APPENDIX C

Mitigation Plans for the Proposed Action

I. Northwest Aggregates. 2004. Mitigation Plan, Maury Island Barge-loading Operations (Extended Dock). June 2, 2004.

II. Northwest Aggregates. 2003 (Revised). Barge Approach and Departure Protocol. Northwest Aggregates-Maury Island Barge-Loading Dock, Revised December 2, 2003.

III. Northwest Aggregates. 2004. Draft Conveyor Replacement Mitigation Planting Plan. Prepared by Grette Associates, May 20, 2004.

Mitigation Plan

Maury Island Barge-Loading Operations (Extended Dock)
Northwest Aggregates

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June 2, 2004

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1. Introduction

Northwest Aggregates proposes to replace and extend the dock at its sand and gravel mine on southeastern Maury Island (Figure 1). This document describes measures that will be implemented to mitigate potential impacts from barge-loading operations at the extended dock. Mitigation measures address potential impacts from gravel spillage, shading, prop wash, and noise associated with operation of the barge-loading dock.

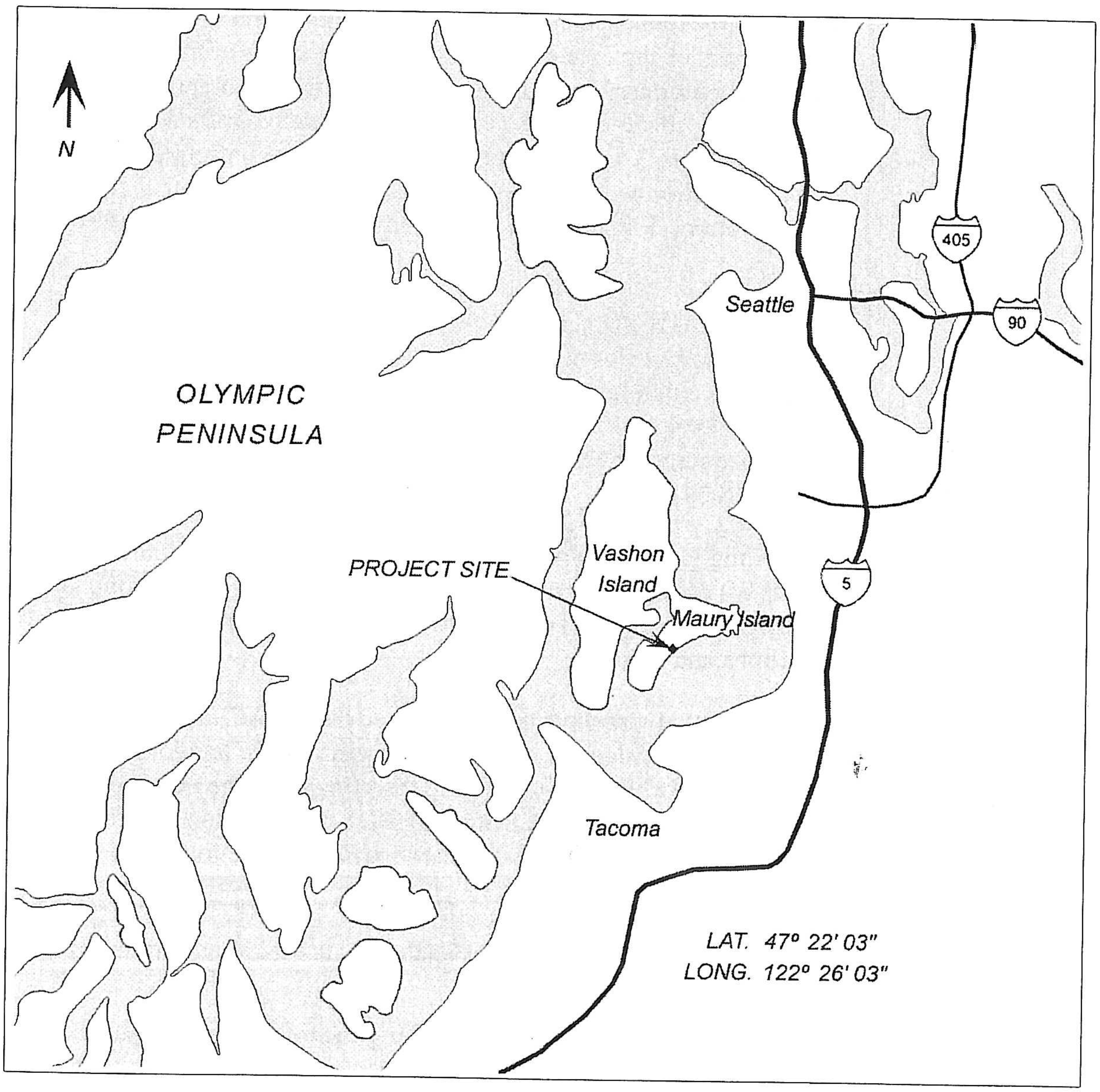


Figure 1 Vicinity Map

Northwest Aggregates originally planed to repair the existing dock and keep it in its current configuration. A Final Mitigation Plan for barge-loading operations at the repaired dock dated May 9, 2002 was submitted to and approved by the Washington Department of Fish and Wildlife (WDFW). The Final Mitigation Plan was incorporated by provision in the Hydraulic Project Approval (HPA) issued by WDFW for the repair project on May 13, 2002 (WDFW Log Number 00-E4751-03).

Subsequent to the issue of the HPA, King County reviewed the project for shoreline management program compliance, and requested replacement of the existing structure and extension of the dock as an added precautionary measure to reduce the risk of potential impacts to eelgrass. Figure 2 shows the existing dock and eelgrass distribution at the site. Figure 3 shows the proposed new dock configuration. Figure 4 is an elevation view of the conveyor for the proposed new dock configuration. Figure 5 is an elevation view of the proposed new dock face.

In response to the County's request, additional propeller wash modeling was performed. Results of the modeling showed that when the dock is extended as proposed, propeller wash from tugboats will not impact eelgrass areas at the site. Results of the propeller wash model are summarized in the County's Addendum to the FEIS (King County 2004).

According to the Washington Department of Fish and Wildlife (WDFW) policy number POL-M5002 on requiring or recommending mitigation, the purpose of mitigation is to achieve no net loss of habitat functions and values.

The WDFW Hydraulic Code Rules (220-110 WAC) define mitigation as, "actions that shall be required or recommended to avoid or compensate for impacts to fish life resulting from the proposed project activity." The Rules state that the type(s) of mitigation shall be considered and implemented, where feasible, in the following sequential order of preference:

A. Avoiding the impact altogether by not taking a certain action or parts of an action.

B. Minimizing impacts by limiting the degree or magnitude of the action and its implementation

C. Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.

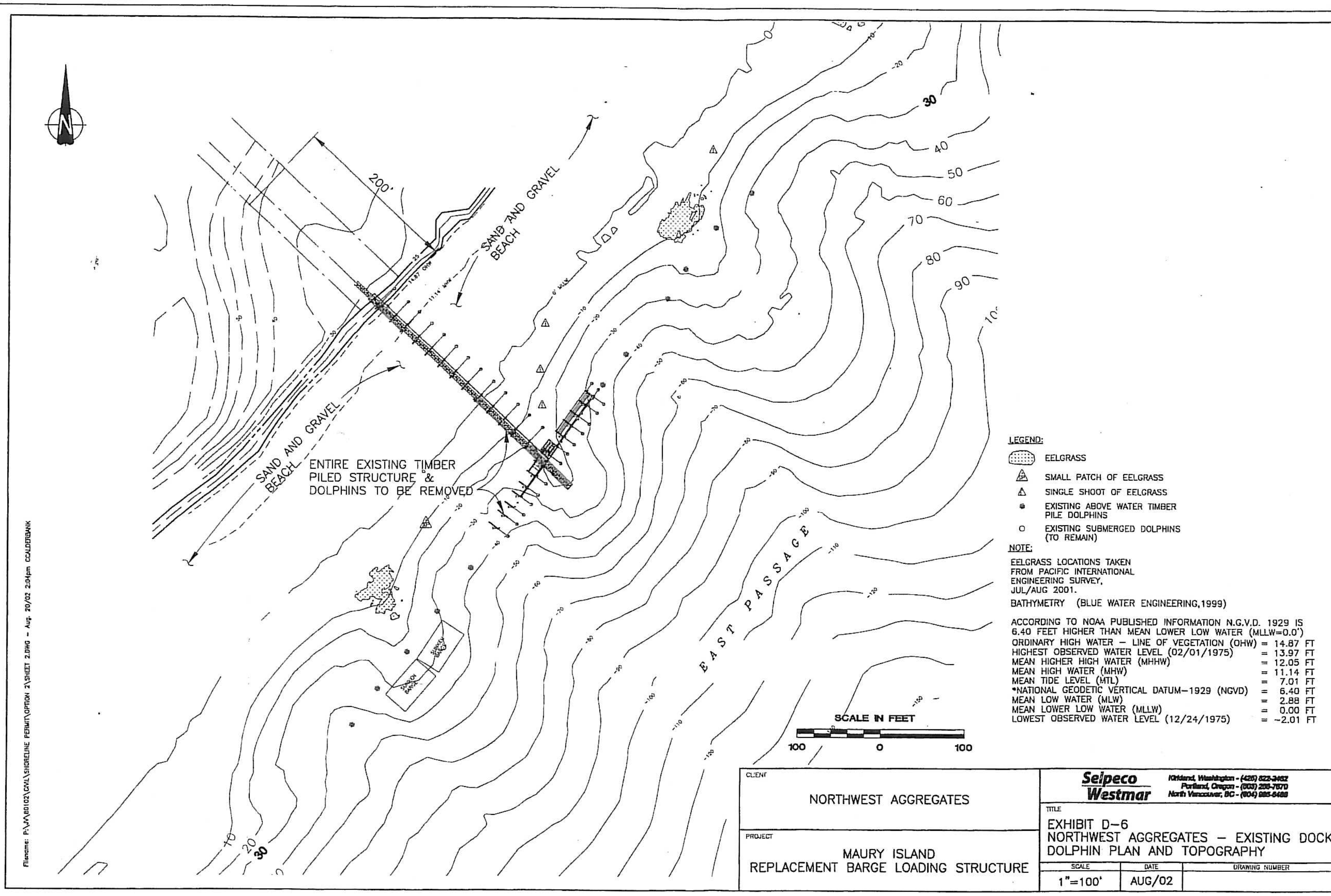


Figure 2 Maury Island Gravel Dock and Distribution of Eelgrass

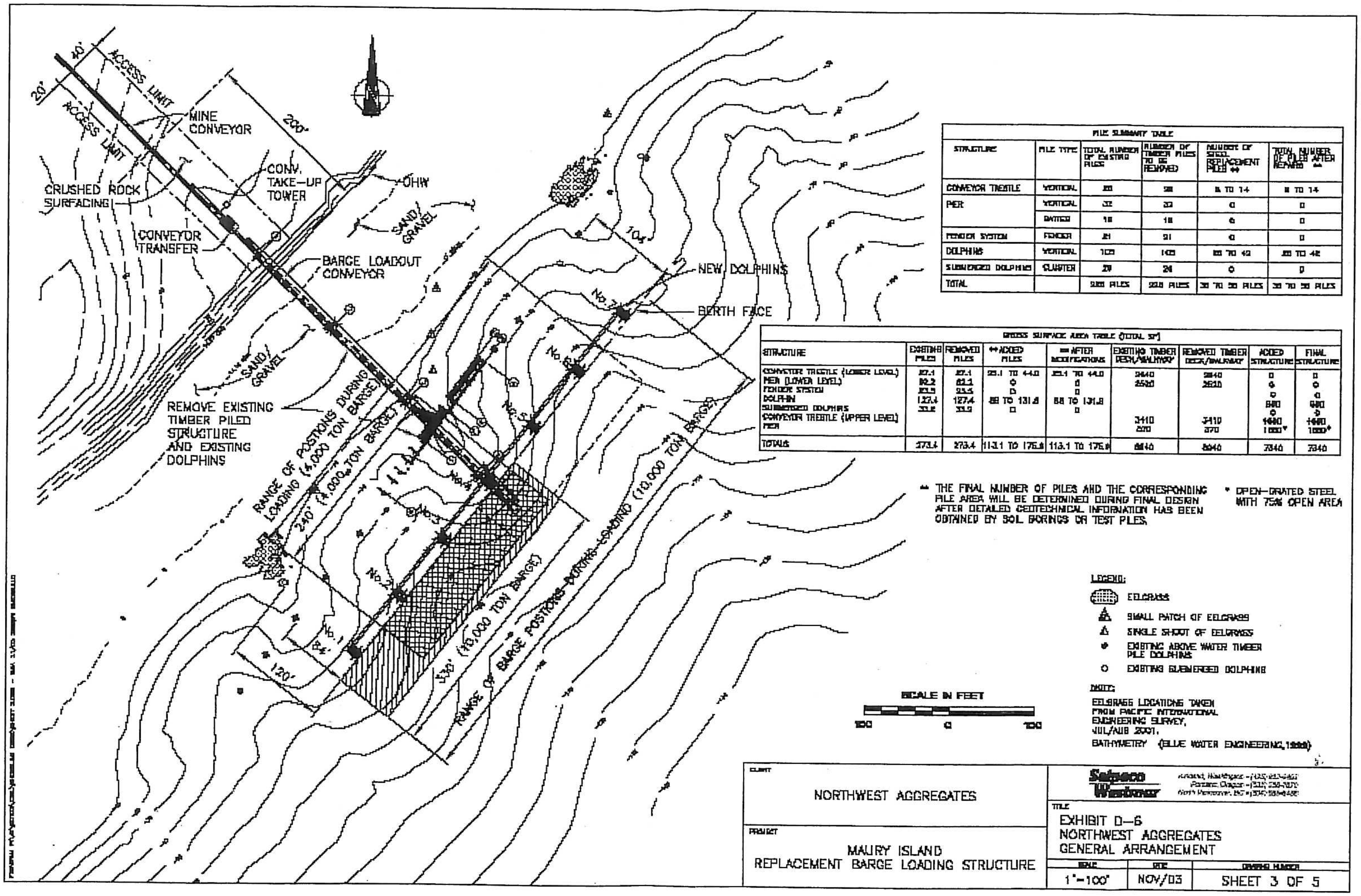


Figure 3 Proposed New Dock Configuration

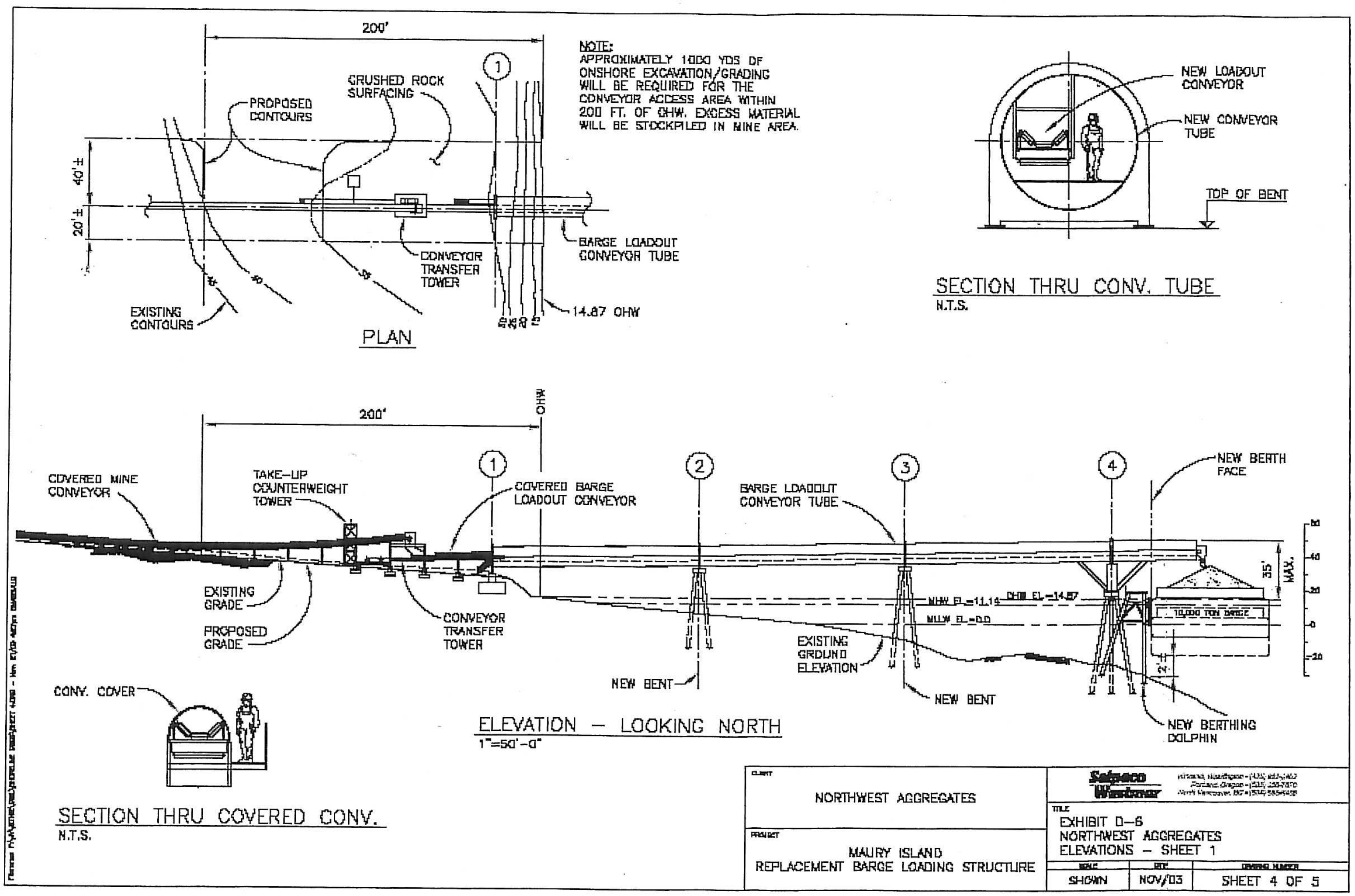


Figure 4 Proposed New Dock Configuration – Elevation view of Conveyor

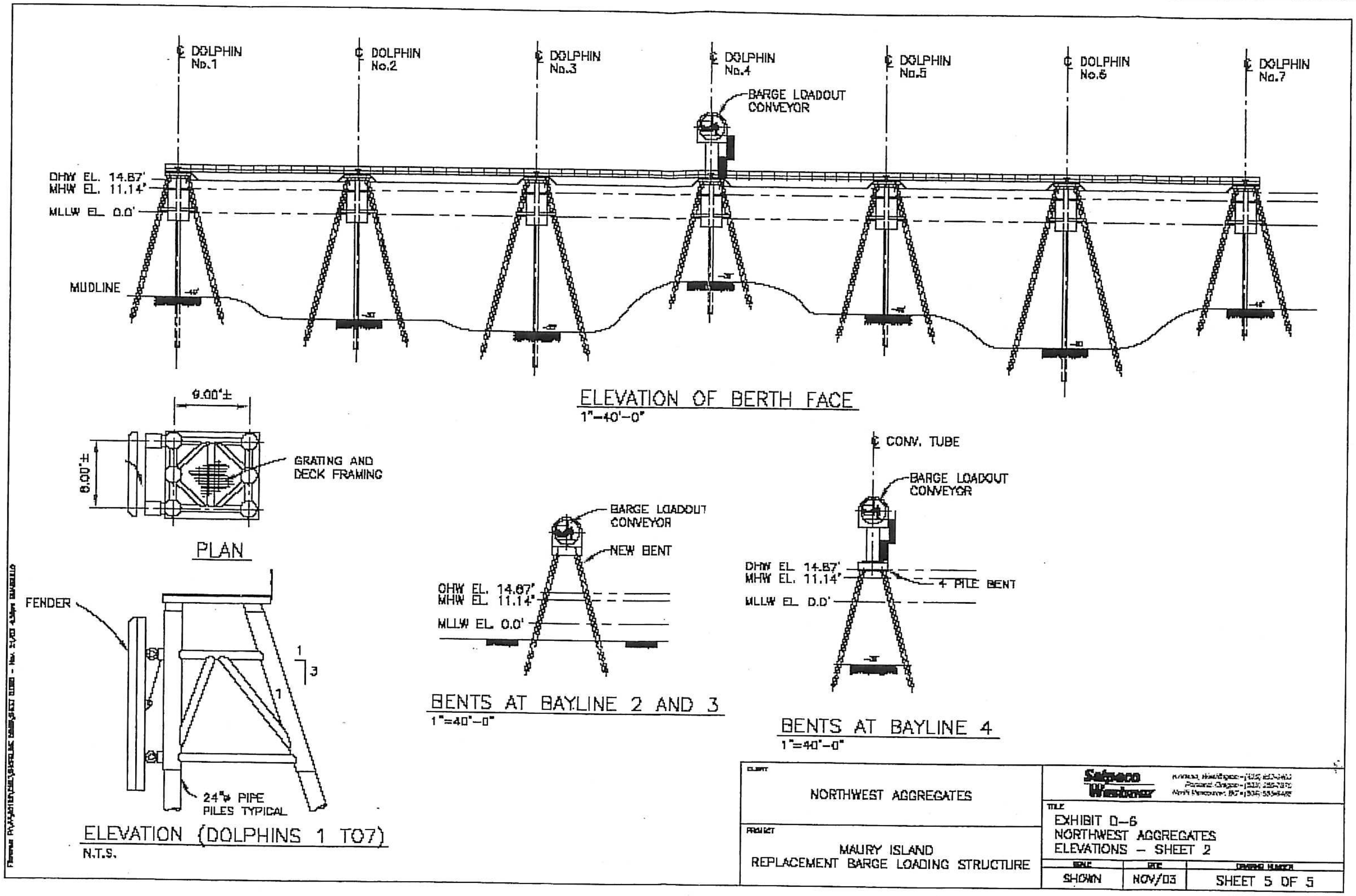


Figure 5 Proposed New Dock Configuration – Elevation view of Proposed New Dock Face

D. Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.

E. Compensating for the impact by replacing or providing substitute resources or environments.

F. Monitoring the impact and taking appropriate corrective measures to achieve the identified goal.

This document describes how the potential for barge-loading operations to impact the aquatic environment have been evaluated, and how mitigation measures that will be incorporated into the operation of the barge-loading dock will avoid and minimize potential impacts. This plan also explains how monitoring results will be used to ensure that avoidance and minimization measures are effective, and how monitoring results may be used to rectify situations that could potentially impact the aquatic environment.

Several surveys of the project area have been completed (AESI 1998, MRC 1998, Jones & Stokes 1999, MRC 2000, EVS 2000, PI Engineering 2001, PI Engineering 2002d) and several technical documents have been prepared (King County DDES 2000, King County DDES 2004, EVS 2000, PI Engineering 2002a, PI Engineering 2002c) evaluating the potential for barge-loading operations to impact the aquatic environment. Figure 2 shows the gravel dock and distribution of eelgrass.

To implement various proposed mitigation measures, Northwest Aggregates will prepare a Barge-Loading Operations Manual that describes the procedures for operating, maintaining and cleaning barge-loading equipment and maintaining records for the facility. The Barge-Loading Operations Manual will include a barge approach and departure protocol and a gravel spill prevention, control and countermeasures plan and will be completed before barge-loading operations begin. The Barge Approach and Departure Protocol (Glacier Northwest 2004) has been prepared and is included as an appendix to the FEIS Addendum (King County DDES 2004). The Barge Approach and Departure Protocol includes procedures that will be used to monitor propeller wash velocities at the site. Internal audits of the facility will be conducted periodically to ensure that prescribed procedures are being followed and evaluate whether additional training, modification of equipment or updating of the Barge-Loading Operations Manual is needed.

2. Background

Six documents have been prepared that evaluate potential impacts of barge-loading operations on aquatic habitat at the site:

- Maury Island Gravel Mine Final Environmental Impact Statement (FEIS) (King County DDES 2000)
- Maury Island Gravel Mine Impact Study: Nearshore Impact Assessment (EVS 2000)
- Technical Memorandum: Response to WDFW letter dated January 7, 2002 Regarding Hydraulic Project Application; WDFW Log No. 00-E4751-02 (PI Engineering 2002c)
- Summary of Observations Report – Maury Island Barge-Loading Dock, Northwest Aggregates (PI Engineering 2002a)
- 2003 Eelgrass Survey Report (Grette Associates 2003)
- Addendum to the Final EIS (King County DDES 2004).

The FEIS identified potential impacts, described potential mitigation measures and alternatives, and included analysis of potential impacts from shading, spillage, prop wash, and noise. The EVS report was prepared for the Washington Department of Ecology (Ecology), and included results from prop wash modeling and further discussion of potential impacts from shading, prop wash gravel spillage and noise. The Technical Memorandum included discussion regarding eelgrass distribution at the site, and potential impacts from shading, prop wash, gravel spillage, and noise. The Summary of Observations and Analyses summarizes and includes the 2001 and 2002 eelgrass survey reports, the Shade Analysis Report, and a Technical Memorandum summarizing propeller wash modeling results for tugboats operating at the dock. The Grette Associates report summarizes eelgrass observations from 2003. The Addendum to the Final EIS summarizes additional information compiled since the FEIS was completed, including independent evaluation of propeller wash from tugboat operations at the dock. Figure 6 is a conceptual model of potential impacts from barge-loading operations and mitigation measures.

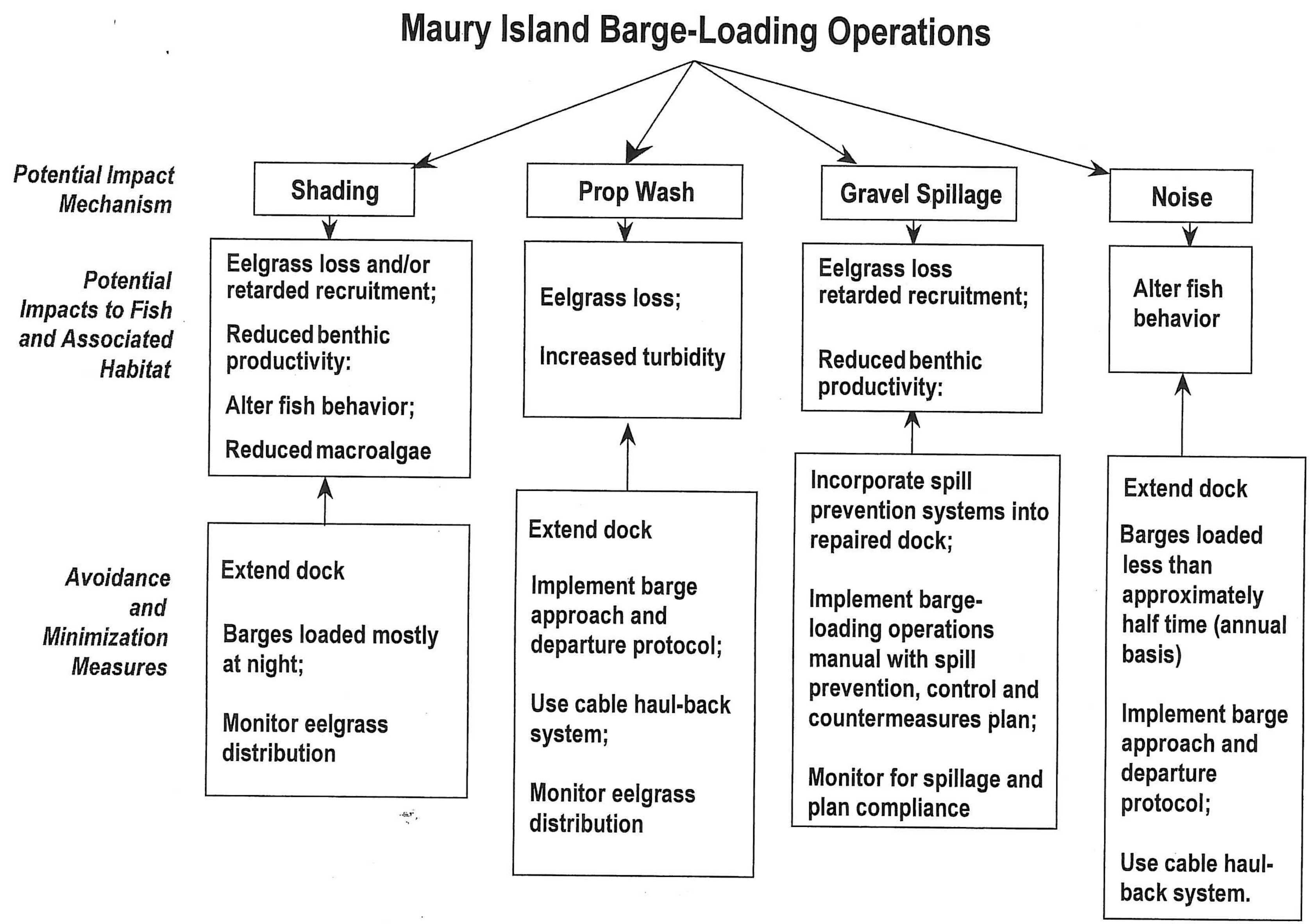


Figure 6 Conceptual Model of Potential Impacts from Barge-Loading Operations and Mitigation Measures

2.1 Potential Impacts from Shading

The shade analysis was conducted to evaluate the potential for barge-loading operations to impact eelgrass if the dock remains in its current configuration. Results of the shade analysis (PI Engineering 2002d) showed that photosynthetically active radiation (PAR) reaching plants below elevation –12 ft (MLLW) could be reduced below the threshold level for eelgrass survival of 3.0 M m^{-2} d^{-1} (moles per meter square per day). Based on the intensive eelgrass survey conducted during summer 2001, the total area of eelgrass below elevation –12 MLLW that may be shaded by barges if the dock remained in its current configuration is less than 50 ft^2. Because the assumptions used in the shade study are extremely conservative, the report concluded that it is unlikely average daily PAR reaching all but one shoot of eelgrass near the middle of the dock will be measurably reduced as a result of barge-loading operations.

Extending the dock will move barges approximately 92 ft seaward of the location modeled in the shade analysis report. This will substantially reduce the time when barges at the dock will cast shadows on eelgrass at the site to the point that any decrease in PAR resulting from shading from barge loading operations will be negligible; therefore, shading from barges is not expected to affect eelgrass at the site.

2.2 Potential Impacts from Prop Wash

As part of the Nearshore Impact Assessment, EVS (2000) conducted an evaluation of prop wash effects using the equation from Blaauw and van de Kaa (1978) and cited in Maynord (1998) to estimate maximum induced bottom velocity from tugboat prop wash at the barge-loading dock. They concluded that the maximum bottom velocity would be approximately 26 cm/sec. Based on their estimate, EVS concluded that bottom velocities induced by the propeller would be capable of re-suspending bottom sediments in waters immediately adjacent to the loading pier, but would not damage eelgrass.

PI Engineering completed additional modeling of propeller wash to evaluate the extension of the dock as an additional precautionary measure to avoid prop wash impacts on eelgrass. The model JETWASH was used to simulate a "worst case" condition where the largest size tugboat was position at the shallowest point along the dock face under maximum maneuvering power while directing propeller wash directly at the main eelgrass patches. Results from the model were compared to results from a flume study conducted for the

Washington State Ferries to evaluate propeller wash impacts on eelgrass (Hart Crowser et. al. 1997) as well as information on eelgrass and current velocity presented in the literature. Results of this comparison showed that propeller-wash-induced near-bottom velocities are unlikely to affect established eelgrass patches at the site.

To address concerns raised by project opponents, Coast and Harbor Engineering conducted a field survey at the Maury Island dock using a tugboat and remote sensors to measure propeller wash velocity. The measurements from the field study were then used to calibrate the propeller wash model. Results from the recalibrated model showed that propeller wash velocities would remain below damage thresholds if the tugboat propeller was 115 ft away from the eelgrass. The new extended dock face would be 120 ft away from eelgrass areas. As an additional precaution, Northwest Aggregates will implement the Barge Approach and Departure Protocol and monitor propeller wash velocities when barge-loading operations begin.

2.3 Potential Impacts from Gravel Spillage

Northwest Aggregates is motivated to prevent a major gravel spill at their barge-loading dock. In addition to the environmental and regulatory consequences, a large-scale spill would likely disrupt barge-loading operations for an extended period of time, damage equipment, and risk injury of personnel working at the site.

Northwest Aggregates will avoid habitat impacts from large- and small-scale spills on the aquatic environment by preventing gravel spills, and minimizing the amount of material spilled.

Areas where gravel spills could occur are at the end of the conveyor and along the barge berthing area. These parts of the gravel dock are away from the areas where eelgrass was observed during the 2001, 2002, and 2003 surveys. Therefore, eelgrass impacts resulting from gravel spillage are not anticipated.

2.4 Potential Impacts from Noise

Potential tugboat-related noise impacts will be limited to times when tugboats are active at the site. The estimated maximum volume of material that could be extracted from the facility is 7.5 million tons per year (King Co. DDES 2000). To reach the maximum rate of extraction, 750 10,000-ton barges would be loaded during a 12-month period. A 10,000-ton barge will be loaded in approximately 4 hours, including ½ hour for the barge to arrive and tie up to the dock, and ½ hour to untie and depart. Assuming, for the purposes of this discussion, that the tugboat operates at the dock for ½ hour during barge arrival and ½ hour during barge departure, tugboats would be operated at the dock a total of one hour to load each barge. Based on this assumption, noise from tugboats will occur for a total of 750 hours, or eight percent of the time over a 12-month period. Therefore, no tugboat-related noise impacts would occur 92 percent of the time. Because no tugboat maneuvers will occur at the dock at least 92 percent of the time, it is reasonable to conclude that tugboat operations at the dock will not prevent fish from using habitat near the dock.

Fish typically become habituated to continuous and partially masked noise, like that produced by the gravel conveyor (Schwarz and Greer 1984, Schwarz 1985, Knudsen et al. 1997). Therefore, it is unlikely that this noise will stimulate a behavioral response from fish.

Most of the noise resulting from aggregate landing on the barge deck will either be dissipated into air or muffled by aggregate accumulated on the deck of the barge. Therefore, fish may not hear gravel landing on the deck of the barge. If gravel landing on the empty barge deck does elicit a behavioral response, the response will be temporary because the noise will be muffled by aggregate as the barge is loaded.

Extending the dock will locate the source of noise associated with barge movement or gravel entering the barges farther from shore, providing a greater distance over which noise will attenuate before reaching nearshore habitat features such as eelgrass and spawning substrate for forage fish.

3. Avoidance and Minimization Measures

3.1 Mitigation Measures to Avoid Shading Effects on Eelgrass

Concerns regarding effects on eelgrass from shading associated with barge-loading operations will be addressed in the approach and departure protocol included in the Barge-Loading Operations Manual. At a minimum, the manual will include the following conservation measures:

- Dock extended so that dock face is 120 ft from edge of established eelgrass areas identified in the 2001 Eelgrass Survey Report (PI Engineering 2001).
- To reduce shading, only one barge will be allowed at the dock at any one time. Barges will be docked only during loading and the dock will not be used as moorage for barges or tugboats.
- Empty barges approaching the dock will remain at least 2,500 ft waterward of the dock while waiting for loaded barges to depart from the dock.
- Gravel barges and tugs will not operate shoreward of the dolphins where eelgrass may be present.
- Tugboats will not operate on the shoreward side of barges at the dock.

3.2 Mitigation Measures to Avoid Prop Wash Effects on Eelgrass

Concerns regarding effects on eelgrass from prop wash associated with barge-loading operations will be addressed in the Barge Approach and Departure Protocol (Glacier Northwest 2004). At a minimum, the manual will include the following conservation measures:

- Dock extended so that dock face is 120 ft from edge of established eelgrass areas identified in the 2001 Eelgrass Survey Report (PI Engineering 2001).
- Gravel barges and tugs will not operate shoreward of the dolphins where eelgrass may be present.
- Tugboats will not operate on the shoreward side of barges except under extreme emergency or adverse weather conditions.
- Tug/barge configurations will approach and depart the dock at the slowest speed practical, given the weather and wind conditions at the time.

- A haul-back system will be used to move the barge during loading. This will eliminate the need for a tug to maneuver the barge during loading, reducing the frequency and duration of tug operation at the facility to avoid and minimize prop wash effects.
- Tugs will "back" the barge away from the dock to minimize prop wash whenever wind and weather conditions allow.
- Tugboats will not operate within 120 ft of the eelgrass reference area.
- Tugboat operators will avoid directing prop wash towards shore, and will avoid use of excessive thrust.
- A minimum distance of three feet will be maintained between the bottom of barges and the seabed.

3.3 Mitigation Measures to Avoid Gravel Spills

Potential gravel spills could fall into two general categories. Steps to avoid and minimize a catastrophic large-scale spill of several hundred cubic yards of material will require different prevention, control and countermeasures than are required for a small-scale spill. At a minimum, the Barge-Loading Operations Manual will incorporate the conservation measures listed for large- and small-scale spills to avoid and minimize gravel spills at the facility.

3.3.1 Large-Scale Spill

Northwest Aggregates is motivated to prevent a major gravel spill at their barge-loading dock. In addition to the environmental and regulatory consequences, a large-scale spill would likely disrupt barge-loading operations for an extended period of time, damage equipment and risk injury of personnel working at the site.

Northwest Aggregates will incorporate the following operational controls and design features to prevent large-scale spills at the dock:

- Over-water sections of the gravel conveyor will be completely enclosed.
- The conveyor will be designed to place the product in the center of the barge.
- A manual limit switch will be installed on the conveyor to prevent the conveyor from operating when a barge is not in place to accept material.

- Only barges with bin walls will be loaded, and material will be loaded so that the material remains at least two feet below the tops of the bin walls.
- Barges will be moved back and forth using a cable haul-back system to ensure even loading.
- A trained dock worker will remain stationed on the dock to observe operations when a barge is loading.
- Tugboat crew and personnel will be trained to watch for situations in which the barge and conveyor are misaligned.
- Operations will be monitored using video cameras, and periodic audits will be conducted to verify that operational controls are being implemented in an effective manner. Annual multibeam bathymetric surveys that provide elevation measurements spaced a maximum distance of 10 ft apart will be conducted to detect accumulated spillage. New operational controls to prevent spills may be identified and implemented following these audits.
- A minimum distance of three feet will be maintained between the bottom of barges and the seabed.

If a large-scale spill does occur, operational controls will be implemented to minimize the amount of material spilled. A detailed description of spill response procedures will be included in the gravel spill prevention, control and countermeasures plan, to be included in the Barge-Loading Operations Manual. At a minimum, these procedures will include the following:

- All barge-loading equipment will be stopped until the source of the spill is identified and any repairs or additional countermeasures are complete.
- All accumulated materials accumulated on the surface of the dock will be cleaned up.
- Washing or sweeping of spilled material into the water will be prohibited.
- One dock worker will remain on the dock at all times during barge-loading operations to monitor for spillage of aggregate material. This person will maintain radio communication with the operator of the facility at all times.
- The gravel spill prevention, control and countermeasures plan will include the instructions for contacting regulatory and company personnel within 24 hours of a spill.

- A multibeam bathymetric survey of the spill area that provides elevation measurements spaced a maximum distance of 10 ft apart will be completed within seven days of the spill.

3.3.2 Small-Scale Spill

Northwest Aggregates will avoid habitat impacts from small-scale gravel spills in the aquatic environment by preventing spills, and minimizing the amount of material spilled.

The following operational controls and design modifications will be incorporated into the barge-loading operation to prevent small-scale spills of gravel into the water:

- The Barge-Loading Operations Manual will specify procedures for cleaning and maintaining equipment.
- Over-water parts of the conveyor will be completely enclosed to prevent wind-blown spillage.
- A fixed downspout will be installed and maintained on the end of the conveyor to prevent wind from blowing material into the water as it is transferred from the conveyor into the barge.
- Washing or sweeping of spilled material into the water will be prohibited.
- The conveyor will be designed to place the product in the center of the barge.
- A manual limit switch will be installed on the conveyor to prevent the conveyor from operating if a barge is not in place to accept material.
- Only barges with bin walls will be loaded, and material will be loaded so that the material remains at least two feet below the tops of the bin walls.
- Barges will be moved back and forth using a cable haul-back system to ensure even loading.
- A trained dock worker will remain stationed on the dock to observe operations when a barge is loading.
- Tugboat crew and personnel will be trained to watch for situations in which the barge and conveyor are misaligned.
- Operations will be monitored using video cameras and periodic audits will be conducted to verify that operational controls are being implemented in an effective manner. Annual bathymetric surveys will be conducted to detect accumulated spillage. New

operational controls to prevent spills may be identified and implemented following these audits.

- A minimum distance of three feet will be maintained between the bottom of barges and the seabed.

If a small-scale gravel spill does occur, operational controls will be implemented to minimize the amount of material spilled. A detailed description of spill response procedures will be included in the spill prevention, control and counter measure plan. At a minimum, these procedures will include the following:

- All barge-loading equipment will be stopped until the source of the spill is identified and any repairs or additional countermeasures are complete.
- All accumulated materials in the spill tray or accumulated on the surface of the dock will be cleaned up.
- Washing or sweeping of spilled material into the water will be prohibited.
- One dock worker will remain on the dock at all times during barge-loading operations to monitor for spillage of aggregate material. This person will maintain radio communication with the operator of the facility at all times.
- The gravel spill prevention, control and countermeasures plan will include the instructions for contacting regulatory and company personnel within 48 hours of a spill.

3.4 Mitigation Measures to Avoid Noise Impacts

Noise associated with tugboat maneuvers at the dock may temporarily alter fish behavior. In order to avoid and minimize potential noise impacts to fish behavior, the following mitigation measures will be incorporated into the Barge Approach and Departure Protocol included in the Barge-Loading Operations Manual.

- Dock extended so that dock face is 120 ft from edge of established eelgrass areas identified in the 2001 Eelgrass Survey Report (PI Engineering 2001).
- Gravel barges and tugboats will not operate shoreward of the dolphins.
- Tugboats will not operate on the shoreward side of the barges except under extreme emergency or adverse weather conditions.

- Tug/barge configurations will approach and depart the dock at the slowest speed practical, given the weather and wind conditions at the time.
- A haul-back system will be used to move the barge during loading. This will eliminate the need for a tugboat to maneuver the barge during loading reducing the frequency and duration of tug operation at the facility.

4. Monitoring for Potential Impacts

Periodic monitoring and reporting will be conducted according to the schedule in Table 1 to verify the barge-loading procedures are being followed and to confirm the mitigation measures are successful. The monitoring plan will be evaluated annually in consultation with WDFW, and if impacts are observed or barge-loading operations have increased substantially, the monitoring schedule may be modified. Monitoring methods will not deviate from those described in this plan without prior consent from WDFW. If problems arise during the course of field sampling, WDFW will be contacted to ensure concerns regarding any deviations to the monitoring plan are adequately addressed. As detailed below, monitoring will include:

- Measurements of temperature which is thought to be an important factor affecting the natural variability of eelgrass distribution and density over time.
- Surveys of eelgrass distribution and density to ensure that eelgrass impacts are successfully being avoided.
- Quantitative and qualitative surveys of macroalgae along the conveyor alignment between the bank and the -30 ft MLLW depth contour will be conducted.
- Survey for herring eggs in eelgrass at the site.
- Bathymetric surveys will be conducted to detect spills and maintain up-to-date baseline bathymetric information.
- Internal audits to verify that procedures in the Barge-Loading Operations Manual are being followed, and are effective.
- Qualitative observations of the presence/absence of fish, macroalgae, substrate conditions, and condition of sunken barges at the south end of the site will be completed according to the schedule shown in Table 1.

4.1 Temperature Monitoring

Fluctuations in water temperature may be an important factor affecting the natural variability of eelgrass distribution and density at the site. For this reason, a recording temperature gauge will be used to monitor water temperature at the site.

Water temperature will be monitored beginning in 2002 and will continue as long as the barge-loading dock is in operation. Temperature will be recorded hourly throughout the year. The recording device will be retrieved, cleaned, and maintained, and the data will be downloaded at least annually.

Table 1 Schedule of Monitoring Activities

	Summer 2004	Pre-Construction[1]	Post Construction	Begin Barge-Loading	2 Weeks	1 Month	3 Months	6 Months	1 Year	18 Months	2 Year	3 Year	4 Year	Ongoing[2]
Temperature	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	Continuous
Eelgrass Depth Contour	♦	♦	♦					♦	♦		♦	♦		
Eelgrass Grid Survey	♦	♦	♦			♦		♦	♦		♦	♦		
Eelgrass Qualitative Survey					♦		♦						♦	Annually[3]
Eelgrass Reference Site	♦	♦						♦	♦		♦	♦		
Qualitative /Quantitative Macroalgae Transect Surveys	♦		♦						♦	♦	♦	♦		
Qual. Macroalgae Survey													♦	Annually[3]
Herring Spawn Survey		♦[4]							♦		♦	♦		Years 5,7,9 and 11 then every 5 years
Bathymetry Survey		♦							♦		♦	♦	♦	Every two years
Internal Audits of Barge-Loading Operations					♦	♦		♦	♦		♦	♦	♦	Annually
Technical Summary of Observations	♦	♦	♦			♦	♦	♦		♦				
Monitoring and Operations Report									♦		♦	♦	♦	Annually

1 The annual survey conducted between July 15 and August 15 may be used as the pre-construction survey provided construction commences after completion of the annual survey in that same calendar year, and is completed by January 14 of the following year.

2 The schedule for ongoing monitoring is based on the assumption that no adverse effects are observed during the first four years of monitoring. However, the schedule for ongoing monitoring may be modified after the first four years if deemed necessary by WDFW (e.g., significant increase in barge-loading activities occur, etc.).

3 Qualitative dive surveys will be conducted annually during the eelgrass and macroalgae growing season. If substantial changes in eelgrass distribution are observed, WDFW will be notified and eelgrass depth contour survey and/or eelgrass grid survey may be conducted to document the change. If substantial changes in macroalgae distribution or density are observed, WDFW will be notified and a macroalgae transect survey may be conducted to document the change.

4 Three diver surveys to check for herring spawn will be conducted during each herring spawn season (Last week in January to third week of February) prior to dock construction.

4.2 Eelgrass Dive Surveys

Dive surveys will be conducted to monitor eelgrass distribution and density using methods described in the Eelgrass Survey Report (PI Engineering 2001). The dive surveys will be conducted in two phases. The first phase will be depth contour surveys where divers will swim each 2-ft depth contour, marking the location of eelgrass patches or plants observed. The purpose of the depth contour survey is to mark the position of individual eelgrass plants or small patches within the survey area. During depth contour surveys, divers will observe bottom substrate looking for changes that may indicate a gravel spill has occurred. If a spill is suspected based on substrate observations, the location of the substrate change will be marked and the position will be recorded using DGPS.

The second phase of the survey will focus on the two main eelgrass patches at the site (see Figure 2). New eelgrass patches observed during monitoring that measure 15 ft x 15 ft (225 ft^2) or greater will be monitored using the grid survey technique. During this second phase, divers will use a grid coordinate system to measure eelgrass density, note substrate observations, and map the distribution of eelgrass within the north and south eelgrass patches.

Qualitative dive surveys will be conducted to record general observations according to the schedule shown in Table 1. Qualitative dive surveys will focus on known eelgrass areas and look for substrate changes that may indicate a spill or prop scour has occurred at the site. Visual observations and locations of evidence of spills, prop scour or damage to eelgrass will be recorded. Divers will also survey and record the general conditions of the sunken barges at the south end of the site, and the presence and absence of macroalgae and fish. WDFW will be notified if substantial difference in eelgrass distribution or density is observed during the qualitative dive survey. Depth contour surveys and/or grid surveys may be conducted to document the change.

4.2.1 Eelgrass Dive Survey Schedule

Dive surveys will be conducted according to the schedule shown in Table 1. Both phases of the eelgrass survey will be completed between July 15 and August 15 of 2004 and during each eelgrass growing season before barge-loading operations begin. Results from these surveys will augment baseline eelgrass information for the site, and document the natural variability of eelgrass distribution and shoot density over time.

The annual survey conducted between July 15 and August 15 may be used as the pre-construction survey, provided construction commences after completion of the annual survey for that calendar year, and is completed by January 14 of the following year. The post-construction survey will be conducted no later than two weeks after construction activities are completed to verify that eelgrass has not been impacted by activities related to the repair of the dock.

Divers will conduct a qualitative survey of the site focusing on the two main eelgrass patches two weeks after barge-loading operations begin. A grid survey of the north and south eelgrass patches will be completed one month after barge-loading operations begin, and a qualitative dive survey will be conducted three months after barge-loading operations begin to verify that no direct impacts from barge-loading operations has occurred in this time. If impacts to eelgrass in the two main eelgrass patches are observed during a qualitative survey, a grid survey of the eelgrass patch will be conducted. Divers will also survey and record the general conditions of the sunken barges at the south end of the site, and the presence and absence of macroalgae and fish.

Both phases of the eelgrass survey will be conducted at the site between July 15 and August 15 of the first three years following the beginning of barge-loading operations. If no eelgrass impacts from barge-loading operations are observed during this time, qualitative surveys of eelgrass and site conditions will be conducted annually at the site. If eelgrass impacts from barge-loading operations are observed at any time, this monitoring schedule may be revised after consulting with WDFW.

4.2.2 Eelgrass Reference Area Monitoring

Monitoring will be conducted at the eelgrass reference area (Figure 7) to measure general changes in eelgrass density and distribution in an area that is removed from the activities at the site. Reference area surveys will be conducted using the same methods used during the 2002 eelgrass survey (PI Engineering 2002b). Figure 8 shows the distribution of eelgrass within the reference area observed in summer 2002.

The grid survey of the reference area will be conducted annually during the growing season, following the same schedule as the depth contour and grid surveys of the two main eelgrass patches and as shown in Table 1, and the same qualitative and quantitative information recorded for patches at the dock will be recorded for the reference area. Results from the reference area monitoring will be compared from year to year to track temporal variability in eelgrass distribution and density. Observed changes in patches at the loading dock will also be compared over time to determine whether changes in distribution and density observed in patches at the barge-loading dock are generally consistent with changes observed at the reference area.

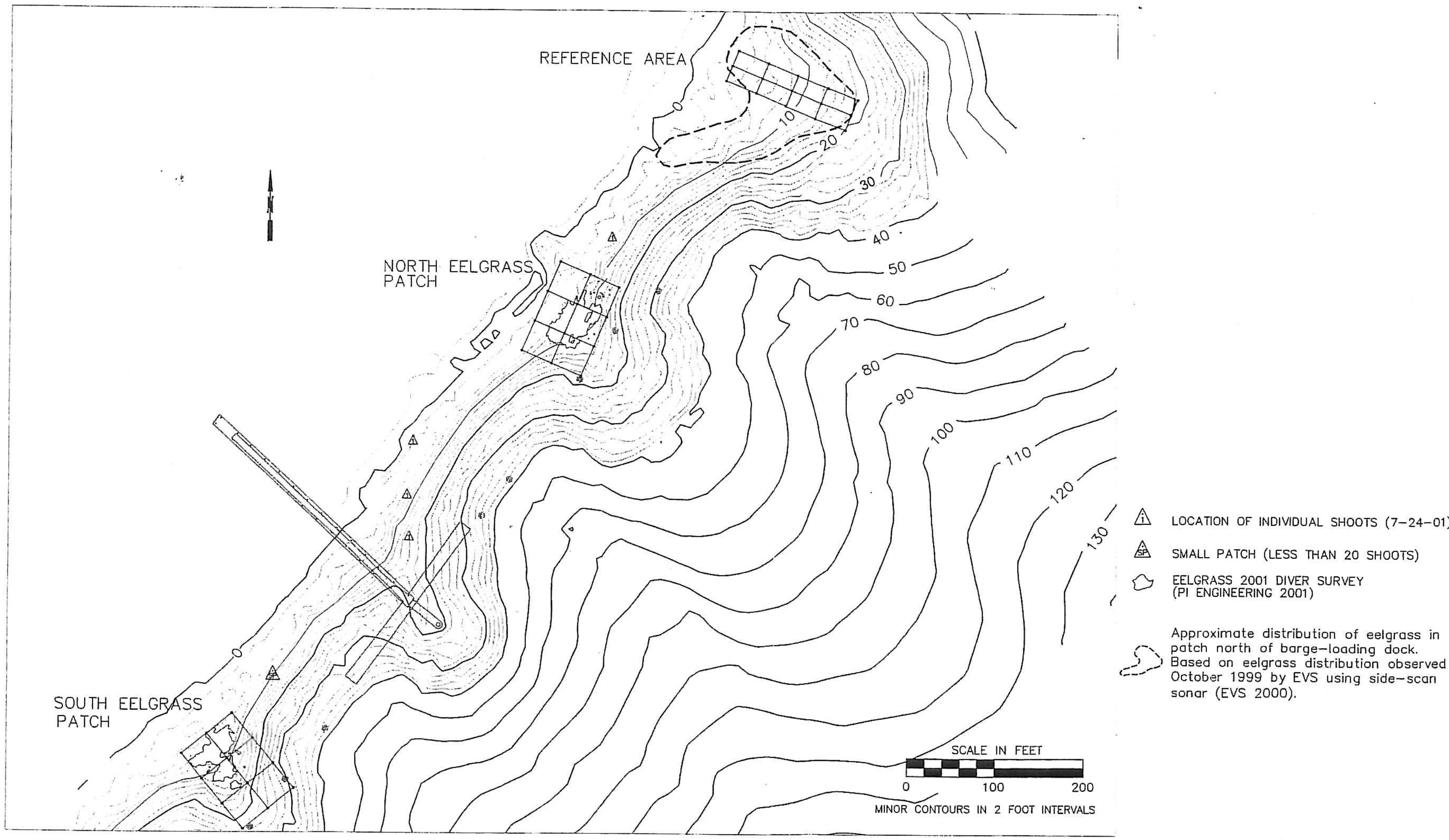
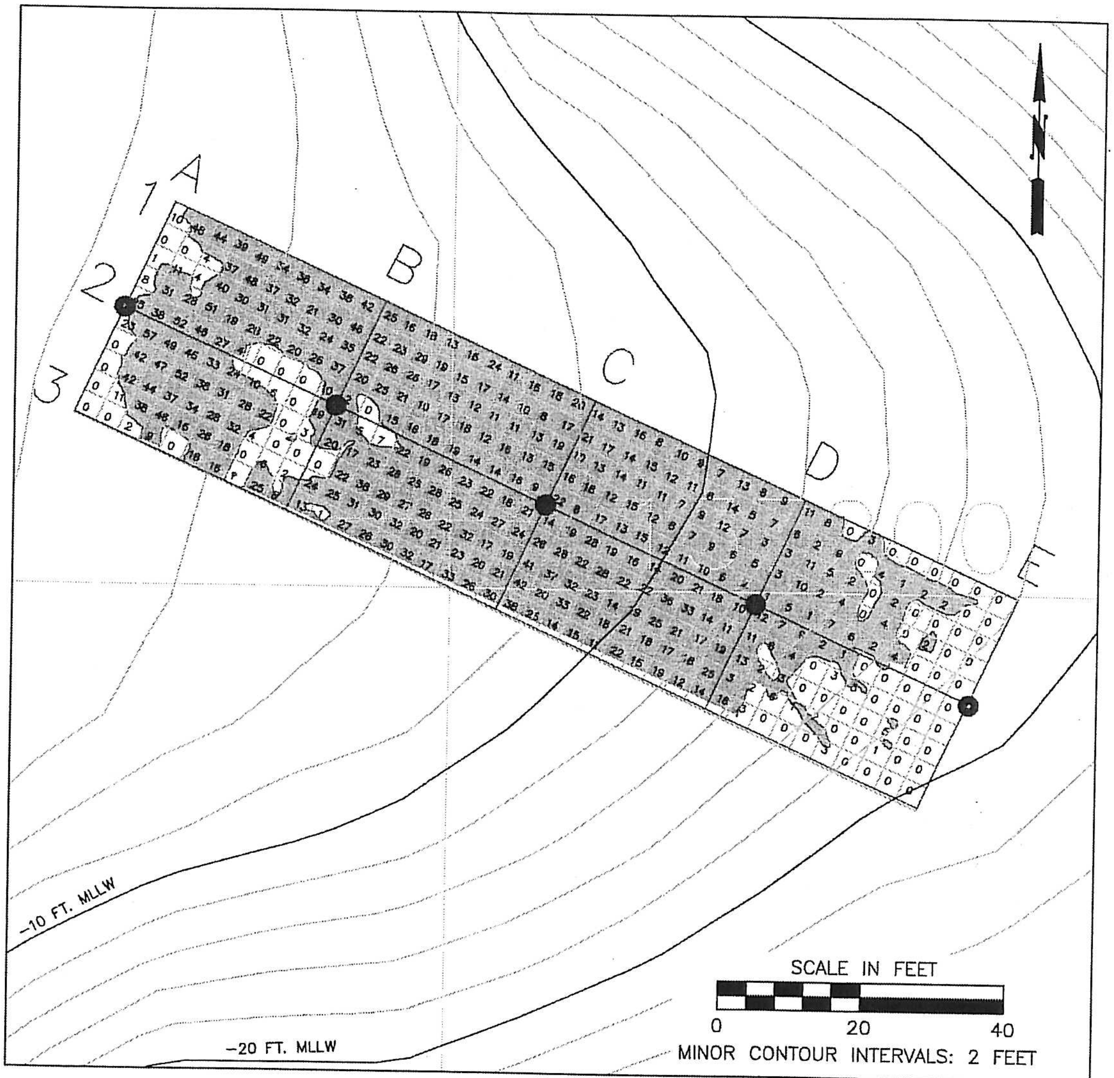


Figure 7 Monitoring Area



EELGRASS PATCH (7-22-02 to 7-26-02)

SHOOT COUNT PER 1/4 m²

CENTERLINE REFERENCE STAKES

NOTE: Figure only shows eelgrass observed within the reference area. Eelgrass is present on either side of the survey grid. No eelgrass was observed landward of the edge of the survey grid.

Figure 8 Eelgrass Reference Area

4.3 Evaluation of Eelgrass Monitoring Results

Eelgrass monitoring results will be compared between surveys to measure changes in shoot density and distribution. Results from the 2001 diver survey and subsequent surveys conducted using the same method prior to construction will be used as baseline and will approximate the amount of natural variability in eelgrass shoot density between years. Differences between the surveys conducted before and after the start of barge-loading operations will then be compared to see if a pattern of change consistent with potential impacts has occurred.

A preponderance of evidence approach will be used to evaluate eelgrass monitoring results in consultation with a recognized, jointly agreed upon eelgrass expert. Maps of eelgrass distribution and data on shoot density will be compared with past eelgrass observations, observed changes in PAR, substrate, temperature and records of barge-loading operations to determine whether changes in eelgrass distribution and shoot density occurred because of barge-loading operations. Changes in eelgrass distribution and density that result from barge loading impacts are expected to occur in a pattern that can be clearly linked to the cause.

For example, eelgrass impacts resulting from propeller wash may be indicated by a pattern of decreased shoot density and distribution coinciding with changes in substrate and bathymetry that form a pattern consistent with prop wash scour.

Because the eelgrass shoot density will be measured in the same locations during each survey event, shoot density within the same survey grid locations taken during different times can be compared to determine if the shoot density within a grid section has increased or decreased compared to shoot density from previous surveys. If lower shoot densities are observed within contiguous grid sections, as shown in Figure 9, a pattern of decreasing shoot density would be indicated. Situations exhibiting a more random distribution of grid sections with differing shoot densities, as shown in Figure 10, would not indicate a pattern consistent with impacts from barge-loading operations.

4.4 Macroalgae Dive Surveys

Dive surveys will be conducted to monitor macroalgae distribution and density as described in the Eelgrass Survey Report (PI Engineering 2002). The purpose of the macroalgae survey will be to document changes in macroalgae density and distribution over time.

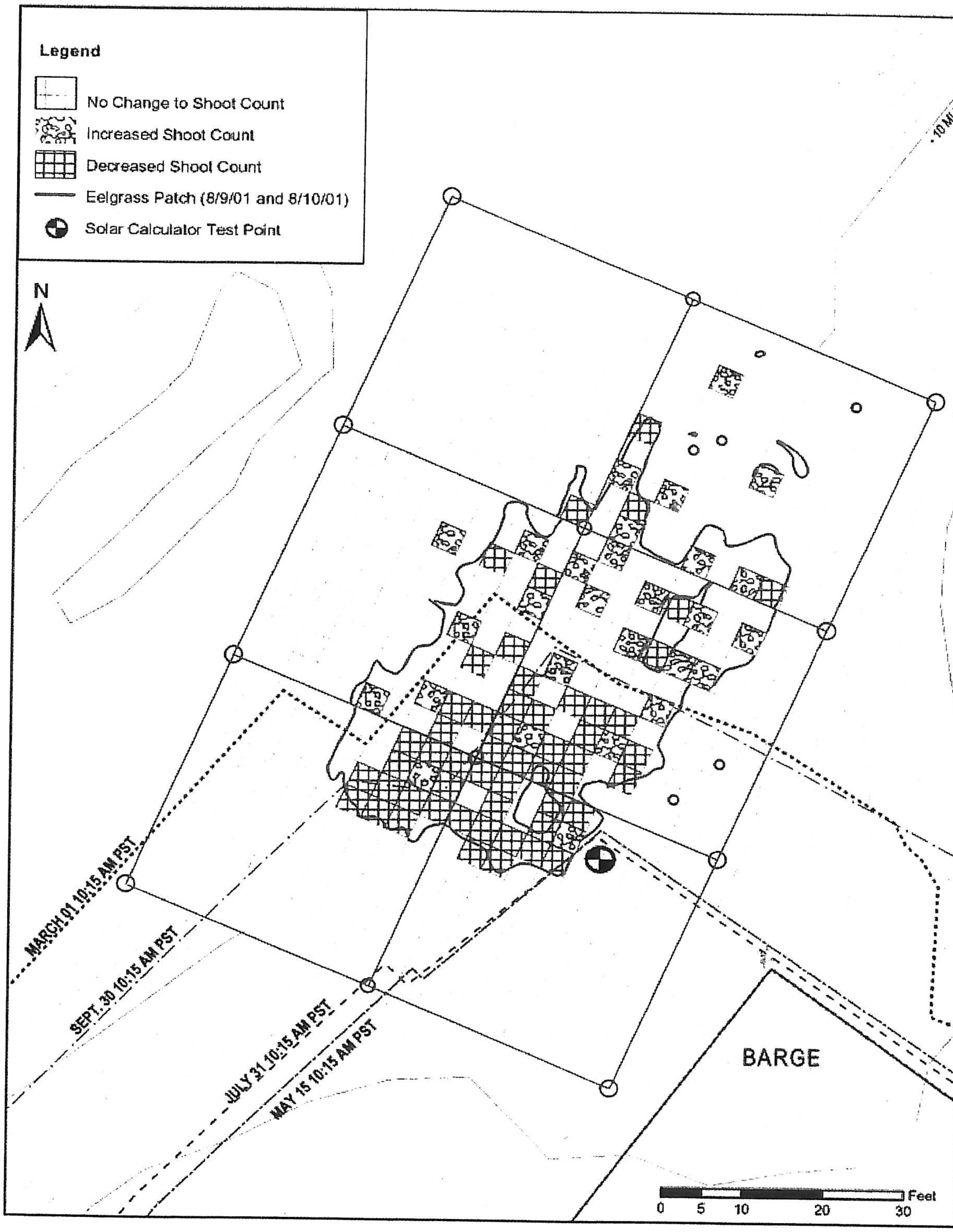


Figure 9 Example of contiguous patterns of sample grids with decreased shoot density indicating shading may be impacting eelgrass

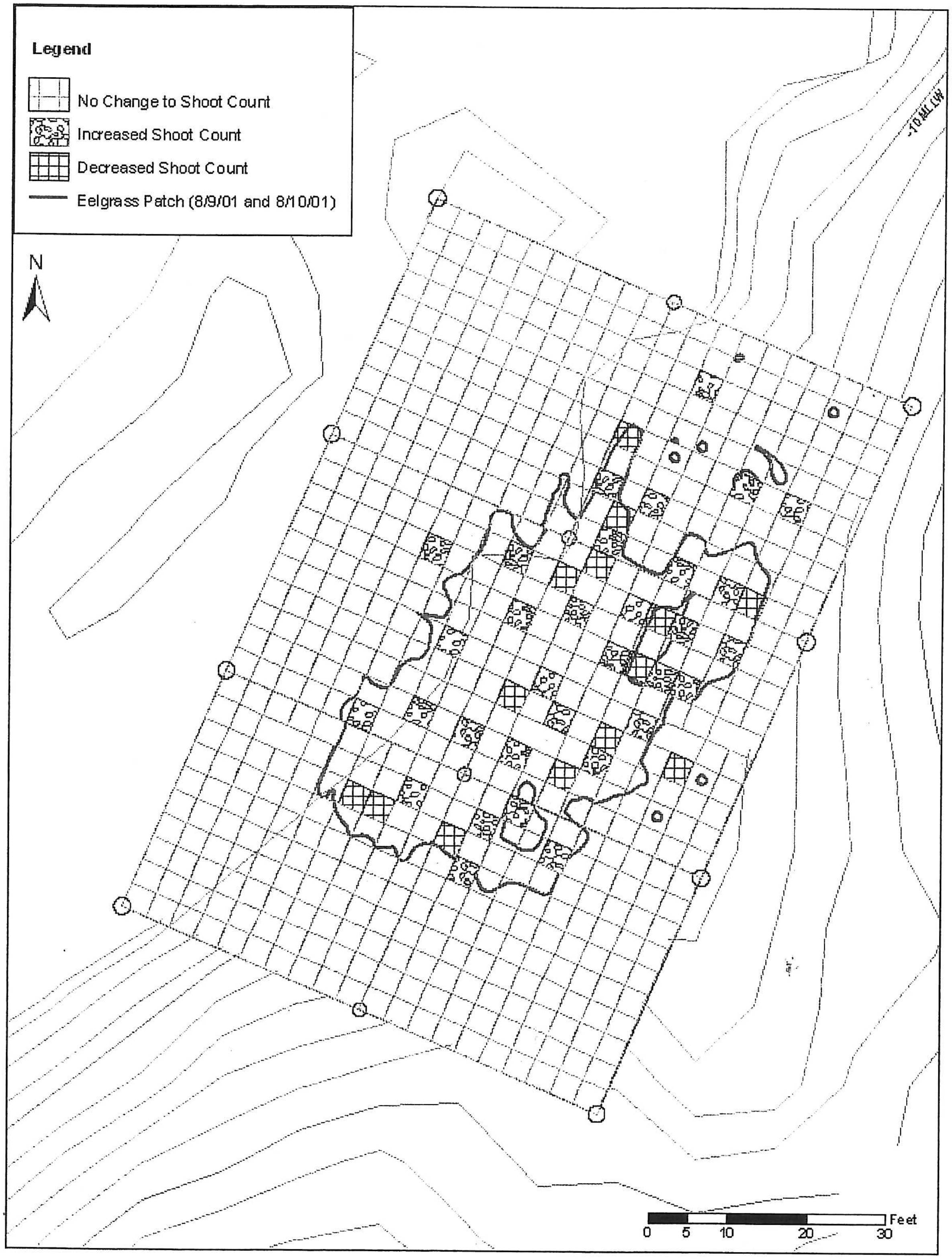


Figure 10 Example of grid survey results showing changes in shoot density at the North eelgrass patch that do not indicate that shading has impacted eelgrass

Macroalgae transect surveys were conducted at the same time as the 2002 and 2003 eelgrass surveys. Results of those surveys are included in the 2002 and 2003 eelgrass survey report. Results of the surveys document the species composition, stipe density and percent cover of macroalgae located under the conveyor between the existing dock face (approximately -18 ft MLLW) and the -30 ft MLLW contour. Macroalgae colonization at the site is confined to limited areas where substrate is suitable for attachment.

No macroalgae was observed attached to the sea bed along the conveyor alignment between the shoreline and the -18 ft MLLW depth contour during any of the dives conducted between 2001 and 2003. Macroalgae attached to the pilings and unattached macroalgae drifting through the site was observed.

4.4.1 Macroalgae Survey Method

Macroalgae surveys will be conducted along a transect lying perpendicular to the shore under the conveyor alignment on a bearing of 110° (magnetic).

Quantitative observations will be made along an approximately 20 meter segment of the transect extending from the reinforced steel bar (rebar) that was installed at the seaward face of the existing dock and centered below the conveyor prior to conducting the transect survey in 2002. The rebar stake is installed at an elevation of approximately -18 ft MLLW.

Divers will proceed along a tape measure used to mark the transect line between the rebar stake and the -30 ft MLLW contour recording observations within one-meter on each side of the transect. Observations recorded will include number of stipes, substrate type, estimated percent macroalgae cover, depth (in ft relative to MLLW), and distance from the dock face. The rebar stake will be left in place to provide a control point for future macroalgae surveys at the dock.

Qualitative observations of macroalgae will be recorded by divers at least 1 meter on either side of the transect line between the bank of the shore and the -18 ft MLLW contour. The location, species composition, and relative size of macroalgae patches will be recorded on a map showing the location of the dock and depth contours relative to MLLW.

4.4.2 Macroalgae Monitoring Schedule

Quantitative and qualitative macroalgae surveys will be conducted between July 15 and August 15 of each year prior to dock construction. Surveys will also be conducted within two weeks after construction is completed and annually between July 15 and August 15 in years 1, 2 and 3 following construction.

After year three, qualitative dive surveys of the entire macroalgae transect between the bankline and -30 ft MLLW will be conducted annually during the same time the qualitative eelgrass surveys are conducted

4.4.3 Interpretation of Macroalgae Monitoring Results

Quantitative macroalgae transect survey data collected following construction will be compared to macroalgae survey data collected prior to construction. The percent cover for all 40 monitoring points below the – 18 ft MLLW contour will be averaged and multiplied times 40 m^2 (the size of the area monitored). The contingency planning and response process described in Section 6 of this report will be initiated if the total number of square meters determined by this calculation to be covered by macroalgae decreases by more than 50 percent.

Interpretation of the qualitative macroalgae survey data collected between the shoreline and –18 ft. MLLW will be limited to examining overall trends in the spatial location, size of patches, and species composition If significant changes occur, the contingency planning and response process described in Section 6 of this report will be initiated and a quantitative macroalgae transect survey may be required.

4.5 Herring Spawn Survey

WDFW has estimated herring spawn biomass for the Quartermaster harbor herring stock annually since 1976. Limited surveys were also conducted between 1972 and 1975. These estimates have not always included sampling at the project site. The WDFW surveys are conducted by sampling from the center of the known spawning grounds outwards to the outer extent of observed spawning area during the survey year. The herring spawning grounds have only been found to extend northward to the project site once. That observation occurred in 2003. The spawning ground was found to extend to a point about 250 yards south of the project site in 1995. Prior to that, the closest documented spawning was observed at sandy shores approximately 800 yards south of the project site during the 1975 survey. WDFW characterizes the spawn deposition intensity in the vicinity of the project site to be very light.

In order to better characterize the frequency of herring spawning at the project site, dive surveys will be conducted to observe the presence or absence of herring eggs in the vicinity of the dock during peak spawning season.

4.5.1 Herring Spawn Survey Method

Prior to conducting the survey, divers will get sample bottles and preservative from WDFW. Divers will swim zigzag patterns through the two main eelgrass patches shoreward of the dock, looking for herring eggs attached to eelgrass, macroalgae or other substrate during each survey event. The survey should begin along one edge of the eelgrass patch, parallel to the shoreline, moving from the shallowest to the deepest edge of the eelgrass patches, and back again to the shallow edge of the vegetation. If eggs are observed, one or two samples selected from locations representing the eggs and egg density will be collected. Eggs will be collected by clipping a piece of the vegetation, and the clipped vegetation with the eggs still attached will be placed into a sample bottle with preservative. A map of the area will be prepared following the survey showing the locations where herring eggs were observed, the locations where samples were collected, the location of the dock, and depth contours in feet relative to MLLW. The map and any samples, along with the date and any other pertinent observations, will be returned to WDFW.

4.5.2 Herring Spawn Survey Schedule

Herring eggs typically take approximately 14 days from the time they are laid until they hatch. Three herring spawn surveys will be conducted approximately 10 days apart during the peak spawning season, which occurs between the last week of January and the third week of February of each scheduled survey year. Surveys will be conducted during the spawning season of each year prior to dock construction and years 1, 2, 3, 5, 7, 9 and 11 following construction. After year 11, spawning surveys will be conducted every 5 years.

4.5.3 Interpretation of Herring Spawn Survey Results

Observation of herring eggs at the dock for three consecutive spawning seasons will trigger the contingency planning process. As part of the contingency mitigation planning process, WDFW and Glacier Northwest will review the available science and determine whether additional mitigation measures and/or modification of this monitoring plan are warranted.

4.6 Bathymetry Surveys

Bathymetry surveys of the area between the dock and shore and the barge berthing area will be conducted to detect changes in the bottom contours that may indicate that a spill has occurred, and to maintain an up-to-date baseline contour map. Bathymetric survey data will be updated and corrected for tidal elevation based on the tidal elevations measured by a recording tide gauge installed at the site prior to the survey. Bathymetric surveys will be conducted during high tide to capture elevations along the beach. Surveys will be conducted to provide depth measurement at points spaced a maximum of 10 ft apart.

4.6.1 Bathymetry Survey Schedule

Bathymetry surveys will be conducted according to the schedule shown in Table 1. A bathymetric survey will be conducted prior to construction, and at one-year intervals for the first four years following the beginning of barge-loading operations. After year four, bathymetry surveys will be conducted every other year.

4.6.2 Interpretation of Bathymetry Survey Data

The bathymetry data will be contoured and compared qualitatively to data collected the previous year. If notable changes in bathymetry are observed, the area of interest will be evaluated more closely by reviewing and comparing x, y, z coordinates for depth measurements. Depending on the size and location of the observed feature, additional observations or information may need to be collected to determine whether a spill has occurred.

If substantial changes in bathymetry are observed, WDFW will be contacted to discuss the survey results and potential next steps including, but not limited to further surveys of the area of interest.

4.7 Internal Audits of Barge-Loading Operations

Northwest Aggregates will conduct periodic audits of their barge-loading operations to ensure that operations conform to the procedures prescribed in the Barge-Loading Operations Manual, and that prescribed procedures are appropriate and effective. A report will be prepared after each audit is completed. At a minimum, the report will include the following:

- Date internal audit was completed

- The number of barges loaded since the last audit
- Description of any deficiencies observed
- Recommended changes in operations to improve compliance with procedures prescribed in the Barge-Loading Operations Manual
- Recommended changes to the barge-loading operations manual to reduce potential environmental impacts.

4.8 Reporting

Two types of reports will be prepared to update WDFW on the monitoring results for the project. The reporting schedule is shown in Table 1.

A technical summary of observations will be prepared to report monitoring results from eelgrass surveys conducted each year prior to and the pre- and post-construction eelgrass surveys. A technical summary of observations will also be prepared summarizing monitoring observations following the first month of barge-loading operations, and at three, six, and 18 months following barge-loading operations.

The technical summary will summarize observations since the last report was presented to WDFW and provide qualitative evaluation and interpretation of results. The technical summary report will be submitted to WDFW within one month following the last date when data was collected for the reporting period.

An Annual Monitoring and Operations Report will be prepared following each year of barge-loading operations. The annual monitoring report prepared following the first year of barge-loading operations, will compile information and observations from summer 2002 through first year of barge-loading operations. Each subsequent annual report will summarize all monitoring information collected over the previous year, and then compare those data to baseline information and information collected in previous years to determine whether impacts have resulted from barge-loading operations. The report will also describe any changes that have been made to barge-loading operations over the last years and recommend future changes to barge-loading operations or monitoring based on observations over the last year. The annual monitoring and operations report will be submitted to WDFW no later than January 31st of each year following the beginning of barge-loading operations.

4.9 Adaptation of the Monitoring Plan

It may be appropriate to modify this monitoring plan based on further observations or to take advantage of new technology that improves the accuracy or efficiency of data collection, processing, or interpretation.

If eelgrass impacts are observed as a result of any of the monitoring activities, additional monitoring and/or reporting may be warranted. Conversely, it may be appropriate to relax monitoring and/or reporting requirements based on observations at the site over time. The monitoring plan will be evaluated in each annual report and the plan may be modified in consultation with WDFW and other permitting agencies.

5. Measures to Rectify and/or Reduce Impacts

As discussed above, potential impacts from barge-loading operations have been evaluated. This evaluation concluded that impacts from barge-loading operations will be avoided and minimized even if the dock remains in its current configuration. Extending the dock as an added precautionary measure further reduces the risk of impact. However, if monitoring results indicated that impacts resulting from barge-loading operations are occurring or have occurred, the problem recognition process will be implemented with the permitting agencies as described in Section 6. Northwest Aggregates will respond by evaluating their operations to identify changes to rectify or reduce impacts. The changes made will depend on the type of impact observed, and whether the change is practical.

5.1 Measures to Rectify and/or Reduce Potential Impacts From Prop Wash

The potential for prop wash to impact eelgrass was evaluated, and prop wash is not expected to impact eelgrass at the site. In addition, several mitigation measures will be implemented to avoid and minimize prop wash effects. If evidence of prop wash impacts to eelgrass is observed, Northwest Aggregates will review their operations to identify the circumstances under which the damage occurred and evaluate steps to avoid, minimize and reduce further damage. Measures to rectify and/or reduce impacts from prop wash may include modifying the Barge Approach and Departure Protocol, or Barge-Loading Operations Manual, or training personnel to improve compliance with the Barge-Loading Operations Manual. Once measures to avoid future impacts to the area are identified, additional actions may be implemented in consultation with permitting agencies.

5.2 Measures to Rectify and/or Reduce Potential Impacts From Gravel Spillage

Northwest Aggregates is incorporating several spill prevention systems into the dock repair (spill tray, wind screen, etc.). In addition, Northwest Aggregates will prepare a Gravel Spill Prevention Control and Countermeasures Plan before barge-loading operations begin. The plan will establish procedures for responding to a spill event. If a gravel spill occurs, Northwest Aggregates will respond by:

1. Taking steps to stop the spillage and prevent additional spills from occurring
2. Report the spill

3. Estimate the amount of material spilled and determine the extent of impact
4. Consult with WDFW to identify the best method for rectifying and/or reducing impacts within 24-48 hours, depending size of spill

6. Contingency Planning and Response

This contingency plan identifies a planning process for selecting appropriate actions to address failure of specific mitigation performance standards. In order to maintain the flexibility needed to respond effectively and appropriately to biological and/or physical conditions, this plan does not present a specific list of actions that will be taken to remedy specific types of failures at the mitigation site.

Northwest Aggregates is committed to ensuring the success of the mitigation efforts at Maury Island, and will undertake additional appropriate actions as may be deemed necessary by WDFW/permitting agencies to ensure complete mitigation of impacts that occur as a result of barge-loading operations.

The potential impact of barge-loading operations has been evaluated, and the mitigation measures described in section 3 are expected to be adequate to avoid and minimize potential impacts. Monitoring will be conducted as described in section 4 to verify that the mitigation measure are effective. If monitoring shows impacts are occurring, measures to rectify and reduce impacts will be implemented as described in section 5.

This contingency plan identifies the steps that will be taken if the measures to avoid, minimize, rectify, and reduce described above fail to mitigate unforeseen impacts from barge-loading operations. Additional contingency actions might include but are not limited to, transplanting eelgrass, or restoring riparian areas at the site.

6.1 Contingency Plan Procedures

The contingency planning procedure consists of three elements: (1) problem recognition, (2) contingency planning, and (3) contingency response.

6.1.1 Problem Recognition

The problem recognition process is an integral part of the monitoring program. As monitoring data are collected, they will be examined and interpreted relative to the performance standards. The purpose of the process is to conduct a rational and deliberate determination of whether there is a problem area, and if so, the nature and extent of the problem. Figure 11 outlines this process and shows potential outcomes of the problem recognition step.

6.1.2 Contingency Planning and Response Process

The purpose of the contingency planning process is to develop contingency actions that may be necessary, depending on the results of the monitoring program and problem recognition step. Figure 12 outlines the contingency planning and response process.

The contingency planning process could result in implementation of an approved response action. Alternatively, it could result in agreement on an approach or set of criteria for taking further action, depending on the results of future monitoring and whether the goal of no net loss is being achieved. In the case of a failure to meet performance standards, the result would depend largely on the reasons for the failure, and the degree to which Northwest Aggregates can predict or control the conditions that contribute to the failure in meeting a specific standard for performance.

Northwest Aggregates and the permitting agencies will make a final determination on an appropriate response, based on available information and scientifically and economically feasible recommendations. Potential responses include, but are not limited to, one or more of the following:

- Concluding that the situation does not require further action,
- Expanding or modifying the monitoring program,
- Developing more specific criteria to evaluate the data, and
- Initiating a corrective action.

If Northwest Aggregates and the permitting agencies cannot reach a consensus, then the permitting agencies will determine the response. If modified or continued monitoring is not an adequate response, the contingency planning and response process will begin as shown in Figure 12.

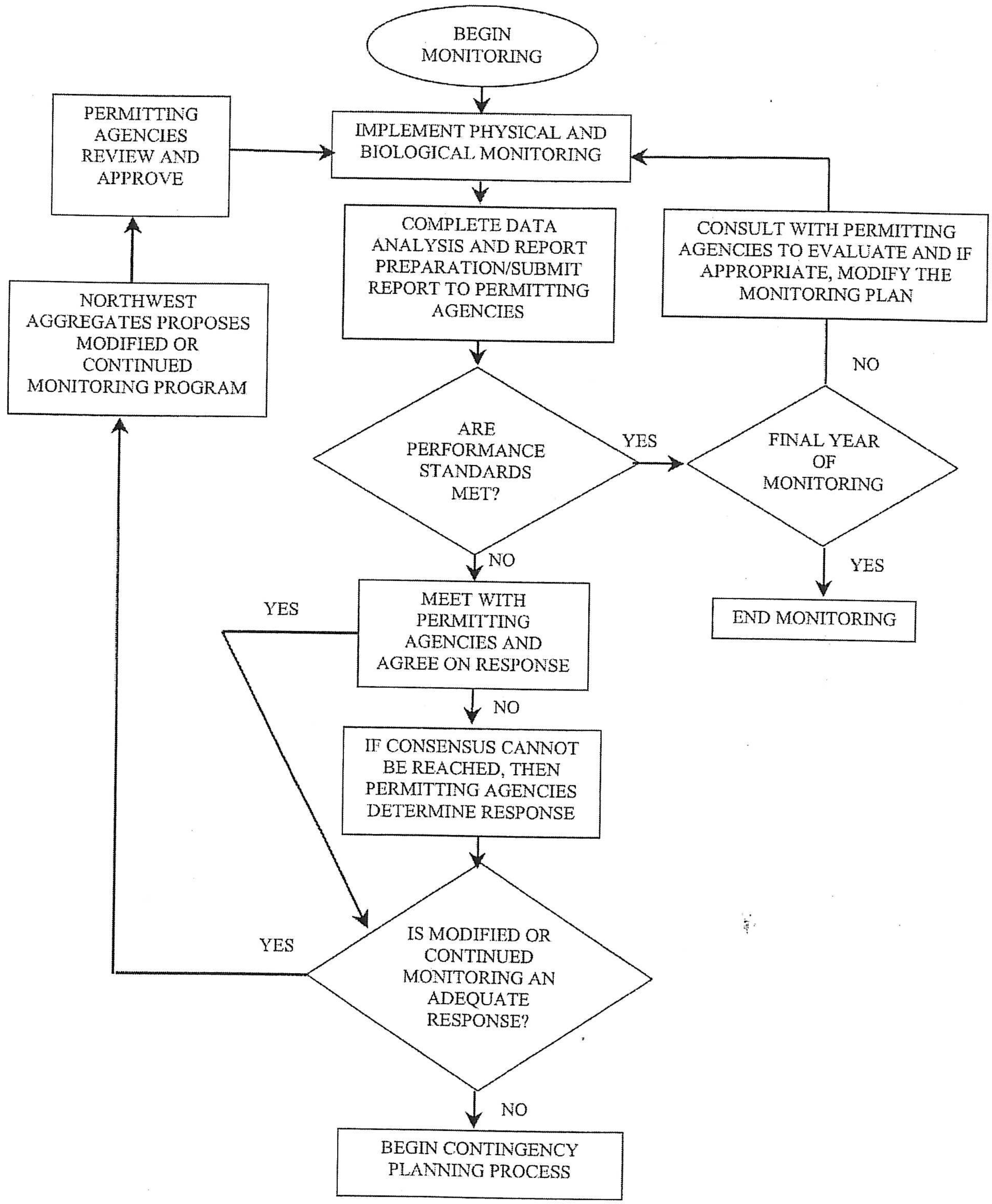


Figure 11 Problem Recognition Process

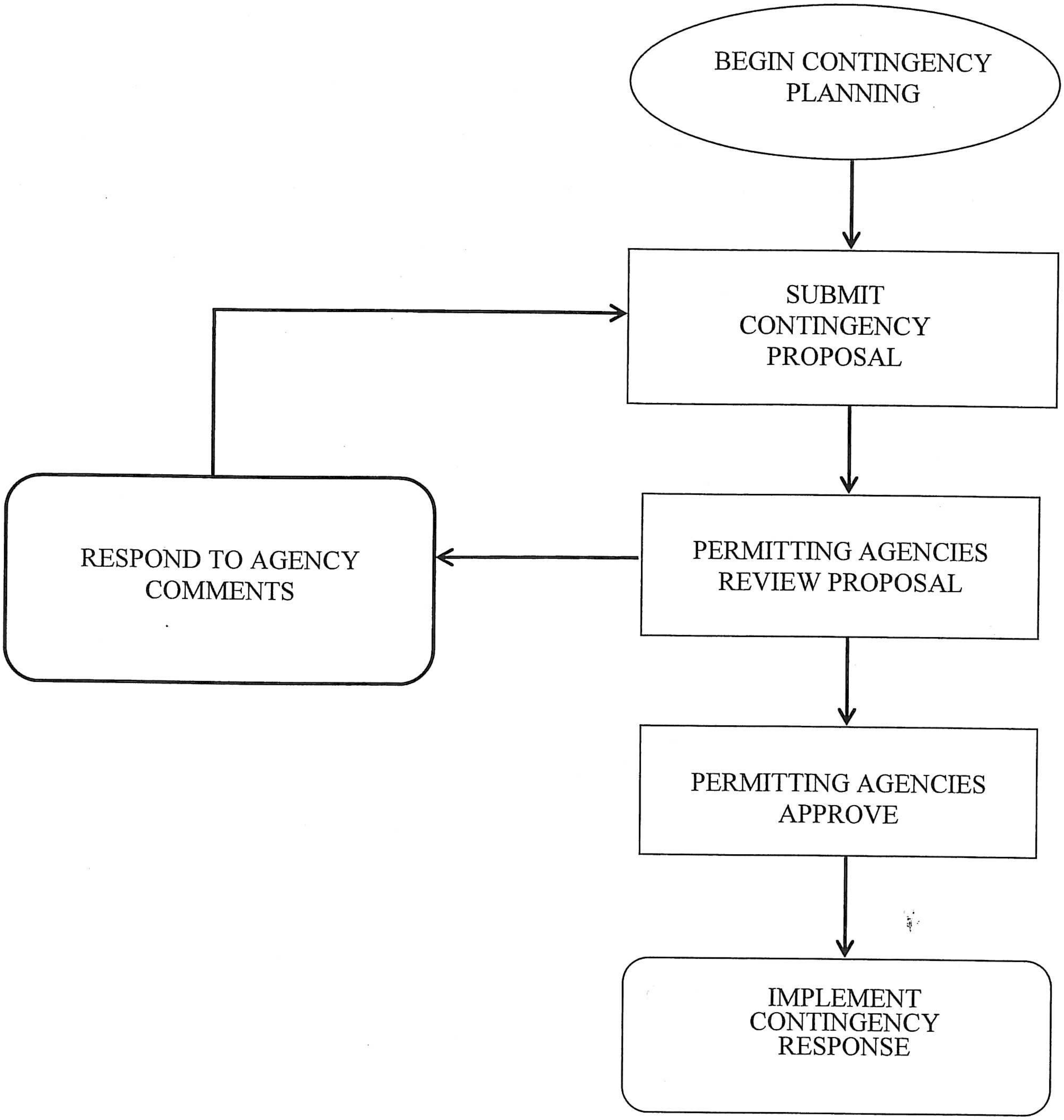


Figure 12 Contingency Planning and Response Process

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GLACIER
NORTHWEST

Barge Approach and Departure Protocol

Northwest Aggregates – Maury Island Barge-Loading Dock

Revised:

December 2, 2003

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1 Introduction

Tugboat propulsion systems can generate propeller wash velocities that can impact eelgrass directly through physical disturbance of the eelgrass plants and surrounding sediment and indirectly by increasing turbidity in the water column and reducing light levels. The stream of water flowing behind the propeller is called the velocity jet. Potential propeller wash impacts to eelgrass can be avoided by controlling:

- the proximity of the propeller to eelgrass;
- the direction of the velocity jet relative to eelgrass;
- the depth of water where the propeller is operating and the velocity jet is directed;
- the speed of the propeller, which translates to thrust and current speed in the velocity jet; and
- the frequency of tugboat operation in the vicinity of the eelgrass.

Eelgrass is present between the dock and shore at the Proposed Northwest Aggregates barge-loading dock on Maury Island (Figure 1). This document is a Barge Approach and Departure Protocol. It describes procedures that Northwest Aggregates and marine transportation companies that operate at the site will follow to avoid potential impacts from propeller wash to eelgrass at the site.

The location of eelgrass patches relative to the proposed extended dock is shown in Figure 2. Surveys conducted in 2001, 2002 and 2003 show that eelgrass distribution at the site was similar in all three years. An evaluation of controlling factors for eelgrass suggests that eelgrass distribution at the site is limited, by slope/substrate, depth (light availability) and wave motion, and that eelgrass occupies all of the areas shoreward of the berth face that are likely to be colonized by eelgrass.

The Final Environmental Impact Statement (FEIS) for the project suggested that propeller wash impacts could be avoided by extending the old dock 50 ft offshore from its existing location. Northwest Aggregates revised the proposed project to extend the dock more than 70 ft and orient the dock so that the berth face was at least 120 ft from the established eelgrass patches at either end of the site.

In order to verify that the protocols described in this document are effective, Northwest Aggregates will monitor propeller wash velocities in the vicinity of the eelgrass patches following a monitoring plan provided in Section 4 of this report, and continue to monitor eelgrass distribution and density at the site as required in the Hydraulic Project Approval.

Copies of this document will be provided to transport companies working at the Maury Island barge-loading dock, and copies will be kept on each of the tugboats that will be used at the dock. A copy of the conditions on tugboat operations listed in Section 3.0, will be posted at the barge-loading dock at all times. Northwest Aggregates personnel must report any deviations from this barge approach and departure protocol to the Manager of Regulatory Affairs for Glacier Northwest within 24 hours of their occurrence.

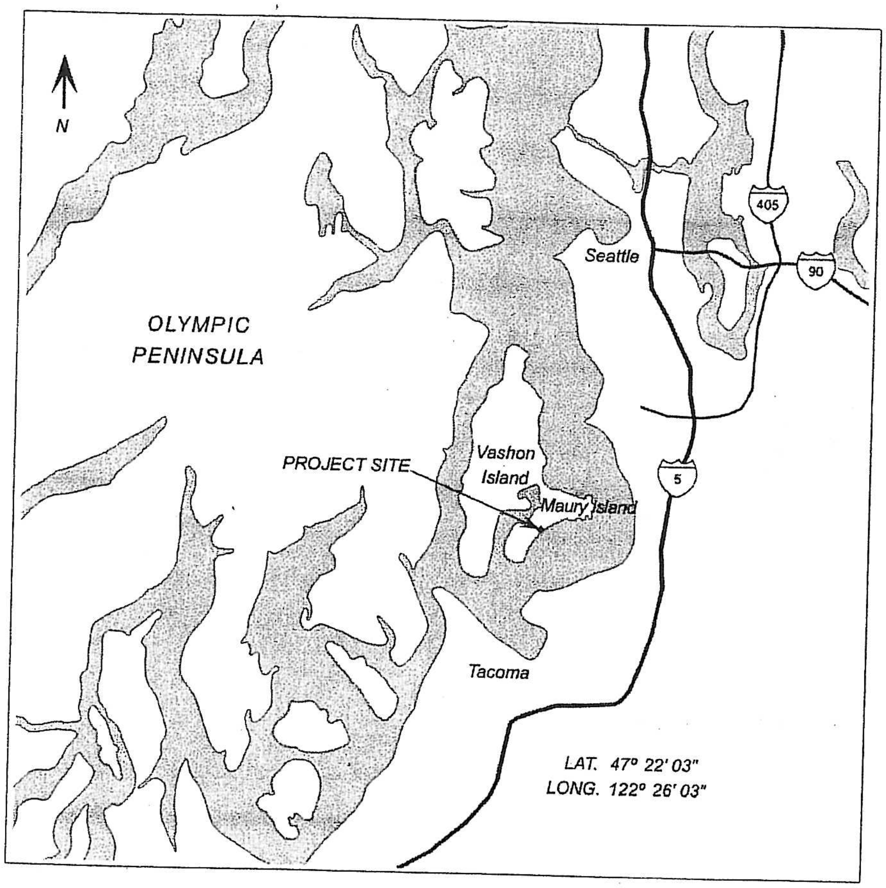

Figure 1. Vicinity Map

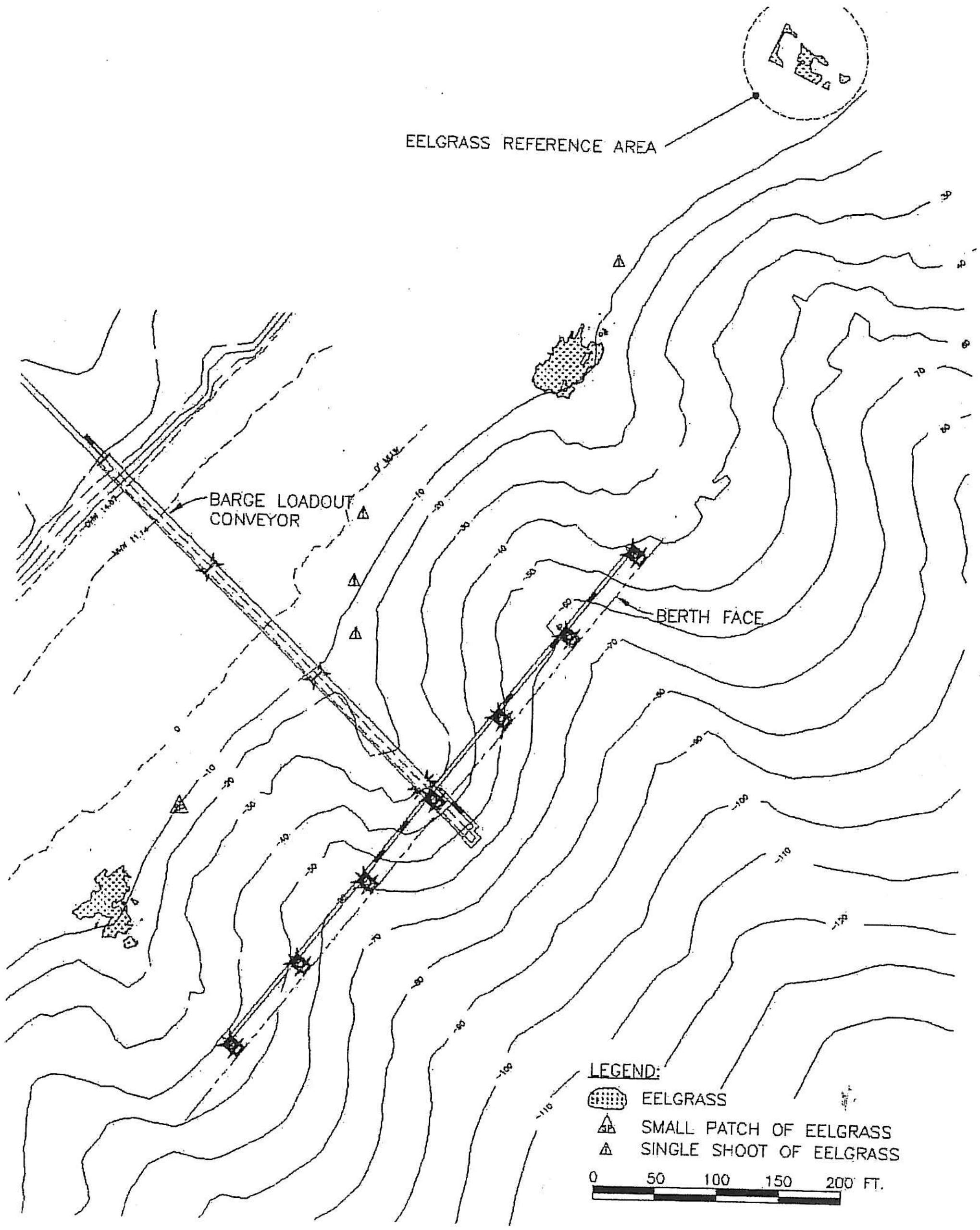

Figure 2. Location of Eelgrass Relative to Proposed Dock

2 Background

An understanding of tugboat maneuvers, operations and propulsion systems is needed to evaluate potential affects of propeller wash from tugboats operating at the proposed Maury Island barge-loading dock. The maneuvers a tugboat makes at the dock will depend largely on the propulsion system used by the tugboat, and the way tugboat is tied or "made-up" to the barge. This section describes the types of tugboats that might be used at the dock and their operations.

2.1 Tugboat Propulsion Systems

There are three basic configurations for tugboat propulsion systems, including a fixed propeller with rudder arrangement, Z-drive configuration, and cycloidal type system.

The fixed propeller system is the most common tugboat propulsion system, and would likely be used most often at the Maury Island barge-loading dock. These types of tugboats typically have one or two propellers that are on a fixed shaft, with rudders aft of (behind) the propeller(s) that are used to direct the thrust and steer the boat. There are variations of the fixed propeller systems including propellers mounted inside a shroud that improves the propeller efficiency; these types of propulsion systems are called kort nozzles. Kort nozzles generate more thrust than open propellers of a similar size.

A Z-drive propulsion system is being installed on newer tugboats. The Z-drive is a shrouded propeller (similar to a kort nozzle) that is mounted in such a way that it can be rotated to direct thrust in any direction. Use of Z-drive propulsion systems improves maneuverability of the tugboat over that obtained with a fixed propeller system without sacrificing thrust. Tugboats with Z-drive propulsion systems may be used occasionally at the Maury Island barge-loading dock.

Cycloidal type propulsion systems are often referred to as eggbeaters because of their configuration. They consist of a series of blades that stick down from the tugboat hull and rotate like an eggbeater instead of a propeller. The angle of the blades can be adjusted causing the vessel to move any direction relatively quickly. Cycloidal propulsion systems are used to optimize the maneuverability of the tugboat, but the power or thrust generated by the tugboat is somewhat compromised. Tugboats with cycloidal drives are most often used to assist ships. It is unlikely that tugboats with cycloidal drives would ever be used to transport barges to and from the Maury Island barge-loading dock.

2.2 Tugboat/Barge Configurations and Maneuvers

Tugboat operators describe the way the tugboat is tied to the barge as "made-up". There are typically three ways that tugboats are made-up to barges. Some tugboats are made-up to the back of barges and push them. Some tugboats are made-up to barges with a tow line and pull them, and some tugboats are made-up on the side of the barge and pull it along side the tugboat.

The way the tugboat is made-up to the barge is determined to a large extent by the type of tugboat and the maneuver to be performed. Many of the tugboats used to move barges in Puget Sound are equipped with bumpers on the front (bow) called push-knees. Tugboats with push-knees typically push tugboats from behind. These boats may also push on the offshore side of the barge to maneuver it up to the dock. When the tugboat comes up to the dock, it will be pushing the barge towards shore with its velocity jet directed primarily away or along shore. When departing, the tugboat will back away from the dock directing the velocity jet forward towards the center of the dock. Boats with push-knees are likely to be the most commonly type of tugboat used to transport barges to and from the Maury Island barge-loading dock.

Tugboats without push-knees typically either tow the barge or are made-up along side the barge. The length of tow line can vary from situation to situation. Typically barges are tied close to the tugboat when barges are being towed up to or away from a dock to increase maneuverability and tied further from the tugboat when underway. Tugboats made-up alongside the barge are tied tightly to the offshore side of the barge when pushing the barge up to or away from the dock. Tugboats may tow a barge to the general vicinity of the dock where they will remove the tow line and make-up alongside the barge before maneuvering the barge up to the dock. Once the barge is away from the dock the tugboat may untie from the barge and use a tow line to transport the barge to its destination.

The most common type of tugboat that is likely to be used at Maury Island will be equipped with push-knees and a fixed propeller propulsion system. These types of boats will either be made up behind the barge to push it, or made-up along side the barge (Figure 3). A tow line will not be used to land at or depart from the dock. Because the propellers on these tugboats are fixed, they will be directing their velocity jet along shore, not towards eelgrass areas.

Two types of vessels are capable of directing their velocity jet any direction. Tugboats equipped with cycloid propulsion are unlikely to be used to transport gravel barges. Tugboats with Z-drive systems may be used to maneuver barges at the dock on occasion.

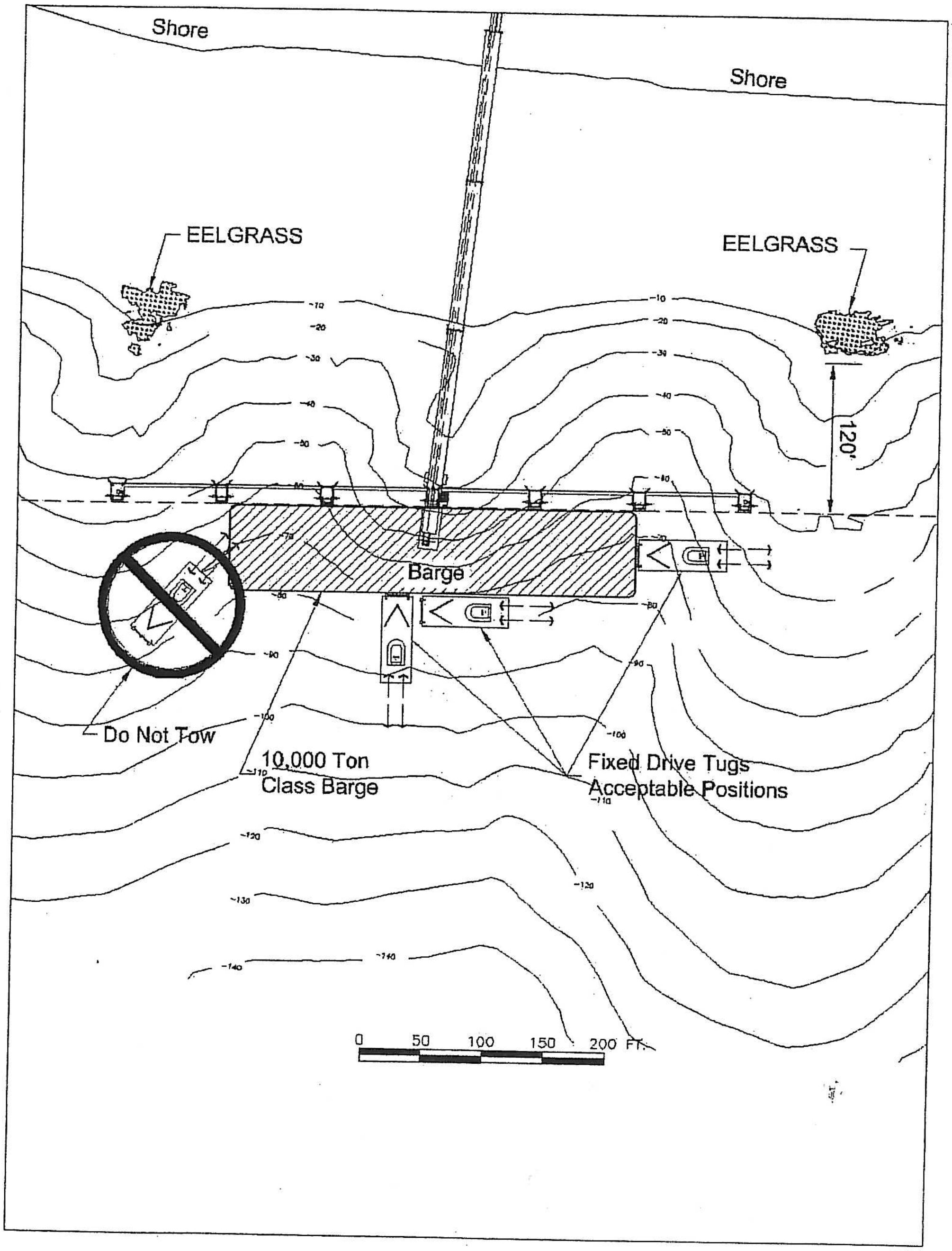

Figure 3. Configuration of Barge and Tugboat with Push-Knees

Potential impacts from either type of vessel can be avoided by controlling the position of the tugboat relative to eelgrass at the dock.

Tugboats with Z-drives or cycloid propulsion will only be allowed to approach or leave the dock with the barge made-up alongside the tugboat (Figure 4). This will keep the tugboat on the offshore side of the barge and place it between approximately 54 and 80 feet water ward of the berth face. Furthermore, when the barges are loaded, they will typically draft more water (float deeper in the water) than the tugboat, effectively providing a barrier between the tugboat propeller and the nearshore area (Figure 5).

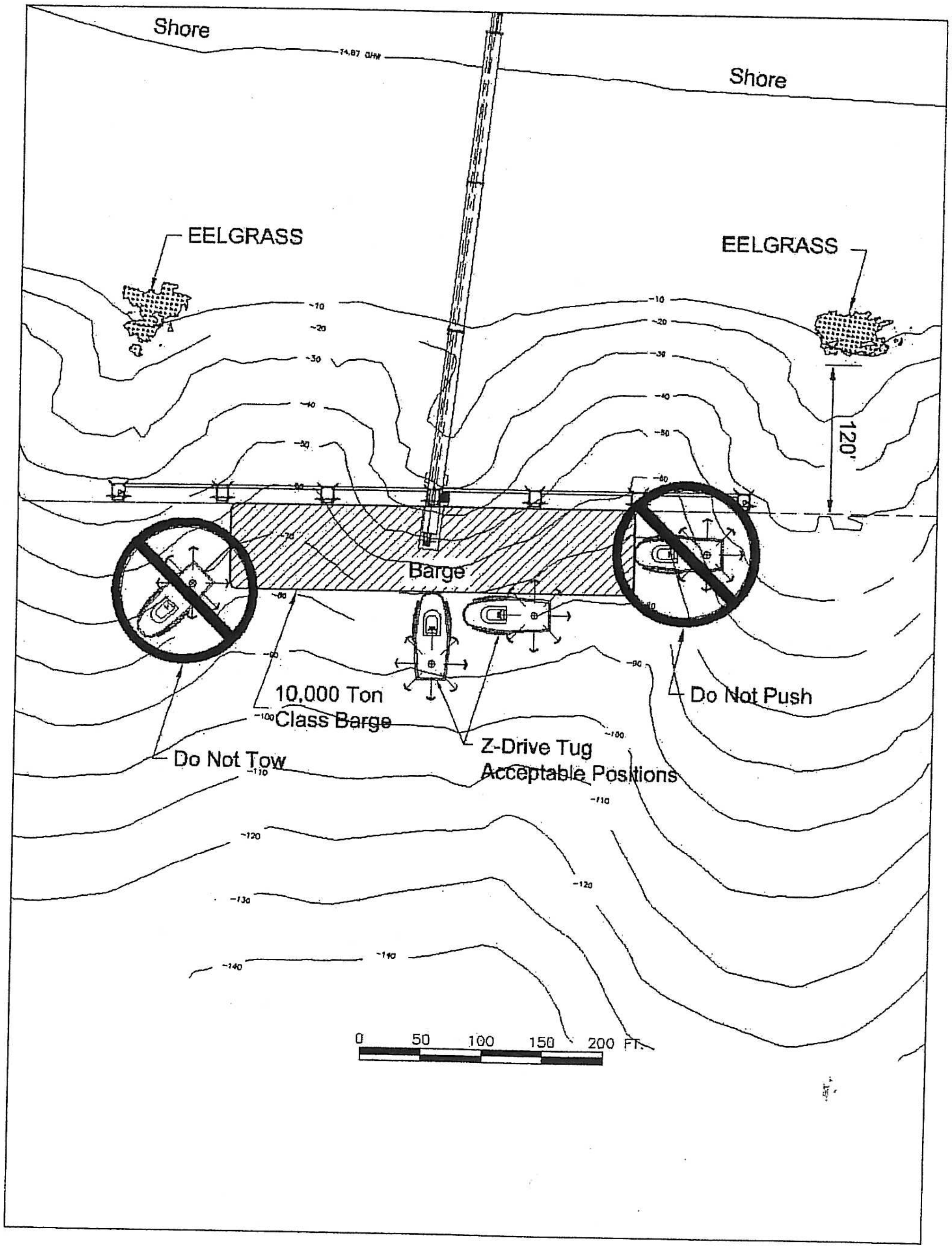

Figure 4. Configuration of Barge and Tugboats with Z-drive or Cycloid Propulsion Systems (Plan View)

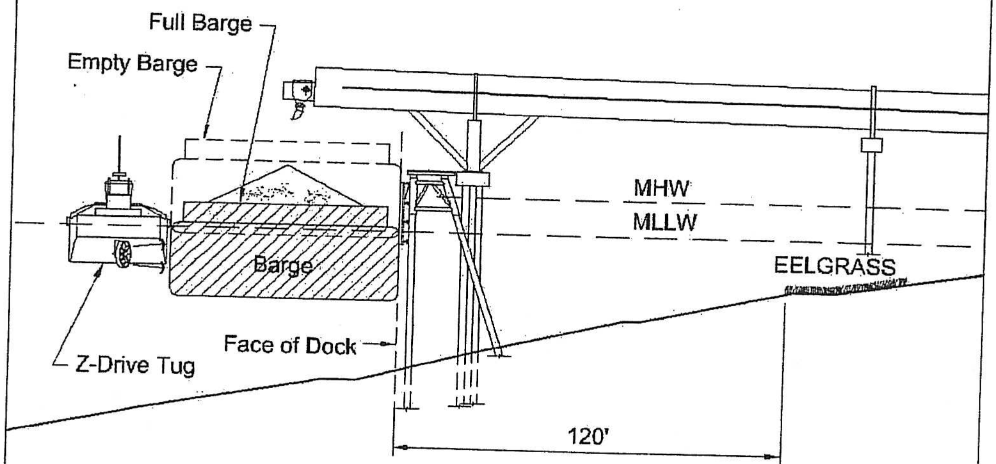

Figure 5. Configuration of Barge and Tugboats with Z-drive or Cycloid Propulsion Systems (Elevation View)

3 Conditions on Tugboat Operations

All tugboats operating at the Maury Island barge-loading dock will operate in accordance with the following conditions:

- Dock extended so that berth face is 120 ft from edge of established eelgrass areas identified in the 2001 Eelgrass Survey Report (PI Engineering 2001).
- Gravel barges and tugboats will not operate shoreward of the dolphins.
- Tugboats will not operate on the shoreward side of barges.
- Tugboat/barge configurations will approach and depart the dock at the slowest speed practical.
- A haul-back system will be used to move the barge during loading. This will eliminate the need for a tugboat to maneuver the barge during loading reducing the frequency and duration of tugboat operation at the facility to avoid and minimize propeller wash effects. If the tugboat is to remain with the barge during loading, the tugboat propellers will remain disengaged during barge loading.
- Tugboats will "back" the barge away from the dock to minimize propeller wash directed towards shore.
- Tugboats with fixed propeller propulsion systems will only be made up along side or behind barges during approach and departure.
- Tugboats with Z-drive or cycloidal propulsion systems will only be made up along the offshore side of the barge during approach and departure.
- The cable haul back system will be used to position the tugboat away from the shallowest areas along the berth face prior to untying the barge from the dock for departure. Figure 6 shows the range of barge movement that can be achieved with the cable haul-back system.
- Barges will not be towed (with tow lines) up to or away from the dock. Barges may be towed to or away from the general vicinity of the dock, but all maneuvers to get the barge up to or away from the dock for loading must be completed following conditions stated here.
- Tugboats will not operate within 120 ft of the eelgrass reference area (Figure 2).
- Tugboat operators will avoid directing propeller wash towards shore, and will avoid use of excessive thrust.
- A minimum distance of three feet will be maintained between the bottom of barges and the seabed.

Tugboat operators are responsible for damages to equipment or docks, and the safety of persons working on their equipment, and should maintain control of their vessel at all times. Operators should not attempt maneuvers in wind or wave conditions that may compromise their ability to maintain control over the vessel.

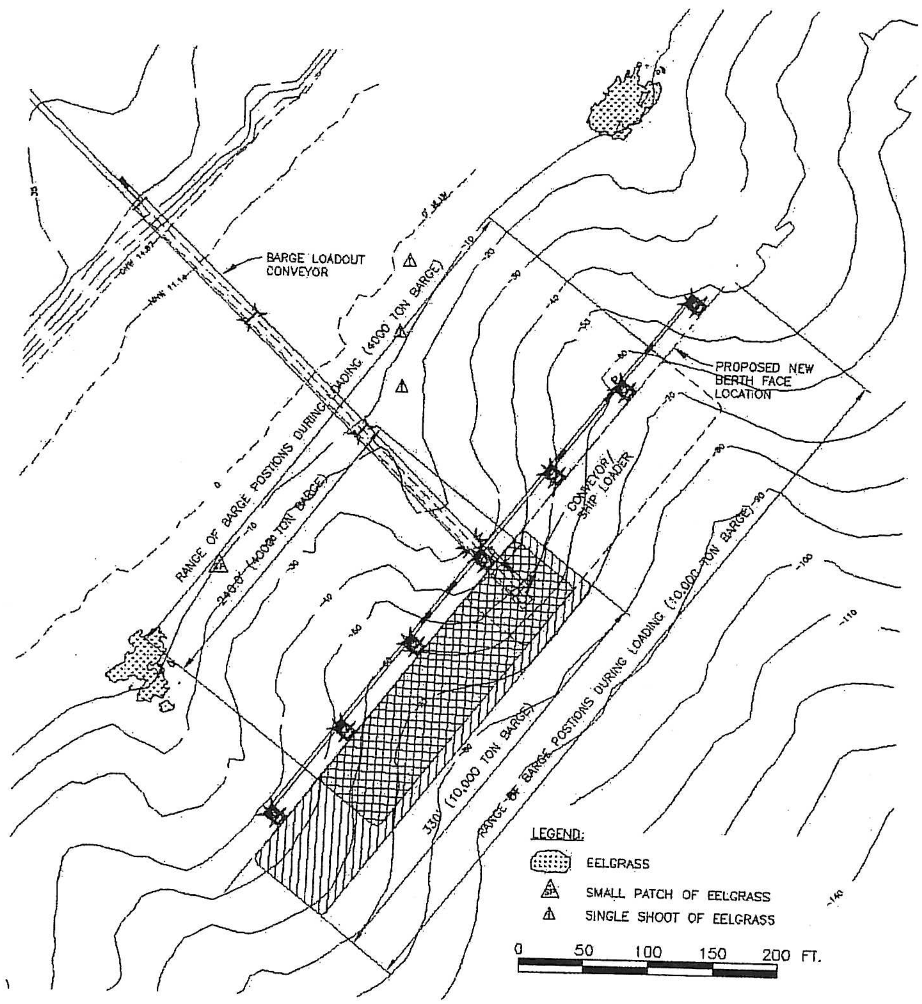

Figure 6. Range of Barge Movement With Cable Haul-Back System

4 Propeller Wash Monitoring

With the implementation of the barge approach and departure protocol propeller wash modeling results predict that propeller wash velocities reaching eelgrass will remain below eelgrass damage thresholds. As an added precaution, recording current meters will be deployed on the seaward edge of the two main eelgrass patches (Figure 7) to monitor for propeller wash in the eelgrass areas. Monitoring will be conducted by an independent third-party to install and operate the current meters for an initial period of 6 months or until 50 barges have been loaded at the site, whichever is longer.

Current meters will be installed as close to the seabed as practical and current meters will be hard wired to a recording station affixed to the dock or designated dolphin.

Current velocity measurements will be time and date stamped so that data from the record can be compared to barge arrival and departure times and video recordings of the dock. The data logger for the velocity meters will be configured to collect velocity measurements at a rate of at least 2 times per second. Velocity measurements will be stored by the data logger without averaging to ensure that individual values measured are available for future statistically evaluation.

Field measurements will be downloaded from the data logger and entered into a spreadsheet program that will be used to average the velocity measurements over 5-second periods. The 5-second average is used because it corresponds to the method used to measure velocity for determining the eelgrass damage thresholds. Data will be downloaded, compared to action values according to the frequency shown in Table 1. The field recorded data and a brief technical memorandum summarizing the velocity observations and comparison to action values will be submitted to the regulatory agencies within 1 week after the scheduled data download and comparison.

If no 5-second mean velocity measurements attributable to the barge-loading operations are observed at velocities above 50 cm/sec during the initial monitoring period, no further propeller wash monitoring will be conducted.

If 5-second mean velocity measurements between 50 and 75 cm/sec are observed during the initial monitoring period, then the initial monitoring period will be extended for another 6 month period. If no mean velocity measurements above 75 cm/sec are observed during the first year of operation, no additional monitoring will be required.

If 5-second mean velocity measurements exceed 75 cm/sec and are attributed to propeller wash from tugboats, the regulatory agencies will be immediately notified, and a multi-disciplinary group comprised of an eelgrass expert, a propeller wash expert, and experienced tugboat skipper will review the operations and available information and recommend additional controls and monitoring to be conducted. The controls implemented will depend on the conditions that caused the velocity to exceed 75 cm/sec. Their recommendations may include operational and/or engineering controls.

Operational controls may include, but are not limited to prohibiting the use of a specific tugboat or type of tugboat from operating at the dock, changing the way a tugboat must be made-up to a barge, or training operators or personnel. Engineering controls may include the construction of a baffle, curtain or other structure to reduce propeller wash velocities observed at the eelgrass.

If 5-second mean velocity measurements exceed 100 cm/sec and are attributed to propeller wash from tugboats, the regulatory agencies will be immediately notified, and all barge loading operations will cease until the multi-disciplinary group identifies and tests additional controls to ensure they will effectively avoid and/or mitigate any propeller wash impacts on eelgrass. The controls implemented will depend on the conditions that caused the velocity to exceed 100 cm/sec. They may include but are not limited to those additional conditions listed above.

If at any time eelgrass monitoring results indicate that propeller wash from tugboats impacted eelgrass, all barge loading operations will cease until additional controls can be identified, tested and reviewed in coordination with the regulatory agencies to ensure that any further impacts to eelgrass will be avoided before barge-loading will be allowed to resume. Any damaged eelgrass will be replanted in the area where the damage occurred. Appropriate operational and engineering controls will be used to prevent damage from reoccurring in the transplanted area(s).

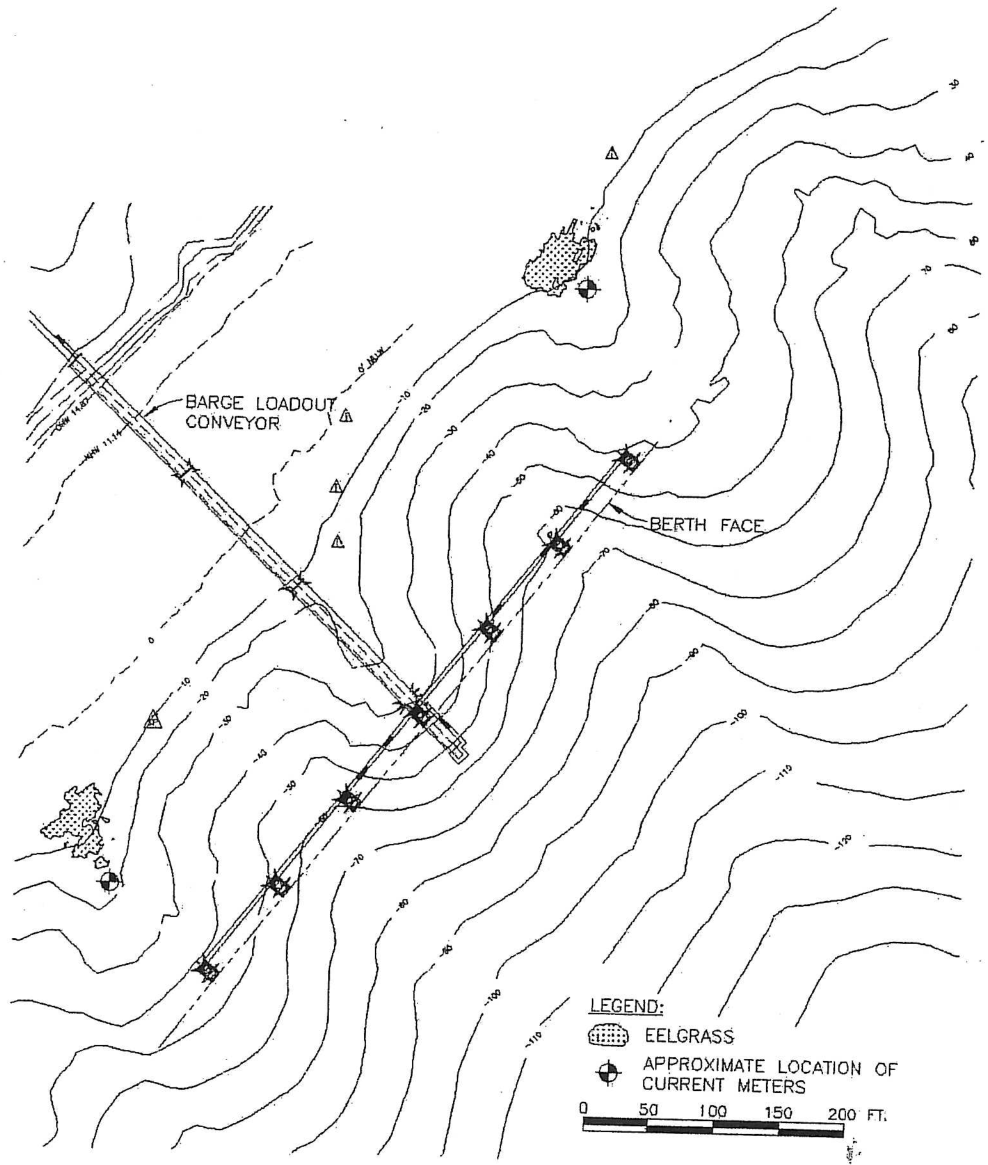

Figure 7. Approximate Locations of Current Meters

Table 1. Frequency of Data Download, Comparison and Reporting.

Number of Barges	Frequency
1 – 5	After Each Barge Load
5 – 20	After Every 5 Barge Loads
20 – 50	After Every 10 Bage Loads
> 50	After Every 10 Barge Loads

MAY 21, 2003

MAURY ISLAND CONVEYOR REPLACEMENT

MITIGATION PLANTING PLAN

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Table of Contents

1 INTRODUCTION

This document presents the Habitat Mitigation Planting Plan for the proposed construction of a portion of a new barge-loading conveyor system at Northwest Aggregate's Maury Island mining operations ("Project"), located along the east shore of Maury Island, Washington. The new conveyor system will replace the existing conveyor. Construction of the upland portions of the proposed conveyor system will involve work within 200 feet of ordinary high water. The mitigation measures proposed in this plan address impacts to vegetation associated with replacement of a portion of the conveyor system that is located within 200 feet of ordinary high water.

2 PROJECT DESCRIPTION

The majority of the on-shore work within 200 feet of ordinary high water will occur in a 60-foot wide corridor (Sheet 1). This 0.28-acre corridor contains the existing conveyor system to be replaced. Work within the corridor will include removal of existing vegetation, removal of the existing conveyor, minor grading, placing crushed rock surfacing and installing the proposed conveyor system. A 40-foot section of the conveyor corridor adjacent to ordinary high water will be replanted upon completion of construction, and is therefore included in the mitigation planting area (Sheet 1). The remainder of the corridor will be maintained during operation of the barge-loading dock to allow access for future maintenance and repair of the corridor.

Vegetation that is outside the corridor will be protected from damage during construction. Road work will be confined within the existing roadway and will be limited to repairing existing roads.

The existing conveyor system will be removed in sections, loaded into trucks and transported off-site to an approved upland disposal site. New conveyors will be pre-assembled off-site as much as possible to reduce the amount of work required in the shoreline area.

3 SUMMARY OF IMPACTS

The primary adverse impacts of the project would result from the removal of vegetation within a 0.28-acre portion of the 200-foot shoreline buffer (Sheet 1). Vegetation removal would occur within the 60-foot conveyor corridor from the ordinary high water line landward past the 200-foot shoreline buffer boundary. The vegetation will be removed to allow for safe and efficient removal of the existing conveyor and installation of the new conveyor system. In addition, minor grading and gravel resurfacing will occur in portions of the corridor to facilitate removal and replacement of the conveyor, as well as to provide access for operation and maintenance activities.

Once the corridor area is cleared of vegetation and access areas are graded and resurfaced, the existing conveyor will be removed and the new conveyor will be assembled. After completion of the new conveyor, the cleared areas will be maintained for operational safety and maintenance of the conveyor system.

4 BASELINE HABITAT CONDITIONS

The shoreline portion of the gravel mining area is currently dominated by Scot's broom (*Cytisus scoparius*) and willow (*Salix* spp.) with various grasses and forbs also present. Within the Project area, the vegetation consists primarily of Scot's broom, red alder (*Alnus rubra*), and willow. Himalayan blackberry (*Rubus discolor*) and Pacific madrone (*Arbutus menziesii*) are also present in this area. Scot's broom, red alder, and willow are present along the ordinary high water line. Several unvegetated staging areas and gravel roadways are also present northeast of the conveyor corridor.

5 MITIGATION DESIGN

Construction and grading activities within the conveyor corridor will result in the loss of approximately 0.28 acre of vegetation within 200 feet of ordinary high water.

To mitigate the affects of the loss of vegetation within the shoreline buffer, Glacier Northwest proposes to plant approximately 0.28 acre of native vegetation along an adjacent portion of the shoreline to the northeast (Sheet 1). Currently, the portion of the shoreline immediately northeast of the conveyor is either unvegetated or dominated by Scot's broom.

All non-native invasive species within the mitigation area will be removed and replaced with native trees and shrubs. The planting area will extend northeast approximately 250 feet parallel to the shoreline from the northeast edge of the conveyor corridor (Sheet 1). Plantings will occur from ordinary high water (approximately +15 feet Mean Lower-Low Water [MLLW]) landward approximately 73 feet.

Plantings will be a mix of black cottonwood (*Populus trichocarpa*), Pacific madrone, live Scouler willow (*Salix scouleriana*) stakes, and red-osier dogwood (*Cornus stolonifera*). The cottonwood will be balled and burlap trees of whichever size is readily available (typically b&b trees are 8-15 feet), and will be planted on 9-foot centers. Madrone will be 2-gallon container plantings, and also will be planted on 9-foot centers. Scouler willow stakes and red-osier dogwood seedlings will be planted on 3-foot centers among the cottonwood and madrone plantings. Once trees and shrubs are planted, the mitigation area will be overseeded with native grasses to help prevent colonization by invasive species.

Adding vegetation to the shoreline will stabilize the bank and screen aquatic and nearshore habitat from mining activities. The plantings will provide approximately 0.28 acre of enhanced vegetated area along the shoreline north of the conveyor. The willow and red-osier dogwood will provide nesting and forge habitat for wildlife species. The cottonwood and madrone will provide near-term screening and small bird nesting opportunities, and long-term roosting and perching opportunities for raptors and piscivorous birds. Plants overhanging the shore will shade nearshore intertidal habitat and introduce leaf litter and insects, important components of quality nearshore habitat for juvenile salmonids.

6 MITIGATION MAINTENANCE AND MONITORING

Northwest Aggregates is committed to providing successful mitigation and compliance with the mitigation plan. While the native species selected for mitigation are hardy and typically thrive in nearshore northwest conditions, some individuals might perish due to dry conditions, poor placement, etc. The project proponent will provide either irrigation or regular watering and plant maintenance for two summers after planting while the vegetation become established. Invasive species will be removed or physically prevented (by mulch or biodegradable fabric) during all three monitoring years. No more than 10 percent cover of invasive species is permitted in any monitoring year. Cottonwood and madrone plantings that fail to survive the first growing season will be replaced.

Scot's broom and Himalayan blackberry, the two invasive species most prevalent on-site are shade intolerant and will not likely thrive within the mitigation site after willows and dogwood establish themselves.

The newly-planted vegetation will be monitored for a period of three years to ensure planted material is thriving on the site. Monitoring will include walk-through surveys to document planted vegetation survival and species composition. Additionally, four permanent photo-points will be established to further document site development over the entire three-year monitoring program. The proposed schedule of monitoring activities is present in Table 1.

Table 1. Proposed schedule of monitoring activities.

Performance Standard	Method	Month	Frequency
Species Composition	Walk-through surveys to document all species present	July	Years 1-3
Planted Vegetation Survival	Walk-through surveys to document plant survival; note presence of seed/fruit	July	Years 1-3
Photo Points	Document site development	July	Years 1-3

Species composition data will be collected once every July for all three monitoring years. Data will be collected by walk-through surveys conducted throughout the entire mitigation site, documenting all plant species present. Documentation will include relative abundance and location of invasive species. This data will be used to identify potential problem areas with respect to invasion of non-native species. All invasive species found during monitoring activities will be removed.

In addition to species composition data, all planted vegetation will be inspected during the walk-through survey to determine percent survival. Parameters such as relative health and vigor and presence of seeds and/or fruit also will be documented.

Table 2 contains the specific performance standards and the contingency actions to be taken if performance standards are not met within the timeframe prescribed.

Table 2. Performance standards and contingency actions for the mitigation site.

Feature	Monitoring Year	Interim Performance Standards	Contingency Action
Invasive species	1-3	All invasive species occurrences will be removed	None
		Invasive species coverage <10% of total mitigation area	None
		Invasive species coverage >10% of total mitigation area	Evaluate reasons for colonization; consider using mulch covering or biodegradable fabric for prevention.
Tree and shrub survival and growth	1-3	> 80% survival of planted stock	None
		60 - 80% survival of planted stock	Evaluate reasons for mortality; replant to achieve performance standard.
		>60% survival of planted stock	Evaluate reasons for mortality; consider species suitability for site conditions; replant with same or alternate species.
	3	Presence of seed and/or fruit production	None
		Lack of seed and/or fruit production	Evaluate potential reasons for lack of seed and/or fruit production; consider fertilization.