ROSS ISLAND SAND & GRAVEL CO.

Ross Island Reclamation Plan

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4.0 RECLAMATION GOALS AND STRATEGIES

4.1 RECLAMATION GOALS

Reclamation goals for Ross Island are as follows:

1. Protect and enhance anadromous fish and wildlife habitat values of the islands;
2. Protect surface water and groundwater resources;
3. Protect the structural integrity of the islands; and
4. Preserve options for future public ownership and benefit.

General strategies for achieving the goals are outlined below. Details regarding implementation are provided in Section 6.0 and technical appendices to the plan.

4.2 STRATEGIES FOR ACHIEVING RECLAMATION GOALS

4.2.1 PROTECT AND ENHANCE ANADROMOUS FISH AND WILDLIFE HABITAT VALUES

- Establish riparian floodplain conditions along portions of the interior lagoon shoreline, as defined by bank slope, vegetation types, and frequency of inundation;
- Establish an emergent wetland to provide diverse habitat for a wide range of fish and wildlife, including juvenile salmonids;
- Provide for diverse aquatic conditions, including a range of lagoon depths;
- Plant and maintain native species of plants in upland areas in order to provide a healthy, diverse vegetation pattern; and
- Provide for continued protection for the heron rookery and bald eagle nests.

Employing these strategies to achieve the goal of protecting and enhancing fish and wildlife habitat values will require that the desired end physical state of the island complex (depth to lagoon bottom, slopes from lagoon shore to lagoon bottom, etc) be revised from the 1979 plan. Continued protection of the heron rookery and bald eagle nests will require that provisions of the original plan be included in the revised plan.

4.2.2 PROTECT SURFACE WATER AND GROUNDWATER RESOURCES

- Minimize soil erosion from reclaimed areas;
- Protect shorelines from bank erosion to the maximum extent practicable;
- Create stable interior berm slopes;
- Prevent scouring of existing fill to avoid exposing contaminated sediments; and
- Use only "Class A" (as that term is defined in the DEQ draft Fill Evaluation Scope of Work dated April 25, 2002) fill for reclamation purposes.

Provisions for accomplishing most of these plan elements are already in place to satisfy requirements of the various regulatory programs under which the Ross Island facility currently operates.

4.2.3 PROTECT THE STRUCTURAL INTEGRITY OF THE ISLANDS

- Maintain current elevation of berm connecting Ross and Hardtack islands to prevent scouring of existing fill on the lagoon bottom and protect newly reclaimed areas, including created wetlands.
- Monitor structural integrity during reclamation period (e.g., Stability of in-water slopes and shorelines)

Over time, natural river forces will change the physical characteristics of the islands - including their size and shape – regardless of the approach to reclamation. At the same time, taking steps to protect the structural stability of the islands will help ensure that the primary goal of providing improved fish and wildlife habitat is not jeopardized.

4.2.4 PRESERVE OPTIONS FOR FUTURE PUBLIC OWNERSHIP AND BENEFIT

- Enhance the environmental qualities of the islands through habitat preservation and restoration.
- Use Only DEQ-defined Class A fill for reclamation purposes.
- Place fill in locations and in a manner that enhances and reinforces existing capping of contaminated sediments.

6.0 IMPLEMENTATION

6.1 INTRODUCTION

This section describes specific actions planned to achieve the goals of reclamation outlined in Section 4.0 and implement the proposed approach to reclamation discussed in Section 5.0. Planned components of the reclamation process include:

- a description of the quantity and likely sources of reclamation fill materials;
- locations for fill placement and placement methods;
- schedule and sequencing of fill placement;
- engineering and landscaping specifications in fill placement relative to habitat restoration and enhancement;
- fill improvement for planting;
- types of plant species that will be introduced and proposed schedules;
- controls that will be implemented during reclamation to mitigate potential impacts on groundwater, surface water, and fish and wildlife resources; and
- other activities, such as development of short-term staging areas for fill stockpiling and removal of these areas post-reclamation, removal of equipment, and removal of access roads.

These planned components of reclamation are described in detail in Sections 6.2 – 6.6.

6.2 FILL

6.2.1 FILL QUANTITY AND SOURCES

As noted previously, RIS&G conducted an analysis of potential fill sources, fill amounts and fill quality in conjunction with this plan. The company's analysis indicated that the amount of fill that can be placed in a given year is constrained by regulatory requirements and operational considerations. The regulatory constraints include "in-water work windows" to protect fish and wildlife resources and increasing scrutiny of contaminants contained in dredged material. Operational constraints include the physical limitations of the quantity of fill that can be dredged, transported, and placed in a year due to equipment and personnel resources.

Dredging in the Columbia River is restricted to four months of the year (November 1 to February 28). On a yearly basis, half of the material (200,000 yd^3) that is dredged and to be used in reclamation activities must be obtained in these 4 months. Dredging on the Willamette River is restricted to six months of the year (July 1 to October 31 and December 1 to January 31) and will provide 50,000 yd^3 per year. These materials can be placed in the lagoon year round below –40 feet but can only be placed above –40 feet during the "in-water work window" of ~~February 15 and June 30 and November 1 to November 30~~ (as stipulated by permit). Same.

The concept that only a portion of dredged material and upland excavation material generated in the metropolitan region is acceptable for use as fill by RIS&G has reduced the amount of material available for reclamation activities.

Based on these constraints, this plan proposes to place approximately 4,500,000 yd^3 of reclamation fill at Ross Island in order to achieve identified goals within the established ten-year time frame. Reclamation fill for the island complex has historically come from three major sources:

- Dredge material from the Columbia and Willamette rivers, typically used as in-water fill.
- Soil from excavations in the greater metropolitan Portland area, typically used as upland fill.
- By-product material from aggregate production (non-commercial grade sand dredged from the facility settling pond), used in the past for in-water fill capping and beach construction.

The same major sources of material will be used for reclamation fill during the period covered by the plan. These sources and the "natural fill" from the Willamette River comprise the 450,000 yd^3 of fill to be placed yearly over the 10-year reclamation period.

The purposes of continued reclamation filling at the island complex are to further stabilize the slopes within the lagoon, enhance existing fish and wildlife habitat, and create new habitat. Results of the hydrology study described in Section 5.0 were used to determine which areas of the lagoon required filling to ensure long-term slope stability. Technical workshop results, current understanding up of upland topography and in-water bathymetry and operational constraints were used to identify the locations and dimensions of the floodplain/wetland/riparian and upland areas proposed to be constructed in the lagoon.

Specific types of fill, identified locations for placement and a proposed placement schedule are discussed in the following sections. The necessary physical characteristics of the fill required to achieve the placement goals are identified by reclamation area.

Consistent with the adaptive management approach, placement of fill has been specifically scoped for a period of ten years after plan acceptance. Review of fill placement and factors that impact fill placement (such as availability of reclamation fill, contribution of natural sedimentation to the reclamation process, and the results of monitoring in place fill) will be reviewed near the end of the five year period. Findings that enhance or adversely impact the achievement of the reclamation goals will be evaluated. This evaluation will inform potential changes in fill placement at the island complex in subsequent years.

6.2.2 Locations and Methods of Fill Placement

To meet the goals of reclamation and address other environmental issues, fill will be placed in-water in the lagoon to meet four objectives:

- Ensure slope stability to preserve the integrity of the island uplands;
- Enhance the stability of existing fill;
- Mitigate isolated surface sediment contaminant issues; and
- Create riparian floodplain and emergent wetland conditions along portions of the interior lagoon shoreline.

Based on the four described objectives, three areas of proposed fill have been identified and are shown as Area A, Area B, and Area C/D on Figure 6-1. Figure 6-1 also illustrates where cross sectional diagrams have been developed to show both the current conditions and projected post-fill conditions in these areas. The total volume of fill needed to meet the objectives in these areas is 4.0 to 4.6 million yd^3. In addition, a slope stability analysis has been conducted to evaluate whether proposed fill regimes will meet acceptable stability criteria using the type of material assumed to constitute future reclamation fill in these areas. Results of these analyses are provided in Appendix D.

In Area A, the existing post-mining slope averages 1.75H:1V (1.75 ft. horizontal to 1.0 ft. vertical). No reclamation activities have been conducted in this area to date. The purpose of placing fill in this area is to widen the existing upland area of Ross Island and create approximately 4.67 acres of upland and 6 acres of shallow water habitat. The newly created upland and bank will be planted with native tree and shrub species (see Appendix A table 2 for zone 1). A cross section of Area A showing current conditions and the reclamation goal is shown on Figure 6-2. The location of this cross section is shown on Figure 6-1. The fill volume required to meet this desired end state in Area A is estimated to be 2.0 to 2.3 million yd^3 including allowance for the method of deposition. The material that will be used as fill in Area A to achieve a 3:1 slope is assumed to be gravelly sand or fine to medium sand with silt.

Based on the results of a study conducted by the Port of Portland relative to their confined cells and verified through independent review, Area B (see Figure 6-1) was identified as a target area for fill placement to further buttress the area where the Port's confined disposal cells are located. The existing slope in this area varies from approximately 1.75 to 1 to 2 to 1. To achieve long-term stability of this fill area, additional fill will be placed in Area B to achieve an approximate 3 to 1 slope. Cross sections of Area B showing current conditions and the reclamation goal are shown on Figures 6-3, 6-4, and 6-5. The locations of these cross sections are shown on Figure 6-1. The fill volume required to achieve this desired end state in Area B is 500,000 to 600,000 yd^3. The material that will be used as fill in Area B to achieve the 3:1 slope is assumed to be gravelly sand or fine to medium sand with silt.

A stability analysis was conducted on the existing slopes between Areas A and C/D. A stability analysis was conducted on section E-E' located as shown on Figure 6-1. The cross-section of E-E' is shown on Figure 6-6. The safety factor of the assumed slope failure is 1.7.

Some limited areas of surface sediment contamination were identified during the course of the facility-wide Remedial Investigation (RI) Area C/D. If remedial action is determined to be necessary to address this sediment contamination, this action will be identified in the Feasibility Study (FS) to be conducted following completion of the RI.

Two types of remedy are most likely to be recommended: focused excavation of the contaminated sediment, or covering the sediment in place with clean fill. Based on contaminant fate and transport modeling in other parts of the lagoon, it is likely that capping will be considered the more acceptable remedy. Area C/D (see Figure 6-1) has been identified as the area where such capping is likely to occur. The capping will serve as a remedy from contaminated sediment and to build emergent wetland/riparian habitat.

Area C/D also has been identified as appropriate for development of riparian floodplain and emergent wetland habitat conditions. Current conditions in these areas with respect to depth and shore-to-bottom slope make them most amenable to rapid filling and completion of a marsh/wetland with a bordering riparian buffer area. These actions are consistent with remedial actions that may be required to address isolated areas of surface sediment contamination. Should results of the FS indicate otherwise, the fill regime may need to be modified.

To allow periodic inundation as required by emergent wetland plants, Area C/D will be filled to slopes ranging from 50:1 (2%) to 33:1(3 %). Beyond the wetland area, fill will be placed at angles ranging from 3:1 to 6:1, depending on the area. Approximately 1.5 to 1.7 million cy of fill will be required to fill Area C/D to the configuration shown in the figure cross sections. Cross sections of Area C/D and their respective reclamation goals are shown on Figures 6-2, 6-3, and 6-4. The locations of these cross sections are shown on Figure 6-1. Additional detail regarding creation of the wetland area is provided in Section 6.3.4 of this plan and the accompanying report by Pacific Habitat Services (Appendix A).

Fill placement is targeted for the northern and southern ends of the island. In the northern area, (Area A), fill will be placed to create approximately 4.7 acres of uplands, approximately 6 acres of shallow water habitat, and as buttressing slope to support the uplands and shallow water habitat. At the southern end (Area C/D), fill will be placed to create approximately 3.5 acres of shallow water habitat and approximately 22 acres of emergent wetland/riparian habitat. Fill will also be placed to create a buttressing slope for the created habitat in Area C/D and to support the existing cells in Area B.

The following table summarizes the amount of fill in each area.

Table 6-1 Fill Amounts For Each Area

Area	Amount of Fill (million yd^3)
Area A	2.0 to 2.3
Area B	0.5 to 0.6
Area C/D	1.5 to 1.7
Total	4.0 to 4.6

6.2.3 POTENTIAL SOURCES OF FILL

The revised reclamation plan depends on three broad categories of fill for reclamation: imported fill similar to that used in current reclamation efforts (dredge material from the Columbia and Willamette Rivers and soil from excavations in the greater metropolitan Portland area), and aggregate processing by-product material. Additional fill is sediment recruited from natural deposition by the Willamette River in Ross Island lagoon. The hydrology study conducted in conjunction with this plan showed that 5 to 10 inches of river sediment will be deposited annually in the lagoon. As a result, imported fill material will be required to buttress slopes and create additional uplands, cover isolated areas of contamination, and get a "head start" on building emergent wetland habitat will need to be imported. The following table summarizes potential sources, volumes and possible criteria for incoming imported fill.

Table 6-2 Potential Fill Sources for the Ten Years of Reclamation

Fill Source	Approximate Volume (yd^3)	Composition
Combined sewer overflow excavation	1,000,000	Soil
RIS&G aggregate processing by-product	500,000	Sand, soil
Columbia River dredge material	2,000,000	Sand, silt
Willamette River dredge material	500,000	Sand, silt
Natural fill	500,000	Sand, silt

6.2.4 SEQUENCE AND SCHEDULE OF FILL PLACEMENT

In general, the priority for fill placement will be in three areas: Area B, to buttress existing fill, Area C/D to create conditions for development of uplands, riparian floodplain and emergent wetland habitat, and Area A. The volume of reclamation fill that can be placed in these areas on an annual basis is constrained

by several factors. First, the fill must be available for use within a fairly limited geographic area and represent a cost-effective acquisition to the company. The fill must be of appropriate quality (see Section 7.1.1 for further discussion on fill quality).

In addition, certain logistical issues must be addressed as fill is brought to the facility. The island complex has little space to stockpile incoming fill until it can be placed. An average flat top barge is approximately 1,500 to 2,000 ton capacity (1150 to 1500 yd^3, assuming that each yd^3 equals approximately 1.3 ton), and a dump barge is typically 3,000 ton capacity (2300 yd^3). If barge capacity averages 1,500 yd^3, approximately, a goal of 750,000 yd^3 per year means over 500 barge trips into the lagoon per year. If a work period for placement of in-water fill of 180 days per year is assumed, three barge loads per day would be required to meet this goal.

Larger barges (up to 10,000 yd^3) may be available for some projects, including dredging projects in the Columbia River. RIS&G's ability to meet this fill goal will be dependent on its ability to receive and unload this fill volume during its limited work window period for in-water filling.

6.2.5 HABITAT CREATION

6.2.5.1 Area A

Habitat development in Area A will include upland and shallow water habitat. The upland habitat will include planting of trees to create additional forested habitat. The northern end of the lagoon will be continuously graded from an elevation of 20 feet RID to an elevation –10 RID. This will allow for a linear slope varying from 4:1 to 7:1 in steepness. The area above 12 RID along the northern end of the lagoon will be planted with trees and shrubs such as black cottonwoods *(Populus balsamifera trichocarpa)*, red elderberry (*Sambucus racemosa*) and scouler's willow (*Salix scouleriana*). Areas below elevation 12 feet RID will be planted with the same shrubs listed under Zones 2 and 3 (see Appendix A).

An area of shallow water habitat will also be created within Area A. The habitat will extend from an elevation of approximately +1 foot RID, which may support a fringe of emergent vegetation, to an undulating bench, which will be created with a maximum width of 140 feet at an elevation of approximately –10 feet RID. Numerous pieces of large wood material (whole trees with root wads and branches still intact) will be anchored on the bench to provide structural complexity that is currently lacking in the lagoon. The bench will provide a substrate for benthic macroinvertebrates, which will in turn provide food for juvenile salmonids. This bench will be supported by the buttressing slope, which will be created at an approximately 3:1 grade.

For further discussion of upland habitat and shallow water habitat see Appendix A.

6.2.5.2 Area C/D

Habitat development in area C/D will include emergent wetland/riparian habitat, new upland forest and the planting of already reclaimed lands. A very shallow slope (between 33:1 and 50:1 will be created in the southern end of the lagoon. This slope will be planted in zones corresponding to inundation regimes suitable for selected vegetation. These idealized zones are depicted on Figure 9 in Appendix A. The lowest elevation of the wetland (Zone 4) will be inundated for much of the year and emerge from the water for the first time after the summer solstice. The highest zone (Zone 1) will occasionally be inundated during flood events, but will likely be dry throughout the year. The idealized location and species proposed for each zone are in Table 2 of Appendix A.

The existing upland plantings will be monitored for 5 years to assure the continued survival of these plants. If the plant counts fall below the 75% survival level 3 years after installation, other trees and shrubs will be installed to bring the number to the requisite 75%.

Weekly spray irrigation will be provided for woody plants above an elevation of 8 feet RID. The irrigation system will deliver the equivalent of 1.5 inches of rainfall once a week between June 20 and September 20. For the second growing season, the irrigation system will be operated every two weeks through the same period. Irrigation beyond the second season should not be needed unless new plants have been installed.

6.2.5.3 Heron Rookery

The continued viability of the heron rookery will be ensured through the reclamation period. As specified in the facility permit, no filling shall occur within 650 feet of the surveyed boundary of the heron rookery between February 1 and July 15 with separate written permission from DSL.

6.2.6 SEISMIC CONSIDERATIONS

Seismic issues related were first raised during the Port of Portland's evaluation of its confined disposal cells in Ross Island lagoon, and examined more fully as part of the Remedial Investigation (RI) for the facility. As part of the RI, the DEQ requested input from technical staff at both DOGAMI and Oregon State University. As reflected in a letter to RIS&G dated December 19, 2001, DEQ and DOGAMI concluded the following:

- The current slopes north of the Port's confined cells in Ross Island lagoon represent a potential risk of failure as a result of shaking induced by a magnitude 6.0 seismic event. Placement of fill in the deep area of the lagoon adjacent to this area is occurring.
- The risk associated with a surface rupture at the facility has an estimated recurrence interval of 2,500 years or more. The rupture of the relevant strand of the Portland Hills Fault has a 5,000 to 10,000 year recurrence interval, according to DOGAMI. DEQ has determined that events with a recurrence interval of 2,500 years or more are outside the boundary of what reasonably needs to be considered in assessing risks relative to surface rupture. As such, the risk is considered very low and below levels warranting further evaluation.
- Long-term management controls to ensure that the existing caps over the confined disposal cells and lateral barriers to contaminant migration are maintained will be required.

The requirement that fill be placed to buttress the area containing the Port's confined cells is addressed as part of the reclamation plan. Long-term management controls have been identified and are described in the monitoring section of this reclamation plan.

6.3 VEGETATION

Four areas of reclamation will require re-vegetation:

- Upland areas currently reclaimed but not vegetated at elevations higher than the riparian zone;
- Uplands to be created under this plan;
- The riparian zone; and
- The scrub-shrub/emergent wetland area.

These areas will be planted as reclamation proceeds. In the case of currently reclaimed upland areas and the riparian zone area RIS&G will plant vegetation in "annual planting parcels" (but no less than 5 acres minimum) as such parcels become available through reclamation. Plant types that will be introduced into the existing uplands and riparian buffer zone are listed in Appendix A. The upland plantings will be installed in the early spring and the riparian zone and wetland plantings will be installed occur in the summer/fall during low water periods.

6.4 PROTECTION OF SURFACE WATER AND GROUNDWATER RESOURCES

Protection of surface and groundwater resources is an important goal of the reclamation process. This goal will be accomplished through several means: continued implementation of monitoring, protection and response programs already in place; use of future reclamation fill that has been appropriately screened and meets acceptance criteria as "Class A Fill", and proposed additional of the RI/FS process. Surface groundwater monitoring, protection and response programs already in place are discussed in this section. The other program elements are discussed in Section 7.0 of this plan.

RIS&G currently maintains two operation programs to protect surface water quality:

- The RIS&G Turbidity Monitoring and Management Program; and
- The RIS&G Sediment and Erosion Control Plan.

Both programs are part of existing DSL dredge and fill permits. Documents describing both programs are available on request. The Turbidity Monitoring and Management Program was developed as a condition for receipt of a Section 401 Water Quality Certification for operation of the facility. It establishes turbidity threshold levels, methods to be used to monitor turbidity, best management practices to be implemented by RIS&G to control turbidity, and additional measures that must be taken in the event that a threshold level is exceeded. The Sediment and Erosion Control Plan was established as a special condition of the DSL permit. It identifies areas of the island complex where specific erosion control measures will be implemented. No additions or revisions to these existing programs are proposed in the revised reclamation plan.

RIS&G currently conducts regular groundwater monitoring at the island complex under two programs. The first program is groundwater monitoring required as a condition for the facility's Water Pollution Control Facilities (WPCF) Permit. This permit allows RIS&G to use water from its settling pond to irrigate newly reclaimed areas. The monitoring wells included in this program are shown on Figure F-1. Monitoring parameters are summarized in Table F-1. A copy of the WPCF permit and the groundwater monitoring program are available on request. RIS&G has completed regular reports to document these monitoring activities, which are on file with the DEQ Water Quality Division. RIS&G will continue to conduct monitoring as required by the WPCF permit under this reclamation plan.

RIS&G is also currently conducting regular groundwater monitoring at the facility as part of the ongoing RI. Monitoring locations are shown on Figure F-1, and monitoring frequency and parameters are summarized in Table F-1. It is likely that groundwater monitoring will continue at some of these wells for a period following conclusion of the RI; however this monitoring program will not be established until after completion of the remedial investigation/feasibility study (RI/FS).

6.5 PROTECTION OF FISH AND WILDLIFE RESOURCES

Although mining in the lagoon has ceased prior to the expiration of the current DSL permit, aggregate processing will continue on Hardtack Island indefinitely using raw material barged from an upland aggregate mine in Avery, Washington. Reclamation filling will continue for a minimum period of ten years. Fish and wildlife resources will require protection from the potential impacts of such ongoing aggregate processing and reclamation activities as well as from increasing recreational use of the island complex.

To meet this objective, buffers established in the current DSL permit limiting activity in the lagoon near the former blue heron rookery and bald eagle nest will remain in effect. Specifically, from February 1 to July 15 there will be no disturbance, including filling or barge mooring, within 300 feet of the former and current eagle nest as surveyed. No filling or barge mooring will occur within 650 feet of the surveyed boundary of the heron rookery between February 1 and July 15 without separate written authorization from DSL. Similar buffers will be set to protect new bald eagle nests or heron rookeries established and inhabited during the period of this permit. Reclamation activities will adhere to these buffers to maintain the area's suitability as a heron rookery.

The buffers around the heron rookery and eagle nest are already permanently marked with upland monuments. Between February 1 and July 15, they will be marked with temporary buoys place in the lagoon to mark where barges may not be moored.

In addition to continued adherence to these buffer zones, in-water filling will be restricted to water depths greater than 40 ft. between February 15 and June 30 and between November 1 and November 30 to ensure that impacts from introduced turbidity on migrating salmonid are minimized. In addition to these fill timing restrictions, RIS&G will continue to adhere to its existing turbidity monitoring program, described in Section 6.4, to control impacts of turbidity on aquatic life.

Reclamation fill brought to the facility will be screened according to the draft Fill Evaluation Scope of Work for RIS&G developed by DEQ (dated 4/25/02 and subject to modification based on discussions with DEQ; this draft document is included as Appendix E) to ensure that it has been adequately tested for presence of contamination, meets the definition of Class A Fill and does not present a threat to human or ecological receptors. Ongoing monitoring will be conducted to ensure that fill already in place does not pose a potential threat to terrestrial or aquatic organisms. This monitoring is described in Appendix F of this plan.

A program for controlling invasive and/or exotic plants in the upland, riparian buffer zone, and emergent wetland areas that currently exist or will be constructed as part of future reclamation is discussed in Section 8.3.3 of this plan. This program will control and mitigate adverse impacts to fish and wildlife resources from loss of habitat to these invasive/exotic plants.

The RIRPAC has recommended that the island complex be reclaimed as a "natural" area, with emphasis on creation of terrestrial and aquatic organism habitat. In order to achieve this goal, areas of the island complex will require protection and restriction from public access both during reclamation and post-reclamation. Public use of areas undergoing reclamation will be restricted as discussed in Section 7.4 of this reclamation plan. No plan for restricting use of the public to areas of the island complex post-reclamation has yet been developed. Since ownership of Ross Island is likely to be transferred to the City of Portland, RIS&G will not develop a formal program for limiting impact on fish and wildlife resources by the public.

6.6 OTHER

6.6.1 PROCEDURES AND TIMELINES FOR EQUIPMENT, REFUSE, STRUCTURE, FOUNDATION REMOVAL

At the present time, an equipment storage yard on Hardtack Island is the only company-managed facility in the area proposed for transfer to the City of Portland. All equipment and refuse will be removed from this area and transferred to the active processing area within six months of a transfer to the City. The active processing area of Hardtack island, including the RIS&G processing plant and associated structures and storage areas, will continue in its current configuration for the entire remaining term of the existing DSL permit (i.e., for the next 25 years). Imported raw materials will be barged to the facility from sources up the Columbia River and processed into finished product at this facility for the foreseeable future. Therefore, no plan for dismantling the active processing area is presented at this time.

6.6.2 LOCATION OF SOIL STORAGE AND STOCKPILE AREAS

Imported reclamation fill may need to be stored on a temporary basis prior to placement. There is limited area on the island complex for stockpiling and storing large quantities of material that has not already been re-vegetated. Therefore, temporary storage of reclamation fill may occasionally occur in upland areas adjacent to the area where it will be placed. Storage will be short term, with the length of storage time keyed to the permitted in-water work period in that area. Stockpiles will be located in a manner such that surface water runoff from stockpiles will not be allowed to flow into the lagoon or Willamette River. Some reclamation fill material may be stored on moored barges for short periods of time (less than 30 days).

6.6.3 ACCESS ROADS

Only one road currently exists in that portion of the island complex proposed to transfer to the City. This is a temporary access road necessary for ongoing reclamation activities. Additional temporary roads may need to be constructed to support these activities. They will be constructed in a manner to prevent erosion or runoff into surrounding surface water. They will be abandoned, re-graded as appropriate, and re-vegetated according to this plan within 1 year of the time that they are no longer needed to support reclamation activities.

The active processing area of Hardtack Island, including the access roads, will continue to operate in its current configuration for the entire remaining term of the existing DSL permit (i.e., for the next 25 years). Therefore, no plan for dismantling the active processing area is presented at this time.

7.0 RECLAMATION FILLING/MONITORING AND MAINTENANCE

7.1 MONITORING PARAMETERS

The overall goal of the monitoring procedures described in this section is to track the progress of reclamation activities toward achieving the reclamation goals described in Section 4.0 and to ensure that the current quality of the environment is not impacted by future reclamation fill or other activities. Monitoring is essential to the effectiveness of adaptive management, which requires that the planned aspects of the reclamation program and changes in the island complex due to natural processes be regularly reviewed and, if necessary, changed to ensure that the overall goals of the reclamation plan are met.

In addition, monitoring provides a basis for establishing that no degradation is occurring in previously mined areas beyond the baseline conditions resulting from the RI/FS process and related action (if any). Specific monitoring parameters, objectives, and methods, and schedules (frequency) are presented in Appendix F for historic filling activities and proposed monitoring under the RI/FS process. Detailed sampling and analysis procedures, monitoring data evaluation techniques, and specific evaluation criteria related to the RI/FS process will be developed in subsequent monitoring plan documents.

In order to organize reclamation monitoring data in a manner that can be easily accessed and compared from year to year, RIS&G will have the facility 2002 bathymetric and topographic information loaded into a GIS database. This will serve as the base map against which future reclamation progress will be compared. As monitoring data is obtained, it will be loaded into the database as separate data layers, allowing monitoring parameters to be compared from year to year.

7.1.1 FILL SOURCES AND QUALITY

The requirements for monitoring of reclamation fill quality will be based largely on the originating source of the fill and the planned area of placement at the island complex. The areas identified for reclamation filling over the next ten years will include areas below the mean high water mark. The riparian buffer area lies in close proximity to mean high water. As a result, this fill will be required to meet contamination limits established based on continual contact with surface water.

At this time, DEQ is reviewing all reclamation fill that will be in contact with surface water on a case-by-case basis to determine if sufficient testing has been conducted. If DEQ determines that the fill has not been adequately characterized, additional testing is recommended. After required testing has been conducted, both DEQ and RIS&G review the data to determine if the fill can be imported to the island complex for use in reclamation. If the fill is accepted at the facility, a file on the fill source and associated data is established by RIS&G. Additional information is collected during fill placement, as discussed in the following sections, to document the location of the fill.

RIS&G intends to use DEQ's proposed draft Fill Evaluation Scope of Work (dated 4/25/02 and subject to modification based on discussions with DEQ) for future fill screening. RIS&G will continue to maintain records of each fill source and associated data, and track fill placement as discussed in the following sections. For reclamation activities, RIS&G will only use material meeting the definition of Class "A" fill. Therefore no specific media monitoring (sediment, surface water, or groundwater) related to placement of Class A fill is proposed.

7.1.2 UPLAND/IN-WATER FILL PLACEMENT AND SEDIMENT MONITORING

7.1.2.1 Upland Reclamation Filling

Placement of upland fill will be documented according to location placed using the technique that is currently in use, which consists of a survey of topographic conditions after each upland fill event occurs. Survey information will be compiled annually and imported into the GIS database for the purpose of developing a current map of the island that depicts the current status of upland reclamation. The results of the mapping exercise will be evaluated and compared to the upland reclamation goals.

Ongoing groundwater monitoring will be conducted to ensure that fill materials already in place do not present a threat to groundwater and surface water in the future, and to allow an extra measure of protection beyond incoming fill screening for future upland fill.

7.1.2.2 Sediment Filling and Accumulation

Monitoring for sediment accumulation and in-water reclamation filling will consist of bathymetric surveys of bottom (mudline) elevation conditions in Ross Island Lagoon. The objectives of this monitoring are to:

- Document changes in lagoon bottom conditions during reclamation activities and provide a means for evaluating whether reclamation elevation goals are being met;
- Provide a method for confirming the locations and approximate volumes of reclamation fill activities;
- Confirm that existing areas of potential concern regarding slope stability are being addressed by reclamation filling;
- Monitor areas of potential concern regarding slope stability, which could possibly develop during reclamation filling; and
- Monitor natural filling (sediment accumulation) or erosion (e.g., scouring) within the lagoon.

This monitoring will be accomplished through an annual bathymetric survey that will be conducted over the next 10-year period during which active reclamation filling will be occurring. The survey will cover the entire lagoon. This lagoon-wide survey will also monitor, to the extent possible, natural filling or erosion within the lagoon during the 5 year filling period.

After the 10-year filling period, annual bathymetric surveys will be discontinued. Additional surveys will only be performed after this period after an unusual event (e.g., severe flooding) has occurred indicating that additional lagoon-wide bathymetric information is warranted.

Estimates of the volume of reclamation filling events, the natural sediment accumulation rate, and erosion rates from bathymetric survey data will be limited to some extent by the accuracy and precision of the survey. Typically, survey mudline elevation measurements are accurate to within approximately 0.5 feet along survey track lines. Between track lines, where elevations are interpolated, there is typically lower accuracy. This is especially true in areas of significant bottom relief.

The bathymetric surveys will be performed using methods employed during previous surveys at Ross Island. A small vessel will be used that is equipped with standard bathymetric survey and differential global positioning system (DGPS) navigational equipment. The bathymetric survey information collected

will be compiled annually and imported into the GIS database for the purpose of developing a map of the island that depicts the current status of lagoon reclamation. The results of the mapping exercise will be evaluated and compared to the in-water reclamation goals.

7.1.3 SLOPE STABILITY

Stability of inwater slopes will be monitored through use of bathymetry. Bathymetric surveys will be conducted as described previously in this section. Any slope failure observed will be reported to DSL and corrective action taken as appropriate.

7.2 MONITORING FREQUENCY AND SCHEDULE

The following table summarizes the aspects of reclamation discussed in this section that will be subject to regular monitoring, monitoring frequency, and the time of year (if dependent on season) the monitoring will be conducted.

Table 7-1 Reclamation Monitoring Frequency and Schedule

Reclamation Activities	Monitoring Activity	Monitoring Frequency
1. Evaluation of fill quality and placement		
- Upland	Phase 1 information and/or chemical data Topographic survey	As generated After each upland fill event
- In-water	Phase 1 information and/or chemical data Bathymetric survey	As generated Annually for 10 years
-Natural sedimentation/erosion	Bathymetric survey	Annually for 10 years and as-needed after "unusual" event such as severe flooding
2. Monitor In-Water Slopes	Bathymetric survey	Annually for 10 years and as needed after "unusual" event such as severe flooding

7.3 MONITORING REPORTING

Data collected from elements of the monitoring program will be compiled and evaluated as appropriate for inclusion in an annual monitoring report to DSL. The report will include any adaptive steps as may be required to redirect the reclamation activities. In addition, RIS&G will report the results of the monitoring of the ongoing reclamation to the community on an annual basis. The report will include results of ongoing monitoring and such adaptive steps as may be required to redirect the reclamation activities.

7.4 PUBLIC USE MANAGEMENT

RIS&G will continue its reclamation activities, as described herein, as long as it owns the island complex. During that time, the company will continue its present policy of discouraging public use of the islands and the lagoon. At the same time, the company recognizes that the lagoon is made up of "waters of the State" and therefore available to all watercraft.

To begin the process of developing a more detailed public use management strategy, RIS&G proposes to convene a "joint management group." The joint management group is envisioned as a public/private task force that will examine a series of management options to ensure the maximum flexibility for public access while providing protection of the resource. The group will also ensure that no decisions will be made that will inhibit or preclude future options. Management options that could be considered by the committee include signage, public education, development of designated public access areas, and management partnerships with other Willamette River stakeholders.

The committee should have broad community representation, and whatever process is employed should include extensive public outreach and involvement. The company proposes that the committee be chaired jointly by the City of Portland and RIS&G and staffed by RIS&G.

8.0 HABITAT SUCCESS CRITERIA/MONITORING AND MAINTENANCE

8.1 WETLAND/RIPARIAN HABITAT SUCCESS CRITERIA

The successful growth of native vegetation and the control of non-native vegetation will form the basis of a successful reclamation effort. Focusing on the success of the vegetation assumes that a fill slope will be created between 2% (50:1) and 3% (33:1); that the lower elevations of the slope will be approximately +1 feet RID; that an aquitard will be placed within the surface of the fill slope; and that each of the planting zones will be exposed to the hydrologic regimes described in the sections above. It is anticipated that variations to this idealized scenario are unavoidable given the large amount of fill that needs to be placed to create the slope and the fact the fill will be placed using a barge and, therefore, cannot be precisely located. For this reason, it is assumed that some alteration of the fill slope may be needed to correct situations that vary widely from the assumptions described above.

The wetland and riparian creation will be considered successful if (1) no more than 20% of the wetland and the planted riparian area below 10 feet RID is covered with reed canarygrass and no more than 20% of the area above 10 feet RID is covered with Scot's broom (*Cytisus scoparius*) or Himalayan blackberry, (2) if at least 75% of the woody plants installed above elevation 4 feet RID (in the wetland, riparian, and upland areas) are surviving 5 years after installation; and (3) that approximately 22 acres of wetland and riparian habitat will be created on the fill slope at the southern end of the lagoon and that a portion of the fill slope meets the definition of jurisdictional wetland as described in the U.S. Army Corps of Engineers, Environmental Laboratory, 1987. Corps of Engineers Wetland Delineation Manual. Technical Report Y-87-1 (1987 manual).

The exact area of wetland that will be created will primarily depend on the water level fluctuations within the lagoon (which are dependent on dam releases and precipitation). It is assumed that wetland will be created below an elevation of 5 feet RID if the fill slope is inundated or saturated to the surface for more than 12.5% of the growing season. Wetland may be created below an elevation of approximately 10 feet RID if the fill slope is inundated or saturated to the surface for more than 5% of the growing season. Based on these elevations, it is estimated that between 8 and 16 acres of the 22-acre wetland/riparian habitat area may satisfy the jurisdictional definition of wetland.

Given the uncertainty of establishing herbaceous vegetation at lower elevations, we feel that RIS&G should not be held to specific success criteria. However, an estimate of total cover within the lower zone (Zone 4) of the reclamation area will be assessed and photographs of the vegetative cover will be included in the annual monitoring reports.

8.2 UPLAND HABITAT SUCCESS CRITERIA

The reclamation of upland areas will be considered successful is at least 75% of the trees and shrubs are living and in good health five years after their installation. If the plant counts fall below the 75% survival level 3 years after installation, other trees and shrubs will be installed to increase the number to the requisite 75%. If necessary, healthy volunteer trees and shrubs of the same species or native species approved by DSL as an appropriate substitute can be counted as replacements in order to reach the 75% survival level.

8.3 MONITORING AND MAINTENANCE

The reclamation areas will be monitored and maintained annually to determine whether the effort is successful. Data collected during the monitoring period will be included in an annual monitoring report

to be provided to interested parties and regulatory agencies. The report will include a discussion on the success of the reclamation effort, issues that may affect the success of the plants and proposed management options; and photographs illustrating the reclamation area.

After each phase of planting, the area planted will be mapped and added to RIS&G's Geographic Information System (GIS) database. Such areas will be subject to monitoring for a period of five years. Specific criteria of the vegetation monitoring program are described in Section 8.3.2 of this reclamation plan and in the wetland and riparian habitat creation plan that accompanies this document (Appendix A). If plant survival does not meet the criteria identified, monitoring will extend beyond the five-year monitoring period for each annual planting area impacted. Upland and riparian buffer zone areas that have been reclaimed will be irrigated, if necessary, until the plants have established themselves sufficiently as to not require further irrigation.

8.3.1 HYDROLOGY MONITORING

The creation of jurisdictional wetland on the fill slope requires that the three required criteria of the 1987 Manual be satisfied: wetland hydrology, dominant hydrophytic vegetation and hydric soils. It is assumed that if the fill slope is graded correctly, it will be exposed to a hydrologic regime that satisfies the jurisdictional definition of wetland hydrology as included in the 1987 manual. It is also assumed that if wetland hydrology is created, hydrophytic vegetation will dominate and soils with redoximorphic features (i.e., hydric soils) will develop.

Areas that always meet the jurisdictional definition of wetland hydrology are those that are inundated or saturated at least 12.5% of the growing season. With supporting wetland characteristics (i.e., dominant hydrophytic vegetation or hydric soils) areas may be inundated only 5% of the growing season. The growing season is defined as the period of time between the last killing frost (defined as the last winter date with minimum temperature of 28° F for five years out of ten) to the first killing frost (the first winter date with minimum temperature of 28° F for five years out of ten). For Portland (during the years 1951-1976) the last killing frost was March 4 and the first killing frost was December 1. This gives a growing season of 272 days.

For the fill slope at the southern end of the lagoon, this means that soils saturated to the surface for less than 14 days (5%) between March 4 and December 1 do not satisfy the wetland hydrology criterion. Soils saturated to the surface for more than 34 days (12.5%) between March 4 and December 1 are definitely considered to have wetland hydrology. Soils with saturation regimes between these extremes require additional evidence to satisfy the wetland hydrology criteria.

The hydrology of the slope throughout the year can be determined by comparing the elevations of the fill slope with the river level fluctuations measured at the Corps of Engineers river gage on the Morrison Bridge. The fluctuations of the water level in the Ross Island lagoon is, of course, closely related to the water surface fluctuations at the Morrison Bridge.

An analysis of the Corps' data, indicates that the water surface elevation of the Ross Island lagoon (River Mile 15) is approximately 0.2 feet above the water surface at river mile 13 near the Morrison Bridge. Lower flows may have a slightly steeper gradient, but with no more than 0.5 feet in river surface elevation difference.

An as-built topographic survey of the fill slope will be prepared each year to establish the slope's elevations. This topographic survey will be compared with the corrected water levels within the lagoon and areas that satisfy the wetland hydrology criterion will be determined. As vegetation becomes

established, it is anticipated that the wetland area may increase due to the dominance of wetland plant communities.

A wetland delineation, to be concurred with by the DSL, will be conducted at the end of the monitoring period to determine the final wetland boundaries.

8.3.2 VEGETATION MONITORING

To determine the success of the plants, monitoring will occur in the late summer using a belt transect placed at 50 feet intervals along the outer edge of the planted zone. Transects will extend 5 feet on each side of a straight line from a baseline established at the upper edge of Zone 1 and extending to the edge of the water. The transects will be broken into 20-foot plots starting furthest away from the lagoon. Areal cover of Himalayan blackberry (*Rubus discolor*), Scot's broom (*Cytisus scoparius*), and reed canarygrass (*Phalaris arundinacea*) and other invasives will be assessed by ocular estimate as a percent of each 10 foot x 20 foot plot. The presence and abundance of woody species will be established within each of the plots along each of the transects.

The transects will cover approximately 20% of the fill slope. The counts for each woody plant within each of the 10 x 20 plots will be used as a sample population for the entire woody plant population. With these samples, we will be able to make a statistical estimate of the plant populations to a given confidence level using the standard deviations and means of the samples.

This same method will also be used at the northern end of the lagoon to establish the success of vegetation within the upland area.

As discussed above, an as-built topographic survey of each new section of the fill slope will be conducted. This survey will aid in determining the optimal elevations for each of the species installed and the elevations at which new plants are colonizing.

8.3.3 INVASIVE/EXOTIC PLANT CONTROL PLAN

As part of the vegetation monitoring plan, all historical and newly reclaimed and re-vegetated areas will be surveyed annually for occurrence of invasive species such as blackberry, Scot's broom and reed canarygrass. Results will be summarized in the annual report to DSL, which is discussed in Section 7.3 of this plan. If more than 20% cover of invasive species is observed in reclaimed and re-vegetated areas, RIS&G will consult with DSL to identify appropriate corrective actions.

In addition to this monitoring and corrective action, as appropriate, RIS&G will continue to mechanically (no herbicides) remove ivy from the base of trees located on the western portion of Ross Island. Ivy removal will occur only between July 15 and January 31.

Blackberries (*Rubus discolor and Rubus ursinus*), Scot's broom, and reed canarygrass will be controlled during the initial plant establishment period to allow the desired plants to thrive. Semiannual mowing of the invading plants during the first two years (or as deemed necessary) following initial installation to control their growth will be conducted.

If more than 20% cover of reed canarygrass is within the wetland area, the grass growing above the water will be mowed three times during the growing season (the first of June, the middle of July, and the middle of October). Areas with more than 20% cover of Scot's broom and Himalayan blackberry will be treated

following the recommendations of the Portland Parks and Recreation Pest Management Program and the Watershed Revegetation Program.

8.4 FISH AND WILDLIFE MONITORING

Regularly scheduled, quantitative monitoring of populations of fish and wildlife are not a component of the reclamation plan monitoring program. It is expected that further development of upland habitat, development of the riparian buffer and wetland areas, cessation of mining in the lagoon, and controlled recreational access to the island complex will result in greater use of habitat by fish and wildlife. Monitoring usage patterns may be identified at a later time as useful information that could be gathered as part of ongoing environmental education programs at the primary, secondary and university level.

Qualitative monitoring will be conducted as part of ongoing reclamation activities to ensure that these activities are not adversely impacting ecological receptors. This will include reporting to DSL in the annual report any unusual response by fish/wildlife, such as additional movement of the heron rookery or bald eagle nest or unusually high or low levels of migrant bird use of the island.

8.5 MONITORING FREQUENCY AND SCHEDULE

The following table summarizes the aspects of habitat creation in this section that will be subject to regular monitoring, monitoring frequency, and the time of year (if dependent on season) the monitoring will be conducted.

Table 8-1 Habitat Monitoring Frequency and Schedule

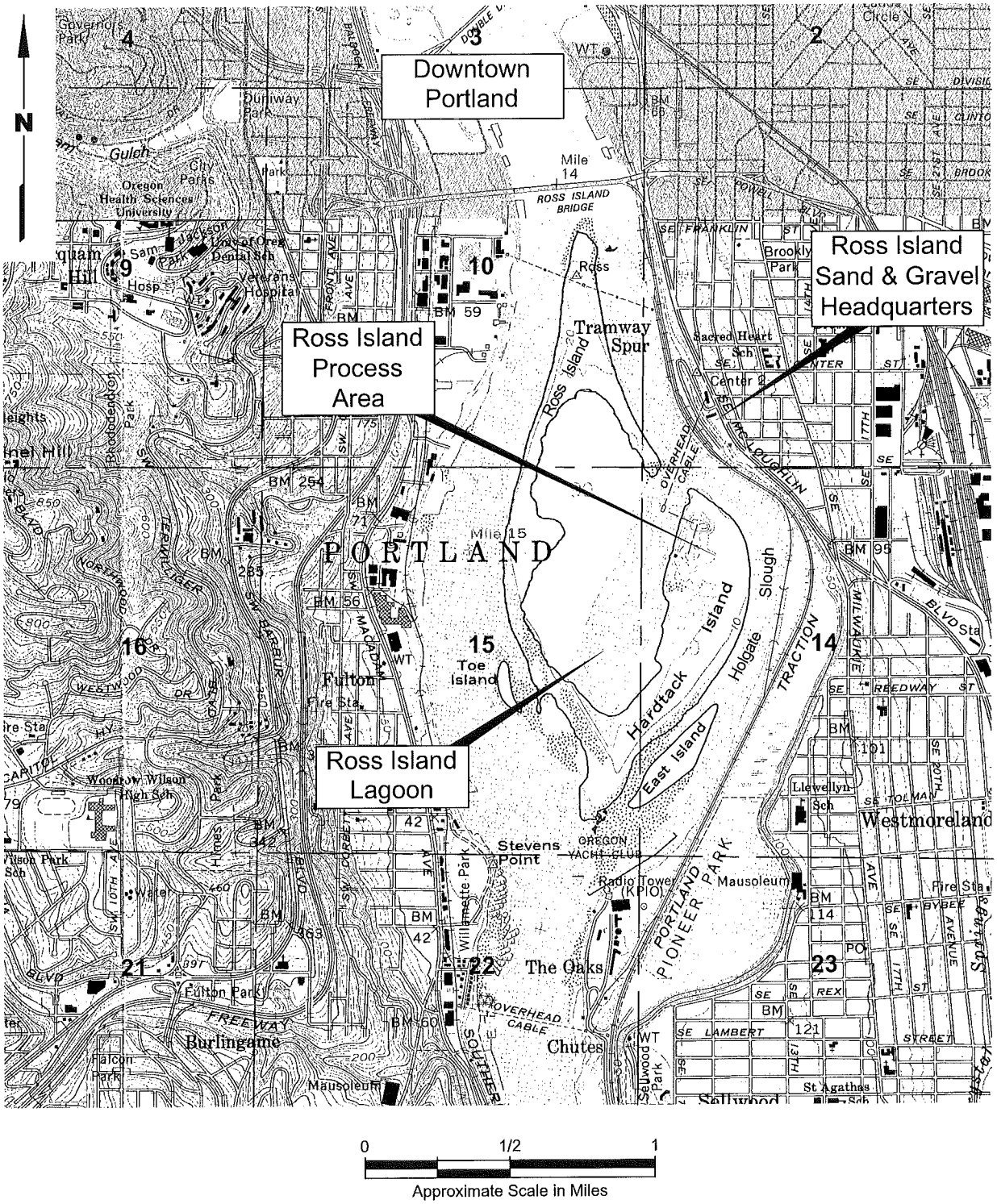
Habitat Activities	Monitoring Activity	Monitoring Frequency
1. Plant growth and survival	Vegetation monitoring	Annually for 5 years following the planting of each "annual planting area"
2. Determination of jurisdictional wetland	Hydrology monitoring	Annually for 5 years following the completion of the as-built topography survey of each reclaimed area
3. Vegetative Composition, Cover and Production	Vegetation monitoring	Annually for 5 years following the planting of each "annual planting area"
4. Diversity and Density of Fish and Wildlife Populations	Qualitative Monitoring	Reporting of unusual response by fish/wildlife

8.6 REPORTING

Monitoring of plant survival in the wetland, riparian and upland habitat areas will be conducted once during each growing season between the summer solstice (June 20) and the autumn equinox (September 20). Transects will be run at low tide to allow a count of all woody plants within each transect. The hydrology monitoring of the created wetland area will occur after the as-built survey of the

wetland/riparian area has been received and comparisons can be made with the hydrology data collected from the gage at the Morrison Bridge.

Data collected from elements of the monitoring program will be compiled and evaluated as appropriate for inclusion in an annual monitoring report to DSL. The report will include any adaptive steps as may be required to redirect the reclamation activities. In addition, RIS&G will report the results of the monitoring of the ongoing reclamation to the community on an annual basis. The report will include results of ongoing monitoring and such adaptive steps as may be required to redirect the reclamation activities.

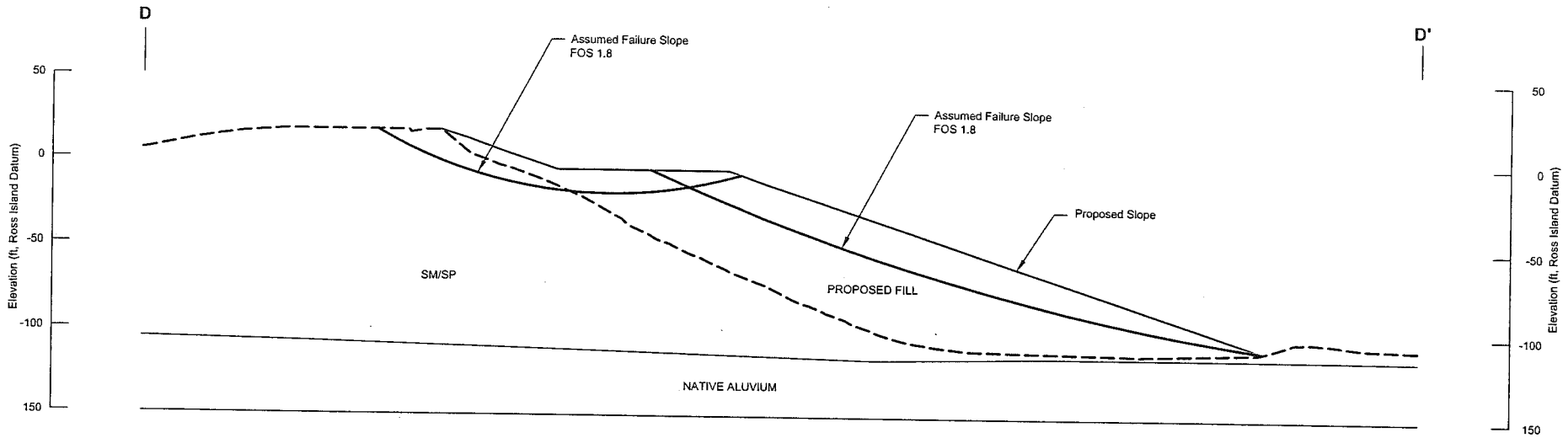


Note: Basemap prepared from the USGS 7.5-minute quadrangles of Portland and Lake Oswego, Oregon (1975 Photo). Contour interval is 10 feet.

Landau Associates

Ross Island Sand & Gravel Portland, Oregon	**Vicinity Map**	Figure 3-1

Ross Island Sand and Gravel/Reclamation Plan | T:\066\0351172\RISG Reclamation Report\Fig3-1.dwg (A) "Figure 3-1" 4/25/2002



Legend

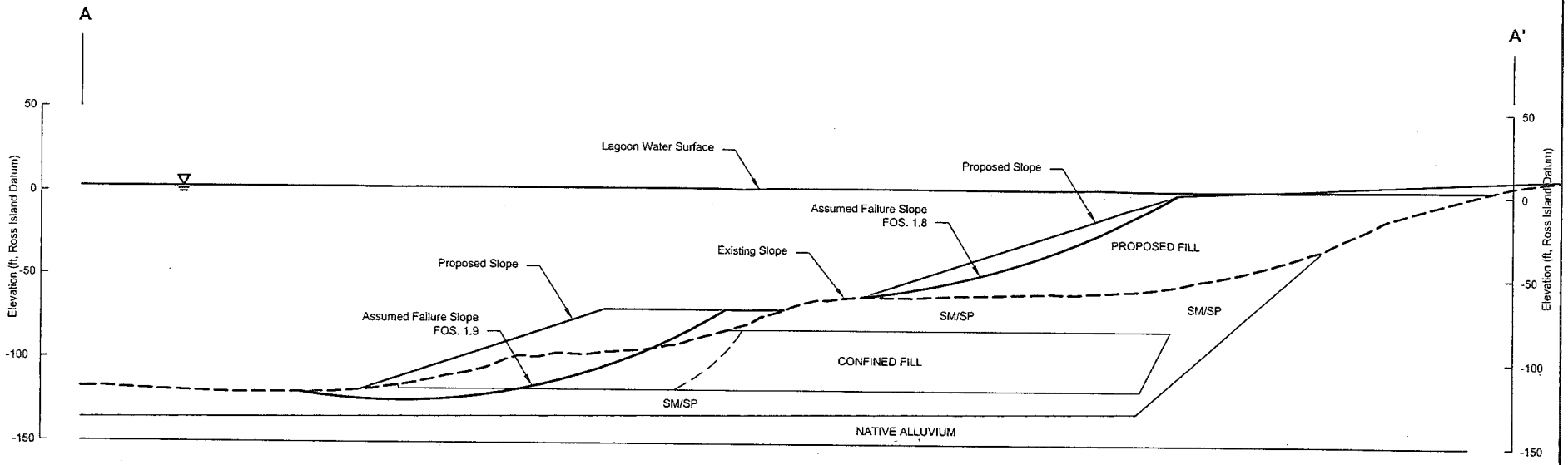
GM/GP	Sandy GRAVEL with Sand (Loose)
ML/CL	SILT with Fine Sand and Clayey SILT
SM/SP	Fine SAND, Fine SAND with Silt Silty Fin SAND
	Confined Port Fill
	Native Alluvium Dense Sandy Gravel
	Dense Native Gravel
	Barge Placed Fine Sand With Silt

0 60 120
Scale in Feet

LANDAU ASSOCIATES

Ross Island Sand & Gravel Portland, Oregon	**Stability Analysis** **Cross-Section D-D'**	Figure 6-2

Ross Island Sand and Gravel\Reclamation Plan Report XI | T:\066\035\172\Reclamation Plan Report XI\Fig6-2.dwg (A) "Figure 6-2" 9/16/2002



Legend

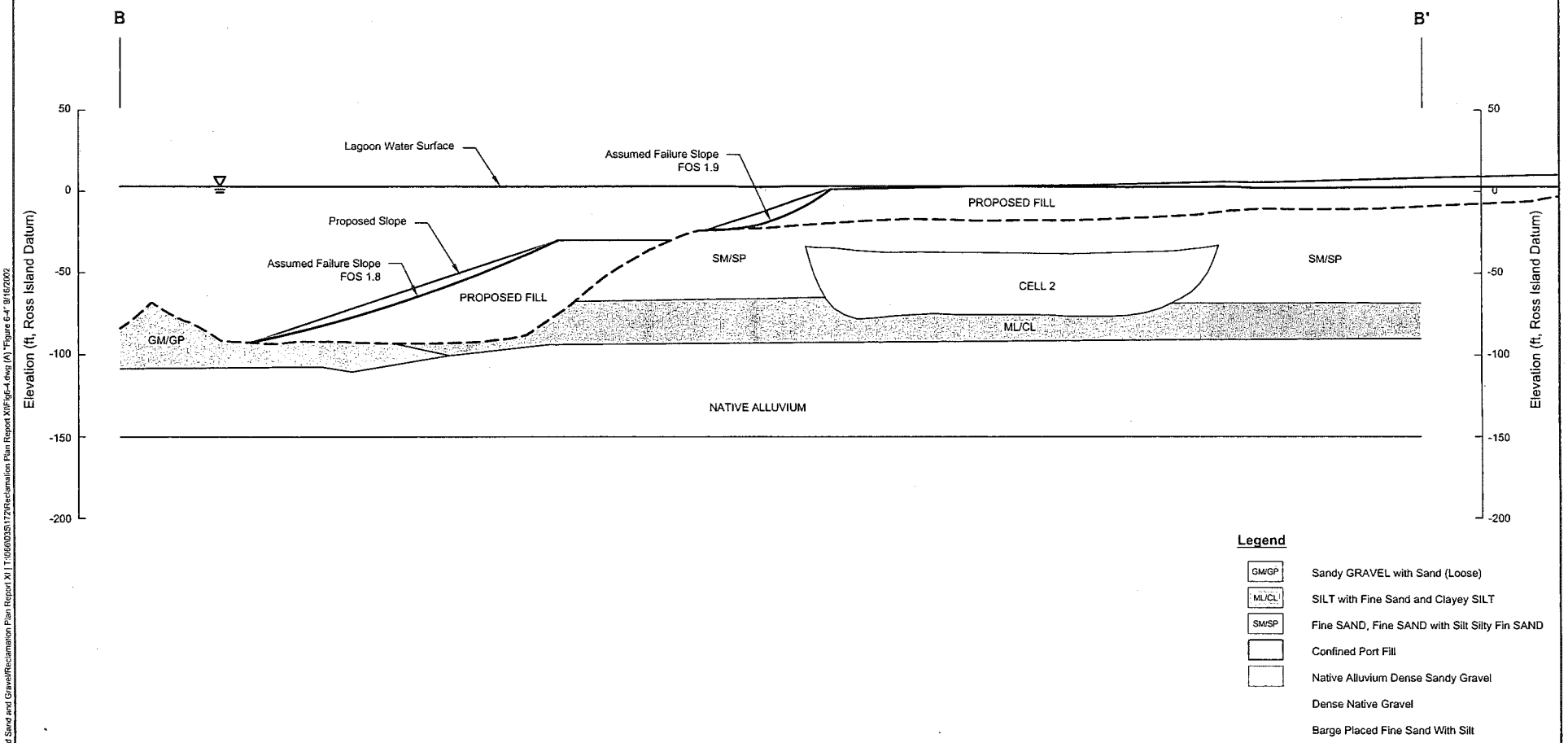
- GM/GP — Sandy GRAVEL with Sand (Loose)
- ML/CL — SILT with Fine Sand and Clayey SILT
- SM/SP — Fine SAND, Fine SAND with Silt Silty Fin SAND
- Confined Port Fill
- Native Alluvium Dense Sandy Gravel
- Dense Native Gravel
- Barge Placed Fine Sand With Silt

LANDAU ASSOCIATES

0 60 120
Scale in Feet

Ross Island Sand & Gravel Portland, Oregon	**Stability Analysis Cross-Section A-A' Extended Slope**	Figure 6-3

Ross Island Sand and Gravel\Reclamation Plan Report XI\T:\0660035\172\Reclamation Plan Report XI\Fig6-3.dwg (A) "Figure 6-3" 9/16/2002



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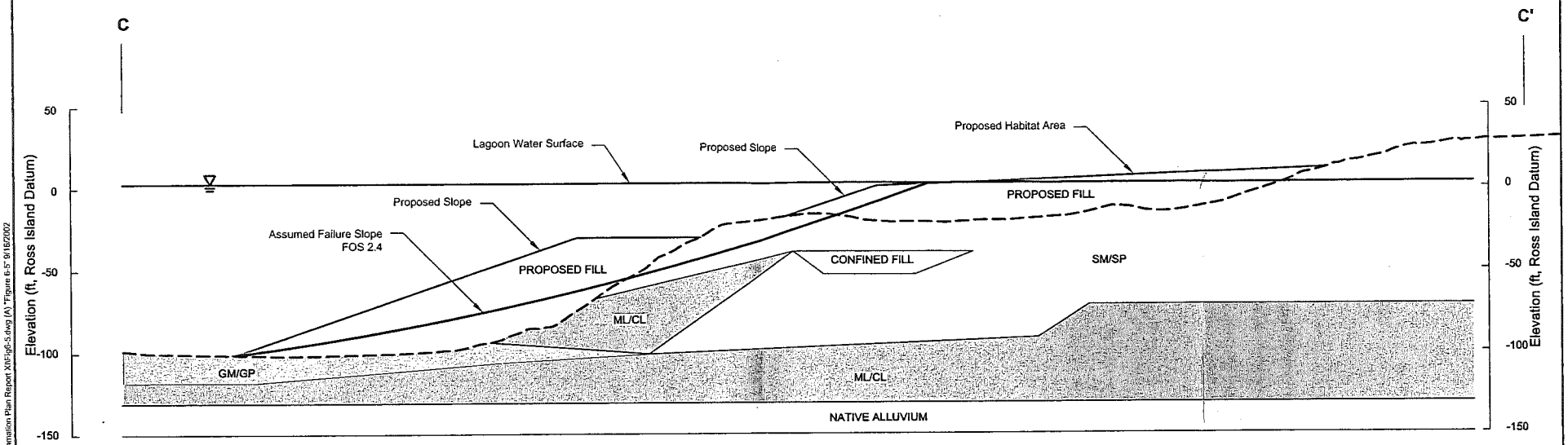
Scale in Feet

LANDAU ASSOCIATES

Ross Island Sand & Gravel Portland, Oregon	**Stability Analysis Cross-Section B-B'**	Figure 6-4

Ross Island Sand and Gravel/Reclamation Plan Report XI | T:\0569\03\172\Reclamation Plan Report XI\Fig6-4.dwg (A) "Figure 6-4" 9/16/2002



Legend

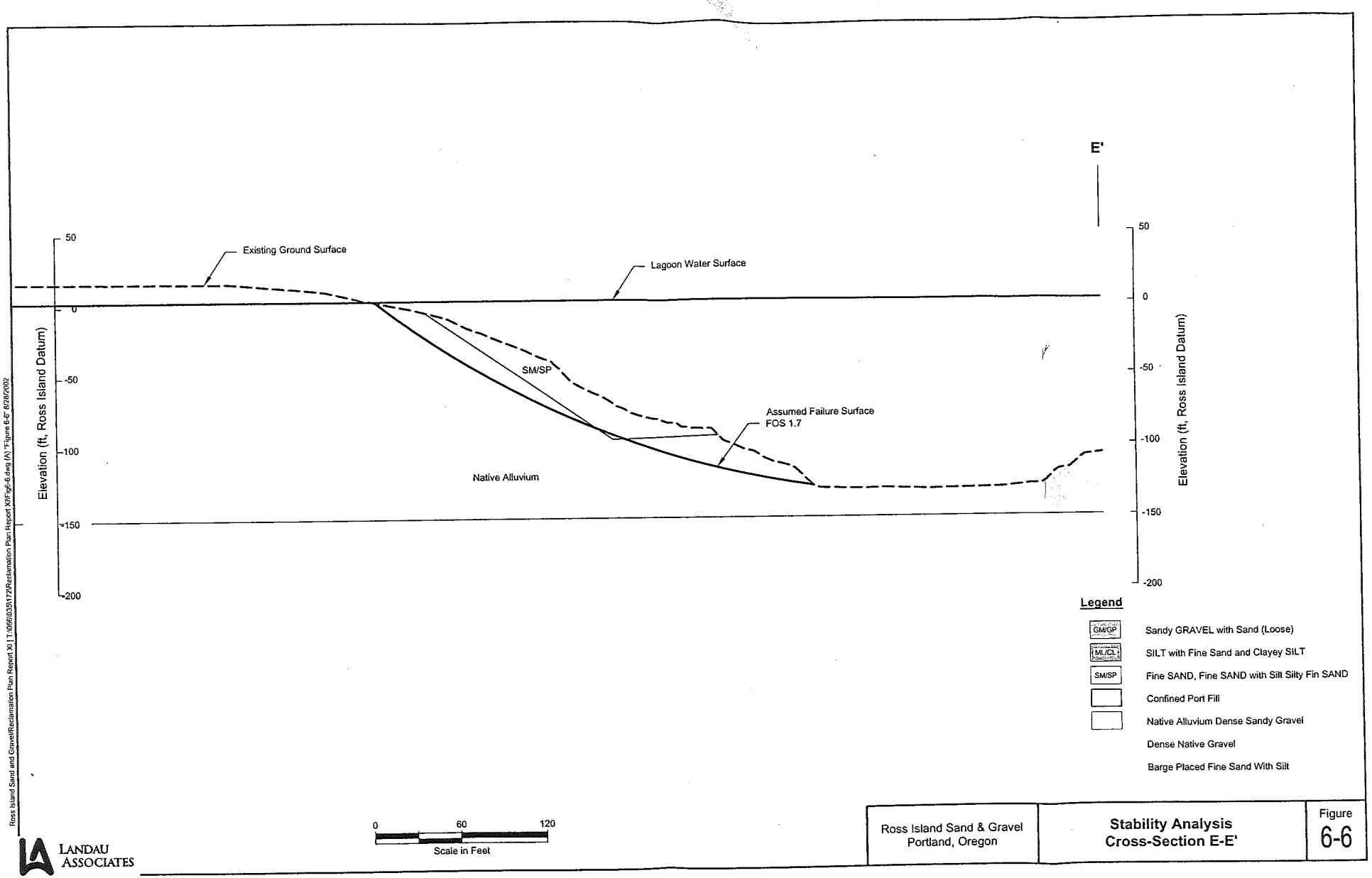
- GM/GP — Sandy GRAVEL with Sand (Loose)
- ML/CL — SILT with Fine Sand and Clayey SILT
- SM/SP — Fine SAND, Fine SAND with Silt Silty Fin SAND
- Confined Port Fill
- Native Alluvium Dense Sandy Gravel
- Dense Native Gravel
- Barge Placed Fine Sand With Silt

0 60 120
Scale in Feet

LANDAU ASSOCIATES

Ross Island Sand & Gravel Portland, Oregon	**Stability Analysis Cross Section C-C'**	Figure 6-5

Ross Island Sand and Gravel/Reclamation Plan Report XI/T:\0060035\172\Reclamation Plan Report XI\Fig6-5.dwg (A) "Figure 6-5" 9/18/2002



LANDAU ASSOCIATES

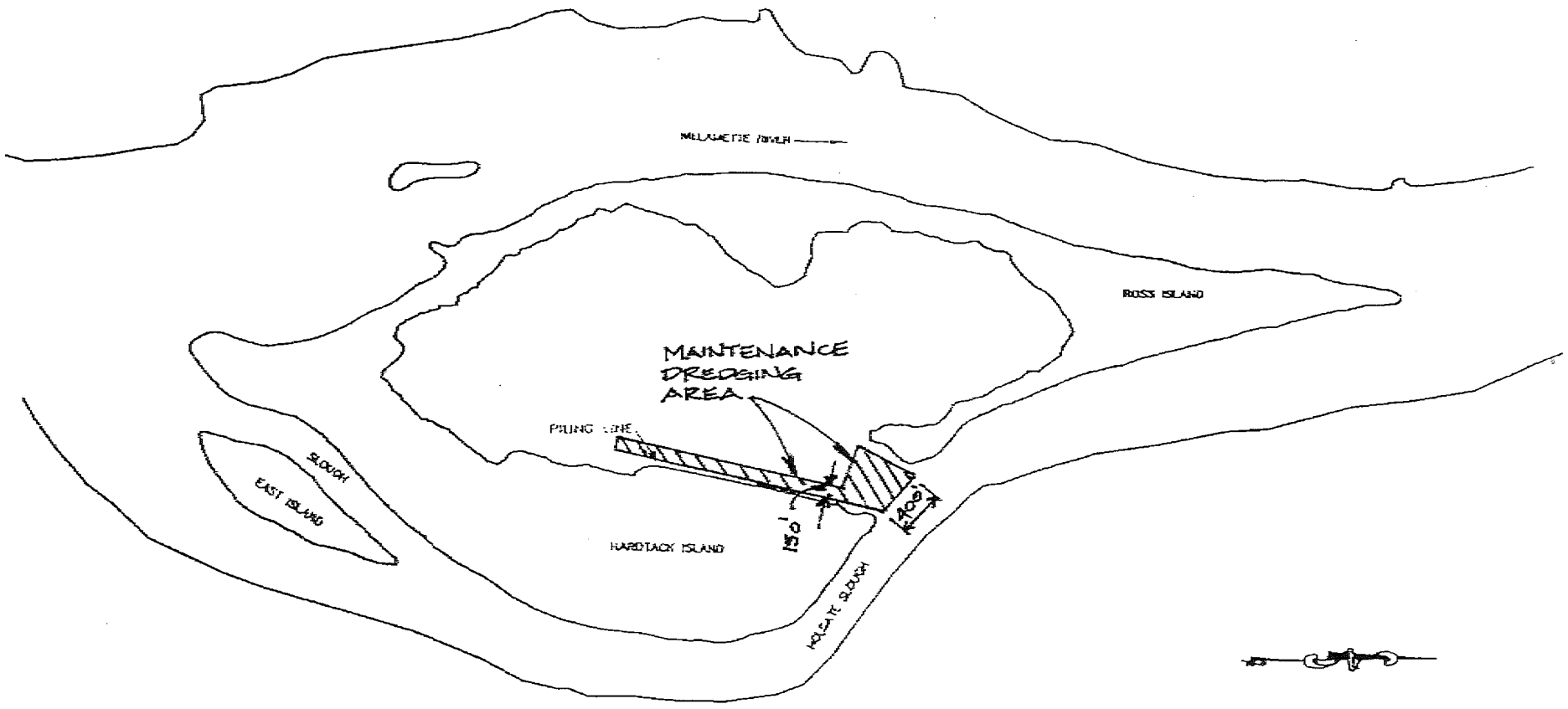
Ross Island Sand & Gravel
Portland, Oregon

Stability Analysis
Cross-Section E-E'

Figure
6-6

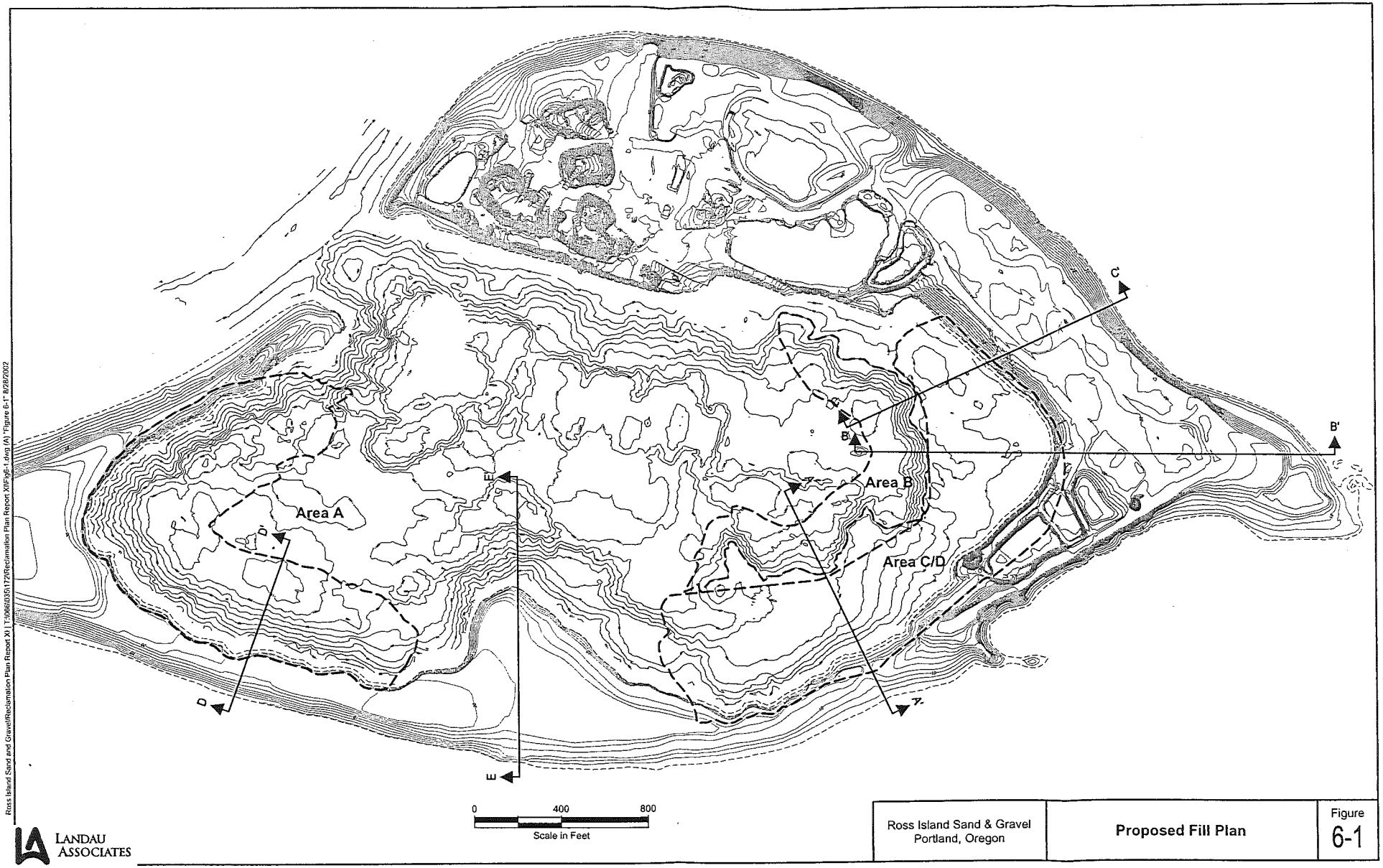
Ross Island Sand and Gravel\Reclamation Plan Report XI | T:\0560\035\172\Reclamation Plan Report XI\Fig6-6.dwg (A) "Figure 6-6" 8/28/2002

ROSS ISLAND LAGOON



MINISTER-GLAESER
SURVEYING INC.
2209 E. EVERGREEN BLVD.
VANCOUVER, WA 98661
(360) 694-3713

Figure 100



LANDAU ASSOCIATES

Ross Island Sand & Gravel Portland, Oregon	**Proposed Fill Plan**	Figure 6-1

Ross Island Sand and Gravel/Reclamation Plan Report XI | T:\0066035\172\Reclamation Plan Report XI\Fig6-1.dwg (A) "Figure 6-1" 8/28/2002

APPENDIX A

Ross Island Wetland and Riparian Habitat Reclamation Plan

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Page

1.0 INTRODUCTION

Overview

This report discusses the feasibility of creating shallow emergent and scrub-shrub wetland, riparian and upland habitat, and shallow water habitat within the Ross Island Lagoon. The Ross Island Lagoon is bordered to the south by an earthen dike, which was constructed between two islands: Ross Island and Hardtack Island in 1926-1927. Ross Island, which is located to the west of Hardtack Island, is bordered on its west side by the mainstem of the Willamette River. Holgate Slough borders Hardtack Island on its east side. Both islands are located at approximately river mile 15 of the Willamette River within the City of Portland, Oregon (T1S, R1E, Sections 10, 11, 14, 15). Figure 1 illustrates the location of Ross Island and its lagoon.

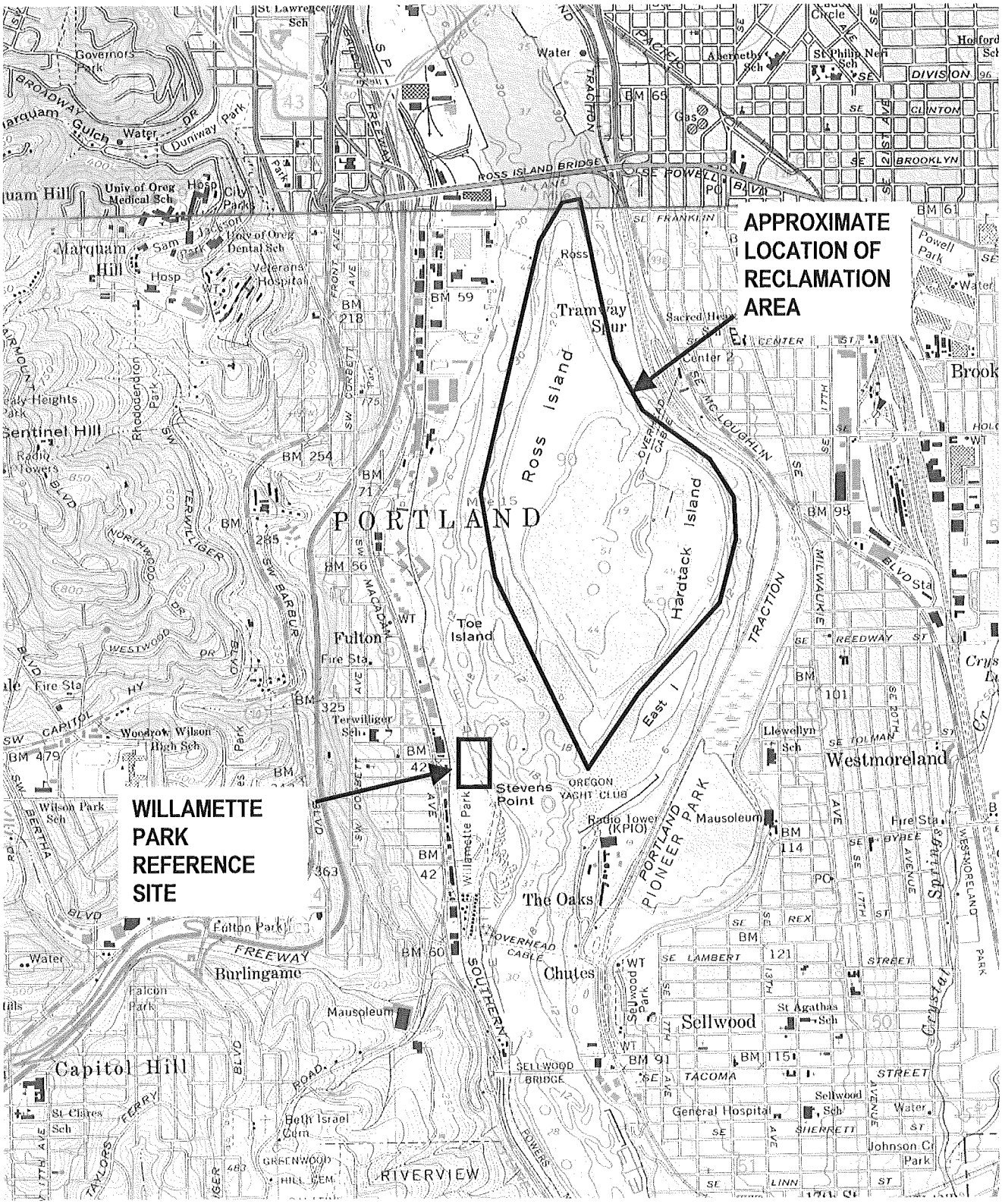
Ross Island Sand and Gravel, Inc. (RIS&G) holds permits from the US Army Corps of Engineers and the Oregon Division of State Lands allowing extraction of sand and gravel from the lagoon and its environs. These permits also provide for the reclamation of the island. The original concepts for reclaiming the island were described in a 1979 plan, which RIS&G and the agencies have agreed to review. The objectives for the new reclamation plan are to improve the quality of habitat within the island complex. This study is a component of this comprehensive review.

Report Summary

The goals of the study include characterizing the existing conditions at Ross Island; locating an area that is subject to a similar hydrologic regime as Ross Island and that contains similar habitats to those proposed within the lagoon; determining whether the conditions at the reference area can be replicated as part of the reclamation process; and establishing a strategy to successfully implement and provide long-term management of the reclamation area.

The habitats proposed as part of this study include expansion of the upland/riparian habitat primarily dominated by black cottonwood (*Populus trichocarpa*) and Oregon ash (*Fraxinus latifolia*) within the higher elevations of the island (i.e. above an elevation of 12 feet Ross Island Datum (RID)); a scrub shrub wetland, subject to periodic inundation and primarily dominated by Pacific willow (*Salix lasiandra*) and Columbia River willow (*S. fluviatilis*); an emergent wetland, which is subject to more frequent inundation and is dominated by herbaceous species such as Columbia sedge (*Carex aperta*), softstem bulrush (*Scirpus tabernaemontani*), northern mudwort (*Limosella aquatica*) and short-seed waterwort (*Elatine brachysperma*).

Our investigation determined that creating the habitats described above is possible, though it will likely be difficult. The reclamation plan needs to be carefully implemented to ensure that conditions conducive to the growth of native plants are achieved. Issues that need to be addressed include: creating a fill slope that allows a hydrologic regime suitable for native plants; ensuring the substrate of the fill slope possesses hydraulic and physical qualities that will facilitate plant growth; and reducing invasive plant competition. The biggest challenge will be to create a slope that not only persists, but that possess a hydrologic regime that causes



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Location and general topography for Ross Island, Portland, Oregon (USGS, Portland, OR-WA quadrangle, 1961, photorevised 1970 and 1977, and Lake Oswego, Oregon quadrangle, 1961, photorevised 1984).

FIGURE 1

—Pacific Habitat Services, Inc.

minimal stress on the plants. Plants will be stressed not only by the annual water level fluctuation of up to 16 feet, but also by the daily tidal fluctuations of 2 to 3 feet. Unlike plants found within estuarine or saltwater environments, relatively few freshwater plants are adapted to this daily fluctuation.

The investigation also determined that the best opportunity for creating wetland is within the southern end of the lagoon. Due to the shallower depths, filling this portion of the lagoon creates the largest wetland area in the shortest period of time. To successfully establish wetland in the lagoon, we feel it is necessary to create a gentle slope ranging between approximately 2% (50:1) to 3% (33:1). This gradual slope will not only provide hydrologic conditions conducive to the growth of wetland plants, but at lower elevations will benefit juvenile salmonids. Juvenile salmonids have been documented using the shallow waters of the lagoon during their outmigration: the lagoon provides off-channel habitat that is lacking within the lower Willamette River. Juvenile salmonids have been documented as using the shallow water beach areas with a gentle slope, some cover, and a substrate of sand/silt or gravel (Beak 2000). Juvenile salmonids will also benefit from the increased production of invertebrates within the created wetland and adjacent riparian area.

Establishing the gentle slope within the southern portion of the lagoon will create a total of approximately 22 acres of wetland and riparian area. A portion of the area will be created each year given the assumption that approximately 4,500,000 cubic yards of fill material will be available. Fill for the wetland/riparian creation and shallow water habitat will be placed within the lagoon during the in-water work periods of July 1 through October 31st and December 1st through January 31st over the 10-year reclamation period. Deep water filling below 40 feet from the water surface may occur year-round.

To improve vegetation success, we recommend placing an aquitard (a relatively impermeable layer) beneath or at the surface of the fill slope to change the drainage within the substrate from mainly vertical to more horizontal. The ideal aquitard is probably a silty clay loam, though any substrate with saturated hydraulic conductivity of less than 0.5 inch per hour will likely suffice. We feel the aquitard is necessary to ensure the substrate responds in a hydraulically steady manner. In other words, water movement through the substrate should be restricted (or dampened) through the daily tidal cycles, which at the lagoon can fluctuate between two and three feet. Generally, plant growth in coarse alluvium (i.e. sand) within a tidal regime, such as that present at Ross Island, is limited by rapid soil-water pressure fluctuations.

We recommend creating the fill slope from an elevation of approximately +12 feet RID at the upper edge to approximately +1 feet RID at the lower edge. A slope approximately 400 feet to 500 feet long appears to be possible within the lagoon.

We recommend initially installing plants in zones according to the hydrologic regime projected along the length of the finished slope. An idealized slope would contain an upper zone above an elevation of +12 feet RID that will be able to support trees and shrubs such as bigleaf maple (*Acer macrophyllum)*, blue elderberry (*Sambucus mexicana*), and black cottonwood (*Populus trichocarpa balsamifera*). These plantings will expand the width of the riparian area within the interior of the lagoon. As the elevations decrease, the slope will be more frequently inundated

and inundated for longer periods. Scrub shrub vegetation dominated by several species of willows will likely dominate the higher elevations (+6 to +10 feet RID) of these zones. The lower elevations (i.e. between +2 and +4 feet RID) will likely be dominated by perennial herbaceous plants.

The lowest zone closest to +1 foot RID should be able to support annual emergent plants that are only exposed during mid summer to early fall. Due to the uncertainty of establishing plants within this zone, it is preferred that plants not be installed, but be allowed to naturally colonize this area. Elevations below the bottom of the slope will be used as shallow water habitat by salmonids. The slope in this area (Area C/D) will be 3:1.

Although the plants will initially be installed in zones, its is assumed that plants will soon start thriving in areas where they are best adapted. Over time, the distinction between the zones will be less well defined.

We recommend planting trees at a density of 10 per 1000 square feet and shrubs at a density of 15 per 1000 square feet. Trees and shrubs should be bare root or cuttings. To increase the likelihood of success, perennial emergents should be planted as plugs and not seeds.

In addition to the wetland/riparian habitat and shallow water habitat proposed for the southern end of the lagoon, we recommend creating shallow water habitat for salmonids within the northern portion of the lagoon. The ability to create wetland in this area is restricted by the relatively narrow width available to create a fill slope. Creating a wide and shallow slope (i.e. 33:1 to 50:1) suitable for wetland conditions would require a large amount of fill material and would probably take many years to create given the amount of annual fill likely available to RIS&G. Although creating suitable wetland habitat appears to not be possible, it appears that shallow water habitat with an average water depth of 15 feet is possible.

We propose that the northern end of the lagoon would be graded from an elevation of +20 feet RID to an elevation –10 feet RID. The area above 12 feet RID along the north end of the lagoon would be planted as upland forest with black cottonwoods (*Populus balsamifera trichocarpa*), red elderberry (*Sambucus racemosa*), and Scouler's willow (*Salix scouleriana*). The plantings between elevation 12 feet RID and 1 feet RID would be planted the same zonation as Area C. The upper portion of this area will support riparian habitat. The portion of the linear slope below +1 feet RID would serve as shallow-water habitat for fish. Between +1 foot RID and –10 feet RID, an undulating bench would be created with a maximum width of 140 feet. Fill will be placed on the bench unevenly to add complexity and diversity to the habitat. To augment the effectiveness of this area as habitat for fish, we propose that whole trees with root wads and branches still intact be anchored in place to provide shelter for juveniles. The National Marine Fisheries Service and the Oregon Department of Fish and Wildlife will be consulted on the number of trees.

We recommend that ongoing maintenance and monitoring of the reclamation area be adaptive to respond to changes in the factors that will shape the wetland. It is likely the reclamation plan will have to be modified to respond to changes in the hydrology, substrate and competition from invasive species within the first few years of creation. Annual reports for 5 years after the initial construction will document the success of the reclamation efforts and will recommend management options for the following year.

Our reclamation recommendations were supported by a preliminary analysis of two reference sites along the shores of Vancouver Lake and the Columbia River. Vancouver Lake, which is located to the east of the Columbia River in Clark County, is generally subject to the same tidal fluctuations as the Ross Island lagoon. Portions of the shoreline of Vancouver Lake have shallow slopes (less than 3%) and wetland plant communities that generally grow in the zones proposed for the reclamation project. The substrate along the margin of the lake is primarily silt, which restricts the vertical movement of water. Another reference site (Frenchman's Bar) is located along the Columbia River to the west of Vancouver Lake. This reference site is also subject to a similar hydrologic regime as the Ross Island lagoon, is dominated by scrub shrub wetland community and has a silty substrate.

Other reference areas include an area of aggrading bank within the Willamette Park along the west bank of the river. This wetland is to the north of the boat launch ramp for the park. This area, which has been aggrading for 10 years, supports a dominant stand of willows growing in fine substrate.

2.0 DESCRIPTION OF EXISTING CONDITIONS WITHIN ROSS ISLAND

2.1 Hydrology

The construction of the earthen dike at the southern end of the island and the later additions of fill to portions of Hardtack Island have created a relatively quiet lagoon that is generally isolated from the scour of the open Willamette River. Water levels in the lagoon, however, are subject to daily tidal fluctuations and from the annual discharges from dams.

An analysis of tidal fluctuations throughout the year was conducted by reviewing data from a US Army Corps of Engineers gauging station located approximately two miles downstream at the Morrison Bridge. This gauge records surface elevations every 15 minutes. The data show a daily irregular 2 to 3-foot tidal fluctuation. The data also show that water levels in the lagoon fluctuate approximately 15 feet annually. Gauging records at the I-5 Bridge near Vancouver, Washington, show a similar water level fluctuation regime with little difference in surface elevation or in tidal timing from the Morrison Bridge. Figures 2, 3, and 4 depict the annual fluctuations

The discharges from the Bonneville dam on the Columbia River are highly regulated by power production requirements, fish migration conditions and to a certain extent by flood control of spring snowmelts. The major fluctuations in water level at Ross Island, however, are likely the result of flood control releases from dams on the upper Willamette River. Since the late 1990's the Army Corps of Engineers have been assisting the outmigration of young salmonids by reservoir releases at the appropriate season. The full effect of the endangered species declaration for several anadromous species was in effect by 1999. The water level records for 1998 and 1999 show a large peak in water level to 12 feet RID for about 10 days in mid-April. Another longer rise in river stage occurs from the last week in May through mid-June. The drought and power shortages of the years 2000 and 2001 have altered the Corps reservoir management to a certain extent, but in the spring of 2002 the same April peak and the longer rise in late May-early June were again noted. These rises in river stage can probably be expected to occur every year.

4.2 Substrate

At this time, the type of material that will be used to create the slope is not known. However, it is possible that much of the material will be sand from dredging projects. If this is the case, it will be necessary to place a layer of relatively impermeable material on top of the sand to hydraulically separate the surface layers from the well-drained materials beneath.

We propose that an aquitard (relatively impermeable layer) be placed approximately parallel to the surface of the slope. The thickness of the aquitard will depend on the contrast in hydraulic properties between the two horizons.

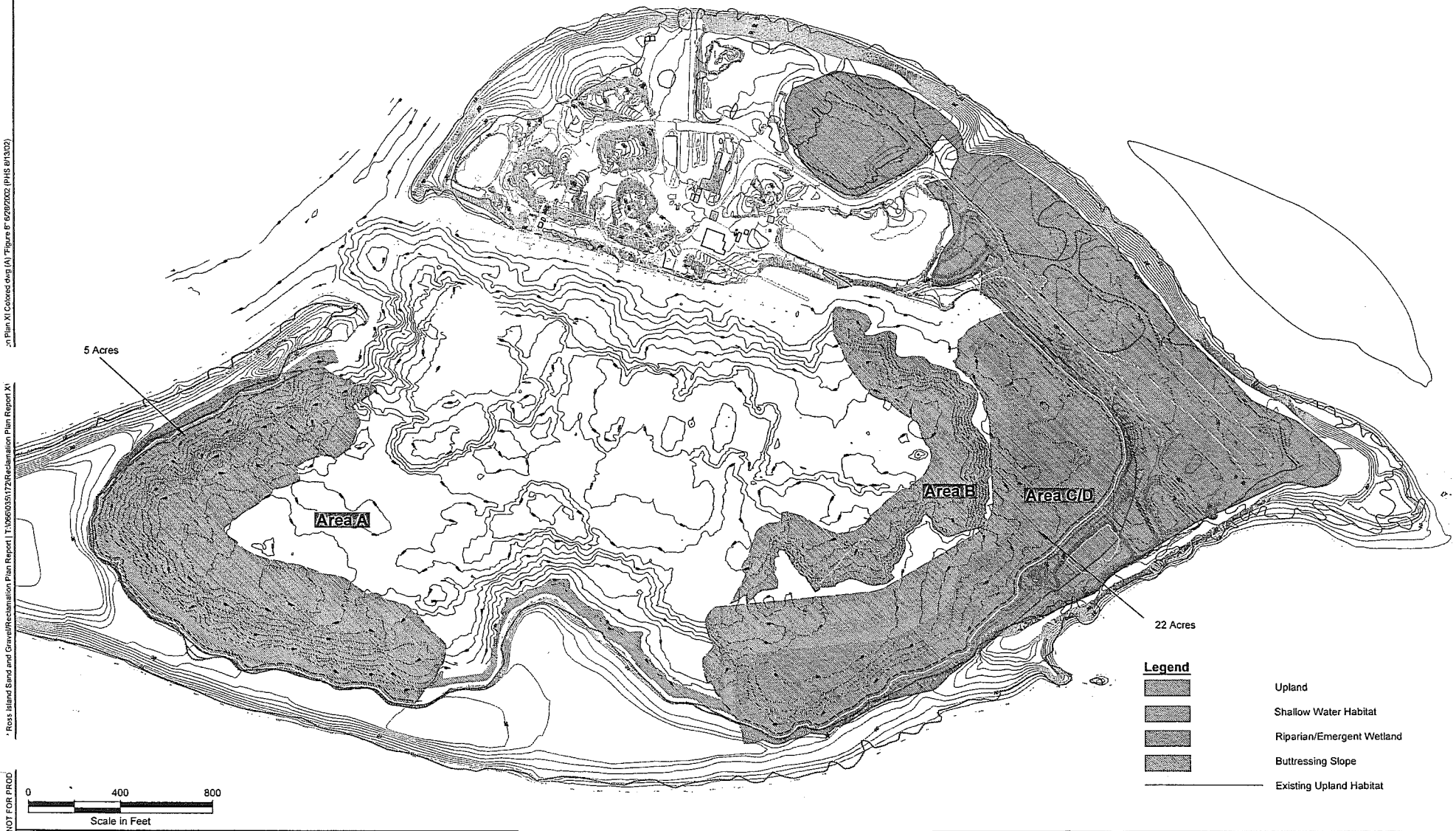
We feel that the aquitard is necessary to change the drainage within the upper horizon from mainly vertical to more horizontal, which will allow the upper profile to respond in a hydraulically steady manner. Vertical water movement through coarse-grained material is quicker than vertical water movement through finer-grained material. In coarse-grained material, the relatively rapid water surface fluctuations create rapid fluctuations in soil-water pressure. Soil-water pressure effects the ability of the plants to transport water and to survive. Pilchuck sand (the mapped series for Ross Island) is a relatively coarse alluvium with little capacity to buffer changing pressures. The fluctuations of soil-water pressure are not as severe in soils such as Sauvie silty clay loam, which is one of the soils mapped along the edge of Vancouver Lake. As such, the ideal aquitard is probably a silty clay loam, though any substrate with saturated hydraulic conductivity of less than approximately 0.5 inch per hour will likely suffice.

4.3 Vegetation Communities

We propose to plant the slope in zones corresponding to inundation regimes for the vegetation. These idealized zones are depicted on Figure 9. The lowest level of the wetland (Zone 4) will be inundated for much of the year and emerge from the water for the first time after the summer solstice. The highest zone (Zone 1) will occasionally be inundated during flood events, but will likely be dry throughout the year. The idealized location and species proposed for each zone are listed below in Table 2.

Table 2 Idealized zonation of plants based on a range of elevations for a reclaimed slope within the Ross Island Lagoon.

Zone 1 (Upland)	12-20+ feet RID	Size	Spacing
Acer macrophyllum	bigleaf maple	2-3 feet	10 feet
Bromus carinatus	California brome	seed	1 lb/1000 ft^2
Elymus glaucus	blue wildrye	seed	1 lb/1000 ft^2
Holodiscus discolor	oceanspray	1-2 feet	7 feet
Populus trichocarpa	black cottonwood	2-3 feet	7 feet
Rhamnus purshiana	cascara	2-3 feet	10 feet
Sambucus mexicana	blue elderberry	1-2 feet	7 feet
Symphoricarpos albus	snowberry	0.5-1 feet	3 feet



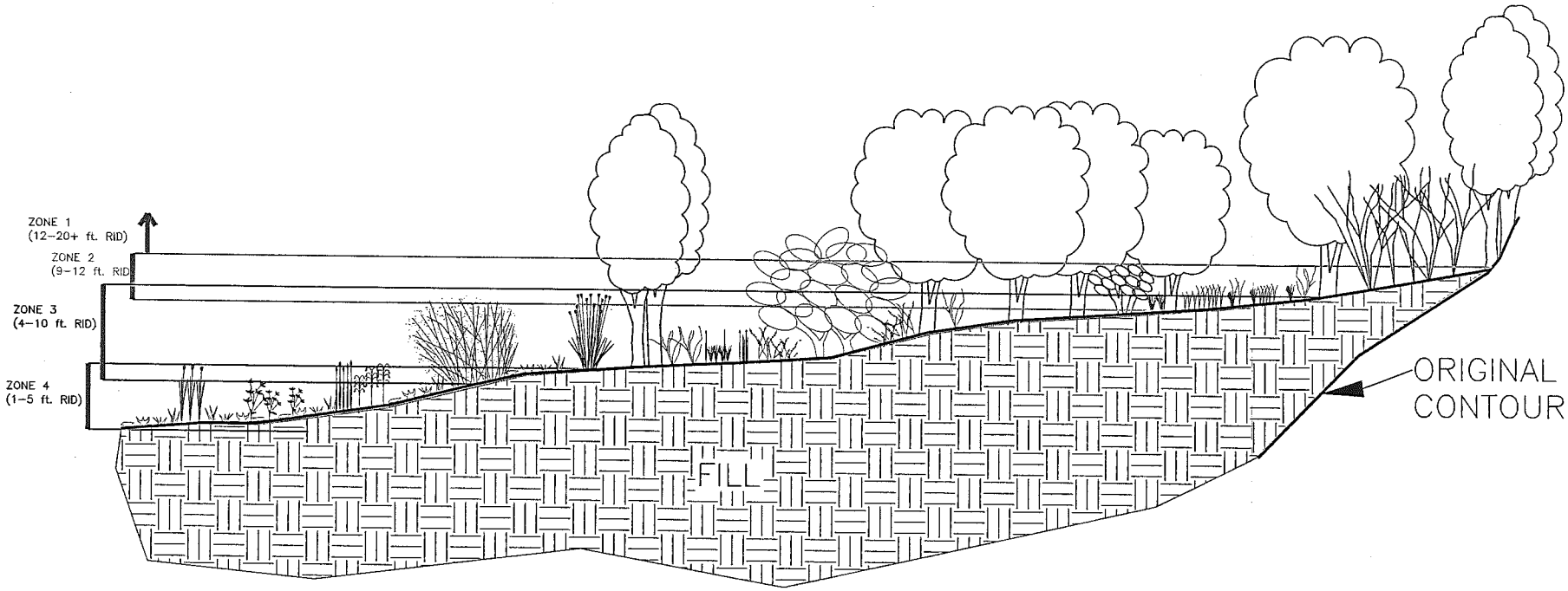
Landau Associates

Pacific Habitat Services, Inc.

Ross Island Sand & Gravel
Portland, Oregon

Proposed Fill Plan and Habitat Creation

Figure 8



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Typical cross–section through the proposed fill slope. Graphic illustrates proposed plants.

FIGURE 9

Pacific Habitat Services, Inc.

Table 2, continued

Zone 2 (Riparian/Scrub Shrub Wetland)	**9-12 feet RID**		
Agrostis exerata	spike bentgrass	seed	0.1 lb/1000 ft^2
Elymus trachycaulus	slender wheatgrass	seed	1 lb/1000 ft^2
Lonicera involucrata	twinberry	1-2 feet	5 feet
Oemleria cerasiformis	osoberry	1-2 feet	6 feet
Populus balsamifera trichocarpa	black cottonwood	2-3 feet	7 feet
Salix scouleriana	Scouler's willow	2-3 feet	10 feet
Zone 3 (Scrub Shrub Wetland)	**4-10 feet RID**		
Agrostis exerata	spike bentgrass	seed	0.1 lb/1000 ft^2
Cornus stolonifera	red-osier dogwood	1-2 feet	5 feet
Deschampsia cespitosa	tufted hairgrass	seed	0.1 lb/1000 ft^2
Fraxinus latifolia	Oregon ash	2-3 feet	10 feet
Salix fluviatilis	Columbia River willow	2-3 feet	4 feet
Salix hookeriana	Hooker's willow	2-3 feet	7 feet
Salix lucida lasiandra	Pacific willow	2-3 feet	6 feet
Salix sitchensis	Sitka willow	2-3 feet	7 feet
Zone 4 (Emergent Wetland)	**1-5 feet RID**		
Alopecurus geniculatus	Water foxtail	seed	0.1 lb/1000 ft^2
Bidens cernua	nodding beggar's ticks	seed	0.2 lb/1000 ft^2
Bidens frondosa	tall beggar's ticks	seed	0.2 lb/1000 ft^2
Carex aperta	Columbia sedge	plugs	2 feet
Cyperus aristatus	awned flatsedge	seed	0.1 lb/1000 ft^2
Elatine brachysperma	short-seeded waterwort	plugs	5 feet
Elatine rubella	red mud-purslane	plugs	5 feet
Eleocharis ovata	ovate spikerush	seed	0.1 lb/1000 ft^2
Gratiola ebracteata	bractless hedge-hyssop	plugs	5 feet
Gratiola neglecta	common hedge-hyssop	plugs	5 feet
Juncus bufonius	toadrush	seed	0.1 lb/1000 ft^2
Juncus oxymeris	pointed rush	plugs	2 feet
Leersia oryzoides	rice cutgrass	seed	0.2 lb/1000 ft^2
Limosella aquatica	mudwort	plugs	5 feet
Lindernia dubia	false-pimpernel	plugs	5 feet
Ludwigia palutsris	water-purslane	plugs	5 feet
Ludwigia peploides	jussiaea	plugs	5 feet
Lythrum portula	peplis	plugs	5 feet
Polygonum hydropiperoides	waterpepper	plugs	3 feet
Rotala ramosier	toothcup	plugs	5 feet
Sagittaria latifolia	wapato	plugs	2 feet
Scirpus tabernaemontani	softstem bulrush	plugs	3 feet
Scirpus cyperinus	woolly sedge	plugs	3 feet
Verbena hastata	simpler's joy	plugs	4 feet

The response of wetland plants to episodic inundation varies. Submergent plants, which remain entirely below the water surface (i.e. below the lower elevations of Zone 4) photosynthesize by direct gas or ionic exchange within the water column. These plants have populations that tend to be transient in time and space. The alkalinity of the Willamette River is probably high enough to maintain a bicarbonate ion supply for these plants during the growing season. These plants will be affected significantly by aquatic predators (e.g. fish and ducks) and by turbidity within the water column. Under the current management regime of the lagoon (i.e. no dredging), near-surface turbidity seems to be limited to a fringe at the water's edge.

Through the low-water conditions of late summer, the lagoon will experience tidal fluctuations of 2-3 feet depending on the phase of the moon, Willamette River discharge controls, and Columbia River discharge controls. Most vascular plants, which are adapted to life in these water level fluctuations, operate by photosynthesizing during periods of exposure to air and shutting down during periods of inundation. A few perennial emergent forbs may have sufficient internal gas storage to maintain an internal recycling of respiration and photosynthesis, but most adapt by rapidly starting and stopping when they meet the air. These are mostly annuals germinating from a seedbank when daily water temperature fluctuations are favorable. They will not be greatly affected by turbidity within the water column. Perennial rushes and sedges can deal with rapid tidal fluctuations and will be adapted to the outer edge of the wetland. These plants will be installed through the zone between 2-4 feet RID. These plants will also be installed as plugs when this zone is exposed to the air on a low tide about the first of July.

Annuals adapted to this regime will dominate Zone 4, though a few perennial herbaceous plants may extend down to this lower zone. The community of skeletal remains of annuals in Zone 4 that retain a seedbank within the zone will probably take several years to develop.

The ability to shut down in periods of inundation during the active growth period is limited to a few woody plants such as Oregon ash and willows. These plants will thrive in areas that are inundated in the spring periods of fish migration. A few species, such as indigobush may thrive under these conditions. However, the status of whether these plants are considered invasive is uncertain. The willows of Zone 4 will be installed in early March before the reservoir releases for outmigrating spring chinook. All of the woody plants in Zones 1-3 will also be installed in early March before the spring high water periods. This will allow the plants some time to adapt to the rooting medium before leafing out and minimize the stress of later inundation.

The grass seeding above 8 feet RID should also be done in early March. Seeding below this elevation will have to wait for lower water levels after the salmonid outmigration (late June-early July).

Many woody plants can survive high winter water levels. The cottonwoods that form the dominant woody canopy on Ross Island are well suited for areas that are occasionally inundated during winter storms.

Plant communities around the perimeter of Vancouver Lake grow in zones reflecting their adaptation (in part) to a specific range of water levels. The creation of a gentle slope within the Ross Island lagoon will also create a range of specific hydrologic conditions and allow for the establishment of planting zones.

Many variables effect plant growth and it is likely that not all plants will survive or stay contained within the zones described above. It is suggested, therefore, that "tongues" of selected plantings extend across the elevations (or zone borders) in order to ensure that plants are exposed to varying conditions.

To increase the likelihood of success of woody plants through the first growing season, an overnight weekly irrigation equivalent to 1.5 inches of rainfall is preferable between June 20 and September 20. For the second growing season and for as many growing seasons as is deemed necessary, the plants can be similarly irrigated every two weeks. Irrigation should not be necessary for plants below +8 feet RID.

4.4 Shallow Water Habitat

Outmigrating juveniles (chinook, steelhead, and coho) have been documented in the lagoon during the outmigration. To augment the habitat for these salmonids, an area of shallow water habitat will also be created within Area A at the northern end of the lagoon. The habitat will extend from an elevation of approximately +1 foot RID, which may support a fringe of emergent vegetation, to an undulating bench, which will be created with a maximum width of 140 feet at an elevation of approximately –10 feet RID. The Corps reservoir releases to assist outmigration may raise water levels in the lagoon from +5 feet RID to a level of +10 feet RID. With these water levels, the shelf will have the 15-20 feet water depths considered important for salmonid habitat. Numerous pieces of large woody material (whole trees with root wads and branches still intact) will be anchored on the bench to provide structural complexity and refuge that is currently lacking in the lagoon. The bench will provide a substrate for benthic macroinvertebrates, which will in turn provide food for juvenile salmonids. This bench will be supported by the buttressing slope, which will be created at an approximately 3:1 grade.

4.5 Upland Habitat

Approximately 5 acres of upland habitat will be created at the north end of the lagoon and approximately 32 acres of upland habitat will be created at the southern end of the lagoon. A portion of the southern end of the lagoon has already been planted with native trees.

Upland plantings along the northern end of the lagoon in the steeper upland fill slopes will consist of black cottonwoods, red elderberry (*Sambucus racemosa*), and Scouler's willow (*Salix scouleriana*). The species listed in Zone 1 will be planted within the upland areas at the southern end of the lagoon.

To ensure their survival, weekly spray irrigation will be provided for woody plants above an elevation of approximately 8 feet RID. The irrigation system will deliver the equivalent of 1.5 inches of rainfall once a week between June 20 and September 20. For the second growing season, the irrigation system will be operated every two weeks through the same summer period. Irrigation beyond the second season should not be needed unless new plants have been installed on the site.

4.6 Success Criteria

Wetland/Riparian Habitat

The successful growth of native vegetation and the control of non-native vegetation will form the basis of a successful reclamation effort. Focusing on the success of the vegetation assumes that a fill slope will be created between 2% (50:1) and 3% (33:1); that the lower elevations of the slope will be approximately +1 feet RID; that an aquitard will be placed within the surface of the fill slope; and that each of the planting zones will be exposed to the hydrologic regimes described in the sections above. It is anticipated that variations to this idealized scenario are unavoidable given the large amount of fill that needs to be placed to create the slope and the fact the fill will be placed using a barge and, therefore, cannot be precisely located. For this reason, it is assumed that some alteration of the fill slope may be needed to correct situations that vary widely from the assumptions described above.

The wetland and riparian creation will be considered successful if (1) no more than 20% of the wetland and the planted riparian area below 10 feet RID is covered with reed canarygrass and no more than 20% of the area above 10 feet RID is covered with Scot's broom (*Cytisus scoparius*) or Himalayan blackberry, (2) if at least 75% of the woody plants installed above elevation 4 feet RID (in the wetland, riparian, and upland areas) are surviving 5 years after installation; and (3) that approximately 22 acres of wetland and riparian habitat will be created on the fill slope at the southern end of the lagoon and that a portion of the fill slope meets the definition of jurisdictional wetland as described in the U.S. Army Corps of Engineers, Environmental Laboratory, 1987. *Corps of Engineers Wetland Delineation Manual. Technical Report Y-87-1* (1987 manual).

The exact area of wetland that will be created will primarily depend on the water level fluctuations within the lagoon (which are dependent on dam releases and precipitation). It is assumed that wetland will be created below an elevation of 5 feet RID if the fill slope is inundated or saturated to the surface for more than 12.5% of the growing season. Wetland may be created below an elevation of approximately 10 feet RID if the fill slope is inundated or saturated to the surface for more than 5% of the growing season. Based on these elevations, it is estimated that between 8 and 16 acres of the 22-acre wetland/riparian habitat area will satisfy the jurisdictional definition of wetland.

Given the uncertainty of establishing herbaceous vegetation at lower elevations, we feel that RIS&G should not be held to a specific success criteria. However, an estimate of total cover within the lower zone (Zone 4) of the reclamation area will be assessed and photographs of the vegetative cover will be included in the annual monitoring reports.

Upland Habitat

The reclamation of upland areas will be considered successful is at least 75% of the trees and shrubs are living and in good health five years after their installation. If the plant counts fall below the 75% survival level 3 years after installation, other trees and shrubs will be installed to increase the number to the requisite 75%. If necessary, healthy volunteer trees and shrubs of the same species or native species approved by the Division of State Lands as an appropriate substitute can be counted as replacements in order to reach the 75% survival level.

4.7 Monitoring and Maintenance

The reclamation areas will be monitored and maintained annually to determine whether the effort is successful. Data collected during the monitoring period will be included in an annual monitoring report to be provided to interested parties and regulatory agencies. The report will include a discussion on the success of the reclamation effort, issues that may affect the success of the plants and proposed management options; and photographs illustrating the reclamation area.

Hydrology Monitoring

The creation of jurisdictional wetland on the fill slope requires that the three required criteria of the 1987 Manual are satisfied: wetland hydrology, dominant hydrophytic vegetation and hydric soils. It is assumed that if the fill slope is graded correctly, it will be exposed to a hydrologic regime that satisfies the jurisdictional definition of wetland hydrology as included in the 1987 manual. It is also assumed that if wetland hydrology is created, hydrophytic vegetation will dominate and soils with redoximorphic features (i.e. hydric soils) will develop.

Areas that always meet the jurisdictional definition of wetland hydrology are those that are inundated or saturated at least 12.5% of the growing season. With supporting wetland characteristics (i.e. dominant hydrophytic vegetation or hydric soils) areas may be inundated only 5% of the growing season. The growing season is defined as the period of time between the last killing frost (defined as the last winter date with minimum temperature of 28° F for five years out of ten) to the first killing frost (the first winter date with minimum temperature of 28°F for five years out of ten). For Portland (during the years 1951-1976) the last killing frost was March 4 and the first killing frost was December 1. This gives a growing season of 272 days.

For the fill slope at the southern end of the lagoon, this means that soils saturated to the surface for less than 14 days (5%) between March 4 and December 1 do not satisfy the wetland hydrology criterion. Soils saturated to the surface for more than 34 days (12.5%) between March 4 and December 1 are definitely considered to have wetland hydrology. Soils with saturation regimes between these extremes require additional evidence to satisfy the wetland hydrology criteria.

The hydrology of the slope throughout the year can be determined by comparing the elevations of the fill slope with the river level fluctuations measured at the Corps of Engineers river gage on the Morrison Bridge. The fluctuations of the water level in the Ross Island lagoon is, of course, closely related to the water surface fluctuations at the Morrison Bridge.

An analysis of the Corps' data, indicates that the water surface elevation of the Ross Island lagoon (River Mile 15) is approximately 0.2 feet above the water surface at river mile 13 near the Morrison Bridge. Lower flows may have a slightly steeper gradient, but with no more than 0.5 feet in river surface elevation difference.

An as-built topographic survey of the fill slope will be prepared each year to establish the slope's elevations. This topographic survey will be compared with the corrected water levels within the lagoon and areas that satisfy the wetland hydrology criterion will be determined. As vegetation becomes established, it is anticipated that the wetland area may increase due to the dominance of wetland plant communities.

A wetland delineation, to be concurred with by the Division of State Lands, will be conducted at the end of the monitoring period to determine the final wetland boundaries.

Vegetation Monitoring

To determine the success of the plants, monitoring will occur in the late summer using a belt transect placed at 50 feet intervals along the outer edge of the planted zone. Transects will extend 5 feet on each side of a straight line from a baseline established at the upper edge of Zone 1 and extending to the edge of the water. The transects will be broken into 20-foot plots starting furthest away from the lagoon. Areal cover of Himalayan blackberry, Scot's broom, and reed canarygrass and other invasives will be assessed by ocular estimate as a percent of each 10 foot x 20 foot plot. The presence and abundance of woody species will be established within each of the plots along each of the transects.

The transects will cover approximately 20% of the fill slope. The counts for each woody plant within each of the 10 x 20 plots will be used as a sample population for the entire woody plant population. With these samples, we will be able to make a statistical estimate of the plant populations to a given confidence level using the standard deviations and means of the samples.

This same method will also be used at the northern end of the lagoon to establish the success of vegetation within the upland area.

As discussed above, an as-built topographic survey of each new section of the fill slope will be conducted. This survey will aid in determining the optimal elevations for each of the species installed and the elevations at which new plants are colonizing.

Non-Native Plant Control

The vegetation zones across the fill slope will likely have to contend with the invasion of weedy species. Blackberries and Scot's broom will likely grow in the higher elevations of the fill slope. Reed canarygrass and creeping bentgrass (*Agrostis stolonifera*) will likely be present in the central elevations of the wetland. In addition, the lowest elevations of the slope may provide habitat for non-native annuals that are adapted to the daily tidal fluctuations.

Controlling blackberries and reed canarygrass during the initial plant establishment period may be necessary to allow the desired plants to thrive. As such, we propose semiannual mowing of the invading plants during the first two years (or as deemed necessary) after initial installation to control their growth.

If more than 20% cover of reed canarygrass is within the wetland area, the grass growing above the water will be mowed three times during the growing season (the first of June, the middle of July, and the middle of October). Areas with more than 20% cover of Scots broom and Himalayan blackberry will be treated following the recommendations of the Portland Parks and Recreation *Pest Management Program* and methodologies of the City's Revegetation Program.

Adaptive Management

Due to the array of variables that can affect plant growth, it will be necessary to adaptively manage the reclamation effort. Issues that may require changes in how the reclamation area is managed include, but are not limited to: competition from non-natives not considered by this study (e.g. purple loosestrife (*Lythrum salicaria*)); predation from herbivores (e.g. geese, beaver, nutria); long-term and short-term instability of the fill slope; plant mortality from annual creation of the fill slope (e.g. smothering newly planted species with fill material); creation of potential fish entrapment sites as the slope is filled; and elevations or angle of slope not conducive to the proposed range of hydrologic regimes.

The annual report will describe any physical changes that may be required to the reclamation area and any changes in management strategies. These changes will be discussed with the agencies prior to implementation the following year.

4.8 Construction and Monitoring Phasing

The buttressing slope at the south end of the lagoon (Area B) will be the first area of fill placed as part of the reclamation plan. This butressing slope may take three years to form and will likely have to be in place before the wetland/riparian area (Area C/D) can be created. The first lobe of wetland/riparian creation will likely be an area along the southwest side of the lagoon near the north end of the earthen berm between Ross Island and Hardtack Island. This lobe will be graded at an approximately 3% slope from an elevation of 12 feet RID on the landward side to an elevation of 1 foot RID at the outer edge of the fill. The first phase of wetland construction will consist of a single year's fill (approximately 450,000 yd^3) extending southeast

from the northwestern corner of the wetland. The basal portion of the fill will probably be fine sand dredge spoil. After the first lobe has been placed it will be planted and then monitored. Each of the lobes will be monitored for five years. Fill will be placed within Area C/D until the approximately 22-acre wetland/riparian area has been created.

Fill will continue to be placed within the lagoon until the approximately 4.5 million yd^3 have been placed to complete the entire reclamation plan. The final phases of the reclamation plan will be to create the upland and shallow water habitat and the buttressing slope at the northern end of the lagoon (Area A). This area will also be monitored for five years after the plants have been installed. Monitoring will begin the first year after the plants have been installed in Area C/D and end five years after the last plants have been installed in Area A. The entire monitoring period, therefore, may extend over more than 10 years.

5.0 REFERENCES

Beak Consultants. 2000. Final Report. Ross Island and lower Willamette River fish monitoring study – 1999. Prepared for Ross Island Sand and Gravel Co. February 25, 2000. 31 pp plus appendices.

Oregon Division of State Lands. May 5, 2000. Removal/Fill Permit RF-26 Renewal issued to Ross Island Sand and Gravel.

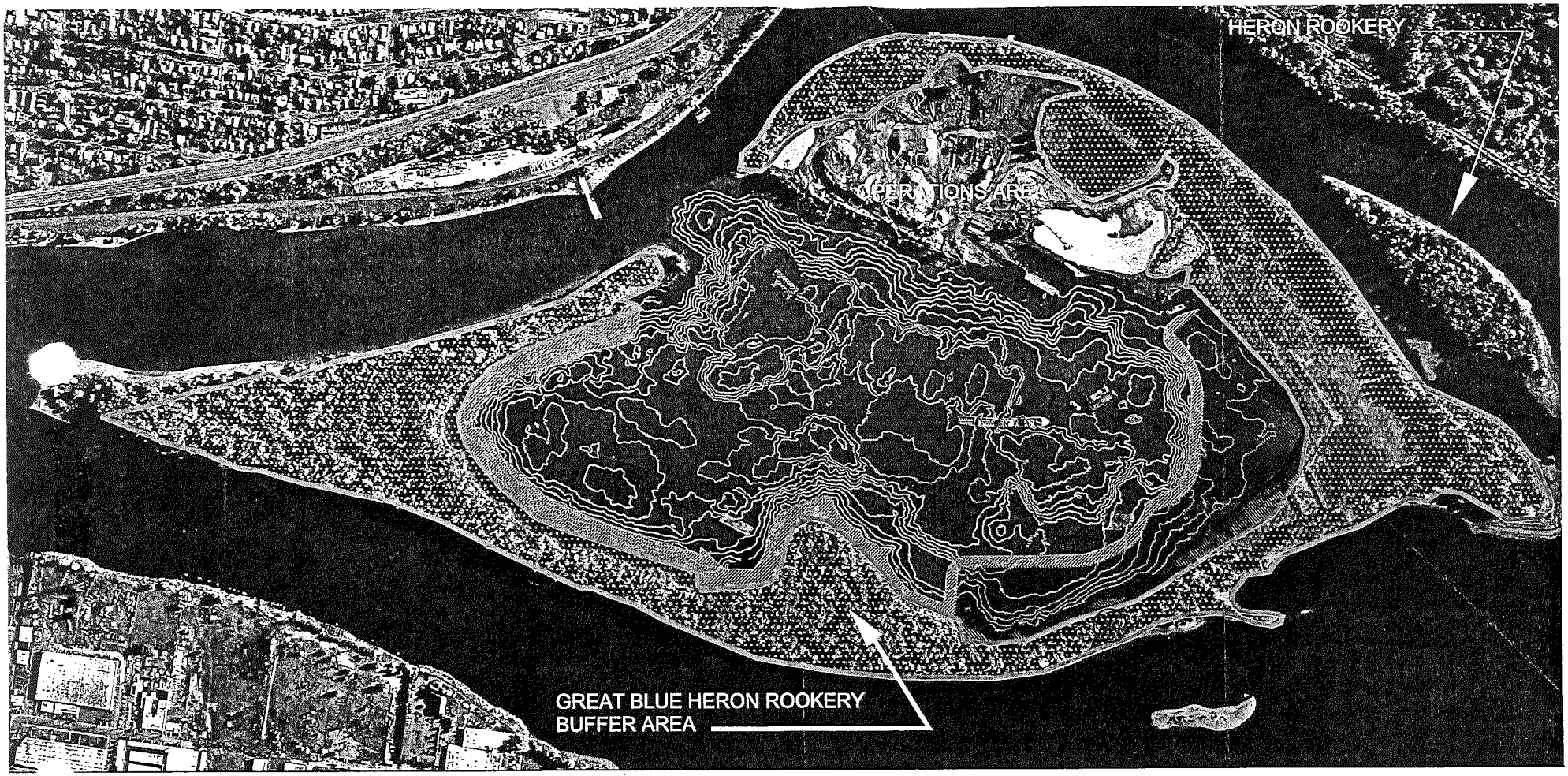
Portland Audubon Society. 2000. Field Notes Archive.

U.S. Army Corps of Engineers, Environmental Laboratory, 1987. *Corps of Engineers Wetland Delineation Manual. Technical Report Y-87-1.*

U.S.D.A., Soil Conservation Service, 1983. *Soil Survey of Multnomah County, Oregon.*

U.S.D.A., Soil Conservation Service., 1989. *Oregon Hydric Soils by Counties.*

U.S. Geologic Survey 7.5 Minute topographic map. Portland OR-WA quadrangle, 1961, photorevised 1970 and 1977, and Lake Oswego, OR quadrangle, 1961, photorevised 1984.



PROPOSED HABITAT TYPES

SHALLOW WATER HABITAT

RIPARIAN/EMERGENT WETLAND

UPLAND FOREST

DEEP WATER AREAS
(greater than and equal to -100 feet RID)

EAGLE NEST

0 250 500 1000
SCALE IN FEET

ROSS ISLAND
2002 PROPOSED RECLAMATION

FIGURE 1