Appendix 5

Doris North Project: No Net Loss Plan for the Roberts Bay Subsea Pipeline and Diffuser (Rescan, November 2013)

TMAC Resources Inc.

DORIS NORTH PROJECT
No Net Loss Plan for the Roberts Bay Subsea Pipeline and Diffuser

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DORIS NORTH PROJECT

NO NET LOSS PLAN FOR THE ROBERTS BAY SUBSEA PIPELINE AND DIFFUSER

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DORIS NORTH PROJECT

NO NET LOSS PLAN FOR THE ROBERTS BAY SUBSEA PIPELINE AND DIFFUSER

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1. Introduction

1. Introduction

TMAC Resources Ltd. (TMAC) is developing the Doris North Gold Mine in the West Kitikmeot Region of Nunavut, located approximately 125 km southwest of Cambridge Bay. It is on Inuit owned land, approximately 5 km south of Melville Sound. The nearest other communities are the hamlets of Omingmaktok, located 75 km to the southwest, and Bathurst Inlet, located 160 km to the southwest. The mine site is remotely located and is not linked by roads to neighbouring communities or facilities. The general location of the mine site is shown in Figure 1-1.

The mine was initially expected to be in operation for approximately two years, but accessing the Doris Central and Connector resources via the Doris North Portal will result in a 2 to 4 year expansion of the mine life (HBML 2011; TMAC 2013). The mine will consist of an underground mine as well as a crushing and milling plant. Ore will be processed using cyanide to recover the gold. Tailings from the ore processing will be treated to destroy residual cyanide and precipitate heavy metals. Following treatment, the tailings will be deposited underwater in the Tailings Impoundment Area (TIA; formerly Tail Lake) through a slurry pipeline from the process plant or underground. The TIA is located at 68°7′25.8″ north latitude and 106°33′31.2″ west longitude.

The permitted water management plan for the TIA involved the discharge of TIA water to Doris Creek. However, as part of the amendment request for the Doris North Type A Water Licence, it is proposed to discharge treated TIA water into Roberts Bay via a subsea pipeline and diffuser (TMAC 2013).

Section 35 of the *Fisheries* Act (1985) prohibits unauthorized harmful alteration, disruption or destruction (HADD) of fish habitat. Under this Act, fish habitat is defined as "spawning grounds and nursery, rearing, food supply, and migration areas on which fish depend directly or indirectly in order to carry out their life processes". In order to maintain the productive capacity of fish habitats under this Act, the Department of Fisheries and Oceans Canada (DFO) adopted a "No Net Loss" principle (DFO 1986).

To further this principle and guide decision making, DFO published a document entitled "Decision Framework for the Determination and Authorization of Harmful Alteration, Disruption or Destruction (HADD) of Fish Habitat" (DFO 1998), with respect to the *Fisheries Act* (Section 35). This publication outlines the decision processes for authorization of HADD. Within the initial application process, DFO determines whether the proposed project could result in HADD. If a HADD could occur as a result of the proposed activities, the next step is to assess whether the adverse effects could be fully mitigated. If the adverse effects can be fully mitigated, then a Letter of Advice specifying mitigation is issued; however, if the potential effects cannot be fully mitigated, then a decision will be made as to whether or not compensation is possible, and an Authorization for the HADD may be issued.

In 2012, amendments to the *Fisheries Act* were tabled (Bill C-38; the *Jobs, Growth, and Long-term Prosperity Act*), revised (Bill C-45), and received Royal Assent. These amendments included Section 35 and prohibit "serious harm" to fish that are part of a recreational, aboriginal or commercial fishery, or to fish that support such a fishery. Specifically, the Department interprets *serious harm* to fish as:

(i) the *death of fish*;

(ii) a *permanent alteration* to fish habitat of a spatial scale, duration or intensity that limits or diminishes the ability of fish to use such habitats as spawning grounds, or as nursery, rearing, or food supply areas, or as a migration corridor, or any other area in order to carry out one or more of their life processes; and

(iii) the *destruction of fish habitat* of a spatial scale, duration, or intensity that fish can no longer rely upon such habitats for use as spawning grounds, or as nursery, rearing, or food supply areas, or as a migration corridor, or any other area in order to carry out one or more of their life processes.

DFO is in the process of implementing these legislative changes, with the new fisheries protection provisions of the *Fisheries Act* coming into force on November 25, 2013. Specific guidance information on the implementation of these new amendments will be available only once the provisions are in force.

This presented No Net Loss Plan is for project-related activities regarding the installation of a subsea pipeline and diffuser in Roberts Bay.

The objectives of this No Net Loss Plan are to:

- provide DFO with the information it needs to determine if a *Fisheries Authorization* is required for this Project under Section 35 of the *Fisheries Act*; and
- propose a strategy for mitigation of fish habitat potentially affected by the construction of the subsea pipeline and diffuser in Roberts Bay (the Project).

Figure 1-1

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Doris North Project Location

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2. Project Description

2. Project Description

On June 19, 2008, Tail Lake was placed on Schedule 2 of the Metal Mining Effluent Regulations (Government of Canada 2011). The tailings are anticipated to be covered by a minimum 2 m-deep freshwater cap, but the depth and water quality of this cap will not be sufficient to support fish. A fish-out program removed almost all of the fish from the lake prior to its conversion to a TIA — any remaining fish will probably be killed by the conversion process.

The currently permitted water management plan for the TIA involves the discharge of TIA water to Doris Creek. However, as part of the amendment request for the Doris North Type A Water Licence, it is proposed to discharge treated TIA water into Roberts Bay via a subsea pipeline and diffuser (HBML 2011).

The proposed discharge system will follow existing corridors and pads from the TIA to the Roberts Bay jetty. In order to avoid disturbing sensitive shoreline fish habitat, the pipeline will be installed along the modified jetty in Roberts Bay, emerging at the toe of the jetty, on the northwest corner. The pipeline will entrenched for the first 110 m past the jetty, and then will daylight in Roberts Bay at the 6 m isobath. The pipeline will then continue along the bottom, held by concrete ballast weights at 8 m intervals, for approximately 2,290 m to the 40 m isobath (PND Engineers, Appendix 12). "Daylighting" of the pipeline at 6 m depth, well below low water, is required to protect it from ice damage and to provide sufficient clearance for vessels approaching the jetty.

Approximately 300 m north of the jetty is a rocky shoal. The shoal is less than 2 m deep and portions are emergent at low tide. At 2 m depth, ice will impact the subsea pipeline; therefore the pipeline route must be diverted to avoid this shoal. It is possible to impart a large radius bend to an HDPE pipe, so the pipeline will curve to the west to avoid the shoal (Figure 2-2).

The subsea pipeline will end in a 20 port diffuser at the 40 m isobath. The TIA discharge will be de-aerated in a head tank on shore in which bubbles can escape to the atmosphere through the liquid surface. This is necessary to avoid air escaping from the diffuser in the form of bubbles. Many species of marine fish show strong avoidance reactions to bubbles (Sharpe and Dill 1997), particularly smaller schooling species such as Pacific herring and capelin, both of which are common in Roberts Bay. Capelin use the nearshore areas of Roberts Bay as a spawning migration route and bubbles from the diffuser could interfere with their migration. De-aeration of the discharge will prevent bubbles from forming in the pipeline.

In summary, an un-insulated (bare) subsea pipeline will be installed in Roberts Bay to discharge the treated TIA water at depth through a diffuser. The outfall will run approximately 2.4 km NNW to the 40 m isobath where it will end in a 95 m long, 20 port diffuser. The subsea pipeline will be entrenched for the first 110 m and will daylight at the 6 m isobath. The remaining 2,290 m will be ballasted with concrete weights.

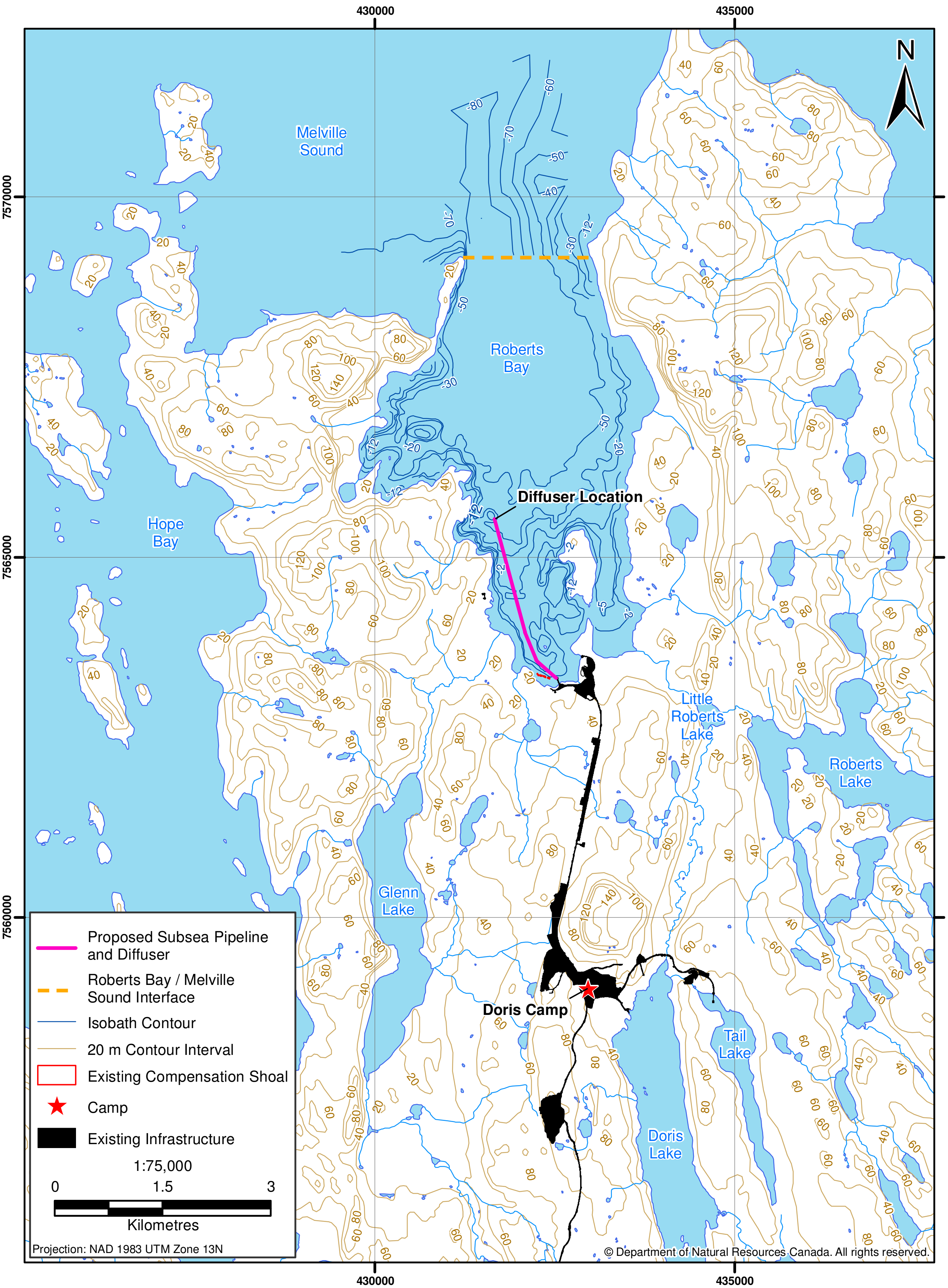

Figure 2-1

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Location of Proposed Subsea Pipeline and Diffuser

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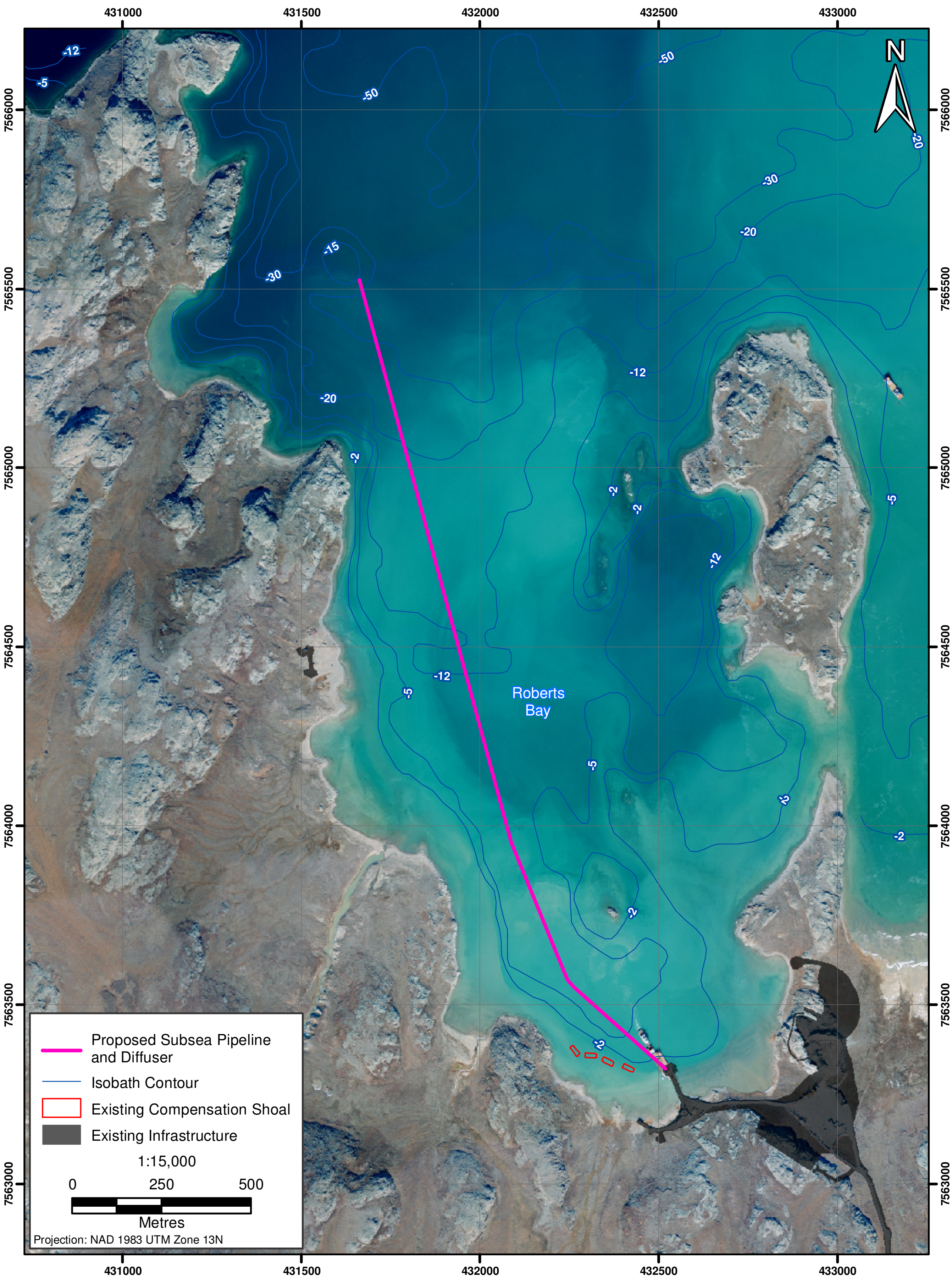

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Roberts Bay Bottom Topography and Proposed Subsea Pipeline Route

Figure 2-2

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3. Environmental Setting and Baseline

3. Environmental Setting and Baseline

Treated TIA water will be piped along the existing road route to the jetty at Roberts Bay. The route has been assessed for fish and fish habitat in the Doris North EIS (Miramar 2005) and in the No. 02 Type A Water License amendment (Rescan 2010a) and has been approved by DFO. There are several small streams and ponds along the airstrip and access road area. All water bodies in this area have been surveyed and found to be non-fish-bearing (Rescan 2010a).

The marine portion of the pipeline in Roberts Bay is new to this project and requires approval from DFO, based on both current and to be amended stipulations of the *Fisheries Act*. The marine portion of the pipeline is the subject of this No Net Loss Plan.

Roberts Bay is located along the southern shore of Melville Sound, Nunavut, positioned between Hope Bay, to the west, and Ida Bay (also known as Reference Bay), to the east (Figure 3-1). The mouth of Roberts Bay faces north, with a width of approximately 1.8 km and the bay extending 6 km southward. Two main freshwater inputs enter Roberts Bay: Little Roberts Outflow, which enters from the southeast and drains the Doris and Roberts watersheds, and Glenn Outflow, which enters from the southwest and drains the smaller Windy Watershed.

Roberts Bay is frozen for most of the year, with melt typically beginning in June, continuing into July, and re-freezing beginning in late October. In both summer and winter a pycnocline separates surface with a salinity of 20 to 26 ppt from deeper water with a salinity of 27 ppt. Water temperatures range from as low as -1.4°C during winter to > 10°C at the surface in the summer. Roberts Bay surface water and deep water is generally well oxygenated (Rescan 2011).

Roberts Bay is inhabited by at least 18 species of fish (Rescan 2011). Of those, five of the species do not typically reside year-round in the marine environment; they tend to use the marine environment to feed during the open-water period. These species include Arctic char (*Salvelinus alpinus*), lake trout (*Salvelinus namaycush*), cisco (*Coregonus artedi*), least cisco (*Coregonus sardinella*), and ninespine stickleback (*Pungitius pungitius*). Common resident marine species encountered include saffron cod (*Eleginus gracilis*), Greenland cod (*Gadus ogac*), fourhorn sculpin (*Triglopsis quadricornis*), capelin (*Mallotus villosus*), Arctic flounder (*Liopsetta glacialis*), shorthorn sculpin (*Myoxocephalus scorpius*), starry flounder (*Platichthys stellatus*), Pacific herring (*Clupea harengus pallasi*), rainbow smelt (*Osmerus mordax*), Arctic shanny (*Stichaeus punctatus*), banded gunnel (*Pholis fasciata*), and longhead dab (*Limanda proboscidea*). Other less common species include snailfish (*Liparis* sp.), sandlance (*Ammodytes* sp.) and poachers (family Agonidae).

The shoreline of Roberts Bay in the area of the pipeline route is classified as good quality fish habitat based on mapping of substrate (Rescan 2001, 2011). From the shoreline to a depth of approximately 2 m, the substrate is composed predominately of sand, with some gravel, cobble, boulder, and bedrock. In waters deeper than 2 m, the substrate rapidly transitions to fine clay and mud.

For most fish species, the potential use of Roberts Bay is for rearing and feeding in the nearshore environment. Habitats in Roberts Bay that provide food and good cover were rated as high quality; however, these were generally restricted to depths of less than 3 m. Capelin use Roberts Bay during spawning migrations. Large numbers of capelin migrate past the pipeline route in late July (Rescan 2011). Studies indicate that capelin do not spawn in Roberts Bay but migrate along the shoreline to spawning areas located elsewhere. None of the species known to occur in Roberts Bay are currently endangered or threatened (COSEWIC 2010).

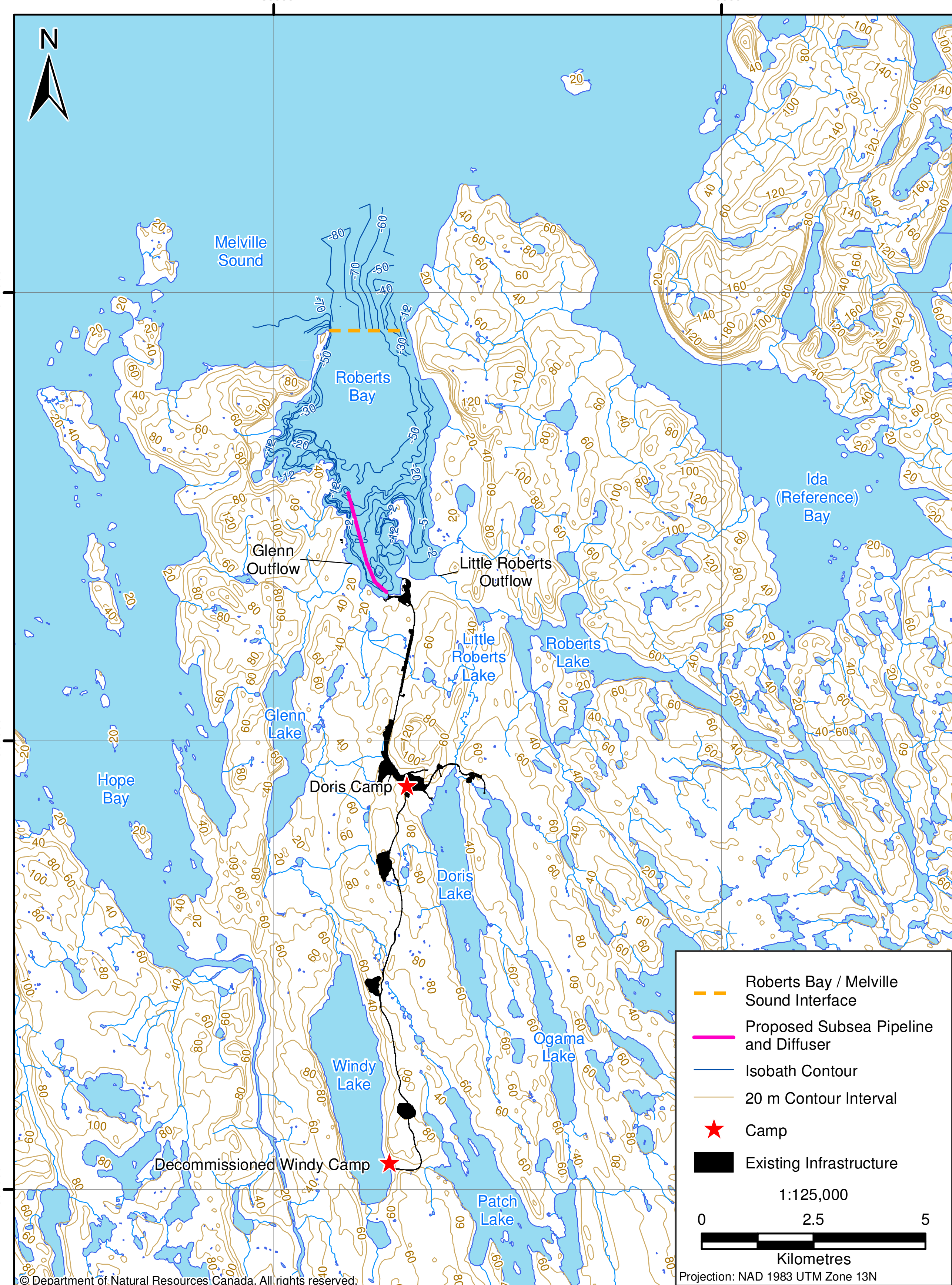

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Figure 3-1

Location of Roberts Bay and Adjacent Bays

The deeper substrates of Roberts Bay, along the subsea pipeline route to the 40 m isobath, are composed entirely of soft fines (clay and mud). These sediments provide habitat for infaunal invertebrates, which in turn provide a food source for fish. These deeper areas would be used by fish primarily for foraging, as there is little suitable shelter for rearing or predator avoidance.

4. Habitat Evaluation and Proposed Mitigative Measures

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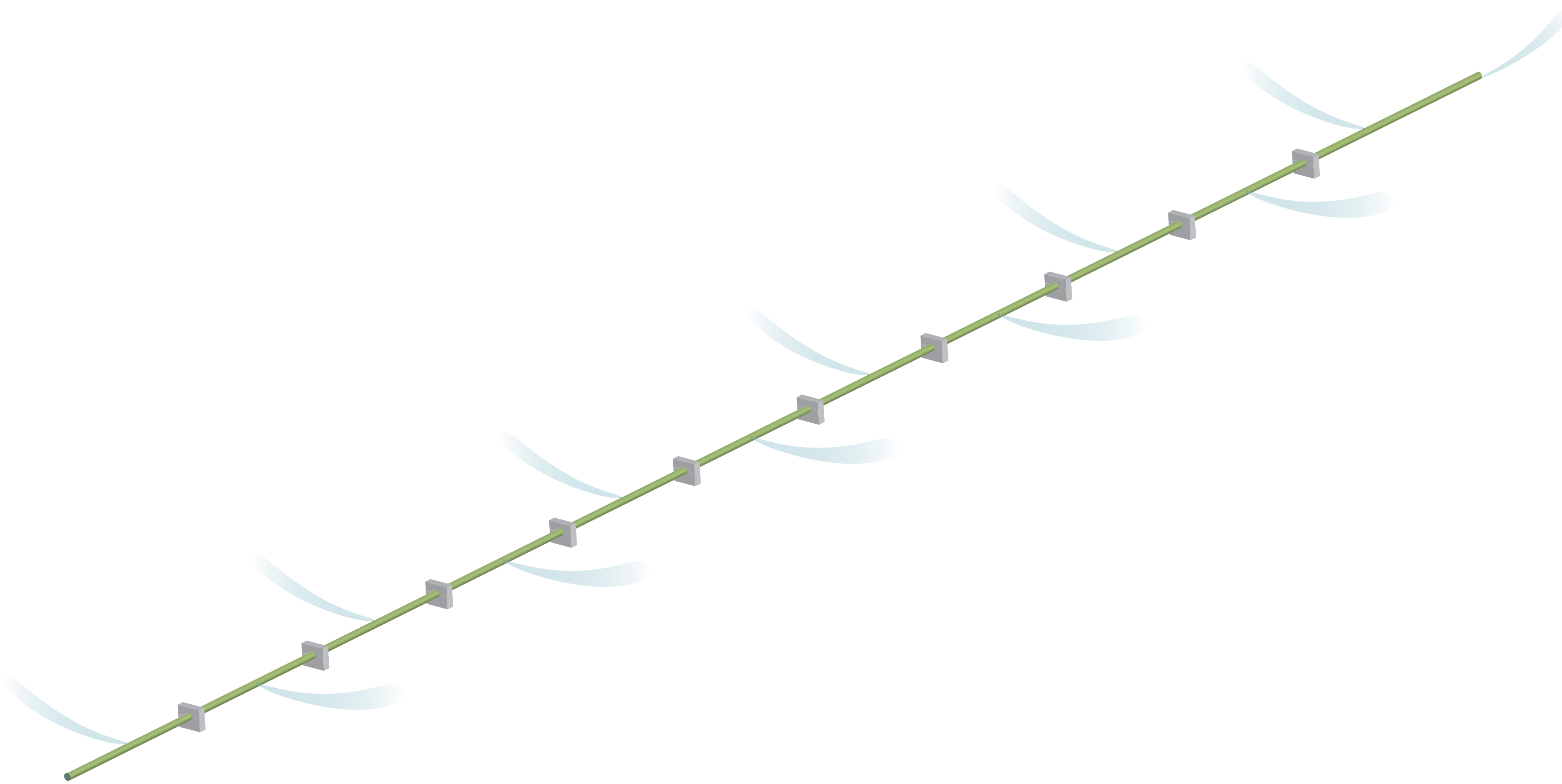
4.1 HABITAT EVALUATION

In many No Net Loss Plans (NNL), the Habitat Evaluation Procedure (HEP) is used to quantify loss of fish habitat. This procedure involves determining the areas of specific habitat types that are used by key species. These areas are then multiplied by a Habitat Suitability Index (HSI) for each of four life stages — spawning, nursery, rearing and foraging — to obtain a number of Habitat Units (HU, ha^2) for each zone and life stage. The HSI ranges from 0.00 for unsuitable habitat to 1.00 for excellent habitat. HSI are generally obtained from the literature or from specific studies of fish habitat utilization. This procedure was used in the original Doris North No Net Loss Plan to determine the amount of habitat lost by the creation of the Tail Lake TIA. However, for the subsea pipeline, no published HSI models exist for the marine fish species encountered in Roberts Bay and HEP therefore cannot be used. For the purposes of this NNL Plan, any habitat utilized by fish will be considered "suitable fish habitat". This approach was also taken in the Doris North No Net Loss Plan (Golder 2007) to obtain the Fisheries Authorization for the Roberts Bay jetty (DFO File No. NU-02-0117).

The nearshore areas of Roberts Bay provide habitat for at least 18 species of marine fish (Rescan 2011). These fishes utilize a variety of habitat types. Flatfishes inhabit sandy bottoms. Sculpins, gunnels and cods inhabit areas of hard substrate with vertical relief for shelter. Arctic char, lake trout and Pacific herring inhabit the mid-water column. Many studies of fish recruitment to artificial habitats indicate that concrete block structures are useful in creating fish habitat, particularly in sediment bottom areas where no other hard substrate exists (Sherman et al. 2002). Gadids (cods) and Cottids (sculpins) are particularly attracted to complex hard substrates (Tupper and Boutilier 1995). In Roberts Bay, this would include four of the most common marine fishes: Greenland cod (*Gadus ogac*), saffron cod (*Eleginus gracilis*), fourhorn sculpin (*Triglopsis quadricornis*) and shorthorn sculpin (*Myoxocephalus scorpius*) (Rescan 2011).

After exiting the northwestern corner of the jetty, the subsea pipeline will be entrenched in the seafloor for a distance of approximately 110 m from the toe of the jetty and will "daylight" at 6 m depth (below low water). The trench will be backfilled with quarry rock to the original seafloor depth. The total area affected by the trench will be 935 m^2 (Appendix A). After daylighting at the 6 m isobath, the subsea pipeline will run approximately 2,290 m NNW to the 40 m isobath where it will end in a 95 m long, 20 port diffuser (Figure 4.1-1). The pipeline will be ballasted with concrete weights that will stabilize the pipeline along the bottom of the seafloor.

Each ballast weight will have a footprint of 80 × 40 cm or 0.32 m^2 (Figure 4.1-2). The ballast weights will be spaced at approximately 8 m intervals for the total length of 2,290 m, requiring 286 ballast weight units. Thus the total footprint of the ballast weights will be 91.5 m^2 (Table 4.1-1). The total surface area (excluding the bottom surface) of each ballast weight will be 2.08 m^2. Thus the maximum total amount of new fish habitat created by the ballast weights will be 593 m^2, although some settling of the ballast weight into the soft sediments is expected. Ballast sizes could also increase by up to 20% affecting both impacted and proposed compensation habitat areas. In addition to increasing fish habitat complexity, the rough concrete surface of the ballast weights will form a settlement substrate for algae and sessile invertebrates, which may form a food source for small fishes and macroinvertebrates. This process of colonization has already been documented on the Roberts Bay jetty and compensation shoals (Rescan 2009, 2010b).



Not to scale

Figure 4.1-1

Concept Sketch of One Half of Diffuser Showing Discharge Plumes

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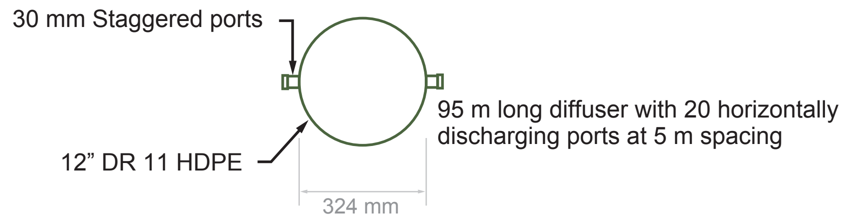
Diffuser



Counter Buoyancy Weight

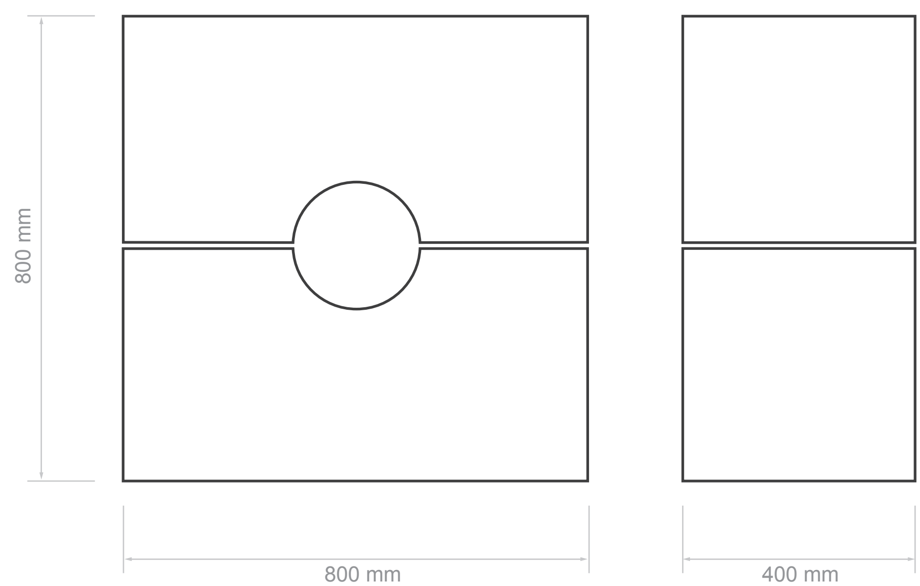


Table 4.1-1. Detailed Information of Impacted Habitat and Proposed Compensation

Habitat	Area (m^2)
Trench	935
Ballast Weight Footprint (each 0.32 m^2)	91.5 (110*)
Pipeline Footprint (exludes ballast weight footprint)	705
Total Impacted Habitat	1,731.5 (1,750)
Total Area Needed for Compensation (i.e., 2:1 lost habitat)	**3,463 (3,500)**
Compensation - Rocky Backfill of Trench	935
Ballast Weight Surface Area (286 fully exposed weights, no settlement)	593
Compensation - 3 Shoals each 696 m^2	2,088
Total Proposed Compensation	**3,616**

Notes:
Estimates are based on 286 exposed ballast weights sitting on the seafloor.
Ballast weight footprint is 0.4 × 0.8 = 0.32 m^2.
Diameter of pipeline is 0.324 m.
Ballast weight surface area (each 2.08 m^2) excludes area of pipeline passing through.
Compensation habitat shoal dimensions is 12 × 58 m.
**Ballast weight footprint could increase by 20%. Values in brackets refer to the ballast weight increasing in size by 20%.*

In addition to the ballast weights, the pipeline itself will likely be colonized by algae and sessile invertebrates. In creating new habitat, it is important to note that horizontal and vertical habitats may differ in relative quality among different species groups. For example, planktivorous fishes often prefer vertical structures, while piscivorous ambush predators prefer ledges or caves, and flatfish require relatively horizontal bottoms (Wilhelmsson et al. 2006).

The total area affected by the subsea pipeline will be 1,731.5 m^2 (935 m^2 for the outfall trench plus 91.5 m^2 for the ballast weights footprint plus 705 m^2 for the pipeline footprint; Table 4.1-1). A 20% increase in ballast size would slightly increase this value to 1,750 m^2. In keeping with the policy of NNL of productive capacity, habitat compensation is needed at a compensation ratio of 2:1 (i.e., two units of compensation habitat created for each unit of natural habitat lost). Thus, 3,463 m^2 of compensation habitat are required. This compensation will include 935 m^2 of the backfilled trench, 593 m^2 in the form of 286 specially designed concrete ballast weights, as described above, and 2,088 m^2 in the form of three constructed rock4-44-4 shoals (essentially artificial reefs), each covering 696 m^2.

The proposed location of the shoals is in the eastern portion of Roberts Bay (Figure 4.1-3; Appendix 12). This location was chosen on the basis of proximity to existing roads, and proximity to the outflow of Little Roberts Lake. The shoals may be useful foraging areas for Arctic char smolts descending the outflow of Little Roberts Lake, and upstream Roberts Lake, to feed over the summer in Roberts Bay. The shoals will be oriented roughly parallel to shore (Appendix 12). Each shoal will measure 58 m in length and 12 m in width and roughly 1 m in height after settlement into the seabed (Appendix 12). The shoals will be installed in approximately 3 to 4 m depth, so that the shoal tops are approximately 2 m below mean low water.

The compensation shoals will be created by placing rock at surveyed locations on the ice during winter. As the ice breaks up in spring, the rock will fall to the seafloor forming shoals with large surface to volume ratios and many crevices within which juvenile fish can seek cover. Because the proposed enhancement areas will be in areas where the seabed is gently sloping, the rock will remain in place after ice melt. Similar rock shoals have previously been approved by DFO as compensation habitat for other developments for the Doris North Project.

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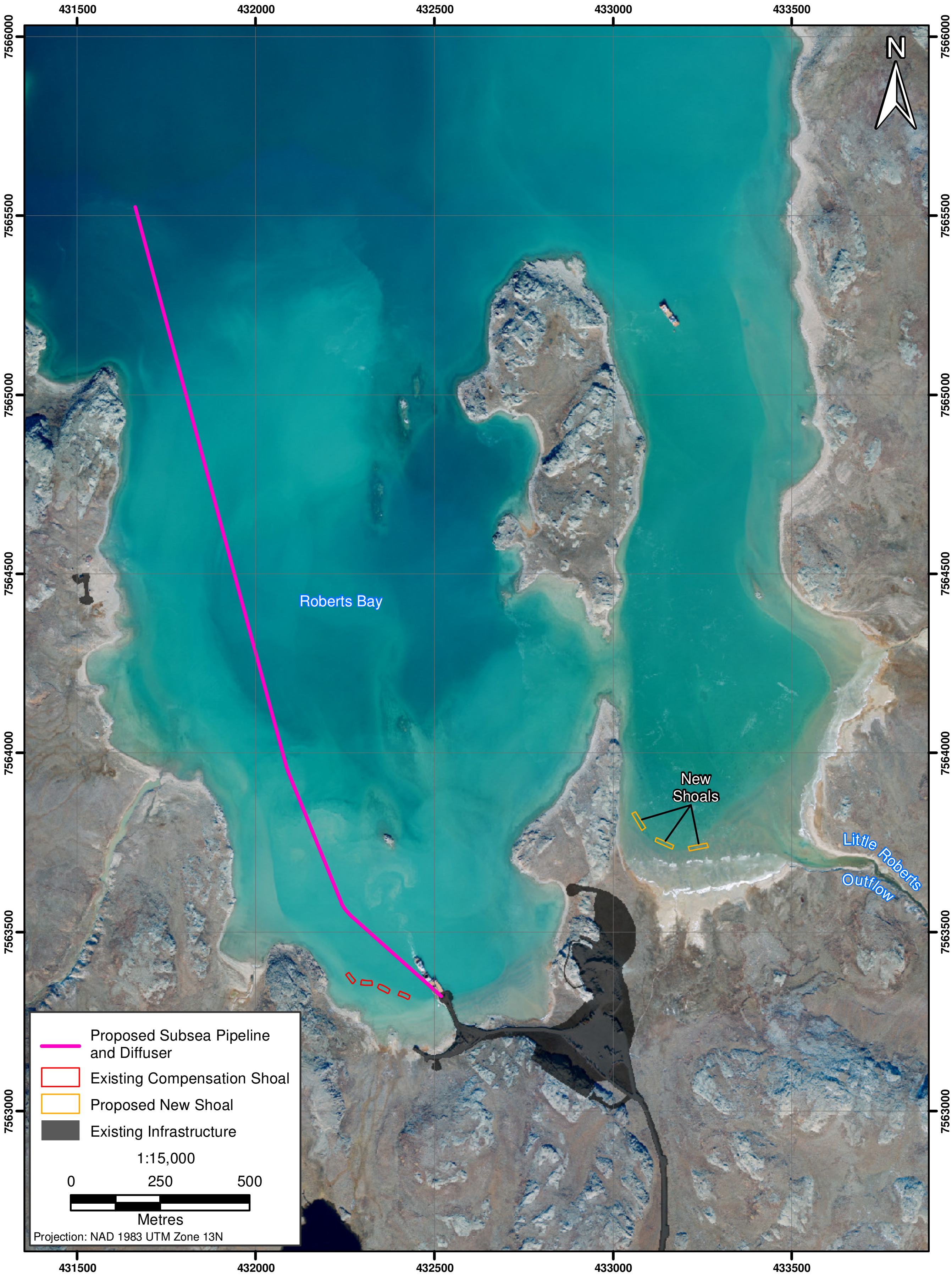

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Proposed Locations of Compensation Shoals in Roberts Bay

Figure 4.1-3

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To date, four shoals have been constructed in Roberts Bay, with another two previously authorized (NU-10-0028) as compensation related to anticipated jetty improvements, in addition to the six constructed shoals in Windy Lake.

Monitoring of the existing Roberts Bay shoals indicates that they have been successful in enhancing habitat productivity. Two years after deployment, the shoals appeared to be structurally stable and were colonized by periphyton, benthic invertebrates and fishes. In particular, recruitment of young-of-the-year fish indicated that the shoals may serve as nursery habitats for several species of fish (Rescan 2009; 2010b). Because the productive capacity of the proposed compensation habitats will likely be greater than that of the marine silt and clay bottom they will replace, the functional compensation ratio of this NNL Plan will probably be higher than the simple 2:1 increase in habitat area.

4.2 MITIGATION MEASURES

Starting at the landward end of the jetty, the pipeline will be entrenched within the jetty, and then entrenched within the seafloor for a further 110 m past the toe of the jetty. The pipeline will "daylight" at a depth of 6 m in Roberts Bay. This entrenchment of the pipeline within the jetty is necessary to prevent it from destruction by shoreline ice scour during the winter months and to protect sensitive shoreline habitats from damage caused by pipeline construction activities.

The construction of compensation shoals and the use of specialized concrete ballast weights to stabilize the subsea pipeline along the seafloor will increase habitat area and complexity and provide suitable habitat for benthic invertebrates and fishes, as discussed in Section 4.1. The compensation shoals will be constructed from run-of-quarry rock certified as having low acid generation potential and low metal leaching potential.

The timing of in-water activities will follow the guidance provided by DFO. The use of silt curtains enclosing the in-water construction area around the jetty, pipeline trench and compensation shoals will reduce suspended sediment to a level to meet the federal CCME (1999) water quality guidelines.

The treated TIA water will be de-aerated in a head tank on shore in which bubbles can escape to the atmosphere through the liquid surface. This is necessary to avoid air escaping from the diffuser in the form of bubbles. Many species of marine fish show strong avoidance reactions to bubbles and bubbles from the diffuser could interfere with their migration. De-aeration of the discharge will prevent bubbles from forming in the pipeline. Furthermore, by routing the pipe through the central portion of Roberts Bay, disturbance to foraging or migrating fishes will be minimized, as most fish species tend to prefer the more structurally complex nearshore habitats.

It is anticipated that the compensation shoals and concrete ballast weights will provide fish habitat that increases in quality over time as more food organisms colonize the shoals, ballast weights and possibly the pipeline. Hence, it is proposed to keep the subsea pipeline and concrete ballast weights in place upon mine closure, as would be done for the shoals. The final closure plan will be determined in discussions with DFO and other interested parties.

5. Monitoring

5. Monitoring

5.1 COMPENSATION SHOALS

The backfilled trench and compensation shoals will be monitored using the same protocols established for the initial four shoals located in Roberts Bay, which were constructed as compensation for the Roberts Bay Jetty under *Fisheries Act Authorization* NU-02-0117. The key measures of enhancement success will be the establishment of primary and secondary producers on the enhancement structures (i.e., which provide food sources for fish), as well as the documentation of the use of the structures as rearing and feeding habitat for fish. The follow-up study design will be a Control/Impact design identical to that described for the existing Roberts Bay compensation shoals in Rescan (2009) and Rescan (2010b).

For the study design, the constructed shoals would be classified as the impacted study area, and a control area has already been established in Ida Bay (also known as Reference Bay). The control area has been monitored since 2009 based on two conditions: 1) the site was a good representation of the habitat of the jetty and constructed shoals in Roberts Bay (i.e., similar substrate and depth), and 2) it would not be impacted by future mining activities.

The control and impact sites would be assessed for fish use twice during the open water season. The first assessment would take place in early summer, shortly after ice-out. The second assessment would take place in August, during the summer growing season. Each sampling period will identify different life-stages of the species that use the compensation and control habitat. From experience with the construction of the existing Roberts Bay shoals, a full year is required after placement on the ice to allow the shoals to settle and stabilize on the seafloor (Rescan 2009). Thus, monitoring will be conducted during the second, third and fifth years following installation.

Results from the backfilled trench and compensation shoal monitoring will be presented in a report that will include the methods, results and conclusions of the survey. A separate report will be prepared for each monitoring year. These reports will be provided to DFO within 6 months of completion of the surveys.

5.2 PIPELINE BALLAST WEIGHTS

In order to confirm the utility of the concrete ballast weights in providing fish habitat, a monitoring program will be established for the subsea pipeline. This program will involve underwater video assessment of the ballast weights at four depth strata: 6 m, 10 m, 15 m, and 20 m. Observers will use a Delta Vision SplashCam or similar underwater video system, lowered from a boat, to record the colonization of the ballast weights and pipeline by sessile marine organisms and to record the presence of fish associated with the ballast weights.

A total of two hours of video will be recorded at each depth stratum during August of the year following pipeline installation, and again three years following pipeline installation. Colonization of the pipeline and concrete ballasts in Roberts Bay will likely be too slow to warrant yearly monitoring. In each video recording, the percentage cover of encrusting organisms on the pipe and ballast weights will be estimated, and the number and species of macroinvertebrates and fish will be recorded.

Results from the ballast utilization monitoring will be presented in a report that will include the methods, results, and conclusions of the survey. A separate report will be prepared for each monitoring year. These reports will be provided to DFO within 6 months of completion of the surveys.

6. Summary

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6. Summary

The proposed new TIA water management plan involves discharging treated TIA water to Roberts Bay via a pipeline and diffuser. The overland portion of the system will follow existing corridors and pads. The marine portion will originate at the jetty and extend 2.4 km to the 40 m isobaths, consisting of a pipeline with both entrenched and exposed sections.

This No Net Loss Plan covers the subsea pipeline and diffuser in Roberts Bay. The objectives of this No Net Loss Plan are to: 1) provide DFO with the information it needs to determine if a *Fisheries Authorization* is required for this project under Section 35 of the *Fisheries Act*, and 2) propose a strategy for mitigation of fish habitat potentially affected by the construction of the subsea pipeline and diffuser in Roberts Bay.

An un-insulated (bare) subsea pipeline will be installed in Roberts Bay to discharge the treated TIA water at 40 m depth through a diffuser. In order to avoid disturbing sensitive shoreline fish habitat, the pipeline will be installed along the modified jetty in Roberts Bay, emerging at the toe of the jetty, where it will be entrenched for a further 110 m before daylighting at the 6 m isobath. Entrenchment of the pipeline is required to protect it from ice damage. Pipeline construction will follow the guidance provided by DFO.

After daylighting at 6 m, the pipe will be laid along the seafloor and ballasted by concrete weights. The weights will stabilize the pipeline in place, and it is expected that it will sit along the seafloor. A total of 593 m^2 of new habitat will be created by the concrete ballast weights (assuming fully exposed ballasts). In addition, three rock shoals (artificial reefs), each 696 m^2 in area, will be constructed in the eastern portion of Roberts Bay. It is anticipated that the pipeline itself will also be colonized by algae and sessile invertebrates. The colonization of the ballast weights and pipeline will be monitored by underwater videography.

The treated TIA water will be de-aerated in a head tank on shore in which bubbles can escape to the atmosphere through the liquid surface. This is necessary to avoid air escaping from the diffuser in the form of bubbles. Many species of marine fish show strong avoidance reactions to bubbles and bubbles from the diffuser could interfere with their migration. De-aeration of the discharge will prevent bubbles from forming in the pipeline.

The total area affected by the subsea pipeline will be 1,731.5 m^2 (935 m^2 for the outfall trench + 91.5 m^2 for the ballast weights footprint + 705 m^2 for the pipeline footprint), but could be as high as 1,750 m^2 if larger ballast weights are required. In keeping with the policy of No Net Loss of productive capacity, habitat compensation is needed at a compensation ratio of 2:1 (i.e., two units of compensation habitat created for each unit of natural habitat lost). Thus, 3,463 m^2 of compensation habitat are required. In addition to the trench being backfilled with coarser substrates (935 m^2), this compensation will include 593 m^2 in the form of 286 specially designed concrete ballast weights and 2,088 m^2 in the form of three constructed rock shoals (artificial reefs) in the eastern portion of Roberts Bay, each covering 696 m^2. Because the productive capacity of the proposed compensation habitats will likely be greater than that of the marine silt and clay bottom they will replace, the functional compensation ratio of this No Net Loss Plan is potentially higher than a simple 2:1 increase in habitat area.

For closure, it is recommended that the shoals, subsea pipeline and concrete ballast weights remain in place, as they will continue to provide fish habitat that increases in quality over time.

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