

# Compendium of Monitoring Activities at Disposal at Sea Sites in 2000.



**Disposal at Sea Program  
Marine Environment Branch  
Toxics Pollution Prevention Directorate  
Environmental Protection Service  
Environment Canada**

December 2001

*Cover Photo: Rock Lobster on the seafloor taken in May 2000 at the Malaspina Strait Disposal Site, British Columbia, by the Department of Fisheries and Oceans remote operated vehicle,*

## Summary

Each year, Environment Canada conducts representative monitoring at disposal at sea sites. This is one of the measures in place to protect Canada's marine environment under the *Canadian Environmental Protection Act, 1999* (CEPA) and meet our international commitments under the *London Convention 1972* and its *1996 Protocol* on preventing marine pollution by controlling the disposal of wastes at sea. This report provides a technical summary of monitoring activities conducted in the year 2000 and a table summarizing relevant financial information.

- In the Atlantic Region, bathymetric measurements of accumulated material at Black Point disposal site off Saint John New Brunswick, determined that 15 to 25 percent of the disposed material since 1959 has remained on site. Trace metal measurements and other geological measurements suggest some of disposed material has migrated 2-5 km west of the disposal site. Bathymetry found a southward slump of material from the site. Despite the sediment transport, the accumulated material remaining poses a potential concern for navigation with the site being only 3.7 m at its shallowest point. As a result of this work, adjustments will be made to where and how dredged material is placed at the site to prolong the life of the site and better manage the slumping or erosion of material.
- In the Quebec Region, increased PAHs were found in the Ste-Thérèse-de-Gaspé Harbour sediments. The concentrations of PAHs measured at its disposal site, ST-4, however, were found to be below the Lower Action Levels of the National Action List set out in the *Disposal at Sea Regulations*. The Depot "D" disposal site in the Magdalen Islands remains closed because of concerns about impacts to lobster habitat. Further studies are underway with the long term view of determining if the site could re-open under certain management conditions.
- In the Pacific and Yukon Region, sediment chemistry analysis at the Malaspina Strait Disposal Site found elevated levels of cadmium and biological tests exhibited toxic responses. The data from the reference site and disposal site suggest that cadmium is geological in nature, as the area is known for high levels of cadmium and that the biological responses observed appear to be related to unexpected grain size sensitivities of the test organisms. As these observed effects are not related to disposal at sea activities no restrictions on the use of this site are envisioned at this time. As well for all sediments disposed of at the site, the cadmium concentrations were below the Lower Action Levels. Work to examine Sand Heads disposal site was cancelled because of severe weather and was rescheduled for 2001.

## Comments

Comments may be sent to:

Paul Topping  
Disposal at Sea Program  
Marine Environment Branch  
Toxics Pollution Prevention Directorate  
Environmental Protection Service  
Environment Canada  
Ottawa, Ontario  
K1A 0H3

Tel.: 819-953-0663  
Fax: 819-953-0913  
Email: paul.topping@ec.gc.ca

## Table of Contents

<b>SUMMARY</b>	<b>3</b>
<b>COMMENTS</b>	<b>3</b>
<b>TABLE OF CONTENTS</b>	<b>4</b>
<b>INTRODUCTION</b>	<b>5</b>
THE ROLE OF MONITORING	5
CONDUCTING MONITORING STUDIES	6
INTEGRATIVE ASSESSMENT	6
INTENSITY OF MONITORING	7
REPORTING	7
<b>OVERVIEW OF FINDINGS FOR 2000</b>	<b>7</b>
<b>ATLANTIC REGION: MONITORING AND EVALUATION OF CONDITIONS AT THE BLACK POINT OCEAN DISPOSAL SITE</b>	<b>9</b>
FACTS ABOUT THE SITE	9
HYPOTHESES TESTED AT THE SITE	9
PARAMETERS MEASURED	9
OBSERVATIONS AND RESULTS	10
FOLLOW UP	11
<b>QUEBEC REGION: PAH CHARACTERIZATION AT SAINTE-THÉRÈSE-DE-GASPÉ</b>	<b>15</b>
FACTS ABOUT THE SITE	15
HYPOTHESES TESTED AT THE SITE	15
PARAMETERS MEASURED	15
OBSERVATIONS AND RESULTS	16
<b>QUEBEC REGION: FOLLOW UP TO SITE ASSESSMENT AT DÉPÔT D: SITE CLOSURE DECISION</b>	<b>17</b>
FACTS ABOUT THE SITE	17
BACKGROUND	17
DECISION	17
FOLLOW UP	17
<b>PACIFIC AND YUKON REGION: MALASPINA STRAIT DISPOSAL SITE</b>	<b>18</b>
FACTS ABOUT THE SITE	18
HYPOTHESES TESTED AT THE SITE	18
PARAMETERS MEASURED	18
OBSERVATIONS AND RESULTS	19
<b>PACIFIC AND YUKON REGION: SAND HEADS DISPOSAL SITE</b>	<b>23</b>
FACTS ABOUT THE SITE	23
<b>ANNEX 1. MONITORING COSTS</b>	<b>24</b>
<b>ANNEX 2. OFFICES FOR THE DISPOSAL AT SEA PROGRAM</b>	<b>25</b>

## **Introduction**

Canada is a maritime nation. It possesses 243,790 km of coastline, the longest of any nation in the world, and has a vital interest in preserving a healthy marine environment. Though by world standards the Canadian maritime environment is relatively uncontaminated, Canada's territorial waters do have some problems, especially in harbours, estuaries and near shore areas.

Canada regulates disposal at sea through a permit system under the *Canadian Environmental Protection Act, 1999* (CEPA). This is one of the measures in place to protect Canada's marine environment and meet our international obligations under the *London Convention 1972* and its *1996 Protocol* on preventing marine pollution by controlling the disposal of wastes at sea.

Historically, long-term monitoring has been conducted annually at representative disposal sites. CEPA now requires Environment Canada to monitor selected disposal at sea sites each year. This is conducted in accordance with national monitoring guidelines and dependant on available resources from the monitoring fees collected. In order to respond to Canada's national and international reporting obligations, this National Compendium of Monitoring Activities, based on regional reports, is produced annually.

## **The Role of Monitoring**

Besides being required by law, disposal site monitoring allows permittees continued access to suitable disposal sites by helping to ensure that the permit conditions were met and the use of the site has not caused unacceptable or unpredicted impacts. It verifies that assumptions made during the permit review and site selection process were correct and sufficient to protect the marine environment and human health. Monitoring allows Environment Canada to gather information and take appropriate action to manage the sites in an environmentally sound manner.

Monitoring also plays a critical role in reviewing the overall adequacy of controls. Information compiled nationally or regionally, over time, provides the basis to assess whether the disposal at sea regulatory controls, guidelines and permit conditions are adequate to protect the marine environment and human health.

Experience gained with monitoring may also point to the need for research to develop better monitoring tools, or to refine the monitoring program, on specific environmental, health or public concerns. It is also expected that monitoring will uncover gaps in our understanding of impacts, particularly in the area of cause and effect relationships.

In order to increase the level of involvement of stakeholders, annual meetings with clients and other interested parties provide additional comments on past monitoring and better indication of Regional priorities for future assessments. The annual meetings also ensure Environment Canada's decisions concerning monitoring activities are carried out in an open and transparent manner.

Finally, Environment Canada's disposal site monitoring, reporting and communication with stakeholders are activities critical to fulfilling the federal obligation to apply the Precautionary Principle in administering CEPA.

## Conducting Monitoring Studies

Monitoring a disposal at sea site is conducted according to national guidelines. Activities carried out in a given year are based on available resources and can involve an assessment of the physical, chemical and biological features. The impact hypotheses generated by permit reviews form the basis of subsequent monitoring.

Physical monitoring relates to the collection of relevant geological information for determining the area of deposition, delineating the disposal site boundaries, studying the accumulation of dredged material within the area of deposition, and documenting evidence of sediment transport from the disposal site.

Biological and chemical assessments are undertaken concurrently and the monitoring design for these parameters takes into account the size and dispersal characteristics of the site. Chemical monitoring is aimed at measuring the levels of chemicals in sediments and comparing them to lower action levels set out by the *Disposal at Sea Regulations* or other national screening levels for additional parameters of concern. Biological monitoring is primarily centred on biological testing in the laboratory and benthic community surveys. The biological test methods currently used for sediment assessment include:

- an acute toxicity test using marine or estuarine amphipods (the end point is lethality);
- a fertilization assay using echinoids (the endpoint is significant reduction in fertilization);
- a toxicity test using a photoluminescent bacteria, the Microtox® solid-phase test (the end point is significant reduction in bioluminescence);
- a bedded sediment bioaccumulation test using bivalves (the end point is significant bioaccumulation).

### Lower Action Levels for chemicals in sediments (*Disposal at Sea Regulations*) (mg/kg, dry weight)

Chemical	Current Level
Cadmium	0.6
Mercury	0.75
total PCBs	0.1
total PAHs	2.5

## Integrative Assessment

If sediments are below the lower action levels, or other national screening levels, for contaminants and pass all biological tests, no further action is required. However, if levels of contaminants or biological test results demonstrate a cause for concern then the first step is to verify compliance with the terms of the permits issued since the site was last monitored.

The second step will generally involve checking potential sources of pollutants and conducting further site characterization. After considering this information, the following hierarchy of interpretative guidance can be applied to the concurrent chemical and toxicological data:

- *if sediments at the disposal site contain substances in excess of national screening levels (including lower action levels), pass the acute toxicity test, but fail one sublethal or bioaccumulation test: consideration could be given to modifying further use of the site and investigating the long term stability of the material onsite;*
- *if the sediments contain substances below the national screening levels, yet fail any of the biological tests, then further investigation would be required to determine if this is the result of either a confounding factor such as laboratory anomaly, or the presence of a contaminant not included in the chemical screening; or*

- *if the sediments contain substances in excess of the national screening levels and either fail the acute test or fail two (or more) additional tests including the sublethal tests and the bioaccumulation test: further monitoring, site closure or remediation could be considered.*

As well, cursory benthic community surveys can be used as a general sediment quality indicator. The overall assessment of the disposal site considers all available information from physical, chemical and biological monitoring.

### **Intensity of Monitoring**

Monitoring at every disposal site is not considered necessary, as current knowledge of impacts related to disposal of dredged material allows for good assessments to be drawn from representative disposal sites. In addition, the program attempts to ensure that the major sites (>100,000 m<sup>3</sup> of dredged materials/year) are monitored on at least a five year cycle. The monitoring of other sites are determined by triggers set out in the national monitoring guidelines which are based on volume, proximity to sensitive areas, or level of concern. The number of sites monitored in a year and the parameters measured at each site depend the available resources through the collection of the monitoring fees from permittees.

### **Reporting**

Canada's Disposal at Sea Program is administered through regional offices which are largely responsible for the permit review process, as well as for planning, conducting and reporting on monitoring studies undertaken in their administrative areas. This compendium, based on regional detailed reports, is now produced annually to respond to Canada's national and international reporting obligations. Readers may request detailed information on any of the monitoring activities in this compendium, from the appropriate regional office.

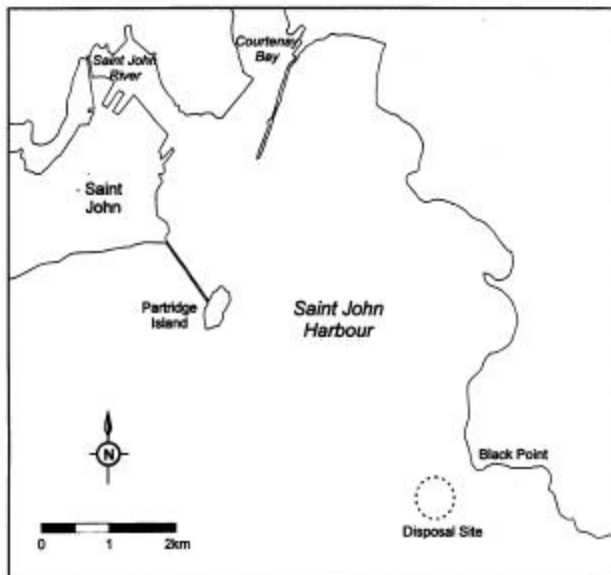
### **Overview of Findings for 2000**

- In the Atlantic Region, bathymetric measurements of accumulated material at Black Point disposal site off Saint John New Brunswick, determined that 15 to 25 percent of the disposed material since 1959 has remained within 1.5 km of site centre. Trace metal measurements suggest some of disposed material has migrated 2-5 km west of the disposal site. Bathymetry found a southward slump of material from the site. While trace metal concentrations of the disposed material were greater than natural background, they remained below lower action levels of the National Action List. The trace metal chemistry may be used as one means to distinguish the dredged material placed at a disposal site from the original sediment indigenous to the site. This could be especially helpful where grain sizes are very similar, and sediment transport conditions make it difficult to distinguish deposited dredged material by traditional bathymetric measurements. Despite the sediment transport, the accumulated material remaining poses a potential concern for navigation with the site being only 3.7 m at its shallowest point. As a result of this work, adjustments will be made to where and how dredged material is placed at the site to prolong the life of the site and better manage the slumping or erosion of material.
- In the Quebec Region, increased PAHs were found in the Ste-Thérèse-de-Gaspé Harbour sediments. The concentrations of PAHs measured at its disposal site, ST-4, however, were found to be below lower action levels. The Depot "D" disposal site in the Magdalen Islands remains closed because of concerns about impacts to lobster habitat. Further studies are underway with the long term view of determining if the site could re-open under certain management conditions.

- In the Pacific and Yukon Region, sediment chemistry analysis at the Malaspina Strait Disposal Site found elevated levels of cadmium and biological tests exhibited toxic responses. The data from the reference site and disposal site suggest that cadmium is geological in nature, as the area is known for high levels of cadmium and that the biological responses observed are related to unexpected grain size sensitivities of the test organisms. As these observed effects are not related to disposal at sea activities no restrictions on the use of this site are envisioned at this time. As well for all sediments disposed of at the site, the cadmium concentrations were within the lower action levels. Work to examine Sand Head disposal site was cancelled because of severe weather and was rescheduled for 2001.



## Atlantic Region: Monitoring and Evaluation of Conditions at the Black Point Ocean Disposal Site



### Facts about the site

- Site** Black Point, in the Bay of Fundy, 45°12.00' N, 66°00.97' W, serving the Saint-John Port Authority, Saint John, New Brunswick.
- Depth** Ranges from 10 to 30 m.
- Material** Dredged material (silty sand).
- Quantity** About 18,000,000 m<sup>3</sup>, scow measure, was disposed of at the site; averaging 300,000 m<sup>3</sup> per year since the 1960's.
- Status** Continues to receive material annually.
- Concerns** Black Point is the largest disposal site on the East Coast. There are concerns among fishers and the public that the accumulated dredged material has physically altered the marine habitat in the area, poses a threat to navigation and has introduced chemical contaminants.

### Hypotheses tested at the site

- That the majority of the historical material, since 1959, has remained within site boundaries, defined as 1.5 km radius around the site coordinates 45°12.00' N, 66°00.97' W.
- That the majority of the modern sediments, has remained within site boundaries, defined as 1.5 km radius around the site coordinates 45°12.00' N, 66°00.97' W.
- That the depth of the site is safe for navigation.
- That the level of metals and other contaminants are below national screening levels for the Disposal at Sea Program.

### Parameters measured

In 2000, Environment Canada and the Geological Survey of Canada signed an agreement to undertake a geological and geochemical study of the Black Point disposal site with some

geotechnical measurements. The data from bathymetry surveys in 1999 and 1959 were used to calculate the change that occurred in the seafloor at the disposal site over the duration of regulated disposal activities at the site. A review of existing geophysical and bathymetric data for the Black Point disposal site was performed to determine existing conditions at the site and to provide background information for the design of the new surveys.

### **Observations and results**

Sediment distribution was interpreted, and the effects of dredged material disposal were evident in the data collected. Indications of reworking of the seafloor sediments have been seen in seafloor photographs, sidescan sonar records, and multibeam bathymetry data. The reworking was probably caused by wave action during storms and by the strong currents in the area. The accumulation of dredged material at the disposal site was evident on all of the bathymetry surveys since 1959.

The calculated surface (a three-dimensional view of seafloor of the site determined from the bathymetry data) shows accumulation of material, with a maximum height of about 13.7 metres in height relative to the 1959 surface. A small amount of erosion has occurred in areas around the main area of disposed sediments. Material was eroded from various portions of the surveyed area, with a maximum height difference of 2.7 metres shown between the 1959 and 1999 surveys. Net deposition between the 1959 and 1999 surveys was calculated. Approximately 15-25 percent of the material disposed of at the site has remained within about 1.5 km of the centre of the disposal site over the past 40 years. The remaining fraction of the material has been transported out of the immediate area of the disposal site.

The coloured shaded-relief image of the 1999 bathymetry (Figure 3) shows that a large accumulation of dredge material had shoaled to less than 3.7 m water depth at the disposal site. A large slump can be seen spreading southward from the large mound of material. Despite the sediment transport, the accumulated material remaining poses a potential concern for navigation given the shallow depth.

A review of existing geophysical and bathymetric data for the Black Point disposal site was performed to determine existing conditions at the site and to provide background information for the design of the new surveys. Preliminary analysis of geophysical and multibeam bathymetry data from the disposal site has shown that the accumulated mound of material disposed of at the site has collapsed, forming a series of slumps that extend about 1.5 km south of the disposal buoy. Comparison of sidescan sonar mosaics from 1993 and 1999 show that prominent features on the 1994 survey (such as evidence of dredge spoils) are no longer visible and may have been buried by recent sediment deposited by the Saint John River. Detailed analysis of the sidescan sonar data from beyond the base of the slump show active bedforms, suggesting sediment transport, and the presence of fresh anchor furrows. Analysis of current-formed features on the sidescan sonar records from deeper water near the base of the slump indicates transport of fine-grained sediments from east to west, out of the Bay of Fundy.

A preliminary analysis of the seafloor photographs collected at the disposal site, and at control sites in deeper water, show a decrease in turbidity and an increase in the diversity and abundance of fauna with an increase in water depth. Bioturbation features and megafauna are more abundant at control sites outside the disposal site than near the disposal site.

Geochemical interpretation of pore water redox chemistry, organic carbon data, and trace

element concentrations in marine sediments collected from Saint John Harbour in May and October 2000 leads to the following main conclusions and recommendations:

- Sediment accumulation rates are highest near the mouth of the harbour channel exceeding 2 centimetres per year (cm/yr). Near the Black Point Ocean Disposal Site, sediment accumulation is estimated to be in the range of 0.5 to 2 cm/yr.
- Concentrations of arsenic, chromium, copper, lead, and zinc in surface sediments within the disposal site are significantly higher than natural background levels. Elevated concentrations also occur in surface sediments extending 2 to 5 km west of the disposal site. These patterns suggest that dredge spoils are being transported westward by bottom currents.
- The concentrations of most trace elements (arsenic, chromium, copper, lead, and zinc) in surface sediments at the Black Point disposal site are below the Canadian Marine Interim Sediment Quality Guidelines. The concentration of lead in one sediment sample from the disposal site exceeded the Probable Effect Level for lead. The lead and cadmium contents of all sediment samples collected from Saint John Harbour will be reanalyzed in 2001/2002 using a more sensitive analytical technique to confirm the concentrations of these elements.
- In general, the concentrations of most trace elements are relatively low as compared to many industrialized harbours.
- Existing data for organic contaminants (e.g. PAHs, PCBs) in the harbour sediments are relatively sparse. Additional studies of the concentrations of organic contaminants are warranted, given the likely sources in the area. A high-density sampling program was planned for March 2001.
- The characterization of the spatial distribution of trace element concentrations is a useful tool for determining the mobility of dredge spoils disposed of near Black Point. These techniques can and should be applied to other disposal at sea sites in Canada.

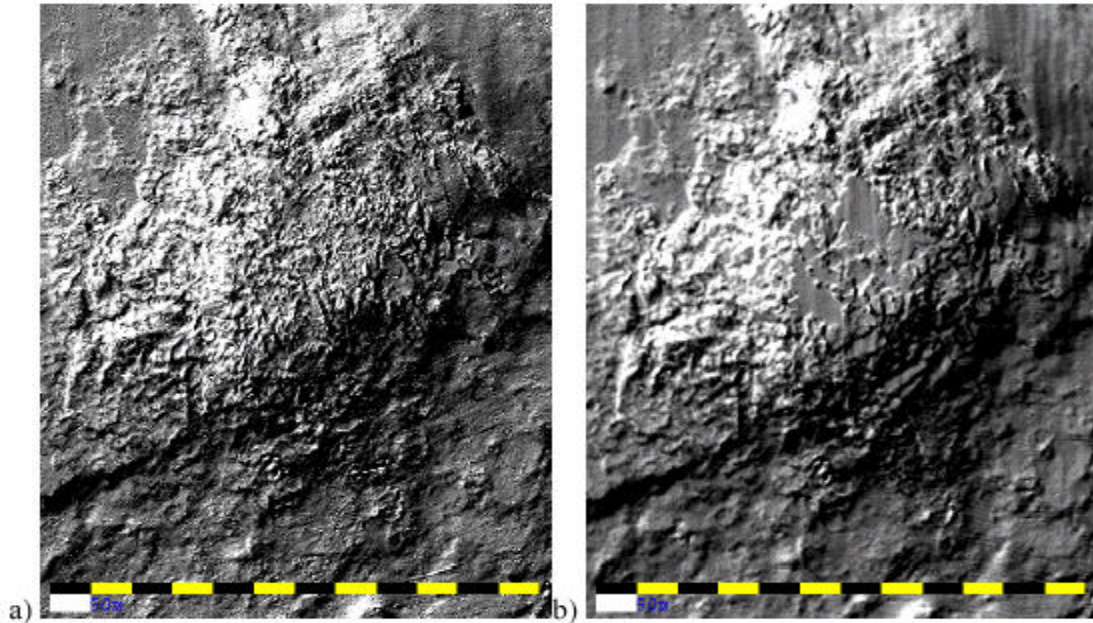
### **Conclusions and Follow Up**

This work, in testing the previously mentioned hypotheses, found the following:

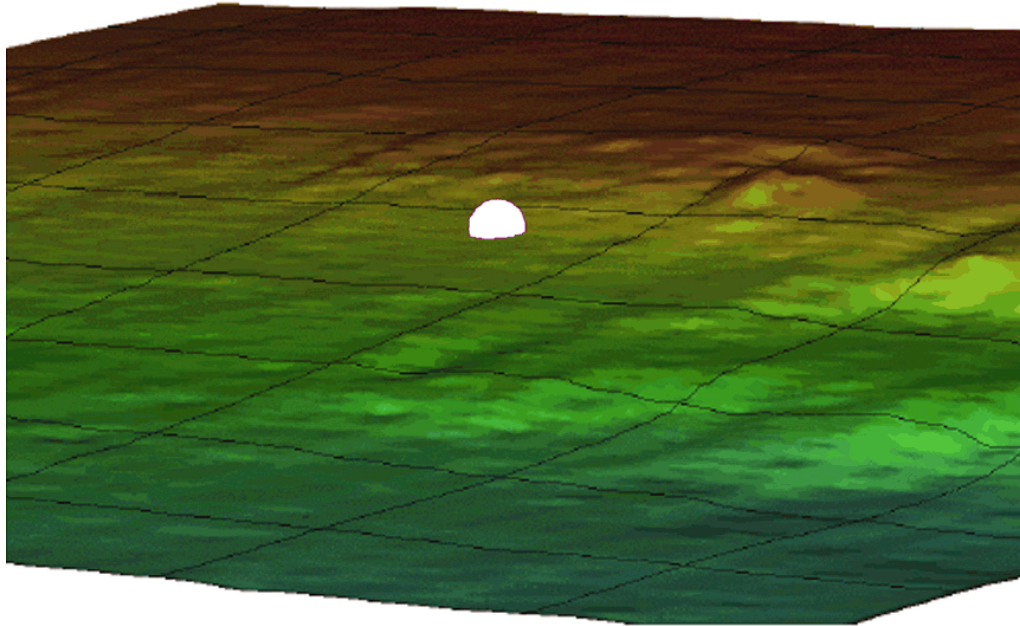
- That the majority of the historical material, since 1959, has remained within site boundaries, defined as 1.5 km radius around the site coordinates 45°12.00' N, 66°00.97' W.
  - ⇒ This hypothesis cannot be confirmed as the work estimated that only 15 to 25 percent of the material has remained on the site.
- That the majority of the modern sediments, have remained within site boundaries, defined as 1.5 km radius around the site coordinates 45°12.00' N, 66°00.97' W.
  - ⇒ The remaining observed accumulated material appears to be largely modern dredged sediments, which supports the confirmation of this hypothesis.
- That the depth of the site is safe for navigation.
  - ⇒ This hypothesis cannot be confirmed as shallow areas observed at a depth of 3.7m indicate a potential hazard for navigation
- That the level of metals and other contaminants are below national screening levels for the Disposal at Sea Program.

⇒ This hypothesis is supported, overall, by the results of the chemical analysis. A single station with a high lead result will be re-examined.

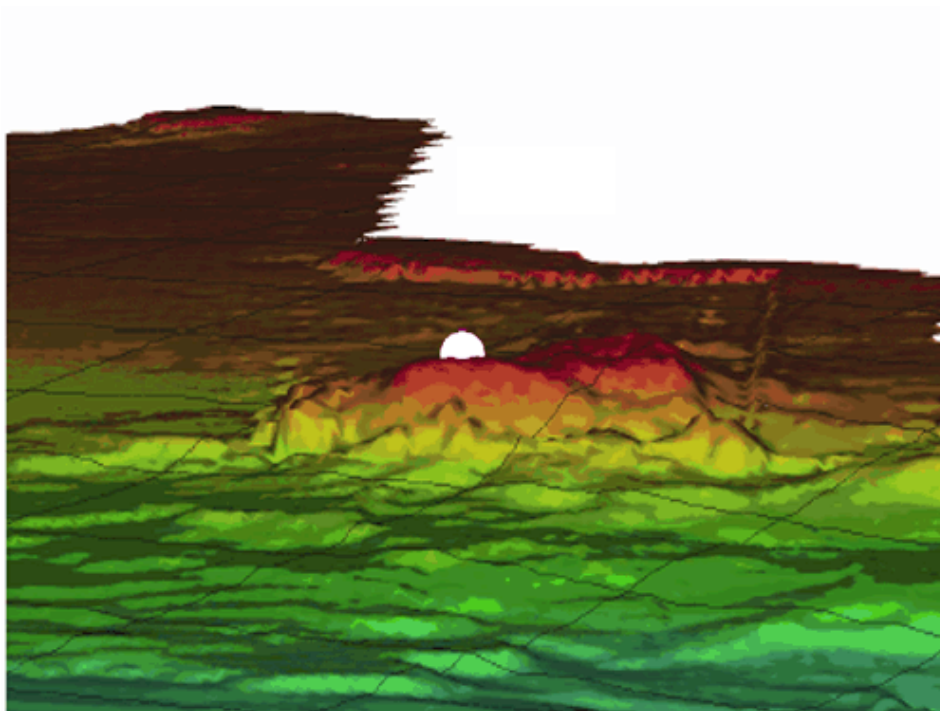
- A workshop was held in April 2001 to discuss issues related to sediment transport and dispersion of contaminants at Black Point and will be reported in the 2001 Compendium.
- As a result of this work, adjustments will be made to where and how dredged material is placed at the site to prolong the life of the site and better manage the slumping or erosion of material.



*Figure 1. Shaded relief image generated from multibeam bathymetry data collected in a) April 2000 after the winter storms, and in b) October 2000 during disposal operations at Black Point. Note how the disposal operations, which were underway during the October 2000 survey, have infilled the rough topography evident on top of, and surrounding, the disposal pile during the April 2000 survey giving the appearance of a terraced topography.*

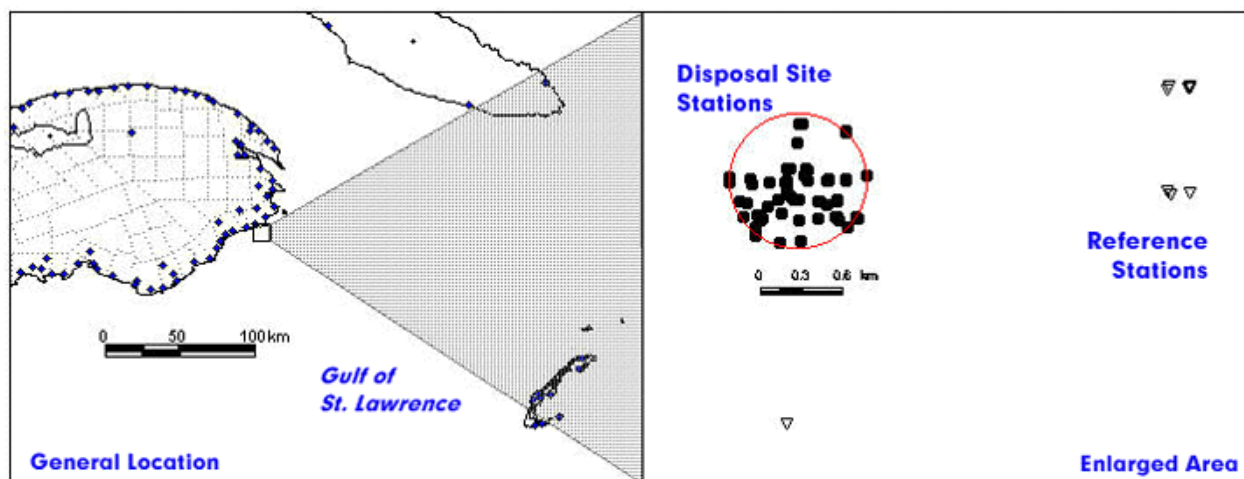


*Figure 2. Bathymetry survey performed by CHS in 1959 over the Black Point Disposal site using single beam survey equipment.. The white sphere indicates the location of the disposal site buoy.*



*Figure 3. Composite multibeam bathymetry data collected over the site in separate surveys in 1994 and 1999 over the Black Point Disposal site. The white sphere indicates the location of the disposal site buoy.*

## Quebec Region: PAH Characterization at Sainte-Thérèse-de-Gaspé



### Facts about the site

- Site** ST-4 Ste-Thérèse-de-Gaspé 48°23.40' N, 64°23.20' W.
- Depth** 51 m.
- Material** Dredged material composed of 64.4% of sand, 17.3% of silt, 15.4% of clay and colloids and 2.8% of gravel. TOC varies from 2-4%
- Quantity** 17 000 m<sup>3</sup> since 1986.
- Status** Continuing to receive material annually.
- Concerns** The most recent chemical characterization of the dredge site (1995) revealed levels of total PAHs higher than the guideline level established by the Disposal at Sea Program. Since chemical evaluations are required once every 4 years, there is a possibility that contaminated harbour sediments have been disposed of at the disposal site.

### Hypotheses tested at the site

From the permit assessments, it was expected that the disposal of dredged material would not introduce contaminants into the sediments at the disposal site or cause adverse effects to the environment. Monitoring in 2000 tested the following two hypotheses:

1. That levels of PAHs in sediments at the site would be within national screening levels,
2. That biological measurements within the site would be statistically similar to measurements outside of the site.

### Parameters measured

A 1999 bathymetric survey did not show the precise locations of the accumulated dredged material. Given this, an area of 1 km<sup>2</sup> around the disposal site was sampled according to a systematic sampling design. A total of 43 stations were sampled within the disposal site and 5 in a reference area 2 km from the site. Only 37 valid samples were taken since half of the disposal zone is located on bedrock or hard substrate. Samples were subjected to a physicochemical and biological evaluation including: PAHs, TOC, grain size analysis and *in situ* exoenzymatic activity measurements. Metal concentrations were assessed at the reference site to evaluate the

background levels of nickel in the Chaleur Bay area since a concern of high nickel levels has often been identified in harbour sediments from the Gaspé.

### Observations and results

Out of the 37 valid samples taken from an area of 1 km<sup>2</sup> around the disposal site ST-4, the highest concentration of PAHs found in the sediments was 0.21 mg/kg. The mean concentration was determined to be 0.027 mg/kg and the upper 95% confidence limit was determined to be 0.043 mg/kg. Both the maximum value and the upper 95% confidence limit were below the lower action level for total PAHs of 2.5 mg/kg. Measurements of exoenzymatic activity did not indicate any significant difference between the reference stations and the disposal site stations.

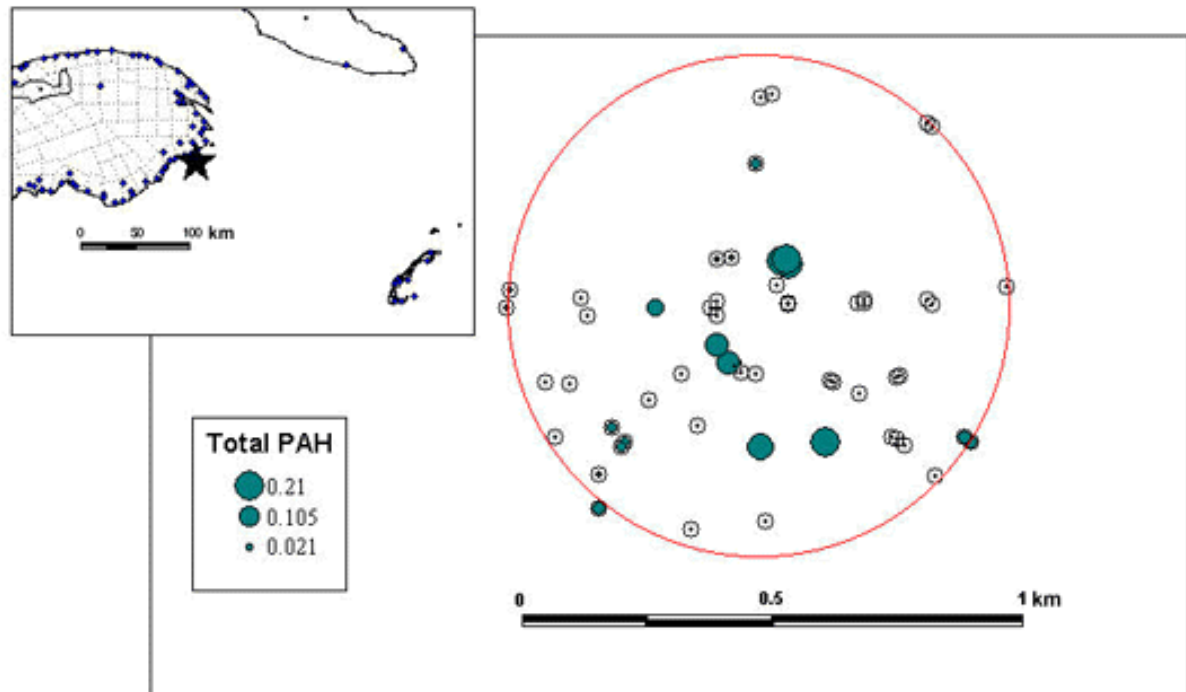


Figure 4 Distribution of PAHs found at sampling stations at the ST-4 disposal site.

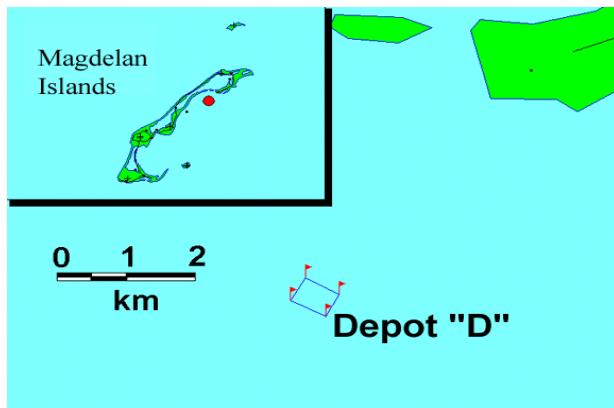
### Conclusions

The PAHs in the sediments were found to be below national screening levels (lower action levels) confirming the first hypothesis. Biological measurements (exozyme activity) found no significant difference between the disposal site and surrounding area, which confirmed the second hypothesis.

Based on these results disposal at sea activities may continue at the site under current permit conditions.



## Quebec Region: Follow up to Site Assessment at Dépôt D: Site closure decision



### Facts about the site

**Site** Depot "D", Magedalen Islands. Region bound by: 47°31.17' N, 61°36.29' W;  
47°31.37' N, 61°36.12' W; 47°31.22' N, 61°35.73' W; 47°31.02' N, 61°35.89' W.

**Depth** 12 m.

**Material** Dredged material.

**Quantity** Received quantities in 1980-1982 totalling 565,000 m<sup>3</sup>, in 1992 totalling 610,000 m<sup>3</sup>, and in 1997 totalling 192,487 m<sup>3</sup> from channel dredging operations.

**Status** Closed.

**Concerns** The material appeared to have migrated west of Depot D into an area of known lobster habitat.

### Background

Depot D was assessed in 1999. The results showed that the material appeared to have migrated to the west of Depot D into an area of known lobster habitat. The data indicated that the entire site was under constant erosion from 1982 to 1998 as part of a wider process occurring throughout the surrounding area. As the precise amount of material coming from Depot D, relative to that being deposited though natural processes is not known, the extent of disposal related impact from Depot D on the lobster habitat remains uncertain.

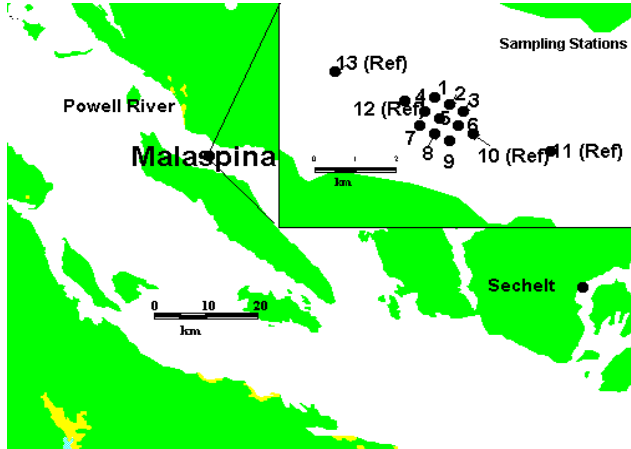
### Decision

As a follow up to work in 1999, Disposal site "Dépôt D" was officially closed unless the permittee, Mines Seleine, could demonstrate that the sediment dynamics at the site do not lead to significant harmful effects in the receiving environment (lobster habitat).

### Follow up

During the summer of 2000, Mines Seleine decided to assess these impacts. Study results gave information on the uptake of suspended matter in the water column, bottom sediment transport, measurement of wave currents related to wind velocity and direction etc. These parameters were assessed with optical back scatter probes and current meters on both the disposal site and the nearby environment in order to evaluate the contribution of the disposal site (in comparison with the surrounding environment) to the sediment transport dynamic on a lobster habitat. Environment Canada, Fisheries and Oceans Canada, INRS-Océanologie, Laval University and Mines Seleine collaborated on this project. Mines Seleine is planning to fund another study in 2001 to quantify the impact of sediment transport from the site as compared to the sediment transport from the surrounding environment. The results of these studies should be presented in 2002 .

## Pacific and Yukon Region: Malaspina Strait Disposal Site



### Facts about the site

- Site** Malaspina Strait Disposal Site, British Columbia. Its centre is situated at 49°45.00'N; 124°27.00'W and has a diameter of one nautical mile.
- Depth** 320 m.
- Material** Dredged material.
- Quantity** Since 1976, the site received approximately 550,000 m<sup>3</sup> of dredged material and 25,000 m<sup>3</sup> of excavation material.
- Status** Remains a designated site for disposal at sea.
- Concerns** Need to verify that assumptions of permit decisions were correct. Known elevated levels of cadmium in sediments both at the disposal site and the surrounding area.

### Hypotheses tested at the site

- That the disposal at sea activity did not introduce contaminants to the area.
- That the concentrations of cadmium measured at the disposal site, while expected to be above national screening levels for the Disposal at Sea Program, would be comparable to levels in a reference area.
- That the concentrations of other contaminants at the disposal site were below national screening levels for the Disposal at Sea Program and were comparable to contaminant levels in a reference area.
- That video survey observations of biota at the site were comparable of the surrounding area outside of the site boundaries.

### Parameters measured

Previous studies of Malaspina Strait found elevated levels of cadmium in the sediments and found toxic responses in biological tests. Caution, however, must be exercised since amphipod survival at the reference sites have not met the performance criteria for reference survival as set out in the standard reference method (EPS/RM/35). It was unclear if the observed responses were due to contaminants or confounding factors such as grain size. Further core sampling and analysis, to

examine the deeper historical sediments, was undertaken to help determine if the cadmium is geological in nature; which is a common occurrence on the BC coast.

In May 2000, surface sediment samples were collected by grab samplers together with core samples from 13 stations at the Malaspina Strait disposal site and in the surrounding area. An additional site, for geological reference was located in nearby Hotham Sound. The samples were analysed for trace metal concentrations, organics, TOC and particle size distribution. Composite samples were collected from 11 stations for biological testing. (Amphipod with *E. washingtonianus* and *R. abronius*, Echinoid, and Microtox solid phase) Additional sediment chemistry analyses were conducted on the composite samples for sulphides, ammonia, redox, and AVS/SEM. Porewater samples were further analyzed for total and dissolved metals, ammonia and sulphide.

In addition, samples for trace metals, organics, particle size distribution and TOC were collected from the sampling grid at the Cape Mudge disposal site. Preliminary results will be added to the database for this disposal site.

In November 2000, the Department of Fisheries and Oceans ROV, *ROPOS*, was used to record benthic conditions at the Malaspina Strait site. A previous survey undertaken in 1994 was hampered by poor weather conditions and the transect lines were not completed. Video and still images will be compiled and georeferenced for assessment and for comparative purposes for future surveys.

### **Observations and Results**

As in previous studies, cadmium levels at the disposal site were elevated above lower action levels. These studies, however, found elevated cadmium levels at core depths within the disposal site that were consistent with historical sediments before disposal activities began in 1976. Elevated cadmium levels also were found at the reference site and the nearby Hotham Sound site.

Biological test results found toxicity at the disposal site, the reference site, and the Hotham Sound site. The data suggested that one of the test organisms (*Eohaustorius washingtonianus*) exhibited a grain size sensitivity to the sediments —where the type of sediment collected was not compatible with the test organisms' habitat requirements and they subsequently could not survive the test. *Repoxinius abronius* showed toxicity in sediment samples from the Hotham sound site, but did not show toxicity from samples either at the reference site or disposal site. The Echinoid test indicated toxicity at two stations in the disposal site. The Microtox test indicated toxicity for all disposal site stations, but not for the reference site or Hotham Sound.

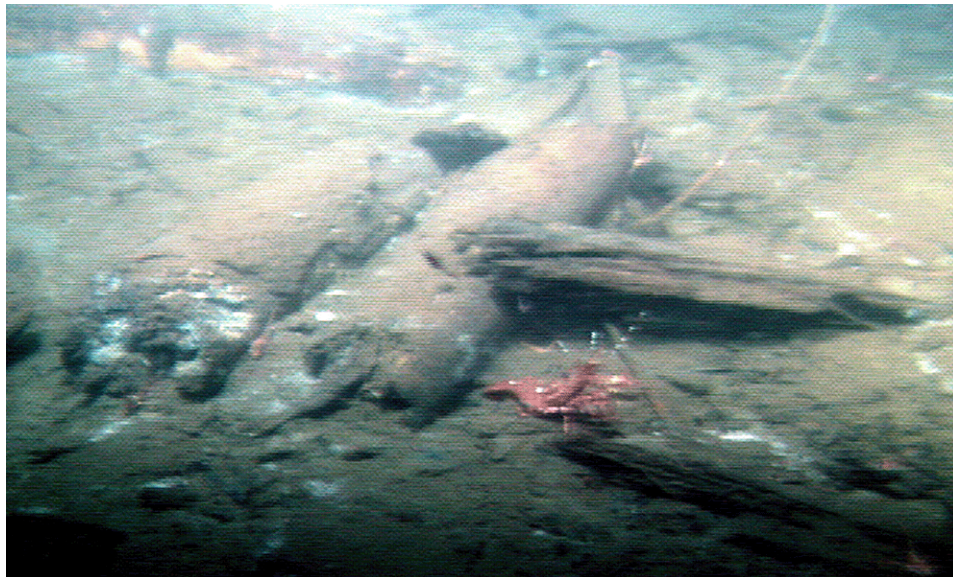
Examples of the computer captured images from the video survey are presented in Figures 5-9.

### **Conclusions and Follow Up**

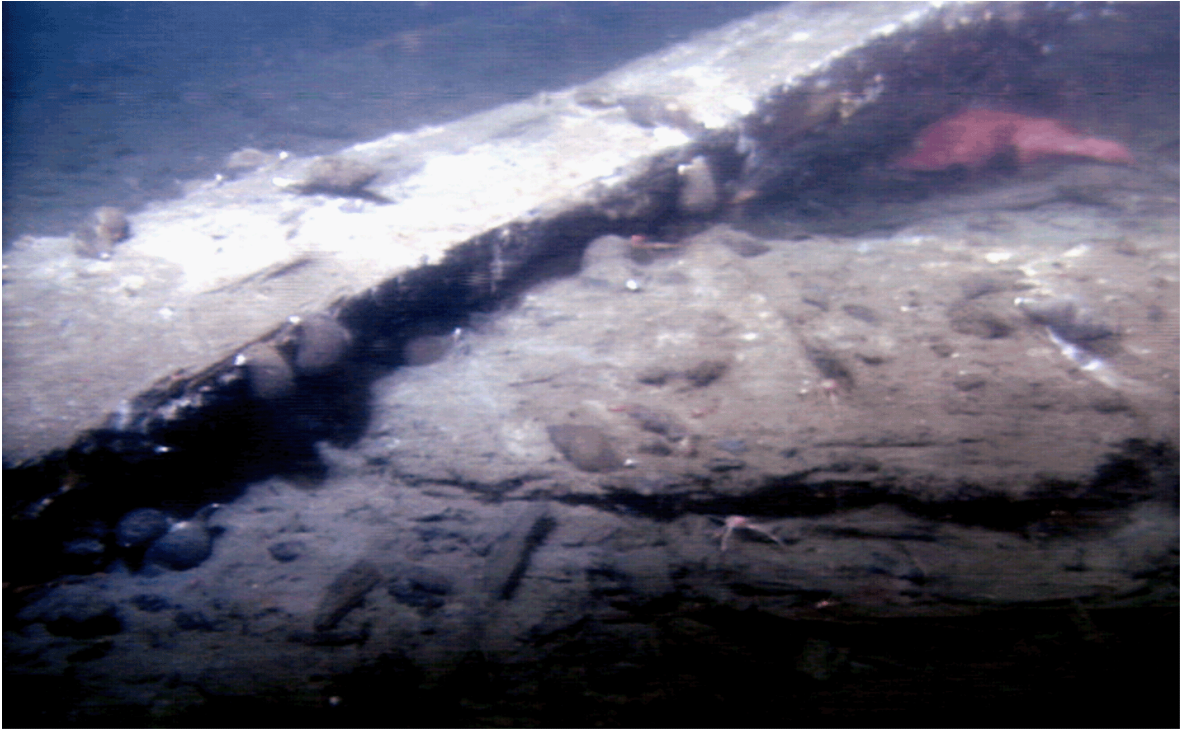
This work, in testing the previously mentioned hypotheses, found the following:

- The first three hypotheses were supported by the results of the chemical analysis which indicated sediments at the disposal site were not significantly different from the reference sites.
- Cadmium levels at the disposal site were found to be above the lower action level, however, during the permit assessment phase, analysis of the material to be disposed of from the dredge site found cadmium levels to be under the lower action level.

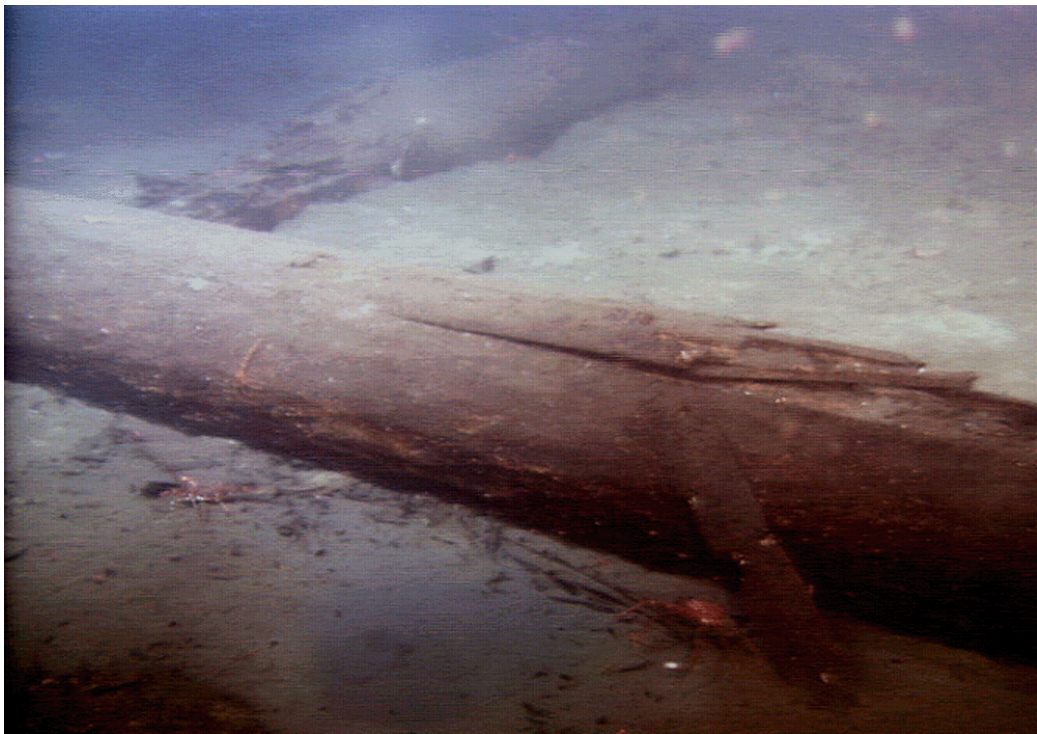
- The last hypothesis was supported as the video survey observations of biota at the site were comparable of the surrounding area outside of the site boundaries.
- These overall findings indicate that the cadmium is likely of a geological nature and that disposal at sea activity did not contribute to the presence of this naturally occurring contaminant. Given this, no restrictions on disposal at sea activities at Malaspina Strait are envisioned at this time.
- Further work on the biological tests will be carried out as part of the Disposal at Sea Program research to examine the effects of grain size and other confounding factors. This work will be funded through program budgets other than monitoring.
- As the biological test methods continue to be developed, the site will be revisited to better examine the toxicological measurements. Further work to examine sediment biota at the site, including bioaccumulation testing and benthic community studies, will provide a better indication of its environmental quality.



*Figure 5. Woodwaste with prawn at Malaspina Strait Disposal Site, November 2000*



*Figure 6. Log with neptuna and rock fish at Malaspina Strait Disposal Site, November 2000*



*Figure 7. Log with squat lobsters (Munida sp.) at Malaspina Strait Disposal Site, November 2000.*

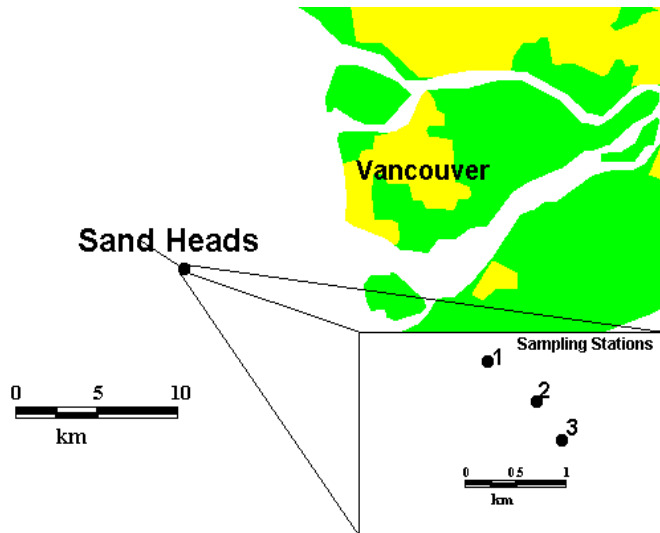


*Figure 8. Squat lobster (Munida sp.) at Malaspina Strait Disposal Site, November 2000.*



*Figure 9. Bundle wire at Malaspina Strait Disposal Site, November 2000.*

## Pacific and Yukon Region: Sand Heads Disposal Site



### Facts about the site

**Site** Sand Heads Disposal Site, British Columbia, located at 49°06.00'N, 123°19.5'W. The site boundaries were delineated to allow position fixing on the navigation aids at the mouth of the main arm of the Fraser River. It is used almost exclusively by the Fraser River Port Authority for disposal of sand and silt from maintenance dredging in the navigation channels of the main arm of the Fraser River.

**Depth** 70 m.

**Material** Dredged material.

**Quantity** Since 1974, approximately 11,500,000 cubic metres of material have been taken to the disposal site.

**Status** Remains a designated site for disposal at sea receiving material annually.

**Concerns** Need to verify that assumptions of permit decisions were correct. The site is located in a highly dynamic zone subject to significant freshwater flow, tidal action and the marine weather conditions of the Strait of Georgia. The foreslope of the Fraser Delta is also subject to frequent sloughing into the Georgia Basin.

In November 2000, a survey planned for the disposal site was cancelled due to severe weather conditions. The work was subsequently completed in 2001 and will be included in the 2001 Compendium.

## Annex 1. Monitoring Expenditures

In March 1999, pursuant to Treasury Board policy on cost recovery, Environment Canada introduced a monitoring fee of \$470 per 1000m<sup>3</sup> of dredged or excavated material. This fee is known as a “right or privilege” fee and is meant to provide Canadians with a fair return for use of public resources. Proceeds from this fee are used to cover the cost of disposal site monitoring, thus allowing environmentally sound management and allowing users continued access to their disposal sites.

Part of Environment Canada’s commitment to the regulated community was to provide an annual summary of revenues and expenditures related to disposal site monitoring. The figures below represent the second year of cost recovery.

Expecting reduced revenue, the Disposal at Sea Program carried out a reduced monitoring program in 2000 to avoid a deficit. For the year 2000-2001, the revenues generated were less than the total expenditures for the monitoring program. The net cost to the federal government was \$559,000 and the net cost for Environment Canada was \$211,000.

---

### Monitoring Expenditures 2000-2001

Atlantic Region	\$	269,000
Quebec Region	\$	97,000
Pacific and Yukon Region	\$	229,000
Headquarters	\$	20,000
Environment Canada indirect expenditures	\$	247,000
<b>Sub total expenditures for Environment Canada</b>	<b>\$</b>	<b>862,000</b>
In-kind support from other federal departments	\$	348,000
<b>Total expenditures for federal government</b>	<b>\$</b>	<b>1,210,000</b>

---

### Resources Recovered 2000-2001

Monitoring Fees	\$	651,000
-----------------	----	---------

---

### Net Expenditures 2000-2001

<b>Net federal government expenditure</b>	<b>\$</b>	<b>559,000</b>
<b>Net Environment Canada expenditure</b>	<b>\$</b>	<b>211,000</b>

---



## **Annex 2. Offices for the Disposal at Sea Program**

The Disposal at Sea Program Offices are located in the following Environment Canada offices.

### **Atlantic Region-Maritimes**

Disposal at Sea Program  
Environmental Protection Branch  
Environment Canada  
45 Alderney Drive, 4<sup>th</sup> Floor  
Dartmouth, Nova Scotia  
B2Y 2N6

### **Quebec Region**

Disposal at Sea Program  
Environmental Protection Branch  
Environment Canada  
105 McGill Street, 4<sup>th</sup> Floor  
Montreal, Quebec  
H2Y 2E7

### **Pacific and Yukon Region**

Disposal at Sea Program  
Environmental Protection Branch  
Environment Canada  
224 W. Esplanade Avenue  
North Vancouver, British-Columbia  
V7M 3H7

### **Atlantic Region-Newfoundland and Labrador**

Disposal at Sea Program  
Environmental Protection Branch  
Environment Canada  
6 Bruce Street, Mount Pearl  
Newfoundland and Labrador  
A1N 4T3

### **Prairie and Northern Region**

Disposal at Sea Program  
Environmental Protection Branch  
Environment Canada  
5204 - 50<sup>th</sup> Avenue, Suite 301  
Yellowknife, Northwest Territories  
X1A 1E2

### **National Capital Region**

Disposal at Sea Program  
Environmental Protection Service  
Environment Canada  
351 St. Joseph Boulevard, 12<sup>th</sup> Floor  
Hull, Quebec  
K1A 0H3

Further details and contacts for program staff may be found on-line at the Program's web site [www.ec.gc.ca/seadisposal/index.html](http://www.ec.gc.ca/seadisposal/index.html)