Contract 30006543 Revised Exhibit A (Amendment 5)
Statement of Work

Columbia Boulevard Wastewater Treatment Plant
Secondary Treatment Expansion Program
BES Project No. E07947

INCLUDES APPROVED CHANGE REQUESTS (CR-001 through CR-022) & CONTRACT AMENDMENTS 1 through 4

Project Understanding

The City of Portland, Bureau of Environmental Services (BES) serves the Portland community by providing water quality protection, watershed planning, wastewater collection and treatment, sewer installation and stormwater management. The Columbia Boulevard Wastewater Treatment Plant (CBWTP) treats an annual daily average of 76 million gallons per day of municipal wastewater and is essential to BES to accomplish its mission. To support its mission, Consultant is to provide engineering services related to its Secondary Treatment Expansion Program (Program), which includes the addition of two new 150-foot-diameter secondary clarifiers, along with a combination of projects that are either in close proximity or operationally connected, including a complete upgrade of its biosolids thickening and dewatering facilities.

BES will act as Program Manager, where the Program will be implemented under a Construction Manager-General Contractor (CM/GC) delivery approach and with assistance from an Owner Agent. The Program is driven by a compliance schedule in BES's Mutual Agreement and Order with the Oregon Department of Environmental Quality (DEQ), with an amended completion date for secondary treatment facilities of December 30, 2024.

Engineering services will be provided under this contract to define the project, complete the design, and support construction and startup of the following elements:

- Secondary Clarifiers Expansion:
  - Two 145-foot-diameter secondary clarifiers and associated return activated sludge (RAS) and waste activated sludge (WAS) facilities. Based on the proposed hydraulic grade line, intermediate pumping is not planned to be included in the project.
  - Effluent metering.
  - Mixed liquor (ML) piping and flow split to the new secondary clarifiers.
  - RAS pump station and secondary scum pumping. The scope of work is based on a dry well type RAS pump station.
  - New RAS piping from the new secondary clarifiers to the aeration basins.
  - Demolition of existing, aging structures, including a staff modular unit, storage space, a shop area, and a decommissioned Taulman-Weiss composting facility that is partially used for odor control of 29,000 standard cubic feet per minute (scfm) from the solids handling building.

  - Replacement of the double-ended medium voltage composting facilities unit substation with a substation that can supply the new secondary clarifiers and RAS pump station, any existing loads to remain and potentially the new non-process facilities.

- RAS Line Replacement and Tunnel Piping Work:
  - Replacement of the RAS lines. The Program is intended to provide a more efficient layout of the tunnel piping, including RAS and ML piping modifications, and remove the liability from existing in-gallery piping, which is an aging and failing critical asset, while coordinating with the new process piping from the addition of the new clarifiers.
  - Demolition of the Silver Tunnel Boilers. Evaluation of more efficient heating approaches for the buildings serviced by the Silver Tunnel Boilers that would provide constructability benefits to the Program and long-term energy efficiency, while restoring the building heating systems to current standards. Proposed HVAC improvements include a new steam plant to service the Dodd Building and Wet Weather Screening Facility, new direct-fired make up air handlers to service the tunnels, and a new heating and ventilation system for the Pipe Tunnel Gallery.
  - Improvement/upgrades to tunnel ventilation to meet National Fire Protection Association (NFPA) 820 requirements and environmental ventilation requirements.
  - Removal/demolition of abandoned piping and equipment in the existing gallery.
- Solids Handling Improvements:
  - Replacement of the existing solids handling building with a new Solids Facility (SOFA).
  - Demolish the existing solids handling building, providing a connection from the Silver Tunnel to the new Solids Facility.
  - Complete process mechanical upgrades are required for the new solids **facility**, dewatering centrifuges, co-thickening gravity belt thickeners, conveyance and biosolids load out equipment, odor control, polymer feed system, and associated support systems.
  - Co-thickening of primary sludge (PS) with WAS will be implemented to increase solids processing performance and to eliminate the cost of a separate PS facility, which is currently identified in BES's capital improvement plan.
  - Demolition of the existing odor control system (existing fans and biofilters located in the existing compost facilities). Temporary odor control facilities (as needed) during demolition and construction of new odor control system to serve the new solids handling facilities.
- Electrical Switchgear, Substation Transformers and Motor Control Centers (MCCs) in the Silver and Blue tunnels, and the Effluent Pump Station:
  - Removal and replacement of 480-volt MCCs and associated medium-voltage switchgear and transformers to a flood protected location The following equipment would be included in this work:

    - Silver Tunnel: Silver Tunnel: Substations T-5, T-6, T-7, and T-8, including all associated 15kV switches and 480V switchboards.
      - MCCTA (MCCBE, east tunnel)
      - MCCTB (MCCBW, east tunnel)

        TUSI-MCCW (east tunnel)

        - TUSI-MCCWA (east tunnel)
        - MCCAE (west tunnel)
        - MCCAW (west tunnel)
      - Effluent Pump Station
        - EPH-MCCA
  - New above-grade electrical building~~(s)~~ to house the replaced low voltage electrical gear.
  - Coordinate with other electrical work at the CBWTP, especially the CBWTP Main Substation Replacement, as concerns overall electrical system impacts, availability, and acceptable outage periods.
- Non-Process Facilities:
  - **Two** new buildings to provide up to 16,000 square feet of combined common staff space, workshop area, and covered storage space intended to replace the demolished non-process facilities in the way of the new secondary clarifiers, addressing ~~,~~flexible storage needs and accommodating projected growth of the SOG and Parks departments.
  - Metal Storage Building 05 (STO 05) rehabilitation, including new siding, roofing, and lighting without structural modifications.
  - Storage Building 04 (STO 04) demolish down to structural frame and slab and renovate to accommodate storage and fabrication functions displaced by the STEP project. Truck scale relocation.
- Aeration Basins Interior Floors/Walls Surface Rehabilitation to address concrete spalling, cracks, and erosion.
- Effluent measurement and hypochlorite disinfection associated with new clarifiers.

Scope of Work and Deliverables

Contents

Task 1 Preliminary Design

The primary purpose of the preliminary design phase (through 30% design) is to firmly establish the project design criteria, conduct key evaluations, define the recommended project, and develop a project cost estimate and schedule. Work during this phase will culminate in the preparation of the Basis of Design Report. The preliminary design phase consists of four phases, with project initiation activities, a 20% design (project definition), a value engineering (VE) effort, and the preparation of the 30% (schematic) design submittal captured in the Basis of Design Report.

Task 1.1 Project Initiation

Provide services to manage the work tasks and team to achieve the objectives of this scope of work. This work task includes regular communications with BES staff, issuance of monthly project reports, preparation for management meetings and/or other presentations, quality assurance/quality control (QA/QC) planning, change management, and monthly invoicing. An overall schedule and work plan will be developed and regularly updated to assure work activities are completed in a properly integrated and timely manner. In addition, this task includes those elements necessary to properly manage, lead, coordinate, and control the Project team toward the intended results and min risks to the success of the Program, including the management and development of Disadvantaged Minority-owned Women-owned Emerging Small Business (DMWESB) subconsultants.

The following subtasks are provided under this task.

Task 1.1.1 Project Management Planning and Initiation

Develop a set of procedures in the form of Work Plan and a Management Plan to facilitate management of the project. The project instructions and management plan will cover operating procedures, information and BES review requests, communications flow, document and file management, records management, and communications protocol between BES and the Consultant team, regulatory agencies, and other outside parties.

Prepare for and conduct a Project Kickoff/Chartering Meeting, including Agenda and Summary Notes, including decisions/action items.

Using the work breakdown structure (WBS) developed in this scope of work and respecting the approved regulatory timelines for completion of the program, develop a comprehensive design schedule showing the expected timing of all tasks, preliminary dates for deliverables, and anticipated dates for workshops, meetings, submittals and critical points of coordination with BES and/or the CM/GC. Identify float or contingencies.

Prepare a Change Management Plan that addresses the schedule and budget impacts of implementing changes and scope modifications. Develop a change log template.

Meetings

- Project Initiation/Chartering Meeting.

Deliverables

- Project Work Plan/Management Plan, including approach to project progress, communications, and expenditure tracking.
- Agenda and summary notes for project kickoff/chartering meeting and “refresher” meetings.
- Integrated design schedule.

- Project meeting and project workshop templates.
- Change management plan, including templates for forms/logs.
- Invoice templates.
- Project status report template.
- Risk Register template.

Task 1.1.2 Quality Management Planning

Execution of the quality assurance program (QAP) will be scoped/budgeted as part of each discrete design task. This Quality Management Planning task under Project Management covers the development of the QAP and management of that process.

As part of each design phase, the Consultant will carry out a QAP. The purpose of this QAP is to monitor the quality of the Project using workshops and internal QA/QC reviews as described herein, as well as meeting the requirements of the BES Design Checklists. The Consultant will manage multidiscipline internal QA/QC review activities with the senior review team during the progress of the design. Formal QC reviews by the Consulting team will be performed before BES review of the design.

BES will consolidate the BES staff review comments into one comprehensive package before submitting review comments to the Consultant. For major deliverables, Consultant will provide 15 printed copies and one electronic copy in PDF format, and BES will submit review comments within the period allocated in the project schedule (typically 4 weeks following BES receipt of the review submittal). For smaller technical memorandums (TMs) and meeting notes, Consultant will provide one electronic copy in PDF format, and BES will submit review comments within 14 calendar days following BES receipt of the deliverable. Consultant's responses to BES consolidated review comments will be returned to BES for their records. Consultant will provide native files with final deliverables.

Under this task, a Quality Management Plan (QMP) will be prepared for the project to serve as a guide for all phases of the project. Key features of the QMP will include:

- A single point of contact (Craig Massie) responsible for all quality management.
- A project-specific QMP that focuses on delivering BES project quality objectives and guiding principles and meeting the requirements of the BES Design Checklists.
- Consistent quality policy and procedures instituted and subcontractors.
- Independent quality review performed by discipline-specific quality reviewers to ensure critical analysis without bias. The focus of this effort will:
  - Establish functional QA/QC processes and procedures.
  - Train design team personnel to use the processes and procedures.
  - Verify that the processes have been properly implemented and all requirements are being met through checking and auditing.
- Design criteria, standards, and processes.
- Procedures for engineers; detailed checks of design reports, calculations, drawings, and specifications.

Audits by QA personnel will be conducted to verify conformance with the approved QMP and confirm that required checking and review functions are completed, culminating in either approval or a non-

conformance report (NCR). The QA audits follow checklists based on project procedures applicable to the area being audited.

Design quality review documentation will demonstrate that the quality review process is complete and review comments are acceptably addressed as a component of the overall records management system. BES or its delegate will be provided access to QMP-related documentation for auditing purposes. The following documentation will be prepared, collected, and properly stored in the project records system:

- Quality review forms (QRFs) used during internal quality reviews.
- Issue tracking forms used to document quality-related issues.
- Design review forms (DRFs) used by BES to document quality review comments.
- Project checklists or milestone checklists signed by the reviewer and the appropriate project staff.
- Copies of quality review markups or comments not included on the QRFs or DRFs.
- Review-related correspondence with BES staff and other external agencies or entities.
- QMP-related documents for subcontracted work.
- Audit correspondence, including results and corrective action documentation.

Deliverables

- Quality Management Plan.
- QAP-related forms for each deliverable.
- Consultant responses to BES's consolidated review comments.

Task 1.1.3 DMWESB Development Plan

Provide structured support to DMWESB subconsultants with the goals of: high quality deliverables production, schedule compliance, and long-term DMWESB capacity development. Conduct a DMWESB Development Program, as described in the following subtasks.

Assumptions

- Assumes participation of eight firms in the DMWESB program, assuming most subconsultants engaged on only an as needed basis will not participate.
- Fees are based on an average level of effort per participating firm. Allocation among firms will depend on level of effort and duration of engagement on the project.

Task 1.1.3.1. Project Planning

The Consultant will do the following as part of this subtask:

- Develop DMWESB Development Plan Memorandum.
- Develop draft outline for DMWESB project plans.
- Conduct a kickoff meeting with BES. Discuss DMWESB subconsultant's identified scopes of work, roles and responsibilities, lessons learned from past projects, and review draft outline for DMWESB project plans.
- Conduct an initial meeting to confirm project schedule, delivery requirements, communication procedures, and potential opportunities for DMWESB mentoring.
- Meet with DMWESB subconsultant firms to develop a project plan for each firm. Elements will include:

- Project expectations including deadlines, quality requirements, and communication expectations.
- Capacity development strategy identifying specific opportunities to increase the technical or management capacity of the DMWESB and a specific approach to transfer knowledge from the prime Consultant.
- Staffing strategy ensuring sufficient staff capacity and opportunities to increase capabilities of existing staff.
- Specific metrics that will be used to track performance and progress (e.g., deliverables that meet quality standards, mentoring opportunities completed).

- Review project plans. Confirm structure and timing of mentoring and development opportunities.

Assumptions

- Fee for this task assumes 8 hours for each project plan.

Deliverables

- Draft and final versions of the DMWESB Development Plan Memorandum.
- DMWESB Development Program Kickoff meeting agenda and notes.
- Up to eight individual firm draft and final project work plans.

Task 1.1.3.2. On-Going Quality Assurance Check-Ins

Perform quarterly check-ins to discuss any new challenges or successes. Facilitate kickoff and interim check-in meetings with DMWESB firms. Timing of check-ins will be such that they will allow DMWESB to incorporate feedback before major deliverables. Check-ins will include the following:

- Check-in with BES.
- Two-way feedback between DMWESB firms and prime Consultant.
- Tracking of metric identified in project plans (e.g., schedule compliance, quality compliance, mentoring hours).
- Identify any concerns or challenges that need to be addressed. Where needed, develop a performance plan with prime Consultant and DMWESB firm to address concerns.

Assumptions

- Assumes an average of 12 hours per firm for on-going QA check-ins.

Deliverables

- Meeting notes summarizing quarterly check-in meetings.
- Up to forty-eight progress reports (includes overall monthly project progress reporting), which may be issued monthly or quarterly, depending on project phase.

Task 1.1.3.3. DMWESB Development Support

Provide support to DMWESB firms, either as identified in their project plans or in response to corrective actions within a performance plan. Examples of support are as follows:

- Coaching of individual team members to improve time management.
- Developing or refining QA/QC procedures.
- Implementing earned value project management.

- Improving workload planning systems.

Assumptions

- Fee for this task assumes an average of 12 hours for each DMWESB firm.

Deliverables

- Documentation of development support activities provided to each firm.

Task 1.1.3.4. Tracking and Reporting

Produce the following reports:

- DMWESB Development Program Summary: Summarize DMWESB development approach and planned efforts. Develop DMWESB development fact sheet for internal and external stakeholders.
- DMWESB Development Program Progress Memoranda: Provide two progress reports summarizing performance on metrics and highlighting program wins and challenges. Meet with BES to identify needed adjustments to DMWESB Development Program.
- DMWESB Development Program Results Memorandum. Near project completion, develop a summary of DMWESB Development Program results, including successes and lessons learned. Include one-page executive summary for stakeholders.

Deliverables

- DMWESB development fact sheets.
- Draft and final versions of two DMWESB Development Program Progress Memorandum, including reporting on DMWESB development support activities.
- Draft and final versions of DMWESB Development Program Results Memorandum.

Task 1.1.3.5. Project Closeout

Develop a project close-out summary for each DMWESB firm, including review of metrics in project plan, lessons learned with prime Consultant and DMWESB subconsultant, and additional action items for DMWESB firm to leverage experience from the project on future marketing efforts and projects.

Assumptions

- Assumes an average of 6 hours for each DMWESB firm for closing out and documenting lessons-learned.

Deliverables

- Up to eight individual firm closeout reports.

Task 1.1.4 Develop Initial Risk Register

Develop a Risk Register using a template approved by BES. The register will be used to inform initial project development to characterize items that have the potential to significantly impact cost. The Initial Risk Register shall include the following information, at a minimum:

- Risk and opportunity identification.
- Activity or activities affected (tied to schedule activities).
- Risk description including qualitative categorization of risk.
- Estimated probability that risk may occur.
- Phase of project that risk could impact.

- Potential schedule impact should risk occur.
- Potential cost impact should risk occur.
- Potential health and safety impacts should risk occur.
- Risk trigger.
- Risk owner.
- Risk management strategy (transfer, mitigate, accept, exploit).

Assumptions

- Consultant team will develop the initial Risk Register and then hold a workshop with BES and Program Support Consultant to review and support additional development.

Workshops

- One initial Risk Register review workshop.

Deliverables

- Draft and Final Initial Risk Register.
- Workshop material.

Task 1.2 20% Design

The intent of this task is to produce a Basis of Design Report that will include TMs and drawings incorporating preliminary engineering evaluations, criteria development, input received from BES in design workshops, and document decisions made during the Project Definition phase.

The primary purpose of the Project Definition phase is to firmly establish the project design criteria. The Project Definition phase work, as defined below, will culminate in preparation of the Basis of Design Report.

Task 1.2.1 Client Objectives, Standards, and Preferences

The purpose of this task is to define BES's objectives and success factors for the project and to document BES's institutional standards as they pertain to this work. The Consultant will focus on the intended outcome achieved from established standards to propose, as applicable, updates to be in line with current industry standards and emerging trends. Project objectives and standards (coordinated with the Program Support Consultant) in the following areas will be considered and documented in a TM:

- **Project objectives:** Discussion of the overall purpose for this project to ensure that all participants have the same understanding. BES will define for the project team what will make this a successful project from their perspective.
- **BES design criteria standards and preferences:** Document BES guidelines and standards for design criteria or standard products.
- **Seismic Resiliency Criteria:** Document City of Portland and BES standard seismic resiliency goals and criteria. Consistent with the Oregon Structural Specialty Code and drawing on the Level of Service work previously done by Portland BES, as well as the seismic resiliency criteria developed for the Tryon Creek Headworks Improvements project, seismic resiliency criteria will be defined for structures, equipment, etc.

- **Graphic standards:** Standard drawing size/border, standard symbols/legends, CAD software standards (including software versions), requirements for electronic deliverables, standards/preferences for process and instrumentation diagrams (P&IDs), process flow stream IDs etc. This task will also include a kickoff meeting and follow-up with all design team subconsultants to coordinate CAD design standards, document presentation standards, etc.
- **Procurement policies:** Bidding/procurement requirements, sole source restrictions, any existing master agreement for the purchase of materials, and equipment.
- **Labor standards and policies:** Design provisions for staff/visitors with accessibility limitations, any existing noise restrictions, any existing labor union restrictions, site security requirements, parking requirements, etc.
- **Equipment and materials:** Preferences on indoor versus (vs.) outdoor locations for equipment; heating, ventilation, and air conditioning (HVAC) preferences (natural gas vs. electric heat, air conditioning requirements, etc.); preferred equipment types and suppliers; local control/local disconnect preferences (lockable MCCs vs. local disconnect switches); and preferences regarding the use of adjustable frequency drives, etc.
- **Approach to alternatives analysis and decision process:** Document approach to alternative evaluations, to be applied throughout the project. Evaluations will include triple-bottom-line analysis, including life-cycle cost criteria, capital costs, and non-cost criteria to support the decision process. Establish local parameters to be utilized in cost models and estimating tools for the purposes of Task 1.2 evaluations.

Deliverables

- Draft and final Client Objectives, Standards and Preferences TM.
- Draft and final chapter/TM of the Basis of Design Report.

Task 1.2.2 External Constraints and Standards

The purpose of this task is to define the external standards and criteria that influence the project design work. The standards and criteria in the following areas will be considered and documented in a TM:

- **Industry Standards:** Identify industry standards applicable to this project. General standards will be included here and specific standards will also be captured in the individual discipline fact sheets.
- **Regulatory Agencies:** Document natural resource and environmental regulatory agencies with jurisdiction for this project and specific contact people. List all known permits required for construction and operation. Document specific requirements that may dictate approach. Note that effort to develop this information is included in Task 2.5.
- **Civil:** Identify local stormwater control agency, document restrictions as they pertain to the proposed project, define permitting requirements; identify any local public work standards as they pertain to roads, stormwater, sewer etc.; any local restriction regarding dust control, demolition, construction traffic/noise, excess earthwork disposal, any existing floodplain restrictions etc.
- **Reliability/Redundancy requirements:** Document DEQ/U.S. Environmental Protection Agency (EPA) minimum requirements in addition to BES in-plant standards and goals.
- **Structural/Architectural/Mechanical:** Identify local building permitting agency, obtain current local design codes and standards that are in effect, including Portland's Green Building Policy, and document building permitting requirements.

- **Electrical/Instrumentation and Control (I&C):** Define redundancy requirements and identify primary contact at local utility.
- **Construction Phasing Constraints:** Identify which existing unit treatment processes and facilities must remain in service while any improvements or expansion facilities are being constructed; document known weather-related constraints for outage requests; using information provided by the Program Support Consultant team, document other projects at CBWTP that may impact this program, identifying issues to track and potentially identify in the Risk Register.

Deliverables

- Draft and final External Constraints and Standards TM.
- Draft and final chapter/section of the Basis of Design Report.

Task 1.2.3 Define Existing Conditions

The purpose of this task is to document characteristics of the existing facility. Results of this task will be documented in several TMs and/or field reports, intended to serve as appendixes to the Basis of Design Report.

Task 1.2.3.1. Data Review and Initial Condition Assessment

Provide initial assessment of the major components affected by the proposed scope of work including such assets as structural components, pumping systems, electrical, communications network, and major equipment. The intent of this initial condition assessment is a broad-based review of the age, the capacity, and the condition of existing facilities that are likely to be re-used as part of the future facilities.

The approach will be as follows:

- Collect existing documents and data, including but not limited to hydraulic profiles, effluent pump station operation information, odor control records, dimensions and location of treatment infrastructure (basins, channels, pipeline, substations, control panels, utilities, etc.), process data, electrical data, communication data, etc.
- Review collected documentation and identify data gaps and inconsistencies.
- Meet with BES staff to develop the limits of this initial evaluation and a list of the key individual components or systems to be assessed. Develop the methodology for assessment and determination of the useful life of an asset. It is assumed that the condition assessment will be based on record drawing information, maintenance records, visual observations and staff knowledge.
- Conduct field survey to determine condition of selected assets.
- Document findings.

Assumptions

- BES will provide 5 years of process performance data.
- BES will provide existing information relative to existing equipment, capacities, age, etc.

Deliverables

- Draft Condition Assessment TM (note that draft TM will be appended during follow-up condition assessment work conducted during the 30% design phase).

Task 1.2.3.2. Structural Assessments

- Site visit for structural evaluation of the existing solids building, including the floor and basement, the Silver Tunnel (for RAS and ML pipes and pipe supports for these pipes), the Wet Weather Effluent Channel, and major tie in points. Evaluations do not include an evaluation of equipment anchoring or other elements that are not a part of the structure. The structural evaluation will be presented in a workshop.
- Structural condition assessment (visual assessment) of the Aeration Basins to confirm recommended wall repair and rehabilitation requirements.

Assumptions

- The structural team can rely on the existing February 12, 2016, BergerABAM report for information related to the wall repair recommendations for the existing aeration basins.
- Visual observations will only serve to orient the design team and confirm BergerABAM recommendations.
- Evaluation of structural problems associated with existing plant facilities, other than the existing thickening/dewatering building.

Deliverables

- Draft Structural Assessment TM.

Task 1.2.3.3. Electrical Assessments

- Site visit for electrical evaluation of the existing facilities, including substations, MCCs, and conduit runs in the project area.
- Determine preferred tie-in locations and routing for new fiber optic control ductbanks to help achieve City goal of creating a fiber loop.

Assumptions

- BES will provide existing record drawing information and existing equipment information.
- BES will provide latest electrical system study information and current site electrical metering information.
- Plant fiber optic duct banks will generally consist of 4-inch PVC conduits with innerducts. Work is limited to a portion of the existing fiber optic system on the North end of the plant.
- Not included: Electrical review of existing facilities or building areas that are not specifically included in the project scope.

Deliverables

- Draft Data Collection and Condition Assessment Electrical TM.

Task 1.2.3.4. Site Survey Work

The site survey work will include of the following activities:

- Establish a horizontal and vertical control network for the project area. Horizontal control will be based upon the Oregon Coordinate Reference System datum. Vertical control shall be based upon City of Portland vertical datum.
- Perform site survey of the intended project area with the following guidelines:
  - Tie features within the survey limits of the project and include three-dimensional (3D) coordinates. Topographic features include, but are not limited to, utilities, drainage, trees (6

inches diameter at breast height or greater) and shrubs, and improvements (paved areas, curb, sidewalk, fences, and structures).

- Collect supplemental topographical data to create points and break lines in adequate quantity to accurately represent the surface of the ground to be included in the digital terrain model (DTM).
- Map and record utility facility structures (e.g., concrete pads, top slab of vaults, pump station housing, equipment pads and enclosures, barrier screens or fenced enclosures). Individual pieces of equipment will not be tied.
- Establish field ties of utility features including, but not limited to, underground storm water lines and structures, underground wastewater lines and structures, underground water lines and structures, underground and overhead power lines, and underground gas lines.
- Collect data for the top of each of the eight existing secondary clarifiers basin walls (and influent/effluent channels, Wet Weather Effluent Channel) and measure 8 to 10 water surface elevation points. This activity will be coordinated with the BES staff to note the specific flows at the time of measurement.

- Perform 3D scanning of Silver Tunnel, Blue Tunnel and Tunnel 8 (east of Squircles). Collect data for existing underground tunnels between the secondary clarifiers and aeration tanks utilizing stationary scanners.
- Perform 3D scanning of solids building, including basement.
- Create detailed base map file in AutoCAD format with survey data collected.
- Not included: Location/verification of existing belowground utilities using test pits, magnetic meters, or ground penetrating radar.

Assumptions

- An existing base map in AutoCAD format featuring the major site improvements will serve as the base for the addition of the topographic data that are collected for the project.
- BES will coordinate the marking of onsite utilities, provide record maps, and assist with the mapping/identification of the various utility lines in the production of the base map.
- Surveyors will provide for one additional site visit for the collection of supplemental topographic data identified as necessary with the design development task.
- Detailed topographic data will not be collected for the reactor building (Composter) and associated equipment because this area is proposed to be demolished. Consultant will collect sufficient data for the generation of the DTM for the future design and surface visible utilities.
- Legal, easement, or plat surveys will not be provided under this scope.

Workshops

- Surveyors will attend a kickoff meeting and one mid-project meeting to discuss scope, schedule, and project progress.

Deliverables

- DTM and CAD files of surveyed data.
- Workshop materials.

Task 1.2.3.5. Geotechnical Investigations

Perform geotechnical investigations to support design development. This subtask includes the following:

- Perform desktop review of existing geotechnical information. Review existing groundwater and dewatering data.
- Geotechnical Field Explorations Planning. Develop preliminary approach and locations for geotechnical field explorations.
- Site visit to observe site access and ground conditions for geotechnical field investigations.
- Finalize geotechnical field exploration plan.
- Stake out locations of proposed explorations and complete the "1-811" one-call utility locates notification. Provide locations to BES staff to allow for evaluation of potential utility interferences. Evaluate the presence of underground utilities using a third-party utility locates firm.
- Utilize results of environmental review (prepared as part of **Error! Reference source not found.**) to inform drilling and decontamination practices.
- Perform a geotechnical exploration program consisting of the following:
  - 12 geotechnical soil borings. The depth of these borings will be on the order of 60 to 100 feet.
  - 8 cone penetrometer test (CPT) probes with seismic shear wave measurements at 1-meter intervals. The depth of CPT soundings will be on the order of 60 to 80 feet.
  - Install 5 vibrating wire piezometers with data loggers to facilitate observation of groundwater fluctuations near the secondary clarifiers.
- Collect soil samples from soil borings using standard penetration test samplers and thin-walled Shelby tube samples at regular 5-foot intervals. Rhino One personnel will log the borings in accordance with the Unified Soil Classification System and ASTM D2488 by observing cuttings and collect samples.
- Develop laboratory testing program and complete laboratory testing on select, representative soil samples to develop engineering parameters. The laboratory testing will consist of up to 200 moisture contents, 36 grain size analysis, 36 Atterberg Limits, 6 one-dimensional consolidation tests, and up to four sets of pH, electrical resistivity, chlorides, and sulfates.
- Complete specialized laboratory testing to evaluate the ground response of low plasticity silts to cyclic shaking. The evaluation of these silts is often conservatively based on assuming the same behavior as clean sand, whereas these silts can often be shown to be more resistant to liquefaction triggering when using specialized laboratory testing.
- Prepare a preliminary Geotechnical Data Report that includes both previously existing geotechnical information and data obtained during the current geotechnical exploration.

Assumptions

- BES will provide copies of all available geotechnical, geologic, and groundwater reports and studies completed at the project site.
- BES will provide access to site required to complete geotechnical explorations.
- BES will assist Consultant with reviewing potential underground utility interferences with proposed geotechnical exploration locations.
- Geotechnical exploration will commence within 2 months of notice to proceed (NTP) and be completed within 3 months of NTP.
- Assume that explorations will encounter ground having limited contamination. Therefore:

- The drill cuttings will be stored in 55-gallon drums. Drums will be stored onsite until environmental testing/characterization is complete. It is assumed that the cuttings are non-hazardous and therefore disposed as such.
- Drums and drill cuttings/investigation derived waste (IDW) will be removed from the site. Level of effort includes costs for transport and disposal of the drums and cuttings. The level of effort does not include costs for constructing storage facilities.
- Air monitoring during completion of the geotechnical explorations will not be required.
- Mud-rotary drilling techniques will be used. The drill rods will be steam cleaned between the drill holes if needed.
- A different geo-probe/drill rig will be utilized for samples collected for environmental testing (**Error! Reference source not found.**).

Meetings

- Three site visits before field work.
- Field exploration.

Deliverables

- Preliminary and Final Geotechnical Data Report.

Task 1.2.3.6. Contaminated Soil

Environmental Sampling and Analysis Plan

A soil Sampling and Analysis Plan will be prepared for CBWTP to provide guidance in executing environmental sampling to provide baseline anticipated environmental site conditions to be considered during construction. Based on a review of the historical information, and the *1998 Environmental Data Report for Dry Weather Primary Clarifiers and Odor Control Facilities* (CH2M, 1998) the Sampling and Analysis Plan will describe the proposed sampling techniques and analytical methods to be used for environmental sampling for the project.

Assumptions

- The analytical methods are assumed to be total polychlorinated biphenyls, total metals (As, Pb, Hg, Cu, Cd, Cr, Se, Ag), total petroleum hydrocarbons, and pesticides.
- No site visits are included in this task.
- BES will provide one set of consolidated comments on the Draft Sampling and Analysis Plan.
- Groundwater will not be sampled.

Deliverables

- Draft and final Sampling and Analysis Plan.

Field Sampling (Conducted by BES with Consultant Oversight)

After approval of the Sampling and Analysis Plan from BES, BES will conduct the soil sampling. Sampling will be conducted to obtain a discrete sample from each location at two depth intervals at each location, from surface to 10 feet below ground surface. Samples will be obtained from a depth of up to 10 feet, with a Geoprobe, using stainless steel hand tools to collect the sample. Samples will be collected at the direction of the Consultant. A total of 25 individual samples will be analyzed.

BES will place IDW into a 55-gallon drum, labeled as analysis pending, and stored onsite. Based on previous soil results, the IDW is assumed to be non-hazardous. Consultant will coordinate disposal of the

IDW at a BES-approved facility. Consultant will provide BES an email summary at the end of the field day documenting field activities.

Assumptions

- Field work will be conducted by one Consultant staff member and will be completed in one 10-hour day.
- Consultant will conduct the necessary utility locate notification services.
- Consultant will provide 3rd party utility locate services for each decision unit before conducting the sampling.
- Disposal costs are not included in this scope of work.

Deliverables

- Email summary of field sampling activities.

Reporting

Following the completion of investigation sampling activities, the field information and analytical data will be reviewed in detail and evaluated to identify potential additional data needs. The evaluation will include a qualitative review of laboratory QA/QC data to validate analytical data.

A subsurface investigation summary report will be prepared, and the following information will be included:

- A description of the work completed, a summary of the results, and the proposed scope of subsequent field work, if needed.
- Tables presenting results for Contaminants of Potential Concern for the media (soil) and IDW.
- Soil data will be compared to DEQ risk-based concentration screening levels for construction worker, direct contact pathway, or similar screening value.
- Up to four figures will be prepared that show the results for the two decision units.

Deliverables

- Draft and final Subsurface Investigation Summary Report.

Task 1.2.3.7. Odor Characterization

Perform sampling and analysis of specific solids odors to better understand and characterize odorants. This rolls into the technology selection effort. Some technologies do a better job of removing complex odorants than others. Data will be used as starting point for Basic of Design Report. Guidelines for this task are as follows:

- Sampling from separate locations as follows:
  - Biosolids storage.
  - Biofilter inlet/outlet.
  - Thickening/dewatering facilities at other facilities.[1]
  - Fat, oil, and grease (FOG) receiving station/sludge storage tank at other facilities.[1]
- Laboratory Analysis:
  - Reduced sulfur analysis (bag samples, Australian Laboratory Services (ALS)).

[1] This will depend on the FOG/Food Waste and the change in thickening/dewatering approaches and technologies that will be proposed for the CBWTP.

- Carboxylic acid analysis (sorption tubes, ALS).
- Aldehyde analysis (sorption tubes, EPA Method TO-11A).
- NH_3/amine analysis (sorption tubes, ALS).

- Field Analysis:
  - OdaLogs® (at inlet of biofilter to obtain better understanding of diurnal loadings).
  - Jerome meter.
  - SMS100 field olfactometer.
  - Gastech sorption tubes.
  - Airflow rates (to determine odor emission rates).
  - Negative pressure under covered process units (to determine odor capture efficiency).

Assumptions

- Sampling from a total of six separate locations at two or, at maximum, three facilities, including CBWTP.
- Field equipment and laboratory analysis provided by Consultant.
- Access to facilities provided by BES.

Deliverables

- Sample plan: plan for sampling, measurements and analysis with plant input/agreement.
- Raw sampling data.

Task 1.2.3.8. Baseline Noise Condition

Conduct ambient noise monitoring at property lines to inform development of acoustical design criteria and construction phase performance limits. If existing noise levels are below code limits, BES may prefer to establish project design criteria more stringent than code limits. In preparation for this effort, a noise monitoring plan will be prepared and submitted to BES for review. After the measurements are completed, a Baseline Noise Study TM will be developed, comparing measured levels with code limits, and recommended design criteria for the project.

Assumptions

- Ambient noise monitoring will be conducted at up to two locations at property lines for up to 72 hours.
- Short-term measurements would also be conducted in the nearby community (receptors to the south, including commercial and residential zones) for interpreting property line sound levels.

Deliverables

- Draft and final Baseline Noise Study, with noise measurement data.

Task 1.2.4 Update CBWTP Process Model

The purpose of this task is to establish the basis for Task 1.2 evaluation efforts.

Update existing CBWTP process models (developed as part of Secondary Process Improvements project) to prepare a whole-plant model to support Task 1.2 evaluations and subsequent design effort. Calibrate model utilizing facility parameters and performance data captured and presented in the *Columbia Boulevard Wastewater Treatment Plant Facilities Plan Update* (2016 Facilities Plan Update) (HDR, December 2016).

Include two years of additional data in the projections and use an alternate methodology to track the rolling-average values instead of percentile-rank values for a closer fit of back-calculated projection curves with the historical plant data. [CR-002]

Developing revised Flow & Load Projections [CR-002]

Present model inputs, assumptions, and results of calibration effort in a TM. Document secondary treatment and digestion system capacities based on current operational strategy.

Assumptions

- Effort will rely on information captured in 2016 Facilities Plan Update, including
  - Influent flow and load criteria (current and projected) (Tables 4-1 through 4-9).
  - Influent characterization (Tables A1 and A2 in Appendix 4-A).
  - Unit process performance (as described in Chapter 5).
- Effort will also rely on alternative projection methods and additional workshops/meetings because projections captured in the 2016 Facility Plan Update may not be applicable. It is anticipated this will result in an extended project schedule.
- BES will provide native (spreadsheet) files of unit process performance data, captured in 2016 Facilities Plan Update.
- BES will provide updated process control data (post-2016).
- Additional meetings/workshops required to make decisions related to flow/load projections.

Deliverables

- Calibrated process models (solids/liquids process model and mass balance).
- Draft and final Existing CBWTP Process Model TM.
- Process Design Criteria Assumptions TM presenting revised flow and load projections.

Task 1.2.5 Define Long-Term Process Scenarios and Resulting Unit Process Criteria

Develop and evaluate long-term process configuration alternatives, resulting unit process criteria, and document results in a TM. Document system capacities, resulting wastewater/sludge characteristics, and range of criteria to inform subsequent unit process development for which the design should make provisions. Document the impact on sludge and recycle stream quantities and characteristics resulting from up to eight scenarios, including:

- Co-thickening vs. separate PS/WAS thickening.
- Current digestion configuration vs. a more streamlined parallel flow with co-digestion of primary, secondary, FOG, and food waste. Consider operation of WAS storage tank as a phosphorus release tank for struvite control. Evaluate impact of eliminating use of Digesters 1 through 4 from digestion processing.
- Increasing sludge production, food waste, and FOG acceptance. Document impact on gas production and solids dewatering.
- Long-term biosolids utilization/management options, like pilot or small-scale Class A dryer with local (internal to BES) distribution.

- Varying solids and wastewater characteristics resulting from Chemically Enhanced Primary Treatment (CEPT).
- Future nutrient removal requirements (ammonia limits, or operation with nitrification).

Scenario development will address:

- Digestion capacity.
- Solids processing capacity.
- Biogas generation.
- Biosolids management and use.
- Liquids process impacts.
- Sludge dewaterability.

Assumptions

- Assume four model scenarios will be developed.

Deliverables

- Draft and final Unit Process Criteria TM.
- Process model output (solids/liquids process model and mass balance).
- Process flow diagrams.
- Range of unit process design criteria for follow-on Secondary Treatment and Solids Processing tasks below.

Task 1.2.5.1. Optional Subtask – Evaluate Future Scenarios

As part of BES long-range planning, once the scenarios above are developed, BES may choose to further evaluate the most plausible scenarios by developing the following:

- Capital cost, life-cycle cost, and non-cost evaluations.
- Conceptual site plans.

Assumptions

If authorized, this scenario development would be conducted to the extent of the available budget. Deliverables would be defined as part of the authorization process.

Task 1.2.6 Seismic Resiliency Approach

Develop and evaluate alternative design approaches to support adequate seismic resiliency of improvements. TM will include results of the following activities:

- Perform a site visit to observe and collect information on existing structures intended for reuse (e.g., solids building, secondary tunnels).
- Analyze and perform evaluation of seismic stability of said structures.
- Drawing on established BES goals and criteria, as well as the seismic resiliency criteria developed for the Tryon Creek project, work with BES to define specific seismic resiliency criteria for program improvements.
- Document seismic retrofit alternatives evaluation and recommended approaches for existing solids handling building. Reflect building uses by different equipment configuration options. Identify

potential limited rehab, if re-use of existing building is found possible in some sub-alternatives. Include order-of-magnitude cost estimates for use in Task 1.2.8 evaluations.

- Establish seismic resiliency criteria for new facilities.
- Develop and document foundation and construction approaches for East Pad buildings, secondary clarifiers, new solids building, and miscellaneous new structures.

Deliverables

- Seismic Resiliency TM.

Task 1.2.7 Geotechnical Design Approach

Develop and evaluate alternative geotechnical design approaches to support development of improvements. TM will include results of the following activities:

- Develop code-based spectral accelerations to be used for preliminary seismic design.
- Complete simplified liquefaction triggering evaluation. Use results to estimate the magnitude of seismically induced settlements.
- Utilize simplified methods to evaluate potential for seismically induced flow failures and lateral spread.
- Complete preliminary assessment of ground improvement methods to mitigate seismically induced settlement and lateral spread.
- Document ground improvement alternatives evaluation and recommended approaches for secondary clarifiers and Columbia River Slough stabilization. Include order-of-magnitude cost estimates for use in Task 1.2.8 evaluations.
- Document ground improvement alternatives evaluation for potential new solids building. Include order-of-magnitude cost estimates for use in Task 1.2.10 evaluations.
- Document ground improvement alternatives evaluation and recommended approaches for East Pad buildings. Include order-of-magnitude cost estimates for use in Non-Process Building evaluations.
- Document potential dewatering approaches to support development of 20% cost estimate.

Deliverables

- Geotechnical TM documenting assessment of ground improvements.

Task 1.2.8 Secondary Treatment

Develop and evaluate components of secondary treatment improvements related to the addition of two new clarifiers. Secondary Treatment TM will address major components of the secondary treatment expansion, as described below.

Task 1.2.8.1. Mixed Liquor Withdrawl

The CBWTP secondary process currently relies on symmetry, with eight aeration basins and eight clarifiers. The mismatch that occurs with the addition of two clarifiers requires careful management. The number of units, configuration, dimension, depth, elevation, grade, allowable loading rate, and performance of the new clarifiers will differ significantly from the existing squircles. Since the new clarifiers will be maximized and have capacity to treat more flow and load per unit than the existing ones, accurately managing the split of flow and ML to the new clarifiers is critical to optimizing their benefit.

Investigate options to promote consistent ML withdrawal from the existing eight aeration basins. This task includes development of a sequence of computational fluid dynamic (CFD) models to evaluate the hydraulic flow characteristics of the CBWTP at the section from aeration basin outlet to the secondary clarifiers. This information will help minimize risk and improve the design for the distribution of flow from the existing aerations basins to the expanded clarifier arrangement. This analysis will assist with understanding the flow split hydraulics, identifying potential inefficiencies, and developing comparative analysis for the existing and proposed upgrades. The models will be used to do the following:

- Characterize the hydraulics between the aeration basins and secondary clarifiers as currently designed.
- Evaluate the flow split hydraulics to determine the potential for inefficiencies and poor performance.
- Evaluate changes to determine the potential for performance improvement based on alternative configurations.

The scope of the analysis will include the following main points:

- Review historic data, including but not limited to inlet and outlet flow and velocity, and clarifier operating levels, if available.
- Create a 3D model of the overall model domain. This will include key hydraulic features such as aeration basin walls, the location, size and orientation of inlets and outlets, and lengths of piping relevant to the analysis. Extended piping and clarifier weirs will be incorporated via boundary conditions to maintain reasonable computational size and corresponding run times.
- Review model geometry and boundaries with the project team and BES to determine appropriate scenarios for analysis. This may include maximum, minimum, or critical flow rate conditions.
- Develop the CFD model including appropriate mesh and to capture overall hydraulic performance and spatial variation within the model and appropriate boundaries based on the agreed scenarios.
- Run the initial model over an appropriate period to characterize the hydraulics and flow distribution. Similarly, run the subsequent upgraded configuration models to identify potential for improvements or inefficiencies within the tank relative to the existing configuration.
- The initial model will be evaluated to determine level of convergence of the solution and overall hydraulics. The mesh will be updated and refined to ensure accuracy of results appropriate to describe the hydraulic features.
- Repeat analysis for up to two modifications to the specific tank model based on the initial results and discussion with the project team.
- Various post-processing techniques will be used to describe the results of the model. These may include 3D velocity streamlines, contour planes, iso-surfaces, and volumetric rendering of velocity, tracer concentration, pressure, or other parameters.
- Other numerical techniques may be used to characterize hydraulic performance such as an analysis of the flow split.

Assumptions

- The aeration basin flow rates will be evaluated for an initial scenario under steady inlet and outlet conditions. Further scenarios may evaluate additional steady flow conditions.
- Depending on configuration, the model may be modeled as two-fluid (air and water) or single fluid (water). A fixed free water surface, if applicable, will be modeled as a zero-shear stress boundary.

- Small features that do not significantly impact the analysis may not be included.
- Moving mechanical parts may be simplified or omitted from the model.
- Because of the lengthy computer computation run times associated with CFD modeling, it will require approximately 8 weeks after authorization to complete the work. Preliminary information will be provided after approximately 5 weeks for input and discussion to help direct the final runs.
- BES will provide a description of the geometric features of the collection tanks and the flow conditions to be evaluated. These fundamental information requirements are listed below:
  - Dimensioned drawings or hand sketches to build all solid surfaces the water will contact. This includes structural drawings for the inlet, outlet, and tank. For existing structures, as-built drawings are preferred and pictures are helpful for understanding the project features.
  - Description of flow magnitude and water surface elevation ranges for the basins.
  - Specific scenarios to be evaluated: flow rates, water levels, and physical configurations.
  - Any history of past problems or flow characteristic data.

Deliverables

- Draft CFD Model TM describing model inputs and results.

Task 1.2.8.2. Mixed Liquor and Secondary Effluent Flow Routing to and from New Clarifiers

The purpose of this subtask is to develop alternatives for routing of flow to the new secondary clarifiers. This subtask specifically considers whether this can be accomplished with gravity flow, or if an intermediate pump station is required. This subtask includes the following:

- Use existing plant drawings to develop an accurate hydraulic model from the aeration basin to the outfall.
- Document existing operation and operational limitations of existing Effluent Pump Station.
- Work with plant operational staff to incorporate existing plant control strategy for squircles and effluent pump station, and effluent flow measurement into simulation model.
- Work with BES staff to determine critical flow scenarios.
- Use plant data to calibrate model and ensure hydraulic and controls accuracy.
- Develop and evaluate alternatives (five alternatives at three flow scenarios), including proposed control strategies so that operational philosophies and performance can be evaluated. Include consideration of impacts to existing disinfection dosing location and configuration. Alternatives may include:
  - Discharge to Wet Weather Effluent Channel.
  - Discharge to dry weather pump station.
  - Pump from aeration basins to secondary clarifier.
  - Pump from new secondary clarifier to disinfection.
  - Additional alternative to be determined.
- SECL Location

Prior to the start of 30% design phase, confirm detailed location of secondary clarifiers based on 20% clarifier configuration. The steps included in this task include the following:

- Prepare a list of constraints on the horizontal location of the clarifiers. Include constraints during construction that impact location as well as constraints related to the final layout after STEP completion.
- Prepare CAD model of constraints to the location of the proposed circular secondary clarifiers, including:
  - Structures
    - Primary Clarifiers (existing)
    - Cake loadout (existing)
    - SECL 7 and 8 (existing)
    - New SECL 9 and 10
    - New RAS Pump Station (RAPU)
    - New ML and RAS piping
    - Wet weather primary clarifier effluent channel (existing)
    - Wet weather effluent channel (existing)
    - New Hypochlorite facility (HYPO)
  - Utilities
    - Medium Voltage duct bank (existing)
    - New Medium Voltage duct bank
    - Dry weather primary clarifier effluent line (existing)
    - New Primary Sludge lines
  - Traffic (during construction and post-construciton)
    - Cake hauling trucks
    - Hypochlorite delivery trucks
    - Design emergency vehicle
    - Walking path
  - Other Constraints
    - Construction Shoring
    - Soil improvement development zone
    - Clear distance for formwork
    - Environmental zone (existing)
    - Resiliency criteria for medium voltage cabling
    - Grade
    - Contingency space

- Prepare for and attend 2 workshops.
- Revise CAD to incorporate comments and additional constraints in the model, publish for comment.
- Finalize and distribute the location of SECL-9 and SECL-10 to the design team by Dec 15, 2019.

Meetings

- 2 Workshops:
    - Internal Workshop with key designers and permit lead to review constraints and preliminary locations
    - Client Workshop with key stakeholders (BES Engineering and O&M, CMGC, design leads, permitting leads, etc.) to review constraints and select location

Deliverables

- Information from this Task will be summarized in a TM.

Task 1.2.8.3. Secondary Clarifier Configuration

Develop and document configuration of the new secondary clarifiers. The following characteristics will be addressed:

- Secondary clarifier interior baffling.
- Mechanism type.
- Inlet/sludge withdrawal.
- RAS Pump Station Location and configuration (e.g., dry well).
- Integration of new RAS system with existing, including consideration of operational upgrades to the existing RAS pumps, notably the addition of a second VFD to each pair of pumps.

Deliverables

- Information from this Task will be summarized in a TM.

Task 1.2.8.4. Identify Design Considerations for Future Secondary Treatment Alternatives

Identify and document accommodations for the following future secondary treatment alternatives, incorporating:

- Squircle upgrades/conversion (and evaluate possible upgrades to existing RAS pumping).
- West clarifier expansion.
- CEPT.
- Ammonia management alternatives.

Deliverables

- Information from this Task will be summarized in a TM.Silver Tunnel Upgrades

Document upgrades required within the Silver Tunnel. Consider the following system components:

- Existing piping: define limits of current and proposed use and portions of piping that can be demolished.
- Existing RAS pump drives and control.

- Non-process facilities heating alternatives to replace the Silver Tunnel boilers and restore the building heating systems to current standards. Address constructability benefits in the tunnel and the replacement of a dated building heating system with more efficient alternatives, including distributed system, and consideration of potential energy incentives.
- Ventilation and lighting.
- Access.
- Evaluate existing dewatering pump stations.
- Addition of WiFi connectivity.

Assumptions

- Assume direct buried piping between Silver Tunnel and new circular clarifiers (no new gallery or tunnel).

Deliverables

- Information from this Task will be summarized in a TM. Aeration Basins Structural Rehabilitation

Work includes updating the structural condition assessment prepared by BergerABAM and preparing specific repair methods for implementation. Task includes the following:

- Document findings and recommendations captured in *Columbia Boulevard Wastewater Treatment Plant Aeration Basins 1 through 6 Structural Evaluation* (BergerABAM, February 12, 2016).

Assumptions

- Additional evaluation of aeration basin rehabilitation is required to define the basis of cost for the 20% design phase.
- Coordination with separate BES project Wet Weather Clarifiers Improvements recommendations for structural rehabilitation will be required for consistency. **Deliverables**
- Information from this Task will be used to prepare the memorandum in Task 1.2.8.6 Prepare Technical Memorandum.
- **Field Report [CR-012]**

Task 1.2.8.5. Hypochlorite System Upgrades and Relocation

Work includes a condition assessment of the existing system, identifying needed upgrades, and evaluating alternative locations, as follows:

- Background review and site visit preparation.
- Site visit: two Consultant staff will visit the site 1 day.
- Develop report of assessment findings. Develop alternatives to address condition items and opportunities for relocation, including key considerations for current design.
- Prepare cost estimate and schedule, considering other upgrades to secondary treatment.
- Present results to BES.
- Prepare the final report.

Task 1.2.8.6. Prepare Technical Memorandum

Task 1.2.9 Major Electrical Systems Replacement

Develop and evaluate electrical requirements, including the following:

- Conduct an initial walk-through with BES staff (budgeted under Existing Conditions Task).
- In a workshop, identify objectives for the relocation of medium voltage system (such as speed of recovery, asset protection, or continuous operation).
- In a workshop, identify the limits of the project, flood scenarios, and task objectives.
- Develop a consolidated one-line diagram within the scope of the work.
- Identify decisions from other project elements (such as secondary and solids projects that will impact substation design [location, backup power, capacity, sump pumps]).
- Participate in two coordination meetings for main substation replacement.
- Flood elevation criteria, considering risk and cost analysis.
- Develop three flood scenarios such as cause of flood, depth of the flood, and duration of the flood.
- Evaluate the electrical components affected by flood and prioritize with BES the items to be removed and replaced in a flood protected area. Evaluation will include the following:
  - Medium voltage switchgear, and cabling.
  - Low voltage cabling and distribution equipment.
  - Unit substation (transformers).
  - MCCs.
  - Local control panels.
  - Plant control system (programmable logic controller [PLC]) panels.
- Identify three electrical system approaches:
  - System diagrams.
  - Conduct cost/non-financial evaluations.
- Identify preferred alternative and resulting infrastructure (electrical building, etc.).
- Evaluate sump pump approach.
- Evaluate relocation or elimination of unit substation at Composter Facility.
- Evaluate electrical construction sequencing constraints, temporary provisions, and shutdowns.
- Evaluate electrical classification as a result of this work (NFPA 820 considerations): area classifications, ventilation requirements, alarm requirements.
- Check load on medium voltage (related to impacts of centrifuge installation, potentially 1,200 horsepower). Critical driver for substation decisions. Critical driver for substation decisions.
- Review existing SKM model and reports.
- Compile results of evaluations in a comprehensive draft TM. Review draft with BES staff and prepare final TM.

Assumptions

- NFPA 820 analysis is limited to the facilities to be modified in this project.
- Two workshops: one to develop flood scenarios and then one to present evaluation results and proposed approach.

Deliverables

- Draft and final Electrical System Replacement TM.
- Workshop materials and minutes.

Task 1.2.10 Solids Processing

Develop and evaluate components of solids processing improvements. Several interim TMs will be prepared to present the subtask evaluations for all subtasks under Tasks 1.2.10.

Develop a stand-alone procurement of trailer mounted dewatering equipment to meet current dewatering capacity needs, to provide additional capacity to ease construction sequencing and to provide capability for BES to clean and dewater digesters. Develop specification, support BES with procurement and post-procurement services for the mobile dewatering equipment trailer.

Scope includes the following:

- Facilitate conference call meeting with dewatering equipment vendor to identify BES needs and available options and take meeting minutes.
- Contact dewatering equipment manufacturers to get information and proposals for new and used trailer-mounted dewatering equipment.
- Hold review meeting with BES on draft technical specification and take meeting notes.
- Prepare draft and final trailer mounted dewatering equipment technical specification. No procurement documents (front ends, bidding forms, contracts, etc.) will be prepared by Jacobs.
    - Bid documents should require the contractor commit to an on-site start date so BES can use a single procurement process for a new centrifuge which allows competition and puts the onus on the manufacturer to accelerate their lead time or bridge the gap with a temporary solution.
    - Specification to balance BES preferences on equipment components (i.e.; motors, adjustable speed drives, package control systems, etc.) with manufacturers' standard products to reduce equipment lead time.
    - Consider life cycle cost in the bid form by providing assumptions on production rates, duration (5 years), etc.
- Support BES through bid phase, submittal reviews, delivery, startup, and functional and performance testing of new equipment.
- Perform factor witness test of equipment prior to delivery.
- Specific scope tasks:
    - Project Management
    - Summarize options in memo
    - Coordination call with BES
    - Coordination meeting/conference calls with BES and Vendor

- Prepare draft spec – assume single package spec utilizing vendor standard equipment (motors, control, etc.)
- Review meeting with BES
- Prepare final spec
- Procurement coordination/support
- Bidding phase services
- Shop drawing reviews
- Attend factor witness test
- Delivery coordination and inspection
- On-site facility coordination prior to testing
- Support Functional Testing
- Support Performance Testing

Task 1.2.10.1. Thickening Technology Evaluations (and Building/Housing Evaluation)

- Develop sizing criteria for thickening equipment.
- Evaluate and select equipment. Consider co-thickening and separate WAS/PS thickening and impacts on equipment, number of operating units, future solids processing operation such as thermal hydrolysis, and layout. Reflect odor control/ventilation with each option. Develop raw sludge blend tank requirements for co-thickening. Develop thickened sludge blend tank requirements before digestion.
- Evaluate filtrate/centrate management, conveyance.
- Evaluate temporary thickening and related facilities.
- Evaluate co-digestion impacts (effect of enhanced thickening on additional digestion capacity).

Deliverables

- Information from this Task will be used to prepare the memorandum in Task 1.2.10.7 Prepare Technical Memorandum.

Task 1.2.10.2. Dewatering Technology Evaluations (and Building/Housing Evaluation)

- Develop sizing criteria for dewatering equipment.
- Develop long list of alternatives and screen to a short list of alternatives
- Evaluate and select dewatering equipment (including pumping, grinders). Consider operations schedule, impacts on dewatering feed and cake storage facility sizing. Evaluate dewatering feed tank mixing alternative.
- Evaluate filtrate/centrate management, conveyance.
- Evaluate temporary dewatering and related facilities.

Deliverables

- Information from this Task will be used to prepare the memorandum in Task 1.2.10.7 Prepare Technical Memorandum.

Task 1.2.10.3. Cake Conveyance and Cake Storage/Loadout Technology Evaluations (and Location Evaluation)

- Develop sizing criteria for cake conveyance/storage/loadout equipment.
- Consider conveyance type.
- Consider hopper type (live bottom, push-floor, rotary discharger, are assumed technologies for evaluation), and loadout gate type.
- Consider operational requirements.
- Identify cake hauling vehicle/trailer requirements, including multi-modal containers.
- Evaluate possible phasing options for cake handling.
- Identify truck scale requirements.

Deliverables

- Information from this Task will be used to prepare the memorandum in Task 1.2.10.7 Prepare Technical Memorandum.

Task 1.2.10.4. Identify Design Considerations for Future Solids Treatment Alternatives

Identify and document accommodations for the following future treatment alternatives:

- Drying/Class A product.
- CEPT.
- Ammonia management alternatives.
- Others, e.g., Thermal hydrolysis, gasification, etc.

Deliverables

- Information from this Task will be used to prepare the memorandum in Task 1.2.10.7 Prepare Technical Memorandum.

Task 1.2.10.5. Site Visits to Operating Facilities (for All Candidate Technology Evaluations)

Work with equipment manufacturers to arrange site visits to observed top candidate technologies.

Assumptions

- Assume all site visits are within the northwest.
- Assume two staff will attend each site visit.
- Assume three separate all-day visits are required to tour biosolids cake pumping installation and to perform additional review of vertical cake conveyor installations to Cleanwater Services Durham and Rock Creek (Day 1); King County Brightwater and South Plan (Day 2) and Vancouver Westside (Day 3).
- Assume one additional site visits to Cleanwater Services to review vertical screw conveyors (Day 4).

Deliverables

- Site visit reports.

Task 1.2.10.6. Solids Processing Configuration

Determine disposition of existing solids building and evaluate up to four full building configurations including modification/addition to existing facility, and new solids handling facility layouts (including two-story or three-story new building). Task includes the following:

- Determine disposition of existing solids building and evaluate up to four full building configurations including modification/addition to existing facility, and new solids handling facility layouts (including 2-story or 3-story new building).
- Evaluate WAS and PS thickening alternatives, including co-thickening; evaluate thickened WAS (TWAS) storage tank requirements, and modifications to TWAS feed to digestion.
- Evaluate PS thickening alternatives potentially including CEPT, gravity thickening, gravity belt or rotary drum thickener, and modification to existing primary clarifier structure or operations.
- Evaluate impact on ammonia return stream from intermittent dewatering and centrate return. Intent of this activity is to confirm that existing secondary process can operate in anticipated compliance with permit limits with planned dewatering centrate return.
- Coordinate with civil discipline for site truck circulation, truck scale location, and construction phase circulation and site constraints.
- Dewatering feed tank need/sizing.
- Sludge pumping (i.e., WAS, PS, TWAS, digested sludge [dewatering feed]), scum pumping, and filtrate/centrate pumping (if required) upgrades/modifications.
- Sludge sampling requirements. Identify special sampling facilities required.
- Identify solids building laboratory facilities required by BES (polymer trials, optimization).
- Polymer feed systems:
  - Common or separate systems for thickening/dewatering.
  - Dry vs. liquid.
  - Polymer activation equipment.
  - Bulk polymer storage.
  - Dilute polymer storage and use of day tanks. Tank mixing, and/or recirculation requirements.
  - Polymer spill management facilities (sump location, pump types).
- Cranes, monorails, and hoisting requirements.
- Evaluate sludge conditioning requirements/facilities (evaluate Orege conditioning process on dewatering feed; motorized polymer blenders on feed to thickening and dewatering equipment).
- Strategies for solids building space, including ventilation, air transfer, space heating needs, large duct routing requirements, conflicts with equipment removal.
- Provide data to support construction cost estimate.

Deliverables

- Information from this Task will be used to prepare the memorandum in Task 1.2.10.7 Prepare Technical Memorandum.
- Prepare for and conduct co-digestion workshop with BES staff.

- Develop primary scum transfer alternatives and digester operational strategy.
- Prepare for and conduct review workshop with BES staff.

Task 1.2.10.7. Prepare Technical Memorandum

No Scope completed under this task.

Task 1.2.10.8. Solids Dewatering Piloting

This task describes the scope for performing demonstration pilot testing of candidate dewatering equipment. The goals of the pilot testing program are as follows:

- Allow staff to gain operator familiarity with high solids centrifuge dewatering technology.
- Provide operational data and verify the process design criteria, including solids throughput, cake concentration, solids capture, and polymer dosage.
- Determine potential/actual centrifuge performance and polymer requirements on the CBWTP solids.
- Provide a summary report of the testing results and recommended design criteria for the centrifuges, which will enable the design Consultant to develop more precise, performance-based specifications.

Pilot testing requires significant staff and Consultant resources to implement, and while the pilot test performance is helpful to confirming design criteria, uncertainty remains in actual full-scale implementation pilot testing due to factors that may change in feed solids. For these reasons, only one centrifuge manufacturer will be identified to pilot its high solids dewatering centrifuge system. Consultant will identify and coordinate with a vendor who can meet schedule requirements and identify compensation to be paid by BES to support the required equipment-related services and staff-related services for conducting the pilot tests. A detailed schedule for the program will be prepared upon consultation with the selected vendor. The following tasks will be performed.

Prepare Pilot Testing Plan for Dewatering
A pilot testing plan and protocol will be developed and a draft plan submitted to BES. The pilot testing plan will delineate procedures, sequences, and responsibilities of the parties (BES, centrifuge manufacturer, and Consultant). It is anticipated that BES will be responsible for providing personnel and resources for: (1) procurement support for pilot testing contracting, (2) the installation of miscellaneous support facilities, (3) utility hookups, (4) site preparation, (5) disposal of generated dewatered biosolids, and (6) supervisory staffing during testing. BES and each pilot testing manufacturer staff will coordinate pilot testing activities associated with the delivery, installation, system checkout, and system startup of the pilot test equipment.

The testing plan will define data collection requirements that focus on information required to determine anticipated operating costs, system performance, and system reliability.

Consultant will arrange with up to four dewatering equipment manufacturers (including selected pilot test manufacturer) for shipment of dewatering feed samples for bench-scale testing of the sludge samples.

BES staff will have the opportunity to operate the pilot centrifuge for a minimum of 1 day during the pilot testing period to gain direct centrifuge-operating experience.

The Consultant will act as BES representative and full-time observer during the demonstration tests.

The Consultant and the pilot testing manufacturer staff will assist BES in coordinating pilot testing activities associated with the delivery, installation, system checkout, and system startup of the pilot test equipment.

The Consultant will assist BES staff in the supervision of the centrifuge tests. The Consultant will work in cooperation with BES staff to coordinate utilities requirements, miscellaneous support facilities, and site preparation requirements. It is anticipated that the pilot system will be trailer- or skid-mounted, and that utility hookups, site preparation, and miscellaneous support facilities (such as feed pumps and dump truck or dumpsters for dewatered biosolids handling), will be provided by BES.

It is anticipated that the manufacturer will provide a startup Consultant and field technician to perform system checkout and system startup services, and provide training for BES operations staff.

It is anticipated that the staff of the centrifuge pilot test manufacturer will operate the pilot system on an 8-hour per day basis for up to 2 weeks (Monday through Friday) to obtain the required data on system performance, reliability, and operating characteristics. These data will be used by the Consultant to prepare the Report of Pilot Testing Results.

Sampling Requirements and Data Collection
Samples for each individual test will be split: one sample will be taken by Consultant staff and analyzed by a third-party laboratory, and one sample will be taken and analyzed by manufacturer-selected laboratory. This scope includes allowance for sampling as follows (including shipping):

Flow Stream/Parameter	Expected Lab Samples
Centrifuge Sludge Feed	
Percent total solids (each test)	8 tests per day, x 8 days per vendor x 1 vendor = 64 tests
Percent volatile solids (once per day)	8 tests per day, x 8 days per vendor x 1 vendor = 64 tests
pH (once per day)	Assume field measurement
Temperature (once per day)	Assume field measurement
Cake Solids	
Percent total solids (each test)	8 tests per day, x 8 days per vendor x 1 vendor = 64 tests
Centrate	
Percent total suspended solids (each test)	8 tests per day, x 8 days per vendor x 1 vendor = 64 tests
Total dissolved solids (once per week)	1 test per day = 1 x 8 days per vendor x 1 vendor = 8 tests

Reporting of Test Results
After completion of the pilot test and sample analysis, the centrifuge manufacturer shall provide a report detailing the procedures followed, variations from the set protocol, results of the testing, and full-scale performance recommendation.

Upon completion of the pilot testing program, the Consultant will prepare a summary technical report. The Consultant will evaluate the field test data collected by BES and the centrifuge manufacturer, discuss the trends and results with representatives of the centrifuge pilot test manufacturer, and recommend full-scale design criteria for the centrifuges based on the pilot test results. The design criteria will be sufficient for use in the preparation of evaluation-based bids (if such approach is selected during final design) and performance-based specifications for the centrifuges. A draft report will be submitted to BES for review and comment. A final draft will be submitted incorporating BES comments.

Deliverables

- Pilot Testing Plan.
- **Preliminary Pilot Test Plan**

Task 1.2.11 Odor Control

Task 1.2.11.1. Permanent Odor Control

Develop alternatives and recommendation for the permanent odor control approach:

- Initial screening of established technologies. Develop a short-list of technologies for moving forward into alternatives analysis. Consider odor characterization data from Odor Assessment and Characterization Study (described above) to remove any not considered viable.
- Develop non-financial criteria for technology ranking.
- Workshop 1: Non-Financial Criteria Ranking Workshop. Useful in gathering stakeholder input and understanding value system and hot buttons. Forced-choice exercise. Output is final listing of all non-financial criteria along with specific rankings/weightings.
- Alternatives Development:
  - Short-list of technologies includes dry media adsorption, chemical scrubbing, organic media biofilter, engineered media biofilter, and biotrickling filter (BTF) (includes high rate BTFs and possibly dual-stage combinations of technologies).
  - Consider odor characterization data from separate study (described above, including data collected from other facilities) to rank specific technologies.
  - Utilize CH2M in-house Multi-Criteria Analysis (MCA) tool to cost and compare all alternatives. Output includes benefit-to-cost and net-present worth for all alternatives.
- Air Dispersion Modeling:
  - Using AERMOD, develop a model for the entire plant. Model provides understanding of offsite impacts related to various technologies, treatment system locations, and stack heights.
- Workshop 2: Alternatives Analysis Odor Control Workshop. Present analysis summary, findings, and recommendations and gather BES/operator input for designing permanent odor control system.

Meetings

- Workshop 1 and Workshop 2.

Deliverables

- Draft and final TM on selected technology, including model report.
- Workshop materials.

Task 1.2.11.2. Temporary Odor Control

Considering alternatives for permanent odor control and the potential construction schedule, develop alternatives and recommendation for temporary odor control approach during construction, as follows:

- Alternatives Development:
  - Technologies to consider include activated carbon, existing biofilter, and ultraviolet photoionization, dispersion.

  - Criteria: Footprint, location, performance, duct routing, costs, opportunity to phase-in with permanent odor control, and operator experiences.
  - Utilize MCA tool to cost and compare all alternatives. Output includes benefit-to-cost and net-present worth for all alternatives.
- Air Dispersion Modeling:
  - Utilize model developed from the permanent alternatives analysis. The model will assist in selecting the best location, technology, and stack height.
- Workshop: A single workshop summarizing the analysis, findings, and recommendations.

Meetings

- Workshop: Present analysis summary, findings, and recommendations for permanent odor control.

Deliverables

- Draft and final TM on selected technology.
- Workshop materials and minutes.

Task 1.2.12 Non-Process Facilities

With the campus-wide programming work being completed by others, the evaluation and development of the non-process facility design can be carried to a higher level of completion (30% level) during the 20% design phase.

Programming for the three new buildings to replace these functions is being completed by MWA Architects (under separate contract with BES). MWA is expected to provide the following as the basis for schematic design:

- Functional and space programs for three proposed buildings.
- Three concept design options for each building, including architectural themes, building systems and envelope design, building materials selections, initial floor plans, architectural volumes and schematic roof designs, sketches and 3D views. These options will vary by size: base program, “wish list” program, and a compromise in-between.
- Green Building Policy (Leadership in Energy and Environmental Design [LEED]) checklist to confirm certification path for each option.
- Construction cost estimate for each option.
- Summary report including information from the programming and concept design effort.

This scope of services for the project includes schematic design, final design, construction documents and construction administration for three non-process buildings that are part of the larger expansion program. These non-process buildings are anticipated to be on the East Pad of the site and will replace the following existing buildings, in addition to some electrical and instrument functions currently in the Dodd Building:

Building	Area (square feet)	Use
STO1	5,000	Special Operations Group (SOG), computer terminals, break room, showers and locker rooms, shop space and storage
STO1 Outbuilding	1,500	Unused prefabricated building

Building	Area (square feet)	Use
STO2 – SOG/Stores	5,000	Used by SOG as shop space for small portable equipment repair, and by Stores for equipment and supply storage
STO2 Outbuilding	1,500	Training and office space
Composter Building	5,000	Portion of building is used for storage
STO4	2,500	Storage and truck scale
STO3	600	Parks maintenance building located on the East Pad

Beginning with the three design concepts developed by Others, conduct the following tasks during this phase of the work:

- Review the program and other information furnished by BES.
- Provide minor refinements to the program and produce a final Program Statement.
- Provide BES with comments on the conceptual designs, systems, and materials options.
- Meet with stakeholders to assess each option and select one design concept for further development.
- Review laws, codes, and regulations and meet with planning and building department staff to review design and obtain feedback that affects the proposed design.
- Review Geotechnical Report findings.
- Refine and produce final schematic design package including a site plan and preliminary building plans that show room wall, building sections, and elevations. Major building systems and construction materials shall be noted on the drawings or described in writing.
- With Project Team, evaluate sustainability goals with respect to budget and make go/no-go decisions. Coordinate development of a cost estimate; then review that estimate with BES and stakeholders. Refine documents as required to meet budget.
- Develop a site traffic evaluation reflecting vehicle and foot traffic.
- Develop educational signage concepts associated with the public face of these buildings (public trail, etc.).

Schematic design of the non-process facilities will proceed for the selected design option and includes the following tasks:

- Attend and facilitate regular design team meetings to refine work scope, budget, and schedule, including producing and publishing meeting minutes.
- Attend and facilitate regular stakeholder design workshops to develop the design, and to refine the budget and schedule.
- Review laws, codes, and regulations and meet with BES planning and building department staff to review design and obtain feedback that affects the proposed design.
- Work with BES to set seismic resiliency goals and features for each structure.
- Facilitate an eco-charrette workshop, inclusive of all stakeholders and design team to establish clear project priorities, responsibilities, and sustainability strategies, concluded in a summary report.

- Refine and produce final schematic design package including a site plan, preliminary building plans, sections and elevations, and conceptual 3D views. Major building systems and construction materials will be noted on the drawings or described in a systems narrative.
- With the stakeholders and the design team, evaluate sustainability goals with respect to budget and make go/no-go decisions.
- Support development of a construction cost estimate.
- Conduct internal QA of schematic design documents.
- Conduct QA activities in accordance with the project-wide QMP.

This task includes revising MWA's East Pad Space Planning Space and Use Needs Assessment to accommodate additional functions. This scope includes:

- Develop revised Space Needs Table
- Develop revised Adjacency Diagram
- Develop revised Alternative Floorplan Diagram
- Develop revised Concept Plan
- Jacobs management and coordination effort

Assumptions

- Design includes up to three buildings totaling 30,000 square feet and a covered storage area.
- Buildings to be designed on the East Pad are for maintenance, storage, shared, and administration uses.
- The administration building is anticipated to be a two-story building. The remaining structures are single story.
- Stormwater management features and landscaping plans and sections are included as part of the overall site/civil and landscape architecture work.
- Scope assumes security/access from the public trail are unchanged from current configuration.
- Assume that the City of Portland will engage a CM/GC before start of construction documents, and the project will be delivered following a CM/GC process.

Meetings

- Five schematic design workshops.
- One eco-charrette.
- Programming meeting
- Workshop to review the revised program
- Workshop to review concept plans
- Workshop to review Final Concept Design

Deliverables

- Meeting minutes of stakeholder meetings and workshops.
- Meeting notes from planning and building department meetings.
- Draft and final Schematic Design Report, including:

  - Building and zoning code review summary.
  - Narrative describing major building systems and construction materials.
  - Memorandum of comments in response to construction cost estimate.
- Drawings, including site plan, preliminary building plans, sections, and elevations.
- Eco-charrette scorecard, listing project priorities related to sustainability, strategies for achieving certification, and responsibilities of various parties of the design team.

Seismic Risk Category IV

The 30% design will consider the Seismic Risk Category IV designation and associated foundation and structure design to ensure that the design for the Non-Process Facilities meets the seismic requirements for risk category IV. Activities includes reprogramming the building and site concept for Non-Process facilities per direction from BES.

A description of what this work includes is as follows:

- Attend brainstorming meeting (08/22/2019).
- Attend kickoff meeting (09/09/2019).
- Collaborate with Owner's Representative on program spreadsheets and generate program options.
- Develop site diagrams (two options).
- Develop STO4 site options
- Develop high-level building diagrams (two options)
- Assist Kiewit with cost estimating

Reprogramming for Non-Process Facilities alignment to STEP

The scope includes reprogramming the building and site concept for Non-Process facilities to better align with the STEP project. It is intended to be high-level for the purposes of developing an updated high-level cost estimate that will be used to confirm the scope of the project relative to the project budget before proceeding further into a new schematic design effort.

Assumptions:

- Kiewit will develop preliminary cost estimates. Design team will coordinate with Kiewit and communicate design intent.
- This effort does not include concept building design.
- Engagement of civil engineer or landscape architect is not necessary for this initial work and is not included.
- Geotechnical involvement is limited to coordination with structural engineer to determine the building foundation type most suitable per BES direction to design a Type II resilient structure with no ground improvements. No ground improvement design is included.
- Budget for this change request assumes work will be start 08/22/2019 and end 10/11/2019.
- If design direction provided by the BES such as program or geotechnical engineering is revisited or unresolved during this duration, additional time or fee may be required.

Task 1.2.13 Demolition

A preliminary Decommissioning and Demolition (D&D) Plan will be prepared with the primary objective of providing a roadmap to demolishing the composter and sludge hoppers, and planning key aspects of that work:- material surveys that would be needed, permitting requirements, salvage items, proposed schedule (Level 1) for the process, a Class 4 budgetary estimate (Concept/Feasibility Study level), and any other information that would provide value to BES. At this phase of the project, it is recommended that the preliminary D&D Plan focus on demolition planning because detailed technical issues will be addressed in more detail during project implementation when the work is better defined.

Strategic Planning
Strategic planning will be the guide for BES to meet the objectives of the D&D of the planned facilities. To accomplish this objective, Consultant proposes a robust effort to salvage and recycle as much equipment and materials as reasonable to provide for an economical, efficient, and effective D&D that is completed safely and in compliance with federal and state laws and regulations as well as identification of the permits that will be required to complete the D&D.

Initial reviews of the as-builts for the plant will be completed noting the location, age, type, and amount of salvageable equipment and recyclable materials. Based on this information, a conceptual plan for removal, staging, and selling and or recycling will be completed. Materials that could potentially have reuse value include the boilers, turbines, MCCs, transformers, tanks, and vessels. Materials that could potentially have recycle value include metal support infrastructure, wiring, piping, alloy metals, miscellaneous metals, concrete, and asphalt.

Sequencing
An overview of the sequence of activities proposed for the demolition engineering and contractor procurement will be developed. To expedite permitting and reduce overall demolition costs, agency requirements and potential impacts will be considered during planning and the plans will include items that provide mitigation measures or avoid potential impacts altogether.

The aboveground and belowground features to be demolished and the existing facilities that should be protected and remain in place post-demolition will be established.

The aboveground and belowground utilities that will need to be disconnected and or relocated to allow for D&D, such as transmission systems, gas, water, communications, and related underground piping and duct banks will be identified.

The major foundations and underground structures at the facility that will be included in the D&D will be established. It will be generally assumed that all aboveground features will be decommissioned and demolished utilizing one of several approaches including a top down surgical approach or a felling and material segregation approach. Logistical and safety considerations will be evaluated to determine the most efficient and safest approach. The onsite and offsite sources of borrow material to backfill excavations will be identified and may include use of crushed concrete from foundations. The D&D Plan will define testing requirements for imported fill.

General and Specific Information
Other objectives of the strategic D&D Plan are to provide both general and specific information to be used for the planning, budgeting, and eventual demolition of the composter, sludge hopper and non-process buildings at CBWTP.

The strategic D&D Plan will be prepared using best professional judgment and best management practices (BMPs) and is intended to describe how the demolition will occur, the sequence it will follow, what equipment and manpower will be required, what material will be brought onto the site, types and estimated volumes of material and waste that will leave the site, and what can be salvaged for resale,

reuse, or recycling. Additionally, the D&D Plan needs to be of sufficient quality and detail to be included as part of a formal Request for Proposals (RFP) to be solicited to prospective bidders for the demolition work in the future.

Waste Management and Minimization
In conformance with City of Portland policies and requirements, the D&D Plan will be based on the assumption that demolition of the compost area of CBWTP will utilize waste diversion techniques intended to maximize recycling, reduce the volume of material requiring transport offsite, and reduce the waste that would require disposal at local landfills. However, the actual methods and techniques employed during demolition will be the choice of the demolition contractor selected to conduct the demolition, and those methods and techniques might vary from those described in the proposed D&D Plan.

Requirements for management of demolition debris and waste include, but are not limited to, general demolition debris, environmentally regulated materials (ERMs), recyclable materials, spill prevention and control, decontamination water, construction dewatering (if required), soil, and reporting requirements. Identify materials that are deemed acceptable for onsite disposal (if allowed), offsite disposal, or recycle. Identify existing BES-approved offsite waste transport contractors and disposal/recycling facilities.

Project Total Installed Cost Estimate
The estimate that will be prepared for this D&D Plan will follow the guidance provided by the Association for the Advancement of Cost Engineering (AACE) International standard for Class 4 budgetary cost estimates.

The estimate will be prepared using available historical reports and information provided by BES, including quantity takeoffs for concrete, major equipment/components, and site work items. Historical percentages will then be used to compute values for other divisions of work. Consultant will try to obtain budgetary quotes for salvage of major equipment/component items. In the absence of quoted prices, these estimates can be produced with parametric models and historical pricing data.

Assumptions
- Facilities or systems included in demolition scope include: a staff modular unit, storage space, a shop area, a decommissioned Taulman-Weiss composting facility that is partially used for odor control, abandoned piping and equipment in the existing gallery, scum removal system, existing odor control system, Building STO 03, and Building STO 04.
- BES will provide as-builts of the facility in electronic and/or hard copy.
- A visual and desktop review for ERMs will be completed to identify and estimate the types and volumes of ERMs that will require offsite disposal.
- The Class 4 budgetary cost estimate will be provided in a summary and will include detail information for the summary. Volumes of materials will be estimated based on review of the as-builts and site walk observations. Detailed take offs of each as-built are not included in this scope of work.
- Current permitting requirements will be evaluated and included in the plan; however, they may change or increase before the actual D&D. A plan will be developed that will assist in monitoring these potential changes.
- Planning documents including a Traffic Control Plan and Waste Management Plan will be developed in an abbreviated format to allow for the initial planning activities. More detailed plans will be required as the planning moves into the final stages before D&D.

- Descriptions of work for the various structures and supporting systems will be included based on information obtained through reviews and the site walk.
- The graphics for the individual areas of the plant site will be simple blow ups of the overall site map with some highlights and call outs that will be referenced in the text.

The tables and graphs for the equipment usage, labor, and cost will be excel spreadsheets and graphs that will provide a visual look at the total and estimated monthly utilization of resources and burn rate of costs.

Task 1.2.14 Develop Recommended Program Technical Memorandum

Based on the findings of Task 1.2.4 through Task 1.2.13, develop the proposed Program. This will be captured in a TM that includes fact sheets and preliminary drawings documenting a comprehensive summary of the recommended program (project definition). The intent is to perform sufficient development to support development of a Class 4 budgetary cost estimate and provide a clear basis for the VE effort. The TM will include the following:

- Unit Process Fact Sheets:
  - Process model results.
  - Hydraulic results.
  - Unit process design criteria for new and modified facilities.
  - Preliminary equipment List and major/controlling instrument list.
  - Major equipment selections.
  - Preliminary process control narratives.
  - Recommended predesign evaluations, including site visits.
  - Recommendations for construction sequencing and maintenance of plant operation during construction (Maintenance of Plant Operations Plan).
  - Temporary facilities.
- Discipline Fact Sheets:
  - Site civil, plant utilities, and stormwater criteria.
  - Landscape architecture concepts and criteria, including pedestrian circulation and hardscapes, planting and irrigation design.
  - Potholing Plan.
  - Geotechnical criteria.
  - Structural criteria, including foundation design, aeration basin rehabilitation recommendations, and seismic resiliency recommendations.
  - Preliminary excavation and shoring requirements.
  - Architectural concepts and criteria, including facility access and egress, bird-friendly design, green building policy attributes, and any lab space and control room requirements.
  - Acoustical criteria and improvements.

  - Code interpretation and permit requirements for the project to verify that all codes and standards have been included and all relevant design conditions have been met.
  - Building mechanical (HVAC and plumbing) design criteria, including ventilation to address NFPA 820 requirements.
  - Fire protection design criteria.
  - Coatings/corrosion evaluation. Identify alternatives for coating concrete sludge holding tanks, and process areas.
  - Process mechanical and acoustical criteria.
  - Initial evaluation of safety considerations for equipment access and daily maintenance considerations.
  - Electrical approach for relocating existing equipment for flood protection and providing electrical service to new facilities.
  - I&C system criteria. Review existing plant equipment/instrument tag numbering, naming, and abbreviation conventions.
- Preliminary Drawings:
  - Preliminary Process Data Sheet.
  - Process Schematics.
  - Hydraulic Profile.
  - Large Piping Layout.
  - Site Plan.
  - Preliminary Facility Structural and Mechanical Plans.
  - Electrical One-Lines.

Deliverables

- Recommended Program TM.

Task 1.2.15 Program Implementation Plan

Develop a TM that defines implementation of the proposed improvements, which includes the following:

- Develop process and operations constraints for CM/GC for incorporation in their Preliminary Program Schedule.
- Review CM/GC Preliminary Program Schedule.
- Document Permitting Plan (developed as part of Task 2.5 Permitting).
- Document Public Outreach Plan (developed as part of Task 2.4.1 Develop Communications and Public Involvement Plan).
- Provide Construction Cost Estimate in sufficient detail to provide the expected accuracy range of an AACE International Class 4 budgetary cost estimate: -30% to +50%.

Assumptions

- Effort and budget to develop Public Outreach Plan and Permitting Plan are included in Task 2.4 Public Involvement and Task 2.5.1.1 20% Design Phase, respectively.

Deliverables

- Program Implementation Plan TM.
- Preliminary Program Schedule.
- Construction Cost Estimate.
- Cost estimate will be provided with a database of most modeled content, including size, material, flowstream, volume of concrete, and other major components.

Task 1.2.16 Prepare Basis of Design Report

Compile the Basis of Design Report. The report will encompass all of the products developed as part of Task 1.2.1 through Task 1.2.15. This subtask includes development of an Executive Summary and overall report compilation, to produce a draft report for BES review.

Prepare final report, incorporating BES comments.

Assumptions

- Using Heron (e-Builder) and its redlining tool and PDF comments, BES will provide a compiled, adjudicated set of comments to be incorporated into the 30% design.
- The scope of work does not include plant-wide communication systems, security design, and intercom systems, only accommodation of these systems for new structures. Assume that Consultant design work accommodates these systems but assume they will be installed by BES or separate vendors (to match existing systems).
- BES will provide all updated electrical one-lines.
- Assume limited BES comments since all TMs will have been reviewed and finalized under previous subtasks.
- Design Drawings will be converted to Revit and incorporate the updated CAD/BIM standards at the end of the 20 percent design phase.
- CAD/BIM standards will be provided to Jacobs.

Deliverables

- Draft and final Basis of Design Report (15 printed copies and one electronic copy in PDF format).

Task 1.2.17 Technical Workshops – 20% Design

During this phase, workshops with BES staff will be held to review the development of design criteria, results of technical evaluations, and review of work products. Workshop materials will be developed based on the technical work being conducted and presented to BES in workshops. Workshops will include, but not be limited to, the following:

- Secondary process system configuration and hydraulics.
- Solids dewatering and dewatered sludge conveyance and loadout.
- Solids thickening and co-thickening alternatives.
- Electrical system relocation alternatives.
- Heating alternatives to replace the existing boiler system.

Assumptions

For the 20% design phase, assume a total of fifteen technical workshops, each 2 to 3 hours long, with BES's personnel to review the progress of the work, make decisions, and provide direction.

In addition to the technical workshops described above, the design team will conduct three half-day workshops at the end of 20% design to review work products associated with that phase of the work.

One additional workshop (2 to 3 hours long) will be conducted to review P&IDs for the 20% design phase.

Each workshop is assumed to entail 4 hours of workshop labor plus 2 hours of preparation, four consulting team members per workshop, and 2 hours of meeting notes by junior staff.

Workshops for the non-process facilities are scoped separately, under the Non-Process Schematic Design task above.

Deliverables

- Agenda and meeting materials in advance of the workshops.
- Draft meeting notes from the workshops, distributed to attendees for comment, and included in the 20% design report and submitted to BES.

Task 1.2.18 Quality Management – 20% Design

As part of each the 20% design phase, the Consultant will implement the QMP developed in Task 1.1.2 Quality Management Planning. The Consultant will ensure QA activities are conducted throughout this design phase and Consultant will manage multidiscipline internal QC review activities with the senior review team throughout this design phase. Formal QC reviews by the Consulting team will be performed before BES review of the deliverables.

Audits by QA personnel will be conducted to verify conformance with project-specific design standards, BES checklists, and the approved QMP. The Consultant will confirm that required checking and review functions are completed, culminating in either approval or an NCR. The QA audits follow checklists based on project procedures applicable to the area being audited. Quality review documentation will demonstrate that the quality review process is complete and review comments are acceptably addressed as a component of the overall records management system.

Separate from the main package (20% design), the Consultant team will also provide Quality Management services for the Non-Process Schematic Design package, providing senior quality reviews from outside the core non-process design team.

Assumptions

- BES will consolidate the BES staff review comments into one comprehensive package before submitting review comments to the Consultant. Comments will be compiled using the Heron (e-Builder) platform.
- For major deliverables, Consultant will provide 15 printed copies and one electronic copy in PDF format, and BES will submit review comments within the period allocated in the project schedule (typically 4 weeks following BES receipt of the review submittal).
- For smaller TMs and meeting notes, Consultant will provide one electronic copy in PDF format, and BES will submit review comments within 14 days following BES receipt of the deliverable.
- Consultant's responses to BES consolidated review comments will be returned to BES for their records.

Deliverables

- QRFs used during internal quality reviews.
- Responses to DRFs used by BES to document quality review comments.
- Project checklists or milestone checklists signed by the reviewer and the appropriate project staff.
- Copies of quality review markups or comments not included on the QRFs or DRFs.
- Review-related correspondence with BES staff and other external agencies or entities.
- QMP-related documents for subcontracted work.
- Audit correspondence, including results and corrective action documentation.

Task 1.2.19 Project Management – 20% Design Phase

Perform the following activities for the duration of the 20% design phase:

- Before commencing the 20% design phase, prepare for and conduct a "refresher" kickoff/chartering meeting for Consultant team members, including subconsultants.
- Maintain and update the final work plan for the project that combines staffing commitments and budgets with the deliverables and schedule for the project. Specific responsibilities of each member of the final design project team will be maintained. Update the overall design schedule each month. and review with the BES Program Manager, as needed.
- Supervise and control activities of staff assigned to the project. Coordinate and schedule appropriate project staffing discussions and assignments to meet project requirements and commensurate with project Risk Register. Arrange for the scheduled project workshops, review meetings, and project team meetings. Coordinate the participation of senior staff at appropriate points in the project.
- Coordinate with other projects and BES staff to complete work on schedule and within budget.
- Prepare monthly progress reports and submit with the monthly invoice. The reports will include a status summary of current project tasks, activities completed in the last month, activities planned for the next month, a project action issues checklist, performance compared to budget, and identification of items of concern. Organize monthly invoice and budget status report by WBS element, including a Monthly Subconsultant Payment and Utilization Report by the 15th of each month (reference Part II, Section C.5 of the RFP). Include budget reports based on using an "S" curve that shows budgeted work complete, billings to date, and estimate at completion.
- Monitor project activities for potential changes. Should change occur, and with BES approval, modify project tasks, task budgets, and approach. Inform BES if any changes will impact the cost of engineering services, the construction cost, or the schedule.
- Consultant Project Manager and Design Manager will participate in weekly conference calls with BES Program Manager. Review the project status and discuss activities and needed actions. Prepare and discuss the 3-week look-ahead schedule.
- Submit change management forms, as needed to document scope/schedule/budget changes. Update the change log and review proposed changes and scope modifications with the BES Program Manager at the bi-weekly project management meetings.
- Support and attend (as requested) project briefings by BES project management team to upper management, City Council, etc.

- Maintain project records, manage and process project communications, and coordinate project administrative matters, utilizing the established Portland document management tool (Heron/e-Builder).
- The Program Support Consultant will update BES project standards and guidelines during the design phase. Consultant team will interface with BES and Program Support Consultant to provide input into development of new BES guidelines (led by BES and Program Support Consultant).
- The Program Support Consultant will update and maintain the Risk Register during the design phase. Consultant will participate in regular meetings with CM/GC, Program Support Consultant, and BES to provide input. Program Support Consultant will lead and document meetings.

Assumptions

- Overall design schedule of 15 months.
- Monthly invoices and major project submittals will be submitted through Heron/e-Builder.

Meetings

- One and a half hours every week to meet with BES project management.
- Monthly Risk Register Meetings. Assume three Consultant staff members participate.

Deliverables

- Updates to Program Workplan at completion of 20% design.
- Monthly project invoices and status reports.
- Completed change management forms, as needed, to document impacts of potential changes on engineering fee, construction cost, or schedule.
- Input and updates for incorporation into Risk Register.

Task 1.3 Value Engineering

BES and BES's Program Support Consultant will conduct a VE review of the Basis of Design Report. The VE review will include the following subtasks. BES's Program Support Consultant (or designated representative) will lead and facilitate the VE proceedings as described herein.

Task 1.3.1 Value Engineering Workshop

Participate in a 5-day VE workshop.

- Orient the VE team, separately contracted by BES, to the Basis of Design Report. Prepare and provide a brief project presentation, including identification of alternatives, screening and refining alternatives, detailed development of a short list of alternatives, and presentation of findings/recommendations. Assume the initial session is 1 day, including a field visit, and will be attended by four Consultant staff, including the Project Manager.
- Attend the remaining 3 days of the core VE workshop to be available to provide information and answer specific questions. Assume the VE meetings will be attended by two Consultant staff, including the Project Manager. Other staff will be available remotely for consultation throughout the workshop.
- On the final day, meet with the VE team after their workshop to receive a briefing on VE recommendations. Assume this session is 1 half-day and will be attended by four Consultant staff, including the Project Manager.

Deliverables

- Draft and final PowerPoint presentation for VE Team Kickoff.

Task 1.3.2 Design Response to Value Engineering

- Review and recommend alternatives that BES should consider for adoption and prepare a draft TM evaluating and recommending adoption of elements of the VE team's findings for BES review and action. Indicate which ideas are accepted, accepted with modification, or rejected. In cases where VE proposals are rejected, provide the reason for rejection.
- BES will review the draft memorandum and provide direction as to the final disposition of VE recommendations. These recommendations and associated cost savings will be documented in a final TM and utilized as the basis for incorporation into subsequent design activities.
- VE for Non-Process Facilities on the East Pad and for Ground Improvements (GI).

  Activities include:

  - Prepare presentation for all schematic design phase work, both ground improvement (GI) design and building and site design for the East Pad site.
  - Conduct further GI investigation in response to VE options identified during the VE workshops.
  - Prepare presentation of GI VE options response.
  - Additional GI investigation following initial follow-up meeting and email response.
  - Develop CMS, Scale time histories, 'isotherms' of ground movement behind GI zones, draft reasoning for poor stone column performance.
  - Design response to approved building VE options: coordination with consultant team, develop design revisions, update CAD/Revit model, review changes with BES, finalize changes with consultant team.

Meetings

- Attend two days of VE workshops at CBWTP.
- Attend "Initial Follow-up meeting" to present GI VE options response.
- Prepare for and attend "Final VE follow-up" meeting to finalize GI approach for 60% design.

Deliverables

- Draft and final Design Response TM.
- Updated GI cost estimate.

Task 1.4 30% Design Submittal

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Schematic design advances key project and design features to allow further development of the construction cost estimate and definition of project risks. The level of development will allow clear implementation of change management measures necessary to keep the program within the approved budget and schedule. It requires the use of decisions, data, guidelines, and concepts developed in the Basis of Design report, incorporation of BES priority discussions, development and evaluation of predesign alternatives design concepts. The schematic design will, and identification identify of a single design concept to launch detailed design development and will provide the information needed for BES,

the CM/GC, and Program Support Consultant and the CM/GC(herein identified as "the Program team") to make decisions related to confirming the limits of the project scope and associated risks.

A series of workshops (described in the subsections below) will be conducted during schematic design to present project updates and solicit focused BESProgram team input to inform the development of project deliverables before the conclusion of this task. Specific work activities and deliverables from this task include:

- Develop TMs for each major work/process area listed in the scope below.
- Update unit process and discipline fact sheets listed in the scope below.
- Generate renderings from the 3D model.
- Advance preliminary design drawings and graphics to support the TM's and fact sheets.
- Update detailed P&IDs.
- Generate preliminary Table of Contents for the Technical Specifications.
- Develop a preliminary equipment list that allows basic verification of equipment name and loop number, equipment size, equipment power requirements, primary control (if applicable), electrical classification , and acceptable manufacturers.
- Develop a preliminary Area Classification table.
- Update the overall Design Schedule (based on the Program Support Consultant's overall schedule which incorporates the CM/GC's preliminary construction schedule).
- Develop the construction cost estimate in sufficient detail to provide the expected range of accuracy of an AACE International Class 3 estimate: -20% to +30%. The construction cost estimate will follow the format and constraints established by the Program Support Consultant.

Assumptions

- Schematic design for Process and Non-process facilities will follow the same design schedule.
- Non-process Schematic Design will conform to the scope outlined in Change Request 019, reiterated below.

Deliverables

- Eight printed copies and an electronic copy in PDF format of the 30% Schematic Design Report.

Task 1.4.1 30% Design

Schematic Design will proceed on a single schedule with both the Non-process Facilities and the Process Facilities, as described below. [CR-022]

Task 1.4.1.1. Non-Process Facilities Re-programming

Reprogramming of the Non-Process Facilities includes:

1. A carport style storage building adjacent to the slough
2. Single story (approximate 9,000 sq ft) new SOG/Parks building and shop space
3. Renovating existing ST04 and ST05 structures

The scope of activities includes Concept and Schematic – 30% Re-Design for the STEP – Non-process buildings and site for scope items listed above. This work is broken into the following:

Concept Report Update

Develop an amendment to the Concept Design Report including:

- A memo documenting the purpose of the redesign effort, the design process and the changes made to the program.
- A revised Program Statement
- A drawing showing the Preferred Site Option (previously developed under Task 1.2.12)
- Revised Building Plan Diagrams to accompany the revised program (previously developed under Task 1.2.12)
- A memo documenting the foundation option(s) for each building (previously developed under Task 1.2.12)

Schematic/30% Design Redesign

Develop 30% design documents for the reprogrammed buildings. Meetings for reconfirming user space needs and design with the involved user groups – SOG, Parks and Common Spaces.

***Meetings**:*

- Two design meetings with BES for building planning and design
- Two design meetings with BES for landscape and civil design
- Internal consultant coordination meetings as needed

Deliverables:

- Revised 30% schematic design documents, including existing conditions plan, site utility/yard piping plan, architectural site plan, landscape plans, building floor plans, elevations, sections, mechanical, plumbing and electrical schematic plans and systems narratives, and building design renderings
- A schematic design report.
- A 30% design construction cost estimate

ST04 and ST05 Renovation – Schematic / 30% Design

Develop 30% design documents for to renovate ST04 and ST05 buildings for use as warehouse space, department storage, flexible shop space, and including on single-user restroom. ST04 building will be insulated and minimally conditioned. BES is considering this scope as an alternative to replacing ST04 with a new building (as outlined in Option A above). The scope for ST05 is limited to rehabilitating the roof and siding and providing lighting.

ST04 is a ~4,500 sf enclosed unconditioned metal building. ST04 is currently used for pipe cutting, flexible storage for AST Spares, Stores pre-purchased equipment, E&I and Hydra storage. There is a small office component with a restroom that has been abandoned due to direpair and hazardous conditions.

ST05 is a ~9,000 sf rigid steel framed open-air storage structure, with metal siding enclosing one side. ST05 houses some high bay storage racks, large equipment parking, space for CNG fleet maintenance, and other storage functions.

Scope of work includes:

1. Confirmation of programming for both buildings.
2. Confirmation of scope assumptions: site observation of existing conditions and evaluation of sturctural systems.
3. Existing conditions architectural background plans for both buildings.
4. Coordination with plant master plan requirements including landscape screrening.
5. Coordination with Civil to address site utilities.

***Meetings**:*

- Progress meetings with BES (assume 3 meetings on site).

Assumptions:

- Remove and replace all wall siding and roofing with new roofing and siding of similar constuction/weight but keep the primary structure and floor slabs.
- New lighting, and some modifications to existing power distribution.
- ST04 structure to be insulated and “lightly heated/ventilated”.
- The existing restroom office space at ST04 would be abated and semi-demolished for extensive renovations.
- Some lateral rod bracing may be needed at ST04.
- ST04 would get new garage doors along one side for separate and direct access from different departments, then possible cyclone fencing inside to separate spaces depending how things are organized.
- ST05 will be assessed for reroofing and residing of existing walls. No additional power, but some high bay lighting will be needed in ST05.
- No PV or green roof will be installed on these buildings.
- Shallow/conventional foundations will be adequate, and no ground improvements or deep foundations will be required, pending Geotech findings.
- Existing buildings are not sprinklered. Fire suppression will not be added.
- Record drawings and shop drawings if available will be provided by BES for review.
- BES will provide lift access to underside of structures for assessment phase observations by structural.
- The ST04 and ST05 site is being surveyed and utilities located by others.

Exclusions

- Mechanical and Plumbing design for ST05
- Developing existing-condition structural drawings and calculations
- Civil design for ST05
- Significant changes to the East Pad site layout after completion of Concept Design Report amendment.

***Deliverables**:*

- Development of 30% documents which will be used for cost estimating. Includes existing conditions plan, site plan, site utility/yard piping plans (2), floor and roof plans showing demo and new work, elevations, structural drawings, MEP schematic plans.
- Include information into Schematic Design Report prepared under separate task.

Geotechnical Support

This change request includes hours to plan and complete one additional geotechnical boring in the vicinity of ST0-4. The log of the boring advanced near the ST0-4 buildinig will be included in the subsequent geotechnical data report. This change also includes hours for geotechnical staff to provide further support to the structural engineers in developing a concept design approach for the foundations of proposed East Pad buildings. Geotech work also to include time to establish soil conditions, evaluate seismic risks, and develop foundation recommendations for the new building proposed for the ST0-4 site. The Non-process Geotechnical Recommendations Report will be updated to reflect the additional geotechnical exploration, evaluations, and recommendations for ground improvement or foundation support.

Assumptions:

- Structures will be engineered to a code minimum for each structure. The new building on the East Pad will be category II and the neighboring storage 'carport' will be category I or II (likely II). They will be designed for safe egress in the event of an earthquake.
- Designing the new and carport buildings to code requirements will necessitate that the buildings will be founded on either a ground improvement or deep foundations.
- A deep foundation system consisting of large-diameter drilled shafts will be evaluated for the carport facility. Results of the evaluation will be used to compare the cost of a large-diameter drilled shaft support system to the deep soil mixing ground improvement system previously evaluated. Rhino One engineers will be responsible for completing the evaluation of deep foundation systems.

Task 1.4.1.2. Process Facilities – 30% Design

Develop the Process facilities (as previously defined by the 20 percent Recommended Program and the follow-on Prioritization work by BES), with additional detail specific to each discipline, as described below. Workshops with BES for the 30% Process Facilities design are included under task 1.4.4 Technical Workshops.

Task 1.4.1.2.1 Secondary Clarifiers (SECL 09 and SECL 10)

Task 1.4.1.2.1.1 Secondary Clarifier Pumping Analysis

Background:

Consultant to provide additional hydraulics analysis related to pumping and control of the flows diverted through the new secondary clarifiers. The intent of the analysis to evaluate mixed liquor pumping as an alternative to the gravity flow solution recommended during the 20% design.

Approach:

The team will develop the alternatives in several steps

1. Step 1 – Alternative Description
   The first step will be to develop the definition of the alternatives and check the alternatives with BES to confirm the adequacy before proceeding to a detailed evaluation.

a. Alternative 1 – Secondary Effluent Pumping - This alternative includes gravity flow to the SECL 9 and 10 and dropbox/channel withdrawal from the aeration basins.
b. Alternative 2.A – Mixed Liquor Pumping (Pump Station) - This alternative includes gravity flow to a mixed liquor pump station and dropbox/channel withdrawal from the aeration basins.
c. Alternative 2.B – Mixed Liquor Pumping (Silver Tunnel) - This alternative includes direct pumping from each aeration basin dropbox/channel using eight dry pit pumps with a flow meter that pumps into header to SECL 9 and 10.

2. Step 2 – Evaluation
   The second step will be to provide hydraulic, operational and life cycle analysis of the alternatives and reach a decision with BES on path forward.
3. Step 3 – Summarize Findings
   Provide a draft Alternatives Technical Memo to document the analysis and conclusions.

***Deliverables**:*
Step 1 Deliverables

- Alternative Titles and Project Descriptions – Word
- Mechanical Layouts – Bluebeam
- Hydraulic profiles – Bluebeam or Visio
- Alternatives Matrix

Step 2 Deliverables

- Capital Costs (Construction costs plus program markups in 20% format)
- Operational Costs (estimates of Energy Consumption)
- Lifecycle costs – energy and capital costs only
- Site Plans
- Short Process Control Descriptions
- Estimates of duration of pump operation, number of starts, submergence frequency and duration
- Pros and Cons of alternatives
- Risk assessment (operations, maintenance, construction, permitting, phasing, schedule)

Assumptions:

- All options will show no changes to EFPU controls
- All options are based on Average Columbia River Levels. Does not include the impact of 100-year flood elevation.
- All options include withdrawal from the dropbox in the aeration basin effluent channel (not direct withdrawal).

Task 1.4.1.2.1.2 Secondary Clarifier Schematic Design

Schematic design for the secondary clarifiers will include the following:

- Evaluate equipment alternatives. Visit operating facilities to support equipment selection.
- Develop approach to effluent flow measurement and integration with current systems.
- Develop plant effluent hypochlorite dosing approach.

- Use process model results to select design criteria for major equipment and systems. Assign capacity to existing treatment processes. Finalize size and capacity of unit treatment processes and ancillary systems.
- Finalize side water depth of new clarifiers based on construction costs versus value added.
- Select approach and size permanent groundwater dewatering system.
- Select electrical equipment features and approach to automation.
- Determine plant utility requirements for secondary clarifiers.
- Determine program wide design flood conditions (i.e. 500 year plus 6 inches or 100 year plus 3 ft).
- Assist in determining operational impact of flooded secondary clarifier weir.
- Determine secondary clarifier top of wall.
- Determine secondary clarifier grade elevation and any changes from current grades.
- Integrate seismic resiliency into design criteria and secondary clarifier design.
- Identify areas affected by NFPA 820 criteria.
- Evaluate modifications necessary to utilize the new secondary clarifiers as primary clarifiers (following a significant seismic event). Conduct a preliminary evaluation and define the changes to the design if SECL 09 and SECL 10 were designed to accept Primary Influent during emergency operations. Identify pros and cons, day-to-day compromises, etc.

Assumptions

- STEP team members accompany BES on up to five separate site visits within driving distance of CBWTP.
- Facility leads will contribute towards the development of the following:
  - Design drawings (11x17) and graphics to support the TM's and fact sheets.
  - Preliminary Table of Contents for the Technical Specifications.
  - Preliminary equipment list.
  - Construction cost estimate.

Deliverables

- Draft and final Secondary Clarifier TM.
- Updated Unit Process Fact Sheet
- Develop preliminary process narratives, PIDs, and process flow diagrams.

Task 1.4.1.2.2 RAS Pump Station (RAPU)

Schematic design for the RAPU will include the following:

- Select RAS flow rate criteria, including range of flow and operational safety factor.
- Develop RAS pump hydraulic model.
- Finalize pump and electrical room elevations.

- Assist in selection of electrical equipment features and approach to automation.
- Assist in sizing and locating electrical room.
- Select approach and size Secondary Scum Pumping system.
- Select approach and size Secondary Clarifier Sump pumping.
- Select approach and size Secondary Clarifier Groundwater pumping.
- Identify areas affected by NFPA 820 criteria.
- Determine plant utility requirements for RAPU.
- Develop construction approach and locate RAPU.
- Assist in developing wireless communication requirements.
- Integrate seismic resiliency into design criteria and facility design.

Assumptions

- Facility leads will contribute towards the development of the following:
  - Design drawings (11x17) and graphics to support the TM's and fact sheets.
  - Preliminary Table of Contents for the Technical Specifications.
  - Preliminary equipment list.
  - Construction cost estimate.

Deliverables

- Draft and final RAPU TM
- Updated Unit Process Fact Sheet
- Develop preliminary process narratives, PIDs, and process flow diagrams.

Task 1.4.1.2.3 Solids Facility (SOFA)

Schematic design for SOFA, including the loadout, will include the following:

- Equipment evaluations (thickening, dewatering, odor control, cake conveyance and loadout, polymer storage, makeup and feed).
- Support preliminary building layouts development including evaluation of two alternatives for sludge thickening and dewatering, odor control, chemical feed/loadout, and solids loadout. Confirm requirements for elevator and associated mechanical room.
- Develop ventilation and odor control design based on building layouts.
- Develop design and preliminary details, member sizing, materials and maintenance access requirements for GBT enclosure structure and doors. Integrate monorail and hoist requirements into layouts. Identify layout requirement differences between A and B named manufacturers. Identify opportunities for early equipment procurement.
- Identify major yard piping, and yard electrical requirements to support facility layouts.
- Plan site visits to operating facilities (thickening, dewatering, cake conveyance, storage and loadout, and polymer).
- Identify areas affected by NFPA 820 criteria.

- Select electrical equipment features and approach including automation.
- Use process model results to select design criteria for major equipment and storage tankage. Determine size/capacity of all unit treatment processes and ancillary systems (polymer, thickening feed, filtrate/centrate conveyance, and dewatering feed).
- Identify routing corridors for ductwork, cable tray and piping exceeding 12 inches.
- Advance requirements for location and layout for a new operator control room. A new small operator control room with sound attenuation and separate from odorous area, adjacent to the dewatering area will be considered in addition to the operator control room serving the entire building, depending on layout requirements.
- Develop tunnel access through footprint of existing SLPR basement. Coordinate with TUSI improvements.
- Integrate seismic resiliency into design criteria and facility design.
- Incorporate results of digestion process modeling evaluation (Task 1.4.1.2.9.2) as it impacts thickening and dewatering operations. Integrate findings from co-digestion trial testing into equipment sizing, design criteria, number of units, layouts.
- Develop tunnel access through footprint of existing SLPR basement. Coordinate with TUSI improvements design.

Assumptions

- Facility leads will contribute towards the development of the following:
  - Design drawings (11x17) and graphics to support the TM's and fact sheets.
  - Preliminary Table of Contents for the Technical Specifications.
  - Preliminary equipment list.
  - Construction cost estimate.

Deliverables

- Draft and final Solids Facility TM.
- Draft and final Impacts to Digestion TM.
- Updated Unit Process Fact Sheet.
- Develop preliminary process narratives, PIDs, and process flow diagrams.

Task 1.4.1.2.4 Tunnel Improvements (TUSI, TUBL, TU08)

Schematic design for Tunnel Improvements will include the following:

- Verify seismic approach for tunnel piping.
- Verify NFPA 820 ventilation rate requirements.
- Identify piping to be demolished, abandoned or moved.
- Develop strategy for equipment and piping access into TUSI. Provide permanent equipment hatch at east end of TUSI.
- Select RAS piping approach including bypass piping.
- Advance pipe supports design.

- Select Aeration Basin #8 piloting approach.
- Select location for VFD and PLC for deep well pump.
- Identify equipment needing stand-by power. Select location for new diesel generator.
- Locate new electrical gear for TUBL sump pumps.
- Locate new electrical gear for hypochlorite dosing (TUBL and TU08).
- Identify wireless communication requirements.
- Develop strategy for new tunnel lighting.
- Determine approach for suction pipe for emergency dewatering on east end of TUSI.
- Develop construction sequence for tunnel improvements.

Assumptions

- No structural improvements for the existing tunnel systems will be included in STEP.
- Facility leads will contribute towards the development of the following:
  - Design drawings (11x17) and graphics to support the TM's and fact sheets.
  - Preliminary Table of Contents for the Technical Specifications.
  - Preliminary equipment list.
  - Construction cost estimate.

Deliverables

- Draft and final Tunnel Improvements TM.
- Updated Unit Process Fact Sheet.
- Develop preliminary process narratives, PIDs, and process flow diagrams.

Task 1.4.1.2.5 Boiler and Ventilation Improvements

Prior to beginning schematic design, explore alternatives for reducing overall scope, cost, and impact of demolishing the SLPR boilers.

Assuming the 20% design concepts are moved forward, schematic design for the SLPR Boiler and Tunnel Improvements will include the following:

- Identify existing steam heating equipment serving the tunnels, Dodd Building, Wet Weather Screening Facility, SLPR and Pipe Tunnel Gallery. Audit nameplate information, equipment type, heating capacity, power requirements, condition, etc. Reconcile with current inventory lists and available drawings.
- Locate and size a new boiler plant to serve the Dodd Building and Wet Weather Screening Facility.
- Identify the steam tie-in points for the Dodd Building and Wet Weather Screening Facility.
- Identify temporary ventilation/heating strategy for makeup air unit located in the SLPR Building.
- Identify a new heating and ventilation strategy for the Pipe Tunnel Gallery not dependent on steam.
- Perform load calculations for tunnels, Dodd Building, Wet Weather Screening Facility, and Pipe Tunnel Gallery.

- Identify and review potential options available for heating remaining facilities that are on steam.
- Size and perform equipment selections (i.e. steam boilers, makeup air units, etc.).
- Identify areas affected by NFPA 820 criteria.
- Develop demolition and removal strategy for existing SLPR boilers.
- Coordinate equipment requirements with Electrical, Civil and Structural.
- Provide equipment general arrangements and schematic level steam piping and natural gas piping diagrams and plans.

Assumptions

- Existing SLPR Boilers will be demolished and removed from the tunnel.
- Remote boiler plant will be centrally located between Dodd Building Wet Weather Screening Facility, and Pipe Tunnel Gallery.
- Existing steam equipment serving the Dodd Building, Wet Weather Screening Facility, and Pipe Tunnel Gallery will be reused.
- A new dedicated heating and ventilation system for the Pipe Tunnel Gallery will be identified. The Pipe Tunnel Gallery will not be serviced by the new remote boiler plant.
- The existing steam piping within the Dodd Building and Wet Weather Screening Facility will be reused. Piping from the new steam plant will connect to the Dodd Building and Wet Weather Screening Facility where the steam currently enters each facility. Existing steam piping outside the Dodd Building and Wet Weather Screening Facility (below grade) will be abandoned.
- Makeup air units located in the Effluent Pump Station and Blower Building will be replaced with new, direct-fired make up units.
- The makeup air unit located in the SLPR Building will be required to operate until the SOFA is constructed.
- BES will provide mechanical and HVAC record drawings for tunnels, Dodd Building, Wet Weather Screening Facility and Pipe Tunnel Gallery.
- Two site visits to perform steam heating equipment audit of the Dodd Building, WWSF, Pipe Gallery, and SLPR Building.
- Two site visits to coordinate siting for replacement heating equipment.
- Facility leads will contribute towards the development of the following:
  - Design drawings (11x17) and graphics to support the TM's and fact sheets.
  - Preliminary Table of Contents for the Technical Specifications.
  - Preliminary equipment list.
  - Construction cost estimate.

Deliverables

- Draft and final Remote HVAC Improvements TM.
- Updated Unit Process Fact Sheet

- Develop preliminary process narratives, PIDs, and process flow diagrams.

Task 1.4.1.2.6 Medium Voltage and Sitewide Electrical

Schematic design for Medium Voltage and Sitewide Electrical will include the following:

- Prepare site electrical plans and one lines.
- Perform preliminary sizing for electrical building(s) and show on plans.
- Perform overall load calculations to inform system sizing and potential impact to main substation project.
- Develop a construction phasing description for major electrical work (substations and motor control centers).
- Assist in construction sequencing for medium voltage system.
- Integrate seismic resiliency into design criteria and facility design.

Assumptions

- Work will be coordinated with the scope of the Main Substation replacement.
- Facility leads will contribute towards the development of the following:
  - Design drawings (11x17) and graphics to support the TM's and fact sheets.
  - Preliminary Table of Contents for the Technical Specifications.
  - Preliminary equipment list.
  - Construction cost estimate.

Deliverables

- Draft and final Medium Voltage System Replacement TM.
- Updated Unit Process Fact Sheet.
- Develop preliminary process narratives, PIDs, and process flow diagrams.

Task 1.4.1.2.7 Future Hypochlorite Facility

The Schematic design for the future consolidated Hypochlorite Facility (HYPO) will include the following:

- Update hypochlorite design criteria.
- Determine offloading approach and assist in determining roadway approach.
- Lay out facility footprint in 30% site plans.

Assumptions

- Hypochlorite storage and pumping upgrades are not included in STEP, but the HYPO facility will be coordinated on the site so that it can be added later.

Deliverables

- Updated Unit Process Fact Sheet.
- Consolidated Hypo Facility will be presented on Civil Drawings.

Task 1.4.1.2.8 Discipline Work

The 30 percent design for the process facilities listed in Tasks 1.4.1.1 through 1.4.8 will include development of the following disciplines:

Task 1.4.1.2.8.1 Site Resiliency and Geotech

Schematic design for site resiliency and geotechnical work will include the following:

- Complete additional geotechnical exploration to include soil borings near SOFA and loadout.
- Determine site-specific geotechnical conditions for each facility and structure.
- Develop specific foundation requirements for new facilities, to meet seismic classification III.
- Meet with CM/GC to discuss and evaluate alternatives for ground improvement and seismic mitigation. Include specialty ground improvements subcontractor or technical committee, if possible.
- Develop proposed approach for ground improvements.
- Address groundwater requirements during construction and after facilities are in service.
- Verify constructability (shoring and bracing requirements, dewatering issues).

Assumptions

- Assume site resiliency and geotech work will be conducted early in the 30% design phase to inform the GMP#1 design for SECL and RAPU.

Deliverables

- Draft and final geotechnical design report documenting geotechnical analyses and providing preliminary geotechnical design and construction recommendations.
- Schematic design drawings.
- Technical specifications – Table of Contents.
- Workshop materials and minutes.

Task 1.4.1.2.8.2 Architectural for Process Facilities

Schematic design work for process facilities architectural will include the following activities:

- Perform a code review of the existing tunnel facilities impacted by STEP, identifying areas where the facilities do not meet current architectural codes and occupancy requirements. Determine requirements to bring existing facilities into compliance with current codes and standards, where practical. Identify triggers for code compliance work. Because the requirements for this work are unknown at this time, the scope does not include the detailed design required for bringing facilities into compliance with code.
- Assign code classification to each new building. Meet with local code official and/or authority having jurisdiction to review code classifications and discuss any waivers, if applicable.
- For the new occupied process facilities (RAPU, SOFA), establish preliminary room sizes and egress requirements.

- Develop architectural theme for exterior of buildings. Select interior and exterior construction materials for each building. Select roof type, slope, and roof support system for each building, along with maintenance access requirements and features.
- Compile list of chemicals and amounts to be used. Coordinate with other disciplines (mechanical and electrical) to resolve code compliance issues specific to these disciplines (e.g., National Electrical Code and NFPA 820 issues).
- Coordinate with other disciplines to prepare preliminary building layouts (including plans, sections, and elevations). Develop alternative layouts if required.
- Coordinate with the other disciplines to establish design R-values for exterior walls to meet Oregon Energy Code requirements.
- Develop life safety/egress plans for each building.
- Develop LEED and green building requirements scorecard and criteria for this phase. Incorporate decisions regarding specific LEED points criteria. Coordinate with other disciplines to incorporate requirements into the design.
- Fact Sheet shall provide clear and concise documentation of the Designer's response to the Owner's Program Requirement (OPR) goals, expectations and requirements for commissioned systems.

Assumptions

- Assume process facilities are not required to have LEED certification. However, LEED and Green Building scorecards will be completed for these buildings to assist BES with decision-making.

Deliverables

- Draft and final Architectural Fact Sheet for Process Facilities.
- Schematic design drawings.
- Technical specifications – Table of Contents.
- Workshop materials and minutes.

Task 1.4.1.2.8.3 HVAC/Plumbing (SOFA and RAPU only)

Schematic HVAC and plumbing design for new process facilities will include the following:

- Select ventilation system (tempered inlet air, simple exhaust fan system, etc.).
- Select type of heating system to be used (hot water boiler, hot air furnace, space heaters). Identify fuel (gas, oil, or other fuel) for heating buildings and identify local fuel storage requirements.
- Select type of air conditioning system to be used in personnel spaces (variable air volume system, zoned constant air volume system).
- Coordinate with the architectural discipline to establish design R-values for exterior walls.
- Perform a ventilation code review to identify ventilation requirements for both process and non-process spaces.

Assumptions

MAU-4 currently located in the SLPR Building will be relocated to SOFA. Its location and installation requirements will be coordinated with the tunnel ventilation improvements.

Deliverables

- Draft and final HVAC Fact Sheet for Process Facilities.

- Schematic design drawings.
- Technical specifications – Table of Contents.
- Workshop materials and minutes.

Task 1.4.1.2.8.4 Civil and Site Development

Schematic civil design work around the process facilities will include the following activities:

- Confirm adequacy of topographical and boundary mapping. Evaluate legal, ownership, permitting and zoning constraints. Present environmentally sensitive areas such as wetlands, floodplains, known hazardous waste areas, etc. on drawings.
- Further develop alternative plant site layouts as required. This will include activities such as: (1) confirm/update structure size, location, and orientation; (2) lay out roadways/truck access corridors and define maneuvering requirements (design vehicle); (3) size and locate parking lots for employees and visitors to the facility; (4) confirm emergency vehicle access requirements; (5) evaluate floodplain impacts and constraints; (6) locate stormwater management facilities; (7) locate utility and piping corridors (horizontal and vertical); (8) determine dewatering needs and location of facilities; and (9) show possible construction staging area and equipment/contractor access ways.
- Coordinate with surveyors; define surveyors' scope of work; coordinate with geotechnical engineer on boring locations; and record boring locations on site civil drawings.
- Develop preliminary erosion control plan for project. Determine if erosion control ponds are required; locate ponds on site plan drawings as required. Prepare preliminary stormwater calculations suitable for submission to local site permitting authorities. Develop preliminary stormwater control concepts (swales, curb, and gutter). Meet with local stormwater and erosion and sediment control agency to determine permitting requirements for site plans, and impact of requirements on preparation of Contract Documents. Document findings.
- Set preliminary finished floor levels for new structures. Establish preliminary finished grades, overall major surfaces, road profiles, etc. Iterate preliminary surfaces and structures to optimize earthwork if necessary.
- Provide Handling and Disposal Plan if contaminated media are encountered.
- Work with the geotechnical team to develop excavation profiles for the areas of major earthwork. Assume three profiles will be developed through the new secondary clarifier site and two additional profiles will be developed through the site of the new dewatering/loadout building.

Assumptions

- Contaminated soils will be encountered requiring a Handling and Disposal Plan from the CMGC.
- Three excavation profiles will be developed.

Deliverables

- Draft and final Civil and Site Development Fact Sheet for Process Facilities.
- Schematic design drawings.
- Technical specifications – Table of Contents.

Task 1.4.1.2.8.5 Yard Piping

Schematic yard piping design work will include the following activities for process piping:

- Yard process piping associated with SOFA (sludge piping, filtrate piping, etc.)
- Yard process piping associated with SECL and RAPU (RAS/ML/SE piping, etc.)
- Piping corridor for future HYPO facility piping.

Assumptions

- Contaminated soils will be encountered requiring a Handling and Disposal Plan from the CMGC.

Deliverables

- Draft and final Yard Piping Fact Sheet for Process Facilities.
- Schematic design drawings.
- Technical specifications – Table of Contents.

Task 1.4.1.2.8.6 Electrical for Process Facilities

Schematic design work for ancillary electrical (electrical associated with new or upgraded process facilities) will include the following. Note that Major Electrical Equipment/Medium Voltage Relocation work is covered in a separate task above.

- Prepare one-line diagrams for proposed facilities.
- Prepare preliminary load calculations.
- Provide SKM model update.
- Document the power loss approach for each major unit process.
- Determine requirements for standby power.
- Identify electrical room space requirements.
- Determine redundancy requirements for power supplies and power distribution.
- Establish preferred voltages for power distribution and utilization equipment.
- Perform an electrical code review of existing tunnels that require retrofit/rehabilitation to identify areas where the facilities do not meet current codes. Identify requirements to bring existing facilities into code compliance.
- Coordinate with other disciplines (for example, architectural and mechanical) to resolve code compliance issues specific to these disciplines. Develop preliminary schedule of hazardous and corrosive locations.
- Perform NFPA 820 hazardous area analysis for affected areas and facilities and develop an area classification table.
- Develop construction constraints for electrical work in process facilities.

Assumptions

- The existing electrical service to the site does not require additional upgrades (beyond the Main Switchgear project currently underway).

Deliverables

- Draft and final Electrical Fact Sheet for Process Facilities.

- Schematic design drawings.
- Technical specifications – Table of Contents.
- Electrical System and Equipment alternatives workshop materials and minutes.

Task 1.4.1.2.8.7 Instrumentation and Control Systems

Schematic I&C design work will include the following activities:

- Using the preliminary instrument and equipment lists and the preliminary process flow diagrams, coordinate with the process engineers to refine preliminary P&IDs for each treatment process. Information to be included on each P&ID includes at a minimum: process configuration, flow streams, valve and gate locations (manual and powered), instruments, chemical additions points/types, process equipment location/type including packaged control panels and adjustable-speed drives, flow meters, and other process control or monitoring devices.
- Finalize equipment/instrument tag numbering, naming, and abbreviation conventions.
- Review existing plant equipment/instrument tag numbering, naming, and abbreviation conventions.
- Work with Process Engineer to prepare written operational description of each major process.
- Review and revise current overall control philosophy including local control approach, level of automation, and supervisory control.
- Develop overall control philosophy including local control approach, control system, level of automation, and supervisory control.
- Develop preliminary process control descriptions.
- Update control system network diagram.
- Determine wireless communication requirements for process facilities and tunnels.
- Identify proposed fiber optic duct bank routing on site plans.
- Identify fiber optic/site-wide control system requirements.

Assumptions

- As defined in the existing I&C fact sheet from 20% design.

Deliverables

- Draft and final I&C Fact Sheet for Process Facilities.
- Schematic design drawings.
- Technical specifications – Table of Contents.
- Preliminary process control descriptions.
- Workshop materials and minutes.

Task 1.4.1.2.8.8 Process Mechanical

Schematic process mechanical design will include the following:

- Select and size all major process equipment including pumps. Prepare sizing calculations and obtain review. Establish level of redundancy required for all process equipment.

- Prepare equipment list with sizing for major equipment. Coordinate with BES on preferences of equipment manufacturer and processes.
- Determine valve types and actuator types for each service.
- Determine pipe materials and develop preliminary pipe schedule.
- Determine approach for tie-ins of major yard piping with existing piping/facilities.
- Prepare preliminary drawings for equipment arrangements.
- Review capacity and condition of existing equipment to remain in service where appropriate. Review capacity requirements for existing equipment, as needed for the secondary and solids processes.
- Determine capacity requirements for ancillary facilities and utilities and determine whether adequate capacities are available for systems such as plant water and instrument air.
- Determine flow measurement and sampling requirements.
- Develop process control narratives in coordination with I&C.
- Determine pipe flexibility and seismic resiliency requirements.
- Evaluate optimum pipe routing onsite and in the gallery.
- Corrosion control engineer will develop recommendations for the project based on site and facility characteristics, including material selection.

Assumptions

- The existing electrical service to the site does not require upgrades.

Deliverables

- Draft and final Process Mechanical Fact Sheet for Process Facilities.
- Schematic design drawings.
- Technical specifications – Table of Contents.
- Workshop materials and minutes.

Task 1.4.1.2.8.9 Hydraulics for Secondary Process

The purpose of this task is to prepare a hydraulic profile of the 30 percent design, determine final hydraulic configuration, and evaluate impacts to the effluent pump station controls (EPH), if any. The tasks include evaluations of a limited number of alternatives to determine a final configuration.

Base Case Hydraulic Model

Develop the base case hydraulic model that incorporates decisions during the 20 percent such as:

- Optimize RAS rates and overflow rates to match current process models. Include a mechanical safety factor.
- Optimize final secondary clarifier weir elevation based on final RAS flow and clarifier overflow rates.
- Include direct aeration basin mixed liquor withdrawal (previous model included aeration basin effluent launder withdrawal).

- Update hydraulic model to incorporate ongoing design decisions.
- Modify hydraulic model to include approach to flow measurement and disinfection.
- Model Outfall Scenarios:
  - Existing "blocked diffuser" scenario

Prepare a hydraulic profile (drawing) that includes:

- Wet Weather Peak Flow – 450 mgd (130 mgd through secondary) – G007 open.
- Maximum pumped flow without submerging clarifier weirs.
- Maximum Month Flow – 199 mpg (160 mgd through secondary) – G007 open.
- Maximum gravity flow.
- Average Day Flow – 113 mgd.
- Minimum Day flow – 40 mgd.

Additional Evaluations

Prepare the following additional evaluations to determine the final hydraulic configuration.

Capacity Evaluation: 100-Year Flood

Evaluate the impact of a 100-year flood on hydraulic operations of the plant. Incorporate into hydraulic profile. Models during 20 percent design assumed moderate increases in the Columbia River that were consistent with data during the evaluated year. Using existing effluent pump station controls, determine the maximum flow during 100-year flood using two scenarios:

- The effluent pump station and the permitted outfalls.
- The effluent pump station and the emergency outfalls.

Hypochlorite Dosing Evaluation

Location of gravity tie-in – alternative locations for connecting the secondary effluent to the wet weather channel could improve the measurement and control of hypochlorite and could reduce the complexity of effluent flow measurement. Moving upstream in the wet weather channel will increase the frequency and duration of secondary clarifier flooding. Future secondary effluent pumping will prevent flood for most conditions. Use the hydraulic model to compare three different gravity tie-in locations:

- Base case at Northeast corner of wet weather channel (near SECL-7).
- Upstream of base case.
- Near the current SEDI (Secondary Diversion System).

Offline Existing Clarifiers

In anticipation of a future squircle (existing clarifiers) upgrade, evaluate hydraulic impact of three offline clarifiers in three different combinations. Level of effort does not include CFD modeling of scenarios.

- Model plant hydraulics with an additional control feature to limit flow to new clarifiers during high flow events that submerge clarifier weirs.
- Provide estimates of the electrical demand of the effluent pump station for the current operations and the selected alternative.

- Provide flow rates for CFD analysis (included in a separate subtask: Computational Fluid Dynamics).

Model Outfall Scenarios:

  - Emergency bypass outfalls
  - Future replaced outfall

Assumptions

Equipment is operational:

  - 8 Existing Clarifiers
  - 2 Circular Secondary Clarifiers
  - 8 Aeration Basins

- Operational Simulator based on existing effluent pump station controls and one recommended control strategy

Deliverables

- Hydraulics Technical Memorandum - Prepare a 30 percent hydraulics TM that describes findings and recommendations, including:
  - Capacity with Columbia River at 100-year flood levels
  - Recommendation for location of new secondary clarifier effluent gravity tie-in
  - Impact on wet weather channel
  - Impact of offline existing clarifiers
- Operational Simulator for effluent pump station effluent
- Operational Simulator TM

Task 1.4.1.2.8.10 Computational Fluid Dynamics for Solids Settling

The objective is to develop a sequence of computational fluid dynamic models to evaluate the flow and solids settling characteristics in the proposed secondary clarifier at the Columbia Boulevard Wastewater Treatment Plant. This information will assist with understanding the performance of the clarifier and its impact on settling processes and the sludge blanket. Specifically, this analysis will focus on the impact of sidewall depth on the discharge of suspended solids in the overflow. The models will be used to:

- Characterize the hydraulics and solids settling characteristics in the clarifier as initially designed.
- Evaluate the impact of a shallower clarifier.
- Evaluate modifications to the clarifier or clarifier components to improve solids performance (discharge TSS).

General CFD Modeling Description

Computational Fluid Dynamics (CFD) provides detailed 3-dimensional simulation of fluid flow. The set of governing equations such as conservation of mass, momentum, and energy are simultaneously solved using finite-volume elements. CFD modeling provides a means of evaluating complex fluid flow phenomena coupled with other equations describing the related flow physics such as turbulence or sediment transport. These equations can be solved for detailed geometries representing real-world problems and can be applied for both steady-state and transient conditions. Numerical and graphical

results assist in predicting and understanding velocity distribution and flow patterns. Many problems that in the past required physical modeling can now be investigated using CFD.

A CFD model requires the development of a 3-dimensional solids model that represents the fluid flow space. After development of the fluid model, a suitable finite-volume mesh is created. Mesh refinement techniques are often implemented to resolve computations to a high degree of accuracy in regions where the flow parameters change rapidly. After the volume mesh is created, fluid modeling parameters along with boundary condition information must be assigned. Fluid assignments include parameters such as viscosity, density, velocity, pressures, or other important parameters that influence the flow characteristics being modeled.

CFD results are stored in large binary data files from which data can be extracted and displayed in multiple ways. There is considerable flexibility in reviewing results that aid in interpretation of hydraulic performance. Flow pattern visualization include horizontal and vertical slices showing magnitude contours of various parameters including pressures, velocity, directional velocity components, acceleration, and air volume fraction. Vectors, streamlines, and particle tracking along streamlines can be added to illustrate the direction of parameters such as velocity. Iso-surfaces can be created to illustrate the water surface or certain air water concentration or temperature. Distribution of sediment settling and transport characteristics can be visualized with a variety of methods. Animations can also be created to show time-dependent system behavior. Well-developed visuals can effectively illustrate the complex flow field so it can be understood

Approach

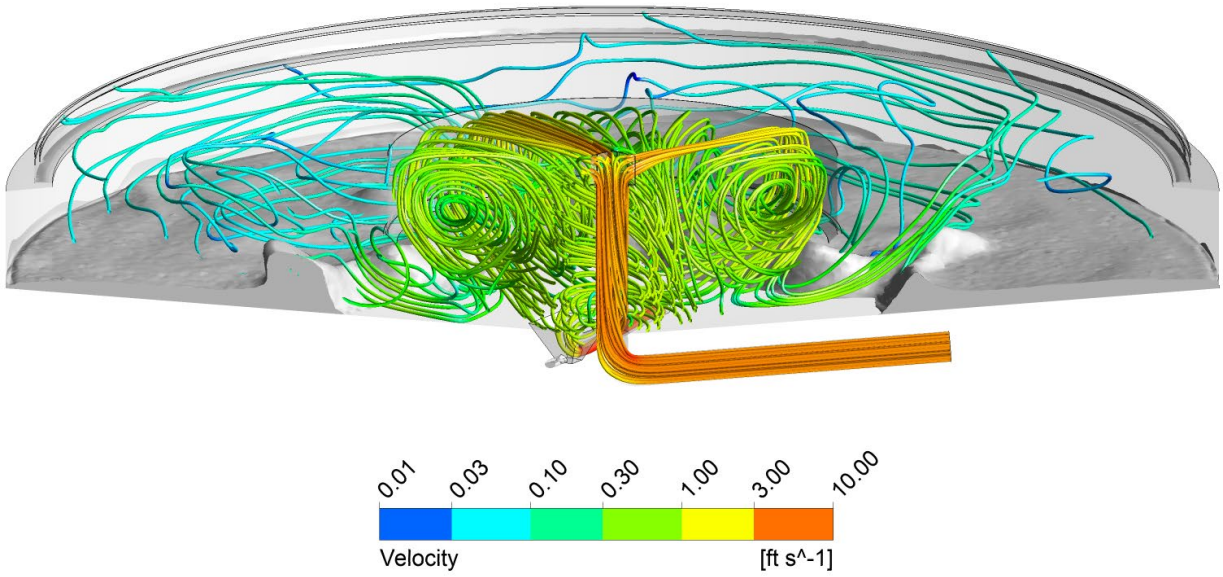
- Review historic operational data, including but not limited to influent, effluent, and Return Activated Sludge (RAS) flow rates; Mixed Liquor, effluent, and RAS solids concentration; and points of hydraulic surcharging.
- Create a 3-dimensional model of the clarifier geometry. This will include key hydraulic features such as the center column, influent structures, energy dissipating inlet effluent weir, and solids removal equipment.
- Subdivide the fluid volume into mesh cells to capture overall hydraulic performance and spatial variation within the clarifier.
- Set up the clarifier influent, effluent, and RAS flow rates based on desired operating conditions.
- Run the initial tank model over an appropriate period of time to characterize the hydraulics and settling within the clarifier.
- The initial model will be evaluated to determine level of convergence of the solution and overall hydraulics. The mesh will be updated and generally refined to more appropriately describe the clarifier based on the initial results.
- Evaluate the clarifier solids settling characteristics by showing the sludge blanket, effluent suspended solids (SS), and RAS solids concentration.
- Propose up to 4 additional improvements to be evaluated with 4 model runs based on the initial results. In order to maintain efficient schedule and scope, not all flow scenarios will be run for all alternative configurations. A tentative matrix of scenarios is shown in Table A.

Table A – Flow scenarios for Computational Fluid Dynamic modeling

Configuration	SVI	Overflow conditions	Under flow conditions	Clarifier Depth	Present results

Alternative 0 – Initial setup	200	1,800 gpd/sf	500 gpd/sf	21.3- foot	Phone Call 1
Alternative 1 – Base Case	200	1,600, 2,200, flow rate from State Point, and state point plus 10%.	500 gpd /sf	21.3- foot	Phase Call 2
Alternative 2 – SVI variation	150, 250	1,800, 2,200, flow rate from State Point, and state point plus 10%.		21.3- foot	Workshop 1 and DRAFT TM
Alternative 3 – Alternative configuration	TBD	TBD	TBD	TBD	Final TM
					Draft

- Various post-processing techniques will be used to describe the results of the model. These will include contours and vectors of velocity, and contours of solids concentration. Additional figures may include 3-dimensional velocity streamlines, contour planes, isosurfaces, and volumetric rendering of velocity, solids concentration, pressure, or other parameters. Figure A below shows a representative output from a different facility.



Assumptions

- The clarifier flow rates will be evaluated for a single design scenario under a steady inlet and outlet conditions. Changes in tank volumes during filling and draining will be simplified with boundary conditions to allow for steady state solutions to provide insights into the performance characteristics.

- The clarifier will be modeled as a single fluid zone and dispersed solids with variable settling rates based on solids concentration. Water properties such as density and viscosity will vary based on the concentration of solids at any given point within the domain.
- Additional details of the two-way coupled fluid-solids interaction are discussed in the following two resources:
  - McCorquodale, et al., 2005.
  - Siczka, et al. 2016.
- Small features which do not significantly impact the analysis may not be included.
- Moving mechanical parts may be simplified or omitted from the model.
- The turbulence will be modeled using a Turbulent Kinetic Energy and Dissipation Rate model (k-ε).
- The model will not incorporate heat transfer.
- Solid surfaces will be impermeable with no-slip conditions.
- Flow boundaries will be arranged to capture the relevant hydraulics conditions.
- Wind effects will not be modeled.
- Clarifier will be modeled at an SVI of 200. See table for variations to SVI.
- Equivalent clarifier does not exist at the site. The modeled solids parameters will be based on input from other plants. Results will be provide proportional information but will not be expected to provide a prediction of the effluent quality of the built clarifier.

Needed Information

The required information includes a description of the geometric features of the clarifier and the flow conditions to be evaluated. These fundamental information requirements are listed below:

- Dimensioned drawings or hand sketches to build all solid surfaces the water will contact. This includes structural drawings for the clarifier, and mechanical cut sheets or sketches for the centerwell, inlet baffles, weir, effluent launder, and outlet box.
- Description of range of influent, effluent, and RAS flow rates.
- Effluent water surface elevation ranges for the clarifier.
- Mixed Liquor solids concentration and anticipated RAS and effluent concentrations.
- Any history of past problems or flow characteristic data.

Deliverables

- CFD configuration Memo - An initial review document indicating geometry and scenario information to be evaluated prior to commencing CFD model evaluation
- CFD results and evaluation DRAFT - Prepare initial design results into an intermediate presentation and technical memorandum to be discussed at the first workshop
- CFD results and evaluation - Develop a final technical memorandum from final results and alternatives evaluation.

Task 1.4.1.2.8.11 Structural

Schematic design for structural will include the following activities.

- Coordinate with architectural discipline on the further development of building concepts. Consult with lead process engineer on building/structure layouts.
- Evaluate any structural problems associated with any existing plant facilities to be modified in this project. Describe the problems and recommended solutions.
- Further develop building foundation and structure concepts based on schematic building layouts.
- Determine design approach for addressing groundwater conditions.

Assumptions

- The existing electrical service to the site does not require upgrades.

Deliverables

- Draft and final Structural Fact Sheet for Process Facilities.
- Schematic design drawings.
- Technical specifications – Table of Contents.

Task 1.4.1.2.8.12 Fire Protection

Schematic design for fire protection will include the following:

- Define the level of design for fire protection systems that will be included in the final drawings—detailed drawings or performance specification.
- Determine site-specific fire protection requirements conditions for each facility and structure.
- Coordinate with local fire marshal and architect to determine requirements for fire protection.

Assumptions

- The fire protection scope is based on system expansion to address only new facilities. The existing fire protection system and main site fire connection are expected to be sufficient for this expansion.
- The existing electrical service to the site does not require upgrades.
- Combustible gas monitoring and fire/smoke alarms in non-occupied areas can be monitored through the plant PLC panels and SCADA system.

Deliverables

- Draft and final Fire Protection Fact Sheet for Process Facilities.
- Schematic design drawings.
- Technical specifications – Table of Contents.

Task 1.4.1.2.8.13 Landscape Architecture

Schematic design work for landscape architecture of process and non-process facilities will include the following activities:

- Coordinate with other disciplines to prepare preliminary design and layout of pedestrian circulation routes and exterior hardscape spaces, including the relocation of the plant egress/ingress to the public trail and Columbia Slough bridge crossing. Develop alternative layouts if required and define hardscape material options.
- Attend workshops that will focus on site-related development relevant to the landscape design.

- Identify site furnishing options, including site lighting fixtures, benches, bike racks and other site amenities.
- Coordinate location and design of vegetated stormwater management facilities with other disciplines.
- Develop preliminary planting plan for project, including new non-process and process facilities. Work to include development of landscape typologies and specific potential plant species and materials to be used in different landscape types. Will include coordination with BES facilities maintenance staff.
- Develop preliminary irrigation plan for the project, defining areas to be irrigated, water sources, type of proposed equipment. Includes coordination with other disciplines and with BES facilities maintenance staff.
- Coordinate with architect for design of eco-roofs.
- Provide review of grading design and input to civil.
- Coordinate landscape design activities with other disciplines.
- Provide graphic illustrations of site and landscape improvements for public involvement meetings and website.

Assumptions

- Design includes landscape areas around new non-process and process facilities.
- Lighting and electrical design is provided by others.
- Eco-roofs are included in project.

Deliverables

- Draft and final Landscape Arch Fact Sheet for Process Facilities area.
- Schematic design drawings.
- Technical specifications – Table of Contents

Task 1.4.1.2.8.14 Design Management

Based on the 30% drawing list, fact sheets, and other design deliverables, Design Management services will be budgeted and tracked within this subtask.

Task 1.4.1.2.8.15 Project Automation Lead

Based on the 30% drawing list and other design deliverables, Project Automation services will be budgeted and tracked within this subtask. **Update all drawings in GMP2 30% deliverable to meet new BES standards as they relate to font size of titles on drawings and index facility text sizes. [CR-024]**

Task 1.4.1.2.9 Process Modeling and Support

The purpose of this task is to update the existing calibrated CBWTP Process Models to support schematic design, illustrate the expected changes to digestion, and reflect the subsequent 30 percent design refinements.

Task 1.4.1.2.9.1 Update existing CBWTP Process Model

Building on the model developed during 20 percent design, update the existing process model and then present additional model inputs, assumptions, and results in a TM. Document secondary treatment and solids processing system capacities based on the latest operational strategies. Prepare solids balance to be carried into final design.

Assumptions

- Effort will rely on information from the Process Model Update TM where applicable, including influent flow and load criteria (current and projected).
- Influent characterization (in absence of any additional sampling performed by BES) will be drawn from the report entitled "CBWTP Secondary Treatment Capacity Analysis Using Indicator SVI," drafted by Brown & Caldwell in October 2008.
- Performance of existing unit processes will be based on historical data derived from plant Discharge Monitoring Reports (DMR's) provided by BES
- BES will provide updated process control data (post-2018).
- Collaborative sessions to present updated model results and train BES users on updated models.

Deliverables

- Calibrated BioWin process models (solids/liquids process model and mass balance).
- Updated draft and final Existing CBWTP Process Model TM.
- Workshop meeting notes and materials.

Task 1.4.1.2.9.2 Develop CBWTP Process Model for Digestion

Using the existing steady-state, Pro2D-based model and the dynamic SUMO or BioWin-based model, simulate digester performance under a range of various operating conditions. Future changes to digester feeding related to co-thickening and FOG/food waste co-digestion, as well as potential future changes in the use of lagoons to stabilize digested sludge, will impact solids dewaterability and dewatering process design and operation. Modeling software to be discussed with BES.

The following scenarios will be modeled to examine the impact on sludge and recycle stream quantities and characteristics:

- Current split digestion feed (PS/WAS & TWAS-only) configuration.
- Homogenized digester feed flow with co-digestion of primary, secondary, FOG, and food waste.
- Increasing sludge production, food waste, and FOG acceptance.

For each of the three scenarios presented above, evaluate under the following conditions:

- With and without Digesters 1 and 2 online, to inform the driver for co-thickening implementation.
- With all units in service and with the largest digester out-of-service.
- Using either future lagoon configuration (receiving only centrate/filtrate recycle streams).
- Using influent projections for years-2025, 2035, and 2045 conditions

Document system capacities, resulting wastewater/sludge characteristics, quantities of dewatered sludge (for hauling), biogas production, and a range of relevant criteria to inform design of the solids handling unit processes, as well as potential operational strategies of the digester/lagoon system.

Assumptions

- Consultant to support dewatering testing through coordination with Bucknell University, fees for testing, etc.
- Assume up to a total of 144 model simulation runs using both the Pro2D and BioWin or SUMO-based models will be developed to capture the three scenarios with the various numbers of digesters and the lagoon in operation over the period from 2024 to 2045.

Deliverables

- Update the Process Model TM.
- Digester capacity, biogas production, and solids output curves from 2025-2045 for each scenario and operating configuration.
- Process model output (solids/liquids process model and mass balance).
- Process flow diagrams for digestion.

Task 1.4.1.2.9.3 Support for BES Digestion Trials

Provide on-call support (up to the limits of the budget) supporting BES as they plan and prepare to run a full-scale digester trial to investigate the effect of adjusting digester feed ratios on digester volatile solids reduction, sludge production, and dewaterability. Assistance may include:

- Review of draft pilot plan
- Advising operations/engineering staff
- Modeling peak loading conditions
- Sample testing

Assumptions

- Estimated level of effort for on-call co-digestion trial support:
  - Digestion Process Tech – 80 hours.
  - Senior Digestion Process Tech – 40 hours.
  - Operations support– 40 hours.

Task 1.4.1.2.10 Additional Site Survey Work

Additional site survey work will be required for schematic design. Now that the project is more fully defined, this subtask provides on-call funding for additional survey services, including the following areas/needs:

- Area of new solids loadout facility.
- Survey along the route of new primary sludge, primary scum, and digested sludge feed lines.
- Area around STO-4 and STO-5.
- Additional tree survey work.
- Survey of CM/GC potholing work.
- Survey of manhole and catch basin rims and top of grate elevations. Open manholes and catch basins and survey pipe invert elevations, direction of pipe entering structure, and diameter of pipes.
- Create detailed base map file in AutoCAD format with survey data collected.

Assumptions

- This additional survey work will be conducted as requested, up to the limits of the budget.
- An existing base map in AutoCAD format featuring the major site improvements will serve as the base for the addition of the topographic data that are collected for the project.
- BES will coordinate the marking of onsite utilities, provide record maps, and assist with the mapping/identification of the various utility lines in the production of the base map.
- Legal, easement, or plat surveys will not be provided under this scope.
- Not included: Location/verification of existing belowground utilities using test pits, magnetic meters, or ground penetrating radar.

Deliverables

- DTM and CAD files of surveyed data.

Task 1.4.1.2.11 Decommissioning and Deconstruction Plan Update

A preliminary Decommissioning and Deconstruction (D&D) Plan was prepared as part of the 20 percent design with the primary objective of providing a roadmap to demolishing the composter facility, Non-process buildings, SLPR Building, and existing truck loadout facility, and planning key aspects of that work: work sequencing, material surveys that would be needed, permitting requirements, salvage items, and other information that would provide value to BES and the CM/GC. This information was then used to develop cost estimates (CM/GC and Design Team) as well as the construction schedules (CM/GC).

Now that the Program is better defined, missing information can be added and technical issues and strategies can be addressed in more detail in coordination with the CM/GC.

In concert with the strategic planning work completed during 20 percent design, the D&D Plan will be updated to include additional hazardous materials sampling and results provided by BES (ERM Survey), with the goal of providing as complete of information packet as possible to the CM/GC for pricing. Requirements for recycling, abatement, waste storage, transport and recovery will be updated based on the scope of the current STEP projects. The asset recovery section of the D&D plan will be updated and refined based on further inventory of stored items (from BES) as well as through meetings/coordination with plant O&M staff.

An update to the sequence of demolition activities and contractor procurement requirements will be developed. To expedite permitting and reduce overall demolition costs, agency requirements and potential impacts will be considered during planning meetings with the CM/GC and the plans will include items that provide mitigation measures or avoid potential impacts altogether.

Assumptions

- Facilities or systems included in deconstruction scope include: a staff modular unit, storage space, a shop area, a decommissioned Taulman-Weiss composting facility that is partially used for odor control, abandoned piping and equipment in the existing galleries, the existing solids processing building (SLPR), existing odor control system, Building STO-3, and Building STO-4.
- BES will provide any additional as-builts of the facility in electronic and/or hard copy.
- A visual and desktop review for ERMs will be completed to identify and estimate the types and volumes of ERMs that will require offsite disposal.
- The construction schedule constraints will include the critical milestones and supporting tasks for the pre-shutdown planning as well as the schedule for the D&D (cradle to grave).

- Working with the CM/GC and Program team, current permitting requirements will be evaluated and included in the plan; however, they may change or increase before the actual D&D. A plan will be developed that will assist in monitoring these potential changes.
- Planning documents including a Traffic Control Plan and Waste Management Plan will be developed by the CM/GC team to allow for the initial planning activities. More detailed plans will be required as the planning moves into the final stages before D&D.
- Descriptions of work for the various structures and supporting systems will be included based on information obtained through reviews and site walks.
- The graphics for the individual areas of the plant site will be simple blow ups of the overall site map with some highlights and call outs that will be referenced in the text.

The tables and graphs for the equipment usage, labor, and cost will be spreadsheets and graphs that will provide a visual look at the total and estimated monthly utilization of resources and burn rate of costs.

Deliverables

- Updated D&D plan.

Task 1.4.1.2.12 Contaminated Soils Update

The schematic design work will include an update to the existing Soil Sampling and Analysis Plan (prepared during 20 percent design) to provide guidance to BES in executing any additional environmental soil sampling to provide baseline anticipated environmental site conditions to be considered during construction. These additional sampling results will then be documented and analyzed in the updated Subsurface Investigation Summary Report.

The updated sampling plan and summary report will focus on the following areas:

- Site of new SOFA building, including biosolids storage/loadout silos.
- Site of temporary construction trailers and temporary SOG/Storage.
- Route of new primary sludge, scum and digested sludge piping.
- STO-4 and STO-5 (if necessary).

Environmental Sampling and Analysis Plan

The 20 percent Sampling and Analysis Plan will be updated to provide guidance to BES in executing additional environmental sampling to provide baseline environmental site conditions to be considered during construction. The updated Sampling and Analysis Plan will describe the proposed sampling techniques and analytical methods to be used for additional environmental sampling for the project.

Assumptions

- The analytical methods are assumed to be total polychlorinated biphenyls (Aroclors), ~~total~~ metals (As, Pb, Hg, Cu, Cd, Cr, Se, Ag), total petroleum hydrocarbons, and pesticides. Pending analytical results further testing for polycyclic aromatic hydrocarbons and specific ranges of hydrocarbons may be warranted.
- No site visits are included in this task.
- BES will provide one set of consolidated comments on the Draft Sampling and Analysis Plan.
- Groundwater will not be sampled.

Deliverables

- Draft and final 30% Design Sampling and Analysis Plan.

Field Sampling (Conducted by BES with Consultant Oversight)

After approval of the Sampling and Analysis Plan from BES, BES will conduct any additional soil sampling. Sampling will be conducted to obtain a discrete sample from each location at two depth intervals at each location, from surface to 10 feet below ground surface. Samples will be obtained from a depth of up to 10 feet, with a Geoprobe, using stainless steel hand tools to collect the sample. A maximum of 25 individual samples will be analyzed.

BES will place IDW into a 55-gallon drum, labeled as analysis pending, and stored onsite. Based on previous soil results, the IDW is assumed to be non-hazardous. Consultant will coordinate disposal of the IDW at a BES-approved facility. Consultant will provide BES an email summary at the end of the field day documenting field activities.

Assumptions

- Field work oversight conducted by one Consultant staff member and will be completed in one 10-hour day.
- BES will coordinate the necessary utility locate notification services. BES will provide 3rd party utility locate services for each decision unit before conducting the sampling.
- Disposal costs are not included in this scope of work.
- Assumes that sample shipment/management conducted by BES/PBS.

Deliverables

- Email summary of field sampling activities.

Reporting

Following the completion of the additional sampling activities, the field information and analytical data will be reviewed in detail and evaluated to identify potential additional data needs. The evaluation will include a qualitative review of laboratory QA/QC data to validate analytical data.

The existing Subsurface Investigation Summary report (prepared during 20% design) will be updated, and the following information will be included:

- A description of the additional work completed, a summary of the results, and the proposed scope of subsequent field work, if needed.
- Tables presenting results for Contaminants of Potential Concern for the media (soil) and IDW.
- Soil data will be compared to DEQ risk-based concentration screening levels for construction worker, direct contact pathway, or similar screening value.
- Up to four figures will be prepared that show the results for the two decision units.

Deliverables

- Draft and final 30% Design Subsurface Investigation Summary Report.

Task 1.4.2 Risk Mitigation activities

- In favor of continuous Risks and Value Engineering reviews through the CM/GC model, risk mitigation activities will be incorporated into the 30% process design as the work progresses

through the constructability workshops and CM/GC design interface. This task will be moved to the detailed design phase to fund risk mitigation activities and impacts during detailed design.

- No budget is provided for this task during 30% design.

Task 1.4.3 Project Cost and Construction Schedule

- Maintenance of plant operations description, building on the description in the 20% design. Identify key operational constraints for the recommended project.
- Update construction sequence and operation during construction.
- Support CM/GC's update of the preliminary construction schedule.
- Provide construction cost estimate in sufficient detail to provide the expected accuracy range of an AACE International Class 3 estimate: -20% to +30%. Consultant will follow format and constraints provided by the Program Support Consultant.

Deliverables

- Updated Program Implementation Plan TM.
- Updated design schedule.
- Construction cost estimate. Cost estimate will be provided with a database of most modeled content, including size, material, flowstream, volume of concrete, and other major components.

Task 1.4.4 Technical Workshops – 30% Design

During this phase, workshops with BES staff will be held to review the development of technical evaluations, alternatives, and review of work products. Workshop materials will be developed based on the technical work being conducted and presented to BES in workshops. Workshops are identified in the attached table.

Non-process building workshops are included under the non-process facilities design effort.

Assumptions

- For the 30% design phase, assume a total of twenty (20) process workshops, each 2 to 3 hours long, with BES's personnel to review the progress of the work, make decisions, and provide direction.
- In addition to the technical workshops described above, the design team will conduct three half-day workshops at the end of 30% design to review work products associated with that phase of the work.
- One additional workshop (2 to 3 hours long) will be conducted to review P&IDs for the 30% design phase.
- Assumes ~~4~~ **5** hours of workshop labor plus ~~2~~ **3** hours of preparation for each workshop, and four consulting team members per workshop ~~-~~ plus the PM.
- Assume 3 total hours of meeting notes (per workshop) by staff.
- Workshops for the non-process facilities are scoped separately, under the Non-Process Design task below. Workshops for GMP#1 are scoped separately with budget allocated within the Detailed Design task below.
- Assume 3 total hours of meeting notes (per workshop) by staff.

Deliverables

- Agenda and meeting materials in advance of the workshops, identifying decisions needed and attendees required, using the shared workshop matrix in SharePoint.
- Draft meeting notes from the workshops, distributed to attendees for comment, and included in the 30% design report and submitted to BES.

Task 1.4.5 Quality Management – 30% Design

As part of the 30% design phase, the Consultant will implement the QMP developed in the task above. The Consultant will ensure QA activities are conducted throughout this design phase and Consultant will manage multidiscipline internal QC review activities with the senior review team throughout this design phase. Formal QC reviews by the Consulting team will be performed before BES review of the deliverables.

Audits by QA personnel will be conducted to verify conformance with project-specific design standards, BES checklists, and the approved QMP. The Consultant will confirm that required checking and review functions are completed, culminating in either approval or an NCR. The QA audits follow checklists based on project procedures applicable to the area being audited. Quality review documentation will demonstrate that the quality review process is complete and review comments are acceptably addressed as a component of the overall records management system.

Assumptions

- BES will consolidate the BES staff review comments into one comprehensive package before submitting review comments to the Consultant.
- For major deliverables, Consultant will provide 15 printed copies and one electronic copy in PDF format, and BES will submit review comments within the period allocated in the project schedule (typically 4 weeks following BES receipt of the review submittal).
- For smaller TMs and meeting notes, Consultant will provide one electronic copy in PDF format, and BES will submit review comments within 14 days following BES receipt of the deliverable.
- Consultant's responses to BES consolidated review comments will be returned to BES for their records.

Deliverables

- QRFs used during internal quality reviews.
- Responses to DRFs used by BES to document quality review comments.
- Project checklists or milestone checklists signed by the reviewer and the appropriate project staff.
- Copies of quality review markups or comments not included on the QRFs or DRFs.
- Review-related correspondence with BES staff and other external agencies or entities.
- QMP-related documents for subcontracted work.
- Audit correspondence, including results and corrective action documentation.

Task 1.4.6 Project Management – 30% Design

Perform the following activities for the duration of the 30% design phase:

- Before commencing the 30% design phase, prepare for and conduct a "refresher" Kickoff/Chartering Meeting for Consultant team members, including subconsultants.

- Maintain and update the final work plan for the project that combines staffing commitments and budgets with the deliverables and schedule for the project. Specific responsibilities of each member of the final design project team will be maintained. Update the overall design schedule each month. and review with the BES Program Manager, as needed.
- Supervise and control activities of staff assigned to the project. Coordinate and schedule appropriate project staffing discussions to meet project requirements. Arrange for the scheduled project workshops, review meetings, and project team meetings. Coordinate the participation of senior staff at appropriate points in the project.
- Coordinate with other Projects and BES staff to complete work on schedule and within budget.
- Prepare monthly progress reports and submit with the monthly invoice. The reports will include a status summary of current project tasks, activities completed in the last month, activities planned for the next month, a project action issues checklist, performance compared to budget, and identification of items of concern. Organize monthly invoice and budget status report by WBS element, including a Monthly Subconsultant Payment and Utilization Report by the 15th of each month (reference Part II, Section C.5 of the RFP). Include budget reports based on using an "S" curve that shows budgeted work complete, billings to date, and estimate at completion.
- Monitor project activities for potential changes. Should change occur, and with BES approval, modify project tasks, task budgets, and approach. Inform BES if any changes will impact the cost of engineering services, the construction cost, or the schedule.
- Participate in weekly conference calls with BES project manager (project manager and design manager). Review the project status and discuss activities and needed actions. Prepare and discuss the 3-week look-ahead schedule.
- Submit change management forms, as needed to document scope/schedule/budget changes. Update the change log and review proposed changes and scope modifications with the BES Program Manager at the bi-weekly project management meetings. **Use the Heron STECR (STEP Contract Change Request process) to submit the forms.**
- Support and attend (as requested) project briefings by BES project management team to upper management, City Council, etc.
- Maintain project records, manage and process project communications, and coordinate project administrative matters, utilizing the established Portland document management tool (Heron/e-Builder).
- The Program Support Consultant will update and maintain the Risk Register during the design phase. Consultant will participate in regular meetings with CM/GC, Program Support Consultant, and BES to provide input. Program Support Consultant will lead and document meetings.

Assumptions

- Assume ~~5~~ **8** months for this task (including cost optimization).
- Assume this 30% Project Management effort covers both the 30% Design Phase as well as the Final Design for GMP#1 (running concurrent to the 30% design work).
- Monthly invoices and major project submittals will be submitted through Heron/e-Builder.

Meetings

- One and a half hours every week to meet with BES project management.
- *One additional hour every week to meet with BES project management for the GMP#1 final design.*

- *Assume three Risk Register Meetings, four hours each during the Schematic Design Phase. Assume three Consultant staff members participate.*

Deliverables

- Updates to Program Workplan at completion of 20% design.
- Monthly project invoices and status reports.
- Completed change management forms, as needed, to document impacts of potential changes on engineering fee, construction cost, or schedule.

Task 1.4.7 Additional Condition Assessment

Task 1.4.7.1. Develop Approach

Identify approach for development of a condition assessment and risk analysis process for BES's wastewater assets. Major activities include the following:

With the 20% design complete, the following existing facilities have been identified as critical to long-term operation of the selected solution, and condition assessments will support defining the timelines for implementation inside or outside of STEP, as appropriate:

- Identify capacity of existing wet weather and dry weather primary sludge pumps. Determine whether modifications are required to existing PS pumping controls. Evaluate capacity and expected life of existing pumping systems. Identify upgrades necessary to support new SOFA facilities.
- Refine routing and sizing of thickened combined sludge from new SOFA to digester feed booster pump station (through existing tunnel system. Evaluate sludge receiving at digester complex including storage, mixing, distribution piping, and booster pump station modifications. Evaluate capacity and expected life of existing pumping systems. Identify upgrades necessary to support new SOFA facilities.
- Identify required modifications for digested sludge feed to dewatering (use of D3, capacity of existing dewatering feed pumps). Assign capacity and expected life of existing pumping systems. Identify upgrades necessary to support new SOFA facilities. Refine routing and sizing of the existing digested sludge transfer line routed from the existing digester complex to the existing SLPR via the Yellow Tunnel. Confirm existing transfer pump controls and modify as needed to integrate with the new centrifuge feed pumps.
- Evaluate distribution of centrate and filtrate - Existing 14" FL/SDS pipe to lagoon (condition/capacity to be evaluated), new 20" line to headworks with branch to the recycle pump station (capacity to be evaluated), and centrate discharge to primary effluent channel (adjacent to SOFA).
- Develop approach to primary scum collection/management. Determine impacts/upgrades to existing primary scum systems.
- Where appropriate, review capacities of existing RAS equipment that is to remain in service.
- Evaluate the performance of existing RAS pumps to determine if they are adequate for the future conditions.
- Evaluate elevations of existing gallery piping as needed to assess the extent of replacement/demolition.

In conjunction with BES's asset management lead and within the existing asset management program, review existing condition assessment information and BES approach to asset management including templates used for assessing asset condition.

Define the approach and scope for implementing the assessment of facilities identified above. Determine if detailed assessments are required for mechanical systems.

Assumptions

- BES Responsibilities:
  - One BES mechanic will be made available during field work to allow transition of the program to BES's staff.
  - One BES electrician will participate during field operations to assist in completing those tasks that require a qualified electrician, such as opening cabinets.
  - Before performing the condition assessment, detailed condition assessment criteria will be discussed with BES staff and agreed-to modifications will be made. Additionally, to facilitate the condition assessment, BES will turn equipment on and off. In order to maintain safe working conditions, BES staff must accompany the condition assessment team(s).
- Detailed assessments including ultrasound, infrared photography, vibration analysis, etc. are outside the scope of this base work. Assume the actual testing/analysis work will be conducted only if authorized by BES and funded under the Owner's Contingency, if required.
- Structural condition assessment of the aeration basins is already completed based on the existing BergerABAM report and subsequent field visits completed during 20% design. No additional assessment work is contemplated as part of this Task.
- Work does not include the evaluation of any existing utility performance and condition.

Deliverables

- Draft and final STEP Condition Assessment TM with recommendations on required improvements for STEP, and opportunities to phase out or incorporate. Provide five printed copies and electronic copy in PDF format.

Task 1.4.8 Cost Optimization Task

- This task was conducted after the 20% design task and will not be repeated after 30% design.
- No budget is provided for this task.

Task 1.4.9 Optional Task: Update Basis of Design Report

Update the Basis of Design Report, incorporating changes, review comments, and CM/GC input. This subtask includes updates to the Design Criteria and the Executive Summary to reflect the Basis of Design at the end of 30% design, resulting in a draft report for BES review.

Prepare final report, incorporating BES comments.

Assumptions

- Assume that TMs and drawings produced during the 30% design effort are appended to the updated Basis of Design Report, but that only the Design Criteria and Executive Summary are updated (from what was delivered at the end of 20% design).
- If authorized, the extent of the Consultant's involvement will be limited to the budget available.

Deliverables

- Draft and final Basis of Design Report (15 printed copies and one electronic copy in PDF format).

Task 1.4.10 Optional Task: Prepare information for Energy Trust Application

Provide support to BES in the development and compilation of information needed for Energy Trust funding. Work with the Energy Trust to define the project elements that have the most likelihood of funding. Support the preparation of engineering materials as well as the applications.

Assumptions

- If authorized, the extent of the Consultant's involvement will be limited to the budget available.
- Deliverables would be defined as part of the budget authorization process.

Task 1.4.11 Operations and Maintenance Support

Provide operations and maintenance (O&M) liaison support to the BES Ops and Maintenance staff throughout design, meeting with them to understand their issues and preferences, to then be in a position to "stand in" for the plant staff during design meetings and reviews. Support staff will also relay design team O&M issues to BES staff, sitting in on lunch meetings or breaks with BES staff and explaining design progress, decisions that need to be made, helping facilitate the review of TMs or Contract Documents, etc.

Building on the work completed during the 20% design, conduct another review of the existing plant operating facilities that are impacted by the proposed construction. The results of this review effort will be presented to the BES's personnel and CM/GC during a 3-4 hour workshop. Primary discussion topics include construction sequence (overall and by facility), including temporary provisions, constraints on timing and duration of work, and any shutdown requirements. The information developed for this workshop, including BES input, will be incorporated into the updated project Maintenance of Plant Operation Plan.

Assumptions

- If authorized, the extent of the Consultant's involvement will be limited to the budget available.
- Level of effort and budget is allocated to individual design and technical workshop tasks.
- Liaison staff will review agendas and consultant deliverables and solicit input from BES O&M staff.

Meetings

- Project sequencing and constraints workshop.
- One-on-ones and phone calls with BES O&M staff.

Deliverables

- Meeting notes.
- Updated Maintenance of Plant Operation Plan.

Task 1.5 Owner's Contingency – Preliminary Design Phase

This task provides an Owner's Contingency for the Preliminary Design Phase equal to 10% of the sum of all other subtask amounts. The Owner's Contingency will be managed by BES's Program Manager within the overall contract not-to-exceed amount. The intent of the Owner's Contingency is to provide budget for tasks for professional services that:

- Are required to complete the project as described herein.
- Result from decisions made by permitting agencies or other parties that influence the scope of professional services required to ensure project completion.

- Are needed to increase task budgets where the assumptions made to create the budget are violated and the violation is beyond the control of the Consultant.

Written authorization from BES's Program Manager is required to reallocate budget from this Preliminary Design Owner's Contingency Task to an existing task or a new subtask that is within the overall scope of the project but not clearly defined as within the scope of Task 1 Preliminary Design.

Task 2 Detailed Design Phase Services

Task 2.1 Non-Process Facilities – Design

The Non-Process Facilities Design work builds on the Non-Process Schematic Design (Task 1.2.12 **and 1.4.1.1). The basis for these Task 2.1 efforts is refelected in the attached sheet list. This sheet list serves as the assumed basis for the final design. Moving forward,** the Non-Process **Facilities Design will progress on the same schedule as** the design of the process facilities **(Task 2.2)**. ~~As a result, the drawings, standard details, and specifications for the non-process facilities will not necessarily be consistent nor standardized with the process design elements.~~

This scope and budget assumes designing ~~three~~ **two** buildings **on the East Pad site**: ~~totaling~~

- **SLOUGH: Approximately 10,000** ~~13,000~~ square feet **building grouping the shop functions into one structure as well as housing spaces that serve the SOG and Parks groups. This building also includes a "mud room", locker rooms, conference room, employee quiet room, and staff break room, as well as building support spaces (i.e., laundry room, storage, electrical and mechanical equipment rooms).** ~~and a~~
- **STO6: An unconditioned, open structure (approximately 4800 square feet) housing storage and maintenance functions. A parking area for charging the electric carts as well as storage and repair area for the campus bike program is provided in this building. A vehicle and equipment wash area with a pressure washer completes the building.** ~~covered storage area.~~

The proposed buildings on the East Pad will be designed for maintenance, storage, and administration, including common areas such as lunch rooms, meeting rooms and locker/shower rooms. ~~One of the buildings is anticipated to be a two-story building. Design of additional spaces beyond 30,000 square feet, if chosen by BES, is included in Task 2.1.3 described below.~~

Task 2.1.1 Design Development (60% Design)

Design development activities for 60% design are as follows:

- Incorporate VE comments **(if applicable) and BES review comments**
- Attend and facilitate regular design team meetings to refine work scope, budget, and schedule, including producing and publishing meeting minutes.
- Attend and facilitate regular stakeholder design workshops to identify specific design needs, develop the design, and refine the budget and schedule. Design workshops will be focused on a specific aspect of project design or a system. The preliminary workshop schedule includes eight workshops addressing the following topics, plus a final review 60% design workshop:
  - Equipment.
  - Casework.
  - Plumbing fixtures.

  - Lighting and electrical power.
  - Door hardware and security.
  - Finishes.
  - Site/civil/landscaping, and stormwater management.
  - Green Building Policy features.
- Develop interior finish schemes and exterior color schemes for review, refinement, and approval.
- Develop site/civil/landscaping, and stormwater management design.
- Develop Green Building Policy features.
- Determine, integrate, and track sustainability measures pertaining to LEED-GOLD certification as required to define, develop, and incorporate determined LEED-GOLD items into the design development documents.
- Provide early decision and design phase energy modeling per American Society of Heating, Refrigeration, and Air-Conditioning Engineers 90.1 Analysis.
- Produce 60% design drawings and specifications, including all building systems (mechanical, structural, fire protection, security, landscaping, stormwater, building mechanical including fire protection, civil, landscaping, electrical, etc.).
- Conduct QA activities in accordance with the project-wide QMP.
- Produce a refined 3D rendered view of the project for communicating the current design to stakeholders and others.
- Support development of a construction cost estimate and review prepared cost estimate.
- Provide 60% design package to BES.

Assumptions

- Specifications will be provided in the 6-digit CSI format.
- Building sprinkler system drawings and specifications are provided as part of design, with detailed design required of system provider.
- Initial planning concepts for non-process facilities developed by others.
- Structures will be designed to be consistent with the seismic resiliency goals identified by BES's resiliency plan.
- CM/GC will develop overall project schedule, construction cost budget, and provide constructability reviews.
- Green roofs are required on non-process facilities. Solar panels will be considered.

Meetings

- Eight workshops will be facilitated to address each of these design topics plus a final review workshop.
- Regular design team meetings will be held for coordinating the design between trades and completing the documents.
- Constructability review meeting with CM/GC.

Deliverables

- Agenda and meeting materials in advance of the workshops.
- Draft and Final Design Development Reports (15 printed copies and one electronic copy in PDF format), including:
  - Space uses, volumes, and configuration confirmation.
  - Basis of design for architectural concepts and key features, including seismic resiliency, security, and fire protection.
  - TM of comments in response to construction cost estimate.
  - Meeting minutes of all stakeholder meetings and workshops Consultant facilitates.
  - Green Building Policy Compliance Report.
  - Refined 3D rendered view of the project for communicating the current design to stakeholders and others.
- Drawings, including site plan, building plans, sections and elevations, equipment plans, finish plans and preliminary details, structural, mechanical, fire protection, plumbing and electrical systems plans, and stormwater management plan.
- Preliminary project specifications (3-part, 6-digit Construction Specifications Institute (CSI) format).
- AACE International Class 3 cost estimates.

Task 2.1.2 Construction Documents

Activities of this task are as follows: Construction Documents

- Attend and facilitate regular design team meetings to refine work scope, budget, and schedule, including producing and publishing meeting minutes.
- Attend three meetings with BES (and CM/GC) to update progress and refine minor design issues.
- Sustainability certification:
  - Determine, integrate, and track sustainability measures pertaining to LEED-GOLD certification as required to define, develop, and incorporate determined LEED items into the Contract Documents.
  - Provide fundamental commissioning specifications per LEED-GOLD requirements of heating, cooling, water heating, and ventilation systems.
- Work with selected CM/GC to develop project phasing plans. Detailed move plans for relocating uses are not included.
- Develop specifications in 6 digit CSI format: Divisions 0 and 1 sections to be reviewed and refined with BES procurement staff.
- Provide progress CD set to Contractor for constructability review and cost estimate update.
- Support development of a construction cost estimate and review prepared cost estimate.
- Develop and coordinate drawings and specifications to produce construction documents suitable for building permits, subcontractor bidding, and final construction.
- Conduct QA activities in accordance with the project-wide QMP.

Assumptions

- CM/GC will lead and Consultant will participate in development of overall project schedule, construction cost budget, and constructability reviews.

Meetings

- Regular design team meetings will be held for coordinating the design between trades and completing the documents.
- Three meetings with BES (and CM/GC) will be attended to update progress and refine minor design issues.

Deliverables

- Updated Green Building Policy scorecard.
- Construction documents (drawings and specifications) suitable for subcontractor bidding (90% documents), and final construction (100% documents).
- Construction documents (drawings and specifications) suitable for building permit application (at 90% design). Review comments will be addressed in final construction documents (100%).
- Energy Code compliance forms (COMCHECK) for permit review.

Task 2.1.3 Optional Task – Additional Building Space

Due to other needs identified at the CBWTP and possible efficiency gains, additional building space that is beyond the base scope of work may be requested. If such situation arise, formal authorization will be provided to the Consultant with funding on a not-to-exceed amount provided from Task 2.6 Owner's Contingency – Detailed Design Phase. No budget is currently authorized.

Task 2.1.4 Quality Control – Non-Process Design

As part of each Non-Process Design deliverable, the Consultant team will implement the QMP. The core Non-Process Design team will ensure QA activities are conducted throughout this design phase and the prime Consultant will manage the multidiscipline internal QC review activities with the senior review team throughout each design phase. Formal QC reviews by the Consulting team will be performed before BES review of the deliverables.

Audits by the prime Consultant will be conducted to verify conformance with project specific design standards, BES checklists, and the approved QMP. The Consultant will confirm that required checking and review functions are completed, culminating in either approval or an NCR. The QA audits follow checklists based on project procedures applicable to the area being audited. Quality review documentation will demonstrate that the quality review process is complete and review comments are acceptably addressed as a component of the overall records management system.

Assumptions

- Through the use of Heron (e-Builder), BES will consolidate the BES staff review comments into one comprehensive package before submitting review comments to the Consultant.
- For major deliverables, Consultant will provide 15 printed copies and one electronic copy in PDF format, and BES will submit review comments within the period allocated in the project schedule (typically 4 weeks following BES receipt of the review submittal).
- For smaller TMs and meeting notes, Consultant will provide one electronic copy in PDF format, and BES will submit review comments within 14 days following BES receipt of the deliverable.
- Consultant's responses to BES consolidated review comments will be returned to BES for their records.

Deliverables

- QRFs used during internal quality reviews.
- Responses to DRFs used by BES to document quality review comments.
- Project checklists or milestone checklists signed by the reviewer and the appropriate project staff.
- Copies of quality review markups or comments not included on the QRFs or DRFs.
- Review-related correspondence with BES staff and other external agencies or entities.
- QMP-related documents for subcontracted work.
- Audit correspondence, including results and corrective action documentation.

Task 2.1.5 Building Permit Support for Non-Process Facilities

Consultant will do the following:

- Issue permit documents through Portland BES for building permit application.
- Track permit process and respond to BDS issued check sheets. Make corrections to Drawings as required.

Task 2.2 Process Facilities – Design

~~It is anticipated that t~~**T**he project scope ~~will be~~**has been** refined after completion of Task **1.4.1**~~2~~ **– 30% Design Submittal**. The basis for **these** Task ~~3~~ **2.2** efforts is ~~included~~ **reflected** in the attached sheet list. This sheet list serves as the assumed basis for the final design.

Task 2.2.1 60% Design Submittal

The purpose of this task is to utilize the conceptual decisions of the project that were made in the previous phase and to complete and finalize the preliminary calculations of the previous phase and develop the project design to achieve a true “design freeze” at the conclusion of this phase. Structures, equipment, major plant piping, process, major electrical, and site plan are all finalized during this phase to allow final detailing of the same in the next phase of design. Drawings and other materials that may be required exhibits for permit applications will be available at the conclusion of this phase. The majority of the QC review and approval will occur before finalization of the work products from design development phase.

As noted above, Non-Process Facilities are proceeding on a ~~separate fast-track~~ **parallel** schedule and are ~~therefore excluded from the work described herein~~**scoped in Task 2.1 above**.

Specific activities and work products from this phase are described in the following subtasks.

Assumptions

- BES will provide Division 0 and Division 1 specifications (standard specification sections are being developed by BES Program Support Consultant). Consultant would contribute to Division 1 specifications (Scope of Work, Startup and Testing, Environmental Conditions, etc.).
- Specifications will be provided following the 6-digit CSI format.
- Workshops for Process Facilities Design are scoped/budgeted under **Task 2.2.1.5 Technical Workshops – 60% Design.** ~~Draft Operational and Control Strategy TM.~~

- ~~Technical Workshops – 60% Design.~~

- Piping support approaches will be preliminary during this phase ~~and will be developed for piping 30 inches in diameter and larger. Piping smaller than 30-inch diameter will be designed by the CM/GC based on specification requirements.~~ **Pipe support design:**
    - **Jacobs to design supports for large piping (greater than 20-inch) and provide guidance on support types and configuration for smaller piping.**
    - **Except in the Silver Tunnel where Jacobs will design supports for piping 12 inches and larger on pipe rack designed by Jacobs.**
- Rebar requirements will be presented in schedule format.
- ~~Standard details will be bound in a separate volume(s) 8-1/2 x 11 format.~~
- Tables and schedules bound will be bound with the specifications.
- Americans with Disabilities Act compliant features are not required in facilities other than the new non-process buildings.
- Additional control system features are not part of the current design scope, including:
    - Communications and paging systems.
    - Security systems.
    - Closed circuit television systems.
    - Cable TV systems.
    - On-line O&M manuals.
    - Preventive maintenance software.
    - Process management reporting.
    - Laboratory information systems.
    - Information technology needs such as local-area networks, wide-area networks, and intranets.
- Site work, including road repaving, is only included for areas within the area affected by new facilities. Assume site grading and piping profiles are not included.
- Corrosion control systems other than materials selection and coating are not required.
- Building sprinkler system drawings and detailed specifications are not required (use performance specification).
- ~~Piping support system drawings and detailed specifications are not required for piping less than 30-inch diameter (use performance specifications).~~

Deliverables

- 60% 11 x 17 drawings **and draft design details (11x17 format)** (15 printed copies and one electronic copy in PDF format).
- 60% specifications and ~~draft design details (8 1/2 x 11 format)~~ (15 printed copies and one electronic copy in PDF format).
- Equipment list that includes equipment number, equipment size, equipment power requirements, and basic controls (15 printed copies and one electronic copy in PDF format).
- Operating strategies for all major unit processes anticipated on the project (15 printed copies and one electronic copy in PDF format).

- Instrument List and Loop/Index List (15 printed copies and one electronic copy in PDF format).
- Responses to 30% BES Design Review Comments.
- Construction Cost Estimate in sufficient detail to provide the expected accuracy range of an AACE International Class 2 cost estimate: -15% to +20%. Cost estimate will be provided with a database of most modeled content, including size, material, flowstream, volume of concrete, and other major components.

Task 2.2.1.1. 60% Design

Prepare 60% Design Documents, including the following:

Architectural

- Develop building 3D electronic models or floor plans and elevations for all buildings.
- Coordinate with I&C and electrical disciplines to size and locate electrical and control rooms.
- Coordinate with the mechanical discipline to select the type of HVAC equipment, locate HVAC equipment rooms, determine space requirements and routing for ductwork if required, and establish design R-values for all exterior walls.
- Coordinate with structural engineer to define the structural design concepts for the facilities.
- Establish applicable codes for all buildings/structures with local code officials and fire marshal. Complete building and fire code analysis. Meet with local code official to review floor plans.
- Prepare first draft of technical specifications.
- Review design development and draft work products with and seek approval from QC reviewer.

HVAC and Fire Protection

- Prepare sizing calculations for HVAC equipment based on energy code requirements and selected building construction materials. Prepare HVAC equipment data sheets and cut sheets.
- Create ventilation concept drawing (louver locations, fan locations, type of equipment, air flows).
- Identify routing or right-of-way for major duct runs. Locate major air handling equipment. Confirm size of mechanical equipment rooms.
- Prepare HVAC system block diagrams. Define HVAC system control philosophy.
- Coordinate with civil engineer for potable water and fire water supply and distribution, as well as plant drain system.
- Prepare first draft of technical specifications.
- Review design development and draft work products with and seek approval from QC reviewer.

Civil and Site Development

- Prepare site plan package at the end of the design development phase (if required) and submit it to the local site permitting agency. *Timing and content of this submittal may vary and must be coordinated with the local agency throughout the design process.*
- Freeze civil design concept. Structures, road, and major site element horizontal locations are finalized. Structure floor/control levels, and finished grades are finalized.
- Define demolition requirements and limits. Define contractor staging, storage, access, and offsite access corridors.

- Prepare preliminary site grading drawings.
- Download survey data to create site-drawing files for final design.
- Set final building and structure elevations.
- Develop preliminary yard piping (18-inch-diameter and larger) and plant drain layouts. Identify corridors for smaller piping and other utilities.
- Show stormwater control concepts (swales, curb, and gutter) on the design development drawings.
- Finalize traffic flow, parking, and lay out road access to all buildings and structures. Coordinate handicap requirements with architectural discipline and local site plan regulations.
- Prepare first draft of technical specifications.
- Review design development and draft work products with and seek approval from QC reviewer.

Additional Site Survey Work

Additional site survey work will be required for final design. This subtask provides on-call funding for additional survey services, including the following areas/needs:

- **Survey of CM/GC potholing work.**
- **Additional site survey work**
- **Electrical maintenance hole/vault surveys**
- **Survey along the route of new primary sludge, primary scum, and digested sludge feed lines.**
- **Additional tree survey work.**
- **Survey of manhole and catch basin rims and top of grate elevations. Open manholes and catch basins and survey pipe invert elevations, direction of pipe entering structure, and diameter of pipes.**

Create detailed base map file in AutoCAD format with survey data collected.

Assumptions

- **This additional survey work will be conducted as requested, up to the limits of the budget.**
- **An existing base map in AutoCAD format featuring the major site improvements will serve as the base for the addition of the topographic data that are collected for the project.**
- **BES and/or the CMGC team will coordinate the marking of onsite utilities, provide record maps, and assist with the mapping/identification of the various utility lines in the production of the base map.**
- **Legal, easement, or plat surveys will not be provided under this scope.**
- **Not included: Location/verification of existing belowground utilities using test pits, magnetic meters, or ground penetrating radar.**

Deliverables

- **DTM and CAD files of surveyed data.**

Landscape Architecture

- Prepare 60% hardscape plans package for pedestrian paving areas for both process and non-process project facilities. This will include definition of materials and layout of paving joints and locations of site furnishings, exterior lighting and other site elements. Develop requisite construction details.
- Coordinate exterior lighting locations with electrical and civil disciplines.
- Prepare 60% site planting and irrigation plans, eco-roof planting, and irrigation plans. Develop requisite irrigation and planting details. Coordinate with the architect and structural engineer for eco-roof landscape design.
- Review site grading and provide input to civil. For special hardscape outdoor areas, landscape architect may provide detailed grading plan to be integrated with the overall site grading plan.
- Review vegetated stormwater facility design and provide input to civil. Coordinate planting design of vegetated stormwater facilities with civil.
- Coordinate landscape improvements with work of other disciplines.
- Prepare first draft of technical specifications.
- Review design development and draft work products with and seek approval from QC reviewer.

Electrical

- Determine locations and sizes for electrical distribution equipment. Prepare preliminary one-line diagrams for proposed facilities. Coordinate with lead process engineers to size equipment motors.
- Prepare detailed electrical load calculations.
- Develop site plans with major electrical equipment and ductbanks, including fiber optic ductbanks required to help City achieve fiber optic control loop.
- Size electrical rooms and prepare a preliminary layout of the major electrical equipment located in each electrical room. Determine equipment requiring uninterruptable power supplies (UPS) and locations of UPS equipment. Coordinate with I&C discipline to determine space requirements and locations for control equipment. Locate major input/output (I/O) termination panels, terminal junction boxes, and control panels.
- Define/document requirements and concepts for special systems: Telephone (including incoming service location, scope of supply, etc.), Data highway (control system), Data highway (local area network, office automation), and fire alarm system. Special systems such as paging system, security system, closed-circuit television system, and security systems will be identified, but are not currently included in the scope of the project.
- Identify rights-of-way and routing methods for electrical conduit and tray. Lay out duct bank system (major runs/manholes). Coordinate with civil yard piping. Locate manholes and hand holes.
- Develop detailed lighting concepts; select luminaire types in conjunction with architect. Prepare preliminary lighting layouts and initial lighting calculations. Prepare preliminary site lighting layout.
- Define hazardous locations (NFPA 820) and document in the area classification table. Define corrosive locations and document.
- Prepare first draft of technical specifications.
- Review design development and draft work products with and seek approval from QC reviewer.

- **Prepare draft electrical short circuit study on proposed new equipment and modified existing equipment using an electrical modeling platform for short circuit analysis to inform design load cacluations.**

Instrumentation and Control Systems

- Coordinate with BES to generate equipment and loop numbers.
- Prepare final CAD-based P&ID drawings including loop numbers and all instrumentation.
- Prepare preliminary I/O count. Size and locate I/O panels. Coordinate space requirements with electrical and architectural disciplines.
- Summarize I&C system design philosophy for each major process in a process control narrative. Include a description of the field elements to be used for each application and preliminary set points for major I&C elements. Update/finalize control system block diagram. Finalize typical control diagrams/loop diagrams for each type of control scheme to be used.
- Coordinate with HVAC engineer regarding control system requirements.
- Coordinate with electrical on requirements for fiber optic system.
- Determine UPS requirements.
- Define control interfaces for all package systems with local controls, including adjustable frequency drives.
- Review mechanical equipment specifications to confirm coordination with P&IDs and control system interface requirements.
- **Develop personnel communication system for STEP facilities**
- **Prepare 60% control narratives**
- **Prepare typical panel layout, panel power, and I/O module wiring diagrams.**
- Coordinate locations of control panels and instruments.
- Prepare first draft of technical specifications.
- Review design development and draft work products with and seek approval from QC reviewer.

Process

- Final major equipment sizing calculations.
- Coordinate process requirements during construction.
- Finalize hydraulics.
- Continue to use simulation model to advance hydraulics design (verify equipment selection, evaluate overflow/drain scenarios, etc.).
- Use simulation model to advance I&C design and develop process control strategies.
- Conduct failure and risk workshop with operational staff and management.
- Evaluate risk of various critical failure events (network communication error, flowmeter erroneous reading, actuator failure, etc.).
- Evaluate plant performance and risk of overflow at various storm events (1-year, 10-year, 50-year, etc.).

- Coordinate with I&C on completion of P&IDs.
- Coordinate with I&C on development of process control narratives.
- Develop process equipment specifications.
- Coordinate with all disciplines for process facility layouts, yard piping, and utility requirements.
- Review design development and draft work products with and seek approval from QC reviewer.
- Attend meetings with BES and operations staff to review facility layouts and walk through 3D models of process facilities.

Mechanical

- Calculate the hydraulic profile for all-major gravity process pipelines and hydraulic structures. Establish maximum and minimum water surface elevations for all process tanks and operating levels for effluent pump station.
- Prepare 3D electronic models or building and structure layouts (plans and major sections).
- Assemble catalog cuts for all major process equipment. Complete equipment data sheets or equipment list on all major equipment items.
- Coordinate with I&C in the finalization of P&IDs.
- Final ancillary equipment sizing and line sizing calculations.
- Final equipment selection (type, size, weight, arrangement).
- Update pipe schedule.
- Develop preliminary gate schedule and actuated valve schedule; confirm valve actuator types and power requirements.
- Determine approach for tie-ins of major yard piping with existing piping/facilities, pipe flexibility details.
- Prepare first draft of technical specifications.
- Review design development and draft work products with and seek approval from QC reviewer.

Geotechnical

- Coordinate with structural engineer to develop foundation loading criteria for proposed facilities.
- Finalize geotechnical analyses based on building layouts and loads and performance criteria.
- Develop horizontal and vertical layouts for ground improvement for proposed facilities.
- Prepare first draft of earthwork technical specifications.
- Finalize geotechnical design report.

Structural

- Coordinate with geotechnical engineer to establish foundation design criteria for proposed facilities. Review geotechnical report and discuss foundation design approach with geotechnical engineer and senior structural reviewer.
- Document structural design concept for each building (room by room) and structure. Finalize materials of construction (cast-in-place vs. precast concrete, roof structures, etc.). Preliminary framing plan for buildings and other structures.

- Engineering sizing developed for all foundations, walls, and elevated slabs.
- Coordinate major pipe tie-ins to new and existing structures.
- Prepare 3D electronic models for all major structures.
- Develop plans and sections for all structures.
- Prepare first draft of technical specifications.
- Review design development and draft work products with and seek approval from QC reviewer.

Task 2.2.1.2. Project Sequencing and Constraints Analysis

Conduct a review of the existing plant operating facilities that are impacted by the proposed construction. This review will list process areas that are impacted by the proposed construction and identify the nature and estimated duration of the impact. The results of this effort will be presented to the BES's personnel and CM/GC during a 1-day workshop. A second workshop will be conducted, if needed, to discuss additional detail of the construction sequence, overall and by facility, including temporary provisions, constraints on timing and duration of work, and any shutdown requirements. The information developed for these meetings, including BES input, will be incorporated into the project Maintenance of Plant Operation Plan.

Meetings

- Two project sequencing and constraints workshops **(with the CMGC)**.
- **Assume 10 separate meetings with BES O&M staff to review and refine constraints register.**

Deliverables

- Meeting notes.
- **Updated** Maintenance of Plant Operation Plan.
- **Workshop notes and PPT slides**

Task 2.2.1.3. 60% Cost Estimate

- Support CM/GC's update of the construction schedule.
- At 60% design, provide construction cost estimate in sufficient detail to provide the expected accuracy range of an AACE International Class 2 cost estimate: -15% to +20%.

Deliverables

- 60% cost estimate.

Task 2.2.1.4. Operational Strategy Technical Memorandum

Based on the current design, develop an Operational Strategy TM that captures the process control narratives per BES standards for each of the major unit processes. This document will narratively describe the operational strategies associated with the design (in conjunction with the process control description specifications) for each unit process. This manual will explain the various primary modes of process operation that may be used, including both normal operation and initial emergency operation procedures such as peak wet weather events, loss of duty units, power failures, etc.

Assumptions

- The Operational Strategy TM will evolve through the rest of design and then form the basis for the Process Operations Manual delivered as part of the Startup and Testing scope section below.

- Draft TM will be submitted as part of the 60% design phase. Updates will be provided at the 90% and 100% design phase.
- This Operational Strategy TM will organize and present the process control narratives developed during design, relying on the P&IDs for reference. Enhanced process flow diagrams and other graphics will be developed and funded under the Process Operations Manual task (scoped under the Startup and Closeout Phase).

Meetings

- ~~Two~~**One** project operational strategy ~~workshops~~**workshop during 60% design. Assumes 5 hours of workshop labor plus 3 hours of preparation for each workshop, and four consulting team members per workshop plus the PM.**

Deliverables

- ~~Meeting~~ **Workshop** notes.
- Draft **60%** Operational and Control Strategy TM.

Task 2.2.1.5. Technical Workshops – 60% Design

During this phase, workshops with BES staff will be held to review the development of design criteria, results of technical evaluations, and review of work products. Workshop materials will be developed based on the technical work being conducted and presented to BES in workshops.

Assumptions

- For the design development phase (through 60% design), assume a total of ~~eight~~ **24** technical workshops, each 2 to 3 hours long, with the BES's personnel to review the progress of the work, make decisions, and provide direction.
- In addition to the technical workshops described above, the design team will conduct three half-day workshops at the end of ~~design development~~**60% design** to review work products associated with that phase of the work.
- One additional workshop (2 to 3 hours long) will be conducted to review P&IDs for the 60% design phase.
- **Assumes 3 hours of workshop labor plus 3 hours of preparation for each workshop, and four consulting team members per workshop plus the PM.**
- ~~Assumes 4 hours of workshop labor plus 2 hours of preparation for each workshop, four consulting team members per workshop, and 2 hours of meeting notes by junior staff.~~
- Workshops for the non-process facilities design are scoped separately, under the Non-Process Design task above.
- **Constructability workshops (with the CMGC) are scoped separately under Task 2.3.2 CM/GC Design Interface**

Deliverables

- Agenda and meeting materials in advance of the workshops.
- Draft meeting notes from the workshops **will be prepared by BES and** distributed to attendees for comment**.** ~~, and~~ **Notes will be updated by the Consultant team and** submitted to BES.

Task 2.2.1.6. Quality Management – 60% Design

As part of each the 60% design phase, the Consultant will implement the QMP developed in the task above. The Consultant will ensure QA activities are conducted throughout this design phase and Consultant will manage multidiscipline internal QC review activities with the senior review team throughout this design phase. Formal QC reviews by the Consulting team will be performed before BES review of the deliverables.

Audits by QA personnel will be conducted to verify conformance with project-specific design standards, BES checklists, and the approved QMP. The Consultant will confirm that required checking and review functions are completed, culminating in either approval or an NCR. The QA audits follow checklists based on project procedures applicable to the area being audited. Quality review documentation will demonstrate that the quality review process is complete and review comments are acceptably addressed as a component of the overall records management system.

Assumptions

- BES will consolidate the BES staff review comments into one comprehensive package before submitting review comments to the Consultant.
- For major deliverables, Consultant will provide 15 printed copies and one electronic copy in PDF format, and BES will submit review comments within the period allocated in the project schedule (typically 4 weeks following BES receipt of the review submittal).
- For smaller TMs and meeting notes, Consultant will provide one electronic copy in PDF format, and BES will submit review comments within 14 days following BES receipt of the deliverable.
- Consultant's responses to BES consolidated review comments will be returned to BES for their records.

Deliverables

- QRFs used during internal quality reviews.
- Responses to DRFs used by BES to document quality review comments.
- Project checklists or milestone checklists signed by the reviewer and the appropriate project staff.
- Copies of quality review markups or comments not included on the QRFs or DRFs.
- Review-related correspondence with BES staff and other external agencies or entities.
- QMP-related documents for subcontracted work.
- Audit correspondence, including results and corrective action documentation.

Task 2.2.1.7. Project Management – 60% Design

Perform the following activities for the duration of the 60% design phase:

- Before commencing the 60% design phase, prepare for and conduct a "refresher" Kickoff/Chartering Meeting for Consultant team members, including subconsultants.
- Maintain and update the final work plan for the project that combines staffing commitments and budgets with the deliverables and schedule for the project. Specific responsibilities of each member of the final design project team will be maintained. Update the overall design schedule each month and review with the BES Program Manager, as needed.
- Supervise and control activities of staff assigned to the project. Coordinate and schedule appropriate project staffing discussions to meet project requirements. Arrange for the scheduled

project workshops, review meetings, and project team meetings. Coordinate the participation of senior staff at appropriate points in the project.

- Coordinate with other projects and BES staff to complete work on schedule and within budget.
- Prepare monthly progress reports and submit with the monthly invoice. The reports will include a status summary of current project tasks, activities completed in the last month, activities planned for the next month, a project action issues checklist, performance compared to budget, and identification of items of concern. Organize monthly invoice and budget status report by WBS element, including a Monthly Subconsultant Payment and Utilization Report by the 15th of each month (reference Part II, Section C.5 of the RFP). Include budget reports based on using an "S" curve that shows budgeted work complete, billings to date, and estimate at completion.
- ~~Monitor and manage DMWESB consultants. Support monthly reporting activities associated with DMWESB program.~~
- Monitor project activities for potential changes. Should change occur, and with BES approval, modify project tasks, task budgets, and approach. Inform BES if any changes will impact the cost of engineering services, the construction cost, or the schedule.
- Participate in weekly conference calls with BES project manager (project manager and design manager). Review the project status and discuss activities and needed actions. Prepare and discuss the 3-week look-ahead schedule.
- Submit change management forms, as needed to document scope/schedule/budget changes. Update the change log and review proposed changes and scope modifications with the BES Program Manager at the bi-weekly project management meetings.
- Support and attend (as requested) project briefings by BES project management team to upper management, City Council, etc.
- Maintain project records, manage and process project communications, and coordinate project administrative matters, utilizing the established Portland document management tool (Heron/e-Builder).
- The Program Support Consultant will update and maintain the Risk Register during the design phase. Consultant will participate in regular meetings with CM/GC, Program Support Consultant, and BES to provide input. Program Support Consultant will lead and document meetings.

Assumptions

- Overall 60% design schedule of 7 months.
- Monthly invoices and major project submittals will be submitted through Heron/e-Builder.
- Updates and input for incorporation in Risk Register.

Meetings

- One and a half hours every week to meet with BES project management.
- Monthly Risk Register Meetings. Assume three Consultant staff members participate.
- **Monthy Contract Status Meetings. Assume two Consultant staff members participate.**

Deliverables

- Updates to program workplan at completion of 60% design.
- Monthly project invoices and status reports.

- Completed change management forms, as needed, to document impacts of potential changes on engineering fee, construction cost, or schedule.

Task 2.2.1.7.1 DMWESB Development Program for 60% Design

- **Monitor and manage DMWESB consultants. Support monthly reporting activities associated with DMWESB program.**

Task 2.2.1.8 – Technical Memoranda

Task 2.2.1.8.1 Simulation to Support Operations

Task 2.2.1.8.1.1 Field Study of Solids Settling Characteristics

The purpose of the field study is to improve the quality of the output of the computational fluid dynamics model. Conduct field tests to measure settling velocity using column settling test. Includes two separate field measurement periods of two days each. Procedures will roughly follow the approach described in *Clarifier Design Manual of Practice No. FD-8*; Water Environment Federation or *the WERF/CRTC Protocols for Evaluating Secondary Clarifier Performance*, WERF, 2001. Alternatively, using a method similar to Griborio, A, 2004, Secondary Clarifier Modeling: A Multi-Process Approach; Ph. D. Thesis, University of New Orleans.

Assumptions

- **Consultant will acquire column.**
- **Owner will provide analysis of samples obtained during the tests.**

Deliverables

- **Testing Plan**
- **Report of Results**

Task 2.2.1.8.1.2 Computational Fluid Dynamics to support Operations

The task objectives are to develop a sequence of computational fluid dynamic models and to evaluate the flow and solids settling characteristics in the proposed secondary clarifier at the Plant to improve the understanding of the stable operational points. This information will assist with understanding the operational performance of the clarifier and its impact on settling processes and the sludge blanket. The model will be used to:

- **Provide additional information about clarification performance at different flow, MLSS, and SVI to inform refinement of the process model.**
- **Evaluate design modifications to the clarifier or clarifier components to improve solids performance (discharge TSS).**

Computational Fluid Dynamics (CFD) provides detailed 3-dimensional simulation of fluid flow. The set of governing equations such as conservation of mass, momentum, and energy are simultaneously solved using finite-volume elements. CFD modeling provides a means of evaluating complex fluid flow phenomena coupled with other equations describing the related flow physics such as turbulence or sediment transport. These equations can be solved for detailed geometries representing real-world problems and can be applied for both steady-state and transient conditions. Numerical and graphical results assist in predicting and understanding velocity distribution and flow patterns.

Approach

- **Evaluate the clarifier solids settling characteristics by showing the sludge blanket, effluent suspended solids (SS), and RAS solids concentration.**
- **Propose up to 3 additional improvements to be evaluated with model runs based on the initial results. Not all flow conditions will be run for all alternative configurations. A tentative matrix of scenarios is shown in Table A.**

Table A – Flow scenarios for Computational Fluid Dynamic modeling

Configuration	SVI	MLSS	Overflow conditions	Under flow conditions	Geometric configuration	Present results
Alternative A1	200	Max	1,350 gpd/sf	500 gpd/sf	30% Design	
Alternative A2	200	Max	1,600 gpd/sf	500 gpd /sf	30% Design	
Alternative A3	300	Max	1,350 gpd/sf	500 gpd /sf	30% Design	
Alternative A4	200	A1	Varies to peak conditions for 3 hours	500 gpd /sf	30% Design	Phone Call
Alternative B1	200	A1	1,350 gpd/sf	500 gpd /sf	Mod 1	
Alternative C1	200	A1	1,350 gpd/sf	500 gpd /sf	Mod 2	Remote Workshop
Alternative D1	200	A1	1,350 gpd/sf	500 gpd /sf	Mod 3	
Alternative D2	200	A2	1,600 gpd/sf	500 gpd/sf	Mod 3	
Alternative D3	300	A3	1,350 gpd/sf	500 gpd /sf	Mod 3	
Alternative D4	200	A1	Varies to peak conditions for 3 hours	500 gpd /sf	Mod 3	Tech Memo

- **Various post-processing techniques will be used to describe the results of the model. These will include contours and vectors of velocity, and contours of solids concentration. Additional figures may include 3-dimensional velocity streamlines, contour planes, isosurfaces, and volumetric rendering of velocity, solids concentration, pressure, or other parameters.**

Assumptions

- **Except as shown in Table A, the clarifier flow rates will be evaluated for a single design scenario under a steady inlet and outlet conditions. Changes in tank volumes during filling and draining will be simplified with boundary conditions to allow for steady state solutions to provide insights into the performance characteristics.**
- **The clarifier will be modeled as a single fluid zone and dispersed solids with variable settling rates based on solids concentration. Water properties such as density and viscosity will vary based on the concentration of solids at any given point within the domain.**
- **Additional details of the two-way coupled fluid-solids interaction are discussed in the following two resources:**
  - **McCorquodale, et al., 2005.**

  - **Siczka, et al. 2016.**

- **Small features which do not significantly impact the analysis may not be included.**
- **Moving mechanical parts may be simplified or omitted from the model.**
- **The turbulence will be modeled using the shear stress transport (SST) model.**
- **The model will not incorporate heat transfer.**
- **Solid surfaces will be impermeable with no-slip conditions.**
- **Flow boundaries will be arranged to capture the relevant hydraulics conditions.**
- **Wind effects will not be modeled.**
- **Clarifier will be modeled at an SVI of 200. See table for variations to SVI.**
- **Equivalent clarifier does not exist at the site. The modeled solids parameters will be based on input from other plants and the field measured sludge settling characteristics. Results will provide proportional information, but will not be expected to provide a prediction of the effluent quality of the built clarifier.**

Needed Information

The required information includes a description of the geometric features of the clarifier and the flow conditions to be evaluated. These fundamental information requirements are listed below:

- **Dimensioned drawings or hand sketches to build all solid surfaces the water will contact. This includes structural drawings for the clarifier, and mechanical cut sheets or sketches for the centerwell, inlet baffles, weir, effluent launder, and outlet box. Alternatives 0 through 2 will be based on the 30% design.**
- **Description of range of influent, effluent, and RAS flow rates.**
- **Effluent water surface elevation ranges for the clarifier.**
- **Mixed Liquor solids concentration and anticipated RAS and effluent concentrations.**
- **Any history of past problems or flow characteristic data.**

Deliverables

- **DRAFT Secondary Clarifier Design CFD Evaluation Technical Memorandum - Develop a technical memorandum describing the alternatives evaluation.**
- **Secondary Clarifier Design CFD Evaluation Technical Memorandum Finalize a technical memorandum describing the alternatives evaluation and final results.**

Task 2.2.1.8.1.3 Update Operations Secondary Tool (SETL) for secondary clarification flow split

The purpose of this scope of work is to update the secondary tool. Provide a solids and hydraulic model of the secondary processes to improve design features and allow operations staff to interact with the proposed design and provide feedback. Connect the simulation model to screen shots of the plant SCADA iFix screens so that the so that the operator inputs/set points in the simulation environment are similar to the SCADA display.

Additionally, the SETL tool will be converted to ExtendSim 10.

Assumptions

- **BES will provide required software for use by consultant:**

- **BES may need to procure additional iFix software licenses necessary for SCADA connection to the simulation model. Consultant will request BES to procure later in design.**

- **BES will provide required software for their use:**
  - **BES will obtain licenses for ExtendSim 10.Meetings**
- **Assume that three meetings will be conducted to present the proposed Integrated model and obtain feedback from operations and engineering staff.**

Deliverables

- **Meeting notes.**
- **Draft Integrated Process and Hydraulic model Technical Memorandum.**
- **SETL (software)**
  - **Runtime Replica model files**

Task 2.2.1.8.1.4 Update Process Model

The purpose of this task is to update the process technical memorandum during 60% design. Activities include:

- **Incorporating results of CFD modeling of Secondary Clarifiers.**
- **Supporting development of solids models for Operations SETL tool.**
- **Answering specific operations questions including assessing the impact of a simultaneous outage of four aeration basins during aeration basin rehabilitation.**

Update existing CBWTP process models (developed as part of Secondary Process Improvements project) to prepare a whole-plant model. Present model inputs, assumptions, and results of calibration effort in an updated TM. Assumptions.

Deliverables

- **Update of CBWTP Process Model TM.**

Task 2.2.1.8.2 Additional Technical Memoranda and Report Updates

Assume two additional technical memorandums and/or detailed life cycle cost evaluations are required as part of the 60% design. Budget is provided for two technical memoranda.

- **(Operational Resiliency TM, including additional discussion on using new Secondary Clarifiers as Primaries**

In addition, assume one additional round of updates for the following reports:

- **Subsurface Investigation Report**
- **Decommissioning Plan (Hazardous Materials Report)**
- **Operational Resiliency TM**

Task 2.2.2 90% Design Submittal

Task 2.2.2.1. 90% Design

Deliverables will include the following:

- General symbols, legends and abbreviations complete.

- Design data and criteria complete.
- Site plan with final location of structures, CM/GC staging, storage, and access.
- Pedestrian hardscape and site furnishings enlarged plan and details.
- Site landscape plans and details – planting and irrigation.
- Eco-roof landscape plans and details – planting and irrigation.
- Final grading plans and stormwater design.
- Details of pavement and trench sections, and other civil details.
- Sedimentation and Erosion Control Plan and details.
- Structural plans, sections, and details coordinated with other design disciplines. Include seismic requirements, piping supports, and structural member sizes.
- Mechanical plans, sections, and details with final location of major equipment, piping, and appurtenances. All piping layouts essentially complete.
- Final electrical site drawings, one-line diagrams, control room layouts, and panel layouts.
- Power plans, control diagrams, and schedules complete and coordinated with mechanical design.
- Final lighting plans.
- Final P&IDs coordinated with final operational control strategies and final network diagrams.
- Final version of Specifications Divisions 1 through 46 incorporating comments from the 60% submittal review and reflecting full coordination with drawings. Include final construction sequence, milestones and constraints, measurement and payment, and proposed bid form.
- Equipment list that includes equipment number, equipment size, equipment power requirements, and basic controls and operating strategies for all equipment on the project.
- Responses to 60% BES design review comments.
- At 90% design and final design, provide construction cost estimate in sufficient detail to provide the expected accuracy range of an AACE International Class 1 cost estimate: -10% to +15%.

Assumptions

- Prepare sealed final design submittal documents, calculations, reports, and other documents required for complete applications for building permits from BES of Portland Bureau of Development Services (BDS). BES staff will submit the Building permit application and pay permit and plan review fees directly to BDS.
- Provide clarifications and changes to the final design submittal documents as required to address plan review check sheets issued by BDS and comments from BES or the CM/GC.

Deliverables

- 90% 11 x 17 drawings **and draft design details (11 x 17 format)** (15 printed copies and one electronic copy in PDF format).
- 90% specifications ~~and draft design details (8 1/2 x 11 format)~~ (15 printed copies and one electronic copy in PDF format).
- 90% design package for building department review (15 printed copies and one electronic copy in PDF format). Assume Program Manager and BES coordinate/interface with building department.

- Class 1 cost estimate. Cost estimate will be provided with a database of most modeled content, including size, material, flowstream, volume of concrete, and other major components.

Task 2.2.2.2. Technical Workshops – 90% Design

During this phase, workshops with BES staff will be held to review the development of the design and work products. Workshop materials will be developed based on the technical work being conducted and presented to BES in workshops.

Assumptions

- For the 90% design phase, assume a total of ~~six~~ **10** technical workshops, each 2 to 3 hours long, with BES's personnel to review the progress of the work, make decisions, and provide direction.
- In addition to the technical workshops described above, the design team will conduct three half-day workshops at the end of design development to review work products associated with that phase of the work.
- One additional workshop (2 to 3 hours long) will be conducted to review P&IDs for the 90% design phase.
- **Assumes 3 hours of workshop labor plus 3 hours of preparation for each workshop, and four consulting team members per workshop plus the PM.**
- ~~Assumes 4 hours of workshop labor plus 2 hours of prep for each workshop, four consulting team members per workshop, and 2 hours of meeting notes by junior staff.~~
- Workshops for the non-process facilities design are scoped separately, under the Non-Process Design task above.
- **Constructability workshops (with the CMGC) are scoped separately under Task 2.3.2 CM/GC Design Interface.**

Deliverables

- Agenda and meeting materials in advance of the workshops.
- **Draft meeting notes from the workshops will be prepared by BES and distributed to attendees for comment. Notes will be updated by the Consultant team and submitted to BES.**~~Draft meeting notes from the workshops, distributed to attendees for comment, and submitted to BES.~~

Task 2.2.2.3. Quality Management – 90% Design

As part of each the 90% design phase, the Consultant will implement the QMP developed in the task above. The Consultant will ensure QA activities are conducted throughout this design phase and Consultant will manage multidiscipline internal QC review activities with the senior review team throughout this design phase. Formal QC reviews by the Consulting team will be performed before BES review of the deliverables.

Audits by QA personnel will be conducted to verify conformance with project specific design standards, BES checklists, and the approved QMP. The Consultant will confirm that required checking and review functions are completed, culminating in either approval or an NCR. The QA audits follow checklists based on project procedures applicable to the area being audited. Quality review documentation will demonstrate that the quality review process is complete and review comments are acceptably addressed as a component of the overall records management system.

Assumptions

- BES will consolidate the BES staff review comments into one comprehensive package before submitting review comments to the Consultant.

- For major deliverables, Consultant will provide 15 printed copies and one electronic copy in PDF format, and BES will submit review comments within the period allocated in the project schedule (typically 4 weeks following BES receipt of the review submittal).
- For smaller TMs and meeting notes, Consultant will provide one electronic copy in PDF format, and BES will submit review comments within 14 days following BES receipt of the deliverable.
- Consultant's responses to BES consolidated review comments will be returned to BES for their records.

Deliverables

- QRFs used during internal quality reviews.
- Responses to DRFs used by BES to document quality review comments.
- Project checklists or milestone checklists signed by the reviewer and the appropriate project staff.
- Copies of quality review markups or comments not included on the QRFs or DRFs.
- Review-related correspondence with BES staff and other external agencies or entities.
- QMP-related documents for subcontracted work.
- Audit correspondence, including results and corrective action documentation.

Task 2.2.2.4. 90% Cost Estimate

- Support CM/GC's update of the construction schedule.
- At 90% design and final design, provide construction cost estimate in sufficient detail to provide the expected accuracy range of an AACE International Class 1 cost estimate: -10% to +15%.

Deliverables

- Construction cost estimate.

Task 2.2.2.5. Project Management – 90% Design

Perform the following activities for the duration of the 90% design phase:

- Before commencing the 90% design phase, prepare for and conduct a "refresher" Kickoff/Chartering Meeting for Consultant team members, including subconsultants.
- Maintain and update the final work plan for the project that combines staffing commitments and budgets with the deliverables and schedule for the project. Specific responsibilities of each member of the final design project team will be maintained. Update the overall design schedule each month and review with the BES Program Manager, as needed.
- Supervise and control activities of staff assigned to the project. Coordinate and schedule appropriate project staffing discussions to meet project requirements. Arrange for the scheduled project workshops, review meetings, and project team meetings. Coordinate the participation of senior staff at appropriate points in the project.
- Coordinate with other projects and BES staff to complete work on schedule and within budget.
- Prepare monthly progress reports and submit with the monthly invoice. The reports will include a status summary of current project tasks, activities completed in the last month, activities planned for the next month, a project action issues checklist, performance compared to budget, and identification of items of concern. Organize monthly invoice and budget status report by WBS element, including a Monthly Subconsultant Payment and Utilization Report by the 15th of each

month (reference Part II, Section C.5 of the RFP). Include budget reports based on using an "S" curve that shows budgeted work complete, billings to date, and estimate at completion.

- ~~Monitor and manage DMWESB consultants. Support monthly reporting activities associated with DMWESB program.~~
- Monitor project activities for potential changes. Should change occur, and with BES approval, modify project tasks, task budgets, and approach. Inform BES if any changes will impact the cost of engineering services, the construction cost, or the schedule.
- Participate in weekly conference calls with BES project manager (project manager and design manager). Review the project status and discuss activities and needed actions. Prepare and discuss the 3-week look-ahead schedule.
- Submit change management forms, as needed to document scope/schedule/budget changes. Update the Change Log and review proposed changes and scope modifications with the BES Program Manager at the bi-weekly project management meetings.
- Support and attend (as requested) project briefings by BES project management team to upper management, City Council, etc.
- Maintain project records, manage and process project communications, and coordinate project administrative matters, utilizing the established Portland document management tool (Heron/e-Builder).
- The Program Support Consultant will update and maintain the Risk Register during the design phase. Consultant will participate in regular meetings with CM/GC, Program Support Consultant, and BES to provide input. Program Support Consultant will lead and document meetings.

Assumptions

- Overall design schedule of **10** months **(including GMP negotiations)**.
- Monthly invoices and major project submittals will be submitted through Heron/e-Builder.

Meetings

- One and a half hours every week to meet with BES project management.
- Monthly Risk Register Meetings. Assume three Consultant staff members will participate.
- **Monthy Contract Status Meetings. Assume two Consultant staff members participate.**

Deliverables

- Updates to Program Workplan at completion of 60% design.
- Monthly project invoices and status reports.
- Completed change management forms, as needed, to document impacts of potential changes on engineering fee, construction cost, or schedule.
- Input and updates for incorporation into Risk Register.

Task 2.2.2.5.1 DMWESB Development Program for 90% Design

- **Monitor and manage DMWESB consultants. Support monthly reporting activities associated with DMWESB program.**

Task 2.2.2.6. Operational Strategy Technical Memorandum Update

Based on the current design, update the 60% Operational Strategy TM that captures the process control narratives per BES standards for each of the major unit processes. This document narratively

describes the operational strategies associated with the design (in conjunction with the process control description specifications) for each unit process. This manual will explain the various primary modes of process operation that may be used, including both normal operation and initial emergency operation procedures such as peak wet weather events, loss of duty units, power failures, etc.

Assumptions

- **The Operational Strategy TM will evolve through the rest of design and then form the basis for the Process Operations Manual delivered as part of the Startup and Testing scope section below.**
- **Draft TM will be submitted as part of the 60% design phase. Updates will be provided at the 90% and 100% design phase.**
- **This Operational Strategy TM will organize and present the process control narratives developed during design, relying on the P&IDs for reference. Enhanced process flow diagrams and other graphics will be developed and funded under the Process Operations Manual task (scoped under the Startup and Closeout Phase).**

Meetings

- **One project operational strategy workshop during 90% design. Assumes 5 hours of workshop labor plus 3 hours of preparation, and four consulting team members per workshop-plus the PM.**

Deliverables

- **Meeting notes.**
- **Draft 90% Operational and Control Strategy TM.**

Task 2.2.3 Final Design Document Submittal

The purpose of this task is to develop the final contract drawings, specifications, and schedules for competitive bidding. Key activities during this phase are described below.

Task 2.2.3.1. Contract Document Completion

- Finalize specifications.
- Prepare final construction drawings.
- Prepare final technical specifications.
- Update the final design documents to incorporate and consolidate all changes made during the building permit plan review.
- Prepare final calculations.
- Complete final checking and coordination review.
- **Finalize Ops Strategy TM (for design). The Ops Strategy TM will form the basis for the Process Operations Manual (submitted as part of the Startup and Closeout Phase below).**

Deliverables

- Final 11 x 17 drawings: 15 printed copies and electronic copy in PDF format and a complete AutoCAD Word set with no password protection along with a database of all information embedded within the P&IDs.
- Final specifications and design details (8 1/2 x 11 format): 15 printed copies and electronic copy in PDF format and a complete MS Word set with no password protection.

- Sealed project plans, specifications, structural calculations, and other reports and documents required for a complete building permit application from BDS in PDF electronic format, and a complete AutoCAD/MS Word set with no password protection. Format of AutoCAD 3D models shall be dimensionally accurate and representative of true installation space requirements. These models will not have any data associated with them after they leave their native software. A database of all information embedded within the P&IDs could be provided.
- Responses to BDS check sheets, including revised project plans, structural calculations, and other reports and documents, as required by BDS, to successfully complete the BDS building permit application process. All submittals shall be in PDF electronic format with AutoCAD/MS Word sets provided to BES with no password protection.

Assumptions

- **Assume no workshops during this design phase.**
- **Assume no technical memorandum are required during this design phase.**

Task 2.2.3.2. Quality Management – Final (100%) Design

As part of each the final design phase, the Consultant will implement the QMP developed in the task above. Formal consultant team QC reviews and BES reviews are not conducted during this phase, but the Consultant will ensure QA activities are conducted throughout this design phase.

Audits by QA/QC personnel will be conducted to verify that all review comments have been addressed and that the quality review documentation demonstrates that the quality review process is complete and review comments are acceptably addressed as a component of the overall records management system.

Assumptions

- Consultant's responses to BES consolidated review comments will be returned to BES for their records.

Deliverables

- Audit correspondence, including results and corrective action documentation.
- Final documentation for all design phases.

Task 2.2.3.3. Project Management – Final (100%) Design

Perform the following activities for the duration of the final (100%) design phase:

- Before commencing the final design phase, prepare for and conduct a "refresher" Kickoff/Chartering Meeting for Consultant team members, including subconsultants.
- Maintain and update the final work plan for the project that combines staffing commitments and budgets with the deliverables and schedule for the project. Specific responsibilities of each member of the final design project team will be maintained. Update the overall design schedule each month. and review with the BES Program Manager, as needed.
- Supervise and control activities of staff assigned to the project. Coordinate and schedule appropriate project staffing discussions to meet project requirements. Arrange for the scheduled project workshops, review meetings, and project team meetings. Coordinate the participation of senior staff at appropriate points in the project.
- Coordinate with other projects and BES staff to complete work on schedule and within budget.

- Prepare monthly progress reports and submit with the monthly invoice. The reports will include a status summary of current project tasks, activities completed in the last month, activities planned for the next month, a project action issues checklist, performance compared to budget, and identification of items of concern. Organize monthly invoice and budget status report by WBS element, including a Monthly Subconsultant Payment and Utilization Report by the 15th of each month (reference Part II, Section C.5 of the RFP). Include budget reports based on using an "S" curve that shows budgeted work complete, billings to date, and estimate at completion.
- ~~Monitor and manage DMWESB consultants. Support monthly reporting activities associated with DMWESB program.~~
- Monitor project activities for potential changes. Should change occur, and with BES approval, modify project tasks, task budgets, and approach. Inform BES if any changes will impact the cost of engineering services, the construction cost, or the schedule.
- Participate in weekly conference calls with BES project manager (project manager and design manager). Review the Project status and discuss activities and needed actions. Prepare and discuss the 3-week look-ahead schedule.
- Submit change management forms, as needed to document scope/schedule/budget changes. Update the change log and review proposed changes and scope modifications with the BES Program Manager at the bi-weekly project management meetings.
- Support and attend (as requested) project briefings by BES project management team to upper management, City Council, etc.
- Maintain project records, manage and process project communications, and coordinate project administrative matters, utilizing the established Portland document management tool (Heron/e-Builder).
- The Program Support Consultant will update and maintain the Risk Register during the design phase. Consultant will participate in regular meetings with CM/GC, Program Support Consultant, and BES to provide input. Program Support Consultant will lead and document meetings.

Assumptions

- Overall design schedule of 3 months.
- Monthly invoices and major project submittals will be submitted through Heron/e-Builder.

Meetings

- One and a half hours every week to meet with BES project management.
- Monthly Risk Register Meetings. Assume three Consultant staff members will participate.
- **Monthy Contract Status Meetings. Assume two Consultant staff members participate.**

Deliverables

- Updates to program workplan at completion of 60% design.
- Monthly project invoices and status reports.
- Completed change management forms, as needed, to document impacts of potential changes on engineering fee, construction cost, or schedule.

Task 2.2.3.3.1 DMWESB Development Program for Final Design

- **Monitor and manage DMWESB consultants. Support monthly reporting activities associated with DMWESB program.**

Task 2.2.4 Final Design Submittal – Early Out Package (GMP #1)

Task 2.2.4.1. Final Design GMP#1

Final design for the following work elements will be included GMP #1:

Project Element
Main Switchgear project (designed by others)
Temp facilities for SOG (designed by others)
Demo Package 1a: • Deconstruction of composter facility and non-process buildings • Temporary electrical demo and relocation • Utility relocation work
SECL and RAPU ground improvements (DSM) and Earthwork/Excavation
Temporary odor control facilities
Temporary skid mounted centrifuge
Aeration basin structural rehabilitation

Task 2.2.4.1.1 Final Design Main Switchgear (MASU)

Designed by Others

Task 2.2.4.1.2 Final Design Temporary SOG and Maintenance facilities

Designed by Others

Task 2.2.4.1.3 Demolition Package 1a

Demolition Package 1a includes the deconstruction of the composter facility and several non-process buildings, and utility relocation activities.

Task 2.2.4.1.3.1 Deconstruct Composter Facility and Non-process Buildings

Provide a deconstruction design package that includes the following:

- Performance-based deconstruction technical specifications.
- Deconstruction boundaries and Contractor direction for handling break points.
- Hazardous material handling requirements as defined in the 20 percent Deconstruction and Decommissioning Plan.
- Material recycle requirements as defined in the 20% Deconstruction and Decommissioning Plan.
- Approach to bidding and bid form

Assumptions

- Facilities included in Demolition Package 1a include the composter facility, STO-1, STO-2, STO-3, Synergen Building, and Former OPS Building.
- A detailed deconstruction design package will be provided by the CM/GC and specialty contractors.
- Specialty contractors will be required to visit the site.
- Division 00 and 01 specifications will be provided by BES.
- Jacobs will perform two site visits during design.
- Jacobs will require two meetings with the CM/GC team during design.

Deliverables

- Deconstruction design package fact sheet
- Interim check set (midway through 60% design period)
- 60% design drawings and specifications
- 90% design drawings and specifications
- 100% drawings and specifications

Task 2.2.4.1.3.2 Temporary Electrical

Provide a deconstruction and electrical relocation design that provides the following:

- Identify loads on existing MCC at composter. Determine need to continue to feed. IF required, design an alternative location.
- Identify miscellaneous electrical or communications in zone of construction that are not associated with the Composter electrical gear.
- Identify signals sent to existing PLC at composter. Determine the need for the signal. If there is a containing function, identify and design the relocation to an alternative PLC.
- Modify fiber optic communications in the demolition area.
- Design medium voltage system to remove Switchgear T-12 and T-13 at composter.

Assumptions

- Division 00 and 01 specifications will be provided by BES.
- Jacobs will perform two site visits during design.

Deliverables

- Fact Sheet for Temporary Electrical Design
- Interim Check Set (midway through 60% design period)
- 60% Design drawings and Specifications
- 90% Design drawings and Specifications
- 100% Drawings and Specifications

Task 2.2.4.1.3.3 Utility Relocation

Deconstruction of the composter facility and Non-process buildings is necessary to provide room for the new STEP buildings includes SECL-9, SECL-10, RAPU, and future HYPO. Significant utilities run in this area

and either feed the existing facilities or transit the area. GMP1 will demolish or replace utilities to accommodate demolition and excavation for new facilities.

Identify utilities within the SECL area that are impacted, determine the current, temporary, and future need for the utilities, and prepare site drawings.

Assumptions

- Division 00 and 01 specifications will be provided by BES.
- Jacobs will perform two site visits during design.
- Jacobs will conduct two workshops during design.

Deliverables

- Fact Sheet for Utility Relocation
- Interim Check Set (midway through 60% design period)
- 60% Design drawings and Specifications
- 90% Design drawings and Specifications
- 100% Drawings and Specifications

Task 2.2.4.1.4 Final Design SECL and RAPU Ground Improvements and Excavation

- Update STEP Geotechnical Data Report to include additional groundwater monitoring data. Provide sealed report (assuming Data Report is required to obtain earthwork and grading permits for the ground improvement and earthwork packages).
- Finalize seismic site-specific seismic analyses to develop response spectra for structural design. Response spectra will be developed for the improved ground conditions beneath the SECLs and RAPU. Response spectra will also be developed for native ground for use in design of utilities or facilities supported on deep foundations.
- Develop a site-specific seismic hazard report to document the site-specific seismic analyses completed.
- Complete numerical modeling analyses required to develop requirements for ground improvement to meet code requirements for seismic risk category III design of the SECLs and RAPU. Numerical modeling will be completed using FLAC software and will involve assessing various ground improvement layout and replacement ratio alternatives. Results of analyses will be communicated during workshops and used to develop drawings and specifications.
- Develop drawings and specifications for the implementation of ground improvements or foundation design for the following facilities:
    - SECL-9
    - SECL-10
    - RAPU
- Includes developing a general approach to soil improvement placement, accommodating existing pile systems.
- Develop specifications for earthwork and groundwater dewatering.
- Develop requirements for excavation support systems including instrumentation and monitoring requirements.

- Coordinate ground improvements with the development of a seismic mitigation approach for mechanical and electrical systems in the yard for SECL and RAPU.
- Support development of grading and excavation permit applications.

Assumptions

- Jacobs will require two meetings with the CM/GC team during design.
- Design to seismic risk category III.
- A final Geotechnical Recommendations Report will not be required to obtain grading and earthwork permits required for construction of ground improvement or excavation support systems. The final Process Facilities Geotechnical Recommendation Report will be developed as part of GMP#2.
- The design scope of work does not include the assessment of the permeabilities of subsurface layers required to develop construction dewatering approaches, nor does it include evaluations of groundwater inflows into temporary excavations. The assessments of construction groundwater dewatering means and methods is the responsibility of the CM/GC.
- The following facilities are not included in the GMP#1 DSM soil improvements.
  - SOFA and Loadout Facility
  - Hypochlorite
  - Electrical Equipment (NW of SECL 1-8)
  - Non-process buildings

Deliverables

- Site-specific seismic hazard report.
- Stamped Geotechnical Data Report (if required to obtain building permits. Otherwise final data report will be delivered as part of GMP#2.)

Task 2.2.4.1.5 Fact Sheet for Ground Improvement and Excavation Design (SECL and RAPU)

- Interim Check Set (midway through 60% design period)
- 60% Design drawings and Specifications
- 90% Design drawings and Specifications/Stamped Permit Set
- 100% Drawings and Specifications

Meetings

- Ground Improvement Design Workshop
- Ground Improvement QA/QC Procedures Workshop
- Mechanical Electrical Seismic Mitigation Workshop

Task 2.2.4.1.6 Final Design Temporary Odor Control facilities

Develop drawings and specifications for procurement of activated carbon odor control equipment. Develop drawings and specifications for integration of odor control system to treat foul air (during STEP construction) from existing thickening and dewatering processes including ductwork, incorporating existing fans, structural and electrical requirements and controls.

Assumptions

- Division 00 and 01 specifications will be provided by BES.
- Jacobs will perform two site visits during design.

- Jacobs will provide process training (in addition to manufacturer-provided training) and startup assistance for temporary odor control but budget is not included in this design scope.

Deliverables

- Fact Sheet for Temporary Odor Control Design
- Interim Check Set (midway through 90% design period)
- 90% Drawings (structural, process mechanical, electrical and P&IDs), stamped permit set, if applicable.
- Updated odor control specification and RFP package for vendors.
- 90% Specifications for associated appurtenances, integration and startup.
- 100% Drawings (structural, process mechanical, electrical and P&IDs).
- 100% Specifications for associated appurtenances, integration and startup.
- Develop preliminary process narratives.
- Workshop materials and minutes for two workshops.

Task 2.2.4.1.7 Final Design Skid Mounted Centrifuge

Develop drawings and specifications for procurement of 30-inch diameter skid-mounted centrifuge to be used during STEP construction. Develop drawings and specifications for integration of skid-mounted centrifuge into existing dewatering system including piping, valves, platform, handrail, cake conveyance and controls.

Assumptions

- Division 00 and 01 specifications will be provided by BES.
- Jacobs will perform two site visits during design.
- Jacobs will provide process training (in addition to manufacturer-provided training) and startup assistance for skid-mounted centrifuge but budget is not included in this design scope.

Deliverables

- Fact Sheet for Skid-Mounted Centrifuge Design
- Interim Check Set (midway through 90% design period)
- 90% Drawings (structural, process mechanical, electrical and P&IDs), stamped permit set, if applicable.
- Updated centrifuge specification and RFP package for vendors.
- 90% Specifications for associated appurtenances, integration and startup.
- 100% Drawings (structural, process mechanical, electrical and P&IDs).
- 100% Specifications for associated appurtenances, integration and startup.
- Develop preliminary process narratives.
- Workshop materials and minutes for two workshops.

Task 2.2.4.1.8 Final Design Aeration Basin Rehab

Develop drawings and specifications for aeration basin rehabilitation per the *Aeration Basin 3 and 4 Condition Assessment – Site Visit* Technical Memorandum dated 9/28/2019.

Develop drawings for Aeration Basin rehabilitation with modeling in Revit. Develop specifications for structural rehabilitation, corrosion protection, piping replacement, diffuser replacement/process improvements. Assume replace in kind diffuser technology, and optimization of diffuser layout.

Assumptions

- Aeration Basin modeling in Revit for drawing generation needs schedule escalated.
- Will include representative pictures from site inspection with BergerABAM report as appendix.
- Assume one workshop and one site visit
- Quantities are unknown and will be included in bid form.
- Scope includes improvements from 20 percent design technical memorandum: *Aeration Basin 3 and 4 Condition Assessment – Site Visit* dated 9/28/2019 and Jacobs 20 percent cost estimate.
- Includes provisions for replacement in kind of diffuser system. No optimization of diffuser layouts is included. Quantities of replacement diffusers and piping are unknown and will be included in bid form.

Deliverables

- Fact Sheet for Aeration Basin Rehab
- Interim Check Set (midway through 90% design period)
- 90% Drawings and Specifications
- 100% Drawings and Specifications
- Bid Form with provisions for unit cost repairs.
- Corrosion Control TM.
- (1) Workshop materials and minutes.

Task 2.2.4.2. Quality Management – GMP#1 Design

As part of each GMP#1 design phase (60%, 90%, etc.), the Consultant will implement the QA/QC procedures developed in the QMP task above. The Consultant will ensure QA activities are conducted throughout each design phase and Consultant will manage multidiscipline internal QC review activities with the senior review team. Formal QC reviews by the Consulting team will be performed before BES review of the deliverables.

Audits by QA personnel will be conducted to verify conformance with project specific design standards, BES checklists, and the approved QMP. The Consultant will confirm that required checking and review functions are completed, culminating in either approval or an NCR. The QA audits follow checklists based on project procedures applicable to the area being audited. Quality review documentation will demonstrate that the quality review process is complete and review comments are acceptably addressed as a component of the overall records management system.

Assumptions

- BES will consolidate the BES staff review comments into one comprehensive package before submitting review comments to the Consultant.

- For major deliverables, Consultant will provide 5 printed copies and one electronic copy in PDF format, and BES will submit review comments within the period allocated in the project schedule (typically 4 weeks following BES receipt of the review submittal). Consultant will confirm how many hard copies to produce prior to production.
- For smaller TMs and meeting notes, Consultant will provide one electronic copy in PDF format, and BES will submit review comments within 14 days following BES receipt of the deliverable.
- Consultant's responses to BES consolidated review comments will be returned to BES for their records.

Deliverables

- QRFs used during internal quality reviews.
- Responses to QRFs used by BES to document quality review comments.
- Project checklists or milestone checklists signed by the reviewer and the appropriate project staff.
- Copies of quality review markups or comments not included on the QRFs.
- Review-related correspondence with BES staff and other external agencies or entities.
- QMP-related documents for subcontracted work.
- Audit correspondence, including results and corrective action documentation.

Task 2.2.4.3. Cost Estimate - GMP#1

- Review CM/GC's update of the construction schedule.
- For the 60/90% design package and 90% design package, provide construction cost estimates in sufficient detail to provide the expected accuracy range of an AACE International Class 2 cost estimate: -15% to +20%.

Deliverables

- Construction cost estimate.

Task 2.2.4.4. Project Management – GMP#1 Design

Perform the following activities for the duration of the GMP#1 design phase:

- Before commencing the GMP#1 design phase, prepare for and conduct a "refresher" Kickoff/Chartering Meeting for Consultant team members, including subconsultants.
- Maintain and update the final work plan for the project that combines staffing commitments and budgets with the deliverables and schedule for the project. Specific responsibilities of each member of the final design project team will be maintained. Update the overall design schedule each month and review with the BES Program Manager, as needed.
- Supervise and control activities of staff assigned to the project. Coordinate and schedule appropriate project staffing discussions to meet project requirements. Arrange for the scheduled project workshops, review meetings, and project team meetings. Coordinate the participation of senior staff at appropriate points in the project.
- Coordinate with other projects and BES staff to complete work on schedule and within budget.
- Prepare monthly progress reports and submit with the monthly invoice. The reports will include a status summary of current project tasks, activities completed in the last month, activities planned for the next month, a project action issues checklist, performance compared to budget, and

identification of items of concern. Organize monthly invoice and budget status report by WBS element, including a Monthly Subconsultant Payment and Utilization Report by the 15th of each month (reference Part II, Section C.5 of the RFP). Include budget reports based on using an "S" curve that shows budgeted work complete, billings to date, and estimate at completion. Participate in monthly contract status report with BES and Program Support Consultant.

- Participate in weekly conference calls with BES project manager (project manager and design manager). Review the project status and discuss activities and needed actions. Prepare and discuss the 3-week look-ahead schedule.
- Monitor project activities for potential changes. Should change occur, and with BES approval, modify project tasks, task budgets, and approach. Inform BES if any changes will impact the cost of engineering services, the construction cost, or the schedule.
- Submit contract change requests in Heron/e-Builder, as needed to document scope/schedule/budget/administrative changes. Update the Change Log and review proposed changes and scope modifications with the BES Program Manager at the bi-weekly project management meetings. Periodically prepare amendments to consolidate change requests or to address necessary formal amendment.
- Support and attend (as requested) project briefings by BES project management team to upper management, City Council, etc.
- Maintain project records, manage and process project communications, and coordinate project administrative matters, utilizing the established Portland document management tool (Heron/e-Builder).
- The Program Support Consultant will update and maintain the Risk Register during the design phase. Consultant will participate in regular meetings with CM/GC, Program Support Consultant, and BES to provide input. Program Support Consultant will lead and document meetings.

Assumptions

- Overall design schedule of 11 months (Jan-Nov 2020).
- Monthly invoices will be combined with GMP#2 invoices and submitted through Heron/e-Builder.
- The design team will provide input to the Risk Register for GMP#1. Assume monthly Risk Register Meetings are budgeted under GMP#2 tasks.
- One hour every week to meet with BES project management.

Deliverables

- Updates to Program Workplan.
- Monthly project invoices and status reports.
- Completed change management forms, as needed, to document impacts of potential changes on engineering fee, administrative contract changes (key personnel, subconsultants, etc.), construction cost, or schedule.

Task 2.3 Support for CM/GC and Guaranteed Maximum Price (GMP) Development During Design

Task 2.3.1 CM/GC Onboarding

- Participate in a Kickoff/Chartering/Partnering Meeting that includes the key project team members from BES, the CM/GC and the Consultant team. Assume that Project Support Consultant will plan for and facilitate this meeting.
- Lead a series of meetings with CM/GC contractor to get them quickly up to speed and engaged on the project. Review current state of design documents, Risk Register, and cost estimate. Assume multiple workshops involving design managers, facility leads and discipline staff to review the following:
  - Project overview.
  - Facility-by-facility review.
  - Discipline-by-discipline review (involving CM/GC major subcontractors).
  - Preliminary project sequencing/schedule.
  - Known constructability issues.

Assumptions

- One 2-hour kickoff meeting with five Consultant staff members attending.
- One 8-hour Partnering meeting with eight Consultant staff members attending.
- Four 4-hour workshops with an average of eight Consultant staff members attending.

Task 2.3.2 CM/GC Design Interface

Task 2.3.2.1. Manage CM/GC Interface

Meet regularly during design with CM/GC contractor to coordinate review and feedback. These meetings are outside the regular design review and BES interface meetings described in Tasks 2 and 3. include:

- Development of a construction sequencing and packaging plan.
- Identify site features or facilities that may require CM/GC preconstruction phase field investigations by the CM/GC to support final design.
- Constructability/means and methods evaluations.
- Concrete mix design and specification details.
- Detailed development of sequencing and constraints approaches, specific to operational interfaces and connections to operating systems.

Assumptions

- 12 months of 3-hour bi-weekly meetings. Assume attendance by four consultant staff members.
- It is anticipated that CM/GC will participate in BES design review meetings described in 20% Design (30% Design Submittal) and Task 2 (Detailed Design Phase Services) as soon as they are under

contract. No hours are included to support CM/GC review of design deliverables. Specific follow-up on CM/GC review comments is addressed as part of this Design Interface Task 2.3.2.

Task 2.3.2.2. Respond to CM/GC Information Requests

This task is scoped as an allowance. The task includes the following:

- Provide technical interpretation and clarification of the design documents during design and prepare proposed responses to all questions and requests, which will then be incorporated into the Contract Documents as part of design completion.
- Provide technical interpretation of design documents utilized for bidding and prepare proposed responses to bidders' questions and requests during CM/GC development of GMPs.
- Manage documentation for CM/GC information requests during the design phase. Document proposed responses to all questions and requests. Assume that the procedures, documentation log, etc. will be developed by the Program Support Consultant.

Assumptions

- The extent of the Consultant's involvement will be limited to the budget available.
- 50 RFIs at 4 hours each.
- 16 hours/month for 12 months to manage documentation process.
- Incorporation of responses and milestone review comments from the CM/GC will be addressed as part of the design progression, covered under Task 3.

Deliverables

- Responses to CM/GC requests for information.

Task 2.3.3 CM/GC Scope Management and Cost Optimization

This task is scoped as an allowance, to support scope management and cost optimization activities at various stages of the design and GMP development process. These activities are outside the scope of normal design development and are intended to allow for investigation of concepts and redesign of components to realize overall program cost and/or value goals. This task includes the following:

- Work with BES and CM/GC to identify opportunities for cost savings or value-add approaches.
- Support CM/GC cost estimating of concepts through conceptual design development.
- Perform redesign of vetted/frozen design concepts when cost optimization ideas are determined to provide overall program value.

Assumptions

- This task is specifically intended to be utilized for project scope changes to existing design concepts, driven by CM/GC innovations or means/methods.
- The extent of the Consultant's involvement will be limited to the budget available. Any additional funding would need to be authorized via in Task 2.6 Owner's Contingency – Preliminary Design Phase.

Task 2.3.4 CM/GC Cost Review

- Review 30%, and 60% CM/GC cost estimates, with the intent to identify and reconcile differences between the Consultant and CM/GC estimates. Consultant will work with the CM/GC and Program

Support Consultant to reconcile cost estimates and identify and update Program risk allocations and usage.

Assumptions

- Four consultant staff members (i.e., project manager, CM/GC Lead, and two estimators) at 24 hours per estimate.
- Program Support Consultant documents results of cost and quantity review.

Task 2.3.5 GMP Development Support

This subtask is scoped as a support activity and Consultant engagement will be as directed by BES. Activities include:

- Arrange and conduct up to three informational conferences to summarize key elements of the design work to support the CM/GC's bidding process for subcontractors.
- Support BES in review of major subcontractors from whom the CM/GC solicits bids during GMP development.
- Participate in review of major equipment procurement proposals solicited during GMP development. Provide review and feedback on acceptability of proposals for conformance with technical specifications.
- Support BES in discussion of appropriate allocation of risk and basis of assumptions for GMP.
- Assist BES in evaluation of GMP against Consultant's and Program Support Consultant's opinions of probable cost.

Assumptions

- The extent of the Consultant's involvement. will be limited to the budget available. Additional funding, if needed, would need be authorized via Task 1.5 Owner's Contingency – Preliminary Design Phase.

Task 2.4 Public Involvement

This task will provide support to BES for involving the broader community in the implementation of the Project. Specific activities are to be authorized in advance on a task-by-task basis following the development of the project and the determination of communications and public involvement support needs.

Since the early 1990s, the CBWTP Citizen Advisory Committee has been the focal point for the community engagement, and that is planned to continue. There's an opportunity with the secondary expansion—the largest capital project in many years—to reengage the community, renew the relationship, and collaboratively find additional community benefits to be provided.

This task includes the following activities:

- Provide planning and support for public involvement that assures community understanding and approval for the planned secondary expansion and associated CBWTP improvements.
- Coordinate development of a public involvement plan that honors the Values & Guiding Principles that are the foundation for the community's highly successful and enduring relationship with BES and the CBWTP.

Task 2.4.1 Develop Communications and Public Involvement Plan

Conduct stakeholder interviews with up to six internal BES staff members to understand communications needs. Based on that input, develop a brief communications plan identifying messaging, target audiences, and appropriate communications tools. The plan will be designed to work within the designated fee for implementation.

Deliverables

- Draft and final Communications and Public Involvement Plan.

Task 2.4.2 Implement Communications and Public Involvement Plan

Implement tasks identified in the Communications Plan. Those items may include:

- Developing content for project fact sheet suitable for internal audience stakeholders.
- Developing content for project fact sheet appropriate for external, community audiences.
- Developing updated content for fact sheets following completion of preliminary design.
- Developing content for PowerPoint presentations to the Citizen Advisory Committee (assume four).
- Developing content for news releases (assume two).
- Developing content for articles for the annual CBWTP community newsletter (assume four).
- Developing content for the bureau's public webpages (updated bi-monthly or as needed).
- Developing plans, agendas, and run-of-show for plant open houses; developing content for materials that support plant open houses and/or tours, including necessary advertisements; (assume 16 hours), and attending tours (up to 4).
- Preparing drawings, graphics, and PowerPoint presentations as appropriate to convey design progress.
- Providing information regarding the construction, progress, schedules, and facilities costs, as appropriate.

Meetings

- Attend meetings with BES to provide input and coordinate communications activities (assume 3 hours per month for 48 months).

Assumptions

- BES will lead any public involvement and media activities.
- BES will have the final review and approval on all print and electronic materials.
- All print and electronic materials will adhere to BES style guides and templates.
- Consultant will plan, coordinate, and support public involvement activities conducted by BES public affairs/communications staff. CAD drawings, maps, and displays will be produced by the engineering team and BES; level of effort will be limited to hours shown in the fee.
- The limited budget and level of effort included is an allowance for use as directed by BES staff. The extent of the Consultant's involvement will be limited to the budget available.
- Active project duration of 48 months.

Deliverables

- Drawings and other design materials, such as posters and PowerPoint presentations that may be required, to the limits of the budget.
- Draft and final versions of four open house/tour announcements for BES website.
- Draft and final version of two project fact sheets and one update.
- Draft and final versions of up to four Citizen Advisory Committee PowerPoint presentations.
- Draft and final versions of two news releases.
- Draft and final versions of up to four community newsletter articles.
- Draft and final versions of initial website content and up to eight updates to that content.
- Draft and final versions of open house guide assumed to consist of a single, two-sided 11 x 17 page.
- Four open houses/tour single sheet plans and run-of-show.
- Provide monthly invoices and progress reporting for all public involvement tasks.

Task 2.4.3 Develop Plant Signage

Design permanent educational signage to support plant tours, including developing content. Assume 10 boards, designed to simply and graphically depict various process areas around the facility. Boards will be collaboratively developed with process engineers, public outreach subconsultant and BES Staff.

Assumptions

- BES will be responsible for production and installation of signage.
- BES will have final approval on design and content.

Deliverables

- Draft and final versions of signage delivered in high quality digital format.

Task 2.5 Permitting

Identify and acquire the permits and approvals required from the BDS, the State of Oregon, and other regulatory agencies for construction of the project.

Task 2.5.1 Natural Resources Environmental Permitting

This task addresses natural resources permitting for duration of the project. The scope of the task encompasses expected environmental review as well as certain state and federal permits (e.g., U.S. Army Corps of Engineers [USACE], Oregon Department of State Lands [DSL], and DEQ).

Task 2.5.1.1. 20% Design Phase

The permitting task for this initial project stage will culminate in a Permitting TM that will serve as a working document, updated at specific stages of the project (e.g., 30%, 60%, and 90% design), and can be integrated into the Basis of Design Report. Key steps include the following:

Data Collection/Assessment

- Compile and review project information, including permit and land use history of project area, BES facility documents, environmental reports, historical data and photos, and other background information on the site and vicinity.
- Compile applicable codes and regulations, including City and BES environmental policies, and state and federal wetland and waterway regulations.

- Assess data gaps to be filled, data sources, potential data acquisition issues, and how to address these.
- Identify related project design, process, or schedule implications.

Early Field Review and Agency Coordination

- Field review of project site and proposed improvements, considering thresholds for review, approval criteria, and mitigation opportunities.
- Review field findings with design team to identify steps that may allow project to avoid or minimize specific permits (such as avoiding jurisdictional waters).
- Early coordination with Mike Reed (BES Streamlining Team coordinator) and, if warranted, coordinate early presentation of project to Streamlining Team.
- Coordination with BES environmental planning staff, DEQ, and other regulatory agencies.

Prepare Draft Permitting TM

- Prepare initial draft of a Permitting TM incorporating findings from Preliminary Design, including the following elements:
  - Permit name, issuing agency, contact information.
  - Project element triggering permit and project specific requirements.
  - Permit schedule with permit review process milestones, BES review periods, public comment periods, agency meetings, synchronized with design milestones.
  - Summary of permit status, comments, unresolved issues, and action plan.
  - Permit costs and team responsibilities.
  - Coordination and review of design plan sheets/specifications related to permit.
  - Reference section listing code citations, correspondence, supporting documentation.
- Identify opportunities for early coordination with regulatory agencies that may facilitate permitting process.
- Prepare a draft permit tracking matrix (with summary of permit needs, requirements, and criteria) to track permits and identify rapid “permit impact” response to any proposed design or construction changes.

Update Permitting TM to Address Basis of Design

- Review Basis of Design Report, including proposed structures and uses, programming, grading, access plan, stormwater and sanitary utilities. Update Permitting TM as appropriate.
- Prepare final Permitting TM for incorporation into Program Implementation TM (Task 1.2.15), identifying and describing required permits.

Meetings

- Meeting with BES staff to review permitting-related issues.
- BES review of draft deliverables.

Deliverables

- Preliminary Permitting TM.
- Draft and final Permitting TM.

Task 2.5.1.2. Design

During the design process, Consultant will attend regular design team meetings, reviewing design work, coordinating with local, state, and federal regulatory agencies, and updating the Permitting TM and matrix to reflect current design and construction plans.

Initial Design Review – 30% Design Phase

Design Team Coordination

- Ongoing review of 30% design progress for permit implications.
- Participate in up to three field meetings to review potential design and construction changes and potential impacts.
- Begin environmental documentation, including:
  - Columbia Slough and wildlife habitat field reconnaissance.
  - Wetland field reconnaissance.
  - Preliminary environmental impact assessments and alternatives analysis.

Agency Coordination

- Ongoing coordination with BES Streamlining Team and attend Streamlining Team meeting.
- Ongoing coordination with BES environmental planning staff.
- Ongoing coordination with state and federal resource agencies.
- Attend pre-application conference to review BES comments on environmental constraints.

Permitting TM Update and Preliminary Applications

- Review and comment on 30% design package.
- Identify specific drawings needed for permit submittal and coordinate with team on permit drawing requirements.
- Prepare outline of BES Environmental Review and USACE/DSL Joint Permit applications.
- Update Permitting TM and permit matrix with outstanding issues flagged.

Deliverables

- Summary of Streamlining Team meeting.
- Outline of permit applications.
- Updated Permitting TM.

BES Input/Review

- Attend meetings, as appropriate.
- BES review of updated Permitting TM and other deliverables.

Intermediate Design Review

Design Team Coordination

- Ongoing review of 60% design progress for permit implications.
- Participate in up to three field meetings to review potential design and construction changes and potential impacts.
- Complete environmental documentation started in previous phase, including:

- Columbia Slough and wildlife habitat field reconnaissance.
- Wetland field reconnaissance.
- Environmental impact assessments and alternatives analysis.

Agency Coordination

- Ongoing coordination with BES Streamlining Team and attend Streamlining Team meeting (before submittal of Joint Permit Application).
- Prepare and submit wetland delineation report to DSL for concurrence.
- Ongoing coordination with state and federal resource agencies.
- Ongoing coordination with BES environmental staff.
- Participate in up to two field meetings with regulators to review potential design and construction plans, potential impacts, and any agency concerns.

Permit Preparation

- Compile and review draft permit package drawings and supporting documentation, including environmental evaluations, construction, stormwater, air emissions, noise, and mitigation plans.
- Prepare draft environmental review application and submit to BES for review.
- Prepare and submit draft Joint Permit Application to BES for review.
- Incorporate BES comments on these documents.
- Coordinate with team on compilation of land use application for BES.
- Prepare Joint Permit Application with USACE/DSL, submit to BES.
- Prepare drafts of DEQ 1200-C and other applicable permit applications. Coordinate with plant site 1200-C permit.

Update Permit Action Plan and Tracking Matrix

- Review of 60% design package, with design refinements and specifications.
- Update Permitting TM and permit matrix, identifying outstanding issues, if any.

Deliverables

- Draft and final permit applications with supporting documentation/attachments (15 printed copies and one electronic copy in PDF format).
- Updated Permitting TM.

BES Input/Review

- Attend meetings as appropriate.
- BES review of permit applications and updated Permitting TM.

Second Intermediate Design Review

Design Team Coordination

- Ongoing review of 90% design progress.
- Monitor review process for permits and respond to agency comments.
- Coordinate with team on presentations at public hearing(s).
- Compile final permits and supporting documentation as attachments to the Permitting TM.

Prepare Updated Permitting TM

- Prepare updated Permitting TM.
- Compile local environmental, state, and federal permit approvals as TM attachments.
- Deliver Permitting TM and supporting documents to BES.

Deliverables

- 90% Permitting TM.
- Completed permit approvals and decisions.

Final Design Review – 100% Design

Remaining permit applications, such as the DEQ 1200-C permit and BES Urban Forestry Permit, will be filed when design is at or near 100%. The permit team will monitor permit progress and address questions and information needs identified by the permitting agencies after review with BES. A final Permitting TM will be prepared with permit status and any actions needed to meet the timeline for start of construction identified.

Task 2.5.1.3. Construction Phase Support Services

Following the design process, provide on-call permit assistance during construction as directed by BES. This work includes meetings and coordination with BES, the construction team, and regulatory agency staff. Also anticipated are field meetings and follow up environmental documentation. Changes to permits can also be triggered, and the permit team would lead these negotiations and permit revisions and/or prepare new submittals and documentation as needed.

Task 2.5.2 Land Use Permitting

Task 2.5.2.1. Land Use Consultation

Provide consultation on land use issues as the project develops, identifying whether planned changes fit within the existing Master Plan (land use permit). Where feasible, work with design team to incorporate changes in a fashion consistent with approved site Master Plan.

Review Basis of Design Report and provide an interpretation of compliance of the proposed project with the approved Master Plan. This documentation will be incorporated into the Program Implementation TM prepared under Task 1.2.15 Program Implementation Plan.

Assumptions

- Work under this task will be on a time and materials basis; level of effort will be limited to approximately 120 hours, unless formally authorized for additional funding under Task 2.6 Owner's Contingency – Detailed Design Phase.

Deliverables

- Brief TM documenting the review effort.
- Various brief communications as necessary, outlining land use interpretation and strategies to maintain compliance.

Task 2.5.2.2. Optional Task – Site Master Plan Amendment

Due to the early planning levels in the project, a Site Master Plan Amendment may be required to accommodate the most cost-effective alternatives. If so determined, formal authorization will be provided to the Consultant with funding on a not to exceed amount provided from under Task 2.6 Owner's Contingency – Detailed Design Phase.

Task 2.5.3 Archaeological

Portions of the CBWTP 5-acre project area have been investigated over the past 25 years but some portions of the project area appear to have not been intensively surveyed for cultural resources. Because the project may involve federal permitting, the project may be subject to federal review and requirements, including cultural resource compliance requirements under Section 106 of the National Historic Preservation Act. The present investigation is proposed to meet those requirements, as well as state compliance requirements, and to gain concurrence of the Oregon State Historic Preservation Office (SHPO). The investigation will include an assessment of both belowground archaeological resources and aboveground structures that are 50 years of age or older that may be located within the Area of Potential Effect (APE). If there is no federal nexus, only structures 75 years of age or older will be assessed.

Task 2.5.3.1. Background Records Search

This phase will entail a standard review of records and literature for the project area and vicinity. Prehistoric site records are on file in Salem at SHPO. HRA will also consult historical maps and aerials. Contacts with appropriate Tribes will be made at the direction of BES.

Task 2.5.3.2. Field Survey

A walkover of the project area will be conducted by archaeologists at intervals of 15 meters or less to define any evidence of sites that may be visible on the surface (i.e., fire-cracked rocks, stone chips, tools, etc.), but because the surface is known to be obscured in places by fill, a surface survey is not expected to be definitive.

Task 2.5.3.3. Geotechnical Monitoring and/or Archaeological Discovery Probing

It is assumed that a surface survey will not be sufficient to evaluate the likelihood of cultural resource sites being present within the proposed project area. Investigations on the parcel so far, including the excavation of 16 borings in 1994, have not identified any archaeological deposits. Previous investigations will be overlain on the phased site plan to determine whether there are areas proposed for construction that should be further tested. Previous work determined that fill up to 7 feet in depth is present in portions of the parcel, but not present in other areas. Due to the presence of fill, standard archaeological hand excavation techniques are not considered likely to be effective in identifying buried deposits.

An archaeologist will either monitor the upper 10 feet of each geotechnical borehole (proposed as part of Task 1.2.3) or the boring logs will be reviewed to assess the likelihood of archaeological indicators being present. If additional borings are needed for archaeological purposes, a mechanical auger with a 4-inch-diameter bore will be used to drill to 10–15 feet in depth. A State of Oregon archaeological permit will be required for archaeological augering.

Should sites or likely site areas be discovered, additional excavations may be necessary to fully define their horizontal and vertical extent. If sites are found, larger scale test excavations will be necessary to establish site significance for those sites that appear to be potentially significant based on augering. This additional work is not covered by this scope of work.

Task 2.5.3.4. Assessment of Historical Resources

A review of structures and features within the parcel that will reach 50 years of age and older during the expansion project will also be conducted if the project has a federal nexus. The intent of the inventory is to identify and characterize the historic resources that may be impacted by the project. The project inventory will consist of a tabulation of resources that are 45 years of age or older, including

photographs, a brief discussion of each resource and its potential National Register of Historic Places eligibility (A-D), and a map that identifies the location of each potential historic resource in the APE.

Task 2.5.3.5. Report of Results

The project reports will include both the results of the background literature search and the results of the field survey and probing. A separate technical report will be prepared for archaeological and historical investigations. The Report Executive Summary will document the Archaeological Plan and requirements that impact project implementation, and will be incorporated into the Basis of Design Report as described in Task 1.2.16.

Deliverables

- Draft and final Project Report.

Task 2.5.3.6. Optional Task – Construction Support

If warranted or required (by previous studies/assessment tasks), provide archaeological observation during construction. Assume 2 months of support from one full time staff.

Assumptions

- If authorized, the extent of the Consultant's involvement will be limited to the budget available.

Task 2.5.4 Support for other Permits

Coordinate with BES to secure additional permits required for construction. Production of final design documentation, including specifications and calculations to support the building permit application, is provided as part of Task 2 .

Prepare building permit applications.

Prepare Erosion and Sediment Control Plan. A 1200-C Permit is anticipated to be needed for this project.

Participate in two meetings with DEQ and BES to review details of the 30% and 60% design documentation to familiarize them with the design and support DEQ's Authority to Construct, specifically considering the CM/GC delivery approach.

Assumptions

- City of Portland Bureau of Development Services: BES will submit the reports, drawings, specifications, calculations, and permit application materials prepared by the Consultant and required for Building Official review of the project compliance with applicable code requirements.
- DEQ Plan Review Approval: BES will submit the Final Project Bidding Documents to DEQ for review of plans and specifications as required by Oregon Administrative Rules 340-052. Assume no additional materials beyond the final design documentation is required.

Task 2.6 Owner's Contingency – Detailed Design Phase

This task provides an Owner's Contingency for the Detailed Design Phase equal to 10% of the sum of all other subtask amounts. The Owner's Contingency will be managed by BES's Program Manager within the overall contract not-to-exceed amount. The intent of the Owner's Contingency is to provide budget for tasks for professional services that:

- Are required to complete the project as described herein.
- Result from decisions made by permitting agencies or other parties that influence the scope of professional services required to ensure project completion.

- Are needed to increase task budgets where the assumptions made to create the budget are violated and the violation is beyond the control of the Consultant.

Written authorization from BES's Program Manager is required to reallocate budget from this Detailed Design Phase Owner's Contingency Task to an existing task or a new subtask that is within the overall scope of the project but not clearly defined as within the scope of Task 2 Detailed Design Phase Services.

Task 3 Construction Phase Design Services

Provide Services during Construction (SDC) as defined below. These SDC would commence when the CM/GC is given NTP on construction activities. These SDC are intended to assist BES to verify that the Contractor's work is in substantial compliance with the Contract Documents, monitor the performance of the construction Contractor as requested, and assist BES in responding to requests and events that occur during the construction. These SDC are based upon the understanding that BES will contract directly with the Contractor and will be actively involved in the construction process to make decisions, provide approvals, and perform other actions necessary for the completion of the construction. These SDC assume that BES will provide Program Management and Construction Management/Inspection services through other contracts or through BES staff.

Safety:

- Consultant will manage the health, safety, and environmental activities of its staff and the staff of its subcontractors to achieve compliance with applicable health and safety laws and regulations.
- Consultant will coordinate its health, safety, and environmental program with the responsibilities for health, safety, and environmental compliance specified in the contract for construction. Coordinate with responsible parties to correct conditions that do not meet applicable federal, state, and local occupational safety and health laws and regulations, when such conditions expose Consultant staff, or staff of Consultant subcontractors, to unsafe conditions.
- Consultant will notify affected personnel of any site conditions posing an imminent danger to them that Consultant observes.

Consultant is not responsible for health or safety precautions of construction workers. Consultant is not responsible for the Contractor's compliance with the health and safety requirements in the contract for construction, or with federal, state, and local occupational safety and health laws and regulations.

Task 3.1 Field Engineering Services During Construction (Onsite Services)

Provide field engineering staffs onsite to assist BES in interpretation of the design documents, communication with the office design staff, and resolution of design issues or alternative solutions offered by the CM/GC. Other field office services (i.e., Construction Manager [CM], Resident Inspector [RI], Construction Inspectors [CI], and field Office Manager [OM]) will be provided by BES or the Program Support Consultant. The field engineering services are estimated based upon the contract times set forth herein and assuming both long term general and specialty short term assignments.

Consultant field engineering services will include the following:

- **Meetings:** The Field Engineer**s are budgeted under this task** ~~will~~ **to** attend the significant meetings **on site as well as remotely attending those** described below under Office Engineering**.** ~~and~~**Field Engineers** will attend a weekly construction meeting coordinated by the CM/GC.

- **Submittals:** Through BES's construction management software Heron (e-Builder) the Field Engineer will track submittals in the design team's court at the project site; log in and monitor the status of the submittals and responses; and work with the designers and document control team to provide timely and complete responses. Submittals will be reviewed onsite to the extent possible based on staff availability and complexity of the submittal.
- **Requests for Information and Design Clarifications:** Clarifications requested from the contractor, or initiated by the designers, will be coordinated through the Field Engineer, working with the office design staff. Responses will be issued in a timely manner and commensurate with project risk. The Field Engineer may recommend minor variations in the work that do not involve an adjustment in the contract price nor time of construction and are consistent with the intent of the Contract Documents (e.g. field orders). All variations in work, whether Field Orders, Design Clarifications, or responses through Requests for Information, will be documented and logged through Heron.

  Design clarifications sealed by the design professional of record including sketches, drawing revisions, specifications, supporting calculations, quantity takeoffs, and cost estimates for the work will be coordinated and may be prepared by the Field Engineer on site and included in the design clarifications as required.
- **Deferred Submittals:** ~~R~~**Coordinate the r**eview~~, stamp,~~ and submit**tal of** Deferred Submittals as required by the Building Official and the Oregon Structural Specialty Code.
- **Rejecting Defective Work:** Assist the CM and RI staff to disapprove or reject work that the CM and RI believe to be deficient and non-conforming to the requirements of the Contract Documents. Coordinate with the CM and the design team for the correction, acceptance, or other resolution of the work.
- **Construction Progress Meetings:** Participate in construction progress meetings as appropriate to assist in review of the work progress, response to questions and clarifications, interpretation of the Contract Documents, and coordination requirements between construction contracts. This activity assumes progress meetings are held weekly throughout the construction contract period.
- **Schedules:** The Field Engineer will support the CM's review and monitoring of the Contractor's progress schedules, the schedule of submittals, and the schedule of values prepared by the CM/GC. Field Engineer will consult with design staff as needed and provide input on key construction constraints, tie-ins to existing systems, etc.
- **Payment Requests:** The Field Engineer will support the CM and RI review of the Contractor's request for payment.
- **Design Change Notices:** The Field Engineer will assist the CM and BES with the preparation and issuance of design changes to the Contract Documents.
- **Evaluations of CM/GC Cost Savings Proposal Request and Change Order Proposal Request**: Respond to Program Support Consultant requests for information.
- **Field Observation Reports:** as required by BES of Portland Building Official. **The Field Engineer will assist the CM and BES with the preparation and submitting of these reports (typically covered under the Design Site Visits task below).**
- **Substantial and Final Completion:** The Field Engineer will support the CM and RI inspections at substantial and final completion, representing the design team, to verify the work is in accordance with the Contract Documents. Field Engineer will assist in preparing a punch list of items requiring completion or correction; and make recommendations regarding acceptance of the work.

Assumptions

- Assumes two separate construction packages **(and schedules):** ~~, one for~~
    - **GMP#1 – Site Prep contract package**
        - **Field Services (and Office Services) are based on a 93-week (452 work day) construction schedule for GMP#1, plus 4 additional weeks from substantial completion to final completion.**
    - **GMP#2 – Main Facilities contract package**
        - Non-Process Facilities~~ and one for~~
            - **Field Services (and Office Services) are based on a 42-week construction schedule for the non-process facilities, plus 4 additional weeks from substantial completion to final completion.**
        - Process Facilities
            - **Field Services (and Office Services) are based on a 122-week (587 work day) construction schedule for the main process facilities, plus 12 additional weeks from substantial to final completion. This assumes that the GMP#2 work will start at the time of the GMP#1 substantial completion.**

            ~~–~~ ~~.~~

            ~~– Field Services (and Office Services) are based on a 42-week construction schedule for the non-process facilities, plus 60 additional work days from substantial completion to final completion.~~

~~Field Services (and Office Services) are based on a 42-month construction schedule for the main process facilities, including early out construction work, plus 90 additional work days from substantial to final completion.~~

Contractor's schedule will be ~~published~~ **updated** ~~at a later date~~**throughout construction** and may vary from what was assumed. Consultant team will request additional fees if construction contract time exceeds the assumed durations.

Task 3.1.1 GMP#1 Early Out Package

- Staffing approach is based on **the following positions**:
    - Long Term Assignment**s:**
        - A **part**-time ~~extended~~ assignment as the field engineer for the duration of **GMP#1** construction~~ (3.5 years)~~. This **part-time** position will be filled by a mid-level engineer onsite **2 days per week** ~~with assignments between 10 months to 18~~**for 93-weeks for GMP#1, plus 4 additional weeks from substantial completion to final completion.** ~~ months.~~ **No travel costs required.**
        - **A part-time senior field engineer for the duration of GMP#1 construction. This part-time position will be filled by a senior engineer onsite 2 days per week for 93-weeks for GMP#1, plus 4 additional weeks from substantial completion to final completion. No travel costs required.**
    - ~~Middle~~ **Short** Term Assignments ~~ time or p~~**P**art time positions as a field discipline engineer/architect during discrete periods of construction. The discipline of the engineering will be based on the type of work being performed during construction and may include geotech,

~~architect,~~ electrical, structural, **corrosion** or process. ~~Staff members are expected to have assignments between 2 to 12 months each~~. **Assume 3 staff at 4 weeks each.**

- **Specific to the ground improvements,** ~~Geotechnical~~ **geotechnical** work **for GMP#1** is assumed to ~~be~~ **require** onsite **observation** for approximately ~~750~~ **33 weeks**~~hours~~**, plus time for summary report preparation**. ~~That~~ **This field** effort is considered part of the work to be performed under the **GMP#1** field engineering task:
  - **Process Facilities (SECL and RAPU) Ground Improvement**
  - **Shoring system (SECLs and RAPU) Installation**
  - **Dewatering and excavation observation**
  - **Subgrade preparation observation**
-

Task 3.1.2 GMP#2 Main Plant Package

- **Staffing approach is based on the following positions:**
  - **Long Term Assignments:**
    - **An assignment as the field engineer for the duration of GMP#2 construction. This part time position will be filled by a mid-level engineer onsite 4 days per week with an assignment of 122 weeks for the main process facilities, plus 12 additional weeks from substantial to final completion. This assumes that the GMP#2 work will start at the time of the GMP#1 substantial completion.**
    - **A second assignment as the field engineer for the duration of GMP#2 construction. This part time position will be filled by a mid-level engineer onsite 4 days per week with an assignment of 122 weeks for the main process facilities (likely split between various disciplines). This assumes that the GMP#2 work will start at the time of the GMP#1 substantial completion.**
    - **A senior field engineer for the duration of GMP#2 construction. This part-time position will be filled by a senior engineer 4 days per week for 122 weeks for the main process facilities, plus 12 additional weeks from substantial to final completion. This assumes that the GMP#2 work will start at the time of the GMP#1 substantial completion.**
    - **A part-time assignment as the field architect for the duration of the Non-Process construction of GMP#2. This half-time position will be filled by a mid-level architect onsite 2.5 days per week for 42-weeks for NonProcess, plus 4 additional weeks from substantial completion to final completion. No travel costs required.**
  - **Short Term Assignments – Part time positions as a field discipline engineer/architect during discrete periods of construction. The discipline of the engineering will be based on the type of work being performed during construction and may include geotech, electrical, structural, corrosion or process. Assume 8 staff at 4 weeks each.**
  - **Specific to the ground improvements, geotechnical work for GMP#2 is assumed to require onsite observation for approximately 36 weeks, plus time for summary report preparation. This field effort is considered part of the work to be performed under the GMP#2 field engineering task:**

  - **NonProcess Facilities (STO-6 and SLOU) Ground Improvement**
  - **SOFA and SOLO Auger Cast Piles**
  - **Dewatering and excavation observation**
  - **Subgrade preparation observation**
  - **Channel Utility Crossing**

- Sustainability certification for Non-Process Facilities:
  - Conduct LEED pre-construction kickoff meeting to review action plan, roles/responsibilities with respect to LEED-GOLD scorecard with BES, architect, Contractor, and major subcontractors.
  - Field verification and rating by LEED rater to include initial inspection, frame-walk inspection, floor-by-floor pre-drywall inspections and final inspection post punch-list.
  - Preparation of LEED-GOLD project package:
    - Preparation of project documents for certification application.
    - Presentation of pre-certification project file to U.S. Green Building Council for final certification.
- Commissioning of Non-Process Buildings:
  - Provide fundamental commissioning per LEED-GOLD requirements of heating, cooling, water heating, and ventilation systems. Commissioning inclusive of kickoff meeting, submittal review, development of functional test procedures, review of testing and balancing, and completion of documentation per summary commissioning report.
  - Provide summary commissioning report inclusive of systems, compliance, issues, testing requirements, and completed functional test.

Task 3.2 Office Engineering Services During Construction (Offsite Services)

Furnish the following engineering support services from the Engineer's office during construction of the Project. The office support services are estimated based upon the contract times set forth herein.

The office services fee estimate is based on providing the services outlined below. The amount of time furnished and the cost of performing such services are estimates based on the assumptions listed in this Task. Additional funding may be authorized from Task 3.5 **Owner's Contingency – Construction Phase**~~Owner's Contingency – Construction Phase~~.

Assumptions

- BES will pay any fees for reviews, permits, systems development, etc., levied by applicable agencies towards the project.
- Calculating/determining development fees may be completed as an additional service.
- Point-to-point wiring diagrams will be provided by others (CM/GC).
- Materials testing, specialty testing, and construction phase surveying services will be provided by others.
- The following services are not included in the estimate of Office Engineering Services: Services necessary due to the default of the Contractor. Services for the investigation and analysis of

contractor claims, preparation of reports on contractor claims, provision of professional claims analysis services, and participation in litigation or alternative dispute resolution of claims. Preparation for and serving as a witness in connection with any public or private hearing or other forum related to the project. Services to support, prepare, document, bring, defend, or assist in litigation undertaken or defended by BES.

- BES or others will provide periodic labor evaluations and processing of prevailing wage documentation.

Task 3.2.1 Meetings and SDC Administration

Task 3.2.1.1. ~~GMP~~ Kickoff Meetings

Key design staff will attend a kickoff meeting ~~at the start of each GMP NTP meeting~~ with the CM/GC, significant subcontractors, and BES **remotely or** at the project site before the commencement of each **construction phase. Assume that significant construction phases include the following:**

- **GMP#1 demo and site work**
- **GMP#1 aeration basin work**
- **GMP#1 ground improvements**
- **GMP#1 medium voltage electrical work**
- **GMP#2 nonprocess ground improvements**
- **GMP#2 auger cast pile work (SOFA and SOLO)**
- **GMP#2 concrete/structural work (SOFA and SOLO)**
- **GMP#2 concrete/structural work (SECL and RAPU)**
- **GMP#2 medium voltage and process electrical work**
- **GMP#2 Silver Tunnel work**

Assume each of the listed meetings (plus 5 additional contingency meetings) will require 2 design team members each plus the design manager or project manager. Fifteen meetings total.

Task 3.2.1.2. Project Site Meetings

Project Site Meetings During Construction: Participate in periodic onsite meetings with the CM/GC, as requested. Others will prepare the minutes of these meetings.

Task 3.2.1.3. Partnering Meetings

Project Partnering Meetings During Construction: Participate in quarterly partnering meetings with BES and the CM/GC. Others will prepare the minutes of these meetings.

Task 3.2.1.4. Office Engineering Admin

Project administration During Construction: Provide design management and administrative support for tasks associated with Office Engineering.

Assumptions

- ~~For the Main Process Design,~~ Consultant's project manager, design manager, ~~lead structural, mechanical, civil, instrumentation, electrical, and process engineers~~ **and lead designer** will attend the~~se~~ Kickoff meetings. ~~The time for the Field Engineer is accounted for above.~~

- ~~Kickoff meetings for the four major construction phases (aligning with the four major areas of work: liquids, solids, non-process, and electrical).~~
- ~~Participation~~ **Assume participation** in one 8-hour program Construction Partnering **kickoff** meeting with up to ~~eight~~ **three** Consultant's staff. **Assume quarterly partnering meetings are 4 hours long (including prep). Assume four years and therefore 16 quarterly meetings with three Consultant staff.**
- **Assume 10 project site meetings with three Consultant attendees each for GMP#1. Assume** twenty project site meetings with three **Consultant** attendees each for **GMP#2**~~the Main Process Design.~~
- **Field Engineer is expected to attend these meetings but time for the Field Engineer is separately accounted for in the tasks above.**
- **Assume office engineering support is provided throughout GMP#1 (93 weeks) and GMP#2 (122 weeks).**
- ~~For the Non-Process Facilities:~~
  - ~~Architect will attend weekly onsite construction meetings to stay familiar with the progress and quality of the portion of the work completed and prepare meeting minutes.~~
  - ~~In conjunction with weekly onsite construction meetings, Consultant will observe the construction work and produce field reports.~~
  - ~~Consultant will provide required structural observation and produce observation reports.~~
  - ~~Attend three additional onsite meetings for mock-up reviews of key envelope assemblies.~~

Task 3.2.2 Shop Drawings and Samples Reviews

Submittals: Review and approve shop drawings and samples in accordance with the Schedule of Shop Drawings and Sample submittals.

Assist BES in reviewing and responding to the CM/GC's requests for substitution of materials and equipment. Review such requests and advise BES as to the acceptability of such substitutions.

Assumptions

- Office staff effort is based on **5.7 hours per submittal and** ~~two~~ **1.25** submittals**/drawing** ~~(including resubmittals and substitutions)~~ **and 1.5 reviews per submittal,** ~~per drawing and~~ **so that** each submittal~~/~~ **plus** resubmittal will require **a total of** ~~5.7~~**10.6** hours of effort. This assumes that some submittal review will be accomplished by BES's Project Representative**, CM Team,** or Consultant's field engineer.
- Review of all shop drawings, samples, and submittals shall be for general conformance with the design concept and general compliance with the requirements of the contract for construction. Such review shall not relieve the CM/GC from its responsibility for performance in accordance with the contract for construction, nor is such review a guarantee that the work covered by the shop drawings, samples, and submittals is free of errors, inconsistencies, or omissions.

Task 3.2.3 Interpretation of Contract Documents (RFIs)

Office support staff will issue such written clarifications or interpretations of the requirements of the Contract Documents as BES may determine necessary. Coordinate such review with the design team and BES as appropriate. Such written clarifications shall be binding on BES and the CM/GC for the limited purposes established in the Contract Documents associated with the role of the Engineer. If BES and

CM/GC are unable to agree on the amount or extent, if any, of any adjustment in the contract price or contract times, or both, that should be allowed as a result of a written clarification or interpretation, a claim may be made as provided for in the Contract Documents.

The team will also respond to any questions raised by regulatory agencies (e.g., DEQ) or the building department.

Assumptions

- Three RFI per drawing, and each RFI will require 2 hours of effort **split between consultants based on the current drawing count**. This assumes that some interpretation of Contract Documents will be accomplished by BES's Project Representative**, CM Team,** or Consultant's field engineer.

Task 3.2.4 Design Team Site Visits

The elements of this task are as follows:

- **Construction Visits:** Consultant will coordinate visits to the site by the design team members to review progress and quality of the work. The visits shall observe the general quality of the work at the time of the visit and review any specific items of work that are brought to the attention of the design team members by the CM/GC or BES. Schedule and frequency of visits will be as needed.
- **Structural Observations**: Structural engineers will provide the required structural observations, as defined in the final design documents. The Structural Engineer of Record's responsibilities are described below:
  - Provide onsite structural ~~inspection~~ **observation** and review as required by the Contract Documents:
    - **NonProcess Facilities**
    - **Process Facilities**
  - Monitor Contractor compliance with plans and specs for rebar placement, concrete placement, dimensional requirements, completeness and acceptability of structural work.
  - **Report to Building Official and interface as required.**
  - ~~Provide special inspections~~**Special inspections are provided by Others**.
  - Report to Building Official.
- ~~**Performance and Witness Testing:** Attend and witness field and performance tests as specified in the contract for construction and this contract scope.~~
- **Factory and Offsite Tests and Inspections:** Coordinate tests and inspections of work, materials, and equipment for the project at offsite facilities and suppliers, as specified in the contract for construction.
- **Subsurface and Physical Conditions:** When the CM/GC notifies BES of subsurface or physical conditions at the site that the contract for construction provides should be so notified, advise BES and inspect the conditions at the site. Advise BES as to the appropriate action(s) and assist BES in responding to the CM/GC.
- **Substantial and Final Completion:** Assist BES with inspections at substantial and final completion for each construction package, in accordance with the contract for construction. Assist in the preparation of up to eight separate punch lists of items requiring completion or correction. Make recommendations to BES regarding acceptance of the work based upon the results of the final inspection.

Assumptions

- ~~Construction Visits –~~ Assume design team visits average 8 hours per week during the entire project. This estimate is reduced assuming the presence of a field engineer as described above. **Construction visits include:**
    - **Construction visits**
    - **Factory and offsite tests and inspections**
    - **Subsurface and physical conditions**
- **Structural observations assume 23 site visits (approximately once per month for 2 years).**
- ~~For the Non-Process Facilities:~~
- ~~Performance and Witness Testing – Assume 8 work weeks to startup the major processes.~~
- ~~Factory and Offsite Tests and Inspections – Assume 15 visits of 2 person-days each to an offsite location.~~
- ~~Subsurface and Physical Conditions – Assume 10 visits of 6 hours of onsite work. Assume an additional 10 visits of 4 hours each for QC of geotechnical field engineering. Significant field assignment for subsurface improvements is identified under the field engineering services.~~
- Substantial and Final Completion – Assume 8 staff for 1 day for each of ~~six~~ **eight** partial substantial completion and final completion **(covering GMP#1 and GMP#2)**.
- Expenses assume all site visits are within the Portland metropolitan area except for Factory Tests.

Task 3.2.5 Contract Modifications

Assist BES with the issuance of contract modifications during construction, as follows:

- **Rejecting Defective Work**: Office support staff will support BES's Project Representative and field staff to disapprove or reject work that Consultant believes to be defective, or that Consultant believes will not produce a completed project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed project as a functioning whole as indicated by the Contract Documents.
- **Authorizing Variations in Work:** Office support staff will support BES's Project Representative and field staff to authorize minor variations in the work from the requirements of the Contract Documents that do not involve an adjustment in the contract price or the contract times and are compatible with the design concept of the completed project as a functioning whole as indicated by the Contract Documents.
- **Contract Modifications:** Office support staff will review potential changes to the contract as requested by BES's Project Representative and field staff and make recommendations to BES regarding the acceptability of the change. Office staff will assist in preparation of contract modifications to the Contract Documents for the CM/GC and BES's review and approval. Design and engineering services to review Contractor-initiated changes and to prepare drawings and specifications for issuance to the Contractor shall be considered as Additional Services, entitling Consultant to additional compensation.

Assumptions

- Assuming that the BES Project Representative and Program Manager lead the contract modification effort, the total Consultant effort **(engineering and CAD)** for this task is estimated to be **2**~~1,000~~ hours**/drawing** split between consultants based on the ~~preliminary~~ **current** drawing count.

- Design and engineering services beyond the limits of this budget will be subject to additional compensation.

Task 3.2.6 Operations and Maintenance Support During Construction and Startup

Provide O&M liaison support to the BES Ops and Maintenance staff throughout construction and startup/commissioning, assisting with O&M training, coordinating operational issues with the CM/GC, representing plant staff during construction meetings, etc. Support staff will also relay CM/GC issues that affect O&M to BES staff, sitting in on lunch meetings or breaks with BES staff and explaining construction progress, decisions that need to be made, facilitating training sessions, providing operations support during training, etc.

Assumptions

- If authorized, the extent of the Consultant's involvement will be limited to the budget available.
- Level of effort and budget is allocated to SDC and Startup Testing tasks.
- BES or Program Support Consultant will coordinate vendor O&M manuals and training.

Task 3.2.7 Update 3D Model during Construction

Update original 3D model electronically until the end of construction. The budget and level of effort included for this task is an allowance for use as directed by BES's staff. Provide services under this task up to the limits of the budget allocated. Specific activities are to be authorized in advance.

Assumptions

- Assume ~~1.0~~**1.5** hours of effort per drawing for updating the 3D model.

The extent of the Consultant's involvement will be limited to the budget available.

Task 3.2.8 Record Drawings and Closeout Files

Over the course of the project monthly as-built updates will be completed in the Revit model files to provide an updated bluebeam model for BES. This assumes that information will be provided by the contractor, so it can easily be incorporated in the model. A total of 12 hours a month of a CAD technician's time are assumed to complete these updates.

At the conclusion of the project, prepare record drawings on the basis of information furnished by the Contractor and the field staff. The record drawings will revise the Contract Document drawings, where applicable, and include the following deliverables:

- Three electronic copies of files on compact disc. Format of AutoCAD 3D models will be dimensionally accurate and representative of true installation space requirements. These models will not have data associated with them.
- Three printed copies of full-size drawings.
- Three printed copies of half-size drawings.
- Electronic copies of drawings.

Assume ~~2.0~~**1.5** hours of effort per drawing for preparation of final record documents, assuming 3D model is also being updated in parallel.

Provide to BES an organized set of project documents, closeout files, and records from the office

engineering tasks.

Task 3.2.9 Warranty ~~Period~~ and Post Startup Services

Provide the following warranty performance review services during the ~~1-year~~ warranty period to assist BES in coordinating corrections of deficient equipment or construction:

- Participate in an end-of-warranty period inspection ~~1 month~~ before completion of the warranty period and provide a letter identifying any deficiencies found and recommended actions.
- Make periodic visits to the site during the warranty period to monitor contract deficiencies in workmanship, materials, or equipment and prepare correspondence informing the Contractor of such deficiencies.
- Provide periodic onsite observation during correction of the deficiencies.

In addition, provide post-startup support for design-related issues, working with BES to troubleshoot design or equipment issues.

Assumptions

- The fee estimate is based on ~~500~~ **350** hours total for inspections**/support** during the ~~11th month (before the end of the Correction Period) for three major packages including two claims made during the Correction Period.~~ **first year after Substantial Completion.**
- Coordination of warranties, guarantees, lien releases will be managed by BES or the Program Support Consultant.
- Additional services related to warranty claims, enforcement, and inspection can be provided, if needed, funded through **Task 3.5 Owner's Contingency – Construction Phase** ~~the Owner's Contingency~~.

Task 3.2.10 Electrical Short Circuit Study

Provide draft short circuit, protective device coordination, harmonic and arc flash study report. Perform a study on propose**d** new equipment and modified existing equipment for short circuit analysis, protective device coordination, harmonic and arc flash analysis. Existing equipment included in the study will only include items being replaced or modified. Equipment included will be those devices defined by National Electrical Code and NFPA 70E. Coordinate with Utility to obtain short circuit data and X/R ratios. Coordinate with BES to obtain copies of previous electrical studies and models and use this to inform updated studies. Draft studies shall be prepared during design and will be used to inform final equipment ratings. Final studies will be coordinated with equipment submittals and construction sequencing. Arc Flash labels will be provided and applied to all installed equipment in coordination with Contractor's work. PowerTools for Windows SKM shall be used for all power system modelling.

Assumptions

- **Assume 2 double-ended 15-kV unit substations, 2 single ended transformers, 3 MV load interrupter switches, 7 MCCs, 7 switchboards, 24 distribution panels, 140 disconnect switches, and 12 packaged control panels (with starters/VFDs), 50 stand-alone VFDs, 3 UPS systems, 2 automatic transfer switches, 2 standby generators.**
- ~~Assume seven double-ended 15-kV unit substations, 17 MCCs, 4 switchboards, 40 distribution panels, 80 disconnect switches, and 20 packaged control panels (with starters/VFDs).~~
- **Separate reports will be required for GMP 1 and GMP 2.**

Deliverables

- Draft and final short circuit study, protective device coordination, harmonics and arc flash study reports. **(One report for GMP#1 and one report for GMP#2.)**
- Create arc flash labels, to be field applied by the Contractor.
- Electronic power model files shall be provided to BES.

Task 3.3 Programming

This task describes services provided to complete the process control system (PCS) software integration for the CBWTP Secondary Treatment Expansion Program (STEP) including workshops with BES to insure programming methods and control functionality meet their requirements. Jacobs intends to use a qualified subconsultant to assist with this task.

The software integration services for the following process equipment will be performed under this task:

- **GMP1**
  - **Skid centrifuge and conveyors package system integration**
  - **Sludge cake handling conveyors**
  - **Sludge hopper feed conveyors**
  - **Sludge hoppers**
  - **Truck loadout ventilation**
  - **Temporary odor control**
- **GMP2**
  - **Secondary clarifiers 9 and 10**
  - **RAPU RAS pumps 1 through 5**
  - **TUSI RAS pumps 1W and 1E through 8W and 8E**
  - **Tank drain pumps 1 and 2**
  - **Groundwater pump station 3**
  - **Mixed liquor pumps aeration basins 1 through 8**
  - **Blue tunnel sodium hypochlorite pumps 1 through 4**
  - **Tunnel 8 hypochlorite pumps 1 through 4**
  - **Secondary effluent hypochlorite mix pumps 1 and 2**
  - **Gravity belt feed tanks 1 and 2 and mix pumps**
  - **Gravity belt sludge pumps 1 through 8**
  - **Gravity belt 1 through 8**
  - **Thickened sludge tanks 1 through 4**
  - **Thickened sludge transfer pumps 1 through 6**
  - **Filter tank and pumps 1 through 3**
  - **Centrifuge sludge grinder and pump 1 through 5**
  - **Centrifuge 1 through 5 package system integration**
  - **Centrifuge discharge conveyors 1 through 5**
  - **Cake transfer system conveyors (6 total)**
  - **Truck hopper feed conveyors 1 and 2**
  - **Truck hoppers 1 through 4**
  - **Cake truck loading bay 1 and 2**
  - **Centrate tank and pumps 1 through 3**
  - **Dry polymer makedown package systems 1 through 3 integration**
  - **Thickening polymer mix tanks 1 and 2**
  - **Thickening polymer feed tanks 1 and 2**

- **Gravity belt polymer pumps 1 through 8**
- **Dewatering polymer mix tanks 1 and 2**
- **Dewatering polymer feed tanks 1 and 2**
- **Centrifuge polymer pumps 1 through 5**
- **SOFA ventilation 1 through 8 monitoring and 32 go nogo lights**
- **RAPU ventilation monitoring and go nogo lights**
- **SLPR ventilation monitoring and go nogo lights**
- **TUBL, TUGR, and TUOR ventilation monitoring and go nogo lights**
- **TURE, TUSI, and TUWH ventilation monitoring and go nogo lights**
- **TUSI deep well pump**
- **TUBL and SLPR sump pumps monitoring**
- **RAPU and SOFA sump pumps monitoring**
- **Odor control fan 1 through 3 and biofilter cell 1 through 3**
- **Generator and automatic transfer switch monitoring**
- **Control network health monitoring of STEP addition to the network**

Work Approach

System Programmer (Jacobs and subconsultant) will complete the work in a phased approach.

- **Phase 1 Software Planning: will include workshops with the appropriate entities (BES, Engineer, Contractor and Package System Vendors) to coordinate programming standards, project schedule, control narratives, HMI graphics development, Programmable Logic Controller (PLC) code development, testing procedures, and testing coordination.**
- **Phase 2 Software Development: will include all offsite software development tasks including Commissioning Database (CDB) development, PLC and HMI development, unwitnessed software test, witnessed software factory acceptance test, panel builder factory acceptance test, and package system factory acceptance test.**
- **Phase 3 Installation and Commissioning: will include onsite installation and commissioning tasks including operational readiness test 2 (ORT2), and PCS Check as described in the construction specifications. This phase will also include PCS software O&M development, training, and system tuning.**
- **Phase 4 Post Startup: will include onsite or remote support for up to 3 months after completion of Phase 3.**

Overall Assumptions

- **Existing iFIX software and the computer hardware it is running on has the capacity and necessary license(s) for adding the STEP functions. No changes to the baseline iFIX system or any associated software or computer hardware is included with the exception of configuring contractor furnished software for 3 new operator workstations and 6 new operator interface terminals (OITs) provided and installed by the Contractor as part of the STEP construction.**
- **Configuration of network communication equipment including switches, routers, firewalls, and WIFI equipment is by others. Configuration to be completed prior to beginning ORT2.**
- **Configuration and testing of personnel WIFI cellular communication equipment is by others.**
- **Configuration and testing of process video systems is not included.**
- **BES will complete software integration including testing and commissioning for Sludge Transfer Pumps 168 and 169, as they have already completed 90% of this work.**

- **Existing secondary diversion flow control programming will not be modified. The instrument replacement included in the construction specifications will be a direct replacement, with no programming changes.**
- **BES will provide reproduction of training materials prior to training sessions.**
- **BES will provide current software standards including examples from active PLCs and HMI code prior to software planning phase.**
- **Edits to software standards including STEP workshop decisions to be completed by BES prior to software development phase.**
- **Upgrading existing databases to the latest Configuration Offline Database (COD) application is not included. COD will not be used on this project, Jacobs Commissioning Database (CDB) will be used instead.**
- **PLC programming will use existing BES standard defined function blocks (DFBs). If new DFBs are appropriate, System Programmer will submit a change proposal for BES review and approval.**
- **Programming is limited to the following PLC's being added or modified as part of STEP.**
  - **SLPR-PLC1, SLPR-PLC2 (GMP1)**
  - **SECL-PLC (GMP2)**
  - **SOFA-PLC1 (GMP2)**
  - **SOFA PLC2 (GMP2)**
  - **RAPU-PLC1 (GMP2)**
  - **TUSI-PLC (GMP2)**
  - **SOFA-DEEP.WELL.PMP.PLC1 (GMP2)**
- **Modifications to existing PLCs will be done in the software and firmware version in operation at the plant at the beginning of the software planning phase of the project (for example modifications to existing Modicon Quantum PLCs using Modicon Concept firmware will be modified using the same software and firmware versions in operation). Any changes in software or firmware versions by BES or others during the project could potentially result in rework or schedule changes.**
- **PLC and human-machine interface (HMI) software development will be at location chosen by System Programmer.**
- **BES will provide PLC hardware (spares furnished under STEP construction contract) to System Programmer prior to software development phase for use in programming and testing the software.**
- **BES will provide necessary PLC and HMI software licenses for the duration of the project prior to software development phase.**
- **BES may provide revisions to HMI graphics once they are functionally correct, operating in the BES environment, have been signed-off, and are turned over to BES.**

- **BES will make available AST staff during the operational readiness test (ORT) and performance acceptance test (PAT) phases to assist in installing integrated applications into operating environment.**
- **BES will provide dedicated (not shared) access to one workstation and one laptop capable of running both PLC and HMI software during ORT and PAT phases. BES will provide secure remote network access to the workstation and laptop via the Internet for System Programmer remote troubleshooting and programming purposes.**
- **Configuration of remote alarm notification software such as Specter Win911 is not included.**
- **Automated Report Generation programming and configuration is not included.**
- **PLC programming includes up to 1950 hard wired input/output (I/O) points**
- **HMI programming includes up to 120 process graphics and up to 590 graphic objects and associated control popup graphics.**
- **Variable frequency drive network communications are not being used on the project.**
- **Reviews of Contractor submittals are covered elsewhere in the construction phase design services and are not included in this software task.**

Task 3.3.1 Software Planning

Software Standards Workshop
Lead one 4-hour PLC and HMI standards workshop with BES to review current BES PLC and HMI programming standards and how to apply them to STEP. Perform a review of available user defined function blocks and general code from other projects provided by BES.

Narrative Review Workshop
Develop preliminary HMI process graphic sketches based on the projects latest design functionality requirements and prepare a PowerPoint presentation. Lead up to five 3-hour P&ID/narrative/prelim graphic workshops with BES to review control narratives and proposed graphics.

Prepare summary of decisions made during workshop

Commissioning Database Workshop
In preparation for workshop, System Programmer will modify the CDB for use with BES standard DFB's and BES standard iFIX objects/tags.

Lead one 3-hour CDB workshop with BES to review functionality and features including HMI and PLC tag exports, alarm functions, testing documentation, and loop description documentation.

Change Management
Software change management will follow the same procedure and use the same forms as the rest of the project.

Deliverables
- **Workshop Agendas**
- **Workshop Powerpoints**
- **Workshop Notes**
- **Revised control narrative documents**
- **Working sample CDB including 5 control loops**

Task 3.3.2 Software Development

The purpose of this task is to complete the STEP programming of the PCS, demonstrate software functions to BES, and to integrate vendor package control systems software into the PCS. The task includes CDB, PLC, HMI, and Historian configuration and programming. Software submittals at the 30%, 60%, and 90% development are included to allow timely coordination and approval of progress by BES staff.

CDB Development
Populate with STEP PLC I/O tags, loop descriptions, DFB's, and alarms.

PLC Development
Develop PLC programs based on results from the Software Planning Workshops.

HMI Development

- **Develop HMI program based on results from the Software Planning Workshops.**
- **Develop one process graphic per P&ID, no more than 120-total.**
- **Integrate up to 3 process graphics from skid centrifuge package control system.**
- **Integrate up to 10 process graphics from centrifuge 1-5 package control system.**
- **Integrate up to 3 process graphics from satellite boiler package control system.**
- **Integrate up to 3 process graphics from dry polymer package control system.**
- **Develop up to 3 custom control pop-up graphics per subsystem, no more than 15-total.**
- **Modify up to 5 existing iFIX process graphics that are affected by STEP project.**
- **Modify existing navigation graphics, site plan graphic, and control network graphic.**

Historian Configuration
Include up to 500 STEP tags into the existing Historian.

Skid Centrifuge Package Control System Coordination
Attend vendor led Application Software Development workshop teleconference and/or live meeting up to 4 hours total.

Replicate package system graphics for the PCS. This will require vendor to provide an electronic copy of package system PLC and HMI code as a reference for developing the PCS HMI graphics 30 days prior to vendor factory test.

Attend vendor factory acceptance test at the vendor's test facility. Demonstrate required interface functionality between vendor-supplied package control system and the PCS. Includes up to 2-person days (1 person for 1 day plus travel)

Centrifuge 1-5 Package Control System Coordination
Attend vendor led Application Software Development workshop teleconference and/or live meeting up to 4 hours total.

Replicate package system graphics for the PCS. *Note: this will require vendor to provide an electronic copy of package system PLC and HMI code as a reference for developing the PCS HMI graphics 30 days prior to vendor factory test.*

Attend vendor factory acceptance test at the vendor's test facility. Demonstrate required interface functionality between vendor-supplied package control system and the PCS. Includes up to 3-person days (1 person for 2 days plus travel)

Satellite Boiler Package Control System Coordination
Attend vendor led Application Software Development workshop teleconference and/or live meeting up to 4 hours total.

Replicate package system graphics for the PCS. This will require vendor to provide an electronic copy of package system PLC and HMI code as a reference for developing the PCS HMI graphics 30 days prior to vendor factory test.

Attend vendor factory acceptance test at the vendor's test facility. Demonstrate required interface functionality between vendor-supplied package control system and the PCS. Includes up to 2-person days (1 person for 1 day plus travel)

Dry Polymer Package Control System Coordination
Attend vendor led Application Software Development workshop teleconference and/or live meeting up to 4 hours total.

Replicate package system graphics for the PCS. ***Note: this will require vendor to provide an electronic copy of package system PLC and HMI code as a reference for developing the PCS HMI graphics 30 days prior to shipment to site.***

Demonstrate required interface functionality between vendor-supplied package control system and the PCS.

Programming QC Review
Provide senior QC review at 30%/60%/90% program development phases. Document review comments and responses.

Unwitnessed Software Test
Test to confirm and document that the PLC and HMI programs are ready for the Software Factory Acceptance Test. PLC inputs to be simulated by forcing discrete inputs On/Off and analog inputs to desired values in PLC code. PLC outputs and analog output registers to be monitored in the PLC program.
Test location: System Programmer Office

Witnessed Factory Software Acceptance Test
Test to demonstrate to BES and document that PLC and HMI programs are ready for Installation and Commissioning phase. Total effort includes up to 8-person days (2 System Programmer staff for 4 days).
Test location: System Programmer Office or CBWTP.

Assumptions
- **Vendors to notify System Programmer of any changes to Vendor Package Control System Programs after integration into PCS or delivery of package system to site.**

Deliverables
- **Preliminary HMI process graphics.**
- **Preliminary HMI custom control pop-up graphics.**
- **PLC program submittals:**

- **30%/60%/90% electronic copy of one PLC program for BES review to confirm compliance with programming standards. All other PLC programs to incorporate BES comments from the initial PLC.**
- **90% electronic copy of all PLC programs.**
- **Final development phase electronic copy of all PLC programs.**

- **Final development phase electronic copy of HMI program.**
- **Final development phase populated CDB.**
- **Signed Witnessed Factory Software Acceptance Test forms.**
- **Vendor factory acceptance test integration with PCS test results.**

Task 3.3.3 Installation and Commissioning

The purpose of this task is to configure 3 operator workstations, configure 9 OITs, install the PCS software additions, provide required onsite testing, provide BES training, and to complete the STEP PCS system startup and tuning.

STEP PCS O&M Manual
Develop PCS O&M manual for PLC/HMI control functions including:

- **STEP graphic screen captures of 120 process graphics and one instance of each type of popup control graphics used.**
- **Final STEP control narratives and loop descriptions.**
- **STEP PLC and HMI program maintenance and troubleshooting.**

Configure Operator Workstations and OITs
Configure operating systems, install necessary HMI software, and integrate into the existing BES iFIX architecture.

GMP1 Existing PLC Hardware Conversion Support
Assist Contractor with verifying existing system wiring diagrams prior to conversion. Assist Contractor with PLC hardware conversion including interpreting existing drawings, troubleshooting discrepancies between wiring in field and existing drawings and testing.

Operational Readiness Test 1 Support (ORT1)
The purpose of this test is to verify point to point wiring between field devices and the PLC (I/O) modules, to confirm Contractor wiring diagrams are accurate, to confirm proper operation of field devices and to confirm calibration of instruments. The Contractor is responsible for developing the test forms and for completing ORT1.

The Software Developer will assist and witness portions of ORT1 to insure Contractor is completing this phase according to the construction specifications.

Operational Readiness Test 2 (ORT2)
The purpose of this test is to verify all I/O devices are reporting to the PCS correctly, and to confirm the I/O points function at the PLC and HMI. Tests to be completed on a loop by loop basis for an entire PLC. The approval of ORT1 test result submittals shall be the basis for beginning ORT2. System Programmer testing to commence no less than 5 days following review and approval of ORT1 test result submittals.

During ORT2, PLC I/O points will be re-tested (repeat of ORT1) jointly by the Contractor, System Programmer, and BES staff using field devices and simulation test fluids when available. Prior to ORT2, System Programmer will review Contractor submitted ORT1 test results to confirm systems are ready for ORT2.

If field equipment, wiring, or hardware problems arise during ORT2, ORT2 shall be suspended and ORT1 repeated for the portions affected. Impacts to budget or schedule to be reviewed with BES prior to resuming ORT2.

PCS Check Test
The purpose of this test is to verify sub-system auto operation including debugging PLC and HMI control logic, exercising control strategies, verifying alarm functions, verifying interlocks, and initial loop tuning.

The PCS Check is a joint effort by the Contractor, System Programmer, Engineer, and BES staff.

Demonstration Test
The purpose of this test is to demonstrate the STEP is fully functional with process fluids for the duration specified in the construction documents.

The Demonstration Test is a joint effort by the Contractor, System Programmer, Engineer, and BES staff.

System Tuning
Tune the system during installation and commissioning to resolve software functions that are not working as described in the process narratives. Jacobs will maintain a log of issues encountered and actions taken to resolve them.

Training
Informal PCS training of BES staff will occur throughout the PCS software integration effort including the software standards workshop, narrative review workshop, CDB workshop, preliminary graphic reviews, PLC program submittal reviews, witnessed factory software acceptance tests, package system vendor factory demonstration test, ORT2, PCS Check, and Demonstration Test.

Formal training will consist of 3 sessions:

- **Operator Training (2 sessions up to 4 hours each): Using PCS O&M manual, train CBWTP staff in the operation of the process through the HMI screens.**
- **Maintenance Training (1 session up to 4 hours): Using PCS O&M manual, train CBWTP staff in the maintenance and troubleshooting of the STEP PLC and HMI programs.**

The formal training sessions will be held at CBWTP. Training will occur on a live system supplemented with simulations to reflect operating conditions over the range of expected operating conditions.

Control Narrative Update
At the completion of Demonstration Test, update the control narratives with software configuration information for incorporation in the STEP PCS O&M manual.

Redline loop drawings with software configuration information for Contractor provided Record Drawings.

Assumptions

- **The level of effort for GMP1 PLC conversion support includes up to 5-person days to verify existing drawings prior to conversion and up to 10-person days onsite to assist with conversion.**

- **Each phase of testing will be done separately for each PLC. Each phase of testing for each specific PLC will be completed on consecutive days.**
- **The level of effort for ORT1 assistance includes 3-person days onsite per PLC, total of 24-person days plus travel. Contractor to schedule ORT1 for each PLC on consecutive days, with all I/O wiring complete for that PLC prior to starting ORT1.**
- **The level of effort for ORT2 includes 20-person days onsite per PLC, total of 160-person days plus travel.**
- **The level of effort for PCS Check Test includes 6-person days onsite per PLC, total of 48-person days plus travel.**
- **The level of effort for Demonstration Test includes 8 hours per day up to 14 consecutive days.**
- **The level of effort for Tuning includes 4 hours per day for up to 90 days.**

Deliverables

- **Initial STEP PCS O&M manual, electronic pdf format.**
- **Signed ORT2 test forms, electronic pdf format.**
- **Signed PCS Check test forms, electronic pdf format.**
- **Signed Demonstration test forms, electronic pdf format.**
- **Updated process narratives and loop narratives.**
- **Redlined loop drawings.**
- **Final STEP PCS O&M manual, electronic pdf format.**
- **Operator training materials, electronic pdf format.**
- **System tuning log, electronic excel format.**

Task 3.3.4 Post Startup

The purpose of this task is to provide up to 48 hours of onsite or remote support for up to 3 months after completion of Installation and Commissioning phase.

- ~~The objective of this task is to ensure BES staff is comfortable with the planned software functionality that will be used to control and monitor all of the process equipment in the Program. Consultant will then proceed to develop that functionality, working closely with City staff, test it, and provide startup support.~~

~~Overall Assumptions~~

- ~~BES will provide reproduction of training materials.~~
- ~~BES will provide edits to software standards capturing workshop decisions.~~
- ~~Traditional analog/discrete wiring methods where limited device data are available.~~
- ~~Upgrading existing databases to the latest Configuration Offline Database (COD) application is not included.~~
- ~~Program flow diagrams will be developed for more complex portions of code or where new DFB is used.~~

- PLC and human-machine interface (HMI) software development will be at location chosen by Consultant.
- BES will provide PLC hardware to Consultant during the software development phase.
- BES will provide temporary software licenses necessary for PLC and HMI programming.
- BES will provide minor graphical revisions to screens once they are functionally correct and operating in BES environment.
- BES will make available AST staff during the operational readiness test (ORT) and performance acceptance test (PAT) phases to assist in installing integrated applications into operating environment.
- BES will provide access to workstation capable of running both PLC and HMI software during ORT and PAT phases.

Task 3.3.5 Software Predesign and Workshops

- Workshop Powerpoints
- Workshop Notes
- Revised control narrative documents
- Working sample CDB including 5 control loops
- Develop preliminary HMI screen sketches based on the project's latest design functionality requirements and prepare a PowerPoint presentation. A collective workshop with Engineering, operations, and maintenance staff will be held at the project site to review this functionality and proposed screens. A TM will be provided to summarize the decisions agreed upon.
- The level of effort for this task includes up to four trips to CBWTP.

Deliverables

- TM summarizing decisions on HMI screens and functionality requirements.

~~COD Database Development~~

~~The COD tool will be used to develop and manage the points that will be created on this project. BES staff will be given the opportunity to review the tagging standards utilized. BES staff will be consulted to determine appropriate alarm behavior and will be configured into the database. Alarm responses and suggested actions will be developed and incorporated into the database, also for later use by O&M staff in the iFIX environment.~~

~~Assumptions~~

~~Conventional control architecture, in lieu of a bus structure, will be used in the design.~~

~~The level of effort for this task includes up to 1,200 hard wired I/O points and 4,000 software points.~~

~~PLC Software Development~~

~~Consultant with AST staff will perform a review of available user definable function blocks and general code from other projects. New function blocks will be developed as needed. Program flow diagrams will be developed where needed to clarify more complex portions of code. The PLC applications software will then be developed specific to this project.~~

~~Assumptions~~

~~The level of effort for this task includes up to three trips to CBWTP.~~

~~**Deliverables**~~

~~Program flow diagrams.~~

~~HMI Software Development~~

~~Develop the iFIX objects and displays. Leveraging screen sketches agreed upon by BES staff, Consultant will configure up to twelve new screens.~~

~~Assumptions~~

~~The level of effort for this task includes up to three trips to CBWTP.~~

~~**Deliverables**~~

~~HMI screens.~~

~~Hardware Field Testing/ORT1 Support~~

~~Develop testing forms to supplement the field hardware Operational Readiness Test 1 (ORT1). Each loop, control circuit, and I/O point will be tested by the Contractor for proper operation.~~

~~Assumptions~~

~~The level of effort for this task includes up to two trips to CBWTP to support ORT1 testing.~~

~~**Deliverables**~~

~~I/O and loop based testing forms to supplement typical startup forms.~~

~~Integrated Software Testing~~

~~Perform a combined PLC/HMI test offsite and/or at the staging site using simulated inputs and outputs. A loop-by-loop testing form will be developed and utilized to exercise the software and aid in troubleshooting.~~

~~During Phase 2 of the Operational Readiness Test 2 (ORT2), software will be re-tested by programmers and AST staff with actual field devices.~~

~~During PAT, the software will be re-tested again for other BES staff to confirm the software is performing as expected.~~

~~Assumptions~~

~~The level of effort for this task includes up to ten trips to CBWTP.~~

~~**Deliverables**~~

~~PLC and HMI import files as needed during startup.~~

~~System Tuning~~

~~Tune the system during and after startup of the system to help the plant staff resolve software problems. Maintain a log of problems encountered and actions taken to resolve them.~~

~~Assumptions~~

~~The level of effort for this task includes services provided before final completion and up to three trips to CBWTP.~~

~~Training~~

~~Develop training material and train CBWTP staff in the operation of the process through the HMI screens. Additional training will be provided to a subset of the staff on the PLC software. The training sessions will be held at CBWTP. Training will occur on a live system supplemented with simulations to reflect operating conditions over the range of expected operating conditions.~~

~~Assumptions~~

~~The level of effort for this task includes up to three 2-hour training sessions.~~

~~**Deliverables**~~

~~Training materials in electronic format.~~

~~Loop Sheet Updating~~

~~Update the process and loop narratives and loop drawings with software configuration information (i.e., alarms, etc.).~~

~~**Deliverables**~~

~~Updated process narratives and loop narratives, loop drawings.~~

Task 3.4 Project Management for Construction Phase Design Services

Perform the following activities for the duration of the final (100%) design phase:

- **Workplan**: Consultant will update the design phase workplan to define the Consultant team's delivery approach, staffing, responsibilities, and project deliverables.
- **Reporting**: The Consultant will keep BES advised of the progress of the design support services during construction. This includes submitting monthly progress reports and burn charts to BES (with the invoice) and holding periodic meetings and consultations with BES.
- **Kickoff Meeting**: Before commencing the construction design phase, prepare for and conduct a "refresher" Kickoff/Chartering Meeting for Consultant team members, including subconsultants.

Assumptions

- The extent of the Consultant's involvement will be limited to the budget available.
- Consultant's SDC are based upon the schedule or duration of construction anticipated at the time that these services are agreed to. Deviations from the anticipated schedule or duration of construction will materially affect the scope of these SDC and Consultant's compensation for the SDC and will require an adjustment to Consultant's compensation.
- Consultant will not be responsible for the means, methods, techniques, sequences, or procedures of the Contractor, nor shall Consultant be responsible for the Contractor's failure to perform in accordance with the Contract Documents.
- **Two separate construction phases are planned:**
    - **GMP#1 – This initial construction period will last 21 months begining November 2020 (temporary odor control) and ending in August 2022 (excavation and subgrade work for RAPU and SECLs).**
    - **GMP#2 –** The main construction period will last ~~42~~ **28** months**, assume it** begin~~ning~~**s in August** ~~January~~ 202**2** ~~(early out projects)~~ and ~~ending~~ **ends** in ~~August~~ **December** 2024. Expected duration of the main construction phase (secondary clarifiers and thickening/dewatering facilities) is 36 months after completion of final design.
- **This Project Management budget for Construction Phase Design Services covers the full duration of construction, including startup.**
- The construction will be delivered as a CM/GC project.
- Support/review of CM/GC bid packages is included in Task 2.3 above **to the limits of those budgets**.
- Any reproduction, distribution, and mailing costs for the bidding of the contract for construction will be paid by BES.
- BES (or their Agent) will review monthly pay requests from the Contractor.
- BES (or their Agent) will provide surveying for baseline control for construction.
- Only BES (or their Agent) will issue decisions on Contractor claims and disputes. Consultant will not issue decisions on Contractor claims or disputes. Consultant will not, except as part of Additional Services, undertake comprehensive and detailed investigation or analysis of Contractor's claims and disputes, nor participate in judicial or alternative dispute resolution procedures for the claims or disputes.
- Separate from Contract Modification support described above, labor and expenses required to address construction claims, claims resolution or litigation assistance requested of Consultant will constitute additional services.
- BES will provide to Consultant all data in BES's possession relating to Consultant's services on the project. Consultant will reasonably rely upon the accuracy, timeliness, and completeness of the information provided by BES.
- BES will make its facilities accessible to Consultant as required for Consultant's performance of its services and will provide labor and safety equipment as required by Consultant for such access. BES will perform, at no cost to Consultant, such tests of equipment, machinery, pipelines, and other components of BES's facilities as may be required in connection with Consultant's services.
- BES will give prompt notice to Consultant whenever BES observes or becomes aware of any development that affects the scope or timing of Consultant's services, or of any defect in the work of Consultant or the Contractor.

- BES will examine information submitted by Consultant and render in writing or otherwise provide decisions in a timely manner.
- BES will furnish required information and approvals in a timely manner.
- BES will cause all agreements with the Contractor to be consistent with Consultant's Agreement.

Task 3.5 Owner's Contingency – Construction Phase

This task provides an Owner's Contingency for the Construction Phase equal to 10% of the sum of all other subtask amounts. The Owner's Contingency will be managed by BES's Program Manager within the overall contract not-to-exceed amount. The intent of the Owner's Contingency is to provide budget for tasks for professional services that:

- Are required to complete the project as described herein.
- Result from decisions made by permitting agencies or other parties that influence the scope of professional services required to ensure project completion.
- Are needed to increase task budgets where the assumptions made to create the budget are violated and the violation is beyond the control of the Consultant.

Written authorization from BES's Program Manager is required to reallocate budget from this Construction Phase Owner's Contingency Task to an existing task or a new subtask that is within the overall scope of the project but not clearly defined as within the scope of Task 3.

Task 4 Startup and Closeout Phase

Task 4.1 Operator Process Training

Provide supplemental instruction to BES's staff in the operation, maintenance, and testing of the unit processes provided under this project. This instruction will cover both the basic operational concept and actual operation of the systems and components under both normal and abnormal operations that are likely to occur. The instruction will also include training of the staff for equipment maintenance. This task includes the following:

- Support BES staff in providing operator training based on design intent and installed systems.
- Conduct three workshops to discuss process theory, project improvements, and operational strategies associated with each process area (secondary, solids, electrical). Each workshop will be conducted twice to allow multiple shifts to attend.
- Conduct training sessions for the new process facilities by conducting classroom training and field training using the new process equipment. This instruction will cover both the basic operational concept and actual operation of the systems and components under both normal and abnormal operations that are likely to occur.
- Set up a series of scenarios in simulation model and conduct operator training for plant staff.

Assumptions

- Process training will be developed and coordinated with BES' senior process engineer.
- Provide 24 hours (8 hours x 3 shifts) of combined classroom and field training per major unit process. Assume there are approximately 15 unit processes (thickening, dewatering, polymer,

sludge pumping, cake loadout, secondary clarifiers, WAS pumping, heating systems, ~~hypochlorite,~~ etc.).

- An additional 24 hours (8 hours x 3 shifts) of combined classroom and field training for the major electrical systems will be provided.
- 4 hours of preparation required per session (4 hours x 16 sessions).
- BES or the Program/Construction Manager will separately coordinate the services of qualified representatives from equipment manufacturers. Process engineer will attend manufacturers' training, assuming 2 hours for 25 pieces of equipment.
- 600 hours required for Replica Flight Simulator Training.

Deliverables

- Agenda and workshop material provided to BES ahead of the three workshops.
- Agenda and training material provided to BES ahead of training sessions.

Task 4.2 Process Operations Manual

Task 4.2.1 Develop Process Operations Manual

Develop a Process Operations Manual describing the operation of the project facilities and systems. This manual will explain the various primary modes of process operation that may be used, including both normal operation and initial emergency operation procedures. The manual will explain the purpose and basic concept of the various processes that are incorporated into the overall plant. Where appropriate, reference will be made to the manufacturers' detailed O&M submittals. It will include instructions for process operations and test or laboratory procedures that may be required to monitor the performance of the facilities. The manual will be suitable for use as an operational tool and to facilitate operator training. The manual will be produced in a computerized format using commercially available software.

Assumptions

- Process Operations Manual will be developed and coordinated with BES' senior process engineer.
- The Operational Strategy TM (developed above) will form the basis for the Process Operations Manual.
- Development of the Process Operations Manual is typically shared with BES's Operations staff. The exact scope of the Consultant's work will be determined before beginning work on this task, and the extent of the Consultant's involvement will be limited to the budget available.
- Fee assumes 480 hours to prepare a Process Operations Manual **plus time for editing, formatting and reviews.**

Deliverables

- Draft and final Process Operations Manual, including preliminary standard operating procedures (SOPs).

Task 4.2.2 Optional Subtask – Process Operations Manual Update

The Consulting team will coordinate with BES staff to revise and update the Process Operations Manual at the end of 1-year of operations, based on actual O&M experience and input from BES staff.

Assumptions

- If this task is authorized, the extent of the Consultant's involvement will be limited to the budget available.

Deliverables

- Update to Process Operations Manual.

Task 4.3 Startup Support

Provide process engineering support and operations and maintenance support during startup of each major process system. Process engineering support will be involved in ensuring that the new process systems are operating as they were designed. This assistance includes the following:

- Review Contractor's startup plan.
- Assist the CM/GC team in preparing a Startup and Commissioning Plan, which will include:
  - Specific actions and related completion dates for startup and operation of the new facilities.
  - Definition of testing parameters to verify conformance with design conditions.
- Provide engineering input and oversight during startup and commissioning of individual unit processes:
  - Witness performance tests as specified in the Contract Documents, review test reports applicable to the equipment and systems, and make recommendations to BES as to acceptance.
  - Analyze equipment and process performance for conformance with intended design conditions.
  - Assist with punch list and deficiency items identification.
- Assist BES during initial startup of the facilities by assisting assigned **BES** operating personnel.
  - ~~Provide certified operations support to advise BES staff during startup/testing or to operate existing facilities while BES staff are engaged in startup/testing and training activities.~~
  - Use simulation model to verify that startup performance is as anticipated and to troubleshoot any unexpected outcomes.
  - Participate in weekly teleconferences, respond to email inquiries, and evaluate operational data and procedures.
  - **Provide operations advice during/after initial startup.**
  - Provide recommendations for operational, system, or control narrative changes to improve system performance.

Assumptions

- Engineering startup support will be closely coordinated with BES' senior process engineer.
- Engineering startup support will be split between senior process engineers and mid-level process engineers.
- **The Consultant team can provide certified operations support to advise BES staff during startup/testing or to operate existing facilities while BES staff are engaged in startup/testing and training activities. These costs are not included in the budget estimate.**
- Operation**s advice/**support **effort** will be split between prime consultant and subconsultants.

- The extent of the Consultant's involvement will be limited to the budget available. Additional funding, if needed, would need to be authorized via **Task 4.7 Owner's Contingency – Startup and Closeout Phase**.

Task 4.4 Operational Process Support

- **Post startup, and in** addition to the Process Operations Manual described above, assist BES process and operations staff in preparing SOPs describing step-by-step operations for each unit process.
- Visit the CBWTP to observe system operation and conformance with the intended design.
- Approximately 3 months after full process startup, once system is determined to be operating as intended in a steady state fashion, use simulation model to verify that startup performance is as anticipated and to troubleshoot any unexpected outcomes. Update process model to calibrate against operating conditions and provide updated model to BES.
- Provide certified operations support **and advice** after startup, as requested.
- Provide additional support as requested by BES. Support may include the following activities:
  - Provide support to plant's process analyst.
  - Onsite support during transition of process operating modes.
  - Troubleshooting of operational and process issues during and after startup.

Assumptions

- A monthly ~~half~~ **full** day visit will be required for the first 12 months of operation.
- ~~480 hours of additional engineering and operational process support will be required (separate from site visits and modeling effort).~~
- The extent of the Consultant's involvement will be limited to the budget available. **Additional funding, if needed, would need to be authorized via Task 4.7 Owner's Contingency – Startup and Closeout Phase.**

Task 4.5 Project Management – Startup and Closeout Phase

Project management efforts during the startup phase are in parallel to other construction activities and therefore scoped under Task 3.4 above (as part of Construction Phase Services). This project management subtask covers only the Closeout Phase.

Perform the following activities for the ~~duration of the startup and~~ closeout phase:

- ~~Before commencing the startup and closeout phase, prepare for and conduct a "refresher" Kickoff/Chartering Meeting for Consultant team members, including subconsultants.~~
- ~~Maintain and update the final work plan for the project that combines staffing commitments and budgets with the deliverables and schedule for the project. Specific responsibilities of each member of the final design Project team will be maintained. Update the overall design schedule each month. and review with the BES Program Manager, as needed.~~
- ~~Supervise and control activities of staff assigned to the project. Coordinate and schedule appropriate project staffing discussions to meet project requirements. Arrange for the scheduled project workshops, review meetings, and project team meetings. Coordinate the participation of senior staff at appropriate points in the project.~~

- ~~Coordinate with other projects and BES staff to complete work on schedule and within budget.~~
- Prepare monthly progress reports and submit with the monthly invoice. The reports will include a status summary of current project tasks, activities completed in the last month, activities planned for the next month, a project action issues checklist, performance compared to budget, and identification of items of concern. Organize monthly invoice and budget status report by WBS element, including a Monthly Subconsultant Payment and Utilization Report by the 15th of each month (reference Part II, Section C.5 of the RFP). Include budget reports based on using an "S" curve that shows budgeted work complete, billings to date, and estimate at completion.
- ~~Monitor project activities for potential changes. Should change occur, and with BES approval, modify project tasks, task budgets, and approach. Inform BES if any changes will impact the cost of engineering services, the construction cost, or the schedule.~~
- Participate in weekly conference calls with BES project manager (project manager and design manager). Review the project status and discuss activities and needed actions. Prepare and discuss the 3-week look-ahead schedule.
- Submit change management forms, as needed to document scope/schedule/budget changes. Update the change log and review proposed changes and scope modifications with the BES Program Manager at the bi-weekly project management meetings.
- ~~Support and attend (as requested) project briefings by BES project management team to upper management, City Council, etc.~~
- ~~Maintain~~ **Close out** project records, manage and process project communications, and coordinate project administrative matters, utilizing the established Portland document management tool (Heron/e-Builder).

Assumptions

- Overall ~~startup~~ **closeout** schedule of ~~4~~ **2** months.
- Monthly invoices and major project submittals will be submitted through Heron/e-Builder.

Meetings

- 2 hours every week for 4 months to meet with BES project management and startup team.

Deliverables

- ~~Updates to program workplan.~~
- Monthly project invoices and status reports.
- Completed change management forms, as needed, to document impacts of potential changes on engineering fee, construction cost, or schedule.

Task 4.6 Optional Task: Facility Automation – HMI with Dynamic Process and Hydraulic Model

Elements of the task are as follows:

- Utilize simulation model to help software integrator understand the intent of process control narratives to support programming effort.

- Advance the simulation model to connect directly to the programed software (PLC, SCADA, etc.) so that the programmed logic can be tested in a simulation environment against simulated hydraulic conditions before being used on the actual plant.
- Advance simulation model to either:
  - Incorporate plant SCADA screens into model so that the operator inputs/set points in the simulation environment are the same as in SCADA.
  - Connect the simulation model directly to the plant SCADA system so that the operator inputs/set points in SCADA are connected to the simulation model.

Task 4.7 Owner's Contingency – Startup and Closeout Phase

This task provides an Owner's Contingency for the Startup and Closeout Phase equal to 10% of the sum of all other subtask amounts. The Owner's Contingency will be managed by BES's Program Manager within the overall contract not-to-exceed amount. The intent of the Owner's Contingency is to provide budget for tasks for professional services that:

- Are required to complete the project as described herein.
- Result from decisions made by permitting agencies or other parties that influence the scope of professional services required to ensure project completion.
- Are needed to increase task budgets where the assumptions made to create the budget are violated and the violation is beyond the control of the Consultant.

Written authorization from BES's Program Manager is required to reallocate budget from this Startup and Closeout Owner's Contingency Task to an existing task or a new subtask that is within the overall scope of the project but not clearly defined as within the scope of Task 4.

Attachments to the Scope

- Level of Effort and Budget.
- Project Schedule.