



Fraser
River
Estuary
Management
Program

Sediment Budget
&
Dredging Activities
Annual Report
For the Fiscal Year
April 1, 2001 to March 31, 2002

Prepared by FREMP's Dredge Management Advisory Committee



2001/02 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, 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. Through the work of its Dredge Management Advisory Committee, FREMP has developed a tool, called the “Sediment Budget”, which allows FREMP to deliver on this key EMP target.

2. THE FREMP SEDIMENT BUDGET

FREMP’s 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 because coarser material does not generally enter the estuary and finer materials do not deposit in the main navigation channel.

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 by Northwest Hydraulic Consultants.

3. THE 2001/02 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 Hope; and
- 2) the annual peak discharge at Mission.

For the 2001/02 freshet, these respective values measured 46,000 million cubic metres and 7,230 cubic metres per second. Both of these values are unusually low compared to historical data. In fact, the latter figure is barely above the recorded historic low of 7,160 cubic metres per second.

Placing these values into the Sediment Budget formula gives an estimate that approximately 0.4 million cubic metres of sediment will be deposited in the riverbed between Hope and the Strait of Georgia during the period April 1, 2001 to March 31, 2002. This value is 43% smaller than the lowest annual sediment load ever recorded (0.7 million cubic metres in 1978). Thus, whereas the 2000/01 inflow was classified as a **moderately low inflow year**, the 2001/02 inflow can be classified as an **extremely low inflow year**.

Dredge Management Advisory Committee members were concerned, stating that the very low values of freshet volume and maximum discharge were outside the range of data used to create the Sediment Budget equation. Thus, the equation's predictive ability in an extremely low inflow year might not be statistically valid. As discussed below, the amount of dredging required to keep the navigation channel open for business during 2001/02, far exceeded the amount estimated by the Sediment Budget equation.

4. DREDGING ACTIVITIES IN 2001/02

During the period April 2001 to March 2002, 1.44 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 2001/02 dredging year. Sediment was removed as follows:

Amount of sediment removed from the river and taken to upland sites (A):	0.76 million cubic metres
Amount of sediment removed from the river and disposed in ocean (B):	<u>0.68</u> million cubic metres
Total removed from River = (A) + (B) =	<u>1.44</u> million cubic metres

The map (attached to the end of this report) shows the locations where sediment was dredged during 2001/02, and for comparison purposes, where sediment was dredged during 2000/01.

Fraser River Port Authority (FRPA) was very concerned about this large net removal and felt that it did not represent "over dredging", rather, it represented a large miscalculation by the Sediment Budget equation due to the extremely low values for the independent variables. As a result, the Port commissioned a report from Public Works & Government Services Canada (PWGSC) that measured the infill and scour volumes between pre-freshet and post-freshet surveys (down river from the Patullo Bridge). The results of the volumetric survey analysis revealed the following:

Volume of Infill	2.02 million cubic metres
Volume of Scour:	0.73 million cubic metres
Net Infill	1.29 million cubic metres

This net infill volume as calculated by PWGSC is very close to the 1.44 million cubic metres of sediment removed from the River by the FRPA.



Since the inception of the Sediment Budget concept, DMAC has been committed to evaluating the predictive ability of the equation. DMAC recommended that this evaluation of the equation should occur every five years. The 2002/03 program year marks the first occurrence of this recommended evaluation cycle. The results from the 2001/02 Sediment Budget forecast, combined with 2001/02 removals from the River and the resulting volumetric survey analysis performed by PWGSC highlight the need to evaluate the predictive ability of the Sediment Budget equation. If the equation is to be relied upon as a tool that DMAC can utilize to properly manage dredging in the Lower Fraser River, there must be confidence in the equation's ability to accurately predict sediment inflows to the Lower Fraser River.

5. OVERALL SEDIMENT BUDGET BALANCE DURING PAST FIVE YEARS

2001/02 marks the fifth year that FREMP's Dredge Management Advisory Committee forecast 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 five years:

Year	Sediment Forecast (0.177mm to 2.000mm)	70% of Sediment Forecast	Actual Removed From River	Net Infill Or (Net Removal)	% of Forecast Removed
1997/98	4.80	3.36	1.47	1.89	30.6%
1998/99	0.73	0.51	1.11	(0.60)	153.4%
1999/00	4.29	3.00	1.99	1.01	46.5%
2000/01	1.47	1.03	1.20	(0.17)	81.5%
2001/02*	0.40	0.28	1.44	(1.16)	361.4%
1997/98 to 2001/02	11.68	8.18	7.21	0.96	61.8%

The February 1999 report by Northwest Hydraulic Consultants states 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." As can be seen from the table, during the past five years, the volume of dredged material amounts to 61.8% of the forecasted incoming bed material load. Thus, there has been a net infill in the navigation channel during the past 5 years that is estimated to be 0.96 million cubic metres.

6. OTHER DREDGING-RELATED ACTIVITIES DURING 2001/02

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 with the assistance of FREMP through the Dredge Management Advisory Committee.

* The Sediment Budget equation's predictive ability in extremely low inflow years may not be statistically valid.



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 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 Nations dock.

Dredging occurred at the temporary transfer pit from March 6 to 15, 2000 and at present 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 main findings of this report are as follows:

- Dredging and backfilling had no effect on water column turbidity at the time of disturbance. The conclusion being made is that suction dredging is substantially more effective than clamshell dredging in preventing change in particle concentration downstream of dredging operations.
- Substrata at the dredge and control sites consisted of medium sand. The grain size distribution of dredge and control site samples remained similar despite the dredging operation. Although a general shift to smaller-sized material was detected in post-dredge samples, the change was not significant.
- Benthic invertebrate densities dropped by more than 70% at the dredge location between dates before and after dredging, while densities increased by 28% at the control location over the same period. Within 6 months of dredging, however, densities had recovered to pre-dredge values that were comparable, if not greater than densities at the control site. It is possible that recovery was more rapid but this could not be determined in the sampling frequency that was assigned.
- Initial findings show that 10 radio-tagged sturgeon have moved less than 5 kilometres since the time of tagging (summer of 2001) and all have remained in the Barnston Island area. Because a single sample of fish at one transfer pit was compared to one sample from a single control in this study, researchers were not able to use statistical approaches to examine dredging effects on fish catch rates or total fish catch. Statistical approaches to examine dredging effects on fish catch rates will be completed in March 2003.
- Backfilling the temporary dredge pit with similar-sized material immediately after dredging mitigated physical changes to the site and likely minimized the degree to which habitat conditions and the ecosystem were impacted.

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 mid-November of 2001 and late-January of 2002. It is anticipated that the field tasks for this project will be completed by December 2002 and a final report will be compiled by March 2003.

Hay & Company Dredging/Floodplain Interaction Study

The Fraser River Port Authority commissioned Hay & Company Consultants Inc. in order to answer the following question:



In the lower Fraser River, what is the extent to which dredging and concomitant lowering of the riverbed serve to reduce flood hazards?

According to the final report, "It has been conclusively demonstrated from recorded water level data that high water levels at New Westminster and Whonnock have been typically 0.5 metres lower during periods when the river was deeper as a result of relative high dredging volumes." Also, the report concludes "Data from the last two or three years indicate that the channel is starting to shoal up, since less dredging is occurring, and one can expect high water levels to increase over the next few years."

Fraser River Dredging Registry Database

During the 2001/02 year, the Dredging Registry Database customized interface was created and installed by Northwest Hydraulic Consultants. 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 shell at this point. Dredging data for 2000/01 and most of 2001/02 have been entered, but historical data entry is still required. As a result of this initial data input stage it was determined that the data interface needed upgrading. For 2002/03, the Dredge Management Advisory Committee has received budgetary approval to upgrade the data entry interface, improve the linkages between the Registry and FREMP's Geographic Information System, and find a cost-effective way to make the Dredging Registry Database accessible via the Internet.

7. MEMBERS OF DMAC

The following agencies are represented on FREMP's Dredge Management Advisory Committee:

Fisheries and Oceans Canada

- Habitat and Enhancement Branch
- Canadian Coast Guard

Environment Canada

- Water Survey Branch
- Ocean Disposal Control

Fraser River Port Authority

North Fraser Port Authority

Public Works and Government Services Canada

BC Ministry of Water, Land and Air Protection

- Fish and Wildlife Science and Allocation Section

Land and Water BC

8. FOR FURTHER INFORMATION

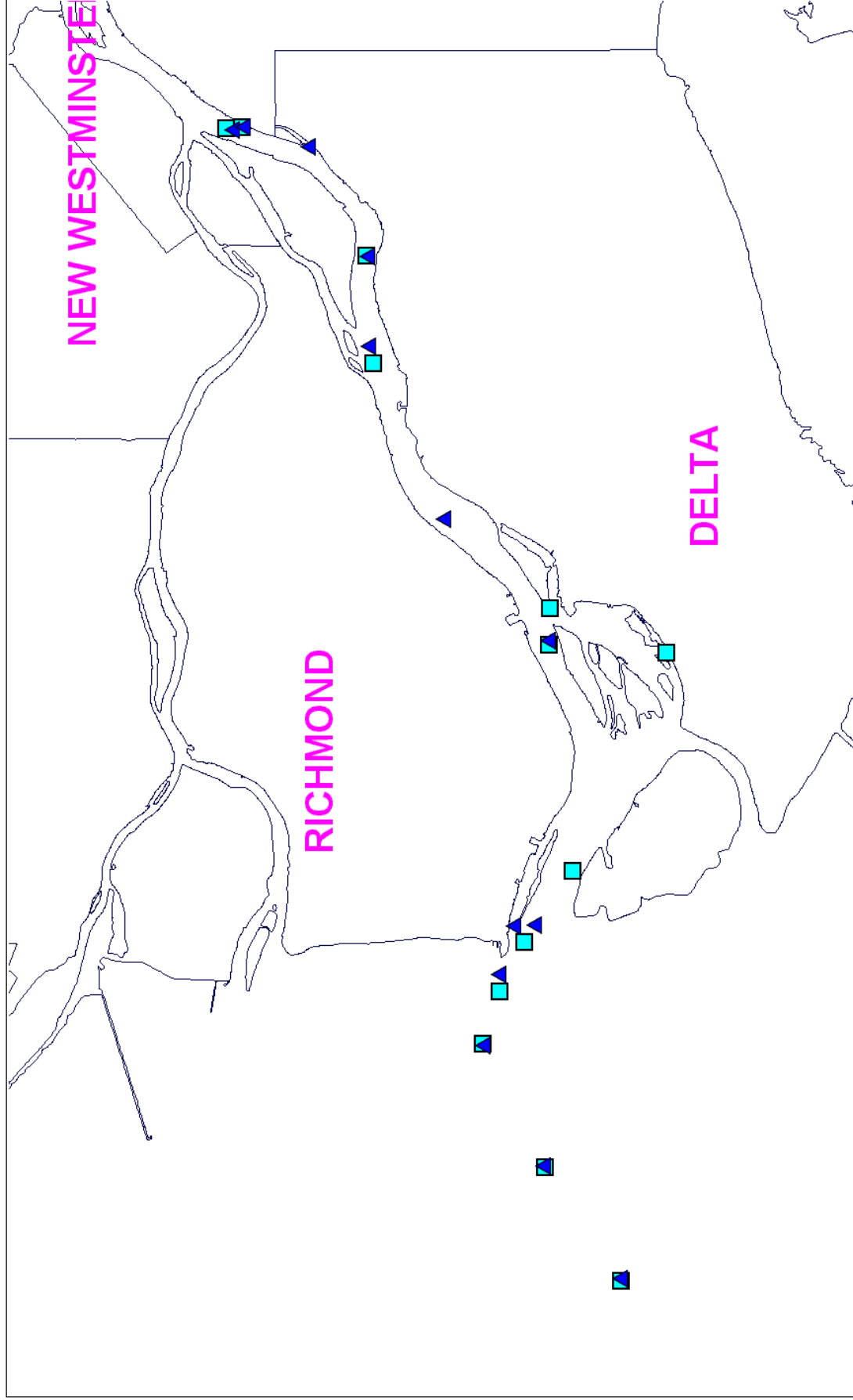
For further information on FREMP, the Sediment Budget, or this Annual Report, please contact:

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Location of Dredging: Comparison of 2000-2001 with 2001-2002



4000 0 4000 8000 Meters

Projection: Universal Transverse Mercator (UTM) Zone 10
Datum: North American Datum 1983 (NAD 83)

Legend

- ▲ Dredge Cuts 2001-2002
- Dredge Cuts 2000-2001