



Fraser River Estuary Management Program (FREMP)

Sediment Budget

&

Dredging Activities

Annual Report

For the Fiscal Year

April 1, 2003 to March 31, 2004

Prepared by FREMP

2003/04 SEDIMENT BUDGET AND DREDGING ACTIVITIES ANNUAL REPORT

1. INTRODUCTION

The Fraser River Estuary Management Program (FREMP) is a partnership among federal, provincial and regional government agencies to foster co-ordinated and sustainable activities in the Fraser River estuary.

FREMP is guided by its Estuary Management Plan (EMP). Developed through a multi-stakeholder consensus process in 1994 and updated in 2003, the EMP outlines a shared vision, goals and an action plan for improving the environmental, economic, and social health of the estuary. A key target in the EMP is to manage the removal of sediment from the Fraser River while maintaining the sediment regime of the river in balance. FREMP developed a tool called the “Sediment Budget”, which allows FREMP to deliver on this key Plan target.

2. THE FREMP SEDIMENT BUDGET

The FREMP Sediment Budget is used to ensure that the average amount of sediment removed over a five- to ten-year period does not change the shape of the riverbed. This “averaging” approach acknowledges two factors:

- The amount of sediment deposited by the Fraser River’s annual spring flood fluctuates widely from year to year.
- Even in years where a relatively low amount of sediment flows into the estuary, water action may form underwater sandbars that need to be removed to prevent grounding of ships using the Fraser River. Conversely, in years where large amounts of sediment may enter the estuary, not all of it will pose a navigational hazard, and therefore, all of it may not need to be removed.

The FREMP Sediment Budget covers sand-sized sediment in the estuary as far upstream as Mission. For the purposes of the Budget, “sand” is any material that has a grain size between 0.177mm and 2.000mm. All other materials are not considered in the Budget. Thus, the Sediment Budget represents the amount of sand within that range that needs to be removed in order to maintain a balanced riverbed from year to year.

The Sediment Budget is derived from a mathematical model which is described in detail in a report entitled “Lower Fraser River Sediment Budget Analysis” prepared for FREMP in 1999 by Northwest Hydraulic Consultants. Following on a FREMP commitment to evaluate the predictive ability of the equation every five years, the model was reviewed in the 2002 by Northwest Hydraulic Consultants (NHC). NHC concluded that a sediment surplus has accumulated since 1996, and that the original target dredging figure of 70% of incoming bed material load is still appropriate and applies to grain sizes greater than 0.177mm. The report also noted that the Fraser River appears to be a stable “transport reach” between Mission and Douglas Island, and recommended that FREMP

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consider maintaining the sediment balance over the long term (10 years) as there is less need for concern about individual years.

3. THE 2003/04 BUDGET

The Sediment Budget is calculated annually for what is called the “freshet” year. Generally, the dredging period runs from August of one calendar year to March of the next calendar year.

The Sediment Budget formula requires data for two separate variables:

- 1) the freshet volume between April and September at Hope¹; and
- 2) the annual peak discharge at Mission.²

For the 2003/04 freshet, these respective values measured 50,700 million cubic metres and 7,935 cubic metres per second. **Placing these values into the Sediment Budget formula gave an estimate that the incoming sediment bed load would be approximately 0.61 million cubic metres during the period April 1, 2003 to March 31, 2004³.** Thus, whereas the 2002/03 inflow was classified as a moderately high inflow year, the 2003/04 inflow can be classified as an extremely low inflow year.

4. DREDGING ACTIVITIES IN 2003/04

During the period April 2003 to March 2004, 1.14 million cubic metres of sediment were removed from the navigation channel of the Fraser River. Thus, dredging managers were above the Sediment Budget in the 2003/04 dredging year. Note, however, that the re-evaluation of the Sediment Budget equation illustrated the need for a long term equilibrium compared to individual years.

Also in 2003-2004, capital dredging was approved to deepen the navigation channel, and 465,000 cubic meters were removed for these purposes. **Thus, a total of 1.61 million cubic meters of sediment were removed from the navigation channel in 2003-2004.**

Sediment was removed as follows:

Amount of sediment removed from the river and taken to upland sites (A):	1.16 million m ³
Amount of sediment removed from the river and disposed in ocean (B):	0.45 million m ³

Total removed from River = (A) + (B) = **1.61 million m³**

¹ Note that the 2003 observed runoff volume of the Fraser River at Hope was 53,100 m³ as noted in Seasonal Runoff Volume Forecast summaries available from MLWAP, <http://wlapwww.gov.bc.ca/rfc/archive/index.html>.

² Peak flow was achieved on June 14, 2003 as noted in peak discharge data available from Environment Canada, <http://scitech.pyr.ec.gc.ca/waterweb/selectProvince.asp>. [Final approved flow data from Environment Canada for the Fraser River at Hope showed peak flow of 7,300 cubic meters per second.]

³ This figure represents the refined FREMP Sediment Budget, calculated in August 2003.

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The map attached to the end of this report shows the locations where sediment was dredged during 2003/04, and for comparison purposes, where sediment was dredged during 2002/03.

5. **OVERALL SEDIMENT BUDGET BALANCE DURING PAST SEVEN YEARS**

2003/04 marks the seventh year that FREMP has forecasted the sediment (size between 0.177 mm and 2.000 mm) that enters the Lower Fraser River. The table below summarizes the annual Sediment Budget forecasts (in millions of cubic metres) and the actual amount of sediment removed from the River by dredging (in millions of cubic metres) during the past seven years.

The data shown below for the Sediment Forecast and Budget are taken from past FREMP Dredging Annual Reports⁴. Note that a comparison of forecast versus hindcast (actual) volumetric sediment loads in the NHC report showed that forecast loads are generally quite close to actual loads.

Data for “Actual Removed from the River” has been updated based on the December 2002 Northwest Hydraulics report. Where previous Annual Reports included in this column dredging totals for all particle sizes, the numbers below for “Actual Removed from River” now reflect net removal of sediment greater than 0.177 mm.

“Net Infill” compares “Actual Removed from River” against the “70% of Sediment Forecast” (i.e. what is still available to be dredged in keeping with sustainable sediment removal).

“Percentage of Forecast Removed” compares actual removed against the sediment bed load forecast.

Year	Sediment Forecast (0.177mm to 2.000mm)	70% of Sediment Forecast	Actual Removed From River (>0.177mm)	Net Infill Or (Net Removal)	% of Forecast Removed
1997/98	4.7	3.3	1.32	1.98	28.1%
1998/99	1.11	0.78	1.00	(0.22)	90.1%
1999/00	4.5	3.15	1.85	1.30	41.1%
2000/01	1.7	1.19	1.20	(0.01)	70.6%
2001/02	0.6	0.4	0.76	(0.36)	126.7%
2002/03	2.98	2.09	2.79	(0.70)	93.6%
2003/04	0.61	0.43	1.61	(1.18)	263.9%
1997/98 to 2003/04	16.2	11.34	10.53	0.81	65.0%

⁴ Previous FREMP Dredging Annual Reports reported a maximum of cubic meters that could be removed without changing the shape of the riverbed. This represented the 70% level of the Sediment Forecast.

⁵ Numbers used in the table are taken from FREMP Dredging Annual Reports, and so represent sediment forecasts based on preliminary discharge data. The NHC Report (2002) included findings based on actual sediment loads.

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The 1999 report by Northwest Hydraulic Consultants stated that “using the results of the Sediment Budget, an approximate long-term equilibrium can be maintained if the net dredging volumes are maintained at about 70% of the incoming bed material load”. During the past seven years, the volume of dredged material amounts to 65% of the forecasted bed material load. Thus, there has been a **net infill in the navigation channel during the past seven years that is estimated to be 0.81 million cubic metres.**⁵

6. OTHER DREDGING-RELATED ACTIVITIES DURING 2003/04

FREMP Dredging Impacts Data Gaps Study

In 2003, FREMP began a project to identify data gaps with respect to the biological impacts of dredging in the estuary. The purpose of the study was to identify areas in the estuary requiring impact analysis (i.e. what data gaps exist with respect to our knowledge of these impacts) and develop appropriate designs for these analyses. A Request for Proposals (RFP) went out in June 2003 and Limnotek/ESSA Technologies were retained for this project.

The project included a literature review and boat reconnaissance to review the division of the river into reaches for purposes of the study. A workshop in November 2003 reviewed a draft set of impact hypotheses and created a prioritized set of feasible environmental studies to fill information gaps in reaches of the river. From the workshop, Limnotek developed a draft report for review in February 2004. A final report incorporating some changes was provided in April 2004 and is currently being reviewed by the FREMP Water and Land Use Committee to identify next steps. The report will be useful for partners - particularly FRPA and DFO - in developing and prioritizing future dredging impact studies in the estuary.

Fraser River Dredging Registry Database

A Fraser River Dredging Registry, previously developed in 2002, is updated annually using recent dredging numbers. Copies of the Registry exist at North Fraser Port Authority, Fraser River Port Authority, Coast Guard and FREMP. The Registry is a customized Microsoft Access data interface and contains dredging data from 1999-2002 including information about particle size, what amount was dredged, and where it was disposed. An associated data layer is also available on the FREMP Geographic Information System (GIS).

Impact Assessment of Dredging Activities at Proposed Transfer Pit Site on Barnston Island

In 2000, the Fraser River Port Authority (FRPA) contracted Limnotek Research & Development Inc. to conduct a three-year \$225,000 study to assess the possible impact that dredging may have on the aquatic community in the Fraser River near Barnston Island. The results of the study will be used to determine if a permanent transfer pit site can be established upstream in this reach of the Fraser River near Barnston Island. The study is being coordinated by FRPA.

The study area covers a portion of the Fraser River upstream of the Port Mann Bridge near Barnston Island adjacent to the main navigation channel. The project at Barnston Island is

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structured into two assessments: one at a temporary transfer pit site located at the lower end of Barnston Island and the other at the proposed permanent transfer pit site at the upper end of Barnston Island, adjacent to the Katzie First Nation dock.

Dredging occurred at the temporary transfer pit in March 2000 and all field tasks related to assessment of the temporary transfer pit are complete. The draft report of this phase of the work was submitted during 2001/02. The field tasks for the next phase (proposed permanent pit) are underway and Limnotek Research will provide an update after each sampling episode. Dredging at the proposed permanent transfer pit occurred between November 2001 and January 2002. Field tasks for this project were completed in fall 2002. Limnotek is also compiling data sets from three dredging impact studies (Mission, Barnston temporary pit, Barnston permanent pit).

Dredging Impact Assessment – Sapperton Bar

A dredging impact assessment is underway at Sapperton Bar funded by Fraser River Port Authority. Following submission of a proposal in October 2002 and subsequent changes to the project sampling design, Limnotek began this study and dredging took place between December 2002 and January 2003. The study involves the collection of benthic invertebrates, turbidity observations and fish data collection in the area both before and after dredging. Sampling was undertaken in fall 2002, spring 2003 and fall 2003. Preliminary findings indicate that dredging of the access channel at Sapperton Bar does not affect catch rates of resident fish using Bar habitat. Further analysis is underway and a draft report including all aspects of dredging impact assessment at Sapperton Bar is expected shortly.

Dredging Impact Assessment – Sand Heads

Fraser Port is also funding a study to assess dredging impacts on benthic communities in the Sand Heads and Steveston segment of the estuary. Sampling occurred in February and April 2004, with dredging taking place in March 2004. There was no consistent difference between control and dredge sites with regards to changes in sandlance catch rates between February (before dredging) and April (after dredging). Preliminary results indicate that any effect of entrainment on sandlance is very short term, with rapid recruitment into the dredged sites after disturbance. Final sampling is to occur in September 2004 with lab work ongoing.

Dredging Impact Assessment - Big Bend (North Arm)

Assessment of sand dredging impacts on benthic communities is also ongoing in the Fraser River North Arm at Big Bend. Sampling took place in November 2003 and in May 2004 following dredging in January 2004. Researchers have found a decline in catchable fish in relation to site disturbance, and the site appears to be remaining in disturbance three months after dredging occurred. The apparent dredging effect in the North Arm may be due to less mobility of fish into and outside of the dredging area that may cause slow recruitment back into the dredge site after disturbance. Final sampling will occur during fall 2004.

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7. MEMBERS OF WLUC

The following agencies are represented on the FREMP Water and Land Use Committee and provide input and expertise with respect to dredging matters:

Fisheries and Oceans Canada

- Habitat and Enhancement Branch
- Canadian Coast Guard

Environment Canada

Fraser River Port Authority

North Fraser Port Authority

Public Works and Government Services
Canada

BC Ministry of Water, Land and Air
Protection

Land and Water BC

8. FOR FURTHER INFORMATION

For further information on FREMP, the Sediment Budget, or this Annual Report, please contact:

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