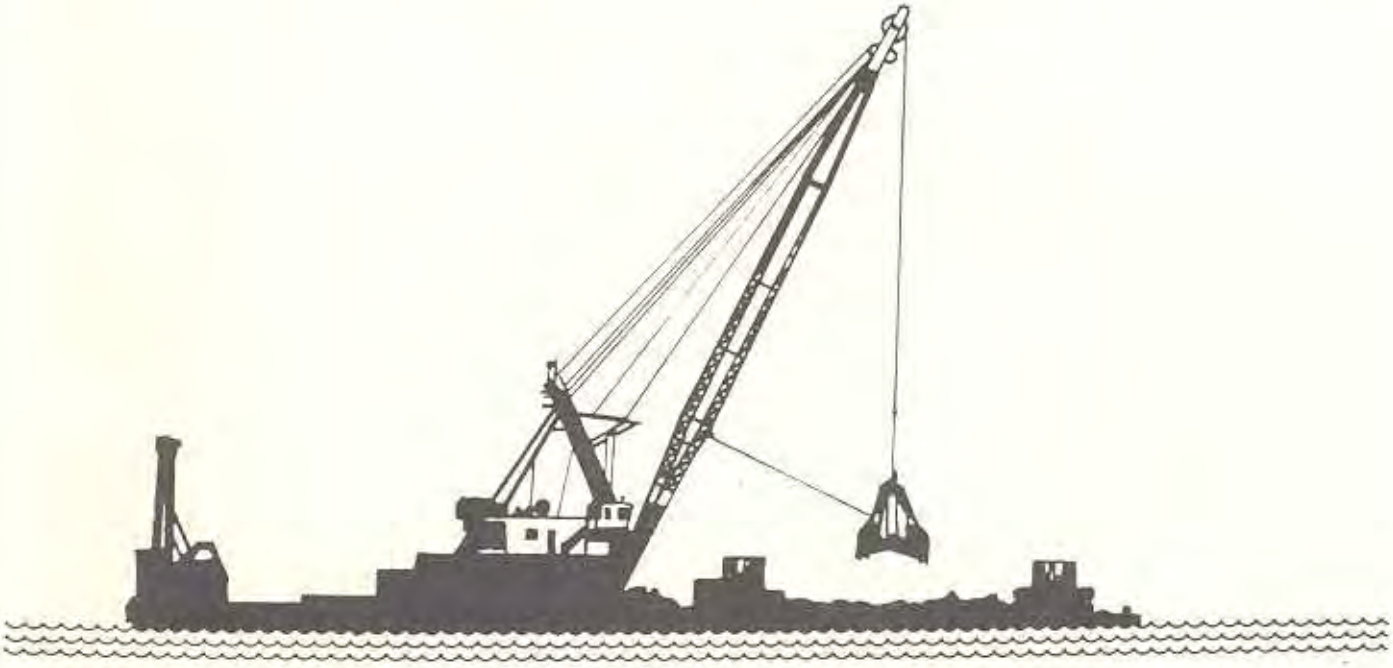
US Army Corps of Engineers
Seattle District

PSDDA Reports

Puget Sound Dredged Disposal Analysis

Washington State Dept. of Natural Resources

MANAGEMENT PLANS TECHNICAL APPENDIX - PHASE I (CENTRAL PUGET SOUND)



JUNE 1988

EPA Region 10

ECOLOGY

MANAGEMENT PLANS TECHNICAL APPENDIX

Management of Unconfined, Open-Water Disposal Sites

For Dredged Material in Central Puget Sound

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Prepared for:

Puget Sound Dredged Disposal Analysis
(PSDDA)

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ORGANIZATIONAL PREFACE

This document is a technical appendix to the Puget Sound Dredged Disposal Analysis (PSDDA) Management Plan Report. The appendix was prepared by Management Plans Work Group (MPWG), assigned the responsibility for developing management plans for public multi-user, unconfined, open-water disposal sites.

Part I of the technical appendix contains introductory and conceptual information for the remaining parts of the document.

Part II is the detailed presentation of the dredging and dredged material management analysis performed by MPWG.

EXECUTIVE SUMMARY

This document is a technical appendix to the Management Plan Report for the Puget Sound Dredged Disposal Analysis (PSDDA) study. The technical appendix was produced by the Management Plans Work Group (MPWG). Members of the work group were the Washington Department of Natural Resources (DNR) as lead agency, supported by the U.S Corps of Engineers (Corps), the U.S. Environmental Protection Agency (EPA), and the Washington Department of Ecology (Ecology).

The technical appendix summarizes results for Phase I of PSDDA, which includes the central portion of Puget Sound from the City of Everett to the City of Tacoma. MPWG's task in Phase I was to assess the existing regulatory process for dredged material disposal and to prepare a management plan for each unconfined open-water disposal site. The major issues addressed by the work group were: agency designation of disposal sites; permits and fees for site use; permit compliance inspection; violations; environmental monitoring; data management; and implementation.

Agency Designation of Disposal Sites

In the past, disposal sites were established by DNR based on the recommendations of its Interagency Disposal Site Selection Committee. In the future DNR will rely on the PSDDA siting procedures when siting any new disposal sites other than those established through the current PSDDA study.

In addition to DNR disposal site designation, EPA and the Corps will apply their authority under 40 CFR 230.80 for advance identification of the PSDDA-selected open-water disposal sites. This should facilitate processing of the Section 404 permit applications and support State designation of disposal sites.

Permits for Site Use

MPWG reviewed the Federal, State, and local authorities and permit processes related to management of open-water disposal. No needs for changes in the permit process were found.

Shoreline Management Master Programs in Puget Sound were reviewed. Master Program policies and regulations for open-water disposal of dredged material were found to vary from jurisdiction to jurisdiction. This has complicated DNR acquisition of permits in the past. MPWG met with local shoreline agency representatives to discuss development of consistent regulations. MPWG developed, and is recommending for adoption by local jurisdictions, a model shoreline master program element for unconfined, open-water dredged material disposal. If the model program element were adopted, then master programs would be consistent with PSDDA findings and consistent throughout Puget Sound.

MPWG also recommends that DNR initial dredging permits be limited to the actual time necessary for each project. Maintenance permits should be issued just for the term of each project but generally not longer than two years. This will keep DNR

informed about the actual use of disposal sites and allow timely program adjustments.

Permit Compliance Inspection

MPWG evaluated three inspection philosophies: voluntary compliance; spot checking; and full-time verification. The spot checking philosophy is recommended with the understanding that routine spot checking be adjusted, when necessary, to keep close track of potential problem areas.

The two major factors of concern are the character of material discharged at a disposal site and the positioning of vessels using the site. The character of material could be inspected either by testing sediments after placement on barges or by limiting disposal to dredged material removed from locations where material has been determined to be suitable for unconfined, open-water disposal. The latter practice is recommended, as the former is not timely.

The pre-dredging sediment analyses will be used to determine the locations of sediments suitable for in-water disposal. A system for determining dredging site inspection requirements is recommended. This system varies inspection depending on the absence or presence of contaminants. If all sediments are found to be suitable for unconfined, open-water disposal, only spot checking of the dredging operation will be required to ensure that other aspects of the dredging operation are in compliance with special permit conditions, e.g., time restrictions etc. Dredged material that is found unsuitable for unconfined, open-water disposal will be placed at confined disposal sites. Provision is made for use of non-agency inspectors when intensive on-site dredging inspections are required. A dredging inspection plan will be prepared by the administering agencies prior to dredging.

Barge positioning at the disposal site is the other element to be checked. MPWG commissioned a study of positioning and inspection techniques to aid in the work group's investigation. The study found that some currently used positioning techniques (standard radar and visual observation) cannot provide the desired accuracy. For accurate positioning, continued use of the Coast Guard's Vessel Traffic Service, where available, and Loran-C with variable range radar, elsewhere, were recommended. MPWG also contacted dredgers who recommended that buoys be used to provide positioning assistance. The Coast Guard has indicated that buoys in Commencement and Elliott Bays would not be acceptable due to potential navigation conflicts.

For Commencement Bay, Loran-C and variable range radar are proposed. For Elliott Bay, the Coast Guard VTS system and radar back-up will be used. A buoy is believed to be the best positioning aid in Port Gardner. However, due to potential impacts to the drift net fishery, variable range radar will be used instead.

The study also considered the size of the surface target area and concluded that the target area should be smaller than the desired surface disposal zone. This will provide a margin for error in barge positioning. The recommended surface target area radius is 600', while the surface disposal zone radius is 900' for all disposal sites.

For verification of compliance with disposal site positioning requirements, the study recommended that disposal records always be kept and that VTS be used where

coverage is available. In addition, the study suggested remote monitoring supplemented with spot checks. MPWG recommends that VTS, backed up by spot checking, be used in Elliott Bay, and that spot checking be used in Commencement Bay and Port Gardner. User records are recommended in all cases.

After evaluating the capabilities of each agency for performing inspections, MPWG recommends that for non-Corps projects, Ecology perform necessary inspections at the dredging site and that DNR perform inspections at the disposal site. For Corps projects the Corps will monitor its contractors.

Violations

MPWG reviewed each agencies' authorities for addressing violations. It was found that better coordination could be achieved in responding to violations. MPWG recommends that DNR, Ecology, and the Corps (for Corps projects), as the inspecting agents, report violations to each other so each can apply appropriate sanctions within its authorities. Coordinated actions will be sought.

Environmental Monitoring

An environmental monitoring plan has been established for the PSDDA preferred disposal sites to ensure compliance with the Section 404(b)(1) guidelines and to field verify the PSDDA predictions of site conditions following disposal. Moreover, monitoring will provide the data to allow direct response to agency and public questions regarding site conditions and environmental impacts. Baseline studies will be done by Ecology for the three Phase I area unconfined open-water disposal sites to document existing conditions at and near the sites, and at offsite reference areas prior to disposal. Follow-up environmental monitoring will be done to identify environmental changes. The Corps will generally collect the physical monitoring data and DNR will generally collect the chemical and biological monitoring data. The follow-up monitoring will be adjusted for each site depending on the amount of use. An anticipated schedule of monitoring has been developed based on expected disposal activity. Costs have been projected based on this schedule. The total estimated cost for baseline and monitoring studies of the three PSDDA sites (excluding permit compliance) is $2,008,600 over 15 years, or about $134,000 per year.

Data Management

Based on an analysis of ongoing data management requirements, the Corps will maintain sediment quality data derived from dredged material testing and environmental monitoring on a computer system and provide annual summary reports to DNR and other agencies. Cost data on sampling and testing will also be collected and maintained on the system. Stored sediment test data will be provided to Ecology for updating sediment quality values used to compute the Apparent Effects Threshold (AET) values which are employed in setting the screening level (SL) and maximum level (ML) values for the PSDDA evaluation procedures. Ecology will also assess the need for changes in the sediment quality values used in the evaluation procedures and present this assessment along with supporting data and analysis to the other PSDDA agencies as part of the annual review of the PSDDA plan. Data management systems will facilitate the

use of dredged material data by other programs, to the extent feasible.

DNR will maintain data obtained during the DNR permit application process. Permit compliance inspection reports will be filed by DNR for disposal site use. A project file of disposal volumes and fees will also be maintained for each site. DNR will produce an annual disposal permit compliance report.

Financing and Implementation Actions

The cost of implementing PSDDA recommendations for EPA, Ecology, and Corps permit administration and compliance will be borne by those agencies out of their operating budgets. Major new costs will be incurred for disposal site baseline studies, environmental monitoring studies, DNR disposal site compliance inspections, and Ecology dredging site compliance inspections.

A detailed set of implementation actions, by agency, is presented.

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C 40 CFR 230.80
D Treatment of Dredged Material Disposal in Shoreline Management Master Programs
E Model Shoreline Master Program Element
F DNR Disposal Site Use Report Forms
G Recommended Inspection Plan Format
H Correspondence with U.S. Coast Guard
I Environmental Monitoring Plan
J Disposal Site Management Plans
K Noise Monitoring Reports
L Corps of Engineers 404(b)(1) Procedures and Policies on Dredging and Dredged Material Disposal

PART I. INTRODUCTION

1. STUDY GOALS, DESCRIPTION, AND ORGANIZATION

This technical appendix addresses the management of sites to be used for unconfined open-water disposal of dredged material in Central Puget Sound, pursuant to implementation of the Clean Water Act and related authorities and pursuant to State aquatic land proprietary interests. A review and synthesis of studies conducted, information gathered, and analysis performed are provided.

Since the 1970's high concentrations of chemical contaminants have been found in some sediments of a number of bays in Puget Sound. These contaminants have also been identified in fish, shellfish, and other organisms. While research is continuing about the ways in which exposure to contaminated sediments affects marine life or human health, recent field studies have noted adverse biological effects in areas of high sediment contamination. Because open-water disposal of dredged material from harbors and navigation channels can result in a transfer of contaminated sediment from shallow to deep water, both State and local governments have begun to impose stringent conditions on renewals of open-water disposal through shoreline permits and water quality certifications. Dredging is necessary to keep shipping channels and harbors open, to construct new ports, and sometimes to clean up contaminated material. Consequently, dredging in Puget Sound is an ongoing necessity and has been commonplace for many years.

Five basic disposal options are possible. These include unconfined open-water, unconfined nearshore/upland, confined aquatic, confined nearshore, and confined upland disposal. The three confined options result from the need to address sediment contamination levels that are unacceptable for unconfined or conventional disposal.[1] Open-water sites are located offshore in submerged areas. Unconfined open-water disposal occurs through free fall of released material to the bottom with no subsequent handling. Confined aquatic disposal involves follow-up capping with material suitable for unconfined, open-water disposal. Nearshore disposal sites are typically diked aquatic areas, but the final surface of the site is usually above the water line. Upland disposal sites are areas created on land entirely above the water line, and are often diked. PSDDA addresses unconfined, open-water disposal in detail (i.e., siting, dredged material evaluation procedures, and site management) and deals with all other disposal options in a generic manner.

Cost effective evaluation, disposal, and management of dredged material is essential to the economic interests of the Puget Sound region, which serves as a major port for the nation. More than 200 small boat harbors meet the needs of commercial fishing vessels and pleasure craft in the Puget Sound region. Periodic dredging is necessary in most of these small boat harbors as well as in the major ports. For uncontaminated dredged material, disposal at unconfined, open-water sites has been the least costly alternative. As upland and intertidal areas become more difficult to secure, the demand for this type of disposal will increase.

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[1] See the Evaluation Procedures Technical Appendix for Detailed Discussion of Disposal Options.

1.1 Puget Sound Dredged Disposal Analysis

The Puget Sound Dredged Disposal Analysis (PSDDA) is an interagency study which involves the U.S. Army Corps of Engineers (Corps) as lead agency, supported by the U.S. Environmental Protection Agency (EPA) and the Washington Departments of Natural Resources (DNR) and Ecology (Ecology). The goal of PSDDA is to provide the basis for publicly acceptable guidelines governing environmentally safe, unconfined, open-water disposal of dredged material, and to provide Puget Sound-wide consistency and predictability. The objectives of PSDDA are as follows:

- Identify acceptable unconfined open-water disposal sites,
- Define consistent and objective evaluation procedures for dredged material to be discharged at those sites,
- Formulate disposal site use management plans that will ensure adequate controls and public accountability.

Three work groups have been formed to address the PSDDA objectives with staff from the four PSDDA agencies serving on each work group. Many other interest groups including representatives from Puget Sound ports, environmental groups, the dredging industry, local governments, and other State and Federal agencies are also participating in work group activities. The work groups, under the general guidance of the PSDDA Study Director, have conducted a number of technical studies. These work groups include:

- Disposal Site Work Group (DSWG)
- Evaluation Procedures Work Group (EPWG)
- Management Plans Work Group (MPWG)

DSWG was assigned the responsibility for selecting and dealing with physically monitoring concerns for unconfined, open-water disposal sites in central Puget Sound. EPWG was assigned the responsibility for developing a decision-making framework and technical specifications for assessing the quality of dredged material and delineating which materials are suitable for unconfined, open-water disposal. MPWG was assigned the responsibility for developing the management plan for use of each of the unconfined, open-water disposal sites.

The work of PSDDA is divided into two phases that differ geographically and temporarily (see Figure I.1-1). Phase I of the study began in April 1985 and covers a smaller geographic area than Phase II. The Phase I study area includes Puget Sound from Everett south to Tacoma. The focus of this technical appendix is Phase I of the PSDDA study, but public scoping meetings have been held by PSDDA in the Phase II communities of Olympia, Port Townsend, and Bellingham. These meetings were held to ensure that the public in the Phase II area would have an opportunity to influence the Phase I process. Phase II of the PSDDA study covers the balance of Puget Sound up to the Canadian border and south Puget Sound.

The regulatory context for the PSDDA study is Section 404 of the Clean Water Act of 1977 (Public Law 92-500), which establishes a Federal permit system for the

disposal of dredged and fill material, and Section 401, which requires a water quality certification from the State prior to issuance of a Federal permit. The Coastal Zone Management Act (CZMA) (Public Law 92-583) requires that Federal projects in a particular State be consistent to the maximum extent practicable, with the State's coastal zone management program. For non-Federal projects, full consistency is required. The CZMA appeal process for projects not in compliance differs for Federal and non-Federal projects. In addition, Section 10 of the 1899 Rivers and Harbors Act applies to disposal activities in navigable waters. A more detailed description of the legal requirements relevant to disposal of dredged materials is presented in Part II of this technical appendix.

1.2 Management Plans Work Group (MPWG)

The goal of the Management Plans Work Group was to develop plans for management of unconfined, open-water disposal. MPWG sought improvements in permitting, permit compliance, environmental monitoring, and interagency coordination for future program adjustments.

1.3 Management of the Management Plans Work Group

1.3.1 Participants and Coordination or Work

Four agencies are the principal participants in MPWG. The lead and chair agency is the Washington Department of Natural Resources (DNR). The U.S. Army Corps of Engineers (Corps), the U.S. Environmental Protection Agency (EPA) and the State of Washington Department of Ecology (Ecology) are supporting agencies. Representatives of these agencies met as necessary to coordinate the work. In addition to the four primary agencies, port, city, county, other State and Federal agencies, Indian tribes, and other interests were also involved in the activities of MPWG (Table I.1-1).

For most meetings (Table I.1-2), detailed minutes were recorded that summarized the conclusions of the work group discussion. Meetings were frequent enough to enable thorough discussion of any issues that needed to be addressed. The ultimate resolution of such issues appears in the minutes or in special reports.

Another function of the MPWG meetings was general monitoring of the work as it proceeded. This monitoring included contract oversight and review of technical documents submitted by agencies or contractors.

1.3.2 Public Involvement

The public was also involved in the MPWG decision-making process through a series of meetings held at several locations during the summer of 1986. These public meetings were publicized through news media coverage, informational brochures, newsletters, and by encouraging involvement of various organizations.

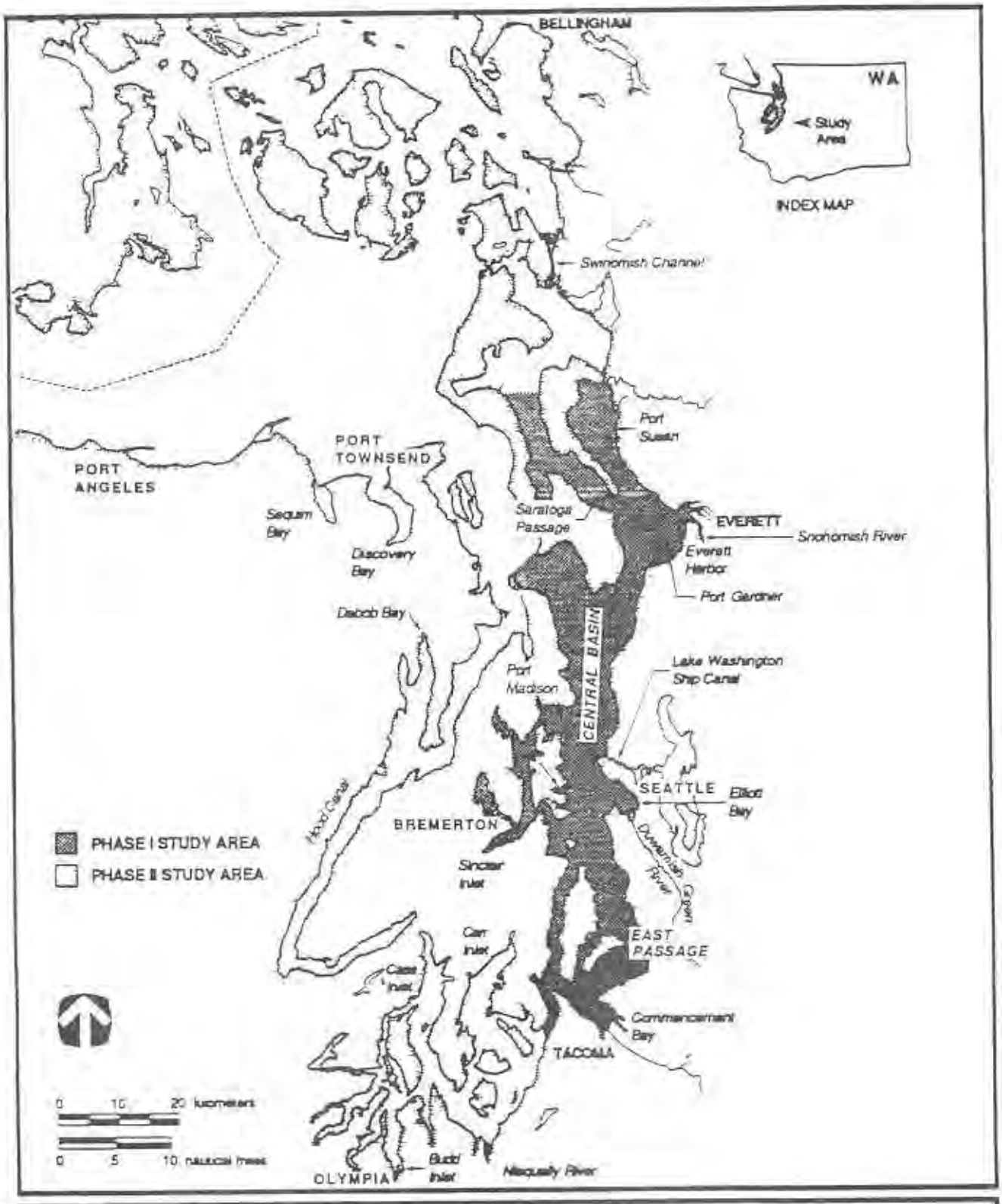


FIGURE I. 1-1 PSDDA STUDY AREA

TABLE I.1-1 OTHER PARTICIPANTS IN MPWG PHASE I ACTIVITIES

- State of Washington

  Department of Transportation
  Department of Fisheries
  Department of Game
  Department of Commerce
  Department of Social and Health Services
  Puget Sound Water Quality Authority
  State Parks and Recreation Commission

- Federal

  National Oceanic and Atmospheric Administration (NOAA)
  U.S. Fish and Wildlife Service (USFWS)
  U.S. Coast Guard (USCG)

- Local Governments/Agencies/Port Districts

  Mason County
  Thurston County
  Island County
  Jefferson County
  Kitsap County
  Snohomish County
  King County
  Pierce County
  City of Everett
  City of Seattle
  City of Tacoma
  METRO
  Puget Sound Council of Governments (PSCOG)
  Port of Bellingham
  Port of Everett
  Port of Seattle
  Port of Port Townsend
  Port of Tacoma
  Port of Anacortes
  Port of Edmonds
  Port of Olympia
  Port of Port Angeles
  Port of Skagit County

- Indian Tribes

  Muckelshoot
  Puyallup
  Tulalip
  Suquamish

- Environmental Groups/Organizations

  Puget Sound Alliance
  Washington Environmental Council

- Industry

  General Construction
  Brusco
  Jay Spearman
  Ogden Beeman

- Private Citizens

  Bonnie Orme

- Other

  Washington Public Ports Association
  Northwest Indian Fisheries Commission

TABLE I.1-2 MPWG MEETINGS

Meeting No.	Date
1	19 April 1985
2	6 May 1985
3	4 June 1985
4	18 June 1985
5	17 September 1985
6	9 October 1985
7	25 October 1985
8	13 November 1985
9	23 December 1985
10	10 January 1986
11	20 February 1986
12	14 March 1986
13	11 April 1986
14	23 May 1986
15	13 June 1986
16	26 June 1986
17	29 July 1986
18	19 August 1986
19	16 October 1986
20	29 July 1987

2 BACKGROUND, OVERVIEW, AND STRATEGY

2.1 Definition of Dredged Material

Dredged material is sediment excavated from the bottom of a waterway or water body.

2.2 Existing Unconfined Open-Water Disposal Sites

As the proprietor of State-owned aquatic lands, the Washington State Department of Natural Resources (DNR) has a responsibility to ensure these lands are used properly. In the early 1970's, State and Federal resource agencies realized that control of dredged material disposal was needed. Debris from some disposal operations was causing hazards to commercial fishing and navigation. Later in the decade, control over contaminated sediments also became an issue.

In 1970, DNR created the Interagency Open-Water Disposal Site Evaluation Committee. This committee, composed of representatives of State and Federal agencies, advised DNR in selecting appropriate sites for disposal of dredged material. (See the DSWG Technical Appendix [(DSS TA)] for a discussion of this process.)

Historically, DNR's major concern has been disposal site management, not the character of the dredged material. Lack of adequate funding prevented field compliance monitoring. Also, monitoring was not thought to be necessary because the material was thought to be "clean." DNR relied on the regulatory agencies, acting under Federal Clean Water Act requirements, to ensure that only suitable sediments were sent to open-water disposal sites. (See the EPWG Technical Appendix ((EPTA)) for a detailed discussion of this process.)

2.3 Need for Reevaluation of Unconfined Open-Water Sites

See the DSS TA for a discussion of the need for reevaluation of disposal site locations.

2.4 Issues

Key issues in the site management process were: efficient coordination of the various agencies' permit processes, verification of permit compliance, coordination of action against violators, management of data, environmental monitoring of site impacts, and interagency coordination during implementation.

Permit coordination is important due to the number of permits required by various agencies and because individual local agencies exert major control over aquatic land use. Dredged material disposal needs to be managed on a regional basis. Therefore, local governments must deal with open-water disposal consistently and predictably.

In the past, there have been some public complaints about compliance with permit conditions by disposal site users. For example, claims of off-site disposal were made. The PSDDA plan will require more certainty as to how sites are used. Coordinating action against permit violators and coordination of data management were two areas which were explored.

A major issue in establishment and use of open-water disposal sites is accountability for environmental impacts caused by these activities. Since Phase I sites were selected for their ability to generally retain dredged materials, monitoring of environmental impacts of site use was feasible and mandatory.

Implementation of PSDDA will require action by all PSDDA agencies and by other State and local agencies. These actions must be clearly understood and a continuing mechanism for interagency coordination established to take care of any problems that might arise.

2.5 Assumptions

The Management Plans Work Group assumed that implementation of PSDDA would rely on existing agency authorities but that additional funds may have to be sought for such activities as permit compliance and environmental monitoring.

An assumption was also made that material suitable for unconfined, open-water disposal would generally be sent to the nearest disposal site. However, it was also recognized that, in some cases, dredged material might be transported beyond the nearest site if that site were unavailable and if sediment evaluation guidelines for the alternative site were met.

2.6 Objectives

The specific objectives of MPWG in the Phase I area were to review existing regulatory procedures, establish appropriate disposal site management guidelines, and prepare management plans for each of the recommended unconfined open-water disposal sites.

2.7 Strategy

The Management Plans Work Group developed a detailed Plan of Work which defined the issues to be addressed and necessary products (see Exhibit A). Most subjects were addressed through research by committee members and discussion of the findings. In some cases, knowledgeable people were invited to the work group meetings to discuss the issues and make recommendations.

Work group recommendations were made on a consensus basis. When there was an irreconcilable difference of opinion, the issue was referred to the Study Director and Technical Steering Committee for resolution.

PART II. DREDGED MATERIAL MANAGEMENT ANALYSIS

1. STATE AND FEDERAL DESIGNATION OF DISPOSAL SITES

1.1 Past Practice

Pre-PSDDA open-water disposal sites were established by the process described in the Department of Natural Resources regulations (WAC 332-30-166 see Exhibit B). Under these regulations, "sites are selected and managed by the department with the advice of the interagency open water disposal site evaluation committee." This advisory committee is composed of representatives of State and Federal regulatory agencies. The DNR regulations also contain physical and biological guidelines for site selection.

1.2 PSDDA and PSDDA Implementation

1.2.1 Disposal Site Selection Process

A major effort of PSDDA is to establish a process for identifying acceptable locations for unconfined, open-water dredged material disposal to meet projected needs through the year 2000. With the aid of siting criteria developed by PSDDA, a map overlay system was used to identify potentially suitable areas (see the DSS TA). Sediment, current and biological studies were conducted to verify the suitability of these areas and to determine the exact location of disposal sites.

The PSDDA site selection process has been adopted by the four PSDDA agencies. In addition, DNR will revise its regulations on site selection (WAC 332-30-166) to include the PSDDA site selection process. The site selection process will be used, as needed, in modifying sites and identifying new sites. Section 7 of this Technical Appendix explains the process for post-PSDDA interagency coordination, including establishment of sites.

1.2.2 Identification of Specific Disposal Sites

As part of PSDDA, the site selection process is being applied in Puget Sound to identify sites to meet projected needs through the year 2000. EPA and the Corps will officially identify the PSDDA sites under authority of Federal regulations (40 CFR 230.80, Exhibit C). These regulations provide for advance designation of areas which are potentially suitable for open-water disposal. The EPA and the Corps will evaluate PSDDA-selected disposal sites against the guidelines contained in Section 404(b)(1) of the Federal Clean Water Act as part of the 40 CFR 230.80 review.

The 40 CFR 230.80 process will run concurrently with PSDDA. Publication of the final PSDDA document will allow the final 40 CFR 230.80 determinations to be made. This should facilitate the Section 404 permit application process and support the State designation of disposal sites.

At the State level, DNR will only seek shoreline management permits for use of sites which have been identified through the site selection process. These permits will be for the maximum period possible (currently 5 years). Subsequently, the DNR will only issue permits for unconfined, open-water disposal at these sites. The Corps will not obtain permits from DNR for Federal use of the sites, but will coordinate with, and report all site use to, DNR.

2. PERMITS FOR SITE USE

2.1 Introduction

The MPWG examined the permits and permit processes applicable to use of open-water disposal sites. Due to the overlapping authorities of Federal, State, and local jurisdiction, a number of agencies regulate or manage open-water disposal. The permitting process appears complex and could become unwieldy without close interagency coordination. Two possible changes were identified; a regional Corps permit and uniform shoreline management master program language.

2.2 Permit Authorities

Authority over disposal of dredged materials is distributed among the Corps of Engineers, Washington Departments of Ecology, Natural Resources, and Fisheries, and cities and counties. The Environmental Protection Agency and other Federal and State agencies are involved through the Corps' permitting process.

2.2.1 Corps of Engineers

The U.S. Army Corps of Engineers' responsibility to regulate disposal of dredged or fill material in the waters of the United States is mandated by Section 404 of the Clean Water Act (CWA) (see Exhibit L). The purpose of the CWA is to restore and maintain the chemical, physical and biological integrity of waters of the United States.

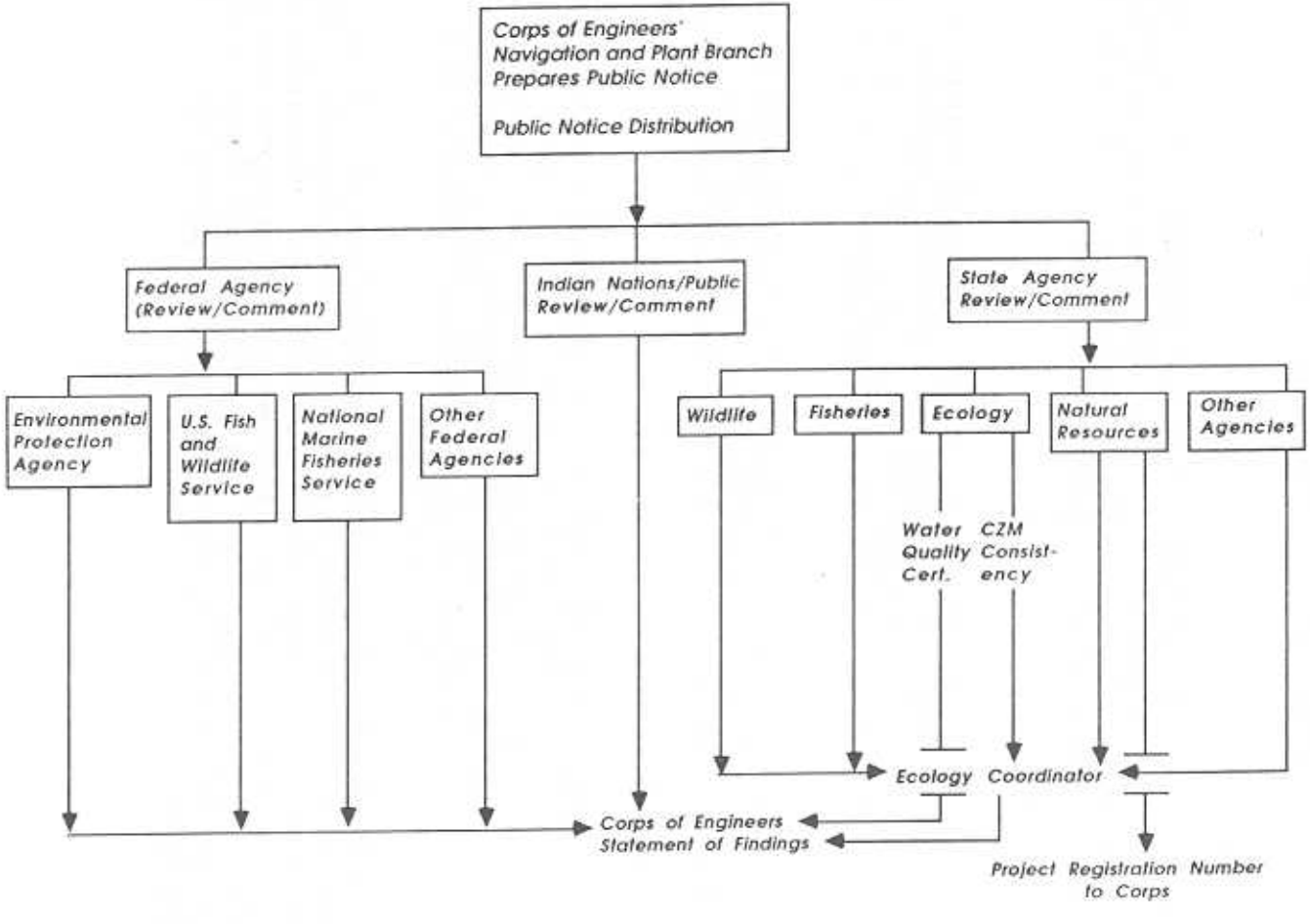
In addition, dredging, disposal, and the performance of most work, including installation of structures within the navigable waters of the United States, is regulated by the Corps under Section 10 of the Rivers and Harbors Act of 1899.

2.2.1.1 Non-Corps Projects

Corps permitting process for both dredging and disposal permits is shown in Figure II 2-2. After the District Engineer determines that an application is acceptable and complete, a Public Notice is issued to all known interested individuals, groups and governmental agencies. Substantive comments received in response to the Public Notice are furnished to the applicant to allow an opportunity to resolve or rebut the comments or objections.

The District Engineer may hold a public hearing (or hearings) to provide interested parties a forum in which to express their views and to develop pertinent data to evaluate the permit application. The District Engineer's decision to issue a permit is based on an evaluation of the probable impact of the proposed activity on the public interest and compliance with the 404(b)(1) guidelines. A permit will be granted unless the District Engineer determines that the project would be contrary to the public interest.

Figure 11 2-1
Dredging and Disposal Permitting Process for
Corps Projects



2.2.1.2 Corps Projects

Corps constructed and maintained projects which involve discharge into navigable waters are subject to public notice procedures which could include public hearings. The District Engineer uses the same evaluation process used for non-Corps projects. Generally, a Corps project has a local sponsor who, by Congressional authorization, is required to furnish dredged material disposal areas. When open-water disposal is used, the designated local project sponsor or the Corps (for projects where no sponsor exists) will seek the appropriate approvals.

The Corps, in issuing a Public Notice of dredging will determine that the proposed work is consistent to the maximum extent practicable with the State's coastal zone management program. Should there be a conflict with local or State coastal zone programs, the criteria for resolution are contained in the Coastal Zone Management Act. The permit process for Corps projects is shown in Figure II 2-2.

2.2.1.3 Regional Permits

The Corps District Engineer could issue two types of regional permits for certain clearly described categories of work, including dredging and disposal of dredged materials. One type of regional permit authorizes a category or categories of activities which are substantially similar in nature and would cause only minimal individual and cumulative environmental impacts. The other type of regional permit avoids unnecessary duplication of regulatory control exercised by another Federal, State or local agency, provided the environmental consequences are individually and cumulatively minimal. When the District or Division Engineer determines, on a case-by-case basis, that the concerns for the aquatic environment so indicate, he may exercise discretionary authority to override the regional permit and require an individual application and review.

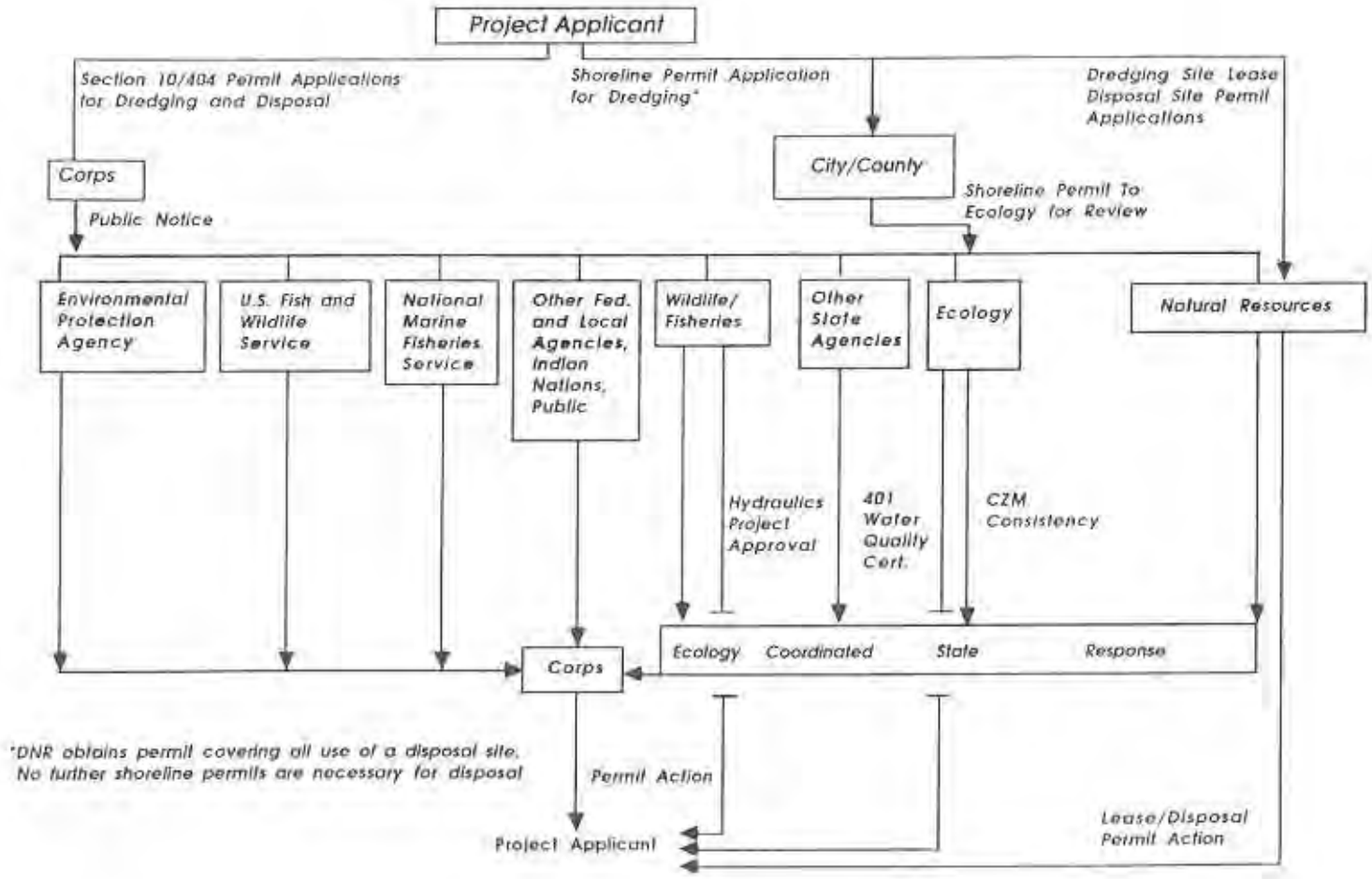
2.2.2 Environmental Protection Agency

The Clean Water Act prohibits the discharge of dredged or fill material except in compliance with Section 404. The Corps of Engineers approves discharges at particular sites through application of Section 404 (b)(1) "Guidelines for Specification of Disposal Sites for Dredged or Fill Material" (40 CFR Part 230).

EPA's role under Section 404 is several-fold. First, EPA has the responsibility for developing the 404 (b)(1) guidelines in conjunction with the Corps. Second, EPA reviews the Corps' Public Notice and gives comments to the Corps. The Corps determines compliance with the Section 404 (b)(1) guidelines. Third, the EPA Administrator, via Section 404 (c), may prohibit the specification of a discharge site, or restrict its use, if it is determined that discharge would have an unacceptable adverse effect on fish and shellfish areas, municipal water supplies, wildlife, or recreation areas.

In addition, EPA and the Corps may jointly, under 40 CFR 230.80 (Exhibit C) provide advance identification of disposal sites. Such identification will specify those sites that would generally be suitable for disposal as well as sites which would generally be unsuitable.

Figure II 2-2
Dredging and Disposal Permitting Process for
Non-Corps Projects



2.2.3 Department of Ecology

The State of Washington Department of Ecology has been given responsibility for certifying compliance with Section 401 of the Clean Water Act. This certification is required from any applicant for a Federal permit to conduct any activity which may result in any discharge into State waters. Compliance with Section 401 also ensures that any such discharge will comply with the applicable provisions of Sections 301, 302, 303, 306 and 307 of the Clean Water Act and relevant State laws.

The State's public notice for the Clean Water Act and Coastal Zone Management Act certification are mailed together with the Corps Public Notice. If a project involves disposal in water, data on the sediments is required. After review of all data, the application is approved or denied. It is the responsibility of the project applicant to provide a copy of the Water Quality Certificate to the DNR and to the Corps before these agencies can, respectively, issue disposal site use and Section 10 and 404 permits.

Ecology coordinates the final overall State response to the Corps Public Notice. To fulfill this responsibility, Ecology, after receiving all State agency responses, sends a letter to the Corps. This letter states the agencies' concerns, if any, and recommends approval or denial of the Corps permit.

Ecology also establishes guidelines for State/local administration of the Washington Shoreline Management Act. Ecology ensures that permits issued by local governments are consistent with the intent of the Act. If a permit does not appear to be consistent, Ecology may appeal the permit to the Shorelines Hearings Board.

2.2.4 Department of Fisheries

Fisheries authority over open-water disposal originates in Chapter 75.08.012 (The Fisheries Code) and 75.20.100 RCW and Chapter 220-100 WAC which establishes the Hydraulic Project Approval (HPA) process. The purpose of the HPA is to protect fish life. Through an interagency agreement with the Department of Game, Fisheries administers most HPAs in saltwater areas.

The Corps of Engineers' Public Notice, although not intended by the Corps, is accepted as the application for the HPA. Under RCW 75.20.100, the HPA must be approved or denied within 45 days once a complete application is received and the State Environmental Policy Act (SEPA) compliance has been achieved. Approved HPAs are issued to the project applicant.

2.2.5 Department of Natural Resources

DNR, in contrast to the regulatory agencies, acts as proprietor of State-owned aquatic lands. To manage open-water disposal, DNR has established a site selection procedure and an open-water disposal permit. Sites are selected with the advice of the Interagency Open-Water Disposal Site Evaluation Committee. This committee is composed of representatives of Federal and State resource agencies and meets when needed. Siting guidelines have been established in WAC 332-30-166(10) (Exhibit B) which will be revised to be consistent with the PSDDA process.

Once sites are selected, DNR acquires shoreline permits for the maximum period

possible (currently 5 years). This provides more predictability to the site users, speeds the project review process, and ensures regional consistency in site management. As the shoreline permit applicant, DNR is also lead agency under SEPA. Shoreline permits are requested to cover all anticipated disposal operations at the site over the term of the permit.

DNR issues dredged material disposal permits for each individual disposal operation in accordance with WAC 332-30-166 Open- Water Disposal Sites. Upon receipt of a Corps Public Notice, DNR sends the proponent an application form. The applicant submits the application and fee to DNR. The permit is not issued until copies of the Corps permit and Ecology Water Quality Certification have been received by DNR. The Corps does not apply for a permit for Corps' navigation projects. For Corps projects having local sponsors, the sponsors obtain the permits. In the case of non-sponsor projects, the Corps does obtain a registration number so DNR can track overall site use.

DNR disposal permits have been issued for varying terms. Some permits have been issued for up to five years when requested by a site user. Permits are required both for initial navigation project dredging and subsequent maintenance dredging. Site users request longer term permits to retain flexibility in their dredging schedules. However, with longer permit terms, DNR has more difficulty keeping track of current site use. Also, longer permits without a periodic review clause may make it more difficult for agencies to incorporate any new sediment evaluation criteria or other program adjustments.

2.2.6 Local Shoreline Management

Under the Shoreline Management Act, local governments have the responsibility for general land use planning for shoreline development. Local governments control shoreline land use through issuance of shoreline substantial development permits. Currently, DNR acquires shoreline permits for use of open-water disposal sites. Once shoreline permits are granted, no further local regulatory actions are required for site use. Disposal site users obtain permits for each disposal operation from the Corps, Fisheries, Ecology, and DNR. This process is shown in Figure II 2-1.

In the past, DNR has obtained one shoreline management permit for each disposal site. The DNR has been responsible for ensuring the site user's compliance with the requirements of the shoreline permits as well as with DNR's own requirements.

Each shoreline permitting jurisdiction approaches open-water disposal differently. The Management Plans Work Group reviewed most individual Puget Sound Shoreline Master Program's criteria on open-water disposal. Current Shoreline Master Program policies and regulations on open-water disposal are summarized in Exhibit D. Differences appeared in requirements for scientific background information on the disposal operation, preference for other than open-water disposal, and in use of sites established through the DNR WAC process. These differences have made acquisition of shoreline permits a time consuming process. There is no certainty that a shoreline permit will be issued and sites made available when needed, even though all PSDDA criteria are met.

Using the permit process, some jurisdictions have insisted on retaining the authority to evaluate individual disposal operations. This effectively removes the

value of the shoreline permit issued to DNR and complicates the permitting process, particularly when the dredging and disposal are in different jurisdictions. There should be no need for denial of a disposal operation if PSDDA procedures and site use conditions are stipulated by State and Federal regulatory agencies.

Some jurisdictions with disposal sites have concerns about accepting dredged material from other jurisdictions. The PSDDA disposal site selection process is establishing sites that each serve a number of jurisdictions. Establishment of separate disposal sites for each jurisdiction would be cumbersome, expensive to administer, and greatly increase the environmental impact due to the additional bottom area covered. It is anticipated that the PSDDA process will alleviate local concerns about the source of material by providing specific acceptable guidelines for sediment evaluation, site selection, and site management.

2.3 Possible Changes In Permit Processing

Usually, proposals for use of open-water disposal sites are associated with dredging projects. Both parts of a project (dredging and disposal) are evaluated through the same application. Figure II.2-1 shows the typical sequence of events in the dredging permit application process. Two potential changes in the permit process that could be implemented are institution of a Corps Regional Permit for dredging and/or open-water disposal and institution of Shoreline Master Program consistency, either through adoption of uniform local regulations or State pre-emption of disposal site permitting. In addition, disposal permit application forms, permit forms, and permit terms could be adjusted, as necessary, to be consistent with PSDDA.

2.3.1 Corps Regional Permit

MPWG discussed with the Corps the desirability of issuing a regional permit for certain types of dredging and disposal operations. Issuance of a Regional Permit requires a determination that the environmental consequences of the action are individually and cumulatively minimal. The decision to issue a Seattle District Regional Permit would be based on an evaluation of the probable public interest impact of the proposed activity. Issuance of a Regional Permit would not eliminate obtaining other required State or local permits. A Regional Permit could be revoked if it were determined that the cumulative effects of the activities authorized were having an adverse impact on the public interest, including the environment. Consideration of a Regional Permit is a separate action from the PSDDA study and will be evaluated on its own merits.

2.3.2 Shoreline Master Program Revisions

Local adoption of the PSDDA guidelines for open-water disposal is anticipated as a result of coordination with local jurisdictions. This would streamline the permitting process and still allow public review of dredged material disposal at the local level. In cooperation with Ecology's Shorelands Division and local governments, MPWG has developed model Shoreline Master Program policies and regulations for unconfined, open-water dredged material disposal (see Exhibit E). Local governments will be assisted by Ecology in incorporating these policies and regulations into their Shoreline Management Master Programs as soon as possible. This approach relies on amendments by local governments which may not be accomplished in the time frame required for permitting of the new PSDDA sites. However, existing shoreline policies

and regulations will allow issuance of shoreline permits to DNR for the new disposal sites. These permits will be sought for the maximum permissible period (currently 5 years).

The value of local adoption of the model language, even after the first shoreline permits are issued, is that the model incorporates the assumptions about local policy upon which PSDDA is based. The model language integrates local policy with State, and Federal management of unconfined, open-water disposal sites. The model language will also facilitate permit renewals.

If the final PSDDA Management Plan report is approved by the Puget Sound Water Quality Authority, adherence to PSDDA recommendations would be required of all State and local agencies.

2.3.3 Revisions to the Shoreline Management Act

Should Shoreline Master Program consistency not be possible among local jurisdictions, another solution may be legislative change. The Shoreline Management Act could be amended to make approval of open-water disposal sites a State, rather than local, responsibility. This would simplify the permit process without reducing the effectiveness of PSDDA guidelines for open-water disposal.

2.3.4 Disposal Permit Application Forms

The Department of Natural Resources should revise its Open-Water Disposal Permit Application form, the Open-Water Disposal Permit, and the Plan of Operation to reflect PSDDA recommendations.

In addition to individual agency adjustments to application forms, it should be possible to develop a single permit application form that could serve as initial input for local, State, and Federal agencies. Currently, shoreline management, Corps, and DNR application forms are separate. A single application form could be used to supply basic project information. Specialized information, such as financial capability required by DNR and sediment testing required by the Corps and Ecology could be requested by individual agencies after the initial application is received. The Corps and Ecology have been discussing joint application procedures for their permits.

There is a need to coordinate tracking of disposal project information among agencies. Currently, each agency assigns numbers under its own system. To facilitate cross-referencing project information, a consistent numbering system is recommended.

2.3.5 Terms of DNR Open-Water Disposal Permits

The terms of the DNR disposal permits should be limited to the actual time necessary for an individual project. This would keep DNR better informed about current use at a site and ensure that new sediment evaluation requirements or site use measures are incorporated into projects in a timely manner. Permit terms for disposal of maintenance dredging should consider the need for retesting of sediments when there is a likelihood of contamination appearing at the site. DNR should seek guidance from the Corps, Ecology, and EPA when setting permit terms.

3. PERMIT COMPLIANCE INSPECTION

3.1 Introduction

Permit compliance is verification that the requirements of open-water disposal permits and authorizations are met. Compliance verification is required by permits issued by the Corps under Section 404 of the Clean Water Act and Section 10 of the River and Harbors Act, Ecology's Water Quality Certification, Department of Fisheries Hydraulics Project Approval, DNR disposal permit, and local Shoreline Management Permit. The individual permits are reviewed in detail in Section II-2 of this technical appendix.

The remainder of this chapter is divided into six sections: Compliance Philosophy, Verifying the Character of the Material, Verifying the Location of Disposal, Designating Responsible Agencies, Inspection and Compliance, and Costs.

3.2 Compliance Philosophy

MPWG has identified three alternate philosophies which could be followed in verifying permit compliance. These philosophies could be applied in any permit program, Federal, State, or local. For purposes of discussion, these are characterized as: voluntary compliance, spot checking, and full-time verification.

3.2.1 Voluntary Compliance

This philosophy presumes that operators will follow approved practices and that occasional, presumably infrequent, violations would not significantly harm the environment. This is similar to current practice. Operators would be given detailed instructions about acceptable practices. They would periodically report on operations and immediately report any problems. Citizen complaints would be the major independent method for identifying improper practices.

Implementation cost to the agencies would be minimal. There would be no field verification of disposal. Monitoring of dredging would be up to individual agency capabilities and requirements (e.g., an after-dredge survey by the owner being submitted to the Corps, Fisheries, etc.).

3.2.2 Spot Checking

Spot checking assumes that operators working under permit will generally try to follow approved practices and that occasional violations would not significantly harm the environment. However, spot checking also presumes that some operators may be more diligent or skilled than others and relies on random checks to identify serious problems and to keep the operators aware of agency concerns.

Operators would file routine reports on their operations but immediately report any on-site problems. Periodic checks would be made at different stages in the operation - dredging and material handling (to verify type of material discharged at the disposal site), transporting to the disposal site, disposal site location, etc. Special practices could be required and more frequent monitoring could be done where dredged materials unsuitable for unconfined, open-water are known to exist. The cost of a spot checking system would be greater than what agencies allocate today for

monitoring of dredging and disposal sites.

3.2.3 Full-Time Verification

This option assumes that operators may not voluntarily follow proper practices and/or that violations could cause significant damage to the environment. Full-time verification would be implemented by continuous, independent checking of all factors. For example, full-time agency inspectors would watch the dredging operation to ensure the correct materials are placed in barges. Disposal location and timing would be monitored by placing personnel or electronic sensors on barges. A full-time verification system would significantly raise the costs to the dredging industry or significantly increase State agency budgets.

3.2.4 Recommendations

The "spot checking" philosophy is recommended. This allows flexibility to pursue permit compliance according to the needs of each operation. Total voluntary compliance deprives the agencies of any independent verification while full-time verification is unnecessarily costly.

3.3 Verifying the Character of Dredged Material

3.3.1 Options

Prior to disposal of dredged material at an open-water site, two factors must be verified: the acceptability of material and accurate positioning at the disposal site. Acceptability of the material could be verified in two ways: indirectly, by observing the dredging operation and ensuring that only material from previously sampled and acceptable areas is sent; or directly, by sampling the material in each barge before it is taken to the disposal site. The latter is not feasible.

Corps 404 permits and Ecology's 401 Water Quality Certifications are issued for each dredging project. Before a permit is issued, the character of sediments at the dredging site is determined through selective sampling and a dredging plan is developed. Areas containing materials not suitable for open-water disposal are identified.

It is possible to verify the character of material designated for open-water disposal by knowing where the dredged material will come from. Verification that the material comes from the proper portions of the dredging site could be done by the dredger, by an independent engineer, or by an agency staff person. The verification will be based on sediment sampling information that has been mapped on navigation charts.

Selection of the responsible person could be based on the likelihood of a problem occurring at the dredging site. If unsuitable materials were present or if there would be difficulty in separating them from suitable materials, some independent verification could be required. Also, depending on the likelihood of a problem, verification could be done by observing the dredging operation or by taking soundings of the dredged site either during or on completion of dredging.

An advantage of verifying the source of material at the dredging site is that

several agencies already have responsibility for controlling the dredging operation. Ecology enforces water quality standards, Fisheries enforces the Hydraulics Project Approval, and local governments enforce shoreline permits. Verification of compliance with PSDDA guidelines could be added to and coordinated with current efforts with minimal extra cost.

The character of material also could be verified either by sampling material placed in the barges or by sampling material after placement at the disposal site. Sampling material in barges would have to be done carefully to obtain statistically accurate results. Unless the barge were required to wait until testing were complete (10 to 30 days), the results would only be useful as a future data source rather than a preventive measure. Sampling is also very expensive, often running over $1,500 per sample. Sampling at the disposal site would establish the existence of a problem but would not necessarily identify who caused the problem.

3.3.2 Recommendations

Compliance inspection at the dredging site should verify that:

a. Only material suitable for unconfined, open-water disposal is sent to a PSDDA disposal site.

b. Only bottom-dump barges are used because other types of barges cause excessive dispersion of material during disposal.

c. Floatable and non-floatable debris are not placed in barges destined for PSDDA disposal sites.

Continuous inspection should not be required for dredging at sites where all materials are suitable for unconfined, open-water disposal and the potential for debris is low. Dredging at these sites should be inspected on a random spot check basis.

At some dredging sites, some material will not be acceptable for unconfined, open-water disposal. Routine inspection should be performed at these sites to verify separation of acceptable from unacceptable material. This inspection could be performed either directly by agency staff or, at the discretion of the agency, by an independent inspector hired by the dredger.

Prior to all dredging projects, a visual survey should be made of the dredging site to determine the potential for floating and non-floating debris. A written dredging inspection plan for each project will be developed by the inspecting agency and provided to DNR before disposal begins. A recommended format is shown in Exhibit G. The inspection plan should be based on the results of the sediment sampling and visual survey. The plan should describe any independent inspection required to be provided by the operator as well as the minimum level of agency inspection activity. Any independent inspection to be provided by the operator also should be specified in the Water Quality Certification.

Non-agency inspectors, if used, should be qualified and experienced in evaluating marine construction projects. Inspection reports could be filled out by on-site construction managers or supervisors. However, they should be approved by a licensed

engineer. Non-agency inspectors should be required to notify the responsible agency personnel by phone within 12 hours and in writing within 48 hours of discovery of a permit violation and/or significant unforeseen conditions, such as discovery of contaminants in an area where they were not expected.

Some dredging sites have sediments of differing quality separated into layers or zones. Some of these may contain material that may be acceptable for unconfined, open-water disposal and some may not be acceptable. If the unacceptable material can be completely removed before removal of acceptable material, inspection may be changed from continuous to random or spot checking. In this case, disposal operators should provide:

a. Written certification that daily on-site inspections were undertaken for the duration of dredging and disposal operations necessary to remove unacceptable sediments. If dredging occurs on a 24-hour basis, the daily inspection shall be divided equally among shifts; and

b. Written certification that a final inspection demonstrated that all unacceptable material was removed prior to dredging of the material acceptable for unconfined, open-water disposal. This final inspection will include measurements of dredging depths and visual inspection, if possible, of sediments which remain to be dredged.

If both acceptable and unacceptable sediments are present at a dredging site but the unacceptable material cannot be removed from the site before removal of acceptable material begins, routine inspection should be required during the whole dredging project.

While a disposal site is being used, monthly summary reports should be sent to DNR on disposal activity as shown in Exhibit F.

3.4 Verifying the Location of Disposal

The other major factor needing verification is the position of barges at the time of disposal. PSDDA Phase I disposal sites have been located in low-energy areas such that dredged materials are generally expected to remain on-site, provided that the materials are released within a prescribed surface disposal zone. This will facilitate long-term monitoring of environmental impacts. Figure II.3-1 presents the parameters of the typical disposal site, showing the relationship of the surface disposal zone to the surface target area and to the disposal site (bottom impact area). An infrequent, inaccurate dump of materials should not have a significant adverse effect on the environment. The actual effect would depend on the depth, current, and environmental features of the discharge location. However, it is important to take all responsible measures to ensure off-site disposal doesn't occur.

3.4.1 Past Positioning Problems

In the past, disposal site positioning has been verified only at the Four Mile Rock site. This was done through the Coast Guard Vessel Traffic System (VTS) described below. VTS was first used in 1985. During the winter and early summer of 1986, upland residents reported several off-site disposal operations. Three violations of hours of operation were verified.

3.4.2 Positioning Accuracy

An understanding of positioning problems is necessary to develop reasonable expectations for dredges, dredging contractors, the public, and agencies.

PSDDA funded a study of techniques for positioning at disposal sites and for verifying the accuracy of disposal operations (Evaluation and Development of Positioning and Monitoring Protocols for Dredge Material Disposal in Puget Sound, PSDDA, February, 1986) The following analysis is a result of this "positioning study" and of follow-up work done by the Management Plan Work Group.

The positioning study found that positioning accuracy depends on the maneuverability of the barge/tug combination and on the accuracy of positioning methods used.

Barges in Puget Sound range in length from 50 to 250 feet. Most are longer than 130 feet. Barges generally are not self-propelled, but rather are pushed or pulled by tugboats.

Maneuverability decreases with increasing distance between the barge's inertial center and the tug. The offset distance between the barge and tug varies with transport method and barge size. Wind, waves and currents make it very difficult to position a barge at a predetermined location.

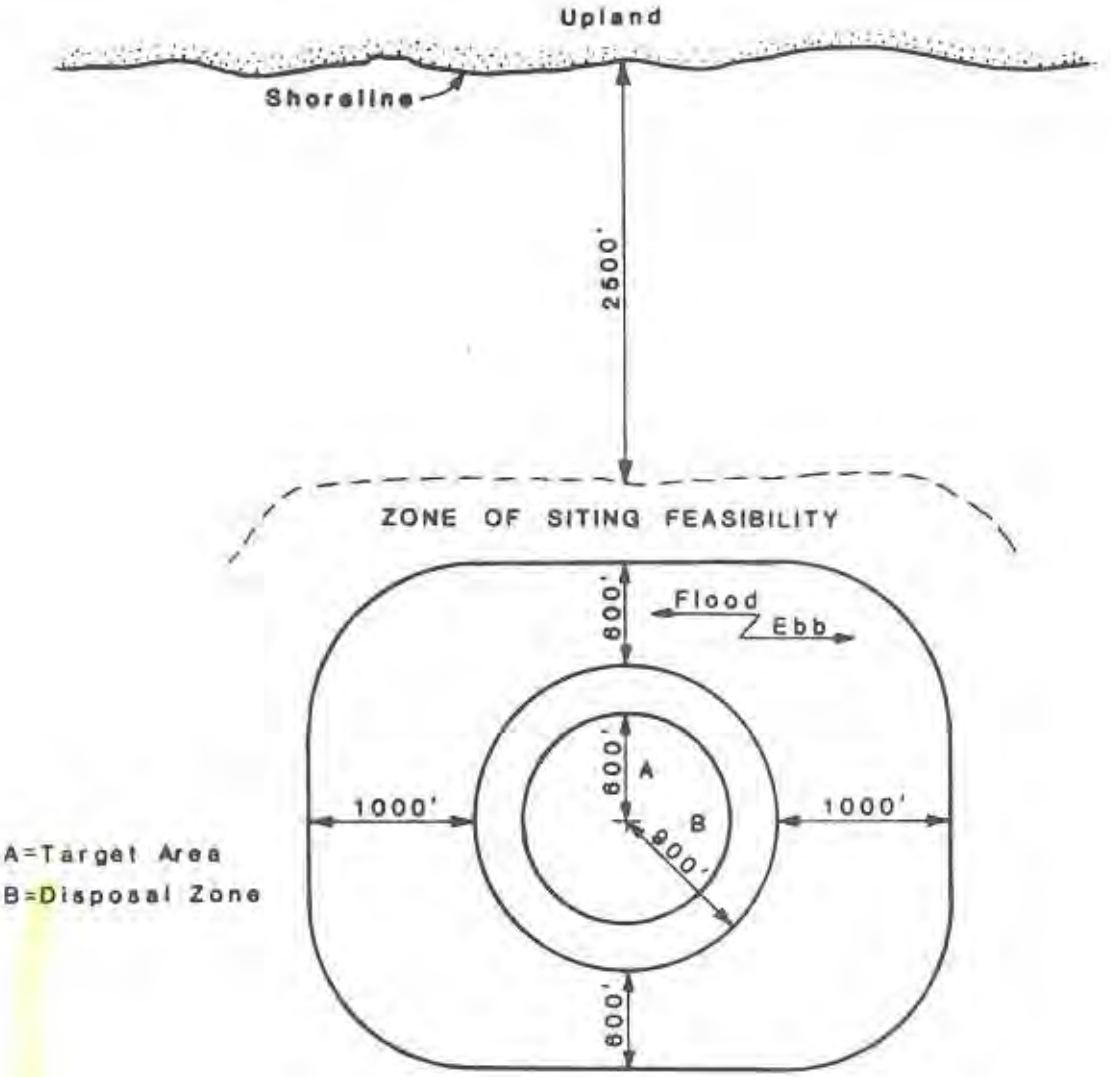
The positioning study concluded that "the barge/tug combination does not have sufficient maneuverability for fine-scale positioning and is subject to drift while releasing its load. Therefore, the area within which the larger barges (250 ft) can be consistently positioned is limited."

The positioning study further concluded that "Methods currently used in Puget Sound to position barges at disposal sites cannot consistently place the barge within surface disposal zone boundaries." Most barge positioning at disposal sites in recent years has been accomplished with radar ranges and visual sightings rather than Loran-C. Radar is standard equipment on tugs and is normally used to navigate. Loran-C is distrusted in inland waters because the nearby land masses distort the Loran-C signal. Additionally, military transmissions frequently cause wild distortions in Loran-C readings in certain areas of Puget Sound.

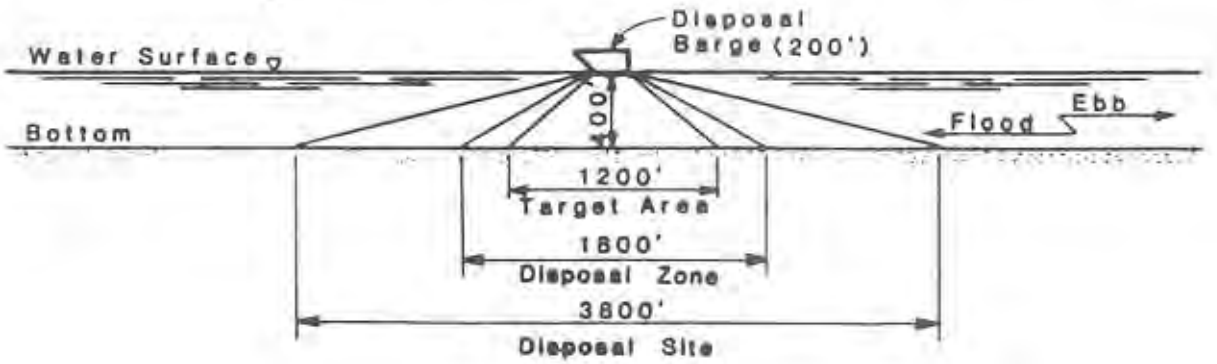
The positioning study found that all positioning methods are subject to inherent limitations of accuracy and to external limitations imposed by the site. For disposal zone positioning, absolute accuracy is important during initial setting of the disposal zone and target area. Return to the site depends on repeatable accuracy. If the coordinates for a disposal site have been established by the same positioning method that will be required of users, the margin of positioning error at that site will be defined by repeatable accuracy rather than by absolute accuracy. Because repeatable accuracy is typically better than absolute accuracy, a wide range of navigation methods can then meet the positioning accuracy requirements for a given disposal site.

The degree of accuracy is limited by many factors. These include familiarity of the operator with the positioning method, proper record keeping, and accuracy of maps

Figure II.3-1 Disposal Site Parameters



PLAN VIEW



ELEVATION VIEW

used to locate positions from fixes. Weather, currents, and other site conditions affect the ability to maintain position within the disposal site. Proximity to land and the physical terrain also limit the accuracy of certain methods.

3.4.3 Surface Disposal Zone

The positioning study evaluated the size of the surface target area required to achieve different levels of accuracy. The size of the target area is influenced by the size of barges being positioned, wind, currents, time needed to dump and the accuracy of the positioning method used.

Most material is completely discharged within 30 seconds to 10 minutes after the barge doors are opened. However, 20 minutes or more may elapse from the time a barge arrives on-site and discharge is complete. The speed of the discharge depends on the cohesion of material and type of equipment used. During disposal, maneuverability is extremely limited and the barge may be displaced from the target by wind and currents.

The positioning study recommended that the target area for operators be smaller than the desired surface disposal zone. This would provide a buffer zone and allow for positioning errors and drift. The study recommended a minimum 500-foot radius target area as adequate for most conditions when positioning. This is twice the maximum barge length.

The positioning study also suggested that a buffer width be at least 90 feet to allow for positioning error (with 68% confidence). This assumes use of a positioning method such as Loran-C with a repeatable accuracy of 66 feet. The study recommended that disposal zone radii be no less than 800 feet for positioning methods with plus or minus 66 feet accuracy.

Site users may either stop at an up-current or up-wind side of the target area and drift while dumping or drive through the target area and discharge at the same time. With a target area 1200 feet in diameter, a boat drifting at one-half knot would cross through the target area in 24 minutes. A boat running at three knots would cross the area in four minutes.

3.4.3.1 Recommendations

The overall surface disposal zone should have a radius of 900 feet and the target area a radius of 600 feet.

3.4.4 Electronic Positioning Systems

Electronic positioning methods use the transmission of electromagnetic waves from two or more shore stations and a vessel transmitter to define the vessel's location. These systems include single and double shore-based stations which are managed by the user, Loran-C (a navigation system provided by the Coast Guard), and satellite-based systems, which will become available in the future.

3.4.4.1 VTS

The Vessel Traffic System (VTS) radar is used by the Coast Guard to minimize the

danger of collisions or groundings in Puget Sound. As described in the positioning study, the VTS system uses 10 remote radar stations to fix the position of ships on major traffic lanes from the Strait of Juan de Fuca to Three Tree Point south of Seattle. VTS can be used as a disposal site positioning aid but only VTS covers Seattle in the Phase I PSDDA study area.

3.4.4.2 Loran-C

Loran-C, an acronym for long-range navigation, is an electronic navigation system. In very simplistic terms, receivers match cycles to measure time differences between arriving signals. These differences can be plotted to show lines-of-position for course tracking. There are two drawbacks to use of Loran-C in Puget Sound. One is that the proximity to land warps the Loran-C signal and makes Loran-C an unreliable navigation tool. In spite of this warpage, the signal is stable and can provide accurate guidance in repositioning dump barges if the coordinates of the dump site are taken by positioning a boat at the site, rather than by projecting the coordinates on paper.

The other drawback to Loran-C in Puget Sound is that interference from radio transmissions occasionally distorts the signal. Charlie Eaton, owner and operator of the Kittiwake research vessel, has had extensive experience positioning in all three Phase I areas during PSDDA fish trawl data gathering studies. He reports that Loran-C is unreliable in Port Gardner due to radio interference. He reported good Loran-C reception in Commencement Bay and acceptable reception in Elliott Bay.

Other people familiar with Loran-C use in Puget Sound reported that the interference could theoretically be filtered out with the right equipment. They believe Loran-C could provide reliable repositioning guidance. (Personal communication with Lynn Westbo, P.E., Assistant Branch Chief, Electronics Engineering Branch, 13th Coast Guard District Headquarters, Seattle and Michael G. Dilley, Sales Representative, Sound Marine Electronics, Inc., Ballard). Scott Smith, who attended a MPWG meeting, cautioned that, if Loran-C is used, there should be standards for the type, placement, and use of equipment to ensure consistent results.

Loran-C equipment, if used for positioning, will read out the bearing and distance to the desired coordinates. It would be possible to plot two points on either side of the target area circle. A tug/barge could head for the first point, start discharging when the barge crosses the target area circle, and then head for the second point on the target area circle. Disposal would have to be completed before reaching the second point. The choice of direction to cross the target area could vary based on wind, currents, approach direction, or other factors. Using the target area for control would ensure that disposal takes place within the disposal zone and therefore, that material stays within the designated disposal site.

Method of locating site for disposal

Ken Preston of General Construction said that even though Loran-C will continually plot the distance and bearing to a site, following that plot could take an operator on a crooked path. This is due to warpage in the Loran-C lines caused by close proximity to land masses. While changing directions in a small boat is no problem, this can be difficult for a tug with barge in tow.

3.4.4.3 Satellite Systems

The positioning technique study pointed out that within five years, satellite navigation systems should be available which provide positive positioning accuracy to within 25 feet for a cost comparable to Loran-C. The satellite signals will not be subject to warpage or interference as is Loran-C.

3.4.4.4 Buoys

Buoys provide the most positive means of positioning. The watch circle or swing of the buoy will depend on the current and type of mooring used. Buoys tethered with chain and cable or rope will swing a great deal more than buoys tethered with an elastic line. An elastic mooring in 400' of water with 1 knot current would confine the watch circle to less than 50'. The cost of an elastically tethered buoy would be around $11,000 and maintenance parts would average $3,200/year. Installation parts and maintenance would be extra. (Personal communication with David Wyman, Buoy Technology, Inc., 11/10/86).

The Coast Guard estimates that the swing of a nylon rope tethered buoy in 570 feet of water would be 250 feet in a one knot current. This would be acceptable for target area positioning. MPWG asked the Coast Guard about cooperating in placement and maintenance of normally tethered buoys. The Coast Guard said they would be willing to place and maintain buoys under interagency agreement. The cost would average $3,000 per year per site including materials, placement and maintenance. (See Exhibit H.)

MPWG also discussed with the Coast Guard the acceptability of placing buoys at the three preferred PSDDA Phase I sites. The Coast Guard responded that buoys would probably not be allowed at the Elliott Bay and Commencement Bay sites due to conflicts with navigation. A buoy system may be possible at the Port Gardner site, depending on the ultimate location of the Navy disposal site and any buoys associated with that site (personal communication with Lt. Stephenson). As the Navy project, if approved, will be completed within a few years, there should be no long term problem with a buoy at the Port Gardner PSDDA site. However, it has been determined that use of a buoy may conflict with the drift net fishery in Port Gardner.

3.4.4.5 Range Markers

Range markers on shore could serve as an alternative to buoys. However, they are expensive ($30,000 - $60,000 per disposal site) and could present visibility problems in bad weather. The Coast Guard expressed willingness to cooperate in placement and/or maintenance of range markers. (Personal communication with Lt. Stephenson, Chief, Operations Section, Aids to Navigation Branch, 13th Coast Guard District.)

3.4.4.6 Variable Range Radar

Variable range radar (VRR) fixes a position by measuring the distances to three targets on the radar screen which can be accurately identified on a map. A variable range marker measures the distance to the object (as identified by its radar reflection). This distance then is drawn with a compass as a line of position on the chart. The intersection of the three lines of position marks the vessel's position.

The MPWG Positioning and Monitoring study states, "Positioning barges with VRR should provide sufficient accuracies for a 900-foot radius dump zone in almost any type of weather. Providing range limitations to predetermined targets identified by the regulatory agency will reduce the radial error even further. Most tugs already are equipped with VRR and other [types of] radar can add variable range markers for $1,000 to $2,000. The newer digital systems, priced in the $5,000 to $10,000 range, offer multilevel processing for better target pickup and provides map plotting ability on the screen."

Charlie Eaton, skipper of the Kittiwake, recommended that if radar is to be used in Elliott Bay, that a new radar reflector be placed on the existing marker off Duwamish Head. Using that and the tip of the Lockeed dry dock should provide adequate radar reference points.

Ken Preston of General Construction suggested that radar positioning in Port Gardner could be accomplished by placing radar reflectors on Buoy #1 (a piling) and two other locations around Port Gardner. He said he would rather have a buoy at the disposal site but that radar would be the next preferred alternative. He suggested that, if a buoy were placed at the Navy disposal site in Port Gardner, a radar reflector on that buoy could aid in positioning at the PSDDA Port Gardner site.

Lt. Stephenson said it is Coast Guard policy to place radar reflectors in all structural navigation aids. This has not been fully implemented but the Coast Guard would place reflectors on any existing aids if requested (personal communication with Steve Tilley, September 1986).

3.4.5 Recommendations

Based on currently available data, MPWG recommends the following positioning methods for both Corps and non-Corps projects.

3.4.5.1 Elliott Bay

The Coast Guard Vessel Tracking System (VTS) should be the ultimate reference for barge operators in Elliott Bay. VTS is accurate and has the added advantage of providing independent verification of positioning accuracy. However, operators should be prepared to position themselves with VRR and Loran-C in case VTS operators are not available. Operators should be required to receive confirmation of positioning from the Coast Guard just before dumping starts. Loran-C coordinates should be provided to the operators by the administering agency. These coordinates should be obtained by taking readings from a Loran-C instrument positioned at the disposal site by some other, more accurate, method. The VTS screens should be marked at the same time. The following radar reference points are recommended for Elliott Bay:

1. Dolphin north of Duwamish Head
2. Northern tip of Duwamish Head
3. Northern tip of pier 13
4. Northern tip of the western pier of pier 14
5. Northeastern tip of terminal 18

3.4.5.2 Commencement Bay

In Commencement Bay, variable range radar and Loran-C should be the primary positioning methods. Loran-C is the most cost-effective and provides the required accuracy. Loran-C coordinates should be provided to the operators by the administering agency. Loran-C coordinates should be obtained by taking a reading from a Loran-C instrument positioned at the disposal site by some other, more accurate, method. In addition to the Loran coordinates, the following radar reference points are recommended:

1. Western tip of Browns Point
2. Western tip of Dash Point
3. Eastern tip of Piner Point
4. Eastern tip of Neil Point

Buoys are preferred by site users and should be considered, if allowed by the Coast Guard, and if the cost is justified by the potential use.

3.4.5.3 Port Gardner

A buoy would be the preferable positioning aid for Port Gardner. However, due to potential conflicts with drift nets, variable range radar should be used instead. The following radar reference points are recommended:

1. Ferry terminal at Mukilteo
2. Navy pier at Mukilteo
3. Southern tip of Gedney Island
4. Bell buoy east of Gedney Island at the entrance to Port Susan
5. Bell buoy west of the mouth of the Snohomish River and north of the anchorage area.

Loran-C positioning in Port Gardner is not reliable at this time due to interference from radio transmissions.

3.4.6 Verifying Disposal Site Positioning Compliance

Several methods for independently verifying positioning accuracy were evaluated for accuracy, flexibility, portability, reliability, servicing, availability, cost, convenience, user sophistication, and documentability. Table II.3-1 outlines the findings of the positioning study.

Verification methods not considered appropriate by the study included those with severe visibility limitations and those with high logistical requirements. The remaining methods require little operator effort. Site use records and VTS radar monitoring would be the easiest programs to implement. Remote monitoring methods would be more expensive and labor intensive.

3.4.6.1 User Records

User records of the time, location, and depth at the beginning and end of the dumps would be valuable as a general checking tool. The positioning study recommended that user records be required for all operations. However, independent verification

is not available.

3.4.6.2 Shore-based Visual Observation

Shore-based observation with theodolites or range-azimuth systems can be used as a full-time or spot check of disposal accuracy. These methods are limited by visibility requirements. Costs of equipment and staff time would vary depending on the amount of monitoring deemed necessary.

3.4.6.3 Vessel Traffic System

VTS and placement of automatic sensors on the barges are examples of remote electronic monitoring methods. VTS is a radar system which manages boat movements and is similar to air traffic control at airports. VTS coverage is limited to certain areas of Puget Sound. Only Elliott Bay is covered in the PSDDA Phase I area. An advantage of VTS is that it can also aid dumpers in positioning themselves on the sites.

VTS is currently being used at the Four Mile Rock disposal site in Elliott Bay. Operators contact the Coast Guard when they head for a disposal site and are directed to the site. They report when the dump occurs and this is logged by the Coast Guard. VTS can verify the position of the barge in the dump site and the reported beginning and ending time of disposal, but not that the dump occurred when reported.

3.4.6.4 Other Remote Electronic Monitoring Systems

In New York, the Coast Guard has installed an Ocean Dumping Surveillance System (ODSS). Automatic sensors are installed on all barges which are coupled with a Loran-C system and radio. These sensors determine draft and indicate when the barge is dumping. Barge draft and Loran position can be recorded on-board or transmitted immediately to a base station. The cost of the ODSS system is around $10,000 per remote station plus the cost for a base station or central computers. The Coast Guard is using this system in New York because the offshore sites are up to 100 miles away and there is a great incentive for the dumpers to unload before arriving at the site.

Other Loran-based monitoring systems are also available. The cost of each system varies, depending on capability. An example of a fairly simple system is II Morrow, Inc.'s Nav-Track. This system consists of a Loran-C unit, Nav-Track Model 312 and a radio on each boat. The price of the package is in the range of $3,500 per vessel. A base station consists of a radio receiver, a Model 314 unit and a printer costing around $3,500. A vessel can call the base station to report its position or the base station can ask any vessel its position. Positions are printed out. With the right type of radio, one base station could serve all of Puget Sound. Alternatively, the base station could be mounted in a truck. An inspector in the truck making periodic inspections could visually determine the time of dump from shore and check the vessel's location at the same time.

Shore-based electronic observation could also be done with a radar unit mounted on a truck. The radar unit would be consistently positioned at a known shore point. An overlay could be drawn for the radar screen which would identify the location of the disposal site. The radar operator would need to be in visual contact with the

TABLE II.3-1
MAJOR SITE-SPECIFIC COMPLIANCE OPTIONS

	VTS[1]	User Log	Auto. Electronic Monitoring[2]	Visual From Shore[3]	Radar On Shore[4]
Commencement Bay	N/A	Yes	Yes	Yes	Yes
Elliott Bay	Yes	Yes	Yes	Yes	Yes
Port Gardner	N/A	Yes	N/A	Yes	Yes

[1]By itself, can verify position but not time of dump.

[2]Depending on level of sophistication, could report location only or location and time of dump. Loran-C problems eliminate Port Gardner.

[3]Difficult to determine exact position unless some type of equipment used.

[4]Performs same as VTS but is somewhat less accurate. If aided by a buoy, would be very accurate. By itself, can verify position but not time of dump.

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barge to know when dumping occurs. The cost of such a radar unit would be $2,000-4,000. The cost of initial surveying of the shore site would vary, depending on availability of control points.

3.4.6.5 Water-based Observation

Verification of disposal site positioning can be done by personal observation from a boat. The Corps manages dredged material disposal sites in New England in this way. Verification of disposal accuracy is done through placing an inspector on every barge. The cost of the inspectors' time is charged to the barge operators at a rate of $22/hour.

Alternatively, disposal operations could be observed from other boats either on a full-time or spot check basis. Full-time observation from another boat would be more expensive due to the cost of the extra boat. Part-time observation would still require some boat time.

3.4.6.6 Recommendations

Procedures for verifying the location of disposal should be designed individually for each site based on the positioning methods and other site-specific characteristics. However, user records should be required for all sites. Independent verification checks should be routinely compared to user records.

At the Elliott Bay site, verification should be accomplished by the Coast Guard VTS with periodic oversight inspections by the administering agency. A memorandum of agreement should be developed with the Coast Guard to detail their responsibilities and procedures to be followed. DNR should obtain a record from the Coast Guard of each individual disposal contact. This record should contain the information shown in Exhibit F.

Verification at Tacoma and Everett should be accomplished through use of truck-mounted radar and Loran-based radio tracking.

The Corps should institute a positioning verification process for Corps projects with reliability equal to or higher than that established by DNR for non-Corps projects. The Corps should send DNR monthly reports on disposal site use in the same form as are required for nonFederal projects (See Exhibit F). The Corps should also send DNR monthly reports on disposal site inspections performed.

3.4.7 Other Use Requirements

Other factors of concern are: type of barges, noise during dumping, release of debris, and conflicts with commercial fisheries.

3.4.7.1 Bottom-Dump Barges

It is the consensus of PSDDA agencies that the current policy of allowing only bottom-dump barges to use open-water disposal sites should be continued. These barges minimize turbidity and mixing of sediments with the water. Use of bottom-dump barges can be checked at either the dredging or disposal site.

3.4.7.2 Noise

Noise has been identified as a problem in some locations. Noise can be evaluated either directly by monitoring disposal operations or by periodically testing equipment and certifying it for use. The latter procedure is now used at the Four Mile Rock site in Elliott Bay. Exhibit K contains noise monitoring reports for equipment used at Four Mile Rock.

Limits on hours of operation have been applied in Seattle due to concerns about noise and ability to monitor the dump location. Recently, residents adjacent to the Four Mile Rock dump site have said noise is not a problem and that the reason for their concern about hours of operation is to be able to see violations. They are still concerned about the effectiveness of monitoring at night. With electronic monitoring, the remaining concern is whether the monitoring is being done diligently.

3.4.7.3 Debris

Disposal of debris at open-water disposal sites has for some time been prohibited by several regulatory programs. Debris can include both floatables such as old pilings and non-floatable material such as steel bands and waterlogged stumps. Ecology's 401 Water Quality Certification authority extends to disposal of debris. A clause prohibiting disposal of bark and wood debris is normally included in the Certification.

Fisheries' regulations require that "Debris or deleterious material resulting from construction shall be removed from the beach area and prevented from entering State waters." (WAC 330-115-270(5)) Fisheries' HPAs are normally conditioned to require that, "Any debris resulting from this project shall be removed from the water and disposed of or placed in such a manner to prevent its being washed back into the water by high water or wave action."

For its own maintenance work, the Corps normally requires that floatable debris be disposed of by the contractor in an upland disposal area, rather than the open-water disposal area.

3.4.7.4 Treaty Indian Concerns

Concern about use of the Elliott Bay and Port Gardner sites has been raised by the Suquamish, Muckleshoot, and Tulalip Tribes. The proposed Phase I disposal sites are located in traditional Indian fishing grounds. Although fishing can occur any time of day or night, little fishing occurs between 10 a.m. and 4 p.m. The fisheries are opened for short periods from June - January on as little as 12 hours notice. Gill nets may extend 1800' from the boat and may drift over a disposal site. However, U.S. Coast Guard Rule 18 states that power-driven vessels underway must avoid fishing vessels. There have been no reported cases of conflict between Tribal fishing and disposal site use.

3.4.7.5 Recommendations

In general, only bottom dump barges will be allowed to use PSDDA disposal sites in order to minimize water quality impacts. Other types of dumping, such as direct sluicing or pushing material off flat-top barges, result in greater dispersion of material.

Disposal operations should be specifically required to meet the State and local noise standards, if local conditions warrant. Where noise control is necessary, disposal equipment should be tested periodically (once a year should be adequate) and certified for use at a site. Limiting hours or days of operation should not be necessary if noise is adequately controlled.

Dredging and disposal site inspection should ensure that non-floatable debris which becomes visible during dredging is removed from the dredged material at the dredging site. The size of debris which must be removed should be clearly specified in permits and contracts to provide certainty to the dredgers when they bid the jobs. Floatable debris should be either removed at the dredging site or picked out of the water at the disposal site.

Compliance with any site-specific use requirements should be inspected on a spot check basis.

Potential disposal site use conflicts with general navigation, Indian and non-Indian fishing should be evaluated prior to issuance of site-use permits. If necessary, site-use restriction should be applied to minimize conflicts.

To minimize conflicts with Tribal fisheries, DNR will consider the need for

applying special permit conditions on a case-by-case basis. Such conditions might include complete disposal site closure or limiting disposal to daylight hours during which Tribal fishing would normally not occur.

While not anticipated at this time, additional project or permit-specific requirements may be identified on a case by case basis by either agency and imposed as a specific condition for disposal of the individual section 404 permit, section 401 Water Quality Certification, or DNR site use permit.

3.5 Agencies Responsible for Verification

3.5.1 Current Practice

As mentioned earlier, agencies involved in permitting open-water disposal are the Corps of Engineers, Department of Natural Resources, Department of Ecology, Environmental Protection Agency, Department of Fisheries, and local governments. These agencies' enabling authorities are separate and do not provide for functional coordination.

3.5.1.1 Corps of Engineers

The Corps Regulatory Branch has the authority to inspect dredging and disposal operations for compliance with Section 404 and Section 10 permit terms and conditions. Currently, the Corps verifies permit compliance for non-Corps dredging activities. During annual contract inspections, dredging depth is spot checked if dredging has occurred. The Corps funds these annual inspections. The Corps has the authority to condition permits to require permittees to pay inspection expenses in accordance with Section 9701 of Public Law 97-258 (31 U.S.C.A 9701).

The Corps inspects for water quality compliance on Corps projects, but relies on Ecology to verify compliance for non-Corps projects. The Navigation Branch, Seattle District administers Corps funded dredging and disposal activities and will comply with PSDDA guidelines for inspecting disposal site use.

3.5.1.2 Department of Natural Resources

DNR does not verify compliance with standards for character of material dumped. Through an agreement with the Coast Guard, barge movement and disposal location in Elliott Bay are verified through the Vessel Traffic System. There is no cost to DNR for this service. Additional State compliance costs could be recovered by adjusting the disposal fee.

3.5.1.3 Ecology

The Department of Ecology verifies compliance with the Section 401 Water Quality Certification (at the dredging site) on a spot check basis. Frequency of checking is based on whether there is a potential for accidentally picking up contaminated material at individual sites. In some cases, as a condition of the Section 401 Water Quality Certification, Ecology requires the permittee to monitor water quality conditions at the dredge site. In the past, no requirements for monitoring water quality at open-water disposal sites have been imposed.

Ecology can pass compliance costs on to permittees by requiring permittees to provide inspections. Inspections by Ecology would have to be funded from the State General Fund or through a fee system. Ecology is not currently authorized to charge a fee for Water Quality Certifications or modifications.

3.5.1.4 Environmental Protection Agency

EPA has not verified compliance at the dredging sites or at open-water disposal sites. When made aware of problems, such as off-site disposal, EPA has notified appropriate authorities. To fund compliance work, EPA would have to use its general appropriation funds.

3.5.1.5 Local Governments

Shoreline management agencies generally inspect for permit compliance only when there is a report of a problem. Local agencies charge fees specified by local ordinance.

3.5.2 Alternative Arrangements

Alternatives for verifying permit compliance are to continue current practice with agencies acting independently or to consolidate inspections. Either option could be used with any of the permit compliance philosophies outlined in Section 3.2 of this report (voluntary compliance, spot checking, full-time verification).

3.5.2.1 Continue Current Practice

Agencies could continue to conduct compliance verification as separate entities. This would reflect the roles and responsibilities of each agency. Each may have a particular interest in a specific phase or impact of a project. These impacts may require expertise that would normally be unique to trained personnel from one agency. Compliance verification by each agency separately requires more personnel and time than a cooperative system.

3.5.3 Consolidation of Permit Compliance Activities

Theoretically, permit compliance activity could be consolidated by appointing one entity to be responsible for inspecting dredging technique and disposal location. This responsibility could be assumed by any of the PSDDA agencies, by local government, or by site users.

Factors to be considered in assigning this responsibility to a local, State, or Federal agency are:

a. Ability to recover costs;
b. Technical expertise of staff; and
c. Authority to take immediate enforcement action.

EPA has no ability to recover costs directly from permittees. Ecology would need some legislative authorization to charge a user fee for Water Quality Certifications. DNR would want legislative authorization to increase fees substantially above the current level. The Corps presently covers such costs out of its own budget but can

charge user fees to cover unusual costs.

EPA, Ecology, and the Corps have technical expertise in water/sediment quality. DNR doesn't have expertise in either water quality monitoring or positioning. The Corps also has expertise in dredging, disposal operations, and positioning.

The inspecting agency should have the authority to immediately stop or modify violations which might be discovered. Agency authorities to deal with violations are covered in detail in Chapter 5 of this Appendix.

Local governments are responsible for ensuring compliance with shoreline permits. This is true whether the permits are issued to DNR (or other coordinating agency) or directly to disposal site users. Local governments could assume responsibility for compliance with all the respective permits. The advantage is that local governments are closest to the scene and to the local public. However, local agencies would need additional funding and new, specialized staff to do this on a regular basis. Also, local governments may resist inspecting use of a site that serves regional, in addition to local, needs. Smaller jurisdictions would find this particularly difficult. Furthermore, ensuring consistency between a number of local inspectors could be difficult. The frequency of site use would not support a full-time staff position in Everett or Tacoma.

Responsibility for compliance could be shifted to dredgers and site users. They could be required to hire independent inspectors approved by agencies to conduct monitoring under PSDDA guidelines. Evaluating and certifying the inspectors would still require a certain amount of agency oversight. A cooperative arrangement of compliance verification would simplify the interaction with the permittee.

3.5.4 Recommendations

The Department of Ecology should take the lead in inspecting non-Corps dredging compliance with the Water Quality Certifications and Corps 404 permits. This could be funded out of Ecology's general fund appropriation. Inspection should ensure that only suitable material is sent to the disposal site. Any violations should be reported to the Corps, EPA, and DNR. DNR should also be notified if any floatable material needs to be removed during the dumping operation.

DNR should take the lead in verifying non-Corps compliance with the requirements for disposal site use, including positioning accuracy and removal of floatables at the disposal site (if not removed at the dredging site). DNR should recover the costs of compliance inspection through disposal site user fees. For non-Corps projects, a dredging site inspection plan should be written by Ecology and provided to DNR for each project prior to initiation of dredging.

The Corps of Engineers should institute procedures similar to the above for compliance inspection of Corps contractors dredging and disposal operations.

Site-specific management plans are contained in Exhibit J. These plans summarize, for each site, the recommendations on disposal site size, navigation controls, reporting, inspection, use restrictions and environmental monitoring.

3.6 Inspection and Compliance Costs

Costs of inspection and compliance would be borne both by dredgers/disposal site users and inspecting agencies.

3.6.1 Agency Costs

Ecology estimates than an adequate compliance inspection program would require an annual increase in expenditure of $75,000 annually for the Puget Sound phase I and II areas. This cost is only for an inspector's time. It doesn't include pre-dredging sampling and analysis plans, data interpretation, consultant conferences, etc. Under authorization, this cost would be borne by Ecology's General Fund appropriation. There would be no cost to dredgers.

DNR estimates that disposal site administration will require one/half-time staff person to meet PSDDA Phase I administration requirements. This would include processing disposal permit applications, maintaining records, developing inspection plans, establishing Loran-C coordinates and radar reference points for disposal sites, and spot-checking disposal site positioning. Violations follow-up, program refinement, travel, and equipment would also be included. The cost is estimated at $28,000/year with an $18,000 start-up cost for a truck-mounted radar. This cost should be charged to disposal site users as part of the DNR disposal permit fee.

3.6.2 Industry Costs

Dredgers are responsible for providing dredging site inspectors when required by appropriate permits. This could cost from $20 to $75 per hour depending on whether the actual inspections are performed by technicians or an engineer (personal communication, Jay Spearman, Consulting Engineer 9/23/86).

Disposal site users at Commencement Bay, Port Gardner, and Elliott Bay will need Loran-C (except at Port Gardner) and VRR equipment. If not already on board, this equipment can be purchased for less than $5,000 per vessel. (Personal communication with Michael Dilly, Sound Marine Inc., August 1986.)

4. VIOLATIONS

4.1 Nature of Violations

Violations of permits for use of open-water disposal sites may involve the character of material dumped, positioning at the disposal site, or special conditions such as noise.

Violation of the criteria for material to be dumped could be evidenced either at the dredging site or on the transport barge. The character of the material will be controlled by permit conditions which specify the location and depth of approved material at the dredging site. Evidence of dredging at improper locations and depths could constitute a violation of both the dredging and disposal permit requirements.

In transport, violations could occur if dredged material sloughs off a barge or if material were disposed of at a non-approved site.

At a disposal site, violations could occur through improper positioning at the site, oil sheens which violate water quality standards, floating debris, use of unauthorized equipment, improper disposal time, or excessive noise (if noise limits are set).

4.2 Types of Agency Action Against Violators

Possible enforcement actions vary with the severity of the violation and with the authority of the agency involved. Actions currently available include:

a. Stop work orders from agencies,
b. Civil court orders requiring stop work and/or remedial action,
c. Suspension, modification, or revocation of issued permits,
d. Civil or criminal court penalties and/or imprisonment,
e. Withdrawal or cancellation of proprietary authorization for use of a disposal site, and/or
f. Assessment for damage to the land.

Agencies have the following specific enforcement authorities.

4.2.1 Corps of Engineers

Rivers and Harbors Act of March 3, 1899

a. Criminal fines;
b. Cease and desist orders or required remedial work; and
c. Prosecution of Section 10 violations for criminal penalty, remedial action, injunctions and/or imprisonment.

> Civil penalties are not specified in the law. Section 12 provides criminal penalties for Section 10 violations which include imposition of fines not less than $500 nor greater than $2,500, or imprisonment not exceeding one year, or both. Also, a 1984 amendment to Federal Criminal Law established a fine increase up to $100,000 for all criminal misdemeanors.

Section 404 of the Clean Water Act

a. Cease and desist order; and
b. Legal action for civil/criminal penalty remedial action, injunctions and/or imprisonment.

Other Sections of the Clean Water Act

Section 301 of the Clean Water Act prohibits the discharge of dredged material into waters of the United States, including adjacent wetlands, without first having obtained necessary permits. Section 309 of the Clean Water Act provides both civil and criminal penalties for violation of Section 301. The civil penalties include imposition of fines of up to $10,000 per day of violation. Criminal penalties consist of fines of up to $25,000 per day of violation, or for imprisonment for not more than one year, or both.

Contract Enforcement

The Corps may refuse payment to contractors who violate the terms of a contract.

4.2.2 Environmental Protection Agency

a. Clean Water Act 308 request for information order;
b. Clean Water Act 309 administrative order requiring cease and desist and/or remedial action; and
c. U.S. Attorney referral for civil/criminal penalty, remedial action, injunctions and/or imprisonment.
d. Other provisions of Clean Water Act include:

Section 301 of the Clean Water Act prohibits the discharge of dredged material into waters of the United States, including adjacent wetlands, without first obtaining necessary permits.
Section 309 of the Clean Water Act provides both civil and criminal penalties for violation of Section 301. The civil penalties include imposition of fines of up to $10,000 per day of violation. Criminal penalties consist of fines of up to $25,000 per day of violation, or imprisonment for not more than one year, or both.

4.2.3 Washington Department of Ecology

RCW 90.48 Water Pollution Control

Orders can be issued for cease and desist, remedial action plans, or prevention of potential violation. Notice of violation can include cease and desist, fines, remedial action and recovery of costs for environmental resource damage.

Section 401 of the Federal Clean Water Act

The State water quality 401 certification may be withdrawn, thereby

nullifying the Corps 404 permit. Cause for withdrawing certification could lead to either an order for further action or a notice of violation.

Shorelines Management Act (see Cities and Counties below)

4.2.4 Washington Department of Natural Resources

WAC 332-30 Aquatic Land Management, Section 166

a. Revoke proprietary authorization for use of the disposal site, and
b. Assess damage costs.

4.2.5 Washington Department of Fisheries

Hydraulic Code Rules (WAC 220.110.030(19)(c))

a. Warning or citation issued by patrol officer.
b. Violation is a gross misdemeanor punishable by fine or imprisonment.

4.2.6 Cities and Counties

Shorelines Management Act

a. Local government attorney or State attorney general may bring injunctive, declaratory, or other actions necessary to prevent conflict with the shoreline program and to enforce shoreline management provisions.
b. Willful violation is a gross misdemeanor punishable by a fine of not less than $25 and not more than $1,000 and/or up to 90 days in jail. Repeated violations carry heavier fines.
c. Violators are liable for all damage caused, including costs of restoration.

d. Private persons may bring suit for damages and recover attorney's fees and costs.

4.2.7 Coast Guard

Section 307 of the Clean Water Act

a. Administrative fines for oil spills, and
b. U.S. Attorney referral for civil/criminal penalty and/or remedial action.

4.2.8 NEPA and SEPA

In addition to the above, the National Environmental Policy Act (NEPA) and State Environmental Policy Act (SEPA) provisions relating to environmental impact statements may be used. If false claims are made in NEPA/SEPA documentation, this information could be used in conjunction with above authorities to strengthen enforcement actions. Permit conditions applied pursuant to SEPA are enforced in the same manner as if they were imposed under the underlying permit authority.

4.3 Interagency Coordination

The current response to violations is on a case-by-case basis and not always effectively coordinated. The best results would be achieved if the agencies responsible for permit compliance were to coordinate immediate enforcement response. If a violation were in progress, the agency could act or contact another agency which could stop the violation and initiate any immediate response to the problem. If a past violation were discovered, the agency would investigate and coordinate with other agencies to bring appropriate enforcement action.

4.4 Recommendations

DNR, Ecology, and the Corps, as agencies responsible for compliance inspections should coordinate with each other and with other agencies as necessary to respond effectively to violations.

DNR should report any violations of disposal site use to Ecology and the Corps. DNR should rely on those agencies to pursue appropriate civil and/or criminal penalties. Where damage to State-owned aquatic land can be shown, DNR should seek damages from the operator and consider revocation of the disposal permit.

5. ENVIRONMENTAL MONITORING

5.1 Need For And Objectives

The primary functions of the environmental monitoring proposed for the PSDDA disposal sites are to ensure compliance with the Section 404(b)(1) guidelines and to field verify the PSDDA predictions of site conditions following disposal. Moreover, monitoring will provide the data to allow direct response to agency and public questions regarding site conditions and environmental impacts. Finally, environmental monitoring data forms the basis for the annual review of the need for changes in the evaluation procedures.

This chapter presents the key features of the overall proposed PSDDA monitoring plan. The complete proposed environmental monitoring plan is contained in Exhibit I.

The monitoring plan is designed to address well-defined objectives or questions that directly relate to verification that unacceptable chemical and physical impacts have not resulted from dredged material disposal. These questions are:

- Does the deposited dredged material stay on-site?
- Is the biological effects condition for site management (Site Condition II) exceeded at the site due to dredged material disposal?
- Are unacceptable adverse effects, due to dredged material disposal, occurring to biological resources offsite?

Site Condition II (see sections 2 and 4 of the FEIS) will be the biological effects condition for site management at the unconfined, open-water disposal sites. By definition, Site Condition II could allow "minor effects on biological resources" at the disposal site due to chemicals of concern. This accepts some on-site sublethal or chronic biological effects. It should be noted that this is a maximum condition of site management and that actual site conditions are generally expected to be better as much of the dredged material will have very low levels of chemicals.

5.2 Scope

Given the assumption that disposal will be limited to dredged material that is consistent with site management Condition II, environmental monitoring during actual disposal operations is not considered to be necessary. In addition to supporting biological information, this decision is based on field studies that document a very small loss of fines and associated chemicals to the water column during disposal prior to impact on the bottom (see Evaluation Procedures and Disposal Site Selection Technical Appendixes). Studies have also shown that conventional pollutants (e.g., sulfides, TOC, and total volatile solids) should not be a significant problem. Consequently, water surface monitoring, as well as beach monitoring, will not be undertaken. Instead, the monitoring will focus on the benthic environment both on or near the site. However, water column effects over the disposal site are also addressed.

As the preferred disposal sites are located in low energy and low currents areas, offsite impacts are not expected. However, offsite monitoring will be conducted to

verify these expectations.

A significant number of mobile species are not expected at the active disposal sites. On-site benthic communities are expected to be buried to varying degrees following disposal of dredged material. Full recolonization of the disposal sites is not expected during active use of the site since continued disposal operations will tend to cover any recolonizers. Partial recolonization will occur each year during periods when dredging operations are restricted (due to fisheries closures), however, these recolonizers would be buried once disposal operations resume. Permanent recolonization of the sites is expected once they are no longer used for the disposal of dredged material (Dexter et al. 1984; Rhoads and Germano, 1986, see references, Exhibit I). Prior to that time, the sites are not expected to provide sufficient prey to attract additional mobile species beyond the few that were observed during site identification studies.

The environmental monitoring element of the PSDDA plan includes a predefined management response strategy dealing with how monitoring data are to be used and interpreted, i.e., "triggers" for appropriate management action. These actions may include additional sampling at the site ("verification sampling"), adjusting the evaluation procedures used to assess dredged material, or modifying use of the site.

Based on the questions set forth in paragraph 5.1, and utilizing accepted protocols, the monitoring plan specifies monitoring techniques, stations, and frequency for each of the selected Phase I area disposal sites.

The key field analysis concepts used in the monitoring plan are: measurement of gradients, comparison to established guideline values, comparison to baseline conditions, and comparison to nearby benchmark areas. Gradient measurements assess parameters down-current from the site, looking for evidence of offsite movement of dredged material chemicals of concern from that material. Sediment chemical values and bioassay responses will be compared to the PSDDA guidelines to verify that the site Condition II has not been exceeded. This analysis will serve as a check of the sampling aspects of the disposal guidelines, i.e., characterization of the dredged material. Also, analysis of on-site dredged material will help provide a "field reason to believe," basis for deciding when additional site studies are necessary.

Comparison of offsite conditions to baseline conditions measured prior to disposal will be done to verify that no unacceptable changes have occurred due to dredged material disposal. Changes in parameters on-site and offsite will be compared to nearby relatively undisturbed areas (benchmark stations) to determine if changes are due to other sources or natural fluctuations.

The most intensive monitoring will occur during the first few years of site use. This will allow for early response should unexpected adverse impacts occur. Future monitoring effort may be lessened if monitoring indicates no significant effects have occurred, (i.e., PSDDA evaluation procedures are producing the expected results). Field studies will be conducted during the same season each year (i.e., during late spring). Intensity of monitoring may differ from year to year based on the volume of dredged material disposal during the year at the site. A tentative schedule of monitoring studies has been established for the sites, but this schedule may be adjusted if insufficient material is deposited at a site to warrant full study.

5.3 General Monitoring Plan

The general monitoring plan consists of several types of field studies, each varying in intensity and frequency, and field measurement techniques. Illustrated in table II 5-1, the various categories, parameters, and techniques, and their relation to the monitoring questions, are described in the following paragraphs.

5.3.1 Monitoring Categories

The monitoring plan will be accomplished in two separate steps: a baseline study before disposal takes place and periodic monitoring after disposal occurs. Table II 5-2 contains the proposed schedule for baseline studies and environmental monitoring. This schedule assumes disposal volumes will be sufficient to warrant monitoring. Delays in opening one or more sites in 1988 could depress volumes and impacts which might be measured through monitoring. If volumes are too low to warrant cost-effective monitoring, monitoring implementation may be delayed. Decisions on monitoring effort will be made by DNR, based on actual site use, in consultation with the Corps, Ecology, and EPA.

a. Baseline. The purpose of the baseline is to document conditions existing at and around the disposal site and at benchmark areas prior to disposal of dredged material. The information will serve as a basis for comparison of post-disposal conditions at the site, allowing an assessment of disposal impacts. Baseline data will be obtained for the same chemical, biological, and physical parameters that will be assessed during post-disposal monitoring.

Baseline studies were initiated during the spring of 1988. While biological activities occur year-round at the disposal sites, spring months are normally the time of high biological activity. This is when new recruitment occurs to the benthos and demersal predators experience higher feeding rates. Accordingly, the spring is the time in which most benthic impacts can be expected and therefore it serves as the best period for checking site conditions. Monitoring will occur during this same season over the life of the program to allow a comparison of data for trend analysis.

b. Partial Monitoring. The purpose of partial monitoring is to verify that the dredged material is staying on-site and that site condition II has not been exceeded. A minimum number of chemical stations will be sampled to determine chemical characteristics of the sediment. A map of the disposal area mound and spread will be produced to determine the location and direction of material movement. Both sonar and sediment vertical profiling system (SVPS) imagery will be used. In addition, SVPS biological data will provide a general impression of biological impacts on and offsite. Partial monitoring addresses two of the three key monitoring questions, (see Table II 5.1).

c. Full Monitoring. The purpose of full monitoring is to determine if the physical, chemical, and biological, parameters, documented during the baseline study, have changed. Full monitoring frequency will vary by site and disposal volume. However, full monitoring will be considered after 45,000 cubic yards of dredged material have been placed there. Two full monitoring studies are felt to be necessary within the first 5 years of site use (depending on volume placed at each

TABLE II 5-1

RELATIONSHIP OF KEY MONITORING QUESTIONS TO TYPES OF MONITORING, PARAMETERS, AND TECHNIQUES USED IN THE PHASE I ENVIRONMENTAL MONITORING PLAN

	Monitoring Questions		
	Material Stays Onsite?	Site Condition II Not Exceeded?	Biological Resources Unaffected Offsite?
Types of Monitoring:			
Baseline	X	X	X
Partial Monitoring	X	X	
Full Monitoring	X	X	X
Parameter:			
Physical Mapping	X		
Sediment Chemistry-Onsite		X	
-Offsite	X		
Sediment Bioassay-Onsite		X	
Infaunal Tissue Chemistry			X
Infaunal Abundance			X
Techniques:			
Box Cores		X	X
Side-Scan Sonar	X		
SVPS[1]	X		

[1] Sediment vertical profiling system.

TABLE II 5-2

PROPOSED SCHEDULE FOR BASELINE STUDIES AND ENVIRONMENTAL MONITORING AT EACH DISPOSAL SITE OVER A 15-YEAR MONITORING PERIOD

YEAR	SITES		
	Elliott Bay	Commencement Bay	Port Gardner
1988	B	B	B
1989	P[1]	P[1]	P[1]
1990	F	-	-
1991	P[2]	F	F
1992	F	-	-
1993	-	F	F
1994	-	-	-
1995	P	-	-
1996	-	-	-
1997	-	-	-
1998	-	P	P
1999	P	-	-
2000	-	-	-
2001[3]	-	-	-
2002[3]	-	-	-
2003[3]	P	P	P

B = Baseline
P = Partial
F = Full

[1]The first monitoring effort after baseline will only take place after the site has been used and volumes are sufficient to reasonably expect that observable changes will be present.

[2]Physical monitoring only.

[3]The years 2001, 2002, and 2003 are beyond the planning horizon for PSDDA, but were used in preparing the costs of the monitoring plan for the Phase I disposal sites.

site) to establish whether unacceptable impacts are occurring on or offsite. Full monitoring addresses all the questions discussed in paragraph 5.1. (Also see Table II 5.1.)

5.3.2 Monitoring Parameters

Three general groups of parameters will be measured during baseline and monitoring: physical, chemical, and biological. They employ different sampling tools and stations.

a. Physical. The purpose of physical measurements is to document the aerial extent of the disposal impact area and subsequent material movement. This is accomplished through mapping the topography (macroscale) and microscale sediment characteristics of the site and surrounding area.

A sidescan sonar will be used, if possible, to document the macroscale topography of the site, including down-current sediment movement, as well as provide some indication of small scale relief (sediment surface texture). Based on the side-scan sonar imagery, SVPS stations will be used to examine the depth of disposal material on the flanks of the disposal mound relative to the site boundaries. These data will provide a quantitative indication of the location and direction of disposal material movement.

b. Chemical. Chemical monitoring stations will be sited based upon the evidence of possible material movement offsite as shown by the physical data. The purpose of chemical measurements is to document the presence of chemicals of concern on and offsite due to dredged material disposal and establish if they are causing unacceptable adverse impacts. This serves as a check on the sampling and analysis of the dredging site sediments. It answers the questions: (a) was the dredged material properly characterized; and (b) has the site management condition been met?

c. Biological. The purpose of biological measurements is to augment chemical measurements by documenting benthic organism responses to the presence of chemicals in their environment. For the disposal site, bioassays will be used to check the site management condition. Biological tests of offsite stations will measure biological responses through bioaccumulation tests and a check of benthic infauna abundances. These responses will be compared to baseline and/or along a gradient to determine if there is an unacceptable impact from dredged material disposal.

Measurements will be made on the bioaccumulation of toxic chemicals in the body tissue of sessile benthic organisms such as worms and clams that have been exposed in the laboratory to sediments taken from the field. Bioaccumulation examines the relative exposure of these organisms to chemicals in the sediments, overlying water, and suspended particulate matter (nepheloid layer), and the relative uptake of those chemicals. Chemical benthic species have implications for the health of the measured organism, and for the degree to which the contaminant levels may affect tissue residues of predators.

d. Offsite Benchmark Stations. The purpose of offsite benchmark stations is to determine if differences in chemical and biological measurements, noted during monitoring of the disposal site, represent natural or background variation at a similar depth and substrate within the general area. In general, benchmark samples

will be archived and analyzed only if changes in parameters occur at the other monitoring stations that require a benchmark comparison.

5.4 Data Analysis, Interpretation, and Response

5.4.1 Introduction

Management of the disposal sites will be based upon analysis and interpretation of the field monitoring data, and upon subsequent agency administrative decisions. Monitoring data will be analyzed either through an evaluation based on the PSDDA dredged material disposal guidelines or a statistical comparison of the monitoring data to baseline data. Interpretation of the monitoring results in terms of ecological significance will require an understanding of the data evaluation procedures and professional judgment. In addition to data analysis and interpretation, site management actions will depend on the degree of environmental risk and other considerations, e.g., feasibility.

Statistics will be employed in the data analysis phase, solely to identify where observed differences between monitoring data (obtained subsequent to use of the site for dredged material disposal) and baseline data (obtained prior to site use) are potentially significant when considering the methods used, the variability of the parameters measures, the number of measurements made on each parameter, and the magnitude of the observed differences. Statistics consider the accuracy and precision of the monitoring methods in indicating whether the observed differences at the disposal site warrant further professional evaluation. Statistical significance does not imply ecological significance; professional judgment is essential in interpreting monitoring indications and recommending site management actions.

Statistical indicators used in data analysis are often developed by application of statistical power analysis, a widely applied environmental planning tool for considering the relationship between parameter variability, the number of samples to be taken, and the statistical confidence desired in the resulting data. The statistical triggers used in the monitoring plan are determined primarily by the variability of the parameter being measured and the work effort (number of samples) allocated by the monitoring plan. They represent minimum differences that should be observed before additional data interpretation (to consider ecological significance) is conducted.

Several study participants suggested using differences between monitoring and baseline data that were substantially smaller than those shown in the monitoring plan for determining if a condition of concern exists. However, the power analysis (see appendix to Exhibit I) indicated that these smaller differences would not be possible to measure without substantially more samples and analysis or significantly reducing the desired confidence level. Consequently, the study participants agreed that the statistically-derived differences were the best possible, given the current level of monitoring effort proposed.

5.4.2 Data Analysis

Onsite monitoring will be limited to verification that the site management condition II has not been exceeded. This will be done through analysis of onsite sediment chemical concentrations and bioassays. If the site management condition is

being exceeded, then disposal guidelines adjustments will be considered.

Analysis of the monitoring data for offsite checking and development of a management response to the findings is a more complex process that includes both statistical procedures and professional review of the data. Each step in the three-step process can be posed as a question that must be addressed before moving to the next step in the decision-making process. The answer to each question determines whether further evaluation of the monitoring data is required. The question associated with each of the decision-making steps is:

Step 1: Are the value for the parameters measured during monitoring different than the values found during the baseline?

Step 2: If differences are found, are they due to the disposal of dredged material or due to other causes (changes due to other chemical sources or due to natural variation)?

Step 3: If the differences are due to the disposal of dredged material, what type of management action is warranted based on an assessment of the ecological impact associated with the changed conditions?

The first step in the process is to determine whether the values observed during the monitoring effort (partial or full monitoring) differ from the values found during the baseline (step 1 in the site management process). Depending on the parameter being evaluated, one of several methods are used to determine if the monitoring data are different from the baseline values. Sediment chemistry and SVPS data used to determine if the dredged material has spread beyond the disposal site are compared to data on sediment characteristics gathered during the baseline for stations at the site perimeter line located approximately 1/8 of a mile beyond the site boundary.

Offsite chemical concentrations and bioassay results at other stations are compared to baseline values for sediment chemical concentrations and toxicity (for bioassay). Data on benthic body burdens and benthic abundance are statistically compared to the baseline data to determine if differences between the data are supported. The interpretation guidelines for all of these comparisons is presented in Exhibit I.

If comparison of the monitoring data to the baseline data does not indicate that any offsite changes have occurred since disposal activity began, then it can be reasonably assumed that dredged material discharged at the disposal sites is staying on-site. However, if any of the data are found to differ from the baseline values then a question arises as to whether the differences observed are due to dredged material disposal or due to other factors operating within the disposal site area (step 2 in the site management process).

If changes are detected, the archived benchmark samples from the recent monitoring effort must be analyzed and compared to the appropriate baseline benchmark station data. If, after analysis, changes are also observed in the benchmark data, then the changes observed in the monitoring data from the disposal site area may not be due to dredged material disposal, but due to other factors. At this point in the decision-making process, three decision scenarios are possible with respect to the benchmark data and their importance in determining what may have caused the changes

observed at the disposal site.

Scenario 1: If the monitoring benchmark and baseline benchmark data are not different, the changes in the monitoring station data reflect a potential impact from disposal of dredged material.

Scenario 2: If the monitoring benchmark for benthic body burdens and benthic abundances and baseline benchmark data for these parameters are significantly different, but that difference is not sufficient to account for the difference in the monitoring data for the offsite stations, the changes in the offsite monitoring stations data also reflect a potential impact from disposal.

Scenario 3: If the monitoring benchmark and baseline benchmark data are significantly different, and that difference is sufficient to account for the differences in the monitoring station data, the changes in the monitoring stations data most probably reflect Puget Sound influences other than dredged material disposal (e.g., from natural variation or other chemical sources).

5.4.3 Response

If, after evaluation of the benchmark data, the changes observed in the vicinity of the disposal site are concluded to not be due to disposal of dredged material (scenario 3), then no management action would be required. If, however, analyses of the benchmark station data suggest that changes around the disposal site are probably due to dredged material disposal, then best professional judgment will need to be applied in evaluating the ecological significance of the observed changes (step 3 in the site management process). The variety of management actions that might be appropriate at this time could include (in order of increasing significance):

- analysis of the remaining archived samples for the other monitoring parameters to determine the extent and the ecological significance of the changes;
- offsite investigations to verify the presence of dredged material and to determine the extent and ecological significance of the effects;
- program adjustments, such as modification of site use or amendment of disposal guidelines to bring the site management into the Clean Water Act requirements of not allowing unacceptable adverse impacts; and
- major program responses such as site relocation or mitigation at the existing site.

Any action, however, must be based on a careful evaluation by all the PSDDA agencies of the monitoring results and an interpretation of these findings relative to potential ecological significance.

5.5 Agency Responsibilities, Costs, and Funding.

Baseline monitoring will be conducted by Ecology with $450,000 appropriated from the state general fund for this purpose. The Corps and DNR will be jointly responsible for subsequent environmental monitoring. Monitoring studies will be coordinated to

minimize costs, assure proper temporal sequencing, and data compatibility. Environmental monitoring reports produced by the Corps and DNR will be exchanged and provided to EPA and Ecology for technical review, from these reports Ecology will prepare a summary report that will be the basis for the period review by the PSDDA agencies, affected local governments and other interested parties of disposal site monitoring (see Chapter 7).

The Corps will generally be responsible for the costs of physical monitoring, currently estimated at $191,600 for the fifteen year period. DNR will generally be responsible for the costs of chemical and biological monitoring, currently estimated at $1,435,800 for the 15 year period. Current projections of environmental monitoring costs by year are shown in Table II 5-3. Sources of funding are discussed in section 7.5

TABLE II 5-3

PROJECTED ENVIRONMENTAL MONITORING COSTS

STATE FISCAL YEAR	PHYSICAL MONITORING (CORPS)	BIO/CHEMICAL MONITORING (DNR)	TOTAL PROJECTED COSTS
1989	$ 27,400	$47,500	$174,900
1990	15,500	159,700	175,200
1991	132,100	314,000	346,100
1992	15,500	159,700	175,200
1993	26,200	315,200	341,400
1994			
1995	10,700	47,700	58,400
1996			
1997			
1998	21,400	98,300	119,700
1999	10,700	47,700	58,400
2000			
2001			
2002			
2003	32,100	146,000	178,100
TOTAL	$191,600	$1,435,800	$1,627,400

6. DATA MANAGEMENT

6.1 Introduction.

This chapter describes how data, collected in implementing the PSDDA management plan, will be managed through an overall data management system. Data on sediment quality are currently collected and stored through a variety of mediums from elaborate computer systems to simple paper files. Several major studies have utilized microcomputer systems, while sediment data from everyday processing of dredging project permit applications are assembled in paper files.

The PSDDA study has generated considerable data in developing sediment evaluation procedures and the extensive gathering of biological and physical data on preferred and alternative disposal sites. Implementation of the PSDDA plan will produce much more data and a requirement for immediate data analysis. This further supports the need for an overall dredged material data management system. It is the intention of the PSDDA agencies that data be collected and stored in a format that is useful to as many users as possible, with the data easily accessible to all interested parties.

An annual review will be conducted by the PSDDA agencies and other interested parties of all elements of the management plan based on the environmental monitoring data collected for each of the selected public multi-user unconfined open-water disposal sites, and the data generated from implementation of the dredged material evaluation procedures. Consideration will be given to costs and environmental effects associated with the plan as well as new findings resulting from nationwide and Puget Sound research. The intent is to ensure appropriate management adjustments are made on a timely basis, consistent with adequate supporting information and sound scientific considerations (see Chapter 7 for further discussion of the annual review and update of the PSDDA plan.

6.2 Data Management Objectives.

Some of the data resulting from the PSDDA program will be immediately analyzed with the results used in administrative decisions. This includes sediment test results and environmental monitoring. Other data, such as disposal site use logs, will be stored for documentation or later long-term evaluations. The objectives of data management are to (a) facilitate the implementation of the PSDDA management plan and (b) provide the means for review and update of the plan.

As regulatory agencies and project sponsors are interested in the costs associated with dredged material evaluations, permit applicants may be asked to also provide information on sampling and testing costs incurred. This cost data could then become part of the overall data management program and be readily considered during annual program reviews.

6.3 Dredged Material Test Data.

Dredged material sediment test data, obtained by the Corps for Section 10 and 404 permit applications and by Ecology for Section 401 water quality certifications, will be maintained by the Corps on a computer system. Cost data on sampling and testing will also be collected and maintained on the system. The Corps will prepare an annual report summarizing data for dredged material tested over the previous dredging year

(which ends on March 15). Sediment quality data from environmental monitoring of the disposal sites will also be maintained on the Corps computer system. See paragraph 6.6 for related sediment quality data management activities by Ecology.

6.4 Dredging and Disposal Permit Compliance Data.

Dredging site inspection plans and permit (DNR and Corps) compliance findings collected by Ecology and the Corps during dredging site inspections will be sent to DNR as they are developed. DNR will store these data in a hard copy file along with disposal site use permit compliance findings obtained by DNR and the Corps. Compliance findings and operational status will be stored by DNR on a personal computer for active projects. DNR will provide an annual permit compliance report to the relevant local jurisdictions, other PSDDA agencies, and other interested parties.

6.5 Environmental Monitoring.

DNR and the Corps will share environmental monitoring responsibilities in recognition of each agency's defined regulatory responsibilities and requirements under the CWA. DNR will be generally responsible for biological and chemical monitoring and will provide that data to the Corps for input to the PSDDA data management system. The Corps will be generally responsible for physical monitoring, including the collection and analysis of physical data and inputing these data to the PSDDA system.

Technical reports will be prepared by the Corps and DNR, for their respective monitoring activities, for each disposal site within 2 months after field data have been collected and laboratory work completed. These reports will summarize the field data, analyze the significance of the data in relation to the monitoring objectives and draw tentative conclusions as to whether or not the data suggest a basis for concern based on ecological significance. Copies of the reports will be provided for technical review to the other PSDDA agencies. Ecology will prepare an environmental monitoring summary report based on the Corps and DNR technical reports. The summary report will be part of the annual review of the PSDDA plan with copies of this report available to the PSDDA agencies and other interested parties (see Chapter 7).

6.6 Data Management System.

The Corps will be responsible for developing and maintaining the computerized information management system for the data described in paragraphs 6.3 and 6.5 above. The other PSDDA agencies will have access to this system. To ensure greatest possible utility, the system will be planned on a cooperative basis through a PSDDA agency representative data management working group. A separate interagency agreement or other document will set forth: (a) the scope of the system; (b) quality assurance (QA) requirements for data entered into the system; (c) data input and output formats; (d) responsibilities for data analysis; (e) system accessibility; (f) agency responsibilities; and (g) other appropriate aspects of concern to the PSDDA agencies.

The Corps PSDDA database system will be real time, accessible to the other PSDDA agencies and in a format compatible with Ecology's data management system and, to the extent feasible, also compatible with the Puget Sound Water Quality Authority (PSWQA)'s system. The Corps will perform a quality assurance (QA) check of all sediment test data resulting from project evaluations prior to entering these data

into the PSDDA data management system. Stored PSDDA sediment test data will be provided to Ecology for updating sediment quality values used to compute the Apparent Effects Threshold (AET) values which are employed in setting the screening level (SL) and maximum level (ML) values for the PSDDA evaluation procedures (see EPTA section II). Ecology may also use other Puget Sound sediment data that meets QA checks for updating the AET values including that data resulting from the Puget Sound Ambient Monitoring Program (PSAMP) and other programs. As part of this update Ecology will assess the need for changes in the sediment quality values used in the PSDDA evaluation procedures and present this assessment along with supporting data and analysis to the other PSDDA agencies as part of the annual review of the PSDDA plan.

7. PSDDA IMPLEMENTATION

7.1 General Requirements

Individual and cooperative actions will be required by the Corps, EPA, DNR and Ecology, local governments and others to implement the PSDDA Management Plan. Many aspects of the plan relate to individual actions under Sections 404 and 401 of the Clean Water Act. Some of these aspects, particularly dredged material testing, test interpretation, and determination of acceptability for unconfined, open-water disposal, are highly technical and complex and therefore require considerable expertise for proper evaluation. Accordingly, technical expertise required for project analysis will be contributed by each of the regulatory agencies and the annual reviews of the dredged material evaluation procedures will be a cooperative undertaking by all four PSDDA agencies.

Close coordination will be necessary to implement the PSDDA plan. New scientific information is continually being developed on Puget Sound water and sediment quality, on the toxicity of various chemicals of concern, and on appropriate testing protocols. These facts, along with the recognition that agency personnel changes will occur, require established communications procedures. Dredged material management activities needing interagency coordination include the following:

- Review and processing of permit applications for dredging and dredged material disposal.
- Application of dredged material evaluation procedures to determine testing and test interpretation for specific projects.
- Consideration of adjustments in dredged material evaluation procedures.
- Use of public multi-user, unconfined, open-water disposal sites.
- Environmental monitoring and consideration of adjustments to disposal site environmental monitoring.
- Consideration of new disposal sites and/or changes in existing site locations or boundaries.

7.2 Roles and Responsibilities

The various roles and responsibilities of each of the four PSDDA agencies, for implementation of the proposed management plan, are discussed in the following paragraphs. Implementation is predicated, where appropriate, on the availability of required funds.

7.2.1. Corps of Engineers

The Corps will:

a. Cooperate with EPA and Ecology when processing applications for Section 404 permits.

b. Provide Section 404(b)(1) dredged material evaluation reports on Corps dredging projects to Ecology and EPA prior to making disposal decisions.

c. Develop a dredging and disposal operation inspection plan (see Section 3.3.2 and Exhibit G), for each Corps dredging and disposal project and provide a copy to Ecology and DNR prior to initiation of dredging.

d. Comply with all appropriate disposal site use requirements (see Chapter 3) when the disposal site is being used for Corps dredging projects.

e. Consider, in conjunction with EPA, PSDDA sediment evaluation procedures, including disposal guidelines, in specifying dredged material sampling and testing requirements for Section 404 permits.

f. Inspect each Corps and Corps permitted dredging and disposal project in a similar manner as Ecology and DNR inspect non-Corps dredging and disposal projects (see Chapter 3).

g. Advise Ecology and DNR of any violations to the Section 404 permit by Corps and Corps permitted dredging contractors. Also advise Ecology and DNR of any actions the Corps regards as being required because of the violation(s).

h. Provide to DNR the disposal site use reports on Corps and Corps permitted dredging projects.

i. Prepare, by July of each year, the annual summary report on dredged material sampling and testing conducted over the previous dredging year (which ends on March 15) for Section 10 and 404 dredging and dredged material disposal project actions (permits, existing proposed Corps projects and those under study); and Section 401 water quality certifications. Reports will include data on the costs of sampling and testing. Information will be provided for each public multi-user unconfined open-water disposal site.

j. Conduct physical environmental monitoring studies of the disposal sites and coordinate these with DNR biological and chemical environmental monitoring studies. Input the physical monitoring data to the Corps' data management system. Prepare, within two months of the completion of the monitoring studies, a technical report on physical monitoring for each disposal site for that monitoring event. Relate the new monitoring data to data from previous monitoring events. Provide these reports to EPA, DNR and Ecology for technical review. Review environmental monitoring and disposal site use reports prepared by DNR and Ecology. As part of the annual PSDDA plan review and update (see m. below) present Corps proposed disposal site management changes.

k. In conjunction with EPA, DNR and Ecology, review the sediment quality values and biological tests used in the PSDDA dredged material evaluation procedures, and assess the need for changes in these procedures based on environmental monitoring data, other pertinent environmental information e.g. Ecology's expanded sediment quality data management system, new research findings, etc.; and cost considerations (including aspects of dredging and dredged material disposal in addition to sampling and testing). As part of the annual PSDDA plan review and update, present Corps proposed changes to the evaluation procedures.

l. Develop and maintain a centralized computer data based system for all pertinent Section 10, 404, and 401 dredged material sediment quality data and physical, chemical, and biological baseline and environmental monitoring data collected for each public multi-user, unconfined open-water disposal site. Make the data and the computer system accessible to EPA, DNR, and Ecology. The data will also be made available to others, subject to request processing requirements.

m. Convene, in January of each year, the annual PSDDA plan review and update meeting, prepare the meeting record, and distribute by March the notification to interested parties of agreed upon changes to the plan. The Corps will implement those plan changes, if any, that are in agreement with applicable Corps policies and within its authorities, responsibilities, and funding capabilities.

7.2.2 Environmental Protection Agency

EPA will:

a. Consider, in conjunction with the Corps, PSDDA sediment evaluation procedures, including disposal guidelines, in specifying dredged material sampling and testing requirements for Section 404 permits.

b. Review the annual summary report prepared by the Corps on dredged material sampling and testing for Section 10 and 404 permits and Section 401 water quality certifications.

c. Review Section 404(b)(1) material evaluations for Corps projects in cooperation with the Corps and Ecology.

d. Review Corps, DNR and Ecology environmental monitoring and site use reports.

e. In conjunction with the Corps, DNR and Ecology, review the dredged material evaluation procedures based on the considerations identified in paragraph 7.2.1 k. above. As part of the annual PSDDA plan review and update (see f. below) present EPA proposed changes to the evaluation procedures.

f. Participate in the annual PSDDA plan review and update meetings. Implement those agreed upon plan changes, in any, that are in agreement with applicable EPA policies and are within its authorities, responsibilities, and funding capabilities.

7.2.3 Department of Natural Resources

DNR will:

a. Amend WAC 332-30-166 to be consistent with the disposal site selection and management process developed through PSDDA, including revising the fee schedule and interagency coordinating committee.

b. Notify existing disposal site permittees that their existing DNR permits will have to be amended prior to use of the preferred disposal sites.

c. Acquire local shoreline management permits for preferred unconfined, open-water

disposal sites for the maximum period permissible (currently 5 years).

d. Perform disposal site user permit (DNR) compliance inspections.

e. Enter into formal agreement with the U.S. Coast Guard for continued use of the VTS (Vessel Traffic System) for verifying proper disposal barge positioning at the Elliott Bay preferred disposal site.

f. Establish variable range radar reference points for use by disposal barge operators at Commencement Bay, Elliott Bay, and Port Gardner disposal sites.

g. Establish Loran-C coordinates for use by disposal barge operators at the Commencement Bay and Elliott Bay disposal sites.

h. Continue use of current DNR data management system for tracking disposal site use and share this information with all interested parties.

i. Review the annual summary report prepared by the Corps on dredged material sampling and testing conducted for Section 10 and 404 permits and Section 401 water quality certifications.

j. Conduct chemical and biological environmental monitoring studies of the public multi-user, unconfined open-water disposal sites and provide these data to the Corps for input to the Corps' data management system. Prepare, within two months of the completion of the monitoring studies, a technical report for each disposal site for that monitoring event. Relate the new monitoring data to data from the baseline and/or previous monitoring events. As part of the annual PSDDA plan, review and update (see m. below) present DNR proposed disposal site management plan changes.

k. Prepare annual site use reports and provide to PSDDA agencies, local shoreline jurisdictions, and others.

l. In conjunction with the Corps, EPA, and Ecology, review the sediment quality values and biological tests used in the PSDDA dredged material evaluation procedures based on the considerations identified in paragraph 7.2.1 k. above. As part of the annual PSDDA plan review and update present DNR proposed changes to the evaluation procedures.

m. Participate in the annual PSDDA plan review and update meetings. Implement those agreed-upon plan changes, if any, that are in agreement with applicable DNR policies, and within its authorities, responsibilities, and funding capabilities.

7.2.4 Department of Ecology

Ecology will:

a. Adopt, through regulation or as agency guidelines, PSDDA dredged material evaluation procedures as a basis for Section 401 water quality certification determinations.

b. Conduct baseline studies at each disposal site in conformance with the PSDDA

monitoring plan and transmit data to Corps for entry into Corps' dredged material data management system. Provide these data to DNR for comparison with results from subsequent environmental monitoring studies.

c. Develop dredging operation inspection plans for non-Corps projects and coordinate with the Corps to assure inspection plans are similar to those for Corps projects.

d. Conduct onsite inspections of Corps (per the Corps developed inspection plans) and non-Corps dredging projects and report results to the Corps.

e. In conjunction with the Corps, EPA, and DNR, review the sediment quality values and biological tests used in the PSDDA dredged material evaluation procedures and assess the need for changes in these procedures based on the considerations identified in paragraph 7.2.1 k. above. As part of the annual PSDDA plan review and update (see i. below) present Ecology proposed changes to the evaluation procedures.

f. Review DNR and Corps disposal site use and environmental monitoring technical reports.

g. Assist local governments in amending their shoreline management master programs to be consistent with PSDDA-recommended model shoreline master program elements for unconfined, open-water dredged material disposal (see Exhibit B).

h. Prepare, within two months of receiving the Corps and DNR technical monitoring reports, a summary report on the physical, chemical and biological environmental monitoring studies which assesses the effectiveness of the environmental monitoring plan and the need for changes in management of the public multi-user unconfined open-water disposal sites in accordance with the procedures contained in Exhibit I. Provide this report, at least one month prior to the annual plan review meeting, to the Corps, EPA, DNR and other interested parties, e.g., local shoreline jurisdictions, Indian tribes, ports, etc. As part of the annual PSDDA plan review and update present Ecology proposed disposal site management changes.

i. Participate in the annual PSDDA plan review and update meetings. Implement those agreed upon plan changes, if any, that are in agreement with applicable Ecology policies and within its authorities, responsibilities, and funding capabilities.

7.2.5 Local Shoreline Jurisdictions

The City of Seattle, the City of Everett, and Pierce County shall perform the following:

a. Use PSDDA program documents for reviewing disposal site shoreline permit applications submitted by DNR for preferred disposal sites.

b. Issue shoreline permits to DNR for PSDDA preferred disposal sites for 5-year periods with option for 1-year extension.

c. Amend, as soon as practicable, local shoreline management master programs to be consistent with PSDDA recommended model shoreline master program elements for unconfined, open-water dredged material disposal (see exhibit B).

7.2.6 Other Interested Parties.

Interested Puget Sound ports, Indian tribes and other organizations will be given an opportunity to participate in the annual reviews of the PSDDA plan and have access to technical data/reports resulting from environmental monitoring of the permitted disposal sites.

7.3 Authorities

Basic authority and responsibility for decisions on the disposal of dredged materials will rest with the Seattle District Engineer, Corps; the Region X Administrator, EPA; the Commissioner of Public Lands, Washington DNR; and Director, Washington Ecology. Each agency will carry out its roles and responsibilities as defined in paragraph 7.2, under existing authorities.

7.4 Annual Review and Plan Updates

As noted above an annual review of the PSDDA plan will be undertaken by the Corps, EPA, DNR, and Ecology to assess impacts and the need for plan revisions based on both environmental and economic considerations. Other interested parties will be given an opportunity to participate in the reviews (see 7.2.6 above). Scientists and other dredged material experts may also be invited to participate. If these reviews establish that changes to the plan are appropriate then the changes will be made by the above agencies with all interested parties notified of the changes. All plan changes will be subject to the review of the heads of the above agencies.

The purpose of the reviews will be to assess how effective and efficient the process is in meeting the PSDDA goal and objectives. Issues to be covered during the annual reviews may include:

a. Whether environmental impacts of disposal are within acceptable and prescribed levels.

b. Whether there have been any serious navigational conflicts over use of the disposal sites.

c. Whether the PSDDA guidelines for sediment evaluation and site impacts continue to be adequate and necessary.

d. Whether developments in the state-of-the-art elsewhere might be incorporated to better meet the PSDDA goal and objectives.

The typical sequence of events from monitoring to the annual review meeting will be as follows:

a. Environmental Monitoring

DNR conducts biological/chemical monitoring.
Corps conducts physical monitoring.

b. Technical Reports

Within two months of completing monitoring studies, DNR and the Corps prepare reports on the results.

By July of each year, the Corps prepares a summary report on dredged material sampling and testing.

DNR and the Corps submit their reports to each other and to EPA, and Ecology.

The Corps provides the stored PSDDA sediment test data to Ecology.

c. Summary reports

Ecology prepares reports on: a) monitoring plan effectiveness and recommendations for changes; and b) sediment quality values and recommended changes in the screening levels and maximum levels used in the disposal guidelines.

Ecology submits these reports to DNR, EPA, and the Corps at least one month before the annual review meeting.

d. DNR, EPA, Ecology, and the Corps attend the annual review meeting.

7.5 Program Funding.

With implementation of the PSDDA plan, ongoing dredged material regulatory functions of the agencies will continue but at expanded levels for Ecology, DNR, and the Corps.

Historically, the Corps and EPA use Federal appropriations for administering dredged material disposal permits and compliance efforts. The Corps is expected to incur a permit administration and compliance program cost increase. Ecology will experience increased costs for permit administration and will continue to fund its program from the State general fund. The major new program costs for PSDDA are for the environmental baseline and monitoring studies. The phase I environmental baseline studies, estimated to cost $450,000, have been funded by the Washington legislature through Ecology.

Environmental monitoring responsibilities will be shared by the Corps and DNR. The Corps will be responsible for physical disposal site monitoring consistent with Federal requirements under Section 404. The cost for physical monitoring is currently estimated at $191,600 (excluding inflation) over 15 years.

DNR will be responsible for chemical and biological monitoring. These costs are currently estimated at $1,435,800 (excluding inflation) over 15 years. DNR will cover its administration and environmental monitoring costs through a combination of general fund requests and user fees. Expenditure of state general fund money for this purpose is appropriate since most sediment contamination was caused by upland runoff and sewage discharges rather than the marine industries which require dredging.

The 1987 legislature authorized DNR to establish fees for management of dredged material disposal. The fees are limited to the amount necessary to cover the costs of disposal site management. The legislature also appropriated $193,000 from the general

fund to help fund environmental monitoring during the FY 87-89 biennium and established an Aquatic Land Dredged Material Disposal Site Account to receive fee revenues.

DNR established initial disposal site user fees in June, 1988 through the regulation adoption process which provided for public review and comment. Fees are based on projections of disposal volume and general fund appropriations. Current (conservative) estimates of disposal volumes are shown in Table II 7-1.

Based on projections of general fund appropriations and fee revenues, DNR set initial Phase I user fees at $.40/cubic yard. This assumes that DNR will receive State general fund appropriations totaling $673,000 over three bienniums. If revenues and costs are as projected, DNR should be able to decrease the fees after the major monitoring efforts of the first few years. By law, fees are limited to levels necessary to cover program costs. The basis for the fees and alternative user fee/general fund funding scenarios will be fully discussed prior to future fee revision. Fees will be adjusted periodically based on the availability of general fund money, actual user fee revenues and monitoring costs, and on updated projections of disposal volumes.

7.6 Economic Costs.

The PSDDA plan will have an economic impact on the private sector, Puget Sound ports, and others performing dredging activities. Even though sampling, testing, and test interpretation costs are expected to rise for some projects by as much as 34 percent (see EPTA Chapter 5), the overall impact is expected to be lower costs for dredged material disposal as more material is expected to be found acceptable for unconfined, open-water disposal than under existing Puget Sound Interim Criteria (see FEIS, Section 5). Also, the resolution of issues associated with unconfined, open-water dredged material disposal should reduce costly project delays.

7.7 Dispute Resolution.

DNR, the Corps, Ecology, and EPA will continue to coordinate their respective activities in carrying out the PSDDA plan. Resolution of any differences regarding elements of the plan will be pursued through involvement of the four agency heads, if need be. However, each agency must carry out its responsibilities in accordance with its own authorities. There is no intention through development of the PSDDA plan that these authorities be diluted, delegated, or infringed upon.

TABLE II.7-1

ESTIMATED PER-YEAR VOLUMES OF DREDGED MATERIAL SUITABLE FOR UNCONFINED IN-WATER DISPOSAL AT VARIOUS DISPOSAL SITES BASED ON ESTIMATED CHEMICAL LEVELS IN THE SEDIMENT

Site	Upper Level (ML_2)[4]	Mid Range	Lower Level (ML_1)[4]
Port Gardner[1]	128,000 CY	115,000 CY	101,000 CY
Elliott Bay[2]	222,000	205,000	187,000
Commencement Bay[3]	75,000	44,000	13,000
TOTAL	425,000 CY	364,000 CY	201,000 CY

[1]Volumes do not include 20 percent of the Lower Snohomish material (200,000 cy) nor all of the navigation maintenance dredged by the Corps in the Upper Snohomish (2,000,000 cy). This material is relatively clean and it is expected that much of this material will be applied to beneficial uses or preferentially placed in upland disposal sites. In addition, 50 percent of the material forecasted to be dredged by parties other than the Corps or ports was not included. This is due to an expected short-term reduction in the degree of development in East Waterway due to construction of the Navy Homeport project. Over the remaining dredging years forecasted by the PSDDA study (1991-2000), dredging activity in the Port Gardner area is expected to meet levels observed between 1970-1985.

[2]Volumes do not include the Duwamish Widening and Deepening project (2,500,000 cy); 20 percent of the Upper Duwamish material dredged by the Corps; nor 20 percent of the Upper Duwamish Turning Basin material dredged by the Corps. This material is relatively clean and it is expected that much of the material will be applied to beneficial uses or preferentially placed in upland disposal sites.

[3]Volumes do not include the Blair/Siteum Navigation Improvement Project (2,500,000 cy).

[4]See EPTA

EXHIBIT A

MPWG PLAN OF WORK

PHASE I

OBJECTIVE. MANAGEMENT PLAN

TASK. 4a. GUIDELINES FOR REVIEW OF PROPOSALS FOR SITE USE.

DESCRIPTION. These guidelines will establish the preferred process for coordinating regulation of use of PSDDA sites between local, state, and Federal agencies. The purpose of the guidelines will be to consolidate application submittal requirements, minimize permit processing time and duplication of agency effort, insure adequate opportunity for public involvement, and ensure consistency among permits issued by different agencies. In addition, the guidelines will establish a procedure to coordinate among agencies to assure materials not suitable for inwater disposal are properly handled. The guidelines will:

(1) Summarize information, testing, and documentation (including any bonding or insurance) which must be submitted in order for agencies to consider proposals for site use.

Schedule.

Start: February 1986
Complete: August 1986

(2) Describe the preferred process for coordinating local, state, and federal permit review and SEPA and NEPA compliance.

Schedule.

Start: December 1985
Complete: August 1986

(3) Establish procedures for any permit acquisition by agencies themselves.

Schedule.

Start: November 1985
Complete: August 1986

(4) Review shoreline master programs and propose any changes to achieve consistency with PSDDA.

Schedule.

Start: November 1985
Complete: August 1986

TASK. 4b. GUIDELINES FOR VERIFYING PERMIT COMPLIANCE

DESCRIPTION. These guidelines will describe how agencies will insure that site use complies with conditions in disposal permits. Examples of permit conditions which may need compliance monitoring are: (1) location, type and/or volume of material dredged and dumped; (2) timing or methods of disposal; and (3) accuracy of the dump. A contractor will evaluate the available navigation systems for contracting dumping with the designated dump zone. The guidelines will:

(1) Describe the division of responsibilities among agencies and procedures for compliance monitoring.

Schedule.

Start: November 1985
Complete: August 1986

(2) Describe requirements for reporting by site users.

Schedule.

Start: April 1986
Complete: August 1986

(3) Determine the appropriate method for monitoring accuracy of dumping.

Schedule.

Start: January 1986
Complete: August 1986

TASK. 4c. GUIDELINES FOR MANAGING PROGRAM VIOLATIONS

DESCRIPTION. These guidelines will provide a basis for interagency coordination when a program violation occurs. A violation could be accidental or purposeful. Examples are spills, disposal off-site, and disposal of unapproved material. The guidelines will:

(1) Define the types of violations which require action.

Schedule.

Start: January 1986
Complete: April 1986

(2) Define the types of action agencies can take.

Schedule:

Start: January 1986
Complete: August 1986

(3) Describe the process for coordinating regulatory action.

Schedule.

Start: January 1986
Complete: August 1986

TASK. 4d. GUIDELINES FOR ADMINISTRATION OF SITE ENVIRONMENTAL MONITORING AND RESPONSE.

DESCRIPTION. Environmental monitoring and verification will be conducted based on recommendations of other work groups. The monitoring tests and scientific procedures will be defined by the Evaluation Procedures and Disposal Site Work Groups. These guidelines will:

(1) Designate agencies responsible for conducting environmental monitoring and for evaluating monitoring data.

Schedule:

Start: November 1985
Complete: August 1986

(2) Establish a process to distribute monitoring findings to interested local, state, and federal agencies and other parties.

Schedule.

Start: March 1985
Complete: August 1986

(3) Establish an interagency process to insure identified long term site problems are addressed. Action could be taken to remediate specific site problems, to change program standards, etc.

Schedule.

Start: April 1986
Complete: August 1986

TASK. 4e. PROCEDURE FOR MEETING UNFORESEEN DISPOSAL NEEDS

DESCRIPTION. This procedure will coordinate agency response to requests for open-water disposal sites in addition to those identified in the initial PSDDA effort and for modifications to site use guidelines.

Schedule.

Start: April 1986
Complete: August 1986

TASK. 4f. GUIDELINES FOR DATA COLLECTION AND STORAGE

DESCRIPTION. These guidelines will coordinate data collection and storage so the information collected through program implementation is preserved, cataloged, and available to all interested parties. MPWG will recommend what agency or agencies will be responsible for maintaining the data management system produced by PSDDA (see task 3b). Data collection will also be coordinated with other related studies and planning.

Schedule.

Start: January 1986
Complete: August 1986

TASK. 4g. PROTOTYPE USER GUIDE

DESCRIPTION. A prototype generic guide for prospective unconfined open-water disposal site users will be prepared as a by-product of PSDDA. This guide will present: (1) permit application procedures and dredged material sampling and testing requirements; (2) typical dredging operational requirements; and (3) disposal site user costs.

Schedule.

Start: April 1986
Complete: August 1986.

TASK. 4h. REQUIREMENTS FOR IMPLEMENTATION OF PSDDA

DESCRIPTION. This section will describe necessary modifications to specific local, state, or federal plans, regulations, or operating procedures, and funding levels and services.

Schedule.

Start: April 1986
Complete: August 1986

TASK. 41. PREPARE DRAFT AND FINAL TECHNICAL APPENDIX

DESCRIPTION. Tasks 4a. through 4f. constitute elements of the site management plans. Each designated disposal site will have its own plan and will be presented separately in the technical appendix. This task will combine all products of Tasks 4a.-h. (except Task 4g.) into a draft technical appendix. Three drafts and a final appendix will be prepared in accordance with the following schedule:

1 September 1986	Draft to Study Director
15 October 1986	Draft to TSC/PRC
15 February 1987	Draft to Public
July 1987	Final to EPA

APPROACH. The final products of Task 4 will be the draft technical appendix and prototype user guide. This task will be carried out by the Management Plan Work Group assisted by a contractor who will help write the technical appendix and develope the prototype user guide. Writer-editor contractor assistance is estimated to cost $7K. Also a contractor will be used to evaluate navigation system for dumping at designated disposal sites ($7K). Printing of the public review draft and final appendixes are budget at $5K.

SCHEDULE.

Start: May 1986
Finish: July 1987

WAC 332-30-166 Open water disposal sites. (1) Open water disposal sites are established primarily for the disposal of dredged material obtained from marine or fresh waters. These sites are generally not available for disposal of material derived from upland or dryland excavation except when such materials would enhance the aquatic habitat.

(2) Material may be disposed of on state-owned aquatic land only at approved open water disposal sites and only after authorization has been obtained from the department. Applications for use of any area other than an established site shall be rejected. However, the applicant may appeal to the interagency open water disposal site evaluation committee for establishment of a new site.

(3) Application for use of an established site must be for dredged material that meets the approval of federal and state agencies and for which there is no practical alternative upland disposal site or beneficial use such as beach enhancement.

(4) The department will only issue authorization for use of the site after:

(a) The environmental protection agency and department of ecology notify the department that, in accordance with Sections 404 and 401, respectively, of the Federal Clean Water Act, the dredged materials are suitable for in-water disposal and do not appear to create a threat to human health, welfare, or the environment; and

(b) All necessary federal, state, and local permits are acquired.

(5) Any use authorization granted by the department shall be subject to the terms and conditions of any required federal, state, or local permits.

(6) The department shall suspend or terminate any authorization to use a site upon the expiration of any required permit.

(7) All leases for use of a designated site must require notification to DNR in Olympia twenty-four hours prior to each use. DNR Olympia must be notified five working days prior to the first use to permit an on-site visit to confirm with dump operator the site location.

(8) Pipeline disposal of material to an established disposal site will require special consideration.

(9) An application and a lease fee will be charged at a rate sufficient to cover all departmental costs associated with management of the sites. Fees will be reviewed and adjusted annually or more often as needed. A penalty fee may be charged for unauthorized dumping or dumping beyond the lease site. Army Corps of Engineers navigation channel maintenance projects are exempt from this fee schedule.

FEES

(a) Application fee:

(i) Puget Sound and Strait of Juan De Fuca: $.15 per cubic yard (c.y.) for the first 200,000 c.y.; Negotiated fee for project volumes exceeding 200,000 c.y. Minimum fee $2,000.00.

(ii) Grays Harbor/Willapa Harbor: Minimum fee $300.00.

(b) Lease fee - $100.00 all sites.

(c) Penalty fee - $5.00/cubic yard.

(10) Open water disposal site selection. Sites are selected and managed by the department with the advice of the interagency open water disposal site evaluation committee (a technical committee of the aquatic resources advisory committee). The committee is composed of representatives of the state departments of ecology, fisheries, game, and natural resources as well as the Federal Army Corps of Engineers, National Marine Fisheries Service, Environmental Protection Agency, and Fish and Wildlife Service. The department chairs the committee. Meetings are irregular. The committee has developed a series of guidelines to be used in selecting disposal sites. The objectives of the site selection guidelines are to reduce damage to living resources known to utilize the area, and to minimize the disruption of normal human activity that is known to occur in the area. The guidelines are as follows:

(a) Select areas of common or usual natural characteristics. Avoid areas with uncommon or unusual characteristics.

(b) Select areas, where possible, of minimal dispersal of material rather than maximum widespread dispersal.

(c) Sites subject to high velocity currents will be limited to sandy or coarse material whenever feasible.

(d) When possible, use disposal sites that have substrate similar to the material being dumped.

(e) Select areas close to dredge sources to insure use of the sites.

(f) Protect known fish nursery, fishery harvest areas, fish migration routes, and aquaculture installations.

(g) Areas proposed for dredged material disposal may require an investigation of the biological and physical systems which exist in the area.

(h) Current velocity, particle size, bottom slope and method of disposal must be considered.

(i) Projects transporting dredged material by pipeline will require individual review.

(j) Placement of temporary site marking buoys may be required.

(k) The department will assure disposal occurs in accordance with permit conditions. Compliance measures may include, but are not limited to, visual or electronic surveillance, marking of sites with buoys, requiring submittal of operator reports and bottom sampling or inspection.

(l) Special consideration should be given to placing material at a site where it will enhance the habitat for living resources.

(m) Locate sites where surveillance is effective and can easily be found by tugboat operators.

(11) The department shall conduct such subtidal surveys as are necessary for siting and managing the disposal sites.

EXHIBIT C

40 CFR 230.80

Subpart I - Planning To Shorten Permit Processing Time

230.80 Advanced identification of disposal areas.

(a) Consistent with these Guidelines, EPA and the permitting authority, on their own initiative or at the request of any other party and after consultation with any affected State that is not the permitting authority, may identify sites which will be considered as:

(1) Possible future disposal sites, including existing disposal sites and non-sensitive areas; or

(2) Areas generally unsuitable for disposal site specification;

(b) The identification of any area as a possible future disposal site should not be deemed to constitute a permit for the discharge of dredged or fill material within such area or a specification of a disposal site. The identification of areas that generally will not be available for disposal site specification should not be deemed as prohibiting applications for permits to discharge dredged or fill material in such areas. Either type of identification constitutes information to facilitate individual or General permit application and processing.

(c) An appropriate public notice of the proposed identification of such areas shall be issued:

(d) To provide the basis for advanced identification of disposal areas, and areas unsuitable for disposal, EPA and the permitting authority shall consider the likelihood that use of the area in question for dredged or fill material disposal will comply with these Guidelines. To facilitate this analysis, EPA and the permitting authority should review available water resources management data including data available from the public, other Federal and State agencies, and information from approved Coastal Zone Management programs and River Basin Plans.

(e) The permitting authority should maintain a public record of the identified areas and a written statement of the basis for identification.

EXHIBIT D
TREATMENT OF DREDGED MATERIAL DISPOSAL IN
PUGET SOUND SHORELINE MANAGEMENT MASTER PROGRAMS
December 1986

1. Island County

   A. SMMP Date: 12/75
   B. ZSF* Shoreline Environment: Aquatic
   C. Permitted uses in Aquatic Environment Dredged material disposal is not listed as an allowable use in the aquatic environment. Disposal may fall under dredging, which is a conditional use.
   D. Regulations on dredged material disposal. Chapter 16.21.075 of the Island County Code contains a use requirement that dredged material be deposited on upland sites wherever possible and in any case, only on those sites authorized by a shoreline permit.

2. Snohomish County

   A. SMMP Date: September, 1974
   B. ZSF Shoreline Environment: Conservancy
   C. Permitted uses in Conservancy Environment
      Dredged material disposal is allowed at designated DNR "underwater sites".
   D. Regulations on dredged material disposal at open-water sites are contained on pages F-20-F-23. Applications for dredging permits must state location, size, capacity, and physical characteristics of the disposal site and method of spoil disposal. New dredging projects must also provide a plan for disposal of maintenance spoils for at least 50 years ahead. The regulations imply that disposal site approval would have to be gained for each disposal operation rather than a one-time approval of a disposal site for general use. There are no specific regulations on spoil disposal.

3. Everett

   A. SMMP Date: January, 1986
   B. ZSF Shoreline Environment: Conservancy Recreation
   C. Dredged material disposal is a conditional use in Conservancy Recreation Environment
   D. Regulations on dredged material disposal at open-water sites

*This information was collected relative to the Zones of Siting Feasibility (ZSF's) identified in the DSWG Technical Appendix.

are contained on pages IV-20-21. Policies on page IV-21 relate more to selection of fill sites than open-water sites. There are no specific policies or regulations related to designation or operation of open-water disposal sites. The Spoils Management Plan contained on page F-1 deals only with nearshore and upland sites.

4. Seattle

   A. SMMP Date: Mayor's Recommended Seattle Shoreline Master Program, September, 1985 (not yet adopted)
   B. ZSF Shoreline environment: Conservancy Natural
   C. Establishment of an open water dredge material disposal site pursuant to DNR regulations is a conditional use in the CN Environment. Conditional uses must pass the tests contained in WAC 173-14-140. In addition, in authorizing conditional uses the city or DOE may attach special conditions to prevent "undesirable effect."
   D. Regulations on dredged material disposal at open-water sites are contained on page 97. There are general environmental protection standards for "design" of dredged material disposal. Open-water disposal of dredge material is permitted only at designated disposal sites.

5. Tacoma

   A. SMMP Date: December, 1976
   B. ZSF Shoreline Environment: Conservancy
   C. Open-water spoil disposal is not listed as a permitted or conditional use in Chapter 13.10.160 of the official code of the City of Tacoma.
   D. Regulations on dredged material disposal are contained on page 65 of the shoreline plan. In-water disposal is only allowed for resource protection, habitat improvement, or where land disposal is more environmentally detrimental. The plan says deep-water spoil disposal areas have been proposed by DNR and that future use of these sites is underway.

6. King County

   A. SMMP Date: May, 1976
   B. ZSF Shoreline Environment: Conservancy?
   C. There are no policies or regulations related to open-water spoil disposal operations or designation of open-water spoil disposal sites.

7. Skagit County

   A. SMMP Date: December, 1976
   B. ZSF Shoreline Environment: No ZSF identified yet but all submerged areas have been given the Aquatic Environment designation.

C. Dredge spoil disposal is a conditional use in the aquatic environment.

D. Regulations for open-water spoil disposal are contained on pages 7-21 through 7-25.

1. Spoil disposal is only allowed when the ultimate use of the disposal site will be for a use permitted within the shoreline area. Presumably, this relates to disposal operations which will result in spoil islands.

2. Dredge spoil disposal is prohibited in estuaries and natural wetlands except as an element of an approved shore restoration or beach enhancement program.

3. Applications for dredging must provide a physical and biological analysis of the disposal site and a plan for disposal or use of maintenance dredge spoils for at least a 50 year period.

4. Disposal in water is discouraged except when less environmentally harmful than on land.

5. There are detailed criteria on page 7-22 for identification of in-water spoil disposal sites.

6. Spoil disposal operations should use techniques that cause the least dispersal and broadcast of materials. Sidecast disposal "should be" prohibited.

3. Whatcom County

A. SMMP Date: June, 1978

B. ZSF Shoreline Environment: No ZSF identified yet but all submerged areas have been given the Aquatic Environment Designation.

C. Spoil disposal is regulated under the dredging policies and regulations. Dredging is a conditional use in the aquatic environment. Regulations for spoil disposal are contained on pages 52-53 of the SMMP.

1. The regulations recognize the existing DNR open-water disposal site. The plan states that if alternate sites are needed, they should be selected in cooperation with specified agencies.

2. Several environmental protection requirements are placed on identification of suitable areas for open-water disposal.

3. The plan recommends the county obtain information on individual disposal operations so the site and means of

disposal can be made consistent with the SMMP and other agency programs.

4. The plan recommends consideration of chemical, biological and physical information in reviewing extensive projects or those in sensitive areas.

9. City of Bellingham

A. SMMP Date: April, 1974
B. ZSF Shoreline Environment: No ZSF identified yet. Aquatic lands are not assigned a specific environment in the plan. Presumably, aquatic lands are given the environment of the abutting uplands. However, it is difficult to determine the environment in the middle of Bellingham Bay. The City will be asked to provide a map of the environments for open water in the Bay.

C. Dredge spoils are regulated under Section 25 G. Dredging. "Dredge spoils shall not be stock piled or disposed on any shorelines of the city, provided dredge spoils may be disposed as landfill. Such landfill disposal shall meet the regulations pertaining to landfills contained herein." The landfill section does not pertain to open water spoil disposal.

10. Clallam County

A. SMMP Date: August, 1984
B. ZSF Shoreline Environment: No ZSF identified yet. Shoreline environments in the vicinity of Port Angeles are designated Urban, Rural, and Conservancy. Disposal in Rural environments is allowed only for habitat improvement for fish and shellfish resources. Disposal in the suburban environment is only allowed for habitat improvement, to correct problems of material distribution adversely affecting fish or shellfish resources and/or where upland alternatives are more environmentally harmful. The master program is silent on disposal in the urban, conservancy and natural environments.
C. Regulations on dredged material disposal is contained in Chapter 5.15 of the master program, pages 71 and 72. The policy is that, "Deposition of dredged materials in water areas should be allowed primarily for habitat improvement, to correct problems of material distribution adversely affecting fish and shellfish resources, or where the alternatives of depositing materials on land is more detrimental to shoreline resources than depositing in water area." The regulations state that disposal will only be allowed at approved disposal sites. Disposal shall minimize water turbidity, degradation of water quality and disruption of fish, shellfish and wildlife habitats. There are also some general guidelines for confined disposal. The county will be asked to provide a map

projecting the environment boundaries into the water to the county line within 10 miles on either side of Port Angeles.

11. Jefferson County and Port Townsend

A. SMMP Date: June, 1983
B. ZSF Shoreline Environment: No ZSF identified yet but all water bodies are designated Aquatic.
C. Regulations for dredged material disposal are contained in section 5.70 Dredging. "Dredge material disposal sites in water areas should also be identified by local government in cooperation with the Washington State Departments of Natural Resources, Game, and Fisheries. Dredged material disposal will only be allowed to correct problems of material distribution adversely affecting fish and shellfish resources, or where the alternatives of depositing material on land are more detrimental. However, the performance standards allow open water disposal at authorized areas identified by the county and state. "Depositing of dredge materials in water shall be done in a manner that doesn't unnecessarily interrupt natural geohydraulic processes or interfere with the use or value of adjacent properties."

Dredged material disposal is allowed in the aquatic environment but is guided by the allowability of the activity in the environment of the abutting uplands. Dredged material disposal is allowed adjacent to the Urban, Suburban, and Conservancy upland environments when related to maintenance dredging. New dredged material disposal is allowed adjacent to the Urban and Suburban environments but is a conditional use adjacent to the Conservancy environment. Dredged material disposal is not allowed in the natural environment.

12. Kitsap County

A. SMMP Date: July, 1977
B. ZSF Shoreline Environment: No ZSF identified yet.
C. Regulations on dredged material disposal are contained on pages 7-33 through 7-34, Landfill. Landfills are permitted in the Urban, Semi-rural, Rural, and Conservancy environments. Landfills are prohibited in the Natural environment. There are two policies specifically applicable to dredged material disposal:
   a. "Spoil deposit sites in water areas should be identified with the cooperation of the State Department of Natural Resources, Game, and Fisheries.
   b. "Depositing of dredge materials in water areas should be allowed only for habitat improvement, to correct problems of material distribution adversely affecting fish and shellfish resources, or where the alternative of depositing materials on land is more detrimental to shoreline resources than depositing it in water areas."

13. Mason County

A. SMMP Date: No date
B. ZSF Shoreline Environment. No ZSF identified yet. All marine waters 60 feet and deeper are in the Natural environment. Waters within 2000 feet of Brisco Point, Hartstene Island are also Natural. Marine waters from 6 to 60 feet deep are in the Conservancy environment. Marine waters adjacent to an Urban Industrial environment out to 60 feet deep are also in that environment. Waters adjacent to an Urban Commercial environment out to 60 feet in depth are also in that environment.
C. The regulations applicable to dredged material disposal are contained in Section 7.16.170(2)(f). "Dredged material, when not deposited on land shall be placed in spoils deposit sites in water areas to be identified by the county. Depositing of dredge material in water areas shall be allowed only for habitat improvement, to correct problems of material distribution affecting adversely fish and shellfish resources or where the alternatives of depositing material on land are more detrimental to shoreline resources than depositing in water areas."

14. Thurston County

A. SMMP Date: October, 1984
B. ZSF Shoreline Environment: All water 60' and deeper is in the Natural-Aquatic environment. Shallower waters fall under one of the related upland environments.
C. Regulations for dredged material disposal are contained in section V., Dredging, pages 33-34. Open water spoil disposal is allowed on sites approved by the Interagency Open Water Disposal Site Evaluation Committee (WAC 332-30-166). Deep water disposal of dredge spoils is allowed in the Natural-Aquatic environment, but not in the other shoreline environments. There are no specific requirements for dredged material disposal operations.

15. City of Port Angeles

A. SMMP Date: August 5, 1976
B. ZSF Shoreline Environment: No ZSF identified.
C. Regulations on dredged material disposal are found under Dredging on page 61.
D. Disposal policies. There are three policies applicable to disposal which discourage environmental and esthetic degradation, encourage cooperation between permitting agencies, and discourage open water sites where upland deposit sites are available.

16. Pierce County

A. SMMP Date: 1979
B. ZSF Shoreline Environment: Urban
C. Regulations on dredged material disposal are found in Chapter 65.32.
D. Disposal policies. General Regulation 65.32.020 C. is the only regulation applicable to open-water dredged material disposal. It states, "Deep water spoil disposal shall be done only at approved disposal sites and only when material meets EPA criteria for deposit in open waters".

Exhibit E

Model Shoreline Master Program Element
Unconfined, Open-Water Dredged Material Disposal

Policies

A. Selection of unconfined, open-water disposal sites should follow the process developed in the Puget Sound Dredged Disposal Analysis (PSDDA) and incorporated into DNR WAC 332-30-166 Open Water Disposal Sites.

B. Unconfined, open-water disposal of dredged material should occur at the _____ disposal site, as identified in the final Puget Sound Dredged Disposal Analysis report and adopted by the Washington Departments of Natural Resources and Ecology.

C. Due to the necessity of managing unconfined, open-water dredged material disposal on a regional basis, the _____ disposal site will serve several jurisdictions. However, the character and total volume of material deposited on the site from all sources shall comply with the standards contained in the final PSDDA report.

D. The quality of material dumped at the _____ disposal site shall meet the standards established in the final PSDDA study for unconfined open-water disposal and adopted by Ecology.

E. Due to the need for long-term management of open-water disposal sites, a public agency may acquire an exclusive permit for managing use of the _____ disposal site.

F. The long term environmental impact of disposal at the _____ site shall be monitored by the shoreline management permittee. The permittee shall provide for long-term environmental monitoring and any necessary remedies. Periodic reports on site use and environmental impact shall be submitted to the _____ Planning Department.

Regulations

1. Unconfined, open-water disposal of dredged material shall only occur at sites identified through the process defined in the final PSDDA Study document and incorporated in DNR WAC 332-30-166 Open Water Disposal Sites.

2. The _____ disposal site shall be managed in accordance with the final PSDDA Study document and subsequent revisions.

3. General Permit Procedures

   A. To assure that dredged material disposal operations are consistent with this program, no disposal of dredged materials may occur at the _____ disposal site unless authorized by a shoreline management permit. Federal use of the site must be found to be consistent to the maximum extent practicable with the provisions of this Shoreline Management Master Program and, by reference, with the final PSDDA report.

   B. It shall be the responsibility of the permit holder to assure that disposal of dredged material and management of the disposal site comply with the permit conditions and with the PSDDA report.

   C. Review of applications for use of the disposal site shall be based on the criteria and guidelines established through the final PSDDA study.

3. Exclusive Use Permits

   A. An exclusive permit for use of the _____ disposal site may be issued to a public agency when that agency maintains total management control of the site. The agency shall be responsible for managing the site in accordance with the terms of the shoreline permit.

   B. Yearly status reports shall be required of the agency. The reports shall state the quantity of material dumped, characterize the quality of the material, and review any other factors necessary to determine continuing compliance with the shoreline management substantial development permit. When such a permit has been issued, no other shoreline permits will be issued for use of the site without permission of the site managing agency.

   C. The term for exclusive site management permits issued to public agencies will be five years with a one year extension option, unless a shorter term is requested by the agency. However, if longer permit terms are allowed by the Department of Ecology, the permit term shall be indefinite. This indefinite term shall be contingent on inspection and environmental monitoring programs established in accordance with the final PSDDA report to ensure that environmental impacts are as predicted.

EXHIBIT F DNR PERMITTING AND COMPLIANCE DOCUMENTS

DRAFT
DEPARTMENT OF NATURAL RESOURCES
BRIAN J. BOYLE, COMMISSIONER
APPLICATION FOR UNCONFINED, OPEN-WATER DISPOSAL SITE USE PERMIT

1. Applicant name and address

   Phone Day_____, Night _____

2. Agent name and address

   Phone Day _____, Night _____

3. Name of disposal site to be used _____

4. Projected disposal site use

Year	Volume	Year	Volume
1.		3.	
2.		4.	

(attach additional schedule as needed)

5. Corps public notice or permit # _____

   Water Quality Certification # _____

6. Alternative disposal sites

   a. Identify any upland or in-water disposal sites within ten miles of the dredging site where your material could be used for a beneficial use (i.e., recreational beach, cap contaminated material, etc.) or where material could be placed in a land fill, gravel pit or other suitable upland location. Provide a map of such sites and volumes which could be used.

   b. What environmental, economic, or social constraints prevent use of the above sites (attach separate sheets as necessary)?

7. Additional information

Applicant agrees to furnish a copy of its U.S. Army Corps Permit and also furnish satisfactory evidence from Environmental Protection Agency (EPA) and from Department of Ecology (Ecology) showing that this material is suitable for unconfined, open-water disposal. If it is determined to be in the public interest, additional information may be requested.

I hereby certify that I have prepared this application, and to the best of my knowledge, the information provided is an accurate and true representation of the facts. Applicant/permittee agrees to defend and hold the department and the state of Washington harmless from any and all claims suffered or alleged to be suffered on the site or arising out of misstatements or operations by the applicant. I further attest that I have the authority to submit this application and to agree with conditions of the permit. I understand that all material must be from in-water sources, unless otherwise approved by the department, and that no material can be placed on the site until a permit is issued by the Department of Natural Resources.

Dated at_____ Washington, this_____ day of_____, 19___.

Signed _____

Mail this application along with a check for the application fee (see attached fee schedule) to Division of Aquatic Lands, Department of Natural Resources, M/S QW-21, Olympia, WA 98504.

Amount Submitted $_____

For Office Use Only-Aquatic Lands	
Amount Rec'd $_____	Date_____
Disp. App. No._____	Initial____

(3/4/87)

DISPOSAL SITE USER LOG (EXAMPLE)

DISPOSAL SITE_____ SITE CENTER: Lat_____, Long_____, SITE RADIUS 600'

TUG NAME_____

	DATE	DNR PERMIT #	BARGE NAME	BEGIN DUMPING		END DUMPING		VOLUME (CU. YD.)	DESCRIBE FLOATABLES REMOVED	TIME LEFT SITE	SKIPPER'S SIGNATURE
				TIME	BEARING AND RANGE (FROM CENTER OF SITE)	TIME	BEARING AND RANGE (FROM CENTER OF SITE)				
1.											
2.											
3.											

COAST GUARD DISPOSAL SITE USE LOG (EXAMPLE)

DISPOSAL SITE_____

TUG NAME_____

	DATE	DNR PERMIT #	BARGE NAME	TIME		ON SITE DURING DISPOSAL YES?/NO	LOCATION OF DISPOSAL IF OFF SITE BEARING AND RANGE FROM CENTER	SIGNATURE
				BEGIN DUMPING	END DUMPING			
1.								
2.								
3.								

EXHIBIT G

SAMPLE FORMAT
DREDGING SITE INSPECTION PLAN

1. Project Sponsor
   Name _____

   Address _____

   _____

   Contact Person _____

   Phone (day) _____
   (night) _____

2. Project Description
   Name of Project _____

   Corps # _____

   Location ____Sec. ____Twp. _____ Range

   Latitude _____

   Longitude _____

   Attach a plan and profile of the project site showing area to be dredged.

   Total volume to be dredged _____ (cubic yards)

3. Character of Sediment

   Are all materials suitable for open-water, unconfined disposal? ____Yes ____No
   If not, attach plan and profile maps showing location and volume of materials which are unsuitable for open-water disposal. Describe where these materials will be sent and method of transport.

4. Presence of Debris

   Does visual inspection of dredging site indicate potential for debris in dredged material? ____Yes ____No
   If yes, attach description of amount and disposition of debris.

5. Inspection of Dredging Operation (explain frequency and personnel responsible for inspecting dredging)

EXHIBIT H
CORRESPONDENCE WITH THE COAST GUARD

US Department of Transportation
United States Coast Guard

Commander
Thirteenth Coast Guard District

915 Second Avenue
Seattle, WA 98174-1067
Staff Symbol: (oan)
Phone: (206) 442-5864

16500
June 10, 1986

Mr. Steve Tilley
Assistant Division Manager
Aquatic Lands Division
Washington State Dept. of Natural Resources
Olympia, WA 98504

Dear Mr. Tilley:

In reply to your letter of June 3, 1986, the Coast Guard would be able to establish lighted radar reflective buoys to mark dredge disposal areas in Puget Sound. These buoys would be established on a reimbursable basis in accordance with current regulations. The estimated cost to establish each buoy is $4,023.00 figured as follows:

Vessel time: est. 2 hours to establish each buoy at $669.00 per hour	$1,480.00
Buoy Preparation Cost	1,110.00
Equipment charges	377.00
Monthly Servicing ($88.00 per month)	1,056.00

The annual cost to maintain each buoy on station for years two and four would be $2,102.00 based on an estimate of one hour of vessel time to service the buoy. The cost for years three and five would be slightly higher, $2,771.00, based on an average of two hours to perform a mooring inspection. If the buoy is in deep water (over 200 feet) mooring inspection would be performed every ten years and the cost of years three and five would be the same as year two. Buoys are normally replaced every six years, starting the billing cycle over again.

The Coast Guard checks the position of buoys during every visit. Visits are scheduled annually. If you require the positions to be checked more frequently, we would have to charge you the hourly rate for the type of vessel performing the check.

Until we know the specific sites we can not determine the watch circle of the buoys or if additional survey work is required. In answer to your other questions, the watch circle would normally be an ellipse aligned in the direction of the flood and ebb currents. No permit would be required for the Coast Guard to establish these buoys. The decision to establish a buoy at your Duwamish site would have to be made by you.

If you have any further questions, please contact LT Stephenson of my staff.

Sincerely

T. M. NUTTING
Captain, U. S. Coast Guard
Chief, Aids to Navigation Branch
By direction of the District Commander

WASHINGTON STATE DEPARTMENT OF
Natural Resources

BRIAN BOYLE
Commissioner of Public Lands

OLYMPIA, WA 98504

March 10, 1987

Captain T.M. Nutting
Chief, Aids to Navigation Branch
c/o Commander, Thirteenth Coast Guard District
915 Second Ave.
Seattle, WA 98174-1067

Dear Captain Nutting:

Last June, I wrote and asked you about the possibility of placing buoys to mark open-water dredged material disposal sites in Commencement Bay, Elliott Bay and Port Gardner. In your June 10, 1986 letter, you agreed that the Coast Guard would place and maintain buoys for the PSDDA open-water disposal sites. The cost was estimated at $4,023.00 for installation and first year maintenance and $2,102 for subsequent annual maintenance in deep water. However, Lt. Stephenson later told me informally that buoys would not be allowed in Commencement or Elliott Bays due to conflicts with navigation. He said a decision on Port Gardner could not be made due to questions about the Navy Homeport project.

I understand that the mechanics of the Navy's use of the confined disposal site are fairly well defined (subject to permit approval). This would involve use of a hydraulic pipeline from the harbor to the Navy disposal site over the period of a few years. The Navy site is approximately 3,000 feet, center to center, from the PSDDA preferred unconfined, open-water disposal site in Port Gardner.

We are assuming that installation of a buoy at the PSDDA Port Gardner site will not be a significant navigational obstruction either during or after the Navy project and that you will approve installation of our buoy. The location of the buoy will be at Latitude 47 degrees 58.86 minutes and Longitude 122 degrees 16.67 minutes. This is slightly different from the location I gave you last summer. The depth at this location is about 400 feet.

Would you please review our proposal for Coast Guard placement and maintenance of a buoy at the Port Gardner site and let me know if our understandings are accurate? I would also like to know what steps

would need to be taken to formalize an agreement between our agencies for buoy placement and maintenance. I would like to hear from you by April 1 so we can proceed with planning. Thank you for your cooperation.

Sincerely,

Steve Tilley

Steve Tilley, Assistant Division Manager
Division of Aquatic Lands
206/586-6375

c: Frank Urabeck
John DeMeyer
Dave Jamison

pscg

U.S. Department of Transportation
United States Coast Guard

Commander
Thirteenth Coast Guard District

915 Second Avenue
Seattle, WA 98174-1067
Staff Symbol: (oan)
Phone: (206) 442-5864

16500
March 20, 1987

Mr. Steve Tilley
Assistant Division Manager
Division of Aquatic Lands
Washington State Department of Natural Resources
Olympia, Washington 98504

Dear Mr. Tilley:

Based on your letter of March 10, 1987 we have re-evaluated our decision on the establishment of a buoy in Port Gardner to mark the dredge disposal area. Upon the completion of a formal agreement for reimbursement of associated costs we will establish this buoy per your request.

In order to establish a formal agreement between the Coast Guard and the State of Washington we will need to know when you need the buoy established and how often you require the position of the buoy to be checked. Normally we check the position of a buoy every year; a more frequent schedule will raise the annual fee. Once we have this information from you we will draft a proposed agreement for your approval.

Sincerely,

R. J. PARSONS
Commander, U. S. Coast Guard
Chief, Aids to Navigation Branch
By direction of the District Commander

EXHIBIT I

ENVIRONMENTAL MONITORING PLAN FOR UNCONFINED, OPEN-WATER, DREDGED MATERIAL DISPOSAL SITES

PHASE I AREA - CENTRAL PUGET SOUND

This Environmental Monitoring Plan was prepared with participation from all Work Groups of the Puget Sound Dredged Disposal Analysis. Significant contributions were made by the following staff:

Keith Phillips, Seattle District, U.S. Army Corps of Engineers

Dr. Mike Johns, Tetra Tech, Inc.

Dr. David Jamison, Washington Department of Natural Resources

Frank Urabeck, Seattle District, U.S. Army Corps of Engineers

David Kendall, Seattle District, U.S. Army Corps of Engineers

June, 1988

ABSTRACT

This document presents an environmental monitoring plan for the Puget Sound Dredged Disposal Analysis (PSDDA) Phase I unconfined, open-water disposal sites for dredged material. The Phase I sites include one each in Commencement Bay, Elliott Bay and Port Gardner. The monitoring plan is designed to verify that no unacceptable adverse effects have occurred within or beyond the disposal site and to assure that dredged material disposed at the sites remains within the disposal site boundary.

Three types of monitoring efforts are described, including a baseline survey of the sites to establish conditions prior to initiation of disposal activity, as well as partial and full monitoring efforts which will be conducted following use of the site. Full monitoring is an intensive field evaluation of conditions within and beyond the disposal site boundary, while partial monitoring involves a less intensive monitoring effort. Partial monitoring will occur when disposal activity at the disposal sites is not great enough to warrant a full evaluation of area conditions. Partial monitoring will be sufficient to establish if unexpected conditions are developing due to dredged material disposal. Only partial monitoring will be used following the first 5 years of extensive monitoring if the monitoring data demonstrates that conditions within and outside the disposal sites do not exceed predicted conditions.

Parameters measured during monitoring include disposal site physical characteristics (mapping), chemical and toxicity analysis of the dredged material present on site, chemical reconnaissance outside the disposal site boundary, and determination of benthic abundance and bioaccumulation in benthic species located down-current from the disposal site. Disposal site physical characteristics (mapping) will establish the limits of dredged material spread, while the other parameters are intended to determine the chemical and toxicological properties of the material disposed at the open-water sites, and determine if dredged material is impacting resources outside the disposal site boundary.

In addition to presenting a general monitoring plan for all three Phase I sites, site-specific aspects of the plan are also presented. Site-specific adaptations are needed because of topographic features of the site (Elliott Bay site) and because of special considerations associated with the proximity of other contaminant sources to the disposal sites.

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1. INTRODUCTION

The Puget Sound Dredged Disposal Analysis (PSDDA) is a 4-year study of dredged material disposal in Puget Sound initiated in April 1985. The study is being conducted jointly by the Corps of Engineers (Seattle District), Environmental Protection Agency (EPA), and the Washington Departments of Natural Resources and Ecology. PSDDA is being conducted in two phases (each about 3 years in length): Phase I covers central Puget Sound and Phase II (initiated in April 1986) covers south and north Puget Sound.

The objectives of PSDDA are to locate sites in Puget Sound for unconfined, open-water disposal of dredged material, define evaluation procedures for determining when dredged material is acceptable for discharge at these sites, and prepare site management plans (including permit and monitoring requirements). Responsibility for accomplishing these three objectives was assigned to three interagency work groups (Disposal Site Work Group (DSWG), Evaluation Procedures Work Group (EPWG), and Management Plan Work Group (MPWG)), who work under the direction of the PSDDA Study Director. This Exhibit describes the environmental monitoring plan for the Phase I study area (central Puget Sound).

All work groups contributed to the development of the Phase I monitoring plan. DSWG and EPWG determined the environmental monitoring requirements, with DSWG focusing on requirements for evaluating physical placement and effects, and EPWG placing emphasis on requirements for evaluating chemical effects of dredged material disposal. MPWG addressed plan funding and implementation (see Section 7 of Part II of the Management Plan Technical Appendix).

This document describes the environmental monitoring plan (including baseline conditions that must be established prior to initiation of disposal activity) for the PSDDA Phase I (central Puget Sound) preferred disposal sites. The monitoring plan is expected to be implemented in the spring of 1988 when baseline studies would be accomplished. This would allow the new central Puget Sound sites to be available during the fall of 1988.

The primary functions of the monitoring plan are to ensure compliance with the Section 404(b)(1) guidelines and to field verify the PSDDA predictions of site conditions following disposal. Moreover, monitoring will provide the data to allow direct response to agency and public concerns regarding site conditions and environmental impacts. Finally, environmental monitoring data forms the basis for the annual review of the need for changes in the evaluation procedures.

The monitoring plan presented in this report was developed in a six-step process, taking into account disposal site characteristics and the dredged material that will be allowed for disposal at the open-water sites. Development of the plan proceeded from a general consideration of potential impacts of dredged material disposal at the open-water sites to detailing of site-specific monitoring programs and data interpretation guidelines. Also included is an estimate of costs of conducting the monitoring plan. Steps taken in developing the plan were:

1. Identification of concerns that warrant monitoring (Section 2).

2. Development of testable hypotheses to address monitoring concerns (Section 3).
3. Design of a general monitoring program (types of data to be collected, tools

used to collect data, frequency of collection, etc.) which will gather sufficient data to test the hypotheses (Section 4).

4. Definition of site-specific monitoring requirements to address the effects of concern identified in step 1 (Section 5).

5. Development of a site management strategy and data interpretation guidelines (Section 6).

6. Determination of costs associated with the monitoring plan (Section 7).

As new information is developed during the PSDDA monitoring program, the Puget Sound Water Quality Authority ambient monitoring program, and other studies, both here and in other parts of the country, elements of the monitoring program may be changed to reflect the most appropriate technique.

2. IDENTIFICATION OF CONCERNS THAT WARRANT MONITORING

The quality of dredged material that will be acceptable for disposal at the preferred PSDDA open-water sites influences monitoring requirements. "Site condition II" has been selected as the preferred biological effects condition for site management at the unconfined, open-water disposal sites in central Puget Sound (see PSDDA Phase I Management Plan Report (MPR) and Final Environmental Impact Statement (FEIS), June 1988). By definition, site condition II could result in "minor adverse effects, due to chemicals of concern in dredged material, on biological resources" at the disposal site (EPTA, 1988). Minor effects are defined as potential sublethal chronic effects, but no significant acute toxicity within the site, or its dilution zone (see MPR management Chapter 7). Because only acceptable sediments will be discharged at the disposal sites, the aggregate condition of each site is expected to be substantially better than allowed under the proposed management condition.

This section discusses potential pathways of exposure to aquatic species due to dredged material disposal and the biological resources of interest. Finally, those pathway/biological resource combinations that warrant monitoring at the open-water site are identified.

2.1 Pathways of Exposure

For the preferred Phase I disposal sites, nearly all of the dredged material released from a barge is expected to settle to the bottom within the confines of the disposal sites (Bokuniewicz, 1985; Truitt, 1986). The settled dredged material represents the major exposure pathway for organisms that may visit the site. However, some minor losses of material are expected to occur during and after disposal that can be potential pathways of exposure to biological resources beyond the disposal site boundaries (Figure 1). During disposal operations, fine particles and organic matter can be released into and accumulate in the sea-surface microlayer. Also, as discharged dredged material descends through the water column, a portion of the dredged material will entrain water and particles can be "stripped away" (figure 1). Upon impact, dredged material, as well as previously settled material, will become suspended due to the surge effect of impact (Tsai and Proni, 1985; Trawle and Johnson, 1986). This material can become incorporated into the nepheloid layer and be transported off site, depending on bottom currents (see

EPTA, 1988 for a further discussion on potential pathways of exposure). Movement of resuspended material off the preferred PSDDA disposal sites, however, is expected to be minor since all sites are characterized as having weak (less than 25 cm/sec) current regimes (DSS TA, 1988).

Of these potential pathways, exposure from settled material (dredged material within the disposal site) and exposure to that portion of dredged material which becomes incorporated into the nepheloid are considered by PSDDA to be the potentially significant sources of exposure to biological resources (PSDDA MPR/FEIS 1988). Consequently, they are the only exposure pathways that will be monitored at the open-water disposal sites. The water column pathways (contributions to sea-surface microlayer and material stripped away from the descending mass) are short-term in nature and, because of the low chemical concentrations present in material allowed for unconfined, open-water disposal, do not require environmental monitoring. Potential impacts to the water column from disposal operations will only be transient, resulting from temporary changes in suspended solids levels and small increases in levels of sediment-bound chemicals which are not expected to be significant (Baumgartner et al. 1978; MPR and FEIS, 1988).

2.2 Biological Resources

Three biological resource groups are of interest in the PSDDA monitoring plan: (a) on-site benthic infauna communities, (b) benthic biological resources (including infauna and important biological communities) located off the disposal site, and (c) mobile shellfish and fish species which might use the surrounding areas, and occasionally the disposal mound as feeding habitat following disposal operations.

On-site benthic communities are expected to be buried to varying degrees following disposal of dredged material. For those organisms surviving burial, exposure to chemicals associated with the dredged material is possible (PSDDA MPR and FEIS, 1988). Organisms that recolonize the disposal sites could also experience exposure to chemicals in the disposed dredged material. Full recolonization of the disposal sites, however, is not expected during active use of the site since continued disposal operations will periodically impact parts of each site. Once disposal ceases, the sites are expected to be rapidly recolonized (Dexter et al. 1984; Rhoads and Germano, 1986). Partial recolonization will occur each year during periods when dredging operations are restricted (due to fisheries closures); however, most of these recolonizers may be buried once disposal operations resume. Permanent recolonization of the sites is expected once the sites are no longer used for the disposal of dredged material.

While not considered likely, benthic communities located near a disposal site could be impacted if suspended dredged material is incorporated into the nepheloid layer and transported by tidal currents from the site. Impacts to offsite benthic communities would depend primarily on whether the material contains chemicals of sufficient concentration to affect biological resources. Impacts to offsite biological resources could result from bioaccumulation of chemicals associated with dredged material.

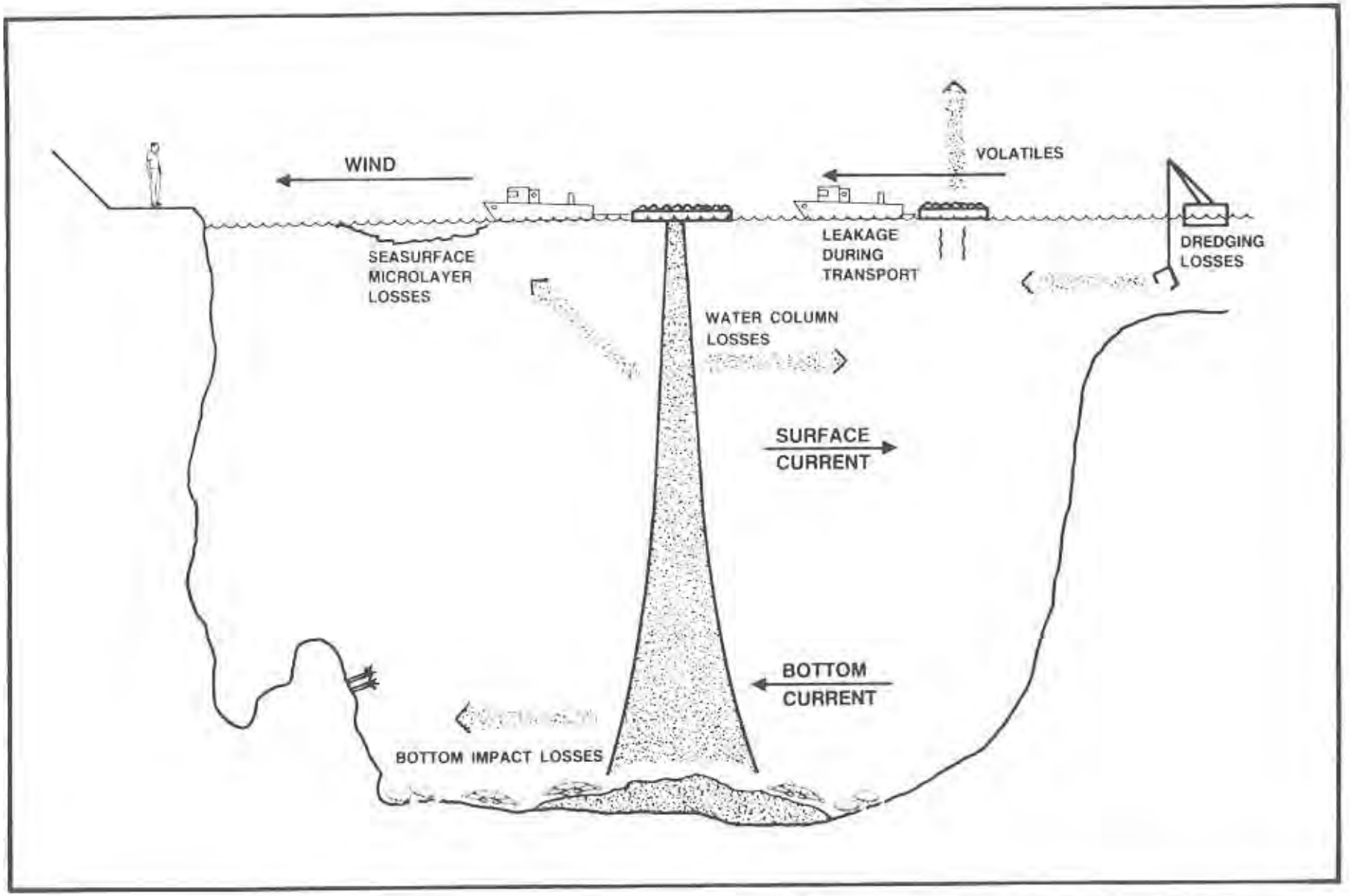


Figure 1. Dredging and disposal processes.

Mobile species might accumulate some chemicals present at the site through the food chain if the disposal site were recolonized with benthic species that are utilized as food by mobile predators. However, as stated above, complete recolonization of the disposal sites is not expected to occur during active use of the sites. In addition, the preferred disposal sites are located in areas determined from field studies to contain relatively low food habitat resources (DSS TA, 1988). Incomplete recolonization, which may occur during low periods of disposal activity can still act as a pathway for bioaccumulation in mobile species. Direct contact with sediment disposed at the mound could also act as a pathway of bioaccumulation. Even though there may be recovery between disposal episodes at relatively low use sites, such as Port Gardner and Commencement Bay, and direct contact of some mobile species with sediments at all the disposal sites, impacts to mobile species are not expected to be significant (PSDDA MPR and FEIS, 1988).

2.3 Identified Questions That Warrant Monitoring

Based on the above discussion, the monitoring plan has been designed to address three questions that directly relate to verification that unacceptable chemical and physical impacts have not resulted from dredged material disposal. These questions can be stated as follows:

Question No. 1: Does the deposited dredged material stay on-site?

Question No. 2: Is the biological effects condition for site management (site condition II) exceeded at the site due to dredged material disposal?

Question No. 3: Are unacceptable adverse effects, due to dredged material disposal, occurring to biological resources offsite?

As written, question No. 1 presumes that disposal of material is occurring within the disposal zone. If dredged material appears outside the disposal site, due to offsite dumping practices, then agency action will be taken against disposal barge operators not complying with site use regulations. The types of action taken (including remedial action) are discussed in section II.4 of MPTA (1988).

3. DEVELOPMENT OF TESTABLE HYPOTHESES TO ADDRESS MONITORING QUESTIONS

In order to clearly evaluate the questions listed above, they were further defined in terms that allow development of sampling programs. To accomplish this, testable null hypotheses were developed for each concern. A null hypothesis identifies the specific effect to be monitored and defines the level that is considered to warrant additional site investigation and/or management. Use of null hypotheses allows the environmental questions to be framed in such a way that they can be tested using data gathered during monitoring and, more importantly, allows for a clear interpretation of the monitoring results. If null hypotheses are not used or are not adequately framed, it is likely that the monitoring outcome would be ambiguous and result in uncertainty as to how well the objectives of the plan are being met.

When developing null hypotheses, three considerations need to be made: (1) the space (on-site/offsite) and (2) time (yearly or greater) scales on which differences are to be observed, and (3) the magnitude of change that must be observed in order to

establish conditions of concern (Segar and Stamman, 1986). For the PSDDA monitoring plan, six hypotheses were developed to address the three questions for biological resources on and off the disposal site. They are:

Hypothesis No. 1: Dredged material stays within the disposal site boundary (Addresses issues in question No. 1).

Hypothesis No. 2: Chemical concentrations at the offsite monitoring stations do not measurably increase over time following initiation of disposal activities due to dredged material disposal (Addresses issues in question No. 1).

Hypothesis No. 3: Sediment chemical concentrations at the on-site monitoring stations do not exceed the chemical concentrations associated with site condition II chemical disposal guidelines due to dredged material disposal (Addresses issues in question No. 1).

Hypothesis No. 4: Sediment toxicity within the disposal site does not exceed the site condition II biological response disposal guidelines due to dredged material disposal (Addresses issues in question No. 2).

Hypothesis No. 5: No significant increase has occurred in the chemical body burden of benthic infaunal species collected in the vicinity (down-current) of the disposal site due to dredged material disposal. (Addresses issues in question No. 3).

Hypothesis No. 6: No significant decrease in the abundance of dominant benthic infaunal species has occurred in the vicinity (down-current) of the disposal site due to dredged material disposal. (Addresses issues in question No. 3).

Hypothesis No. 1 presumes that disposal operations have been in compliance with permit requirements that dumping can only occur once correctly positioned within the disposal zone. If dredged material is found offsite then intensive sampling around the material found offsite must be conducted to determine if material is due to a failure to comply with permit requirements (see section 6.2 for discussion of data interpretation for the appearance of dredged material beyond the disposal site boundaries).

No conditions of concern are considered to exist within and beyond the disposal sites if the monitoring data indicate that the statements framed in the null hypotheses 1 through 6 are correct. Conditions of concern due to dredged material disposal can be considered to possibly exist if data from a monitoring effort do not support the hypotheses as stated. If the monitoring data indicate that the magnitude of change observed is great enough to indicate conditions of concern (e.g., guideline values are exceeded for hypotheses No. 2, 3 or 4, or significant increase in tissue body burdens, or significant decreases in abundance of dominant benthic infauna occur), then the null hypothesis is "rejected." In such a case, best professional judgment of the site managers must be used to determine appropriate actions to take. The triggers used to establish conditions of concern are presented in section 6.2.

4. GENERAL MONITORING PLAN

The monitoring plan for the PSDDA disposal sites focuses the majority of effort during the first 5 years of site use. This allows early consideration of changes in the dredged material management plan which may include adjustments in the dredged material evaluation procedures or in disposal site use requirements. Extensive monitoring during the first 5 years will allow future monitoring effort to be reduced to periodic checking of the sites providing the monitoring data demonstrates that conditions within and beyond the disposal site are not different from the predicted conditions.

The monitoring plan consists of: a baseline survey and partial and full monitoring studies (table 1). The purpose of the baseline is to document conditions existing at and around the Phase I site and at disposal site benchmark areas prior to the initiation of disposal activity. Following use of the sites, partial or full monitoring studies are conducted depending on the volume of material disposed at the site. Partial monitoring provides a minimum number of measurements at the disposal site and site perimeter, sufficient to determine whether material being disposed results in exceeding site condition II and whether material is moving offsite. Partial monitoring will be conducted when dredged material volumes are insufficient to warrant a full monitoring effort. Partial monitoring will address null hypotheses No. 1, 3 and 4.

Once enough dredged material has been disposed, full monitoring will be conducted to determine if site condition II has been exceeded on-site and whether any unacceptable offsite biological impacts have occurred due to dredged material disposal. Data gathered during full monitoring will address all six hypotheses.

Key concepts to be used in the analysis of field data include:

- Comparison of data to established guideline values (to assure that dredged material allowed for disposal at the open-water sites does not exceed the site condition II disposal guidelines).
- Measurement of gradients down-current from the disposal site (to evaluate movement of material offsite and determine if down-current effects are due to dredged material from the disposal site).
- Comparison of monitoring data to baseline conditions (to determine if changes are occurring).
- Comparison of monitoring station data to data from benchmark stations (to assure that changes seen over time at the monitoring stations are due to dredged material disposal and not due to other chemical sources or due to natural variation).

Conditions within the disposal site (as determined by sediment chemistry and bioassays) will be compared to PSDDA disposal guideline values to determine whether they exceed site condition II levels (see section 6.2 for discussion of guideline values). On-site stations, which will be used to collect sediment for bulk chemistry and bioassays, will not be fixed in space for the life of the monitoring program.

TABLE 1

RELATIONSHIP OF MONITORING QUESTIONS
TO HYPOTHESES, MONITORING TYPES, PARAMETERS, AND TECHNIQUES
USED IN PHASE I ENVIRONMENTAL MONITORING PLAN

	Monitoring Questions		
	Question 1: Material Stays Onsite?	Question 2: Site Condition II Not Exceeded?	Question 3: Biological Resources Unaffected Offsite?
Hypotheses:			
No. 1: Sediment Movement Offsite	X		
No. 2: Offsite Sediment Chemistry	X		
No. 3: Onsite Sediment Chemistry		X	
No. 4: Sediment Toxicity		X	
No. 5: Infaunal Body Burden			X
No. 6: Infaunal Abundance			X
Types of Monitoring:			
Baseline	X	X	X
Partial Monitoring	X	X	
Full Monitoring	X	X	X
Parameter:			
Physical Mapping	X		
Sediment Chemistry-Onsite		X	
-Offsite	X		
Sediment Bioassay-Onsite		X	
Infaunal Body Burden			X
Infaunal Abundance			X
Techniques			
Box Cores		X	X
Sidescan Sonar	X		
SVPS	X		

Rather, they will be determined for each monitoring event based on a mapping effort which will identify the physical configuration and limits of disposed dredged material spread within the disposal site (e.g., the stations will "float" within the disposal site).

In addition to the measurement of chemical conditions within the disposal site, sediment chemistry will also be determined for material collected around the perimeter of the disposal site boundary. For the purposes of the PSDDA monitoring plan, the perimeter is defined as the area within 1/8 mile of the disposal site boundary. As with stations within the disposal site boundary, stations in the perimeter will be "floating" and will be determined by the mapping effort during the first post-disposal monitoring effort. Sediment chemistry concentrations collected at the perimeter stations will be compared to baseline concentration levels (see section 6.2 for data interpretation guidelines).

Unlike the on-site and perimeter chemistry stations, gradient measurements will be made at "fixed" stations down-current from the disposal site. As distinguished from floating stations, fixed stations remain in the same location throughout the monitoring program and allow for comparison of monitoring data to baseline data. Data collected from these stations will be used to establish if dredged material is impacting offsite biological resources.

If significant changes are observed at any of the monitoring stations relative to baseline values (i.e., a null hypothesis is rejected), then changes in conditions at the monitoring stations will be compared to nearby off-site benchmark areas (i.e., stations which lie outside the probable influence of the disposal site) to evaluate whether the observed changes are the result of dredged material disposal or are due to contaminant sources located outside the disposal site, or due to natural variation. Typically, there are two off-site benchmark stations: one away from any potential sources (which acts as a measure of natural variation) and one that is situated between the disposal site and possible contaminant sources (which acts as a measure of chemicals coming into the area of the disposal site). As far as practicable, the off-site benchmark stations will be similar to the biological monitoring stations including depth, substrate type, benthic species composition, and species abundance. In general, samples from the off-site benchmark stations would be archived and analyzed only if changes at any of the monitoring stations require a comparison to off-site benchmark stations. (The exception to this is the need to conduct benchmark station bioassays using fresh sediments; see 4.1 below.)

4.1 Monitoring Parameters and Techniques

This section presents the monitoring parameters and the field techniques associated with each parameter. In all three monitoring types (baseline, partial, and full) physical, chemical, and biological data will be gathered (table 1). The main difference between the monitoring types is sampling intensity and, in some cases, the number of parameters for which data are collected. At all stations, position will be determined and maintained using a microwave navigation system (e.g., Trisponda, Mini-Ranger). To ensure accuracy of the positioning system, it is recommended that four remote stations (located on shore) be used.

4.1.1 Physical Mapping

The purpose of physical measurements is to determine the stability of dredged material placed at the site since the baseline survey or since the last monitoring event. This is done to test hypothesis No. 1 (whether significant offsite movement has occurred). This will be accomplished through mapping the disposal site and vicinity up to the perimeter line located 1/8 mile beyond the site boundary. Mapping the extent of bottom covered by dredged material disposal will provide data on question No. 1. The mapping effort undertaken during the baseline will also provide a means of establishing "floating" stations to be occupied during partial and full monitoring efforts.

An appropriate variable frequency sidescan sonar will be used to determine, if possible, the location and general spread of dredged material. This instrument will be particularly effective if material within the disposal site forms mounds or is substantially different from ambient sediments (e.g., different grain size or type). However, because of the similarity of sediments that are expected to be disposed compared to sediments native to the disposal sites, and the fact that monitoring will not take place until some months after disposal, it is not certain whether sidescan sonar will prove useful in providing an image of the central portion of the disposal mound. Sidescan sonar will be tried in this monitoring effort since it is a cost effective means of mapping the disposal mound under certain conditions (Morton et al. 1984). If the sidescan sonar does not prove useful another approach, possibly using an echo sounder, may be employed to gather supplemental data on mound configuration (Morton, 1983).

In addition to using sidescan sonar to map the disposal site, the location, extent of dredged material spread, and the depth of dredged material on the flanks of the disposal mounds relative to the site boundary will be determined primarily through the use of a sediment vertical profiling system (SVPS) such as described in Rhoads and Germano, 1982. The SVPS system provides a photograph of the sediment cross-section to depths up to 20 cm from which some physical characteristics can be assessed. It is possible to differentiate sediments from recent and previous disposal events using the SVPS system (Rhoads and Germano, 1986). Data from the SVPS will be used to establish the direction of movement assuming random dumping has occurred within the surface disposal zone and that no significant mounding occurs within the impact zone. The SVPS system will be additionally equipped with a 35 mm camera which will take a plan view of the sampling stations.

Mapping effort during the baseline will primarily focus on the disposal site (to characterize the sediments prior to disposal activity), although some sampling will take place offsite, in the direction of expected net current flow (figure 2). SVPS and sidescan sonar mapping during partial and full monitoring will focus on the perimeter line of the disposal site (to determine if dredged material has left the site and reached the perimeter line) and in the direction of the net current flow (figure 3). Based on sidescan and SVPS surveys of the disposal site and surrounding area, on-site and offsite chemical monitoring stations will be located for the partial and full monitoring efforts.

4.1.2 On-site Sediment Conditions

The purpose of on-site chemical measurements is to assess the concentration of chemicals in the sediment as a check against predisposal characterization of the dredged material (addresses hypothesis No. 3). Also, bioassays will be conducted with samples of these same sediments to determine if the dredged material disposed at the site is acutely toxic and, therefore, exceeds site condition II (addresses hypothesis No. 4). In addition to providing information on the disposed dredged material, chemical and bioassay monitoring of the disposal site will provide feedback on whether the procedures used to evaluate the dredged material placed at the site are sufficient to characterize the material. The bioassays are a cost effective measure of the biological effects of concern within the disposal site.

The chemicals of concern that will be analyzed in on-site sediment samples are the same as those used to evaluate sediment for suitability for unconfined, open-water disposal (table 2). The only addition to this list is tributyltin (TBT), which will be analyzed only during the baseline studies. Sediment is being analyzed for TBT to establish baseline concentrations of this chemical prior to initiation of disposal operations. This chemical is not currently one of the chemicals of concern for which proposed dredged material is assayed; however, evidence exists (outside the Puget Sound area) to suggest that it might be present in some sediments (especially material from marinas), and can potentially have significant impacts on biological resources (Cardwell and Sheldon, 1986). A decision on whether to include TBT as part of the chemicals routinely analyzed in dredged material is expected to be made during PSDDA Phase II studies.

Chemical samples will be collected from sediment taken by box core from within the disposal site boundary. One composite sample (composed of subsamples from six box cores) will be analyzed for chemicals of concern at each chemical station. The top 10 cm of material from a
cored sample taken from the box core will be used in compositing the sample. This depth represents an approximate zone (0 - 10 cm) of major biological activity, and the depth to which chemical contamination would likely be found (through biological reworking of the surface sediments) following recolonization of the disposal mound. Sampling to a depth of 10 cm will also provide an integrated sample of the past disposal activity, considering that the disposal mound will consist of sediments from a number of dredging projects.

Quality control and quality assurance (QA/QC) requirements and procedures for chemical analysis outlined by the Puget Sound Estuary Program will be followed in the PSDDA monitoring effort. A portion of each composite will be archived for possible future analysis.

In addition to measurement of chemical concentrations, bioassays will be conducted on the composited sediment samples taken within the boundary of the disposal site. The bioassays will serve to verify that material being disposed at the sites is consistent with the site management condition. These bioassays are an indirect assessment of biological effects within the disposal site. Three bioassays will be conducted on the composited sediment samples including the amphipod (Swartz et al. 1985), the oyster larval (Chapman and Morgan, 1983), and the Microtox (Schiewe et al. 1985) tests. These are the same three bioassays employed in the evaluation procedures

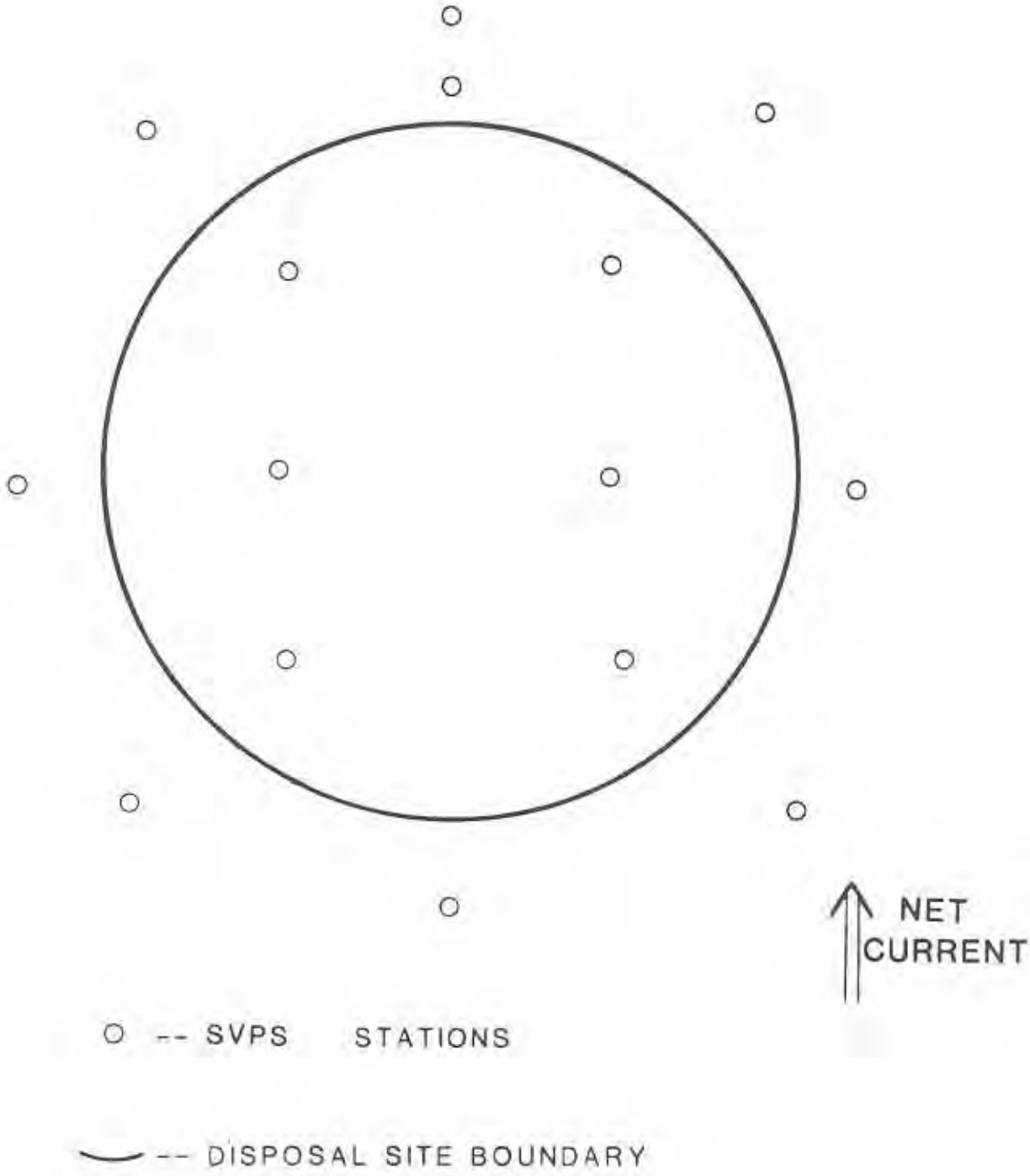
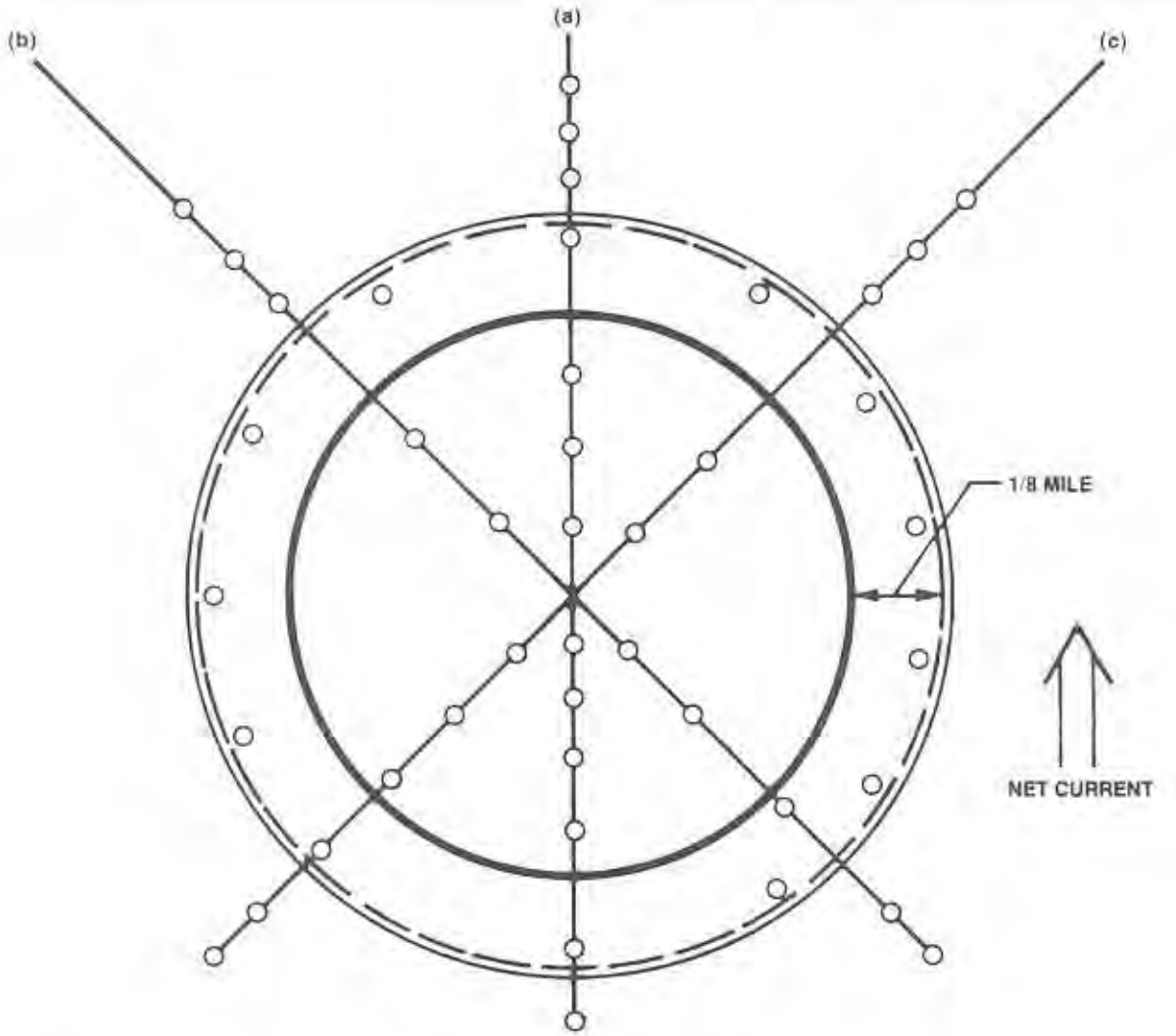


FIGURE: 2 SVPS STATIONS FOR BASELINE STUDY
(15 STATIONS, PLUS 20%REPLICATION)



○ SVPS STATION

DISPOSAL SITE BOUNDARY

SVPS TRANSECT LINE

DISPOSAL SITE PERIMETER

SVPC STATIONS WILL BE SAMPLED AS FOLLOWS: A CIRCLE ALONG PERIMETER LINE AND PRIMARY TRANSECT (a) THRU SUSPECTED DIRECTION OF DREDGED MATERIAL MOVEMENT WILL BE SAMPLED FIRST. BASED ON RESULTS, TWO OTHER TRANSECTS (b and c) WILL BE LOCATED AND SAMPLED.

Figure 3. SVPS stations for partial and full monitoring (45 stations, plus 20% replication).

for determining the suitability of dredged material for unconfined, open-water disposal. Where appropriate, the protocols used in these bioassays will follow those recommended by PSEP (Tetra Tech, 1986a). Interpretive guidelines for evaluating the bioassay results are presented in section 6.2.

4.1.3 Perimeter Sediment Conditions

The purpose of offsite chemical measurements is to assess the concentration of chemicals in sediments beyond the disposal site boundary (addresses issues in hypothesis No. 2). Chemical analyses will be conducted on sediment collected from approximately 1/8 of a mile from the site boundary (identified as a perimeter line). The chemicals analyzed will be the same as those measured at the on-site chemical stations. Sediment samples will be collected using a box core and the number of subsamples comprising a chemical station composite will be the same as that described for on-site sediment chemical analysis.

Unlike the sediment samples taken on-site, only the upper 2 cm of sediment will be taken for chemical analysis for offsite chemical analysis, according to PSEP protocols.

4.1.4 Offsite Biological Conditions

The purpose of offsite biological measurements is to document the possible responses of benthic organisms down-current from the disposal site boundary to the presence of chemicals in their environment that may have been derived from dredged material disposal (addresses hypotheses No. 6). These measurements enable a further check for unanticipated dredged material effects beyond that possible to measure through sediment analysis alone. The parameters measured are chemical bioaccumulation and benthic infauna abundances. These data are then compared to baseline conditions to determine the significance of the chemical effect.

Bioaccumulation in benthic species will be determined at fixed offsite monitoring stations. At each station, two replicate samples will be taken for benthic (infaunal) tissue chemistry analysis. Only animals such as tube-dwelling worms and certain clams that either feed on suspended particulate matter or pump overlaying water containing suspended particles through their burrows will be collected. These animals, through their contact with suspended particulate matter, offer the best means of examining impacts of chemicals carried in the nepheloid layer. Sufficient box cores will be taken at each station to provide enough tissue for analysis. Animals will have any sediment in the gut and adhering to the outer body removed prior to chemical analysis.

Large bivalves, if present in the samples, will be the choice species to be analyzed. If they are not present, then a sample of another representative species (e.g., polychaetes, Holotheroids, etc.) will be chosen for analysis. For any given station, the same species will be analyzed throughout the monitoring program. The tissue residues will be analyzed for the chemicals presented in table 2, and QA/QC procedures outlined by PSEP will be followed where possible.

Benthic infaunal abundance will be used as a measure of offsite population response to disposal activity. Benthic abundance has been used in Puget Sound (Tetra Tech, 1986b; Long and Chapman, 1985) and other areas to measure the effects of

TABLE 2

CHEMICALS OF CONCERN

METALS:

Antimony	Arsenic
Cadmium	Copper
Lead	Mercury
Nickel	Silver
Zinc	Tributyltin 1/

ORGANICS:

Naphthalene	Acenaphthylene
Acenapthene	Fluorene
Phenanthrene	Anthracene
2-Methylnapthalene	Fluoranthene
Benzo(a)Anthracene	Chrysene
Benzofluoranthenes	Benzo(a)Pyrene
Indeno(1,2,3-c,d)Pryene	Dibenzo(a,h)Anthracene
Benzo(g,h,i)Perylene	1,2-Dichlorobenzene
1,3-Dichlorobenzene	1,4-Dichlorobenzene
1,2,4-Trichlorobenzene	Dimethyl Phthalate
Diethyl Phthalate	Di-N-Butyl Phthalate
Butyl Benzyl Phthlate	Bis (2-Ethylhexyl) Phthalate
Di-N-Octyl Phthalate	Phenol
2 Methylphenol	4 Methylphenol
2,4-Dimethyl Phenol	Pentachlorophenol
Benzyl Alcohol	Benzoic Acid
Dibenzofuran	Hexachlorobutadiene
Hexachloroethane	Pyrene
	Hexachlorobenzene
N-Nitrosodiphenylamine	Trichloroethene
Tetrachloroethene	Ethylbenzene
Total Xylenes	Total DDT's
Aldrin	Chlordane
Dieldrin	Heptachlor
Lindane (gamma-HCH)	Total PCB's

1/Tributyltin (TBT) will be measured during baseline only. PSDDA is currently evaluating the status of this chemical group in the dredged material evaluation procedures. A decision on whether to include measurement of TBT will be made during future years of monitoring. The protocols and QA/QC requirements for TBT will be established prior to baseline sampling.

pollutants on benthic communities. As with bioaccumulation, benthic abundance will be determined at both fixed offsite monitoring stations and at off-site benchmark stations. For each station, five replicate box corer samples will be taken for analysis of dominant benthic species abundances.

For each biological transect line (three stations along a gradient), eight SVPS samples (without replication) will be taken. For each off-site benchmark biological station, three SVPS samples (without replication) will be taken. These SVPS samples provide a qualitative amplification of the benthic community box corer samples, i.e., they provide an expanded view of benthic community condition along the transect lines and at the off-site benchmark stations.

A box corer will be used to collect sediment for the benthic abundance analysis. The box corer used will be capable of penetrating down to 50 cm within an unconsolidated bottom and capable of penetrating a compacted fine sand to a depth of at least 15 cm. An example of an appropriate device is the 0.06 square meter Gray-O'Hara box corer (Lunz and Kendall, 1982; Clarke, 1986). Sediment will be sieved through a 1.0 mm sieve, fixed with 10 percent seawater- buffered formalin and infaunal biomass estimates determined. Following this, total abundance of the dominant species for the entire sediment sample will be determined. Dominant species are considered those organisms whose abundance comprises 80 percent of the total number of individuals present in the samples.

In addition to collecting benthic organisms, sediment grain size, total organic carbon and depth of collection will be determined for each sample. Total abundance of the dominant species will be the primary indicator of off-site population effects (Pearson and Rosenberg, 1978).

4.1.5 Archiving

During monitoring, there will be a need to archive sediment and biological samples for possible future analysis. Archiving will be needed for samples collected for benthic abundance and tissue body burden analysis during the baseline effort, as well as for benchmark samples collected for sediment chemical analysis, benthic abundance, and tissue body burden analysis during full monitoring. The following section provides information on how samples should be archived for each of these parameters.

Sediment samples taken for future chemical analysis should be kept frozen until analysis. Storage of the sediment should be in appropriately cleaned glass containers or other suitable substitute. The sediment samples should be held at -20 degrees C until analyzed.

Samples to be stored for benthic infaunal abundance should be sieved (see Section 4.1.4 for appropriate sieve size to use) prior to archiving. Material remaining on the sieve should then be stained with a vital stain (to facilitate later sorting), fixed with formalin, and after a sufficient period of time to allow for penetration of the fixative, the samples should be stored in air tight glass or plastic jars containing preservative (either ethanol or isopropanol, with glycerin).

Animals to be taken for tissue body burden analysis should be collected during sediment sieving and washed clean of remaining debris. (Target species to be used in the tissue body burden analysis will be determined during the planning and conduct of

baseline monitoring. Species selection will give preference to larger animals for analysis.) The gut of the target species should be purged (by retaining the animals live in seawater, if possible) or cleaned of sediment. The samples should then be stored in cleaned glass containers and frozen at -20 degrees C until analyzed.

4.2 Monitoring Study Types

As mentioned earlier, three types of studies will take place within the PSDDA monitoring plan. They are: baseline surveys, partial monitoring studies, and full monitoring studies. Each study type requires that certain monitoring parameters be measured and that a given number of samples be collected. An overview of each type of monitoring type is given below.

4.2.1 Baseline

The baseline survey for each disposal site consists of measurement of the following parameters:

- Mapping the disposal site and gradient stations.
- On-site chemistry and bioassays.
- Chemistry stations along the perimeter line of the disposal site.
- Tissue body burden analysis and benthic abundance determinations for samples from the gradient stations.
- Chemistry and bioassays at the benchmark chemistry stations.
- Tissue body burden analysis and benthic abundance determinations for samples from benchmark biological stations.

Sampling requirements for the baseline are presented in table 3 and include a total of 153 SVPS stations, a complete sidescan sonar survey for each site, and a minimum of 473 box cores to collect sediment and benthic organisms for analyses. Each disposal site will be characterized through site mapping and determination of site sediment chemical concentrations and relative sediment toxicity.

Each site will be mapped based on eighteen SVPS stations and a complete sidescan sonar transect of the site. Predisposal status of the disposal site sediments (i.e., chemical concentrations and relative toxicity) will also be determined for each disposal site (figures 4 and 5). The number of sediment samples taken and the number of analyses conducted for each site is dependent, to some degree, on site-specific characteristics (table 4; see section 5.1 through 5.3 for a further explanation of site-specific sampling and analytical requirements).

In addition to characterizing the disposal sites, sediment at the 1/8 mile perimeter line surrounding each site will also be chemically characterized. Chemical characterization of sediments surrounding the disposal site allows for comparison to sediment samples taken after disposal activity begins and a determination of whether dredged material is moving beyond the site boundary providing that all disposal operations are made within the disposal zone.

Benthic organism samples from the down-current gradient stations will be collected during the baseline in order to determine predisposal tissue body burden levels and abundance of dominant infaunal species. Because of the uncertainty of the exact direction from the disposal site dredged material might travel, a series of gradient stations will be sampled covering the general direction of net current movement established through PSDDA site selection studies (DSS TA, 1988). This will be done for each disposal site. The number of gradient series sampled and their relative orientation to the axis of the disposal site differs for each site (see sections 5.1 through 5.3 for site-specific station locations).

The orientation of the gradient stations to the disposal site is based on available information concerning the probable direction of sediment transport from the sites, if in fact transport does take place (little or none is anticipated). Organisms collected from the gradient stations will not be immediately analyzed but rather will be archived for future analysis (table 3). During the first post-disposal monitoring effort at each site, net direction of sediment transport off the disposal site will be estimated using the results of the mapping effort. At that time, the gradient stations best representing the down-current direction will be analyzed. These data will then form the baseline information for the gradient stations for that particular site.

Finally, sediment samples will be collected from both benchmark chemistry and benchmark biological stations during the baseline. Samples collected from the benchmark chemistry stations include sufficient sediment to determine pre-disposal chemical concentrations and enough sediment to conduct bioassays to determine the relative toxicity of the sediment. Samples from the benchmark biological stations include collection of benthic organisms for determining abundance of dominant infaunal species and for determining tissue body burdens. Unlike the benthic samples collected for the gradient stations, samples for benthic abundance and tissue body burdens for benchmark stations will be analyzed as part of the baseline effort (table 4). The number of benchmark chemical and biological stations associated with each site is dependent on site-specific requirements (see sections 5.1 through 5.3 for a further explanation of site-specific sampling and analytical requirements).

4.2.2 Partial Monitoring

Partial monitoring will occur when the volume of material going to the disposal sites is not great enough to warrant full monitoring. It will also be employed at periodic times following the first 5 years of disposal activity, but only if results of the full monitoring effort indicate that dredged material behavior and effects are no greater than those predicted (e.g., no conditions of concern).

The partial monitoring effort for each disposal site consists of measurement of the following parameters:

- Mapping the disposal site and perimeter.
- On-site chemistry and bioassays.

TABLE 3. SAMPLING REQUIREMENTS FOR BASELINE

Monitoring Parameter	Disposal Site: Commencement Bay	Elliott Bay	Port Gardner	Total
Dredged Material Stability				
SVPS 2/	51	46	56	153
Sidescan Sonar	Complete Transects Of Site	Complete Transects of Site	Complete Transects of Site	Complete Transects of Site
On-site Sediment Conditions				
On-site Chemistry and Bioassay 3/	6	6	2	14
Perimeter Chemistry 4/	72	72	42	186
Off-site Biological Condition				
Benthic Abundance 5/	45 (45)1/	30 (30)1/	60 (60)1/	135 (135)1/
Benthic Body Burden 6/	18 (18)	12 (12)	24 (24)	44 (44)
Benchmark Stations				
Chemistry Stations				
Chemistry and Bioassay 4/	18	12	12	42
Biological Stations				
Benthic Abundance 6/	15	20	10	45
Benthic Burden 7/	6	8	4	18

1/Numbers in parentheses are samples to be archived for future analysis.
2/Number of SVPS samples taken. The number of samples includes 20 percent replication of selected stations.
3/Minimum number of box core samples required. Each box core will be subsampled (upper 10 cm) to provide sufficient sediment for chemical analytical requirements and to conduct the three bioassays.
4/Minimum number of box core samples required. Each box core will be sampled (upper 2 to provide sufficient sediment for analytical requirements.
5/Minimum number of box core samples required. All samples will be sieved, fixed in preservative and stored until the first full monitoring effort. At that time, those samples taken from the selected gradient stations will be analyzed.
6/Minimum number of box core samples required (see Footnote 5.)

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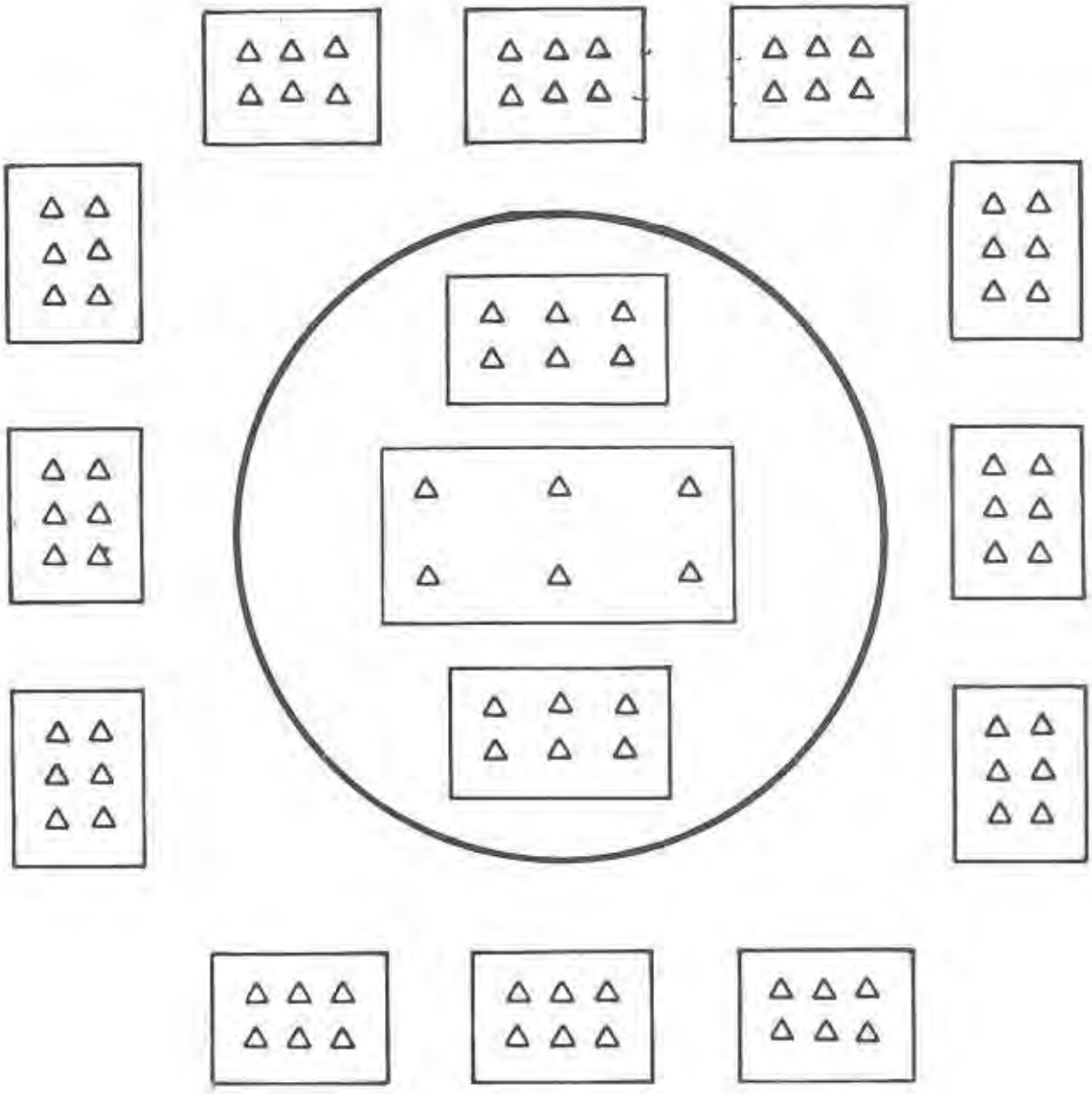

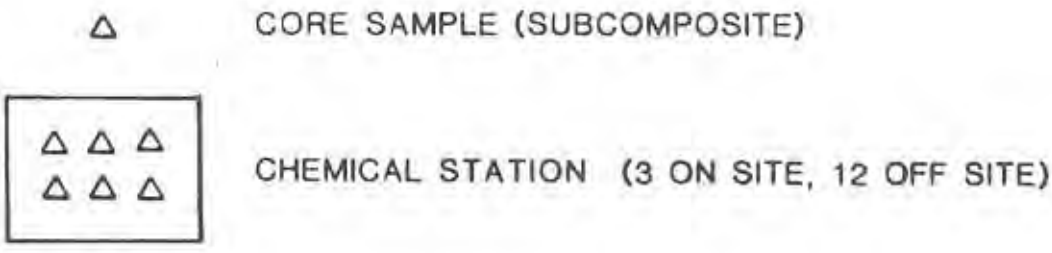

FIGURE: 4 BASELINE CHEMICAL STATIONS FOR ELLIOTT AND COMMENCEMENT BAYS DISPOSAL SITES

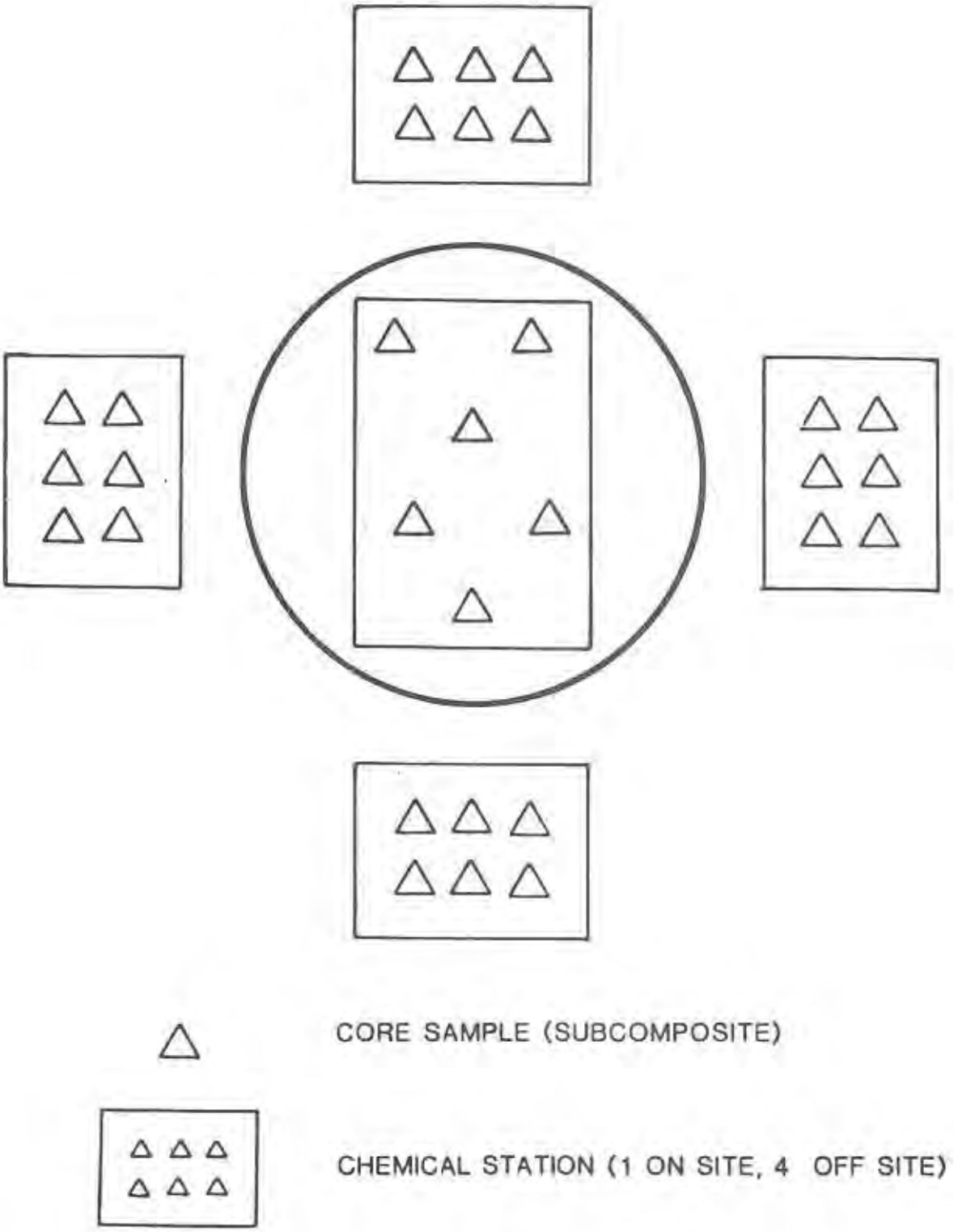

FIGURE: 5 BASELINE CHEMICAL STATIONS FOR PORT GARDNER SITE

TABLE 4. ANALYTICAL REQUIREMENTS FOR BASELINE

Monitoring Parameter	Disposal Site: Commencement Bay	Elliott Bay	Port Gardner	Total
Dredged Material Stability				
SVPS	51	46	56	153
Sidescan sonar	Analysis of Transect Record	Analysis of Transect Record	Analysis of Transect Record	Analysis of Transect Record
On-site Sediment Conditions				
On-site Chemistry 1/	3	3	1	7
On-site Bioassay 2/	3	3	1	7
Perimeter Chemistry 1/	12	12	13	37
Off-site Biological Condition				
Benthic Abundance 3/	15	15 5/	15	45
Benthic Body Burden 4/	6	0 7/	6	12
Benchmark Stations				
Chemical Stations				
Chemistry 1/	3	2	2	7
Bioassays 1/	3	2	2	7
Biological Stations				
Benthic Abundance 2/	15	20 6/	10	45
Benthic Body Burden 4/	6	0 7/	4	10

1/Each chemistry sample is composed of six subcomposites (each representing a single box core) from each station grid.
2/Sediment for each bioassay is a composite of six subcomposites (each representing a single box core) from each station grid.
3/Each box core will be analyzed separately. There are five replicates per stations.
4/Each station will be analyzed separately. There are two replicates per station.
5/These samples will not be analyzed until the appropriate downcurrant gradient station is identified during the first post dispoal monitoring event.
6/These samples will be analyzed to determine degree of biological varability.
7/Insufficient biomass was found to permit body burden analysis.

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- Chemistry stations along the perimeter line of the disposal site.
- Chemistry and bioassays at the benchmark chemistry stations.

Sampling requirements for partial monitoring are presented in table 5 and include a total of 162 SVPS stations (54 per site) located within the disposal site and perimeter, a complete sidescan sonar survey for each site, and a minimum of 132 box cores to collect sediment for analyses. Benthic abundance and tissue burden analyses will not be conducted as part of the partial monitoring effort. The number of sediment samples taken and the number of analyses conducted for each site (table 6) is dependent on site-specific characteristics (see section 5.1 through 5.3 for a further explanation of site-specific sampling and analytical requirements).

As part of the partial monitoring effort, sediment chemical analyses and bioassays will be conducted on sediment samples collected from within the disposal site and from the perimeter stations. Also, sediment samples will be collected from the benchmark chemistry stations. Bioassays on the benchmark station will be conducted using freshly collected sediment. Sediment for benchmark chemistry will be archived until analyses are completed on the on-site and perimeter samples (table 6). If results from on-site and perimeter samples indicate possible movement of sediment offsite (see section 6.2 for test interpretation guidelines), then the sediment from the benchmark chemistry stations will be analyzed (for chemical concentrations). If results do not indicate movement of dredged material offsite, the sediment sample needed for chemistry will remain archived for possible future use.

4.2.3 Full Monitoring

Full monitoring will occur once the disposal site has received a large enough volume of dredged material (approximately 45,000 to 50,000 cubic yards) to warrant measurement of all monitoring parameters. The first full monitoring is forecasted to occur after the second year of use at the Elliott Bay site and after the third year of use for the Commencement Bay and Port Gardner sites.

With full monitoring, all parameters measured during the baseline will be sampled including:

- mapping the disposal site, perimeter, and gradient stations;
- on-site chemistry and bioassays;
- chemistry stations along the perimeter line of the disposal site;
- chemistry and bioassays at the benchmark chemistry stations;
- tissue body burden analyses and benthic abundance determinations for samples from the benchmark biological stations; and
- tissue body burden analyses and benthic abundance determinations for samples from the gradient stations.

TABLE 5. SAMPLING REQUIREMENTS FOR PARTIAL MONITORING

Monitoring Parameter	Disposal Site: Commencement Bay	Elliott Bay	Port Gardner	Total
Dredged Material Stability				
SVPS 2/	54	54	54	162
Sidescan Sonar	Complete Transects of Site	Complete Transects of Site	Complete Transects of Site	Complete Transects of Site
On-site Sediment Conditions				
On-site Chemistry and Bioassay 3/	6	6	6	18
Perimeter Chemistry 4/	24	24	24	72
Off-site Biological Condition				
Benthic Abundance	0	0	0	0
Benthic Body Burden	0	0	0	0
Benchmark Stations				
Chemical Stations Chemistry and Bioassay 5/	18 (18)	12 (12) 1/	12 (12) 1/	42
Bilogical Stations				
Benthic Abundance	0	0	0	0
Benthic Body Burden	0	0	0	0

1/Numbers in parenthesis are samples to be archived for future analysis.
2/Number of SVPS samples taken. The number of samples includes 20 percent replication of selected stations.
3/Minimum number of box core samples required. Each box core will be subsampled (upper 10 cm) to provide sufficient sediment for chemical analytical requirements and to conduct the three bioassays.
4/Minimum number of box core samples required. Each box core will be sampled (upper 2 cm) to provide sufficient sediment for analytical requirements.
5/Minimum number of box core samples required. Each box core will be subsampled (upper 2 cm) to provide sufficient sediment for chemical analytical requirements and to conduct bioassays. Bioassays for the reference stations will be conducted using fresh sediments. The sediment samples for chemistry will be archived (frozen for chemical analysis) until results of on-site chemistry are complete.

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TABLE 5. ANALYTICAL REQUIREMENTS FOR PARTIAL MONITORING

Monitoring Parameter	Disposal Site: Commencement Bay	Elliott Bay	Port Gardner	Total
Dredged Material Stability				
SVPS	54	54	54	162
Sidescan Sonar	Analysis of Transect Record	Analysis of Transect Record	Analysis of Transect Record	Analysis of Transect Record
On-site Sediment Conditions				
On-site Chemistry 1/	1	1	1	3
On-site Bioassay 1/	1	1	1	3
Perimeter Chemistry 1/	4	4	4	12
Off-site Biological Condition				
Benthic Abundance	0	0	0	0
Benthic Body Burden	0	0	0	0
Benchmark Stations				
Chemical Stations				
Chemistry 1/	3	2	2	7
Bioassay 1/	3	2	2	7
Biological Stations				
Benthic Abundance	0	0	0	0
Benthic Body Burden	0	0	0	0

1/Each chemistry and bioassay sample is composed of six subcomposites (each representing a single box core) from each station grid.

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Sampling requirements for full monitoring are presented in table 7 and include a total of 213 SVPS stations, a complete sidescan sonar survey for each site, and a minimum of 438 box cores to collect sediment and benthic organisms for analysis.

In most cases, the number of parameters measured and the number of replicates taken during full monitoring will be the same as taken during the baseline (table 8). One exception to this is mapping, where approximately three times as many SVPS stations will be taken during full monitoring as were taken during the baseline. The increase in number of SVPS stations over the amount used in the baseline is due to an increase in sampling within the disposal site and perimeter and due to the addition of SVPS stations along the gradient. The increase in SVPS stations within the disposal site and perimeter are needed to characterize the extent of spread of dredged material disposed at the site. The addition of stations along the gradient are intended to provide complementary data to the benthic abundance data. Previous work with an SVPS type system in other parts of the country have shown that it can be used to assess gross features of the benthic community (Rhoads and Germano, 1982).

For the other parameters measured, the number of samples taken is similar to those taken during the baseline (table 7). One difference between the baseline and full monitoring is that with full monitoring the sediment samples collected from the benchmark chemical and biological stations are archived until analysis of the on-site, perimeter, and gradient samples are completed (except for benchmark station bioassays conducted on fresh sediment). Samples from the benchmark stations were analyzed during the baseline. If results from any of the full monitoring stations indicate possible movement of sediment off the disposal site or exceedance of on-site guidelines, then the appropriate benchmark station sample will be analyzed. Otherwise, the benchmark station sediment for chemical analysis and organism samples will remain archived.

5. SITE-SPECIFIC MONITORING PLANS

The general monitoring plan is adapted to each of the Phase I sites based on physical and biological conditions at the site, anticipated annual loading, and proximity of potential contaminant sources to the disposal site.

5.1 Commencement Bay Disposal Site (Figures 6 a-c)

The Commencement Bay site is in a relatively flat, nondispersive area with water depths varying from 540 to 560 feet with northwest to southeast currents (DSS TA, 1988). Monitoring stations for the Commencement Bay site include three floating chemical stations within the site and 12 perimeter stations at the perimeter line (figure 6a-c). Monitoring also includes three stations along the down-current gradient, three off-site benchmark chemistry, and three off-site benchmark biological stations (figure 6c). In all cases, each off-site benchmark chemistry station is paired with an off-site benchmark biological station.

Three off-site benchmark chemistry and off-site benchmark biological stations are associated with the Commencement Bay disposal site (figure 6a). One of these stations is located in inner Commencement Bay (southeast of the disposal site) and represents a monitor of the Puyallup River and urban areas of Commencement Bay as potential confounding sources of contamination in monitoring the disposal site. The Puyallup River plume represents a major source of both dissolved and particulate metals

discharged into Commencement Bay (Curl et al. 1987). The off-site benchmark station located just west of Browns point (northeast of the disposal site) also represents a monitoring station for sources of contamination. Analysis of bottom currents indicate that water generally flows from the head of the bay along the north shoreline and continues counterclockwise towards the disposal site (DSS TA, 1988). The off-site benchmark station west of Browns Point will act as a monitor for contaminants being transported in this current pattern. The third off-site benchmark station is located north of Browns Point and will act as a monitor of changes in benthic characteristics due to natural variation.

During the baseline, chemical analyses and bioassays will be conducted on three composited samples from within the disposal site boundary, while 12 composited samples will be chemically analyzed for the perimeter stations (table 9). Also, three gradient transects will be sampled (figure 6a). All three transects are to the south to southwest of the disposal site and represent the probable direction of deep water currents from the disposal site (DSS TA, 1988). One of these three transects will become the down-current gradient stations for the post-disposal monitoring effort.

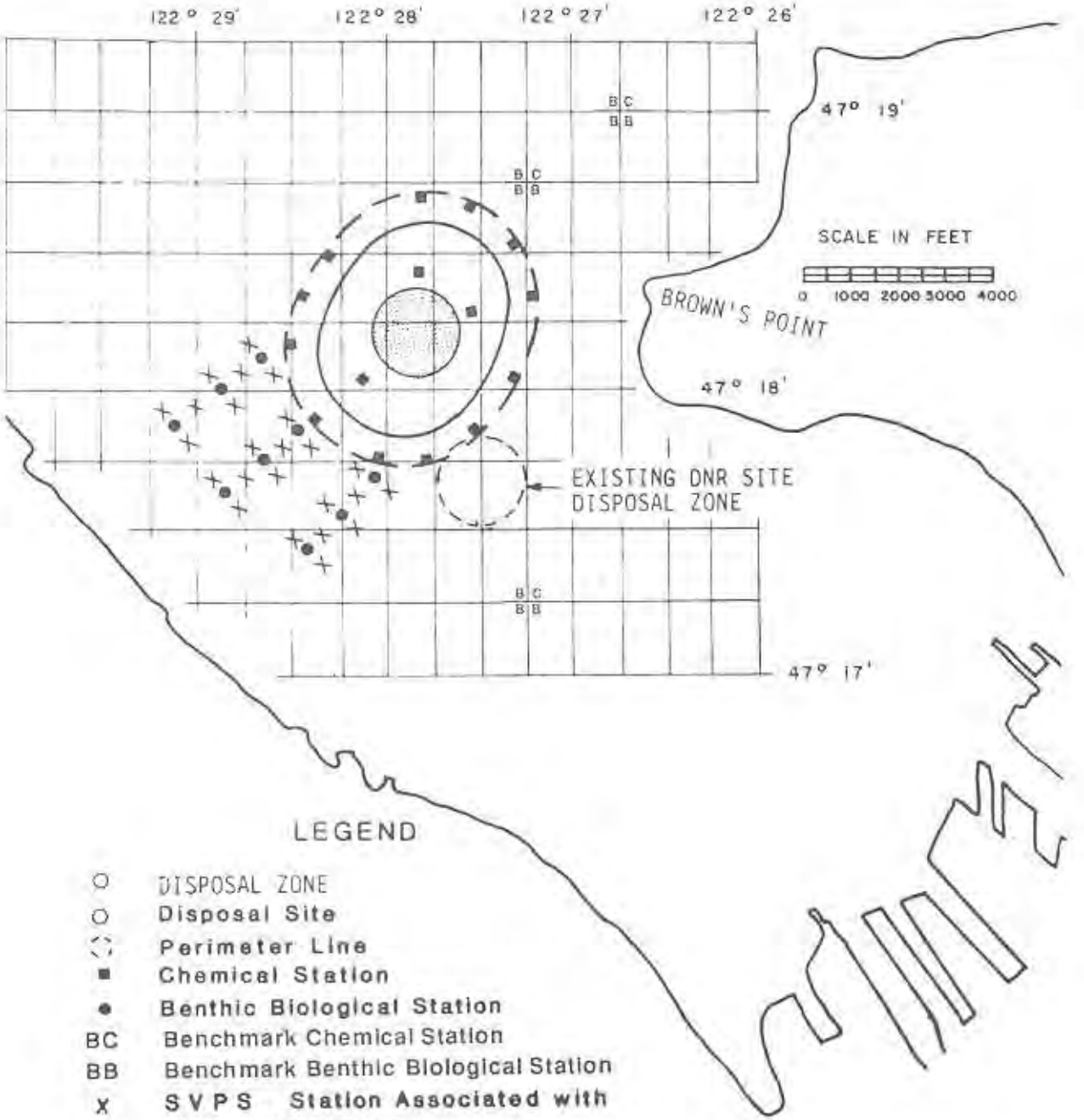
Partial monitoring of the Commencement Bay disposal site includes analysis of one on-site chemistry and one on-site bioassay series (all three bioassays conducted with the sediment sample) and analysis of
sediment from four perimeter chemistry stations (table 9; figure 6b). In addition, sediment from the three benchmark chemistry stations will be collected, bioassays conducted, and sediment for chemical analysis archived.

Sampling during full monitoring will include collection of sediment and biological organisms from all stations as outlined in the general description of full monitoring (section 4.2.3). Analyses will be conducted on all samples collected except for that collected from the benchmark chemical analysis and benchmark biological stations (table 9). These samples will be archived.

5.2 Elliott Bay Disposal Site (Figures 7 a-c)

The Elliott Bay disposal site is in a gently sloping nondispersive area at a depth ranging from 200 feet at the south edge of the site to 360 feet at the north edge, with weak and variable currents (DSS TA, 1988). Monitoring stations for the Elliott Bay site include three on-site chemistry/bioassay stations, 12 perimeter chemical stations, and two off-site benchmark chemistry stations (figure 7a; table 10).

Biological stations in Elliott Bay may be a useful indicator of the condition of the bay. However, much of the benthic area around the proposed site is already in an impacted condition (Tetra Tech, 1986c). It may be difficult or impossible to test off-site benthic species and distinguish between impacts due solely to dredged material disposal from those due to other sources in the Elliott Bay area. While chemical and biological gradients may be evident in and around the preferred site location, the proximity of other chemical sources may not allow the establishment of a simple benchmark system to determine the cause of any observed changes in these gradients. A significantly expanded and complex work effort may be required to identify the contribution of different chemical sources. Therefore, the degree of existing biological variation will be examined during the baseline study. If

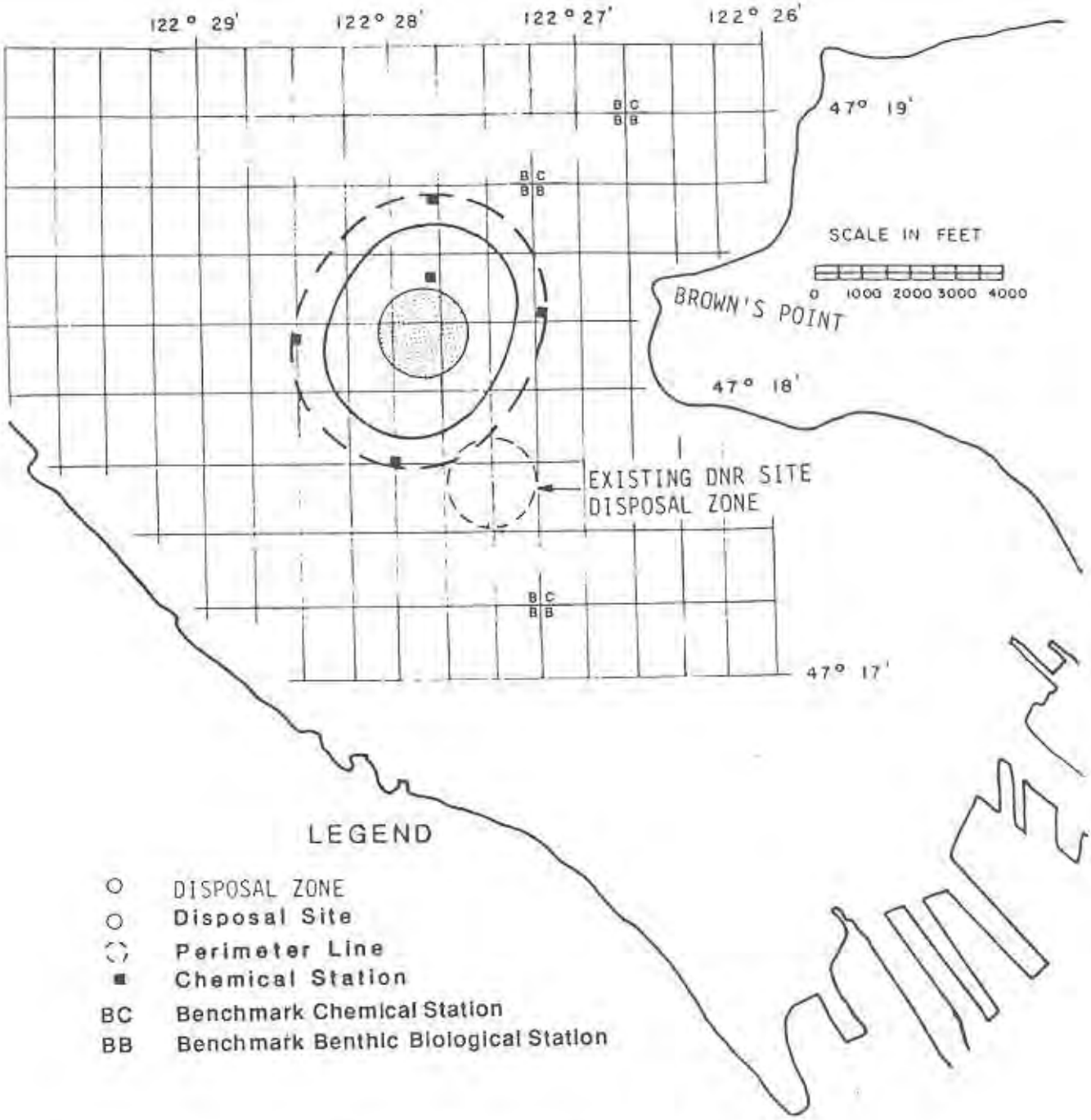


LEGEND

- DISPOSAL ZONE
- Disposal Site
- Perimeter Line
- Chemical Station
- Benthic Biological Station
- BC Benchmark Chemical Station
- BB Benchmark Benthic Biological Station
- X SVPS Station Associated with biological Station

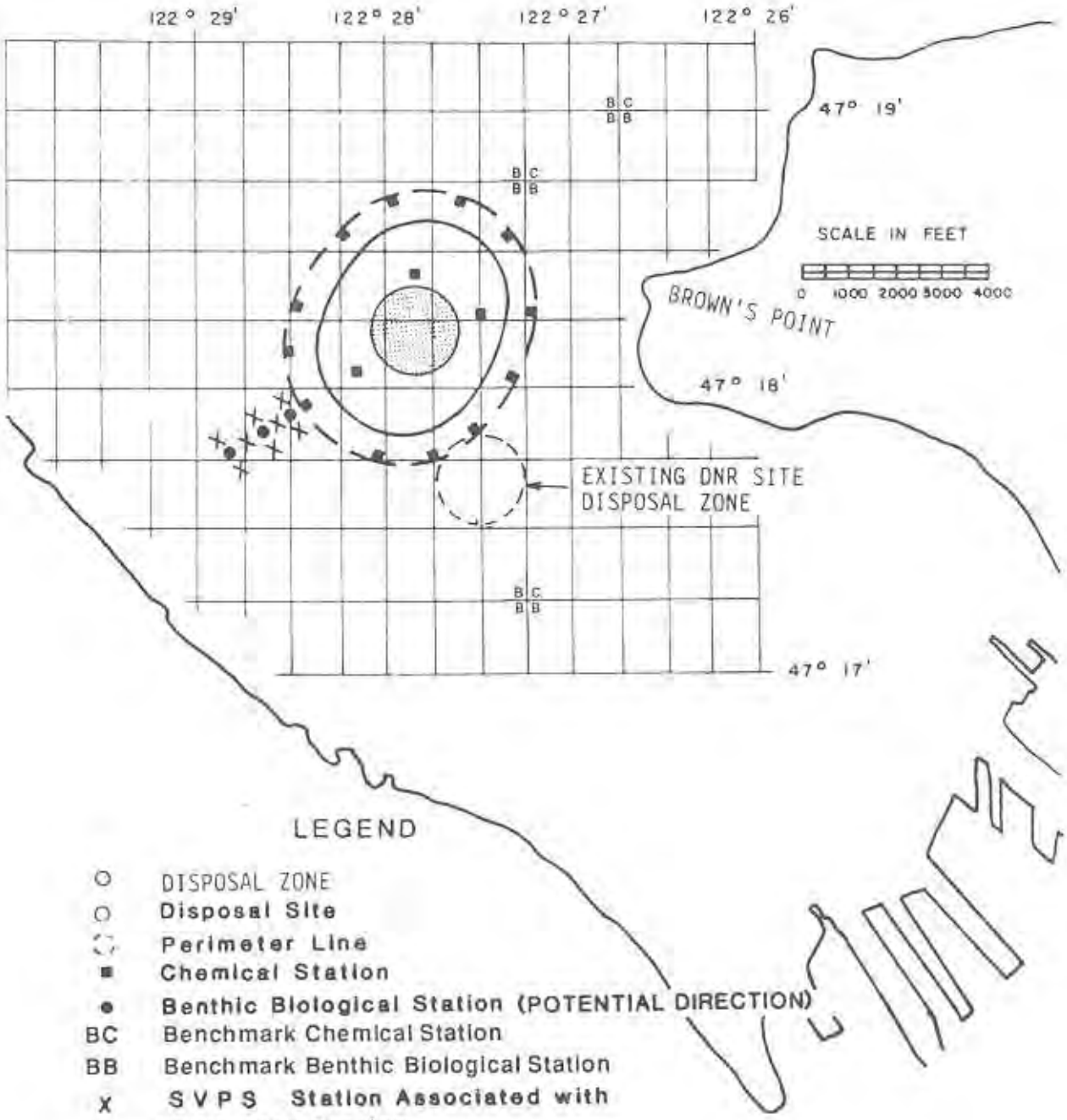
(Sonar mapping and SVPS stations for mapping the disposal site mound and flanks are also conducted, but are not shown)

Figure: 6a COMMENCEMENT BAY BASELINE SURVEY



(Sonar mapping and SVPS stations for mapping the disposal site mound and flanks are also conducted, but are not shown)

Figure: 6b COMMENCEMENT BAY PARTIAL MONITORING



LEGEND

- ○ DISPOSAL ZONE
- ○ Disposal Site
- ◌ Perimeter Line
- ■ Chemical Station
- ● Benthic Biological Station (POTENTIAL DIRECTION)
- BC Benchmark Chemical Station
- BB Benchmark Benthic Biological Station
- X S V P S Station Associated with biological Station

(Sonar mapping and S V P S stations for mapping the disposal site mound and flanks are also conducted, but are not shown)

Figure: 6c COMMENCEMENT BAY FULL MONITORING

TABLE 7. SAMPLING REQUIREMENTS FOR FULL MONITORING

Monitoring Parameter	Disposal Site: Commencement Bay	Elliott Bay	Port Gardner	Total
Dredged Material Stability				
SVPS 2/ Sidescan Sonar	71 Complete Transects of Site	74 Complete Transects of Site	68 Complete Transects of Site	213 Complete Transects of Site
On-site Sediment Conditions				
On-site Chemistry and Bioassay 3/	18	18	18	54
Perimeter Chemistry 4/	72	72	72	216
Off-site Biological Condition				
Benthic Abundance 5/	15	15 9/	15	45
Benthic Body Burden 5/	6	6 9/	6	18
Benchmark Stations				
Chemical Stations				
Chemistry and Bioassay 6/	18 (18) 1/	12 (12) 1/	12 (12) 1/	42 (42) 1/
Biological Stations				
Benthic Abundance 7/	15 (15)	20 (20) 9/	10 (10)	45 (45) 9/
Benthic Body Burden 8/	6 (6)	8 (8) 9/	4 (4)	18 (18) 9/

1/Numbers in parentheses are to be archived for future analysis.
2/Number of SVPS samples taken. The number of samples includes 20 percent replication of selected stations.
3/Minimum number of box core samples required. Each box core will be subsampled (upper 10 cm) to provide sufficient sediment for chemical analytical requirements and to conduct the three bioassays.
4/Minimum number of box core samples required. Each box core will be subsampled (upper 2 cm) to provide sufficient sediment for analytical requirements.
5/Minimum number of box core samples required.
6/Minimum number of box core samples required. Each box core will be subsampled (upper 2 cm) to provide sufficient sediment for chemical analytical requirements and to conduct bioassays. Bioassays for the benchmark station will be conducted using fresh sediments. The sediment samples for chemistry will be archived (frozen for chemical analysis) until results of on-site chemistry are complete.
7/Minimum number of box core samples required. All samples will be sieved, fixed in preservative, and stored until the first full monitoring effort. At that time, those samples taken from the seleced gradient stations will be analyzed.
8/Minimum number of box core samples required. All tissue samples will be frozen until the first full monitoring effort. At that time, samples taken from the selected gradient stations will be analyzed.
9/Samples may be taken if full biological monitoring is implemented after baseline.

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TABLE 8. ANALYTICAL REQUIREMENTS FOR FULL MONITORING

Monitoring Parameter	Disposal Site: Commencement Bay	Elliott Bay	Port Gardner	Total
Dredged Material Stability				
SVPS	71	74	68	213
Sidescan Sonar	Analysis of Transect Record	Analysis of Transect Record	Analysis of Transect Record	Analysis of Transect Record
On-site Sediment Conditions				
On-site Chemistry 1/	3	3	3	9
On-site Bioassay 2/	3	3	3	9
Perimeter Chemistry 1/	12	12	12	36
Off-site Biological Condition				
Benthic Abundance 3/	15	15 6/	15	45
Benthic Body Burden 4/	6	0 7/	6	12
Benchmark Stations				
Chemical Stations				
Chemistry 5/	3	2	2	7
Bioassay	3	2	2	7
Biological Stations				
Benthic Abundance 5/	15	20 6/	10	45
Benthic Body Burden 5/	6	0 7/	4	10

1/Each chemistry sample is composed of six subcomposites (each representing a single box core) from each station grid.
2/Sediment for each bioassay is a composite of six subcomposites (each representing a single box core) from each station grid.
3/Each box core will be analyzed separately. There are five replicates per station.
4/Each station will be analyzed separately. There are two replicates per station.
5/These samples will only be analyzed if changes are noted between monitoring and baseline data.
6/Samples may be taken if full biological monitoring is implemented after baseline.
7/Insufficient biomass was found during baseline to permit body burden analysis.

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acceptable levels of variation are found, then biological measurements will be made of the benthos during full monitoring.

The perimeter line for the Elliott Bay disposal site is not located 1/8 mile at all places along the disposal site boundary. Along the western portion of the disposal site, the perimeter line is less than 1/8 of a mile due to topographic features (presence of a ridge which forms the configuration of the disposal site). This topographic feature, will limit the movement of dredged material off the western side of the disposal site, will function as the perimeter line.

Four benchmark stations are associated with the Elliott Bay disposal site. Both stations will act as monitors of contaminant sources that might influence the disposal site. One station is located at the mouth of the West Duwamish Waterway. The Duwamish River, in general, and the West Waterway, in particular, represent major sources of contaminant input into Elliott Bay (Curl et al. 1987). Another benchmark station is located to the east of the disposal site and acts as a monitor to sources of contaminants that exist along the Seattle waterfront shoreline (Curl et al. 1987). The next station is north of the site between it and the middle waterfront. The last station is west of the site between Duwamish Head and Magnolia.

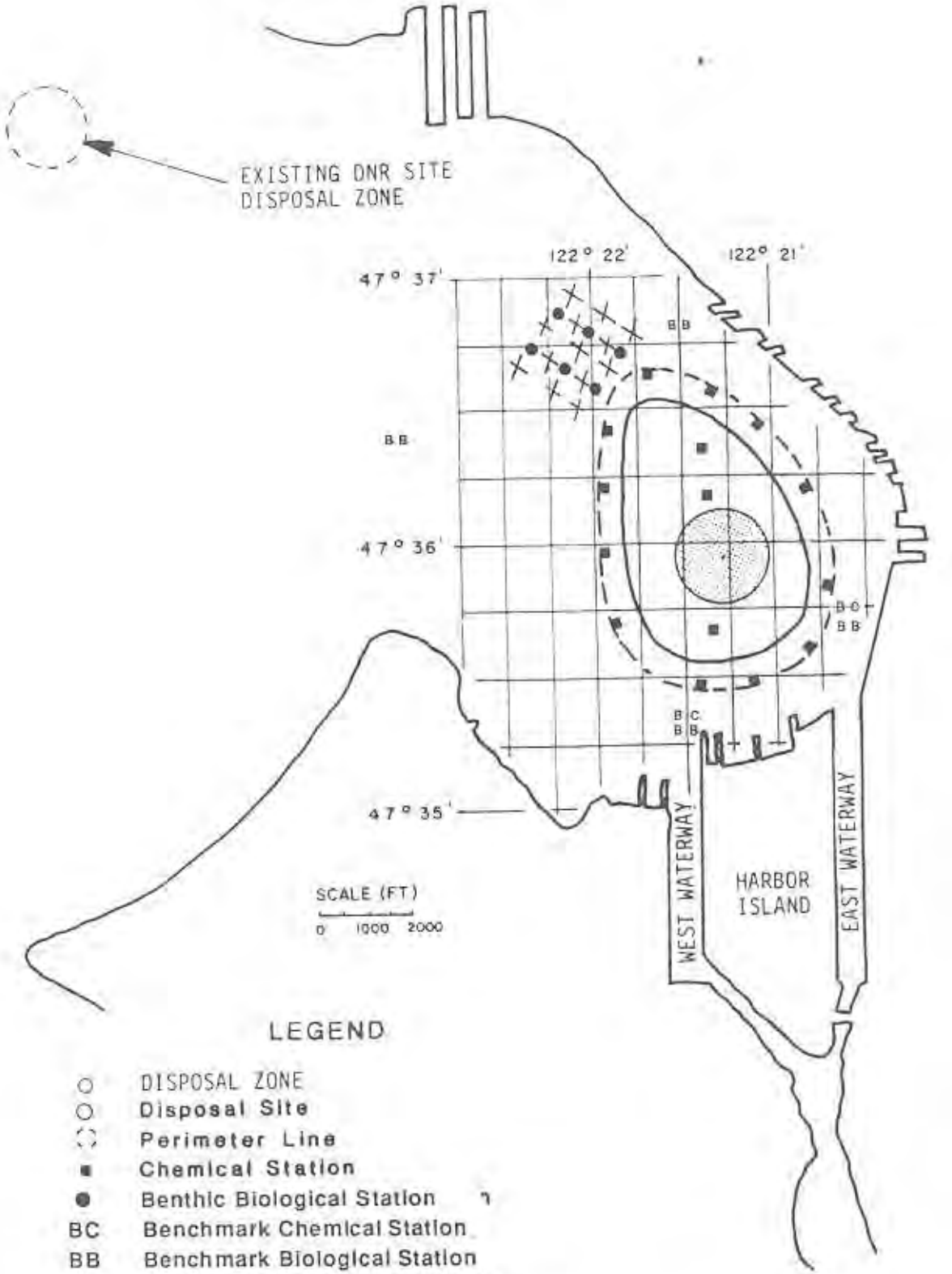
Proposed chemical stations during baseline and full monitoring include three on-site chemistry stations, 12 perimeter stations, and two benchmark chemistry stations (figures 7a and 7c). Chemical and bioassay analyses will be conducted on the on-site station samples, while only chemical analyses will be conducted on the perimeter station samples (table 10). The benchmark samples for chemical analysis will be archived during full monitoring, but will be analyzed during the baseline.

Partial monitoring includes one on-site chemistry station, three perimeter chemistry stations, and two benchmark chemistry stations (figure 7b). As with full monitoring, samples from the on-site and perimeter stations will be analyzed while samples from the benchmark chemical analysis will be archived.

If biological testing is included in full monitoring, the stations will be located in the same area as the baseline stations. As at other sites, only three stations in one gradient transect will be sampled.

5.3 Port Gardner Disposal Site (Figure 8 a-c)

The Port Gardner disposal site is in a relatively flat nondispersive area with currents that are weak and tend to flow southeast to northwest at depth (DSS TA, 1988). The average depth at the site is about 420 feet. Monitoring stations for the Port Gardner disposal site include on-site chemistry stations, perimeter chemistry stations, two off-site benchmark chemistry, two off-site benchmark biological stations, and a gradient transect (figure 8a; table 11). Placement of the off-site benchmark chemical and biological stations was largely influenced by the expected presence of the proposed confined aquatic disposal (CAD) site that will be used for dredged material from the Navy Homeport project. The proximity of the CAD site to the boundary of the Port Gardner disposal site requires that a benchmark station be placed just off the perimeter line (figure 8a). As projected construction plans now stand, the Navy Homeport project will begin soon after the PSDDA baseline effort has been completed at the PSSDA site. Close coordination between the PSDDA and CAD monitoring

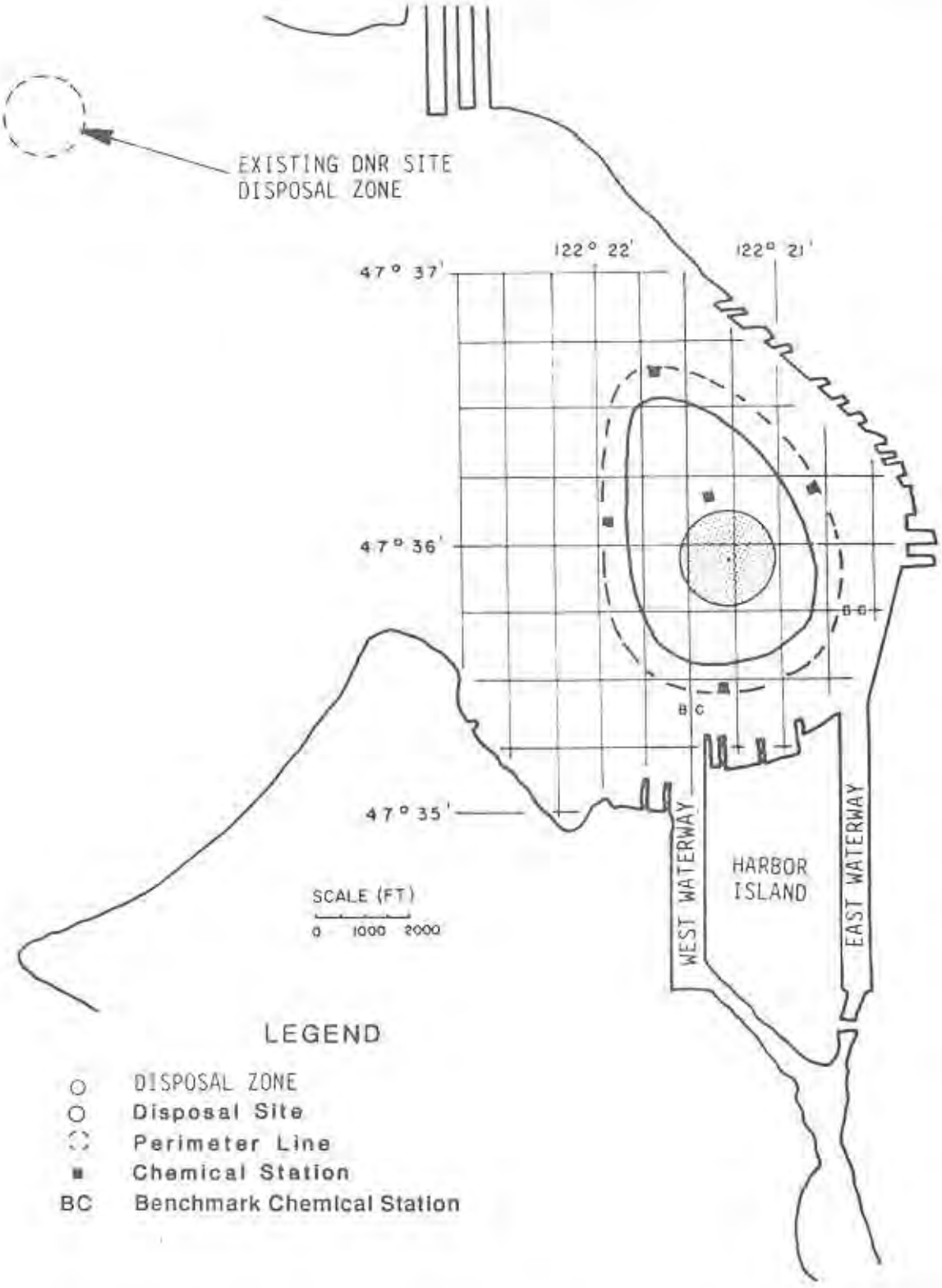


LEGEND

- ○ DISPOSAL ZONE
- ○ Disposal Site
- ⛶ Perimeter Line
- ■ Chemical Station
- ● Benthic Biological Station
- BC Benchmark Chemical Station
- BB Benchmark Biological Station
- X S V P S Station Associated with Biological Station

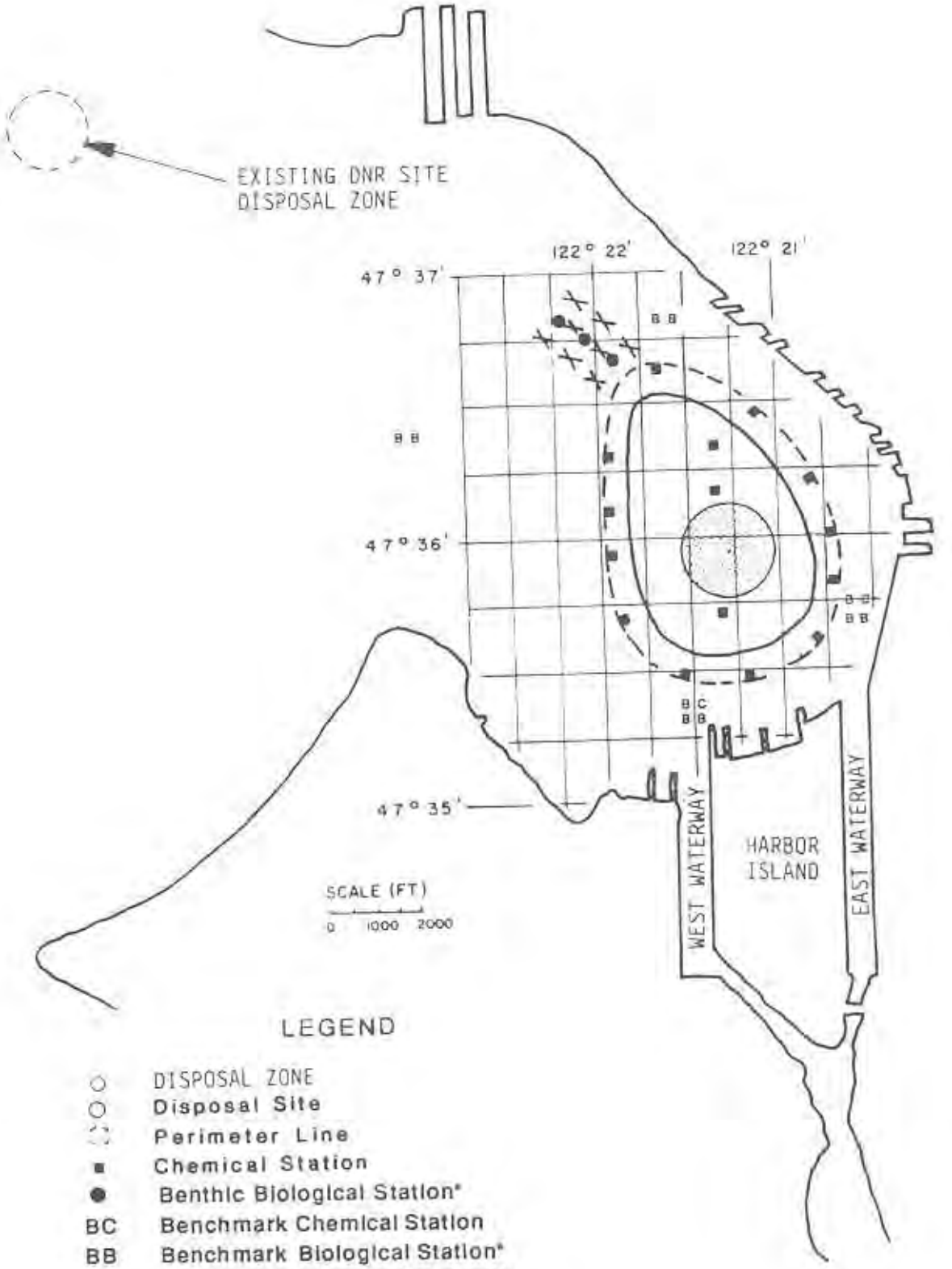
(Sonar mapping and S V P S stations for mapping the disposal site mound and flanks are also conducted, but are not shown)

Figure: 7a ELLIOTT BAY BASELINE SURVEY



(Sonar mapping and S V P S stations for mapping the disposal site mound and flanks are also conducted, but are not shown)

Figure: 7b ELLIOTT BAY PARTIAL MONITORING



LEGEND

- ○ DISPOSAL ZONE
- ○ Disposal Site
- ⛶ Perimeter Line
- ■ Chemical Station
- ● Benthic Biological Station*
- BC Benchmark Chemical Station
- BB Benchmark Biological Station*
- X S V P S Station Associated with Biological Station*

(Sonar mapping and S V P S stations for mapping the disposal site mound and flanks are also conducted, but are not shown)

*May not be included in full monitoring depending on results of baseline biological studies.

Figure: 7c ELLIOTT BAY FULL MONITORING

TABLE 9

SUMMARY OF ANALYTICAL REQUIREMENTS
PROPOSED TO BE UNDERTAKEN AT THE COMMENCEMENT BAY SITE

	Baseline	Partial	Full Study
On-site Chemistry	3	1	3
On-site Bioassays	3	1	3
Perimeter Chemistry	12	4	12
Benchmark Chemistry	3	3	3 2/
Benchmark Bioassays	3	3	3
Benthos Abundance	3 (5 reps each) 1/	0	3 (5 reps each)
Benthos Body Burden	3 (2 reps each)	0	3 (2 reps each)
Benchmark Benthos Abundance	3 (5 reps each)	0	3 (5 reps each) 2/
Benchmark Benthos Body Burden	3 (2 reps each)	0	3 (2 reps each) 2/
Sidescan	Complete	Complete	Complete
SVPS 3/	51	54	71

1/The number of stations sampled during the baseline will be greater than shown (see Figure 6a). Those stations from the off-site gradient will be archived until year one when only those along primary direction of movement will be analyzed.
2/Samples will be archived and analyzed only if results of on-site, perimeter, or gradient monitoring station data require testing of benchmark station samples.
3/Includes 20 percent replication of selected SVPS stations.

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TABLE 10

SUMMARY OF ANALYTICAL REQUIREMENTS
PROPOSED TO BE UNDERTAKEN AT THE ELLIOTT BAY SITE

	Baseline	Partial	Full Study
On-site Chemistry	3	1	3
On-site Bioassays	3	1	3
Perimeter Chemistry	12	4	12
Benchmark Chemistry	2	2 2/	2 2/
Benchmark Bioassays	2	2 2/	2
Benthos Abundance	15	0	15
Benchmark Benthos Abundance	20	0	20
Sidescan	Complete	Complete	Complete
SVPS 1/	46	54	74

1/Includes 20 percent replication of seleced SVPS stations.
2/Samples will be archived and analyzed only if results of on-site, perimeter, or gradient monitoring station data require testing of benchmark station samples.

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efforts will be needed to properly integrate data of the respective disposal activities.

The second off-site benchmark chemistry and benchmark biological station is located to the southwest of the disposal site (direction of incoming deep water to Port Gardner; DSS TA, 1988) and will act as a monitor of changes in parameters due to natural variation.

Transport of water off the disposal site is expected to be in a westerly direction; however, the currents are sufficiently weak enough that direction of movement is uncertain. Because of this, four gradient transects will be taken during the baseline and extend outward from the disposal site in directions ranging from southwesterly to northwesterly direction (figure 8a).

During baseline sampling, only one on-site chemistry and four perimeter chemistry stations will be sampled and analyzed (figure 8a; table 11). Fewer baseline chemical stations (on-site and perimeter) will be used in Port Gardner compared to Elliott Bay and Commencement Bay because chemical concentrations are expected to be low and relatively homogenous in sediments in and around the disposal site. Sampling and analytical requirements during partial and full monitoring will be the same as those outlined under the general monitoring strategy (figures 8b and 8c; table 11).

6. DATA INTERPRETATION AND DECISIONS ON SITE MANAGEMENT

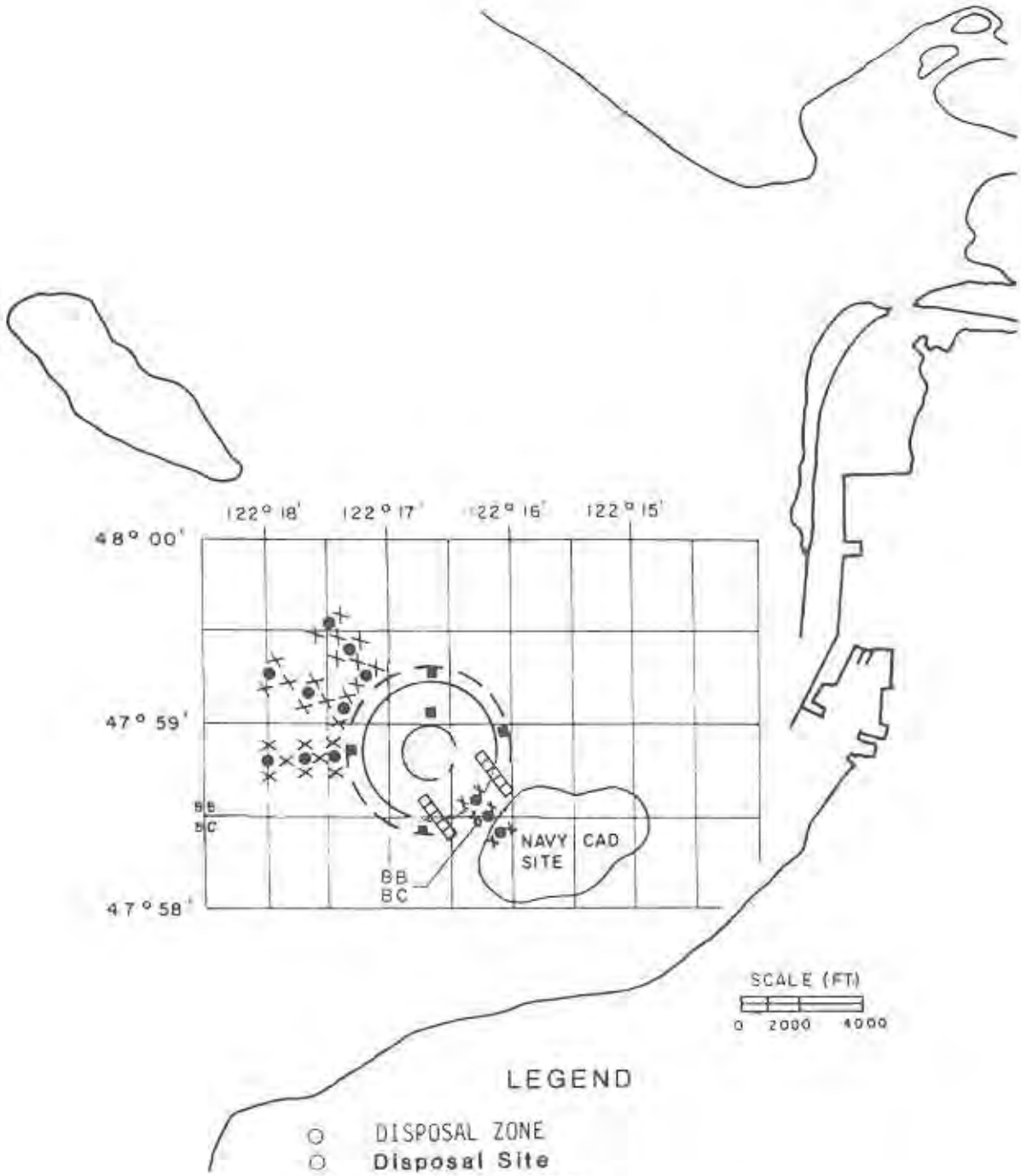
The ultimate purpose of environmental monitoring is to determine whether changes are needed in disposal site management. Possibilities include changes in positioning techniques, boundaries or enforcement; in site boundaries; in sediment evaluation procedures; or in the monitoring program itself. Decisions on site management will be based on analysis and interpretation of field monitoring data and on administrative factors such as the degree of environmental risk a problem presents, funding, etc.

This section describes a step-wise data analysis process and underlying statistical methods and assumptions. This process will determine whether monitoring study data show disposal impacts to be acceptable or indicate a potential unacceptable impact which may need further study and, possibly, changes in disposal site management.

Before proceeding, it should be noted that data analysis uses statistical methods to determine whether observed differences between monitoring and baseline data are significant and warrant further study. Consideration is given to the data collection methods used, the variability of the parameter measured, the number of measurements of each parameter, and the magnitude of the observed differences. However, statistical significance does not imply ecological significance. Professional judgment is needed to interpret the statistical indicators and determine a course of action.

6.1 Data Analysis Steps

On-site monitoring will be limited to verification that the site management condition has been complied with. This will be done through analysis of on-site chemical concentrations and bioassays. If site management conditions are not being

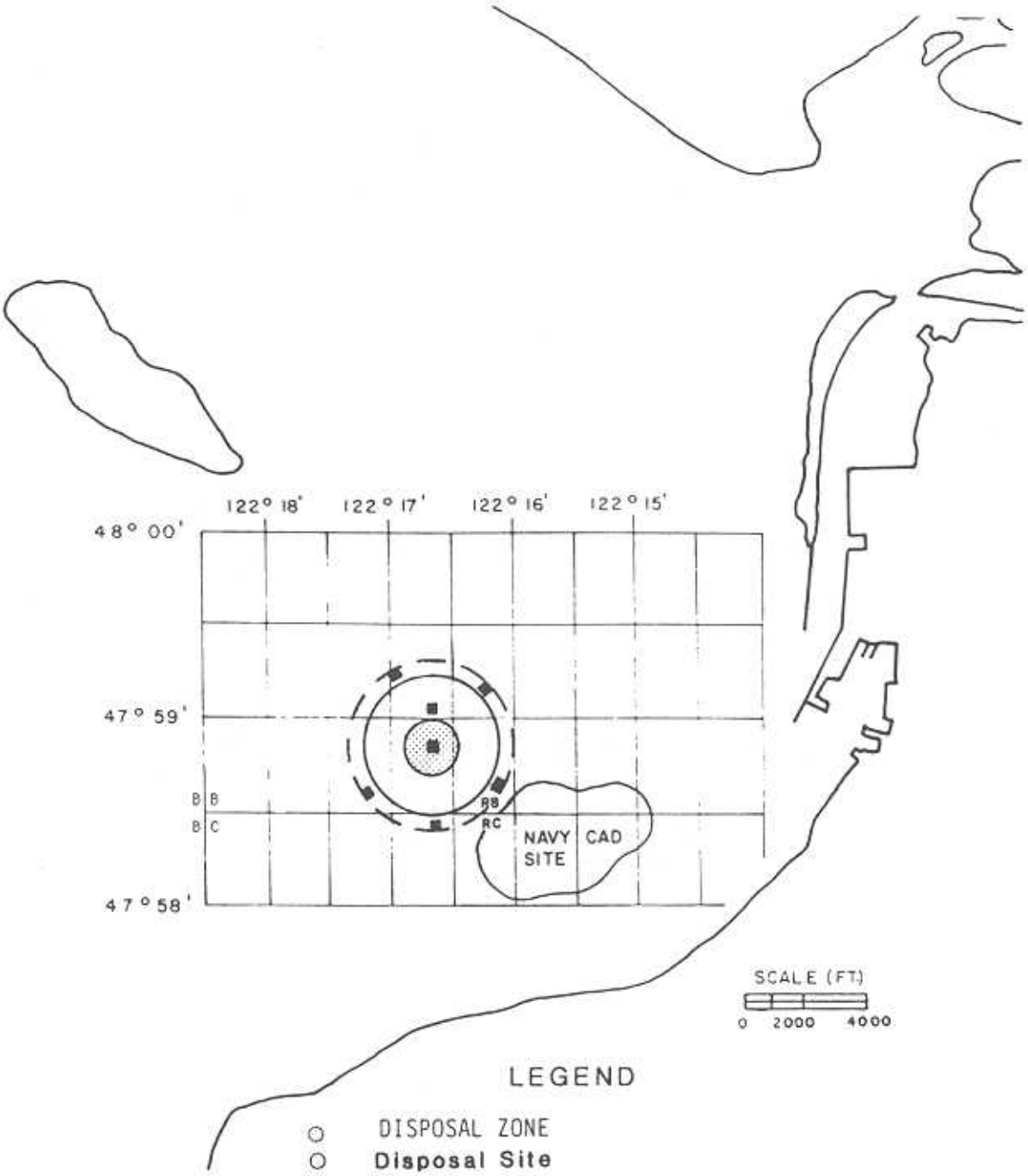


LEGEND

- ○ DISPOSAL ZONE
- ○ Disposal Site
- ◌ Perimeter Line
- ■ □ Chemical Station
- ● Benthic Biological Station
- BC Benchmark Chemical Station
- BB Benchmark Benthic Biological Station
- X S V P S Station Associated with biological Station

(Sonar mapping and S V P S stations for mapping the disposal site mound and flanks are also conducted, but are not shown)

Figure: 8a PORT GARDNER BASELINE SURVEY



LEGEND

- DISPOSAL ZONE
- Disposal Site
- Perimeter Line
- Chemical Station
- BB Benchmark Benthic Biological Station
- BC Benchmark Chemical Station

(Sonar mapping and S V P S stations for mapping the disposal site mound and flanks are also conducted, but are not shown)

Figure: 8b PORT GARDNER PARTIAL MONITORING

TABLE 11

SUMMARY OF ANALYTICAL REQUIREMENTS
PROPOSED TO BE UNDERTAKEN AT THE PORT GARDNER SITE

	Baseline	Partial	Full Study
On-site Chemistry	1	1	3
On-site Bioassays	1	1	3
Perimeter Chemistry	13	4	12
Benchmark Chemistry	2	2	2 2/
Benchmark Bioassays	2	2	2
Benthos Abundance	3 (5 reps each) 1/	0	3 (5 reps each)
Benthos Body Burden	3 (2 reps each)	0	3 (2 reps each)
Benchmark Benthos Abundance	2 (5 reps each)	0	2 (5 reps each) 2/
Benchmark Benthos Body Burden	2 (2 reps each)	0	2 (2 reps each) 2/
Sidescan	Complete	Complete	Complete
SVPS 3/	56	54	68

1/The number of stations sampled during the baseline will be greater than shown (see Figure 8a), but only those stations from the gradient that is along the primary direction of movement will be analyzed. Archived until year one when only those along primary direction of movement will be analyzed.
2/Samples will be archived and analyzed only if results of on-site, perimeter, or gradient monitoring station data require testing of benchmark station samples.
3/Includes 20 percent replication of selected SVPS stations.

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If changes are detected, the archived off-site benchmark samples from the recent monitoring effort must be analyzed and compared to the appropriate baseline off-site benchmark station data (figure 9). If, after analysis, changes are also observed in the benchmark data, then the changes observed in the monitoring data from the disposal site area may not be due to dredged material disposal, but due to other factors. At this point in the decision-making process, three decision scenarios are possible with respect to the benchmark data and their importance in determining what may have caused the changes observed at the disposal site (figure 9):

Scenario 1: If the arithmetic means of the monitoring and baseline data from the off-site benchmark stations are not significantly different, the changes in the monitoring station data reflect a potential impact from disposal of dredged material.

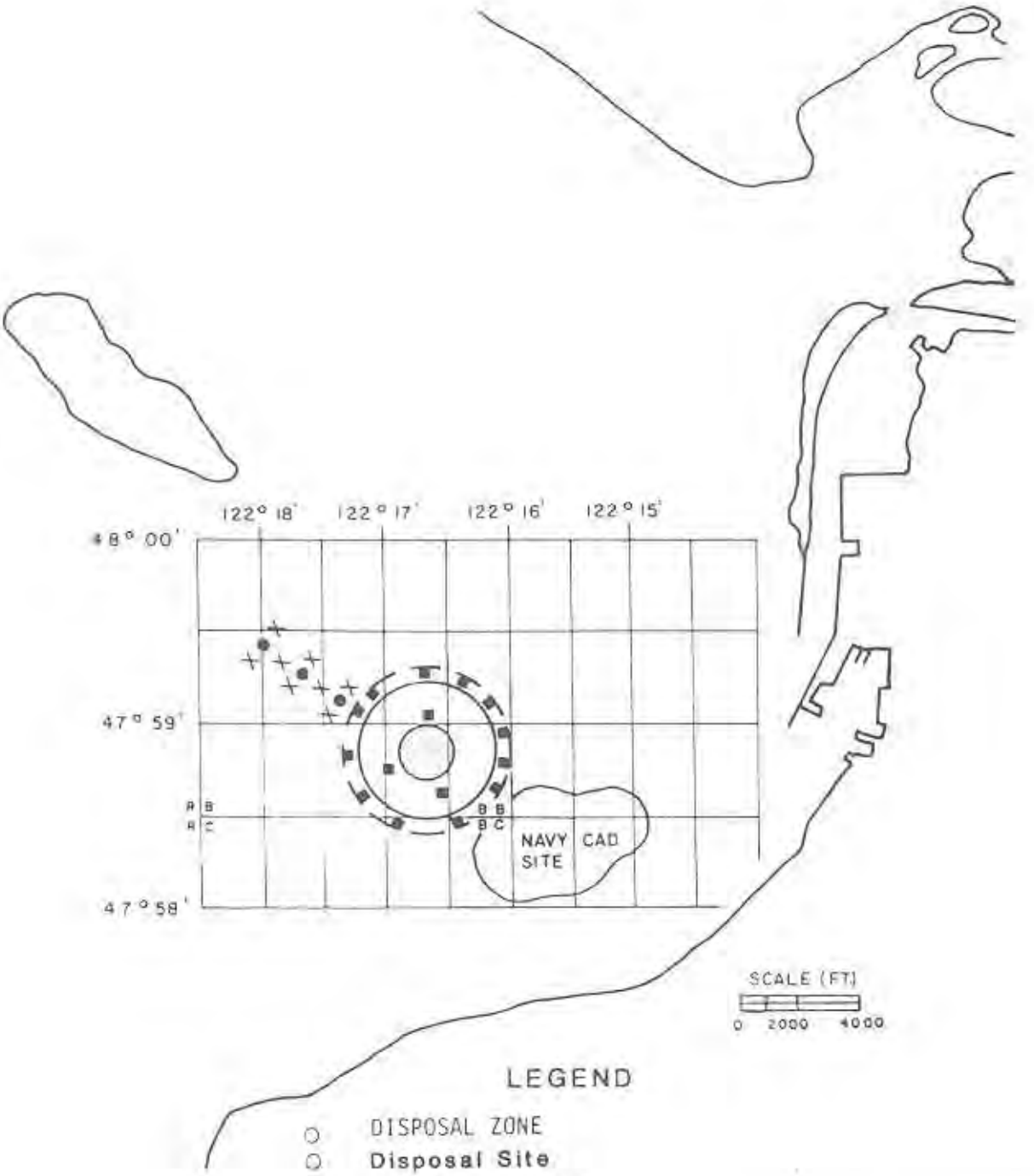
Scenario 2: If the arithmetic means of the monitoring and baseline data from the off-site benchmark stations are significantly different, but that difference is less than 50 percent of the difference between the monitoring station data mean and the baseline data station mean, the changes in the monitoring station data reflect a potential impact from disposal, e.g., the difference between the baseline and monitoring data from the off-site benchmark stations must be less than 0.5(x); given the (x) is the difference between baseline and monitoring station data. Use of the 50-percent level of difference as a guideline was set by judgment.

Scenario 3: If the arithmetic means for the monitoring and baseline data from the off-site benchmark stations are significantly different, but that difference is greater than 50 percent of the differences between the monitoring station data mean and the baseline station data mean, the changes in the monitoring station data most probably reflect Puget Sound influences other than dredged material disposal (e.g., from or other contaminant sources, e.g., the difference between the baseline benchmark and monitoring benchmark data is equal to or greater than 0.5(x); given that (x) is the difference between baseline and monitoring station data).

If, after evaluation of the benchmark data, the changes observed at the disposal site are concluded to not be due to disposal of dredged material (scenario 3), then no further action would be required. If, however, analyses of the benchmark station data suggest that changes in and around the disposal site are probably due to dredged material disposal, then best professional judgment will need to be applied in evaluating the ecological significance of the observed changes (step 3 in the data analysis process). The variety of actions that might be appropriate at this time could include (in order of increasing significance):

- analysis of the remaining archived samples for the other monitoring parameters to determine the extent of the changes;

- field investigations to verify that significant movement of dredged material has occurred offsite and to determine the extent and magnitude of associated effects;



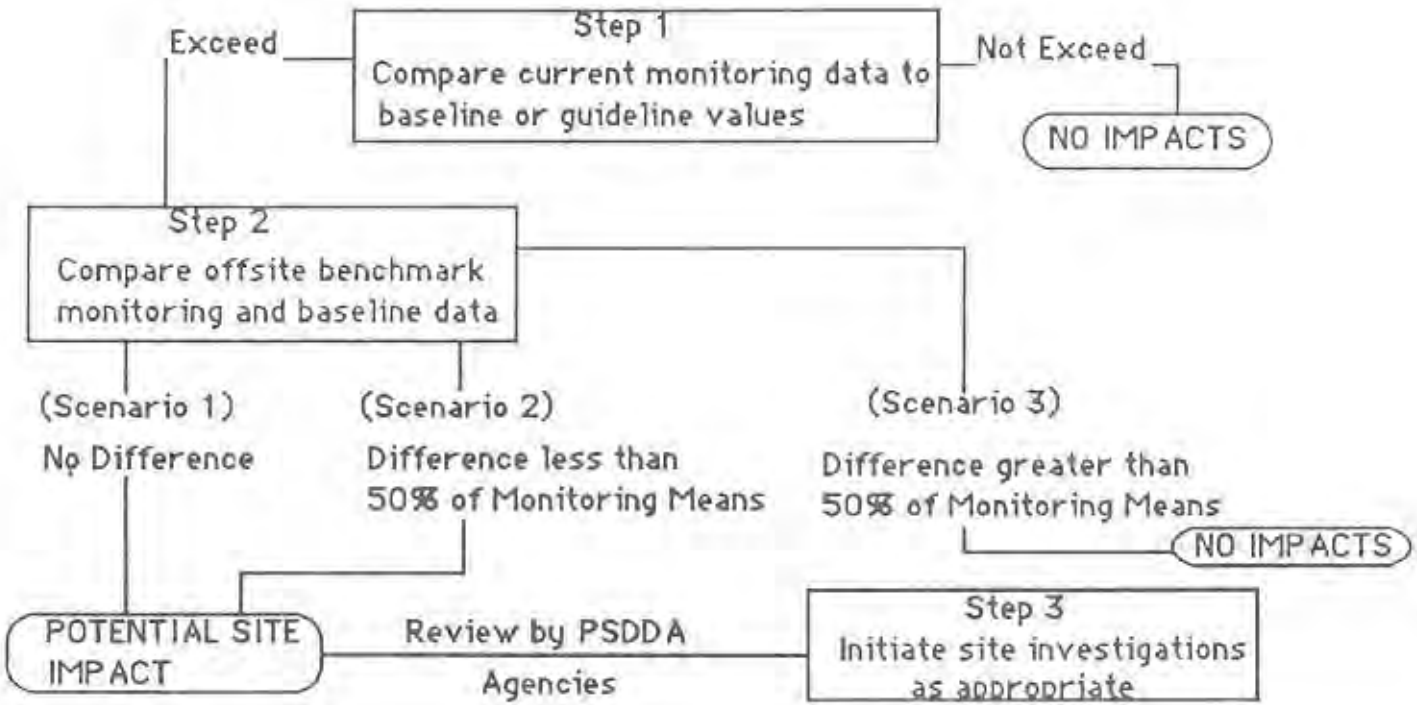
LEGEND

- ○ DISPOSAL ZONE
- ○ Disposal Site
- ⬚ Perimeter Line
- ■ Chemical Station
- ● Benthic Biological Station (POTENTIAL DIRECTION)
- BC Benchmark Chemical Station
- BB Benchmark Benthic Biological Station
- X S V P S Station Associated with biological Station

(Sonar mapping and S V P S stations for mapping the disposal site mound and flanks are also conducted, but are not shown)

Figure: 8c PORT GARDNER FULL MONITORING

Figure 9: Steps in Analysis of Monitoring, Baseline and Benchmark Data



- program adjustments, such as modification of site use conditions or amendment of disposal guidelines to bring the site into the Clean Water Act requirement of not allowing unacceptable adverse impacts; and

- major program responses such as site relocation or mitigation at the existing site.

Any action, however, must be based on a careful evaluation of the monitoring results and an interpretation of these findings relative to potential ecological significance.

6.2 Statistical Analysis - Confidence Limits and Guidelines for Data Interpretation

Statistical indicators used in data analysis are often developed by application of statistical power analysis, a widely applied environmental planning tool for considering the relationship between parameter variability, the number of samples to be taken, and the statistical confidence desired in the resulting data. The statistical triggers used in the monitoring plan are determined primarily by the variability of the parameter being measured and the work effort (number of samples) allocated by the monitoring plan. They represent minimum differences that should be observed before additional data interpretation (to consider ecological significance) is conducted.

Several study participants suggested using differences between monitoring and baseline data that were substantially smaller than those shown in the monitoring plan for determining if a condition of concern exists. However, the power analysis indicated that these smaller differences would not be possible to measure without taking many more samples or significantly reducing the desired confidence level. Consequently, the study participants agreed that the statistically derived differences were the best possible, given the current level of monitoring effort proposed.

In order to test the null hypotheses presented in section 3, levels at which differences in data are considered significant must be set. For the mapping data, a finding of significance between baseline and monitoring results is largely based on a determination of whether SVPS indicate that material has physically moved offsite (table 12). Further investigations would be needed to verify the extent of movement of material offsite. Intensive sampling of the suspected area of offsite material would be needed to establish that the presence of offsite material is not due to offsite dumping of dredged material.

For on-site chemistry and bioassay data, determination of significance (step 1 of the management process) is based on a comparison of the monitoring values to established guideline values (table 12). In such cases, data that exceeds the guideline values will be considered as indicative of a change in conditions since the baseline. (For the Elliott Bay Site, where baseline studies may identify some sediment chemicals that already exceed guideline values, the measured baseline concentration will be the appropriate comparison value for evaluating monitoring results.) Determination of whether the observed changes in chemical concentration or toxicity is due to the disposal of dredged material (step 2 of the data analysis process), the decision scenarios presented above for the benchmark data would be applied.

For offsite chemistry data, determination of significance (step 1 of the site management process) is based on a comparison of the monitoring values to baseline

values (table 12). When offsite monitoring chemical concentrations are more than 125 percent of baseline values, such a change will be considered as indicative of a change in conditions since the baseline survey. For a determination of whether the observed changes in chemical concentration are actually due to disposal of dredged material (step 2 of the data analysis process), the decision scenario presented for benchmark data would be applied.

For the biological data (bioaccumulation and benthic abundance), determination of significance is based on a comparison of the monitoring data to baseline data. The number of replicates taken, the number of stations evaluated, and the expected variation in the data that will be collected, were considered in setting the statistical significance at an 80-percent confidence level rather than at the traditional confidence level of 95 percent. This applies to both the comparison of monitoring data to baseline data (step 1 of the data analysis steps per 6.1) and comparison of the monitoring data to the benchmark data (step 2 of the data analysis steps) (table 13). Appendix A of this Exhibit presents an analysis and rationale for deciding upon a confidence level of 80 percent.

For purposes of developing a sampling program for the monitoring plan, a power analysis using the types of data (coefficient of variation) expected for bioaccumulation and benthic abundance was conducted (appendix A). Power analysis provides an effective means of planning monitoring sampling programs and estimating the types of impacts that would be required before statistical significance can be detected with any degree of certainty (i.e., above 80 percent confidence) (Bernstein and Zalwiski, 1983). The power analysis resulted in definition of the differences required between the mean baseline value and the mean monitoring value before a conclusion of statistical significance could be made. The guidelines for interpreting bioaccumulation and benthic abundance data are presented in table 14.

According to the power analysis, a 194 percent increase in the mean concentration of any metal in body tissues over baseline would be required to reject the null hypothesis given that two replicates will be taken (using a statistical confidence level of 80 percent). The interpretation guidelines are only approximate, since calculation of the values required making an estimate of the coefficient of variation expected for the data being gathered (see Exhibit I Appendix). The interpretation guideline values may change once the coefficient of variation of the actual field data has been determined.

7. ESTIMATED MONITORING SCHEDULE AND COSTS

A proposed 15-year monitoring schedule is summarized in table 15. This schedule assumes there will be sufficient use at all three disposal sites in the first 3 years to require full monitoring at each site within that period. Disposal activity forecasted for the Elliott Bay site indicates that a sufficient volume of material will be disposed in the second and fourth years of site use to warrant full monitoring. Disposal activity at the other two sites is forecasted to be low enough that full monitoring would not be required until the third year of site use. However, actual disposal volumes could vary significantly from projections. Delays in opening one or more sites in 1988 could depress volumes and impacts which might be measured

TABLE 12

INTERPRETIVE GUIDELINES FOR
MAPPING, CHEMISTRY, AND BIOASSAY DATA

Parameter	Steps in Data Analysis Process	
	Step1[1]	Step2[2]
Mapping	Dredged material exceeds 3cm at the perimeter line	Further assessment to determine full extent[3]
Onsite Chemistry	Exceed chemical guideline values[4]	Comparison of off-site reference monitoring data to off-site reference baseline data[5]
Offsite Chemistry	Greater than 125% of baseline value	Comparison of off-site reference monitoring data to off-site reference baseline data[5]
Bioassay	Exceeds toxicity guideline values	Baseline reference data exceeds toxicity guideline values

[1]Comparison of monitoring data to baseline data.

[2]Comparison of benchmark monitoring and benchmark baseline data.

[3]Further assessment could include additional mapping to determine the extent of offsite dredged material movement and to establish, if possible, whether the presence of material offsite is due to improper disposal operations.

[4]If dredged material with chemical concentrations above the guideline value is allowed to be discharged at a site (e.g., meets the extended biological testing procedures outlined in EPTA, 1988, then changes in the on-site management plan will need to be made at that time).

[5]In step 2, off-site benchmark data must be compared as depicted in figure 9 and described in section 6.1. Scenarios 1-3, as described in section 6.1 would apply to the outcome of these comparisons.

TABLE 13

INTERPRETIVE GUIDELINES FOR BENTHIC ABUNDANCE AND TISSUE BODY BURDEN DATA

Parameter	Steps in Data Analysis Process: Step 1[1]	Steps in Data Analysis Process: Step 2[2]
Benthic Abundance	Exceed interpretive guideline value 1/3x of baseline[3]	Exceed interpretive guideline value 1/3x of baseline[3]
Tissue Body Burdens	Exceed interpretive guideline value Metals: 3x of baseline[3] Organics: 5x of baseline[3]	Exceed interpretive guideline value Metals: 3x of baseline[3] Organics: 5x of baseline[3]

TABLE 14

INTERPRETIVE GUIDELINE VALUES FOR TISSUE BODY BURDEN AND BENTHIC ABUNDANCE

Parameter	COV[1]	MMD[2]	Guideline Values
Benthic Body Burden/Metals	70%	+ 194%	3x of baseline
Benthic Body Burden/Organics	150%	+ 416%	5x of baseline
Benthic Abundance	150%	- 213%	1/3x of baseline

[1]COV = Coefficient of Variation. Percentage variation typically expected about the mean of the parameter being measured. The COV used in this power analysis was estimated using past data. The COV will be recalculated following the baseline study. This may change the trigger values and the mean detectable difference.

[2]MDD = Mean Detectable Difference. Percentage difference between means that can be detected as significant given a level of statistical confidence.

through monitoring. If volumes are too low to warrant cost-effective monitoring, initial monitoring may be delayed by one year. Decisions on monitoring will made by DNR and the Corps, based on actual site use, in consultation with EPA and Ecology.

The monitoring schedule also assumes that no evidence of impacts due to dredged material offsite is found and that chemical concentrations and toxicity on-site or within the dilution zone do not exceed guideline levels. If any of these conditions exist after the first 5 years of monitoring (following three full monitoring efforts at each site) then the monitoring schedule might have to be altered.

Estimates for the costs of the proposed PSDDA monitoring plan are based on 1986 price levels for sampling, analysis, boat time, and monitoring program administration. The cost of monitoring for each disposal site is presented in table 16. These estimates include 20 percent agency overhead and management, and 15 percent contingency. Inflation was not considered in the calculation of costs. Costs are projected over a plan horizon of 15 years following the monitoring effort sequence presented in table 15. The costs presented in table 16 include costs of conducting steps 1 and 2 in the site management process. However, they do not include funds for conducting extensive site surveys if unacceptable impacts due to dredged material disposal are found (i.e., step 3 in the site management process). The potential need for funding extensive site investigations will be evaluated in the third year of monitoring when at least one full monitoring effort has been conducted at each site.

TABLE 15

PROPOSED SCHEDULE FOR BASELINE STUDIES AND ENVIRONMENTAL MONITORING AT EACH DISPOSAL SITE OVER A 15-YEAR MONITORING PERIOD

YEAR	SITES		
	Elliott Bay	Commencement Bay	Port Gardner
1988	B	B	B
1989	P[1]	P[1]	P[1]
1990	F	-	-
1991	P[2]	F	F
1992	F	-	-
1993	-	F	F
1994	-	-	-
1995	P	-	-
1996	-	-	-
1997	-	-	-
1998	-	P	P
1999	P	-	-
2000	-	-	-
2001[3]	-	-	-
2002[3]	-	-	-
2003[3]	P	P	P

B = Baseline
P = Partial
F = Full

[1]The first monitoring effort after baseline will only take place after the site has been used and volumes are sufficient to reasonably expect that observable changes will be present.

[2]Physical monitoring only.

[3]The years 2001, 2002, and 2003 are beyond the planning horizon for PSDDA, but were used in preparing the costs of the monitoring plan for the Phase I disposal sites.

TABLE 16

ESTIMATE COSTS FOR BASELINE AND MONITORING
OVER A 15 YEAR MONITORING PERIOD
AT EACH DISPOSAL SITE

	Year	Commencement Bay	Elliott Bay	Port Gardner	Total Yearly Cost
Baseline	1988	$204,300	$110,400	$135,300	$450,000 1/
Monitoring	1989	61,300	58,400	55,200	174,900
	1990	--	175,200 4/	--	175,200
	1991	175,900	10,700	159,500	346,100
	1992	--	175,200	--	175,200
	1993	179,200	--	162,200	341,400
	1994	--	--	--	--
	1995	--	58,400	--	58,400
	1996	--	--	--	--
	1997	--	--	--	--
	1998	62,900	--	56,800	119,700
	1999	--	58,400	--	58,400
	2000	--	--	--	--
	2001 3/	--	--	--	--
	2002 3/	--	--	--	--
	2003 3/	62,900	58,400	56,800	178,100
		$542,200	$594,700	$490,500	$1,627,400 2/

1/Estimated 1986 costs from Table 7 include, 20 percent agency overhead and administration, and 15 percent contingency (inflation is not included).
2/Total does not include baseline costs.
3/The years 2001 - 2003 are beyond the planning horizon for PSDDA (1985-2000), but were used in preparing the costs of the monitoring plan for the Phase I disposal sites.
4/Costs may be lower if biological monitoring is not done at Elliot Bay.

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EXHIBIT I APPENDIX: POWER ANALYSIS

NPSEN-PL-PSDDA
April 1987

MEMO FOR: RECORD

FROM: D. Michael Johns

SUBJECT: PSDDA Environmental Monitoring - Power Analysis and Hypotheses

1. Background. This memo describes the statistical power to be applied and hypotheses to be tested with the environmental monitoring plan for the Puget Sound Dredged Disposal Analysis.

2. Relationship Among Variables Used in Power Analysis.

a. As the Coefficient of Variation (CoV) increases, the Mean Detectable Difference (MDD) needed to detect a statistical difference between two means increases. Put another way, the more variable the data are for a given parameter the greater the difference between two means has to be in order to detect significant differences. Table 1 displays these relationships.

b. For any given significance level, as the number of replicates increases, the lower the MDD can be and still detect significant differences.

c. Within any CoV group, as the significance level is relaxed (e.g., from 0.05 to 0.30, 95 percent to 70 percent, respectively), the difference in MDD needed for statistical significance decreases. However, as significance level is reduced, the greater the chance of rejecting a null hypothesis that is true (i.e., of saying the dredged material disposal causes significant impacts when it does not).

d. For any given significance level, the reduction in MDD gained in adding replicates decreases after three replicates. The curve depicting this relationship is presented in figure 1.

e. Depending upon the significance level chosen, the MDD needed to detect significant differences increases as the number of stations increases. This is true for significance levels of 0.20 and 0.30. For 0.05, the MDD decreases a small amount as the number of stations increases, but the change in MDD is not great and for practical purposes could be considered the same.

3. Present Monitoring Analysis Scheme.

a. Number of replicates for each monitoring parameter: The following replicates are currently being considered for the monitoring parameters:

Bulk Chemistry Data--1 Analysis per station (6 cores composited per station)

Sediment Bioassays--1 Analysis per Station (6 cores composited per station)

TABLE 1

POWER ANALYSIS MATRIX
2 STATIONS
(e.g., Comparison Between Baseline and Monitoring Station Data)

	Confidence Level[1] (Percent)	MEANDETECTABLE DIFFERENCES[3] Number of Replicates 2	4	5
70% COV[2]	95	396%	167%	142%
	80	194	113	99
	70	155	97	86
100% COV	95	565	238	202
	80	278	162	142
	70	222	139	123
150% COV	95	848	357	304
	80	416	243	213
	70	332	208	184

[1]Statistical Significance Level. Level of significance (or confidence) at which one is testing whether the null hypothesis (that dredged material is not causing a significant impacts is true.

[2]COV = Coefficient of Variation. Percentage variation typically expected about the mean of the parameter being measured.

[3]Mean detectable Difference (MDD). Percentage difference between means that can be detected at a given significance level for data having a given coefficient of variation.

Benthic Body Burdens---2 replicates (2 analyses per station; 3 samples per analysis)

Benthic Abundance---5 replicates (5 analyses per station)

Since bulk chemistry data will be compared to chemistry concentration guidelines (ML) established by PSDDA there is no need to collect replicates or statistically analyze this data. The values in the ML list represent a single "trigger" number for which to compare the bulk chemistry concentrations.

A similar approach should be used with the sediment bioassay data. Established bioassay action levels will be set for the category of material being allowed to go to open water disposal sites. These action levels represent single "trigger" numbers for which to compare bioassay results for each monitoring station.

For benthic abundance, five replicates may not be necessary. The reduction in MDD gained in going from four to five replicates (representing a change in power to detect differences) is not great (see figure 1). In fact, it may be cost ineffective to add

the fifth replicate. To fully address this issue, consideration must be given to the reasons other than increasing statistical power for doing five replicates instead of four (review previous graph). Patchy distribution of infaunal species would be a reason for using five replicates. Compatibility to PSEP protocols would be an additional reason.

b. Present Monitoring Plan: The monitoring plan calls for a "stepped" analysis of the data and the significance level that is applied to the data being dependent on which step in the analysis is being considered. The following is a brief outline of this "stepped" analysis:

Step i. When comparing current monitoring data to the initial data collected for a station a significance level of 80 percent will be used. If a significant difference is detected it will trigger an analysis of archived samples that represent the benchmark station for the collection station in question.

Step ii. Once the benchmark data are analyzed, it will be statistically tested using a significance level of 80 percent. If the benchmark data are found to be significantly different then this fact may be used to determine that the original differences found in the monitoring data are not due to the disposal of dredged material but due to other Puget Sound contaminant sources. This conclusion would be appropriate providing that the benchmark site is clearly out of the potential impact zone of the disposal site and providing that the relative magnitude of the MDD in the monitoring and benchmark data are the same. If the magnitude of differences in the means for the monitoring data is greater than the differences in the means for the benchmark data (assuming that the data sets have similar coefficients of variation) then it will be difficult to draw conclusions. One method for overcoming this problem might be to say that if the difference in magnitude between the means for the benchmark data is 50 percent of the magnitude between the means of the monitoring station data, then the benchmark data indicates a potential impact to the monitoring station due to the deposal site (see figure 2).

If the benchmark data are not found to be significantly different then this would indicate that the results of the statistical analysis of the monitoring data are valid and point to potential impacts at the monitoring station.

Step iii. If the monitoring data is determined to be significant based on an analysis of the benchmark data it would trigger an investigative step (first level site management response) to determine the extent, magnitude, persistence and/or possible causes of the significant differences that have been detected. The scope of this effort will be determined by a future interagency committee.

Since the investigative action represents a new study (collecting more data from the monitoring station, etc.) then it would be possible to change the significance level at which the data will be tested. Tightening of the confidence level to 95 percent would be justified at this time as you want to be sure to avoid a type I error (rejecting a true null hypothesis and saying disposal is a problem) because of the consequences of doing so (triggering site management responses).

4. Hypotheses for the Monitoring Plan.

The following represent hypothesis for each of the monitoring parameters presented above. For those monitoring parameters that will be subjected to statistical analysis (all except bulk chemistry and sediment bioassays) the action trigger will be any difference in means that exceeds the MDD needed to show a statistically significant difference. For the purposes of the hypotheses developed here, best guess estimates have been made for the coefficient of variation (CoV) that might be expected for each parameter. There will be a need to further refine these CoV's following the baseline survey. The CoV's and resulting MDD's for each monitoring parameter are presented below:

Parameter	CoV	MDD	Trigger Values
Benthic Body Burden/Metals	70%	+194%	3x of baseline
Benthic Body Burden/Organics	150%	+416%	5x of baseline
Benthic Abundance	150%	-213%	1/3x of baseline

The following represent the null hypothesis for each of the monitoring parameters:

Bulk Chemistry: Chemical concentrations at the monitoring station are not representative of the next higher category of contamination as reflected in the maximum level chemistry list.

Sediment Bioassays: Toxicity of the sediment, as tested by bioassays, is not representative of the next higher category of contamination as reflected in the bioassay mortality action levels.

The above two hypotheses can be further identified following selection of the category of material that will be allowed to go to open water, unconfined disposal sites.

Benthic Body Burdens: There will be no significant increase in contaminant body burdens (metals = 194 percent over baseline levels; organics = 416 percent over baseline levels) in species collected around the disposal site due to deposited dredged material.

Benthic Abundance: There will be no significant decrease in major taxa (213 percent reduction in abundance of taxa members) around the disposal site due to deposited dredged material.

It should be remembered that the percentage of change in mean detectable difference between the mean value for the baseline and monitoring data presented here are for planning purposes only. The coefficient of variation used in the power analysis presented in this memo were best guess estimates based on general literature values. The actual MDD needed to detect differences between the baseline mean value and the monitoring mean value will depend on the coefficient of variation found between replicates collected during the baseline.

FIGURE 1 STATISTICAL POWER ANALYSIS

ODES TOOL NO. 14
UNEXPLAINED VARIANCE 900
SIGNIFICANCE LEVEL: .30
ESTIMATED MEAN: 100

NOTE: MINIMUM DETECTABLE DIFFERENCE EXPRESSED AS PERCENT OF MEAN

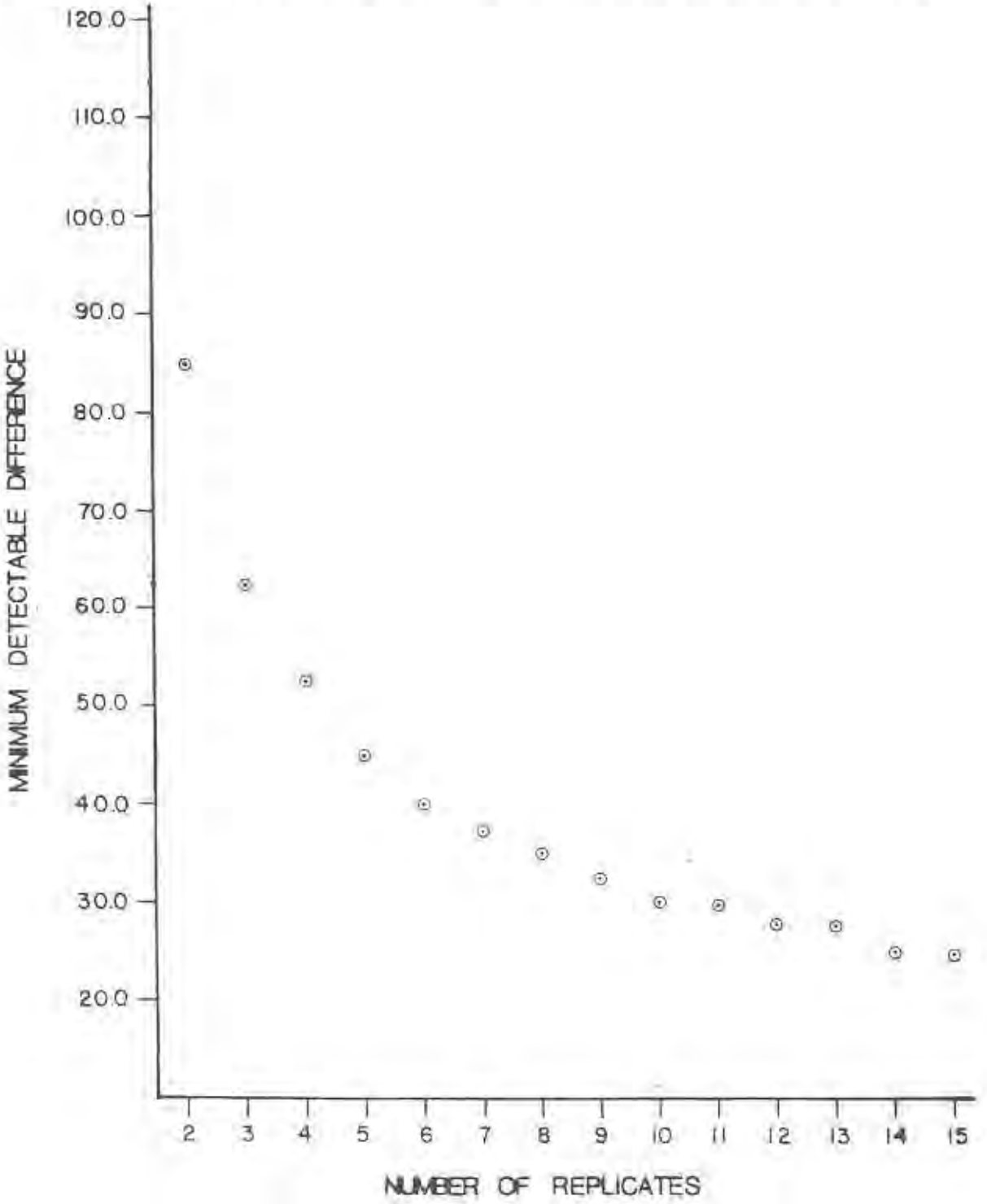
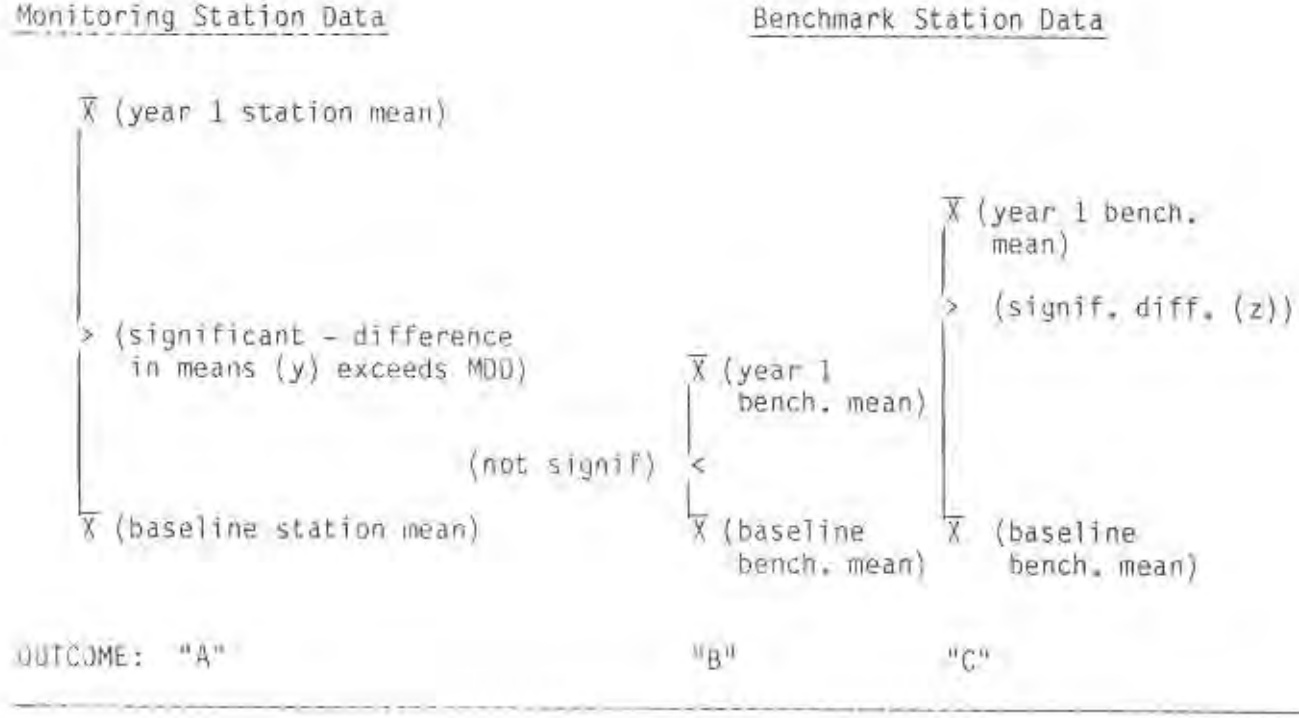


FIGURE 2

Interpreatation of Benchmark Station Data



Interpretation of Benchmark Data:

If the benchmark baseline and year one means are not significantly different (Outcome B), then the monitoring station data (Outcome A) reflects potential impact from the disposal site.

If the difference between means for the benchmark data are significant (Outcome C) and are <50 percent of the difference between the means of the monitoring station data (i.e., Z <0.5Y), then the monitoring station data reflects potential impact form the disposal site.

If the difference between means for the benchmark data are significant (Outcome C) but are >50 percent of the difference between the means of the monitoring station data (i.e., Z >0.5Y), then the monitoring station data does not reflect impact from the disposal site, but rather changes due to other Puget Sound influences.

EXHIBIT J

DISPOSAL SITE MANAGEMENT PLANS

1. Commencement Bay

1.1 Disposal Goals

The goals of Commencement Bay disposal site management are to ensure that appropriate dredged materials are placed accurately, in accordance with any project requirements, and that long term environmental impacts of disposal are known to be acceptable.

1.2 Future Dredged Material Disposal Volumes

The total volume of dredged material projected to be sent to the Commencement Bay disposal site is a range of 195,000 to 3,269,000 cubic yards over the 15-year period of 1985 to 2000 (see EPTA, Table II.10-4). Actual volumes disposed will depend on actual dredging projects and results of chemical and biological tests.

1.3 Disposal Target Area

The disposal target area is a circle with a 600' radius centered at Latitude 47 degrees 18.22' and Longitude 122 degrees 27.84'. This area will be specified in all permits issued for disposal at this site. The 600' radius is an achievable positioning goal given the methods specified for this disposal site in Section 1.4 below. However, it is recognized that intricate positioning of tug and barge combinations is difficult. Disposal must not begin until at least some part of the barge is within the target area and end before the entire barge leaves the target area. This margin for error is built into sizing of the 900' radius surface disposal zone. Disposal will be acceptable if some part of the barge is within the 600' target area. However, the entire barge must be within the disposal zone throughout the time of dredged material release.

1.4 Navigation Controls

The official positioning aids will be Loran-C and variable range radar (VRR). Loran-C coordinates will be provided before site use begins. The following radar reference points are proposed:

1. Western tip of Browns Point
2. Western tip of Dash Point
3. Eastern tip of Piner Point
4. Eastern tip of Neil Point

1.5 Site Use Reporting

Disposal site users will be required to complete the DNR Site User Log (Figure J-1) for each use of the disposal site. Copies of the site use records shall be submitted to DNR at least once per month. Copies of the records shall also be retained on the tug for one month.

1.6 Compliance Inspection

Only dredged material meeting the PSDDA disposal guidelines may be disposed of at the Commencement Bay site. Compliance will be ensured through pre-dredging testing of dredged material. A dredging inspection plan will be prepared by Ecology to define inspection necessary to assure the quality of material sent to open-water disposal. Dredging site inspection will be the responsibility of Ecology for non-Corps projects and that of the Corps for its own contractors.

Disposal site positioning accuracy will be inspected on a spot-check basis by DNR. DNR inspection of positioning accuracy at the Commencement Bay site will normally be done through the use of shore-based radar and site visits.

Inspection of dredging and disposal site positioning for Corps projects will be conducted by the Corps. A dredging inspection plan will be prepared and disposal site user records will be kept in the same manner as for non-Corps projects. The Corps will send copies of disposal site user records and disposal site inspection reports to DNR.

Copies of all Ecology and Corps dredging site inspection plans will be forwarded to DNR before dredging begins.

1.7 Site Use Restrictions

There are no blanket restrictions on disposal site use for noise or navigation impacts at the Commencement Bay disposal site. However, individual permits may be conditioned for these or other factors.

1.8 Environmental Monitoring

The Commencement Bay Site is in a relatively flat, generally nondispersive area with a depth of 540' with northeast to southwest currents.

Table J-1 summarizes the estimated fifteen-year monitoring schedule for the Phase I area disposal sites. As shown, the Commencement Bay site is programmed to receive a checking study the first year of initial site use and a full monitoring within two years of the checking study. Two full monitoring and three checking studies are planned over a fifteen-year period.

2. Elliott Bay

2.1 Disposal Goals

The goals of Elliott Bay disposal site management are to ensure that appropriate dredged materials are placed accurately, in accordance with any project requirements, and that long term environmental impacts of disposal are known to be acceptable.

2.2 Future Dredged Material Disposal Volumes

The total volume of dredged material projected to be sent to the Elliott Bay disposal site is a range of 3,197,000 to 5,119,000 cubic yards over the 15-year period of 1985 to 2000 (see EPTA, Table II.10-4). Actual volumes disposed will depend on

FIGURE J-1

DISPOSAL SITE USER LOG (EXAMPLE)

DISPOSAL SITE_____ SITE CENTER: Lat_____, Long_____, SITE RADIUS 600'

TUG NAME_____

	DATE	DNR PERMIT #	BARGE NAME	BEGIN DUMPING		END DUMPING		VOLUME (CU. YD.)	DESCRIBE FLOATABLES REMOVED	TIME LEFT SITE	SKIPPER'S SIGNATURE
				TIME	BEARING AND RANGE (FROM CENTER OF SITE)	TIME	BEARING AND RANGE (FROM CENTER OF SITE)				
1.											
2.											
3.											

TABLE J-1

PROPOSED SCHEDULE FOR BASELINE STUDIES AND ENVIRONMENTAL MONITORING AT EACH DISPOSAL SITE OVER A 15-YEAR MONITORING PERIOD

YEAR	SITES		
	Elliott Bay	Commencement Bay	Port Gardner
1988	B	B	B
1989	P[1]	P[1]	P[1]
1990	F	-	-
1991	P[3]	F	F
1992	F	-	-
1993	-	F	F
1994	-	-	-
1995	P	-	-
1996	-	-	-
1997	-	-	-
1998	-	P	P
1999	P	-	-
2000	-	-	-
2001[3]	-	-	-
2002[3]	-	-	-
2003[3]	P	P	P

B = Baseline P = Partial F = Full

[1]The first monitoring effort after baseline will be done only after use of the site has occurred and volumes are sufficient to reasonably expect that observable changes will be present.

[2]The years 2001, 2002, and 2003 are beyond the planning horizon for PSDDA, but were used in preparing the costs of the monitoring plan for the Phase I disposal sites.

[3]Physical monitoring only.

actual dredging projects and results of chemical and biological tests.

2.3 Disposal Target Area

The disposal target area is a circle with a 600' radius centered at Latitude N 47 degrees 35.97' and Longitude W 122 degrees 21.38'. This area will be specified in all permits issued for disposal at this site. The 600' radius is an achievable positioning goal given the methods specified for this disposal site in Section 2.4 below. However, it is recognized that intricate positioning of tug and barge combinations is difficult. Disposal must not begin until at least some part of the barge is within the target area and end before the entire barge leaves the target area. This margin for error is built into sizing of the 900' radius surface disposal zone. Disposal will be acceptable if some part of the barge is within the 600' target area. However, the entire barge must be within the disposal zone throughout the time of dredged material release.

2.4 Navigation Controls

The official positioning aid for the Elliott Bay disposal site is the Coast Guard Vessel Traffic Service (VTS). All site users must contact the VTS and obtain positioning confirmation before initiating disposal. However, Loran-C and variable range radar reference points will be provided to aid operators in positioning. The following radar reference points are proposed:

1. Dolphin north of Duwamish Head
2. Northern tip of Duwamish Head
3. Northern tip of pier 13
4. Northern tip of the western pier of pier 14
5. Northeastern tip of terminal 18

2.5 Site Use Reporting

Disposal site users will be required to complete the DNR Site Use Log (Figure J-1) for each use of the disposal site. Copies of the site use records shall be submitted to DNR at least once per month. Copies of the records shall also be retained on the tug for one month.

2.6 Compliance Inspection

Only dredged material meeting the PSDDA disposal guidelines may be disposed of at the Elliott Bay site. Compliance will be ensured through pre-dredging testing of sediments and identification of any materials unsuitable for unconfined, open-water disposal. A dredging inspection plan will be prepared by Ecology to define inspection necessary to assure the quality of material sent to open-water disposal. Dredging site inspection will be the responsibility of Ecology for non-Corps projects. See below for Corps projects.

Disposal site positioning accuracy will be verified for each use by VTS. Site users will be required to contact the Coast Guard before disposal to confirm positioning and to report the tug, barge, and skipper's names, DNR permit number, and the time dumping begins. Site users must also report the time disposal ends. The Coast Guard will contact any vessels which appear to be making improper use of the site. This could include improper timing, lack of permits, use of improper equipment, or inaccurate

positioning. If improper use is discovered, the Coast Guard will:

a. Tell the operator why and advise them to stop;

b. Record the type of improper use and ask the source and yardage of material and name of project employer (if disposal has already occurred); and

c. Notify DNR immediately or on the next working day.

The Coast Guard will maintain a record (example in Figure J 1) of all contacts with vessels using the disposal site. A copy of the record will be sent to DNR weekly.

DNR will provide the Coast Guard with the following:

a. A statement of any site use restrictions for which violations could be identified through VTS;

b. Names and permit numbers of all tugs and barges authorized to use the site; and

c. Work and off-hours phone numbers for emergency contacts in case a violation is discovered in-progress and advice is needed.

DNR will inspect site use on a spot-check basis. DNR inspection of positioning accuracy at the Elliott Bay site will normally be done through the use of shore-based radar with occasional site visits.

Inspection of dredging and disposal site positioning for Corps projects will be conducted by the Corps. A dredging inspection plan will be prepared and disposal site user records will be kept in the same manner as for non-Corps projects. The Corps will send copies of disposal site user records to DNR.

Copies of all Ecology and Corps dredging site inspection plans will be forwarded to DNR before dredging begins.

2.7 Site Use Restrictions

There are no blanket restrictions on disposal site use for noise or navigation impacts at the Elliott Bay disposal site. However, individual permits may be conditioned for these or other factors.

2.8 Environmental Monitoring

The Elliott Bay Disposal Site, having a site center depth of about 270 feet, is in a gently sloping, generally nondispersive area which has weak and variable currents. The same basic monitoring strategy as provided for Commencement Bay will apply to Elliott Bay, although full and checking monitoring studies will be more frequent for Elliott Bay due to the greater volume of dredged material anticipated.

Table J-1 summarizes the estimated fifteen year monitoring schedule. Full monitoring will probably occur at Elliott Bay after the second year of site use.

3. Port Gardner

3.1 Disposal Goals

The goals of Port Gardner disposal site management are to ensure that appropriate dredged materials are placed accurately, in accordance with any project requirements, and that long term environmental impacts of disposal are known to be acceptable.

3.2 Future Dredged Material Disposal Volumes

The total volume of dredged material projected to be sent to the Port Gardner disposal site is up to 5,243,000 cubic yards over the 15 year planning period of 1985 to 2000 (SEE EPTA, Table II.10-4). Actual volumes disposed will depend on actual dredging projects and results of chemical and biological tests.

3.3 Disposal Target Area

The disposal target area is a circle with a 600' radius centered at Latitude 47 degrees 58.86' and Longitude 122 degrees 16.67'. This area will be specified in all permits issued for disposal at this site. The 600' radius is an achievable positioning goal given the methods specified for this disposal site in Section 3.4 below. However, it is recognized that intricate positioning of tug and barge combinations is difficult. Disposal must not begin until at least some part of the barge is within the target area and end before the entire barge leaves the target area. This margin for error is built into sizing of the 900' radius surface disposal zone. Disposal will be acceptable if some part of the barge is within the 600' target area. However, all the barge must be entirely within the disposal zone throughout the time of dredged material release.

3.4 Navigation Controls

The official positioning aid will be variable range radar (VRR). The following radar reference points are proposed:

1. Ferry terminal at Mukilteo
2. Navy pier at Mukilteo
3. Southern tip of Gedney Island
4. Bell buoy east of Gedney Island at the entrance to Port Susan
5. Bell buoy west of the mouth of the Snohomish River and north of the anchorage area

3.5 Site Use Reporting

Disposal site users will be required to complete the DNR Site Use Log (Figure J-1) for each use of the disposal site. Copies of the site use records shall be submitted to DNR at least once per month. Copies of the records shall also be retained on the tug for one month.

3.6 Compliance Inspection

Only dredged material meeting the PSDDA disposal guidelines may be disposed of at the Port Gardner site. Compliance will be ensured through pre-dredging testing of dredged material. A dredging inspection plan will be prepared by Ecology to define

inspection necessary to assure the quality of material sent to open-water disposal. Dredging site inspection will be the responsibility of Ecology for non-Corps projects. See below for Corps projects.

Disposal site positioning accuracy will be verified by DNR for each use on a spot-check basis. DNR inspection of positioning accuracy at the Port Gardner site will normally be done through the use of shore-based radar with occasional site visits.

Inspection of dredging and disposal site positioning for Corps projects will be conducted by the Corps. A dredging inspection plan will be prepared and disposal site user records will be kept in the same manner as for non-Corps projects. The Corps will send copies of disposal site user records and disposal site inspection reports to DNR.

Copies of all Ecology and Corps dredging site inspection plans will be forwarded to DNR before dredging begins.

3.7 Site Use Restrictions

There are no blanket restrictions on dredged spoil disposal for noise or navigation impacts at the Port Gardner disposal site. However, individual permits may be conditioned for these or other factors.

3.8 Environmental Monitoring

The Port Gardner Disposal Site, having a site center depth of about 400 feet, is in a relatively flat, generally nondispersive area with currents that are weak and tend to flow southeast to northwest at depth.

Table J-1 summarizes the estimated fifteen year monitoring schedule for Port Gardner which should receive a full monitoring study within three years of initial site use.

EXHIBIT K

NOISE MONITORING REPORTS

MEASUREMENT REPORT
4 MILE ROCK DISPOSAL SITE
TUG WALDO MEASUREMENT

Prepared for

WESTERN MARINE CONSTRUCTION INC.

by

MICHAEL R. YANTIS ASSOCIATES

June 24, 1986

INTRODUCTION

This report documents sound level measurements taken on June 23, 1986, of the 4 Mile Rock Simulated Disposal. The measurements were to determine the sound levels produced by Western Marine Construction company's Tug Waldo at the closest residential receiver location and certify that they do not exceed the 55 dBA criteria.

MEASUREMENT EQUIPMENT

Bruel & Kjaer 2209 Sound Level Meter
Bruel & Kjaer 4230 Calibrator -- 93.6 dBA at 1000 Hz
Bacharach Sling Psychrometer

LOCATION

The measurements were taken at 1970 Perkins Lane, the nearest residential area directly across from the disposal site. The measurements were taken 4 feet above road level facing the water in 78 degree (F) weather and 60% humidity. The wind was from the north at 4 to 5 knots. Visibility was clear.

MEASUREMENT DATA

A sound measurement of one to two minutes was taken on the equipment that would be used for the project. All measurements are Sound Pressure Levels, dB re 2 micropascals, and are A-weighted to comply with the Washington State Administrative Code 173-60.

The equipment for the disposal operation was measured from the following simulated operations:

1. Arriving at Site:

    a. The tug twin diesel engines were on full power. Tug was travelling in a northerly direction.

2. Pulling Away from Site:

    a. The tug twin diesel engines were on full power. Tug was travelling in a southerly direction.

The results of the measurements are as follows:

4 MILE ROCK TUG WALDO MEASUREMENT

NOISE	TIME	AVG LEVEL	RANGE	NOTES
Calibration	12:30pm	93.2 dBA	---	Before Test
Ambient	12:35	45 dBA	42-65	No tugs operating, but occasional aircraft & ferry visible Note 1, 2
Tug Waldo	12:40	42 dBA	41-43	Dumping Note 1
Tug Waldo	1:00	42 dBA	42-43	Pulling Away Note 2, 3

Notes:

1. Primary background noise levels were produced by water and wind (42-44 dBA), seagulls (55 dBA), jet aircraft (65 dBA), local traffic (49 dBA), large pleasure boat (44 dBA).

2. Measurements of tug entering and leaving the dump site are appropriate for the path used by tug during dumping operation. The tug entered the site from the south and left in a southern direction.

3. Noise from tug arriving and departing is barely audible.

DISCUSSION

The wind was from the north at 4 to 5 knots. The same equipment could produce higher noise levels on the shore, if the wind was gusting from the disposal site to the measurement location. However, a significant increase in noise levels could occur without exceeding the allowable noise levels according to the state ordinance. It is very unlikely that the equipment tested for the operating conditions and travel paths used, would ever exceed the State Noise Ordinance.

The primary background noise was produced by wind, trees, birds, and water. Seagulls generated 50 to 55 dBA. A large pleasure boat produced 44 dBA. Overhead aircraft produced noise levels of 65 dBA.

The ambient noise levels dominated the measured levels. Measured sound levels less than 47 dBA were effected significantly by the ambient noise levels.

The direction that the tugs travel to and from the disposal site will effect the sound levels measured. The measured sound levels for this test strictly apply for the paths taken by the tugs to and from the disposal site. It is possible that measured noise levels could increase substantially if the paths of the tugs carried them significantly closer to the shore.

All equipment met the 55 dBA limit set by WAC 173-60. In most cases, the operation of Tug Waldo was inaudible or barely audible at the measurement location.

MICHAEL R. YANTIS ASSOCIATES
1950 112th Avenue NE Suite 201
BELLEVUE, WASHINGTON 98004
Phone 454-4283

JOB WESTERN MARINE CONSTRUCTION SEATTLE, WASHINGTON
SHEET NO ____ OF ____
CALCULATED BY MRY/SDR DATE 6-23-86
CHECKED BY ____ DATE ____
SUBJ 4 MILE TUG/BARGE SITE

PURPOSE OF TEST: MEASURE SOUND LEVELS GENERATED FROM TUG @ 4 MILE DISPOSAL SITE.

TIME: 1235.

WEATHER: CLEAR, SUNNY
WET TEMPERATURE: 67°F TEMP
DRY TEMPERATURE: 78°F
HUMIDITY: 60%
WIND: NORTH @ 4-5 KNOTS

EQUIPMENT: B & K 2209 SOUND METER
CALIBRATED TO 93.6 dBA

MEASUREMENT LOCATION: 1967 PERKINS LANE
SEATTLE, WA

MEASURED SOUND LEVELS

DUMP SCOW #	SOUND LVL IN dBA	DUMPING TUG IDLING	PULLING AWAY TUG IN FULL POWER	TIME
–	43 dBA NOTE: TUG IS BARELY AUDIBLE WHILE MOVING TO DUMP SITE.	–	–	1240
WALDO TUG (W/NO BARGE) WITH TWIN DIESEL ENGINES.			42 dBA 42-44 dBA NOISE IS AUDIBLE	1255

NOTE: ENGINE COMPARTMENT TREATED.

NOTE: ENGINES & EXHAUST MUFFLERS NEW 1½ YRS AGO.

NOTE: AMBIENT NOISE FROM PROP. PLANE @ 48 dBA; LARGE PLEASURE BOAT @ 44 dBA

NOTE: BACKGROUND NOISES FROM WAVES, WIND, ETC. @ 42-44 dBA
BIRDS @ 55 dBA; LOCAL TRAFFIC @ 49 dBA; JETS @ 65 dBA.

MEASUREMENT REPORT
4 MILE ROCK DISPOSAL SITE
BARGE and TUB MEASUREMENT III

Prepared for

MANSON CONSTRUCTION

by

MICHAEL R. YANTIS ASSOCIATES

June 1986

INTRODUCTION

This report documents sound level measurements taken on May 29, 1986, of the 4 Mile Rock Simulated Disposal. The measurements were to determine the sound levels produced by Manson Construction Company Barges and Tugs at the closest residential receiver location and certify that they do not exceed the 55 dBA criteria.

MEASUREMENT EQUIPMENT

Bruel & Kjaer 2209 Sound Level Meter
Bruel & Kjaer 4230 Calibrator — 93.6 dBA at 1000 Hz (for all locations)
Bacharach Sling Psychrometer

LOCATION

The measurements were taken at 1970 Perkins Lane, the nearest residential area directly across from the disposal site. The measurements were taken 4 feet above road level facing the water in 70 degree (F) weather and 59% humidity. The wind was from the north at 15 to 20 knots. Visibility was clear.

MEASUREMENT DATA

A sound measurement of one to two minutes was taken separately of each piece of equipment that would be used for the project. All measurements are Sound Pressure Levels, dB re 2 micropascals, and are A-weighted to comply with the Washington State Administrative Code 173-60.

The equipment for the disposal operation was measured from the following simulated operations:

1. Dumping Operation:

    a. The tug diesel engine was on idle.

    b. The barge diesel engine was on full power.

2. Pulling Away Operation:

    a. The tug diesel engine was on full power.

    b. The barge diesel engine was off.

The results of the measurements are as follows:

4 mile Barge Measurement III

NOISE	TIME	AVG LEVEL	RANGE	NOTES
Calibration	1:00pm	93.2dBA	—	Before test
Ambient	1:30	41dBA	38-70dBA	No tugs or barges operating, but occasional aircraft & ferry visible, Note 1
Barge #55 & Tug Margaret M	1:45	41dBA	38-41dBA	Dumping, Note 2
Barge #55 & Tug Margaret M	1:50	37dBA	37-38dBA	Pullying Away, Note 3,4
Barge #54 & Tug Elmer M	2:00	38dBA	37-38dBA	Dumping, Note 2
Barge #54 & Tug Elmer M	2:05	38dBA	37-38dBA	Pullying Away, Note 3,4
Barge Seaport & Tug Jeffery M	2:10	41dBA	40-41dBA	Dumping, Note 2
Barge Seaport & Tug Jeffery M	2:15	41dBA	40-41dBA	Pullying Away, Note 3,4

Notes:

1. Primary background noise levels are produced by wind, birds (seagulls 50-55dBA), water, jet aircraft(70dBA).

2. The noise from the dumping operation is inaudible.

3. Measurements of tug noise entering and leaving the dump site are appropriate for the path used by the tug during dumping operation. The tugs entered the site from the south. They left in a south westerly direction.

4. Noise from tug departing is barely audible.

DISCUSSION

The wind was from the north at 15 to 20 knots. The same equipment could produce higher noise levels on the shore, if the wind was gusting from the disposal site to the measurement location. However, a significant increase in noise levels could occur without exceeding the allowable noise levels according to the state ordinance. It is very unlikely that the equipment tested for the operating conditions and travel paths used, would ever exceed the State Noise Ordinance.

The primary background noise was produced by wind, trees, birds, and water. Seagulls generated 50 to 55 dBA. Overhead aircraft produced noise levels of 70 dBA.

The ambient noise levels dominated the measured levels for the dumping equipment. Measured sound levels less than 47 dBA were effected significantly by the ambient noise levels.

The direction that the tugs travel to and from the disposal site will effect the sound levels measured. The measured sound levels for this test strictly apply for the paths taken by the tugs to and from the disposal site. It is possible that measured noise levels could increase substantially if the paths of the tugs carried them significantly closer to the shore.

All equipment met the 55 dBA limit set by WAC 173-60. In most cases, the operation of the tug and barges was inaudible or barely audible at the measurement location.

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MEASUREMENT REPORT, 4 MILE ROCK DISPOSAL SITE
MICHAEL R. YANTIS ASSOCIATES
JANUARY 24, 1986

INTRODUCTION

This report documents sound level measurements taken on January 21, 1986, of the 4 Mile Rock Simulated Disposal. The measurements were to determine the sound levels produced by each piece of machinery at the closest residential receiver location and certify that they do not exceed the 55 dBA criteria.

MEASUREMENT EQUIPMENT

Bruel & Kjaer 2209 Sound Level Meter
Bruel & Kjaer 4230 Calibrator — 93.6 dB at 1000 Hz
(for all locations)

LOCATION

The measurements were taken at 1970 Perkins Lane, the nearest residential area directly across from the disposal site. The measurements were taken 4 feet above road level facing the water in 50 degree (F) weather and 50% humidity. The wind was calm. Visibility was clear, although the sky was partly cloudy.

MEASUREMENT DATA

A sound measurement of one to two minutes was taken separately of each piece of equipment that would be used for the project. All measurements are Sound Pressure Levels, dB re 2 micropascals, and are A-weighted to comply with the Washington State Administrative Code 173-60.

The equipment for the disposal operation was measured from the following simulated operations:

1. Dumping Operation:

   a. The tug diesel engine was on idle.
   b. The barge electric motor was on full power.

2. Pulling Away Operation:

   a. The tug diesel engine was on full power, dominating the sound level readings.
   b. The barge electric motor was off.

4 MILE ROCK DISPOSAL SITE
PAGE TWO

The results of the measurements are as follows:

NOISE SOURCE	TIME	AVE LEVEL	RANGE	NOTES
Calibration	2:00pm	93.8 dBA	—	Before test
Ambient	2:05pm	43.5 dBA	43.5-57 dBA	No tugs or barges operating, but occasional aircraft & ferry visable, Note 1
✓Barge Gidney & Tug Margaret M.	2:10pm	44.0 dBA	44.0 dBA	Dumping, Note 2
✓Barge Gardner & Tug Margaret M.	2:20pm	46.0 dBA	46.0 dBA	Dumping, Note 2
✓Tug Margaret M.	2:30pm	45.5 dBA	45.5 dBA	Pulling Away, Notes 3, 4

Notes:

1. A distant, constant noise is producing the 43.5 dBA ambient.

2. The noise from the dumping operation is inaudible.

3. Measurements of tug noise entering and leaving the dump site represent the path used by the tug during dumping operation. The tug entered the site from southwest. It left north, then headed in a south westerly direction.

4. Noise from tug departing is barely audible, occasionally.

DISCUSSION

The wind was calm, and had no effect on the measurements. The same equipment could produce higher noise levels on the shore, if the wind blows from the disposal site to the measurement location. However, a significant increase in noise levels could occur without exceeding the allowable noise levels according to the state ordinance.

The ambient noise level was constant at 43.5 to 45 dBA. Although there were no other constant sources of noise that were apparent, the fact that it was constant and higher than previous measurements at the same location suggests that a distant noise source was operating and creating a majority of the ambient noise measured. In all cases, the ambient noise level dominated the measured noise levels for the dumping equipment. Sound level measurements less than 47 dBA were effected significantly by the ambient noise levels.

The direction that the tugs travel to and from the disposal site will effect the sound levels measured. The measured sound levels for this test strictly apply for the paths taken by the tugs to and from the disposal site. It is possible that measured noise levels could increase substantially if the paths of the tugs carried them significantly closer to the shore.

All equipment met the 55 dBA limit set by WAC 173-60. In most cases, the operation of the tug and barges was inaudible or barely audible at the measurement location.

noise control SERVICES, INC.

SURVEYS · ENGINEERING · DESIGN · FABRICATION · INSTALLATION

January 14, 1986

A. H. Powers Inc.
5659 40th West
Seattle, Washington 98199

Attention: Mr. Albert Powers

Subject: Noise Survey for Barge named Brusco #101

Dear Mr. Powers,

Second noise survey was taken at 2:00 P.M. near 4 mile rock at lower Magnolia Bluff on Tuesday, January 14, 1986.

Noise reading taken before you arrived was 48dba at 50 yards off-shore and 50 dba at 15 yards off-shore. When barge was operating there was no measurable noise increase.

Best regards,

Rod Sannes

Rod Sannes

RS:gm

(See Note, 1/11.)

2115 S.W. 152nd, Seattle WA 98166 / Seattle (206) 248-0141 Portland (503) 228-1200

noise control SERVICES, INC.

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January 6, 1986

A. H. Powers, Inc.
5659 40th Avenue West
Seattle, Washington 98189

Attention: Mr. Albert Powers

Subject: Noise Survey

Dear Mr. Powers,

Below are the noise readings and pertinent information needed per your request:

Location: 4 Mile Rock below Magnolia Bluff

Time of Day: 8:00 A.M. - 8:30 A.M.

Type of Equipment in question:

Tug: Double Eagle - 20' x 60', 800 HP Black Hull-Yellow & Green Terex Loader #72-31, 3 cylinder

Noise readings were taken by a Scott sound level meter, Type 452 ANSI Type 2 S1.4.

Ambient noise levels measured before equipment was in place were as follows measured in the dba scale:

Before 55 dba, 40 feet from shore, incoming waves measured intermediatly at 57 dba to 60 dba. While both the tug and the Terex Loader were operating, there was no measurable increase in the noise levels.

The equipment, when measurements were taken, were 1/2 mile off shore. The requirements state they would be operating at 3/4 of a mile, but this distance was not obtainable because of heavy traffic in the area. However, this distance is much closer to shore than the equipment will actually be operating.

Best regards,

Rod Sannes

RS:gm

2115 S.W. 152nd, Seattle, WA 98166 / Seattle (206) 248-0141 Portland (503) 238-1200

MICHAEL R. YANTIS ASSOCIATES
Consulting in Acoustics and Vibration
1950-112th Ave. N.E., Suite 201
Bellevue, WA 98004

MEASUREMENT REPORT, 4 MILE ROCK DISPOSAL SITE
MICHAEL R. YANTIS ASSOCIATES
NOVEMBER 15, 1985

INTRODUCTION

This report documents sound level measurements taken on November 14, 1985, of the 4 Mile Rock Simulated Disposal. The measurements were to determine the sound levels produced by each piece of machinery at the closest residential receiver location and certify that they do not exceed the 55 dBA criteria.

MEASUREMENT EQUIPMENT

Bruel & Kjaer 2209 Sound Level Meter
Bruel & Kjaer 4230 Calibrator — 93.6 dB at 1000 Hz
(for all locations)

LOCATION

The measurements were taken at 1970 Perkins Lane, the nearest residential area directly across from the disposal site. The measurements were taken 4 feet above road level facing the water in 40 degree (F) weather and 75% humidity. The wind was south westerly from 0 to 5 mph and the visibility was clear.

MEASUREMENT DATA

A sound measurement of one to two minutes was taken separately of each piece of equipment that would be used for the project. All measurements are Sound Pressure Levels, dB re 2 micropascals, and are A-weighted to comply with the Washington State Administrative Code 173-60.

The equipment for the disposal operation was measured from the following simulated operations:

1. Dumping Operation:

   a. The tug diesel engine was on idle.
   b. The barge diesel engine was on full power, dominating the sound level readings.

2. Pulling Away Operation:

   a. The tug diesel engine was on full power, dominating the sound level readings.
   b. The barge diesel engine was on idle.

4 MILE ROCK DISPOSAL SITE
PAGE TWO

The results of the measurements are as follows:

NOISE SOURCE	TIME	AVE LEVEL	RANGE	NOTES
Calibration	9:10am	93.8 dBA	—	Before test
Ambient	9:12am	42.5 dBA	45.2 dBA	No tugs or Barges Operating
Barge #54 and Tug Jeffry M.	9:25am	42.5 dBA	42.5 dBA	Dumping, Note 1
Ambient	9:27am	44 dBA	44 dBA	Pulling Away, Note 2, 3
Barge #55 and Tug Elmer M.	9:34am	42.5 dBA	42.5 dBA	Dumping, Note 1
Ambient	9:36am	42.5 dBA	42.5 dBA	Pulling Away, Note 2, 3
Barge Basalt & Tug Gladys M.	9:45am	45 dBA	44-47 dBA	Dumping, Note 1
Ambient	9:49am	51 dBA	45-55 dBA	Pulling Away, Note 2, 3
Calibration	9:57am	93.8 dBA	—	After Test

Notes:

1. Barge #54 and #55 have been modified to reduce noise; cabins have been lined with 2 inch styrofoam, plus oversized mufflers have been installed on engines.

2. Measurements of tug noise entering and leaving the dump site represent the path used by the tugs during dumping operation. All three tugs entered the site from south west. The Jeffry M. and the Elmer M. left site in a south westerly direction. The Gladys M.'s departure was to the East, heading towards shore, then changed heading to the south west.

3. The tug Jeffry M. and the tug Elmer M. have caterpillar diesel engines. The tug Gladys M. has a G.M.C. Diesel Engine.

DISCUSSION

During the measurements, the wind was blowing from a south westerly direction, which was perpendicular to the path of the sound between the disposal site and our measurement location. Therefore, the wind has very little effect on the sound levels measured. It is possible that the same equipment would produce higher levels on the shore, if the wind was blowing from the disposal site to the measurement location. However, with the exception of the tug Gladys M., a significant increase in noise levels could occur without exceeding the allowable noise levels according to the state ordinance.

The ambient noise level was constant at 42 to 45 dBA. Although there were no other sources of noise that were apparent, the fact that it was constant and higher than previous measurements suggests that a distant noise source was operating and creating a majority of the ambient noise measured. In most cases, the ambient noise level contributed to the measured noise levels for the dumping equipment. Sound level measurements less than 45 dBA were effected significantly by the ambient noise levels.

The direction that the tugs travel to and from the disposal site will effect the sound levels measured. The measured sound levels for this test strictly apply for the paths taken by the tugs to and from the disposal site. The Gladys M. had a noisier engine than the previous two tugs, but it also left the disposal site at a direction that brought it initially closer to the shore. Although it did not stay on that direction long, the fact that it exited the disposal site on the near side, rather than the far side, increased its noise levels as measured on the shore. It is possible that measured noise levels could increase substantially if the paths of the tugs carried them significantly closer to the shore.

All equipment met the 55 dBA limit set by WAC 173-60. In most cases, the operation of the tugs and barges was inaudible or barely audible at the measurement location.

noise control SERVICES, INC.

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October 10, 1986

Brusco Tug & Barge
P.O. Box 1060
Longview, Washington 98632

RCVD
BREML
'86 OCT 15 PM2:05

Attention: Mr. Henry Brusco

Subject: Noise Survey for Ref. Disposal Permit No. 9645-131

Dear Mr. Brusco,

Below are the noise readings and pertinent information needed per your request.

Location: 4 Mile Rock below Magnolia Bluff

Time of Day: 10:30 A.M. - 11:00 A.M., Oct. 10, 1986

Type of equipment in question:

Tug: Donna Foss #522088

Barges names: Brusco #100, #252611
and
Brusco #101,#254401

Noise readings were taken by a Scott sound level meter, Type 452 ANSI, Type 2 S1.4.

Ambient noise levels measured before equipment was in place were as follows, measured in the dba scale.

Before 45-47 dba 40 feet from shore incoming waves measured intermediately at 48 dba to 53 dba.

While both the tug and barges were simulating dump procedures, there was no measurable increases in noise levels.

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The weather conditions were clear and dry with winds from the Northwest approximately 18-20 knotts.

Best regards,

Rod Sannes

Rod Sannes

RS:gm

MICHAEL R. YANTIS ASSOCIATES
Consulting in Acoustics and Vibration
(206) 454-4283
1950 - 112th Ave. N.E., Suite 201
Bellevue, WA 98004

MEASUREMENT REPORT, 4 MILE ROCK DISPOSAL SITE
MICHAEL R. YANTIS ASSOCIATES
September 20, 1985

INTRODUCTION

This report documents sound level measurements taken on September 18, 1985 of the 4 Mile Rock simulated disposal. The measurements were to determine the sound levels produced by each piece of machinery at close residential receiver location and certify that they do not exceed the 55 dBA criteria.

MEASUREMENT EQUIPMENT

Bruel & Kjaer 2209 Sound Level Meter
Bruel & Kjaer 4230 Calibrator - 93.6 dB at 1000 Hz
(for all measurements)

LOCATION

The measurements were taken at 1970 Perkins Lane, nearest residential area directly across from the disposal site. The measurement was taken 4 feet above road level facing the water in 49 degree (F) weather and 99% humidity. The wind was north easterly from 8 to 13 mph and the fog reduced the visibility to just being able to see the site.

Phone call to Mike Yantis 9/20 [illegible]
No acknowledgment of [illegible]
should need [illegible]

MEASUREMENT DATA

A sound measurement of one to two minutes was taken separately of each piece of equipment that would be used for the project. All measurements are Sound Pressure Levels, dB re 2 micropascals and are A-weighted to comply with the Washington State Administrative Code 173-60. The results of the measurements are as follows:

NOISE SOURCE	TIME	AVG LEVEL	RANGE	NOTES
Ambient	10:15 am	35	34-35	
BASALT (barge)	10:25 am	50	44-55	(1)
ORIENT (barge)	10:50 am	39	38-39	
BONITA (barge)	10:55 am	38	38	
NORTHERN BRAVE (tug)	11:00 am	42	42	
3 barges & tug	11:05 am	39	39	
FOSS 1-40 (barge)	11:15 am	43	42-43	(2)
RUBY 6 (tug)	11:20 AM	42	40-43	
HELEN S (tug)	11:30 am	42	42	(3)
RUBY 11 (tug)	11:35 am	45	45	

Notes:

1. Maximum level of 58 for very short time. Wind at 12 mph. Fog almost gone.
2. Wind to 13 mph.
3. Tug not audible over background noise.

DISCUSSION

The wind, fog, and humidity somewhat altered the sound levels that were measured. The wind, by blowing almost directly from the source to the receiver made the wind gradient a worst case condition. Had the wind blown in the opposite direction, the sound levels would have been decreased.

The fog tends to aid sound transmission. "It is commonly said that on days of light fog or precipitation, sound carries remarkably well. While this observation is true, it is not attributable to any remarkable acoustic property of fog or rain, but to secondary effects. During light precipitation, the gradients of temperature and wind (measured vertically above the ground) tend to be small so that the sound 'carries' farther outdoors than on a sunny day with the attendant micrometeorological inhomogeneities resulting from the sun's heating. Another factor that contributes to this observation is background noise level. When there is fog, the noise of traffic, birds, aircraft, children, and other outdoor activities diminishes appreciably." (Beranek, LL, Noise and Vibration, McGraw-Hill Company, 1971.)

The 99% humidity also made the measurement a worst case since high humidity reduces the attenuation caused by air absorption.(Beranek, LL, Noise and Vibration, McGraw-Hill Compay, 1971.).

When the lower measurements (below 40 dBA) were taken. It was difficult to discern the equipment noise from the ambient noise. Since the two levels were so close, the ambient noise likely added at least 3 dB to the equipment noise. The measured levels over 40 dBA, however, were loud enough compared to the ambient level that the ambient level did not effect it and the equipment noise was distinguishable.

The Shoreline permit for the 4-Mile Rock disposal site required that the operation not exceed 55 dBA and that each piece of equipment not exceed 55 dBA. All vessels except the BASALT barge are well within the given criteria as seen in the previous table. The BASALT, although varying from 44-55 dBA, had maximums of 57-58 dBA for a few seconds. The WAC 173-60 and the City will allow a 5 dBA increase for 15 minutes in an hour, 10 dBA increase for 5 minutes in an hour, and 15 dBA increase for 1 1/2 minutes. Since the projected dumping time for the BASALT is 15 minutes, and since these higher noise levels (55-58 dBA) occur for a relatively short time during the dumping, all of the equipment will meet the Shoreline permit criteria if the disposal does not occur at night in accordance wth the Dredged Material Disposal Equipment Noise Affidavit.

Signature	Date
Michael R. Yantis	9/20/85
Michael R. Yantis	9/20/85

MICHAEL R. YANTIS
STATE OF WASHINGTON
6477
REGISTERED
PROFESSIONAL ENGINEER

EXHIBIT L

CORPS OF ENGINEERS 404(b)(1) PROCEDURES AND POLICIES ON DREDGING AND DREDGED MATERIAL DISPOSAL

Introduction. Navigable waterways of the United States have and will continue to play a vital role in the Nation's development. The Corps, in fulfilling its mission to maintain, improve, and extend these waterways, is responsible for the dredging and disposal of large volumes of sediment each year. Nationwide, the Corps dredges about 230 million cubic yards (c.y.) in maintenance and about 70 million c.y. in new dredging operations annually at a cost of about $450 million. In addition, 100-150 million c.y. of sediments dredged by others each year are subject to permits issued by the Corps. In accomplishing its national dredging and regulatory mission, the Corps has conducted extensive research and development in the field of dredged material management. Regulations, policies and technical guidance prepared and used by the Corps are based on operating experience and results from extensive research programs. Federal expenditures on dredged material research have cumulatively exceeded $100 million. Corps policy is evolving as dredged material research provides a better understanding of the environmental impacts that can be anticipated from dredging and dredged material disposal. Evolving Corps national policy is reflected in the proposed regulation for Corps operation and maintenance dredging of Federal navigation projects (51 Fed. Reg. 19694) and in the final rule for the Corps' regulatory program published 12 January 1987 (33 CFR Parts 320-330).

This chapter describes standard Corps policies with regard to the disposal of dredged material which provides for the least costly alternative, consistent with sound engineering practices and appropriate environmental quality standards. The details of the dredged material testing and test interpretation guidelines are included in the Evaluation Procedures Technical Appendix.

Corps Authorities and Responsibilities. The Corps has responsibility for all dredged material disposal activities that occur within waters of the United States. The Corps responsibility involves review of some 10,000-30,000 permit applications each year as well as appropriate maintenance of, and improvements to, the 25,000-mile congressionally authorized Federal navigation system serving 42 of the 50 states.

Section 404 requires the Corps to evaluate the proposed discharge of dredged material into waters of the United States in accordance with the Section 404(b)(1) Guidelines (the Guidelines). Requirements of other Federal laws may also apply.

The Guidelines require compliance with several conditions prior to allowing disposal of dredged material in waters of the United States. Compliance required the avoidance of "unacceptable adverse effects" to the aquatic environment. The Guidelines specify four conditions of compliance ("restrictions on discharge" per 40 CFR 230.10):

1. There is no other practicable alternative that would have less adverse impact on the aquatic environment.

2. The disposal will not result in violations of applicable water quality standards after consideration of dispersion and dilution (40 CFR 230.10(b)(1)), toxic effluent standards, or marine sanctuary requirements, nor will it jeopardize the continued existence of threatened or endangered species.

3. The disposal will not cause or contribute to significant degradation of the waters of the United States.

4. All appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic environment.

Findings for compliance with condition No. 2 are based in large part on water quality standards.

The findings of compliance with condition No. 2 are to be based, in part, on "evaluation and testing" of the proposed dredged material disposal on the aquatic environment (40 CFR 230.11). Per the Guidelines (40 CFR 230.61), specific evaluation procedures, including chemical and biological tests to determine compliance with the Guidelines and State water quality standards, are used by the Corps.

The Corps final decision on any proposed dredged material disposal activity, however, must be based on a broad public interest review which not only considers information derived from chemical and biological tests but which also considers an evaluation of the probable impact, including cumulative impacts of the proposed activity, on the public interest. In addition, embodied within this public interest review, is a Corps requirement to ensure that the substantive concerns of over 30 Federal environmental laws, Executive Orders (EO's), etc., are properly addressed, whenever applicable. These include the Coastal Zone Management Act, the Marine Protection, Research, and Sanctuaries Act, the Endangered Species Act, the Fish and Wildlife Coordination Act, EO 11990 (Protection of Wetlands) and EO 11988 (Floodplain Management). While each of these Federal Statutes (including the CWA) is generally resource specific in regard to environmental protection, the Corps public interest review necessitates full consideration of all relevant information before rendering a decision.

The benefits which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the proposed activity will be considered.

The Corps' (District Engineer's) final decision will reflect the national concern for both protection and utilization of important resources. As such, the Corps is neither a proponent or opponent of dredging projects, but considers the merits of each on a case-by-case basis.

Corps Policy. The Corps, as agency policy, utilizes a standard philosophy and process in evaluating proposed dredged material disposal activities relative to the general public interest. This process is intended to meet environmental requirements at the least cost within a consistent national framework. The standard provides a reference point for Corps field offices in addressing regional issues in dredged material management. Its intent is to ensure a necessary level of national consistency in the manner in which individual proposals for dredged material disposal are evaluated (e.g., testing procedures) and undertaken, while also ensuring a necessary level of flexibility by the Corps field offices to account for region-specific considerations. However, significant deviations from this national testing and evaluation guidance requires consideration of cost, utility of information and full technical explanation and documentation in the 404(b)(1) evaluation.

For dredging projects, it is the Corps responsibility, in developing dredged material disposal alternatives, to consider all facets of the dredging and disposal operation, including technically appropriate test and evaluation procedures, cost, engineering feasibility, overall environmental protection, and the no dredging option. The alternative selected by the Corps should be the least costly alternative, consistent with sound engineering and scientific practices and meeting applicable Federal environmental statutes. This is being proposed as the Federal Standard (51 Fed. Reg. 19694).

The following paragraphs summarize the manner in which the Corps implements its policies in evaluating dredging projects.

a. Permit Activities. The applicant for a Section 404 permit will receive guidance from the Corps as the permitting authority (40 CFR 230.61) concerning appropriate tests and evaluation procedures that will be applied to material proposed for dredging. This guidance will be in compliance with the Section 404(b)(1) Guidelines.

b. Federal Projects. For Federal projects, the Corps is required to use the Section 404(b)(1) Guidelines to determine the appropriate test and evaluation procedures for delineating the least costly, environmentally acceptable disposal alternative as well as to demonstrate compliance with applicable State water quality standards.

The Corps submits its findings concerning project compliance with the 404 Guidelines and State water quality standards to the State via the Public Notice process along with a request for Water Quality Certification. The certification request also includes relevant information to demonstrate compliance with applicable State water quality laws.

The Corps Public Notice and Findings of Compliance or Non-Compliance with the Section 404(b)(1) Guidelines serves as a point of reference in any subsequent negotiations with the State on additional requirements or conditions which the State may require for Water Quality Certification. The Corps' District Engineer has the necessary discretionary authority to develop additional evaluative information requested by the State, which in the District Engineer's

opinion, is technically justified and reasonably related to enforcement of the State's water quality standards. If the District Engineer determines that a State's requirements are excessive and/or technically unjustified, he may request that the State or project sponsor fund the additional costs associated with any such requirement. In such cases where the State or project sponsor agrees to fund the additional costs, the District Engineer must also determine and appropriately notify the State and project sponsor that such additional costs may affect the continued economic viability of the Federal project in question. In the event that the State or project sponsor does not agree to fund the additional cost, the District Engineer may defer dredging while determining if the dredging project is economically justified and is in the public interest.

The Corps of Engineers Disposal Guidelines. The following discussion presents the procedures by which the Corps regulates and manages the disposal of dredged material in the waters of the United States under its authorities and policies described in chapter 5 of the management plan. It should be noted that these procedures have been developed and have evolved over the past decade and are subject to additional change and modification as new information and technology develop and are adequately evaluated.

Section 404 of the CWA provides that guidelines developed by EPA in conjunction with the Corps be applied by the Corps in selecting disposal sites and in the application review process. EPA published technical guidelines in 1975 for use by the Corps in conducting the required ecological evaluation of the proposed permit activity. The Corps issued final regulations for the Regulatory Program in July 1977 to be used in evaluating proposed discharges of dredged or fill material into inland and ocean waters. In May 1976, the Corps issued an interim guidance manual as specified in the Federal Register to initiate technical implementation of the program.

The guidelines are to include:

a. the effect of disposal of pollutants on human health or welfare, including but not limited to plankton, fish, shellfish, wildlife, shorelines, and beaches;

b. the effect of disposal of pollutants on marine life including the transfer, concentration, and disposal of pollutants or their by-products through biological, physical, and chemical processes; changes in marine ecosystem diversity, productivity, and stability and species and community population changes;

c. the effect of disposal of pollutants on esthetics, recreation, and economic values;

d. the persistence and permanence of the effects of disposal of pollutants;

e. the effect of the disposal at varying rates of particular volumes and concentrations of pollutants;

f. other possible locations and methods of disposal and recycling of pollutants including land-based alternatives; and

g. the effect on alternate uses of the oceans, such as mineral exploration and scientific study.

These "legal/technical" considerations form the framework from which the ecological evaluations must be developed. Several of the considerations and inclusions are, however, at the forefront of the state-of-the-art and require research level approaches to be implemented into a dynamic, field oriented regulatory program.

The Section 404(b)(1) Guidelines recognize that compliance evaluation procedures will vary depending on the seriousness of the proposal's potential for unacceptable adverse impacts (40 CFR 230.10) and, provide general guidance for evaluation and testing. Pursuant to the Guidelines, specific evaluation procedures, including chemical and biological tests, are furnished by the District Engineer on a case-by-case basis ("interim guidance by the permitting authority," 40 CFR 230.61).

To assist the Corps in the overall long-term management of the disposal of dredged material, a management strategy was developed by the U.S. Army Engineer Waterways Experiment Station (MP D-85-1, Francinques, Palermo, Lee and Peddicord, 1985, "Management Strategy for Disposal of Dredged Material: Contaminant Testing and Controls"). This strategy has been adopted as Corps policy and is incorporated by reference in 51 FR 19694; Proposed revision to 33 CFR 290.145 (39 FR 26636, 22 July 1974). The steps for managing dredged material disposal consist of the following:

1. Evaluate contamination potential.

2. Consider potential disposal alternatives.

3. Identify potential problems.

4. Apply appropriate testing protocols.

5. Assess the need for disposal restrictions.

6. Select an implementation plan.

7. Identify available control options.

8. Evaluate design considerations.

9. Select appropriate control measures.

Following the development of the management strategy, it was utilized as a framework for an example application for highly contaminated material at Commencement Bay, Washington (a Superfund site), under the sponsorship of the State of Washington Department of Ecology and the Corps (MP D-86, Peddicord, Lee, Palermo and Francinques, 1986, General Decisionmaking Framework for Management of Dredged Material, Example Application of Commencement Bay, Washington"). This example application considers all alternatives for disposal, and provides detailed technical rationales and flowcharts for evaluating disposal alternatives based on the results of appropriate testing.

Since the mid-1970's the Corps has been involved in the disposal of dredged material under the authority of 33 CFR Parts 320 through 330 and 40 CFR Part 230 (1975) for waters of the United States and under the authority of applicable sections of 40 CFR 220-229 (1973) for ocean dumping. In fulfilling the obligations and responsibilities mandated by those authorities it has conducted extensive research under the Dredged Material Research Program and continues to conduct research under the Field Verification Program, and the Long-Term Effects of Dredging Program, and provides field assistance and management activities under the Dredging Operations Technical Support Program. In addition, it has published two guidance manuals, one for the CWA (MP D-76-17, Ecological Evaluation of Proposed Discharge of Dredged or Fill Material into Navigable Waters, 1976) and a joint manual with EPA for ocean dumping (Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters, 1977); the latter provides much more detailed guidance than the former. Although these documents were state-of-the-art at the time of publication subsequent operational experience has led to changes in specific application. In particular, there has been a tendency for Corps coastal districts to use, depending on the subject of concern, portions or all of the testing procedures in the implementation manual for 404(b)(1) determinations whenever estuarine or marine waters are involved. Although a major reason for this is the detailed guidance, others include similarities between the 404 Guidelines and those in Section 102(a) of Public Law 92-532 and the fact that saline waters are involved. Additionally, shortly after the issuance of the Corps/EPA implementation manual on ocean dumping, the Corps and EPA were sued by the National Wildlife Federation. The suit was based on the technical validity of the testing procedures and interpretation of test results. Judgment was made in favor of the Corps and EPA and there has been no further challenge. Because of the above factors, the ocean dumping testing procedures and interpretive approaches have been in widespread use and have led to the informal but widespread adoption of the general testing and evaluation protocol from ocean dumping to 404(b)(1) evaluations.

This should not be construed to imply that the ocean dumping procedures/interpretation are "required" or "mandated" for 404(b)(1) evaluations. They should be considered in light of local or regional concerns and, where appropriate, <u>may</u>, in part or in whole, be used. However, they do, <u>de fact</u>, constitute an acceptable and widely used technique which has withstood court challenge and for which a major technical data base exists. That no absolute procedure exists for 404(b)(1) evaluations is further evidenced by cooperative efforts currently in progress between the Corps and EPA to establish standard testing and evaluation procedures. The protocol is given below.

In essence, the protocol consists of a tiered approach with each successive tier being based on a "reason to believe" that there is potential for unacceptable adverse effects. Such multiple tests are clearly allowed by 40 CFR 230.4-1 ("No single test or approach can be applied in all cases to evaluate the effects of proposed discharges of dredged or fill material," and "Suitability of the proposed disposal sites may be evaluated by the use, where appropriate, of sediment analysis or bioevaluation."). However, such tests must be conditioned by, "In order to avoid unreasonable burdens on applicants in regard to the amounts and types of data to be provided, consideration will be given by the District Engineer to the economic cost of performing the evaluation, the utility of the data to be provided, and the nature and magnitude of any potential environmental effect."

The first tier of the existing protocol consists of a "reason to believe" that contaminants are or are not present and is commonly referred to as the "exclusion clause" (40 CFR 230.4-1(b)(1)). If there is no reason to believe that contaminants are present and if certain other conditions are met, including grain size and chemical/physical similarity of the dredged material and the substrate at the disposal site, no further testing is required. If there is reason to believe that contaminants are present, or if sufficient information is not available, a second tier or evaluation may be conducted which consists of a bulk sediment analysis. Should sufficient information be available from previous testing and evaluation no additional chemical analyses are necessary.

The bulk sediment analysis is essentially an inventory of contaminants of concern and is used to compare the chemical composition of the dredged material to the composition of the material at the disposal site with emphasis generally placed on heavy metals, PCB's, PAH's, pesticides, and other substances of ecological or human health significance. If substantially greater concentrations are observed in the dredged material and there is reason to believe that the substances are bioavailable and sufficient information is not available, a third tier of testing may be required. This tier includes testing for water column impacts and/or benthic impacts.

If there is concern regarding water column impacts, an elutriate test is performed to evaluate contaminant release into dredging or disposal site water. The results of the elutriate test are compared to water quality standards. If there are no water quality standards, or the standards are thought to be inappropriate or inadequate, a water column liquid and/or solid suspended particulate phase bioassay may be conducted. Again, depending on where the concern lies, the water column bioassay may address the dissolved constituents and/or the suspended solid particulate phase.

If there is concern regarding impacts to benthic organisms, a benthic bioassay may be conducted. In general, for a comprehensive assessment of potential impacts, three organisms are generally used; a filter-feeder, a deposit-feeder, and a burrowing species. These relate to different ecological niches at the disposal site. In addition, a Mysid shrimp is recommended and has been widely used as an internal standard and to form a basis for quality assurance.

If there is a reason to believe that bioaccumulation is of concern, a second component of the third tier consists of evaluating the potential uptake of contaminants. This may be done either in the field or in the laboratory, whichever is most appropriate. If done in the laboratory, it is customary to utilize survivors of the toxicity bioassays for bioaccumulation assessment if sufficient biomass is present in the survivors.

The tiered testing approach described above is essentially the procedure followed for the evaluation of the aquatic disposal alternative in the development of the Federal Standard for a given dredging project. This approach should be applied consistently to each and every dredging project, Federal or permit. The approach is flexible to some extent in allowing consideration of the three phases of the aquatic environment (liquid, suspended solids, and solid), as appropriate, that potentially could be impacted by the discharge of dredged material. Testing of the appropriate phase is determined by the reason to believe that a potential for unacceptable adverse impacts in one or more phases could occur. Additional flexibility is incorporated in the approach in relation to the selection of bioassay species to be used in the tests. Species can be selected such as a bivalve, polychaete, and a crustacean (mysids, amphipods, shrimp) or other available, appropriate, developed and evaluated local species. The intent is to evaluate the potential impact on a deposit feeder, a burrower and a suspension feeder representative of major ecological compartments.

The following discussion addresses in more detail the interpretation of bioassay test results from the tiered testing approach used to evaluate the aquatic disposal alternative portion of the Federal Standard. Additional detail on the evaluation of the aquatic disposal alternative can be found in the Peddicord, Lee, Palermo, and Francinques, 1986.

If there is reason to believe that the dredged material contains contaminants of concern at concentrations higher than those contained in the disposal site sediment, and that these contaminants are potentially bioavailable and could result in a significant adverse impact, then bioassay tests should be conducted. The bioassay tier testing is used to determine if there is reason to believe contaminants in the dredged material will result in an unacceptable adverse impact to the water column and/or the benthic component of the aquatic disposal environment. The water column consists of a dissolved phase and a suspended solid particulate phase. There is an overwhelming preponderance of evidence from years of studies relating the potential of water column impacts of contaminants released from dredged material disposal to demonstrate that adverse impacts on the water column from dissolved contaminants released from dredged material are negligible. While this evidence does not unequivocally prove that water column impacts will not occur with aquatic disposal, it does indicate that such impacts are sufficiently unlikely that the District Engineer must decide whether it is appropriate to focus evaluation on the other issues rather than testing for potential water column impacts in association with disposal in aquatic sites where the majority of the material is deposited on the bottom and the remainder is subject to rapid dispersion and dilution.

In many cases it will be possible to assess the potential for water column impacts on the basis of previous water column testing and characteristics of the disposal site without conducting additional sediment specific testing.

There may be a reason to believe that the suspended solid particulate phase of the water column may result in a potential unacceptable adverse impact to the disposal environment. If this is the case, the suspended solids bioassays may be conducted. Likewise, if there is reason to believe that unacceptable adverse impact may occur in the solid phase, then a solid phase bioassay can be conducted.

If the results of the bioassay tests show unacceptable toxicity to the test species, further testing may be required. In the case of suspended solids phase bioassay testing, consideration of mixing zone at the disposal site should be evaluated to determine if an acceptable mixing zone is available to eliminate significant adverse impact due to potential toxicity at the disposal site. If unacceptable toxicity is shown in the solid phase test and mortality is sufficiently elevated above control and/or reference, a significant impact has been shown.

If unacceptable toxicity is not observed in the solid phase test species and there is reason to believe that there is a potential for bioaccumulation, or the results of the bioassays are not conclusive, further testing may be required. The surviving bioassay animals may be analyzed for bioaccumulation after exposure to the dredged material for an appropriate length of time.

Bioaccumulation by bioassay species exposed to the dredged material is compared to that of species exposed to disposal site sediment or an appropriate reference site in the disposal site environment. Additional discussion of test result interpretation can be found in Peddicord, Lee, Palermo, and Francinques (1986).

The above discussion has addressed the first four steps of the Management Strategy (Francinques, Palermo, Peddicord, and Lee, 1985). Additional information on the need for restrictions and control measures for aquatic disposal and the evaluation of other disposal alternatives can be found in Francinques, Palermo, Peddicord, and Lee (1985). A more comprehensive discussion of the interpretation of test results is provided by Peddicord, Lee, Palermo, and Francinques (1987).

Conclusions. This guidance serves as a consistent national framework and reference point for Corps field offices which must also address regional issues in dredged material management. In applying the process to different projects or regions of the country, it is necessary to detail specific testing procedures and adapt interpretation guidelines, as appropriate. Corps field office evaluations must be generally consistent with the national procedures, defensible in light of research results and scientific judgment, cost and time effective, and of direct use in Section 404 decisionmaking.

GLOSSARY OF TERMS AND ABBREVIATIONS

PUGET SOUND DREDGED DISPOSAL ANALYSIS (PSDDA)
GLOSSARY OF TERMS

Amphipods. Small shrimp-like crustaceans (for example, sand fleas). Many live on the bottom, feed on algae and detritus, and serve as food for many marine species. Amphipods are used in laboratory bioassays to test the toxicity of sediments.

Apparent Effects Threshold. The sediment concentration of a contaminant above which statistically significant biological effects would always be expected.

Area Ranking. The designation of a dredging area relative to its potential for having sediment chemicals of concern. Rankings range from "low" potential to "high" potential, and are used to determine the intensity of dredged material evaluation and testing that might be required.

Baseline Study. A study designed to document existing environmental conditions at a given site. The results of a baseline study may be used to document temporal changes at a site or document background conditions for comparison with another site.

Bathymetry. Shape of the bottom of a water body expressed as the spatial pattern of water depths. Bathymetric maps are essentially topographic maps of the bottom of Puget Sound.

Benthic Organisms. Organisms that live in or on the bottom of a body of water.

Bioaccumulation. The accumulation of chemical compounds in the tissues of an organism. For example, certain chemicals in food eaten by a fish tend to accumulate in its liver and other tissues.

Bioassay. A laboratory test used to evaluate the toxicity of a material (commonly sediments or wastewater) by measuring behavioral, physiological, or lethal responses of organisms.

Biota. The animals and plants that live in a particular area or habitat.

Bottom-Dump Barge. A barge that disposes of dredged material by opening along a center seam or through doors in the bottom of the barge.

Bottomfish. Fish that live on or near the bottom of a body of water, for example, English sole.

Bulk Chemical Analyses. Chemical analyses performed on an entire sediment sample, without separating water from the solid material in a sample.

Capping. See confined aquatic disposal.

Carcinogenic. Capable of causing cancer.

Clamshell Dredging. Scooping of the bottom sediments using a mechanical clamshell bucket of varying size. Commonly used in over a wide variety of grain sizes and calm water, the sediment is dumped onto a separate barge and towed to a disposal site when disposing in open water.

Code of Federal Regulations. The compilation of Federal regulations adopted by Federal agencies through a rule-making process.

Compositing. Mixing sediments from different samples to produce a composite sample for chemical and/or biological testing.

Confined Disposal. A disposal method that isolates the dredged material from the environment. Confined disposal may be in aquatic, nearshore, or upland environments.

Confined Aquatic Disposal (CAD). Confined disposal in a water environment. Usually accomplished by placing a layer of sediment over material that has been placed on the bottom of a water body (i.e., capping).

Contaminant. A chemical or biological substance in a form or in a quantity that can harm aquatic organisms, consumers of aquatic organisms, or users of the aquatic environment.

Contaminated Sediment.

Technical Definition: A sediment that contains measurable levels of contaminants.

Management or Common Definition: A sediment that contains sufficient concentration(s) of chemicals to produce unacceptable adverse environmental effects and thus require restriction(s) for dredging and/or disposal of dredged material (e.g., is unacceptable for unconfined, open water disposal or conventional land/shore disposal, requiring confinement).

Conventional Nearshore Disposal. Disposal at a site where dredged material is placed behind a dike in water along the shoreline, with the final elevation of the fill being above water. "Conventional" disposal additionally means that special contaminant controls or restrictions are not needed.

Conventional Pollutants. Sediment parameters and characteristics that have been routinely measured in assessing sediment quality. These include sulfides, organic carbon, etc.

Conventional Upland Disposal. Disposal at a site created on land (away from tidal waters) in which the dredged material eventually dries. Upland sites are usually diked to confine solids and to allow surface water from the disposal operation to be released. "Conventional" disposal additionally means that special contaminant controls or restrictions are not needed.

Depositional Analysis. A scientific inspection of the bottom sediments that identifies where natural sediments tend to accumulate.

Depositional Area. An underwater region where material sediments tend to accumulate.

Disposal. See confined disposal, conventional nearshore disposal, conventional upland disposal, and unconfined, open-water disposal.

Disposal Site. The bottom area that receives discharged dredged material; encompassing, and larger than, the target area and the disposal zone.

Disposal Site Work Group. The PSDDA work group that is designating locations for open-water unconfined dredged material disposal sites that are environmentally acceptable and economically feasible.

Disposal Zone. The area that is within the disposal site that designates where surface release of dredged material will occur. It encompasses the smaller target area. (See also "target area" and "disposal site".)

Dredged Material. Sediments excavated from the bottom of a waterway or water body.

Dredged Material Management Unit. The maximum volume of dredged material for which a decision on suitability for unconfined open-water disposal can be made. Management units are typically represented by a single set of chemical and biological test information obtained from a composite sample. Management units are smaller in areas of higher chemical contamination concern (see "area ranking").

Dredger. Private developer or public entity (e.g., Federal or State agency, port or local government) responsible for funding and undertaking dredging projects. This is not necessarily the dredging contractor who physically removes and disposes of dredged material (see below).

Dredging. Any physical digging into the bottom of a water body. Dredging can be done with mechanical or hydraulic machines and is performed in many parts of Puget Sound for the maintenance of navigation channels that would otherwise fill with sediment and block ship passage.

Dredging Contractor. Private or public (e.g., Corps of Engineers) contractor or operator who physically removes and disposes of dredged material for the dredger (see above).

Disposal Site Work Group. The PSDDA work group that is designating locations for open-water unconfined dredged material disposal sites that are environmentally acceptable and economically feasible.

Ecosystem. A group of completely interrelated living organisms that interact with one another and with their physical environment. Examples of ecosystems

are a rain forest, pond, and estuary. An ecosystem, such as Puget Sound, can be thought of as a single complex system. Damage to any part may affect the whole. A system such as Puget Sound can also be thought of as the sum of many interconnected ecosystems such as the rivers, wetlands, and bays. Ecosystem is thus a concept applied to various scales of living communities and signifying the interrelationships that must be considered.

Effluent. Effluent is the water flowing out of a contained disposal facility. To distinguish from "runoff" (see below) due to rainfall, effluent usually refers to water discharged during the disposal operation.

Elutriate. The extract resulting from mixing water and dredged material in a laboratory test. The resulting elutriate can be used for chemical and biological testing to assess potential water column effects of dredged material disposal.

Entrainment. The addition of water to dredged material during disposal, as it descends through the water column.

Environmental Impact Statement. A document that discusses the likely significant environmental impacts of a proposed project, ways to lessen the impacts, and alternatives to the proposed project. EIS's are required by the National and State Environmental Policy Acts.

Erosion. Wearing away of rock or soil via gradual detachment of soil or rock fragments by water, wind, ice, and other mechanical and chemical forces.

Estuary. A confined coastal water body where ocean water is diluted by inflowing fresh water, and tidal mixing occurs.

Evaluation Procedures Work Group. The PSDDA work group that is developing chemical and biological testing and test evaluation procedures for dredged material assessment.

Gravid. Having eggs, such as female crabs carrying eggs.

Ground Water. Underground water body, also called an aquifer. Aquifers are created by rain which soaks into the ground and flows down until it collects at a point where the ground is not permeable.

Habitat. The specific area or environment in which a particular type of plant or animal lives. An organism's habitat provides all of the basic requirements for life. Typical Puget Sound habitats include beaches, marshes, rocky shores, bottom sediments, mudflats, and the water itself.

Hazardous Waste. Any solid, liquid, or gaseous substance which, because of its source or measurable characteristics, is classified under State or Federal law as hazardous, and is subject to special handling, shipping, storage, and disposal requirements. Washington State law identifies two categories of hazardous waste: dangerous and extremely hazardous. The latter category is more hazardous and requires greater precautions.

Hopper Dredge. A hydraulic suction dredge that is used to pick up coarser grain sediments (such as sand), particularly in less protected areas with sea swell. Dredged materials are deposited in a large holding tank or "hopper" on the same vessel, and then transported to a disposal site. The hopper dredge is rarely used in Puget Sound.

Hydraulic Dredging. Dredging accomplished by the erosive force of a water suction and slurry process, requiring a pump to move the water-suspended sediments. Pipeline and hopper dredges are hydraulic dredges.

Hydraulics Project Approval. RCW 75.20.100 Approval from the Washington Department of Fisheries and Washington Department of Wildlife for the use, diversion, obstruction or change in the natural flow or bed of any river or stream, or that will use any salt or fresh waters of the State.

Hydraulically Dredged Material. Material, usually sand or coarser grain, that is brought up by a pipeline or hopper dredge. This material usually includes slurry water.

Hydrocarbon. An organic compound composed of carbon and hydrogen. Petroleum and its derived compounds are hydrocarbons.

Infauna. Animals living in the sediment.

Intertidal Area. The area between high and low tide levels. The alternate wetting and drying of this area makes it a transition between land and water organisms and creates special environmental conditions.

Leachate. Water or other liquid that may have dissolved (leached) soluble materials, such as organic salts and mineral salts, derived from a solid material. Rainwater that percolates through a sanitary landfill and picks up contaminants is called the leachate from the landfill.

Local Sponsor. A public entity (e.g., port district) that sponsors Federal navigation projects. The sponsor seeks to acquire or hold permits and approvals for disposal of dredged material at a disposal site.

Loran C. An electronic system to facilitate navigation positioning and course plotting/tracking.

Management Plan Work Group. The PSDDA work group is developing a management plan for each of the open-water dredged material disposal sites. The plan will define the roles of local, State, and Federal agencies. Issues being addressed include: permit reviews, monitoring of permit compliance, treatment of permit violations, monitoring of environmental impacts, responding to unforeseen effects of disposal, plan updating, and data management.

Material Release Screen. A laboratory test proposed by PSDDA to assess the potential for loss of fine-grained particles carrying chemicals of concern from the disposal site during disposal operations.

Mechanical Dredging. Dredging by digging or scraping to collect dredged materials. A clamshell dredge is a mechanical dredge. (See "hydraulic dredging.")

Metals. Metals are naturally occurring elements. Certain metals, such as mercury, lead, nickel, zinc, and cadmium, can be of environmental concern when they are released to the evironment in unnatural amounts by man's activities.

Microlayer, Sea Surface Microlayer. The extremely thin top layer of water that can contain high concentrations of natural and other organic substances. Contaminants such as oil and grease, many lipophylic (fat or oil associated) toxicants, and pathogens may be present at much higher concentrations in the microlayer than they are in the water column. Also the microlayer is biologically important as a rearing area for marine organisms.

Microtox. A laboratory test using luminescent bacteria and measuring light production, used to assess toxicity of sediment extracts.

Molt. A complex series of events that results in the periodic shedding of the skeleton, or carapace by crustaceans (all arthropods for that matter). Molting is the only time that many crustaceans can grow and mate (particularly crabs).

Monitor. To systematically and repeatedly measure something in order to detect changes or trends.

Nutrients. Essential chemicals needed by plants or animals for growth. Excessive amounts of nutrients can lead to accelerated growth of algae and subsequent degradation of water quality due to oxygen depletion. Some nutrients can be toxic at high concentrations.

Overdepth Material. Dredged material removed from below the dredging depth needed for safe navigation. Through overdepth is incidentally removed due to dredging equipment precision, its excavation is usually planned as part of the dredging project to ensure proper final water depths. Common overdepth is 2 feet below the needed dredging line.

Oxygen Demanding Materials. Materials such as food waste and dead plant or animal tissue that use up dissolved oxygen in the water when they are degraded through chemical or biological processes. Chemical and biological oxygen demand (COD and BOD, respectively) are different measures of how much oxygen demand a substance has.

Parameter. A quantifiable or measurable characteristic of something. For example, height, weight, sex, and hair color are all parameters that can be determined for humans. Water quality parameters include temperature, pH, salinity, dissolved oxygen concentration, and many others.

Pathogen. A disease-causing agent, especially a virus, bacteria, or fungi. Pathogens can be present in municipal, industrial, and nonpoint source discharges to the Sound.

Permit. A written warrant or license, granted by an authority, allowing a particular activity to take place. Permits required for dredging and disposal of dredged material include the U.S. Army Corps of Engineers Section 404 permit, the Washington State Department of Fisheries Hydraulics Permit, the city or county Shoreline Development Permit, and the Washington Department of Natural Resources Site Use Disposal Permit.

Persistent. Compounds that are not readily degraded by natural physical, chemical, or biological processes.

Pesticide. A general term used to describe any substance, usually chemical, used to destroy or control organisms (pests). Pesticides include herbicides, insecticides, algicides, and fungicides. Many of these substances are manufactured and are not naturally found in the environment. Others, such as pyrethrum, are natural toxins which are extracted from plants and animals.

pH. The degree of alkalinity or acidity of a solution. Water has a pH of 7.0. A pH of less than 7.0 indicates an acidic solution, and a pH greater than 7.0 indicates a basic solution. The pH of water influences many of the types of chemical reactions that occur in it. Puget Sound waters, like most marine waters, are typically pH neutral.

Phase I. The PSDDA study is divided into two, 3-year long, overlapping phases. Phase I covers the central area of Puget Sound including Seattle, Everett, and Tacoma. Phase I began in April 1985.

Phase II. The PSDDA study is divided into two, 3-year long, overlapping phases. Phase II covers the north and south Sound (including, Olympia, Bellingham, and Port Angeles)--the areas not covered by Phase I. Hood Canal is not being considered for location of a disposal site. Phase II began in April 1986.

Pipeline Dredge. A hydraulic dredge that transports slurried dredged material by pumping it via a pipe. (See "hydraulic dredge".)

Point Source. Locations where pollution comes out of a pipe into Puget Sound.

Polychaete. A marine worm.

Polychlorinated Biphenyls. A group of manmade organic chemicals, including about 70 different but closely related compounds made up of carbon, hydrogen, and chlorine. If released to the environment, they persist for long periods of time and can concentrate in food chains. PCB's are not water soluble and are suspected to cause cancer in humans. PCB's are an example of an organic toxicant.

Polycyclic (Polynuclear) Aromatic Hydrocarbon. A class of complex organic compounds, some of which are persistent and cancer-causing. These compounds are formed from the combustion of organic material and are ubiquitous in the environment. PAH's are commonly formed by forest fires and by the combustion

of fossil fuels. PAH's often reach the environment through atmospheric fall-out, highway runoff, and oil discharge.

Priority Pollutants. Substances listed by EPA under the Clean Water Act as toxic and having priority for regulatory controls. The list includes toxic metals, inorganic contaminants such as cyanide and arsenic, and a broad range of both natural and artificial organic compounds. The list of priority pollutants includes substances that are not of concern in Puget Sound, and also does not include all known harmful compounds.

Puget Sound Water Quality Authority. An agency created by the Washington State legislature in 1985 and tasked with developing a comprehensive plan to protect and enhance the water quality of Puget Sound. The Authority adopted its first plan in January 1987.

Range Markers. Pairs of markers which, when aligned, provide a known bearing to a boat operator. Two pairs of range markers can be used to fix position at a point.

Regional Administrative Decisions. A term used in PSDDA to describe decisions that are a mixture of scientific knowledge and administrative judgment. These regionwide policies are collectively made by all regulatory agencies with authority over dredged material disposal to obtain Sound-wide consistency.

Regulatory Agencies. Federal and State agencies that regulate dredging and dredged material disposal in Puget Sound, along with pertinent laws/permits, include:

U.S. Army Corps of Engineers

- o River and Harbor Act of 1899 (Section 10 permits)
- o Clean Water Act (Section 404 permits)

U.S. Environmental Protection Agency

- o Clean Water Act (Section 404 permits)

Washington Department of Natural Resources

- o Shoreline Management Act (site use permits)

Washington Department of Ecology

- o Clean Water Act (Section 401 certifications)
- o Shoreline Management Act (CZMA consistency determinations)

Washington Department of Fisheries

- o Hydraulics Project Approval

Washington Department of Wildlife (Formerly Washington Department of Game)

- o Hydraulics Project Approval

Local shoreline jurisdiction e.g., City of Seattle, City of Everett, Pierce County

- o Shoreline permit to non-Federal dredger/DNR

U.S. Fish and Wildlife Service (Key reviewing agency)

National Marine Fisheries Service (Key reviewing agency)

The Resource Conservation and Recovery Act. The Federal law that regulates solid and hazardous waste.

Respiration. The metabolic processes by which an organism takes in and uses oxygen and releases carbon dioxide and other waste products.

Revised Code of Washington. The compilation of the laws of the State of Washington published by the Statute Law Committee.

Runoff. Runoff is the liquid fraction of dredged materials or the flow/seepage caused by precipitation landing on and filtering through upland or nearshore dredged material disposal sites.

Salmonid. A fish of the family Salmonidae. Fish in this family include salmon and trout. Many Puget Sound salmonids are anadromous, spending part of their life cycles in fresh water and part in marine waters.

Sediment. Material suspended in or settling to the bottom of a liquid, such as the sand and mud that make up much of the shorelines and bottom of Puget Sound. Sediment input to Puget Sound comes from natural sources, such as erosion of soils and weathering of rock, or anthropogenic sources, such as forest or agricultural practices or construction activities. Certain contaminants tend to collect on and adhere to sediment particles. The sediments of some areas around Puget Sound contain elevated levels of contaminants.

Site Condition. The degree of adverse biological effects that might occur at a disposal site due to the presence of sediment chemicals of concern; the dividing line between "acceptable" (does not exceed the condition) and "unacceptable" (exceeds the site condition) adverse effects at the disposal site. Other phrases used to describe site condition include "biological effects condition for site management" and "site management condition."

Spot Checking. Inspections on a random basis to verify compliance with permit requirements.

Statistically Significant. A quantitative determination of the statistical degree to which two measurements of the same parameter can be shown to be different, given the variability of the measurements.

Subtidal. Refers to the marine environment below low tide.

Suspended Solids. Organic or inorganic particles that are suspended in water. The term includes sand, mud, and clay particles as well as other solids suspended in the water column.

Target Area. The specified area on the surface of Puget Sound for the disposal of dredged material. The target area is within the disposal zone and within the disposal site.

Toxic. Poisonous, carcinogenic, or otherwise directly harmful to life.

Toxic Substances and Toxicants. Chemical substances, such as pesticides, plastics, detergents, chlorine, and industrial wastes that are poisonous, carcinogenic, or otherwise harmful to life if found in sufficient concentrations.

Treatment. Chemical, biological, or mechanical procedures applied to an industrial or municipal discharge or to other sources of contamination to remove, reduce, or neutralize contaminants.

Turbidity. A measure of the amount of material suspended in the water. Increasing the turbidity of the water decreases the amount of light that penetrates the water column. Very high levels of turbidity can be harmful to aquatic life.

Unconfined, Open-Water Disposal. Discharge of dredged material into an aquatic environment, usually by discharge at the surface, without restrictions or confinement of the material once it is released.

Variable Range Radar. Radar equipped with markers which allow measurement of bearings and distances to known targets.

Vessel Traffic Service (VTS). A network of radar coverage for ports of Puget Sound operated by the Coast Guard to control ship traffic. Most commercial vessels are required to check in, comply with VTS rules, and report any change in movement.

Volatile Solids. The material in a sediment sample that evaporates at a given high temperature.

Washington Administrative Code. Contains all State regulations adopted by State agencies through a rulemaking process. For example, Chapter 173-201 WAC contains water quality standards.

Water Quality Certification. Approval given by Washington State Department of Ecology which acknowledges the compliance of a discharge with Section 401 of the Clean Water Act.

Waterways Experiment Station (WES). Corps of Engineers (Corps) research facility located in Vicksburg, Mississippi, that performs research and support projects for the various Corps districts.

Wetlands. Habitats where the influence of surface or ground water has resulted in development of plant or animal communities adapted to such aquatic or intermittently wet conditions. Wetlands include tidal flats, shallow subtidal areas, swamps, marshes, wet meadows, bogs, and similar areas.

Zoning. To designate, by ordinances, areas of land reserved and regulated for specific land uses.

ABBREVIATIONS

AET. Apparent Effects Threshold.

CFR. Code of Federal Regulations.

Corps. U.S. Army Corps of Engineers.

CWA. The Federal Clean Water Act, previously known as the Federal Water Pollution Control Act.

DEIS. Draft Environmental Impact Statement.

DMRP. Dredged Material Research Program.

DNR. Washington Department of Natural Resources.

DSS TA. Disposal Site Selection Technical Appendix.

DSWG. Disposal Site Work Group.

Ecology. Washington Department of Ecology.

EIS. Environmental Impact Statement.

EPA. Environmental Protection Agency.

EPTA. Evaluation Procedures Technical Appendix.

EPWG. Evaluation Procedures Work Group.

FVP. Field Verification Program.

HPA. Hydraulics Project Approval. RCW 75.20.100.

ML. Maximum Level.

MPTA. Management Plans Technical Appendix.

MPWG. Management Plan Work Group.

NEPA. National Environmental Policy Act.

PAH. Polycyclic (Polynuclear) Aromatic Hydrocarbon.

PCB's. Polychlorinated Biphenyls.

PMP. Proposed Management Plan.

PSDDA. Puget Sound Dredged Disposal Analysis.

PSEP. Puget Sound Estuary Program.

PSIC. Puget Sound Interim Criteria.

PSWQA. Puget Sound Water Quality Authority.

RAD's. Regional Administrative Decisions.

RCRA. The Resource Conservation and Recovery Act.

RCW. Revised Code of Washington.

SEPA. State Environmental Policy Act.

SL. Screening Level.

SMA. Shoreline Mangement Act.

WAC. Washington Administrative Code.

WES. Waterways Experiment Station.

401. Section 401 of the Clean Water Act.

404. Section 404 of the Clean Water Act.

4MR. The Fourmile Rock DNR disposal site in Elliott Bay.