PART 1 - GENERAL

1.1 Related Sections

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 35 00.06 - Special Procedures for Traffic Control.

.3 Section 01 74 21 - Construction/Demolition Waste Management.

.4 Section 31 32 19.01 - Geotextiles.

.5 Section 31 23 33.01 - Excavating, Trenching & Backfilling.

1.2 Measurement for Payment Procedures

.1 Mobilization, demobilization, site work, and removals will constitute a lump sum for measurement purposes.

.2 Salvage, sorting and reuse of existing fill, concrete and armour materials within the new service area and within the rebuilt breakwater limits will constitute a lump sum for measurement purposes. Estimated volumes of material to be salvaged is as follows:

- .1 Existing Armour/Filter material: 1500 m3
- .2 Existing Concrete Slab material: 150 m3
- .3 Existing Fill material: 150 m3

.3 Layout and survey control, including cross sections during placement, will constitute a lump sum for measurement purposes.

.4 The excavation (to 1 m below existing bottom) and toe-in of the filter and armourstone at the head of the rebuilt breakwater will be incidental to the work.

.5 All lump sum and all unit price items shall include all materials, labour, equipment and all other items necessary to complete the work.

.6 Weight receipts from a certified and calibrated scale, provided by the Contractor, are required for each load of Type 2, 3, 4 and gravel materials delivered to the site. The weight receipts are to be in triplicate,

one copy for the Contractor, one for the quarry, and one for the Departmental Representative. Receipts from the quarry and the site are to be matched and/or reconciled prior to the Contractor submitting a progress claim.

.7 New Type 1 fill (Premium Borrow) will be measured in cubic meters (m3) truck measure of material incorporated into the work and accepted by the Departmental Representative. Tickets are to be provided for confirmation. Payment will include supply, handling, loading, trucking, placing, weighing, compacting and all related work.

.8 New Type 2 fill (Corestone) will be measured in tonnes (t) of material incorporated and accepted into the work. Payment will include supply, handling, loading, trucking, weighing, placing and all related work.

.9 New Type 3 fill (Filterstone) will be measured in tonnes (t) of material incorporated and accepted into the work. Payment will include supply, handling, loading, trucking, weighing, placing and all related work.

.10 New Type 4 fill (Armourstone) will be measured in tonnes (t) of material incorporated and accepted into the work. Payment will include supply, handling, loading, trucking, weighing, placing and all related work.

.11 New Surface Gravel will be measured in tonnes (t) of material incorporated and accepted into the work. Payment will include supply, handling, loading, trucking, weighing, placing and all related work.

.12 There will be no payment for any fill or rock materials, corestone, filterstone or armourstone that is washed out, removed, missing or deteriorated by weather or wave action. All are to be retrieved and reset in the work.

.13 Transportation of material to the site, installation and any related excavation and preparation of the site will not be measured for payment but will be considered incidental to the work.

.14 No payment will be made for material used to construct and/or maintain haul roads, causeways, fills or working roadways on top of filter and armour layers.

.15 Weighing, logging and provision of either truck tickets for the borrow or weigh scale receipts for the gravel, core, filter and armourstone will be incidental to the work.

.16 Making good to the satisfaction of the Departmental Representative, any damage to the existing structures will be considered incidental to the work.

.17 Do not mix different categories of material in the same truckload. Only one class of material will be weighed for payment at any given time. If rocks of markedly different sizes are present, Departmental Representative reserves the right to weigh and measure such rocks separately for payment. There will be no additional payment for weighing individual stone units which do not meet the category of material listed for the truckload.

.18 Supply of all traffic control devices and personnel shall not be measured for payment.

.19 Surveys, cross sections, and materials testing shall not be measured for payment.

1.3 References

.1 American Society for Testing and Materials (ASTM)
.1 ASTM C 136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
.2 ASTM C127-88(1993)e1 (or latest edition) Specific Gravity and Absorption of Coarse Aggregate
.3 AASHTO T85-88 (or latest edition) Specific Gravity and Absorption of Coarse Aggregate

.2 Refer to Section 31 23.33.01 for further requirements for the fill and rock materials.

1.4 Existing Conditions and Haul Roads

.1 It is important that Contractors intending to bid on work visit the site and ascertain what preparatory work will be required for the following:

.1 Condition of existing structures over which material must be hauled.

.2 Design, peparation, maintenance and removal of any temporary roadways, causeways and/or fills that may be required for the use of trucks, cranes, excavators, draglines, etc.

.3 The land surrounding the site is the property of Her Majesty the Queen in the Right of Canada and the Contractor will exercise extreme care to prevent damage to the land.

.4 Contractor shall be solely responsible for the design, construction, stability, and maintenance of haul roads which shall be considered incidental to the work. All temporary roads shall be removed at the completion of the project and the land restored to its original condition.

.2 Refer to the requirements of Section 01 10 10 Clause 1.2 Familiarization with Site prior to site visit.

1.5 Submittals

.1 Samples
.1 The Contractor's Materials Engineer shall test samples in accordance with specifications.
.2 Inform Departmental Representative of proposed source of materials and submit 3 test results of quarry for each fill type supplied by the Contractor, minimum 2 weeks prior to beginning work.
.3 Final acceptance of materials shall be by the Departmental Representative.

1.6 Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management.

.2 Separate and dispose of existing breakwater materials not suitable for re-use.

.3 Collect and separate for disposal paper, plastic polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

PART 2 - PRODUCTS

2.1 Materials

.1 Rock Materials:
.1 All rock materials to be tested and approved by the Departmental Representative prior to installation in the work.
.2 All rock materials to be free from cracks, seams and other defects which may impair durability.

.3 Actual specific gravity and absorption will be determined by testing selected samples of material being incorporated into the work. Materials with a specific gravity less than the specified minimum or an absorption rate in excess of the specified maximum will be rejected.

.2 Type 1 Fill (Premium Borrow) Supplied and Placed by Contractor:

.1 To be non-plastic, well graded, and composed of clean, uncoated particles free from lumps of clay or other deleterious material with a maximum particle size of 100mm, and a maximum of 20% of the material passing the 4.75mm sieve shall pass the 75 um sieve.

.2 To meet above specifications and shall also be required to be accepted by the Departmental Representative and the Departmental Representative's materials testing firm.

.3 Free from cracks, seams and other defects which may impair durability. Slate and shale not acceptable.

.3 Type 2 Fill (Corestone .1 to 400 kg) Supplied and Placed by Contractor:

.1 To be pit run or quarried material rough and angular in shape requiring approval by the Departmental Representative prior to being used in the work.

.2 Material not to contain organic matter, frozen lumps, sod, roots, logs, stumps or any other objectionable matter.

.3 Sandstone, slate and shale not acceptable for Type 2 fill.

.4 Corestone gradation shall be within the following limits.

Metric Size	% Passing by mass
650 mm	100
200 mm	45 -70
100 mm	25 -40
50 mm	0

.5 Material to be screened, if required to ensure no more than 1 to 3% fines or stones less than 0.1 kilograms are placed in the work.

.6 Material to be blended so that a homogeneous mix of smaller and larger sizes within the approved range is attained.

.7 Thickness of Corestone Layer: as shown on drawings.

.4 Type 3 Fill (Filterstone 200 to 800kg), Supplied and Placed by the Contractor:

.1 Filterstone shall be quarried or field stone, rough and angular in shape.
.2 Greatest dimension of each stone not to exceed two times least dimension.
.3 Filterstone shall vary in size between 200 kg and 800 kg where shown on the drawings.
.4 Specific gravity not less than 2.65 when tested to ASTM C127.
.5 Absorption not more than 2% when tested to ASTM C127.
.6 Sandstone, slate, siltstone, shale, conglomerate and mudstone are not acceptable for Type 3 fill.
.7 Thickness of Filterstone Layer: as shown on drawings.

.5 Type 4 Fill (Armourstone 2 to 4 tonne), Supplied and Placed by the Contractor:
.1 Armourstone to be quarried or field stone, rough and angular in shape.
.2 Greatest dimension of each stone not to exceed two times least dimension.
.3 Armourstone shall vary in size between 2 and 4 tonnes as shown on the plans. (Material utilized as existing shore protection may vary.)
.4 Specific gravity not less than 2.65 when tested to ASTM C127.
.5 Absorption not more than 2% when tested to ASTM C127.
.6 Sandstone, slate, siltstone, shale, conglomerate and mudstone are not acceptable for Type 4 fill.
.7 Thickness of Armoustone Layer: as shown on drawings.

.6 Surface Gravel, Supplied and Placed by Contractor:
.1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.
.2 Crushed, pit run or screened stone, gravel.
.3 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
.4 Table:

Sieve Designation	% Passing
	Surface Gravel
75 mm	-
50 mm	-

37.5 mm	-
25 mm	100
19 mm	75-100
12.5 mm	-
9.5 mm	50-100
4.75 mm	30-70
2.00 mm	20-45
0.425 mm	10-25
0.180 mm	-
0.075 mm	3-8

.5 Surface Gravel shall meet above specifications and shall also be required to be accepted by the Departmental Representative and the Departmental Representative's materials testing firm.

.7 Geotextiles: in accordance with Section 31 32 19.01 - Geotextiles.

PART 3 - EXECUTION

3.1 Removals, Salvage and Installation

.1 Remove and relocate existing rock, fill and concrete material as indicated on the drawing.

.2 Sort salvaged rock material and incorporate uniformly into new armour and filter work.

.3 Place salvaged fill and concrete materials in locations as indicated on the Drawings and in keeping with Section 31 23 33.01.

3.2 Type 1 Fill

.1 Refer to Section 31 23 33.01 - Excavation, Trenching and Backfilling.

3.3 Type 2 Fill (Corestone)

.1 Place corestone rock to lines, grades and dimensions indicated on the drawings. Contractor should realize the large distance (from shore)required to place the rock fill core into tidal water, supply necessary equipment to complete safely and efficiently as shown on Drawings.

.2 Side slopes to be as shown on drawings.

.3 Place material on harbour bottom to specified grades, and after the removal of kelp, debris, snow, ice, etc.

.4 Sequence construction operations in such a manner to protect core material from storm wave action or tidal erosion damage. Replacement of material lost due to storm or erosion damage will be the cost and responsibility of the Contractor.

.5 Do not extend corestone material for breakwater more than 10 meters beyond filterstone protection.

.6 Corestone material may be placed by end dumping. However, Contractor shall note that due to the side slopes of the breakwater that mechanical placing of the core may also be necessary to produce the slopes and shapes required.

.7 Grades, lines, dimensions, slope and quantity of core, to be reviewed and approved by the Departmental Representative before proceeding with overlaying filter layer. Surveyed sections are required.

3.4 Type 3 Fill (Filterstone)

.1 Place filterstone layers to grades, dimensions, profiles and cross sectional elements indicated on the drawings. Contractor should realize the large distance (from shore) required to place the filterstone out into tidal water, supply necessary equipment to complete as shown on drawings.

.2 Place filterstone material on harbour bottom to specified grades, and after the removal of kelp, debris, snow, ice, etc.

.3 Side slopes to be as shown on drawings.

.4 Do not extend filter material for breakwater more than 10 meters beyond armourstone protection.

.5 Place each filterstone individually using mechanical means to the lines, grades and dimensions shown on the plans. Do not dump filter units into place. Commence placement at toe of slope and proceed up the slope towards the crest. Place each filterstone so that it is stable, secure on slope and supported by units below. Control placement of filterstone so as to produce a uniform, interlocked, and continuous cover over the underlying corestone layer.

.6 Replace filterstone units broken or damaged during

placement. Damaged units to be removed from the work and will not be paid for.

.7 Grades, lines, dimensions, slopes, surveyed sections, and quantity of filterstone to be reviewed and approved by Departmental Representative before proceeding with the overlying armour layer.

.8 Filterstone is to be mechanically placed so as to knit together with adjacent stones.

3.5 Type 4 Fill (Armourstone)

.1 Place armourstone to lines, grades and dimensions indicated on the drawings. Contractor should realize the large distance (from shore) required to place the armourstone out into tidal water, supply necessary equipment to complete as shown on drawings.

.2 Place each armourstone individually using mechanical means to the lines, grades and dimensions shown on the plans. Do not dump armour units into place. Commence placement at toe of slope and proceed up the slope towards the crest elevation. Place each unit so that it is stable and secure on slope and supported by units below. Control placement of armour units so as to produce a uniform, interlocked, and continuous cover over the underlying filterstone layer.

.3 Place armourstone to a total layer thickness as indicated on the drawings.

.4 Place armourstone material on harbour bottom to specified grades, and after the removal of kelp, debris, snow, ice, etc.

.5 Grades, lines, dimensions, slopes, surveyed sections, and quantity of armourstone to be reviewed and approved by Departmental Representative.

.6 Side slopes to be as shown on drawings.

.7 Choose stones and place them in such a way that the whole structure will be bonded and consolidated to as great an extent as nature of rock will allow. Rocks should vary in size so they don't create steep slopes when placing to the grade lines as indicated on the drawings.

.8 Replace armourstone units broken or damaged during placement. Damaged units to be removed from the work and will not be paid for.

.9 Armourstone is to be mechanically placed so as to knit

together with adjacent stones.

3.6 Surface Gravel .1 Refer to Section 31 23 33.01 - Excavation, Trenching and Backfilling.

3.7 Toe Protection .1 Provide toe protection, as indicated on the Drawings, either by keying in the armour and filterstone layers (1 meter into existing bottom)at the head of the breakwater or by placing interlocking toe stones on existing bottom along the trunk of the breakwater.

,3.8 Tolerances .1 Completed component layers to be within following tolerances of lines and grades as indicated:

.1 Type 1 (borrow) Fill: plus or minus 50 mm.
.2 Type 2 (corestone) Fill: plus or minus 50 mm.
.3 Type 3 (filterstone) Fill: plus or minus 100 mm.
.4 Type 4 (armourstone) Fill: plus or minus 100 mm.
.5 Toe Protection: plus or minus 100 mm.
.6 Average specified thickness must be maintained throughout.

3.9 Cross Sections .1 During construction the Contractor shall submit cross-section sheets to the Departmental Representative showing the following:

.1 The as-built cross-section showing the slope and crest of each material layer in a solid line weights.

.2 An underlying sectional layer showing the design cross-section of the proposed core, filter, and armourstone in dashed line weights.

.3 Superimposed in dashed lines elevations taken at 2 meter intervals perpendicular to the centerline and at top and toe of slopes showing core, filter, and armourstone as constructed surfaces.

.4 Cross-sections to be referenced to the plan view of the breakwater with stations shown for reference.

.5 Cross-sections to be submitted as work at each station is completed for each class of stone. Next layer not to be placed until Departmental Representative or his representative has reviewed and approved the as-built elevations for underlying layer.

.6 After construction is complete and before the Final Certificate of Completion will be paid, Contractor to submit detailed as-built survey plan to Departmental Representative to show that contract grades and elevations have been achieved. Provide an electronic file of the cross sections and two sets of prints. Divers will be required to assist with survey for elevations required below chart datum. The following minimum requirements to be met:

.1 Elevations every 10 meters along the centerline of the breakwater and every 6 meters perpendicular to the centerline, on the end cone, and top and toe of slopes.

.2 All survey work to be in meters with elevations relative to chart datum (LNT) based on the NAD83 datum UTM Zone 20 projection.

3.10 Protection

.1 Take into account anticipated weather conditions and degree of exposure of the marine site and tidal conditions in setting requirements for protection.

.2 Schedule and carry out construction so that each phase of work is not left exposed longer than necessary.

.3 Consider the geotechnical reports available through the Departmental Representative of existing soil conditions.

.4 Progress of placement of core and stone to be recorded daily by the Contractor. If the Departmental Representative has an inspector on site concurrence is required at the end of each day. Replacement of material lost due to storm wave action or tidal erosion damage to be based on daily journal of work progress and to be considered incidental to the work.

3.11 Roadways

.1 Construction, maintenance and removal of working roadway layers as required to be the responsibility of the Contractor and is to be considered incidental to the work.

.2 Construction, maintenance and removal of causeways, fills, etc. as required, to be the responsibility of the Contractor and is to be considered incidental to the work.

3.12 Sequence

.1 Place all Type 2, 3 and the bulk of 4 fill materials prior to placing Type 1 fill (unless a different

procedure is approved by the Departmental Representative).

.2 Submit construction sequence for removal, reuse and placement of all materials (new and salvaged)to the Departmental Representative, for consideration, prior to commencing.

.3 Ensure that fill, corestone and filterstone are protected at the end of each day so that no material is dislodged or washed away.

.4 If materials are dislodged or washed away, the Contractor shall replace all materials at no cost.

3.13 Temporary Navigational Buoys

.1 The Contractor is to maintain temporary buoy's to mark the position of the outer end of the breakwater toe as construction proceeds. All buoys are to meet the requirements of Canadian Coast Guard Standard TP968 and be equipped with radar reflectors.

.2 The Contractor shall coordinate the buoy installation with the local harbour authority.

.3 The Contractor is responsible for all costs associated with the supply, installation and removal of all temporary navigational buoys.

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