets local and state building codes (as of December 31, 2017). The task will be conducted in the following design phases: Schematic Design, Design Development, Construction Documents and Construction Administration. Services for these tasks will be provided by a sub-consultant to Brown and Caldwell. Brown and Caldwell will coordinate these services for the overall project.

Approach. An architectural and site development plan and code review will be completed using the services of an architectural subconsultant. The Architectural subconsultant will directly prepare all architectural drawings and specifications required to construct the architectural treatment for the new structures included in the Project, including the Chemical Storage / Controls Building.

The following services will be provided in accordance with the project schedule and phasing approach:

1. Review, coordination of codes and submittals to regulatory agencies
1. Observe existing property conditions that impact the project
2. Architectural planning and design of new building structure



3. Detailing of code-required items such as fire barriers, fire walls, egress and accessibility
4. Architectural site design / coordination with Brown and Caldwell
5. Coordination of City approvals for building structure (not larger site development)
6. Participate in two City review meetings

Products. Basis of Design, including: facility description, materials, planning criteria, and code summary.

Bidding and construction document sealed drawing set, including:

1. Cover Sheet with general notes, abbreviations, key
2. Architectural Site plan
3. Floor plans
4. Roof plan
5. Reflected ceiling plans
6. Exterior elevations
7. Building and Wall sections
8. Exterior and Interior details
9. Door and finish schedule and details
10. ComCheck envelope energy analysis
11. CSI Format specification manual

Construction Administration:

1. Review shop drawings and submittals
2. Respond to “requests for information” (RFI) and other contractor requests

Assumptions. The following assumptions are made for this task:

1. City views this facility as a functional / utility structure.
2. The building will be slab on grade, split face block, with metal or shingle roof.
3. The building will have power service but no potable water plumbing, municipal water service, or sanitary sewer service.
4. The City will conduct inspections services during construction for building structural, common plumbing, and electrical services for the building. BC will conduct inspection for controls and electrical components directly associated with the operation of the treatment system.
5. Not included in the services and/or budget are the following:
 - a. Permit fees required for code or agency submittals and approvals.
 - b. Catwalk, mezzanine, or other designed access to tanks.
 - c. Geotechnical / Sub-surface soils exploration
 - d. Plumbing and/or fire protection design.
 - e. Basement or below-grade space (building will be a slab on grade structure).
 - f. Hazardous material survey, testing or evaluation.
6. The building will not require City of Madison formal approval by any City Department, except for the Engineering Division.

Task 360/460/560 – Electrical / SCADA Design

Objective. The purpose of this task is to prepare electrical final design including electrical design calculations, and final drawings and specifications for bidding of the project. The final design is based on the preliminary design report.

Approach. The scope of this task will consist of all work necessary for preparation of all electrical improvements for the treatment system components of the project. The identified components that will require power and/or SCADA design are listed as:

1. Stream monitoring upstream of RR spur culvert (flow, depth, water quality).
2. Up to two (2) recording rain gauges (either on- or off-site).
3. Culvert gates or inflatable weir.
4. Inlet diversion structure gate.
5. Pump station.
6. Chemical equipment and storage building.
7. Rapid mix tank.
8. Monitoring equipment at pond inlet pipe.
9. Monitoring equipment in pond.
10. Monitoring equipment at the pond outlet or channel below outlet.
11. Instream water quality monitoring in the stream (downstream of system discharge).

The tasks include:

1. Define classified areas in the project building and sites.
2. Prepare one-line diagrams for the plant power distribution systems.
3. Develop electrical specifications.
4. Develop electrical drawings, including site plans, building plans and standard details. Design will encompass site power distribution from the secondary side of the utility transformer and distribute the power at 480V. Coordination with the utility Madison Gas & Electric (MG&E) will be included.
5. Develop raceway and cable schedules and panel schedules.
6. Provide SKM Power Tools Model, Short Circuit Analysis Report, Arc Flash Hazard Report, and Protective Device Settings table to City upon completion. Additionally, Arc Flash Hazard labels will be provided for attachment to the electrical panels.
7. COMCheck

Products. Analysis and calculations associated with design of electrical systems. Electrical drawings and specifications will be submitted with the milestone submittals as detailed in the preliminary drawing list provided in Exhibit D.

Assumptions. The following assumptions are made for this task:

1. A plan set of 30% level design drawings is not included in this scope of work.
2. New utility service is required from Madison Gas & Electric. Existing 480V, 3 Phase power is not available in the vicinity of the project therefore extension of the utility grid system is necessary. A separate fee will be paid by the City for the extension of a power to the new building / pump station location including a utility pad mounted transformer.
3. Engineering services for coordination with MG&E during design is included.
4. Design of a back-up or standby power system is not included in scope and design budget.
5. Security system is not included.

6. The design will conform to v2012 International Building Code, IDAPA 07.03.01-Rules of Building Safety, local county and State electrical codes, and 2014 NFPA 70 (NEC) Codes shall be as of December 31, 2017.
7. Electrical equipment manufacturer preferred is Eaton. Specifications to name Eaton as a manufacturer and be written around Eaton equipment to match the City's existing facilities.
8. Lighting design associated with the building and pump station area will include an efficient approach utilizing LED type fixtures and lighting controls to be in compliance with local energy standards as mandated by the State. Compliance forms will be included in the specifications where required. This lighting system is specific to the treatment system itself. It is separate from the site lighting to be provided by the City of Madison and described under Task 310/410/510.
9. Lighting design associated with the bike trail and operations area is not included in this scope of work.
10. A lightning protection system is required and will be included in the design.
11. Telephone or plant paging system design is not included.

Task 370/470/570 – Instrumentation and Controls Design

Objective. The purpose of this task is to provide instrumentation and controls design for bidding of the Project. The controls will provide the ability to monitor the operations in real-time and provide the ability to make treatment changes remotely.

Approach. The scope of this task consists of work necessary to develop the instrumentation and controls construction documents for this project. The components of the project requiring controls include:

1. In-channel pneumatic weir or mechanical slide gates
2. Diversion structure control gate
3. Rapid mix chamber equipment
4. Chemical storage / equipment building
5. Pump station
6. Water quality and flow sampling / monitoring / testing equipment. (two locations) necessary for operating the treatment system. NOTE: the equipment listed here is not related to instruments to meet regulatory requirements.

Specific activities are as follows:

1. Develop control and instrumentation interlock notes.
2. Write narrative descriptions of control strategies and sequences.
3. Specify sensors and instruments to be used and coordinate with electrical for hazardous environments requirements.
4. Instrumentation and control system drawings, including symbol and detail sheets.
5. Provide control system network diagrams.
6. Provide instrumentation loop wiring diagrams, interconnection diagrams, and elementary diagrams.
7. Prepare technical specification of control system hardware and software requirements.
8. Assistance in development of the P&IDs including addition of instrumentation and telemetry.

Products. Instrumentation drawings and specifications will be submitted with milestone submittals as detailed in the preliminary drawing list provided in Exhibit D.

Assumptions. The following assumptions are made for this task:



1. The new facility control system will be monitored remotely at the Larry D. Nelson Engineering Operations Facility (1600 Emil Street, Madison, WI). via a telephone type wide area network (WAN) connection.
2. A radio frequency (RF) type wireless WAN study and design is not included in this work.
3. PLC and SCADA programming is provided under Task 360 / 460 / 560 of this scope of work.
4. Instrumentation and control work will be conducted in conformance with ISA 5.1.
5. BC will provide control descriptions for use by construction contractor. Construction contractor to provide all programming services. BC will provide up to 16 hours of remote support for programming services provided by contractor during startup (Task 730)

Task 380/480/580 – Building Mechanical Design

Objective. The purpose of this task is to prepare HVAC design calculations, drawings, and specifications for bidding of the chemical storage/equipment building of the project.

Approach. This task includes final HVAC system design, consisting of the preparation of mechanical plans and sections, and specifications.

Products. Plans and specifications as identified in Exhibit D.

Assumptions. The following assumptions are made for this task:

1. A plan set of 30% level design drawings is not included in this scope of work.
2. Building mechanical is limited to HVAC for the chemical building.
3. The building contains no plumbing, natural gas, fire protection or alarms, water service, or sanitary service.
4. COMCheck coordination with Architectural subconsultant
5. Design will be in accordance with the International Building Code as adopted and amended by the State of Wisconsin.

Not included in the services and budget are the following:

1. Permit fees required for codes or agency submittals.
2. Plumbing, gas, and/or fire protection design.

Task 390/490/590 – Document Preparation

Objective. Coordinate project standards and prepare the milestone submittals.

Approach. Draft versions of the drawings and specifications will be prepared and submitted for the permit drawings and milestone submittals. All specifications will be prepared in Microsoft Word.

The Consultant will prepare electronic copies (PDF half sized composite drawings), six 11x17 paper hard copies of the intermediate designs, and one 11x17 paper hard copy of the Final Documents for internal distribution to the City. One full electronic copy of drawing in native AutoCAD format will be provided with the final submittals for both bid sets. The City will be responsible for advertising and bidding the Projects. It is assumed that the City will integrate City front-end documents into the Final Documents as part of preparing the bid packages.

Products. Drawings and specifications will be submitted with the milestone submittals (drawings and specifications for the 60%, 90% milestones).

Assemble drawings and specifications for the Final Documents for this project (one electronic PDF file of the documents).

Electronically seal the Final Documents.



Assumptions. The following assumptions are made for this task:

1. No plan submittal will be performed at 30 percent completion. BC will review the preliminary plans with the city in a workshop setting.
2. BC will BC is only responsible for preparation of the technical specifications and not responsible for preparation of “front end” bidding documents
3. The City is responsible for the costs and effort of bidding and advertising the project.
4. It is assumed that there will be two separate bid documents.

Task 591 – Opinion of Probable Construction Cost

Objective. Provide construction opinion of probable cost

Approach. BC will estimate the probable cost for construction.

Products. BC will prepare the Construction Opinion of Probable Cost. BC will subdivide the cost estimate by process area. Construction Opinion of Probable Cost will be prepared and submitted with the 60%, 90%, and final plan submittals. Accuracy levels shall be Class 2 at 60%, and Class 1 at 90% and final.

Task 600 Series – Agency Permitting and Regulatory Compliance

Task 610: Federal, State, County, and City Permitting.

This task involves preparation of permit applications, and limited meetings with federal, state, County, and City agencies as described below:

Objective. Prepare Federal, State, County, and City permit applications as described below.

Approach. BC will prepare permit application documents as required by each agency on behalf of the City. The permits applications are limited to those identified below.

1. US Army Corp of Engineers: Permit for Structures in or Affecting Navigable Waters of the U.S. (33 CFR Part 322).
2. US Army Corp of Engineers: General Permit for Wetland Disturbance.
3. Wisconsin Department of Natural Resources: Chapter 30 individual permit for quarry pond re-grading.
4. Wisconsin Department of Natural Resources: Chapter 30 individual permit for placement of structures within Starkweather Creek.
5. Wisconsin Department of Natural Resources: NR 281.36 Wetland permit.
6. Wisconsin Department of Natural Resources: eNOI for construction erosion control, and post-construction stormwater management plan.
7. Dane County: Erosion Control and Post-Construction Stormwater Management permit.

Products. Permit applications for each permit identified above will be prepared and delivered to the City for submittal to the appropriate agency. As part of the permit applications the following documents will be prepared:

1. A Construction Site Erosion Control Plan including narrative, operations and maintenance plan, and relevant maps. The plan will reference the erosion control plan sheets of the construction plans as appropriate.
2. A Post-Construction Storm Water Management Plan for the site. This plan will document how the requirements for on-site storm water management are met.



3. A practical alternatives analysis for filling existing wetlands (if needed based on 60% site grading).
4. Other applicable documents and information as required for the permit applications listed above, except as noted below.

Assumptions: The following assumptions are made for this task:

1. The City is responsible for all permit fees.
2. BC cannot guarantee ultimate approval of a permit application.
3. The scope of work includes no more than a total of four (4) face-to-face and/or web-meetings with federal, state, or county agencies related to the permit applications.
4. The WDNR will issue the treatment system discharge permit as part of the City's current MS4 permit. No separate WPDES discharge permit will be required.
5. Wetland delineations for the project area will be provided by others to be included in the permit submittals.
6. Post-construction stormwater management requirements only apply to the pump station, building, maintenance road, and operations area of the project.

Task 620 CLOMR and LOMR (FEMA) – East Branch Starkweather Creek

Objective. Prepare revised FEMA flood mapping conditions based on Project design impacts to Starkweather Creek and floodplain. BC will prepare a Conditional Letter of Map Revision (CLOMR) and a Letter of Map Revision (LOMR).

Approach. Under this task the following analyses and subtasks will be conducted:

1. Iterative Modeling: The current HEC RAS model will be modified to represent optional site plans and stream crossings (prepared under Task 310) to minimize potential floodplain impacts from the final site design and grading plan. Up to three (3) iterations will be performed.
2. BC will utilize the latest version of HEC-RAS for this task. As the first step, BC will use the FEMA and WDNR approved floodplain model for this portion of Starkweather Creek and rerun it in the current version of HEC-RAS. This is considered the Duplicate Effective Model.
3. Upon completion of the above step, the proposed project conditions will be modeled. This is the Post-Project Model and will be compared to the Duplicate Effective Model and will be documented in a CLOMR for submittal to the WDNR and FEMA.
4. Upon construction completion, as-built drawings will be used to create a Post-Project Model. This model will be compared to the Duplicate Effective Model.
5. Prepare LOMR for submittal to WDNR and FEMA.
6. This task includes time for BC to respond to two (2) additional data requests from the WDNR or FEMA after submittal of the CLOMR and LOMR.

This task includes up to one (1) meeting with the WDNR and the City, and up to three (3) conference phone calls with the WDNR and/or FEMA, and the City to discuss the modeling and mapping methodologies, assumptions, and results.

Products. Updated mapping and documents formatted for a CLOMR and LOMR submittal.

Assumptions:

1. The City will be responsible for the actual deliverable of the prepared documents to the WDNR and FEMA.
2. The City will be responsible for all federal and state fees associated with this task.

3. The CLOMR submittal will be based upon the final design drawings prepared by BC under “Task 300 / 400 / 500 Series – Detailed Design Tasks”
4. The CLOMR and LOMR will account for site changes from the designed bike trail, maintenance road and treatment system as a single submittal.
5. The City will provide the project’s as-built drawings for use in the LOMR development.

Task 621 CLOMR and LOMR (FEMA) – Milwaukee Street Tributary

Objective. As part of the bike trail addition, a crossing of the Milwaukee Street Tributary is required. The Milwaukee Street Tributary is currently a FEMA mapped floodplain. BC will prepare revised FEMA flood mapping conditions based on Project design impacts to the Milwaukee Street Tributary and floodplain. BC will prepare a Conditional Letter of Map Revision (CLOMR) and a Letter of Map Revision (LOMR).

Approach. Under this task the following analyses and subtasks will be conducted:

1. BC will obtain the current Effective Model.
2. BC will run the current Effective Model in the latest version of HEC-RAS. This will be considered the Duplicate Effective Model.
3. BC will update the Duplicate Effective model with the survey data collected at the proposed crossing. This will be the Corrected Effective Model.
4. Upon completion of the above step, the proposed project conditions will be modeled. This is the Post-Project Model and will be compared to the Duplicate Effective Model and will be documented in a CLOMR for submittal to the WDNR and FEMA.
5. Upon construction completion, as-built drawings will be used to create a second Post-Project Model. This model will be compared to the Corrected Effective Model.
6. Prepare LOMR for submittal to WDNR and FEMA.
7. This task includes time for BC to respond to two (2) additional data requests from the WDNR or FEMA after submittal of the CLOMR and LOMR.

This task includes up to one (1) meeting with the WDNR and the City, and up to three (3) conference phone calls with the WDNR and/or FEMA, and the City to discuss the modeling and mapping methodologies, assumptions, and results.

Products. Updated mapping and documents formatted for a CLOMR and LOMR submittal.

Assumptions:

1. The City will be responsible for the actual deliverable of the prepared documents to the WDNR and FEMA.
2. The City will be responsible for all federal and state fees associated with this task.
3. The CLOMR submittal will be based upon the final design drawings prepared by BC under “Task 300 / 400 / 500 Series – Detailed Design Tasks”
4. The CLOMR will account for site changes from the designed bike trail and bridge as designed by the City and provided to BC.
5. The City will provide the project’s as-built drawings for use in the LOMR development.

Task 630 System Performance Monitoring Design

Objective. Identify instrumentation necessary to monitor the pre-treatment and post-treatment water quality, flow, and volume for calculating the performance of the treatment system in total phosphorus reduction.



Approach. BC will:

1. Meet with the WDNR and City to define and verify the parameters that will be measured with the monitoring instruments.
2. Research instrumentation available on the market to perform the necessary water quality and flow measurement parameters. Preference will be given to in-situ measurements.
3. Consult with vendors, the USGS, the WDNR, and City to identify the instruments most appropriate for the monitoring needs.
4. Identify the physical locations for installation of the monitoring equipment.
5. Provide a conceptual design for the location, power and communication lines, and instrumentation installation at two locations.

Products:

1. A Technical Memo describing the instrumentation needs and specifications.
2. A conceptual plan sheet showing the location and installation of the monitoring equipment and power / communication lines.

Assumptions:

1. Vendors will provide the on-site installation and calibration necessary for proper use of the instruments. Brown and Caldwell is not responsible for equipment installation or training.
2. Vendors will train city staff on use and maintenance of the instruments.

Task 640 Environmental Assessment Preparation

Objective. Provide a document on behalf of the City to the WDNR to meet Wisconsin's WEPA requirements.

Approach. BC will prepare an Environmental Assessment (EA) document on behalf of the City for submittal to the WDNR. The purpose of the document is to comply with the state's WEPA policy.

Products. The EA document will have similar topical content and level of information as provided in the *Final Environmental Impact Assessment for Willow Creek Project – Phase 1* (June 11, 2015). BC will provide a draft version of the document for the City's review and comment before preparing the final document.

Also, included in the scope of work is one (1) face-to-face meeting with the City, WDNR representatives, and BC. The meeting will be held early in the EA development process to verify that the information and content of the proposed document will meet the WDNR requirements.

Assumptions.

1. No environmental monitoring or field investigations will be conducted by BC for this task beyond what is already defined elsewhere in this scope of work.
2. All information required for the EA will be available from material developed under other tasks from this scope of work, or from readily available sources through public web sites.

Task 700 Series - Construction and Post-Construction Services

Task 710 – Bidding Phase Assistance – Bid Set #1 (Civil / Site)

Objective. Provide limited technical consulting services as requested by the City during the bidding process.

Approach. This task includes an allowance for BC's support to the City as requested. The budgeted time for this task is ten (10) staff hours from BC. Activities may include the following:

1. Provide input and review the City-bid package.



2. Respond to project questions during the proposal period as directed by the City.
3. Participate with the City in a pre-proposal meeting to give Proposers the opportunity to ask questions prior to submitting proposals.

Products. As requested by the City.

Assumptions:

1. City will lead procurement process and pre-Proposal conference.
2. BC will not provide legal review services.
3. BC will not review bid submittals.
4. The assistance in this task will not include preparation of addenda.
5. BC will track labor hours for this task and inform the City when 80% of the labor hours are expended. Labor hours exceeding the budgeted time will require a contract amendment.

Task 715 – Bidding Phase Assistance – Bid Set #2 (Process / Mechanical)

Objective. Provide limited technical consulting services to the City during the bidding process.

Approach. This task includes support to the City during the bidding process. The budgeted time for this task is no more than fifty (50) staff hours from BC. Expected activities may include the following:

1. Provide input and review the City-bid package.
2. Respond to project questions during the proposal period as directed by the City.
3. Participate with the City in a pre-proposal meeting to give Proposers the opportunity to ask questions prior to submitting proposals. BC will prepare the agenda, assist in leading the meeting, and prepare meeting minutes. Budget for this task includes “in-person” attendance of two (2) staff from Wisconsin offices, and two staff from outside Wisconsin via conference call.
4. Assist the City in the preparation of up to two (2) addenda.
5. Assist the City in the review of bid submittals.

Products. As requested by the City.

Assumptions:

1. City will lead procurement process and pre-Proposal conference.
2. BC will not provide legal review services.
3. BC will track labor hours for this task and inform the City when 80% of the labor hours are expended. Labor hours exceeding the budgeted time will require a contract amendment.

Task 720 - Construction Phase Services – Bid Set #1 (Civil / Site)

Objective. Provide limited support to the City during construction to complete the project in compliance with the construction documents prepared by BC.

Approach. The City will provide BC will provide limited support during this phase of construction only as requested by the City. The budgeted time for this task is no more than sixteen (16) staff hours from BC.

Services associated with Bid Set #1 may include:

1. If requested by the City, attend the pre-construction conference. Attendance in-person by BC Civil staff from Wisconsin offices. Attendance via conference call by BC structural lead.
2. Conduct Site Visits only upon request by the City.
3. The City is conducting reviews of the structural components of the project.
4. Assist the City in responding to questions from the contractor not to exceed the budgeted hours.
5. Assist the City in preparing change orders as requested by the City.



6. BC will track labor hours for this task and inform the City when 80% of the labor hours are expended. Labor hours exceeding the budgeted time will require a contract amendment.

Products: As requested by the City.

Assumptions:

1. The City will provide full-time construction supervision, inspection and special inspections for all work throughout the construction period.
2. The City is responsible for review of contractor submittals and will consult BC on a limited basis as defined in the “Approach” section under Task 720.

Task 725 - Construction Phase Services – Bid Set #2 (Process / Mechanical)

Objective. Provide support to the City during construction to complete the project in compliance with the construction documents prepared by BC.

Approach. The City will provide full-time construction supervision and inspection throughout the construction period. During construction of the Treatment System BC will be actively involved in the construction process through project close-out as defined below. Items in this task include:

1. Prepare agenda and attend the pre-construction conference. This task include in-person attendance by Civil and Process leads, leads from other project disciplines will attend via conference call.
2. Review a total of up to twenty five (25) Contractor submittals (including shop drawing reviews).
3. Answer design related questions from the City.
4. Conduct an average of 1.5 site visits per week for 24 weeks (36 visits) by BC staff based in Madison, Wisconsin.
5. Conduct additional site visits to provide discipline specific review and oversight. Assume three (3) trips by each discipline (treatment system process, pump station process, mechanical, electrical, and instrumentation/controls).
6. Assist the City in responding to up to twenty five (25) RFIs as requested by the City.
7. Assist the City in preparing up to two (2) Change Orders as requested by the City.
8. Attend the Substantial Completion Inspection and provide a list of items to be completed.
9. Review Contractor close-out documents including warranty information and start-up, operation, and maintenance documents.
10. Attend the Final Completion Inspection by two (2) BC staff.
11. Review Contractor as-built drawings for conformance with contract requirements..

Products:

1. Agenda and meeting minutes for pre-construction meeting.
1. Stamped Contractor submittals.
2. Responses to questions via email.
3. Bi-weekly Site Visit Reports – electronic.
4. Response to RFIs via email.
5. Information for Change Orders via email.
6. List of items to be completed from Substantial Completion Inspection.
7. Comments on test reports.
8. Comments on contractor close-out documents including start-up and operation and maintenance documents.

9. Comments from Final Completion Inspection.
10. Comments on as-built drawings.
11. Permit clearance documents.

Assumptions:

1. The City will provide full-time construction supervision, inspection, and special inspections (per structural requirements) throughout the construction period. The City is responsible for construction inspection for structural, HVAC, electrical, building, and erosion control elements.
2. Current budget is based on assumptions outlined above.
3. Construction will be completed (to Final Completion) in 9 months from Notice to Proceed.
4. The City will conduct, and/or contract for testing required by the Contract Documents.

Task 730 – System Startup, Training, and O&M Services

Objective. Provide support to the City during system start-up to verify the treatment system is operating in accordance with the design objectives. Provide training to City staff regarding the operation and maintenance of the system.

Approach. The City will be responsible for the operation and maintenance of the treatment system. BC will work with the Contractor to start-up the treatment system and conduct testing to confirm the system is operating in accordance with the design objectives. BC will also perform initial O&M visits; perform basic testing, and record operations information. During this time BC will train City staff regarding the operation and maintenance of the system.

1. Observe the operation of these components during the Contractor start-up and testing:
 - a. Water pump station
 - b. Inlet Gates and weir(s)
 - c. Rapid mix system
 - d. Flow rate and water depth meters
 - e. Water quality monitoring equipment
 - f. Chemical injection system
 - g. Chemical storage tank level
 - h. System controls
 - i. SCADA

Provide comments to the City and Contractor and retest the equipment, if necessary, to observe compliance with the project design requirements. It is assumed that this task will occur immediately following the substantial completion inspection (conducted the following day). Assume attendance by each discipline (structural, treatment system process, pump station process, mechanical, electrical, and instrumentation/controls).

1. Prepare an Operation and Maintenance Plan with electronic observation forms.
2. Perform continued start-up and testing of the treatment system for approximately 3 months. Visit the site approximately 2 times per week (26 visits total), check the system operation, and complete the observation forms. Review the recorded data for water depth, water flow rate, total water volume, coagulant use, influent and effluent total phosphorus concentration (from lab data), and other parameters monitored. Depending on the observed total phosphorus removal efficiency and load reduction, fine tune, if necessary, the coagulant dose to increase the TP removal efficiency. It is assumed that site visits will primarily be conducted by BC staff from Madison, Wisconsin offices. The treatment system process lead engineer will conduct two site visits.



3. System Operations Training – During the initial start-up and testing visits, train city staff regarding the operation and maintenance of the system. Up to six (6) – two (2)-hour training sessions will be completed.
4. BC will provide up to 16 hours of remote support for programming services provided by contractor during startup.

Products:

1. Operation and Maintenance Plan and electronic observation forms– electronic.
2. Comments from Contractor start-up and testing.
3. Completed observation forms – electronic.

Assumptions:

1. The City will be responsible for the long term operation and maintenance of the treatment system
2. The City will provide BC access to the site and treatment system.
3. All City staff will be trained at the same time.
4. The City will be responsible for the purchase of all coagulant and other materials required for the operation of the system.
5. The Contractor will be responsible for all treatment system repairs or replacement under a one-year warranty. BC will not be responsible for any repairs or replacement, or purchase of coagulant or other materials.

Exhibit B

Schedule

It is estimated that all work associated with the proposed scope through Task 600, will require 18 months to complete from the Notice to Proceed. However, the schedule will be dependent on many factors, some of which are outside the influence and control of Brown and Caldwell. Certain design components cannot be conducted until milestones are achieved, including, but not limited to:

1. Site access
2. Completion of detailed survey
3. Completion of field wetland delineation
4. Completion of geotechnical investigations.

The project's schedule will be updated as milestones are achieved. For budgeting purposes, it is assumed that all work described in this Scope of Work will be completed by December 31, 2018.

Exhibit C

Project Budget

The budget for the scope of work under Exhibit A is shown in the table below. The table is provided for informational purposes only and Brown and Caldwell is not bound by the individual line budgets. This budget assumes all work will be completed by December 31, 2018.

Phase	Phase Description	Total Labor Hours	Total Labor Effort
100	Project Management; Workshops; and Professional Services Coordination	596	\$96,078
200	Pre-Design Activities	330	\$54,089
300 / 400 / 500	All Design Components	3,666	\$501,614
600	Agency Permitting & Regulatory Compliance	542	\$82,322
700	Construction Services (Bidding & Construction Phase)	745	\$120,439
730	System Startup, Training, and O&M	356	\$47,548
	Labor Only:	6,235	\$902,090
	Architectural Sub consultant:		\$10,300
	Expenses:		\$22,240
	TOTAL		\$934,630

Exhibit D

Anticipated Drawing List

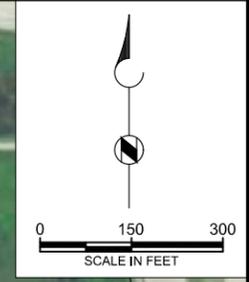
Bid Set #1			
Sheet Number	Drawing Number	Drawing Title	Comments / Assumptions
GENERAL			
1	-	Cover Sheet	
2	G-1	Drawing List	
3	G-2	Symbols, Abbreviations and General Notes	
4	G-3	Symbols and Abbreviations	
CIVIL / SITE			
5	C-1	Overview	
6-11	C-2 - C-7	Site Layout & Demo	
12-17	C-8 - C-13	Erosion Control Plan	
18-19	C-14 - C-15	Inlet Storm Sewer Plan & Profile	
20-29	C-16 - C-25	Site Grading	
30	C-26	Diversion Structure Layout	
31	C-27	Culvert Layout	
32	C-28	Building/Parking Area	
33-34	C-29 - C-30	Outlet Storm Sewer & Channel Plan and Profile	
35-36	C-31 - C-32	Pond Cross Sections	
37-42	C-33 - C-38	Access Road/Bike Trail Plan & Profile	
43-47	C-39 - C-43	Access Road/Bike Trail Cross Sections	
48-52	C-44 - C-48	Site Lighting	
53	C-49	Pavement Details	
54	C-50	Misc Details	
STRUCTURAL			
55	S-1	Structural Notes 1	
56	S-2	Structural Notes 2	
57	S-3	Special Inspections 1	
58	S-4	Special Inspections 2	
59	S-5	Structural Standard Details 1	
60	S-6	Structural Standard Details 2	
61	S-7	Structural Standard Details 3	
62	S-8	Structural Standard Details 4	
63	S-9	Structural Standard Details 5	
64	S-10	Structural Standard Details 6	
65	S-11	Stream Diversion Structure - Plans	
66	S-12	Stream Diversion Structure - Sections and Details	
67	S-13	Stream Diversion Structure - Sections and Details (Bar Rack & Screen)	
68	S-14	Pipe/Headwall - Demolition Plan	

Bid Set #1			
Sheet Number	Drawing Number	Drawing Title	Comments / Assumptions
69	S-15	Box Culvert - Plans	
70	S-16	Box Culvert - Sections and Details 1	
71	S-17	Pond Outlet Structure - Plan	
72	S-18	Pond Outlet Structure - Sections and Details	
73	S-19	Pumping Station -Plans	
74	S-20	Pumping Station - Sections and Details 1	

Bid Set #2			
Sheet Number	Drawing Number	Drawing Title	Comments / Assumptions
GENERAL			
1	-	Cover Sheet	
2	G-1	Drawing List	
3	G-2	Symbols, Abbreviations and General Notes	
4	G-3	Symbols and Abbreviations	
CIVIL / SITE			
5	C-1	Overview	
6 - 9	C-2 - C-5	Sheets Repeated from Bid Set #1	
10	C-6	Misc Details	
ARCHITECTURAL			
11	A-1	Architectural Notes 1	
12	A-2	Architectural Standard Details 1	
13	A-3	Architectural Standard Details 2	
14	A-4	Schedules - Door, Window and Coatings	
15	A-5	Chemical Storage Building - Floor Plan	
16	A-6	Chemical Storage Building - Roof Plan	
17	A-7	Chemical Storage Building - Elevations	
18	A-8	Chemical Storage Building - Elevations	
19	A-9	Chemical Storage Building - Sections and Details 1	
20	A-10	Chemical Storage Building - Sections and Details 2	
STRUCTURAL			
21	S-1	Structural Notes 1	
22	S-2	Structural Notes 2	
23	S-3	Structural Standard Details 1	
24	S-4	Structural Standard Details 2	
25	S-5	Chemical Storage Building - Foundation Plan	
26	S-6	Chemical Storage Building - Roof Plan	
27	S-7	Chemical Storage Building - Sections and Details 1	
28	S-8	Chemical Storage Building - Sections and Details 2	

Bid Set #2			
Sheet Number	Drawing Number	Drawing Title	Comments / Assumptions
PROCESS MECHANICAL			
29	D-1	Process Standard Details 1	Need to pick up the control gates on the new "bridge" and on the diversion pipe.
30	D-2	Process Standard Details 2	
31	D-3	Process Standard Details 3	
32	D-4	Stream Diversion Structure - Bottom Plan	
33	D-5	Stream Diversion Structure - Top Plan	
34	D-6	Stream Diversion Structure - Sections and Details 1	
35	D-7	Mixing Chamber - Plans	
36	D-8	Mixing Chamber - Sections and Details	
37	D-9	Chemical Storage Building - Floor Plan	
38	D-10	Chemical Storage Building - Roof Plan	
39	D-11	Chemical Storage Building - Sections and Details 1	
40	D-12	Chemical Storage Building - Sections and Details 2	
41	D-13	Pumping Station - Foundation Plan	
42	D-14	Pumping Station - Top Plan	
43	D-15	Pumping Station - Sections and Details 1	
44	D-16	Pumping Station - Sections and Details 2	
45	D-17	Notes, symbols and abbreviations	
46	D-18	Standard Details 1	
47	D-19	Standard Details 2	
48	D-20	HVAC Schematics	
49	D-21	Chemical Storage Building - Floor Plan	
50	D-22	Chemical Storage Building - Roof Plan	
51	D-23	Chemical Storage Building - Sections and Details 1	
52	D-24	Chemical Storage Building - Sections and Details 2	
ELECTRICAL / INSTRUMENTS / CONTROLS			
53	E-1	Electrical Legend and Symbols 1	
54	E-2	Electrical Legend and Symbols 2	
55	E-3	Electrical Legend and Symbols 3	
56	E-4	Standard Details 1	
57	E-5	Standard Details 2	
58	E-6	One Line Diagram	
59	E-7	Control Schematics	
60	E-8	MCC Elevations	
61	E-9	Site Power and Lighting Plan	
62	E-10	Stream Diversion Structure - Power and Lighting Plan	
63	E-11	Mixing Chamber - Power and Lighting Plans	
64	E-12	Chemical Storage Building - Power and Lighting Plan	

Bid Set #2			
Sheet Number	Drawing Number	Drawing Title	Comments / Assumptions
65	E-13	Chemical Storage Building - Electrical Room Plan	
66	E-14	Pumping Station -Power and lighting Plan	
67	E-15	Pumping Station - Control Panel Details	
68	E-16	Instrumentation Legend and Symbols 1	
69	E-17	Instrumentation Legend and Symbols 2	
70	E-18	Instrumentation Details	
71	E-19	Stream Diversion Structure - P&ID	Controls for diversion gates
72	E-20	Chemical Feed System - P&ID	Includes Bulk Storage tanks, metering pumps and mixing chamber
73	E-21	Pumping Station - P&ID	Pumping station controls



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**STARKWEATHER
CREEK COAGULANT
TREATMENT
SYSTEM DESIGN
CITY OF MADISON
WISCONSIN**

REVISIONS		
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APPROVED:

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BC PROJECT NUMBER:
147143
CLIENT PROJECT NUMBER

**PROJECT AREA
AND
DESIGN LIMITS**

DRAWING NUMBER
FIGURE 1
SHEET NUMBER
OF

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