Prepared for

City and Borough of Sitka

Consulting Services for

Blue Lake Expansion Project

Task Order Nos. 2 & 3
(Final Design Services)

April 5, 2010

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1 Introduction

With reference to our Professional Services Agreement dated March 31 and April 2, 2009, we are pleased to present this proposal for the Task 2 and Task 3 engineering for the Blue Lake Expansion Project. Task 2 is for the development of equipment and material specifications for procurement contracts, and Task 3 is for the final design and specifications for construction contracts. The scope of work for these tasks is presented in Request for Proposal (RFP) provided by the City and Borough of Sitka (CBS) dated February 2, 2010 and is intended to include all engineering services to bring the project to the completion of design. The work includes designs, drawings, procurement specifications, construction specifications, support during the bidding/bid review process, recommendation for contract award, and delivery of the conformed contract documents.

The work follows on from the Task1 activities completed in February 2010, which included final feasibility and design development studies as well as preparation of a comprehensive Design Development Report.

In developing the Task 2 and 3 work scope, we carefully followed the requirements of CBS's RFP. Some small modifications to the scope are proposed to ensure a smooth interface with the Task 1 effort and to provide an orderly process of engineering activities. These possible scope modifications are discussed below is Section 2 of our proposal.

The proposal below presents a detailed scope of work that identifies project deliverables, an engineering schedule consistent with the planned overall project schedule, the estimated engineering costs, and the proposed engineering team. The document and data management process for the project is also discussed.

2 Background

The Blue Lake Project was commissioned in 1961 and is located about five miles east of the City and consists of three powerhouses, including the 2 x3 MW Blue Lake powerhouse, the 0.67 MW Fish Valve Unit (FVU) and the 0.87 MW Pulp Mill Feeder Unit (PMFU). Flow is provided from the Blue Lake reservoir and is used for hydroelectric generation, instream flow needs, municipal water use and water sales. In addition to the powerhouses and the reservoir, the project comprises a concrete arch dam, a submerged intake structure, tunnels, penstocks, transmission lines and access roads.

The Blue Lake Project is operated in conjunction with the Green Lake Project, with back-up power available from four diesel-powered electric generators when hydro generation is insufficient to supply the load. The City owns and operates all electric generation facilities. The Blue Lake Project is generally operated as a base load resource and the Green Lake project as a load following plant, with interactive operation between the plants to manage storage levels in the reservoirs. The Blue Lake powerhouse contains the control center for the City's entire electric system.

A significant increase in load growth is expected in the near future, mostly on account of customer conversion from oil to electric heating and from new energy intensive industries, resulting in the need for system expansion by 2013. The best alternative to achieve this is through increasing the dam height of the Blue Lake Project and installing three generating units in a new powerhouse. The Blue Lake Expansion Project is intended for this purpose and comprises the following elements:

- A dam raise by 83 ft;
- A new powerhouse, housing three 5.3 MW new generating units, which are to replace the existing Blue Lake units;
- A modification to the existing intake;
- A new tunnel segment;
- A new penstock segment;
- A new surge chamber; and
- A new switchyard.

One of the main goals of the design for the new Blue Lake Units (BLU) (which will be load following) will be to improve the electrical system frequency. This will be achieved through a combination of a new surge chamber, improved governors, a flywheel, interruptible resistance loads, and other measures.

A key element of the project is the raising of the existing dam. Raising the dam to its geological limit by 83 ft will increase existing generation by approximately 50%. Dam raising will require expertise in concrete arch dam stress analysis, including the dam-reservoir interaction, abutment design, expansion joint analysis and rock mechanics engineering.

Design development studies were started early in 2009 and have now been completed. Project relicensing activities are underway. The next steps in the project include detailed engineering design and development of procurement and construction contracts.

3 Approach – Final Design Services

3.1 General

CBS's RFP includes the following items of work procurement and construction specifications for the complete project. The individual procurement specifications may include:

- **Contract 1.** Turbine and generator equipment;
- **Contract 2.** 12.47 kV switchgear;
- **Contract 3.** Station service switchgear and 480 V transformers;
- **Contract 4.** Gates and hoists;
- **Contract 5.** Penstock and tunnel liner extensions;
- **Contract 6.** Main transformers;
- **Contract 7.** Powerhouse overhead traveling bridge crane; and
- **Contract 8.** Powerhouse steel building.

[Note: CBS may elect to modify the above list of contracts, possibly combining one or more, or eliminating one or more. For example, the station service switchgear may be incorporated into either the main switchgear procurement contract or into the general construction contract. These contracting changes will be established early in the Task 2 work effort]

Three construction contracts are planned:

- **Contract 9.** Underground Contract for tunnelling and portal excavation;
- **Contract 10.** Reservoir clearing; and
- **Contract 11.** General construction for all surface structures, the powerhouse, the dam, the intake gate chamber, tunnel breaches and plugs.

The procurement specifications will be Task 2 of our engineering work, and the design drawings and specifications for the construction contracts will be Task 3.

The RFP states that the Task 2 work on the procurement contracts will end with the recommendation for contract award and delivery of the conformed contract documents to the CBS. This approach is satisfactory for almost all of the procurement contracts. However, as an optimized powerhouse design is dependent on the details of the turbine and generator equipment, it is preferable to finalize the general arrangement of the powerhouse and prepare the detailed design after the drawings from the equipment supplier have been submitted and reviewed. These will include overall dimensions, loads and features of the turbine and generator equipment, including turbine inlet valves, hydraulic power unit (HPU) and controls. Therefore, we have allowed for review of the principal turbine and generator equipment drawings from the supplier in the Task 2 work program.

We have assumed that the Task 3 work will also include:

- Completion of additional studies and analysis as recommended by the FERC Board of Consultants (BOC) in the recent meeting on February 12 and 13, 2010; and

- Finalizing the design criteria and attributes list that were started in Task 1.

3.2 Design Freeze

The design freeze is the engineering milestone on a project where the arrangement and dimensions of the project features are fixed. Following approval of these feature arrangements by

CBS, the detailed engineering effort can begin. The purpose of the design freeze is to ensure an economical project arrangement and to minimize redesign of structures and project features.

Specifically, the design freeze point will occur when:

1. The design criteria manual is complete, for portions related to the project feature.
2. General arrangement drawings have been finalized for the individual project features
3. A specific list of contract drawings for the project feature (for the construction or procurement contract documents) has been finalized.
4. A specific list of design calculations (to be performed for the feature during the final design effort) has been developed.
5. A specific list of contract specifications for the project features has been finalized.
6. The concrete outline dimensions of any structure related to the project feature have been defined, with all dimensions considered frozen.
7. The dimensions and length of all hydraulic openings (tunnels, shafts, surge chamber, gates, trashracks have been defined.
8. Nomenclature for the project feature is finalized, in the project nomenclature list.

While concepts developed during preliminary engineering may undergo considerable change, once the basic design is completed and approved, it is "frozen" and becomes the foundation for the detailed engineering that follows.

Any changes to project features which are needed as a result of the detailed design effort shall be provided to CBS for review and approval, before the final design effort on the feature continues.

As work is proceeding in various fronts for several project features, it will be necessary to implement in stages design freezes for each of the following different structures and associated equipment:

- Intake Structure and Gate House;
- Dam Raise Arch Structure;
- Spillway and Plunge Pool Structures;
- Left Thrust Block and Foundation Treatment;
- Tunnel Modification features;
- Penstock;
- FVU Powerhouse;
- BLU Powerhouse; and
- Switchyard.

On project work, the Project Engineer (PE), in consultation with the Project Discipline Leads, will determine the sequence of design freeze points for the Project. It is a requirement that CBS approval of the design freeze documents be obtained before detailed engineering can proceed. Approval for certain features related to dam safety will also involve the BOC and FERC.

When the PE and PM have determined that a project feature has reached the design freeze point, the PE will issue the relevant drawings and technical documents as described above, for internal approval. After the necessary internal approvals have been obtained, the PM will issue the drawings and technical documents to the client for final approval. Once written approval has been obtained from CBS, the PM will instruct the PE in writing to freeze the design.

With a CBS approved design freeze, certain procurement contracts could then commence. For example, a design freeze on the BLU powerhouse will allow for the start of preparing, Contract 7 (powerhouse overhead traveling bridge crane) and Contract 8 (powerhouse steel building. Design freeze of the intake structure will allow for the start of preparing Contract 4 (gates and hoists). Design freeze of the penstock will allow for the start of preparing Contract 4 (penstock and tunnel liner extensions).

4 Scope of Services for Blue Lake Expansion Project

4.1 Task Order 2 – Procurement Contracts

4.1.1 General

Hatch will prepare individual procurement contracts for equipment and materials as listed in Section 3 to permit bid packages to be issued by CBS. The work will include all underlying design services needed to assemble these bid packages and ensure that the equipment and materials are appropriate for the overall project. The attributes and design criteria documents will be finalized for use in preparing the bid documents.

Except for the turbine and generator equipment contract, the work scope for each procurement contract will be for services up through contract award. Drawing review and other contract support will be part of a further Task Order 4, to be performed by Hatch or by others.

In general, the work to be performed for each procurement contract will include the following:

- Preparation of technical specifications and drawings as required;
- Assembly of the bid packages;
- Management of bidding process;
- Bid evaluation; and
- Preparation of the conformed contract.

Technical Specifications

The development of the technical specifications for each of the above listed procurement documents will require the further development of design from the comprehensive design development study (DDR) as well as discussions with CBS in order to define the new equipment design and/or operating criteria.

For the equipment to be selected, existing technical information and drawings will be reviewed. Discussions with CBS will be conducted to determine expectations, constraints and limitations that will define the expected characteristics of the equipment to be procured. Aspects will include:

- Development of technical drawings from the DDR, Task Order 3 design, or from as-builts, where appropriate.

- Development of technical specifications, including:
  - Material requirements
  - Manufacturing requirements

- Performance requirements.

Commercial & Contractual Requirements

The development of the commercial and contractual requirements of the bid documents will be performed by the CBS with support from Mr. Paul Carson. The CBS will make use of the Engineers Joint Contract Documents Committee (EJCDC) documentation, with special conditions prepared to provide for deviations from the EJCDC. Hatch will provide input to the special conditions. It is assumed that bidders will need to include qualifications to meet minimum bidding requirements. The turbine-generator contract is an exception to this rule where prospective bidders were pre-

qualified prior to issuance of the procurement documentation and only a selected number of contractors will be invited to bid.

Assemble Bid Package

When the technical specifications and commercial and contractual conditions have been reviewed, Hatch will assemble suitable electronic files for the bid documents and deliver these to CBS to put on the city website. In addition, the contract no. 1 bid packages will be assembled by Hatch and mailed to the prospective bidders on CD,

In parallel with assembly of each overall bid package, Hatch will provide an engineer's estimate for the goods and services that are included in each bid package.

Bid Support

Hatch will manage the overall bid process including:

- Arranging and coordination of pre-bid teleconference when a teleconference is specified;
- Coordination of responses to bidders' questions. Responses to technical questions will be prepared by Hatch and reviewed by CBS. It is assumed responses to commercial and contractual questions will be made by CBS; and
- Preparation and issue of bid addenda, as required.

Bid Evaluation

This work will include:

- Review of prospective sellers' bids;
- Performance and economic evaluations of the individual bids;
- Comparison study of the offers;
- Review of any technical exceptions taken by the bidders;
- Development of any clarification requests that will be submitted to the bidders;
- Participation on pre-award discussions with the preferred bidder(s) as required; and
- Preparation of a report with conclusions and recommendations for bidder selection.

It is assumed that the contractual items related to the bids will primarily be reviewed by CBS. However, the results of these reviews will be factored into Hatch's recommendation for contract award.

Conformed Contract

When the bid evaluation is completed and the preferred bidder selected, a conformed contract will be compiled and delivered to CBS. The conformed contract will include the appropriate portions of the bid documents, modified to include all previously issued addenda and all agreed upon exceptions to the specifications that have been made by the selected bidder. The conformed contract will also include the applicable sections of the successful bidder's proposal. Ten paper copies of each conformed contract will be provided along with Microsoft Word, AutoCAD and .pdf electronic copies of all the final documents.

Deliverables for Each Procurement Contract

With the exception of the Turbine-Generator supply contract, where such services are in part being performed in Task Order No. 1, the preparation of the procurement contracts, will included the following deliverables:

- Draft technical contract documentation in electronic form plus input to the EJCDC with respect to supplemental conditions and bidding instruction;
- Contract drawings and appropriate reference drawings.
- Assemble the completed bid packages and issue them to the City for placement on the website.
- Final contact documentation to be prepared in CD such that it can be mailed to a shortlist of up to 30 vendors;
- Ten (10) paper copies of the conformed contract will be prepared for CBS use. If more are required, CBS will generate additional paper copies.

The deliverables for the period between bid issuance and contract award will include the following deliverables for all contracts:

- Drafting responses to Bidder questions for the City to incorporate onto its letterhead;
- Drafting addendums for issuance to bidders;
- Providing a Bidder evaluation report;
- Providing redline comments to contracts being negotiated between Buyer and Seller; and
- Compile conformed contract document for Contract Award.
- Provide electronic copies of the final documents in MS Word, AutoCAD, and .pdf format to the CBS.

4.1.2 Subtask 2.1 – Turbine-Generator Procurement Contract

(a) Scope of Work

This task is a continuation of work performed in Task Order 1, which is for the procurement of turbine-generators for the Blue Lake Units (BLU) powerhouse and for the Fish Valve Unit (FVU) powerhouse. The BLU equipment includes the turbines, governors, turbine inlet valves (TIVs), generators, excitation equipment and control board. The FVU will include a replacement turbine, generator, and gate positioner. The existing turbine inlet valve will be retained. A new FVU control board is being provided in the coming month and will not be required.

Work being performed for this task is assumed to commence at the point when the contract is issued for bidding, which is assumed to occur on March 30, 2010.

On-going work to Contract Award date includes all of the bidding assistance items stated in the prologue of this section (Section 4.1.1).

(b) Deliverables

The deliverables will be those as listed in Section 4.1.1. Design and reference drawings were provided in Task Order 1, as shown in Section 4.3 (Tables 4.1 and 4.2).

(c) Schedule

Hatch will make every effort to be timely in its response such that the City can maintain its schedule.

4.1.3 Subtask 2.2 – Switchgear (12.4 kV)

This procurement contract strategy may later be revised such that it is included in the General Construction Contract, or combined with another procurement contract. CBS will review and the following work scope will later be amended, if needed.

(a) Scope of Work

This task is to include the design of the generator switchgear for the BLU powerhouse and switchyard, including design and reference drawings to be used in the contract documents.

Technical specifications will then be developed. Manufacturing requirements will be specified and expected performance characteristics defined for the new equipment.

On-going work to Contract Award date includes all of the bidding assistance items stated in the prologue of this section (Section 4.1.1).

(b) Deliverables

The deliverables will be those listed in Section 4.1.1. Contract drawings for this subtask may include:

- 69kV - 12.47kV Main - Single Line Diagram (E-01);
- Electrical Physical Arrangements (Conduits & Cable Trays)(E-04) (Ref Drawings) –4 sheets;

(c) Schedule

The schedule as presented in Section 5 provides the intended dates for the submittal of the deliverables.

4.1.4 Subtask 2.3 – Station Service Switchgear & 480 V Transformers

This procurement contract strategy may later be revised such that it is included in the General Construction Contract, or combined with another procurement contract. CBS will review and the following work scope will later be amended, if needed.

(a) Scope of Work

This task is to include the design and preparation of plans and specs for the station service (480V) switchgear and 480V transformers for the BLU powerhouse. Manufacturing requirements will be specified and expected performance characteristics defined for the new equipment.

On-going work to Contract Award date includes all of the bidding assistance items stated in the prologue of this section (Section 4.1.1).

(b) Deliverables

The deliverables will be those listed in Section 4.1.1. Contract drawings for this subtask may include:

- 480V Main - Single Line Diagram (E-02);
- E-04 Reference Drawing

(c) Schedule

The schedule as presented in Section 5 provides the intended dates for the submittal of the deliverables.

4.1.5 Subtask 2.4 – Gates & Hoists

(a) Scope of Work

This task is to include the design of the gates (fixed wheel and bulkhead) and hoist for the intake structure. Work includes preparation of the gate design drawings, which is to be included in this subtask.

Technical specifications will be developed. Manufacturing requirements will be specified and expected performance characteristics defined for the new equipment. The equipment and components to be designed include:

- Trashracks (the trashracks may be included in the general construction contract);
- Fixed-wheel gate and hoist; and
- Bulkhead gate.

Drawings to be included will comprise the intake and gate shaft general drawings similar to those prepared in the DDR, but further developed up to the design freeze.

On-going work to Contract Award date includes all of the bidding assistance items stated in the prologue of this section (Section 4.1.1).

(b) Deliverables

Contract drawings to be provided are indicated in Table 4.2 and will include the following:

- Trashrack Guides (IC-03);
- Trashracks & related embedments (IC-04);
- Bulkhead Gate Embedments (guides, etc.)(IC-05) – 2 sheets;
- Bulkhead Gate (IG-01);
- Fixed Wheel Gate Embedments (guides, etc.) (GH-01) – 2 sheets;
- Fixed Wheel Gate (IG-02) – 3 sheets;
- Fixed Wheel Gate Hoist (including framing) (IG-03); and
- Fixed Wheel Gate Embedments (guides, etc.) (IG-05) – 2 sheets.

Reference drawings to be provided are indicated in Table 4.2 and will include the following:

- Gate House (Plan, sections, elevation & details) (GH-02) – 3 sheets;
- Gate House Concrete & Reinforcement (GH-03) – 3 sheets;

(c) Schedule

The schedule as presented in Section 5 provides the intended dates for the submittal of the deliverables.

4.1.6 Subtask 2.5 – Penstock & Tunnel Liner Extensions

(a) Scope of Work

This task is to include the design for the penstock, manifold and steel liner extensions. This will include developing the dimensions and alignments (both plan and profile) of the penstock pressure vessels.

Technical specifications will then be developed. Manufacturing requirements will be specified and expected performance characteristics defined for the new equipment. The equipment and components to be evaluated include:

- Approximately 7-ft-diameter steel liners for the tunnel in the North River Portal, South River Portal and Lower Portal areas;
- 9-ft-dia. steel penstock and fittings between Lower Portal and manifold;
- 9-ft-dia. to 8-ft dia. steel penstock transition piece at the manifold;
- Manifold (assume 8-ft diameter inlet with 54-inch diameter outlet pipes); and
- 54-inch-dia. steel penstock spool up to the TIVs.

Additional optimization is needed, but only to confirm revisions to the manifold and penstock spools. It is assumed that the steel liners for the North and South River Portals will be less than 7-ft diameter such that they can slide into place; however, constructability reviews will be done by Hatch to assess the optimal solution to minimize installation costs and durations, yet minimize hydraulic head losses. Placement of fill on top of the North River Portal at a location where the steel liner ends will be assessed and results presented if it is determined that a reduction or elimination of the additional steel liner at the North River portal can be achieved.

Contract drawings to be included will initially be comprise the penstock and tunnel general drawings similar to those prepared in the DDR, but further developed up to the design freeze. The design freeze will be on the arrangement of the penstock, including thrust blocks, taps and manifold. Then contract drawings for procurement as well as final construction detail drawings can commence.

On-going work to Contract Award date includes all of the bidding assistance items stated in the prologue of this section (Section 4.1.1).

(b) Deliverables

In addition to the deliverables listed in Section 4.1.1, certain design drawings will be provided, as shown in Section 4.3. Specifically, the following contract drawings will be included:

- Penstock Plan & Profiles (PS-02) – 3 sheets;
- Manifold Plan, Sections and Details (PS-03) – 3 sheets;
- Penstock Elbows (PS-04);
- Lower Portal Plan, Section & Elevation (PS-06);
- Misc Penstock Details (man holes, pipe taps, etc.) (PS-08) – 2 sheets;
- Penstock Drain Valve & Vault (24-inch Drain Line) (PS-09); and

- Penstock Transitions (M-01) – 2 sheets.

In addition, the following reference drawings will be included:

- North Portal Plan & Profile (new liner, etc.) (T-02) – 2 sheets;
- South Portal Plan & Profile (new liner, etc.) (T-03) – 2 sheets;
- Lower Portal Plan & Profile (new liner, etc.) (T-04) – 2 sheets;
- Typical Steel liner Details (common to 3 areas) – 2 sheets.
- Existing Penstock Demolition (PS-01);
- Anchor Blocks - Plans & Sections - Concrete & Reinforcing (PS-05) – 3 sheets; and
- Retaining Wall at Portal (Timber Crib) (PS-07).

(c) Schedule

The schedule as presented in Section 5 provides the intended dates for the submittal of the deliverables. It indicates the expected design freeze date needed in order to provide delivery of the pipe and manifold structure needed by the general construction contractor to achieve the scheduled dates of installation as described in the DDR. Table 5.1 indicates that the manifold and penstock connecting branches to the TIV need to be delivered to the Project site by March 21, 2012, only three months following notice to proceed of the general construction contractor. As such, the design and procurement of the penstock is on the critical path to achieving the current design and development schedule. The reason for early delivery of the manifold is such that it can be installed with the foundation slab and enable construction of the south and west walls of the powerhouse structure to provide cofferdam protection for when the reservoir later begins spilling as early as July [TBV].

4.1.7 Subtask 2.6 – Main Transformers (continuation of Work in Progress)

(a) Scope of Work

This task is a continuation of work performed in Task Order 1, which is for the procurement of main 12,470 V-69 KV power transformers at the BLU switchyard.

Technical specifications will then be developed. Manufacturing requirements will be specified and expected performance characteristics defined for the new equipment.

On-going work to Contract Award date includes all of the bidding assistance items stated in the prologue of this section (Section 4.1.1).

(b) Deliverables

The deliverables will be those listed in Section 4.1.1. There will be no contract and reference drawings for this subtask.

(c) Schedule

The schedule as presented in Section 5 provides the intended dates for the submittal of the deliverables.

4.1.8 Subtask 2.7 – Bridge Crane

(a) Scope of Work

This task is to include the preparation of plans and specifications for bridge crane procurement for the BLU powerhouse. Manufacturing requirements will be specified and expected performance characteristics defined for the new equipment. The equipment and components to be evaluated include the bridge crane

On-going work to Contract Award date includes all of the bidding assistance items stated in the prologue of this section (Section 4.1.1).

(b) Deliverables

In addition to the deliverables listed in Section 4.1.1, certain design drawings will be provided, as shown in Section 4.3. Specifically, a clearance drawing will be prepared from existing powerhouse general arrangement drawings.

The crane runway drawing prepared for Contract 11 will be included as a reference drawing.

(c) Schedule

The schedule as presented in Section 5 provides the intended dates for the submittal of the deliverables.

4.1.9 Subtask 2.8 – Steel Building

(a) Scope of Work

This task is to include the design criteria (e.g. loadings) and specifications for a pre-engineered building for the powerhouse superstructure, which will be designed by the supplier of the superstructure metal materials.

Manufacturing requirements will be specified and expected performance characteristics defined for the new equipment. The equipment and components to be evaluated include:

- Pre-engineered building for BLU powerhouse; and
- Structural columns and beams for the bridge crane.

Not included are the architectural treatments of the building. Hatch has been in discussion with representatives of VP Building, who have indicated that they can provide a pre-engineered building that meets the design requirements of the BLU powerhouse and intake valve house. We will work with VP Building, or other local building suppliers, in assessing whether any optimization of the superstructure building can be achieved to reduce the overall project cost.

Contract drawings to be included will be comprised of the powerhouse general drawings similar to those prepared in the DDR, but further developed after the design freeze.

On-going work to Contract Award date includes all of the bidding assistance items stated in the prologue of this section (Section 4.1.1).

(b) Deliverables

In addition to the deliverables listed in Section 4.1.1, certain contract drawings will be provided, as follows:

- Superstructure Structural Steel (SS-01) – 2 sheets

Reference drawings to be provided will include:

- Crane Runway (Plan, Section & Details) (SS-04) – 2 sheets;
- Architectural Details – Misc. Windows & Doors (PA-01);
- Architectural Details - PH Roll-up Doors (PA-02);
- Architectural Details - PH Roofing & Flashing (PA-03) - 2 sheets; and
- Architectural Details - PH Air vent Louvers & Roof vents (PA-05).

(c) Schedule

The schedule as presented in Section 5 provides the intended dates for the submittal of the deliverables.

4.2 Task Order 3 – Final Design & Construction Contracts

4.2.1 General

Final design of the Project will include all engineering services required to prepare the construction contract bid documents. It is assumed that all of the on-site construction will be completed under the following three construction contracts:

a. **Contract 9 -- Underground Contract**: Tunneling, surge chamber and related underground openings, less the tie-in work;
b. **Contract 10 -- Reservoir Clearing Contract**; and
c. **Contract 11 -- General Construction Contract** for all surface structures, the powerhouse, the dam, the intake structure and gates, tunnel breaches and plugs, installation and startup of all Owner furnished equipment.

This work does not include a utilities relocation contract, but we could work with CBS in the preparation of such a contract if required. Of particular importance will be the confirmation of the location and elevation where the 30-inch water main will cross under the proposed penstock alignment. Following design freeze of the powerhouse and penstock excavation plan, the realignment of the 30-inch water main can be developed, as will the relocation of the other utilities.

Hatch will prepare bid-ready drawings (see **Table 4.1**) of the following project features and systems, which includes a list of all drawings that we anticipate preparing for the project, broken down by contract.

1. Site plans, work areas, and survey control drawings
2. Reservoir clearing
3. Roads, excavation, and site development
4. Site erosion control and remediation
5. Underground excavations
   a. Intake Tunnel
   b. Intake Gate Shaft
   c. Surge Chamber and adit tunnel
   d. Gate installations, rock traps, steel liner extensions and misc. features
6. Dam related drawings:
   a. Site prep, abutment excavation
   b. Grouting and drainage systems
   c. Thrust blocks and access modifications

d. Dam concrete
e. Spillway and all appurtenant concrete
f. Plunge pool modifications
g. Mechanical-electrical, including gates, valves and misc. features

7. Civil, Structural, Mechanical, and Electrical drawings for the following features:
   a. Trashrack structure
   b. Gate shaft structural and gate house
   c. Fish Valve Unit Building Modifications
   d. Existing Utilities Relocation
   e. Penstock and thrust blocks
   f. Powerhouse
   g. Raw water pumping systems at powerhouse
   h. Switchyard Modifications
   i. Electrical Design, coordinated between contracts by Hatch

Reports and Documents to be prepared will include the following:

a. Design freeze packages, with drawings, drawing and specification lists, etc.
b. Supporting Design Report;
c. Interim design progress documents for FERC Board meetings (at 50% and 95% completion);
d. Design calculation books, including all calculations for sizing structural members, equipment and systems. These will be arranged by discipline and project feature;
e. Construction cost estimates
   1. Two interim estimates during final design (at 50% and 95% completion); and
   2. Engineer's estimate of probable cost for each contract.

Project schedules will be developed and maintained as follows:

- Design schedule (updated monthly); and
- Project construction schedule.

Task 3.1 -- Finalize Design Criteria Manual & Attributes List

(a) Scope of Work

Two documents that were initiated during Task Order 1 included the following:

- Design Criteria Manual; and
- Attributes List.

Additional development of these documents is planned such that the criteria to be used in the design are agreed upon and the design features and equipment requirements of CBS are identified.

Completion of the Design Criteria Manual and the Attributes List is a key milestone leading up to design freeze. Ultimately, design freeze will occur in stages for the following project structures: a) intake; b) dam raise; c) penstock (inclusive of tunnel modifications and surge chamber); d) BLU powerhouse; e) FVU powerhouse and f) switching and interconnection. With the exception of the turbine-generator procurement contract, the other procurement contracts wouldn't proceed until the respective design freeze points have been achieved, which are highlighted within our Gantt chart in Section 5. In general, the design freeze occurs when CBS has approved the Hatch prepared general layout drawings for the respective project structures,

inclusive of outline dimensions, specification lists, detailed drawing lists, nomenclature and principal functionality of the project feature.

As the Design Criteria Manual is the key manual in addressing design loads and project functionality, its development and review by CBS and the BOC is important. This document, plus the technical memorandums (TM) described later herein will be submitted to the BOC and FERC prior to the BOC Meeting Nos. 3 and 4. In order to adhere to the design schedule, BOC acceptance of the criteria relating to the Intake, Penstock and Powerhouse (both BLU and FVU) needs to occur shortly following the BOC Meeting No. 3. The remaining criteria relating to the Dam works needs to occur shortly following BOC Meeting No. 4.

As the Design Criteria Manual is already at 50% completion, the 90% completion review by the City will occur following the initial project kick-off meeting. Subsequent revisions will occur following input from the BOC and FERC.

(b) Deliverables

It is anticipated that two additional drafts of each document will be submitted for review to CBS and that substantial review will take place at the kick-off meeting in Amherst in the development of the first draft of these documents.

The Design Criteria Manual drafts will occur as follows:

- 90% completion prior to the initial meeting with CBS in Amherst;
- 95% completion prior to the BOC meeting No. 3;
- 100% completion prior to the BOC meeting No. 4; and
- 100% conformed document incorporating final CBS, BOC and FERC comments.

The Attributes List is really a supplemental document to the Design Criteria Manual, but it needs to be completed prior to the design freeze of the respective project features. The drafts of the Attributes List document will occur as follows:

- 90% completion prior to the initial meeting with CBS in Amherst; and
- 100% completion prior to design freeze of the powerhouse, penstock and intake structures.

(c) Schedule

The schedule for completing each of the drafts is described above under the deliverables. The key drafts of each are prior to the initial Amherst meeting and following the BOC Meeting No. 3. Input to the Design Criteria Manual will be from the studies described below. For the 95% completion draft, key TMs and additional data providing input will include:

- Interim Dam Design Report (TM-26);
- Dam Foundation Report (TM-27);
- Interim CFD Analyses of Spillway & Plunge Pool (TM-28);
- Concrete Sampling, Strength Tests & Test Pits;

For the 100% completion draft, key TMs for completing the Design Criteria Manual will include:

- Final Dam Design Report (TM-26);
- Final CFD Analyses of Spillway & Plunge Pool (TM-28); and
- Supplemental PFMA.

4.2.2 Task 3.2 -- Dam Design Report (TM-26):

(a) Scope of Work

Additional dam shape investigations will be performed to establish whether a concrete notch at El. 310 can be raised or eliminated all together. The dam shell will be maintained with a thickness of 8 ft at the dam crest. The following refinements to the design will be studied during the final design phase as recommended by the FERC and the BOC:

- The compressive strength of 3,000 psi assumed in the DDR analyses unfairly limits the criteria valve for allowable strengths in judging acceptable stress levels. Hatch will provide locations to CBS for subcontracting out field work (to be performed by R&M as Hatch subcontractor) for extracting representative large diameter (6 inch) concrete cores from readily accessible locations on the dam. Laboratory specimens will be cut and tested for both compressive strength and tensile strength. More appropriate strength criteria values can then be determined.

- The elevation selected for use as criteria for the low reservoir level in the stress analysis evaluation should be set closer to the expected low operating level, which should be an elevation near that designated by the low point of the reservoir rule curve.

- With the use of the expected higher allowable strengths in evaluating the acceptability of the stress analyses results, it is anticipated that the need to bond new concrete to the upstream face will likely be eliminated. This change will simplify the contraction joint grouting procedures and eliminate the need to remove as much of the existing concrete in the crest area.

- Both the existing spillway flip structure and the new spillway configuration will be added to the FEA model since their mass affects the dynamic behavior of the structure. Some questions were raised whether these projecting overhanging structural elements may affect the stiffness of the structure, which will appear to depend on whether the contraction joints separate the structural action or whether the reinforcement is continuous. Hatch will include these overhanging spillway elements to ascertain that the model can be made representative.

- A modification of the FEM model by introducing gap elements at the abutment contacts is desirable.

- Following determination of a final dam raise configuration that yields the most advantageous stress distribution, a check of the resulting stresses which might result if the new concrete were separated by a through going crack at the interface with the existing dam will be undertaken. The joint should be free to move with only friction acting to restrain movement. This could be considered a check of an extreme condition and not one which is anticipated.

The analyses will result in a Dam Design Report that supports the final design of the selected structure. Specific tasks include:

- Once the FERC has provided to CBS the selected earthquake for the dam, Hatch will prepare final seismic time histories;

- Hatch will modify the Dam Finite Element Model as prescribed above, e.g. with proposed thrust block and spillway structure;

- Static analyses will be performed for normal maximum and normal minimum reservoir levels, the PMF level, and temperature loads;
- Seismic analyses will be performed for three time-history earthquakes and check analyses with through-going horizontal crack at old/new concrete interface;
- Post-processing and assessment of the static and seismic analyses; and
- Prepare a Final Dam Design Report, which is designated as Technical Memorandum 26.

(b) Deliverables

- An electronic copy (Adobe Acrobat pdf format) of the Interim Dam Design Report, which provides initial static and seismic analyses supporting the dam design shape; and
- An electronic copy (Adobe Acrobat pdf format) of the Final Draft Report. Once the final report has been approved, Hatch will provide to the CBS five (5) paper copies of the final report

(c) Schedule

The interim and final reports will be submitted for review prior to the BOC Meeting 3 and 4, respectively, as indicated in the schedule as presented in Section 5.

4.2.3 Task 3.3 – Dam Foundation Report (TM-27)

(a) Scope of Work

Several analyses will be performed, with principal focus on the left abutment of the dam.

Abutment Stability Analysis
The design approach to left abutment stability will be developed to take advantage of the evidence provided by the existing structure both in regard to stability and also joint water pressure. Appropriate three-dimensional analyses will be performed to evaluate the behavior of the left abutment rock mass prior to designing any needed reinforcement. The reinforcement proposed in the DDR is inappropriate.

During the geotechnical investigation program, geological mapping was undertaken at, and four boreholes were drilled into, the left abutment. Using the LIDAR data and the discontinuity data collected from geological mapping and oriented discontinuity data collected during drilling, a 3D geological model will be created. This model will show the potential wedges and sliding planes in the left abutment.

Once all of the blocks have been included in the model and the sliding planes have been identified, the volumes of the each block will be determined. Simple 2-dimensional limit equilibrium pseudostatic analyses will be undertaken for each block. Loads under normal conditions will be applied to the individual abutment blocks as taken from 3-dimensional ANSYS analysis. The forces from the dam acting on each separate block during the design seismic event will be extracted from the results of the ANSYS analysis for each time step. Seismic acceleration acting directly on the mass of the blocks will be included in the analyses.

Left Abutment Thrust Block

The left abutment thrust block concept shown in the DDR minimizes the concrete volume by the use of inclined rock anchors. It should be noted however that the rock anchors used are predominantly required for the normal loading case; under the extreme seismic event the Factor of Safety (FOS) approaches 1.0 even with no rock anchors.

The FERC BOC has stipulated that in final design the thrust block should be stable for the design seismic event without recourse to the use of rock anchors, because over time the anchors may lose tension. For this reason the thrust block design will be evaluated further using a more massive concrete block that is capable of resisting the reaction imposed by the arch dam without the requirement for rock anchors for the most critical seismic load case. (The thrust block design previously shown in the FEM analysis model may be a possible solution). The design will include pressure relief drains to reduce hydrostatic pressure; the pressure relief drains will be provided with serviceable clean–outs for long-term inspection and maintenance.

It should be noted that relying on the weight of a concrete thrust block alone for stability may not be practical for the normal loading case at the Blue Lake site for several reasons:

- To eliminate a single inclined rock anchor (466 kip capacity) will require an equivalent volume of about 100 cy of concrete;
- The in-situ rock that is removed in order to construct a concrete anchor block is 10% more dense and 5 times stronger than the concrete which will replace it; and
- The existing rock contours at the left abutment are not conducive to cutting back a suitable excavation for this purpose.

If it is found that rock anchors are required (under normal reservoir hydraulic loading only), the anchors will be installed with double corrosion protection (PTI Class 1). Access to the anchors will be provided and they will be designed so that they can be tested and/or re-tensioned in the future, if required.

In no event will the stability of the thrust block be controlled by rock anchors under extreme seismic load conditions.

Concrete Cut-Off Wall: If a separate cutoff wall is employed, it will be designed to be stable under its own weight and will be separated from the thrust block by a joint which can accept the expected movement during a seismic event.

For the final design solution, the thrust from the dam will be applied to a vertical face on the thrust block rather than the sloping face shown in the DDR.

Drainage Systems: The stone filled trench presented in the DDR to minimize uplift on the thrust block will not be used in final design. An alternative solution using horizontal drains will be developed instead. Horizontal drains are also likely to be needed in the rock at lower elevations in the left abutment to enhance the stability of the rock. A fan of horizontal drains in the rock close to the foundation of the block could be drilled from the canyon side. Horizontal drains may also be needed in the rock at lower elevations on the left abutment.

The drainage systems installed will be detailed to allow for routine clean-out and maintenance; and the groundwater level will be monitored using piezometers to confirm that the pressure relief system is functioning correctly.

(b) Deliverables

Interim and Final reports will be prepared; where the Interim Report presents the recommended thrust block shape for development and the Final Report presents the final design with supporting calculations.

(c) Schedule

The Interim and Final reports will be submitted to CBS for review prior to the BOC Meetings 3 and 4, respectively, as shown in the design schedule (Section 5).

4.2.4 Task 3.4 -- CFD Analyses of Spillway & Plunge Pool (TM-28)

(a) Scope of Work

A computational fluid dynamics model (CFD) simulation of the fluid flow from the spillway into the plunge pool and out to the dewatered reach will be undertaken to examine the effects of the existing plunge pool geometry on turbulent velocity and pressure patterns and energy dissipation for various design cases. The spill flows are channeled and deflected by the form of the plunge pool, an influence not taken into account in the equations from TM-23. It is of particular interest to examine whether any conceivable condition will aggravate erosive attack in the direction of the dam. The application of a CFD model will likely be more flexible and less expensive than a physical model. The CFD model will also provide a basis for evaluating the form and effectiveness of the erosion protection wall and/or tailrace control wall. It is of interest and concern to know how the dynamics of the flow will change and whether, at any discharge, rollers or eddies will impinge strongly on the downstream foundations of the dam. This analysis, together with ongoing monitoring, is expected to lead to an effective solution.

Replacement of the spillway crest provides an opportunity to spread the spill flow over a greater length and to decide if convergence of the walls and concentration of the flow is a favorable feature or not. A lower unit flow over a longer crest will be conducive to reducing the intensity of scour in the plunge pool but may result in an impact area nearer the toe of the dam. The spillway design will be completed interactively with evaluation of the plunge pool performance using the CFD model to predict nappe profiles, impact areas and tailrace flow conditions.

Methodology
The FLOW-3D computer program has been selected for use in this study. The FLOW-3D computer program is developed and distributed by Flow Science Incorporated out of Santa Fe, New Mexico. This advanced CFD model is capable of simulating the dynamic and steady state behaviour of liquids and gases, in one, two, or three dimensions through a solution of the complete Navier Stokes equations of fluid dynamics. The program is capable of simulating free surface flows, and can handle transitions between subcritical and super critical flow within a single model setup. These capabilities make it well suited to simulate the complex hydraulic conditions downstream of the spillway.

Hatch has successfully used FLOW-3D to model a variety of complex hydraulic engineering problems, and as such, we are well acquainted with this powerful tool. Most recently, the program was used to provide design support for the Boundary Dam TDG mitigation studies for Seattle City Light. This included detailed modelling of both the high level spillways and the low level sluiceways. It was particularly important in the study that the model be capable of replicating spillway jet trajectories, and the subsequent plunge of the jets into the downstream plunge pool. The model successfully simulated this hydraulically complex and challenging environment.

Subtask 1 – Data Collection

A brief project initiation meeting will be held by teleconference during the initial kick-off meeting prior to embarking on the development of the numerical model. The purpose of the meeting will be to discuss/confirm the proposed modelling strategy to ensure all study objectives are being met by this proposed plan. Steps will also be made to collect all data required for the set up of the numerical model, including all cross sections and available construction drawings. Data to be obtained includes:

- Topographic data showing the plunge pool geometry for various dates in time, e.g., in 1983, 1994, 1997, and 2009, plus a review of TM-23;
- Any available information on the spillway and it's past operation.
- Topographic data to be used in constructing a digital elevation model of the reach. It is expected that the data collected in previous investigations (i.e. plunge pool bathymetric surveys and LiDAR based topographic surveys), along with available USGS topographic mapping, will be sufficient to build the model. Data will be required for a distance of approximately 500 ft downstream of the dam, and 100 ft upstream of the dam. Bathymetric information upstream of the dam will be used if available, but is not expected to be critical to the assessment. The upstream bathymetry can be represented with a simplified geometry;
- Construction drawings of the dam that can be used to develop a three dimensional model of the structure. (Note this can likely be done in combination with what the structural analysis team is developing if easily available. Otherwise, the dam will be represented as simply as possible, essentially getting the curvature of the top of the dam correct so that the spillway can be correctly modeled);
- Photographs of the structure in operation; and
- Any available data that can be used to develop a tailwater relationship downstream of the plunge pool.

Subtask 2 – Model Setup

Upon completion of Subtask 1 above, our CFD team will set up a numerical model representing the existing configuration of Blue Lake dam and plunge pool. This model will be "constructed" based on available as-built drawings, and cross sections/topographic surveys. This can be done most conveniently by creating a three-dimensional model using AutoCAD software, and importing this geometry directly into the FLOW-3D software.

The model will extend for a short distance upstream of the dam, and extend down to a suitable point located downstream of the existing plunge pool. The exact distance will be selected upon review of the project drawings and previous study results. The forebay upstream of the spillway will be modeled as a simple box, with limited extents that will be sufficient to provide the correct depth and width to cover the spillway. The model will be setup to allow for maximum flexibility in terms of the structure operation. The upstream boundary for the model will consist of a specified water level in the reservoir, while the downstream boundary will consist of a specified tailwater level. The tailwater relationship for the plunge pool will be estimated based on simple hand calculations using 3 or 4 cross sections scaled from the topographic mapping. If in the unlikely event that hand calculations are not sufficient, then some additional time will be needed to set up a more detailed HECRAS model to establish the tailwater-flow relationships. This analysis will utilize available topographic data downstream of the plunge pool and engineering judgement to select an appropriate roughness for the exit channel. The upstream level will be selected based on the expected stage – discharge relationship for the spillway.

Following the model's set up, an initial run will be undertaken to test the model's overall performance, and allow for some testing of the grid and its effect on simulated flow patterns and spillway jet trajectories. Grid resolution will be adjusted to ensure stable operation of the model, to optimize the runtimes, and to achieve an adequate resolution for each solution.

Subtask 3 – Calibration – Modeling of Existing System
Once developed, the model will simulate, and if necessary be calibrated to match a number of past spillway events. The calibration will basically be undertaken in two phases.

Phase 1: Calibration of Spillway Hydraulics: In the first phase, the model will be run to simulate three conditions involving spill over the spillway: a low (approximately 3000 cfs), medium (approximately 7500 cfs), and high (approximately 12,000 cfs) flow event. Specific flows for each category will be confirmed following a full data review. Once the runs are completed, model predictions of flow conditions over the spillway will be compared to any available observed data and/or hand calculations. Parameters to be compared include spillway discharge rates as well as spillway trajectory and impact zones.

Phase 2: Assessment of existing plunge pool development. This phase will involve additional runs to assess and compare flow conditions which have occurred over the 50 year operating life of the plunge pool. For this series of runs, the model configuration will be based on the current or 2009 plunge pool bathymetry. Three flow events (low, medium, and high) will be simulated. For each flow event, the maximum pressure profiles and maximum velocities along the plunge pool bed will be documented. Since the plunge pool appears to have reached an equilibrium state, it is postulated that these conditions represent a threshold for movement of the bed within the plunge pool. These threshold values can then be used to try to predict how the plunge pool may respond to the more severe flow conditions that will result after the dam has been raised.

Subtask 4 – Identification of Post-Project Plunge Pool Scour
Following the model's successful calibration (and verification that it can be used to predict scour in the existing plunge pool), it will be modified to represent the post project condition. Modifications will include updating of the arch dam geometry to simulate a rise in the crest of the dam to elev. 425 ft, and construction of the new spillway structure. The work will be undertaken in three basic phases:

Phase 1: Initially, a review of the appropriateness of the plunge pool design discharge assumption of 17,000 cfs will be undertaken, as it is very high and maybe overly conservative.

Phase 2: Next, a number of simulations will be undertaken to refine the hydraulic design of the new overflow spillway. The objective of these runs will be to confirm the proposed length/location of the spillway and the shape/placement/length of the training walls such that the jet spread is maximized and stream power is minimized on the water surface below the dam. We believe that many of the possible configurations can be analyzed by hand to help narrow down the design alternatives to three. These three alternatives will then be tested in the CFD model, and following these simulations, a single alternative will be recommended for testing in Phase 3.

Phase 3: Once Phase 2 has been completed, runs will be undertaken to evaluate the predicted growth of the plunge pool when exposed to the more severe jet impacts associated with the operation of the new spillway configuration. Initially, simulations will be undertaken for three flow conditions (high, medium and low) assuming the existing plunge pool configuration is in place. The hydraulic conditions within the plunge pool will be evaluated and potential scour areas identified based on simulated velocities and bed pressures. These velocities and pressures will be compared to those exhibited under existing conditions, as determined in Subtask 3 above. Areas which exceed these threshold values will be flagged as potential scour zones. In

addition, Annandale's scour estimates will be refined based on the simulated flow conditions entering the plunge pool. Following this, the plunge pool will be manually "excavated" within our numerical model at the sites identified as being scour susceptible, and the flow simulations repeated. Once again flow conditions within the plunge pool will be evaluated to identify scour susceptible locations. This cycle will be repeated until a stable plunge pool configuration has been identified. It has been assumed that three such iterations will be sufficient to identify a stable scour hole configuration.

In all cases, test results will be summarized graphically, through a series of colour contour plots showing impacts on depth and velocity within the plunge pool.

(b) Deliverables

Following completion of the technical analysis, the results of the study will be summarized in a technical memorandum. This memorandum will provide further description of the FLOW3D program, the methodology of analysis, and the results of the test scenarios. Reports will be provided in stages as follows:

- Interim Report: This report will provide initial results for the existing dam design and plunge pool and establish the criteria to be used for the final report analysis.
- Final Report: This report will continue with the investigation with the raised dam design.

(c) Schedule

The Interim and Final reports will be submitted to CBS for review prior to the BOC Meeting 3 and 4, respectively, as shown in the design schedule (Section 5).

4.2.5 Task 3.5 -- Supplemental Potential Failure Mode Analysis (PFMA)

(a) Scope of Work

PFMA

Per the requirements under Part 12 Subpart D of the Commission's regulation, a supplemental PFMA is to be conducted when major modifications are to be constructed. The supplemental PFMA is to be conducted using the same procedures outlined for the Initial PFMA. The design is to be to the 50% level to enable the PFMA team to critically evaluate the modification of potential failure modes and to determine if construction of the recommended alternative may adversely impact other structures, resulting in a failure mode not considered in the initial PFMA. Therefore, this work will only commence once the general arrangement drawings are completed and when the other design studies are completed. Such documentation will be included in the Supporting Technical Information (STI) document to be provided to the Core Team prior to the PFMA session to be held in Sitka. Accordingly, the task procedures include:

- Development of the STI (it is assumed that CBS will be responsible for compiling the STI; although Hatch will provide documents related to its ongoing investigation;
- The PFMA session (Hatch will provide the Independent Consultant (IC), a facilitator collectively having expertise in geologic and civil structures; and
- Development of a Surveillance and Monitoring Plan (It is assumed that this plan will be prepared by CBS, with input from Hatch as required).

CBS should be familiar with the PFMA methodology having performed them recently for both the Blue Lake and Green Lake Dams and just recently updating (2009) the Blue Lake PFMA. It should be noted that when Projects have significant modifications to it, a more substantial scrutiny of the proposed design by FERC and the consultant may be required over what Hatch is proposing. As an example, for the Swift Project in Washington State, which involved a large rebuild of Project features, the engineering consultant had ten of their engineers participate in the PFMA session. Five representatives of FERC participated and a member of the BOC (a geologist) also participated.

As the time frame for completing the PFMA can be as long as 90 days (prescribed time in FERC regulations), Hatch is assuming that it can accelerate the schedule such that the final report be made available to FERC and BOC 30 days following the PFMA session. As FERC and the BOC will be providing input to the draft report, providing an advance copy of the report prior to the BOC Meeting No. 4 should not be required.

Surveillance and Monitoring Plan (SMP)
In connection with the PFMA, Hatch will assist CBS in updating the Blue Lake SMP, which will be of interest to both FERC and the BOC. We have assumed 8 hours of engineering time from the Independent Consultant (e.g. Jim Rutherford).

Emergency Action Plan (EAP)
In connection with the PFMA, Hatch will assist CBS in updating the Blue Lake EAP, which will be of interest to both FERC and the BOC. We have assumed 8 hours of engineering time from the Independent Consultant (e.g. Jim Rutherford).

An important element of the EAP is presenting inundation mapping from a dam break study that presents the additional flood levels associated with a larger reservoir from the 83-foot dam raise. Joe Groeneveld will be responsible for leading this study, the results of which will be used to develop modified inundation mapping. We have assumed 220 hours of engineering time would be required to setup the dam break model and produce the revised mapping series.

(b) Deliverables

- Within one month of the PFMA, Hatch will submit a dam break analyses report, which will include mapping of the flood inundation downstream of Blue Lake Dam along Sawmill Creek.
- Within one week following the PFMA session in Sitka, the Independent Consultant (IC) will transcribe the Major Findings and Understandings (MF&U) and send them to the Facilitator and core team for comment.
- Within one week following receipt of comments of MF&U, the IC will complete its draft PFMA report.
- Within one week following receipt of comments of draft report, the IC will submit the revised draft PFMA report.
- Within one week following receipt of comments of revised draft report, the IC will submit the final PFMA report.

(c) Schedule

The PFMA session will need to be conducted when all of the design analyses are completed. Assuming that the number of participants in the Core team is kept to a group familiar to the site

and the results of the previous PFMA and is knowledgeable about the Project design, then it is hoped that some of the steps listed above can be reduced or the turnaround of drafts expedited such that the final report is completed within 30 days of the PFMA session.

4.2.6 Task 3.6 - Concrete Sampling & Test Pits

(a) Scope of Work

For this task, Hatch will develop plans and coordinate with CBS to undertake the following:

- Coring approximately ten 6-inch diameter concrete samples from the dam combined with laboratory results to obtain concrete strength parameters to be used for the dam FEA.
- Test pits in the vicinity of the powerhouse structure to better identify utilities locations and depth of bedrock beneath the powerhouse structure, and the crossing location of the 30" water line and the proposed penstock.

R&M Consultants out of Anchorage has the capability to obtain the desired cores over a 1 or 2 day period. Some of the testing will be performed out of their Anchorage Office, while other testing could be performed either in Seattle or Niagara Falls.

Due to its small scope, the coring work will be performed under an existing subconsultant agreement between Hatch and R&M, while the test pits work will be directed by CBS with office input from Hatch.

(b) Deliverables

Test results and photos of concrete core locations will be provided as an addendum to the Dam Design Report.

(c) Schedule

Work in obtaining the cores could be initiated immediately with laboratory results available for the FEA analysis within two months.

Test pit excavation work is not immediately needed and can wait unit the powerhouse general arrangement is finalized.

4.2.7 Task 3.7 - Intake Structure Design

(a) Scope of Work

This work is in connection with the development of both the General Construction Contract and the Underground Construction Contract. Work includes additional design analyses in the development of the design drawings for the intake structure and gate shaft.

While the BOC recommends that a computational fluid dynamics (CFD) model be used to examine the approach flow conditions for the proposed intake and scan them for indications that vortex phenomena may occur, we believe such analysis to be unnecessary, as the proposed minimum submergence is well above industry criteria, when considering the intake design that minimizes contraction influences and provides for low inlet velocity. If additional work toward

completing the general layout arrangement and analyses indicates a need for a CFD analyses, such will be proposed as a change order to this work task. Modifications to the design will be to optimize the structure for reduced costs and for lowering the invert of the intake structure, if possible.

(b) Deliverables

The drawings to be submitted include those civil, mechanical and electrical drawings listed under the Intake Drawings and the Intake Gatehouse Drawings of Section 4.3.

(c) Schedule

The general layout drawings will be further developed and completed prior to the BOC meeting No. 3, as indicated on the design schedule (Section 5).

Once design freeze of the intake structure has been confirmed by CBS by the acceptance of the Design Criteria Manual section relating to this structure and in the completion and acceptance by CBS of the concrete outlines of the general arrangement drawings, then the final design will commence and will include the completed drawing set (95%) to be finalized prior to the BOC meeting No. 4, as indicated on the design schedule.

4.2.8 Task 3.8 -- Dam Structure Design

(a) Scope of Work

This work is in connection with the development of the General Construction Contract. Work includes additional design analyses in the development of the design drawings for the dam structure. Most of the dam analysis is performed in related tasks above.

Dam Foundation Seepage Analysis
The foundation material stability with increased head is an outstanding issue that begs resolution until more information can be gathered. The foundation may not require any additional treatment. Additional information to assess whether adequate stability is verified or whether additional treatment is required should be gathered early during construction. To this end, CBS should undertake further review of construction documentation to establish if additional information might be available with respect to the grouting program. If additional treatment is required, Hatch will develop a plan that could be performed during construction. Providing for this contingency will be made in the drawings and specifications.

(b) Deliverables

- Additional calculations related to the dam foundation stability within the river Thalweg will be prepared in a technical memorandum.
- The drawings to be submitted include those civil drawings listed under the Dam Extension Drawings of Section 4.3 plus the general arrangement drawing to be converted to 3D.

(c) Schedule

- The dam foundation stability calculation (TM-27) will be completed prior to the BOC meeting No. 3 to be held on mid to lat-July 2010, as indicated on the design schedule (Section 5). Other documentation completed at this stage includes the Interim Spillway

and Plunge Pool CFD Analyses (TM-28). Also completed will be the general layout and outline drawings of the left thrust block.

- Prior to BOC Meeting 4 to be held in January 2011, the final Dam Design Report (TM-26) and the final Spillway and Plunge Pool CFD Analyses (TM-28) and the PFMA report will be completed. With the completion of the spillway CFD analysis, the general spillway layout design drawings can be initiated.

- The 50% completed drawing set will be finalized prior to the BOC meeting No. 4, as indicated on the design schedule. The 50% drawing set is only the general layout drawings, which provides the outline of the concrete structures for the dam, spillway, intake, left thrust block, and plunge pool structures, if any.

4.2.9 Task 3.9 - BLU Powerhouse

(a) Scope of Work

This work is in connection with the development of the General Construction Contract. Work includes additional design analyses in the development of the design drawings for the powerhouse structure.

(b) Deliverables

- Calculations related to the powerhouse structure stability.

- The drawings to be submitted include those civil, mechanical and electrical drawings related to the powerhouse structure as listed in Section 4.3.

(c) Schedule

The design freeze for the BLU powerhouse structure occurs following design input by the turbine-generator procurement contractor. This includes the centerline setting of the turbine runner distributor and the dimensions of the equipment. Additionally, the applicable criteria for the Design Criteria Manual need to be finalized to the satisfaction of the CBS and BOC. Accordingly such documentation will be made available prior to the BOC meeting No. 3. Finally, the Attributes List and the equipment layout drawings throughout the powerhouse structure should be finalized to the satisfaction of the CBS.

- The powerhouse stability calculation will be completed prior to the BOC meeting No. 4, as indicated on the design schedule (Section 5).

- The 50% completed drawing set will be finalized prior to the BOC meeting No. 4, as indicated on the design schedule, which includes completion of all general layout drawings with outlines of the concrete for the powerhouse substructure.

- The 95% completed drawing set will be finalized prior to the BOC meeting No. 5, as indicated on the design schedule.

- The associated 50% and 90% specification documents to be presented are associated with the General Construction Contract documents and will be submitted for review as a single document for all civil works features.

4.2.10 Task 3.10 - FVU Powerhouse

(a) Scope of Work

This work is in connection with the development of the General Construction Contract. Work includes additional design analyses in the development of the design drawings for installation of the new generating unit within the FVU powerhouse structure.

(b) Deliverables

- The drawings to be submitted include those civil, mechanical and electrical drawings related to the FVU as listed in Section 4.3.

(c) Schedule

The design freeze for the FVU powerhouse structure occurs following design input by the turbine-generator procurement contractor. This includes the centerline setting of the turbine runner distributor and the dimensions of the equipment. Additionally, the applicable criteria for the Design Criteria Manual need to be finalized to the satisfaction of the CBS and BOC. Accordingly such documentation will be made available prior to the BOC meeting No. 4. Finally, the Attributes List and the equipment layout drawings throughout the powerhouse structure should be finalized to the satisfaction of the CBS.

- The 50% completed drawing set will be finalized prior to the BOC meeting No. 4, as indicated on the design schedule, which includes completion of all general layout drawings with outlines of the concrete demolition and limits of new concrete for the FVU turbine and generator equipment.

- The 95% completed drawing set will be finalized prior to the BOC meeting No. 5, as indicated on the design schedule.

4.2.11 Task 3.11 – Penstock Design

(a) Scope of Work

This work is in connection with the development of the General Construction Contract. Work includes additional design analyses in the development of the design drawings for the penstock installation, inclusive of a) the three thrust blocks; b) details for burying the penstock between the Lower Portal and the BLU powerhouse structure; and c) timber crib wall stability design.

The timber-crib wall stability design is still undefined with CBS providing an alternative to burying the wall with structural fill. A concept needs to be developed and agreed to that will provide a long-term solution to a structure that is deteriorating and potentially becoming unstable. Hatch will review the CBS concept and make suggestions for improvement, provide alternative cost estimates between the CBS concept and the concept presented in the DDR to establish with CBS as to the design to pursue. This will mark the design freeze for the timber wall stabilization.

(b) Deliverables

- Calculations related to the penstock structure stability and thrust block restraints;

- Calculations for stability of the timber crib wall located north of the penstock near the Lower Portal; and

- The drawings to be submitted include those civil drawings related to the penstock structure as listed in Section 4.3.

(c) Schedule

- The thrust block stability calculation and finalizing the timber-crib wall stability concept will be completed prior to the BOC meeting No. 3, as indicated on the design schedule (Section 5).
- The 50% completed drawing set will be finalized prior to the BOC meeting No. 3, as indicated on the design schedule, which permits the design freeze for this subtask. The 50% drawing set includes all general arrangement outline drawings.
- The 95% completed drawing set will be finalized prior to the BOC meeting No. 4, as indicated on the design schedule.

4.2.12 Task 3.12 – Modifications to the Existing Tunnel

(a) Scope of Work

This work is in connection with the development of the General Construction Contract. Work includes additional design analyses in the development of the design drawings for the modifications to the existing tunnel, which includes the steel-liner extensions, the rock traps, the transition connections at the concrete collar locations and the concrete plugs.

In addition to the Norwegian Geotechnical Institute (NGI) approach to lining design, the lining requirements will be evaluated using other criteria that were successfully employed in designing lining, e.g., Terzaghi, Deere, US Army Corps of Engineers, and US Bureau of Reclamation. A risk analysis will be performed using the results of the evaluation, and alternatives to meet the chosen lining requirements will be evaluated from the perspective of construction schedule and cost impact.

(b) Deliverables

- Calculations related to the steel liner requirements using USBR and COE criterion, which will supplement TM-02 work performed in Task 2.
- The drawings to be submitted include those civil drawings related to the penstock structure as listed in Section 4.3.

(c) Schedule

Design Freeze occurs with the CBS acceptance of the design freeze documents described earlier. With respect to the tunnel steel liner inserts, that portion of design freeze occurs upon the completion of the supplemental TM-02 and with CBS acceptance on the means and method of installing the steel liner inserts within the tunnel.

- The steel liner calculation will be completed prior to the BOC meeting No. 3, as indicated on the design schedule (Section 5).

- The 50% completed drawing set will be finalized prior to the BOC meeting No. 4, as indicated on the design schedule.
- The 95% completed drawing set will be finalized prior to the BOC meeting No. 5, as indicated on the design schedule.
- The associated 50% and 90% specification documents to be presented are associated with the General Construction Contract documents and will be submitted for review as a single document for all civil works features.

4.2.13 Task 3.13 – General Construction Contract

(a) Scope of Work

Similar to that described in Task Order No. 2, technical specifications for the General Construction Contract will be developed. It is assumed that the City will use EJCDC specifications for general conditions and Hatch will assist in providing input to supplemental conditions.

Contract drawings to be included are those developed in Tasks 3.7 through 3.12

On-going work to Contractor's notice to proceed (CONTRACT AWARD) date includes all of the bidding assistance items stated in the prologue of this section (Section 4.1.1). In addition, it is assumed that one of Hatch's engineer's will travel to Sitka to assist CBS with the pre-bid meeting.

(b) Deliverables

In addition to the deliverables listed in Section 4.1.1, certain design drawings will be provided, as shown in Table 4.3. Specifically, the following drawings from **Table 4.1** will be excluded:

- Contractor Staging Areas – Tunnel Adit (SA-03); and
- Reservoir Clearing Drawings – 8 sheets.

The following drawings shown in **Table 4.1** will only be used as reference drawings as they relate to procurement contracts:

- Bulkhead Gate(IG-01);
- Intake Gate (IG-02);
- Intake Tunnel Plan, Profile, etc. (T-01);
- Adit & Surge Chamber Plan, Elevation and Sections (AS-01); and
- Penstock Transitions (e.g. pipe enlargement or reduction) (M-01); and
- Utilities Plan, Sections and Details.
- Turbine – generator approved shop drawings;
- Penstock procurement approved shop drawings;
- Switchgear and transformer approved shop drawings;
- Pre-Engineered approved shop drawings;
- Gates and Hoists approved shop drawings; and
- Powerhouse overhead traveling bridge crane approved shop drawings.

The technical specifications and the contract bidding documents will be submitted for CBS review at:

- 50% completion;
- 90% completion; and
- 100% completion

This contract will include a specification of all the contractor supplied materials and equipment, e.g. station service generator

Ten (10) paper copies of the conformed contract will be prepared for CBS use. If more are required, CBS will generate additional paper copies. Hatch will be happy to produce additional copies as requested by the potential bidders; however, we will request payment of about $300 per set. It has been our recent experience, that the bidders will be happy to make use of CD and make their own copies.

(c) Schedule

The schedule as presented in Section 5 provides the intended dates for the submittal of the deliverables.

4.2.14 Task 3.14 – Underground Construction Contract

(a) Scope of Work

Similar to that described in General Construction Contract, technical specifications will be developed. It is assumed that the City will use EJCDC specifications for general conditions and Hatch will assist in providing input to supplemental conditions. Hatch will discuss with CBS the merits of various contracting approaches that address the sharing of construction site risks. Such approaches can affect bid pricing.

Prior to preparing specifications, additional design and constructability investigations will be performed to correctly plan the work. It is not expected that the analysis will be significant.

Surge Chamber Diameter: As the 25-ft diameter surge chamber will require extensive rock support system, consideration of the 20-ft diameter chamber will be revisited. It is assumed that Redpath will provide to CBS a cost estimate of each, with Hatch providing the associated rock support system to be used for each.

Intake Riser Shaft Diameter: Given the revised construction plan to evacuate a jumbo drill and mucker vehicle through the intake shaft, further construction evaluation and costs need to be assessed with Redpath's assistance.

Intake Tunnel Construction Schedule: Further assessment of the two-season construction schedule needs to be reviewed with Redpath to better assess CONTRACT AWARD date and durations of intake tunnel and gate shaft excavation duration. CBS will need to assess the effects on construction during a hydraulic wet year as well as a hydraulic dry year. Consideration of further lowering the intake invert will also be assessed.

Intake Portal Development: This includes the excavation plan and access road into the new intake tunnel to assess what can be done to improve the location and setting of the portal such that a mobile crane could at times be mobilized for ease in installing the bulkhead to service the fixed wheel gate guides.

On-going work to Contractor's notice to proceed (CONTRACT AWARD) date includes all of the bidding assistance items stated in the prologue of this section (Section 4.1.1). In addition, it is assumed that one of Hatch's engineer's will travel to Sitka to assist CBS with the pre-bid meeting.

(b) Deliverables

A supplemental technical memorandum to TM-05 will be prepared, which will provide recommendations with respect to the design and constructability issues above.

In addition to the deliverables listed in Section 4.1.1, certain contract drawings will be provided, as shown in Table 4.3. Specifically, the following drawings from **Table 4.1** will be included:

- General Project Location Map (GA-01);
- Contractor Staging Area – Dam and Intake (SA-01);
- Contractor Staging Area – Tunnel Adit (SA-02);
- Sediment and Erosion Control Plan (Dam and PH Areas) & Details (SA-04) – 2 sheets;
- Borehole Plans (BH-01) (reference drawing);
- Borehole Logs (BH-02) (reference drawing);
- Material Properties (BH-03) (reference drawing);
- Water Conveyance Plans (Tunnels and Penstocks) (GA-01) – 2 sheets;
- Disposal Areas (EX-01);
- Intake Tunnel Plan, Profile, Detailed Profile, Misc. Details (T-01) – 3 sheets;
- Typical Rock Support Details (T-05);
- Adit & Surge Shaft Plan, Elevation & Section (AS-01) – 2 sheets; and
- Concrete and Reinforcing Sections and Details (AS-02)
- Intake Portal Excavation Drawing.

(c) Schedule

The schedule is more relaxed for this contract and deliverables are generally shown in the design schedule (Section 5). It is assumed that the general layout drawings will be completed prior to the BOC Meeting No. 4 and that the final design drawings will be completed prior to Meeting No. 5. However, it is certainly realistic to accelerate the completion of these drawings if desired.

4.2.15 Task 3.15 -- Reservoir Clearing Contract

(a) Scope of Work

This task is to include the reservoir clearing contract to clear timber between the existing (El. 342) and the future (El. 425) normal maximum reservoir level.

As the requirement for producing the contract documents for reservoir clearing can be deferred until the 3rd or 4th quarter of 2011, it is likely worthwhile to wait for license amendment feedback from resource agencies before commencing with this work. Therefore, prior to or upon FERC issuance of the Project license amendment, the technical specifications will be developed.

Contract drawings will comprise of reservoir clearing drawings, which indicate the limits of clearing (assume 6 sheets). Reference drawings will indicate staging areas for the contractor use, e.g. the dam area staging site.

On-going work to Contractor's notice to proceed (NTP) date includes all of the bidding assistance items stated in the prologue of this section (Section 4.1.1). In addition, it is assumed that one of Hatch's engineer's will travel to Sitka to assist CBS with the pre-bid meeting.

(b) Deliverables

In addition to the deliverables listed in Section 4.1.1, certain design drawings will be provided, as shown in Section 4.3. Specifically, the following drawings from **Table 4.1** will be included:

- General Project Location Map (GA-01);
- Contractor Staging Area – Dam and Intake (SA-01);
- Reservoir Area Plan and Location Map (RC-01);
- Reservoir Clearing Plans (RC-02) – 6 sheets; and
- Miscellaneous Details (RC-03).

(c) Schedule

The schedule as presented in Section 5 provides the intended dates for the submittal of the deliverables.

4.2.16 Task 3.16 – BOC Meetings

(a) Scope of Work

Three meetings are scheduled to present findings to the Board of Consultants (BOC) and to the FERC, as follows:

- Meeting No. 3 via teleconference (with WebEx);
- Meeting No. 4 at 50% design completion (at SeaTac Hotel); and
- Meeting No. 5 at 95% design completion (at SeaTac Hotel).

We have assumed that Hatch participants for meeting Nos. 3 and 4 will include Steve Hart, Peter Rodrigue, Dan Curtis, Rick Donnelly, Peter Friz and Keith Moen. Meeting No. 5 will be limited to Steve Hart, Peter Rodrigue, Rick Donnelly and Keith Moen.

Similar to Meeting No. 2 held on February 11 and 12, 2010, we have assumed that from Meeting Nos. 4 and 5 that FERC staff and the BOC will arrive the night before for a two-day meeting, with the initial meeting consisting of a presentation of the design results during the first day and the BOC providing its report with recommendations to the design.

The objective of Meeting No. 3 will be to address the comments by the BOC from Meeting No. 2. Hatch will present the interim results of the Dam Design Report; Abutment Stability Design Report and the Spillway and Plunge Pool CFD analyses. We will also have final results completed for the dam foundation seepage analysis and tunnel lining design. For the intake structure, we will be in a position to discuss whether a CFD analyses is required for the intake structure and provided an update to the Intake Submergence TM, which will include any conclusions with respect to a possible need of a CFD analyses. Given the date of this meeting in mid-July 2010, Hatch will propose to present final general layout arrangement of the intake, powerhouse and penstock structures, such that BOC comments could be provided prior to commencing with the final design drawings. Given that the amount of discussion is different than what was initially suggested for Meeting No. 3, CBS may wish to consider an actual meeting at a SeaTac Hotel rather than with a conference call.

The objective of Meeting No. 4 will be to receive any final comments of the BOC and FERC prior to proceeding with final design drawings of the dam and tunnel, the structures where there is potential dam safety issues to be addressed. Accordingly, final reports for the dam design, spillway and plunge pool and dam foundation reports will be completed. Also completed will be the general layout drawings for the dam and tunnel structures, as well as final design drawings for the intake, penstock and powerhouse structures. The PFMA session will have been completed and a final report provided to the BOC and FERC.

The objective of Meeting No. 5 is to present the drawings and specifications for the General Civil Works and Tunnel Construction Contracts prior to issuance for bid.

(b) Deliverables

In connection with each BOC meetings, Hatch will perform the following:

- Prepare Microsoft power point presentation material;
- Prepare meeting minutes of the meeting; and
- Provide draft responses to the BOC comments.

(c) Schedule

The schedule as presented in Section 5 provides the intended dates for the submittal of the deliverables. Meeting 3 (conference call principally on interim dam FEA, spillway CFD and left abutment thrust block design study) will occur on mid to late July, 2010. Meeting No. 4 will occur in mid-January, 2011; and Meeting No. 5 will occur in July, 2011.

4.2.17 Task 3.17 -- Construction Cost Estimates

(a) Scope of Work

Previously, cost estimates were prepared for the DDR based on:

- Civil works cost estimates prepared by a construction engineer when considering labor rates in Alaska, construction practices (6 day work week) in Alaska and conditions of a remote site that can slow construction progress;
- Underground construction costs based on estimates prepared by Redpath, who had the opportunity to visit the site;
- Equipment procurement pricing based on in-house cost data and recent procurement contracts and bids of similar equipment; and
- Construction bids on previous contract work in similar environment.

Construction quantities were roughly approximately estimated to a reasonable level of accuracy. A fairly high contingency factor was used (25%) despite the availability of good geotechnical base-line data from an exploratory field program. Construction cost estimates will be prepared for the following milestone completions:

- 50% Design Completion;
- 95% Design Completion;
- Prior to Bid; and

As the Turbine-Generator contract will have actual bid pricing for the equipment being tendered, the level of accuracy of Project costs will increase with a higher level of certainty. Recent construction bids indicate that contractors are becoming more aggressive with lower bids for both construction and procurement. Hopefully, this will be indicative of good bid timing by CBS.

As many of the procurement contracts are being issued prior to the 50% design completion date; Hatch will revisit the previous pricing as presented in the DDR and provide an updated equipment pricing by obtaining price quotes from potential procurement contractors.

For the construction contracts, which will not be issued for bid until next year, Hatch will provide an overall updated construction cost update based on the refinement of the Project design. Prior to each cost estimate submission, Hatch and CBS will collectively decide on a reasonable construction contingency, which could be different for civil and electro-mechanical equipment items depending on the perceived risk of change orders and claims.

The major civil costs for the project (excavation, demolition, backfill, formwork, concrete, reinforcing steel, structural steel, etc.) for the powerhouse, intake and conduits (tunnels and penstocks) will be determined on a unit price basis, using quantities taken from the engineering design drawings. Unit prices will be taken from recent construction contracts in the contiguous U.S., with adjustment for escalation. Corrections for labor and material rates in Alaska will be factored into the evaluation. As a check on the cost estimate, we will also provide cost estimates with contractor type input (bottom up approach) for the significant features requiring attention, such as for the dam raise, spillway, powerhouse and penstock structures and for the tunneling work. The bottom up approach for the underground construction will be obtained from Redpath as before in the DDR (Task Order 1).

Installation costs for electrical and mechanical equipment for similar projects with which we are familiar will be added to the associated supply costs.

If the City wishes to have a fully-loaded capital cost estimate as previously provided in the DDR, we will review financing assumptions in order to derive capital requirements for Project development.

(b) Deliverables

In connection with this task, Hatch will provide the following deliverables:

- Engineer's estimate for each of the following procurement contracts:
  - 12.47kV switchgear;
  - Station service switchgear and 480V transformer;
  - Gates and hoists;
  - Penstock and tunnel liner extensions;
  - Main transformers;
  - Powerhouse crane; and
  - Powerhouse steel building.
- Detailed construction cost estimate at 50% design completion; and
- Detailed construction cost estimate per construction contract prior to issuance of bid:
  - General Construction Contract;
  - Underground Construction Contract; and
  - Reservoir Clearing Contract.

(c) Schedule

The schedule as presented in Section 5 provides the intended dates for the submittal of the deliverables.

4.2.18 Task 3.18 Project Management

(a) Scope of Work

This item includes management of the Hatch team and related budgets and schedule, and general administration (cost reports, invoicing etc.) that cannot be assigned to a specific task. Also included are various meetings related to the review of Project work.

Progress Reports and Monthly Invoices
A progress report will be submitted during Hatch's billing cycle near the end of each month. Accompanying the invoice will be a brief progress report stating a summary of the activities completed last month and what activities are expected to occur during the previous month. The engineering schedule for the Task 2 and Task 3 will be updated each month and included with the progress report. Similar to what was provided for Task Order No. 1, Hatch will also include a cost report that tracks our budget with respect to percent completion of each task. We generally believe it best to minimize the number of sub work orders for tracking purposes and plan on providing a number for each of the 26 subtasks described herein.

Conference Calls
With work occurring at various offices and with ongoing input by the CBS, brief conference calls on a weekly basis is planned initially, which at times could be relaxed to bi-weekly. The higher frequency of such calls is needed to ensure that all parties are focused on the tasks at hand and such that important decisions can be made quickly once sufficient information has been gathered and evaluated. Participants of the Call should generally always include Dean Orbison and Paul Carson of CBS and Steve Hart and Peter Rodrigue of Hatch, with others being brought into the conference call as required depending on the agenda items to be discussed. The purpose of the meetings is to ensure that people are focused on the right tasks and do not misunderstand their assignments.

The total number of conference calls assumed under this task is 52 that will be attended by up to 6 Hatch engineers with an average duration of 1 hour, or total budget allowance of 312 hours. Brief meeting minutes will be prepared and distributed at an additional budget allowance of 40 hours. Internal review meetings of Hatch staff are assumed to account for an additional 280 hours.

There will also be a number of individual feature-based conference calls to discuss the design of individual project features, the progress of major modeling or design analyses, the resolution of CBS comments on specific submittals, etc. These calls will occur as needed and are considered part of the design sub-tasks for the project.

Review Meetings
CBS/Hatch Review Meeting No. 1 (Amherst)
We have assumed that a Task Order 2 and 3 scoping meeting be held in Amherst over a 3 day period (May 4 -6), similar to what occurred for Task Order 1. Other items to be included in the agenda will be to review:

- Additional input to the Design Criteria Document and the Attributes List.;
- Document communication protocol with Microsoft SharePoint, or equal;

- Review status of the Bidding Process, e.g., addendums to contract; questions to bidders, etc.
- Review of Intake Structure General Arrangement;
- Review of Tunnel Tie-In Structures;
- Review of Powerhouse General Arrangement;
- Review of Utilities Relocation; and
- Review of Penstock General Arrangement.

For bullet items 4 through 8 above, discussions should focus on what remaining revisions to the design are needed to establish Design Freeze. The penstock general arrangement might be near the point of design freeze. However, the timber wall shoring concept should first be finalized.

For this task, we have assumed that Hatch core participants for meetings in the Amherst Office will include Steve Hart, Peter Rodrigue, Mike Dumont and Steven Perkins. For meetings to discuss the dam design approach, we will travel to the Niagara Falls Office and talk with Dan Curtis, Allen Mee and Rick Donnelly. Other folks brought into the discussion will include Glen Holden, Chris May, Hans de Meel and Harbinder Gill. In discussing the CFD model, we will conference in Joe Groeneveld from our Calgary Office and utilize WebEx, if needed.

To better facilitate review of contract documents, we recognize that additional meetings are needed for better review progress rather than accomplishing such through exchange of documentation. The following additional meetings are proposed, but could be modified later, as requirements dictate:

CBS/Hatch Review Meeting No. 2 with Glenn Holden and Bob Dryden traveling to Sitka for a 2 day meeting (occurring in April 2010):

- Review of 12.47 kV Switchgear Procurement;
- Review Switchyard design; and
- Review of Main Transformer Procurement;
- Review of Turbine Generator spec.

CBS/Hatch Review Meeting No. 3 with Dean Orbison, Paul Carson and Steve Hart traveling to Amherst for a 3 day meeting (occurring in early mid-July 2010):

- Review of Intake Structure Arrangement Drawings toward obtaining CBS acceptance for design freeze (with Joe Groeneveld & Mike Dumont; Steve Perkins);
- Review of 50% Timber Wall Shoring Design and obtain CBS acceptance for design freeze (with Steven Perkins);
- Review of Penstock General Arrangement and obtain CBS acceptance for design freeze (with Chris May);
- Review 50% Utilities Relocation and obtain CBS acceptance for design freeze (with Steve Perkins);
- Review Turbine-Generator supplier preliminary input to BLU powerhouse general arrangement (with Peter Rodrigue);
- With the exception of the turbine-generator setting, review powerhouse general arrangement toward obtaining CBS acceptance for design freeze (with Peter Rodrigue, Glen Holden and Steven Perkins);
- Review of Tunnel Lining Design with supplemental TM-02, e.g. lining requirement with USBR and COE criteria (with Rick Donnelly);
- Review Left Abutment Block Analyses (TM-29) and set up for basic design of Left Abutment Thrust Block (with Rick Donnelly and Peter Friz via phone);
- Review the revised 3-D model setup of proposed dam raise structure with the proposed thrust block and spillway structure (with Dan Curtis);
- Review initial setup of the spillway and plunge pool CFD analyses (Interim Report TM-28) (with Joe Groeneveld via phone); and

- Review agenda for BOC Meeting No. 3, which will focus on answering more completely BOC comments from BOC Meeting No. 2 and potential design freeze of above mentioned structures.

CBS/Hatch Review Meeting No. 4 with Dean Orbison, Paul Carson and Steve Hart traveling to Amherst for a 3 day meeting (occurring in September 2010):

- Review of Gates and Hoists Procurement Contract (with Chris May);
- Review of Penstock & Lining Extension Procurement Contract (with Chris May);
- Final Review of General Layout drawings of Intake, Powerhouse and Penstock, if necessary (with Peter Rodrigue, Steve Hart and others, as required);
- Review Final Spillway and Plunge Pool CFD analyses (TM-28) (with Joe Groeneveld via phone);
- Review interim status of dam FEA analyses and left abutment analyses (with Dan Curtis and Rick Donnelly)
- Review of 50% Existing Tunnel Modifications (with Rick Donnelly and Dean Brox via phone).

CBS/Hatch Review Meeting No. 5 with Dean Orbison, Paul Carson and Steve Hart traveling to Amherst for a 2 day meeting (occurring in November 2010):

- Review of 90% Bridge Crane Procurement Contract (with Peter Rodrigue);
- Review of final Dam Design Report (TM-26) (with Dan Curtis);
- Review of final Dam Foundation Report (TM-30) (with Rick Donnelly and Steven Perkins);
- Review plans for PFMA analyses and compiling STI; and
- Review agenda for BOC Meeting No. 4 for presentation of 50% completion to occur in mid December 2010 in Seattle or early January 2011.

CBS/Hatch Review Meeting No. 6 with Dean Orbison traveling to Seattle for a 2 day meeting and Paul Carson participating (in November 2010):

- Review of 50% Underground Contract design drawings (with Dean Brox traveling from Vancouver);
- Review of Revised Construction Schedule and Construction Cost Estimate (with Dick Freeman).

CBS/Hatch Review Meeting (3 additional) with Two Hatch Engineers traveling to Amherst or Seattle for a 2 day meeting (Undefined):

CBS/Hatch Review Meeting (undefined) CBS may elect to have Paul Carson travel to Amherst to work with the Project Engineer as the need may arise. These meetings could be monthly during the design effort.

(b) Deliverables

In connection with this task, Hatch will provide the following deliverables:

- For each meeting, brief meeting minutes will be prepared with action items and progress report of % completion.
- Monthly invoices will include a monthly progress and budget report.

(c) Schedule

Meetings will be scheduled as work progresses. Meeting minutes will be issued prior to the next meeting, and within a few days of the meeting.

4.3 Preliminary List of Contract Drawing

Hatch has developed a consolidated list of drawings to be used for the eleven (11) envisioned procurement and construction contracts. The numbering convention will be similar to that adopted for the Green Lake Project contract drawings in 1979. The March 2, 2010 letter from Currents Consulting (Paul Carson) to CBS will be used for the numbering system. The contract drawing numbers and titles for each contract will be based on this numbering system. A preliminary list of each contract's drawings will be developed at the start of the Task2/3 work.

A list of all the design drawings on the project follows below. This list will be broken down into the contract drawing lists at the start of the Task 3 design effort.

Drawings will be filed electronically by Title, drawing number and issue date similar to other project documents.

Table 4.1 – List of BLU Drawings for Construction and Procurement Contracts

Page Count	Hatch Code	Description	Contract	Reference Copy	Comments
		General Drawings			
1	G-01	Cover Sheet	11	9,10	
2	G-02	Drawing List	11	9,10	
1	G-03	Legends and Abbreviations	11	9,10	
1	G-04	General Project Location Map**	11	1, 9,10	
1	R-01	Blue Lake Reservoir and Area Capacity (w/ Rule Curve)**	11	9,10	
1	SA-01	Contractor Staging Areas - Dam & Intake**	11	9,10	
1	SA-02	Contractor Staging Areas - Sawmill Creek Industrial Park	11	9,10	
1	SA-03	Contractor Staging Areas - Tunnel Adit	11	9,10	
2	SA-04	Sediment and Erosion Control Plan (Dam & PH Areas) & Details	11	9,10	
		Existing Conditions (see also reference drawings)			
4	ET-01	Existing Tunnel Survey - Plan & Profile**	11		
2	ET-02	Existing Tunnel Survey – Sections**	11		
1	ET-03	Existing Utilities Plan (PH area)**	11		
		Borehole Plans and Logs			
4	BH-01	Borehole Plans**	11		
3	BH-02	Borehole Logs	11		
1	BH-03	Material Properties	11		
		Reservoir Clearing			
1	RC-01	General Area Plan and Location Map	10		
6	RC-02	Plans	10		Sheets dictated by scale.
1	RC-03	Miscellaneous Details	10		
		General Arrangement Drawings			
1	GA-01	Intake Area Plan (Convert to 3D)**	11	4, 9,10	
1	GA-02	Dam Area Plan (Convert to 3D)**	11	10	
2	GA-03	Water Conveyance Plans (tunnels & penstocks)**	11	9,10	
7	GA-04	Powerhouse GA's (6 existing + 1 spare)**	11	7	3 clearance drawings for Contract 7
2	GA-05	Powerhouse Final Grading & Drainage Plan	11		
		Cofferdams			
2	CF-01	Powerhouse Cofferdam - Plan, sections & details**	11		May not need.
		Excavation Drawings			
3	EX-01	- Intake Excavation (includes Access Road)**	11		
1	EX-02	- Gate Shaft**	11		
1	EX-03	- Dam Abutment Excavations	11		
1	EX-04	- Plunge Pool Tailout Wall Excavation**	11		May not need.
4	EX-05	- Powerhouse Excavation (includes Access Roads & Penstock)**	11		
1	EX-06	- Disposal Areas (drawing allowance)	11	9	
2	EX-07	- Adit & Surge Shaft**	11	9	
		Dam Extension			
3	DE-01	Dam Wall Geometry – GA Plan, Section & Details**	11		

Page Count	Hatch Code	Description	Contract	Reference Copy	Comments
1	DE-02	Demolition Details	11		
3	DE-03	Left & Right Abutments (see MS-04 for Rock Anchor Details)**	11		
1	DE-04	Spillway Details	11		
5	DE-05	Concrete & Reinforcing (Dam Raise, Abutments, Spillway)	11		
2	DE-06	Plunge Pool Plan & Tailout Wall Concrete & Reinforcing**	11		
1	DE-07	Howell Bunger Valve Replacement	11		
2	DE-08	Grouting - Plan and Section	11		
		Intake Drawings			
		- Civil			
2	IC-01	Plans & sections with reinforced concrete superstructure**	11	4	
3	IC-02	Concrete & Reinforcing (incl. Crane pad wall)	11		
1	IC-03	Trashrack Guides	11		
1	IC-04	Trashracks	4	11	
2	IC-05	Bulkhead Gate Guides	11		
		- Mechanical			
2	IG-01	Bulkhead Gate **	4	11	
		- Electrical			
1	IE-01	Water pressure transducers	11		
		Fixed Wheel Gate House Drawings			
		- Civil			
2	GH-01	Fixed Wheel Gate Embedments (guides, etc.)	4	11	
3	GH-02	Gate House (Plan, sections, elevation & details)	11	4	
3	GH-03	Gate House Concrete & Reinforcement	11	4	
		- Mechanical			
3	IG-02	Fixed Wheel Gate**	4	11	
1	IG-03	Fixed Wheel Gate Hoist (including framing)	4	11	
1	IG-04	Misc. Mechanical (louvers, pumps, heating, etc)	11		
2	IG-05	Fixed Wheel Gate Embedments (guides, etc.)	4	11	
		- Electrical			
1	IE-01	Gate House Single line	11		
1	IE-02	Gate House Physical Arrangement	11		
1	IE-03	Gate House Lighting, Outlets & Grounding	11		
1	IE-04	Gate House Cable Schedule	11		
		Tunnel Drawings			
3	T-01	Intake Tunnel Plan, Profile, Detailed Profile, and Details**	9	11	
2	T-02	North Portal Plan & Portal (new liner, etc.)	11	5	to be sent to the pipe supplier so he cuts the ends correctly, etc.
2	T-03	South Portal Plan & Profile (new liner, etc.)	11	5	
2	T-04	Lower Portal Plan & Profile (new liner, etc.)	11	5	
2	T-05	Typical Rock Support Details & Tunnel Plugs	9		Concrete plug is in Contract 11
2	T-06	Typical Steel liner Details (common to 3 areas)	11	5	

Page Count	Hatch Code	Description	Contract	Reference Copy	Comments
		Adit & Surge Shaft Drawings			
2	AS-01	Adit & Surge Shaft Plan, Elevation & Section**	9	11	
1	AS-02	Concrete & Reinforcing Sections & Details	9	11	
		Penstock			
1	PS-01	Existing Penstock Demolition	11	5	
3	PS-02	Penstock Plan & Profile**	5, 11		
3	PS-03	Manifold Plan, Sections & Details**	5	11	
1	PS-04	Penstock Elbows**	5	11	
3	PS-05	Anchor Blocks - Plans & Sections - Concrete & Reinforcing**	11	5	
1	PS-06	Lower Portal Plan, Section & Elevation	5, 11	9	
1	PS-07	Retaining Wall at Portal (Timber Crib)	11	5	
2	PS-08	Misc Penstock Details (man holes, pipe taps, etc.)	5	11	
1	PS-09	Penstock Drain Valve & Vault (24-inch Drain Line)	5	11	
		Substation			
1	EES-01	Modifications to Existing Substation - 69kV - General Arrangement	11	6	
1	EES-02	El 38.75	11		
1	EES-03	El 48, El 42	11		
1	EES-04	El 60, El 54	11		
1	EES-05	Sections A-A, B-B, C-C	11		
1	EES-06	Sections D-D, E-E	11		
		Architectural Details			
1	PA-01	Misc. Windows & Doors	11	8	Steel Build Supplier needs this information for the box-outs.
1	PA-02	PH Roll-up Doors	11	8	
2	PA-03	PH Roofing & Flashing	11	8	
1	PA-04	Gate House Roofing & Flashing	11		
1	PA-05	PH Air vent Louvers , ducts & vents	11	8	See above comment
		Miscellaneous Civil Details			
2	MS-01	Fencing, Waterstop, Drainage Details, etc.	11		
2	MS-02	Miscellaneous Metals (stairs, grating, handrail, ladders, etc.)	11		
2	MS-03	Concrete & Reinforcing Details (box-outs, penetrations, etc.)	11		
2	MS-04	Rock Anchor Details & Schedule Tables (PH, Dam, Cofferdam)	11	9	
1	MS-05	Piezometers & Geotechnical Instrumentation Details	11		
1	MS-06	Dam Movement Instrumentation	11		
		Powerhouse Drawings			
		- Civil Drawings (see also GA's)			
2	SS-01	Superstructure Structural Steel	8	11	
1	SS-02	Stair Tower	11	8	
1	SS-03	Mono-rails & hoists	11	8	
2	SS-04	Crane Runway (Plan, Section & Details)	7	8,11	
1	C-01	Concrete Notes & Laps & Embedments	11		
6	C-02	Concrete & Reinforcing Plans, Sections, Elevations & Details	11		

Page Count	Hatch Code	Description	Contract	Reference Copy	Comments
1	C-03	Floor Hatch Details	11		
3	C-04	Concrete Draft Tube Details	11		
2	C-05	Weir Plan & Details	11		
2	C-06	Raw Water Supply Sump & Conduit	11		
1	C-07	Masonry Wall Details	11		
1	C-08	Misc. Steel Details (typical Stairs, ladders & pit covers)	11		
2	C-09	Floor Drainage Plans, Sumps and Pits	11		
1	C-10	Conduit Runs to the Existing Blue Lake powerhouse	11		
2	C-11	Existing Utilities Relocation (for Utilities Relocation Contract)		11	
		- Mechanical Drawings			
2	M-01	Penstock Transitions	5	11	
3	M-02	Turbine General Arrangement (BLU)	1	11	
3	M-03	Flow Diagrams (drainage, unwatering, raw water, service water)**	11		
3	M-04	Flow Diagrams (fire protection, compressed air)**	11		
4	M-05	Embedded Piping	11		
6	M-06	Exposed Piping and Equipment	11		
2	M-07	HVAC Systems (PH & Gate House)	11		Gatehouse: Heat only
1	M-08	Powerhouse Crane Clearance Diagram	7	11	
		- Electrical Drawings			
1	E-01	69kV - 12.47kV Main - Single Line Diagram**	1	2,3,6,11	
1	E-02	480V Main - Single Line Diagram**	1	2,3,6,11	
1	E-03	Control Block Diagram**	1	2,3,6,11	
4	E-04	Electrical Physical Arrangements (Conduits & Cable Trays)	11	2,3,6	
1	E-05	Cable Schedules	11	2,3,6	
2	E-06	Lighting & Receptacles	11	2,3,6	
1	E-07	Exposed Grounding	11		
1	E-08	Embedded Grounding	11		
1	E-09	Misc Details (conduit duct bank details, etc.)	11		
1	E-10	Oil containment diagram	11		
2	E-11	Fire Protection & Suppression Plan	11		
4	E-12	Interconnection Diagrams	11	2,3,6	
6	E-13	Modify existing drawings (Allowance)	11	2,3,6	
		- Miscellaneous Electrical Drawings			
1	EM-01	Utilities Plan, Sections and Details	11	2,3	
1	EM-02	Ties to the Existing BL Powerhouse	11	2,3	
1	EM-03	Cable Schedule	11	2,3	
1	EM-04	Raw Water Supply – SLD	11		
1	EM-05	Raw Water Supply – GA and Grounding	11		

** Reuse and develop further from DDR (Task Order 1)

Table 4.2 – List of FVU Drawings for Construction and Procurement Contracts

Page Count	Hatch Code	Description	Contract	Reference Copy	Comments
		Cover Sheet (Separate from Main Project)	11	1,9,10	See Table 4.1
		Drawing List	11	1,9,10	See Table 4.1
		General Drawings			
		General Project Location Map**	11	9,10	See Table 4.1
1	SA-05	Contractor Staging Areas - FVU & Camp Ground	11	9,10	
		Existing Conditions (see also reference drawings)			
		FVU Powerhouse Drawings			
		- Civil Drawings			
1	SS-07	Miscellaneous Steel: Monorails & hoists	11		
		Concrete Notes & Laps & Embedments			See Table 4.1
3	C-12	Concrete & Reinforcing Plans, Sections, Elevations & Details	11		
1	C-13	By-pass Valve Modifications	11		
		- Mechanical Drawings			
1	M-09	Penstock Transitions			
1	M-10	Turbine General Arrangements (FVU)	1	11	
1	M-11	Piping & Cooling Water Systems	11		
1	M-12	Bypass Valve Modifications	11		
		- Electrical Drawings			
1	E-14	FVU - Single Line**	11		
1	E-15	FVU - Control Block Diagram	11		
3	E-16	FVU - Electrical Physical Arrangements (Conduits & Cable Trays)	11		
1	E-17	FVU - Cable Schedules	11		
1	E-18	FVU - Misc. Details (conduit duct bank details, etc.)	11		
2	E-19	FVU - Interconnection Diagrams	11		

4.4 Document Control

Document management and file naming conventions shall be as follows, for all information to and from CBS.

File names: Alpha numeric with narrative and date. Date format shall be mmddyy

Example for Technical Memorandum No. 4 Surge Chamber Analysis 90 percent draft issued on March 15, 2010:

File name: TM4 Surge Chamber Analysis 90percent draft 031510.doc

Reviewer's edits shall be made using track changes and the edited file shall be renamed with the reviewers' initials. The date in the file name does NOT change until all the reviews of this document are complete and the next milestone issue of the document is prepared. Example for reviewed memo comments on Technical Memorandum No. 4 Surge Chamber Analysis:

File name: TM4 Surge Chamber Analysis 90percent draft 031510 do ptc.doc. (This version includes comments from Dean Orbison and Paul Carson on the 90 percent document.

Final Published documents shall be in .pdf format. In general, published documents shall be compiled such that a small number of files are published for a given milestone. For example, the compiled file for the Turbine generator conformed contract might have a single file:

- Contr 1 Supply Turb Gen - conformed contract 071510.pdf

If the file sizes are too large, a logical breakdown of the files should be used, for example splitting the general and supplementary conditions from the technical specs and drawings, for the general contract.

Pdf drawing files shall be compiled pdf documents, such that groups of drawings are in a single file, up to a reasonable limit of file size (approx 8 mb max).

Document naming and numbering conventions for use on the SharePoint web site for managing the procurement and construction contracts will be provided by CBS to Hatch.

5 Schedule

The schedule as shown in **Figure 5.1** (attached) for completing the design studies, drawings and contract documents for the Blue Lake Expansion Project is based on a notice to proceed date of March 30, 2010. The dates will need to be revised as needed once NTP is issued by CBS.

The schedule was generally created to establish dates critical for issuance of equipment procurement Contract Award such that equipment with long lead time requirements are delivered on to allow most construction completion prior to the 2013 outage. For example, the key delivery dates and provided lead times are as shown in **Table 5.1**.

Table 5.1 – Delivery Schedule of Major Equipment

Supply Contract Item	Notice to Proceed Date (Manufacturing)	Delivery Date	Duration (months)
Turbine and Generator Equipment	Mar 18, 2011	Dec 1, 2012	16
12.47 kV Switchgear	Flexible		
Sta. Service Switchgear & 480V Transformer	Flexible		
Gates and Hoists	Apr 2, 2011	May 1, 2012	13
Penstock & Tunnel Lining Extension	Jul 26, 2011	Mar 21, 2012	8
Main Transformer	Jan 2, 2012	Mar 1, 2013	14
Bridge Crane (could be delivered by Sept. 2012)	Feb 1, 2012	Sept 1, 2012	7
Steel Pre-Engineered Building	Oct 1, 2011	Aug 1, 2012	10

It may be advantageous to delay the notice to proceed for manufacture until receipt of the FERC license amendment. Contract award can be made earlier, and where the supplier's design information is required by Hatch to complete the project design, the suppliers can be given a notice to proceed for design. Early design is particularly necessary for the turbine and generator equipment. Where schedule dictates, notice to proceed for manufacture will be necessary prior to receipt of the FERC license amendment.

The design work and contract development of the General Civil Works Contract is generally on the critical path of development with a tight schedule. The design analysis for the dam works requires a substantially long lead time to develop the interim and final reports for the FEA. The interim reports for these analyses as well as for the thrust block and intake CFD will be submitted in mid-July 2010, or prior to the BOC Meeting No. 3. This meeting will provide input from the BOC and FERC on their satisfaction with the direction of the Hatch analyses and respond to the BOC comments from Meeting No. 2. With their input, Hatch will then continue with its completion of analysis of these structures and have final analyses performed and reports prepared by December 1, 2010. The PFMA requires that all documents related to Project safety be 50% complete before such an analysis can commence. Therefore, the PFMA session is assumed to start shortly after this data is available, and that the completion of the PFMA can be accomplished within 30 days. As the FERC prescribed timeline for the PFMA activity allows for up to 90 days, there is a possibility of a delay for the BOC Meeting No. 4 in reviewing the 50% completion design documents, which must include the PFMA report. However, some BOC members and FERC staff will be involved in the PFMA, which will eliminate a requirement to submit the report for review 2 weeks in advance of the BOC meeting. Nevertheless, Hatch will try to obtain their cooperation in the parties to expedite their review of the

PFMA document. While the BOC may consider this the 50% completion date for the dam structure, the other structures (intake, powerhouse, and penstock) need to be more advance by this time, which the design schedule and work approach reflects.