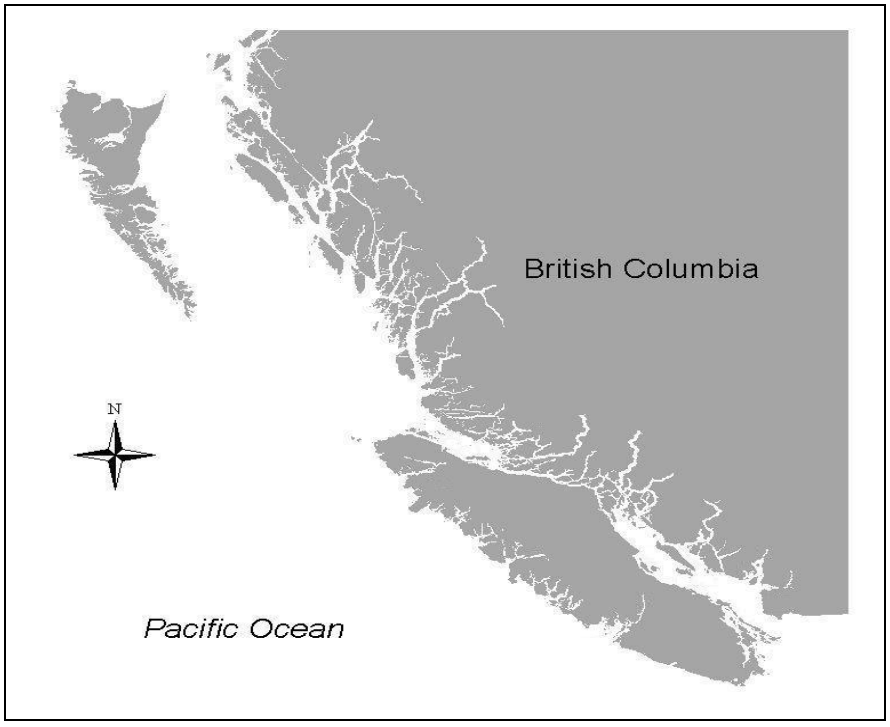
Environment Canada
Environnement Canada

DISPOSAL AT SEA ACTIVITIES SUMMARY

1999

PACIFIC AND YUKON REGION



Regional Program Report No.06-02

By:

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ABSTRACT

Environment Canada's administration of disposal at sea activities undertaken in the Pacific and Yukon Region from 01 January 1999 to 31 December 1999 is summarized in this report. Disposal at sea sites in this region are used primarily for the disposal of dredged and excavated spoils. This report includes information on 12 disposal sites that were used in 1999 and three disposal site monitoring programs.

This report is a continuation of a series of reports documenting disposal at sea activities from 1975 to 1998 and includes Ward and Sullivan (1980), Sullivan (1987), Kim and Sullivan (1993), Kim et al. (1997), Sullivan et al. (1997), Schnider and Sullivan (1997a), Schnider and Sullivan (1997b), Kim et al. (1999) and Sullivan et al. (1999). To obtain copies of these reports and other disposal at sea information please visit our website at http://www.pyr.ec.gc.ca/disposal_at_sea/index_e.htm.

RÉSUMÉ

Ce rapport résume les activités d'administration des dépôts en mer exécutées par Environnement Canada, Région du Pacifique et du Yukon, entre le 1er janvier 1999 et le 31 décembre 1999. Il porte plus spécifiquement sur les activités visant douze sites de dépôt ayant été utilisés au cours de l'année 1999, ainsi que sur trois programmes de surveillance afférents. Ces sites de dépôt servent principalement à l'élimination des matériaux de dragage et d'excavation.

Ce rapport fait partie d'une série de comptes rendus sur les activités de dépôt en mer concernant la période comprise entre 1975 et 1998: Ward et Sullivan (1980), Sullivan (1987), Kim et Sullivan (1993), Kim et coll. (1997), Sullivan et coll. (1997), Schnider et Sullivan (1997a), Schnider et Sullivan (1997b), Kim et coll. (1999) et Sullivan et coll. (1999). Pour obtenir une copie de ces rapports et pour toute autre information concernant les activités de dépôt en mer, consultez notre site web : http://www.pyr.ec.gc.ca/disposal_at_sea/index_f.htm.

ACKNOWLEDGMENTS

The authors wish to thank numerous co-op students from Simon Fraser University for their input in the preparation of the report series, and the master and crew of the CCGS VECTOR for their assistance in the field portion of the monitoring surveys.

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1.0 INTRODUCTION

Environment Canada administers the requirements for disposal at sea under authority of the *Canadian Environmental Protection Act, 1999* (CEPA 1999), Part 7, Division 3. Disposal at sea is regulated according to the terms and conditions in permits issued by Environment Canada. To ensure compliance with the conditions of the permit, inspections are routinely conducted by Environment Canada, Enforcement and Emergencies Division.

This report describes all disposal at sea activities conducted in 1999 in the Pacific and Yukon Region. There are 36 designated disposal sites in British Columbia, 27 of which are located in southern British Columbia (Figure 1). In 1999, 12 of these disposal sites were used and three were monitored (Table 1).

2.0 ADMINISTRATION

2.1 APPLICATION AND REVIEW PROCESS

Under the authority of CEPA 1999 material destined for disposal at sea or loaded for the purpose of disposal at sea requires a permit. Maintenance dredging activities involving less than 4 000 cubic metres of approved dredged material, or excavation projects involving approved undisturbed native till may be carried out under the terms and conditions of a multi-site disposal at sea permit. New dredging projects, maintenance dredging activities involving volumes in excess of 4 000 cubic metres and unique excavation projects require a site-specific permit. Permits are valid for a one year period. Information on the application and permitting process can be obtained from Environment Canada, 201–401 Burrard Street, Vancouver, British Columbia, V6C 3S5 or online at: http://www.pyr.ec.gc.ca/disposal_at_sea/index_e.htm. Figure 2 shows a schematic of the complete permitting process.

Permit applications are reviewed by Environment Canada with advice from the Regional Ocean Disposal Advisory Committee (RODAC). This committee has representation from Environment Canada, Fisheries and Oceans Canada (DFO) and British Columbia Ministry of Environment. Following the application review process, only material which has been rigorously tested and found to meet the criteria outlined in the Disposal at Sea Regulations (2001) and the Interim Contaminant Testing Guidelines for Disposal at Sea (ICTG), Pacific and Yukon Region (Appendix I), is approved for disposal at sea.

The public can voice their concerns regarding disposal at sea projects throughout the application review and permitting process. Public advisory of all disposal at sea permit applications is made through a Notice of Intent published by the applicant in a newspaper in the area of the proposed disposal at sea activity. As part of Environment Canada's responsibility to conduct an environmental assessment of each project under the *Canadian Environmental Assessment Act*, a Notice of Commencement for all environmental assessments is posted on the Canadian Environmental Assessment Registry (CEAR). The public has a 15 day period to communicate comments or concerns to the CEAR, Suite 320 - Sinclair Centre, 757 West Hastings Street, Vancouver, British Columbia, V6C 1A1, or on the CEAR website:

http://www.ceaa-acee.gc.ca/050/index_e.cfm. Prior to issuance, all disposal at sea permits and amendments are published in the Canada Gazette (http://canadagazette.gc.ca) and subject to a 30 day public review period.

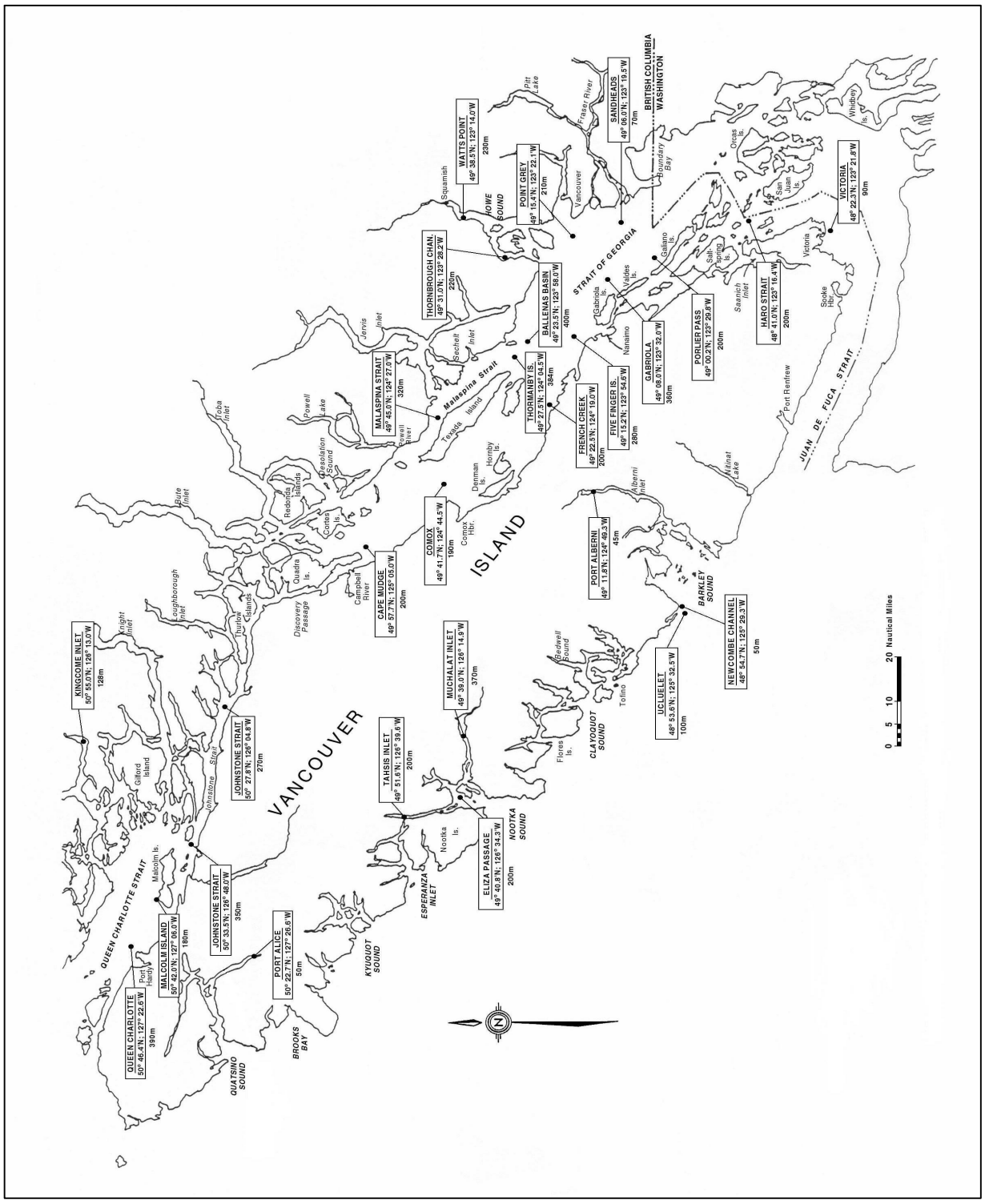


Figure 1. Designated disposal at sea sites in southern British Columbia.

Table 1. Disposal at sea sites used and monitored in 1999.

Disposal Site	Depth (m)	Co-ordinates	Volume Disposed in 1999	
Sand Heads	70	49°06.00'N; 123°19.50'W	670,580	m^3
* Point Grey	210	49°15.40'N; 123°22.10'W	339,811	m^3
Comox (Cape Lazo)	190	49°41.70'N; 124°44.50'W	13,716	m^3
Malaspina Strait	320	49°45.00'N; 124°27.00'W	10,995	m^3
Thornbrough Channel	220	49°31.00'N; 123°28.30'W	9,500	m^3
Johnstone Strait -Hanson	350	50°33.50'N; 126°48.00'W	6,500	m^3
* Five Finger Island	280	49°15.20'N; 123°54.60'W	4,965	m^3
Victoria	90	48°22.30'N; 123°21.80'W	4,616	m^3
Porlier Pass	200	49°00.20'N; 123°29.80'W	4,400	m^3
Thormanby Island	384	49°27.50'N; 124°04.50'W	3,400	m^3
Johnstone Strait - Hickey	270	50°27.80'N; 126°04.80'W	3,250	m^3
Cape Mudge	200	49°57.70'N; 125°05.00'W	1,920	m^3
* Watts Point	230	49°38.50'N; 123°14.10'W	0	m^3
		Total:	**1,073,653**	**m^3**

* Monitoring studies were conducted at these disposal sites in 1999.

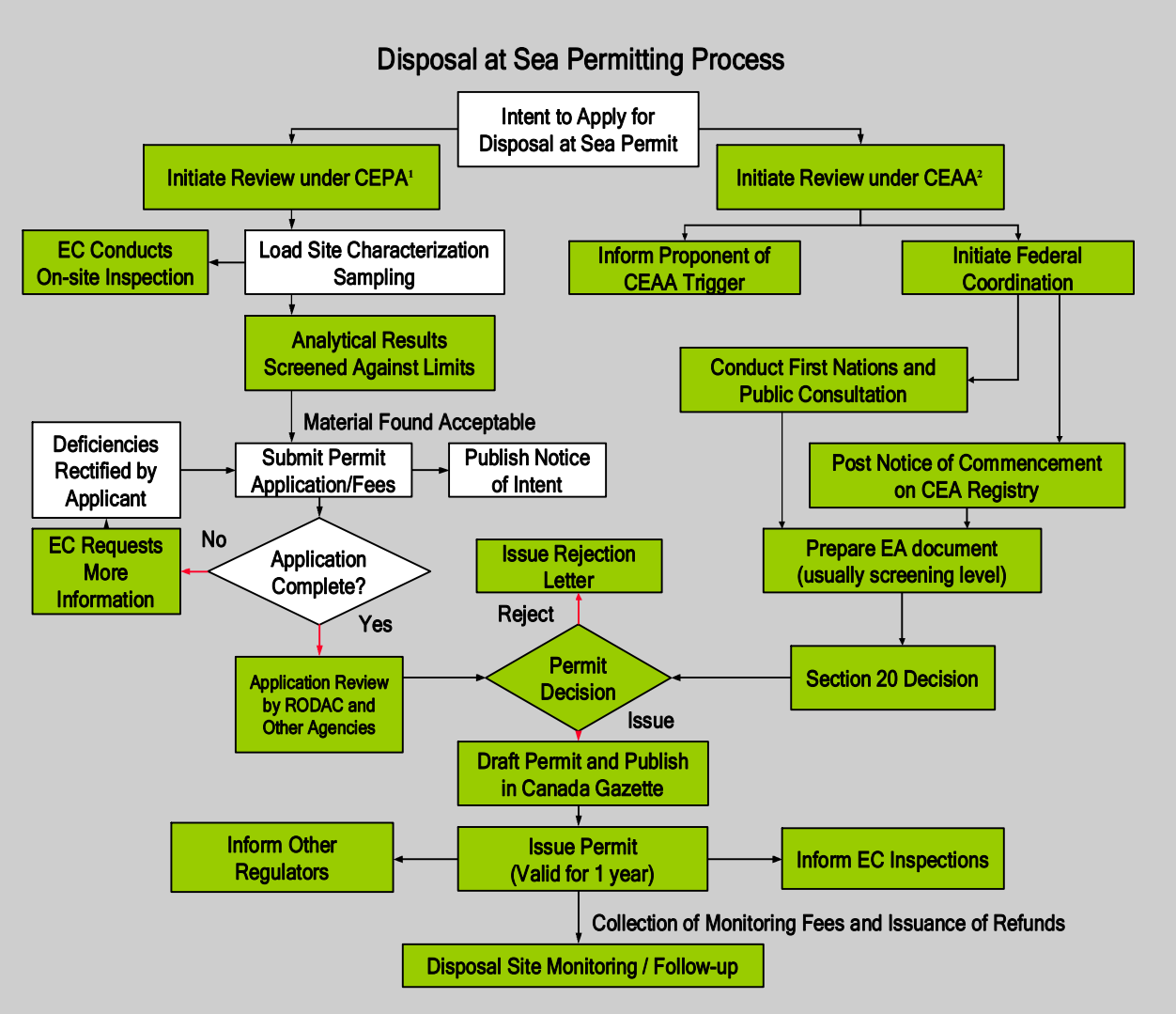


Figure 2. Disposal at sea permitting process.

1. CEPA 1999 – *Canadian Environmental Protection Act, 1999*
2. CEAA – *Canadian Environmental Assessment Act*

2.2 DISPOSAL AT SEA RESTRICTIONS

Disposal at sea is permitted only within the government designated disposal sites and only if the material to be disposed of is listed under CEPA 1999 Schedule 5:

1. Dredged material.
2. Fish waste or other organic matter that comes from industrial fish processing operations.
3. Ships, aircraft, platforms or other structures from which all material that can create floating debris or other marine pollution has been removed to the maximum extent possible if, in the case of disposal, those substances would not pose a serious obstacle to the fishing or navigation after being disposed of.
4. Inert, inorganic geological matter.
5. Uncontaminated organic matter of natural origin.
6. Bulky substances that are primarily composed of iron, steel, concrete or other similar matter that does not have a significant adverse effect, other than a physical effect, on the sea or the seabed, if those substances:

    a) are in locations where disposal or incineration at sea is the only practicable manner of disposing of or thermally destroying the substances; and
    b) in the case of disposal, would not pose a serious obstacle to fishing or navigation after being disposed of.

A permit to dispose of these materials can be obtained only if they meet the conditions listed in Schedule 6 of CEPA 1999 which states that if any feasible options such as re-using, recycling or an alternative form of disposal exist, then disposal at sea is not an option.

Under Schedule 6, Parts 9 and 10, materials mentioned in Schedule 5 may not be allowed for disposal at sea if they exceed the following screening criteria. If the disposal material contains these substances below the following limits, then it is considered below the lower level and will be considered for disposal at sea.

Lower Level of the National Action List

1. Cadmium and its compounds	0.6 mg/kg (dry weight)
2. Mercury and its compounds	0.75 mg/kg (dry weight)
3. Total Polycyclic Aromatic Hydrocarbons (PAHs)	2500 µg/kg (dry weight)
4. Total polychlorinated biphenyls (PCBs)	100 µg/kg (dry weight)
5. Persistent plastics and other persistent synthetic materials (in a suitably comminuted form)	4% by volume

If the disposal material has higher concentrations than these, then it can be tested to see if it meets the upper level criteria. To determine the upper level criteria, a minimum of three marine biological tests for sediment are required. They include:

- one acute lethality test; and
- two sub-lethal tests; or
- one sub-lethal and one bioaccumulation test.

Material that passes all three tests is considered below the lower level and can be considered for disposal at sea. If it passes the acute lethality test but fails one sub-lethal or one bioaccumulation test, then it is below the upper level but above the lower level and will require a more detailed assessment. However, if it fails the acute test or fails the other two tests then it exceeds the upper level and will not be permitted for disposal at sea.

In order to protect fisheries resources, spawning areas, and juvenile and adult migratory areas, the Department of Fisheries and Oceans (DFO) requires that dredging and/or ocean disposal activities be conducted within time frames specified by district Habitat Management Units. Proponents are directed to contact the appropriate DFO units prior to commencing any projects for timing restrictions relevant to the area of proposed activities. For example, Fraser River Environmental Management Program (FREMP) Dredge Management Guidelines for operations within navigation channels specify periods when clamshell or suction dredging is allowed. Dredging outside navigation channels is reviewed on a site-specific basis.

2.3 COMPLIANCE AND ENFORCEMENT

Environment Canada conducts pre-load inspections to verify sampling program design and sample collection as required. Enforcement of the terms and conditions of permits under CEPA 1999, Part 10 is the responsibility of Environment Canada Enforcement Officers. CEPA inspectors routinely conduct compliance and surveillance inspections of dredging/loading and disposal operations. Vessel Traffic Management Centres monitor disposal sites to ensure disposal activities occur within the authorized locations. Any contravention of permit conditions is dealt with under authority of CEPA 1999, Part 7, Division 3 or Section 36 (3) of the *Fisheries Act*.

3.0 DISPOSAL SITE MONITORING

Disposal site monitoring procedures are outlined in the Interim Monitoring Guidelines for Ocean Disposal (1999). Physical monitoring is the first stage of the monitoring approach. Of key importance is the collection of information to determine the area of deposition, delineation of the disposal site boundaries, the accumulation of material within the boundaries, and evidence of sediment transport off the disposal site.

Chemical assessment of a disposal site involves measuring chemical concentrations of sediment from within the disposal site boundary and from one or more nearby reference stations. Using the reference site results as a comparison, Environment Canada can determine whether disposal activities are significantly altering the chemical make-up of sediment within the disposal site.

Biological testing is focused primarily on laboratory toxicity testing and benthic community studies. Biological testing protocols were established in 1992 and continue to be evaluated for use in disposal site assessment. In addition, Environment Canada has published a guidance document entitled "*Guidance Document on the Collection and Preparation of Sediment for Physiochemical Characterisation and Biological Testing* (1994)".

All available information from physical, chemical and biological monitoring is considered in the overall assessment of a disposal site.

4.0 DISPOSAL AT SEA ACTIVITIES

4.1 NUMBER OF PERMITS

In 1999, 18 disposal at sea permit applications were received and 13 permits were issued (Table 2): ten for dredged material and three for excavated material.

Under multi-site permits for dredged and excavated materials, 89 projects were assessed and approved in 1999. Eighty approvals were issued for maintenance dredging projects involving less than 4 000 cubic metres of material throughout the Lower Mainland, Vancouver Island and coastal British Columbia. Nine approvals were issued for excavation projects in the Lower Mainland area.

Table 2. Number of permits issued in the Pacific and Yukon Region - 1987 to 1999.

Permit Type	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Dredge	33	41	28	25	23	20	21	18	20	15	14	23	10
Excavation	2	5	5	4	4	5	3	2	4	6	6	6	3
Vessel	0	0	1	0	2	2	0	0	1	2	1	1	0
Others	2	2	2	2	1	0	1	0	0	0	0	0	0
Total	37	48	36	31	30	27	25	20	25	23	21	30	13

4.2 VOLUME OF MATERIAL DISPOSED OF AT SEA

In 1999, approximately 1 000 000 cubic metres of material was disposed of at various disposal sites in the Pacific and Yukon Region. The Point Grey and Sand Heads disposal sites received approximately 94% of all materials.

Dredged material accounted for approximately 89% of the material sent to disposal sites while excavation projects in the Lower Mainland accounted for the remaining 11%.

In 1999, approximately 641 330 cubic metres of sand from the Fraser River channel maintenance dredging was disposed of at the Sand Heads disposal site. In the future, sand recovery and sales for construction projects may greatly reduce the need for ocean disposal of sediment resulting from channel maintenance.

4.3 MONITORING

Routine monitoring of disposal at sea sites is carried out by Environment Canada to assess physical, chemical and biological effects of disposal operations. At each designated disposal site, a grid of sediment sampling stations has been established to allow repetitive surveys.

Environment Canada undertook one monitoring survey in 1999. During the end of September and the beginning of October, three designated disposal sites were monitored: Point Grey, Five Finger Island and Watts Point. All sediments collected were analysed for trace metals and particle size distribution. Sediment samples collected at Five Finger Island and Point Grey, and composite samples from the Watts Point disposal site, were analysed for concentrations of total polycyclic aromatic hydrocarbon (PAH) and total organic carbon (TOC). Sediment samples collected at the Five Finger Island disposal site were tested for additional substances: ammonia, sulphide, acid volatile sulphides (AVS), and simultaneously extractable metals (SEM).

Biological tests are conducted to determine and monitor effects of ocean disposed sediments on the receiving environment. Biological testing is focused primarily on sediment toxicity testing of two types: acute lethality and sub-lethal tests. Sediment samples from the Five Finger Island disposal site were subject to one acute lethality test, a 10 day amphipod survival test using the marine amphipods *Eohaustorius washingtonianus* and *Rhepoxynius abronius* and two sub-lethal tests including Echinoid Fertilization using *Dendraster excentricus* and the solid phase Microtox® test.

In October 1999, video images of Point Grey and Five Finger Island disposal sites were recorded using a remotely operated submersible, known as the Remotely Operated Platform for Ocean Science (ROPOS II), owned by DFO and operated by the Canadian Scientific Submersible Facility. Predetermined transect lines were followed across the disposal site to examine bottom conditions and evidence of ocean disposal activities. Discussion of the physical monitoring conducted at Point Grey and Five Finger Island is presented in Section 5.0.

5.0 DISPOSAL SITE ACTIVITY SUMMARY

The total quantity of materials found under disposal headings in the following sections is the total quantity disposed of under permit/approval since 1976. Information on specific permits and approvals in 1999 at each disposal site can be found in the disposal site summaries located in Appendix II.

5.1 SAND HEADS

Disposal Site:	Sand Heads
Co-ordinates:	49°06.00'N; 123°19.50'W
Depth:	70 metres
Total Quantity disposed Since 1976:	11 518 301 cubic metres

Comments

The Fraser River Environmental Management Program (FREMP) Dredge Management Guidelines apply to all projects. In general, these guidelines state that for the Lower Fraser River there is no dredging (clamshell or suction) between March 1 and June 15 of volumes greater than 4 000 cubic metres. In addition, no suction dredging is allowed in water less than five metres depth at low tide between June 15 and July 15.

The DFO Habitat Management Unit in New Westminster, British Columbia should be contacted for specific timing restrictions on dredging.

Load Site Information

Only clean sand, silt and gravel (no wood waste) are approved for disposal at the Sand Heads disposal site. In 1999, 670 580 cubic metres of material was disposed of at Sand Heads. Of this amount, 641 330 cubic metres originated from Fraser River channel maintenance projects by the Fraser River Port Authority. Other material sent to Sand Heads typically results from maintenance dredging at load ramps for construction aggregate facilities on the Fraser River. Specific load site information is listed in Appendix II.

Monitoring Information

This site was last monitored in 1996.

5.2 POINT GREY

Disposal Site:	Point Grey
Co-ordinates:	49°15.40'N; 123°22.10'W
Depth:	210 metres
Total Quantity Disposed Since 1976:	9 414 511 cubic metres + 390 tonnes

Comments

DFO requests that the Fraser River Environmental Management Program (FREMP) Dredge Management Guidelines be applied to any dredging project, subject to approval by the appropriate Habitat Management Unit.

Load Site Information

Dredged material totalling 222 995 cubic metres was sent to the Point Grey disposal site in 1999. This material resulted from maintenance dredging operations at various locations in Vancouver Harbour and the Fraser River. In addition, 116 816 cubic metres of excavated native till from the Greater Vancouver Regional District was taken to the disposal site. Specific load site information is listed in Appendix II.

Monitoring Information

Surface sediment samples were collected from 25 stations on the disposal site and the surrounding area (Figure 3). The samples were analysed for trace metal concentrations, total polycyclic aromatic hydrocarbons (PAH), total organic carbon (TOC) and particle size distribution. Results are presented in Table 3. No chemical concentrations exceeded the screening limits outlined in the ICTG except for the total polycyclic aromatic hydrocarbons (PAH) at station 36.

In September 1999, ROPOS II was deployed at the Point Grey disposal site. As part of a physical monitoring program, the remotely operated vehicle is used to observe the benthic condition of the disposal site and surrounding area. In addition, information on the area of deposition of materials and physical characteristics of sediment in and around the disposal site boundary can be gathered from the ROPOS video. Predetermined track lines were plotted over the disposal site and continuous video images were recorded. Computer-captured still images (transferred to slide and CD ROM) were also collected. A selection of these images is presented in Appendix III.

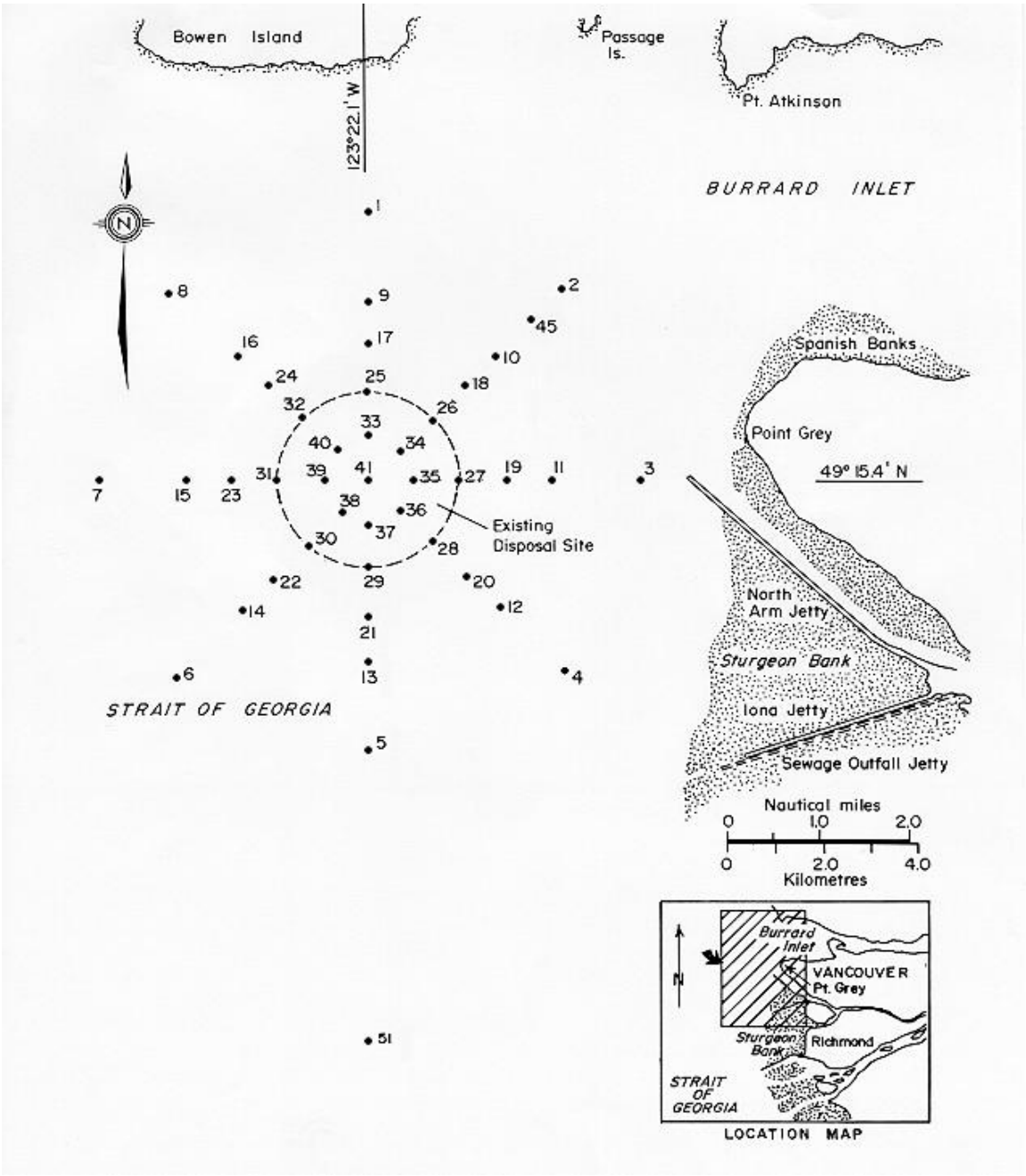


Figure 3. Point Grey disposal site sediment sampling stations.

Table 3. Point Grey sediment chemistry and particle size data - September 1999.

Station	Sediment Chemistry[1]							% Particle Size			
	Cd	Hg	Cu	Pb	Zn	PAH	TOC	Gravel	Sand	Silt	Clay
	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	%	> 2.0 mm	2 - 0.063 mm	0.063 - 0.004 mm	< 0.004 mm
1	0.20	0.09	49.2	20.0	96.9	0.43	0.81	0.00	4.85	46.07	49.08
2	0.17	0.12	56.7	19.0	99.2	0.43	1.00	0.00	1.36	53.84	44.80
3	0.23	0.08	46.0	10.0	79.8	0.31	0.54	0.10	24.41	54.29	20.79
4	0.19	0.10	51.4	10.0	97.0	0.34	0.77	0.00	0.07	55.24	44.09
5	0.20	0.09	47.3	20.0	95.1	0.34	0.79	0.00	0.30	53.06	46.65
6	0.19	0.09	49.0	24.0	100.0	0.44	1.07	0.00	0.39	46.97	52.64
7	0.47	0.12	55.8	22.0	110.0	0.56	1.06	0.00	0.86	42.88	56.26
8	0.18	0.11	56.2	23.0	104.0	0.59	1.02	0.00	0.68	39.13	60.19
25	0.10	0.08	44.3	10.0	85.6	0.51	1.59	0.23	22.06	39.97	37.75
26	0.20	0.04	34.1	-8.0	61.6	0.38	0.73	9.83	42.72	25.94	21.51
27	0.10	0.12	43.9	-8.0	83.4	0.47	0.99	10.58	27.09	34.06	28.70
28	0.20	0.08	45.9	-8.0	91.1	0.37	1.79	0.48	8.66	47.27	43.59
29	0.45	0.08	49.3	9.0	91.2	0.36	1.23	0.18	8.69	46.12	45.01
30	0.17	0.08	48.1	-8.0	94.9	0.45	1.11	1.50	6.95	43.69	47.86
31	0.18	0.07	49.9	10.0	90.3	0.30	1.58	1.38	20.51	37.05	41.06
32	0.10	0.07	46.9	10.0	83.6	0.84	1.15	7.96	26.08	30.68	35.28
33	0.10	0.06	41.5	10.0	78.0	0.37	1.17	4.63	32.77	32.41	30.19
34	0.10	0.08	40.6	-8.0	78.1	0.50	1.17	0.67	41.55	31.16	26.62
35	0.17	0.05	35.8	10.0	71.5	0.46	1.16	1.97	53.15	26.79	18.09
36	0.21	0.06	38.0	10.0	73.3	* 9.03	0.74	2.61	42.58	32.53	22.28
37	0.20	0.07	45.0	21.0	86.5	0.32	1.28	1.29	27.45	41.43	29.83
38	0.20	0.07	42.9	10.0	82.7	0.57	1.05	0.79	32.30	36.74	30.17
39	0.23	0.07	41.4	10.0	80.6	0.48	1.51	9.75	32.44	32.35	25.47
40	0.18	0.07	43.7	-8.0	84.2	0.59	1.23	2.61	33.01	35.90	28.48
41	0.19	0.06	40.2	10.0	78.9	0.43	1.19	7.68	34.00	32.89	25.43

[1] Total metals results are expressed in dry weight.
* Indicates sample exceeded ICTG limit.
Negative numbers represent values below detection limit.

5.3 COMOX (CAPE LAZO)

Disposal Site:	Comox (Cape Lazo)
Co-ordinates:	49°41.70'N; 124°44.50'W
Depth:	190 metres
Total Quantity Disposed Since 1976:	45 633 cubic metres

Comments

The DFO Habitat Management Unit in Nanaimo, British Columbia (South Coast Division) should be contacted for specific time restrictions on dredging.

Load Site Information

In 1999, 13 716 cubic metres of material was disposed of at the Comox disposal site. This material originated from maintenance dredging activities in Courtenay River and Little River on Vancouver Island, British Columbia. Specific load site information is listed in Appendix II.

Monitoring Information

This site was last monitored in 1997.

5.4 MALASPINA STRAIT

Disposal Site:	Malaspina Strait
Co-ordinates:	49°45.00'; 124°27.00'W
Depth:	320 metres
Total Quantity Disposed Since 1976:	561 470 cubic metres + 6 000 tonnes

Comments

The DFO Habitat Management Unit in Nanaimo, British Columbia (South Coast Division) should be contacted for specific timing restrictions on dredging.

Load Site Information

In 1999, 6 645 cubic metres of material resulting from maintenance dredging activities outside the Stillwater Bay Dry Land Sort and at the MacMillan Bloedel (Pacifica Papers) mill in Powell River was sent to the Malaspina Strait disposal site. In addition, 4 350 cubic metres of approved undisturbed excavated native till from Jervis Inlet, British Columbia was disposed of at Malaspina Strait disposal site. Specific load site information is listed in Appendix II.

Monitoring Information

This site was last monitored in 1996.

5.5 THORNBROUGH CHANNEL

Disposal Site:	Thornbrough Channel
The Co-ordinates:	49°31.00'N; 123°28.30'W
Depth:	220 metres
Total Quantity Disposed Since 1976:	83 361 cubic metres

Comments

The DFO Habitat Management Unit in Nanaimo, British Columbia (South Coast Division) should be contacted for specific timing restrictions on dredging.

Load Site Information

In 1999, maintenance dredging at forest industry operations in Howe Sound, British Columbia resulted in 9 500 cubic metres of material being sent to the Thornbrough Channel disposal site. Specific load site information is listed in Appendix II.

Monitoring Information

This site was last monitored in 1996.

5.6 JOHNSTONE STRAIT - HANSON ISLAND

Disposal site:	Johnstone Strait - Hanson Island
Co-ordinates:	50°33.50'N; 126°48.00'W
Depth:	350 metres
Total Quantity Disposed Since 1976:	202 656 cubic metres

Comments

The DFO Habitat Management Unit in Nanaimo, British Columbia (South Coast Division) should be contacted for specific timing restrictions on dredging.

Load Site Information

In 1999, 6 500 cubic metres of dredged material from forestry operations near Port McNeil, British Columbia was disposed of at the Hanson Island disposal site. Specific load site information is listed in Appendix II.

Monitoring Information

This site was last monitored in 1998.

5.7 FIVE FINGER ISLAND

Disposal Site:	Five Finger Island
Co-ordinates:	49°15.20'N; 123°54.60'W
Depth:	280 metres
Total Quantity Disposed Since 1976:	221 094 cubic metres

Comments

The DFO Habitat Management Unit in Nanaimo, British Columbia (South Coast Division) should be contacted to specific time restrictions on dredging.

Load Site Information

In 1999, 4 965 cubic metres of material resulting from forest related industry operations in Nanaimo and Ladysmith, British Columbia was sent to the Five Finger Island disposal site. Specific load site information is listed in Appendix II.

Monitoring Information

In September 1999, surface sediment samples were collected from nine stations at the Five Finger Island disposal site (Figure 4) and from five reference locations in the vicinity of the disposal site (stations 10-14). At one reference station (station 10) and at each of the nine disposal site stations (stations 1-9), three surface sediment samples were taken and combined to make one composite sample. In total, ten composite samples and fourteen surface sediment samples were taken from this site.

Chemical and particle size data were obtained for all samples and are presented in Table 4. There were no trace metal concentrations above the ICTG limits. The composite samples were further analysed for acid volatile sulphides (AVS) and simultaneously extracted metals (SEM). These results appear in Table 5. Acute sediment toxicity, bacterial bioluminescence, and echinoid fertilisation tests were conducted on the composite samples and the results appear in Table 6. Total polycyclic aromatic hydrocarbons (PAH) concentrations at station 9 marginally exceeded the ICTG limit.

In September 1999, ROPOS II was deployed at the Five Finger Island disposal site. As part of a physical monitoring program, the remotely operated vehicle (ROV) is used to observe the benthic condition of the disposal site and surrounding area. In addition, information on the area of deposition of materials and physical characteristics of sediment in and around the disposal site boundary can be gathered from the ROPOS video. Predetermined track lines were plotted over the disposal site and continuous video images were recorded. Computer-captured still images (transferred to slide and CD ROM) were also collected. A selection of these images is presented in Appendix III.

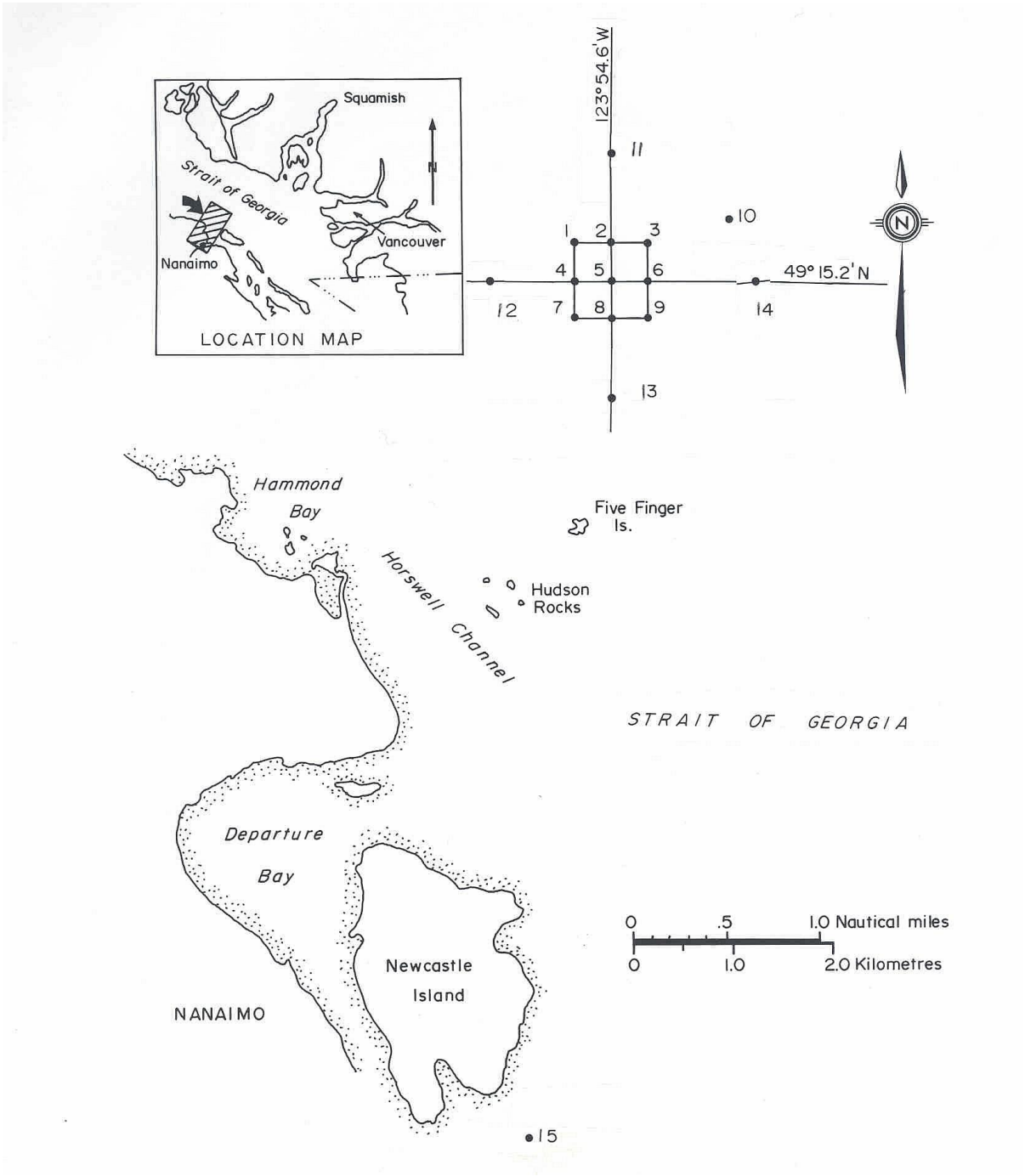


Figure 4. Five Finger Island disposal site sediment sampling stations.

Table 4. Five Finger Island sediment chemistry and particle size data - September 1999.

Station	Sediment Chemistry[1]							% Particle Size			
	Cd	Hg	Cu	Pb	Zn	PAH	TOC	Gravel	Sand	Silt	Clay
	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	%	> 2.0 mm	2 - 0.063 mm	0.063 - 0.004 mm	< 0.004 mm
1	0.32	0.14	67.7	19.0	146.0	1.03	1.81	0.15	0.71	22.99	76.15
2	0.28	0.12	60.9	30.0	132.0	1.02	2.34	1.00	4.29	21.23	73.49
3	0.29	0.12	62.5	17.0	134.0	0.96	1.76	4.91	2.35	19.58	73.16
4	0.33	0.13	62.0	19.0	130.0	1.17	3.81	11.63	25.91	17.55	44.90
5	0.56	0.16	62.2	20.0	128.0	2.34	4.38	37.41	18.31	12.41	31.37
6	0.33	0.12	61.4	18.0	128.0	1.65	3.51	2.65	11.24	22.42	63.69
7	0.29	0.11	54.2	20.0	114.0	1.61	3.41	0.61	21.58	22.33	55.48
8	0.23	0.11	51.2	17.0	102.0	1.38	1.65	1.55	29.12	19.16	50.16
9	0.30	0.12	55.9	20.0	108.0	* 3.36	4.62	4.78	19.67	24.20	51.36
10	0.31	0.13	64.4	18.0	142.0	1.08	1.57	0.00	3.57	21.02	75.41
11	0.33	0.12	66.9	32.0	149.0	0.80	1.49	0.00	0.40	18.45	81.16
12	0.36	0.12	64.7	27.0	138.0	1.25	1.61	0.00	0.81	21.08	78.11
13	0.25	0.11	54.8	10.0	103.0	1.92	3.09	0.00	21.65	29.83	48.52
14	0.26	0.10	52.6	10.0	108.0	1.85	2.82	0.93	23.06	22.37	53.64
Composite 1	0.37	0.13	66.7	29.0	149.0	1.02	1.90	0.81	1.60	17.39	80.20
Composite 2	0.31	0.13	66.7	30.0	215.0	1.09	2.03	0.32	3.93	20.31	75.44
Composite 3	0.32	0.10	57.3	25.0	123.0	0.61	1.04	7.78	25.12	14.96	52.15
Composite 4	0.32	0.14	61.7	24.0	131.0	1.63	3.49	11.45	20.51	18.01	50.03
Composite 5	0.40	0.13	65.5	31.0	138.0	1.68	3.96	16.60	19.65	16.39	47.36
Composite 6	0.30	0.14	64.0	26.0	135.0	1.67	3.51	5.71	11.38	21.01	61.90
Composite 7	0.30	0.13	57.2	10.0	200.0	1.24	1.91	0.12	18.37	21.66	59.86
Composite 8	0.25	0.11	53.2	10.0	104.0	0.88	1.25	2.18	27.39	19.94	50.50
Composite 9	0.26	0.13	53.6	20.0	113.0	2.18	2.47	1.09	20.91	22.13	55.87
Composite 10	0.26	0.12	63.0	27.0	137.0	0.81	1.36	0.11	1.35	20.60	77.94

[1] Total metals results are expressed in dry weight.
* Indicates sample exceeded ICTG limit.

Table 5. Five Finger Island additional sediment chemistry data – September 1999.

Station	AVS µmol/g	SEM µmol/g	Ratio AVS/SEM
Composite 1	6.7	1.69	0.252
Composite 2	1.5	1.38	0.920
Composite 3	5	1.47	0.294
Composite 4	2.4	1.02	0.425
Composite 5	10.3	1.34	0.130
Composite 6	4.5	1.18	0.262
Composite 7	0.4	1.14	* 2.850
Composite 8	-0.2	1.03	-5.150
Composite 9	1.6	1.42	0.887
Composite 10	0.3	1.45	* 4.833

Negative numbers represent values below detection limit.
* AVS/SEM > 1 indicates SEM metals may be bioavailable

Table 6. Five Finger Island toxicity test results – September 1999.

Station	Amphipod *E. wahingtonianus* % survival	Amphipod *R. abronius* % survival	Echinoid *D. excentricus* % survival	Microtox®+ solid phase IC50 % effect
Composite 1	* 23.0 ± 5.7	70.0 ± 17.0	96.0 ± 1.1	0.270
Composite 2	* 32.0 ± 10.4	* 50.0 ± 22.6	89.0 ± 2.7	0.150
Composite 3	* 25.0 ± 19.0	* 47.0 ± 7.6	97.0 ± 1.0	0.300
Composite 4	65.0 ± 7.1	* 58.0 ± 6.7	90.0 ± 4.5	* 0.084
Composite 5	76.0 ± 7.4	* 66.0 ± 21.6	92.0 ± 3.1	* 0.061
Composite 6	78.0 ± 12.0	78.0 ± 8.4	94.0 ± 2.5	* 0.083
Composite 7	72.0 ± 16.8	77.0 ± 4.5	82.0 ± 8.1	0.240
Composite 8	* 61.0 ± 10.8	86.0 ± 5.5	94.0 ± 1.5	0.230
Composite 9	* 20.0 ± 15.8	* 60.0 ± 17.7	92.0 ± 5.1	0.370
Composite 10	93.0 ± 5.7	98.0 ± 2.7	98.0 ± 0.58	0.85

* indicates toxic response observed.
+ Microtox® results have been moisture corrected.

5.8 Victoria

Disposal Site:	Victoria
Co-ordinates:	48°22.30'N; 123°21.80'W
Depth:	90 metres
Total Quantity disposed Since 1976:	296 314 cubic metres + 31 105 tonnes

Comments

The DFO Habitat Management Unit in Nanaimo, British Columbia (South Coast Division) should be contacted for specific timing restrictions on dredging.

Load Site Information

In 1999, 4 616 cubic metres of dredged material was sent to the Victoria disposal site. The material originated from maintenance dredging in Victoria Harbour and a forest industry operation west of Otter Point, near Sooke, British Columbia. Specific load site information is listed in Appendix II.

Monitoring Information

This site was last monitored in 1996.

5.9 PORLIER PASS

Disposal Site:	Porlier Pass
Co-ordinates:	49°00.20'N; 123°29.80'W
Depth:	200 metres
Total Quantity Disposed Since 1976:	181 425 cubic metres

Comments

The DFO Habitat Management Unit in Nanaimo, British Columbia (South Coast Division) should be contacted for specific timing restrictions on dredging.

Load Site Information

In 1999, 4 400 cubic metres of material was sent to the Porlier Pass disposal site resulting from maintenance dredging activities at forest industry operations in Chemainus and Ladysmith, British Columbia. Specific load site information is listed in Appendix II.

Monitoring Information

This site was last monitored in 1995.

5.10 THORMANBY ISLAND

Disposal Site:	Thormanby Island
Co-ordinates:	49°27.50'N; 124°04.50'W
Depth:	384 metres
Total Quantity Disposed Since 1976:	9 585 cubic metres

Comments

The DFO Habitat Management Unit in Nanaimo, British Columbia (South Coast Division) should be contacted for specific timing restrictions on dredging.

Load Site Information

In 1999, 3 400 cubic metres of dredged material was disposed of by a gravel mining operation near Sechelt, British Columbia. Specific load site information is listed in Appendix II.

Monitoring Information

This site was last monitored in 1997.

5.11 JOHNSTONE STRAIT - HICKEY POINT

Disposal Site:	Johnstone Strait - Hickey Point
Co-ordinates:	50°27.80'N; 126°04.80'W
Depth:	270 metres
Total Quantity Disposed Since 1976:	163 437 cubic metres + 40 tonnes

Comments

The DFO Habitat Management Unit in Nanaimo, British Columbia (South Coast Division) should be contacted for specific time restrictions on dredging.

Load Site Information

In 1999, 3 250 cubic metres of dredged material was disposed of at the Hickey Point disposal site. This material originated from forest industry operations in Kelsey Bay, British Columbia. Specific load site information is listed in Appendix II.

Monitoring Information

This site was last monitored in 1998.

5.12 CAPE MUDGE

Disposal Site:	Cape Mudge
Co-ordinates:	49°57.70'N; 125°05.00'W
Depth:	200 metres
Total Quantity Disposed Since 1976:	155 773 cubic metres

Comments

DFO generally prohibits dredging/loading activities during the period December 01 to March 15 in the Campbell River area to protect salmon stocks and to minimise disruption of the local sport fishery.

The DFO Habitat Management Unit in Nanaimo, British Columbia (South Coast Division) should be contacted for specific timing restrictions on dredging.

Load Site Information

In 1999, 1 920 cubic metres of dredged material was disposed of at the Cape Mudge disposal site. This material originated from MacMillan Bloedel operations in Menzies Bay, near Campbell River, British Columbia. Specific load site information is listed in Appendix II.

Monitoring Information

This site was last monitored in 1996.

5.13 WATTS POINT

Disposal Site:	Watts Point
Co-ordinates:	49°38.50'N; 123°14.10'W
Depth:	230 metres
Total Quantity Disposed Since 1976:	487 116 cubic metres

Comments

This disposal site was last used in 1997. Dredging is prohibited from April 01 to June 01 of any year in order to protect juvenile salmonids migrating downstream in Mill Creek. For further timing restrictions on dredging, contact the DFO Habitat Management Unit in New Westminster.

Monitoring Information

Nine surface sediment samples were collected from the Watts Point disposal site in September 1999 (Figure 5). In addition, sediment samples were collected from each of the 9 stations and composited to form 3 composite samples. Chemical and particle size data were obtained for the nine surface sediment samples. Total organic carbon (TOC) and total polycyclic aromatic hydrocarbons (PAH) data were obtained for the three composite samples (Table 7). No chemical concentrations exceeded the Interim Contaminant Testing Guideline screening limits.

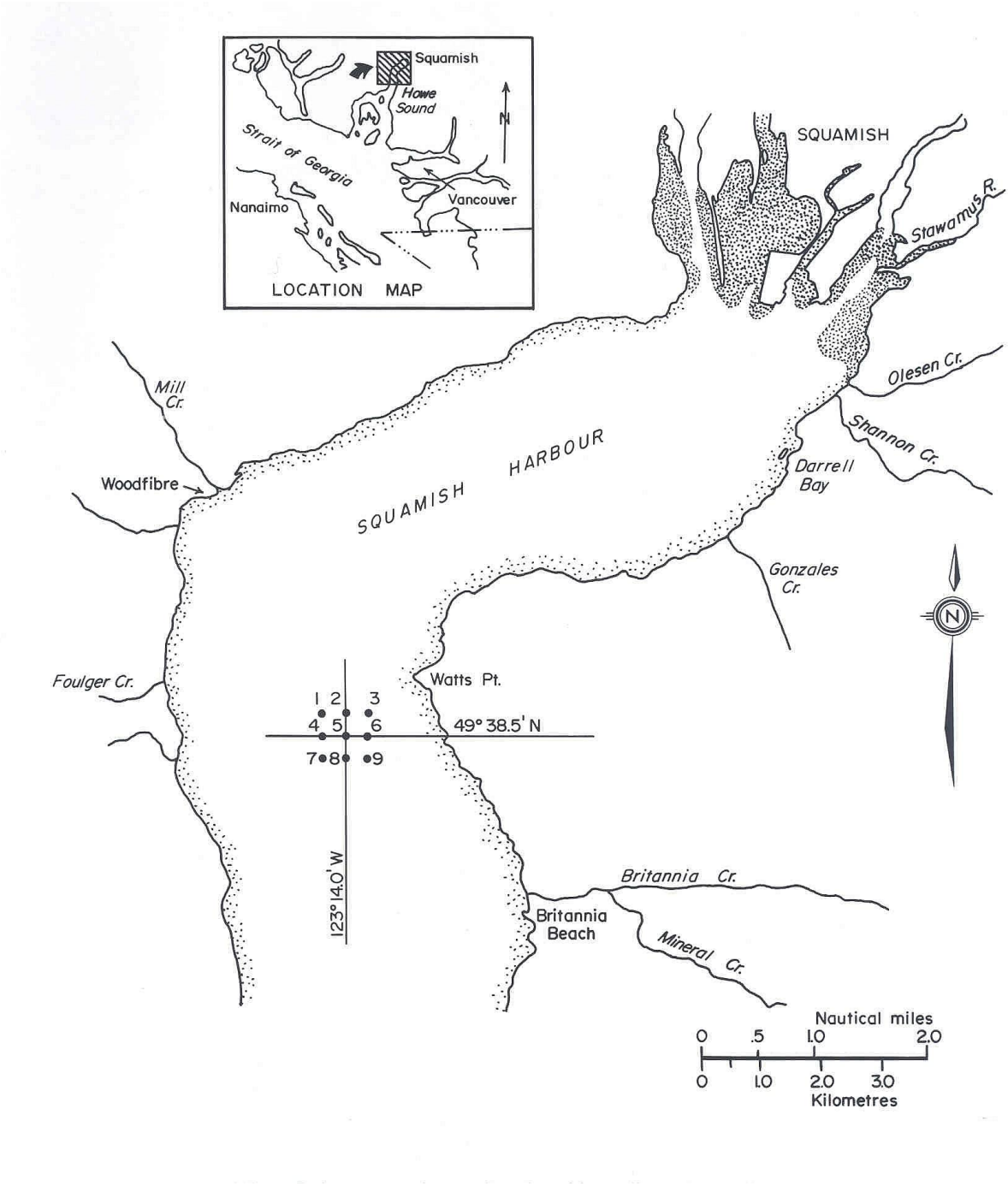


Figure 5. Watts Point disposal site sediment sampling stations.

Table 7. Watts Point sediment chemistry and particle size data - September 1999.

Station	Sediment Chemistry[1]							% Particle Size			
	Cd	Hg	Cu	Pb	Zn	PAH	TOC	Gravel	Sand	Silt	Clay
	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	%	> 2.0 mm	2 - 0.063 mm	0.063 - 0.004 mm	< 0.004 mm
1	0.09	0.03	79.8	10.0	88.6			0.00	1.12	60.66	38.23
2	0.10	0.05	74.4	-8.0	84.8			0.15	4.80	62.37	32.68
3	0.34	0.04	83.7	-8.0	92.5			0.27	6.34	63.01	30.39
4	0.10	0.03	66.6	-8.0	76.2			0.00	2.35	65.05	32.60
5	0.10	0.04	79.2	-8.0	90.0			2.62	10.54	53.19	33.66
6	0.10	0.03	81.9	-8.0	87.5			0.80	5.00	58.81	35.39
7	0.09	0.03	66.0	-8.0	77.6			0.18	3.16	62.72	33.94
8	0.10	0.04	87.1	10.0	95.0			0.95	7.17	54.82	37.07
9	0.39	0.06	174.0	21.0	180.0			24.52	15.34	36.00	24.15
composite (123)						0.28	0.53				
composite (456)						0.21	0.65				
composite (789)						0.25	0.49				

[1] Total metals results are expressed in dry weight.
Negative numbers represent values below detection limit.

6.0 REFERENCES

Publications

Environment Canada. 1993. Interim monitoring guidelines for ocean disposal. Environment Canada, Conservation and Protection.

Environment Canada. 1994. Guidance document on the collection and preparation of sediments for physiochemical characterization and biological testing. Environment Canada, Conservation and Protection. Report EPS 1/RM/29.

Fraser River Estuary Management Program. 2005. Revised Fraser River Estuary Management Program Dredge Management Guidelines.

Kim, K., C. Schnider and D.L. Sullivan. 1999. Ocean disposal activities summary 1997 Pacific and Yukon region. Environment Canada, Environmental Protection Branch, Pacific and Yukon Region. Regional Program Report: 1999-02.

Kim, K. and D.L. Sullivan. 1993. Ocean disposal activities summary from 1987 to 1992 for Pacific and Yukon Region. Environment Canada, Conservation and Protection, Pacific and Yukon Region. Regional Program Report: 93-01.

Kim, K., D.L. Sullivan, D.E. Brothers and C. Schnider. 1997. Ocean disposal activities summary for Pacific and Yukon Region 1993. Environment Canada, Conservation and Protection, Pacific and Yukon Region. Regional Program Report: 97-01.

Schnider, C. and D.L. Sullivan. 1997a. Ocean disposal summary for Pacific and Yukon Region 1995. Environment Canada, Conservation and Protection, Pacific and Yukon Region. Regional Program Report: 97-28.

Schnider, C. and D.L. Sullivan. 1997b. Ocean disposal summary for Pacific and Yukon Region 1996. Environment Canada, Conservation and Protection, Pacific and Yukon Region. Regional Program Report: 97-30.

Sullivan, D. 1987. Compilation and assessment of research, monitoring and dumping information for active dumpsites on the British Columbia and Yukon coasts from 1979 to 1987. Environment Canada, Conservation and Protection, Pacific and Yukon Region. Manuscript Report: 87-02.

Sullivan, D.L., D.E. Brothers, K. Kim and C. Schnider. 1997. Ocean disposal activities summary for Pacific and Yukon Region 1994. Environment Canada, Conservation and Protection, Pacific and Yukon Region. Regional Program Report: 97-02.

Sullivan, D.L., D.L. Lee and C. Udell. 1999b. Ocean disposal activities summary 1998 Pacific and Yukon Region. Environment Canada, Environmental Protection, Pacific and Yukon Region. Regional Program Report: 1999-27.

Ward, A.B. and D.L. Sullivan. 1980. A review of existing and historical ocean dumpsites in the Pacific Region. Environment Canada, Environmental Protection Service, Pacific Region. Regional Program Report: 80-5.

Websites

http://www.pgc.nrcan.gc.ca/index_e.php

http://www.bieapfremp.org/fremp/publications/current.html

APPENDICES

APPENDIX I

Interim Contaminant Testing Guidelines for Disposal at Sea Pacific and Yukon Region (2005 August)

INTERIM CONTAMINANT TESTING GUIDELINES FOR DISPOSAL AT SEA PACIFIC AND YUKON REGION

In response to growing concern over the biological implications of contaminants in marine sediments along the Canadian coastline, Environment Canada (EC), Pacific and Yukon Region, in consultation with the Regional Ocean Disposal Advisory Committee, has developed the following guidelines for sampling, analysis and reporting associated with proposed disposal at sea activities.

Under Schedule 6 (Assessment of Waste or Other Matter) of the *Canadian Environmental Protection Act, 1999* (CEPA 1999), EC and permit applicants must consider the availability of practical alternate disposal options. To satisfy this requirement, the applicant must provide a written record of the decision-making process used in selecting disposal at sea as the alternative of choice for disposal of materials. Disposal at sea is only permitted for materials where it is the environmentally preferable and practical alternative.

To assess the potential for environmental impacts of disposal at sea, EC requires chemical analyses to be performed on any material where there is a lack of chemical data, or a reason to believe that contaminants such as selected trace metals or organics are present. Guidance for the number of samples required may be obtained through Environment Canada's Regional Disposal at Sea offices. A proposed sampling program should be developed by the applicant, based on information provided in the following tables, and submitted to the appropriate Regional Office for approval prior to commencement of loading or disposal activities.

Materials found to contain substances of concern at or higher than the regulated or guideline concentrations identified in the following tables, may be considered for disposal at sea under CEPA 1999, Schedule 6. A substance may be considered for disposal at sea if tests show that it can be disposed of so as not to cause acute or chronic effects on marine organisms or human health, whether or not arising from their bioaccumulation in marine organisms. A tiered assessment approach using biological testing is used for this determination. Disposal at sea options such as capping, containment and side-casting will be considered by EC, but their acceptance will be conditional on compliance with Schedule 6.

SAMPLING AND ANALYSIS REQUIREMENTS

The following pages identify the minimum sampling and analytical requirements for dredged and excavated materials based on the size of the project, as well as rejection/screening limits currently used by EC. Sampling requirements will be tailored on a site specific basis at the discretion of EC, and analysis of other parameters may be requested when EC has reason to believe that other contaminants are present.

MINIMUM REQUIREMENTS FOR DREDGED MATERIAL

Sampling Requirements

The following are the minimum sampling requirements for disposal of dredged material. Additional guidance may be obtained from the *Users Guide to the Application Form for Ocean Disposal* (Report EPS 1/MA/1, 1995) available from Regional Disposal at Sea offices. Projects involving disposal of less than 4 000 cubic metres of material resulting from maintenance dredging are eligible for disposal under a valid general permit (Pacific and Yukon Region).

Parentheses indicate the number of composite samples to be analyzed initially for dioxins/furans, if requested by EC.

Table 1. Minimum sampling requirements for dredged material.

Project Quantity	Permit Type	# of Samples	Type of Sampling
0 - 4 000 m^3	General	3 (1)	Surface sampling prior to loading.
0 - 10 000 m^3	Site-Specific	6 (1)	Surface sampling prior to loading.
10 001 - 30 000 m^3	Site-Specific	5 (1) 4 (1)	Surface sampling prior to loading. Sampling to depth prior to loading.
		OR	
10 001 - 30 000 m^3	Site-Specific	9 (2)	Surface sampling prior to loading.
30 001 - 60 000 m^3	Site-Specific	5 (2) 5 (2)	Surface sampling prior to loading. Sampling to depth prior to loading.
> 60 000 m^3	Site-Specific	Sampling requirements will be determined on a project specific basis.	

Should the site history reveal cause for environmental concern, an increased number of samples and/or analysis of additional metals and/or organics may be requested.

Analysis Requirements

Details of minimum analytical requirements may be obtained through Environment Canada's Regional Disposal at Sea offices.

Table 2. Minimum analysis requirements for dredged material.

	Parameter	Limit of Detection
Trace Metals	Mercury	0.2 µg/g
	Cadmium	0.2 µg/g
Organics	PAH	0.1 µg/g
Other	Total Organic Carbon	
	Particle Size	

For Polycyclic Aromatic Hydrocarbons (PAH's), the analytical methodology and quality assurance protocol must conform to that outlined in the 'Interim Quality Assurance Guidelines for Determination of Polycyclic Aromatic Hydrocarbons in Marine Sediments for Ocean Disposal', a copy of which is available from EC.

For dioxin/furan, the analytical methodology and quality assurance protocol must conform to that outlined in the 'Internal Quality Assurance Requirements for Analysis of Dioxins in Environmental Samples', a copy of which is available from EC.

The analysis results are to be reported on a dry weight basis with detection limits less than or equal to those stated above. The precision of the test method should be indicated by reporting analyses on five replicate sub-samples on 10% of the trace metal samples, and two replicate sub-samples on 20% of the organics samples, with a minimum of one replicated sample. Sub-sampling should be done following homogenizing but prior to digestion of the sample and the replicates should not be run consecutively. The accuracy of the test method should be indicated by reporting the results of certified reference materials analyzed at the same time as the test samples.

MINIMUM REQUIREMENTS FOR EXCAVATION MATERIAL

Sampling Requirements

The following are the minimum sampling requirements for disposal of excavated material. Additional guidance may be obtained from the *Users Guide to the Application Form for Ocean Disposal* (Report EPS 1/MA/1, 1995), which is available through Environment Canada's Regional Disposal at Sea offices.

Projects involving disposal at sea of undisturbed native till may be completed under a valid general excavation permit (Pacific and Yukon Region). For other excavated materials, a site specific permit will be required.

Table 3. Minimum sampling requirements for excavated material.

Project Quantity	# of Samples	Type of Sampling
0 - 10 000 m^3	6	Composite of surface native till to 1 metre depth.
10 001 - 30 000 m^3	9	Composite of surface native till to 1 metre depth.
30 001 - 60 000 m^3	12	Composite of surface native till to 1 metre depth.
> 60 000 m^3	Number of samples to be determined on a project specific basis.	

Should the site history reveal cause for environmental concern, an increased number of samples and/or analysis of additional metals and/or organics may be requested.

Analysis Requirements

Details of minimum analytical requirements may be obtained through Environment Canada's Regional Disposal at Sea Offices.

Table 4. Minimum analysis requirements for excavated material.

	Parameter	Limit of Detection
Trace Metals	Mercury	0.2 µg/g
	Cadmium	0.2 µg/g
Organics	PAH	0.1 µg/g
Other	Total Organic Carbon	
	Particle Size	

For PAH's, the analytical methodology and quality assurance protocol must conform to that outlined in the 'Interim Quality Assurance Guidelines for Determination of Polycyclic Aromatic Hydrocarbons in Marine Sediments for Ocean Disposal', a copy of which is available from EC.

For dioxin/furan, the analytical methodology and quality assurance protocol must conform to that outlined in the 'Internal Quality Assurance Requirements for Analysis of Dioxins in Environmental Samples', a copy of which is available from EC.

The analysis results are to be reported on a dry weight basis with detection limits less than or equal to those stated above. The precision of the test method should be indicated by reporting sub-samples on 20% of the organics samples, with a minimum of one replicated sample. Sub-sampling should be done following homogenizing but prior to digestion of the sample and the replicates should not be run consecutively. The accuracy of the test method should be indicated by reporting the results of certified reference materials analyzed at the same time as the test samples.

REJECTION/SCREENING LIMITS

Material found to exceed the following regulated and guideline limits will not be considered for disposal at sea unless tests show it can be disposed of at sea within the criteria established under Schedule 6, CEPA 1999.

Environment Canada may impose more stringent limits if the site history indicates cause for environmental concern.

Table 5. Rejection/screening limits for disposal at sea.

Parameter	Rejection/Screening Limit
Cadmium	0.6 μg/g dry weight
Mercury	0.75 μg/g dry weight
Chlorophenols (PCP) (penta and tetra isomers)	1.0 μg/g dry weight
Polychlorinated biphenyls (PCB)	0.1 μg/g dry weight
Total PAH	2.5 μg/g dry weight
Dioxin/Furan	"Quantifiable" 2,3,7,8 TCDD

STEPS REQUIRED FOR COLLECTING SAMPLES AND SUBMITTING ANALYTICAL DATA

The applicant is required to prepare the following information to be included with the proposed sampling program:

1) A location map for the dredge or excavation site with the street address of the proposed dredge/excavation site;
2) A site map showing the proposed dredge or excavation site relative to known landmarks and/or streets;
3) A list of any known possible contaminant input sources in the vicinity of the proposed works;
4) A written record of the decision making process used in selecting disposal at sea as the preferred disposal option, explaining why other disposal methods are not being used;
5) A site use history for the site from which the material approved for disposal at sea will originate; and
6) A proposed sampling plan of the site showing the proposed sampling locations and a list of proposed analyses. The proposed sampling plan should be developed based on information presented in this document and the *Users Guide to the Application Form for Ocean Disposal*. Assistance in designing a sampling program can be provided by Environment Canada. **The sampling program must be approved prior to taking the samples.**

The information identified above should be sent to EC. If the project does not qualify for completion under the terms and conditions of a general permit, this information should be submitted with a completed Disposal at Sea Application. For information on how to apply, please contact EC.

If the project qualifies for completion under a general disposal at sea permit, this information must be submitted to EC with a covering letter describing the proposed activities in detail and the proposed schedule for the work. Upon completion of the sampling and analyses program, the test data, together with all QA/QC data as identified in the foregoing information, must be sent to EC.

No work may proceed under a general permit until written approval for the specific site has been received from EC and a copy of the approval letter is posted at the work site.

For further information on this document, or any other matter relating to the Disposal at Sea Program, please visit the Pacific and Yukon Region Disposal at Sea website at http://www.pyr.ec.gc.ca/disposal_at_sea/index_e.htm or send an email to OceanDisposal@ec.gc.ca.

GENERAL GUIDE TO SOIL AND SEDIMENT SAMPLE COLLECTION

Containers for the samples should be obtained from the laboratory contracted to conduct the required analyses. Avoid unnecessary contact with clean glassware and utensils. A clean stainless steel or teflon spoon or scoop is ideal for transferring samples. Handle containers by the outsides only. Do not touch the inside of the jar, or teflon (or foil) liners, and use spoons or scoops by the handles only. When removing a foil or teflon liner and lid from a jar, remove as one piece and put down on a piece of foil or other clean surface while filling the jar.

If using a grab sampler, remove the water from the surface of the grab, taking care not to disturb the contents if possible. Use the clean scoop to remove a portion of the sediment from the middle of the sampler down to the depth of the material caught in the grab. The material in the sample jar should be representative of the material to be loaded for disposal at sea.

Alternatively, the sample may be taken by removing the lid, holding the jar by the sides and scooping the sample from the sediment without the use of other utensils. The threads of the jar may then be wiped with a paper towel before replacing the lid. Do not fill the jar more than about 3/4 full, allowing plenty of room for mixing/stirring and expansion during freezing. When the sample is in the jar, replace the teflon/foil liner and lid, and label the jar with project identification, sampling site number and sampling date.

To clean the sampling spoon or grab in between samples, wipe with a paper towel to remove any solids, then rinse with water. Clean the tray in this manner as required.

If three samples are required for analysis, three small jars of sediment should be taken for <u>each</u> sampling station, for a total of nine jars. The three jars per sample will be composited by the analytical lab by taking equal aliquots of sample from each jar for a single analysis of most parameters of concern. The samples may be further composited for other testing as required but would otherwise be maintained as discrete samples.

Keep the samples in a refrigerator or on ice for short term storage (1-2 days); freeze the sample as soon as possible or store over dry ice for long term storage. The laboratory responsible for the analyses should be asked to freeze the samples after removal of sufficient material to complete the required analyses. These samples should remain frozen until the permit, or approval under a general permit, has been issued by EC.

APPENDIX II

Disposal Site Summaries

Disposal Site History Report

For Disposal Activities Between 1999/01/01 and 1999/12/31

Disposal Site Sand Heads
Latitude 49°06.00'N
Longitude 123°19.50'W
Depth (m) 70

Permit Type	Permit	Load Site	Dump Start Date	Quantity
Dredge	3198	FR-LAFARGE CEMENT-RICHMOND	04-Mar-99	1,200 m3
	3207	SERPENTINE RAIL BRIDGE	25-Jul-99	1,000 m3
	3211	FR-WESTVIEW DREDGING	19-Apr-99	1,600 m3
	3211	VAN HBR-MARITIME MUSEUM	14-Jul-99	450 m3
	3216	FR-CANADIAN FISHING CO	12-Oct-99	4,000 m3
	3216	FR-NEW WESTMINSTER QUAY	22-Nov-99	4,000 m3
	3216	FR-TILBURY CEMENT	14-Dec-99	4,000 m3
	3227	FR-MAINTENANCE	01-Aug-99	322,490 m3
	3227	FR-MAINTENANCE	01-Sep-99	27,760 m3
	3227	FR-MAINTENANCE	01-Oct-99	55,855 m3
	3227	FR-MAINTENANCE	01-Nov-99	5,090 m3
	3227	FR-MAINTENANCE	01-Dec-99	230,135 m3
	3234	FR-TILBURY CEMENT	20-Dec-99	8,000 m3
	3233	FR-CANADIAN FISHING CO	29-Oct-99	5,000 m3
			Total Dredge Quantity:	**670,580 m3**

Disposal Site History Report

For Disposal Activities Between 1999/01/01 and 1999/12/31

Disposal Site Point Grey
Latitude 49°15.40'N
Longitude 123°22.10'W
Depth (m) 210

Permit Type	Permit	Load Site	Dump Start Date	Quantity
Dredge	3195	FR-MCKENZIE MILLS	05-Jan-99	1,000 m3
	3195	FRNA-WEST COAST CELLUFIBRE - EAST	30-Mar-99	1,000 m3
	3195	FRNA-LAFARGE-KENT ST	30-Mar-99	1,500 m3
	3195	FRNA-WEST COAST CELLUFIBRE - WEST	30-Mar-99	1,500 m3
	3195	FR-COLUMBIA BITULITHIC	07-Apr-99	500 m3
	3198	VAN HBR-STERLING PULP CHEMICALS	01-Feb-99	3,000 m3
	3198	FRNA-QUEENSBOROUGH	15-Mar-99	2,000 m3
	3198	FR-DOMANS-RICHMOND	30-Mar-99	2,500 m3
	3198	FRNA-MAINLAND SAWMILL	01-Apr-99	4,000 m3
	3198	FRNA-TERMINAL SAWMILL	09-Apr-99	1,500 m3
	3198	FRNA-RICHMOND PLYWOOD	10-Apr-99	2,500 m3
	3198	FR-CIPA LUMBER	25-Apr-99	1,500 m3
	3201	FRNA-MB-NW	01-May-99	700 m3
	3202	FRNA-GOLDWOOD IND	20-Mar-99	2,395 m3
	3206	FRNA-FLETCHER CHALLENGE	04-Jan-99	24,376 m3
	3207	FR-OCEAN FISH-RICE MILL	17-Feb-99	1,689 m3
	3207	FR-OCEAN FISH-RICE MILL	19-Mar-99	1,800 m3
	3207	FRNA-ARROW #4	19-May-99	1,160 m3
	3211	FR-PACIFIC CUSTOM LOG SORT	23-Oct-99	2,800 m3
	3211	VAN HBR-RVYC	23-Nov-99	574 m3
	3212	FR-MILL & TIMBER	03-Nov-99	16,700 m3
	3213	FR-DELTA CEDAR	14-Feb-99	700 m3
	3213	FR-DELTA CEDAR	25-Apr-99	700 m3
	3213	FR-DELTA CEDAR	28-Jun-99	5,300 m3
	3213	FR-DELTA CEDAR	23-Aug-99	6,000 m3
	3213	FR-DELTA CEDAR	12-Sep-99	700 m3
	3213	FR-DELTA CEDAR	28-Nov-99	700 m3
	3214	FR-FRASER MILLS	17-Mar-99	2,500 m3
	3214	FRNA-WESTERN WHITEWOOD	30-Sep-99	3,500 m3
	3214	FR-FRASER MILLS	09-Oct-99	4,800 m3
	3216	FRNA-SILVERTREE SAWMILLS	16-Aug-99	4,000 m3
	3216	FR-ACORN-PRIMEX	21-Aug-99	2,500 m3
	3216	FR-CIPA LUMBER	28-Aug-99	1,500 m3
	3216	United Grain Growers	08-Sep-99	1,500 m3
	3216	FR-FRASER CEDAR	22-Sep-99	3,000 m3
	3216	FR-MAPLE LEAF SHAKE & SHINGLE	28-Sep-99	1,000 m3
	3216	FR-BELL POLE	04-Oct-99	500 m3
	3216	FRNA-RICHMOND PLYWOOD	06-Nov-99	1,500 m3

	3216	FRNA-MAINLAND SAWMILL	11-Nov-99	4,000 m3
	3216	FRNA-GOLDWOOD IND	20-Nov-99	1,500 m3
	3216	FRNA-RIVERSIDE TOWING	25-Nov-99	2,500 m3
	3216	FR-CIPA LUMBER	26-Nov-99	2,500 m3
	3216	FR-FRASER PULP CHIP	29-Nov-99	1,000 m3
	3216	FRNA-TERMINAL FOREST PRODUCTS -	02-Dec-99	3,500 m3
	3216	FRNA-FLETCHER CHALLENGE	05-Dec-99	3,500 m3
	3217	FRNA-MB-CANADIAN WHITE PINE	01-Jul-99	8,675 m3
	3217	FRNA-MB-NW	01-Aug-99	6,050 m3
	3217	FRNA-MB-NW	29-Dec-99	4,500 m3
	3218	FR-S&R SAWMILLS	01-Sep-99	50,777 m3
	3219	FRNA-WEST COAST CELLUFIBRE - EAST	07-Sep-99	2,000 m3
	3219	FRNA-WEST COAST CELLUFIBRE - WEST	07-Sep-99	2,000 m3
	3219	FR-LAFARGE-COQ	23-Sep-99	2,000 m3
	3219	FR-MCKENZIE MILLS	01-Nov-99	3,000 m3
	3219	FRNA-WEST COAST CELLUFIBRE - WEST	01-Nov-99	1,000 m3
	3219	FRNA-WEST COAST CELLUFIBRE - EAST	01-Nov-99	1,000 m3
	3229	FR-STAG TIMBER	09-Nov-99	3,622 m3
	3230	VAN HBR-CONAG FALSE CREEK	06-Dec-99	2,500 m3
	3236	VAN HBR-RVYC	25-Nov-99	2,077 m3
	3236	FR-PACIFIC CUSTOM LOG SORT	22-Dec-99	200 m3
			Total Dredge Quantity:	**222,995 m3**
Excavation	3199	LOWER MAINLAND-BEL	01-Jan-99	1,228 m3
	3199	LOWER MAINLAND-BEL	08-Feb-99	7,130 m3
	3199	LOWER MAINLAND-BEL	01-Mar-99	4,642 m3
	3199	LOWER MAINLAND-BEL	01-Jun-99	5,350 m3
	3222	LOWER MAINLAND-CONAG-NORTH	02-Jan-99	10,050 m3
	3222	LOWER MAINLAND-CONAG-NORTH	01-Feb-99	18,680 m3
	3222	LOWER MAINLAND-CONAG-NORTH	01-Mar-99	3,990 m3
	3225	LOWER MAINLAND-BEL	05-Jul-99	8,133 m3
	3225	LOWER MAINLAND-BEL	13-Aug-99	1,072 m3
	3225	LOWER MAINLAND-BEL	09-Sep-99	11,483 m3
	3225	LOWER MAINLAND-BEL	21-Sep-99	1,722 m3
	3225	LOWER MAINLAND-BEL	01-Oct-99	16,632 m3
	3225	LOWER MAINLAND-BEL	01-Nov-99	19,753 m3
	3225	LOWER MAINLAND-BEL	01-Dec-99	6,853 m3
	3225	LOWER MAINLAND-BEL	01-Dec-99	98 m3
			Total Excavation Quantity:	**116,816 m3**

Disposal Site History Report

For Disposal Activities Between 1999/01/01 and 1999/12/31

Disposal Site Comox
Latitude 49°41.70'N
Longitude 124°44.50'W
Depth (m) 190

Permit Type	Permit	Load Site	Dump Start Date	Quantity
Dredge	3215	VAN IS-PRIMEX-FIELD SAWMILLS	29-Jul-99	10,500 m3
	3216	VAN IS-LITTLE RIVER FERRY	09-Aug-99	3,216 m3
			Total Dredge Quantity:	**13,716 m3**

Disposal Site History Report

For Disposal Activities Between 1999/01/01 and 1999/12/31

Disposal Site Malaspina Strait
Latitude 49°45.00'N
Longitude 124°26.95'W
Depth (m) 320

Permit Type	Permit	Load Site	Dump Start Date	Quantity
Dredge	3208	POWELL RIVER	30-Aug-99	1,590 m3
	3208	POWELL RIVER	01-Sep-99	3,705 m3
	3210	STILLWATER	24-Jun-99	1,350 m3
			Total Dredge Quantity:	**6,645 m3**
Excavation	3220	JERVIS INLET-TREAT CREEK	20-Sep-99	889 m3
	3220	JERVIS INLET-TREAT CREEK	21-Sep-99	882 m3
	3220	JERVIS INLET-TREAT CREEK	22-Sep-99	860 m3
	3220	JERVIS INLET-TREAT CREEK	23-Sep-99	869 m3
	3220	JERVIS INLET-TREAT CREEK	28-Sep-99	850 m3
			Total Excavation Quantity:	**4,350 m3**

Disposal Site History Report

For Disposal Activities Between 1999/01/01 and 1999/12/31

Disposal Site Thornbrough Channel
Latitude 49°31.00'N
Longitude 123°28.30'W
Depth (m) 220

Permit Type	Permit	Load Site	Dump Start Date	Quantity
Dredge	3198	HOWE SD-AVALON DRYLAND LOG SORT	14-Jan-99	4,000 m3
	3198	HOWE SD-TERMINAL FORESTS	20-Jan-99	4,000 m3
	3198	HOWE SD-AVALON DRYLAND LOG SORT	01-May-99	1,500 m3
			Total Dredge Quantity:	**9,500 m3**

Disposal Site History Report

For Disposal Activities Between 1999/01/01 and 1999/12/31

Disposal Site Johnstone Strait-Hanson Island
Latitude 50°33.50'N
Longitude 126°48.00'W
Depth (m) 350

Permit Type	Permit	Load Site	Dump Start Date	Quantity
Dredge	3210	VAN IS-EVE RIVER	15-Jan-99	4,000 m3
	3210	VAN IS-BEAVER COVE-CANFOR	23-Jan-99	1,000 m3
	3210	VAN IS-PORT MCNEILL-MB	24-Jan-99	1,500 m3
			Total Dredge Quantity:	**6,500 m3**

Disposal Site History Report

For Disposal Activities Between 1999/01/01 and 1999/12/31

Disposal Site Five Finger Island
Latitude 49°15.20'N
Longitude 123°54.60'W
Depth (m) 280

Permit Type	Permit	Load Site	Dump Start Date	Quantity
Dredge	3197	VAN IS-DOMANS-DUKE PT-SAWMILL	05-Jun-99	800 m3
	3197	VAN IS-DOMANS-DUKE PT-LOG	07-Jun-99	1,600 m3
	3197	VAN IS-LADYSMITH-DOMANS	12-Jun-99	400 m3
	3221	VAN IS-COASTLAND WOOD IND	18-Jan-99	665 m3
	3221	VAN IS-COASTLAND WOOD IND	10-Jul-99	900 m3
	3226	VAN IS-DOMANS-DUKE PT-SAWMILL	24-Jul-99	600 m3
			Total Dredge Quantity:	**4,965 m3**

Disposal Site History Report

For Disposal Activities Between 1999/01/01 and 1999/12/31

Disposal Site Victoria
Latitude 49°22.30'N
Longitude 123°21.80'W
Depth (m) 90

Permit Type	Permit	Load Site	Dump Start Date	Quantity
Dredge	3226	Van Is-TimberWest-Otter Point	31-Aug-99	3,700 m3
	3226	VAN IS-VIC HBR	24-Sep-99	900 m3
	3226	VAN IS-VIC HBR	05-Oct-99	16 m3
			Total Dredge Quantity:	**4,616 m3**

Disposal Site History Report

For Disposal Activities Between 1999/01/01 and 1999/12/31

Disposal Site Porlier Pass
Latitude 49°00.20'N
Longitude 123°29.80'W
Depth (m) 200

Permit Type	Permit	Load Site	Dump Start Date	Quantity
Dredge	3211	VAN IS-CHEMAINUS-SAWMILL	22-Jul-99	900 m3
	3211	VAN IS-CHEMAINUS-DRYSORT	25-Jul-99	1,350 m3
	3226	VAN IS-TIMBERWEST-LADYSMITH-DRYSORT+	01-Dec-99	2,150 m3
			Total Dredge Quantity:	**4,400 m3**

Disposal Site History Report

For Disposal Activities Between 1999/01/01 and 1999/12/31

Disposal Site	Thormanby Island
Latitude	49°27.50'N
Longitude	124°04.50'W
Depth (m)	384

Permit Type	Permit	Load Site	Dump Start Date	Quantity
Dredge	3216	SECHELT - CONAG	07-Jul-99	3,400 m3
			Total Dredge Quantity:	**3,400 m3**

Disposal Site History Report

For Disposal Activities Between 1999/01/01 and 1999/12/31

Disposal Site	Johnstone Strait-Hickey Point
Latitude	50°27.80'N
Longitude	126°04.80'W
Depth (m)	270

Permit Type	Permit	Load Site	Dump Start Date	Quantity
Dredge	3235	VAN IS-KELSEY BAY-MB	28-Dec-99	3,250 m3
			Total Dredge Quantity:	**3,250 m3**

Disposal Site History Report

For Disposal Activities Between 1999/01/01 and 1999/12/31

Disposal Site	Cape Mudge
Latitude	49°57.70'N
Longitude	125°05.00'W
Depth (m)	200

Permit Type	Permit	Load Site	Dump Start Date	Quantity
Dredge	3235	VAN IS-MENZIES BAY-MB-DRYSORT+	21-Dec-99	1,920 m3
		Total Dredge Quantity:		**1,920 m3**

APPENDIX III

Images Obtained by ROPOS II

1. Wood waste debris at the Five Finger Island disposal site.

2. Burrowing anemone at the Five Finger Island disposal site.

3. Shellfish are attracted to the wood waste debris at the Five Finger Island disposal site.

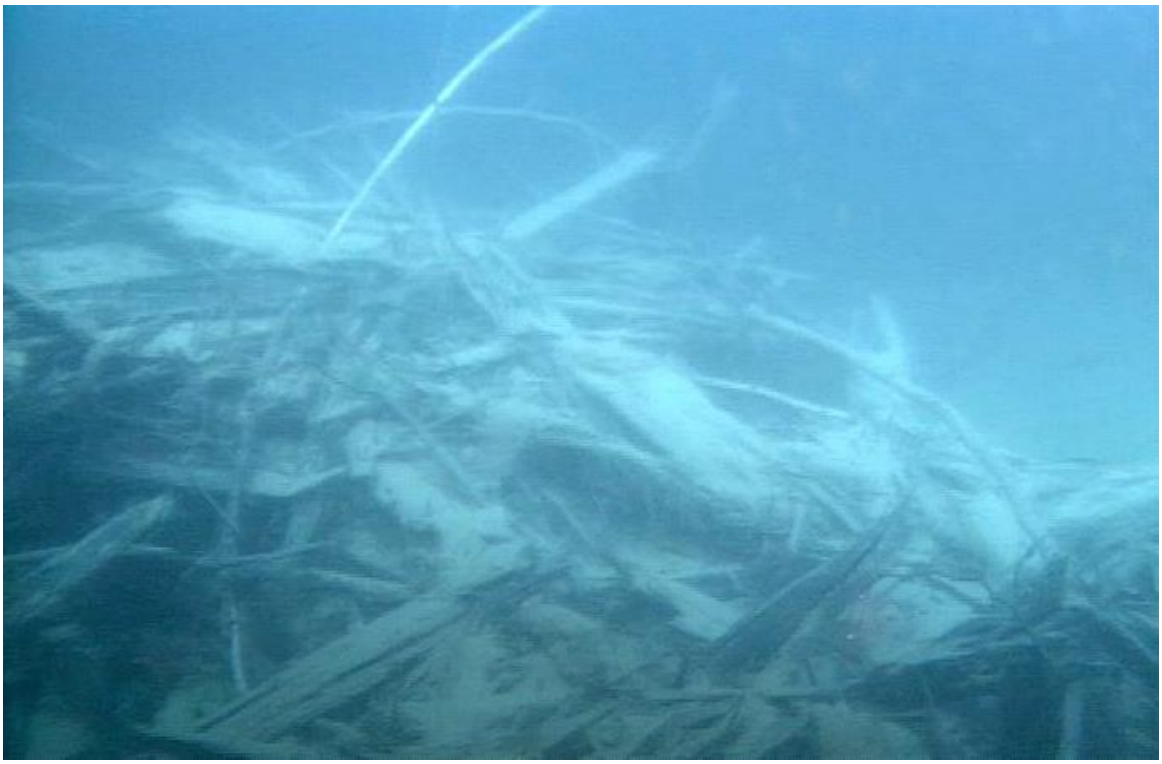
4. Pacific cod (*Gadus macrocephalus*) swimming through the Five Finger Island disposal site.

5. Wood waste debris provides valuable habitat for marine life.

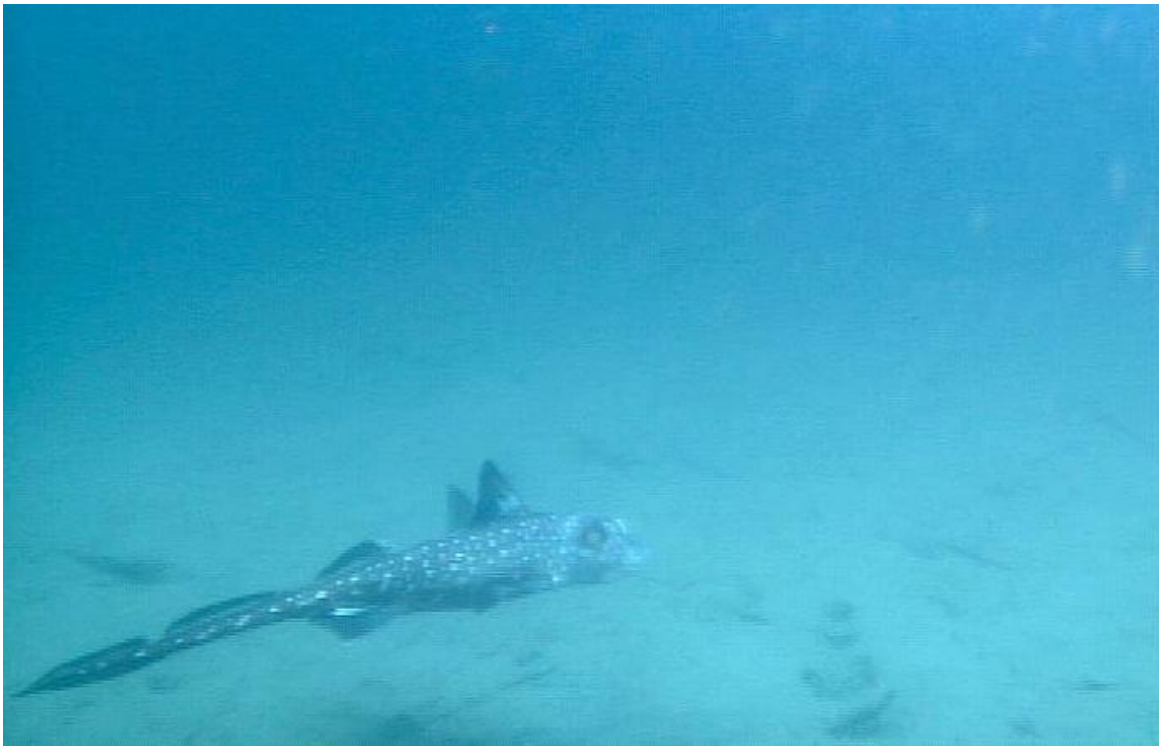
6. Sea anemone at the Point Grey disposal site.

7. Prawns (*Pandalus platyceros*) use wood waste debris as habitat within several disposal sites.

8. Bundle wires are no longer approved for disposal at sea and are recycled.



9. Wood waste debris at the Point Grey disposal site.



10. Ratfish (*Hydrolagus colliei*) are commonly observed at the Point Grey disposal site.