

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 Materials and installation procedures for the installation of the two SS submersible pump guide beams/rails with rock bolts.

### **1.2 RELATED SECTIONS**

- .1 Division 01 – General Requirements.

### **1.3 MEASUREMENT FOR PAYMENT**

- .1 Rock Bolts: 1.5 metre long rock bolts will be measured by the unit installed as specified. Price shall include all rock bolts, mechanical anchors, drilling, grouting, and successful tensioning and testing of rock bolts.
- .2 Beam Installation: No separate measurement for payment shall be made for this, include all work associated with this on the Lump Sum portion of the Bid and Acceptance form. Include incidental to this any rock removal from the walls if required to install the beams plumb and bottom anchors.

### **1.4 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM)
  - .1 ASTM A 53/A53M-latest edition, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  - .2 ASTM A 269-latest edition, Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
  - .3 ASTM A307-latest edition, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.181-latest edition, Ready-Mixed, Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-G40.20/G40.21-latest edition, General Requirements for Rolled or Welded Structural Quality Steel.
  - .2 CAN/CSA-G164-latest edition, Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3 CAN/CSA-S16.1-latest edition, Limit States Design of Steel Structures.

- .4 CSA W48-latest edition, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
- .5 CSA W59-latest edition, Welded Steel Construction (Metal Arc Welding).

## **1.5 CODES**

- .1 Perform work in accordance with all applicable federal, provincial, and municipal regulations provided that in any case of conflict or discrepancy the more stringent requirements apply.
- .2 Meet or exceed requirements of:
  - .1 contract documents
  - .2 specified standards, codes, and referenced documents.

## **1.6 SUBMITTALS**

- .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit to Engineer following samples at least 1 week prior to beginning work.
  - .1 Manufacturers information on rock bolts showing sizes of bolts and all accessories.
- .3 Submit to Engineer copies of mill test data and certificate, at least 1 week prior to start of work and in accordance with Section 01 33 00 – Submittal Procedures.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- .1 During delivery and storage, protect all materials from damage.

## **1.8 WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

## **PART 2 - PRODUCTS**

### **2.1 ROCK BOLTS AND ACCESSORIES**

- .1 Rock bolts shall be galvanized deformed bar suitable for mechanical anchorage to bedrock and for tensioning by means of hexagonal nuts.

- .2 The deformed steel bars shall be minimum 25mm diameter, Grade 400 MPa with an ultimate tensile strength of 242kN and minimum yield strength of 156kN. Installed length of rock bolts shall be 1.2m
- .3 Each rock bolt and hardware shall be galvanized and have:
  - .1 a 200mm x 200mm x 8mm galvanized single key bearing plate
  - .2 galvanized, beveled hardened steel washers (minimum 2 per bolt);
  - .3 galvanized hexagonal nuts, 3-4 required per bolt;
  - .4 a mechanical anchor.
  - .5 shall have minimum of 300 mm threaded end.
- .4 The steel for nuts and washers, shall conform to ASTM A563 and for bearing plates CSA G40.21, Grade 33 G or equivalent.
- .5 Galvanizing shall conform to CSA G164.

## 2.2 **MECHANICAL ANCHOR**

- .1 Rock bolts shall utilize mechanical expansion shell anchor system and shall be set using manufactures spin adaptors using a ¾ inch drill minimum or larger as specified by supplier.
- .2 Mechanical anchors shall be installed in accordance to the manufactures specifications and recommendations and approval by the Engineer.
- .3 The free length of the bolt shall be fully grouted as specified after tensioning and lock-off.
- .4 Substitution of any material or process described in this section must be approved by the Engineer.
- .5 Acceptable products;
  - .1 National Concrete Accessories, SDR-25
  - .2 Williams Spin-Lock, R1J08B14
- .6 Bottom anchors shall be a KWIK bolt type, 316ss, 25 mm dia. x 225 mm long c/w 316ss nuts & washers.

## 2.3 **GROUT**

- .1 Grout shall be as per rock bolt manufactures recommendations for under water/wet locations. The expansive type cement grout or dispersion Stabilized cement type grout mixture shall have minimum 28 day strength of 51 MPa.

- .2 All grout products must be approved by the Engineer before utilization.
- .3 Grout testing will be completed by the Engineer.

### **PART 3 - EXECUTION**

#### **3.1 GENERAL**

- .1 The existing shaft wall is very irregular and is wrapped with two layers of galvanized wire mesh, held in place with (3.0 m long by 25 mm dia.) rock bolts to prevent any loose rock from falling off. Contractor shall be required to chip off any protruding rock points in order to install the beams plumb and permit collar clearance past lower platform.

#### **3.2 NOTIFICATION**

- .1 Contractors shall advise Engineer of work schedule, time on site, etc., so other people in the area who may be affected by the work, such as NWAFC personnel, can be given a minimum of 48 hours notice of the work to be carried out.

#### **3.3 ROCK SCALING**

- .1 Scaling consists of the removal of loose and unstable rock fragments and protruding rock points that will interfere with beam installation, by equipment and methods approved by Engineer from exposed bedrock surfaces as directed by Engineer. All scaled/chipped rock shall be removed from the shaft and deposited at an approved location off site.
- .2 Comply with all safety requirements during the scaling operation.

#### **3.4 INSTALLATION OF ROCK BOLTS – GENERAL**

- .1 Procedures and equipment used for drilling holes in rock, preparing, installing, grouting, and tensioning rock bolts to be in accordance with the manufacturer's recommendations, as specified herein and as approved by Engineer.
- .2 Provide appropriate equipment for drilling, installation, and testing of rock bolts on the vertical wall surfaces.
- .3 Adequately supports all equipment by cable or other means to ensure the safety of the workmen/divers in the performance of the work during the drilling,

installation, and testing of the rock bolts.

- .4 Do not commence rock bolting operation in any area of the rock face until completion of the rock scaling/chipping.
- .5 Prepare rock surface or provide grout pad on rock surface at bolt position to provide even bearing surface for face plate.
- .6 Rock bolts shall be installed using a rotary drill or other similar equipment capable of completing the work as specified.
- .7 Holes for rock bolts shall be of size recommended by the bolt manufacturer to accommodate the diameter of the mechanical anchor. Drill to depths and orientations as directed by the Engineer. Holes shall be flushed to remove all drill cuttings, sludge and debris prior to installation of rock bolts.
- .8 Depth of hole shall be no more than 100mm deeper than the length of rock bolt to be installed.
- .9 End anchors of the rock bolts shall be by mechanical anchorage using expansion shells.
- .10 The Contractor shall conduct rock bolt pull testing in accordance with the International Society for Rock Mechanics (ISRM) standard methods to check the anchor capacity of installed rock bolts as selected by the Engineer. A minimum of 15% of the installed rock bolts shall be tested.

### **3.5 SS BEAMS**

- .1 Beams shall be installed to closely follow the profile of the scaled rock surface as shown on the drawing, true and plumb as possible.
- .2 Due to the length of the beams, contractor shall allow for the removal and reinstatement of the pump house concrete hatch approx. size (3800x2800x200), hatch cover assemblies and/or possibly one of the vertical turbine pumps in order to get the beams into the shaft.