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PART 1 - GENERAL1.1 RELATED SECTIONS

- .1 Section 31 32 19.01 – Geotextiles
- .2 Section 01 74 11 – Cleaning

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C 117-95, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C 127-88(2001), Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
  - .3 ASTM C 535-96e1, Standard Test Method for Resistance to Degradation of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - .4 ASTM C 136-01, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

PART 2 - PRODUCTS2.1 STONES

- .1 Underlayer stone and armor stone:
  - .1 Hard, durable, abrasion-resistant material which will not disintegrate under wave action or wet-dry, freeze-thaw cycles; to Department's Designated Representative's approval.
  - .2 Angular in shape with ratio of maximum to minimum dimensions not exceeding 3, free of weak cleavage planes, hairline cracks or laminations.
  - .3 Relative density (formerly specific gravity): to ASTM C 127, not less than 2.60.
  - .4 Absorption: to ASTM C 127, maximum of 2.0%.
  - .5 Degradation test according to Department of Transportation Standard Specifications.

- .6 Gradation: according to standard ASTM C 136 and opening dimensions of sieves in compliance with CAN/CGSB-8.2. Dimensions of stones forming the underlayer, the armour or other protection shall comply with following criteria.
  - .1 Armour stones 3-5 tons: stone sizes vary uniformly from 3 to 5 tons.

2.2 SOURCE QUALITY CONTROL

- .1 Inform Department's Designated Representative of proposed sources of rock and provide access for sampling at least 4 weeks prior to commencing quarrying of rock.

PART 3 - EXECUTION

3.1 GRADING

- .1 Grade bank slope to lines and grades as indicated.
- .2 Recover the existing embankment stones that went down and that are located beyond the proposed toe slope. Reuse stones to complete existing layer (1-3 tons approximately) according to alignment and desired profile.
- .3 In areas where it is necessary to remove completely stones that are currently on the surface and where the underlying core consequently becomes exposed, over-excavated of at least 1.0m, put in place at least 2 rows of recovered stones of the existing armor layer in order to form a filter layer before putting in place the new armor stones of 3-5 tons.
- .4 Excavated material to be used as fill requires approval before placing.
  - .1 Remove from site, material rejected for fill or surplus to fill requirements.

3.2 UNDERLAYER STONE

- .1 The current armor stone layer will become an underlayer after the re-grading operation, since it will then be covered by a new armor layer of 3-5 tons stones. Do not disturb existing surface when placing underlayer stone.
- .2 Do not end dump unless approved by Department's Designated Representative.

3.3 ARMOUR STONE

- .1 Place armor stone on completed underlayer stone layers of slope. Placing to be arranged to thickness as indicated.
- .2 Set each stone individually. Do not end dump stone. Begin placement at toe of slope and proceed up slope in placing each layer. Place each stone to ensure stability, secure on slope and supported by stone below.

Control placement of armor stones to produce uniform and continuous cover of overlapping units.

3.4 PROTECTION

- .1 Do not leave each phase of Work exposed for an undue period of time, during protection construction.
- .2 Department's Designated Representative may order excavation to be stopped or may order placing of final protective stone layers to be accelerated, depending on anticipated weather conditions.

3.5 CLEANING

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.

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PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Section 01 33 00 – Submittal Procedures.
- 1.2 REFERENCES .1 American Society for Testing and Materials International (ASTM)
- .1 ASTM A 27/A 27M-95, Standard Specification for Steel Castings, Carbon, for General Application.
  - .2 ASTM A 48/A 148M-01, Standard Specification for Steel Castings, High-Strength, for Structural Purposes.
- .2 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-1.61-2004, Exterior and Interior Marine Alkyd Enamel.
- .3 Canadian Standards Association (CSA International)
- .1 CSA G40.20/G40.21-2004, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .4 Master Painters Institute (MPI)
- .1 Architectural Painting Specification Manual-February 2004.
- 1.3 SUBMITTALS .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings, indicating following items:
- .1 Details of bollards, including their dimension and the proper way to install them on structures.
  - .2 Locations, size and installation tolerances of anchor bolts.
  - .3 Bollards' capacity.

PART 2 - PRODUCTS

- 2.1 MATERIALS .1 Metal parts: structural steel to CSA G40.20/G40.21.

- .2 Bollards: carbon steel casting.
  - .1 Type: 350.
  - .2 Maximum working pull: 50 tons (exterior part of wharf).
  - .3 Maximum working pull: 30 tons (interior part of wharf)
- .3 Paint:
  - .1 Shop prime coat: to CAN/CGSB-1.212.
  - .2 Two finish coats: to CAN/CGSB-1.61, color red.
- .4 Grout: shrinkage compensating non-metallic.

## 2.2 CONTROL AND INSPECTION

- .1 The Department's Designated Representative reserves the right to carry out destructive and nondestructive tests. The examinations will be made at the expense of the Department's Designated Representative, unless test results show non-compliance with the requirements of drawings and specifications. The Contractor shall provide the Department's Designated Representative the bollards fabrication schedule.
- .2 The Contractor shall provide the Department's Designated Representative the steelworks certificates for metals used, results of tensile and resilience tests performed on each pour in accordance with standard ASTM A781-M08 and all documentation necessary to additional tests at no cost to the Department's Designated Representative.
- .3 Visual inspection and inspection by magnetic particles: accessible surfaces to all bollards shall be inspected visually and by magnetic particles according to standard ASTM E709, latest edition. No abrupt change in section will be tolerated.
  - .1 The bollards surface shall be smooth, free of any adhering sand, slag, cracks or other adverse defects.
  - .2 The acceptance criteria for visual inspection by magnetic particle are those of standard ASME, section VIII, Division 1, Appendix 6, latest edition.
- .4 Radiography: if a visual inspection and/or magnetic particle inspection showed the presence of defects, the base plate and the neck of a bollard on three of the same model shall be checked by radiography, at the expense of the Contractor. For each bollard found defective by radiography testing, two other bollards will be X-rayed in the same way at the expense of the Contractor.

- .1 The X-rays shall be compared to standard ASTM E446 (Standard Reference Radiographs for Steel Castings up to 2 in. In Thickness), which refers to ASTM E186 (Standard Reference Radiographs for Heavy-Walled (2 to 4.5 in. Steel Casting)) depending on the thickness X-rayed. The maximum acceptable levels of severity are defined in Article 7-3 (Examination Requirements), Schedule 7 (Examination of Steel Castings) of ASME Section VIII, Division 1.
- .2 The acceptance criteria are those of ASME, Section 8, Division 1, Appendix 7, latest edition. For defects of type "Gas Porosity", "Sand and Slag" and "Shrinkage", a higher level (less severe) than the criteria of Appendix 7 of the ASME is tolerated.
- .5 If inspections reveal a defect, the defective part will be discarded or the Contractor will propose a repair method to the Department's Designated Representative. Repairs, if authorized and all other inspections of the defective part will be at the expense of the Contractor.

### PART 3 - EXECUTION

#### 3.1 SETTING AND GROUTING

- .1 Set mooring devices at locations and elevations as indicated.
  - .1 After tightening of anchor bolts or positioning wedges, grout under base.
  - .2 Ensure that temperatures of foundation, air, base and grout are within range specified by grout manufacturer.
  - .3 Do not grout until location of anchor bolts and bollards have been approved by the Department's Designated Representative.