



Public Works and  
Government Services  
Canada

Travaux publics et  
Services gouvernementaux  
Canada

Requisition No. EZ108-151488

MERX I.D. No. \_\_\_\_\_

**SPECIFICATIONS**

for

Esquimalt Graving Dock

825 Admirals Road Victoria, BC

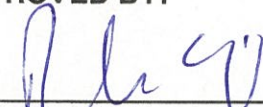
**PENSTOCK GATE AND CYLINDER REFURBISHMENT,**

**INSTALL AUXILIARY SAFETY GATE**

Project No. R.016116.098 and R.016116.114

November 2014

**APPROVED BY:**

  
\_\_\_\_\_  
Manager A&E Resources

2014-11-24  
Date

  
\_\_\_\_\_  
Construction Safety Coordinator

2014-11-24  
Date

**TENDER:**

  
\_\_\_\_\_  
Project Manager

NOVEMBER 21, 2014  
Date

**SPECIFICATIONS**

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1. **RELATED SECTIONS** .1 Section 011155 – General Instructions
2. **WORK COVERED BY CONTRACT DOCUMENTS** .1 Work of this contract includes a refurbishment of the existing main tunnel gate and frame elements, refurbishment of the six penstock gates, frame elements, and hydraulic cylinders, and construction of a new auxiliary safety gate. The site is located at the Esquimalt Graving Dock, 825 Admirals Road, Victoria, B.C. Work is comprised of tasks listed in Section 011155 item 2.2
3. **CONTRACT METHOD** .1 Lump Sum for all work unless specified otherwise.  
.2 For epoxy patch repairs to gate leafs and guides as described in Section 35 60 00 refurbishment of Penstock Gates and Gate Supports, unit price.
4. **WORK BY OTHERS** .1 Co-operate with other Contractors on site in carrying out their respective works and carry out instructions from the Departmental Representative.  
.2 Co-ordinate work with that of other Contractors. If any part of the work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Departmental Representative, in writing, any defects which may interfere with proper execution of work.
5. **WORK SEQUENCE** .1 Construct work in stages to accommodate continued use of premises in immediate surrounding areas.  
.1 Dry dock flooding and dewatering operations will be suspended during scheduled windows to facilitate work as indicated:  
.1 January 5 to February 5, 2015: Main gate and Penstocks #4, 5, 6 and watering/dewatering tunnels must be fully operational at the end of the work day on February 5, 2015 for planned dry dock operations.  
.2 February 9 to February 25, 2015: Main Gate, Penstocks #1, 2, 3 and watering/dewatering tunnels must be

fully operational at the end of the work day on February 25, 2015 for planned dry dock operations.

- .3 March 13 to March 26, 2015: Main gate, Penstocks#1 through #6, Auxiliary Safety Gate and watering/dewatering tunnels must be fully operational at end of work day on March 26, 2015 for planned dry dock operations

- .2 Do not restrict use of other areas of the Graving Dock by others due to the work of this Contract until acceptable alternate access is provided.

- .3 Maintain fire access/control.

## **6. CONTRACTOR USE OF PREMISES**

- .1 Moderate restricted use of site as it is an active ship repair and maintenance facility.

- .2 Co-ordinate use of premises under direction of Departmental Representative.

- .3 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative.

- .4 At completion of operations the condition of existing work must be equal to or better than that which existed before new work started.

- .5 Obtain and pay for use of additional storage or work areas needed for work under this contract.

- .6 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.

## **7. CONCURRENT OCCUPANCY**

- .1 During the entire construction period, PWGSC and others will occupy adjacent areas for execution of normal operations and other work.

- .2 Co-operate with Departmental Representative in scheduling operations to minimize conflict and to facilitate usage of adjacent areas by others. In the event of a conflict the Contractor will accommodate changes to their operations to minimize interference with Esquimalt Graving Dock operations at no additional cost to PWGSC.
- 8. **PWGSC AND CONTRACTOR RESPONSIBILITIES**
  - .1 PWGSC Responsibilities:
    - 1. Removal of debris in proposed work areas, arrange for delivery of up-to-date utility location information, safety requirements, and any site specific work policies.
  - .2 Contractor Responsibilities:
    - 1. Designate Submittals and delivery date for each product in progress schedule.
    - 2. Review all submittals and contract requirements. As soon as it becomes apparent, submit to Departmental Representative written and verbal notification of observed discrepancies or problems anticipated due to non-conformance with Contract Documents.
    - 3. Provide any installation inspections required by public authorities.
    - 4. Receive and unload products and equipment at site.
    - 5. Inspect deliveries jointly with Departmental Representative, record shortages, and damaged or defective items.
    - 6. Handle product at site, including uncrating and storage.
    - 7. Protect product from damage.
    - 8. Repair or replace items damaged by Contractor or subcontractor on site (under their control).
- 9. **EXISTING SERVICES**
  - .1 Notify Departmental Representative of intended interruption of services and obtain required permission. Where work involves breaking into or connecting to existing services, contractor shall submit a written request to the Departmental Representative a minimum of 48 hours prior to the event. The contractor will not proceed until approval

has been granted. The PWGSC Departmental Representative will make all reasonable efforts to accommodate the request; however rescheduling of interruption of services may be required due to facilities operation priorities.

- .2 Minimize duration of interruptions, and where required, provide temporary services to maintain critical systems.
- .3 Provide alternative routes for personnel and vehicular traffic.
- .4 Establish location and extent of service lines in area of work before starting work. Notify Departmental Representative of findings.
- .5 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility including power and communication services. Adhere to approved schedule and provide notice to affected parties.
- .6 Provide temporary services, when directed by Departmental Representative to maintain critical systems.
- .7 Provide adequate bridging over trenches which cross roads or walkways to permit normal traffic.
- .8 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .9 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in a manner approved by Departmental Representative.
- .10 Record locations of maintained, re-routed and abandoned service lines.
- .11 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

**END OF SECTION 01 11 00**

1. **CODES**
  - .1 Perform work to CURRENT Codes, Construction Standards and Bylaws, including Amendments up to the TENDER closing date.
  
2. **DESCRIPTION OF WORK**
  - .1 Work under this Contract covers refurbishment of the penstock main gate, refurbishment of the six penstock gates and hydraulic cylinders, and provision and installation of a new safety gate in the auxiliary tunnel at:  
  
Esquimalt Graving Dock  
825 Admirals Road, Victoria, BC.
  - .2 Work to be performed under this Contract includes, but is not limited to, the following items covered further in the Contract documents.
    - .1 Penstock Main Gate Refurbishment:
      - .1 Remove existing metal cylinder enclosure and concrete roof slab from Main Gate building for crane access to gate.
      - .2 Remove Main Gate cylinder and store and protect on site for reinstallation.
      - .3 Disconnect electrical lighting, gate indicators and related ancillary components. Store and protect for reinstallation.
      - .4 Remove main gate leaf and bolted guide flange for refurbishment.
      - .5 Remove existing brass wear strips from gate guide and gate leaf to allow for cleaning, inspection, and coating. Existing wear strips to be reinstated after work on gate leaf and guides is completed.
      - .6 Clean gate leaf and guide for NDT testing by others.
      - .7 Repair or replace worn parts as indicated in Section 356000 Refurbishment of Penstock Gates and Gate Supports and as directed by Departmental Representative based on

- results of NDT testing by others.
- .8 Prepare gate and guide surfaces and recoat.
- .9 Reinstall wear strips, gate, cylinder, guide flanges, gate level indicator and ancillary components. Purge hydraulic reservoir and verify normal operating conditions.
- .10 Reinstall and make good electrical lighting, gate indicators and related ancillary components.
- .11 Reinstall roof slab and metal enclosure to original condition.

**.2 Penstock Gates and Cylinder Refurbishment:**

- .1 Remove existing skylights and gate position indicator arms at penstock room for crane access to penstock gates.
- .2 Remove six (6) penstock gate leafs
- .3 Remove six (6) gate hydraulic cylinders
- .4 Clean gate leafs, guides, wedges, cylinders, and thimbles for NDT testing by others.
- .5 Replace or repair worn parts as indicated in Section 356000 Refurbishment of Penstock Gates and Gate Supports and as directed by Departmental Representative based on results of NDT testing by others.
- .6 Refurbish cylinders as noted in specifications
- .7 Prepare gate and guide surfaces and recoat.
- .8 Reinstall gates and cylinders and verify normal operating conditions.
- .9 Reinstall skylights and gate position indicator arms to original condition.

**.3 Installation of Auxiliary Tunnel Safety Gate:**

- .1 Demolish existing concrete at auxiliary tunnel access hatch and construct new



- access hatch at existing shaft location.
- .2 Supply and install new hydraulically actuated safety gate in existing access shaft, modify hatch as required for installation and as shown on drawings.
- .3 Supply and install control panel for hydraulic valves and components, and electrical controls.
- .4 Commission and test the new gate.
- .4 Provide as-built drawings, closeout submittals and as-built site survey of all new work. Refer to Appendix D EGD Standards for Survey.
- .5 Project requires work to be carried out in confined spaces and restricted spaces, including areas with lead paint. Refer to Section 01 35 33 Health and Safety Requirements.
- .6 During the work period at the main gate the main tunnel will have two points of engineer certified isolation at the ocean provided and installed by the EGD.
  - .1 Water management within the main tunnel is the Contractor's responsibility.
  - .2 Estimated maximum water volume is 68,190 litres/hour of seepage into the tunnels.
- .7 During the work period at the auxiliary tunnel safety gate the auxiliary tunnel will have a single point of engineer certified isolation at the ocean provided and installed by the EGD. Contractor to verify if secondary means of isolation is required per WorkSafe BC prior to starting any work within the auxiliary tunnel. If secondary isolation is required, Contractor to submit plan for secondary isolation to the Departmental Representative for approval 5 days prior to starting work in the auxiliary tunnel. Contractor to provide and install any secondary isolation required after receiving written approval from the Departmental Representative. Refer to Section 01 35 33.
  - .1 Water management within the auxiliary tunnel is the Contractor's responsibility.

- .2 Estimated maximum water volume is 68,190 litres/hour of seepage into the tunnels.
- .3 Install pump and all associated piping to by-pass existing auxiliary pump and discharge tunnel system during work within the auxiliary tunnel. Ensure by-pass pump system is sensor or float activated.
- .4 Storm drains for water discharge are located near the contractors work area as indicated on the drawings. Storm drains can be used to discharge volumes up to 25,000 litres/minute.

.3 "Green" requirements:

- .1 Use only environmentally responsible green materials/ products with no VOC emissions or minimum VOC emissions of indoor off-gassing contaminants for improved indoor air quality - subject of Departmental Representative's approval of submitted MSDS Product Data.
- .2 Use materials/products containing highest percentage of recycled and recovered materials practicable - consistent with maintaining cost effective satisfactory levels of competition.
- .3 Adhere to waste reduction requirement for reuse or recycling of waste materials, thus diverting materials from landfill.

**3. CONTRACT DOCUMENTS**

- .1 The Contract documents, drawings and specifications are intended to complement each other, and to provide for and include everything necessary for the completion of the work.
- .2 Drawings are, in general, diagrammatic and are intended to indicate the scope and general arrangement of the work.
- .3 For the purpose of any conflict between drawings, specifications and Appendices, specifications govern over drawings and drawings and specifications govern over Appendices.

**4. DIVISION OF**

**SPECIFICATIONS**

- .1 The specifications are subdivided in accordance with the current 6-digit National Master Specifications System.
- .2 A division may consist of the work of more than 1 subcontractor. Responsibility for determining which subcontractor provides the labour, material, equipment and services required to complete the work rests solely with the Contractor.

**5. COMPLETION**

- .1 Commission and ensure gates, cylinders, and tunnels are ready for full operational use by required deadlines as indicated in Clause 7. Dry dock flooding and dewatering operations will be suspended during scheduled windows to facilitate work as indicated:

- .1 January 5 to February 5, 2015: Main gate and Penstocks #4, 5, 6 and watering/dewatering tunnels must be fully operational at the end of the work day on February 5, 2015 for planned dry dock operations.
- .2 February 9 to February 25, 2015: Main Gate, Penstocks #1, 2, 3 and watering/dewatering tunnels must be fully operational at the end of the work day on February 25, 2015 for planned dry dock operations.
- .3 March 13 to March 26, 2015: Main gate, Penstocks#1 through #6, Auxiliary Safety Gate and watering/dewatering tunnels must be fully operational at end of work day on March 26, 2015 for planned dry dock operations.

**6. HOURS OF WORK**

- .1 Restrictive as follows:
  - .1 Schedule deconstruction, removal and construction work during normal working hours of the Graving Dock. Normal weekday working hours are 0730 to 2330 Monday through Friday, excluding statutory holidays.
  - .2 Submit written request to Departmental

Representative for authorization prior to working outside of normal working hours.

**7. WORK SCHEDULE**

- .1 Carry on work as indicated and as follows:
  - .1 Within 5 working days after Contract award, provide a "phasing bar chart" and a schedule showing anticipated progress stages and final completion of the work within the time period required by the Contract documents. Indicate the following:
    - .1 Submission of shop drawings, product data, MSDS sheets and samples.
    - .2 Commencement and completion of work of each section of the specifications or trade for each phase as outlined.
    - .3 Final completion date within the time period required by the Contract documents.
- .2 Do not change approved Schedule - without notifying Departmental Representative.
- .3 Interim reviews of work progress based on work schedule will be conducted as decided by Departmental Representative and schedule updated by Contractor in conjunction with and to approval of Departmental Representative.
- .4 The following is a list of critical dates for this project that must be adhered to:
  - .1 January 5 to February 5, 2015: Main gate and Penstocks #4, 5, 6 and watering/dewatering tunnels must be fully operational at the end of the work day on February 5, 2015 for planned dry dock operations.
  - .2 February 9 to February 25, 2015: Main Gate, Penstocks #1, 2, 3 and watering/dewatering tunnels must be fully operational at the end of the work day on February 25, 2015 for planned dry dock operations.

- .3 March 13 to March 26, 2015: Main gate, Penstocks#1 through #6, Auxiliary Safety Gate and watering/dewatering tunnels must be fully operational at end of work day on March 26, 2015 for planned dry dock operations.

- 8. COST BREAKDOWN** .1 Before submitting the first progress claim, submit a breakdown of the Contract lump sum price in detail as directed by the Departmental Representative and aggregating Contract price.
- 9. CODES, BYLAWS, STANDARDS** .1 Perform work in accordance with the National Building Code of Canada (NBC), 2012 BC Building Code, and other indicated Codes, Construction Standards and/or any other Code or Bylaw of local application.
- .2 Comply with applicable local bylaws, rules and regulations enforced at the location concerned.
- .3 Meet or exceed requirements of Contract documents, specified standards, codes and referenced documents.
- .4 In any case of conflict or discrepancy, the most stringent requirements shall apply.
- 10. DOCUMENTS REQUIRED** .1 Maintain 1 copy each of the following at the job site:
- .1 Contract drawings.
- .2 Contract specifications.
- .3 Addenda to Contract documents.
- .4 Copy of approved work schedule.
- .5 Change orders.
- .6 Other modifications to Contract.
- .7 Field test reports.
- .8 One set of record drawings and specifications for "as-built" purposes.
- .9 Contractor's Safety Plan
- .10 Contractor's Environmental Management Plan
- 11. REGULATORY REQUIREMENTS** .1 Obtain and pay for - Building Permit, Certificates, Licenses and other permits required by regulatory

municipal, provincial or federal authorities to complete the work.

- .2 Provide inspection authorities with plans and information required for issue of acceptance certificates.
- .3 Furnish inspection certificates in evidence that the work installed conforms with the requirements of the authority having jurisdiction.

## **12. CONTRACTOR'S USE OF SITE**

- .1 The Esquimalt Graving Dock shall be assumed to be fully operational for the duration of the Contract.
- .2 Contractor's work site is indicated on the drawings.
- .3 Maintain vehicle access at all times.
- .4 Do not unreasonably encumber site with material or equipment.
- .5 Contractor is designated as Prime Contractor on the Contractor's work site and assumes all responsibilities of Prime Contractor as per relevant acts and regulations. Contractor shall be responsible for all work on Contractor's work site.
- .6 Use of Contractor's work site:
  - .1 Exclusive and complete for execution of contract work.
  - .2 Assume responsibility for assigned premises for performance of the work.
  - .3 Coordinate all work activities on the Contractor's work site, including the work of other contractors engaged by Departmental Representative
  - .4 Provide security of Contractor's work site and all Contractor's and Subcontractor's equipment and material. Secure Contractor's work site at the end of each work day.
- .7 Perform work in accordance with Contract documents. Ensure work is carried out in accordance with any indicated phasing.
- .8 Any area of the Esquimalt Graving Dock property to which access is restricted by sign is a secured or

- restricted area and shall not be entered.
- .9 Do not obstruct access to PWGSC property outside of the Contractor's work site. Maintain overhead clearances, keep roadways and walkways clear, and maintain routes for emergency response vehicles.
- 13. EXAMINATION** .1 Examine site and be familiar and conversant with existing conditions likely to affect work.
- 14. EXISTING SERVICES** .1 Where work involves breaking into or connecting to existing services, carry out work at times directed by the authorities having jurisdiction.
- 15. CUTTING AND PATCHING**
- .1 Cut existing surfaces as indicated on drawings to accommodate new work.
- .2 Remove items so shown or specified.
- .3 Do not cut, bore, or sleeve load-bearing members.
- .4 Make cuts with clean, true, smooth edges. Saw cut where indicated on drawings. Make patches inconspicuous in final assembly.
- .5 Patch and make good surfaces cut, damaged or disturbed, to Departmental Representative's approval.
- .6 Making good is defined as matching construction and finishing materials and the adjacent surfaces such that there is no visible difference between existing and new surfaces when viewed from 1.5 meters in ambient light.
- 16. SETTING OUT OF WORK**
- .1 Assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated.
- .2 Provide devices needed to lay out and construct work.
- .3 Supply such devices as templates required to facilitate Departmental Representative's inspection of work.



**17. ACCEPTANCE OF  
SUBTRADES**

- .1 Each trade shall examine surfaces prepared by others and job conditions which may affect his work, and shall report defects to the Departmental Representative. Commencement of work shall imply acceptance of prepared work or substrate surfaces.

**18. QUALITY OF WORK**

- .1 Ensure that quality workmanship is performed through use of skilled tradesmen, under supervision of qualified journeyman.
- .2 In cases of dispute, decisions as to standard or quality of work rest solely with the Departmental Representative, whose decision is final.

**19. WORKS  
COORDINATION**

- .1 Coordinate work of subtrades:
  - .1 Designate one person to be responsible for review of contract documents and shop drawings and managing coordination of Work.
- .2 Submit shop drawings and order of prefabricated equipment or rebuilt components only after coordination meeting for such items has taken place.
- .3 Convene meetings between subcontractors whose work interfaces and ensure awareness of areas and extent of interface required.
- .4 Provide each subcontractor with complete plans and specifications for Contract, to assist them in planning and carrying out their respective work.
- .5 Ensure that each trade provides all other trades reasonable opportunity for completion of Work and in such a way as to prevent unnecessary delays, cutting, patching and removal or replacement of completed work
- .6 Departmental Representative is not responsible for, or accountable for extra costs incurred as a result of Contractor's failure to coordinate Work.

- .7 Maintain efficient and continuous supervision.
- 20. REVIEW OF SHOP DRAWINGS, PRODUCT DATA AND SAMPLES**
  - .1 In accordance with Section 013300, submit the requested shop drawings, product data, MSDS sheets and samples indicated in each of the technical Sections.
  - .2 Allow sufficient time for the following:
    - .1 Review of product data.
    - .2 Review of shop drawings.
    - .3 Review of re-submission.
    - .4 Ordering of approved material and/or products - refer to technical specifications.
- 21. RELICS AND ANTIQUITIES**
  - .1 Relics and antiquities and items of historical or scientific interest shall remain property of the Crown. Protect such articles and request directives from Departmental Representative.
  - .2 Give immediate notice to Departmental Representative if evidence of archeological finds are encountered during excavation/construction, and await Departmental Representative's written instructions before proceeding with work in this area.
- 22. SECURITY CLEARANCES**
  - .1 Personnel employed on this project will be subject to security check. Obtain requisite clearances, as instructed, for each individual required to enter the premises.
- 23. PROJECT MEETINGS**
  - .1 Departmental Representative will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.
- 24. QUALITY ASSURANCE**
  - .1 Departmental Representative will carry out Quality Assurance activities throughout the construction periods. Appointed independent inspection/Testing Agencies will provide inspection and testing services as required.

**25. TESTING LABORATORY -  
APPOINTMENT  
& PAYMENT**

- .1 Departmental Representative will appoint and pay for services of testing laboratory except for the following:
  - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
  - .2 Inspection and testing performed exclusively for the Contractor's convenience.
  - .3 Tests specified to be carried out by Contractor under the supervision of Departmental Representative.
  - .4 Additional tests specified in Paragraph .2 below.
- .2 Where tests or inspections by designated testing laboratory reveal work not in accordance with Contract requirements; Contractor shall pay costs for additional tests or inspections as Departmental Representative may require to verify acceptability of corrected work.
- .3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- .4 Pay costs for uncovering and making good work that is covered before required inspection or testing is completed and approved by Departmental Representative.
- .6 The Departmental Representative may require, and pay for, additional inspection and testing services.
- .7 Provide Departmental Representative with 2 copies of testing reports as soon as they are available.

**26. SURVEY**

- .1 All construction layout and final accurate construction records shall be the responsibility of the contractor and shall be set by a licensed civil engineer or land surveyor in the Province of British Columbia.
- .2 Contractor to submit name of licensed civil engineer or land surveyor to PWGSC during first project meeting (start-up meeting).

- .3 Contractor to provide survey data in accordance with EGD Standards for Survey (See Appendix D).

**27. AS-BUILT DOCUMENTS**

- .1 The Departmental Representative will provide 2 sets of drawings, 2 sets of specifications, and 2 copies of the original AutoCAD files for "as-built" purposes.
- .2 As work progresses, maintain accurate records to show all deviations from the Contract documents. Note on as-built specifications, drawings and shop drawings as changes occur.
- .3 Refer to Section 017830 – Closeout Submittals.

**28. ENVIRONMENTAL PROTECTION**

- .1 Prevent extraneous materials from contaminating air beyond construction area, by providing temporary enclosures during work.
- .2 Do not dispose of waste or volatile materials into water courses, storm or sanitary sewers.
- .3 Ensure proper disposal procedures in accordance with all applicable regulations.
- .4 Ensure adherence to *Esquimalt Graving Dock Environmental Best Management Practices*.

**29. ADDITIONAL DRAWINGS**

- .1 The Departmental Representative may furnish additional drawings for clarification. These additional drawings have the same meaning and intent as if they were included with plans referred to in the Contract documents.
- .2 Upon request, Departmental Representative may furnish up to a maximum of 10 sets of Contract documents for use by the Contractor at no additional cost. Should more than 10 sets of documents be required the Departmental Representative will provide them at additional cost.

**30. BUILDING SMOKING  
ENVIRONMENT**

- .1 Smoking within buildings is not permitted.
- .2 Smoking is permitted in designated areas only.

**31. SYSTEM OF  
MEASUREMENT**

- .1 The metric system of measurement (SI) will be employed on this Contract.

**32. FAMILIARIZATION  
WITH SITE**

- .1 Before submitting tender, visit site - as indicated in tender documents and become familiar with all conditions likely to affect the cost of the Work.

**33. SUBMISSION OF  
TENDER**

- .1 Submission of a tender is deemed to be confirmation of the fact that the Tenderer has analyzed the Contract documents and inspected the site, and is fully conversant with all conditions.

**END OF SECTION**

- 
- |  |    |   |
|--|----|---|
| <b>1. ACCESS AND EGRESS</b>  | .1 | Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations. |
| <br>   |    |   |
| <b>2. USE OF SITE AND FACILITIES</b>                               | .1 | Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.  |
|  | .2 | Maintain existing services to buildings and provide for personnel and vehicle access.   |
|  | .3 | Closures: protect work temporarily until permanent enclosures are completed.  |
| <br>   |    |   |
| <b>3. ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING FACILITIES</b> | .1 | Execute work with least possible interference or disturbance to ongoing maintenance operations, site personnel and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.                          |
| <br>   |    |   |
| <b>4. SPECIAL REQUIREMENTS</b>                                     | .1 | Carry out noise generating work Monday to Friday from 0730 to 2330. Work outside these hours will not be permitted without written permission of the Departmental Representative.   |
|  | .2 | Submit schedule in accordance with Section 01 33 00 – Submittals.   |
|  | .3 | Keep within limits of work and avenues of ingress and egress as defined by the Departmental Representative.   |

**END OF SECTION 01 14 00**

- 1. GENERAL** .1 This section includes the following:
  - .1 Coordination of Work under administration of Departmental Representative.
  - .2 Scheduled Pre-construction and Site meetings.
  - .3 Walk-through Inspections by Departmental Representative.
  
- 2. DESCRIPTION** .1 Coordinate and manage construction schedule, submittals, use of site, temporary utilities, construction facilities, quality control program, and construction Work, with progress of Work of subcontractors, other contractors, and Departmental Representative.
  
- 3. PRE-CONSTRUCTION MEETING, CONSTRUCTION ORGANIZATION AND START-UP** .1 Pre-construction Meeting:
  - .1 Within 5 days after award of Contract, Departmental Representative will arrange pre-construction meeting.
  - .2 Departmental Representative, Contractor and members of EGD Project Management Office (PMO) will be in attendance.
  - .3 Departmental Representative will establish time and location of meeting and notify parties concerned.
  - .4 The Departmental Representative will chair the meeting, record minutes and issue minutes to all attendees.  
    .2 Construction Organization and Start-up:
  - .1 Comply with Departmental Representative's allocation of mobilization areas of site; for access, traffic, and parking facilities.
  - .2 During construction coordinate use of site and facilities through Departmental Representative's procedures for intra-project communications: Submittals, reports and records, schedules, coordination of drawings, recommendations, and resolution of ambiguities and conflicts.
  - .3 Comply with instructions of Departmental Representative for use of temporary utilities and construction facilities.
  - .4 Coordinate field Engineering and layout work with Departmental Representative.



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- 4. SCHEDULES**
- .1 Submit preliminary construction schedule to Departmental Representative.
  - .2 After review, revise and resubmit schedule.
  - .3 During progress of Work, revise and resubmit as directed by Departmental Representative.
- 5. CONSTRUCTION SITE MEETINGS**
- .1 During course of Work and prior to project completion, Departmental Representative will request Construction Site Meetings as required.
  - .2 Departmental Representative will record minutes of meetings and circulate to attending parties and affected parties not in attendance.
  - .3 Agenda to include following:
    - .1 Review, approval of minutes of previous meeting.
    - .2 Review of Work progress since previous meeting.
    - .3 Field observations, problems, conflicts.
    - .4 Review of Health and Safety including any incidents, near misses, and WorkSafe BC visits.
    - .5 Problems which impede construction schedule.
    - .6 Review of off-site fabrication delivery schedules.
    - .7 Corrective measures and procedures to regain projected schedule.
    - .8 Revision to construction schedule.
    - .9 Progress schedule, during succeeding work period.
    - .10 Review submittal schedules: expedite as required.
    - .11 Update of Red Line As-Built Drawings and review of site survey progress.
    - .12 Maintenance of quality standards.
    - .13 Review proposed changes for affect on construction schedule and on completion date.
    - .14 Other business.
- 6. SUBMITTALS**
- .1 Submit requests for interpretation of Contract Documents, and obtain instructions through Departmental Representative.

- .2 Process substitutions through Departmental Representative.
- .3 Deliver closeout submittals for review and inspections, for transmittal to Departmental Representative.

**7. CLOSEOUT PROCEDURES**

- .1 Notify Departmental Representative when Work is considered Substantially Complete. Contractor to prepare list of defects, deficiencies and incomplete work prior to inspection by Departmental Representative. Follow procedures as outlined in Section 01 78 30 – Closeout Submittals.
- .2 Accompany Departmental Representative on preliminary inspection to determine items listed for completion or correction.
- .3 Comply with Departmental Representative's instructions for correction of items of Work listed in executed Interim Certificate of Completion and for access to Owner-occupied areas.
- .4 Notify Departmental Representative of completion of items of Work determined in Departmental Representative's final inspection.

**END OF SECTION 01 31 00**

## **1. GENERAL**

1. This section includes the following:
  - .1 Shop drawings and product data
  - .2 Samples
  - .3 Certificates and Transcripts
  - .4 All other submissions including Schedules, Health and Safety Plans, and Spill Plans as required in the Specifications.

## **2. RELATED REQUIREMENTS**

1. Section 01 11 55 General Instructions.

## **3. ADMINISTRATIVE**

1. Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
2. Do not proceed with Work affected by submittal until review is complete.
3. Present shop drawings, product data, samples and mock-ups in SI Metric units.
4. Where items or information is not produced in SI Metric units converted values are acceptable.
5. Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
6. Notify Departmental Representative, in writing at the time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

7. Verify field measurements and affected adjacent Work are co-ordinated.
8. Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative review of submittals.
9. Contractor's responsibility for deviation in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
10. Keep one reviewed copy of each submission on site.

#### **4. SHOP DRAWINGS AND PRODUCT DATA**

1. The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
2. Submit drawings stamped and signed by professional engineer registered or licensed in the Province of British Columbia.
3. Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles of equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
4. Allow 5 days for Departmental Representative's review of each submission.
5. Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

6. Make changes in shop drawing as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
7. Accompany submissions with transmittal letter containing:
  1. Date.
  2. Project title and number.
  3. Contractor's name and address.
  4. Identification and quantity of each shop drawing, product data and sample.
  5. Other pertinent data.
8. Submissions include:
  1. Date and revision dates.
  2. Project title and number.
  3. Name and address of:
    1. Subcontractor.
    2. Supplier
    3. Manufacturer.
  4. Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
  5. Details of appropriate portions of Work as applicable:
    1. Fabrication.
    2. Layout, showing dimensions, including identified field dimensions, and clearances.
    3. Setting or erection details.
    4. Capacities.
    5. Performance characteristics.
    6. Standards.
    7. Operating weight.
    8. Wiring diagrams.
    9. Single line and schematic diagrams.
    10. Relationship to adjacent work.
9. After Departmental Representative's review, distribute copies
10. Submit one electronic copy and 2 prints of shop drawings for each requirement requested in

specification Sections and as Departmental Representative may reasonably request.

11. Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
12. Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
  1. Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
  2. Testing must have been within 3 years of date of contract award for project.
13. Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
  1. Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
  2. Certificates must be dated after award of project contract complete with project name.
14. Submit electronic copies and 2 printed copies of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.
  1. Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

15. Submit electronic copies and 2 printed copies of Manufacturer's Field Reports for the requirements requested in specification Sections and as requested by Departmental Representative.
16. Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
17. Submit electronic copies and 2 printed copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
18. Delete information not applicable to project.
19. Supplement standard information to provide details applicable to project.
20. If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
21. The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.
  1. This review shall not mean that PWGSC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
  2. Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.



## **5. SAMPLES**

1. Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
2. Deliver samples prepaid to Departmental Representative's office.
3. Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
4. Where colour, pattern or texture is criterion, submit full range of samples.
5. Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
6. Make changes in samples which Departmental Representative may require, consistent with Contract Documents.
7. Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

## **6. PHOTOGRAPHIC DOCUMENTATION**

1. Submit electronic copy of digital photography on CD in jpg format, standard resolution monthly with progress statement and as directed by Departmental Representative.
2. Project identification: name and number of project and date of exposure indicated.
3. Number of viewpoints: 4 locations.
  1. Viewpoints and their location as determined by Departmental Representative.
4. Frequency of photographic documentation: as directed by Departmental Representative.

## **7. CERTIFICATES AND TRANSCRIPTS**

1. Within 5 working days after award of Contract, submit Work Safe BC status.
2. Submit transcription of insurance within 5 working days after award of Contract.

#### **8. OTHER SUBMISSIONS**

1. Other submissions including Schedules, Health and Safety Plans, and Spill Plans as required in the Specifications:
  1. Submit 1 hard copy and one pdf copy.

**END OF SECTION**

1. **SECTION INCLUDES** .1 Special procedures required during the work due to the presence of contaminated soil beneath the site.
2. **RELATED SECTIONS** .1 Section 017421 – Waste Management and Disposal
3. **REFERENCES** .1 Canadian General Standards Board (CGSB)
  - .1 CGSB 51-GP-51M-81, Polyethylene Sheet for Use in Building Construction.
  - .2 Transportation and Dangerous Goods Act.
  - .3 CCME (Canadian Council of Ministers of Environment) Canadian Soil Quality Guidelines
    - .1 Canadian Soil Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health, Industrial (**CCME IL**).
    - .2 Canadian Soil Quality Guidelines for PAH, Industrial, Environmental Health guidelines, Soil Contact (**CCME ILsc**).
    - .3 Canadian Soil Quality Guidelines for PAH, Industrial, Environmental Health guidelines, Protection of Freshwater Life (**CCME ILfl**).
    - .4 Canadian Soil Quality Guidelines for PAH, Industrial, Environmental Health guidelines, Interim Soil Quality Criteria (CCME 1991) (**CCME III**).
    - .5 Soil Quality Guidelines for the Protection of Human Health (**CCME SQGhh**).
  - .6 BC Environmental Management Act and Contaminated Sites Regulation (CSR) most recent updates related to soil standards and waste soil disposal.
  - .7 BC Ministry of Environmental Technical Guidance Document 1. Site Characterization and Confirming Testing.
  - .8 Department of Fisheries and Oceans Land Development Guidelines.
4. **REGULATORY REQUIREMENTS** .1 Provide erosion and sediment control in accordance with the following documents:
  - .1 Federal Fisheries Act 2012 (and applicable updates).
  - .2 BC Ministry of Environment Water Quality Guidelines and Water Quality Objectives, latest edition.

- .3 Land Development Guidelines for the Protection of Aquatic Habitat, Fisheries and Oceans Canada, and BC Ministry of Environment, Lands and Parks, 1993 (and applicable updates)
- .2 BC Environmental Management Act and Contaminated Sites Regulation (CSR) soil standards and spoil disposal requirements.
- .3 Ensure that water which falls upon or drains across the work site is collected, treated, and released in accordance with the above referenced documents and regulations.
- .4 Comply with federal, provincial, municipal and local anti-pollution laws, ordinances, codes, and regulations when disposing of waste materials, water, soil, debris, and rubbish.

**5. POTENTIALLY  
CONTAMINATED  
MATERIALS**

- .1 The soils at Esquimalt Graving Dock are known potentially to contain contaminants – hydrocarbons and metals. Contractor shall follow appropriate steps as described in this and other sections of the Specifications when performing excavation and removal of any fill or soils.
- .2 Do not commence Work involving contact with potentially contaminated materials until decontamination facilities are operational and approved by the Departmental Representative.
- .3 All excavated soils to be stockpiled by the Contractor in accordance with Clause 9.
- .4 The Departmental Representative will be responsible for testing of stockpiled soil.

**6. ENVIRONMENTAL  
PROTECTION**

- .1 Contractor must adhere to Esquimalt Graving Dock's Environmental Best Management Practices.
- .2 Submit Environmental Management Plan that outlines contractors procedures to achieve environmental protection requirements including the management of soils, erosion and sediment control, waste management, storm water management, spill prevention and response, noise and dust control, archeological, and conformance to applicable environmental regulations, standards and requirements of the EGD Best Management Practice

.3 Contractor shall adhere to the following mitigation/protection measures:

- .1 Spill Response Plan must be submitted to the Departmental Representative prior to project start-up.
- .2 Spill response materials must be on site at all times and must be sufficient to handle potential spills.
- .3 All machinery equipment must be in good working order.
- .4 Fuelling operations/hazardous materials storage must be done in a protected area away from the marine environment and the drainage system.
- .5 No waste materials or wastewater is to be allowed to enter the drainage system or the marine environment. Construction runoff into the marine environment is a contravention of the Fisheries Act. This includes raw concrete and concrete silt. Drains in the vicinity of the project must be covered with filter media.
- .6 Soils must be stockpiled so they are completely contained and stockpiled in an area designated by the Departmental Representative.

## **7. VEHICULAR ACCESS AND PARKING**

.1 Maintenance and Use:

- .1 Prevent contamination of access roads. Immediately scrape up debris or material on access roads which is suspected to be contaminated as determined by Departmental Representative; transport and dispose of in appropriate off-site disposal facility. Clean access roads and any roads used by trucks or equipment at least once per shift using a street sweeper.
- .2 The Departmental Representative may collect soil samples for chemical analyses from the traveling surfaces of constructed and existing access routes prior to, during, and upon completion of Work. Excavate and dispose of clean soil contaminated by Contractor's activities at no additional cost to the Departmental Representative.

**8. DUST AND  
PARTICULATE  
CONTROL**

- .1 Execute work by methods to minimize raising dust from construction operations.
- .2 Implement and maintain dust and particulate control measures immediately during construction and in accordance with Province of British Columbia regulations.
- .3 Provide positive means to prevent airborne dust from dispersing into atmosphere. Use potable water for dust and particulate control only with Departmental Representative's prior written approval.
- .4 Recover and treat any runoff from water applied to the roads or excavated areas. Prevent any water applied to the roads or excavation from discharging directly to the storm sewer or offsite.
- .5 Use chemical means for water misting system for dust and particulate control only with Departmental Representative's prior written approval.
- .6 As a minimum, use appropriate covers on trucks hauling fine or dusty material. Use watertight vehicles to haul wet materials.
- .7 Prevent dust from spreading to adjacent property sites.
- .8 Departmental Representative may stop work at any time when Contractor's control of dust and particulate is inadequate for wind conditions present at site, or when air quality monitoring indicates that release of fugitive dusts and particulate into atmosphere equals or exceeds specified levels in the Contractors Health and Safety Plan and by British Columbia Workers Compensation Board. Cost of such work stoppage shall be borne by the Contractor.
- .9 If Contractor's dust and particulate control is not sufficient for controlling dust and particulate into atmosphere, stop work. Contractor must prepare and discuss procedures to resolve the problem. Make all necessary changes to operations prior to resuming any excavation, handling, processing, or any other work that may cause release of dusts or particulate.

**9. STOCKPILING**

- .1 Provide, maintain, and operate storage/stockpiling facilities as required. Stockpiling location will be adjacent to the Contractor's work area to minimize handling, exact location to be determined by Departmental Representative.
- .2 If not placed on asphalt or concrete paving, install 6-mil polyethylene liner below proposed stockpile locations

- to prevent contact between stockpile material and ground.
- .3 Equip facility with tarps capable of covering all stockpiled material.
- .4 Contractor will ensure that stockpiled material not being actively added to is covered with tarps and these are secured so they do not blow off. Any stockpiles not fully covered by tarps must be fixed immediately.

#### **10. POLLUTION CONTROL**

- .1 Provide methods, means, and facilities to prevent contamination soil, water, and atmosphere from discharge of noxious toxic substances and pollutants produced by construction operations
- .2 Be prepared to intercept, clean up, and dispose of spills or releases that may occur whether on land or water. Maintain materials and equipment required for cleanup of spills or releases readily accessible on site.
- .3 Immediately report spills and releases potentially causing damage to the environment to:
  - .1 Authority having jurisdiction or interest in spill or release including any conservation authority, water supply authorities, drainage authority, road authority, and fire department.
  - .2 Owner of pollutant, if known.
  - .3 Person having control over pollutant, if known.
  - .4 Departmental Representative.
- .4 Contact manufacturer of pollutant if known and ascertain hazards involved, precautions required, and measure used in cleanup or mitigating action.
- .5 Take immediate action using available resources to contain and mitigate effects on environment and persons from spill or release.

#### **11. SURFACE WATER CONTROL**

- .1 Maintain work areas relatively free of water such that the presence of water in the excavation does not interfere with the progress of the work.
- .2 Protect site from puddles or running water. Grade site to drain. Provide berm as necessary to protect the slopes of the excavation from soil erosion.
- .3 Prevent surface water runoff from leaving work areas.
- .4 Do not discharge decontaminated water, or surface water runoff, or groundwater which may have come in contact with potentially contaminated material, off the site or to municipal sewers.
- .5 Prevent precipitation from infiltrating or from directly running off stockpiled or exposed material surfaces.

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- Cover stockpiled or exposed material surfaces at all times with an impermeable liner.
- .6 Direct surface waters outside of the excavation that has not contacted potentially contaminated materials to existing surface drainage systems.
- .7 Control surface drainage ensuring that gutters are kept open, water is not directed across or over pavements or sidewalks except through approved pipes or properly constructed troughs, and runoff from unstabilized areas is intercepted and diverted to suitable outlet.
- .8 Dispose of water in manner not injurious to public health or safety, to property, or to any part of Work completed or under construction.
- .9 Provide, operate, and maintain necessary equipment appropriately sized to keep excavations, staging pads, and other work areas free from water.
- .10 Contain water from stockpiled materials. Transfer all potentially contaminated surface waters to the designated waste water storage tanks.
- .11 Have on hand sufficient pumping equipment, machinery and tankage in good working condition for ordinary emergencies, including power outage, and competent workers for operation of pumping equipment.
- .12 Contain and collect surface and decontaminations water and transfer such collected water to the waste water storage tanks.
- 12. PROGRESS CLEANING**
- .1 Maintain cleanliness of Work and surrounding site to comply with federal, provincial, and local fire and safety laws, ordinances, codes, and regulations.
- .2 Co-ordinate cleaning operations with disposal operations to prevent accumulation of dust, dirt, debris, rubbish, and waste materials.
- 13. FINAL DECONTAMINATION**
- .1 Perform final decontamination of construction facilities, equipment, and materials which may have come in contact with potentially contaminated materials prior to removal from site.
- .2 Perform decontamination as specified to satisfaction of the Departmental Representative. The Departmental Representative will require the Contractor to perform additional decontamination if required.



**14. REMOVAL  
AND DISPOSAL**

- .1 Remove surplus materials and temporary facilities from site.
- .2 Dispose of all non-contaminated waste materials, litter, debris, and rubbish off site.
- .3 Do not burn or bury rubbish and waste materials on site.
- 4 Do not dispose of wastes including hazardous waste into waterways, storm or sanitary drains.
- .5 Do not discharge wastes into streams or waterways.
- .6 Dispose of waste materials at appropriate offsite facilities identified by Contractor and approved by the Department Representative.

**END OF SECTION 013515**

## 1. REFERENCES

- .1 Government of Canada.
  - .1 Canada Labour Code - Part II
  - .2 Canada Occupational Health and Safety Regulations.
- .2 National Building Code of Canada (NBC):
  - .1 Part 8, Safety Measures at Construction and Demolition Sites.
- .3 Canadian Standards Association (CSA) as amended:
  - .1 CSA Z797-2009 Code of Practice for Access Scaffold
  - .2 CSA S269.1-1975 (R2003) Falsework for Construction Purposes
  - .3 CSA S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structures
- .4 Fire Protection Engineering Services, HRSDC:
  - .1 FCC No. 301, Standard for Construction Operations.
  - .2 FCC No. 302, Standard for Welding and Cutting.
- .5 American National Standards Institute (ANSI):
  - .1 ANSI A10.3, Operations – Safety Requirements for Powder-Actuated Fastening Systems.
- .6 Province of British Columbia:
  - .1 Workers Compensation Act Part 3-Occupational Health and Safety.
  - .2 Occupational Health and Safety Regulation

## 2. RELATED SECTIONS

- .1 Project management and coordination: Section 013100
- .2 Submittals procedures: Section 013300
- .3 Special procedures for Contaminated Sites: Section 013515
- .4 Temporary facilities: Section 015100
- .5 Temporary barriers and enclosures: Section 015600

**3. WORKERS'  
COMPENSATION BOARD  
COVERAGE**

- .1 Comply fully with the Workers' Compensation Act, regulations and orders made pursuant thereto, and any amendments up to the completion of the work.
- .2 Maintain Workers' Compensation Board coverage during the term of the Contract, until and including the date that the Certificate of Final Completion is issued.

**4. COMPLIANCE WITH  
REGULATIONS**

- .1 PWGSC may terminate the Contract without liability to PWGSC where the Contractor, in the opinion of PWGSC, refuses to comply with a requirement of the Workers' Compensation Act or the Occupational Health and Safety Regulations.
- .2 It is the Contractor's responsibility to ensure that all workers are qualified, competent and certified to perform the work as required by the Workers' Compensation Act or the Occupational Health and Safety Regulations.

**5. SUBMITTALS**

- .1 Submit to Departmental Representative submittals listed for review in accordance with Section 013300.
- .2 Work effected by submittal shall not proceed until review is complete.
- .3 Submit the following:
  - .1 Health and Safety Plan. See Appendix A for sample.
  - .2 Copies of reports or directions issued by Federal and Provincial health and safety inspectors.
  - .3 Copies of incident and accident reports.
  - .4 Complete set of Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements.
  - .5 Emergency Procedures.
- .4 The Departmental Representative will review the Contractor's site-specific project Health and Safety Plan and emergency procedures, and provide comments to the Contractor within 2 days after receipt of the plan. Revise the plan as appropriate and resubmit to Departmental Representative for review.
- .5 Medical surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of work, and submit

additional certifications for any new site personnel to Departmental Representative.

- .6 Submission of the Health and Safety Plan, and any revised version, to the Departmental Representative is for information and reference purposes only. It shall not:
  - .1 Be construed to imply approval by the Departmental Representative.
  - .2 Be interpreted as a warranty of being complete, accurate and legislatively compliant.
  - .3 Relieve the Contractor of his legal obligations for the provision of health and safety on the project.

## **6. RESPONSIBILITY**

- .1 Assume responsibility as the Prime Contractor for work under this contract.
- .2 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .3 Comply with and enforce compliance by employees with safety requirements of Contract documents, applicable Federal, Provincial, Territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

## **7. HEALTH AND SAFETY COORDINATOR**

- .1 The Health and Safety Coordinator must:
  - .1 Be responsible for completing all health and safety training, and ensuring that personnel that do not successfully complete the required training are not permitted to enter the site to perform work.
  - .2 Be responsible for implementing, daily enforcing, and monitoring the site-specific Health and Safety Plan.
  - .3 Be on site during execution of work.  
NOTE: The Contractor's Superintendent may fulfill this role if qualified.

## **8. GENERAL CONDITIONS**

- .1 Provide safety barricades and lights around work site as required to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.
- .2 Ensure that non-authorized persons are not allowed to circulate

in designated construction areas of the work site.

- .1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.
- .2 Secure site at night time [or provide security guard] as deemed necessary to protect site against entry.

## **9. PROJECT/SITE CONDITIONS**

- .1 The Esquimalt Graving Dock is a dry dock and ship repair facility. It is an industrial site wherein industrial, manufacturing, fabrication, heavy construction, and like works are conducted by a variety of contractors and sub-trades for a variety of owners and sub-trades for a variety of owners and/or PWGSC
- .2 Work at site will involve a number of hazards known to PWGSC as noted in the Preliminary Job Hazard Analysis in Appendix B attached).
  - This site may involve contact with hazardous and/or toxic materials and substances such as, but not limited to:
    - .1 Waste sandblast grit.
    - .2 Paint spray, including solvents and mineral spirits.
    - .3 Waste water.
    - .4 Contaminated soils and debris.
    - .5 Polychlorinated biphenyl (PCB).
    - .6 Creosote and creosote materials.
    - .7 Asbestos.
    - .8 Lead paints and other paints containing toxic substances such as arsenic and carcinogens.
- .3 Other safety hazards or risks which may be encountered include, but are not limited to:
  - .1 Contact with traveling and mobile cranes, forklifts, manlifts and other motorized vehicles.
  - .2 Overhead hazards such as that created by material transported by cranes.
  - .3 Fall hazards.
  - .4 Drowning hazards.
  - .5 Confined space hazards.
  - .6 Electrical hazards.
  - .7 Contact with operating mechanical, electrical, electronic, pneumatic, thermal, and hydraulic machinery and equipment.
  - .8 Fire hazards.

## **10. REGULATORY REQUIREMENTS**

- .1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at site.
- .2 In event of conflict between any provision of the above

authorities, the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, the Departmental Representative will advise on the course of action to be followed.

**11. WORK PERMITS** .1 Obtain specialty permits related to project before start of work.

**12. FILING OF NOTICE**

- .1 The General Contractor is to complete and submit a Notice of Project as required by Provincial authorities.
- .2 Provide copies of all notices to the Departmental Representative.

**13. HEALTH AND SAFETY PLAN**

- .1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards. Incorporate Preliminary Job Hazard Analysis (JHA)-Appendix B provided by PWGSC that identifies those hazards known to PWGSC.
- .2 Prepare and comply with a site-specific project Health and Safety Plan based on hazard assessment, including, but not limited to, the following (see checklist and sample in Appendix A attached):
  - .1 Primary requirements:
    - .1 Contractor's safety policy.
    - .2 Identification of applicable compliance obligations.
    - .3 Definition of responsibilities for project safety/organization chart for project.
    - .4 General safety rules for project.
    - .5 Job-specific safe work, procedures.
    - .6 Inspection policy and procedures.
    - .7 Incident reporting and investigation policy and procedures.
    - .8 Occupational Health and Safety Committee/Representative procedures.
    - .9 Occupational Health and Safety meetings.
    - .10 Occupational Health and Safety communications and record keeping procedures.
  - .2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of

#### **14. EMERGENCY PROCEDURES**

- the work.
  - .3 List hazardous materials to be brought on site as required by work.
  - .4 Indicate Engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.
  - .5 Identify personal protective equipment (PPE) to be used by workers.
  - .6 Identify personnel and alternates responsible for site safety and health.
  - .7 Identify personnel training requirements and training plan, including site orientation for new workers.
- .3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.
- .4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.
- .5 Departmental Representative's review: the review of Health and Safety Plan by Public Works and Government Services Canada (PWGSC) shall not relieve the Contractor of responsibility for errors or omissions in final Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.
- .1 List standard operating procedures and measures to be taken in emergency situations. Include an evacuation plan and emergency contacts (i.e. names/telephone numbers) of:
  - .1 Designated personnel from own company.
  - .2 Regulatory agencies applicable to work and as per
  - .3 Local emergency resources.
  - .4 Departmental Representative and site staff.
- .2 Include the following provisions in the emergency procedures:
  - .1 Notify workers and the first-aid attendant, of the nature and location of the emergency.
  - .2 Evacuate all workers safely.
  - .3 Check and confirm the safe evacuation of all workers.
  - .4 Notify the fire department or other emergency responders.
  - .5 Notify adjacent workplaces or residences which may be affected if the risk extends beyond the workplace.
  - .6 Notify Departmental Representative and site staff.
- .3 Provide written rescue/evacuation procedures as required for,  
but

not limited to:

- .1 Work in confined spaces or where there is a risk of entrapment.
- .2 Work with hazardous substances.
- .3 Workplaces where there are persons who require physical assistance to be moved.
- .4 Design and mark emergency exit routes to provide quick and unimpeded exit.
- .5 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.

#### **15. HAZARDOUS PRODUCTS**

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials, and regarding labeling and provision of Material Safety Data Sheets (MSDS) acceptable to the Departmental Representative and in accordance with the Canada Labour Code.
- .2 Where use of hazardous and toxic products cannot be avoided:
  - .1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents as per Section 013300.
  - .2 In conjunction with Departmental Representative, schedule to carry out work during "off hours" when tenants have left the building.
  - .3 Provide adequate means of ventilation as required by WorkSafeBC regulations.

#### **16. REMOVAL OF LEAD-CONTAINING PAINTS**

- .1 All paints containing TCLP lead concentrations above 5 ppm are classified as hazardous.
- .2 Carry out demolition activities involving lead-containing paints in accordance with applicable Provincial regulations.

#### **17. ELECTRICAL LOCKOUT**

- .1 Develop, implement and enforce use of established procedures to provide electrical, mechanical, pneumatic, hydraulic, chemical, thermal, or potential energy isolation, and lockout and to ensure the health and safety of workers for every event where work must be done on any electrical circuit or facility.
- .2 Prepare the lockout procedures in writing, listing step-by-step



- processes to be followed by workers, including how to prepare and issue the request/authorization form. Have procedures available for review upon request by the Departmental Representative. Site Maintenance Personnel may develop the lockout procedures at some sites since the Contractor may not have the necessary knowledge to develop an effective isolation plan. Comply with site Lockout Policy where one exists.
- .3 Keep the documents and lockout tags at the site and list in a log book for the full duration of the Contract. Upon request, make such data available for viewing by Departmental Representative or by any authorized safety representative.
- 18. OVERLOADING** .1 Ensure no part of work is subjected to a load which will endanger its safety or will cause permanent deformation.
- 19. FALSEWORK** .1 Design and construct falsework in accordance with CSA S269.1-1975 (R2003).
- 20. SCAFFOLDING** .1 Design, construct and maintain scaffolding in a rigid, secure and safe manner, in accordance with CSA Z797-2009 and B.C. Occupational Health and Safety Regulations.
- 21. CONFINED SPACES** .1 Carry out work in confined spaces in compliance with Provincial regulations (B.C. Occupational Health and Safety Regulation, Part 9).
- 22. FIRE SAFETY AND HOT WORK** .1 Obtain Departmental Representative's authorization before any welding, cutting or any other hot work operations can be carried out on site.
- .2 Hot work includes cutting/melting with use of torch, flame heating roofing kettles, or other open flame devices and grinding with equipment which produces sparks.
- 23. FIRE SAFETY REQUIREMENTS** .1 Store oily/paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
- .2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

**24. FIRE PROTECTION AND  
ALARM SYSTEM**

- .1 Fire protection and alarm systems shall not be:
  - .1 Obstructed.
  - .2 Shut off.
  - .3 Left inactive at the end of a working day or shift.
- .2 Do not use fire hydrants, standpipes and hose systems for purposes other than firefighting.
- .3 Be responsible/liable for costs incurred from the fire department, the building owner and the tenants, resulting from false alarms.

**25. UNFORESEEN  
HAZARDS**

- .1 Should any unforeseen or peculiar safety-related factor, hazard or condition become evident during performance of the work, immediately stop work and advise the Departmental Representative verbally and in writing.

**26. POSTED DOCUMENTS**

- .1 Post legible versions of the following documents on site:
  - .1 Health and Safety Plan.
  - .2 Sequence of work.
  - .3 Emergency procedures.
  - .4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.
  - .5 Notice of Project.
  - .6 Floor plans or site plans.
  - .7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.
  - .8 Workplace Hazardous Materials Information System (WHMIS) documents.
  - .9 Material Safety Data Sheets (MSDS).
  - .10 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.
  - .11 Name "Qualified Coordinator" responsible for co-ordination of health & safety activities.
- .2 Post all Material Safety Data Sheets (MSDS) on site, in a common area, visible to all workers and in locations accessible to tenants when work of this Contract includes construction activities adjacent to occupied areas.
- .3 Postings should be protected from the weather, and visible from

the street or the exterior of the principal construction site shelter provided for workers and equipment, or as approved by the Departmental Representative.

**27. MEETINGS**

- .1 Attend health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.

**28. CORRECTION OF  
NON-COMPLIANCE**

- .1 Immediately address health and safety non-compliance issues identified by the Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance with health and safety issues identified.
- .3 The Departmental Representative may issue a "stop work order" if non-compliance of health and safety regulations is not corrected immediately or within posted time. The General Contractor/subcontractors will be responsible for any costs arising from such a "stop work order".

**END OF SECTION**

- |    |                    |    |   |
|----|--------------------|----|---|
| 1. | <b>DEFINITIONS</b> | .1 | <b>Environmental Pollution and Damage:</b><br>presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade environment aesthetically, culturally and/or historically.   |
|    |                    | .2 | <b>Environmental Protection:</b> prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.  |
| 2. | <b>SUBMITTALS</b>  | .1 | Submittals: in accordance with Section 01 33 00 - Submittal Procedures.   |
|    |                    | .2 | Prior to commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Departmental Representative. Environmental Protection Plan is to present comprehensive overview of known or potential environmental issues which must be addressed during construction.   |
|    |                    | .3 | Address topics at level of detail commensurate with environmental issue and required construction tasks.  |
|    |                    | .4 | Environmental protection plan to include: <ul style="list-style-type: none"><li>.1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.</li><li>.2 Names and qualifications of persons responsible for manifesting contaminated soils and hazardous waste to be removed from site.</li><li>.3 Names and qualifications of persons responsible for training site personnel.</li><li>.4 Descriptions of environmental protection</li></ul> |

- personnel training program.
  - .5 Traffic control plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Plans include measures to minimize amount of mud transported onto paved public roads by vehicles or runoff.
  - .6 Spill Control Plan: including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
  - .7 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
  - .8 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off project site.
  - .9 Contaminant prevention plan that: identifies potentially hazardous substances to be used on job site; identifies intended actions to prevent introduction of such materials into air, water, or ground; and details provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.
  - .10 Waste water management plan that identifies methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.
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- |    |                           |    |   |
|----|---------------------------|----|---|
| 3. | <b>FIRES</b>              | .1 | Fires and burning of rubbish on site is not permitted.  |
| 4. | <b>DISPOSAL OF WASTES</b> | .1 | Do not bury rubbish and waste materials on site.  |
|    |                           | .2 | Do not dispose of wastes, including hazardous waste into waterways, storm or sanitary drains. |
| 5. | <b>DRAINAGE</b>           | .1 | Provide temporary drainage and pumping as necessary to keep excavations and site free from    |

- water.
- .2 Do not pump or direct drainage water into waterways, sewer or drainage systems without prior approval from the Department Representative.
- 6. WORK ADJACENT TO WATERWAY** .1 Do not dump excavated fill, waste material or debris in waterways.
- 7. POLLUTION CONTROL** .1 Maintain temporary erosion and pollution control features installed under this contract.
- .2 Control emissions from equipment and plant to local authorities' emission requirements.
- .3 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.
- 8. HISTORICAL / ARCHAEOLOGICAL CONTROL** .1 Give immediate notice to the Departmental Representative if evidence of archaeological finds are encountered during construction and await written instructions before proceeding with work in the vicinity of any such finds.
- .2 Relics, antiquities and items of historical or scientific interest shall remain the property of the Crown. Protect such articles and request directives from the Departmental Representative.
- 9. NOTIFICATION** .1 Departmental Representative will notify Contractor in writing of observed non-compliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
- .2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for

approval by Departmental Representative.

- .3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.
- .4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

## **10. SPILLS OR RELEASE**

- .1 Measures to be implemented to prevent, control or mitigate spills or release of deleterious substances:
  - .1 Contractor shall take due care to ensure no deleterious materials enter any surface drainage pathways located in the project area.
  - .2 Emergency response procedure for spills of deleterious substances must be in place. In the event of a spill, the contractor will immediately implement their Spill Response Protocol.
  - .3 The Contractor is responsible for all costs associated with a spill or release as a result of their actions. This will include but not limited costs of spill response equipment and materials, associated sampling, analysis and any required restoration of the impacted area.
  - .4 Response equipment to be on site at all times (i.e. spill kits) and workers trained in their location and use. The resources on hand must be sufficient to respond effectively and expediently to any spill that could occur on site.
  - .5 All construction equipment brought onto the site will be clean and properly maintained.
  - .6 Any equipment maintenance must occur in a designated area and must be conducted away from any surface water drains or collection points.
  - .7 Any equipment remaining on site overnight shall have appropriately placed drip pans.
  - .8 Waste generated will be prevented from

- entering the environment.
- .9 Prevent discharges containing asphalt, grout, concrete or other waste materials from entering waterways, storm drains or sanitary drains. This includes, but is not limited to:
  - .1 Cleaning equipment off site; and
  - .2 Protection of any other drainage structures not identified here with filter fences and/or silt socks, if required.
- .10 Protection of the roadways from tracking of mud, soil and debris needs to be maintained throughout the work.
- .11 Limit of work activities to normal business hours to minimize noise outside of those hours. Ensure that equipment and machinery is properly maintained to minimize unnecessary noise pollution. Consider local municipal noise bylaws when mobilizing equipment.
- .12 All utilities must be located prior to excavation

**END OF SECTION 01 35 43**



## **1. INSPECTION**

1. Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
2. Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.
3. If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
4. Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

## **2. INDEPENDENT INSPECTION**

### **AGENCIES**

1. Independent Inspection/Testing Agencies will be engaged by Departmental Representative for Purpose of inspecting and/or testing portion of Work. Cost of such services will be borne by Departmental Representative.
2. Provide equipment required for executing inspection and testing by appointed agencies.
3. Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
4. If defects are revealed during inspection and/or testing, appointed agency will request additional inspection

and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and reinspection.

### **3. ACCESS TO WORK**

1. Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
2. Co-operate to provide reasonable facilities for such access.

### **4. PROCEDURES**

1. Notify appropriate Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
2. Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.
3. Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

### **5. REJECTED WORK**

1. Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
2. Make good other Contractor's work damaged by such removals or replacements promptly.
3. If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner will deduct from Contract Price difference in value between Work performed and that called for by

Contract Documents, amounts of which will be determined by Departmental Representative.

## **6. REPORTS**

1. Submit 4 copies of inspection and test reports to Departmental Representative.

## **7. MILL TESTS**

1. Submit mill test certificates as requested.

## **8. EQUIPMENT AND SYSTEMS**

1. Submit adjustment and balancing reports for mechanical, electrical systems.

**END OF SECTION 01 45 00**

- 1. ACCESS AND DELIVERY**
  - .1 Only the designated entrance may be used for access to the site. The designated entry and exit will be via the Main Esquimalt Graving Dock gate on Admirals Road, along the Main Access Road, and along the north side of the dry dock. Access to the south side of the dock will be only by special permission from the Departmental Representative.
  - .2 Vehicular movement in and out of the Esquimalt Graving Dock will pass through check points and be monitored by EGD security. All Contractor's and Subcontractor's staff must carry current photo identification and a valid EGD Contractor's ID.
  - .3 Contractor is required to use only the designated entrance to access the work site, for deliveries to site, and as the exit for offsite disposal.
  - .4 Use of the Esquimalt Graving Dock facility will be granted to the Contractor through the Departmental Representative.
    - .1 Contractor's designated work areas are identified on the drawings. Provide a written request to the Departmental Representative if additional laydown area is required.
    - .2 The contractor's work site is to be used for loading and unloading purposes.
    - .3 Parking for Contractor's staff shall be in the contractor's car park on the north side of the PWGSC site adjacent to Munroe Head. Security will be instructed to have unauthorized vehicles towed at the Contractor's expense.
  - .5 Provide and maintain access roads, sidewalk crossing ramps and construction runways as may be required for access to the work. All roadways and walkways outside of the Contractor's work site must be kept clear of materials and equipment at all times.
  - .6 Provide and maintain competent flag operators, traffic signals, barricades and flares, lights or lanterns as may be required to perform work and protect other users of the Esquimalt Graving Dock.
- 2. STORAGE FACILITIES**
  - .1 Contractor's designated work areas are identified on the drawings. Provide a written request to the

- Departmental Representative if additional laydown area is required.
- 3. POWER** .1 Electrical power may be obtained at site for use during duration of the work free of charge.  
.1 Contractor shall provide 48 hours written notice to the Departmental Representative requesting use of electrical power at site.
- 4. AIR** .1 Compressed air may be obtained at site for use during duration of the work free of charge.  
.1 Contractor shall provide 48 hours written notice to the Departmental Representative requesting use of compressed air at site.
- 5. WATER SUPPLY** .1 Water supply may be obtained at site for use during duration of the work free of charge.  
.1 Contractor shall provide 48 hours written notice to the Departmental Representative requesting use of water at site.
- 6. CRANE SERVICES** .1 Crane services may be obtained at site for use during duration of the work free of charge.  
.1 Contractor shall provide 48 hours written notice to the Departmental Representative requesting use of crane services at site.  
.2 Contractor is responsible to provide qualified rigger(s) and spotter(s), all required rigging and associated equipment required below the hook necessary to perform lifts.
- 7. REMOVAL OF TEMPORARY FACILITIES** .1 Remove temporary facilities from site when directed by the Departmental Representative.
- 8. SIGNS AND NOTICES** .1 Signs and notices for safety and instruction shall be in both official languages or graphic symbols conforming to CAN/CSA-Z321.  
.2 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or when directed by Departmental Representative.

**END OF SECTION 01 51 00**

- |   |    |   |
|---|----|---|
| <b>1. REFERENCES</b>                                  | .1 | Canadian General Standards Board (CGSB)<br>.1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.<br>.2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.                 |
|   | .2 | Canadian Standards Association (CSA International)<br>.1 CSA-O121-M1978(R2003), Douglas Fir Plywood.  |
| <b>2. INSTALLATION AND REMOVAL</b>                    | .1 | Provide temporary construction fencing at perimeter of Contractor's work area(s).   |
|   | .2 | Remove from site all such work after use.   |
| <b>3. ACCESS TO SITE</b>                              | .1 | Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.                                      |
| <b>4. PUBLIC TRAFFIC FLOW</b>                         | .1 | Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect public. |
| <b>5. FIRE ROUTES</b>                                 | .1 | Maintain access to property including overhead clearances for use by emergency response vehicles.   |
| <b>6. PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY</b> | .1 | Protect surrounding private and public property from damage during performance of Work.   |
|   | .2 | Be responsible for damage incurred.   |
| <b>7. PROTECTION OF EXISTING PROPERTY</b>             | .1 | Provide protection for finished and partially finished property and equipment during performance of Work.   |
|   | .2 | Provide necessary screens, covers, and hoardings.   |
|   | .3 | Confirm with Departmental Representative locations and installation schedule 3 days prior to installation.  |
|   | .4 | Be responsible for damage incurred due to lack of or improper protection.   |

**END OF SECTION 01 56 00**

**1. PRODUCTS, MATERIALS  
AND EQUIPMENT**

- .1 Use NEW products/material and equipment unless otherwise specified. The term "products" is referred to throughout the specifications.
- .2 Use products of 1 manufacturer for material and equipment of the same type or classification unless otherwise specified.
- .3 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods.
- .4 Notify Departmental Representative in writing of any conflict between these specifications and manufacturer's instructions. Departmental Representative will designate which document is to be followed.
- .5 Provide metal fastenings and accessories in the same texture, colour and finish as base metal in which they occur, unless specified otherwise.
  - .1 Prevent electrolytic action between dissimilar metals.
  - .2 Use non-corrosive fasteners, anchors and spacers for securing exterior work.
- .6 Fastenings which cause spalling or cracking are not acceptable.
- .7 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .8 Use heavy hexagon heads, semi-finished unless otherwise specified.
- .9 Types of washers as follows, unless otherwise specified on drawings or in technical sections:
  - .1 Plain type washers: use on equipment and sheet metal.
  - .2 Soft gasket lock type washers: use where vibrations occur.
  - .3 Resilient washers: use with stainless steel.
- .10 Deliver, store and maintain packaged material and

equipment with manufacturer's seals and labels intact.

- .11 Prevent damage, adulteration and soiling of products during delivery, handling and storage. Immediately remove rejected products from site.
- .12 Store products in accordance with suppliers' instructions.
- .13 Touch up damaged factory finished surfaces to Departmental Representative's satisfaction.

## **2. QUALITY OF PRODUCTS**

- .1 Products, materials and equipment (referred to as products) incorporated into work shall be new, not damaged or defective, and of the best quality (compatible with the specifications) for the purpose intended. If requested, furnish evidence as to type, source and quality of the products provided.
- .2 Defective products will be rejected regardless of previous inspections.
  - .1 Inspection does not relieve responsibility, but is precaution against oversight or error.
  - .2 Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .3 Retain purchase orders, invoices and other documents to prove that all products utilized in this Contract meet the requirements of the specifications. Produce documents when requested by the Departmental Representative.
- .4 Should any dispute arise as to quality or fitness of products, the decision rests strictly with the Departmental Representative based upon the requirements of the Contract documents.
- .5 Unless otherwise indicated in the specifications, maintain uniformity of manufacture for any particular or like item.
- .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions.



**3. AVAILABILITY OF  
PRODUCTS**

- .1 Immediately upon signing the Contract, review product delivery requirements and anticipate foreseeable supply delays for any items.
- .2 If delays in supply of products are foreseeable, notify Departmental Representative of such in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of the work.
- .3 In event of failure to notify Departmental Representative at the start of work and should it subsequently appear that the work may be delayed for such reason, the Departmental Representative reserves the right to substitute more readily available products of similar character, at no increase in either the Contract price or the Contract time.

**4. MANUFACTURER'S  
INSTRUCTIONS**

- .1 Unless otherwise indicated in the specifications, install or erect products in accordance with the manufacturer's instructions.
  - .1 Do not rely on labels or enclosures provided with products.
  - .2 Obtain written instructions directly from the manufacturer.
- .2 Notify Departmental Representative in writing of conflicts between the specifications and the manufacturer's instructions so that the Departmental Representative may establish the course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes the Departmental Representative to require removal and re-installation at no increase in either the Contract price or the Contract time.

**5. CONTRACTOR'S OPTIONS  
FOR SELECTION OF  
PRODUCTS FOR  
TENDERING**

- .1 Products specified by "Prescriptive" specifications: select any product meeting or exceeding specifications.

- .2 Products specified by performance and referenced standard: select any product meeting or exceeding the referenced standard.
- .3 When products are specified by a referenced standard or by or Performance specifications, upon request of Departmental Representative obtain from manufacturer an independent laboratory report showing that the product meets or exceeds the specified requirements.

**6. SUBSTITUTION AFTER  
CONTRACT AWARD**

- .1 No substitutions are permitted without prior written approval of the Departmental Representative.
- .2 Proposals for substitution may only be submitted after Contract award. Such request must include statements of respective costs of items originally specified and the proposed substitution.
- .3 Proposals will be considered by the Departmental Representative if:
  - .1 Products selected by tenderer from those specified are not available;
  - .2 Delivery date of products selected from those specified would unduly delay completion of Contract, or
  - .3 Alternative product to that specified, which is brought to the attention of and considered by Departmental Representative as equivalent to the product specified, and will result in a credit to the Contract amount.
- .4 Should the proposed substitution be accepted either in part or in whole, assume full responsibility and costs when substitution affects other work on the project. Pay for design or drawing changes required as result of substitution.
- .5 Amounts of all credits arising from approval of the substitutions will be determined by the Departmental Representative, and the Contract price will be reduced accordingly.

**END OF SECTION 01 61 10**

## **1. PROJECT CLEANLINESS**

1. Maintain Work in tidy condition, free from accumulation of waste products and debris.
2. Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative.
3. Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
4. Provide on-site containers for collection of waste materials and debris.
5. Provide and use marked separate bins for recycling. Refer to Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
6. Dispose of waste materials and debris off site.
7. Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
8. Store volatile waste in covered metal containers, and remove from premises at end of each working day.
9. Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
10. Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
11. Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

## **2. FINAL CLEANING**

1. When Work is Substantially Performed removed surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
2. Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
3. Prior to final review remove surplus products, tools, construction machinery and equipment.
4. Remove waste products and debris.

5. Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative.
6. Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
7. Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
8. Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors.
9. Clean lighting reflectors, lenses, and other lighting surfaces
10. Vacuum clean and dust building interiors, behind grilles, louvres and screens.
11. Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
12. Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
13. Remove dirt and other disfiguration from exterior surfaces.
14. Clean and sweep roofs, gutters, areaways, and sunken wells.
15. Sweep and wash clean paved areas.
16. Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.
17. Remove debris and surplus materials from crawl areas and other accessible concealed spaces

### **3. WASTE MANAGEMENT AND DISPOSAL**

1. Separate waste materials for reuse or recycling in accordance with Section 017421 – Construction/ Demolition Waste Management and Disposal.

**END OF SECTION**

## **1. WASTE MANAGEMENT GOALS**

1. Prior to start of Work conduct meeting with Departmental Representative to review and discuss PWGSC's waste management goal and Contactor's proposed Waste Reduction Workplan for Construction, Renovation and/or Demolition waste to be project generated.
2. PWGSC's waste management goal: to divert a minimum 75 percent of total Project Waste from landfill sites. Prior to project completion provide Departmental Representative documentation certifying that waste management, recycling, reuse of recyclable and reusable materials have been extensively practiced. The overall waste diversion goal for this project is **75%**.
3. Target percentage goals are achievable for waste diversion. Contractor to review and confirm Departmental Representative's Waste Audit acceptable values.
4. Minimize amount of non-hazardous solid waste generated by project and accomplish maximum source reduction, reuse and recycling of solid waste produced by activities.
5. Protect environment and prevent environmental pollution damage.

## **2. RELATED REQUIREMENTS**

1. Section 01 11 55 – General Instructions

## **3. REFERENCES**

1. Definitions:
  1. Approved/Authorized Recycling facility: waste recycler approved by applicable provincial authority or other users of material for recycling approved by the Departmental Representative.

2. Class III: non-hazardous waste – construction renovation and demolition waste.
3. Construction, Renovation and/or Demolition Waste: Class III solid, non-hazardous waste materials generated during construction, demolition, and /or renovation activities.
4. Inert Fill: inert waste – exclusively asphalt and concrete.
5. Waste Source Separation Program (WSSP): implementation and co-ordination of ongoing activities to ensure designated waste materials will be sorted into pre-defined categories and sent for recycling and reuse, maximizing diversion and potential to reduce disposal costs.
6. Recyclable: ability of product or material to be recovered at end of its life cycle and remanufactured into new product for reuse.
7. Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
8. Recycling: process of sorting, cleansing, treating and reconstituting solid Waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste,
9. Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
  1. Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
  2. Returning reusable items including pallets or unused products to vendors.
10. Salvage: removal of structural and non-structural materials from deconstruction/disassemble projects for purpose of reuse or recycling.
11. Separate Condition: refers to waste sorted into individual types.
12. Source Separation: act of keeping different types of waste materials separate beginning from the point they became waste.

13. Waste Audit (WA): detailed inventory of estimated quantities of waste materials that will be generated during construction, demolition, deconstruction and/or renovation. Involves quantifying by volume/weight amounts of materials and wastes that will be reused, recycled or landfilled. Refer to Schedule A.
14. Waste Diversion Report: detailed report of final results, quantifying cumulative weights and percentages of waste materials reused, recycled and landfilled over course of project. Measures success against Waste Reduction Workplan (WRW) goals and identifies lessons learned.
15. Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials generated by project. Specifies diversion goals, implementation and reporting procedures, anticipated results and responsibilities. Waste Reduction Workplan (Schedule B) information acquired from Waste Audit.

#### **4. DOCUMENTS**

1. Post and maintain in visible and accessible area at job site, one copy of following documents:
  1. Waste Audit (Schedule A).
  2. Waste Reduction Workplan (Schedule B).
  3. Waste Source Separation Program.

#### **5. ACTION AND INFORMATIONAL SUBMITTALS**

1. Submit in accordance with Section 01 33 00 – Submittal Procedures.
2. Prepare and submit following prior to project start-up:
  1. 1 copy and 1 electronic copy of completed Waste Audit (WA): Schedule A.

2. 1 copy and 1 electronic copy of completed waste Reduction Workplan (WRW): Schedule B.
3. 1 copy and 1 electronic copy of Waste Source Separation Program (WSSP).
3. Submit prior to final payment the following:
  1. Waste Diversion Report, indicating final quantities in tones by material types salvaged for reuse, recycling or disposal in landfill and recycling centres, re-use depots, landfills and other waste processors that received waste materials.
  2. Provide receipts, scale tickets, waybills, waste disposal receipts that confirm quantities and types of materials reused, recycled or disposed of and destination.

## **6. WASTE AUDIT (WA)**

1. Departmental Representative will prepare WA prior to project start-up. WA will be provided with bid documentation (see Schedule A).
2. WA provides detailed inventory, estimated quantities and types of waste materials that will be generated as well as their potential to be reused and/or recycled and project's waste diversion goals and objectives.
3. After award of contract, contractor to review WA and confirm that anticipated quantities of waste generated are accurate and goals achievable.
4. If after review, contractor determines that indicated quantities or opportunities in WA are not accurate or achievable, contractor to provide written details of discrepancies and revised quantities for areas of concern. Contractor to meet with Departmental Representative to review and justify revisions.
5. Post on-site WA where contractor and sub-contractors are able to review content.

## **7. WASTE REDUCTION WORKPLAN (WRW)**



1. Prepare and submit WRW (Schedule B) at least 10 days prior to project start-up.
2. WRW identifies strategies to optimize diversion through reduction, reuse, and recycling of materials and comply with applicable regulations, based on information acquired from WA.
3. WRW should include but not limited to:
  1. Applicable regulations.
  2. Specific goals for waste reduction, identify existing barriers and develop strategies to overcome them.
  3. Destination of materials identified.
  4. Deconstruction/disassembly techniques and schedules.
  5. Methods to collect, separate, and reduce generated wastes.
  6. Location of waste bins on-site.
  7. Security of on-site stock piles and waste bins.
  8. Protection of personnel, sub-contractors.
  9. Clear labelling of storage areas.
  10. Training plan for contractor and sub-contractors.
  11. Methods to track and report results reliably.
  12. Details on materials handling and removal procedures.
  13. Recycler and reclaimer requirements.
  14. Quantities of materials to be salvaged for reuse or recycled and materials sent to landfill.
  15. Requirements for monitoring on-site wastes management activities.
4. Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.
5. Post WRW or summary where workers at site are able to review content.
6. Monitor and report on waste reduction by documenting total volume (in tonnes) and cost of actual waste removed from project.

## **8. WASTE SOURCE SEPERATION PROGRAM (WSSP)**

1. As part of Waste Reduction Workplan, prepare WSSP prior to project start-up.
2. WSSP will detail methodology and planned on-site activities for separation of reusable and recyclable materials from waste intended for landfill.
3. Provide list and drawings of location that will be made available for sorting, collection, handling and storage of anticipated quantities of reusable and recyclable materials.
4. Provide sufficient on-site facilities and containers for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
5. Locate containers to facilitate deposit of materials without hindering daily operations.
6. Provide training for workers in handling and separation of materials for reuse and/or recycling.
7. Locate separated materials in area which minimizes material damage.
8. Clearly and securely label containers to identify types/conditions of materials accepted and assist workers in separating materials accordingly.
9. Monitor on-site waste management activities by conducting periodic site inspections to verify: state of signage, contamination levels, bin locations and condition, personnel participation, use of waste tracking forms and collection of waybills, receipts and invoices.
10. On-site sale of salvaged materials is not permitted.

## **9. WASTE PROCESSING SITES**

1. Contractor is responsible to research and locate waste diversion resources and service providers. Salvaged materials are to be transported off site to approved and/or authorized recycling facilities or to users of material for recycling

## **10. QUALITY ASSURANCE**

1. After award of Contract, a mandatory site examination will be held for this Project for

Contractor and/or sub-contractors responsible for construction, renovation, demolition/deconstruction waste management.

1. Date, time and location will be arranged by Departmental Representative.

## **11. STORAGE, HANDLING AND PROTECTION**

1. Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.
2. Unless specified otherwise, materials for removal become the Contractor's property.
3. Protect, stockpile, store and catalogue salvaged items.
4. Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
5. Protect structural components not removed and salvaged materials from movement or damage.
6. Support affected structures. If safety of building is endangered, cease operations and immediately notify Departmental Representative.
7. Protect surface drainage, mechanical and electrical from damage and blockage.
8. Provide on-site facilities and containers for collection and storage of reusable and recyclable materials.
9. Separate and store materials produced during project in designated areas.
10. Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated processing facilities.
  1. On-site source separation is recommended.

2. Remove co-mingled materials to offsite processing facility for separation.
3. Obtain waybills, receipts, and/or scale tickets for separated materials removed from site.
4. Materials reused on-site are considered to be diverted from landfill and as such are to be included in all reporting.

## **12. DISPOSAL OF WASTES**

1. Do not bury rubbish or waste materials.
2. Do not dispose of any waste into waterways, storm, or sanitary sewers.
3. Keep records of construction waste including:
  1. Number and size of bins.
  2. Waste type of each bin.
  3. Total tonnage generated.
  4. Tonnage reused or recycled.
  5. Reused or recycled waste destination.
4. Remove materials on-site as Work progresses.
5. Prepare project summary to verify destination and quantities on material-by-material basis as identified in the waste audit.

### **Part 2 Products**

#### **1. NOT USED**

1. Not Used.

### **Part 3 Products**

#### **1. APPLICATION**

1. Do Work in compliance with WRW and WSSP
2. Handle waste materials not reused salvaged, or recycled in accordance with appropriate regulations and codes.

## **2. CLEANING**

1. Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning.
  1. Leave work are clean at end of each day.
2. Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 – Cleaning.
3. Waste Management:
  1. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

## **3. DIVERSION OF MATERIALS**

1. From following list, separate materials from general waste stream and stockpile in separate piles for containers, as reviewed by Departmental Representative, and consistent with applicable fire regulations.
  1. Mark containers or stockpile areas.
  2. Provide instruction on disposal practices.

## **4. WASTE DIVERSION REPORT**

1. At completion of Project, prepare written Waste Diversion Report indicating quantities of materials reused, recycled or disposed of as well as the following:
  1. Identify final diversion results and measure success against goals from Waste Reduction Workplan.
  2. Compare final quantities/percentages diverted with initial projections in Waste Audit and Waste Reduction Workplan and explain variances.
    1. Supporting documentation.
    2. Waybills and tracking forms.
  3. Description of issues, resolutions and lessons learned.

## 5. WASTE AUDIT (WA)

### 1. Schedule A – Waste Audit (WA)

(1) Material Category	(2) Material Quantity Unit	(3) Estimated Waste %	(4) Total Quantity of Waste (unit)	(5) Generation Point	(6) % Recycled	(7) % Reused
Wood and Plastics Material Description						
Off-cuts						
Warped Pallet Forms						
Plastic Packaging						
Cardboard Packaging						
Other						
Glass						
Wood						
Metal						
Other						

## 6. WASTE REDUCTION WORKPLAN (WRW)

### 1. Schedule B

(1) Material Category	(2) Person(s) Responsible	(3)Total Quantity of Waste (unit)	(4) Reused Amount (units) Projected	Actual	(5) Recycled Amount (unit) Projected	Actual	(6) Material(s) destination
Wood and Plastics Material Description							
Chutes							
Warped Pallet Forms							
Plastic Packaging							
Cardboard Packaging							
Other							
Glass							
Wood							
Metal							
Other							

## 7. SCHEDULES

1. Following Schedules are attached to this Specification:
  1. Waste Audit – Schedule A.
  2. Waste Reduction Workplan Form – Schedule B.

**END OF SECTION**

- 1. SUBMISSION**
  - .1 Submit two (2) complete binders containing all required final submittal documents plus one electronic copy in portable document format.
  - .2 Prepare instructions and data by personnel experienced in maintenance of described products.
  - .3 Revise content of documents as required before final submittal.
  - .4 If requested, furnish evidence as to type, source and quality of products provided.
  - .5 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- 2. FORMAT**
  - .1 Organize data in the form of an instructional manual.
  - .2 Binders: vinyl, hard covered, 3 "D" ring, loose leaf 219 x 279 mm with spine and face pockets.
  - .3 Cover: identify each binder with type or printed title "Project Record Documents"; list title of project and identify subject matter of contents.
  - .4 Arrange content by product under section numbers and sequence of Table of Contents.
  - .5 Provide tabbed fly leaf for each separate product, with typed description of product and major component parts of equipment.
  - .6 Text: manufacturer's printed data, or typewritten data.
  - .7 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- 3. CONTENTS, EACH VOLUME**
  - .1 Table of Contents – provide the following:
    - .1 Title of project.
    - .2 Date of submission.
    - .3 Names, addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.



- 
- .4 Schedule of products, indexed to content of volume.
  - .2 For each product, list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
  - .3 Product data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
  - .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- 4. AS-BUILT DOCUMENTS .1** Contract drawings and shop drawings: legibly mark each item to record actual construction, including:
- .1 Surveyed locations of buried components referenced to visible survey benchmark and accessible features of construction, See Appendix.
  - .2 Field changes of dimension and detail.
  - .3 Changes made by change orders.
  - .4 Details not on original Contract drawings.
  - .5 References to related shop drawings and modifications.
- .2 **Contract Specifications:** legibly mark each item to record actual "Workmanship of Construction", including:
- .1 Manufacturer, trade name, and catalogue number of each "Product/Material" actually installed, particularly optional items and substitute items.
  - .2 Changes made by addenda and change orders.
- .3 **As-built information:**
- .1 Record changes in red ink.
  - .2 On site "Red Line" As-Built documents to be reviewed with Departmental Representative at every project meeting to ensure up-to-date and accurate As-Built documents at the end of the project.
  - .3 Mark on 1 set of drawings, specifications and shop drawings at completion of project and, before final inspection, neatly transfer notations to second set.

- .4 Provide 1 set of CD's in AutoCAD 2009 file format with all as-built information on the CD's.
- .5 Submit all sets to the Departmental Representative.

**5. WARRANTIES, BONDS,  
TEST REPORTS,  
INSPECTION  
REPORTS**

- .1 Separate each Document with index tab sheets keyed to Table of Contents listing.
- .2 List subcontractor, supplier and manufacturer with name, address, and telephone number of responsible principal.
- .3 Obtain Warranties, Bonds, Test Results, Inspection Reports executed in duplicate by subcontractors, suppliers, manufacturers, and inspection agencies within 5 days after completion of the applicable item of work.
- .4 Except for items put into use with the Departmental Representative's permission, leave date of beginning of time of warranty until the date of substantial performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and bonds until time specified for submittal.

**6. COMPLETION**

- .1 Submit a written certificate that the following have been performed:
  - .1 Work has been completed and inspected for compliance with the Contract documents.
  - .2 Defects have been corrected and deficiencies have been completed.
  - .3 Equipment and systems have been tested, adjusted and balanced as required.
  - .4 Work is complete and ready for final inspection.

**END OF SECTION 01 78 30**

**.1 SUMMARY**

- .1 Section Includes:
  - .1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.
- .2 Related Sections:
  - .1 Section 01 33 00 – Submittal Procedures.
- .3 Acronyms:
  - .1 AFD - Alternate Forms of Delivery, service provider.
  - .2 Cx - Commissioning.
  - .3 EMCS - Energy Monitoring and Control Systems.
  - .4 PI - Product Information.
  - .5 PV - Performance Verification.
  - .6 TAB - Testing, Adjusting and Balancing.

**.2 GENERAL**

- .1 Cx is a planned program of tests, procedures and checks carried out systematically on systems of the finished Project. Cx is performed after systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:
  - .1 Contractor to verify installed equipment operates in accordance with contract documents and design criteria and intent.
- .2 Contractor is responsible for the Cx process, operating equipment and systems, troubleshooting and making adjustments as required.
  - .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency.
  - .2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.
- .3 Design Criteria: To meet the Project functional and operational requirements described in Section 210501.02.

**.3 COMMISSIONING  
OVERVIEW**

- .1 Cx activities supplement field quality and testing procedures described in relevant technical sections.
- .2 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during

Construction and Cx stages to ensure the built system is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.

- .3 Departmental Representative will issue Interim Acceptance Certificate when:
  - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.
  - .2 Equipment, components and systems have been commissioned.

**.4 NON-CONFORMANCE  
TO PERFORMANCE  
VERIFICATION  
REQUIREMENTS**

- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the non-functional system, including related systems as deemed required by Departmental Representative, to ensure effective performance.
- .2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

**.5 PRE-CX REVIEW**

- .1 Before Construction:
  - .1 Review contract documents, confirm by writing to Departmental Representative.
    - .1 Adequacy of provisions for Cx.
    - .2 Aspects of design and installation pertinent to success of Cx.
- .2 During Construction:
  - .1 Co-ordinate provision, location and installation of provisions for Cx.
- .3 Before start of Cx:
  - .1 Ensure installation of related components is complete.
  - .2 Fully understand Cx requirements and procedures.
  - .3 Have Cx documentation shelf-ready.

- .4 Understand completely design criteria and intent.
  - .5 Submit complete start-up documentation to Departmental Representative.
  - .6 Have Cx schedules up-to-date.
  - .7 Ensure systems have been cleaned thoroughly.
  - .8 Complete TAB procedures on systems, submit TAB reports to Departmental Representative for review and approval.
  - .9 Ensure "As-Built" system schematics are available.
- 
- .4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.
- 
- .6 CONFLICT**
    - .1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.
    - .2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.
- 
- .7 SUBMITTALS**
    - .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
      - .1 Submit no later than 2 weeks after award of Contract:
        - .1 Draft Cx documentation.
        - .2 Preliminary Cx schedule.
      - .2 Request in writing to Departmental Representative for changes to submittals and obtain written approval at least 2 weeks prior to start of Cx.
      - .3 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least 2 weeks prior to start of Cx.
      - .4 Provide additional documentation relating to Cx process required by Departmental Representative.
- 
- .8 COMMISSIONING DOCUMENTATION**
    - .1 Departmental Representative to review and approve Cx documentation.
    - .2 Provide completed and approved Cx documentation to Departmental Representative.
- 
- .9 COMMISSIONING SCHEDULE**
    - .1 Provide detailed Cx schedule as part of construction schedule.
    - .2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:

- .1 Approval of Cx reports.
  - .2 Verification of reported results.
  - .3 Repairs, retesting, re-commissioning, re-verification.
  - .4 Training.
- .10 COMMISSIONING MEETINGS**
  - .1 Convene Cx meetings following project meetings and as specified herein.
  - .2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.
  - .3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.
  - .4 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.
  - .5 Meeting will be chaired by Departmental Representative, who will record and distribute minutes.
  - .6 Ensure subcontractors are present at Cx meetings as required.
- .11 STARTING AND TESTING**
  - .1 Contractor assumes liabilities and costs for inspections, including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.
- .12 WITNESSING OF STARTING AND TESTING**
  - .1 Provide 7 days notice prior to commencement.
  - .2 Departmental Representative to witness of start-up and testing.
- .13 PROCEDURES**
  - .1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.
    - .1 All hydraulic fluid must be purged from existing equipment and lines and replaced with new oil prior to any start-up activities. Refer to Section 210501.01.
  - .2 Conduct start-up and testing in following distinct phases:
    - .1 Included in delivery and installation:
      - .1 Verification of conformity to specification, approved shop drawings and completion of PI

- report forms.
- .2 Visual inspection of quality of installation.
- .2 Start-up: follow accepted start-up procedures.
- .3 Operational testing: document equipment performance.
- .4 System PV: include repetition of tests after correcting deficiencies.
- .5 Post-substantial performance verification: to include fine-tuning.
- .3 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.
- .4 Document required tests on approved PV forms.
- .5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:
  - .1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.
  - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.
  - .3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.
    - .1 Rejected equipment to be removed from site and replaced with new.
    - .2 Subject new equipment/systems to specified start-up procedures.
- .14 START-UP DOCUMENTATION**
  - .1 Assemble start-up documentation and submit to Departmental Representative for approval before commencement of commissioning.
  - .2 Start-up documentation to include:
    - .1 Factory and on-site test certificates for specified equipment.
    - .2 Pre-start-up inspection reports.
    - .3 Signed installation/start-up check lists.
    - .4 Start-up reports,
    - .5 Step-by-step description of complete start-up

procedures, to permit Departmental Representative to repeat start-up at any time.

**.15 OPERATIONS AND  
MAINTENANCE OF  
EQUIPMENT AND  
SYSTEMS**

- .1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.
- .2 Operate and maintain systems for length of time required for commissioning to be completed.
- .3 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

**.16 TEST RESULTS**

- .1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.
- .2 Provide manpower and materials, assume costs for re-commissioning.

**.17 START OF  
COMMISSIONING**

- .1 Notify Departmental Representative at least 7 days prior to start of Cx.
- .2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

**.18 INSTRUMENTS /  
EQUIPMENT**

- .1 Provide the following equipment as required:
  - .1 2-way radios.
  - .2 Ladders.
  - .3 Equipment as required to complete work.

**.19 COMMISSIONING  
PERFORMANCE  
VERIFICATION**

- .1 Carry out Cx:
  - .1 Under actual operating conditions, over entire operating range, in all modes.
  - .2 On independent systems and interacting systems.
- .2 Cx procedures to be repeatable and reported results are to be verifiable.



- .3 Follow equipment manufacturer's operating instructions.
- .20 **WITNESSING COMMISSIONING**
  - .1 Departmental Representative to witness activities and verify results.
- .21 **AUTHORITIES HAVING JURISDICTION**
  - .1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.
  - .2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.
  - .3 Provide copies to Departmental Representative within 3 days of test and with Cx report.
- .22 **REPEAT VERIFICATIONS**
  - .1 Assume costs incurred by Departmental Representative for third and subsequent verifications where:
    - .1 Verification of reported results fail to receive Departmental Representative's approval.
    - .2 Repetition of second verification again fails to receive approval.
    - .3 Departmental Representative deems Contractor's request for second verification was premature.
- .23 **SUNDRY CHECKS AND ADJUSTMENTS**
  - .1 Make adjustments and changes which become apparent as Cx proceeds.
  - .2 Perform static and operational checks as applicable and as required.
- .24 **DEFICIENCIES, FAULTS, DEFECTS**
  - .1 Correct deficiencies found during start-up and Cx to satisfaction of Departmental Representative.
  - .2 Report problems, faults or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative.

- 
- |            |  |  |
|------------|--|--|
| <b>.25</b> | <b>COMPLETION OF COMMISSIONING</b>                 | <ul style="list-style-type: none"><li>.1 Upon completion of Cx leave systems in normal operating mode.</li><li>.2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.</li><li>.3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Departmental Representative.</li></ul>  |
| <b>.26</b> | <b>ACTIVITIES UPON COMPLETION OF COMMISSIONING</b> | <ul style="list-style-type: none"><li>.1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.</li></ul>   |
| <b>.27</b> | <b>PERFORMANCE VERIFICATION TOLERANCES</b>         | <ul style="list-style-type: none"><li>.1 Application tolerances:<ul style="list-style-type: none"><li>.1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/- 10% of specified values.</li></ul></li><li>.2 Instrument accuracy tolerances:<ul style="list-style-type: none"><li>.1 To be of higher order of magnitude than equipment or system being tested.</li></ul></li><li>.3 Measurement tolerances during verification:<ul style="list-style-type: none"><li>.1 Unless otherwise specified actual values to be within +/- 2 % of recorded values.</li></ul></li></ul> |
| <b>.28</b> | <b>OWNER'S PERFORMANCE TESTING</b>                 | <ul style="list-style-type: none"><li>.1 Performance testing of equipment or system by Departmental Representative will not relieve Contractor from compliance with specified start-up and testing procedures.</li></ul>   |

**END OF SECTION 01 91 13**

**Part 1 General**

**1.1 DESCRIPTION**

- .1 This section is an outline of items of work; removals, replacement and related work required to complete main gate, penstock gates, and penstock cylinders refurbishment as shown and described in the contract documents.

**1.2 RELATED REQUIREMENTS**

- .1 Section 35 60 00 Refurbishment of Penstock Gates and Supports.  
Section 21 05 01.01 Refurbishment of Penstock Gate Hydraulic Cylinders  
Section 21 05 01.02 Installation of Auxiliary Gate

**1.3 RELATED WORK SPECIFIED ELSEWHERE**

- .1 This section relates to specific items of work to which other specification sections are applicable with respect to materials and installation of those particular trades. Refer to pertinent sections of specifications and drawings, and include materials, labour, equipment and services required to complete the work.

**1.4 REFERENCES**

- .1 Definitions:
  - .1 Removal: systematic dismantling of structure in a manner that achieves safe removal of existing gates, cylinders, and required related components without damaging existing structures and components.
  - .2 Disassembly: physical detachment of materials from structure: prying, pulling, cutting, unscrewing.

**1.5 REMOVALS AND PROTECTION OF EXISTING FACILITIES**

- .1 Protect and prevent movement or damage of existing adjacent structures, surfaces, and services.
- .2 Remove existing services and obstacles where required for refinishing and or making good of existing surfaces and replace same as work progresses.
- .3 Immediately replace or make good any damage of existing adjacent materials and surfaces to the Departmental Representative's approval.

**1.6 CONTRACTOR'S RESPONSIBILITIES**

- .1 Arrange for the services of a mobile crane for lifting and supporting main and penstock gates, cylinders, and access enclosures, the EGD will provide crane service free of charge for this project. Refer to section 01 51 00 Temporary Facilities.

**Part 2 Products**

**2.1 EQUIPMENT**

- .1 Leave equipment and machinery running only while in use, except where extreme temperatures prohibit shutting down.

**Part 3 Execution**

**3.1 SITE VERIFICATION OF CONDITIONS**

- .1 Employ necessary means to assess site conditions and structures to determine quantity and locations of hazardous materials.
- .2 Investigate site and structures to determine dismantling, processing and storage logistics required prior to beginning of Work.
- .3 Confirm location of all buried utilities, service lines, pipes, conduits, obstructions, or other items using X-ray or Ground Penetrating Radar (GPR) prior to any below grade excavation work or drilling through existing concrete or masonry.

**3.2 PREPARATION**

- .1 Position crane and support concrete roof evenly prior to removal.
- .2 Position crane and support gates evenly prior to disconnecting stem couplings and lifting gates out of tunnels.
- .3 Supply and install necessary materials to anchor and secure concrete roof, gates and components, while work is being conducted.
- .4 Throughout removal and disassembly pay close attention to connection and material assemblies. Employ workmanship procedures which minimize damage to materials.
- .5 Ensure workers and subcontractors are trained to carry out work in accordance with appropriate disassembly and reassembly techniques.
- .6 Ensure workers and subcontractors are trained to carry out work in a confined space environment.
- .7 Ensure tools are being used in a manner which allows for reassembly of materials in best condition possible and that refurbished materials will be compatible with existing conditions upon reinstatement.

- .8 Maintain structural integrity of concrete and steel components.
- .9 Erect temporary secured and safe working platform for work where required to carry out work, provide access to Departmental Representative and for inspection purposes. Refer to Section 01 51 00.

### **3.3 REMOVALS AND ALTERATIONS**

- .1 Carry out removals to the extent necessary to provide a clean and compatible substrate for proper application of new and refurbished materials by welding, cutting, drilling, grinding, etc.
- .2 Remove, refurbish/repair and reassemble, main and penstock gates and components, and penstock gate hydraulic cylinders as indicated in contract documents. The extent of repairs will be determined by Departmental Representative upon completion of non-destructive testing by others once gates have been removed and cleaned.

### **3.4 REPLACEMENT**

- .1 Reconnect gate leafs and cylinders, and guides, adjust thread stem couplings for proper operation of the gates in coordination with the Departmental Representative.
- .2 Carefully protect all components of gate and slide assembly to ensure no damage is incurred due to removal and replacement.
- .3 Protect all areas of main and penstock tunnels where damage could occur due to removal and replacement.
- .4 Replace concrete roof slab in original condition when all work in main tunnel is complete.
- .5 Prior to removal of gates and cylinders, and immediately after reinstatement, carry out an inspection with the Departmental Representative. Record all damages, losses or deficiencies, and make good to the approval of the Departmental Representative.

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED SECTIONS**

- .1 Section 03 30 00.01 – Cast-in-Place Concrete Short Form

**1.2 REFERENCES**

- .1 American Concrete Institute (ACI)
  - .1 SP-66-04, ACI Detailing Manual 2004.
    - .1 ACI 315-99, Details and Detailing of Concrete Reinforcement.
    - .2 ACI 315R-04, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1-04/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA-A23.3-04, Design of Concrete Structures.
  - .3 CAN/CSA-G30.18-M92(R2002), Billet-Steel Bars for Concrete Reinforcement, A National Standard of Canada.
  - .4 CSA-G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .5 CSA W186-M1990(R2002), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .3 Reinforcing Steel Institute of Canada (RSIC)
  - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Shop drawings are not required for this Section.
- .2 Detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated.

- 1.4 QUALITY ASSURANCE** .1 Submit in accordance with Section 01 33 00:  
.1 Mill test report: upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, minimum of 2 weeks prior to beginning reinforcing work.
- 1.5 DELIVERY, STORAGE AND HANDLING** .1 Deliver, store and handle material in accordance with Section 01 61 10 Product Requirements.  
.2 Delivery and Acceptance requirements: deliver materials to site in original factory packaging, labeled with manufacturer's name and address.  
.3 Storage and handling requirements:  
.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.  
.2 Replace defective or damaged materials with new.  
.4 Waste Management and Disposal:  
.1 Separate waste materials for reuse and recycling.  
.2 Place materials defined as hazardous or toxic in designated containers.
- 2. PRODUCTS**
- 2.1 MATERIALS** .1 Substitute different size bars only if permitted in writing by Departmental Representative.  
.2 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.  
.3 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.  
.4 Mechanical splices: subject to approval of Departmental Representative.
- 2.2 FABRICATION** .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

- .2 Obtain Departmental Representative's approval for locations of reinforcement splices other than those shown on placing drawings.
  - .3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.
  - .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.
- 2.3 Source Quality Control**
- .1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 2 weeks prior to beginning reinforcing work.
  - .2 Upon request inform Departmental Representative of proposed source of material to be supplied.
- 3. EXECUTION**
- 3.1 FIELD BENDING**
- .1 Field bending and field welding of reinforcement are not permitted.
- 3.2 PLACING REINFORCEMENT**
- .1 Place reinforcing steel as indicated on drawings and in accordance with CSA-A23.1/A23.2.
  - .2 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
  - .3 Ensure cover to reinforcement is maintained during concrete pour.
  - .4 Protect epoxy coated portions of bars with covering during transportation and handling.

**END OF SECTION 03 20 00**



**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 01 11 55 – General Instructions
- .2 Section 01 33 00 – Submittal Procedures
- .3 Section 01 74 21 – Waste Management and Disposal

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
  - .2 ASTM D260-86(2001), Standard Specification for Boiled Linseed Oil.
  - .3 ASTM D1751-04, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non extruding and Resilient Bituminous Types).
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-19.24-M90, Multicomponent, Chemical-Curing Sealing Compound.
- .3 CSA International
  - .1 CSA-A23.1/A23.2-2004, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
  - .3 CAN/CSA-G30.18-M92(R2002), Billet-Steel Bars for Concrete Reinforcement.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 At least 2 weeks prior to beginning Work, inform Departmental Representative of source of fly ash.
  - .1 Do not change source of fly ash without written approval of Departmental Representative .
- .3 Provide testing results for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.
- .4 Provide for review by Departmental Representative any deviations exceeding maximum allowable hauling time of 120 minutes for concrete to be delivered to site of work and discharged after batching.

**1.4 QUALITY ASSURANCE**

- .1 Provide to Departmental Representative, 4 weeks minimum prior to starting concrete work, valid and recognized certificate from plant delivering concrete.
  - .1 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements.
  - .2 Sustainability Standards Certification:
    - .1 Construction Waste Management: provide copy of plan.
    - .2 Recycled Content:
      - .1 Provide listing of recycled content products used.
      - .2 When Supplementary Cementing Materials (SCMs) are used, provide evidence to certify reduction in cement from Base Mix to Actual SCMs Mix, as percentage.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Delivery and Acceptance Requirements:
  - .1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.
    - .1 Do not modify maximum time limit without receipt of prior written agreement from Departmental Representative and concrete producer as described in CSA A23.1/A23.2.
    - .2 Deviations to be submitted for review by the Departmental Representative.
- .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.
- .3 Packaging Waste Management: in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 DESIGN CRITERIA**

- .1 Alternative 1 - Performance to CSA A23.1/A23.2 and as described in MIXES of PART 2 - PRODUCTS.

**2.2 PERFORMANCE CRITERIA**

- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

**2.3 MATERIALS**

- .1 Cement: to CSA A3001, Type GU.

- .2 Supplementary cementing materials: with minimum 20% fly ash replacement, by mass of total cementitious materials to CSA A3001.
- .3 Water: to CSA A23.1/A23.2
- .4 Reinforcing bars: to CAN/CSA-G30.18, Grade 400.
- .5 Premoulded joint filler:
  - .1 Bituminous impregnated fibreboard: to ASTM D1751.
- .6 Joint sealer/filler: to CAN/CGSB-19.24, Type 1, Class B.
- .7 Patching Compounds:
  - .1 Patching compound shall be a prepackaged, 1-component, acrylic polymer modified blend of portland cement, specially graded aggregates and admixtures, designed for low shrinkage, low stress cure, and compatibility with existing host concrete. Prior to patching, sample cores of existing concrete shall be delivered by Contractor to manufacturer for testing and evaluation. Patching compound shall be customized by manufacturer, so that compressive strength does not exceed 28MPa, or 3 MPa above the existing concrete's compressive strength, whichever is lower, as measured by ASTM C-109.
  - .2 Patching compound shall develop a minimum 1.5MPa direct tensile adhesion with host substrate, when applied in accordance with these specifications.
  - .3 Tensile strength of patching compound shall be a minimum of 2.8MPa. Flexural modulus shall be 7550 MPa. Material must be vapor permeable, with a minimum permance of 8 perms at 12mm depth as measured by ASTM E-96.
- .8 Other concrete materials: to CSA A23.1/A23.2.
- .9 Adhesive set anchor rods:
  - .1 Anchor rods: to ASTM A307
  - .2 Anchoring Adhesive: two-component 100% solids based epoxy system supplied in manufacturer's standard side by side cartridge and dispensed through a static mixing nozzle supplied by manufacturer. Epoxy to meet the minimum requirements of ASTM C-881 Specification for type I, II, IV, and V, grade 3, class B and C must develop a minimum 90 MPa compressive yield strength after a seven day cure. Epoxy to have a heat deflection temperature of 58 degrees Celcius.

## **2.4 MIXES**

- .1 Alternative 1 - Performance Method for specifying concrete: to meet Departmental Representative performance criteria to CSA A23.1/A23.2.

- .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 - VERIFICATION.
- .2 Provide concrete mix to meet following hard state requirements:
  - .1 Durability and class of exposure: C-1
  - .2 Compressive strength at 28 day age: 35 MPa minimum.
  - .3 Intended application: header beam in auxiliary tunnel
  - .4 Aggregate size: 20 mm maximum.
- .3 Submit Concrete supplier's certification.
- .4 Provide quality management plan to ensure verification of concrete quality to specified performance.

### **Part 3 Execution**

#### **3.1 PREPARATION**

- .1 Provide Departmental Representative 48 hours notice before each concrete pour.
- .2 Place concrete reinforcing in accordance with drawings.
- .3 During concreting operations:
  - .1 Development of cold joints not allowed.
  - .2 Ensure concrete delivery and handling facilitates placing with minimum of rehandling, and without damage to existing structure or Work.
- .4 Protect previous Work from staining.
- .5 Clean and remove stains prior to application of concrete finishes.

#### **3.2 INSTALLATION/APPLICATION**

- .1 Do cast-in-place concrete work in accordance with CSA A23.1/A23.2.
- .2 Sleeves and inserts:
  - .1 Cast in sleeves, ties, slots, anchors, reinforcement, frames, conduit, bolts, waterstops, joint fillers and other inserts required to be built-in.
  - .2 Sleeves and openings greater than 100 mm x 100 mm not indicated, must be reviewed by Departmental Representative.
- .3 Concrete Patching:
  - .1 Remove all unsound concrete, using lightweight demolition hammers.
  - .2 Pressure wash all indicated surfaces, as required to remove all dust and dirt. Abrasive shall be used in combination with water when cleaning repair cavities, as required to eliminate micro-cracked surface materials

resulting from demolition. No water with concrete dust shall be allowed to remain on any surface following washing, and must be immediately removed, prior to drying and re-hardening.

- .3 Steel reinforcement exposed in the course of removing unsound materials shall be cleaned and prepared in accordance with the above specifications. The result of this cleaning shall be a steel surface free from visible rust or scale.
- .4 Apply cementitious corrosion inhibitive primer and bonding agent to all steel surfaces in accordance with manufacturer's instructions. Observe manufacturer's guidelines with regard to minimum and maximum timing "windows" for patching after application of primer.
- .5 All repair areas to be patched shall be kept continuously wet for at least 20 minutes prior to application of patching compound. Before placing patch, excess water shall be blown, vacuumed or otherwise removed from the surface, leaving the surface damp or saturated/surface dry.
- .6 Brush-apply a slurry coat of cementitious primer / bonding agent with into all cavity surfaces.
- .7 Mix and place patching compound in accordance with manufacturer's instructions.

### **3.3 FINISHES**

- .1 Formed surfaces exposed to view: in accordance with CSA A23.1/A23.2.
- .2 Interior floor slabs to be left exposed requiring smooth surface: initial finishing operations followed by final finishing comprising mechanical floating and steel trowelling as specified in CSA A23.1/A23.2 to produce hard, smooth, dense trowelled surface free from blemishes.
- .3 Equipment pads: provide smooth trowelled surface.
- .4 Pavements, walks, curbs and exposed site concrete:
  - .1 Screed to plane surfaces and use wood floats.
  - .2 Provide round edges and joint spacings using standard tools.
  - .3 Trowel smooth to provide lightly brushed non-slip finish.

### **3.4 CONTROL JOINTS**

- .1 Cut or Form control joints in slabs on grade at locations indicated, to CSA A23.1/A23.2 and install specified joint sealer/filler.

### **3.5 EXPANSION AND ISOLATION JOINTS**

- .1 Install premoulded joint filler in expansion and isolation joints full depth of slab flush with finished surface to CSA A23.1/A23.2.

**3.6 CURING**

- .1 Use curing compounds compatible with applied finish on concrete surfaces free of bonding agents and to CSA A23.1/A23.2.

**3.7 SITE TOLERANCES**

- .1 Concrete floor slab finishing tolerance to CSA A23.1/A23.2.

**3.8 FIELD QUALITY CONTROL**

- .1 Concrete testing: to CSA A23.1/A23.2-1C by testing laboratory engaged and paid for by Contractor.

**3.9 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Use trigger operated spray nozzles for water hoses.
- .3 Designate cleaning area for tools to limit water use and runoff.
- .4 Cleaning of concrete equipment to be done in accordance with Section 01 35 15 Special Procedures for Contaminated Sites.
- .5 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal
  - .1 Prepare Construction Waste Management plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .2 Divert unused concrete materials from landfill to local facility after receipt of written approval from Departmental Representative.
  - .3 Provide appropriate area on job site where concrete trucks and be safely washed.
  - .4 Divert admixtures and additive materials from landfill to approved official hazardous material collections site after receipt of written approval from Departmental Representative.
  - .5 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

**END OF SECTION**

**1. GENERAL**

**1.1 MEASUREMENT  
PROCEDURES**

- .1 This item shall include the supply, installation, finishing, and completion of all work required for the steel beams, posts, and structural steel plates as per the details shown on the Drawings.

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM A 36/A 36M-08, Specification for Structural Steel.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-85.10-99, Protective Coatings for Metals.
- .3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturers Association (CPMA).
  - .1 Handbook of the Canadian Institute of Steel Construction.
  - .2 CISC/CPMA Standard 2-75, Quick-Drying Primer for use on Structural Steel.
- .4 Canadian Standards Association (CSA International)
  - .1 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3 CSA S16-09, Limit States Design of Steel Structures.
  - .4 CAN/CSA-S136-07, North American Specifications for the Design of Cold Formed Steel Structural Members.
  - .5 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel.
  - .6 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.
  - .7 CSA W55.3-1965(R2003), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
  - .8 CSA W59-M03 (R2008), Welded Steel Construction (Metal Arc Welding) Metric.

The Society for Protective Coatings (SSPC) and National

**1.3 ACTION AND  
INFORMATIONAL  
SUBMITTALS**

- .5 Association of Corrosion Engineers.
  - .1 NACE No. 3.SSPC SP-606, Commercial Blast Cleaning.
- .1 Submit in accordance with Section 01 33 00 Submittals.
- .2 Shop Drawings:
  - .1 Provide drawings sealed and signed by professional engineer registered in Province of British Columbia, Canada.
  - .2 Submit Shop Drawings 2 weeks prior to fabrication.
- .3 Erection drawings:
  - .1 Submit erection drawings indicating details and information necessary for assembly and erection purposes including:
    - .1 Description of methods.
    - .2 Sequence of erection.
    - .3 Type of equipment used in erection.
    - .4 Temporary bracings.
- .4 Fabrication Drawings:
  - .1 Submit fabrication drawings showing designed assemblies, components and connections are stamped and signed by qualified professional engineer registered in the Province of British Columbia, Canada.
  - .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, penetrations supports, reinforcement, details, and accessories, as applicable.

**1.4 QUALITY ASSURANCE**

- .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties upon request, including non-destructive weld tests.
- .2 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

**1.5 DELIVERY, STORAGE  
AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 10 Product Requirements and with manufacturer's written instructions.



- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

## **2. PRODUCTS**

### **2.1 MATERIALS**

- .1 Steel plates: to CSA G40.20/G40.21, Grade 350W
- .2 Steel sections: to CSA G40.20/G40.21, Grade 350W
- .3 Welding materials: to CSA W59.
- .4 Welding electrodes: to CSA W48 Series.
- .5 Hot dip galvanizing: galvanize all exterior steel and where indicated, to CAN/CSA-G164, minimum zinc coating of 600 g/m<sup>2</sup>.

### **2.2 DESIGN**

- .1 All welded connections to be full strength, complete penetration welds unless noted otherwise on drawings.

### **2.3 FABRICATION**

- .1 Fabricate structural steel in accordance with CAN/CSA-S16 and in accordance with reviewed shop drawings.
- .2 Welding: in accordance with CSA W59 and shall be performed by fabricators "fully approved" by the Canadian Welding Bureau under CSA W55.3-08.
- .3 Companies to be certified under Division 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components. Fabricator shall submit proof of certification prior to start of work.
- .4 Continuously seal members by continuous welds where indicated.

- .5 Testing of welds to be as specified in Section 3.4 Field Quality Control.

### **3. EXECUTION**

#### **3.1 CONNECTION TO EXISTING WORK**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for structural steel installation.
- .2 Visually inspect substrate in presence of Departmental Representative.
- .3 Verify dimensions of existing work, report discrepancies, unacceptable conditions and potential problem areas to Departmental Representative for direction before commencing fabrication.
- .4 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

#### **3.2 ERECTION**

- .1 Structural steel work: in accordance with CAN/CSA-S16.
- .2 Field cutting or altering structural members not permitted.

#### **3.3 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by steel erection.

#### **3.4 FIELD QUALITY CONTROL**

- .1 Inspection and testing of materials and workmanship will be carried out by testing agency designated and paid for by Departmental Representative.
- .2 All welds to be subject to magnetic particle non-destructive testing.

#### **3.4 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 21 – Waste Management and Disposal.

- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION 05 12 23**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 21 05 01.02 - Installation of Auxiliary Gate
- .2 Section 01 33 00 - Submittal Procedures
- .3 Section 01 61 00 - Product Requirements
- .4 Section 25 01 01.01 -Refurbishment of Penstock Cylinders

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM A53/A53M-07, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  - .2 ASTM A269-08, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
  - .3 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 CSA International
  - .1 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3 CSA S16-09, Design of Steel Structures.
  - .4 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
  - .5 CSA W59-M03(R2008), Welded Steel Construction (Metal Arc Welding) Metric.
- .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .4 The Master Painters Institute (MPI)
  - .1 Architectural Painting Specification Manual - current edition.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:

- .1 Submit manufacturer's instructions, printed product literature and data sheets for sections, plates, pipe, tubing, bolts and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit 2 copies of WHMIS MSDS
  - .1 For finishes, coatings, primers, and paints applied on site: indicate VOC concentration in g/L.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of BC, Canada.
  - .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

#### **1.4 QUALITY ASSURANCE**

- .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

#### **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Steel sections and plates: to CSA G40.20/G40.21, Grade 350W.
- .2 Welding materials: to CSA W59.
- .3 Welding electrodes: to CSA W48 Series.
- .4 Bolts and anchor bolts: to ASTM A307.
- .5 Stainless steel tubing: to ASTM A564/A564M Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes

- .6 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.
- .7 For other fabricated stainless steel items see section 210501.02

## **2.2 FABRICATION**

- .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .2 Use self-tapping shake-proof round headed screws on items requiring assembly by screws or as indicated.
- .3 Where possible, fit and shop assemble work, ready for erection.
- .4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

## **2.3 FINISHES**

- .1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m<sup>2</sup> to CAN/CSA-G164.
- .2 Chromium plating: chrome on steel with plating sequence of 0.009 mm thickness of copper 0.010 mm thickness of nickel and 0.0025 mm thickness of chromium.
- .3 Shop coat primer: MPI- EXT 5.1A/ 5.1B in accordance with chemical component limits and restrictions requirements and VOC limits of CCD-047a
- .4 Zinc primer: zinc rich, ready mix to MPI- EXT 5.2C in accordance with chemical component limits and restrictions requirements and VOC limits of CCD-047a

## **2.4 ISOLATION COATING**

- .1 Isolate aluminum from following components, by means of bituminous paint:
  - .1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
  - .2 Concrete, mortar and masonry.
  - .3 Wood.

## **2.5 SHOP PAINTING**

- .1 Primer: VOC limit 250 g/L maximum to CCD-047a
- .2 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.
- .3 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.
- .4 Clean surfaces to be field welded; do not paint.

## **2.6 ANGLE LINTELS**

- .1 Steel angles: galvanized

- .2 Weld or bolt back-to-back angles to profiles as indicated.
- .3 Galvanize exterior pipe railings after fabrication.

## **2.7 ACCESS LADDERS**

- .1 Stringers: 65mm x 10mm thick, flat bar
- .2 Steel Rungs: 19 mm diameter, welded to stringers at 300mm on centre maximum
- .3 Brackets: sizes and shapes as indicated, weld to stringers as indicated on drawings, complete with fixing anchors.
- .4 Galvanize ladders after fabrication.

## **2.8 TRENCH COVERS AND FRAMES**

- .1 Steel fabricate from 6 mm thick raised pattern plate set in L 55 x 55 x 6 frame. Include anchors at 1200 mm on centre for embedding in concrete. Supply trench covers in 1200 mm removable lengths.
- .2 Finish: galvanized

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal fabrications installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative

### **3.2 ERECTION**

- .1 Do welding work in accordance with CSA W59 unless specified otherwise.
- .2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .3 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .4 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .5 Supply components for work by other trades in accordance with shop drawings and schedule.

- .6 Make field connections with bolts to CSA S16 or Weld field connection.
- .7 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.
- .8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces with primer after completion of:
  - .1 Primer: maximum VOC limit 250 g/L to GS-11.
- .9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.
  - .1 Primer: maximum VOC limit 250 g/L to GS-11.

### **3.3 ACCESS LADDERS**

- .1 Install access ladders in locations as indicated.
- .2 Erect ladders clear of wall on bracket supports.

### **3.4 TRENCH COVERS**

- .1 Install trench covers in locations as indicated.

### **3.5 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.6 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by metal fabrications installation.

**END OF SECTION**



**Part 1        General**

**1.1        RELATED REQUIREMENTS**

- .1    Section 01 11 55 – General Instructions
- .2    Section 01 33 00 – Submittal Procedures
- .3    Section 01 74 21 – Waste Management and Disposal

**1.2        REFERENCES**

- .1    ASTM International
  - .1    ASTM A519 – Standard Specification for Seamless Carbon and Alloy Steel Mechanical Tubing.
  - .2    ASTM A564 / A564M - Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes.
  - .3    ASTM B271/271M - Standard Specification for Copper-Base Alloy Centrifugal Castings.
  - .4    ASTM F593 Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
  - .5    ASTM F594 - Standard Specification for Stainless Steel Nuts.
- .2    Canadian Standards Agency
  - .1    CSA G40.20/G40.21 - General Requirements for Rolled or Welded Structural Quality Steel.
  - .2    CSA W47.1 - Certification of companies for fusion welding of steel.
  - .3    CSA W59 - Welded steel construction (metal arc welding).
  - .4    W178.2-14 - Certification of welding inspectors.
- .3    American Welding Society
  - .1    AWS D1.1 - Structural Welding Code - Steel
  - .2    AWS D14.9/D14.9M - Specification for the Welding of Hydraulic Cylinders.
- .4    Society of Automotive Engineers
  - .1    SAE J429 - Mechanical and Material Requirements for Externally Threaded Fasteners.
  - .2    SAE J995 - Mechanical and Material Requirements for Steel Nuts.
- .5    International Standards Organization
  - .1    ISO 4406 - Hydraulic fluid power -- Fluids -- Method for coding the level of contamination by solid particles.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 At least 2 weeks prior to beginning work, submit to Departmental Representative:
  - .1 Written work plan for cylinder disassembly, refurbishment/remanufacture, reassembly and testing.
  - .2 Drawings and proposed specifications of components requiring replacement or remanufacture.
  - .3 Proof of certification for any required fabrication.
  - .4 Written work plan for coating application

**1.4 QUALITY ASSURANCE**

- .1 All materials used in the refurbishment are to meet the specified material standards and grades.
  - .1 Submit all mill test certificates for all new materials to the Departmental Representative within 2 days of receipt.
- .2 All welds are to be inspected or tested by non-destructive means as required by a third party certified weld inspector, engaged by the Contractor.
  - .1 Submit all weld test results to the Departmental Representative within 2 days of receipt.
- .3 All surface coatings are to be inspected by a third-party NACE certified coatings inspector, engaged by the Contractor.
  - .1 Typical testing SSPC PA2 rule allowing for 80% of minimum DFT for spot measurement shall not apply. The minimum DFT shall be 16 mils on any spot measured.
  - .2 Test for coating continuity (Holiday Testing) in accordance with manufacturer's instructions after the epoxy anti-corrosive has sufficiently cured.
  - .3 Submit all coating test results to the Departmental Representative within 2 days of receipt.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 All materials shall be transported and stored in accordance with the manufacturer's written instructions.
- .2 Any materials not adequately handled or stored shall be removed from site immediately.

**Part 2 Products**

**2.1 PERFORMANCE CRITERIA**

- .1 All components utilized in refurbishment of cylinder are to be suitable for service at a maximum pressure of 140bar (2000psi).
  - .1 Structural elements are to have a 4:1 design factor against burst or rupture.
  - .2 All seals are to be zero-leak type.

**2.2 MATERIAL SPECIFICATIONS**

- .1 Any new barrel material is to be in accordance with ASTM A519 Gr. 1026.
- .2 Any new rod material is to be in accordance with ASTM A564 Gr. 630.
- .3 Any new cap, gland or other plate material is to be in accordance with CSA G40.21 Gr. 300W.
- .4 Wear rings are to be C93200 bronze in accordance with ASTM B271.
- .5 O-rings are to be 70 durometer nitrile.
- .6 Piston seals are to be replaced in kind with new 254OD x 229ID x 41H-Chevron seal sets, 2 per cylinder.
- .7 Rod seals are to be replaced in kind with new 95OD x 76ID x 34H Chevron seal sets, 1 per cylinder.
- .8 Rod wipers are to be replaced in kind with 76mm AN29 urethane wiper seals.
- .9 Any new plain or plated fasteners are to be in accordance with SAE J449 Gr. 8 or SAE J995 Gr. 8.
- .10 Any stainless steel fasteners are to be in accordance with ASTM F593 Group 1 or ASTM F594 Group 1.

**2.3 COATING MATERIALS**

- .1 Cylinder coating is to consist of a high solids polyamide epoxy with 15 year durability suitable for a C5-M environment (high corrosivity – marine) under ISO 12944-2, including immersion, with the following requirements:
  - .1 Coating is to be self-priming.
  - .2 Minimum number of coats = 2.
  - .3 Minimum total dry film thickness = 16 mils
  - .4 Coating shall not be "Bituminous" or contain coal tar.

**Part 3 Execution**

**3.1 INITIAL PREPARATION**

- .1 Remove Cylinders from penstocks as described in Section 01 11 55 General Instructions.
  - .1 All surfaces shall be pressure-washed at 3500psi minimum to remove marine fouling and loose coatings and corrosion.
  - .2 All non-sealing surfaces shall be abrasive blasted to SSPC SP10 to remove corrosion products and coatings.
  - .3 Cylinders shall be fully disassembled including removal of pistons from rods and removal of all seals.
  - .4 Mating components shall be match marked for reassembly.

**3.2 COMPONENT ASSESSMENT**

- .1 All cylinders are presumed to require new barrel assemblies unless inspection reveals otherwise.
- .2 Cylinder rods, pistons, glands and caps shall be inspected to determine requirements for component replacement.
- .3 A detailed listing of component requirements shall be submitted to the Departmental Representative upon completion of assessment.

**3.3 CYLINDER REFURBISHMENT**

- .1 All replacement components approved by the Departmental Representative shall be fabricated as required.
- .2 Cylinders shall be re-assembled with remanufactured components.
- .3 Cylinders shall be tested upon re-assembly in accordance with section 210501.02, clause 3.4.5

**3.4 COATING INSTALLATION/APPLICATION**

- .1 Where necessary remove all weld splatter, smooth weld seams and sharp edges. Fresh water wash to remove all dirt and contamination, as necessary. Degrease according to SSPC-SP1 solvent cleaning.
- .2 Abrasive blast all surfaces to be coated to SSPC SP10, near-white metal. Surface profile shall be >3 mils.
- .3 Coatings shall be applied and cured as per the manufacturer's written instructions. Stripe coats should be applied to all welds, lap joints, plate edges, corners, sharp edges, and any other areas where spray application of the overall coating system may prove difficult resulting in low dry film thickness.

- .4 All sealing, bearing or faying surfaces shall be protected from coating.

### **3.5 COMPONENT COMMISSIONING**

- .1 After installation of all components and prior to verification of pressures and cylinder speeds the contractor shall utilize a "kidney loop" filter on each cylinder circuit to flush the hydraulic system until an ISO 4406 cleanliness level of 16/14/12 is achieved.
- .2 The contractor shall verify proper operation of all controls, indicators and alarms.
- .3 The contractor shall set the pressures and flows for all circuit functions.
- .4 The contractor will record all pressure settings and cycle times.
- .5 The contractor will demonstrate to the owner that all required functionality for the system as specified has been provided.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 01 11 55 – General Instructions
- .2 Section 01 33 00 – Submittal Procedures
- .3 Section 01 74 21 – Waste Management and Disposal
- .4 Section 03 30 00 – Cast in Place Concrete

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM A519 – Standard Specification for Seamless Carbon and Alloy Steel Mechanical Tubing.
  - .2 ASTM A564 / A564M - Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes.
  - .3 ASTM A240 / A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
  - .4 ASTM A269 / A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
  - .5 ASTM D4020 - Standard Specification for Ultra-High-Molecular-Weight Polyethylene Molding and Extrusion Materials
  - .6 ASTM D6712 - Standard Specification for Ultra-High-Molecular-Weight Polyethylene (UHMW-PE) Solid Plastic Shapes
  - .7 ASTM C920 - Standard Specification for Elastomeric Joint Sealants
- .2 Canadian Standards Agency
  - .1 CSA G40.20/G40.21 - General Requirements for Rolled or Welded Structural Quality Steel.
  - .2 CSA W47.1 - Certification of companies for fusion welding of steel.
  - .3 CSA W59 - Welded steel construction (metal arc welding).
  - .4 W178.2-14 - Certification of welding inspectors.
- .3 American Welding Society
  - .1 AWS D1.1 - Structural Welding Code - Steel
  - .2 AWS D14.9/D14.9M - Specification for the Welding of Hydraulic Cylinders.
- .4 National Fluid Power Association
  - .1 NFPA T3.5.1:2002 (R2010) - Hydraulic Fluid Power - Valves - Mounting Surfaces

- .5 Society of Automotive Engineers
  - .1 SAE J514 - Metallic Tube Connections for Fluid Power and General Use
  - .2 SAE J516 – Hydraulic Hose Fittings
  - .3 SAE J517 – Hydraulic Hose
  - .4 SAE J518 – Hydraulic Flanged Tube, Pipe, and Hose Connections, 4-Screw Flange Connection Part 1: 3.5 MPa to 35 MPa (Code 61).
  - .5 SAE J1926 - Connections for General Use and Fluid Power - Ports and Stud Ends with ASME B1.1 Threads and O-Ring Sealing.
- .6 International Standards Organization
  - .1 ISO 4406 - Hydraulic fluid power -- Fluids -- Method for coding the level of contamination by solid particles.

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 At least 2 weeks prior to beginning work, submit to Departmental Representative:
  - .1 Detailed hydraulic schematic identifying all components.
  - .2 Specifications for purchased components.
  - .3 Drawings and proposed specifications of all fabricated components.
  - .4 Identification of suppliers for cylinder.
  - .5 Identification of suppliers for all fabricated components.
  - .6 Written work plan for installation of all components
  - .7 Proof of certification for any required fabrication.

### **1.4 QUALITY ASSURANCE**

- .1 All materials used in fabricated components are to meet the specified material standards and grades.
  - .1 Submit all mill test certificates for all new materials to the Departmental Representative within 2 days of receipt.
- .2 All welds are to be inspected or tested by non-destructive means as required by a third party certified weld inspector, engaged by the Contractor.
  - .1 Submit all weld test results to the Departmental Representative within 2 days of receipt.
- .3 All surface coatings are to be inspected by a third-party NACE certified coatings inspector, engaged by the Contractor.
  - .1 Typical testing SSPC PA2 rule allowing for 80% of minimum DFT for spot measurement shall not apply. The minimum DFT shall be 16 mils on any spot measured.

- .2 Test for coating continuity (Holiday Testing) in accordance with manufacturer's instructions after the epoxy anti-corrosive has sufficiently cured.
- .3 Submit all coating test results to the Departmental Representative within 2 days of receipt.

## **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 All materials shall be transported and stored in accordance with the manufacturer's written instructions.
- .2 Any materials not adequately handled or stored shall be removed from site immediately.

## **Part 2 Products**

### **2.1 General**

- .1 Attached schematics and drawings represent a reference design to indicate required functionality and are to be read in conjunction with the included detailed functional requirements below. Detailed system design and component specification is the responsibility of the contractor.

### **2.2 SCOPE OF SUPPLY**

- .1 The contractor shall supply and install the following items as part of the contract:
  - .1 Complete assembled hydraulic power units consisting of electric motors and pumps as required to achieve the stated functionality and meeting the detailed specifications.
  - .2 Complete assembled hydraulic reservoir meeting the detailed specifications.
  - .3 All hydraulic valves shown on the contractors reviewed schematics and/or required to achieve the stated functionality including any required manifolds.
  - .4 Gate lift cylinder.
  - .5 All required hydraulic hoses.
  - .6 All required hydraulic tubes and pipes (hard lines).
  - .7 All required hose, tube and pipe clamps.
  - .8 All fittings required to connect hoses, tubes, pipes and components.
  - .9 All electrical controls, wiring harnesses, control cabling and indicator components required to operate the system with the required functionality.
  - .10 The auxiliary tunnel gate assembly including gate leaf, gate leaf guides, gate leaf sill, header, link rod and link rod guide.
  - .11 The gate cylinder support frame.
  - .12 Auxiliary tunnel access shaft grating.



- .13 Trenching and covers for external lines traversing existing paved areas (to be made good upon completion).
- .14 Cored penetrations through existing concrete wall in pump house (to be made good upon completion).
- .2 The contractor shall be responsible for commissioning, setup and adjustment of the system per clause 3.6.

## **2.3 PERFORMANCE CRITERIA**

- .1 Gate Assembly
  - .1 The gate assembly is to withstand a maximum hydrostatic pressure of 36 kPa from the seaward side when closed.
  - .2 The gate assembly is to have a maximum leakage rate of 5 liters/min between the seaward side and dock side when fully closed.
  - .3 The gate assembly is to withstand the dynamic forces that may be encountered when closing gate against a flow of approx. 2.6 m<sup>3</sup>/s from the seaward side.
  - .4 The gate assembly is to withstand any other forces that may be imposed upon it while being lowered and lifted by the hydraulic cylinder.
  - .5 The gate assembly shall not be negatively impacted by typical debris that may enter the tunnel from the ocean.
  - .6 The gate assembly is to have a design factor of 5:1 based on ultimate strength.
  - .7 Deflection of the gate leaf under maximum hydrostatic pressure shall not reduce the effectiveness of the gate seal and shall be limited to a maximum of 3mm at the midpoint of the gate.
  - .8 The gate leaf guides and sill shall be rigidly attached to the access shaft walls and floor. Deflection of the gate leaf guides and sill under maximum hydrostatic pressure shall be limited to a maximum of .1mm between anchors.
  - .9 The header assembly shall be rigidly attached to the access shaft wall above the dockside portion of the auxiliary tunnel. Deflection of the header under maximum hydrostatic pressure shall be limited to a maximum of .1mm between anchors.
- .10 Hydraulic system
  - .11 The hydraulic system shall be capable of fully opening or closing the gate assembly in a minimum time of 15 seconds with the ability to adjust the time to a maximum of 60 seconds.
  - .12 All components in the hydraulic system are to be suitable for service at a maximum pressure of 140bar (2000psi).
  - .13 The hydraulic cylinder construction is to be suitable for a maximum piston and rod speed of 100 mm/s.
  - .14 All elements are to have a 4:1 design factor against burst, rupture or buckling.

- .15 All seals are to be zero-leak type.
- .16 All seals are to be effective at operating pressures as low as 200psi

## **2.4 MATERIAL SPECIFICATIONS**

- .1 Cylinder barrel material is to be in accordance ASTM A519 Gr. 1026.
- .2 Cylinder rod material is to be in accordance with ASTM A564 Gr. 630.
- .3 Other plate material on cylinder is to be in accordance with CSA G40.21 Gr. 300W.
- .4 Gate leaf Guide and Sill material is to be in accordance with ASTM A240 Gr. 2205.
- .5 Gate leaf header material is to be in accordance with either ASTM A240 Gr 2205, ASTM D4020 or ASTM D6712.
- .6 Gate Link Rod material is to be in accordance with ASTM A564 Gr. 630.
- .7 Cylinder support frame material is to be in accordance with CSA G40.21 Gr. 350W for rolled shapes and Gr. 300W for plate and channels.
- .8 The hydraulic reservoir is to be in accordance with ASTM A240 Type 316L.
- .9 Hydraulic manifolds are to be in accordance with CSA G40.21 Gr. 300W.
- .10 Hydraulic hoses are to be in accordance with SAE J517.
- .11 Hydraulic tubing is to be in accordance with ASTM A269.
- .12 Hydraulic fluids shall:
  - .1 Meet the warranty requirements of all components in the hydraulic system.
  - .2 Be suitable for the anticipated temperature ranges that the hydraulic system will operate within.
  - .3 Be classified as "anti-wear".
  - .4 Be classified as inherently biodegradable.
  - .5 Have data for environmental persistence and toxicity designations as determined by standardized tests (i.e. ASTM D 6046) available.
- .13 All Joint Sealants are to be in accordance with ASTM C920, suitable immersion in seawater.

## **2.5 COATING MATERIALS**

- .1 Coating is to consist of a zinc rich epoxy primer with a high solids polyamide epoxy coat and a polyurethane topcoat with 15 year durability suitable for a C5-M environment (high corrosivity – marine) under ISO 12944-2 with the following requirements:
  - .1 Minimum primer dry film thickness = 3 mils.
  - .2 Minimum epoxy coat dry film thickness = 7 mils.

- .3 Minimum polyurethane topcoat dry film thickness = 2.5 mils.
- .4 Epoxy coating shall not be "Bituminous" or contain coal tar.

### **Part 3 EXECUTION**

#### **3.1 GENERAL**

- .1 The attached schematics and drawings represent a general reference design to indicate the preferred configuration of finished components and structures and are to be read in conjunction with the included detailed requirements below. Detailed system design and component specification is the responsibility of the contractor. Items not included in this portion of the specification or elsewhere in the specifications shall be constructed as detailed on the project drawings.

#### **3.2 GATE ASSEMBLY**

- .1 Gate Leaf
  - .1 The gate leaf is to be of fabricated stainless steel construction
  - .2 The gate leaf is to include an attachment point at the top of the leaf for connection of the leaf to a link rod above.
- .2 Gate Leaf Guides and Sill
  - .1 The gate guides and sill are to be of fabricated or machined stainless steel construction.
  - .2 The guides and sill are to be mounted to the existing access shaft walls and tunnel floor with no removal of concrete required.
  - .3 The gate guides are to support the gate leaf under all hydrostatic and hydrodynamic loads that may be encountered.
  - .4 The gate guides shall incorporate wear materials to eliminate metal to metal contact between the leaf and guides and sealing elements to provide a positive seal when the leaf is in the closed position
  - .5 The guides and sill shall be mounted in such a manner as to eliminate bypassing between the elements and the surfaces on which they are mounted.
- .3 Gate Leaf Header
  - .1 The gate leaf header is to be of fabricated from either stainless steel, UHMW Polyethylene or a combination of both.
  - .2 All areas on the header where the gate leaf may be in sliding contact with the header or supported by the header in the closed position are to be UHMW polyethylene except for any sealing elements where required.
  - .3 The gate leaf header is to be mounted to the existing access shaft wall with no removal of concrete required.

- .4 The gate leaf header shall be mounted in such a manner as to eliminate bypassing between the header and the surface on which it is mounted and between the header and gate leaf guides.
- .4 Link Rod and Guide
  - .1 A link rod is to be used to connect the gate leaf to the hydraulic cylinder rod.
  - .2 Pinned connections shall be utilized at each end of the link rod
  - .3 A guide shall be located approximately at the midpoint of the access shaft to provide lateral restraint to the link pin. The guide shall be attached to the access shaft wall with adhesive anchors and consist of a galvanized steel body with a UHMW insert in which the link rod will move.

### **3.3 CYLINDER ASSEMBLY**

- .1 Hydraulic Cylinder
  - .1 The gate lift cylinder is to be hung from a support frame at the top of the access shaft utilizing a clevis arrangement on the support frame.
  - .2 The gate lift cylinder is to be laterally restrained at the gland end of the cylinder by a brace or bracket attached to the existing concrete wall surrounding the shaft opening with adhesive anchors.
  - .3 The gate lift cylinder shall be coated per sections 2.4 and 3.5
- .2 Cylinder Support Frame
  - .1 The cylinder support frame shall consist of two columns extending up from the top of the access shaft and a wide flange member spanning between the columns.
  - .2 The columns shall bear directly on the concrete at the top of the access shaft via grouted base plates and adhesive anchors.
  - .3 The columns shall each be laterally restrained by connection to the concrete wall surrounding the access shaft with adhesive anchors.
- .3 General
  - .1 The cylinder assembly shall have provisions for setting the final height of the cylinder such that the final seated position of the gate occurs at the end of stroke of the cylinder.
  - .2 The cylinder assembly shall have sufficient stroke to lift the gate high enough to leave the auxiliary tunnel unobstructed by the gate.

### **3.4 HYDRAULIC SYSTEM**

- .1 Hydraulic Power Unit (HPU)
  - .1 The HPU shall be installed in the pump house control room adjacent to the North wall.
  - .2 The HPU for the hydraulic system shall consist of a pressure compensated pump mounted to a 10 HP electric motor.

- .3 The electric motor shall be a 575 VAC 3-phase unit with a 1.15 service factor and an S6 duty cycle rating.
- .4 The pump shall be capable of providing sufficient supply of oil to achieve the required gate closure times.
- .5 The hydraulic power unit shall incorporate an emergency relief valve.
- .6 The pump control and hydraulic valves shall be configured such that no oil is pumped over any relief valve during normal operation.
- .7 The HPU shall be fitted with covers to contain oil spray in the event of a leak at hose ends, port fittings or valve interfaces.
- .2 Reservoir
  - .1 The reservoir shall be mounted directly above the Hydraulic Power Unit.
  - .2 The reservoir shall have a minimum capacity equal to 120s of pump flow in addition to 115% of the swept area of the gate lift cylinder.
  - .3 The reservoir shall contain sufficient baffling to allow de-aeration of the hydraulic fluid to a level acceptable for the operation of the hydraulic pump unit.
  - .4 The reservoir shall be fitted with a sight glass for visual confirmation of fluid levels.
  - .5 The reservoir shall be fitted with provisions for indicating the temperature of the hydraulic oil and for signaling to the control system if the hydraulic oil temperature is above the required operating range.
  - .6 The reservoir shall incorporate a #100 mesh screen complete with a bypass valve rated at 3 psi or lower at the suction outlet for the purpose of capturing vagabond contamination.
  - .7 The reservoir shall be fitted with a drain port at the lowest practical point in the system, a removable clean-out cover positioned to maximize access to the inside of the reservoir and a readily accessible fill port with sufficient clearance for filling the reservoir from a standard 20L pail.
  - .8 The reservoir shall be fitted with a breather for the purpose of limiting reservoir pressurization. The breather shall contain a filter to prevent the ingestion of airborne contaminants.
  - .9 The suction outlet port of the reservoir shall be fitted with a ball valve which is lockable in the open position.
  - .10 The reservoir shall include a secondary containment area below the main reservoir with an oil containment capacity equal to the maximum volume of the main reservoir and configured such that any leakage from the main reservoir will be contained.
- .3 Filtration
  - .1 High and low pressure filters shall be included in the hydraulic system for the purpose of capturing and isolating contaminants that may be introduced into the system through normal wear or component failure.

- .2 A high pressure filter shall be located immediately downstream of the hydraulic power units.
  - .3 A low pressure filter shall be located immediately upstream of the hydraulic reservoir.
  - .4 All filters shall have a pressure rating greater than the maximum anticipated pressure at the point of installation in the hydraulic circuit.
  - .5 All filters shall have a minimum filtration rating of  $\beta_{<5}=1000$  or better if required by the manufacturers of any specified hydraulic components.
  - .6 All filters shall have the capability for indicating excessive pressure drop through the filter element.
  - .7 All filters shall have a bypass valve that will open in the event of an excessive pressure drop across the element to prevent possible collapse of the filter element.
- .4 Hydraulic Valves
- .1 All hydraulic valves are to be mounted in a new control cabinet located in the Northwest corner of the pump house control room on the West wall.
  - .2 Hydraulic valves shall consist of individual components in the form of cartridges or sub-plate mounted assemblies combined with manifolds as required. Mono-block style valve assemblies shall not be used.
  - .3 All hydraulic valves shall be based upon industry standard mounting patterns and cavities unless a demonstrated cost/performance advantage can be shown by the use of proprietary components.
  - .4 Mounting patterns and cavities shall be considered industry standard only if standard dimensions are readily available with wide adoption and interchangeable components are available from multiple manufacturers. Examples of standard patterns and cavities include the following:
    - .1 ANSI/NFPA DO3/D05 sub-plates
    - .2 SAE ORB port based cavities
  - .5 Any specifications for proprietary components shall include information regarding availability and interchangeability of those components.
  - .6 All external ports on manifolds shall conform to SAE J514 (o-ring boss) for sizes 04 to 12 and to SAE J514 or J518 (4-bolt flange) as required by pressures for sizes 16 and above.
  - .7 All valves and manifolds shall be sized appropriately for the anticipated flow rates required to achieve the indicated cycle time requirements.
  - .8 Counterbalance valves are required on cylinder circuits where loads must be held by the cylinder without drifting or lowered in a controlled fashion.
  - .9 Counterbalance valves shall be mounted at the cylinder ports.
  - .10 All manifolds shall be of steel construction.
  - .11 Manually actuated valves shall be located in the cabinet such that the manual operators protrude through the cabinet housing at the front and are operable without opening the cabinet.

**.5 Gate Lift Cylinder**

- .1 The cylinder shall be suitable for operation in the splash zone of a saltwater marine environment.
- .2 The cylinder shall be of fabricated construction without tie-rods.
- .3 The cylinder shall incorporate end of stroke cushioning on cylinder extend.
- .4 The cylinder assembly is to include an integral analog position indication sensing device providing a scaled 4-20mA loop powered signal to be used for position indication.
- .5 All welding of hydraulic cylinders is to be performed in accordance with AWS D14.9/D14.9M.
- .6 Cylinder bearings shall be of a self-aligning type with maintenance free bearing surfaces.
- .7 All typical serviceable elements of the hydraulic cylinder such as seals, wear rings, wipers, glands and bearings shall utilize standard readily available profiles and sizes.
- .8 All hydraulic lines permanently fixed to the cylinder shall consist of hydraulic tubing or piping.
- .9 The cylinders shall be designed to meet the specific performance requirements for the application and to interface with mounting location as detailed on the structural drawings.
- .10 The cylinder shall be proof tested at 150% of maximum design pressure for a period of 10 minutes minimum with no cylinder leakage or bypassing detected. Testing must be performed with the piston within the middle 1/3 of the travel range.
- .11 The contractor shall supply pins for the barrel and rod end lugs of the cylinder. Design of cylinder pins and implementation of pin locks shall be coordinated with the structural contractor and submitted for approval prior to fabrication.
- .12 Cylinder pins shall be fabricated from stainless steel of a grade suitable for marine service and capable of withstanding all anticipated loadings with a design factor of 4:1.
- .13 The cylinder shall be fitted with lifting lugs as required for installation and service requirements.
- .14 The cylinder gland shall be configured to provide attachment of a brace or bracket which will provide lateral restraint.

**.6 HYDRAULIC PLUMBING**

- .1 Hydraulic plumbing shall consist of all hoses, tubes, pipes and fittings required to connect all supplied components as a working system.
- .2 Hydraulic tubing shall be used at all locations except where: Flexibility is required to allow relative motion between components; Vibration isolation is required or; Component alignment with "hard" lines is not practicable.

- .3 The contractor shall be responsible for selecting the appropriate sizes for all hydraulic hoses, tubes and fittings required to minimize pressure loss in the hydraulic system. Total pressure loss calculations shall consider the effects of both frictional losses in hoses and tubes and losses through all fittings.
- .4 The usage of "jump" or reducer fittings shall be avoided wherever possible.
- .5 Hydraulic tubes and pipes shall be seamless stainless steel and supplied in conformance with ASTM A269, GR. TP316L or A53.
- .6 Hydraulic tube and pipe shall be rated for a minimum working pressure of 3000psi with a design factor of 4:1, calculated in accordance with ASME B31.3.
- .7 Hydraulic hoses shall be rated for a minimum working pressure of 3000psi, unless the circuit is specifically identified as a low pressure circuit operating at less than 500psi. Hoses in low pressure circuits shall be rated for a minimum of 1000psi.
- .8 Hydraulic hoses shall be supplied in accordance with SAE J517 and shall utilize hose-end fittings in accordance with SAE J516.
- .9 All hose-end fittings to be located outside of the pump house shall be GR. 316L stainless steel.
- .10 Hose, tube and pipe fittings shall have a pressure rating greater than or equal to the hose or tube to which they are attached. Acceptable types of fittings are as follows:
  - .1 37° flared in accordance with SAE J514.
  - .2 4-bolt split flanges in accordance with SAE J518.
  - .3 O-ring face seal (ORFS) in accordance with SAE J1453.
- .11 All hoses, tubes and pipes shall be cleaned using a pneumatic projectile type cleaner prior to installation.
- .12 All hoses, tubes and pipes shall be proof tested to 150% of maximum system pressure prior to installation.
- .13 Hydraulic hoses, tubes and pipes shall be mounted using rail mounted split clamps sized specifically for the required sizes of line. Mounting locations and configurations for the clamps are to be approved by the engineer. All metal components of clamps shall be stainless steel GR. 316L. All other clamp materials are to be suitable for installation in the splash zone of a saltwater marine environment.
- .14 Mounting of hydraulic tubes and pipes:
  - .1 All hydraulic tubes and pipes longer than 1500mm shall be mounted with a minimum of 1 clamp.
  - .2 Spacing between clamps shall not exceed 1600mm
  - .3 Clamps shall not be located further than 250mm from the end of a tube or pipe or 500mm from any 90° bend in a tube or pipe unless



support is provided by attachment to a manifold, bulkhead fitting or component.

- .15 Mounting of hydraulic hoses:
  - .1 All hydraulic hoses longer than 1000mm shall be mounted with a minimum of 1 clamp.
  - .2 Spacing between clamps shall not exceed 1600mm unless required for hose flexure.
  - .3 Clamps shall not be located further than 250mm from the end of a hose or 500mm from any 90° bend unless support is provided by attachment to a manifold, bulkhead fitting, component or hydraulic tube or pipe.
- .16 All hydraulic hoses and tubes shall be routed and clamped in a "tidy" manner which will ensure ease of access and maintenance to all areas of the control room and hydraulic system.

### **3.5 COATING INSTALLATION/APPLICATION**

- .1 Where necessary remove all weld splatter, smooth weld seams and sharp edges. Fresh water wash to remove all dirt and contamination, as necessary. Degrease according to SSPC-SP1 solvent cleaning.
- .2 Abrasive blast all surfaces to be coated to SSPC SP10, near-white metal. Surface profile shall be >3 mils.
- .3 Coatings shall be applied and cured as per the manufacturer's written instructions. Stripe coats should be applied to all welds, lap joints, plate edges, corners, sharp edges, and any other areas where spray application of the overall coating system may prove difficult resulting in low dry film thickness.
- .4 All sealing, bearing or faying surfaces shall be protected from coating.

### **3.6 COMPONENT COMMISSIONING**

- .1 After installation of all components and prior to set up of pressures and cylinder speeds the contractor shall utilize a "kidney loop" filter to flush the hydraulic system until an ISO 4406 cleanliness level of 16/14/12 is achieved.
- .2 The contractor shall verify proper operation of all controls, indicators and alarms.
- .3 The contractor shall set the pressures and flows for all circuit functions.
- .4 The contractor will record all pressure settings and cycle times.
- .5 The contractor will demonstrate to the departmental representative that all required functionality for the system as specified has been provided.

### **3.7 DOCUMENTATION**

- .1 The contractor shall include at completion of their scope of work, the following documentation:
  - .1 An "as-built" schematic showing final circuit pressures and cylinder speeds.
  - .2 An "as-built" electrical schematic.
  - .3 An operating manual complete with start-up procedures and requirements and routine service requirements.
  - .4 A bill of materials identifying all components.
  - .5 Hose sheets for each hydraulic hose, fully specifying the all details of the hose and fittings.
  - .6 Drawings of any components or manifolds designed or fabricated by the contractor.

**END OF SECTION**

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**Part 1        General**

**1.1        REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.1-2012, Canadian Electrical Code, Part 1 (21st Edition), Safety Standard for Electrical Installations.
  - .2 CAN3-C235-83(R2000), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
  - .1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.
- .3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
  - .1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

**1.2        DEFINITIONS**

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

**1.3        DESIGN REQUIREMENTS**

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
  - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English

**1.4        ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings:
  - .1 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure coordinated installation.
  - .2 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
  - .3 Indicate on drawings clearances for operation, maintenance, and replacement of operating equipment devices.
  - .4 Submit copies of 600 x 600 mm minimum size drawings and product data to authority having jurisdiction.

- .5 If changes are required, notify Departmental Representative of these changes before they are made.
- .3 Quality Control: in accordance with Section 01 45 00 - Quality Control. Provide CSA certified equipment and material.
  - .1 Where CSA certified material is not available, submit such material to authority having jurisdiction for special approval before delivery to site.
  - .2 Submit test results of installed electrical systems and instrumentation.
  - .3 Permits and fees: in accordance with General Conditions of contract.
  - .4 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
- .4 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

**1.5 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid "FSR-A" Contractor license or apprentices in accordance per the conditions of Provincial Act respecting manpower vocational training and qualification.
- .3 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

**1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract.
- .2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**1.7 SYSTEM STARTUP**

- .1 Instruct EGD Operational Staff and Departmental Representative in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

## **1.8 OPERATING INSTRUCTIONS**

- .1 Provide operating instruction for each system as specified in technical sections for use by operation and maintenance personnel.
- .2 Operating instructions to include following:
  - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
  - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
  - .3 Safety precautions.
  - .4 Procedures to be followed in event of equipment failure.
  - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
  - .6 Maintenance instructions including recommended intervals and maintenance actions as well as recommended service intervals for component replacement.
- .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
- .4 Post instructions where directed.
- .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
- .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

## **Part 2 Products**

### **2.1 MATERIALS AND EQUIPMENT**

- .1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Material and equipment to be CSA certified. Where CSA certified material and equipment is are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.
- .3 Factory assemble control panels and component assemblies.

### **2.2 WARNING SIGNS**

- .1 Warning Signs: in accordance with requirements of inspection authorities.
- .2 Decal signs, minimum size 175 x 250 mm.

### **2.3 WIRING TERMINATIONS**

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

## **2.4 EQUIPMENT IDENTIFICATION**

- .1 Identify electrical equipment with nameplates and labels as follows:
  - .1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, black face, white core, lettering accurately aligned and engraved into core.
  - .2 Sizes as follows:

NAMEPLATE SIZES			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters
- .2 Labels: embossed plastic labels with 6mm high letters unless specified otherwise.
- .3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .7 Terminal cabinets and pull boxes: indicate system and voltage.
- .8 Transformers: indicate capacity, primary and secondary voltages.

## **2.5 WIRING IDENTIFICATION**

- .1 Identify wiring with permanent indelible identifying markings, numbered, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

## **2.6 CONDUIT AND CABLE IDENTIFICATION**

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	

Emergency Voice	Prime	Auxiliary
Other Security Systems	Red	Blue
	Red	Yellow

## 2.7 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
  - .1 Paint outdoor electrical equipment light gray to EEMAC 2Y-1.
  - .2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

## Part 3 Execution

### 3.1 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

### 3.2 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

### 3.3 CONDUIT AND CABLE INSTALLATION

- .1 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .2 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

### 3.4 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

### 3.5 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

### 3.6 FIELD QUALITY CONTROL

- .1 Load Balance:
  - .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
  - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

- .3 Provide upon completion of work, load balance report as directed in PART 1 - SUBMITTALS: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
  - .1 Power distribution system including phasing, voltage, grounding and load balancing.
  - .2 Circuits originating from branch distribution panels.
  - .3 Lighting and its control.
  - .4 Motors, heaters and associated control equipment including sequenced operation of systems.
  - .5 Insulation resistance testing:
    - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
    - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
    - .3 Megger 5001-25kV circuits, feeders and equipment with a 5000 V instrument.
    - .4 Check resistance to ground before energizing.
- .3 Carry out tests in presence of Departmental Representative.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

### **3.7 CONTROL SYSTEMS AND DEVICES**

- .1 Control systems and devices shall be fully commissioned, tested and demonstrated to Departmental Representative to show complete and correct operation as laid out in the drawings and specifications. All control scenarios including ( but limited to ) simulated faults; manual operation; indication; automatic operation and hydraulic over-ride.
- .2 If the indicated sequence of operations does not coincide with control schemes, devices or equipment provided, clarification of desired operation shall be sought by the contractor from the Departmental Representative. Correct and safe operation of all systems is expected at completion of this project.
- .3 All control panel assemblies or modification to existing approved control panel assemblies shall be inspected and approved to suitably compliant CSA or similar



standards. CSA approval of individual components does not grant approval of the constructed assembly.

- .4 Where any control devices require confirmation for set points or operational data, this information shall be requested by the contractor from the Departmental Representative in a timely fashion such that installation or commissioning progress is not impeded.

### **3.8 CLEANING**

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

**END OF SECTION**

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**Part 1 General**

**1.1 SECTION INCLUDES**

- .1 This section specifies copper conductors rated 0-1000 Volts and the most common electrical insulation and covering materials.

**1.2 REFERENCES**

- .1 CSA C22.2 No .0.3 latest edition, Test Methods for Electrical Wires and Cables.
- .2 CAN/CSA-C22.2 No. 131 latest edition, Type TECK 90 Cable.

**1.3 GENERAL REQUIREMENTS**

- .1 Typically use insulated 98% conductivity copper conductor wiring enclosed in EMT (steel) conduit for the general wiring systems unless otherwise indicated.
- .2 Teck cable may only be used where specifically indicated on the drawings or in the specifications. Where permitted, Teck wiring up to 750 system volts to be PVC jacketed armoured cable, multi-copper conductor type Teck90 1000 volt having a PVC jacket with FT-4 flame spread rating.
- .3 Refer to Equipment Schedule(s) for detailed responsibilities.

**Part 2 Products**

**2.1 WIRE AND CABLE GENERAL**

- .1 Conductors: stranded for 10 AWG and larger. Minimum size #12 AWG.
- .2 Insulation to be 600 volt RW90XLPE (X link) for the general building wiring in conduit.
- .3 Use RW90XLPE for underground installations.
- .4 Site services sub-circuits, including site lighting, to be minimum #10 AWG for power and #12 for controls. Increase wiring size for lengthy and/or loaded circuits so that system will not exceed the maximum voltage drop as recommended by the Canadian Electrical Code CSA 22.1, latest edition.
- .5 Main feeders to be conduit and copper insulated wiring unless otherwise noted on drawings. Provide ground wiring for all conduits in or below slabs. Increase conduit size as required.
- .6 TBS90 #14 AWG stranded shall be used in all switchgear assemblies. Current transformer secondary wiring shall be #12 AWG stranded. Current transformer leads shall incorporate ring type tongues for termination purposes.
- .7 Conductors to be colour-coded. Conductors No.10 gauge and smaller shall have colour impregnated into insulation at time of manufacture. Conductors size No.8 gauge and larger may be colour-coded with adhesive colour coding tape, but only black insulated conductors shall be employed in this case, except for neutrals which shall be white wherever possible. Where colour-coding tape is utilized, it shall be applied for a minimum of 50 mm at terminations, junctions and pullboxes and conduit fittings. Conductors not to be painted.

## **2.2 TECK CABLE**

- .1 Cable: to CAN/CSA-C22.2 No. 131 latest edition.
- .2 Conductors:
  - .1 Grounding conductor: copper.
  - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
  - .1 Type: ethylene propylene rubber.
  - .2 Chemically cross-linked thermosetting polyethylene rated type RW90, 600 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking galvanized steel or aluminum.
- .6 Overall covering: thermoplastic polyvinyl chloride material.
- .7 Fastenings:
  - .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
  - .2 Channel type supports for two or more cables at 1000 mm centers.
  - .3 Threaded rods: 6 mm dia. to support suspended channels.
- .8 Connectors:
  - .1 Watertight approved for TECK cable.

## **2.3 CONTROL CABLES**

- .1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket.
- .2 Low energy 300 V control cable: solid annealed copper conductors sized as indicated, with TWH over each conductor and overall covering of PVC jacket.
- .3 600 V type: stranded copper conductors, sizes as indicated with R90 (x-link) ethylene-propylene rubber insulation type over each conductor and overall covering of PVC jacket.

## **Part 3 Execution**

### **3.1 INSTALLATION OF BUILDING WIRES**

- .1 Install wiring as follows:
  - .1 In conduit systems in accordance with Section 26 05 34.
  - .2 In underground ducts in accordance with Section 26 05 34.
  - .3 All wires are to be pulled in together in a common raceway, using liberal amounts of lubricant.
  - .4 No combining of circuits onto common neutral will be permitted. Use 2 pole or 3 pole breakers for combined circuits, no connector clips will be allowed.
  - .5 Ensure that all single phase loadings are reasonably closely balanced over the main feeders.

**3.2            INSTALLATION OF TECK CABLE 0 -1000 V**

- .1    Install cables.
  - .1        Group cables wherever possible on channels or in cable trays.
- .2    Install cable in trenches in accordance with Section 26 05 34.
- .3    Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

**3.3            INSTALLATION OF CONTROL CABLES**

- .1    Control cable and conduit will be supplied and installed by Electrical Contractor. Controls wiring must be installed in conformance with Electrical Specifications. Install control cables in conduit.
- .2    Ground control cable shield at one end only.

**END OF SECTION**

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**Part 1            General**

**1.1            SECTION INCLUDES**

- .1       This section specifies rigid and flexible fasteners, fittings and installation.

**Part 2            Products**

**2.1            OUTLET AND CONDUIT BOXES - GENERAL**

- .1       Size boxes in accordance with CSA C22.1.
- .2       102 mm square or larger outlet boxes as required for special devices.
- .3       Gang boxes where wiring devices are grouped. Do not use sectional boxes.
- .4       Blank cover plates for boxes without wiring devices.
- .5       Combination boxes with barriers where outlets for more than one system are grouped.

**2.2            SHEET STEEL OUTLET BOXES**

- .1       For larger boxes use GSB solid type as required.
- .2       Boxes for surface mounted switches, receptacles, communications, telephone to be 100mm square No. 52151 or 52171 with Taylor 8300 series covers.

**2.3            MASONRY BOXES**

- .1       Electro-galvanized steel masonry single and multi gang type MDB boxes for devices flush mounted in exposed block walls.

**2.4            CONCRETE BOXES**

- .1       Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

**2.5            SURFACE CONDUIT BOXES**

- .1       Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles.

**2.6            FITTINGS – GENERAL**

- .1       Bushing and connectors with nylon insulated throats.
- .2       Knock-out fillers to prevent entry of foreign materials.
- .3       Conduit outlet bodies for conduit up to 35 mm. Use pull boxes for larger conduits.
- .4       Double locknuts and insulated bushings on sheet metal boxes.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1    Typical outlet box mounting heights are indicated in Section 26 05 00 or refer to wiring device and communication specification sections and to architectural layouts for particular mounting heights of outlet boxes where indicated.
- .2    Support boxes independently of connecting conduits.
- .3    Fill open boxes with paper, sponges, foam or similar approved material to prevent entry of construction material. Remove upon completion of work.
- .4    Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not to be used.
- .5    All outlet boxes to be flush mounted in all areas, excluding mechanical rooms, electrical rooms, and above removable ceilings.
- .6    No sectional or handy boxes to be installed.
- .7    Provide vapour barrier wrap or boots behind outlets mounted in exterior walls. Maintain integrity of the vapour barrier and insulation to prevent condensation through boxes.

**END OF SECTION**

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**Part 1        General**

**1.1        SECTION INCLUDES**

- .1        This section specifies rigid and flexible conduits, fasteners, fittings and installation.

**1.2        REFERENCES**

- .1        Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware: to CSA C22.2 No. 18.
- .2        Rigid metal conduit (RMC): to CSA C22.2 No. 45.
- .3        Electrical metallic tubing (EMT): to CSA C22.2 No. 83.
- .4        Flexible metal conduit (FMC): to CSA C22.2 No. 56.

**1.3        BASIC WIRING METHODS**

- .1        Underground or in concrete exterior to building:
  - .1        All wiring shall be in Schedule 40 RPVC conduit.
- .2        Concrete walls and slabs interior to building:
  - .1        All wiring shall be in Schedule 40 RPVC conduit.
- .3        Partition walls and ceilings:
  - .1        All wiring to be run in EMT conduit for:
    - .1        Branch circuits.
    - .2        Low voltage systems.
    - .3        Distribution feeders and sub-feeders.
    - .4        Surface wiring in electrical and mechanical rooms.
- .4        Motors, transformers and all vibrating equipment:
  - .1        Short (600mm to 1200mm) PVC jacketed flexible conduit with liquid tight connectors shall be used. Allow sufficient slack to avoid strain on connectors at extreme extension of equipment movement.
- .5        Surface raceways - interior:
  - .1        All surface raceways shall be EMT, except if located without protection in areas susceptible to damage, which shall be rigid steel conduit.
- .6        Surface raceways - exterior:
  - .1        All surface raceways shall be UV compensated Schedule 40 RPVC conduit, protected from damage and excessive heating to the Consultant's satisfaction.

**1.4        LOCATION**

- .1        Electrical drawings are diagrammatic and do not show all conduits, wire, cable, etc. Electrical contractor to provide conduit, wire cable, etc., for a complete operating job to meet in all respects the intent of the drawings and specifications.
- .2        Outlet positions shown on other drawings (plans and elevations) to take precedence over locations and mounting heights indicated on electrical plans or in specifications.

- .3 Locate electrical devices on walls with regard given for convenience of operation and conservation of wall space. Switches, receptacles, fire alarm pull stations, etc. generally to be vertically lined up where items are in the same general location. Adjacent common devices to be installed in common outlet box.
- .4 Review the exact location criteria of each electrical outlet and device with the Departmental Representative prior to rough-in. Relocate any item installed without confirmation as required by the Departmental Representative at no cost to the contract as long as the relocation is within 3m of the location originally shown on the electrical drawings.
- .5 Locate light switches on latch side of doors. Locate disconnect devices in mechanical rooms on latch side of door.
- .6 All outlets located on exterior walls to be complete with moulded plastic vapour barriers to maintain integrity of wall vapour barrier system.
- .7 All raceways and wiring shall be installed concealed in building fabric, except for mechanical and electrical rooms where they shall be installed on the surface.
- .8 All outlet boxes, junction boxes, and cabinets to hold electrical devices shall be mounted so the equipment can be flush mounted unless indicated otherwise.
- .9 All junction boxes and other raceway access devices shall be mounted to avoid being visible from public areas. Obtain approval from Departmental Representative for any and all junction boxes that, due to the building design, cannot be concealed.
- .10 All junction boxes mounted, out of necessity, on surface of solid walls shall be painted to match adjacent surface, with junction boxes painted to match designated systems.

## **Part 2 Products**

### **2.1 RIGID PVC RACEWAY SYSTEM**

- .1 Rigid PVC fittings shall be of the same manufacturer as the conduit.
- .2 All fittings with removable covers shall be complete with VC gaskets and brass securing screws and inserts. All metal components shall be brass or stainless steel.
- .3 All Rigid PVC conduit installed below grade or in a duct bank shall use long radius, "street" type bends with bending radius of 750mm minimum.

### **2.2 RIGID METAL CONDUIT RACEWAY SYSTEM**

- .1 Rigid threaded metal conduits shall be installed as noted in drawings.
- .2 All couplings and connection to enclosures shall used threaded fastening or locknuts; use of set screw type connections will not be accepted.
- .3 Galvanized coating with easy pull internal treatment.
- .4 All threads shall be tapered; Running threads will not be accepted.
- .5 Factory formed threads shall be used where possible. When field threading is required, provide application of cold galvanizing paint or coating,



**2.3 EMT RACEWAY**

- .1 Electrical Metallic Tubing (EMT) shall be galvanized steel of sufficient quality and thickness to allow smooth field formed bends.
- .2 EMT couplings, connectors and fittings shall be steel. Cast type units shall not be used on this installation.

**2.4 PVC JACKETED FLEXIBLE CONDUIT**

- .1 PVC jacketed flexible conduit (liquid tight) shall be interlocking spiral aluminum conduit with continuous extruded PVC jacket.
- .2 Conduit fittings shall be steel liquid tight type that fit over PVC jacket and seal uniformly all round.

**2.5 FLEXIBLE ELECTRIC NON-METALLIC (ENT) TUBING**

- .1 Flexible electrical non-metallic tubing (ENT) shall not be used on this project.

**2.6 OUTLET BOXES AND JUNCTION BOXES**

- .1 Except as noted for rigid PVC raceways, all outlet boxes and junction boxes shall be one piece formed or welded.
- .2 Outlet boxes to be galvanized steel.
- .3 Junction boxes to be galvanized steel or aluminum.

**2.7 CONDUIT FASTENINGS**

- .1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1500mm oc.
- .4 Threaded rods, 6 mm dia., to support suspended channels.

**2.8 CONDUIT FITTINGS**

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory-"ells" where 90° bends are required for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

**2.9 FISH CORD**

- .1 Polypropylene.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.

- .3 Use electrical metallic tubing (EMT) except in cast concrete and above 2.4 m not subject to mechanical injury.
- .4 Use rigid PVC conduit underground, in corrosive areas, and surface mounted in wet areas not subject to damage.
- .5 Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without a prewired outlet box, connection to surface or recessed fluorescent fixtures and work in movable metal partitions.
- .6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .7 Minimum conduit size for lighting and power circuits: 19mm.
- .8 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .9 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .10 Install fish cord in empty conduits.
- .11 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .12 Dry conduits out before installing wire.
- .13 Conduits shall be installed mechanically continuous from outlet to outlet and without pockets. All the necessary standard bushings, elbows and bends shall be provided. All conduit bends shall have a radius of not less than six (6) times the internal diameter of the conduit and in no case shall the equivalent of more than four quarter bends from outlet to outlet be made. For all conduit sizes to be used for low voltage raceway, the conduits shall have a minimum bending radius of 230mm.
- .14 Conduit bends shall be made with no more than 10% flattening of the conduit. Bends shall be smooth throughout deformations.
- .15 On surface wall runs, all conduit shall be installed in true vertical or horizontal direction and on ceilings in true 90 degree angles or parallel to the walls. Crossings of conduits shall also be made at 90 degree angles. Parallel running conduit shall be kept on equal spacing on the entire length of run including bends.
- .16 All conduits shall be fastened to structure with steel straps (no cast type straps allowed).
- .17 Where more than three conduits are run parallel in ceiling cavity, they shall be installed on cantruss type channel, complete with all manufacturers fittings to secure channel to structure and to conduit.
- .18 Raceways extending out concrete slabs shall be securely protected using rebar stubs or similar material. All duct stubs are to be kept sealed during construction

### **3.2 SURFACE CONDUITS**

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended or surface channels.

- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

### **3.3 CONCEALED CONDUITS**

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

**END OF SECTION**

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**Part 1            General**

**1.1            SECTION INCLUDES**

- .1        Materials for moulded-case circuit breakers, circuit breakers, and ground-fault circuit-interrupters.

**1.2            RELATED SECTIONS**

- .1        Section 01 33 00 - Submittal Procedures.
- .2        Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

**1.3            REFERENCES**

- .1        Canadian Standards Association (CSA International).
  - .1        CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

**1.4            SUBMITTALS**

- .1        Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Include time-current characteristic curves for breakers with ampacity of 100A and over.

**1.5            WASTE MANAGEMENT AND DISPOSAL**

- .1        Separate waste materials for reuse and recycling accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.
- .2        Separate for recycling all waste in accordance with Waste Management Plan.

**Part 2           Products**

**2.1            BREAKERS GENERAL**

- .1        Moulded-case circuit breakers, Circuit breakers, and Ground-fault circuit-interrupters to CSA C22.2 No. 5
- .2        Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient
- .3        Common-trip breakers: with single handle for multi-pole applications.
- .4        Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
  - .1        Trip settings on breakers with adjustable trips as noted.
- .5        Circuit breakers with interchangeable trips as indicated.
- .6        Circuit breakers to have minimum 10kA symmetrical rms interrupting capacity rating or as noted in drawings or panel schedules.

**2.2 THERMAL MAGNETIC BREAKERS**

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

**2.3 MAGNETIC BREAKERS - MOTOR CIRCUIT PROTECTOR**

- .1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.
- .2 Field adjustable trip settings for instantaneous protection.
- .3 Provide one set of auxiliary contacts wired to terminal block in starter enclosure.

**2.4 OPTIONAL FEATURES**

- .1 Refer to drawings, single lines and panel schedules for features to be included on moulded case breakers.
- .2 Include:
  - .1 On-off locking device.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install circuit breakers in switchboard or panel board assemblies as noted in drawings.
- .2 Install motor circuit protectors in combination motor starter/disconnect switch assembly.

**END OF SECTION**

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**Part 1            General**

**1.1            REFERENCES**

- .1    National Electrical Manufacturers Association (NEMA)
  - .1    NEMA ICS 1-2000 (R2008), Industrial Control and Systems: General Requirements.

**1.2            ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Product Data:
  - .1    Submit manufacturer's instructions, printed product literature and data sheets for control devices and include product characteristics, performance criteria, physical size, finish and limitations.
- .3    Shop Drawings:
  - .1    Include schematic, wiring, interconnection diagrams.

**1.3            QUALITY ASSURANCE**

- .1    Conduct tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

**1.4            CLOSEOUT SUBMITTALS**

- .1    Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2    Operation and Maintenance Data: submit operation and maintenance data for control devices for incorporation into manual.

**1.5            DELIVERY, STORAGE AND HANDLING**

- .1    Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2    Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3    Storage and Handling Requirements:
  - .1    Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2    Store and protect control devices from nicks, scratches, and blemishes.
  - .3    Replace defective or damaged materials with new.
- .4    Packaging Waste Management: remove for reuse as specified in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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**Part 2            Products**

**2.1            AC CONTROL RELAYS**

- .1 Control Relays: to CSA C22.2 No.14 and NEMA ICS 1.
- .2 Fixed contact plug-in type: general purpose low coil current with 3 poles. Coil rating: 120 V. Contact rating: 120V, 10 A.
- .3 Control relays shall incorporate octal base plug in configuration with DIN rail mounted base.
- .4 Relays shall have a manual actuator for forcing relays on/off.
- .5 Relays shall have an LED indicator integral to relay body indicating relay status.

**2.2            RELAY ACCESSORIES**

- .1 Standard contact cartridges: normally-open - convertible to normally-closed in field.

**2.3            PUSHBUTTONS**

- .1 Standard Heavy duty, Oil tight. Operator extended type, color as indicated with 1-NO and 1-NC contacts rated at 120 VAC, labels as indicated. Stop pushbuttons coloured red with mushroom type operator.
- .2 Momentary operating mechanism.

**2.4            INDICATING LIGHTS**

- .1 Heavy duty, Oil tight, full voltage, LED type, push to test, lens colour: as indicated, supply voltage: as indicated.

**2.5            ANALOG ALARM RELAY**

- .1 DIN railed mounted signal conditioner for processing 4-20mA or 0-5V analog control signal and providing contact closure at preset signal level.
- .2 LED indication for power and relay status.
- .3 Field configurable for analog signals. Field configurable alarm or set points.
- .4 Power supply is external from analog signal.

**2.6            KEY SWITCH**

- .1 Panel mounted key operated latching switch.
- .2 Standard Heavy duty, Oil tight. Operator extended type, color as indicated with 1-NO and 1-NC contacts rated at 120 VAC, labels as indicated.
- .3 Provide 4 matching keys in total.

**2.7            LOOP POWER SUPPLY**

- .1 120VAC input, DC output to connect in series with 4-20mA transducer to provide loop power.
- .2 50 watt maximum power with 5% voltage regulation on output over power range. 24 VDC or as compatible with signalling device.

- .3 DIN rail mounted.
- .4 Provide input/output fusing as recommended by manufacturer.

## **2.8 CONTROL AND RELAY PANELS**

- .1 CSA Type 1 sheet steel enclosure with hinged padlockable access door, accommodating relays, signal conditioners, timers, labels, as indicated, factory installed and wired to identified terminals.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for control devices installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery. Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.2 INSTALLATION**

- .1 Install all control devices in common enclosure and connect to field mounted sensors or control interfaces.
- .2 Provide finalized as built drawings showing all wire numbers, terminal blocks names/numbers and connection points.

### **3.3 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at time and check out operation of section.
- .3 Upon completion of sectional test, undertake group testing.
- .4 Check out complete system for operational sequencing.

### **3.4 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**



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**Part 1            General**

**1.1            SECTION INCLUDES**

- .1    This Section describes combination magnetic motor starters for motors up to 600 volts

**1.2            REFERENCES**

- .1    International Electrotechnical Commission (IEC)
  - .1    IEC 947-4-1-latest edition, Part 4: Contactors and motor-starters.
  - .2    CAN/CSA – C22.2 No.14-latest edition, Industrial Control Equipment.

**1.3            SHOP DRAWINGS AND PRODUCT DATA**

- .1    Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Indicate:
  - .1    Mounting method and dimensions.
  - .2    Starter size and type.
  - .3    Layout of identified internal and front panel components.
  - .4    Enclosure types.
  - .5    Wiring diagram for each type of starter.
  - .6    Interconnection diagrams.

**1.4            CLOSEOUT SUBMITTALS**

- .1    Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 26 05 00 – Common Work Results - Electrical.
- .2    Include operation and maintenance data for each type and style of starter.

**1.5            EXTRA MATERIALS**

- .1    Provide listed spare parts for each different size and type of starter:
  - .1    1 operating coil.
  - .2    2 control fuses.

**Part 2           Products**

**2.1            FULL VOLTAGE COMBINATION MAGNETIC STARTERS**

- .1    Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
  - .1    Contactor solenoid operated, rapid action type.
  - .2    Motor overload protective device in each phase, manually reset from outside enclosure.
  - .3    Wiring and schematic diagram inside starter enclosure in visible location.
  - .4    Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

- .5 All remote wiring is to interface with motor starter using terminal blocks.  
Field wiring shall not be extended directly to a device connection terminal.
- .2 Combination type starters to include moulded case circuit breaker (motor circuit protector) with operating lever on outside of enclosure to control circuit breaker, and provision for:
  - .1 Locking in "OFF" position with up to 3 padlocks.
  - .2 Independent locking of enclosure door.
  - .3 Provision for preventing switching to "ON" position while enclosure door open.
- .3 Accessories:
  - .1 Selector switches: heavy duty, oil tight, labelled as indicated.
  - .2 Indicating lights: LED, heavy duty, oil tight, type and color as indicated.  
Push to test functionality:
  - .3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.
  - .4 Auxiliary contact from circuit breaker wired to terminal block.

## **2.2 CONTROL TRANSFORMER**

- .1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.
- .2 Size control transformer for control circuit load plus 20% spare capacity.

## **2.3 FINISHES**

- .1 Apply finishes to enclosure in accordance with Section 26 05 00 - Common Work Results - Electrical.

## **2.4 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install starters, connect power and control as indicated.
- .2 Ensure correct overload devices elements installed. Field adjust overload to actual measured full load motor current and confirm per nameplate and service factor.
- .3 Provide detailed markups for all wire numbers, tags and identification used in final connections.

### **3.2 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and manufacturer's instructions.
- .2 Operate switches, contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.

- .4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.
- .5 Verify actual operating current with that of name plate, shop drawings and ensure correct overload selection.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 01 11 55 – General Instructions
- .2 Section 01 33 00 – Submittal Procedures
- .3 Section 01 74 21 – Construction Waste Management and Disposal

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM A48M – Standard Specification for Gray Iron Castings.
  - .2 ASTM A834 – Standard Specification for Common Requirements for Iron Castings for General Industrial Use.
  - .3 ASTM D1002 - Shear Strength of Adhesively Bonded Metal Specimens
  - .4 ASTM D4541 - Pull Off Adhesion Testing of Coatings
  - .5 ASTM D695 - Testing Methods for Compressive Properties of Rigid Plastics
  - .6 ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus
  - .7 ASTM D22240 - Standard Test Method for Rubber Property—Durometer Hardness
  - .8 ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
  - .9 ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
  - .10 ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
  - .11 ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts
  - .12 ASTM F436 - Standard Specification for Hardened Steel Washers
  - .13 ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
  - .14 ASTM F2329 - Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 At least 2 weeks prior to beginning Work, submit to Departmental Representative:
  - .1 Written work plan of surface cleaning/preparation,
  - .2 Written work plan of epoxy resin repairs,

- .3 Written work plan of coating application.
- .3 Provide testing results for review by Departmental Representative.
- 1.4 QUALITY ASSURANCE**
  - .1 All epoxy resin repairs and all surface coatings are to be inspected by a third-party NACE certified coatings inspector, engaged by the Contractor.
    - .1 Typical testing SSPC PA2 rule allowing for 80% of minimum DFT for spot measurement shall not apply. The minimum DFT shall be 16 mils on any spot measured.
    - .2 Test for coating continuity (Holiday Testing) in accordance with manufacturer's instructions after the epoxy anti-corrosive has sufficiently cured.
    - .3 Submit all coating test results to the Departmental Representative within 2 days of receipt.
- 1.5 DELIVERY, STORAGE AND HANDLING**
  - .1 All materials shall be transported and stored in accordance with the manufacturer's written instructions.
  - .2 Any materials not adequately handled or stored shall be removed from site immediately.
- Part 2 Products**
  - 2.1 PERFORMANCE CRITERIA**
    - .1 Quality Control Plan: ensure epoxy resin repairs are completed with an appropriate quality control plan in place, and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.
    - .2 Quality Control Plan: ensure coatings are installed with an appropriate quality control plan in place, and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.
  - 2.2 EPOXY RESIN REPAIR MATERIALS**
    - .1 Epoxy for repair of pitted and damaged sections of gate leafs, guides, wedges, and thimbles:
      - .1 Two component paste grade system with ceramic steel blended with high molecular weight reactive polymers and oligomers with the following minimum hard properties at 7 days.
        - .1 Taber abrasion resistance (1 kg load) :
          - .1 H10 Wheels (wet): 852mm<sup>3</sup>
          - .2 CS17 Wheels (Dry): 24mm<sup>3</sup>
        - .2 Tensile Shear Adhesion tested to ASTM D1002: 19 Mpa

- .3 Pull Off Adhesion tested to ASTM D4541:
  - .1 Ambient Cure: 22 MPa
  - .2 Post Cure: 20.5 MPa
- .4 Compressive Strength tested to ASTM D695:
  - .1 Ambient cure: 88.9 MPa
  - .2 Post cure: 113.7 MPa
- .5 Corrosion resistant to ASTM DB117: no visible corrosion after 5,000 hours
- .6 Flexural Strength tested to ASTM D790:
  - .1 Ambient cure: 66.2 MPa
  - .2 Post cure: 98.6 MPa
- .7 Shore Hardness tested to ASTM D2240: 84
- .8 Barcol Hardness tested to ASTM D2583:
  - .1 Ambient cure: 85
  - .2 Post cure: 92
- .9 Thermally stable between -30 degrees and + 90 degrees
- .10 Impact strength tested to ASTM D256
  - .1 Ambient cure: 37 J/m
  - .2 Post cure: 39 J/m

## 2.3 BOLTS

- .1 Bolts: ASTM A325, galvanized, 31.8mm diameter x 165mm long to match existing
- .2 Nuts: ASTM A563 DH, galvanized
- .3 Washers: ASTM F436-1, galvanized.
- .4 Galvanizing to ASTM F2329 and ASTM A153

## 2.4 COATING MATERIALS

- .1 Anti-Corrosion Coating shall be a high-solid, abrasion resistant, aluminum pure epoxy coating conforming to the following:
  - .1 Curing agent - ENA383
  - .2 Volume of solids – 78% (ISO 3233:1998)
  - .3 Mix ratio – 2.5 Agitate to 1.0 curing agent
  - .4 Typical film thickness – 0.41mm
  - .5 Theoretical coverage – 4.88 m<sup>2</sup>/litre
  - .6 Flash point – Part A 42 Degrees C, Part B 40 C, mixed at 41 C
  - .7 Max VOC – 206 g/lit as supplied

**Part 3 Execution**

**3.1 INITIAL PREPARATION**

- .1 All surfaces shall be pressure-washed at 24MPa minimum to remove marine fouling and loose coatings and corrosion.
- .2 All surfaces shall be abrasive blasted to SSPC SP10 to remove corrosion products and coatings.
- .3 All surfaces shall be re-pressure-washed at 24MPa minimum to remove chlorides.
- .4 Test surface for chlorides; Acceptable level of chlorides shall be <5ppm prior to final abrasive blasting.

**3.2 PRE EPOXY RESIN REPAIR PREPARATION**

- .1 Requirement for epoxy resin repairs of gate leafs and supports to be determined by Departmental Representative after initial surface preparation.
- .2 Grind out corroded material back to sound material.
  - .1 Remove all free graphite and feather back to non-corroded skin of casting
- .3 Prepare surface in accordance with manufacturer's specifications

**3.3 PRE-COATING PREPARATION**

- .1 Final surface preparation shall not proceed until ambient conditions are suitable for coating in accordance with the coating manufacturers published data sheets.
- .2 Ensure surface is completely dry. Since cast iron has a degree of porosity, this can best be accomplished by heating the surface to >20C above dewpoint temperature for a minimum of 2 hours.
- .3 Abrasive blast all surfaces to be coated to SSPC SP10, near-white metal. Surface profile shall be >0.08 mm.

**3.4 EPOXY RESIN REPAIRS**

- .1 Epoxy resin to be applied and cured as per manufacturer's written instructions
- .2 Departmental Representative to determine extent of epoxy resin repairs required upon results of NDT testing and inspection.
- .3 Each location on any gate or gate support component where the extent of corrosion is determined to warrant epoxy resin repair by the Departmental Representative shall be repaired with a minimum patch thickness of 20mm, thicker patches may be required as directed by the Departmental Representative.
- .4 Provide unit rates for epoxy resin repairs based on the following units of work:
  - .1 Gate Leaf repairs – 50mm wide x 50mm long surface area of repair  
Estimated Quantity = 100

- .2 Gate Guide repairs – 50mm wide x 50mm long surface area of repair  
Estimated Quantity = 40
- .3 Unit rate to include all materials and labour required to prepare surface  
and carry out repair as specified.
- .4 Mobilization and Demobilization costs for epoxy resin repairs to be  
included in lump sum price and not in the unit rate.

### **3.5 BOLT REPLACEMENT**

- .1 All gate to guide bolts on the Main Gate to be replaced with new.
- .2 Bolts shall be replaced with new 31.8 mm diameter x 165mm long galvanized  
A325 bolt to match existing.

### **3.6 COATING INSTALLATION/APPLICATION**

- .1 Coatings shall be applied and cured as per the manufacturer's written  
instructions. At a minimum, the following will apply:
  - .1 Two coats, at 0.2 mm/coat in contrasting colours,
  - .2 First coat shall be stripe coated and back-rolled or brushed to work  
coating material into crevices, pores or rough pitted surface.

**END OF SECTION**



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Esquimalt Graving Dock  
Victoria, BC  
Penstock Gate and Cylinder Refurbishment,  
Install Auxiliary Tunnel Safety Gate  
Project No. R.016116.098 and R.016116.114

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**APPENDIX A**

**November 2014**

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## **APPENDIX A**

### **SAMPLE CONTRACTORS HEALTH AND SAFETY PLAN**



## HEALTH AND SAFETY REQUIREMENTS

## APPENDIX A

November 2014

Penstock Gate and Cylinder Refurbishment and Install Auxilliary Tunnel Safety Gate

Project No. R.016116.098 and R.016116.114

### CHECKLIST OF HEALTH & SAFETY PLAN REQUIREMENTS

Prepare and comply with a site-specific project Health and Safety Plan (see sample below) based on hazard assessment, including, but not limited to, the following:

- ☐ Reference to Contractor's health & safety policy.
- ☐ Indication Health & Safety has been fully considered in the bid.
- ☐ General safety rules for the project.
- ☐ Commitment to comply with all applicable regulations and applicable policies and procedures of PWGSC and Esquimalt Graving Dock.
- ☐ Confirmation that PWGSC will be informed of any sub-contractors before they enter the site and that PWGSC has the right to remove any sub it deems unsatisfactory.
- ☐ Commitment to completion of a Job Hazard Analysis and ensuring workers are made aware of the hazards and comply with specific requirements.
- ☐ Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations.
- ☐ Commitment to the documentation of job-specific safe work procedures and ensuring workers are trained in those procedures before starting work.
- ☐ Define regular communication channels to ensure information is transferred between the Construction team and the Departmental Representative/ operations and record keeping procedures.
- ☐ Commitment to provision of plans by Qualified Persons when required by regulation (e.g. fall arrest program, etc.), ensuring workers are trained in the plan, have approved equipment and follow the agreed plan.
- ☐ Commitment to ensuring no worker (including sub-trades) enters the job site without proper training. Ensuring Workers are made aware of their right to refuse work they consider too hazardous. Acknowledgement that the PWGSC orientation is not to be considered complete training.
- ☐ Commitment to using only "Qualified Persons" on the project and provision of proof of qualification as required.
- ☐ Definition of roles & responsibilities for project safety/organization for project specifically the Construction Superintendent, OH&S Representative and Worker Safety Representative. Identify any alternates and the qualifications of all individuals.
- ☐ A commitment to holding Occupational Health and Safety Meetings at a frequency agreed with the Departmental Representative and provision of minutes within 2 days of the meeting.
- ☐ Define Inspection Policy & Procedures. A commitment to holding formal site inspections at a frequency agreed with the Departmental Representative and provision of a report within 2 days of the inspection. The Worker Safety Representative will participate whenever possible.
- ☐ A commitment to conform to all environmental requirements and safe work procedures for hazardous materials. This includes provision of MSD Sheets and training of workers in correct use, handling, disposal and personal protective measures to be used.



Public Works and  
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Canada

## HEALTH AND SAFETY REQUIREMENTS

## APPENDIX A

November 2014

**Penstock Gate and Cylinder Refurbishment and Install Auxilliary Tunnel Safety Gate**  
**Project No. R.016116.098 and R.016116.114**

- ☐ Definition of how First Aid will be provided and how medical emergencies will be treated.
- ☐ Incident reporting and investigation policy and procedures. Commitment to reporting all incidents, accidents, near-miss and WORKSAFEBC inspections/orders to the Departmental Representative immediately followed by copies of relevant reports etc. within 2 days.
- ☐ Occupational Health and Safety Committee/Representative procedures.
- ☐ Occupational Health & Safety communications and record keeping procedures.
- ☐ List hazardous materials to be brought on site as required by work.
- ☐ Indicate engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.
- ☐ Identify personal protective equipment (PPE) to be used by workers.
- ☐ Identify personnel and alternates responsible for site safety and health.
- ☐ Identify personnel training requirements and training plan, including site orientation for new workers.

XYZ CONSTRUCTION  
CONTRACTOR'S HEALTH & SAFETY PLAN – sample only

XYZ Construction (XYZ) considers safety to be an integral part of doing the work and takes pride in its safety program and record. See XYZ safety policy and program documentation attached.

XYZ's Safety Plan to ensure compliance with WORKSAFEBC Regulations and Environmental practices as required under this contract includes the following elements.

**Safety & Health Considered in Bid:**

XYZ confirms all known hazards and safety requirements have been considered in the bid and that it will follow all applicable policies and procedures of PWGSC as the owner's representative and comply with all applicable regulations.

**Sub-Contracting:**

XYZ confirms it will not enter into any sub-contracting agreement without the approval of the PWGSC Departmental Representative. XYZ confirms PWGSC will retain the right to remove any sub-XYZ from the work site if the Departmental Representative deems it necessary and has so informed its sub-contractors.

Sub contractors will be identified to the Departmental Representative prior to entering the work site.

**Job Hazard Analysis**

XYZ will work with sub-trades and other resources to complete the Job Hazard Analysis to the extent possible. XYZ will then assist in finalizing the Job Hazard Analysis documentation with the Departmental Representative, Safety specialists and IOS Operations Representatives *prior* to starting work. The Departmental Representative will review the Job Hazard Analysis provided by the XYZ prior to worker orientation proceeding. XYZ will ensure worker compliance with requirements included in the Job Hazard Analysis, job/site specific procedures and all regulations.

XYZ will comply with the PWGSC Lockout Policy, Confined Space Entry Policy and other applicable site rules/policies.

**Safe Work Procedures:**

XYZ will work with safety professionals, engineers and others as required to document safe working procedures for all hazardous work and ensure workers are trained in these procedures prior to starting work. Where required, Personal Protective Equipment will be provided and a list is attached.

**Provision of Plans by Qualified Persons:**

Where regulations require plans provided by Qualified Persons (e.g. Fall Protection Plan, Crane lifting plans, Confined Space Entry procedures) XYZ will identify the requirement, provide the plan and commit to ensuring

## XYZ CONSTRUCTION

### CONTRACTOR'S HEALTH & SAFETY PLAN – sample only

workers are trained in the plan, have suitable approved equipment and follow the agreed plan. ABC Engineering will provide the required documentation for the 3 identified needs.

#### Worker Training:

XYZ will ensure no worker (including sub-trades) enters the job site without proper training in applicable WORKSAFEBC Regulations and project specific procedures as defined in the Job Hazard Analysis, Emergency Response /Rescue Plans, or detailed work procedure. XYZ will ensure all workers understand the hazards of the work and those inherent in working at IOS and that they have the right to refuse work they consider to be too hazardous. XYZ will provide documentation confirming training to the Departmental Representative prior to the workers starting work. It is understood that the Orientation to be conducted by PWGSC cannot be considered complete training in everything the workers must know and Supervisors are ultimately responsible for workers being fully trained. No worker will enter the site without a complete orientation.

#### Qualified Persons:

XYZ will ensure that only "Qualified Persons" are used on the project and provide proof of qualification prior to the Pre-startup Orientation and Tour for workers as requested by the Departmental Representative. The list of designated qualified persons for this project is attached.

#### Construction Superintendent:

XYZ will ensure that the Construction Superintendent is qualified to supervise the work and will be capable of carrying out the following roles & responsibilities. John Smith, an employee with 34 years experience in building/construction type of work will supervise during the most critical activities and otherwise Dustin Brown, a senior employee with 10 years experience will act as alternate Construction Superintendent. Resumes are attached. The Construction Superintendent and Alternate meet the requirements outlined below:

1. To document a Project Safety Plan (this document) for both his people and any sub-trades involved on the project. This will be prepared in conjunction with the sub-contractor management as necessary and provides the framework for safety and health related activity on the project.
2. To train and/or ensure training has been done for any worker under his/her supervision including sub-trades.
3. To monitor the daily activities of his workers, including sub-trades, for compliance with safe work practices and immediately correct any violations.
4. To ensure no worker operates IOS equipment of any kind.
5. To re-train and coach workers as required for the purpose of correcting improper practices. To ensure the same is done for workers of sub-trades.
6. To report any injury, near miss or hazardous condition observed or brought to his attention to the PWGSC Departmental Representative immediately.
7. To report any WORKSAFEBC Orders or Inspections received by XYZ to the PWGSC Departmental Representative immediately.
8. To conduct safety meetings as outlined in the section below.

XYZ will ensure sufficient supervision to monitor the activities of the workers and ensure compliance with safe

## XYZ CONSTRUCTION

### CONTRACTOR'S HEALTH & SAFETY PLAN – sample only

work practices. For this project, the Construction Superintendent or his alternate Construction Superintendent will be on site at all times when work is proceeding.

#### Designated O H & S Person:

XYZ will employ and assign to the work, a competent and authorized representative as the Health and Safety Officer. Jack Brown, the Health and Safety Officer meets the following requirements (resume attached):

1. Have a minimum of 2 years of site-related working experience specific to activities associated with the work.
2. Have basic working knowledge of specified occupational safety and health regulations and site-specific safe work procedures.
3. To finalize the Job Hazard Analysis and safe work practice with the Departmental Representative, Safety Representative(s) and Operations Representative(s).
4. Be responsible for completing Health and Safety Worker Training and Site Orientation sessions, and ensuring that personnel that do not successfully complete the required training are not permitted to enter the site to perform work.
5. Be responsible for implementing and enforcing daily, and monitoring, the site-specific Health and Safety Plan.
6. Be on site during execution of work.
7. To be responsible for carrying out accident/incident investigations and provide a copy of the report to the PWGSC Departmental Representative. The Departmental Representative and/or his representative will *assist* in doing this.
8. Conduct regular drills, in co-ordination with Departmental Representative, to test adequacy of emergency response procedures and worker knowledge of their roles and responsibilities.
9. To conduct site inspections daily, as agreed with the PWGSC Departmental Representative and provide documentation of inspections to the Departmental Representative on a weekly basis.
10. To participate in safety meetings as outlined in the section below.

#### Worker Safety Representative:

The Worker Safety Representative on this project will be Sam White. Sam has been XYZ's worker safety rep for 5 years and is very familiar with applicable WORKSAFEBC regulations and safe work practices. Workers will be encouraged to contact their safety rep regarding safety and health issues that may arise. The Worker Safety Rep will participate in safety meetings and inspections and the resolution of health & safety issues.

#### Safety Meetings:

It is agreed that safety meetings with workers will consist of weekly meetings to be held every Monday morning with minutes to be provided to the Departmental Representative by the following Wednesday. The Construction Superintendent will document the actions of the meetings, who attended and provide a copy to the PWGSC Departmental Representative or his designate.

Typical topics for meetings will include but are not limited to:

- Review of hazards and safe work procedures and use of protective equipment.

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### CONTRACTOR'S HEALTH & SAFETY PLAN – sample only

- Changes in work practices, schedule or adjacent work areas which could affect worker safety,
- A review of critical procedures (e.g. Fall arrest plan, Fire and Emergency procedures,)
- Discussion of any injury, near miss or accident and steps to prevent recurrence.
- Worker health & safety concerns.

If changing conditions require communication to the workers prior to the next safety meeting, a “tail-gate” meeting will be held to train the workers prior to commencing work.

#### Inspections:

The Construction Superintendent/ OH&S resource will carry out daily inspections to identify new hazards, observe adherence to safe work practices and record findings and actions in his log. Written Inspection Reports will be provided to the PWGSC Departmental Representative weekly. Whenever possible, the weekly inspection will be conducted together with the Workers Safety Representative. This inspection will make use of the Job Hazard Analysis as a checklist of items to inspect.

#### Hazardous Materials & Environment:

XYZ confirms it will conform to all environmental requirements as defined in the contract and comply with Environmental Services best practices and directives. Material Safety Data Sheets will be provided prior to finalizing the Job Hazard Analysis for all potentially hazardous materials to be used. Workers will be fully trained by XYZ in the hazards of these materials and the proper use, storage, handling, Personal Protective Equipment (PPE) usage, disposal of these materials, appropriate emergency response and any other relevant information from the MSD Sheets. XYZ will ensure workers have received WHMIS training as required by regulations. A list of hazardous materials and PPE to be used on this job is attached.

#### First Aid/ Medical Assistance:

XYZ will provide a written risk assessment and detailed procedures for dealing with various types of possible injuries to comply with WORKSAFEBC First Aid amendments effective 31 Mar/04 and ensure required First Aid coverage is in place *prior* to the first day of work. A Level 1 First Aid Kit will be kept at the XYZ field office trailer near the work area. All First Aid Attendants will have their *Original* certificates on site for inspection by WORKSAFEBC if required. Three employees, Bob Horvath, Brian West, and George Taylor have level 1 First Aid training.

In the case of non-serious injury not requiring a stretcher or ambulance, the injured worker will be taken to: Admirals Walk Health Centre; 105-1505 Admirals Rd. (PH. 380-9070) using a company truck.

In the case of more serious injury, 911 will be called and ambulance service will be provided. Two XYZ workers will have 4-channel radios and can raise the alarm. The Construction Superintendent has a cell phone and will call 911.

#### Emergency Response Plan

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### CONTRACTOR'S HEALTH & SAFETY PLAN – sample only

XYZ will work with sub-trades, fire departments and others to document the response procedures in the event of an emergency or serious injury if work is of a nature that requires these details. Documentation will be posted and all workers trained. Plans will be compatible with IOS emergency response for fire, bomb threat, earthquake and confined space rescue.

#### **Accident/Incident/Injury/WORKSAFEBC Order Reporting & Investigation:**

XYZ will emphasize to employees that ALL accidents, injuries, equipment damage and incidents are to be reported and will ensure they are documented and reported to the PWGSC Departmental Representative immediately. Also, report to WORKSAFEBC as required by regulation and cooperate with any officer performing inspections or investigations. Any WORKSAFEBC Order or Inspection will be immediately reported to the PWGSC Departmental Representative.

XYZ will complete a full investigation of all incidents, near misses and accidents and take immediate corrective action as required to prevent recurrence. The Departmental Representative will participate with XYZ in investigations and planning appropriate action to prevent recurrence.

Approved by (XYZ): \_\_\_\_\_ Date: \_\_\_\_\_

General Manager, XYZ Construction



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Esquimalt Graving Dock  
Victoria, BC  
Penstock Gate and Cylinder Refurbishment,  
Install Auxiliary Tunnel Safety Gate  
Project No. R.016116.098 and R.016116.114

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**APPENDIX B**

**November 2014**

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## **APPENDIX B**

### **PRELIMINARY JOB HAZARD ANALYSIS CHECKLIST**



## Preliminary JOB HAZARD ANALYSIS CHECK LIST

November 2014

### APPENDIX B

Project Title: Penstock Gate and Cylinder Refurbishment Install Auxiliary Safety Gate      Project No. R.016116.098 and R.016116.114

Inspection Date: 21 October 2014

Inspection/Job Hazard Analysis Conducted By: Jon Siska

#### Note:

1. This form is also intended for use as a checklist when making daily inspections of the worksite. Therefore some questions will not apply to the initial inspection/ job hazard analysis.
2. This form is intended as a guide only and does not necessarily cover every situation regulated by WORKSAFEBC or other jurisdictions. It is imperative that the Contractor be familiar with safety requirements and add anything that is relevant but not listed below. New items should be noted to the attention of the Department Representative for inclusion in future revisions. Contractors must finalize the JHA to reflect the methods/equipment etc. they will use to do the work.
3. Department Representatives must review all items as part of creating preliminary JHA. Do not simply reuse this form from a previous project. Delete or add to "Hazard/action required" items as appropriate for your project and enter checkmarks or NA (not applicable) or TBD (to be determined with Contractor) under "Existing" column as appropriate.
4. CODES:
  - "48" indicates covered in Basic Site Orientation for Contractors presentation by PWGSC.
  - "S" indicates item covered in startup meeting with Contractor and up to Contractor to carry out appropriate action. Not covered in EGD orientation session.
  - "O" indicates item covered in EGD project specific orientation session. This does not relieve the contractor of responsibility for training workers regarding to this item.
5. Column "WORKSAFEBC Ref." May also contain Canadian Occupational Safety & Health (COSH) regulation references.

#### Brief description of work to be done:

Refurbish Main Penstock Gate, refurbish the secondary Penstock Gates and hydraulic cylinders, and install a new safety gate at the auxiliary tunnel.

Anticipated Construction Dates: Jan-Mar 2015

Contractor will remove components from the tunnels and refurbish off site, re-install after refurbishment and commission systems for safe operation. New safety gate will be installed into auxiliary tunnel and commissioned for safe operation. Existing auxiliary tunnel access manhole to be demolished.

#### Significant Risks include but are not limited to:

- Hazards associated with entry to confined space. Ensure confined space program, procedures training and supervision are in place before starting. Welding fumes may be a factor contributing to ventilation requirements.
- Hazards associated with welding including possibility of burns, arc flash, breathing welding fumes and high noise levels.
- Risk of falling 30 feet when entering access to main/auxiliary tunnel
- Risk of accidental tunnel flooding or of electrocution if lockout procedures are not followed. Lockout of hydraulic and electrical systems that control the gates, hydraulic systems and pumps req'd
- Risk of workers being struck by or crushed by gate or cylinder components or tools being removed or lowered into place in the tunnels. Ensure safe lifting plans are defined and workers trained.
- Risk of individuals being struck by components being moved as part of the project or by yard traffic. Ensure traffic control plan is implemented.
- Risk of exposure to lead based paints in the Main Penstock Building NS 34 and Penstock Rooms NS 7 but work does not entail removal of paint.





# Preliminary JOB HAZARD ANALYSIS CHECK LIST

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Project Title: Penstock Gate and Cylinder Refurbishment Install Auxiliary Safety Gate

Cond No.	Condition	Existing ✓	CODE	WORKS AFEBC Ref. #	Hazard/ Action Required
1.1	<p>Notice of Project (NOP) given to WORKSAFEBC? Check regulations for conditions requiring notice:</p> <ul style="list-style-type: none"> <li>- Over \$100,000.</li> <li>- All or part of works are required to be designed by P.Eng.</li> <li>- Asbestos removal</li> <li>- Disturb Lead coatings</li> <li>- Significant Risk of Occupational Disease</li> <li>- New construction, major alteration, structural repair or demolition of : <ul style="list-style-type: none"> <li>- Bldg over 2 stories (or 20ft.)</li> <li>- Bridge</li> <li>- Earth/water retaining structure over 10'</li> <li>- Silo/chimney over 20'</li> </ul> </li> <li>- Work in compressed air environment</li> <li>- Work in a caisson</li> <li>- Work in a tunnel (see 22.2)</li> <li>- Work on underground working (22.6)</li> <li>- Trenches 4' deep and 100' long or other type of excavation over 4' a worker must enter.</li> <li>- Diving Operations check 24.9</li> <li>- Aircraft involved? check 29.8</li> </ul>	✓	S	20.2 24.9 22.6 29.8	<p>Contractor to provide NOP to WORKSAFEBC and provide copy to Department Representative before pre-startup safety orientation meeting.</p> <p>Note that WORKSAFEBC NOP Form 52E49 is used for general construction work and when asbestos or lead is involved.</p> <p>Use WORKSAFEBC Form 52E48 for NOP when diving, underground workings or aircraft are involved.</p> <p>NOP should go to WORKSAFEBC 4-5 days before starting work if possible and MUST be submitted no less than 24 hrs before commencing work.</p> <p>The white copy is for the site and the canary and pink copies go to the WORKSAFEBC.</p> <p>Photocopies should be posted on the safety notice board, placed on the project file, contract file and sent to the Regional Safety Coordinator.</p> <p>Note also the requirement to provide written notice to WORKSAFEBC before commencing (under Part 19) if workers, equipment, machinery or materials could come in contact with energized high voltage conductors or other exposed electrical equipment.</p> <p>Note application to underground workings in WORKSAFEBC section 22.2</p>
1.2	<p>Multiple Contractor Coordination.</p> <ul style="list-style-type: none"> <li>- 2 or more employers?</li> <li>- Overlapping work areas</li> <li>- Appoint qualified safety coordinator</li> <li>- Post construction procedures and JHA</li> </ul>	✓	S	Review WORK SAFEBC 20.3	<p>Contractor to appoint Worker Safety Representative and Construction Superintendent. Coordination with EGD personnel and others on site will be through Department Representative. Post Final JHA and procedures.</p>
1.3	Building and other permits obtained?	✓	S		Building permit required for new construction.
1.4	Notice of Project Posted?	✓	S		Contractor will post on safety notice board.

GENERAL



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1.5	Post emergency response plan and site plan? Workers trained in emergency response? Conduct risk assessment for: Work at high-angles Special needs individuals Others as required by 4.13 or identified in other sections below	✓	*	4.13-4.18 20.3	Site plan and emergency response to be posted on safety notice board. Contractor to ensure all workers trained in emergency response for fire, earthquake, medical, bomb threats, power outage and hazardous materials accidents before starting work. Ensure response plan is coordinated with EGD site emergency response plan. Note the special rescue requirements for high-angle work and the need for written agreements to provide service.
1.6	Regular Safety Meeting Minutes Posted?	✓	*	3.2	Weekly safety meeting to be held. Contractor to provide minutes to Department Representative for posting.
1.7	WORKSAFEBC Orders, Inspections or "Notice to Workers" Posted? Notification of compliance posted?	✓	S	Div. 10 183	Contractor to provide any WORKSAFEBC inspections and/or orders to Department Representative and post any inspections and compliance reports.
1.8	Regular Inspections carried out with Safety Rep and Posted? Conduct special inspection if required due to malfunction or accident.	✓	S	3.5 3.7 3.8	Provide inspection reports to P.M. and post.
1.9	Contractor's workers safety representative identified for each employer? Alternatively, a Joint Committee set up if required by WORKSAFEBC Div. 4?	✓	S	20.3 Div4 125-140	Worker Safety representative if 9 or more workers.
1.10	Insufficient lighting?	✓	S	4.65	Contractor to ensure lighting levels are sufficient for work to be performed. Provide portable lighting where necessary.
1.11	Workers informed of the hazards of the job and that they have the right to refuse work they consider too hazardous without discriminatory action?	✓	*	Review 3.12	To be covered in orientation session and reinforced by Contractor
1.12	Workers with physical or mental impairment that could affect work must inform their supervisor.	✓	*	4.19	To be covered in orientation session and reinforced by Contractor. Do not work at heights if subject to dizziness or if worker has a fear of heights
1.13	Workers informed no alcohol, drugs or other substance so as to endanger self or others?	✓	*	4.20	To be covered in orientation session and reinforced by Contractor. Inform First Aid attendant of any medications being taken as they may be important in case of accident.
1.14	Firearms of any kind are prohibited on site.	✓	*		To be covered in orientation session and reinforced by Contractor
1.15	Duties of Employers, Workers, Supervisors and Owners	✓	*	Div.3 115-119	Review duties/responsibilities of parties involved. To be covered in orientation session.



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1.16	General Duty: In the absence of a specific requirement, all work must be carried out without undo risk of injury or disease to anyone.	✓	*	2.2	To be covered in orientation session and reinforced by Contractor
1.17	Do not remove or render inoperative any safeguard and ensure safeguards are in place before operating equipment.	✓	*	4.11 4.12	To be covered in orientation session and reinforced by Contractor
1.17a	All workers must be given adequate instruction in the fire prevention and emergency evacuation procedures applicable to their workplace	✓	O	4.16	To be covered in orientation session and reinforced by Contractor
1.18	Do not operate any EGD equipment. Only those trained and authorized by the contractor are to operate contractor's equipment.	✓	*	4.10	
1.19	Ensure equipment inspection & maintenance record (s) are readily available to equipment operators or inspectors.	✓	*	4.9	To be covered in orientation session and reinforced by Contractor
1.20	Workers must not engage in improper activity that could constitute a hazard to themselves or others including horseplay threats or physical force. Improper activity must be investigated. Contractor has written policy regarding violence in the workplace?	✓	*	4.24-4.31 COSH 20.3 20.8	To be covered in orientation session and reinforced by Contractor. Violence or harassment will not be tolerated. Contractor carry out risk assessment of injury from violence if there is potential for violence. Inform workers and prepare plans to minimize risk as required by 4.30 Post policy re violence in the workplace and procedures to call for help if subjected to violence.
1.21	Workers to restrict activity to designated areas of the site.	✓	*		Restrictions to be discussed at pre-start-up safety orientation meeting.
1.22	Workers informed of location of copy of WORKSAFEBC Regulations and Worker's Compensation Act.	✓	*		Cover at orientation meeting. Contractor to ensure current copy of Regulations and the Act is available on site.
1.23	Written work procedures developed? Provided to P.M. and workers?	✓	S & O		Contractor to document work procedures and sequence of activities and provide to Department Representative and workers before starting work.
1.24	Do not work on site outside of agreed working hours.	✓	*		EGD must ensure an employee is on site anytime contractors are on site. Therefore notice is required.
1.25	If work damages a utility it must be reported.	✓	O	4.18	Immediately inform the Utility and then the Department Representative



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Project Title: Penstock Gate and Cylinder Refurbishment Install Auxiliary Safety Gate

1.26	Wildlife, rodents may be encountered on the site.	✓	O	Be aware of potential for encounters with wildlife on the site. Rodents may leave droppings in crawl spaces that could present a hazard if dust is breathed. Also, raccoons may be aggressive if cornered and deer may protect their young.
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FIRST AID & INVESTIGATIONS				
2.1	Has the Contractor carried out an assessment and identified the numbers of workers who may require first aid at any time; the types of injuries that might occur; barriers to first aid being provided to an injured worker; and time required to transport an injured worker to medical attention?	✓	*	3.16 & 3.17 Contractor to provide written first aid assessment and written procedures for providing first aid to comply with first aid amendments effective 1 Feb/08
2.2	Workers instructed to report ALL injuries or near misses, hazardous conditions?	✓	*	3.10 To be covered at the pre-startup safety orientation meeting.
2.3	Workers know where first aid is located and how to call for first aid? Communication between first aid attendant and ambulance service defined?	✓	*	3.17 & 3.18 Contractor MUST have own First Aid. Before starting work. Identify location & adequacy of Contractor's F.A. equipment. Cover procedures in orientation.
2.4	First Aid qualified person(s) on contractor's crew? ORIGINAL Certificate(s) must be with person(s) on site. Provide photocopy to Department Representative.	✓	S	Part 3 Required. Provide certificate(s) to Department Representative before orientation session.
2.5	First Aid equipment on site where required? Must comply with "High" Hazard class 20 min or less travel to hospital.	✓	S	3.16 Provide location and type.
2.6	Provide immediate investigation & notice to WORKSAFEBC for: - serious injury/death - major structural failure of bldg., bridge, tower, crane, hoist, excavation, temp. construction support system. - major release of a hazardous substance - incident required to be reported.	✓	S	Div. 10 172 To be covered in project startup meeting with Contractor. Do not disturb the accident site except to attend injured persons, prevent further injuries or protect property. Assist investigators every way possible.
2.7	Provide emergency transport to hospital as required by WORKSAFEBC and written procedures for transport	✓	S	3.17 Contractor to define procedures for provision of first aid, calling ambulance service etc. as required by regulation. Post them and ensure workers are informed.



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2.8	Is the first aid attendant available to render prompt service?	✓	S	3.18	Do not assign activities that will interfere with the attendant's ability to receive and respond to call for first aid. Ensure coverage during lunch and other breaks. Provide backup first aid immediately for planned absences. About ½ shift absence is permissible for unplanned absence until replacement attendant is in place.
2.9	Has the general contractor included all subs in determining the numbers or workers and first aid requirements	✓	S	3.20	General Contractor's first aid assessment and procedures to include sub-contractors.
2.91	Has the contractor assigned a person to manage first aid service?	✓	S	3.17	Assign someone to ensure attendants, supplies, facilities and equipment are always available.
2.92	Does the Contractor have New or Young Workers as defined by WorkSafeBC regulations?	✓	S	3.22-3.25	Ensure New or Young workers receive special orientation and training as required by regulations and documentation is provided to the Department Representative. Ensure follow up observation and provide reinforcement training if required or requested by the worker.
2.91	Has the contractor assigned a person to manage first aid service?	✓	S	3.17	Assign someone to ensure attendants, supplies, facilities and equipment are always available.

CHEMICAL/ BIOLOGICAL - WHMIS					Contractor to provide Material Safety Data (MSD) Sheets for all hazardous substances to be used including welding materials and gases. Sheets must be provided by the contractor at first meeting with the engineer in order to complete the Job Hazard Analysis and define safe work practices. Ensure effective written procedures are prepared and implemented to prevent exposure by any route that could cause an adverse health effect, and to address emergency and cleanup procedures in the event of a spill or release of the substance. Ensure the supervisor and the workers are trained in and follow the established procedures.
3.1a	Hazardous Substances Used? Provide details.	TBD	O	PART 5	Environmental Assessment to be provided to Contractor.
3.1b	Environmental Assessment completed? Check identified hazards and measures to be taken.	TBD	S		Contractor to follow Best Management Practices provided by Environmental Services.
3.1c	EGD Environmental Best Management Practices applicable?	TBD	O		Contractor to follow Implementation plan checklist for hazardous substances. See WORKSAFEBC section 5.7
3.2	Implementation Plan Checklist completed?	TBD	S	5.7	



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3.3	Material Safety Data Sheets Available?	TBD	O	5.16	Contractor to provide MSD Sheets and make available at worksite to all workers.
3.5	Emergency Response Defined?	TBD	O		Contractor to define emergency response as appropriate for hazardous substances.
3.6	Training Checklist Completed?	TBD	S	5.7	Contractor to follow education & training checklist for hazardous substances provided by WORKSAFEBC. See 5.7
3.7	Flammable/Combustible Substances?	TBD	O	5.27-5.35	
3.8	Substances under pressure?	TBD		5.36-5.47	
3.9	Controlling Worker Exposure	TBD	O	5.48-5.59	If the work period is more than 8 hours in a 24 hour day, the 8-hour TWA limit must be reduced by multiplying the TWA limit by the appropriate factor in reg. 5.5
3.10	Ventilation controls?	TBD	O	5.60-5.71	
3.11	Internal Combustion Engines operated in poorly ventilated areas?	TBD		5.72-5.75	
3.12	Hazardous Wastes & Emissions	TBD	O	5.76-5.81	
3.13	Personal Hygiene	✓	O	5.82-5.84	Wash hands before eating or smoking or at breaks as required by regulation.
3.14	Emergency Washing Facilities, eyewash required?	TBD	O	5.85-5.96	Contractor to provide emergency washing facilities where required due to hazardous substances.
3.15	Emergency Procedures defined? Review First Aid, Fire, Spill Control.	TBD	O	5.97-5.102	Contractor to review emergency procedures with workers
3.16	First Aid and Fire depts. aware of substance and quantities used and locations stored?	TBD	S	4.17	Contractor provide notice if required by regulations.
3.17	Supervisor & Workers trained? General WHMIS instruction as well as substance specific training?	TBD	S		Contractor to ensure Workers and Supervisors have WHMIS training and training in dealing with specific substances.
3.18	Substance specific requirements?	TBD	S	PART 6	Review Part 6 and ensure compliance as per MSD sheets. See also sections 25, 28 and 29 below.
3.19	Evaluate worker understanding of substance specific requirements and emergency/spill procedures during inspections.	TBD	S		Inspection item.
3.20	Ensure containers for hazardous substances are maintained to ensure secure containment. Keep covered when not in use.	TBD	S	5.20-5.22	Inspection item.





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3.21	Keep only enough for one shift, store balance of quantity in designated separate area. Ensure workplace/supplier labels are on EVERY container.	TBD	S	5.23	To reduce the risk of a major spill, fire etc. minimize quantities on site. Ensure workers can easily tell what is in every container. Inspection item.
3.22	Store incompatible substances so that they can not mix in event of leakage, breakage etc.	TBD	S	5.24	Serious consequences can result from mixing certain substances. Ensure they cannot mix. Inspection item.
3.23	Store hazardous substances so they can't fall, be damaged or exposed to extreme temperatures.	TBD	S	5.25	Inspection item.
3.24	Ensure the designated storage area meets design requirements.	TBD	S	5.26	Inspection item.
3.25	Protective and spill equipment available?	TBD	O		Contractor to ensure all personal protective equipment and spill response equipment is readily available and workers are trained in spill response plan.
3.26	Follow proper procedures in disposing of hazardous substances.	TBD	S		Follow MSD Sheet instructions.
3.27	Ensure compressed air, gas or steam is not used to clean surfaces of structures, machinery or materials	TBD	S	COSH 10.21	
3.28	Other	TBD			
	Note: Refer to WHMIS Implementation Plan checklist when doing inspections for hazardous substances	TBD	S		Create inspection checklist where required.

WORKING ALONE	4.1	Working alone process defined for workers assigned to work alone? Note new guidelines Nov./08 for determining if working alone regs apply. Amongst other things a "person check" system alone is unlikely to meet the "readily available" test.	No working alone	*	4.21-4.23	There will generally be no working alone. Document special procedures and agree with Department Representative if working alone is necessary. Note regulation changes 1 Feb/08
	4.2	Working alone process followed?	✓		4.21-4.23	Inspection item.
	4.3	Restricted Access area?	✓	O		Contractor to ensure workers follow procedures for restricted access and access to confined spaces.



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CONFINED SPACE					
5.0	Confined Space Entry Control required?	✓	S		Considerable danger may exist if personnel enter designated confined spaces without proper ventilation and other controls/procedures being in place. Confined Space access is required.
5.1	Confined Space Entry Controlled and/or hazard identified?	✓	S	9.3, 9.12	Department Representative to identify confined space and inform Contractor.
5.2	Hazard Assessment Completed by Qualified Person?	✓	S	9.9-9.11	Ensure space has been assessed by a Qualified Person. All known spaces have been assessed at EGD.
5.3	Entry permits completed, signed and posted per regulations? Keep permit for 1 year.	✓	S	9.13- 9.16	Inspection item.
5.4	Confined Space Entry Program Defined including details as per reg. 9.5(c)?	✓	S	9.5	Follow WORKSAFEBC regulations. Contractor will use own policy and forms. EGD CSE policy and forms to be used for EGD workers. Ensure emergency/rescue plans are coordinated and compatible. Contractor must provide own standby and rescuer service.
5.5	Person assigned to administer confined space program?	✓	S	9.6	EGD confined space program is administered by EGD Best Management Practices.
5.6	Confined Space Entry Program including pre-entry atmospheric testing and periodic testing by qualified person followed? Continuous atmospheric monitoring where practicable.	✓	S	9.25	Contractor must identify person/position responsible for contractor's confined space program. EGD workers will Follow the PWGSC Standard on Entry into Confined Spaces and EGD Site Specific Confined Space Policy and Program. Contractor will follow own program. Inspection item.
5.7	Workers & Supervisors Qualified & Trained?	✓	O	9.7 9.8	Contractor to ensure supervisor is qualified and trained to supervise confined space entry. Ensure each person having duties or responsibilities is adequately trained in the hazards and proper procedures for entry, monitoring air quality and rescue.
5.8 b	Ventilation adequate?	✓	S	9.30 9.33	Check ventilation considering work to be done and airborne contaminants etc. Each job must be separately assessed. Qualified person to define ventilation design details and monitoring requirements.
5.9	Lockouts Performed when required including blanks/blinds where required?	✓	O	9.17-9.20	Lockout will be required as part of the confined space entry procedure. Follow EGD lockout policy.
5.10	Rescue Equipment condition checked.	✓	S		Check equipment maintenance log.
5.11	Standby worker requirements being followed?	✓	O	9.34-9.36	Inspection item.



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5.12	Rescuer's trained and drills conducted?	✓	O	9.37-9.38	If the rescue persons are employees of another firm, or an agency such as a fire department, there must be a written agreement detailing the services that are to be provided. Standby Rescuers to have performed drills in this area, otherwise conduct drill before starting work.
5.13a	Notify Rescue personnel before workers enter and again when workers complete work unless agreement is for 24 hour service. Ensure rescuers monitor the signalling system.	✓	S	9.39 9.40	Follow agreed protocol with rescuers. Generally must have rescuers on standby at entrance with Fire Dept. considered backup.
5.13b	Ensure Confined Space Rescue or evacuation procedures are documented and directed by a supervisor who is adequately trained in such procedures or by a qualified rescue person.	✓	S	9.41	No rescue worker entry unless another trained rescuer is on standby outside the space. Maintain continuous communication between rescuers and person directing rescue.
5.13c	Workers must wear a harness of a type which will keep the worker in a position to permit rescue and attach a lifeline tended at all times. Standby person must be equipped with suitable lifting equipment if necessary to permit rescue.	✓	S	9.42-9.45	If rescue cannot be effected by the standby person(s) using harnesses, lifelines and lifting equipment, then one or more additional workers must be stationed at the entrance to the confined space and these workers must be equipped and capable of entering the space and effecting rescue.
5.14	No cylinders of compressed gas inside confined space.	✓	S	9.48	Inspection item.
5.15	Welding/Cutting torches and hoses must be removed when not in use.	✓	S	9.49	Inspection item.
5.16	Ensure electrical tools & equipment meets WORKSAFEBC 9.50	✓	S	9.50	Inspection item.
5.17	Use only non-sparking tools if flammable/explosive gases, vapors or liquids are present.	✓	S	9.51	Inspection item.
5.18	Provide means of communication – radio for workers inside confined space.	✓	O		Inspection item.
5.19	Ensure rescue equipment is inspected by Qualified Person before each use.	✓	S		Contractor to ensure inspection and document.
	Note: Follow Confined Space Entry program details as inspection guideline. These must be agreed with Rescuer personnel.	✓	O		

6.1	Has the EGD Lockout policy been reviewed and relevant sections complied with?	✓	S		Policy to be reviewed by Contractor with workers as part of training.
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6.2	Each worker has own lock, no combination locks? Means of identifying lock owner?	✓	O	PART 10	Every worker must have own lock and tag identifying worker and company.
6.3	Lockout procedures documented for project?	✓	O	PART 10	To be documented and agreed with EGD Electrical Department and permit issued before initiating lockout.
6.4	Workers and Supervisors trained in lockout? Only certified electricians to do electrical work.	✓	O	PART 10	Contractor to ensure all Workers and Supervisors are trained in the lockout procedure. Contractor to provide proof of certification to Department Representative before start of work.
6.5	All isolation points identified?	✓	S	PART 10	To be done in conjunction with EGD Electrical Department and documented in lockout procedure.
6.6	Electrical ground hazard?	✓	S		To be done in conjunction with EGD Electrical Department and documented in lockout procedure.
6.7	Pneumatic Devices hazard?	✓	S		Document if this type of hazard exists and controls required.
6.8	Potential Energy hazards? All parts secured against inadvertent movement?	✓	S		Document if this type of hazard exists and controls required.
6.9	Kinetic Energy hazards? All parts secured against inadvertent movement?	✓	S		Document if this type of hazard exists and controls required.
6.10	Hydraulic Energy hazards?	✓	S		Document if this type of hazard exists and controls required.
6.11	Chemical Energy hazards (eg. Flammable, Combustible, corrosive) ?	✓	S		Document if this type of hazard exists and controls required.
6.12	Radiation hazards (eg microwave, lasers, Ultraviolet, infrared)				No Radiation hazards anticipated on this project
6.13	Thermal Energy hazards (eg, steam, hot water or other substances, refrigeration lines)				No Thermal Energy hazards anticipated on this project
6.14	If over 750V follow H.V. guidelines in lockout policy.	NA			No H.V. work anticipated on this project
6.15	No working NEAR energized H.V. equipment or conductors.	Not permitted	S	Lockout Policy	Not permitted.
6.16	No working on energized lighting circuits.	Not permitted	S	Lockout Policy	Not permitted.
6.17	Control the use of metal ladders, wire reinforced ladders,, metal scaffolds or work platforms.	✓	S	19.10	Planned use of ladders, scaffolds etc. to be determined with Contractor and electrical risks assessed.
6.18	No Qualified workers within 1 m. of uninsulated, energized parts.	Not permitted	S	Lockout Policy	Not permitted. Keep unqualified personnel at least 3 m. from energized parts.
6.19	If using an insulated aerial device has it been tested as required by WORKSAFEBC Reg. 19.9	✓	S	19.9	Check plans to use aerial device & insure compliance.



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6.20	Is all portable electrical equipment either double insulated and so marked or effectively grounded? Workers trained to inspect?	✓	S	19.14	Contractor to check any portable equipment and ensure workers trained in inspecting electrical equipment for safe operation.
6.21	Is all portable electrical equipment used outdoors or in wet/damp conditions protected by Class A Type ground fault circuit interrupters?	✓	S	19.15	Contractor to check any portable equipment and ensure workers trained in inspecting electrical equipment for safe operation.
6.22	Ensure good access to electrical equipment and that no flammable materials are stored or placed close to electrical equipment.	✓	O	19.7	Practice good housekeeping. Keep areas clear in front of electrical panels, fire alarms & extinguishers. No flammables inside work areas unless agree by Department Representative.
6.23	Other, specify:				
6.24	Are lockout points easily identifiable (e.g. By number) to prevent lockout errors and identify the equipment it serves?	✓	S	19.13	All lockout points are labelled.
6.25	Note that lockout of a panel door preventing access to other live breakers is unacceptable.	✓	S		Generally there should be no other users of panels while the project work is underway. Confirm.
6.26	Note lockout of Control Circuits is not sufficient for total isolation.	✓	S		Reminder item
6.27	Be SURE to understand what will happen if an energy source is activated.	✓	S		Reminder item
6.28	Consider severity of injury, frequency of doing the job and probability of injury in assessing tasks.	✓	S		Reminder item
6.29	Before the conclusion of the job and after energizing, have conspicuous signs been placed near the equipment stating "Danger - Energized Equipment"?	✓	O	19.11 19.17	Place signs when finished.
6.30	Ensure electrical instrumentation is functioning properly and has not been the subject of recall by the manufacturer.	✓	S		Note that some Fluke Model 179 Multimeters have exhibited faulty readings and need to be replaced.



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FALL PROTECTION					
7.0	Fall Protection required?	✓	S	11.2	1. Work over 7.5 ft. (CLC requirement) or shorter distance if risk of injury greater than fall to flat surface 2. Use guardrails or similar restraint if practicable. 3. Use other fall restraint if 2 not practicable. 4. If 3 not practicable use fall arrest system 5. If 4 not practicable ensure work procedures acceptable to WORKSAFEBC are used. Note changes to WORKSAFEBC regulations 1 Jan/05
7.1	Fall Protection System defined in writing?	✓	S&O	11.3	Contractor to define fall protection plan for any work over 7.5 ft. (CLC requirement) above ground on unguarded surfaces from which fall greater than 7.5m. (25ft) can occur or 11.2(5) applies.
7.2	Workers & Supervisors Trained?	✓	S&O	11.2(6)	Contractor to ensure all workers & supervisors trained in fall protection procedures before work starting and provide documentation to Department Representative.
7.3	Workers trained & Fall Protection Procedures followed?	✓	S	11.2(6)	Inspection item.
7.4	Inspection of fall arresting equipment before each use by a qualified person being done?	✓	S	11.9-	Qualified Person to perform inspection before use on each shift. Keep free from foreign substances & conditions that can contribute to deterioration & keep in good working order.
7.5	Fall Protection System used?	✓	S	11.2(7)	Ensure workers use system
7.6	Safety Belts used for fall restraint only? Otherwise use body harness.	✓	S	11.4	Follow written fall protection plan.
7.7	Ensure equipment meets standards	✓	S	11.5	Ensure components are suitable and compatible, sufficient to support the forces and meet and are used in accordance with standards.
7.8	Ensure anchors meet standards	✓	S	11.6	Check anchors meet WORKSAFEBC requirements. Changed 1 Apr/13
7.9	Temporary horizontal lifeline system used?	✓		11.7	Acceptable if 1) manufactured for commercial use and installed and used per written instructions and drawings (available on site) 2) designed, installed & used per written instruction and drawings (available on site) certified by P.Eng. 3) other acceptable to WORKSAFEBC Changed 17 May/06
7.10	Need to remove from service?	✓	s	11.10	If fall protection system has arrested fall of a worker remove from service until inspected and recertified safe by manufacturer or P.Eng.



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FIRE RELATED						
8.1	Workers aware they generally do not fight fires? First priority is to raise the alarm and get selves and others to safety.	✓	*			Workers to fight fires only if small (2'x2') and they have been trained in fire extinguisher use and they are confident they can extinguish the fire. To be reinforced at orientation meeting and reinforced by Contractor.
8.2	Fire Extinguishers Available and accessible?	✓	O			Contractor to ensure proper type and number of extinguishers available. Check monthly inspection and tags.
8.3	Electrostatic Discharge	✓	O			Contractor to determine risk of ignition due to discharge and take preventive measures.
8.4	Ignition Sources eliminated or controlled if flammable gas or liquid used or stored?	✓	O	5.27		No smoking on this project except in designated areas defined by Department Representative. Define any other ignition sources and controls required.
8.5	Flammable gas concentrations	✓	S&O			Ensure adequate ventilation to comply with WORKSAFEBC regulations. Monitor flammable gas concentrations and use forced ventilation if required.
8.6	Combustible materials	✓	O			Keep area clear of combustibles. Practice good housekeeping. Store oily rags in approved metal containers with tight fitting lids and empty daily. Burning of waste is prohibited.
8.7	No smoking in buildings, on cranes, in caissons or tunnels. Define other restrictions. Rules being followed?	✓	O	4.81		Contractor to enforce no smoking except in areas designated by the Department Representative.
8.11	Do not use flammable liquids as a manual cleaning solvent.	✓	S	5.32		Flammable fumes can collect on clothes and result in the worker being engulfed in flames should ignition occur. Also, these substances are often hazardous to health and can be absorbed through the skin. Contractor to reinforce with workers and monitor for compliance.
8.12	Hot Work Permits issued and posted?	✓	*			Obtain permit from Department Representative before starting any cutting, welding, brazing, soldering, grinding, heat-treating or other hot work like roof tarring, thawing pipe, hot riveting or using powder-driven fasteners.
8.13	Fire Alarms explained?	✓	*			To be covered at pre-startup meeting and worker orientation session.



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LADDERS/SCAFFOLDS & TEMP WORK PLATFORMS					Work off ladders/scaffolds foreseen.
9.0	Is work off ladders/scaffolds etc planned? Note new guidelines Nov/08 re suitable ladders, work platforms, and scaffolding, and to specify that the top plate of interior or exterior walls, the top plate/top walers used in concrete formwork, or other elevated surfaces narrower than 50 cm (20 in) are not considered suitable work platforms or acceptable as elevated walkways.	✓	S		
9.1a	Workers trained and authorized to use temporary work platform?	✓	S	COSH 3.5	Ensure all workers trained before authorizing use.
9.1b	Weather conditions likely to be hazardous to use of temporary structure?	✓	S	COSH 3.3	No work in rain, snow, hail or electrical/wind storm likely to be hazardous to worker safety
9.2	Has Qualified Person inspected temporary structure before use each shift?	✓	S	COSH 3.6	If defect found, do not use until remedied.
9.3	Could temporary structure be contacted by person or vehicle?	✓	S	COSH 3.7	Install hi-viz barricade around base or post a person.
9.4	Ladder type and condition? Meet specifications per WORKSAFEBC?	✓	S	PART 13	Contractor to ensure all ladders are in good condition and meet WORKSAFEBC requirements for the application. Ensure portable ladders are marked with grade of material and use for which ladder constructed.
9.5	Ladder Inclination, Footing and Support and use according to WORKSAFEBC regulations	✓	S	PART 13 COSH 3.11	Check for minimum 1/4 maximum 1/3 inclination, solid footing and support. Projects at least 1m (3ft.) or 3 rungs above upper landing to which it supplies access. Check extension overlap. Tie off if possible for stability during use. No working off the top 3 rungs of a single/extension ladder or top 2 of a step ladder. Follow safe ladder work practices
9.6	Contractor to ensure work off ladders meets regulations: If work cannot be done safely from a ladder provide work platform.	✓	O	13.6	
9.7	Heavy/bulky objects or others that may make ascent or descent unsafe not to be carried up ladders	✓	O	13.6	Use an assist to raise & lower tools.
9.8	Scaffold or other work platforms to be designed and approved by a P.Eng.?	✓	S	Check WORKS AFEBC PART 13 13.11	Contractor to provide P.Eng. certified scaffolding plan where required by regulation 13.11. Follow instructions including fall protection during erection/ dismantling and use of the system. Signed copy to be available on site.





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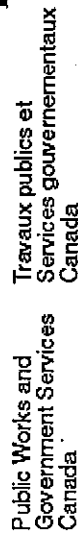
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9.9	Employer must ensure scaffold is in a safe condition regardless of who erected it. Ensure scaffold manufacturer's technical data & instructions for erection available on site.	✓	O	13.13, 13.15 COSH 3.10	Ensure manufacturer's documentation is on site or follow P.Eng. instructions. Contractor ensure compatibility if different manufacturers of components used. Ensure qualified Person supervises erection, use and dismantling and scaffold capable of holding 4 times load likely to be imposed. (COSH)
9.10	Guardrails and toe boards installed at every open edge of platform?	✓	S	4.55-4.60 COSH 3.8	Ensure guardrails and toeboards installed
9.11	Tools/equipment/materials arranged to prevent being accidentally knocked off platform?	✓	S	COSH 3.4	Ensure safe arrangement on platform
9.12	Check Scaffold Stability, Bracing, Access and all connections secure.	✓	S	13.17 13.18	Ensure scaffold is stable, plumb and level and WORKSAFEBC requirements are met. If height 3 times min. base dimension or other circumstance requiring stability- bldg ties/guys required. Inspection item.
9.13	Plank type & condition inspection. Planks secured?	✓	S	13.14 13.16	Contractor Inspect planks regularly and secure to scaffold frame. Dimensions and guardrails meet requirements?
9.14	Scaffold grounded if near high voltage or hazardous level of voltage likely to be induced in scaffold?	✓	S	13.19	Ensure grounding. Inspection item
9.15	Safe access provided to work platform?	✓	S	13.7 COSH 3.9	Provide safe access. Temporary stairs have uniform steps, slope not exceeding 1.2 in 1; hand-rail between 90 and 110cm above stair level. Ensure temporary ramps securely fastened; safe footing, braced if necessary; slope 1 in 3 except in stairwells check COSH Inspection item
9.16	Work platform strength sufficient for load and secured against separation from supporting equipment, structure or surface?	✓	S	13.8	Ensure scaffold can support 4 times load likely to be imposed on it (COSH 3.10)
9.17	Work platform subjected to sudden drop, contact with electrical conductors or showing signs of mechanical damage/wear?	✓	S	13.12	Remove from service until certified safe by manufacturer or P.Eng.
9.18	Ensure movable work platforms are clearly marked as required by reg.13.20	✓	S	13.20	Also check for marking on components (e.g. rigging capacity, counterweight, etc.) as required by regulations
9.19	For elevating work platforms ensure operation manual, maintenance instructions, replacement parts information are reasonably available to workers.	NA		13.21	If information is not available, equipment must not be used until obtained or written instructions provided by P.Eng. <b>No use of manlifts anticipated.</b>



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PROTECTIVE EQUIPMENT		✓	S	4.58	Contractor to ensure guardrails are installed and meet regulations. Inspection item.
9.24	Guardrails installed? Ensure temporary guardrails meet specs.	✓	S	4.58	Contractor to ensure guardrails are installed and meet regulations. Inspection item.
9.25	Forklift mounted work platform not to be used except as defined by WorkSafeBC regulation.	✓	S	13.30	Check revised regulations 1 Feb/13. Inform Department Representative before using a forklift mounted platform.
10.1	Hard Hats Worn at all times. Chinstraps available for high wind/bending over?	✓	*	8.11-8.13	Contractor to monitor and enforce hardhat and chinstrap usage.
10.2	High Visibility Clothes, correct type for the job.	✓	O	8.24-8.25	Wear high viz vests when required. Traffic Control Persons will have special requirements.
10.4	Safety Footwear	✓	*	8.22-8.33	Approved steel-toed footwear in good repair, required at all times meeting WORKSAFEBC requirements for the work to be performed.
10.5	Approved Safety Eyewear/ Face Shields. Note new guidelines re acceptable standards Nov/08	✓	O	8.14-8.18	Eye protection required when energizing and de-energizing breakers. Also when doing any other work where flying objects may be encountered. Also may be required when using hazardous substances (TBD).
10.6	Wear Hearing Protection when required by WORKSAFEBC regulations.	✓	O	7.1-7.9	Hearing protection required when in high noise situations exceeding WORKSAFEBC noise exposure limits. Implement and provide evidence of noise control and hearing conservation program where required by regulation. Post warning signs in high noise areas and enforce wearing approved hearing protection.
10.7	Respiratory Protection & Fit	✓	O	8.32-8.37	Wear approved respiratory protection considering the respirator protection factor and maximum use concentration, MSD Sheets, exposure to oxygen deficient atmosphere when selecting respirators for workers that may be exposed to dusts or hazardous fumes/mists above exposure limits.
10.71	Respirator fit tests conducted?	✓	O	8.38-8.41 8.44	Ensure proper fit tests per regulations and keep records. Workers must perform a positive or negative pressure user seal check in accordance with <i>CSA Standard before each use</i> .
10.72	Worker's ability to use a respirator in doubt for medical reasons?	✓	O	8.42	Ensure worker examined by a physician, and advice obtained re the ability of the worker to wear a respirator.
10.8	Gloves, Aprons, leg protection	✓	O	8.19-8.21	Wear protective clothing when performing work that could result in cuts, slivers, abrasions, etc. Check added requirements from MSD Sheets.
10.9	Flame resistant clothing	✓	O	8.31	Wear when welding or cutting or other hot work hazards
10.10	Welding Goggles	✓	O		Wear when welding or cutting



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10.11	Welding Clothes (e.g. leather aprons, face shields, leather gauntlet gloves etc.)	✓	O		Wear when welding or cutting. Also those working nearby may need to wear protective clothing.
10.12	Vibration Reduction	✓	O	7.10-7.16; 5.54	Provide written exposure control plan where required by regulation and inform worker of hazards. Employers ensure equipment is labelled to identify hazard. Ensure hands and arms not exposed to cold if also exposed to vibration.
10.13	Radiation Exposure Control for welding	✓	O	7.17-7.25	Provide written exposure control plan where required by regulation and inform worker of hazards.
10.14	Personal clothing, rings, hair etc. OK	✓	O	8.10	Ensure workers do not have loose clothing, long hair or rings which could become entangled if operating rotating power tools.
10.16	Safety belts, harnesses, lanyards & shock absorbers	✓	O		Follow fall protection plan and use prescribed equipment.
10.17	Employees must wear suitable personal clothing for the work they are doing to reduce risk of injury.	✓	S		Contractor to ensure workers wear suitable clothing.
	Note: Check all protective equipment for proper fit and condition.	✓	S		Contractor responsible for ensuring proper fit and care of all protective equipment and documentation thereof.

CRANES, HOISTS & RIGGING					
13.1	Note WorkSafeBC definitions for "critical lift" "duty cycle work", "load bearing component", "sign truck" and "tandem lift"	✓	S		Changes effective 1 Feb./08 to add clarity.
13.1a	Only EGD Operators operate EGD Cranes/hoists or other equipment.	✓	*		No plans to use any EGD equipment. Contractor to reinforce that only EGD workers are to operate EGD equipment.
13.1b	Contractor supplied crane meets specifications and has required labelling etc per WORKSAFEBC regulation?	✓	S	14.2-14.8	Ensure crane is marked with: a) Manufacturer, model, sr# b) rated capacity or load chart. c) boom angle, boom extension and load measure (where applicable) d) any modifications to the crane or components
13.1c	Crane Hoist documentation available?	✓	S	14.12	Ensure manufacturer's crane/hoist manual, including instructions for assembly/disassembly, maintenance, and safe operation are readily available on site.



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13.1d	Inspection and maintenance carried out and documented including any modifications? Operator to carry out start of shift inspection and document.	✓	S	14.13 to 14.16 14.35	(1) Each crane and hoist must be inspected and maintained at a frequency and to the extent required to ensure that every component is capable of carrying out its original design function with an adequate margin of safety. (2) A crane or hoist must not be used until any condition that could endanger workers is remedied. (3) Any repair to load bearing components of a crane or hoist must be certified by a professional engineer or the original equipment manufacturer.
13.1e	Crane properly equipped?	✓	S	14.17 to 14.33	Ensure crane/hoist meets all WORKSAFEBC requirements for stops, audible warnings, guards, controls, operator protection, etc. as per WORKSAFEBC regulations
13.2	Weight lifted determined and communicated to operator and all others involved in lift?	✓	O	14.36 14.38	Contractor to ensure that load weights are accurately determined and communicated to the crane operator and others involved. Crane operators must not lift if there is any doubt about the safety of the lift.
13.3	Ensure crane operators meet the trade qualification specified by WORKSAFEBC	✓	S	14.34	Provide proof of qualification to Department Representative before starting work.
13.4	Ensure workers stay clear of swinging loads and equipment when swinging creates a hazard	✓	O	14.40 14.41	Position equipment to ensure 2 ft. clearance or more between crane parts etc. and obstructions in any area accessible to workers.
13.5	Multiple Crane lift? Follow WORKSAFEBC regs	NA	S	14.42	No multiple crane lifts planned.
13.6	Travel with load? Follow WORKSAFEBC regs.	✓	S	14.43	Follow safe practices.
13.7	Prevent passing over workers with load	✓	O	14.44	Contractor to ensure loads do not pass over workers.
13.8	Load left suspended and unattended?	✓	O	14.45	Do not leave loads suspended & unattended.
13.9	Hook position over load to prevent side loading?	✓	O	14.46	Ensure straight lifts are used. If lifts on an angle are necessary observe working load limit (WLL) reduction.
13.10	Designated signalman? Use std signals? Use radio if possible.	✓	O	14.47 to 14.49	Ensure trained workers use standard signals when communicating with crane operator. Use dedicated 2-way radio communication on UHF at power assigned and coordinated by the WORKSAFEBC whenever possible.
13.11	High voltage in vicinity? Risk of induced charge? Review and follow WORKSAFEBC requirements.	✓	O	14.51-14.52	No lifts planned near high voltage.
13.12	Up-travel limit tested for bridge, gantry & OH traveling cranes? (crane operator daily check)	✓	O	14.55	If crane/hoist is not EGD operated equipment, Contractor to ensure operator has tested limits.



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13.13 a	Ensure mobile cranes are on surface capable of supporting the load	✓	S	14.69	Contractor to check before lift.
13.13 b	Mobile cranes or boom trucks inspected at least annually?	✓	S	14.71	Ensure mobile cranes or boom trucks are inspected at least annually. Provide proof to Department Representative.
13.14	Rigging/slinging work done by or under direct supervision of qualified workers familiar with the rigging to be used.	✓	S	15.2	Contractor to use trained riggers following accepted good practices when performing lifts and provide a list of trained individuals to the Department Representative.
13.15	Ensure rigging is identified with the manufacturer and Working Load Limit (WLL) as well as any other information required by WORKSAFEBC and meets the WORKSAFEBC requirements for the work to be performed.	✓	O	15.5 15.42 15.46 15.55 15.59	Do not use rigging without proper permanent identification. DO NOT EXCEED the designated WLL; also applies to below-the-hook lifting devices.
13.16	Use only rigging permanently marked with an adequate working load limit considering the angle of lift, termination efficiencies, numbers of legs used, conditions for the lift, temperature restrictions and good rigging practices.	✓	S	15.9	Follow good rigging practices. Ensure design factors comply with changes Jan/05.
13.17	Ensure any attachments (rings, shackles, couplings etc) are designed for use with the rigging to which they are fastened.	✓	S		Contractor to ensure compatibility in design.
13.18	Slings & attachments must conform with specifications and be visually inspected before use on each shift.	✓	S	15.30 15.31	Remove defective equipment from service immediately.
13.19	Do not subject the rigging to dynamic loading.	✓	S		Apply the load slowly & smoothly
13.20	Do not use rope/slings with evidence of wear or distortion, broken strands, kinking, bird-caging, corrosion, heat or arc damage that meets the rejection criteria specified by WORKSAFEBC.	✓	S	15.25- 15.27 15.48-49	Remove equipment from service immediately if it meets rejection criteria.
13.21	Do not use worn or damaged hooks that fail to meet WORKSAFEBC regulations.	✓	S	15.29	Remove rejected hooks from service immediately.
13.22	Protect slings from damage if passing over a sharp edge and store properly.	✓	S	15.37 15.39	
13.23	Follow WORKSAFEBC rules for slinging to prevent slipping or overstressing the sling and when lifting multiple piece lifts.	✓	S	15.40 15.41	
13.24	Hooks must have safety latches unless meeting the exemption of WORKSAFEBC 15.10(2)	✓	S	15.10	



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MOBILE EQUIPMENT & TRANSPORT OF WORKERS						
13.25	Consider effect of wind on loads	✓	S			Crane operator to use judgement and consider wind velocity in determining if lift can be safely made. Crane operator has final decision on making any lift.
14.1	Does the contractor intend to use any mobile equipment on site other than trucks for transporting workers?	TBD	S		PART 16	To be determined. Define equipment to be used and any special requirements.
14.2	Are contractor's vehicles safe for transport of worker's?	✓	S		16.3	Contractor to ensure vehicles are properly equipped and maintained.
14.3	Are workers obeying speed limits? Max speed 20kph	✓	*		PART 16	Cover at start up orientation meeting.
14.4	Are vehicles properly parked?	✓	*		PART 16	Workers will be shown the designated parking areas. Do not park in areas where crane travels, Fire Lanes, blocking fire hydrants, fire/emergency alarm pull stations or fire extinguishers.
14.6	Ensure seat belts used and roll over protection provided if required. Note guidelines Nov./08	✓	O		PART 16	Requirements depend on contractor use of this type of equipment. TBD in final JHA
14.8	Do not leave delivery vehicles unattended for extended periods.	✓	*			
14.9	Do not hitch a ride on forklifts unless proper seats exist for this purpose.	✓	*			Contractor to enforce.
14.10	Ensure volatile, flammable, or hazardous materials transported in isolated compartment accessible only from outside & properly ventilated & drained	✓	S		17.6	Contractor to ensure vehicles meet WORKSAFEBC requirements.
14.11	Ensure tools/materials/ equipment are carried in separate designated area for that purpose.	✓	S		17.5	Contractor to ensure workers cannot be injured by unsecured items in the vehicle.
14.12	Equipment properly secured if elevated? No use of hydraulic or pneumatic lifts as blocks unless collapse not possible.	✓	S		16.37	Ensure workers do not leave equipment parts unattended in an elevated condition or work under equipment unless properly secured.
14.13	Loads secured according to regulations? Loads do not interfere with lift truck operation?	✓	S		16.44-16.46	Contractor to ensure loads are properly secured.
14.14	Workers have procedures, equipment and training for tire repairs?	✓	S		16.4716.48	Contractor to ensure workers have training & equipment if they will change tires.
14.15	Motorized materials handling equipment handling flammable substances equipped with minimum 5BC dry chemical fire extinguisher?	✓	S		COSH 14.12	





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TRAFFIC CONTROL					
15.1	Is there any blocking of roadways, or aisles during the project? If so install signs, barricades etc.	✓	S&O		Define road blocking and traffic control requirements. Contractor to ensure proper traffic control if temporary road blocking is required to deliver materials etc. Contractor to ensure non-project personnel are kept out of the work area as agreed with the P.M. before starting work.
15.2	Will gantry crane travel through the work area? Coordinate with the crane supervisor.	✓	*		Workers to be instructed regarding crane travel and alarms during pre-startup meeting as they may encounter them enroute to work location. Ensure work is planned and communicated to crane supervisor before start.
15.3	Is there operations activity near the project site? Ensure coordination and minimize impact.	✓	S&O		The Engineer will ensure all supervisors and contractors on site are aware of the work and schedule.
15.7	Is there an individual assigned supervisory responsibility for traffic control?	✓	S&O		Contractor to assign an individual. Ensure all workers and supervisors are trained in safe work requirements and supervisors ensure workers follow prescribed procedures.
15.8	Are Traffic Control Persons trained?	✓	S&O		Contractor to ensure only trained individuals engage in traffic control and that they have written instructions.
15.9	Has the Contractor kept records of changes in traffic control?	✓	S&O		Contractor to maintain records to assist investigation in event of an accident.
15.10	Are there risks to workers due to vehicles/equipment operating on the construction work site?	✓	S&O		Contractor to define risks to workers on the construction site due to vehicles and measures to minimize risks of injury. Risks to employees of other companies to be acknowledged, minimized and communicated to appropriate supervisors

EVACUATION & RESCUE	16.1	Written procedures developed? See Confined Space Entry procedures including rescue.	✓	S&O	4.13	Contractor to ensure need for emergency rescue assessed and procedures for rescue documented. Call 911. Rescue from confined spaces will be by contractor supplied trained rescuers on standby at entrance. Emergency response outside the confined spaces will be by DND/Esquimalt Fire Dept. Ensure all workers understand process to call for assistance and have emergency numbers. Review emergency procedures at orientation session.
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17.0	Diving /Marine Operations?	NA	S	No diving or marine related work anticipated on this project.
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CONSTRUCTION, EXCAVATION & DEMOLITION					
18.1	Protection from falling materials	✓	S	20.9	Requirements to be determined in final JHA based on detailed construction plans.
18.2	Safe access/ egress to worksite? Ramps at least 20" wide with guardrails & cleats.	✓	S		Requirements to be determined in final JHA based on detailed construction plans.
18.4	Fall prevention / protection required? See also group 7 checklist items.	✓	O	20.9	Required for all work over 7.5ft on unguarded surfaces (CLC requirement). Fall protection plan required.
18.5	Chutes	✓	S	20.10	Requirements to be determined in final JHA based on detailed construction plans.
18.9	All construction details available on site including drawings, erection procedures, temp. bracing, falsework	✓	O	20.15	All drawings and specifications will be available on site at the project office. Contractor will also ensure his Superintendent has latest copies on site.
18.11	Plans & specs for Concrete Formwork & Falsework approved by P.Eng.?	✓	S	20.17	Requirements to be determined in final JHA based on detailed construction plans.
18.12	Qualified Supervisor for erection/use of formwork/ falsework? Workers trained in hazards & proper methods?	✓	S	20.18	Contractor to ensure Superintendent qualified to install formwork and workers are trained in the hazards and proper methods.
18.13	Erection drawings, design responsibility, continuity of engineering complies?	✓	S	20.19-20.21	PWGSC will ensure continuity of design services.
18.14	Protruding reinforcing steel removed or guarded?	✓	O	20.23	Guard or remove during construction.
18.15	Worker access restricted under formwork when steel or concrete has just been placed?	✓	O	20.23	Requirements to be determined in final JHA based on detailed construction plans.
18.16	Formwork inspected before pour?	✓	O		No pouring until Qualified Supervisor has performed final inspection and OK given.
18.17	Formwork exhibits any weakness, excess distortion, or undue settlement?	✓	O	20.23	Superintendent to monitor and take appropriate action.
18.18	No loads on uncured concrete except as per dwgs or specs.	✓	S	20.23	Superintendent to ensure drawings/specifications followed regarding loading.





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EXCAVATION /DEMOLITION	19.0	Excavation work to be carried out?		✓	O	S	Excavation on this project but less than 4 ft. deep	
	19.1	Written instructions/ drawings by P.Eng. available for excavation work?		✓	O	20.78	Keep all instructions/ drawings readily available at the site. Train workers to follow instructions.	
	19.2	All utilities accurately located & danger determined?		✓	S&O	20.79	Contractor to get details on utility location and necessary approvals before digging.	
	19.3	Utilities instructions followed regarding excavation?		✓	S	20.79	Obtain necessary approvals and instructions.	
	19.11	Are there soil contaminants expected or chance of encountering archeological materials?		✓	O		Workers to be shown sample of archeological materials and instructed to stop excavating if they encounter possible archeological materials. Also provide workers with details of soil contaminants and potential risks. Stop work and immediately report to P.M. if anything is encountered including suspected soil contaminants.	
DEMOLITION/EXCAVATION	19.12	All Workers must be aware that soils on the site may contain hydrocarbons and metals such as arsenic, zinc, copper, lead.		✓	O		All excavation and management of soils must be in compliance with the Interim Soil Management Plan for Munroe Head, Esquimalt Graving Dock and North Naden - stored fully contained, sampled, and disposed off-site if above federal industrial criteria. Department Representative to provide guidance for specific project.	
	19.13	Ensure structure and adjoining structure are properly supported during demolition to the extent and manner prescribed by a P. Engineer IF Workers could be endangered by the demolition or adjoining structures could have their stability compromised.		✓	S&O	20.111	Follow demolition/ temporary support procedures and detailed schedule as defined by an Engineer in writing. Copy of the plan must be available on site.	
	19.15	Stop all work if hazardous materials are discovered during demolition and not previously identified.		✓	O		Report to Department Representative immediately.	
	19.16	Ensure all electric, gas, water and other services are disconnected		✓	O	20.113	Contractor to ensure all services are properly disconnected before starting work.	
	19.21	Do not let debris accumulate if it will in any way endanger workers		✓	O	20.120	Follow Engineer's demolition plan.	



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HOUSEKEEPING; MATERIALS STORAGE	20.1	Refuse spills and waste materials not allowed to accumulate and create a hazard	✓	O	4.41	Cover at start up orientation meeting.
	20.2	No use of compressed air to clean clothing of any potentially hazardous dusts etc.	✓	O	4.42	Compressed air can penetrate skin, enter bloodstream and result in death. Do not use compressed air to clean work surfaces. Cover at start up orientation meeting.
	20.3	Check state of repair of floors, ramps, stairs and free of tripping and slipping hazards	✓	O	4.39	Cover at start up orientation meeting.
	20.6	Use metal containers with tight fitting lids for oily or painting rags & empty daily.	✓	O		Oily or paint soaked rags can ignite through spontaneous combustion. Store properly. Also Inspection item
	20.7	Use proper containers for refuse.	✓	O		Inspection item
	20.8	Are work areas free of protruding nails?	✓	O		Ensure nails are either removed or bent over to eliminate the hazard of stepping on them.
	20.9	Are nuts/bolts etc. stored in containers to reduce tripping hazards?	✓	O		Clean up components frequently to reduce risks.
	20.10	Returned tools to proper place after use.	✓	O		Ensure tools are properly stored.
	21.1	Equipment operator's manuals at site?	✓	S		Keep manuals on site with equipment. Includes equipment like concrete pumping trucks
	21.2	Equipment operated by qualified persons?	✓	S		Contractor to provide proof of qualification of equipment operators.
EQUIPMENT MAINTENANCE & USE	21.3	Equipment maintained according to manufacturer's instructions?	✓	S		Maintain equipment as specified by manufacturer and maintain a record of maintenance.
	21.4	Equipment inspection before use carried out?	✓	S	16.34	Operators inspect equipment before use, record results (where required by WORKSAFEBC) and report any defects to Supervisor. Do not use defective equipment until defect is remedied.
	21.5	Explosive operated tools maintained, and used properly? Operator's trained? Equipment & shots stored in restricted area?	✓	S		Provide proof of training to Department Representative for users of this equipment before starting work. Check with P.M. for Hot Work permit requirement also.
	21.6	Air operated nailing guns trigger mechanism working properly?	✓	S		Ensure safety mechanisms working properly.
	21.7	Air operated tools and hoses supported to prevent injury if dropped?	✓	S	COSH 13.6	Ensure supports are used
	22.0	Follow safe lifting practices. Use mechanical lifting assist wherever feasible or get assistance.	✓	S		Contractor to train all workers in safe lifting practices and monitor for compliance.



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22.1	Materials and things stored and placed such that workers will not be overextended or strained when manually lifting?	✓	S	COSH 14.50	
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CONCRETE PUMPING					
23.1	Placing boom certified safe within last 12 months?	✓	S	20.47	Serious injury could result due to failure of components, couplings etc. if pressures or other loads are exceeded. Contractor provide certificate copy to P.M.
23.2	Permanent equipment labels on pump, boom and mast per WORKSAFEBC requirements?	✓	S	20.27	Inspection item.
23.3	Outriggers used properly and within maximum extension and load?	✓	S	20.40	Inspection item
23.4	Ensure concrete delivery pipe meets boom manufacturer's specs and is rated at greater than maximum pressure pump can generate. Ensure pipe clamps are of proper rating and properly installed per regulations.	✓	S	20.42 20.43 20.44	Inspection item.
23.5	Ensure agitator guards meet WORKSAFEBC specifications & are properly used and maintained. Do not stand on the grill when agitator is running.	✓	S	20.37	Inspection item
23.6	Ensure discharge line couplings are guarded and attachments to placing boom restrained	✓	S	20.45 20.46	Inadvertent disconnection could cause injury from flying concrete. Inspection item
23.7	Weight of each removable section of placing boom marked?	✓	S	20.49	Inspection item.
23.8	Placement boom not to be used for hoisting loads	✓	S	20.50	Contractor to instruct workers in proper use. Inspection item.
23.9	Clean out operations are to be done off site	✓	S	20.51	Excess concrete to be properly disposed of by Contractor off site unless agreed with Department Representative.
23.10	Pumper operator must have full control and no other duties while operating or placing boom or mast.	✓	S	20.52	If cleanout on site is agreed follow WORKSAFEBC restrictions Contractor to ensure control.
23.11	If operating near H.V. lines or exposed energized conductors, comply with WORKSAFEBC PART 19	✓	S	20.53 PART 19	No operation near electrical conductors foreseen.
23.12	Operator must see hopper on concrete pump at all times or means of signalling a problem must be provided.	✓	O	20.54	Contractor to enforce.



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23.13	Wear eye protection at all times when pumping concrete. Wear gloves to protect against concrete.	✓	O		Contractor to ensure protective equipment is used.
23.14	Controls have functions identified and emergency shutoff to stop pumping?	✓	S	20.31 20.36	Inspection item.
23.15	Hydraulic valves have pressure relief and holding valves?	✓	S	20.32	Inspection item.
23.16	Ensure manufacturer's operating and maintenance manuals and regular inspection and maintenance records are readily available to operators, inspectors and maintenance personnel.	✓	S	20.28 20.29	Inspection item.
23.17	Ensure operator inspects concrete pump, placing boom and mast and test its safety and control devices before use on each shift and record the results of the inspection and tests in accordance with section 20.29	✓	S	20.30	Report and defect immediately to the supervisor or employer, who must determine the course of action. If a defect may affect the safe operation of the concrete pump, placing boom or mast, the equipment must not be used until the defect has been remedied.

25.1	Workers possibly exposed to potentially hazardous levels of asbestos? E.g. <ul style="list-style-type: none"><li>- workplace has asbestos-containing materials present or used</li><li>- operation involves abatement of asbestos-containing materials</li><li>- exposure to asbestos fibre in excess of 50% of exposure limits may occur</li></ul>	NA	O	PART 6 6.2	No exposure to asbestos is foreseen under this project. Should the Contractor encounter any questionable situation involving asbestos, lead paints or other potentially hazardous substance, immediately stop work and report to Department Representative for direction.
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27.1	Are workers qualified to perform welding/cutting work and work performed according to standard?	✓	S	12.112	Contractor to provide proof of qualification. Perform work according to CSA Standard W117.2-94 Safety in Welding, Cutting and Allied Processes or other standard acceptable to WORKSAFEBC and manufacturer's instructions for equipment being used.
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27.2	Workers must be aware of the health effects of exposure to welding smoke. The combination of base materials, coatings, shielding gases and other factors can create many different substances that can potentially have an adverse effect on almost any part of the body.	✓	S	12.124	Contractor to identify the specific hazards associated with a particular welding operation and the environmental conditions and ensure workers understand the short-term and long-term health effects of exposure to welding smoke and how to protect him or herself. Undertake appropriate engineering controls or work practices to control/remove welding fumes. Ensure respirators are the correct type and fit-tested.
27.3	Coatings must be removed from base metal before welding/cutting.	✓	S	12.115 12.129	Coatings could emit harmful contaminants during welding or cutting. Remove coatings and wear protective equipment. Do not apply paint to materials about to be welded.
27.4	Workers must be aware of the risk of burning due to contact with hot slag, metal chips, sparks and hot electrodes.	✓	S	12.125	Contractors to ensure workers protect themselves and others against the risk of burns. Wear suitable protective clothing. Ensure recently welded or flame cut work is marked 'HOT' or guarded to prevent accidental contact.
27.5	Workers must be aware of the risks associated with exposure to ultraviolet or infrared light from welding which can damage the eye and result in skin burns.	✓	S	12.122	Contractors to ensure workers understand the hazards of exposure to the welding arc and how to protect themselves. Be sure the lens shade number is adequate for the type of welding/cutting being performed. Hand-held screens are not acceptable. Use barriers of flame resistant non-reflective material to protect other people from exposure to the arc, heat, and hot spatter. Also use signs to warn of the dangers of looking at the arc.
27.6	Workers must be aware that exposure to the noise of welding can permanently damage hearing, cause stress leading to increased blood pressure.	✓	S		Contractor to ensure workers have regular hearing test and that wearing protective equipment is enforced.
27.7	Workers must be aware of the risks of electrical shock especially in wet or cramped conditions. Even a small shock can lead to a fall or other accident. Brain damage or death can result from a large shock.	✓	S		Ensure workers use dry gloves, rubber-soled shoes or an insulating layer. Ensure work piece and frame of electrically powered machines are grounded. Keep electrode holders and cables dry and in good condition. Electrodes should not be changed with bare hands, with wet gloves or if standing on grounded surfaces or wet floors.
27.8	Workers must be aware of dangers of welding on containers, pipes or structures or in any place that has held flammable or combustible materials unless thoroughly cleaned.	✓	S	12.116	Fires, explosions or release of toxic vapours can result. Containers with unknown contents should be assumed flammable or combustible. Ensure a qualified person has tested



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27.9	Beware of backfires and flashbacks when using compressed gases.	✓	S	12.120	Do not ignore these warnings. Undertake immediate corrective action. Ensure safety devices are used to prevent reverse flow and arrest flashbacks on oxyfuel systems
27.10	Ensure fire prevention and fighting capabilities before welding/cutting.	✓	S	12.121	Suitable fire extinguishing equipment must be available close to the work. Use a firewatcher if work is being done where other than a minor fore might develop. Maintain the fire watch at least ½ hour after welding or cutting work is completed to detect smouldering fires. Keep areas clear of combustibles and cover those that cannot be removed with flame-resistant materials, Cover doorways, windows and cracks. Provide and use receptacles for electrode stubs.
27.11	Welders must wear required personal protective equipment including flame resistant clothing, gauntlet gloves, etc.	✓	S	12.123	Ensure welders wear all required special PPE
27.12	Check Gas Cylinder Condition & Securing/Upright storage, & protection from sparks, flames, heat, physical damage or corrosion. Ensure pressure relief valves are present.	✓	S	5.36	Cylinders of compressed gas can explode or become projectiles if exposed to excessive heat, or if the valve stem were to break should the tank be knocked over from a vertical position. Inspection item
27.13	Ensure empty gas cylinders have regulator removed, capped & are tagged as empty.	✓	S		Identify empty tanks. Inspection item
27.14	Ensure Cylinders are identified re type of gas and valid testing.	✓	S	5.37-5.39	Cylinders must be pressure tested to ensure ability to perform safely and the test date recorded. The cylinder must be identified regarding the type of gas in the cylinder to prevent confusion and potential accidents. Inspection item Do not use cylinders or contents for other than intended purpose.
27.15	Ensure Cylinder valves are closed when not used.	✓	S		Do not rely on the welding torch or other device to control the release of gas other than when manned by an operator. Dangerous leakage could occur with gas building up inside buildings, vessels etc. with potential for explosion or other hazards. Inspection item



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LEAD	28.1	Worker exposure to lead? Lead based paints exist in the Main Penstock Building NS 34 and Penstock Rooms NS 7. The work will not directly involve lead based paints but workers need to be aware and exposure controlled. The paint is heavily flaking off from surfaces within NS 34.	✓	S	6.60 6.67	Develop and implement an exposure control plan meeting the requirements of section 5.54 if workers are or may be exposed to lead in excess of 50% of the exposure limits, or if exposure through any route of entry could result in elevated lead body-burdens. Develop and maintain a health protection program.
	28.2	Airborne exposure possible?	✓	S	6.61	Provide monitoring per regulation.
	28.3	Warning signs	✓	S	6.62	Post signs at the boundary of any work area where hazardous lead exposures could occur
	28.4	Contamination of exposed skin and/or clothing possible?	✓	S	6.63 PART 5	Follow personal hygiene requirements
	28.5	Work surfaces protected?	✓	S	6.64 6.65	Protect work surfaces from finely divided lead; prevent dispersal of finely divided lead into work area
	28.6	Workers trained?	✓	S	6.66	Provide training in hazards of lead, written work procedures, correct operation and use of any required engineering controls and personal protective equipment, personal hygiene and decontamination procedures, and purpose and significance of any health monitoring.
	28.7	Records maintained?	✓	S	6.68	Maintain records of risk assessments, worker exposures and worker training. Produce for Department Representative if requested.
ROCK DUST	29.1	Rock crushing, drilling, mucking, excavation, loading, transportation, road grading, road construction or conveying of rock or similar operations?	✓	S	6.110 6.111	Ensure that dust concentrations to which a worker may be exposed are maintained at or below the established exposure limits, by one or a combination of (a) mechanical ventilation, (b) the use of water spray, (c) other equally effective methods.
	29.2	Access restricted?	✓	S	6.112	Restrict access to area of exposure
	29.3	A rock drill, other than a manually-powered rock drill used?	✓	S	6.113	Must be equipped with a dust suppression system, that uses water jet, spray, or other equally effective means to suppress drilling dust.



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Project Title: Penstock Gate and Cylinder Refurbishment Install Auxiliary Safety Gate      Project No. R.016116.098 and R.016116.114

MUSCULO-SKELETAL INJURY	30.1	Is there a risk of musculoskeletal injury?	TBD	S	4.47	Contractor to eliminate or control risk
	30.2	Are controls required?	TBD	S	4.50-4.52	Contractor to define control measures and train workers in risks and safe work procedures, use of PPE etc.  Contractor to monitor for compliance and effectiveness.

Contractor's Superintendent: \_\_\_\_\_ Date: \_\_\_\_\_

#### Distribution:

EGD Operations Manager  
EGD Supervisors  
Engineer-of Record  
Resident Engineer/Construction Coordinator  
Project File



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Esquimalt Graving Dock  
Victoria, BC  
Penstock Gate and Cylinder Refurbishment,  
Install Auxiliary Tunnel Safety Gate  
**Project No. R.016116.098 and R.016116.114**

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**APPENDIX C**

**November 2014**

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## **APPENDIX C**

### **EGD ENVIRONMENTAL BEST MANAGEMENT PRACTICES**



# Esquimalt Graving Dock

## Environmental Best Management Practices



**Prepared By:**  
Public Works and Government Services Canada  
Environmental Services

**Date:** October 6, 2010  
**Version:** 04



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## Overview

The **Esquimalt Graving Dock (EGD)** is a federal-government-operated, multi-user ship repair and maintenance facility located in Esquimalt, British Columbia. The facility has been in operation since 1925, and provides service to local, Federal, and international vessels. The vessel repair and maintenance work at the EGD is carried out by privately owned shipyards that rent the required sections of the drydock and lease upland work space from the government, and pay a fee for services such as cranes, compressed air, water and power.

Industrial ship maintenance and repair operations have the potential to result in significant environmental issues and impacts. To help identify and manage these potential impacts, the EGD has implemented an **Environmental Management System (EMS)** certified under the internationally recognized standard **ISO 14001**. The EMS provides the framework for identifying potential impacts, and ensures adequate controls are in place to effectively manage them.

This manual contains a series of recommended **Environmental Best Management Practices (EBMPs)** to reduce potential environmental impacts of common activities and operations at the Esquimalt Graving Dock. The manual contains guidance for those operating at the EGD, and is intended to complement existing environmental legislation. It does not remove the responsibility of all contractors and companies operating at the facility to abide by all applicable regulatory requirements and industry standards. All users of the facility are expected to follow the EBMPs.



**For further information on environmental rules and standards contact the EGD Environmental Department.**





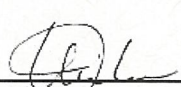
# Environmental Policy

It is the goal of the  
**Esquimalt Graving Dock,**  
in partnership with the ship  
repair industry, to be the premier  
ship repair, construction and  
maintenance facility on the  
west coast of North America.

The Esquimalt Graving Dock and  
its Users realize that environmental  
management is an integral part of  
attaining that goal. Through the  
implementation of an ISO 14001  
Environmental Management System,  
we are committed to managing the  
actual and potential environmental  
impacts of our operations.

## **To meet our commitment we will:**

- *Protect the natural environment and prevent pollution.*
- *Meet or exceed applicable federal, provincial and municipal legislation and regulations; uphold departmental policies; and abide by industry standards, practices and other requirements related to our identified environmental aspects.*
- *Establish and review our programs, objectives and targets to ensure we are meeting our environmental commitments.*
- *Communicate openly with our employees, Users, tenants, contractors, suppliers, neighbours and other stakeholders regarding our Environmental Management System and the nature of our operations.*
- *Educate our employees and the Users of our facility to ensure they are aware of and understand their roles and responsibilities in protecting the environment.*
- *Meet the evolving needs and expectations of our industry and community through the continual improvement of our systems, programs and procedures.*

		
<small>Bonnie MacKenzie Director General Engineering Assets Strategy Sector</small>	<small>Jim Milne Director Esquimalt Graving Dock Engineering Assets Strategy Sector</small>	<small>David Latyski Operations Manager Esquimalt Graving Dock Engineering Assets Strategy Sector</small>

JULY 2009



Public Works  
Gouvernement du Canada

Travaux publics et Services  
gouvernementaux Canada

ISO 14001  
EMS-011  
OQSB



Canada



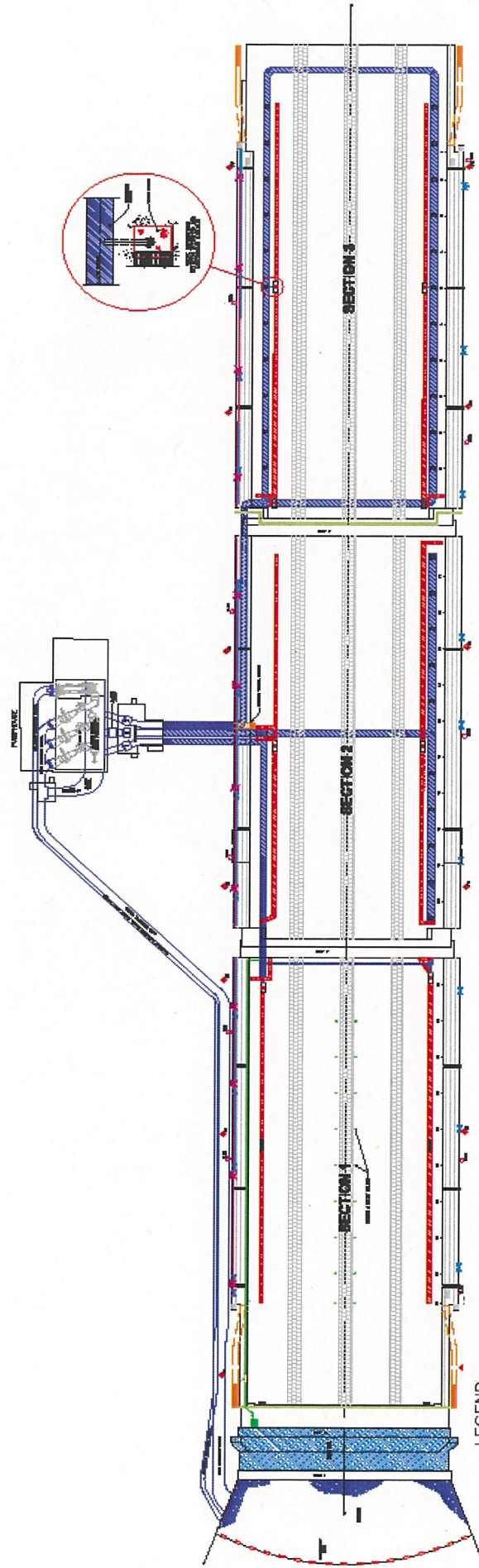
# Esquimalt Graving Dock





# ESQUIMALT GRAVING DOCK DRAINAGE PLAN

Note: It is intended that this drawing be printed in colour.  
If printed in black and white some detail will be lost.



## LEGEND

LADDER	
STAIR	
FIRE ACCESS	
ELECTRICAL CONN.	
AIR CONNECTION	
WATER CONNECTION	
WATER PIPE	
TRENCH GRATE	
TUNNEL GRATE	
TUNNEL MANHOLE	
NET CAGE	
MAIN TUNNEL ACCESS	
TRENCH DRAIN	
DE-WATERING TUNNEL	
SILL PUMP & PIPE	
MOON POOL	

**ESQUIMALT GRAVING DOCK**  
117' (361.8m) LONG  
126' (41.2m) WIDE  
48.5' (16m) DEEP

THIS DRAWING IS NOT TO SCALE



## **BMP #1**

### **High Pressure/ Ultrahigh Pressure Washing**

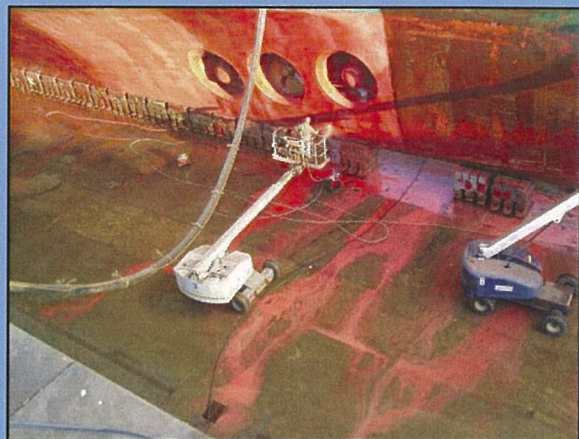
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One of the first activities to occur on a dry-docked vessel is the high pressure washing of the vessel hull to remove salts and marine growth prior to surface preparation or painting. This typically involves pressure washing the hull and/or super structure with water at 2,000 – 3,500 psi, which may produce large volumes of paint contaminated wastewater. Shipyards may use an Ultra High Pressure (UHP) washing process (from 40,000 – 55,000 psi) to completely remove all paints, eliminating the need for further surface preparation prior to painting. This operation generates even larger volumes of wastewater and solids, which will need to be managed.

#### **Management of Wastewater on the Graving Dock Floor**

- Ensure all wastes and wastewater discharges resulting from hull washing activities are collected and disposed properly.
- Coordinate high pressure washing operations to ensure effective collection of wastewater.
- Close all sump well valves in the floor collection system prior to and during high pressure washing operations.
- Divert contaminated wastewater that falls outside of the dock floor containment area away from the tunnel drains.
- Direct non-contaminated water (i.e. ballast water, cooling water) away from contaminants on the dock floor.
- Collect and dispose of stormwater that comes into contact with contaminants.
- Do not use environmentally harmful detergents or additives in wash water.

**All wastewater containing paint contaminants must be directed to the collection drains and sumps on the drydock floor, collected, and sent for treatment.**



Antifoulant contaminated wash water entering the trench drain sump wells on dock bottom.

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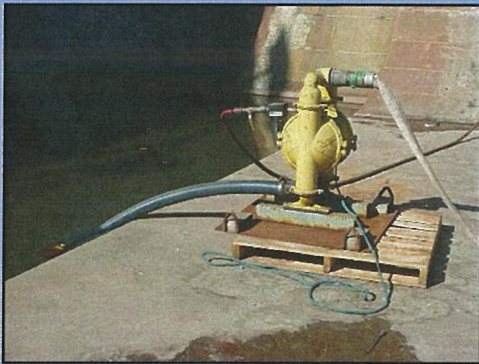
## Section 1 Considerations – Caisson Leakage and Sediment

### **Diversion of sill water away from pressure washing areas**

Water leaking into Section 1 of the graving dock from the caisson can be diverted from the work area by using a sump pump hooked to the PVC pipe installed along the north wall of the graving dock (Section 1).

### **Managing Entrained Sediment**

Harbour sediment may become trapped in section 1, and accumulate in the corners, trenches and sumps. The users of the section will need to be aware of this. This sediment will have to be removed if it becomes contaminated with pressure washing wastewater, sandblast grit, paint chips, paint overspray, or other contaminants.



The sill diversion pump removes clean saltwater from the pool at the front of Section 1 (moon pool) and discharges to the tunnel drains through a hard pipe on the dock wall.



Sediment from the harbour often settles on dock bottom after dewatering. This may become contaminated with paint, etc. and must be disposed of.

## **Ultra High Pressure (UHP) Washing**

Ultra high pressure washing generates significant volumes of wastewater and sludge that may pose a challenge for collection and disposal.

- Prepare in advance for the management of the UHP waste.
- Remove all water, sludge and debris generated from UHP washing from the dock.
- Ensure the sludge is disposed of at an appropriately permitted facility.



The hull of a cruise ship being ultra high pressure washed. Inset: sludge produced during ultra high pressure washing.

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### Management of Small Vessel High Pressure Wastewater in the Upland Areas

- Perform pressure washing only in designated areas where wastewater management can be effectively achieved.
- Completely block off all drains prior to use for collecting wastewater from pressure washing.
- Ensure sufficient equipment is available for the timely collection and removal of wash water.
- Clean up work area and drains prior to removal of collection equipment. (i.e. filter cloth, plugs, tarps)



A small vessel is power washed on the North Landing Wharf (NLW).



The trench drain is blocked and a sump pump is installed to collect wash water into a tote.



Example of styrofoam blocks used as a drain blocker on the NLW.



Example of a pump set up used to collect wash water on the NLW.

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## **BMP #2**

### **Abrasive Blasting**

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Abrasive blasting is a common operation performed at the Esquimalt Graving Dock (EGD) to prepare vessel surfaces for painting. However, this operation creates challenges with respect to controlling air emissions and the waste materials generated.

Fugitive emissions from blasting operations have the potential to negatively affect employees, facility users, neighbours, equipment and infrastructure. The dust from blasting may contain harmful environmental pollutants which may enter the harbour directly or via stormwater runoff.

Waste grit may be contaminated with antifouling paint which poses a risk to marine life if not handled properly.

#### **Dust Control**

- Cover all blast media (new and used) during transport.
- Use containment such as tarps, shrouds or portable structures to prevent airborne particles from entering the atmosphere and surface waters.
  - Containment should be large enough to adequately enclose or segregate the working area.
  - Ensure containment devices are connected so there are no gaps.
  - Ensure that containment reaches the dock floor or walls



- Where physical containment techniques are not sufficient to prevent fugitive emissions water curtains may be used to mitigate dust emissions in problem areas.
- Do not abrasive blast during conditions that render containment ineffective (i.e. during windy conditions)
- Minimize dust emissions by ensuring blast nozzles are angled close to perpendicular and aimed slightly downward during blasting.
- No abrasive blasting of vessels shall be performed while vessels are docked at the North Landing Wharf or South Jetty

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### Air Quality Alarm

The Esquimalt Graving Dock has an onsite PM<sub>10</sub> monitor in partnership with the Ministry of Environment.

If particulate matter levels in the air exceed 100µg/m<sup>3</sup> an alarm sounds in the Pumphouse, at which time corrective actions must be taken.

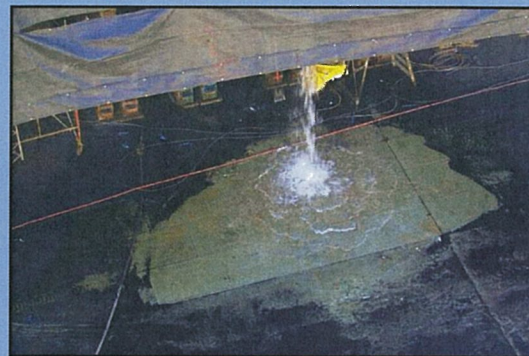


### Waste Grit Management

- Remove waste grit from work areas as soon as possible.
- Store all waste grit in appropriate containers to prevent stormwater and wind impacts.
- Cover all skips, storage bins, tanks, and hoppers to prevent dust emissions.
- Dispose of waste grit in accordance with applicable provincial regulations.



Store all waste grit away from drains, to prevent contaminated water migrating into the marine environment.



Sweep waste grit under the vessel to prevent it from being washed down the drain.



Store waste grit in appropriate containers, protected from inclement weather.



Remove waste grit from work areas as soon as possible.

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## Keel/Bilge Blocks

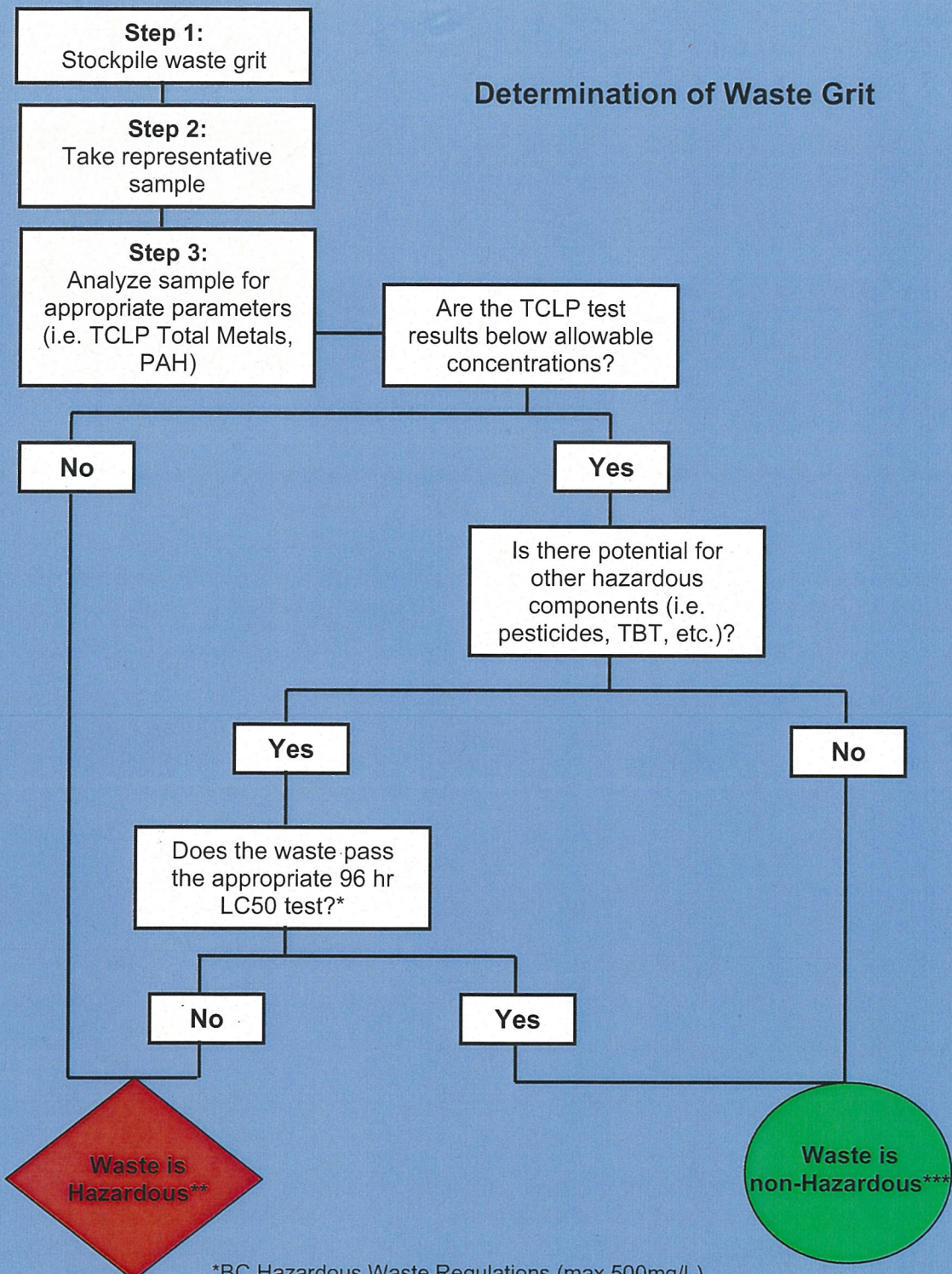
Keel and bilge blocks on dock bottom present a challenge for clean up of spent waste grit.

Excess blocks stored in dock bottom may be moved prior to sandblasting, or covered to prevent grit from collecting between the blocks.



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\*BC Hazardous Waste Regulations (max 500mg/L).

\*\*Waste must be disposed of at a permitted facility.

\*\*\*non-Hazardous waste may be considered "Controlled" and must be disposed of at an approved facility.



## BMP #3

### Painting and Coating

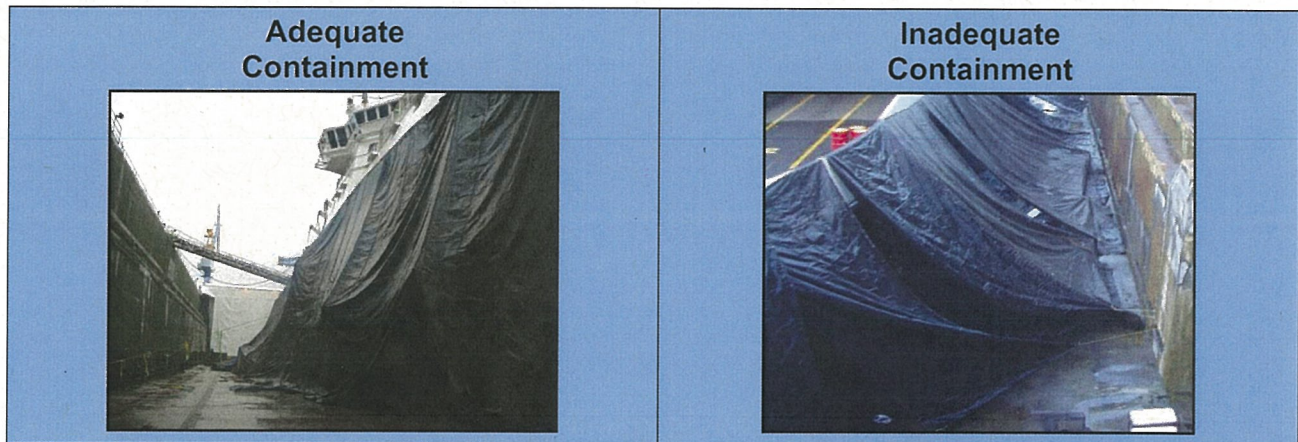
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Ship repair and maintenance often requires painting and coating of vessel surfaces to protect from corrosion or to inhibit growth of marine life. The industrial nature of marine paints, in particular antifouling paints, may result in negative impacts to the environment and surrounding infrastructure if not properly managed.

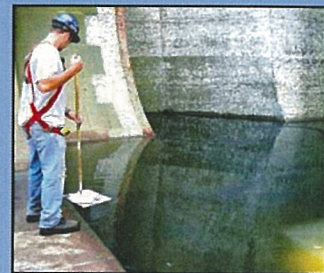
#### Paint Overspray

Paint overspray has the potential to impact the marine environment, soils, neighbouring residences, and nearby equipment and infrastructure.

- Use containment such as tarps, shrouds or portable structures to prevent airborne particles from entering the atmosphere and surface waters.
  - Containment should be large enough to adequately enclose or segregate the working area.
  - Ensure containment is secured so there are no gaps.
  - Ensure that containment reaches the dock floor or walls.



- Do not spray paint during conditions that render containment ineffective (i.e. windy).
- Place containment beneath and around structures being painted on dock floor and in work areas to ensure overspray does not reach the surrounding area (i.e. during painting of anchor chains, grates, etc.).
- Manage overspray on the graving dock floor to prevent safety hazards (e.g. slippage).



For vessels docked in **Section 1** ensure that overspray does not reach the sill water. Avoid docking vessels so they extend over sill area.

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## Painting Dockside

- Do not spray paint vessels docked at the North Landing Wharf or South Jetty.
- Use rollers and brushes to paint vessels dockside
- Ensure tarps are in place below work areas, as well as in between the vessel and the dock to prevent spills and drips from entering the water.
- Ensure paint cans are stored securely when working alongside vessel edges.
- Ensure floor grates of manlifts are covered to prevent spills to the marine environment
- Waste generated from grinding and hand tooling must be prevented from entering the marine environment.



Ensure tarps are in place to prevent overspray impacting the surrounding work area.



While painting vessels berthed at the North Landing Wharf and the South Jetty do not spray paint, and take measures to prevent paint from entering the marine environment.

## Temporary Paint Storage/Mixing Areas

- Must be under cover to protect from inclement weather
- Only in designated areas
- Must be on secondary containment (a tarp at minimum)
- Ensure empty paint cans and other associated wastes from painting are stored properly, protected from the weather, and removed from dock bottom as soon as possible.



In **rare** situations (i.e. shape of the vessel combined with ideal weather conditions) containment may not be necessary to prevent overspray from escaping the area.

In this situation, the User must notify PWGSC **prior** to beginning the work, and obtain approval, **in writing**, to paint without completely enclosing the vessel. Restrictions and monitoring requirements will be applied.

To this date this has only been allowed in three situations:

- painting underneath a flat bottom barge
- painting the underwater hull portion of the midsection of a cruise ship
- painting of a C-class ferry underwater hull area during calm wind conditions

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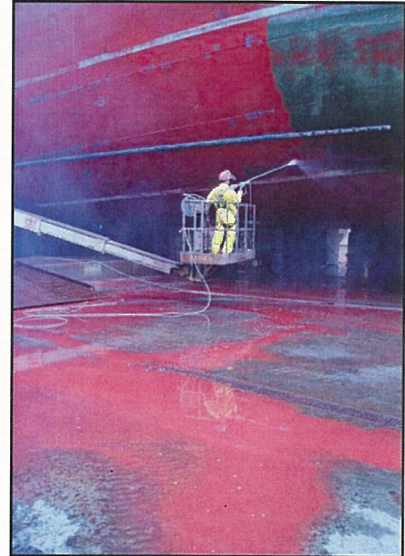


## BMP #4

### Dry Dock Floor Management and Cleanup

#### Drain Management

- All sump well valves must be closed prior to and during power washing operations.
- Cover all tunnel drains and net cages during sandblasting, painting and power washing to prevent contaminants from entering the marine environment.
- In the case of a spill or release on dock bottom all sump well valves must be closed and all contaminated material contained and removed from dock bottom.
- Direct all contaminated water to the trench drain system, to avoid entering the tunnel drains.
- Collect and properly dispose of all contaminated water. Ensure sufficient equipment is available for contaminated water collection.
- Ensure all non-contaminated water is directed away from work areas and into the tunnel drain system. (i.e. ballast water, cooling water, caisson sill water).



#### Sediment Management



- Segregate any marine sediment which may enter the dock during vessel transfer from pollutants generated from vessel repair in order to reduce the amount of wastes requiring disposal.
- Collect and properly dispose of marine sediment that becomes contaminated with waste generated from vessel repair.
- Remove all contaminants and residues from the trench drains and sump wells prior to flooding at the end of work period.

#### Hazardous Materials Management

- Store hazardous materials (i.e. fuel, paint, waste oils) away from the drains on dock bottom.
- Store hazardous materials to the inside of the trench drains so that any spills or releases can be captured.
- Store hazardous materials in areas protected from the weather, water curtains and other water sources.
- Ensure adequate spill response equipment is in close proximity to hazardous material transfer operations. At a minimum one spill kit is required per section of the graving dock.

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## Housekeeping

- Remove waste sandblast grit from the work area as soon as possible to prevent migration of grit contaminants into tunnel drain system.
- Store wastes collected from the dock floor in appropriate secondary containment and removed from dock bottom as soon as possible.



Residual paint in the cans, may drip out of the skip and enter the marine environment through the drain systems.



Leaving garbage around the work site attracts wildlife such as seagulls, racoons, and rats.



When cleaning dock bottom, skips of waste sandblast grit may leak contaminated water and should be removed as soon as possible.



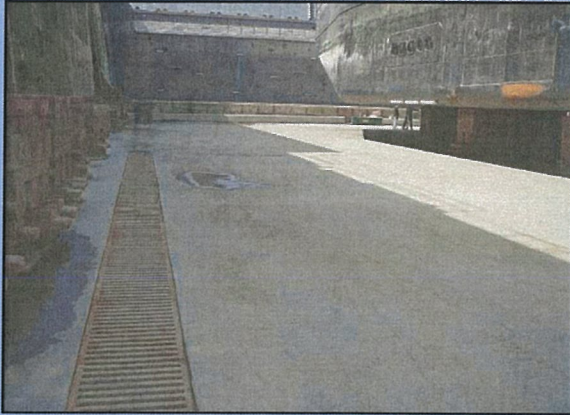
All hazardous materials must be stored in appropriate containment and away from tunnel drain system.

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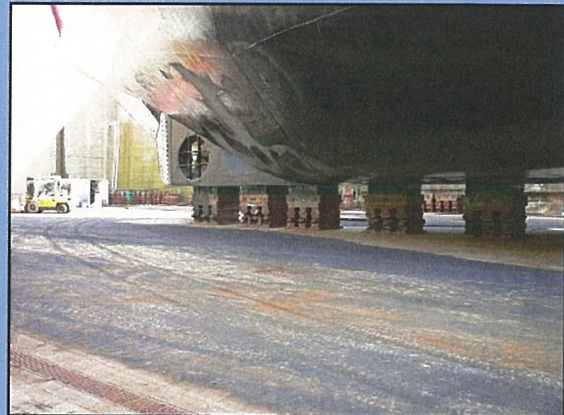


## Inspection and Cleanliness

- Prior to flooding, the drydock must be cleaned to meet the Esquimalt Graving Dock (EGD) Standard of Cleanliness, as determined by the EGD undocking supervisor.
- Users must ensure that the dock floor is free of deleterious substances prior to flooding.
- Water may be used to clean the dock floor; however, any wastewater generated must be collected and disposed of properly.
- If a vessel occupies a shared portion of a dock section each User must clean the trench drains up to and including the section sump well.



Example of a dock floor that would pass inspection.



Example of a dock floor that would not pass inspection.

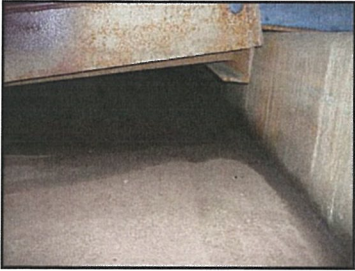
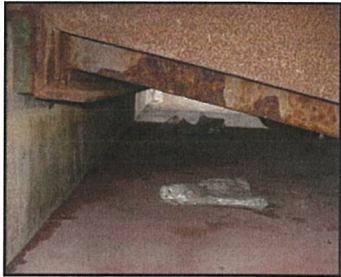






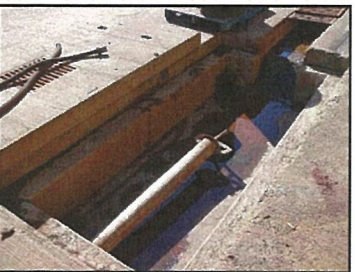

## EGD Standard of Cleanliness

Due to the importance of drydock cleanliness prior to flooding, and since quantitative testing is impractical due to time and cost restrictions, the following guidelines will be used to assess cleanliness of drydock surfaces.

- All drydock surfaces, including stairwells and sills must meet the standard for “**residue free**” prior to flooding of the drydock. “**Residue free**” is considered met when a person of normal visual acuity, while standing, is unable to detect visible accumulations of potential pollutants.
- This includes, but is not restricted to, the removal of abrasive grit, paint residues, cutting and grinding wastes, oil and grease, food and drink containers, ear plugs, dust masks, rope, cigarette packs, or any other refuse that may have been deposited during the work period.
- Debris of natural origin that may have been deposited during the previous flooding of the drydock, such as wood, sand, silt, seaweed, or marine life may be exempt from these requirements, as long as it will not contaminate the environment upon reintroduction.

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Important Locations	Acceptable	Not Acceptable
Ramps		
Sills		
Keel Blocks		
Trench Drains		
Sump Wells		

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## BMP #5

### Hazardous Materials Handling and Storage

---

A variety of materials are used, stored and transported by the Users at the Esquimalt Graving Dock (EGD). If not handled appropriately, these materials have the potential to negatively impact worker health and safety, infrastructure or the environment.

#### Long Term Storage

Users must have designated storage areas suitable for the materials they use on site. These areas must:

- Have appropriate secondary containment suitable to the quantity and nature of the material in that area
- Ensure materials are stored in accordance with compatibility requirements
- Be protected from the weather
- Have placards and ventilation (where applicable)
- Have controlled access



#### Short Term Storage and Working Areas

These areas must be:

- Clearly identified and labelled
- Located away from pathways to the marine environment
- Located on impervious surfaces (i.e. concrete, asphalt)
- Protected from the weather

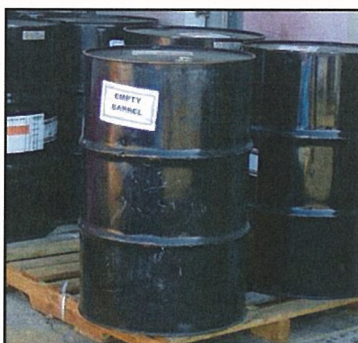


#### Materials must be:

- Stored in containers appropriate for the nature of the material
- Labelled appropriately with product name, first aid information, and PPE requirements.
- Secured appropriately during transport



MSDS for all products stored on site must be available to all employees.



Empty containers must be labelled "Empty".



Inspect all valves and storage containers for rust or damage before use.

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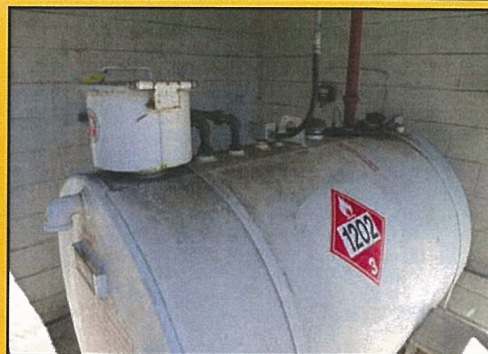


### Federal Regulation for Fuel Storage Tanks

As the EGD is a Federal facility, any storage tanks onsite may fall under the Petroleum and Allied Petroleum Products *Storage Tanks Regulations* (2008). Tenants may be required to register their tanks with Environment Canada.

### National Fire Code

This code outlines the containment, labelling and location requirements for flammable liquid storage.



### Areas to Avoid Storing Containers of Hazardous Materials

**Drains:** Although the trench drains provide the opportunity to collect accidentally released materials, if a tote or drum is placed directly over top or beside a drain the material will flow directly into it and the spill may not be noticed until it is too late.



**Fire Holes:** On the South Jetty the fire holes flow directly into the harbour. If any containers fail near the fire holes, the material will not be able to be recovered once it is in the harbour..



**South Jetty and North Landing Wharf Edges:** Any containers placed near the edge of the jetties have the potential to spill directly into the harbour as there are no berms or secondary containment available.



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## **BMP #6**

### **Waste Management and Recycling**

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Operations at the Esquimalt Graving Dock (EGD) generate a variety of waste streams including hazardous waste, international wastes, and general refuse and recyclables.

#### **Hazardous Waste**

Hazardous wastes generated at the EGD may include waste oil and oil filters, antifreeze, batteries, paint and solvents, oily rags and absorbent materials, spent grit, solids generated during power washing, and asbestos. Appropriate management of hazardous waste will reduce environmental liability associated with inappropriate disposal and storage as well as reduce the risk of human injury and environmental impact.

Hazardous waste storage shall be segregated from new product storage.

- Ensure designated storage areas are away from active work areas.
- Ensure areas are covered to reduce exposure to environment and wildlife.
- Ensure that waste accumulation areas are organized.

Hazardous waste should be segregated into separate containers.

- Ensure containers used are appropriate for the type of waste (i.e. separate drums for waste oil, oil filters, antifreeze, batteries, paint and solvents, oily rags and absorbent material, spent grit)
- Store batteries in a manner that prevents leakage of acid to the environment.
- Properly dispose of contaminated clean-up materials (i.e. absorbents, rags, etc.)
- Do not dilute or mix hazardous waste other hazardous or non-hazardous wastes.
- Cover waste containers to prevent exposure to weather (i.e. rain)

Clearly label all hazardous waste containers.

- Labels should include: type of waste, generator/company name, and contact information

#### **Asbestos**

All asbestos containers and asbestos-containing materials must be identified by signage and labelling in accordance with applicable legislation.

Companies which engage in asbestos related work at the EGD must be qualified to do so.



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### Biological Waste

Marine life removed from vessel hulls may contain paint contaminants. This waste may be considered a controlled or hazardous waste and would need to be handled and disposed of accordingly.



### Recycling

All Users of the EGD are responsible for collecting and disposing of the solid waste they generate from their activities, properties and vessels they are responsible for.

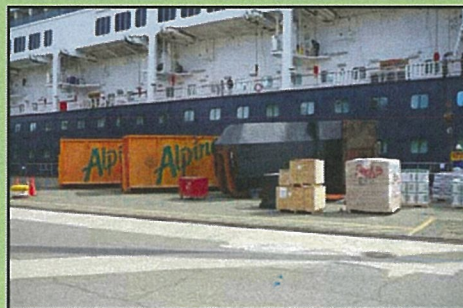
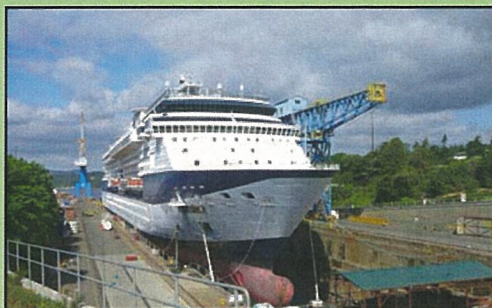
- Recycle solid waste such as plastic, glass, aluminum, mixed paper and cardboard. Recycling areas should be conveniently located and easily identifiable.
- Segregate other solid waste, such as scrap metal, wood, electronics, polystyrene foam and soft plastics for recycling at an approved facility.
- Leaf and yard waste collected on property should be composted at designated sites located on dock property.
- Construction and demolition waste should be reused or recycled wherever cost effective and technically feasible.
- Encourage the use of recyclable products to reduce the solid waste impact on the environment.

### International Waste

Like hazardous waste, International Wastes may pose a threat to human health and the environment.

**Dunnage** from vessels has been known to carry invasive insects to local areas. Foreign dunnage must be identified, stored, and disposed of at an approved facility.

**Food wastes** may carry pathogenic organisms that could cause illness to those handling it. Food wastes shall be kept in separate, closed containers. The Canadian Food Inspection Agency (CFIA) will inspect foreign vessels and issue directions on disposal.



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## **BMP #7**

### **Fuelling and Oil Transfer**

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At the Esquimalt Graving Dock (EGD) the transfer of oil and fuel is a common activity. An accidental release during these operations has the potential to negatively impact the environment, and health and safety of those at the facility.

- Prior to any fuelling or oil transfer operations an emergency plan must be in place, adequate spill response equipment must be available, and employees aware of spill response procedures must be on hand.
- All transfer and storage equipment must be in good condition, tested, and properly connected.
- Do not place storage and transfer equipment near pathways to the marine environment (i.e. storm drains, edge of the dock).
- Berthed vessel fuelling operations involving trucks and barges as well as bulk oil transfers exceeding 10 tonnes (10,000 L) per day must comply with the **EGD Fuelling and Oil Transfer Policy and Checklist**.

#### **Vessel Fuelling and Bulk Oil Transfer**

**Definition of Oil: as described in the Canada Shipping Act oil is considered petroleum in any form, including: crude oil, fuel oil, sludge, oil refuse, and refined products.**

- All berthed vessels receiving fuel from a truck or a barge require a containment boom.
- Transfers of greater than 10 tonnes of oil per day to/from a berthed vessel require a containment boom.
- An **EGD Oil Transfer Checklist** must be filled out and signed by representatives from the truck and the vessel and submitted to EGD representatives in the pumphouse prior to fuelling or oil transfer operations.
- Transfer operations must comply with the *Canada Shipping Act, Regulations for the Prevention of Pollution from Ships and for Dangerous Chemicals Subdivision 5*.

#### **Containment Boom Rental**

The Esquimalt Graving Dock has a boom and deployment equipment available for rent. To arrange for booking or rental contact the EGD Operations Manager.



An orange containment boom surrounds the vessel while being fuelled

The EGD boom reel and containment boom



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## Example Scenario Requirements

### Scenario 1: Fuelling a berthed vessel



- Completed and signed EGD Oil Transfer Checklist submitted to EGD Pumphouse
- Containment boom adequately secured at both ends.
- Emergency response plan in place.
- Adequate spill response equipment and qualified personnel available.

### Scenario 2: Fuelling a vessel or bulk oil transfer (greater than 10 tonnes a day) in the drydock



- Completed and signed EGD Oil Transfer Checklist submitted to EGD Pumphouse.
- Pumphouse operator on site prepared to shut down auxiliary pumps in case of an emergency.
- Receiving containers located away from pathways to the harbour (i.e. tunnel drains).
- Adequate spill response equipment and qualified personnel available.
- Emergency response plan in place.

### Scenario 3: Bulk oil transfer from berthed vessel (greater than 10 tonnes a day)



- Completed and signed EGD Oil Transfer Checklist submitted to EGD Pumphouse.
- Containment boom adequately secured at both ends.
- Receiving containers located away from pathways to the harbour (i.e. storm drains, edge of dock).
- Emergency response plan in place.
- Adequate spill response equipment and qualified personnel available.

### Scenario 4: Onshore oil transfer between containers



- All containers located away from pathways to the harbour (i.e. storm drains, edge of dock).
- Emergency response plan in place.
- Adequate spill response equipment and qualified personnel available.

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## BMP #8

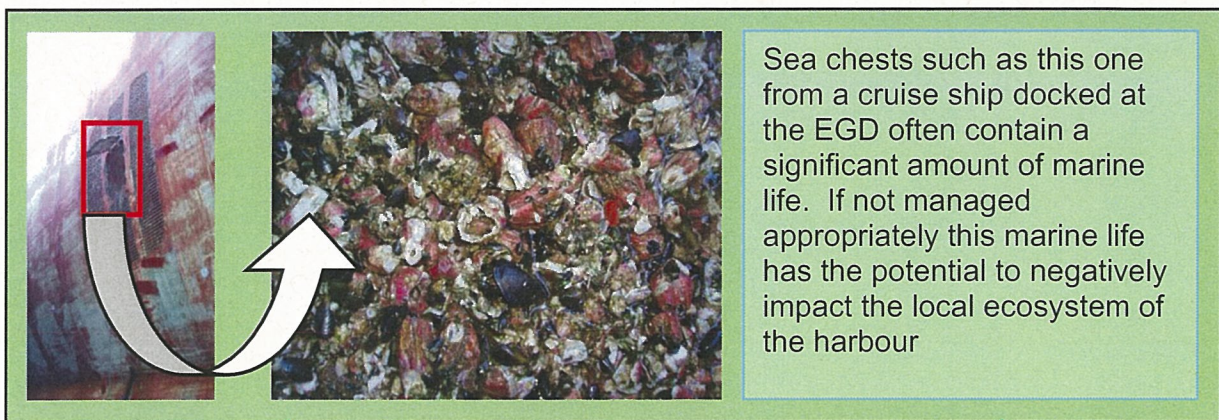
### Invasive Species (Ballast Tanks and Hulls)

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Invasive species are a significant threat to the marine ecosystems of British Columbia and Esquimalt Harbour. In 2000 a Fisheries and Oceans sponsored study of invasive species found that Esquimalt Harbour had a disproportionately high number of non-indigenous species. It has been widely recognized that the primary source of non-indigenous marine species in local waters are the ballast tanks and hull surfaces of transoceanic vessels.

**Marine growth removed from vessel hulls must not be allowed to enter the harbour through the graving dock drainage system.**

- Ballast Water
  - Vessels must follow Transport Canada Ballast Water Control and Management Regulations
- Ballast Tank Sediment
  - Shipyards must follow Transport Canada Ballast Water Control and Management Regulations
  - Sediments removed from the ballast tanks at the EGD must be contained, collected and disposed of at an authorized facility.
  - **Sediments must not be allowed to enter the harbour.**
- Anchor chain-growth
  - All biological material removed from anchor chains must be contained, collected and disposed of appropriately.
- Sea chests
  - All biological material removed from sea chests must be contained, collected and disposed of appropriately.



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## **BMP #9**

### **Fish and Wildlife Management**

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The daily operations and activities of the Esquimalt Graving Dock (EGD) have the potential to negatively impact wildlife which frequents the property.

#### **Fish**

Fish and other marine life have the potential to become stranded in the graving dock during normal vessel docking/undocking operations. This may include, but is not limited to: salmon, octopus, other fish species, and seals.

- The bubble curtain must be employed during vessel transfer into and out of the graving dock.
- EGD employees must monitor the graving dock for stranded fish and/or other marine life during dewatering.
- Whenever possible, EGD employees must retrieve fish and marine life and safely return them to the Esquimalt Harbour.
- Users are prohibited from removing fish and marine life from the graving dock.



**Report all instances of fish and marine life interaction with the  
Graving Dock to EGD Environmental Services**

#### **Authorization for the Destruction of Fish (Section 32)**

The EGD has received authorization for the destruction of fish associated with normal operation of the graving dock from the Department of Fisheries and Oceans.

##### **Conditions of the Authorization:**

- ▶ Take all reasonable precautions to prevent the trapping and mortality of fish
- ▶ Monitor the success of preventative measures and retrieval success
- ▶ Report to the DFO annually

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## Wildlife

A variety of wildlife is known to occupy areas of the EGD property. In some cases wildlife may use the facility as a nesting/breeding ground, while others are present for short periods of time to pass to another location or to feed. Activities and operations at the EGD have the potential to impact the well being of wildlife at the facility.

Such wildlife includes: deer, raccoon, mink, river otter, great blue heron, osprey, raven, cormorants and a variety of other common nesting and song birds.

- All wildlife must be left alone
- Injured or orphaned wildlife must not be handled without proper experience and equipment.
- Dispose of dead wildlife appropriately.
- Prior approval from EGD Environmental Services is required for the relocation or removal of nesting wildlife.

**In all cases, call EGD Environmental Services for wildlife related incidents**

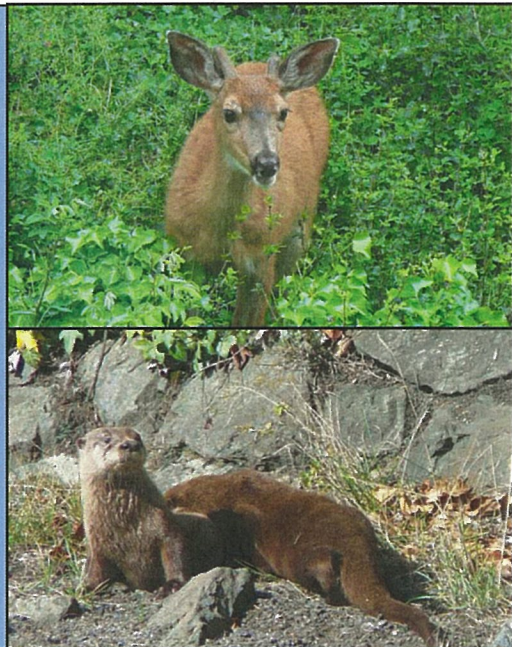
### EGD Wildlife Management Plan Contact Information

#### Conservation Officer

T: (250) 391-2225 (daytime)  
1-800-663-9453 (after hours call centre-will take messages and pass along to the Conservation Officer)

**BC SPCA Wild ARC**  
(Animal Rehabilitation Centre)  
T: (250) 478-9453

**Vancouver Aquarium Rehabilitation/Rescue**  
T: (604) 258-7325



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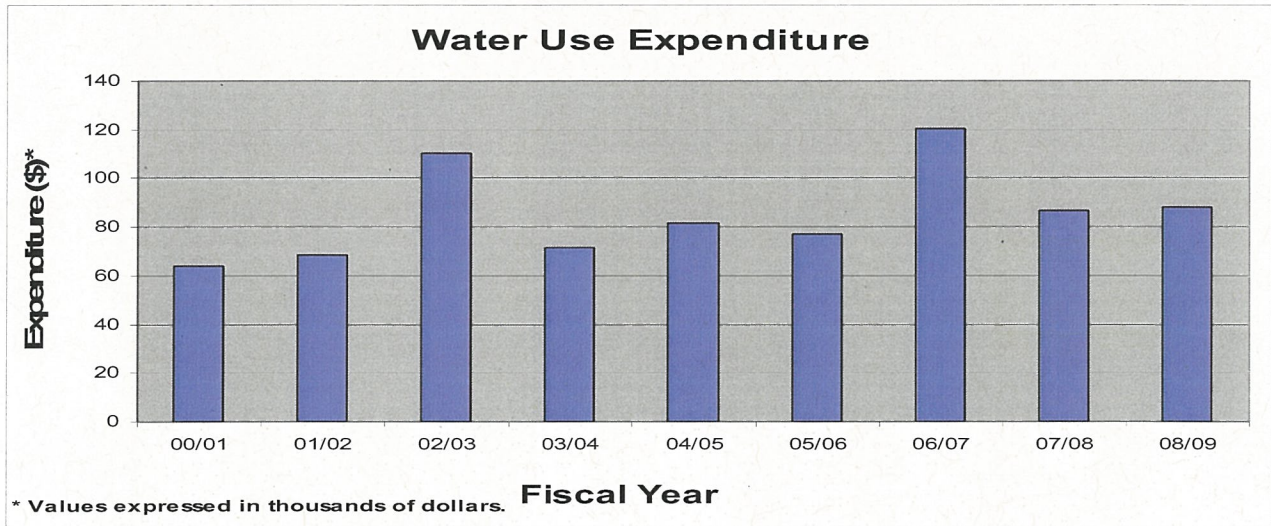
## BMP #10

### Water Use

Water consumption and the quality of water are considerations of the environmental management system at the Esquimalt Graving Dock (EGD).

#### Water Consumption

Large volumes of water are used during normal operations at the facility; because of this the EGD is considered a high volume user of fresh water in the Capital Region.

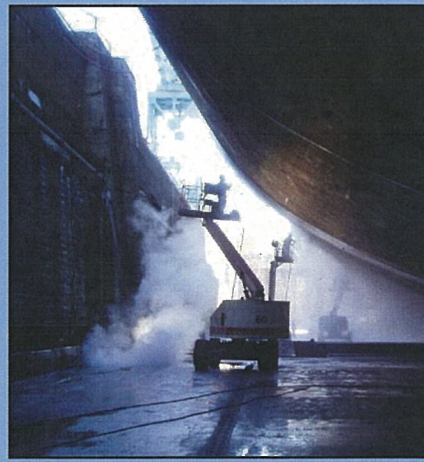


#### Significant Water Consuming Activities



**Water Curtains**

Water curtains are used to mitigate the escape of dust from sandblasting operations in dock bottom



**Ultra High Pressure Washing**

Ultra high pressure washing uses large amounts of water at high pressure to scour paint and biological material from the hulls of ships

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**In order to reduce the amount of water consumed onsite:**

- Only use water curtains when all other attempts to contain particulate emissions from sandblasting have failed.
- Avoid use of freshwater to clean work areas (e.g. graving dock bottom, wharves, jetties).
- Maintain fittings in buildings and on equipment to prevent leakages.

**Metered Water Use at the Esquimalt Graving Dock**

- Users must ensure that water is accessed from a metered line when connecting to the water distribution system
- Portable meters are to be used where necessary.
- Pumphouse must be contacted for proper access to the water distribution system.



The EGD maintains the water distribution system.

- Flushing of the entire system is conducted on an annual basis.
- Collection and analysis of water in comparison to drinking water quality guidelines is conducted regularly.

The water distribution system at the EGD was originally designed as a firefighting system; therefore, the water in certain areas of the system may not be considered potable.

- Users are responsible for ensuring that the water they use meets guidelines for the purpose intended.



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## **BMP #11**

### **Energy Conservation**

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The Esquimalt Graving Dock (EGD), as a facility, is a major energy consumer. Inefficient energy use may result in a negative economical and environmental impact. Economical impacts are associated with inefficient electrical usage (i.e. cost). Environmental impacts include those associated with the consumption of fuel (i.e. air emissions).

#### **Electrical Consumption**

There are a number of opportunities to increase the efficiency of electrical usage at the EGD:

- Turn off lights when not in use (flood lights, office buildings)
- Turn off equipment when not in use
- Use energy efficient equipment whenever possible
- Stagger equipment start-up to decrease load on electrical system



#### **Fuel Consumption and Emissions**

The second largest source of greenhouse gas emissions from the dock is employee commuting and fuel consumption. Some opportunities to decrease the amount of fuel consumed by day to day activities are:

- Use energy efficient vehicles
- Use alternative fuels/energy sources if possible
- Avoid idling vehicles
- Use shore power whenever possible
- Encourage staff to find alternative means for commuting to work (i.e. carpool, public transit, cycling)

#### **Idling Vehicles**

Idling Vehicles produce unnecessary air emissions and noise.

- Do not idle vehicles near building doorways or air intakes
- Vehicles must be turned off if idling for more than 3 minutes in a 60 minute period

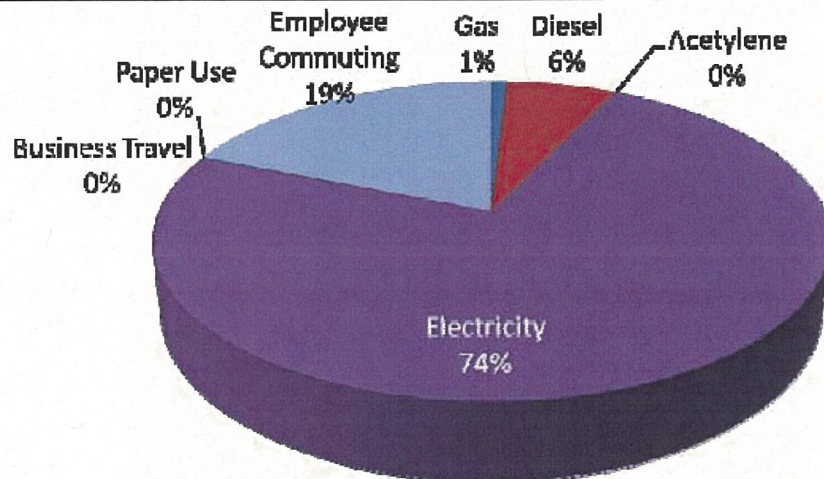


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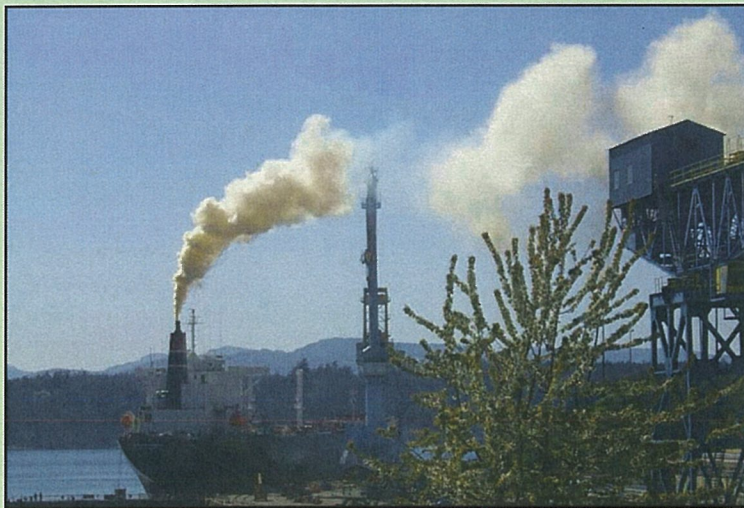
## Greenhouse Gas Emissions:

Energy consumption results in the production and release of greenhouse gas emissions through the combustion of fossil fuels. Every aspect of work at the EGD results in the release of greenhouse gases whether it is running the cranes or printing a report. It is important to minimize energy consumption wherever possible to mitigate the release of harmful greenhouse gases.



**Figure 1: Emissions Source Contributions  
2006/2007**

The Royal Roads University (RRU) Greenhouse Gas Audit determined that the largest source of carbon emissions at the EGD was electricity use. Employee commuting was the second largest greenhouse gas producer.



### Shore Power

When vessels are moored at the North Landing Wharf or the South Jetty it is important that they utilize shore power. With shore power the generator can be turned off thereby saving fuel and preventing the release of harmful air pollutants.

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## BMP #12

### Nuisance Pollution (Noise/Odour/Light)

The daily operations of the Esquimalt Graving Dock (EGD) tenants have the potential to negatively impact the work and living environment of neighbouring businesses and homes. Nuisance pollution is often created by noise, odour and light.

#### Noise

- The main sources of noise at the EGD include sandblasting, drilling, hammering, compressors, generators and the crane warning bell. Even general shop repair activities generate large amounts of noise.
- Whenever possible schedule noisy activities for daytime hours 0700 hrs to 2300 hrs on weekdays, and from 0700 hrs to 1900 hrs on weekends and holidays. Through worker education and good practice the generation of high-level intermittent or non-continuous noises can be minimized.
- The EGD Environmental Policy makes a commitment to follow all applicable municipal laws and regulations, therefore it is expected that the daily operations at the EGD will meet the Esquimalt Noise Control Bylaw (2677).



The EGD is considered an “Activity Zone” and the neighbouring area is considered a “Quiet Zone”. Building and infrastructure related projects at the EGD may fall under the definition of a “Construction Zone” as per the Esquimalt Noise Control Bylaw.

Esquimalt Noise Control Bylaw		Noise Receiver Zone	
		Quiet	
		Day	Night
Noise Source Zone	Activity	60 dBA	55 dBA

#### Construction Zone

Building and infrastructure related projects at the EGD may fall under the definition of a “Construction Zone” as per the Esquimalt Noise Control Bylaw. The definition of a construction zone according to the Esquimalt Noise Control Bylaw is:

- the erection, alteration, repair, relocation, dismantling, demolition and removal of a building;
- structural maintenance, power-washing, painting, land clearing, earth moving, grading excavating, the laying of pipe and conduit, concrete placement, and the installation, or removal of construction equipment, components and materials in any form or for any purpose;
- any work being done in connection with any of the work listed in paragraphs (a) or (b);

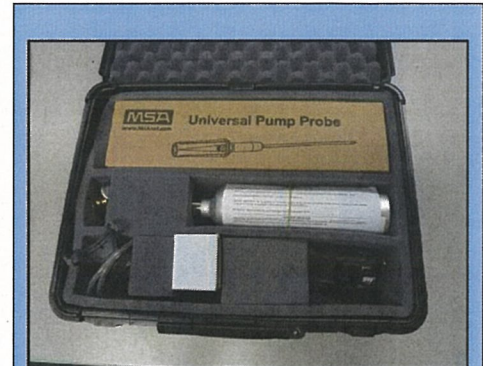
The noise level limit for a “Construction Zone” is **85 dBA** day and night.

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## Odour

- Daily dock operations often create strong and unpleasant odours whether from the release of VOCs, H<sub>2</sub>S, organic materials, or chemicals an offensive smell can reduce the quality of the work environment for neighbouring tenants and home owners.
- In the event that odours are negatively affecting other tenants or stakeholders odour mitigating measures may be required.
- Contact EGD Environmental Services in the event of a nuisance odour from an unknown source.

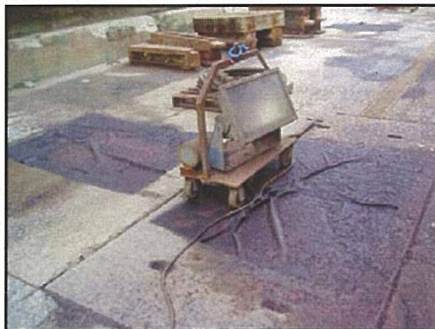


### H<sub>2</sub>S Meter

The EGD utilizes an H<sub>2</sub>S meter to ensure that any emissions released from the sanitary sewer system that create nuisance odours are not hazardous to adjacent work areas.

## Light

- Night time dock operations require spotlights to provide a safe work environment. However for residential neighbours strong spotlights can be a significant intrusion.
- Utilizing spotlights only when absolutely necessary will help prevent disturbing the neighbours as well as provide a more energy efficient work environment.
- Changing the direction of the lights may reduce the effect they have on the neighbours.
- Turn off or report to your supervisor any unnecessary lights left on.



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## BMP #13

### Sanitary Waste Management and Sewer Use

The Esquimalt Graving Dock is authorized by the Capital Regional District (CRD) as a ship and boat waste disposal facility.

**Discharge to the sanitary sewer at any location other than at the LS#15, LS#11 or the four vessel connections at the Graving Dock is prohibited.**



The EGD is authorized to discharge to the sanitary sewer at the:

- Lift Station #15 (LS#15),
- Lift Station #11 (LS#11) and
- And the four vessel connections in the graving dock.

#### Permitted wastes include:

- sanitary waste
- grey water
- treated superchlorinated water\*

#### Prohibited wastes include:

- bilge and ballast water
- wastewater sludge
- fuel and oil, paint, paint thinner, solvents, and products containing toxic chemicals

**\*Superchlorinated Water:** must not be discharged to the sanitary sewer unless it has been dechlorinated to less than 5 ppm chlorine.

- Users must notify the Pumphouse before conducting any discharges to the sanitary sewer. Typical methods of discharge are: large (connection to a vessel), and small (portable discharges from totes).
- Users must complete a Sanitary Sewage Discharge Form and provide it to the Pumphouse prior to discharging to the sanitary sewer.
- Pumphouse Operators will ensure that sanitary sewer discharges are in accordance with applicable regulations and authorizations.
- Pumphouse Operators will provide all completed Sanitary Sewer Discharge Forms to EGD Environmental Services, who will submit quarterly reports to the CRD.
- Users must ensure a sample collection point is accessible at the point of discharge.

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## **BMP #14**

### **Spill Preparedness and Response**

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The Esquimalt Graving Dock (EGD) is committed to the protection of human health and the environment. Safety and environmental management programs have been implemented at the EGD to reduce the potential for accidents and spills. Emphasis is placed on the prevention of spills, and although the potential for spills can be reduced through these programs, spills do happen.

**All Users operating at the EGD must have the capability to effectively manage spills resulting from their activities and operations.**

- User employees must have adequate training in spill response
- User employees must have access to appropriate spill response equipment and materials
- Users must have plans and procedures in place to respond to spills



For spills which are beyond the capability of the User or are not being effectively responded to by the User, the EGD will provide assistance. The EGD has additional resources available, including:

- Spill kits and response materials for land and water based spills
- Spill response boom, deployment reels and boat
- Staff trained to deal with land and water based spills

**For access to the EGD spill response resources, contact EGD Management or Commissionaires.**

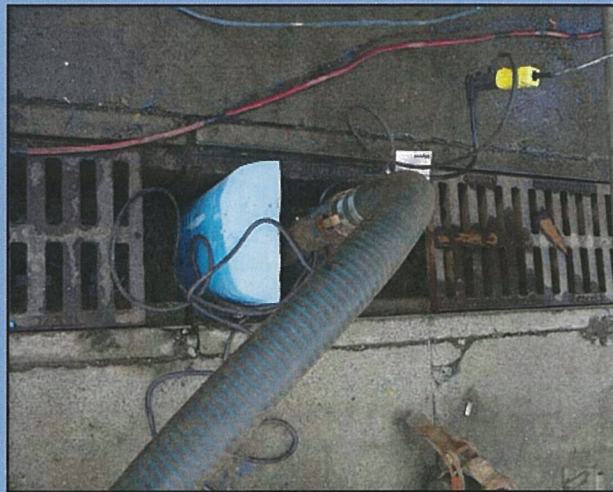
For spills beyond the capability of the facility to manage, the DND, Port Operations and Emergency Services Branch (DND POESB) will provide support for response to land and water based spills.

**ALL Spills Must Be Reported to  
EGD Management**

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**Trench Drains:** The EGD has installed trench drains throughout the site. These drains are easily accessible and allow for rapid containment and recovery of materials spilled on the property or in the drydock.



#### **Environmental Emergency Contacts (24 Hours):**

EGD Commissionaires	250-363-3784
Provincial Emergency Program (PEP)	1-800-663-3456
DND POESB/QHM	250-363-2160 or VHF Channel 10
Canadian Coast Guard	1- 800-889-8852 or VHF Channel 12
Environment Canada	604-666-6100

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## BMP #15

### In-water Hull Cleaning and Maintenance

The cleaning of the underwater hull in water has the potential to release harmful contaminants into the marine environment.

#### In-water Hull Cleaning

- In-water hull cleaning of vessel hulls that are coated with antifouling paint is prohibited at the Esquimalt Graving Dock.
- Vessels coated in non-biocide containing paints (such as silicone based), may be considered on a case by case basis and must be approved by EGD Management prior to the commencement of hull cleaning activities.



Vessel berthed at the North Landing Wharf for in-water hull washing. In-water hull washing must not release antifouling paint. Discoloured water is an indication that you may be harming the environment.

#### Did you know?

**Antifouling paints and their residues contain heavy metals, such as copper, that are toxic to aquatic organisms, including salmon and shellfish. Wash water and solid residues from the washing, scraping, sanding, and blasting of antifouling paints from boat hulls are considered "deleterious substances" under the *Fisheries Act*. Releasing these wastes to fish bearing waters is a violation of the Act.**

#### In-water Hull Maintenance

- Users must receive approval from EGD Management prior to commencement of hull maintenance.
- Cleaning of the anodes, inlets, props, transducers, etc.
- Underwater maintenance required for operational and inspection purposes is permitted at the Esquimalt Graving Dock.

**For inquiries regarding in-water hull washing please contact the Esquimalt Graving Dock Management at (250) 363-8056**

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## **BMP #16**

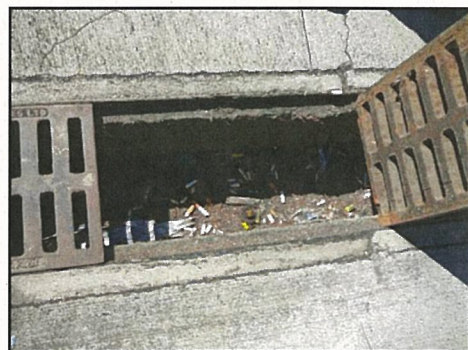
### **Housekeeping**

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An organized, clean facility provides an environment that reduces the potential for pollutants to enter surface and ground water through spills and accidents. General cleanliness will lead to more organized and consistent handling of hazardous materials and waste products.

#### **Clean-Up**

- Clean debris from work areas immediately after any maintenance activity. Dispose of collected material appropriately.
- Ensure garbage and recycling containers are available in all leased areas and are emptied regularly.
- Do not use running water to clean the work areas where the contaminated water could enter the storm drainage system.
- Ensure trench and storm drains within designated leased areas are kept clean and free of debris.
- Sweep and/or clean the active working area of the yard on a regular basis.



#### **Storage**

- Do not store material/equipment outside of identified boundaries of leased areas.
- Regularly inspect the lease areas for unidentified or improperly stored materials.
- Place a drip pan underneath vehicles and equipment when performing maintenance. Promptly transfer the used fluids to the proper waste or recycling drums.
- Ensure all containers (i.e. drums, totes, etc.) are in good condition and have a clean exterior at all times.



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## **BMP #17**

### **Stormwater Management**

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Stormwater has been identified as one of the primary pathways of contaminant loading to the harbour from daily Esquimalt Graving Dock (EGD) operations. Common contaminants found in stormwater samples include cadmium, copper, chromium, arsenic, tributyltin (TBT), extractable petroleum hydrocarbons (LEPH/HEPH), and total suspended solids (TSS). Five stormwater catchment areas terminate into the harbour from the EGD property.

A stormwater monitoring program has been implemented at the EGD. The stormwater outfalls will be sampled semi-annually in the spring and fall. Waste grit separators have been installed upstream of the five stormwater outfalls. These help to remove contaminants or debris that enter the storm drain system from daily operations at the EGD, in particular they remove: fuel or oil, paint, sandblast grit, general debris.

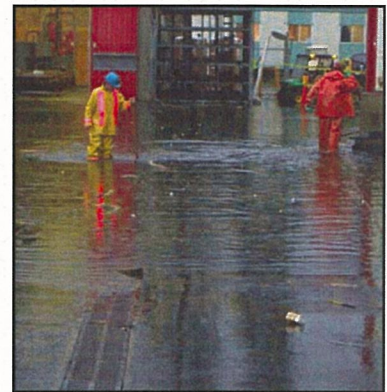
#### **Materials Storage:**

- Store hazardous materials away from storm drains and trenches.
- Store hazardous materials away from the South Jetty fire holes. These holes lead directly to the marine environment.
- Ensure totes, drums and pails containing hazardous materials are protected from the weather.



#### **Storm Drains:**

- Ensure storm drains are kept clear of debris to prevent flooding during heavy stormwater events.
- When using trench drains for secondary containment, ensure the containment system is monitored and removed in a stormwater event. A blocked trench drain may cause flooding of the area.
- Conduct regular inspections of trench drains in lease areas to ensure they are kept clear of debris.



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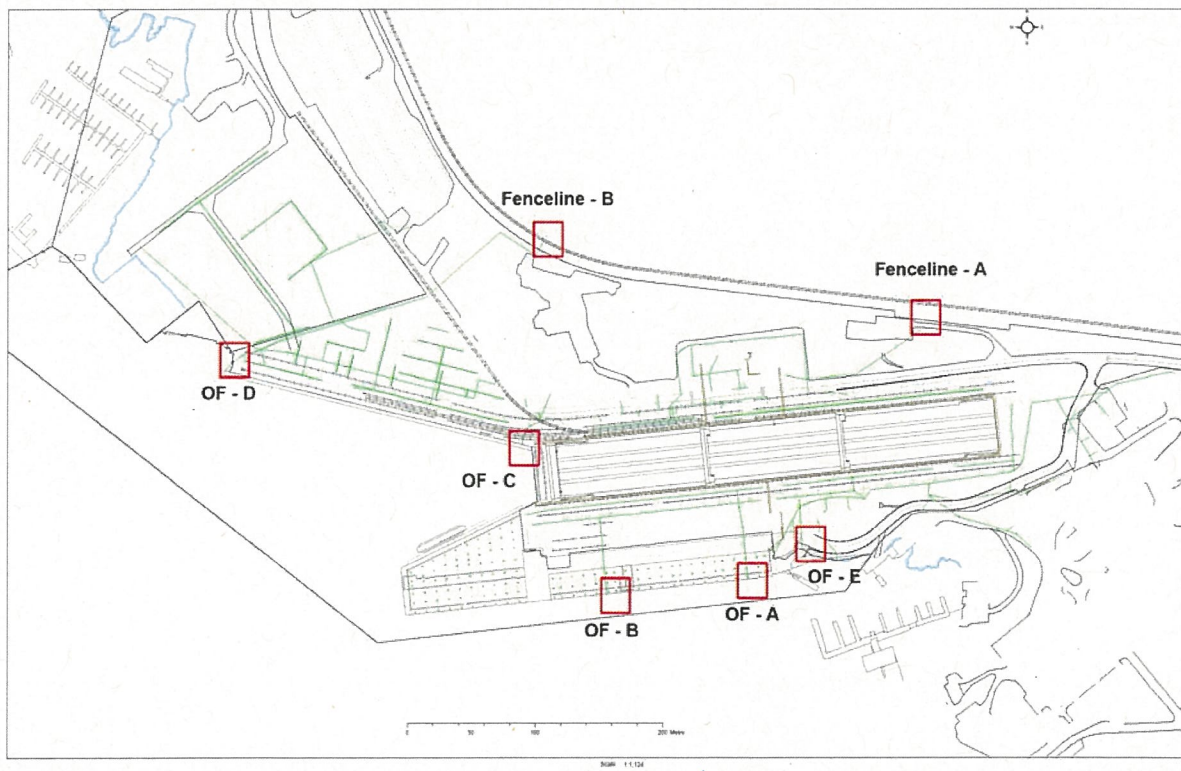
**During heavy rain events in dock bottom:**

Stormwater has the potential to mix with wash water during power washing operations in dock bottom. To reduce the amount of wash water requiring treatment it is good practice to stop power washing operations until storm water can be controlled.

- Sump well valves may be opened to allow storm water to drain in to the tunnel drains if the area is clear of contaminants and debris.
- Sump wells containing visibly contaminated material must be pumped out and cleaned prior to opening the valves.
- Ensure there is capacity in the trench drain/sump well system to manage the expected stormwater volume to prevent flooding of the dock floor.

**Stormwater Monitoring Program**

- Stormwater sampling is conducted semi-annually in the spring and fall by EGD Environmental Services.
- Stormwater samples are tested for: total metals, total suspended solids, tributyltin, LEPH/HEPH and microbiological parameters.

**EGD Stormwater Monitoring Program Sample Sites**

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## BMP #18

### Property and Infrastructure Maintenance, Modifications and Construction

There are significant environmental issues and potential impacts related to the management of Esquimalt Graving Dock properties and infrastructure. Any new construction or modifications to the infrastructure at the EGD must consider environmental issues in the project planning.

#### Infrastructure Maintenance

Maintenance and repair of the aging EGD infrastructure often results in waste generation and other environmental issues which need to be addressed.

##### *Minor Concrete Work*

- Contain dust from cutting and drilling.
- Prevent runoff to the storm drains.

##### *Use of Preserved Wood*

- Avoid use of creosote preserved timbers where possible.
- Follow applicable guideline for use of preserved wood products.
- Creosote wood waste may be considered a hazardous, restricted or controlled waste.



##### *Demolition/Renovation*

- Ensure structures are assessed for the presence of hazardous materials (i.e. lead paint, asbestos) prior demolition or renovation.

#### Infrastructure Modification and Construction

All construction projects taking place at the EGD need to be assessed for environmental impacts, and plans put in place to mitigate these impacts.

#### **Environmental Impact Assessment**

- Any significant changes to infrastructure, changes to an existing lease or application for a new lease, must be approved by EGD Management.
- Prior to the approval of an infrastructure project, a CEAA Environmental Impact Assessment may be required.
- An Environmental Approval Form must be filled out for new lease applications and changes to existing leases.

***\*\*The Environmental Impact Assessment and Environmental Approval Form outlines specific environmental protection and mitigation measures required\*\****

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Common project related aspects that require management include: noise, dust, hazardous materials, storm water runoff, and prevention and management of accidental releases and spills. Requirements for the operational aspects are identified in previous sections of these EBMPs.

Significant non-operational aspects related to construction projects may include:

- Loss of Green Space and Vegetation
- Management of Archaeological Impacts
- Soil Management



### Loss of Green Space and Vegetation

The EGD property includes an area of vegetation that provides many benefits. It is home to a number of sensitive native plant species, provides habitat for wildlife, and acts as a buffer between the industrial operations of the drydock and ship repair operations and the neighbouring residential area.

**All projects which have the potential to impact vegetation must be reviewed and approved by EGD Management.**



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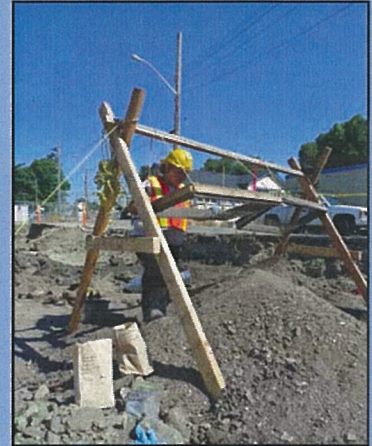
## Archaeological Considerations

The EGD property and surrounding area has a rich First Nations history. There are four Provincially Registered Archaeological Sites listed within the property boundaries of the EGD.

- All excavation projects must be reviewed and approved by EGD management prior to work beginning
- Depending on the scale of the project a detailed Archaeological Impact Assessment may be required.

### Esquimalt Graving Dock Archaeological Overview Assessment

An Archaeological Overview Assessment was carried out in 2010 which outlines the archaeologically sensitive areas on the EGD property and identifies areas of high archaeological potential. Archaeological significant materials found during excavation projects at the facility include artefacts, shell midden, faunal and human remains.



## Soil Management

The EGD has undergone significant capital and operation and maintenance projects in recent years. Extensive investigations into the soil conditions (chemical contamination and structure), utility mapping and identification of archaeological conditions have taken place. The industrial history of the facility has resulted in the contamination of the soil and in-fill material used on site. The primary contaminants commonly found at levels exceeding industrial soil standards include: arsenic, cadmium, copper, lead, mercury, zinc, and polycyclic aromatic hydrocarbons (PAH).

## Requirements for Excavations at the EGD

### Planning Excavation

1. Consult with EGD Facility Management to identify:

- Project area and excavation boundaries.
- Known utilities, structures, and historical information regarding the proposed excavation area.
- Known contaminated soil locations, the nature and level of contaminants potentially in the soils to be excavated.
- Archaeologically significant areas, requirements for mitigation archaeological impacts, and dealing with unanticipated archaeological finds.

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2. Prepare a plan for management, stockpiling, and sampling of soils to be excavated. Key issues to be identified include:
  - Turnaround times for samples may be up to 2 weeks.
  - Parameters to be sampled may vary depending area of excavation. Common parameters include total metals, leachable metals, PAHS, and hydrocarbons (LEPH, HEPH).
  - Stockpile areas must be approved by EGD Management.
  - Soils which exceed the CCME Industrial Levels or BC CSR Industrial levels must be disposed of off site at an approved location.
  - Soils which are below industrial standards may remain on site if geotechnically suitable, approved by EGD Management, and there is an identified use for the soil.
3. Ensure contractors and employees are aware of the health and environmental risks associated with the suspected contaminated soils and have procedures in place to mitigate these risks. This includes adequate Personal Protective Equipment (PPE) and hygiene practices (i.e. no smoking, wear gloves)

#### Conducting Excavation

1. Ensure appropriate PPE and hygienic precautions are in place to prevent exposure to contaminants in the soils.
2. Monitor all excavations for visible soil contamination or archaeologically significant material.
3. Ensure soil is stockpiled, sampled and analysed in accordance with the BC MOE Technical Guidance on Contaminated Sites (January 2009).
4. Ensure soils suspected of contamination are stockpiled on an impervious surface and covered with a minimum 6 mil PVC or plastic liner to prevent exposure to wind, storm water runoff or people.
5. Imported fill material must be certified clean by the supplier.



#### After Excavation

1. Ensure all soil is disposed of at approved facilities.
2. Obtain disposal certificates from the receivers of contaminated soils.
3. Report to EGD Management on the volume, analysis of results, excavation details and dimensions.
4. Provide all as-builts and project drawings to EGD management in the format compatible with the EGD drawing standards.

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### Requirements for Small Excavations (less than 10m<sup>3</sup>)

**In areas of suspect contamination:** soil must be removed, stockpiled and sampled. Soil cannot go back into the excavation or used elsewhere on site until it is determined through analysis to contain contaminants less than industrial soil standards. The EGD management must give approval for any reuse of excavated soil on site.

**In areas of non-suspect contamination:** soil may go back into the excavation if geotechnical suitable. The EGD management must give approval for any reuse of excavated soil on site.

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Esquimalt Graving Dock  
Victoria, BC  
Penstock Gate and Cylinder Refurbishment,  
Install Auxiliary Tunnel Safety Gate  
Project No. R.016116.098 and R.016116.114

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**APPENDIX D**

**November 2014**

## **APPENDIX D**

### **EGD STANDARDS FOR SURVEYS**

# **Esquimalt Graving Dock (EGD) STANDARDS FOR SURVEYS**

Revised 2012-02-28

## **1. INTRODUCTION**

This standard is written to provide the British Columbia Land Surveyor (BCLS) a guideline for producing acceptable topographic survey for all EGD projects.

## **2. APPLICATION OF THE STANDARD**

This standard applies to surveys that are intended to show new installation of structures, utilities and underground conduits including the existing structures, utilities and underground conduits in the vicinity of the project and as requested by EGD Representative.

The Surveyor in making topographic surveys uses accepted terrestrial and/or GPS surveying methods. Topographic surveys that additionally depict the location of property lines must also be in compliance with the current standard for property surveys and show all legal boundary evidence found.

## **3. DEFINITIONS**

- 1) Benchmark (control point) is a relatively permanent material object, natural or artificial, bearing a marked point whose elevation above or below an adopted datum is known and whose horizontal coordinates are known in an accepted coordinate system (UTM NAD 83 CSRS Zone 10).
- 2) A Contour is an imaginary line on the ground, all points of which are of the same elevation above or below a specified datum.
- 3) The Parcel is the area designated by an EGD Representative and is usually, but not necessarily, given by a legal description of the property.
- 4) Utilities are services provided by governmental and private entities that provide the following: electric power, telephone, water, sanitary and storm sewer, gas, etc.
- 5) Acronyms and Definitions:
  - BCLS: British Columbia Land Surveyor
  - EGD: Esquimalt Graving Dock
  - NEZ: Northing, Easting, Elevation – Coordinates
  - PBM: Permanent Benchmark (Control point)
  - TBM: Temporary Benchmark (Control point)
  - Headwall: concrete wall structure on top of or on each side of culvert.

# **Esquimalt Graving Dock (EGD)**

## **STANDARDS FOR SURVEYS**

Revised 2012-02-28

### **4. RESEARCH AND INVESTIGATION**

- 1) The Surveyor shall acquire the elevation and datum of all benchmarks to be used in the survey. The elevation used shall be based on a nationally accepted datum whenever practical or unless otherwise instructed by an EGD Representative. The EGD Representative shall specifically describe the parcel to be surveyed.
- 2) At least four (4) benchmarks shall be established using Global Positioning System and electronic survey total stations, in which the position of all survey works and detected objects shall relate.
- 3) The benchmarks shall be established on stable ground within 6 m (20 ft) adjacent to the project site or as directed by EGD Representative. The benchmarks shall have reference numbers, coordinates and heights above the established datum (geodetic and/or chart datum).

### **5. THE SURVEY**

The survey shall be performed on the ground to obtain the information required in this standard and any additional information requested by EGD. The Surveyor shall select the equipment and procedures necessary to obtain the horizontal and vertical positional accuracy required by these standards.

### **6. DATA**

The surveyor shall locate and show on the survey map the following information:

- 1) The location of permanent structures including retaining walls and culverts.
- 2) The location of street or road paving, entrances, driveway openings and sidewalks.
- 3) Elevations on the top of curbs, gutters and sidewalks.
- 4) EGD building numbers assigned to the parcel.
- 5) North arrow and scale of drawing.
- 6) Legend depicting the symbols and abbreviations used on the drawing.
- 7) Provide buildings footing corners, exterior corners, roof line corners and main floor elevations of all required building listed in Appendix A.
- 8) Location and elevation of existing structures, utilities, underground conduits or drainage courses on or near the surveyed parcel.



# Esquimalt Graving Dock (EGD) STANDARDS FOR SURVEYS

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- 9) Schedule of all benchmarks with the reference numbers coordinates (UTM NAD83 CSRS Zone 10) and heights above the established datum (geodetic and/or chart). Description and location of the benchmarks shall also be submitted.
- 10) Original copy of the survey field logbooks or electronic logbook printouts data duly endorsed by the British Columbia Land Surveyor. All survey data from field logbooks or electronic notebooks shall include and clearly indicate corrections or errors done during surveying work.
- 11) Certificates showing that the surveying equipment used have been calibrated in the last twelve (12) months shall also be attached. These certificates shall also be submitted prior to start of work.
- 12) The surveyor map grid coordinate system shall be based on NAD 83 (North American Datum) UTM Zone 10.
- 13) Levels related to established datum (geodetic and/or chart).
- 14) All other items listed in **Appendix A**.

## 7. POSITIONAL ACCURACY

The following relative positional accuracies are provided as a guide for surveys.

	<b>Vertical Positional Accuracy Feet</b>	<b>Horizontal Positional Accuracy Feet</b>
Contour line 300 mm (1') interval	± 200 mm (0.65 ft)	± 300 mm (1 ft)
Contour line 600 mm (2') interval	± 400 mm (1.30 ft)	± 600 mm (2 ft)
Contour line 1.2 m (4') interval	± 800 mm (2.60 ft)	± 1.200 m (4 ft)
Contour line 1.5 m (5') interval	± 1.000 m (3.20 ft)	± 1.200 m (4 ft)
Contour line 3.0 m (10') interval	± 2.000 m (6.50 ft)	± 2.400 m (8 ft)
Floor elevations	± 10 mm (0.05 ft)	± 300 mm (1 ft)
Spot paving elevations	± 10 mm (0.05 ft)	± 300 mm (1 ft)
Spot ground elevations	± 50 mm (0.20 ft)	± 600 mm (2 ft)
Sewer invert elevations	± 10 mm (0.05ft)	± 300 mm (1 ft)
Underground utilities/conduits	± 10 mm (0.05ft)	± 300 mm (1 ft)
All underground services/structure	± 10 mm (0.05ft)	± 300 mm (1 ft)

*Positional Accuracy is given at the 95 percent confidence level.*

# **Esquimalt Graving Dock (EGD) STANDARDS FOR SURVEYS**

Revised 2012-02-28

## **8. ELECTRONIC DATA DISTRIBUTION**

Surveyor to provide the survey data in an AutoCAD 2012 or 2010 .dwg drawing file. The surveyor shall also provide a signed and sealed hard copy drawing. This drawing shall be the official map and shall be deemed to be correct and superior to the electronic data.

The electronic data file shall also contain a statement that the file is not a certified document and that the official document was issued and sealed by *(name and commission number of the BCLS)* on *(date)*. Surveyor to also provide a table of the survey points data (NEZ) in electronic format (MS Excel, MS Word or PDF).

# **Esquimalt Graving Dock (EGD)**

## **STANDARDS FOR SURVEYS**

### **Appendix A - ITEMS TO BE INCLUDED IN SURVEY**

Revised 2012-02-28

The following items marked with an **(X)** are to be included in the survey:

- ( ) Boundary survey of the parcel.
- ( ) Plot the location of easements and rights-of-way as shown on the recorded subdivision plan and all easements evidenced by a recorded document provided by EGD. The plan or document number of each shall be shown.
- ( ) Vicinity map with subject property highlighted.
- ( ) Observable evidence of recent earth moving work, borrow or fill.
- ( ) Cross-section of offsite drainage courses for engineering studies.
- ( ) Spot elevations covering the entire survey limits showing high points, low points, grade changes, and at sufficient intervals to represent the general character of the terrain. Existing contours shall be drawn with major contour lines at 10m (25') intervals and minor contour lines at 2m (5') intervals unless otherwise noted.
- ( ) Elevations at the inside of walk, top of curb, and gutter at approximately one inch 3cm (1") intervals at the final map scale.
- ( ) Dimensions of curb, sidewalk, and gutter lines or ditch lines and centerline of all streets, alleys or roads adjoining the parcel. Indicate type of paving surface and condition.
- ( ) Location, width and elevation at both ends of all existing sidewalks. Include a description of the kind and general condition of the sidewalk.
- ( ) Location, diameter, and species of all trees over 10 cm diameter.
- ( ) Perimeter outline only of thickly wooded areas unless otherwise directed.

# **Esquimalt Graving Dock (EGD) STANDARDS FOR SURVEYS**

## **Appendix A - ITEMS TO BE INCLUDED IN SURVEY**

Revised 2012-02-28

- ( ) Electric utilities – the location of:
  - ( ) power poles – 1 point at ground elevation
  - ( ) power poles – 1 point at top of pole elevation
  - ( ) guy wires – 1 points
  - ( ) anchors – 1 points
  - ( ) Rectangular junction/pull boxes – 4 corners
  - ( ) Round junction/pull boxes – cover center
  - (x) Underground conduits – all tie-ins (existing or new) and change of directions
  - (x) vaults – 4 corners
- ( ) Storm, sanitary or combined sewers – the location of:
  - (x) manholes – cover center
  - ( ) culverts – 2 centreline measurements to show direction of flow
  - ( ) headwalls – 4 corners
  - ( ) catch basins – 4 corners + 1 centre measurement at gutter line
  - ( ) clean-outs – center point
  - ( ) Include elevations of the top and bottom of manholes, culverts, headwall and catch basins.
  - ( ) Show type, size, and direction of flow and invert elevation of all pipes or culverts.
- ( ) Water – the location of:
  - ( ) all water valves – center point
  - ( ) standpipes – center point
  - ( ) regulators – center point
  - ( ) fire hydrants – 1 point at ground elevation
  - ( ) fire hydrants – 1 point at top of hydrant elevation
- ( ) Gas – the location of:
  - ( ) all valves – center point
  - ( ) meters – center point
  - ( ) gas line markers – center point
  - ( ) Show elevation on top of any valves.

# **Esquimalt Graving Dock (EGD) STANDARDS FOR SURVEYS**

## **Appendix A - ITEMS TO BE INCLUDED IN SURVEY**

Revised 2012-02-28

- ( ) Telephone – the location of:
  - ( ) all poles – 1 point at ground elevation
  - ( ) all poles – 1 point at top of pole elevation
  - ( ) manholes – center point
  - ( ) Rectangular junction/pull boxes – 2 opposite corners
  - ( ) Round junction/pull boxes – cover center
- ( ) Street/Roads – the location of:
  - ( ) all lamp poles – 1 point at ground elevation
  - ( ) all lamp poles – 1 point at top of pole elevation
  - ( ) Rectangular junction/pull boxes – 4 corners
  - ( ) Round junction/pull boxes – cover center
  - ( ) road cross-section: Survey spot levels along cross-sections at maximum 5m (15') intervals up to 30m (100') beyond the edges of the road shoulder. The interval of the spot levels shall be varied based on the condition at site. If required, closer spacing shall be surveyed where the terrain is not uniform such as deep gullies and creek areas.
- ( ) Heating – the location of:
  - ( ) steam manholes – center point
  - ( ) vaults – 4 corners
- ( ) Location and dimensions of:
  - ( ) tanks – 2 opposite corners minimum
  - ( ) fences – corners/gates + changes of direction
  - ( ) fences cross-section: Survey spot levels along cross-sections at maximum 5m (15') intervals up to 30m (100') beyond the edges of the fences lines. The interval of the spot levels shall be varied based on the condition at site. If required, closer spacing shall be surveyed where the terrain is not uniform such as deep gullies and creek areas.
  - ( ) obstructions – 2 opposite corners minimum

# **Esquimalt Graving Dock (EGD) STANDARDS FOR SURVEYS**

## **Appendix A - ITEMS TO BE INCLUDED IN SURVEY**

Revised 2012-02-28

- ( ) Existing buildings – the location of:
  - ( ) Main Gate Guard Kiosk
  - (x) NS-34 Main Penstock Building and Auxiliary Tunnel Access all exterior building corners at grade.
  - (x) NS-7 Middle Penstock Building all exterior building corners at grade.
  - (x) NS-6 Pump House northwest corner, west elevation at grade, southwest corner and west elevation 3m beyond east side of tunnel access.
  - ( ) \_\_\_\_\_
  - ( ) \_\_\_\_\_
- ( ) Location and description of any building or major structure on adjoining land that is not more than \_\_\_\_ feet outside the parcel being surveyed.
- ( ) Other – the location of:
  - (x ) New Hydraulic lines
  - ( x) Tunnel Access Shaft all four corners.
  - ( ) \_\_\_\_\_
  - ( ) \_\_\_\_\_
  - ( ) \_\_\_\_\_
  - ( ) \_\_\_\_\_
  - ( ) \_\_\_\_\_
  - ( ) \_\_\_\_\_
  - ( ) \_\_\_\_\_
  - ( ) \_\_\_\_\_



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Esquimalt Graving Dock  
Victoria, BC  
Penstock Gate and Cylinder Refurbishment,  
Install Auxiliary Tunnel Safety Gate  
**Project No. R.016116.098 and R.016116.114**

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**APPENDIX E**

**November 2014**

## **APPENDIX E**

### **SCHEDULE OF EGD DOCK CHARGES**

SCHEDULE  
(section 2, paragraphs 4(2)(e) and 5(1)(c) and sections 34 and 36.1)

## DOCK CHARGES (\$)

Item	Column 1 Services and Facilities	Column 2	Column 3	Column 4	Column 5	Column 6
		April 1, 2010 – March 31, 2011	April 1, 2011 – March 31, 2012	April 1, 2012 – March 31, 2013	April 1, 2013 – March 31, 2014	April 1, 2014 – March 31, 2015
1.	Booking	4,200.00	4,400.00	4,600.00	4,800.00	5,000.00
2.	Draining, per section	3,800.00	4,100.00	4,400.00	4,700.00	5,000.00
3.	Berthage, per metre, per day	5.19	5.35	5.51	5.67	5.84
4.	Rail-mounted crane, per hour					
	(a) with light hook	407.88	420.12	432.72	445.70	459.07
	(b) with main hook, up to 50 tonne lift	589.16	606.83	625.04	643.79	663.10
	(c) with main hook, over 50 tonne lift	906.40	933.59	961.60	990.45	1 020.16
5.	Mobile crane, per hour					
	(a) 9-tonne crane	113.30	116.70	120.20	123.81	127.52
	(b) 20-tonne crane	145.02	149.37	153.86	158.47	163.23
	(c) 30-tonne crane	176.74	182.04	187.52	193.13	198.94
	(d) Forklift	86.11	88.69	91.35	94.09	96.92
	(e) Tower crane	145.02	149.37	153.86	158.47	163.23
6.	Air compressor (first), per manifold hour	99.70	102.70	105.78	108.95	112.22
7.	Air compressor (second), per manifold hour	95.17	98.03	100.97	104.00	107.12
8.	Air compressor (wheeled), per manifold hour	49.85	51.35	52.89	54.47	56.11
9.	Motorized vessel, per hour	164.80	169.74	174.84	180.08	185.48
10.	Fresh water, per cubic metre	1.13	1.17	1.20	1.24	1.28
11.	Electric power, per kilowatt hour	0.13	0.14	0.14	0.15	0.15
12.	Tie-up or letting go	721.00	742.63	764.91	787.86	811.49
13.	Overtime labour services, drydock employee, per hour	88.99	91.66	94.41	97.24	100.16
14.	Security services, per vessel, per day	407.88	420.12	432.72	445.70	459.07
15.	Dockage, 1 section, per day	2,200.00	2,400.00	2,600.00	2,800.00	3,000.00
16.	Dockage, 2 sections, per day	8,400.00	8,800.00	9,200.00	9,600.00	10,000.00
17.	Dockage, 3 sections, per day	11,600.00	12,200.00	12,800.00	13,400.00	14,000.00
18.	Dockage per tonne, per day: under 5,000 gross tonnage	0.00	0.00	0.00	0.00	0.00
19.	Dockage per tonne, per day: 5,000-34,999 gross tonnage	0.12	0.12	0.12	0.12	0.12
20.	Dockage per tonne, per day: 35,000-69,999 gross tonnage	0.11	0.11	0.11	0.11	0.11
21.	Dockage per tonne, per day: 70,000-89,999 gross tonnage	0.10	0.10	0.10	0.10	0.10
22.	Dockage per tonne, per day: over 89,999 gross tonnage	0.09	0.09	0.09	0.09	0.09
23.	Sewer discharge, per litre	0.01	0.01	0.01	0.01	0.01
24.	Vacuum loader	58.92	60.88	62.50	64.38	66.31

SOR/2009-324, s. 16.