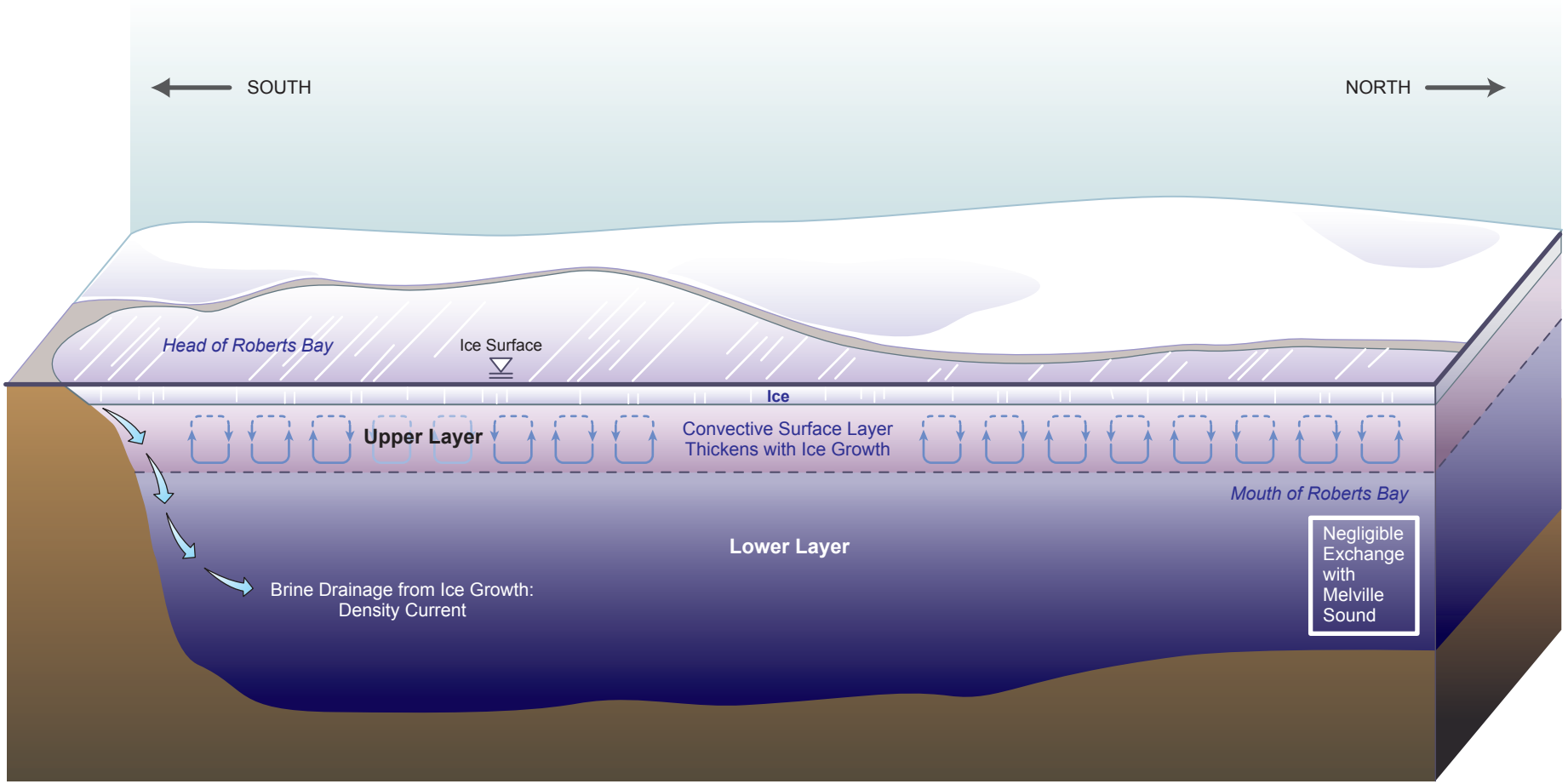
Figure 4.3-7

Example of Roberts Bay Circulation during the 2011 Winter: Vertical Side View



The presence or absence of a sill in a bay is important, as the presence of a sill can result in deep water remaining within a bay.

In order to determine if a sill was present at the mouth of Roberts Bay, a bathymetric field survey was conducted in April 2011. Results of the field survey indicated that no sill is present at the mouth of Roberts Bay, and that there is a channel approximately 80 m in depth that connects Roberts Bay to Melville Sound (Figure 4.3-8).

Numerous bathymetric surveys have been conducted in the nearshore areas of Roberts Bay over the years as part of baseline monitoring and fish habitat compensation monitoring (around the jetty and the compensation shoals). All site-specific bathymetric information is included in Figure 4.3-8.

4.3.5 Water Column Structure and Dissolved Oxygen

Water column structure and dissolved oxygen concentrations have been measured in Roberts Bay during the winters and summers of 2009, 2010, and 2011. Figure 4.3-9 shows the sampling locations along a north-south transect where these measurements have been collected. Because of inter-annual variability in wind strength, climate, and freshwater inputs, some natural variability in the water column structure of Roberts Bay is to be expected.

Figure 4.3-10 shows the water column temperature and salinity over a cross-section of Roberts Bay in April 2010 when the bay was ice covered. The winter water column structure in Roberts Bay consists of two distinct layers. In April 2010, the upper mixed layer depth was approximately 10 m, surface temperature was approximately -1.5^{o}C, and salinity ranged from 23.9 ppt at the nearshore site WT2 to 26.5 ppt at the more seaward sites. At depth, water temperature and salinity approached -0.5^{o}C and 27.3 ppt. Similar to April 2010, the pycnocline depth in April 2009 was at approximately 10 m depth; however, in April 2011, the pycnocline was considerably deeper at 30 m.

Figure 4.3-11 shows a cross-section of the temperature and salinity in Roberts Bay during the open water season in August 2010. The water column in Roberts Bay was strongly stratified, with a pycnocline at approximately 10 m. Surface temperature ranged from 10 to 13^{o}C and salinity ranged from 20 to 24 ppt. At 60 m depth, temperature and salinity approached -0.7^{o}C and 27.4 ppt. In August 2009, the depth of the pycnocline and the deep water conditions were similar to 2010; however, the upper layer was less well-mixed and less saline in August 2009 than in August 2010.

Figure 4.3-12 shows the April (ice covered) and August (open water) concentrations of dissolved oxygen at several sites in Roberts Bay from 2009 to 2011, which vary seasonally and yearly with the climactic conditions. In winter, dissolved oxygen concentrations generally decreased with depth, with the largest decline in dissolved oxygen occurring at the pycnocline. Deep water dissolved oxygen concentrations approached the Canadian Council of Ministers of the Environment (CCME) recommended minimum dissolved oxygen concentration for the protection of marine and estuarine aquatic life of 8.0 mg/L (CCME 2011) in April 2009, and dropped below 8.0 mg/L in April 2010 (reaching a minimum of 7.0 mg/L). In April 2011, dissolved oxygen concentrations throughout the water column were higher than in either April 2009 or April 2010, with 30 m deep mixed-layer observed and a minimum of 9.2 mg/L reached in the deepest waters profiled.

Figure 4.3-8
Roberts Bay Bathymetry

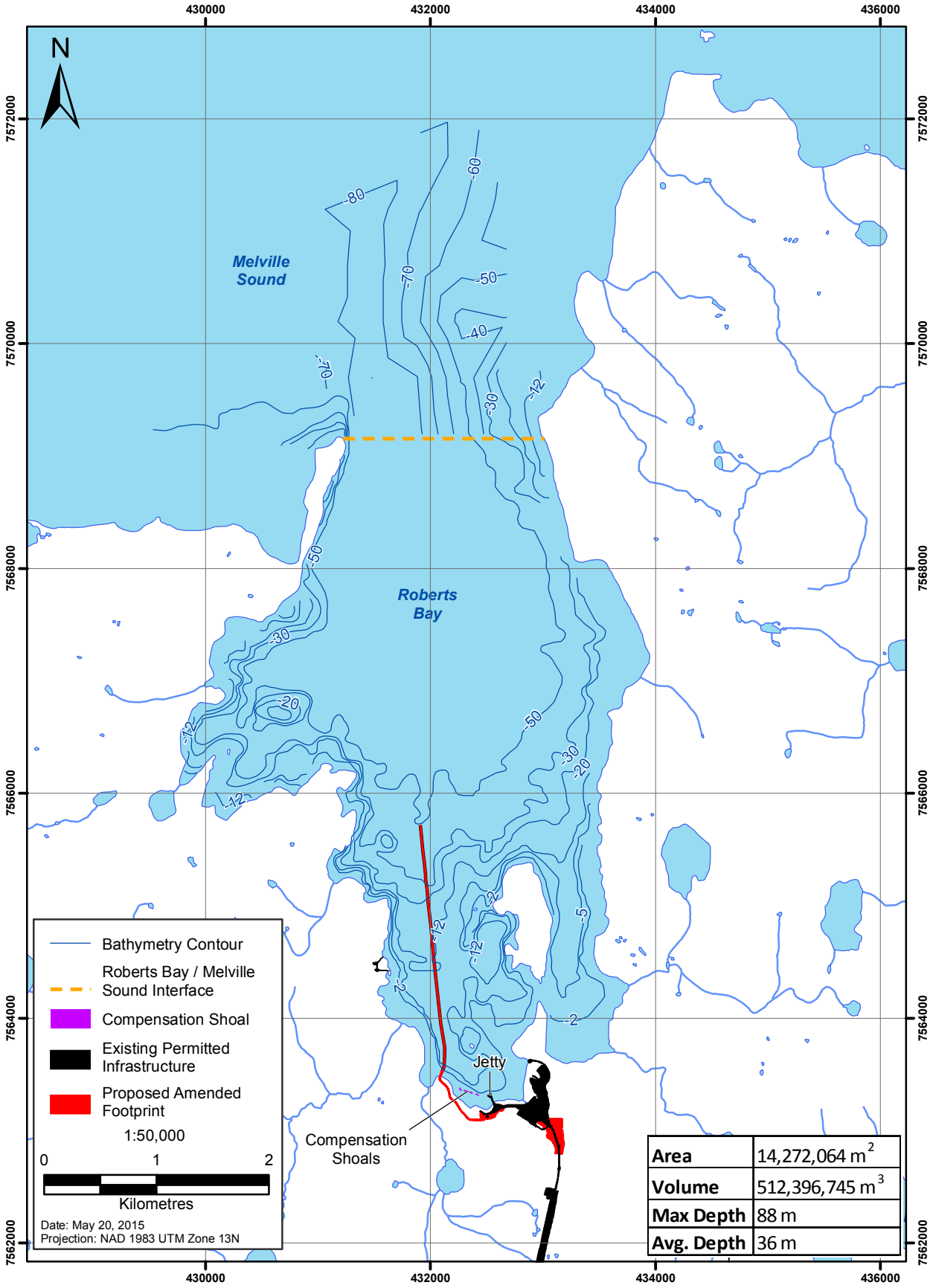


Figure 4.3-9

Roberts Bay CTD and Dissolved Oxygen Profile Stations, 2009-2011

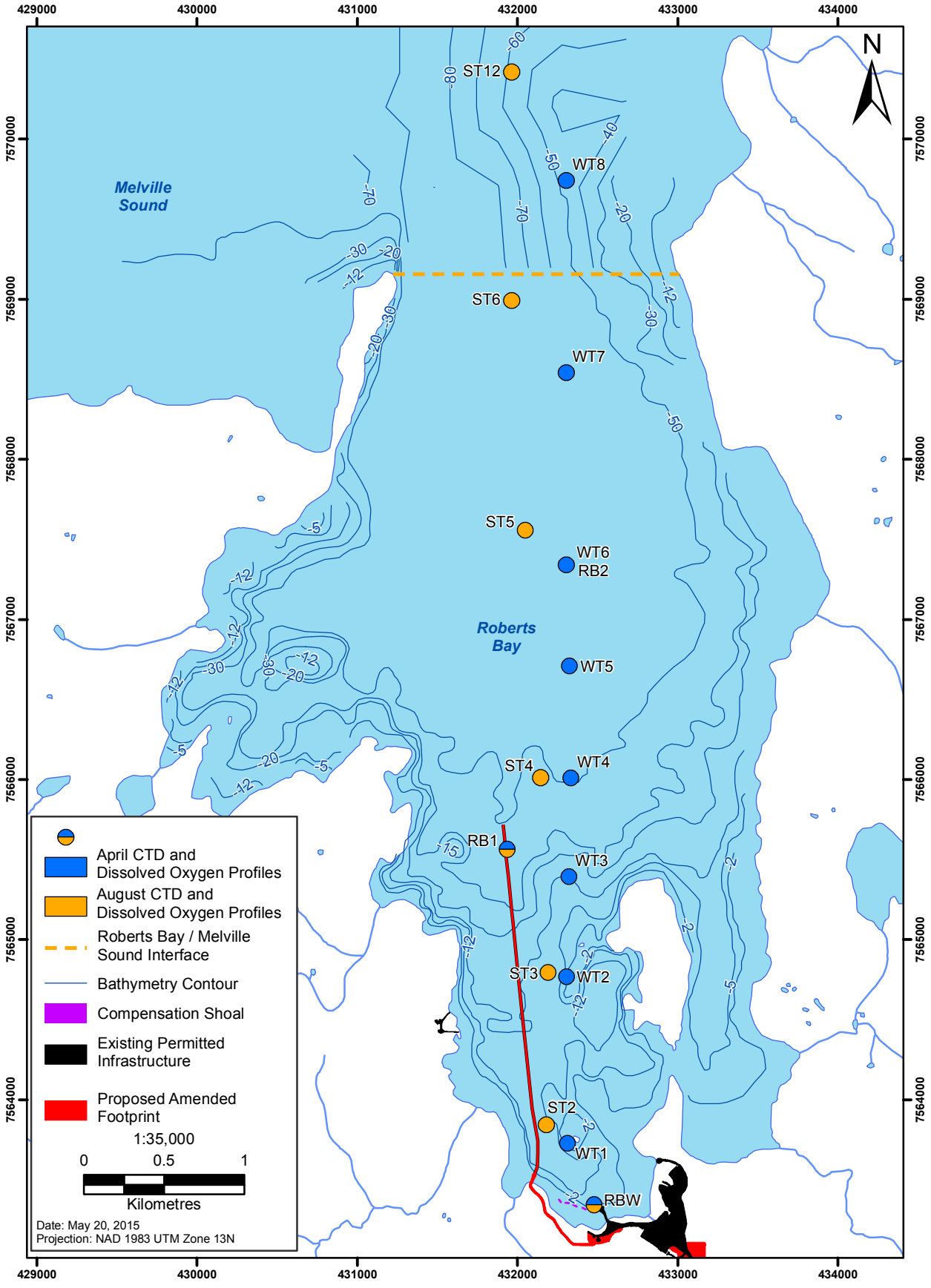
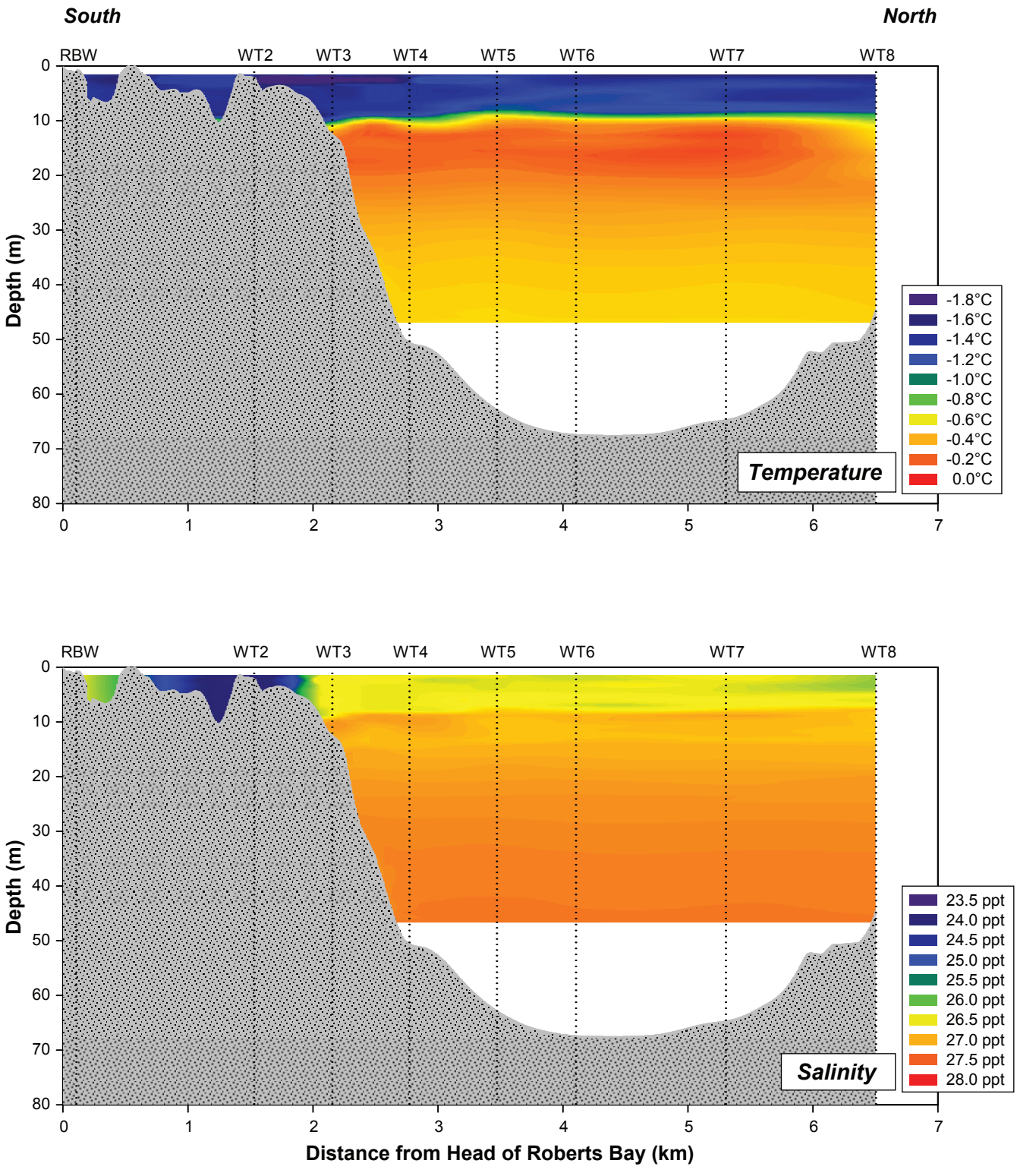


Figure 4.3-10

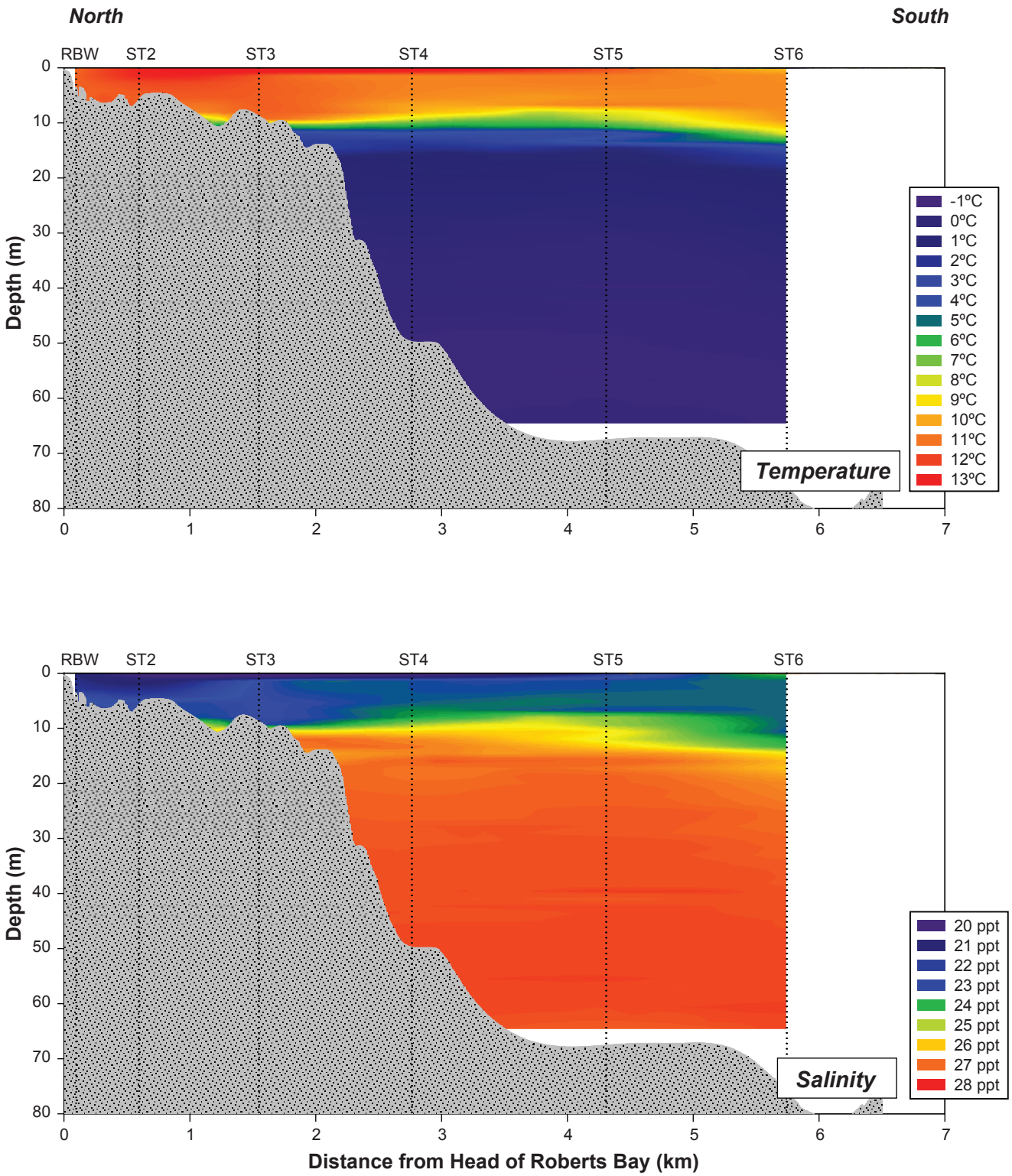
Temperature and Salinity Contours in Roberts Bay, Doris North Project, April 2010



Note: Vertical exaggeration is 44:1

Figure 4.3-11

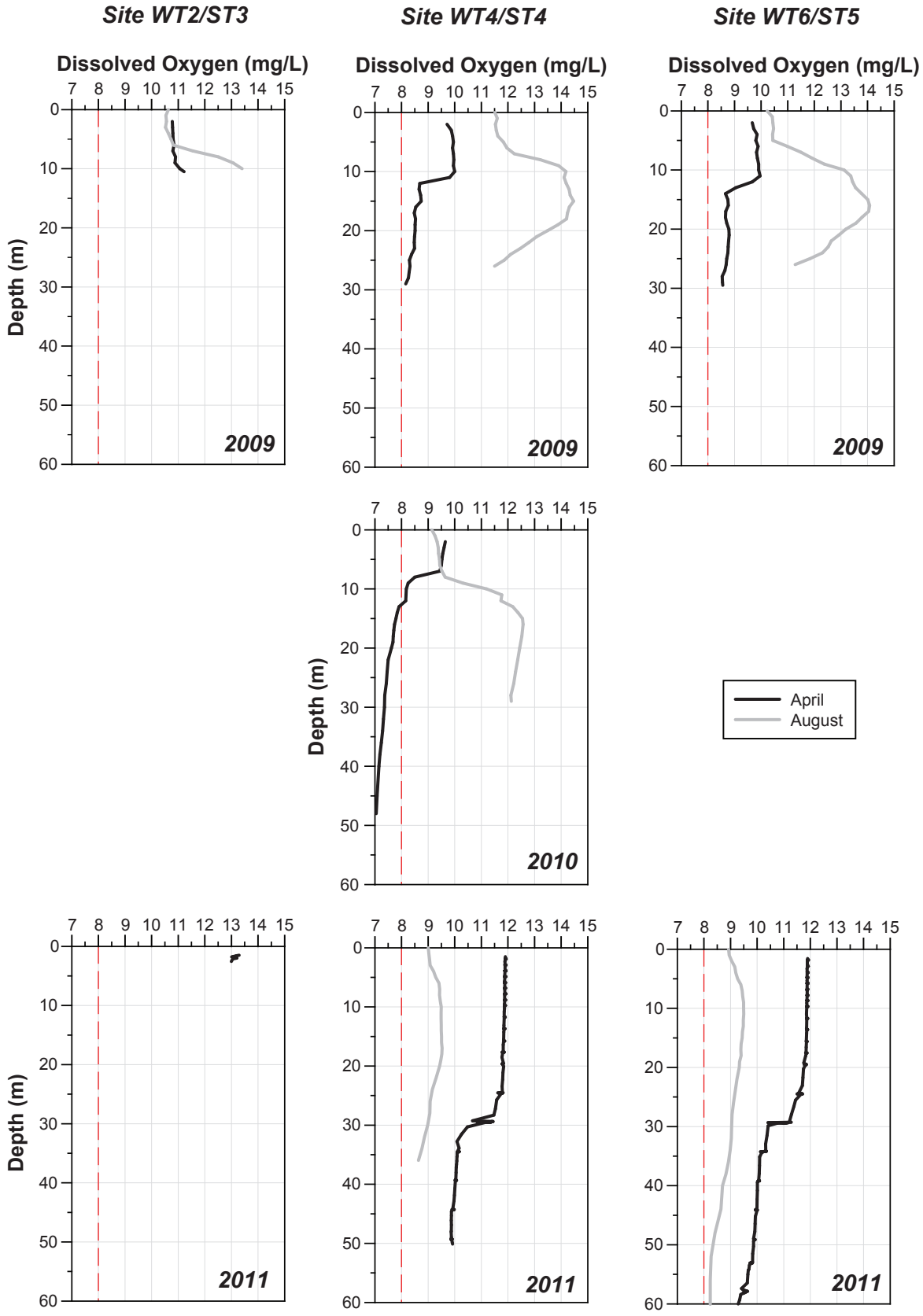
Temperature and Salinity Contours in Roberts Bay, Doris North Project, August 2010



Note: Vertical exaggeration is 44:1

Figure 4.3-12

Dissolved Oxygen Concentration Profiles in Roberts Bay, Doris North Project, 2009-2011



Note: Dashed lines represent CCME water quality guideline for dissolved oxygen in marine and estuarine waters (8.0 mg/L).

In the uppermost 30 m of the water column, August dissolved oxygen concentrations were highest near the pycnocline, and lowest at the surface. In 2009, August dissolved oxygen concentrations ranged between 10.2 and 11.0 mg/L at the surface, and increased to a maximum of 14.5 mg/L at 15 m depth. In 2010, August concentrations ranged from 9.1 mg/L at the surface to 12.6 mg/L at 16 m depth. No prominent subsurface oxygen maximum was observed in August 2011, and concentrations below 9 mg/L were recorded near bottom waters.

4.3.6 Marine Water Quality

Intensive water quality sampling programs were conducted in Roberts Bay from 2009 to 2011. Water quality samples were collected from 17 sites located throughout Roberts Bay from the shallow nearshore area at the head of the bay to the deeper area near the entrance to Melville Sound (Figure 4.3-13). Samples were collected throughout the water column (both above and below the pycnocline) during both the ice-covered and open-water seasons. Under-ice samples were collected using a 2.5 L Niskin bottle, and open-water season samples were collected using a 5 L GO-FLO bottle. Both sampling devices were acid cleaned prior to each sampling session. Water quality samples were analyzed by ALS Laboratory Group in Burnaby, BC.

Table 4.3-1 presents a summary of key water quality parameters in Roberts Bay. The CCME water quality guidelines for the protection of marine aquatic life are also included in Table 4.3-1 (CCME 2015). All water quality parameters in Roberts Bay were below CCME guidelines, except total mercury concentrations at some sites during the 2009 ice-covered season (which exceeded the interim CCME guideline for inorganic mercury of 0.000016 mg/L).

4.3.7 Marine Sediment Quality

Between 2009 and 2011, sediment quality samples were collected from 18 sampling locations near the southern and southwestern shores of Roberts Bay (Figure 4.3-14). Triplicate samples were collected at each site using a Ponar grab sampler, and sampling depths ranged from 2 to 42 m. Sediment quality samples were analyzed by ALS Laboratory Group in Burnaby, BC.

Table 4.3-2 presents a summary of key sediment quality parameters in Roberts Bay. In the shallow near-shore areas, Roberts Bay sediments were composed mainly of sand, with some silt and clay. At the deep site (RB1), sediments were finer being comprised mainly of silt and clay. Concentrations of several parameters co-varied with the fine particle composition of the sediment. Sites with higher proportions of fine sediments (silts and clays) tended to contain the highest concentrations of organic carbon, nutrients, and metals. All sediment parameters were below CCME guidelines, except copper and chromium concentrations measured in some sediments along the southwestern shore of Roberts Bay in 2009 and at the deep site (RB1). These were greater than the more conservative ISQGs but remained below the PELs. Concentrations of polycyclic aromatic hydrocarbons were always below analytical detection limits and CCME guidelines.

Figure 4.3-13

Roberts Bay Water Quality Sampling Locations, 2009-2011

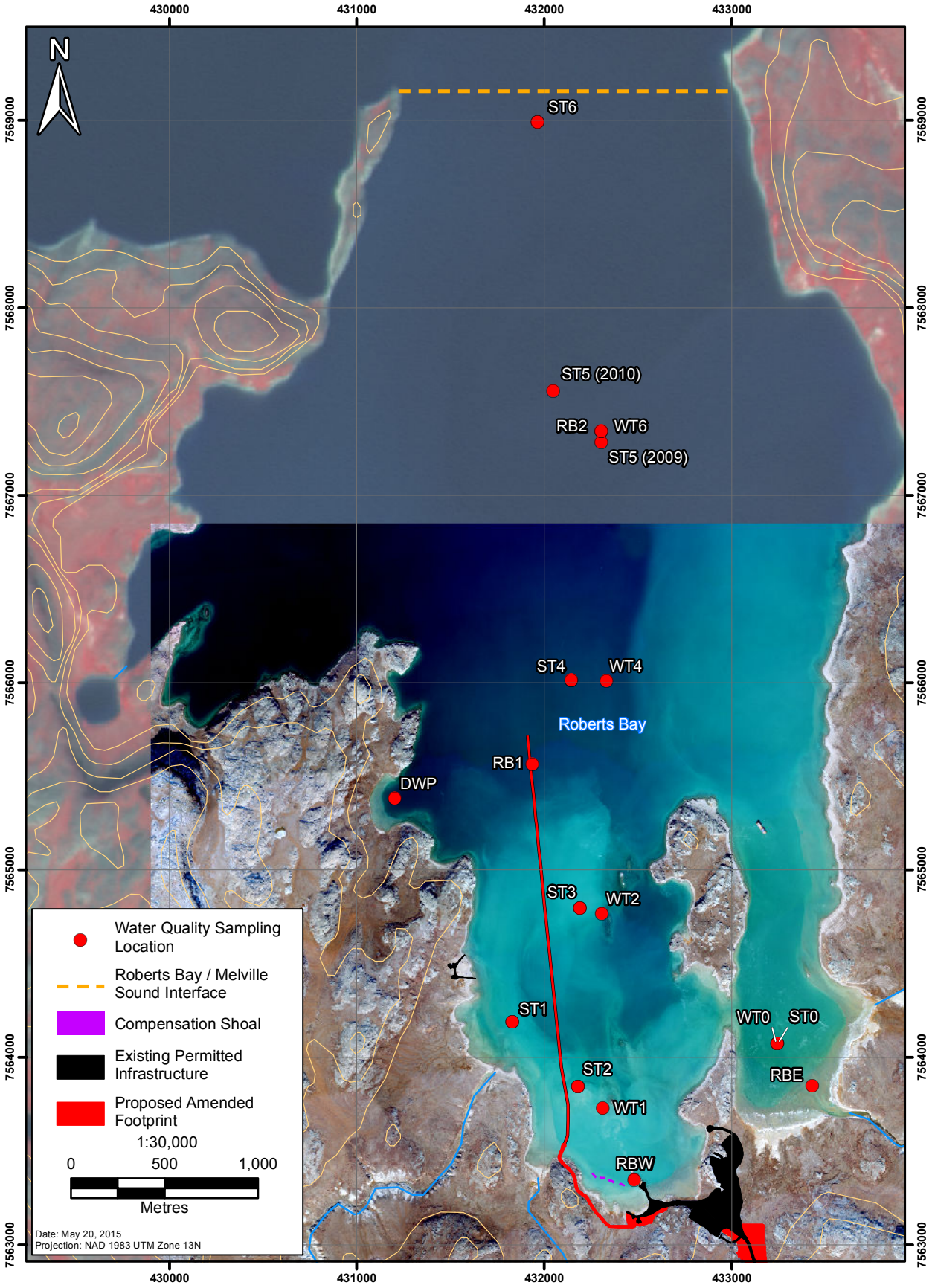


Figure 4.3-14

Roberts Bay Sediment Quality Sampling Locations, 2009-2011

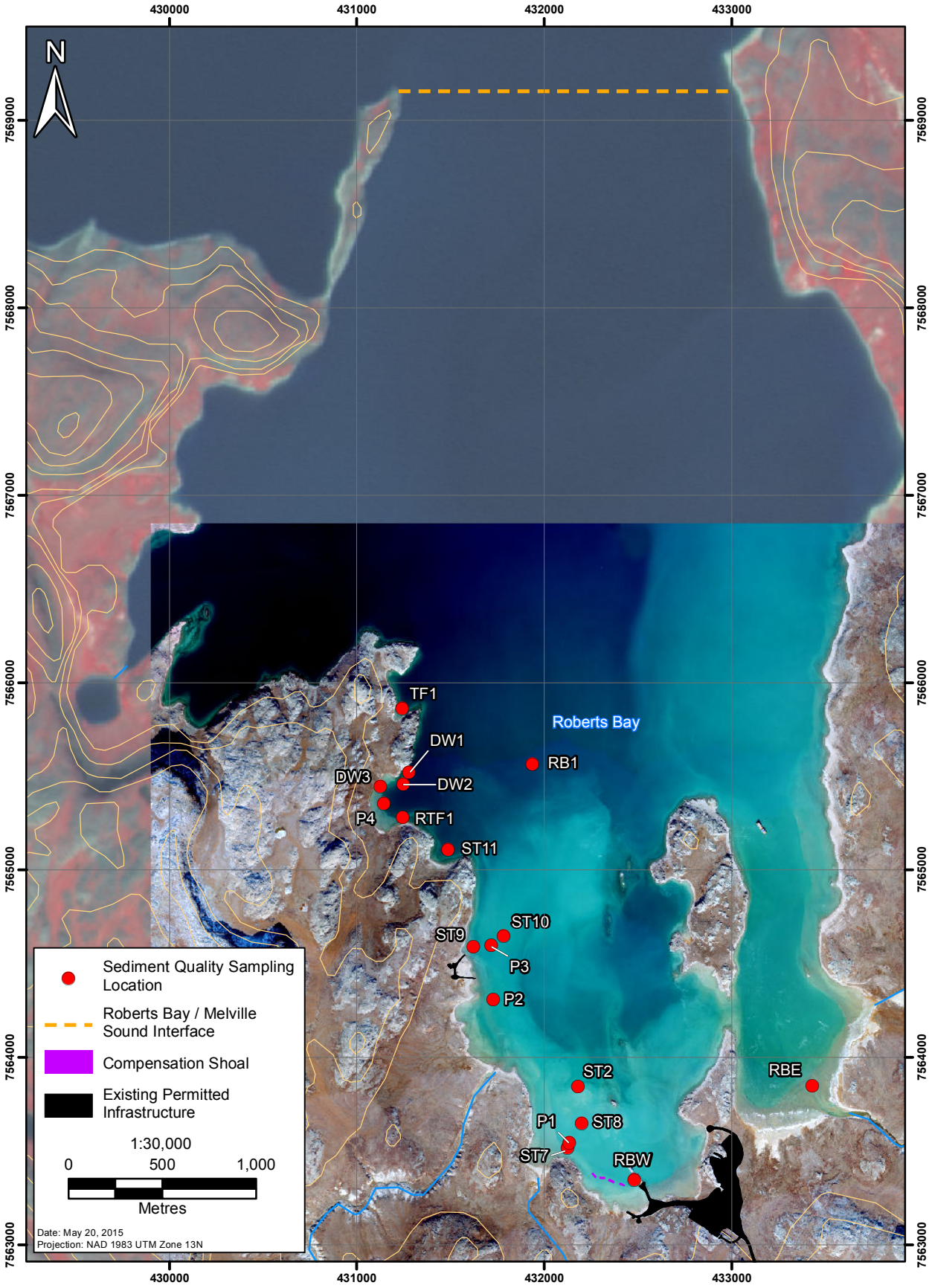


Table 4.3-1. Roberts Bay Water Quality, 2009-2011

Parameter	CCME Guideline for the Protection of Marine Aquatic Life[a]	Concentration (mg/L, unless otherwise noted)		
		Min	Median	Max
Physical Tests				
Temperature (°C)[b]	narrative[c,d]	-1.7	-0.63	12.89
Salinity (ppt)[b]	narrative[e,d]	15.4	26.8	27.6
Hardness (as $CaCO_3$)		727	4,860	5,500
pH (pH units)	7.0–8.7[f]	7.46	7.82	7.94
Total Suspended Solids	dependent on background levels[g]	<2.0	4.4	25
Turbidity (NTU)	dependent on background levels[g]	0.13	0.36	15.7
Anions and Nutrients				
Alkalinity, Total (as $CaCO_3$)		35.8	117	136
Ammonia as N		<0.0050	0.0025	0.155
Bromide (Br)		5.0	43.0	63.9
Chloride (Cl)		2,280	14,350	16,500
Fluoride (F)		<0.40	0.69	1.15
Nitrate (as N)	45	<0.0060	0.003	0.25
Nitrite (as N)		<0.0020	0.001	0.05
Ortho Phosphate (as P)		0.0150	0.0255	0.0462
Total Phosphorus		0.0151	0.0334	0.0564
Silicate (as SiO_2)		0.519	0.836	2.11
Sulphate (SO_4)		295	2,015	2,250
Organic / Inorganic Carbon				
Total Organic Carbon		0.68	1.2	4.98
Total Metals				
Aluminum (Al)		<0.0050	0.0053	0.562
Arsenic (As)	0.0125[b]	0.00050	0.001	0.00137
Boron (B)		0.56	3.4	4.11
Cadmium (Cd)	0.00012	0.00002	0.000053	0.000068
Calcium (Ca)		49.8	318.5	365
Chromium (Cr)	Cr(VI): 0.0015; Cr(III): 0.056[b]	<0.0003	<0.0010	0.025
Cobalt (Co)		<0.000050	0.000025	0.00025
Copper (Cu)		0.00028	0.00048	0.00474
Iron (Fe)		<0.005	0.014	0.649
Lead (Pb)		<0.000050	0.000059	0.00186
Magnesium (Mg)		146	972	1,110
Manganese (Mn)		0.00078	0.0015	0.0166

(continued)

Table 4.3-1. Roberts Bay Water Quality, 2009-2011 (completed)

Parameter	CCME Guideline for the Protection of Marine Aquatic Life[a]	Concentration (mg/L, unless otherwise noted)		
		Min	Median	Max
Total Metals *(continued)*				
Mercury (Hg)	Inorganic Hg: 0.000016[b]	0.0000007	0.000005	0.000096
Molybdenum (Mo)		<0.0020	0.0081	0.0115
Nickel (Ni)		0.00031	0.00048	0.00129
Phosphorus (P)		<1.0	<1.0	<3.0
Potassium (K)		45.9	293	355
Selenium (Se)		<0.00040	0.00025	0.00078
Silver (Ag)		<0.00010	<0.00020	<0.0010
Sodium (Na)		1,180	8,080	9,720
Tin (Sn)		<0.001	<0.001	<0.010
Uranium (U)		<0.00050	0.0021	0.00263
Zinc (Zn)		<0.00050	0.0004	0.0110

Notes:
Units are mg/L unless otherwise indicated.
Half the detection limit was substituted for values below the detection limit for the calculation of the median.
Maximum values represent maximum detectable values. If no concentrations were detectable, the maximum detection limit is reported.
[a] Canadian water quality guidelines for the protection of marine aquatic life, Canadian Council of Ministers of the Environment, accessed March 2015.
[b] Used all available CTD data collected between 2009 and 2011 from sites shown in Figure 4.3-11 for calculation of summary statistics for salinity and temperature.
[c] Human activities should not cause change in ambient temperature of more than ±1°C, nor alter the natural temperature cycle characteristics, nor cause a rate of change of more than 0.5°C per hour.
[d] Interim guideline
[e] Human activities should not cause the salinity to fluctuate by more than 10% of the natural level expected for that time and depth.
[f] Within this range pH should not vary by more than 0.2 pH units from the natural pH. If pH is naturally outside this range, human activities should not cause pH to change by more than 0.2 pH units and any change should tend towards 7 to 8.7.
[g] For clear-flow waters with background TSS levels less than 25 mg/L and turbidity levels less than 8 NTU, CCME guideline is a maximum increase of 25 mg/L TSS or 8 NTU turbidity for any short-term exposure (e.g., 24-h period), or a maximum increase of 5 mg/L TSS or 2 NTU turbidity for any longer-term exposure (e.g., 24 h to 30 d). For high flow or turbid waters with background TSS levels of 25 to 250 mg/L and turbidity levels of 8 to 80 NTU, CCME guideline is a maximum increase of 25 mg/L TSS or 8 NTU at any time.

Table 4.3-2. Roberts Bay Sediment Quality, 2009-2011

Parameters	CCME Guidelines for the Protection of Aquatic Life[a]		Concentration (mg/kg dry wt, unless otherwise noted)		
	ISQGb	PELc	Min	Median	Max
Physical Tests					
Moisture (%)			17.1	27.1	58.3
pH (pH units)			6.95	7.61	8.40

(continued)

Table 4.3-2. Roberts Bay Sediment Quality, 2009-2011 (continued)

Parameters	CCME Guidelines for the Protection of Aquatic Life[a]		Concentration (mg/kg dry wt, unless otherwise noted)		
	ISQGb	PELc	Min	Median	Max
Particle Size					
Gravel (> 2mm) (%)			<0.10	0.5	12.4
Sand (2.0 mm - 0.063 mm) (%)			<0.1	72.7	99.0
Silt (0.063 mm – 4 µm) (%)			<1.0	20.2	98.8
Clay (<4 µm) (%)			<1.0	5.3	50.9
Leachable Anions & Nutrients					
Total Nitrogen (%)			<0.020	0.052	0.141
Organic / Inorganic Carbon					
Total Organic Carbon (%)			<0.10	0.30	0.83
Plant Available Nutrients					
Available Ammonium (as N)			<0.80	3.1	42.5
Available Nitrate (as N)			<2.0	<2.0	<6.0
Available Nitrite (as N)			<0.40	<0.40	<1.2
Available Phosphate (as P)			2.5	17.0	101
Metals					
Aluminum (Al)			3,580	7,490	22,300
Arsenic (As)	7.24	41.6	0.59	2.52	51.9
Cadmium (Cd)	0.7	4.2	<0.10	0.05	0.23
Calcium (Ca)			1,710	3,150	7,340
Chromium (Cr)	52.3	160	11.2	23.9	66.3
Cobalt (Co)			2.8	5.5	13.1
Copper (Cu)	18.7	108	4.7	12.3	28.5
Iron (Fe)			6,670	15,400	49,900
Lead (Pb)	30.2	112	<2.0	3.1	9.7
Magnesium (Mg)			2,660	6,155	17,800
Manganese (Mn)			72.8	141	477
Mercury (Hg)	0.13	0.70	<0.0050	0.003	0.0152
Molybdenum (Mo)			<0.20	0.67	2.54
Nickel (Ni)			6.6	12.3	32.6
Phosphorus (P)			253	470	4,640
Potassium (K)			480	1,890	7,790
Selenium (Se)			0.49	0.25	0.57
Silver (Ag)			<0.10	0.05	0.15
Sodium (Na)			970	3,280	13,400

(continued)

Table 4.3-2. Roberts Bay Sediment Quality, 2009-2011 (completed)

Parameters	CCME Guidelines for the Protection of Aquatic Life[a]		Concentration (mg/kg dry wt, unless otherwise noted)		
	ISQGb	PELc	Min	Median	Max
Sulphur (S)			400	705	1,700
Tin (Sn)			<2.0	<5.0	<5.0
Uranium (U)			0.433	0.590	2.28
Zinc (Zn)	124	271	10.1	22.9	78.1
Hydrocarbons					
EPH10-19			<40	<200	<200
EPH19-32			<40	<200	91.5
LEPH			<40	<200	<200
HEPH			<40	<200	92.0
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	0.00671	0.0889	<0.0050	<0.0050	<0.0050
Acenaphthylene	0.00587	0.128	<0.0050	<0.0050	<0.0050
Anthracene	0.0469	0.245	<0.0040	<0.0040	<0.0040
Benz(a)anthracene	0.0748	0.693	<0.010	<0.010	<0.010
Benzo(a)pyrene	0.0888	0.763	<0.010	<0.010	<0.010
Benzo(b)fluoranthene			<0.010	<0.010	<0.010
Benzo(g,h,i)perylene			<0.010	<0.010	<0.010
Benzo(k)fluoranthene			<0.010	<0.010	<0.010
Chrysene	0.108	0.846	<0.010	<0.010	<0.010
Dibenz(a,h)anthracene	0.00622	0.135	<0.0050	<0.0050	<0.0050
Fluoranthene	0.113	1.494	<0.010	<0.010	<0.010
Fluorene	0.0212	0.144	<0.010	<0.010	<0.010
Indeno(1,2,3-c,d)pyrene			<0.010	<0.010	<0.010
2-Methylnaphthalene	0.0202	0.201	<0.010	0.015	0.015
Naphthalene	0.0346	0.391	<0.010	<0.010	<0.010
Phenanthrene	0.0867	0.544	<0.010	<0.010	<0.010
Pyrene	0.153	1.398	<0.010	<0.010	<0.010
Total PAHs			<0.040	<0.040	<0.040

Notes:
Units are mg/kg unless otherwise indicated.
Half the detection limit was substituted for values below the detection limit for the calculation of the median.
Maximum values represent maximum detectable values. If no concentrations were detectable, the maximum detection limit is reported.
[a] *Canadian sediment quality guidelines for the protection of marine aquatic life, Canadian Council of Ministers of the Environment, accessed March 2105.*
[b] *ISQG = Interim Sediment Quality Guideline*
[c] *PEL = Probable Effects Level*

4.4 EXISTING BIOLOGICAL MARINE BASELINE CONDITIONS

4.4.1 Marine Aquatic Life

Phytoplankton, zooplankton, and benthic invertebrate communities were sampled in Roberts Bay between 2009 and 2011 at the sampling locations shown in Figure 4.4-1. Phytoplankton and zooplankton sampling occurred throughout the entire bay, while benthos sampling was conducted in the shallow water near the southern and southwestern shores of Roberts Bay and at one deep location near the center of the bay (RB1). Table 4.4-1 presents a summary of the phytoplankton, zooplankton, and benthic invertebrate communities in Roberts Bay

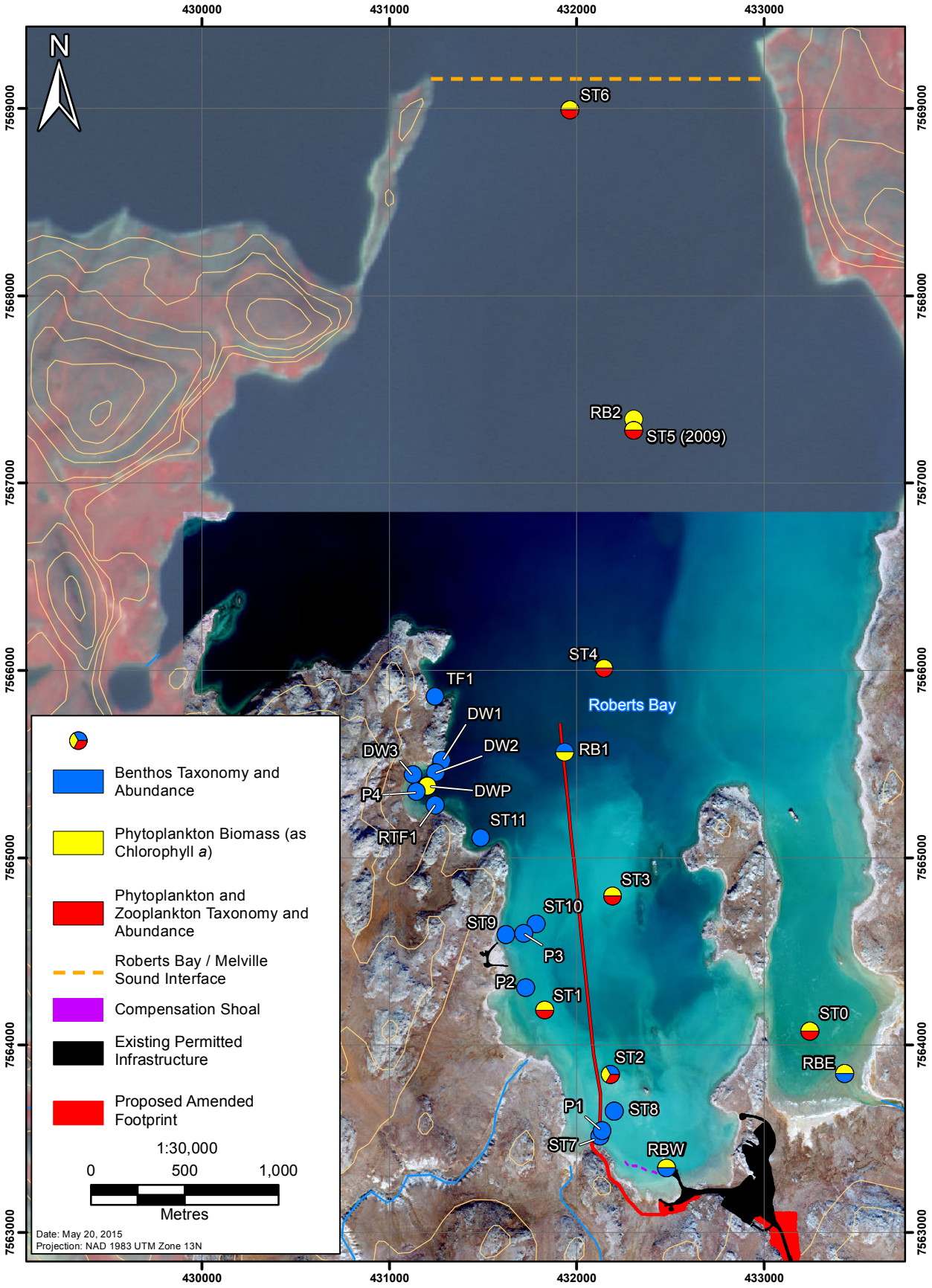
Table 4.4-1. Summary of Roberts Bay Marine Aquatic Life, 2009-2011

Parameter (units)	Min	Median	Max	Predominant Taxa
Phytoplankton				
Biomass (µg chl *a*/L)	0.016	0.11	10.0	most abundant by carbon biomass: *Leptocylindrus danicus* (diatom) *Dinobryon balticum* (chrysophyte) *Ebria tripartita* (silicoflagellate) most abundant numerically: *Dinobryon balticum* (chrysophyte) unidentified small Cryptomonads *Leptocylindrus danicus* (diatom)
Biomass (µg C/L)	4.08	9.17	52.5	
Abundance (cells/L)	91,679	187,956	429,059	
Zooplankton				
Abundance (organisms/m^3)	6,527	12,624	17,734	most abundant numerically: *Acartia longiremis* (calanoid copepod) Pseudocalanidae (calanoid copepod) *Evadne nordmanni* (cladoceran)
Benthic Invertebrates				
Density (organisms/m^2)	79	6,722	66,667	most abundant numerically: Nematodes* Harpacticoid copepods *Nephtys* sp. (polychaete worm)

Notes:
Values represent compiled 2009 to 2011 dataset, except for zooplankton which was only sampled in 2009, and phytoplankton biomass (as µg C/L) and abundance which were only sampled in 2009 and 2010.
Predominant taxa are the three most abundant groups (in descending order) in the pooled total of all samples.
** Nematodes were excluded from total density estimates because nematodes belong to the meiobenthos size category and would be expected to pass through the sieve used to collect macrobenthos, precluding accurate estimates of density.*

Figure 4.4-1

Roberts Bay Marine Aquatic Life Sampling Locations, 2009-2011



Phytoplankton biomass (as chlorophyll *a*) was generally very low in Roberts Bay, with a median biomass of 0.11 µg chl *a*/L between 2009 and 2011. Biomass levels were unusually high at the shallow, nearshore site RBE in August 2010 (ranging from 5.3 to 10 µg chl *a*/L), which may be attributable to the resuspension of benthic primary producers. The median phytoplankton abundance in Roberts Bay was 187,956 cells/L, and the median phytoplankton biomass (as carbon) was 9.17 µg C/L. The diatom *Leptocylindrus danicus* and the chrysophyte *Dinobryon balticum* were abundant numerically, and were also major contributors to phytoplankton biomass (as carbon). The large silicoflagellate *Ebria tripartita* was an important contributor to phytoplankton biomass, but was not present in high numbers. Conversely, cryptomonads were very abundant, but these relatively small organisms contributed little to total phytoplankton biomass.

The median zooplankton abundance in Roberts Bay in 2009 was 12,624 organisms/m^3 (zooplankton was not sampled in 2010 or 2011 in Roberts Bay). The calanoid copepod species *Acartia longiremis* and family Pseudocalanidae were the most abundant zooplankton taxa in Roberts Bay, followed by the cladoceran *Evadne nordmanni*.

Benthic invertebrate density in Roberts Bay was highly spatially variable, ranging from 79 to 66,667 organisms/m^2, with a median density of 6,722 organisms/m^2. Nematodes were the most numerous benthic organism observed in benthos samples; however, nematodes were excluded from total density estimates because nematodes cannot be accurately quantified (nematodes belong to the meiobenthos size category and would be expected to pass through the sieve used to collect macrobenthos). Aside from nematodes, harpacticoid copepods, the polychaete worm genus *Nephtys*, and the clam *Macoma balthica* were also abundant.

4.4.2 Marine Fisheries

Marine fish community and fish habitat information is available for Roberts Bay from 2002 to 2007 and for 2009 to 2010. A combination of sampling methods were used over the years including fyke nets, trap nets, gillnets, and long lines, as well as minnow and crab traps (RL&L Environmental Services Ltd./Golder Associates Ltd. 2003; Rescan 2010b, 2011a). Comprehensive surveys were conducted in 2009 and 2010 for marine fish and fish habitat in Roberts Bay, along with a reference bay to the east (Rescan 2010b, 2011a). A total of 17 confirmed species have been captured in Roberts Bay, including anadromous populations of various salmonid species, in addition to three unconfirmed species (poacher, sandlance and snailfish), for a total of 20 species (Golder 2007; Rescan 2010b, 2011a). Of these, 14 are considered strictly marine fish species. None of the fish species in Roberts Bay are currently considered threatened or endangered (COSEWIC 2010).

Marine Fish Habitat

Roberts Bay is dominated by cliffs up to 50 m in height at the northern and western areas of the bay. The eastern and southern areas of Roberts Bay are more gradually sloped and contain numerous lake drainages. While the cliff areas are generally devoid of terrestrial vegetation, the gently sloped valleys have lush growths of reeds, grasses, and other vegetation. Shoreline habitat of Roberts Bay was assessed along the southern and western shores of Roberts Bay in 2000 (Figure 4.4-2; Rescan 2001), 2009 (Rescan 2010b), and 2010 (Rescan 2011a). The shoreline substrate consists mainly of bedrock in the northwest and south portions of Roberts Bay; however, gravel and sand are present

in bays and at stream outlets. The eastern portion of the bay is dominated by boulder, gravel, and sand substrate. The shoreline habitat quality of Roberts Bay ranges from fair (bedrock dominated northern areas) to excellent (Glenn and Little Roberts outflows in the southern area).

In 2009, a total of 686 m of shoreline littoral habitat located in the southwestern area of Roberts Bay and in the vicinity of the proposed marine outfall berm was surveyed in greater detail (Rescan 2010b; Figure 4.4-3). Of this distance, 51% was composed of cobble, 15% of boulder, 15% of gravel, 14% of fines and 5% of bedrock. An outlet to a stream was present within the western section of the surveyed area. The dominant substrate around the stream outlet was sand and gravel, likely carried down by the stream. In the eastern section of the bay, cobble and boulder dominated the shoreline. Substrate offshore of the littoral zone was dominated by fines with small patches of cobble and/or boulder. Water depths in this area ranged from 0.2 m (near shore) to 10.0 m in open water.

The proposed area of infrastructure development is shown in Plate 4.4-1 with the substrate described in Table 4.4-2 under areas (habitat numbers) 10 to 13 covering a distance of 127 m of shoreline. The substrate off the littoral zone iss also dominated by cobble (48%) and boulder (31%) (Rescan 2010b; Figure 4.4-3), whereas offshore areas consisted primarily of mud, as confirmed through hydroacoustic and underwater video surveys conducted in 2010 (Figure 4.4-4; Rescan 2011a).

Plate 4.4-1. Aerial view of shoreline habitat at the proposed marine outfall berm, 2009.

Figure 4.4-2
Roberts Bay Shoreline Fish Habitat

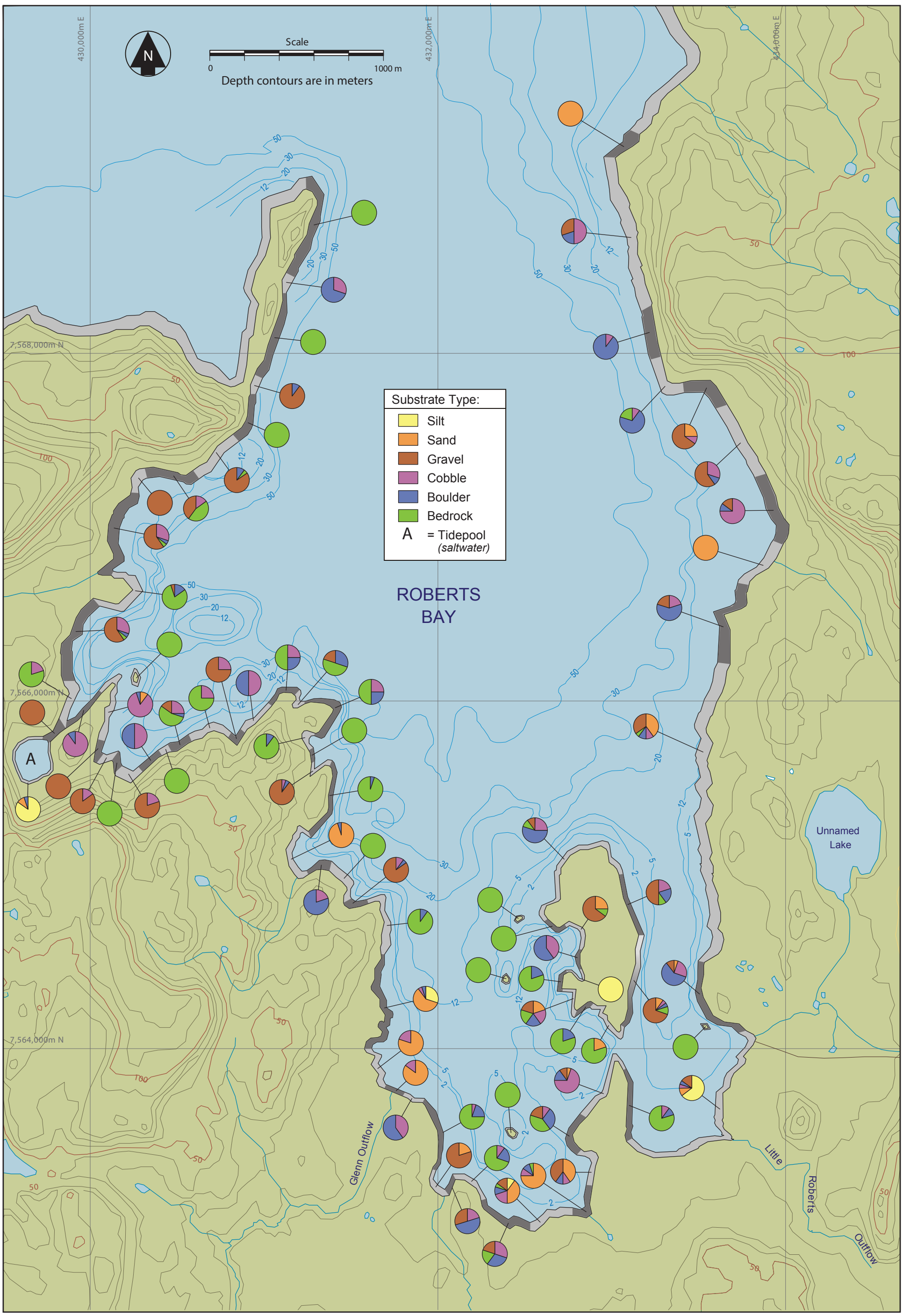


Table 4.4-2. Detailed Habitat Data for the Proposed Marine Outfall Berm in Roberts Bay, 2009

Habitat Number	Habitat Unit Length (m)	UTM Start		UTM End		Area (m^2)	Fines (%)	Fines (m^2)	Gravel (%)	Gravel (m^2)	Cobble (%)	Cobble (m^2)	Boulder (%)	Boulder (m^2)	Bedrock (%)	Bedrock (m^2)
1	16	432291	7563280	432278	7563287	80	0	0	10	8	20	16	20	16	50	40
2	35	432278	7563287	432244	7563292	188	5	9	20	38	60	113	15	28	0	0
3	37	432244	7563292	432215	7563307	197	5	10	10	20	70	138	15	30	0	0
4	17	432215	7563307	432206	7563321	72	0	0	5	4	60	43	35	25	0	0
5	35	432206	7563321	432198	7563352	197	0	0	70	138	27	53	3	6	0	0
6	59	432198	7563352	432183	7563404	238	0	0	5	12	75	179	5	12	15	36
7	10	432183	7563404	432175	7563410	34	0	0	20	7	40	13	40	13	0	0
8	31	432175	7563410	432158	7563434	100	0	0	5	5	30	30	50	50	15	15
9	5	432158	7563434	432156	7563439	12	0	0	0	0	0	0	0	0	100	12
10	***69***	***432156***	***7563439***	***432097***	***7563467***	***230***	***0***	***0***	***2***	***5***	***65***	***149***	***30***	***69***	***3***	***7***
11	***22***	***432097***	***7563467***	***432075***	***7563471***	***80***	***0***	***0***	***0***	***0***	***20***	***16***	***75***	***60***	***5***	***4***
12	***8***	***432075***	***7563471***	***432068***	***7563473***	***43***	***0***	***0***	***25***	***11***	***40***	***17***	***30***	***13***	***5***	***2***
13	***28***	***432068***	***7563473***	***432043***	***7563462***	***145***	***40***	***58***	***10***	***14***	***40***	***58***	***10***	***14***	***0***	***0***
14	26	432043	7563462	432030	7563441	72	20	14	10	7	30	22	40	29	0	0
15	19	432030	7563441	432020	7563424	31	32	10	20	6	33	10	15	5	0	0
16	22	432020	7563424	432000	7563418	20	70	14	30	6	0	0	0	0	0	0
17	52	432000	7563418	431949	7563423	43	50	22	50	22	0	0	0	0	0	0
18	48	431949	7563423	rshore, ro	7563447	121	50	60	35	42	15	18	0	0	0	0
19	111	431907	7563447	431927	7563549	418	20	84	5	21	70	293	5	21	0	0
20	36	431927	7563549	431938	7563583	232	30	70	10	23	60	139	0	0	0	0
21*	-	-	-	-	-	49,570	100	49,570	0	0	0	0	0	0	0	0
Total						**2,553**	**-**	**351**	**-**	**388**	**-**	**1,308**	**-**	**391**	**-**	**116**
Total (%)							**-**	**14**	**-**	**15**	**-**	**51**	**-**	**15**	**-**	**5**

Notes:

** Habitat Unit 21 is the offshore habitat assessed at this location.*

Total area does not include offshore habitat values.

Bold italicized values include habitat units in direct vicinity of proposed marine outfall berm.

Figure 4.4-3
Fish Habitat Assessment in the Vicinity of the Proposed Marine Outfall Berm in Roberts Bay, 2009