Memorandum

To	Gateway Pacific Terminal MAP Team	File no cc	0-915-15338-C Ari Steinberg, SSA
From	Melinda Gray and Kristie Dunkin, Ph.D., P.M.P. AMEC Earth & Environmental, Inc.		
Date	May 20, 2011		

Subject **Draft Marine Biota Baseline Monitoring**

The attached Draft Marine Biota Baseline Monitoring Plan provides a description of proposed sampling to be conducted at the Gateway Pacific Terminal Site. The sampling will provide a baseline description of the marine biological community in the study area to be used for analysis during the project's NEPA review process.

The purpose of the attached document is to provide MAP Team members the opportunity to comment on the proposed Draft Monitoring Plan as discussed at the May 12, 2011 MAP Team meeting. Monitoring is scheduled to be conducted from May 28 through June 9.

Please provide us with your feedback on the monitoring plan by Friday, May 27th, at the latest. If you would like to discuss the monitoring plan with AMEC biologists or other Agencies, please let us know as soon as possible and we will arrange a conference call or meeting sometime the week of May 23rd.

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AMEC Earth & Environmental, Inc.
11810 North Creek Parkway N
Bothell, Washington 98011
(425) 368-1000 Phone
(425) 368-1001 Facsimile
www.amec.com

MARINE BIOTA BASELINE MONITORING

Gateway Pacific Terminal

Cherry Point, Washington

Prepared for:

Pacific International Terminals, Inc.
1131 SW Klickitat Way
Seattle, Washington 98134

Prepared by:

AMEC Earth & Environmental, Inc.
11810 North Creek Parkway North
Bothell, Washington 98011

May 20, 2011

Project No. 0-915-15338-C

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1.0 INTRODUCTION

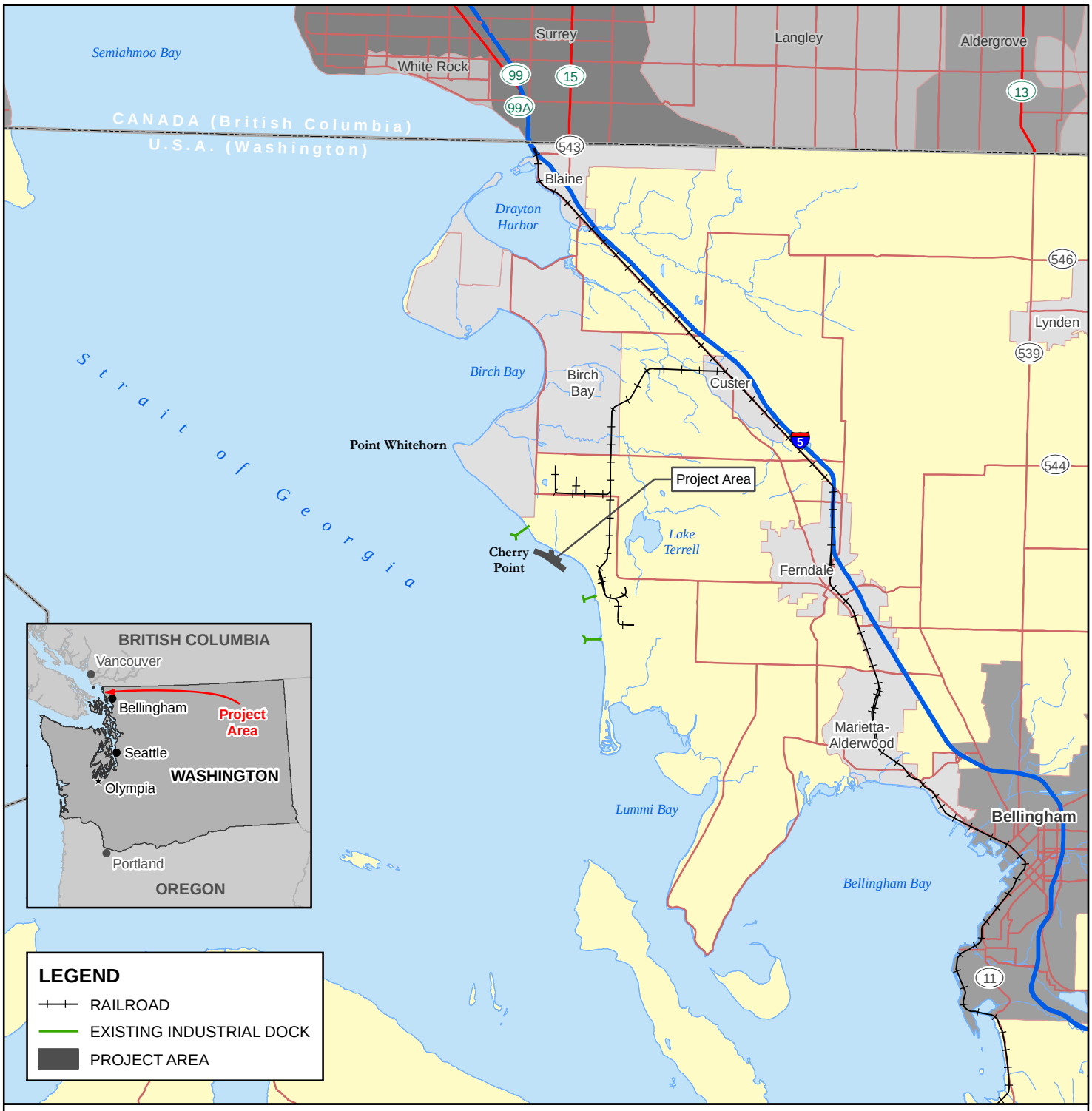
Pacific International Terminals, Inc. (Pacific International Terminals), is proposing the development of the Gateway Pacific Terminal at Cherry Point in Whatcom County, Washington (Figure 1—Vicinity Map). The proposed terminal would include a deep-draft wharf with access trestle and other associated upland facilities for the export and import of multiple bulk commodities ("multimodal deepwater bulk terminal") within the Cherry Point Industrial Area. This document provides a study plan that will implement a study for the collection of baseline conditions of the marine environment within the study area.

A summary of the components of this study, type of data to be collected, questions the data will answer, and the regulatory authority that requires the study is provided in Table 1.

Table 1 Summary of marine biology baseline studies to be conducted

Field Investigation	Type of data to be collected	Questions to be Answered	Regulatory Program
Essential Fish Habitat Evaluation – Including Rockfish	Underwater video of benthic conditions and mapping of habitat information.	What are the characteristics of the essential fish habitat in the study area?	USACE in consultation with NMFS/ Magnuson-Stevens Act.
Geoduck Investigation	Quantitative surveys of geoduck presence and location based on visual observations along transects performed by divers.	What is the distribution and abundance of geoduck in the study area?	DNR Aquatic Reserve Management Plan and Tribal fisheries information request.
Submerged Marine Vegetation (Macroalgae and Eelgrass)	Underwater video of benthic conditions, mapping of habitats and vegetation, followed by quantitative surveys of vegetation types and numbers performed by divers.	What are the characteristics of the study area? What types of marine vegetation are present? What is the location, distribution, and abundance of marine vegetation?	Survey required by Settlement Agreement, specified by DNR Aquatic Management plan, and required for an HPA. Provides supporting information for analysis of potential effects for all other marine-related permits and authorizations. Information provided to Tribes.

Field Investigation	Type of data to be collected	Questions to be Answered	Regulatory Program
Forage fish survey	Walk beach and identify areas where forage fish may spawn. Collect sand samples to determine whether spawning occurs at the Gateway Pacific Terminal site.	Do forage fish (surf smelt and sand lance, specifically) use the shoreline at the Gateway Pacific Terminal site for spawning?	Survey required for a DNR lease and for an HPA.
Epibenthic Invertebrates	Distribution and abundance of epibenthic invertebrates based on underwater video and SCUBA surveys conducted in conjunction with macrophyte surveys.	What is the location, distribution, and abundance of epibenthic dwelling invertebrate organisms?	DNR Aquatic Reserve Management Plan. Information to be provided to Tribes.
Benthic and epibenthic Invertebrates	Distribution and abundance of benthic invertebrates based on sieving of collected sediments and identification of organisms.	What is the location, distribution, and abundance of benthic dwelling invertebrate organisms?	DNR Aquatic Reserve Management Plan. Provides supporting information for analysis of potential effects for all other marine-related permits and authorizations. Information to be provided to Tribes.



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AMEC Earth & Environmental
11810 North Creek Parkway N
Bothell, WA 98011

CLIENT: PACIFIC INTERNATIONAL TERMINALS, INC.

PROJECT: MARINE BIOTA BASELINE MONITORING PLAN	DWN BY: SD	DATUM: NAD83	DATE: MAY 2011
TITLE: VICINITY MAP	CHK'D BY: MG	REV. NO.: -	PROJECT NO.: 091515338C-09-01
	PROJECTION: WA SP North, Ft.	SCALE: 1 inch=3 miles	FIGURE No.: FIGURE 1

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1.1 SITE DESCRIPTION AND BACKGROUND

The marine studies would occur in the marine environment at the location for the proposed Gateway Pacific Terminal.

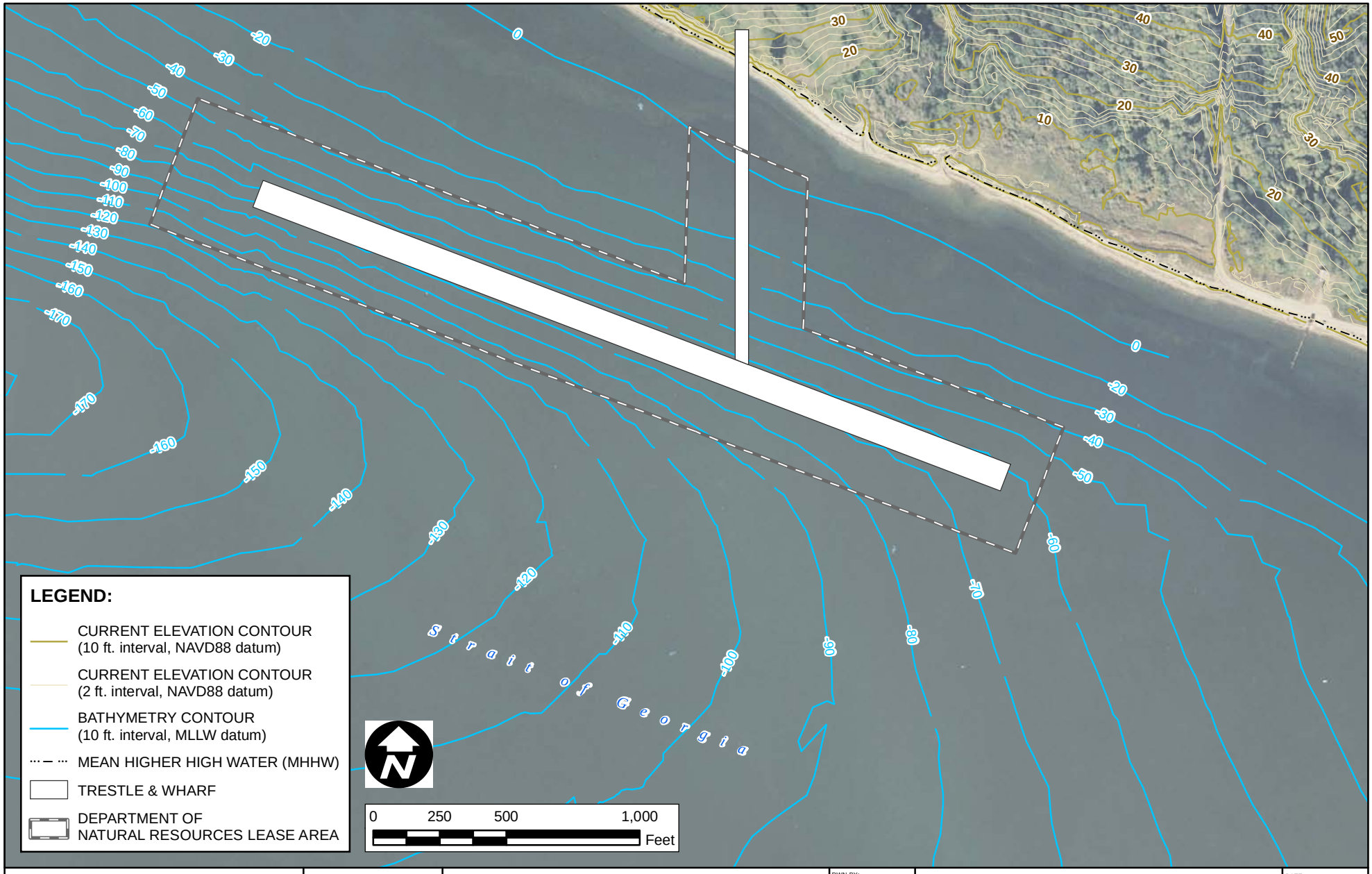
1.1.1 Location

The Gateway Pacific Terminal project would be located on heavy-impact industrial-zoned land located adjacent to the shoreline between BP's Cherry Point refinery to the north and the ALCOA – Intalco Works pier and aluminum smelter to the south along the Cherry Point Reach of the Strait of Georgia (See Figure 1).

1.1.2 Background

In 1997, Pacific International Terminals received a Shoreline Substantial Development Permit (SDP) (SHS92-0020) and Major Development Permit (MDP92-0003) from Whatcom County to construct and operate the Gateway Pacific Terminal (Figure 2—The Permitted Alignment). Several parties—including the Washington State Department of Ecology (Ecology), Washington Department of Fish Wildlife (WDFW), and a coalition of five environmental groups represented by the Washington Environmental Council—appealed the permit to the State Shoreline Hearings Board on the basis that potential environmental impacts from the project were not satisfactorily addressed or mitigated. The appeal led to a settlement agreement among all of the parties executed in 1999 (Settlement Agreement, 1999; Pacific International Terminals, SDP SHS 92-0020 and SHB Appeals Numbers 97-22 and 97-23) which provided a number of conditions to the shoreline permit, including some conditions directing evaluation of existing conditions of the marine environment in the permitted project area.

In 2000, the Washington Department of Natural Resources (DNR) established a State Aquatic Reserve at the Cherry Point reach. The *Cherry Point State Aquatic Reserve Management Plan* (ARMP; DNR 2010) was developed and emphasizes the long-term protection of the aquatic resources within and directly adjacent to the reserve.



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CLIENT: PACIFIC INTERNATIONAL TERMINALS, INC.

AMEC Earth & Environmental
11810 North Creek Parkway N
Bothell, WA 98011

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SCALE:	1 inch = 500 feet

PROJECT: MARINE BIOTA BASELINE MONITORING PLAN

TITLE: PERMITTED ALIGNMENT

DATE:	MAY 2011
PROJECT NO.:	091515338C-09-01
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FIGURE NO.:	2

K:\AMEC US OFFICES\KIRKLAND\15338-0\15338C\T-09-01 Study Plan & Field Investigation\dwg\Figure 2 - Permitted Alignment.mxd

The ARMP describes the Gateway Pacific Terminal as a proposed industrial use of the shoreline, and an allowable use for state-owned aquatic lands as long as the following conditions are met (ARMP, page 52):

- facility meets the conditions of the ARMP,
- serves the objectives of the reserve,
- meets all regulatory requirements, and
- conforms to the terms and conditions of the 1999 Settlement Agreement.

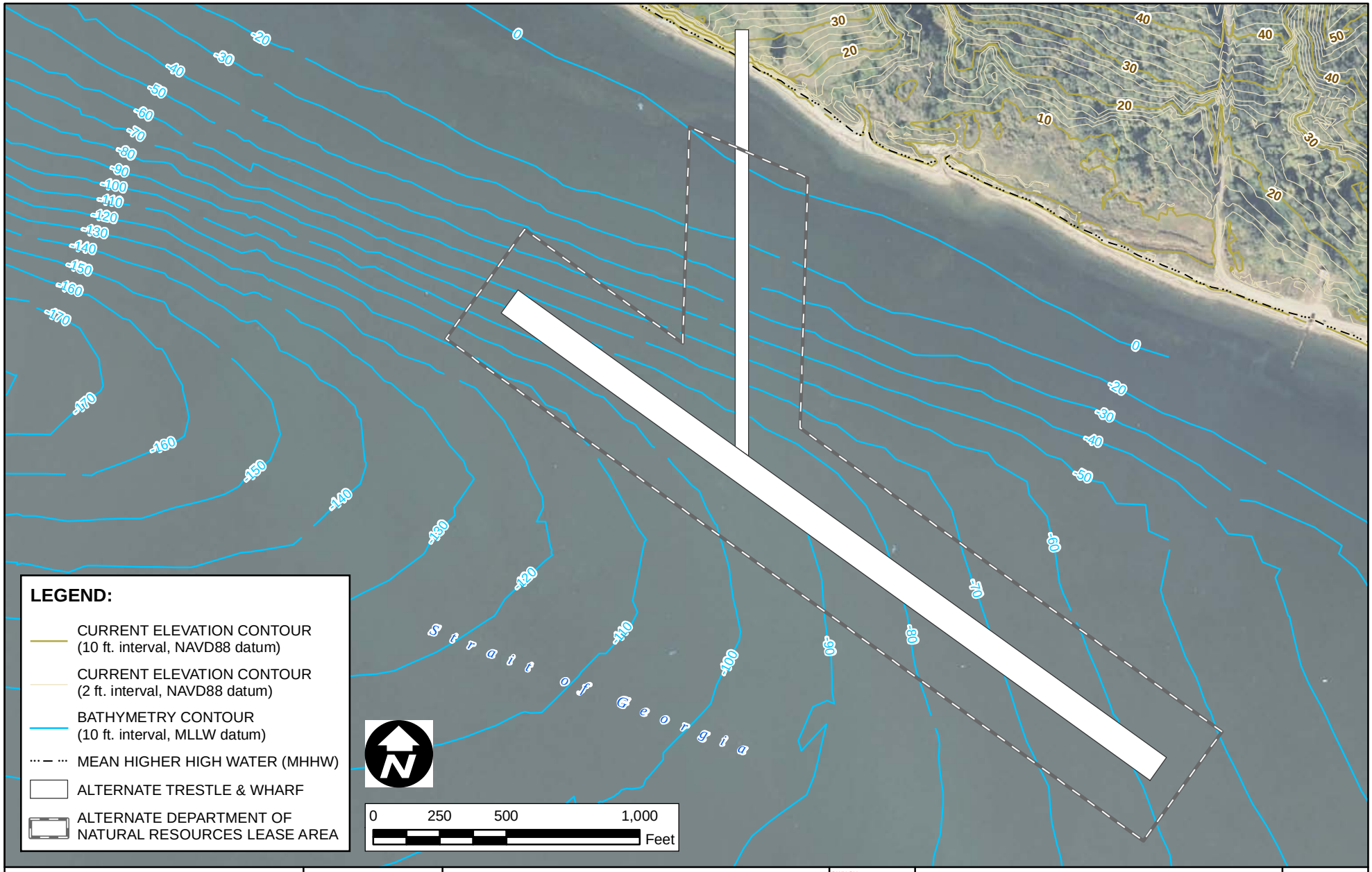
Pacific International Terminals has considered several alternatives for the design and layout of the proposed Gateway Pacific Terminal. Successive changes to the initial development plans have been made as a result of consultation with state and federal agencies and tribes. On-going planning has attempted to identify and avoid and/or minimize impacts to marine resources, particularly Cherry Point herring, associated with construction and operation of the wharf.

The result of this effort is a proposed alternative alignment of the wharf that potentially minimizes disturbance to herring spawning at Cherry Point (Figure 3—Alternative Wharf Alignment). Note that the access trestle for this alignment would remain in the same location as in the permitted alignment, while the trestle would be approximately 100 feet longer and the wharf the same length but shifted to the southeast relative to the trestle.

1.1.2 Study Area Definition

The study area for this marine study was defined by the need to understand existing marine conditions in both the permitted wharf alignment and a similarly sized area that includes the alternative alignment (Figure 4—Study Area). Information collected in the study area will allow comparisons of the potential effects for the two alternatives. The study area also includes two reference areas that will be used to bench-mark any changes and evaluate potential post-construction effects of the project.

The study area covers approximately 76 acres and includes depths from mean lower low water to –125 MLLW (referenced to mean lower low water (MLLW = 0 feet)). The study area includes intertidal and subtidal as well as nearshore habitat conditions.



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CLIENT: PACIFIC INTERNATIONAL TERMINALS, INC.

AMEC Earth & Environmental
11810 North Creek Parkway N
Bothell, WA 98011

amec

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PROJECT: MARINE BIOTA BASELINE MONITORING PLAN

TITLE: ALTERNATIVE ALIGNMENT

DATE:	MAY 2011
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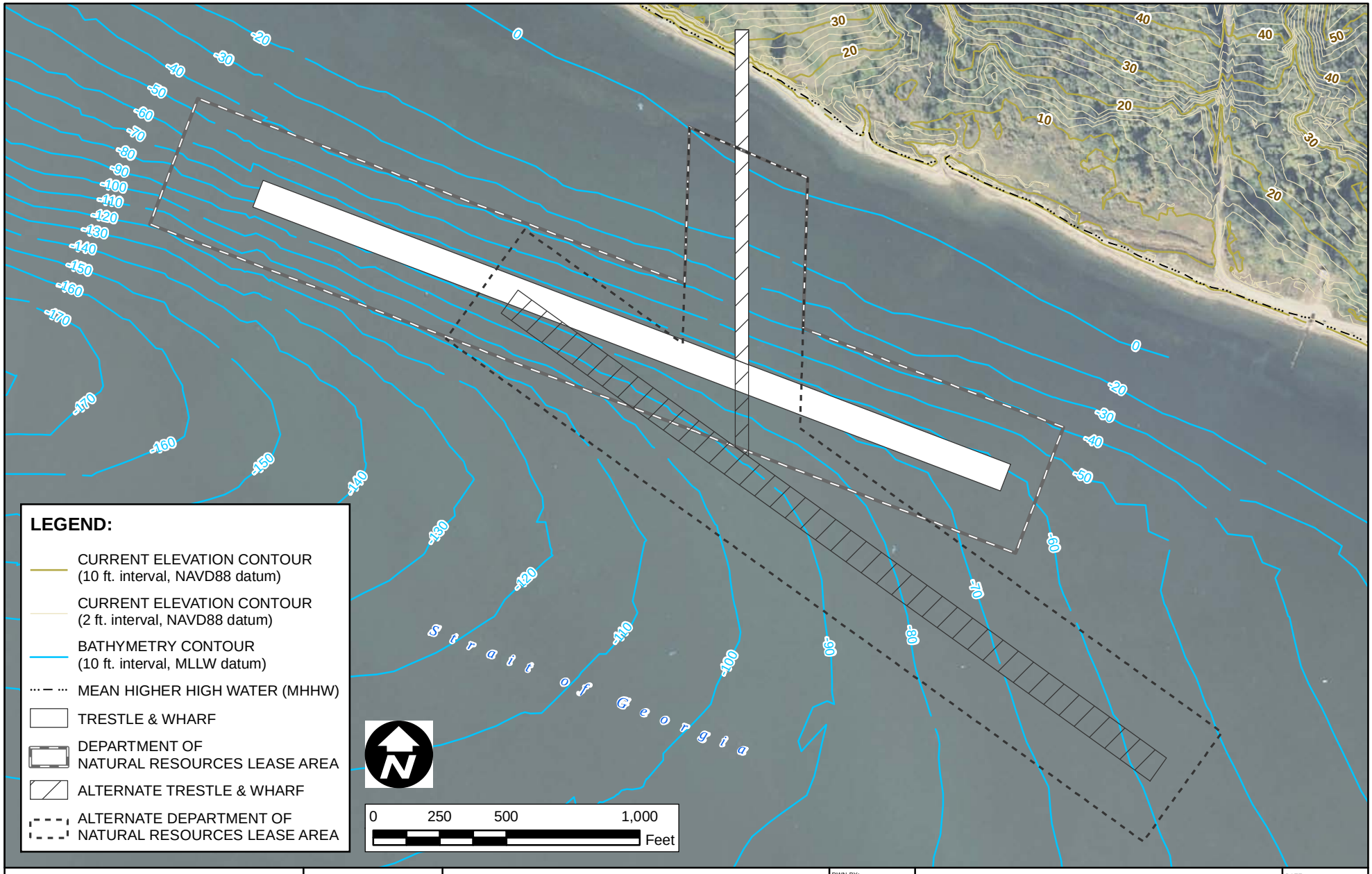

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Pacific International Terminals.

CLIENT: PACIFIC INTERNATIONAL TERMINALS, INC.

AMEC Earth & Environmental
11810 North Creek Parkway N
Bothell, WA 98011

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PROJECT: MARINE BIOTA BASELINE MONITORING PLAN

TITLE: STUDY AREA

DATE:	MAY 2011
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Previous marine biology studies conducted in the study area, and included as an appendix to the 1996 SEPA Environmental Impact Statement include the following:

- Cherry Point Natural Resources Baseline Studies: Macroalgae and Eelgrass Investigation (Shapiro and Associates, 1996)
- Beach Processes at Cherry Point, Washington State (Westmar Consultants, 1996)
- Fisheries and Marine Resource Analyses, including a model to predict effects of shading (Shapiro and Associates, 1996)

In addition, a hardshell clam inventory was conducted in 1997 (Hard Shell Clam Inventory of the Gateway Pacific Terminal Site, Shapiro and Associates, 1997).

2.0 MARINE BIOLOGY BASELINE INVESTIGATION METHODS

As outlined in Table 1, the components of this study include submerged marine vegetation (including macroalgae and eelgrass) surveys, geoduck survey, essential fish habitat and rockfish habitat characterization, and benthic and epibenthic invertebrate organism inventory.

In general, baseline investigations will be conducted using a two-tiered approach, coupling qualitative underwater video survey with subsequent quantitative investigations. The video survey offers the advantage of efficiently covering large areas and provides an archival data source. The video survey will be used to map the study area and to identify specific areas for subsequent quantitative surveys. Benthic invertebrates will be collected in conjunction with a sediment characterization analysis. The following section provides a description of how the video survey will be conducted, how subsequent quantitative surveys will be designed using the video surveys, and how the data will be used.

2.1 SUBMERGED MARINE VEGETATION STUDY DESIGN

An underwater video survey of the study area will be conducted in June 2011 to identify and map the locations of submerged marine vegetation (e.g., eelgrass (*Zostera marina)* and macroalgae) in the study area. The information collected during the video survey will be used to create maps of submerged aquatic vegetation and other habitat types. Divers, using the maps, will then conduct quantitative surveys of the submerged aquatic vegetation according to WDFW's *Eelgrass/Macroalgae Habitat Interim Survey Guidelines* (WDFW 2008), as described later in this section.

2.1.1 Field Investigation Methods

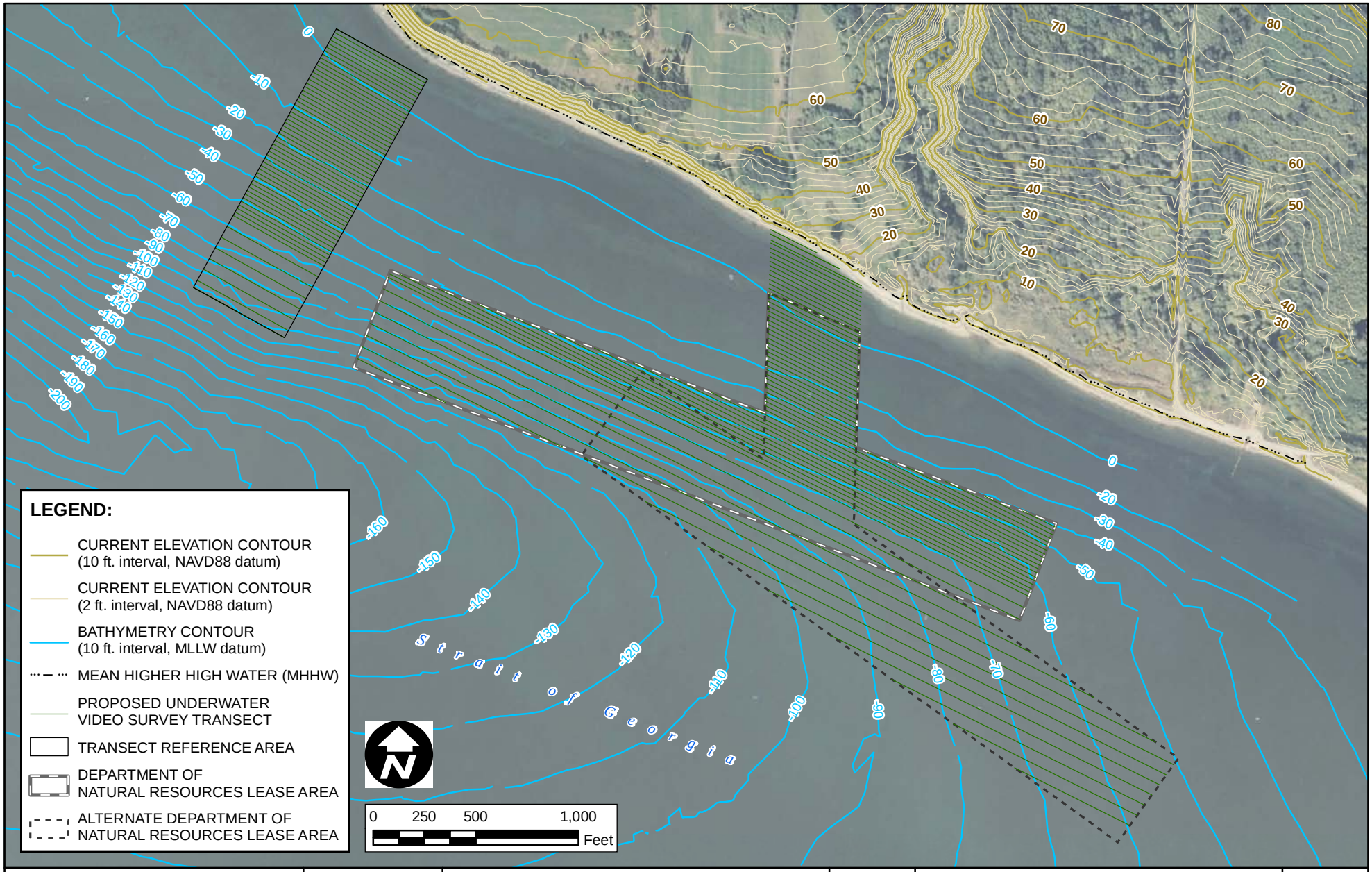
2.1.1.1 Qualitative Survey

The video survey will occur by filming along pre-determined sample transects extending through the study area. Figure 5 shows the proposed location of the transects. The transects will roughly parallel the shoreline and will be spaced at 20-foot intervals out to a depth of approximately -60 feet MLLW or until marine macrophytes are no longer encountered. Eelgrass species (*Z. marina* and *Z. japonica*), if they occur in the study area, are not expected to occur below -25 feet MLLW because of light limitations beyond that depth. Below -25 feet MLLW other marine macrophyte species are likely to occur, for example bull kelp (*Nereocysis luetkeana*). At any locations where three consecutive 20-foot transects detect no macrophytes, the distance between transects will be increased to 60 feet to cover the extent of the study area.

The proposed coordinates for the transects will be entered into a differential global positioning system (DGPS), allowing the survey vessel to track the transects. The actual transects surveyed by the vessel will also be recorded to the DGPS allowing later mapping of the actual transect lines. It is assumed that the actual transect lines may deviate from the proposed transect lines by up to 15 feet due to environmental conditions (wind, current, etc.).

Underwater video will be collected with an Outland Technology, Inc., UWC-325, very-low-light, underwater color camera integrated with a DGPS and an onboard personal computer. The underwater video will be recorded digitally, directly to the computer's hard drive to create a permanent record of the survey and to allow later analysis of the recordings. The integrated DGPS/videography system allows the latitude/longitude coordinates and time stamp to be superimposed onto video frames. The DGPS position is updated every second. A depth sounder integrated with a GPS will simultaneously record depth (feet), time, and position during the video surveys. The depth data will be downloaded later and referenced to MLLW.

The camera will be lowered into the water column until a clear view of the bottom is achieved, then the vessel will progress slowly along each transect. Generally, the camera is suspended 3 to 6 feet above the bottom, depending on visibility and light conditions. A scientist will monitor the video screen throughout the entire video survey, controlling camera depth to insure a relatively constant distance above the substrate and preventing the camera from striking the bottom or other objects.



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Pacific International Terminals.

CLIENT: PACIFIC INTERNATIONAL TERMINALS, INC.

AMEC Earth & Environmental
11810 North Creek Parkway N
Bothell, WA 98011

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SCALE:	1 inch = 650 feet

PROJECT: MARINE BIOTA BASELINE MONITORING PLAN

TITLE: UNDERWATER VIDEO SURVEY TRANSECT LOCATIONS

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2.1.1.2 Quantitative Survey

2.1.1.2.1. Eelgrass

Quantitative characterization of eelgrass beds identified during the video survey will be conducted by scuba divers experienced in conducting eelgrass shoot density surveys. Sampling will occur at 0.25 sq meter quadrats along pre-established transects. Sampling quadrats will be identified using stratified random sampling at intervals along each transect, as outlined in WDFW's *Eelgrass/Macroalgae Habitat Interim Survey Guidelines* (2008). The number of sampling stations along each transect will be developed using WDFW's Sample Size Calculator.

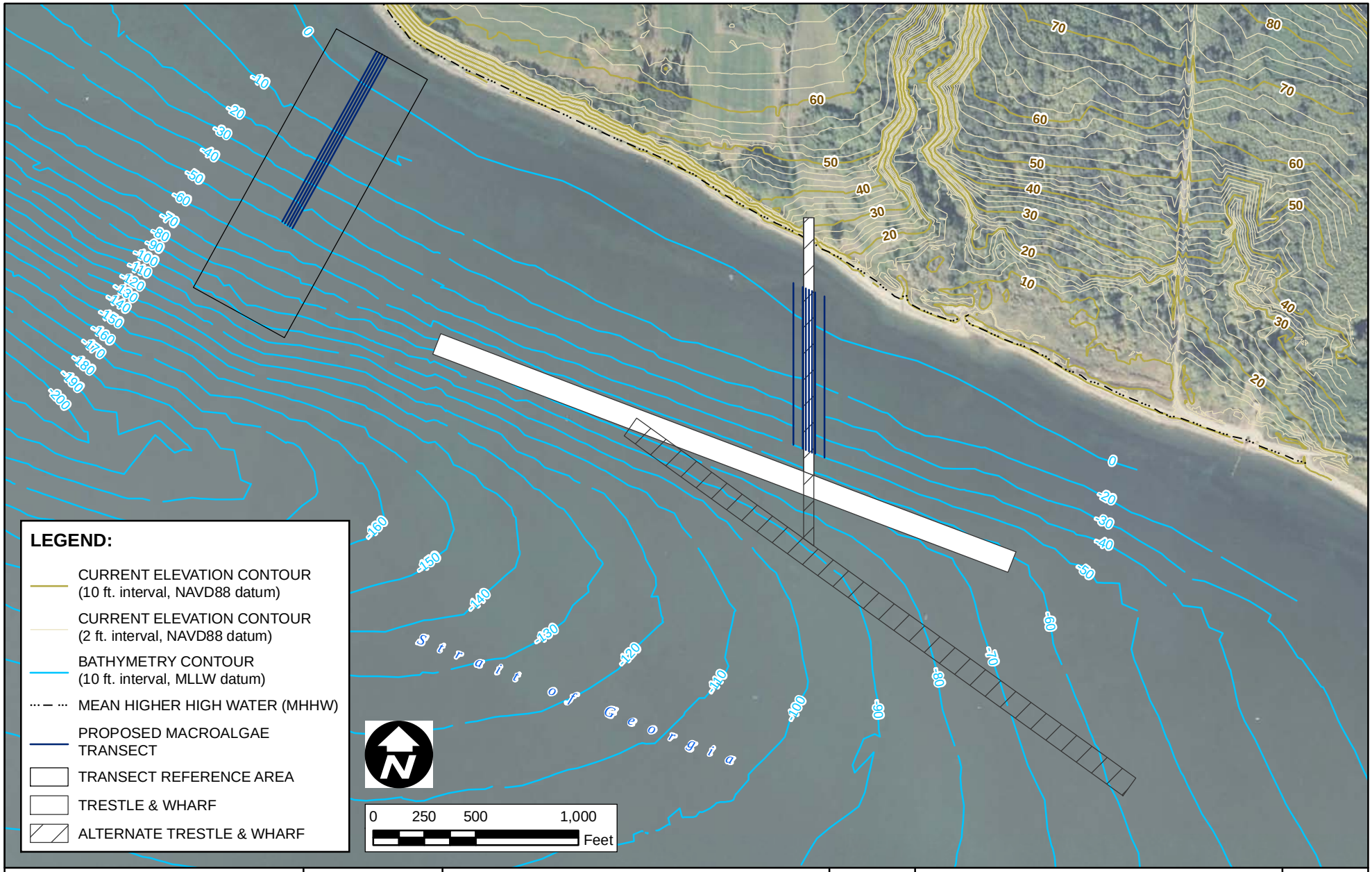
At each sampling station, a 0.25 sq meter quadrat frame made of polyvinyl chloride pipe will be placed by the diver to define the area for sampling. Divers will determine species and record the number of shoots within each sampling station. Divers will also determine the lengths of transects and position of sampling stations using a measuring tape along each transect. The transect endpoints will be delineated using a DGPS.

2.1.1.2.2. Macroalgae

The Settlement Agreement prescribes specific methods for evaluating macroalgae communities; however, since the time of the Settlement Agreement, WDFW has developed more rigorous statistical methods for describing macrophyte communities. As a result, the quantitative methods (number of samples) proposed herein correspond with the more recent WDFW protocol (WDFW 2008), while the layout of the transects within the study area is based on the Settlement Agreement.

Assuming that a macroalgae bed is present within the study area, per the 2008 WDFW protocol, an initial quantitative survey will be conducted to characterize a minimum of 30 samples. The initial sampling will be conducted along a transect that corresponds with the centerline of the proposed trestle. Sampling stations will be spaced at 20-foot intervals, beginning at MLLW, and will continue perpendicular to shore along the transect until macroalgae is no longer apparent and the substrate becomes consistently sand or mud (anticipated to be approximately -30 feet MLLW based on previous observations).

At each sampling point, macroalgae species will be identified to genus, with the exception of kelp species which will be identified to the species level. Holdfast counts for each kelp species encountered and a description of substrate within the 0.25-square quadrat will be recorded. For red and green alga species, percent cover will be recorded. If additional samples are needed to reach the 30-sample minimum the same procedure will be followed for additional transects (Figure 6) as



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CLIENT: PACIFIC INTERNATIONAL TERMINALS, INC.

AMEC Earth & Environmental
11810 North Creek Parkway N
Bothell, WA 98011

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PROJECT: MARINE BIOTA BASELINE MONITORING PLAN

TITLE: MACROALGAE TRANSECT LOCATIONS

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necessary. Using the initial data (30 samples), mean density of kelp holdfasts will be calculated, as well as a sample variance. The statistical design will be based on kelp species only, as green algae (particularly *Ulva*) and red algae are generally evaluated as percent cover.

Using the WDFW Microsoft Excel spreadsheet "Sample Size Calculator," the number of samples needed to characterize the macroalgae (kelp) bed will be calculated. The number of samples required will be evenly distributed along each of the seven transects approximately as shown in Figure 6. The same type of information collected during the initial 30 samples will be collected during the complete survey.

A similar exercise will be conducted at five transects perpendicular to shore, spaced 15-feet apart, at the reference area.

2.1.2 Data Analysis

The video survey results will be reviewed in the office and data recorded. Data will be recorded for each transect noting macrophyte types and position (i.e., GPS coordinates) along each transect, as well as substrate type (e.g., boulder, cobble, or sand). This information will be used to generate polygons in GIS to generate a map of the study area that designates locations of macrophyte beds, their areal coverage, and substrate type.

Results from the quantitative surveys will be analyzed statistically to identify differences (species composition, distribution, and density) between the reference site and study area, and the data will be archived to be used as a baseline for comparison with future monitoring studies.

2.2 ESSENTIAL FISH HABITAT

The objective of this component is to evaluate benthic substrate and bathymetry to assess the potential for the study area to provide Essential Fish Habitat. This will also provide information to evaluate habitat suitability for the juvenile life-history stage of the Endangered Species Act (ESA)-protected species of Puget Sound rockfish.

Essential Fish Habitat is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (Magnuson-Stevens Act). Within the study area, there are potentially three Essential Fish Habitats, including that for groundfish, coastal pelagic species, and Pacific salmon. The Pacific Coast Groundfish Fishery Management Plan (Pacific Fishery Management Council, last amended September 2010) includes seven specific habitat assemblages (estuarine, rocky shelf, non-rocky shelf, canyon, continental slope/basin, neritic zone, and the oceanic zone). This investigation will determine the presence and distribution of these habitat assemblages within the study area.

In addition, three species of rockfish (yelloweye, canary, and bocaccio) in Puget Sound are protected under the ESA. These species are found most commonly at depths between 160 and 820 feet (50 to 250 meters), but may be found as deep as 1,560 feet (475 meters) (NMFS 2005). Adults generally move into deeper water as they increase in size and age, but usually exhibit strong site fidelity to rocky bottoms and outcrops. Juveniles and subadults may be more common than adults in shallower water, and are associated with rocky reefs, kelp canopies, and artificial structures, such as marine wharfs, piers, and oil platforms (NMFS 2005). In the inland waters of Puget Sound and British Columbia, adult rockfish communities have been divided into categories based on their preferred depth range: intertidal; nearshore (subtidal to about 100 feet); shallow shelf (100 to 300 feet); deep shelf (330 to 660 feet); and slope (> 660 feet) (Love et al. 2002). The focus of this investigation is on potential nearshore habitat for rockfish.

Water depths within the study area extend from the intertidal to approximately -110 MLLW. Therefore, other species of rockfish, protected under the Magnuson-Stevens Act through Essential Fish Habitat that may occur in the study area are those for whom suitable habitat occurs in the intertidal and nearshore depth zones. These species include the following (Love et al. 2002):

- Black rockfish;
- Brown rockfish;
- Cooper rockfish;
- Puget Sound Quillback rockfish; and
- Yellowtail rockfish.

Various methods have been used to quantify rockfish abundance in Puget Sound. These include diver surveys (e.g., Carpenter and Shull 2011); remotely operated vehicle surveys (e.g., Grove and Shull 2008; Carpenter and Shull 2011) and video surveys (e.g., Pacunski and Palsson 2001). When methods have been compared over the same depth range, there is high variability between the abundance estimates by the different methods.

For this reason, for the baseline survey we propose to characterize the habitat quality for rockfish within the study area, rather than trying to quantify fish abundance. Measures of habitat quality are variable among monitoring events and studies have shown a good correlation between bottom topography, substrate, and other physical features and rockfish abundance over meso-scale areas (Pacunski and Palsson 2001).

2.2.1 Field Investigation Methods

Subsurface characteristics will be mapped during June 2011 along transects using the underwater video system described in Section 2.1.1. Habitat variables are used to classify substrate characteristics.

2.2.2 Data Analysis

The video for each transect will be analyzed and each substrate variable will be assigned a numeric score along the transects. The habitat scoring will be mapped within the study area and high quality rockfish habitat (rock substrate, wall/high vertical relief, and high complexity) and moderate habitat quality (rock, low vertical relief, moderate to high complexity) could be verified by diver surveys to obtain an accurate estimate of the area of these features, if located during the field investigation.

Following this step, contours (polygons) would be developed for each numeric score using a geospatial program (such as Global Mapper, Surfer, AutoCad, or GIS). Polygons would be developed for each of the habitat variable types used by WDFW for conducting bottom fish video surveys (Table 2).

Following video processing, the three categories of habitat variables (substrate, relief, and complexity) observed along each transect will be mapped in GIS using the transect GPS coordinates recorded for each habitat variable. Following this step, best professional judgment will be used to draw polygons around habitat variable between the individual transects. Tables will be prepared presenting the estimated area of different habitat variables within the study area.

Table 2 Habitat variables used in fish and wildlife bottom fish video surveys

Variable	Score	Description
Substrate	Rock	Hardpan (clay, sandstone), bedrock, boulder
	Coarse grain	Gravel, cobble, shell hash
	Fine grain	Sand, mud
Relief	None	Flat or rolling substrate with vertical relief up to 0.5 m
	Low	Vertical relief from 0.5 m to 2 m
	High	Vertical relief >2 m, slope <45 degrees
	Wall	Vertical relief >2 m, slope ≥45 degrees
Complexity	Simple	Smooth surfaces, no crevices
	Low	Some irregularity, few crevices (<25% of area)
	Medium	Moderate irregularity, ~20-50% of habitat with crevices
	High	Highly irregular, many crevices (>50% of area with crevices)

m meters

2.3 GEODUCK STUDY DESIGN

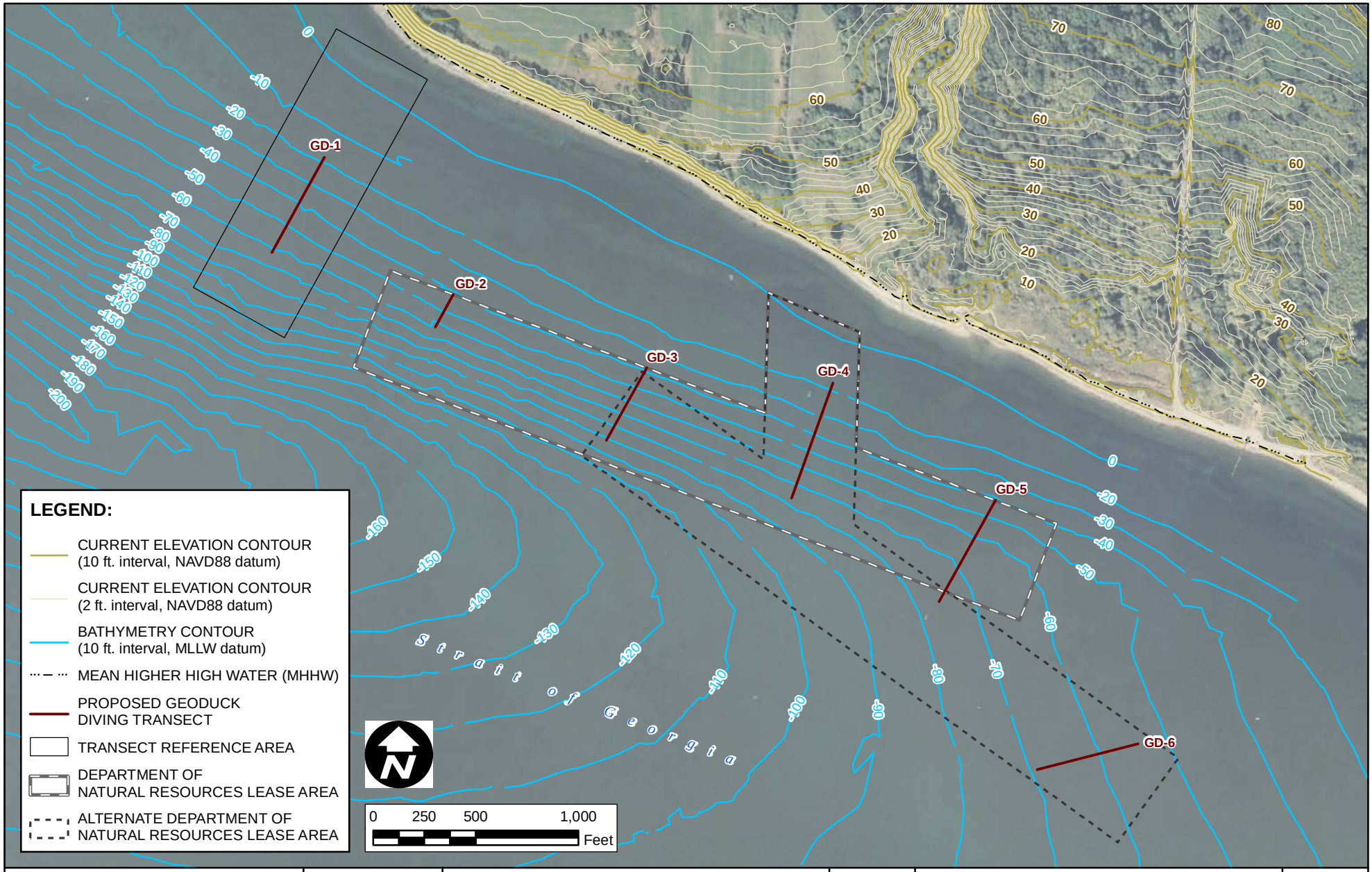
Geoduck (*Panopea abrupta)* abundance will be determined within the depth range of approximately -18 MLLW to -70 MLLW within the study area. The objective for this study is to obtain a baseline survey that can be used for comparing to future monitoring efforts.

2.3.1 Field Investigation Methods

A diving contractor certified will conduct the geoduck stock assessment survey according to WDFW protocols (Bradbury et al. 2000). Geoduck survey transects will be established within the study area and reference area (Figure 7—Geoduck Transect Locations) spaced 1,000 feet apart and perpendicular to shore. The transects will extend from a depth of -18 feet MLLW to a depth of -70 MLLW. Divers will count and map geoducks identified along each transect.

It is estimated that there will be approximately 6 transects within the study area—five transects in the potential study area and one transect within the reference area. The position of each transect will be recorded using DGPS.

To further quantify the number of geoducks within the study area, a “show plot” will be established (Bradbury et al. 2000). The show plot will be a transect that measures 150 feet long by 2 meters (6.56 feet) long that is staked out onsite. The show plot functions to provide a correction factor for geoduck counts conducted within the test transects. Divers conduct an initial survey of the show plot, counting and flagging geoducks. The show plot is then resurveyed each day throughout the duration of the geoduck survey, counting and flagging geoducks that were not counted during previous surveys. The final number of geoducks counted in the show plot is compared to the first day's count to determine a “show factor.” The show factor is applied to the survey counts in the test transects within the study and reference area to adjust for geoducks that may have been missed during the survey. As an extreme example, if 50 geoducks were counted and flagged on the first survey of the show plot, but the final show plot survey determined that there were actually 100 geoducks, then a “show factor” of two would be applied to the survey results from the test transects (Bradbury et al. 2000).



SOURCE: 143166-A400-50010-P3.dwg, Ausenco Sandwell, 04/08/2011.
154199-A100-42S01.dwg (Rev. J), Ausenco Sandwell, 12/24/2010.
2010-04-14-svTPXpiti0006-DEGROSS.dwg, David Evans & Associates, 07/20/2010.

DRAFT

Pacific International Terminals.

CLIENT: PACIFIC INTERNATIONAL TERMINALS, INC.

AMEC Earth & Environmental
11810 North Creek Parkway N
Bothell, WA 98011

amec

DWN BY:	SD
CHK'D BY:	MG
DATUM:	NAD83
PROJECTION:	WA SP North, Ft.
SCALE:	1 inch = 650 feet

PROJECT: MARINE BIOTA BASELINE MONITORING PLAN

TITLE: GEODUCK TRANSECT LOCATIONS

DATE:	MAY 2011
PROJECT NO.:	091515338C-09-01
REV. NO.:	-
FIGURE NO.:	7

K:\AMEC US OFFICES\KIRKLAND\15338-0\15338C\T-09-01 Study Plan & Field Investigation\dwg\Figure 7 - Geoduck Transect Locations.mxd

2.3.2 Data Analysis

Data provided by the diving contractor will be used calculate geoduck density in the study area.

2.4 BENTHIC AND EPIBENTHIC INVERTEBRATES

2.4.1 Field Investigation Methods

2.4.1.1 Benthic Invertebrates

Benthic invertebrate organisms live in sediments. Benthic invertebrates will be collected and characterized from sediment samples. The planned sampling locations are shown on Figure 8. In the field, sample stations will be located with a DGPS. Samples will be collected within 3 meters of the proposed sampling locations. If samples cannot be collected after two attempts, an alternative location may be selected. The actual sample locations will be recorded and logged.

A hand-core sediment sampler (20 centimeters diameter by 10 centimeters deep) will be used to collect the sediment samples at the shallowest water depth. Sediments at all other sampling location will be collected using a 0.1-square-meter stainless-steel Van Veen sediment grab sampler deployed from a sampling vessel.

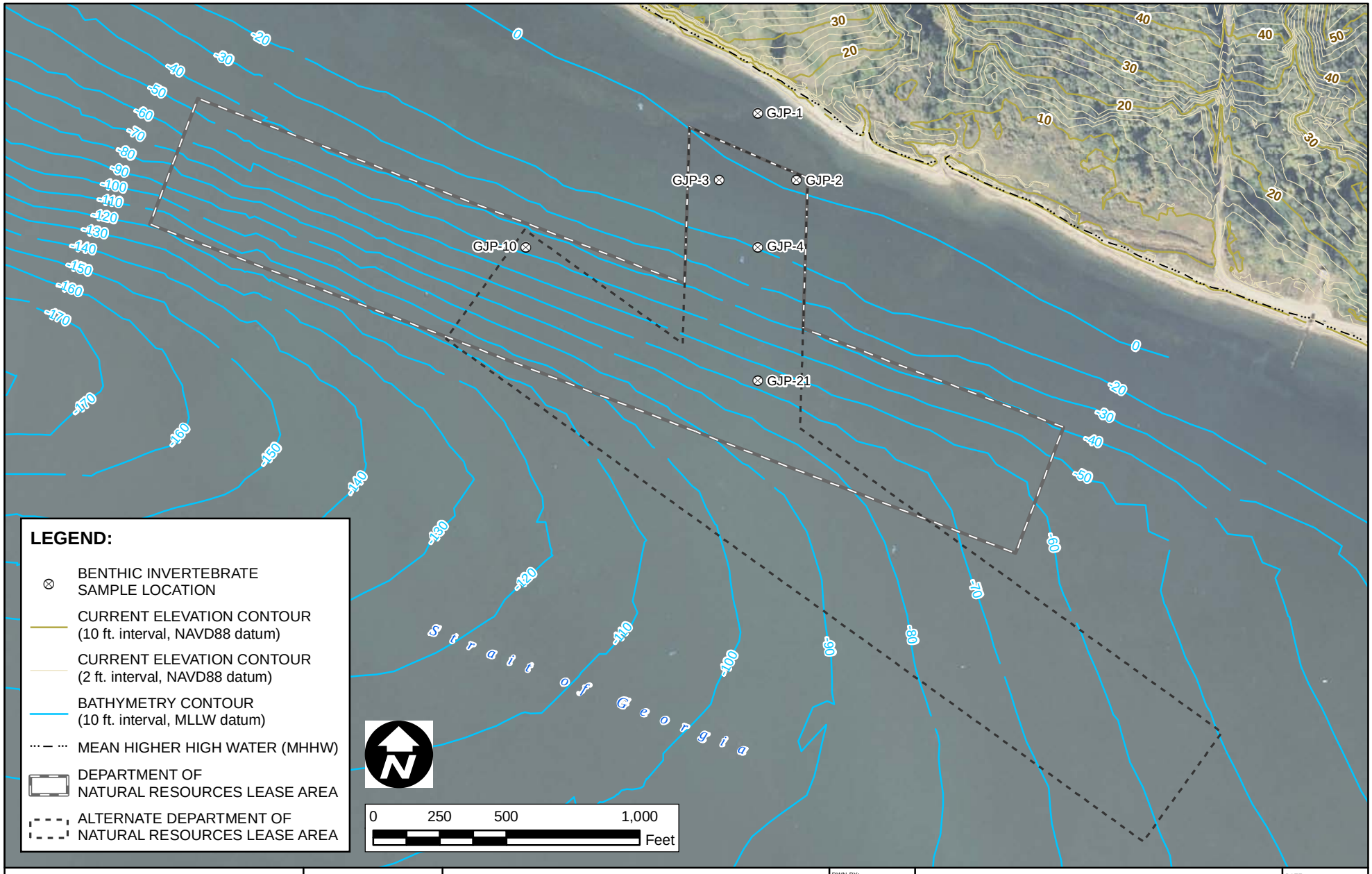
Five replicate samples will be collected at each station and processed according to standard Puget Sound protocols (TetraTech 1987). Each replicate sample will be sieved through 1,000 micrometer (µm) mesh, and organisms retained. Processed samples would be preserved in the field with a 10 percent aqueous solution of borax-buffered formalin. Taxonomic identification and quantification will be conducted by EcoAnalysts, a professional laboratory.

2.4.1.2 Epibenthic Invertebrates

Epibenthic invertebrate organisms live above the sediments on the seafloor. Presence of epibenthic invertebrates will be noted during the video survey and during quantitative macrophyte surveys.

2.4.2 Data Analysis

The video survey results will be reviewed, and data recorded to a spreadsheet. Data will be recorded for each transect noting epibenthic invertebrate types and position (i.e., GPS coordinates) along each transect, as well as substrate type (e.g., boulder, cobble, or sand). This information will be used to characterize the epibenthic community throughout the study area. Additionally, data provided during the quantitative diver surveys will be tabulated to characterize the epibenthic community relative to depth, to evaluate the reference area with respect to the study area, and to compare the two alternative alignments.



SOURCE: 143166-A400-50010-P3.dwg, Ausenco Sandwell, 04/08/2011.
154199-A100-42S01.dwg (Rev. J), Ausenco Sandwell, 12/24/2010.
2010-04-14-svTPXpiti0006-DEGROSS.dwg, David Evans & Associates, 07/20/2010.

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AMEC Earth & Environmental
11810 North Creek Parkway N
Bothell, WA 98011

amec

DWN BY:	SD
CHK'D BY:	MG
DATUM:	NAD83
PROJECTION:	WA SP North, Ft.
SCALE:	1 inch = 500 feet

PROJECT: MARINE BIOTA BASELINE MONITORING PLAN

TITLE: BENTHIC INVERTEBRATE SAMPLE LOCATIONS

DATE:	MAY 2011
PROJECT NO.:	091515338C-09-01
REV. NO.:	-
FIGURE NO.:	8

K:\AMEC US OFFICES\KIRKLAND\15338-0\15338C\T-09-01 Study Plan & Field Investigation\dwg\Figure 8 - Benthic Invertebrate Sample Locations.mxd

2.5 FORAGE FISH

2.5.1 Field Investigation Methods

Forage fish surveys will be conducted following standard WDFW protocols (Moulton and Penttila 2006). Suitable spawning areas in the study area will be investigated, where potential spawning areas are described as areas with a mixture of sand and small gravels, usually with fine shell fragments mixed in, from +7 to +9 feet MLLW. If suitable spawning areas are identified, samples will be collected at each potential spawning area. A single sample consists of four scoops of gravel evenly spaced along a 100-foot stretch of beach.

2.5.2 Data Analysis

Each forage fish sample will be condensed and final separation of any eggs from the sand will be performed using a dissecting microscope. Eggs will be counted by species (sand lance or surf smelt), and the counts entered into a lab data form. The eggs will then be archived for confirmation of species by WDFW biologists.

3.0 REPORTING

For this study, the data collected and analyzed will be consolidated into two reports: (1) Marine Biology Baseline Inventory: Submerged Marine Vegetation and Marine Invertebrates, and (2) Essential Fish Habitat Baseline Characterization Report. The Marine Biology Baseline Inventory report will include the results of the submerged marine vegetation investigation, the epibenthic and benthic invertebrate investigations, and the geoduck investigation. It will include statistical analyses characterizing the relative abundance of species, species distribution, and comparisons between the study area and control sites. The data will be used to make correlations between species distribution and abundance relative to habitat.

The Essential Fish Habitat Baseline Characterization Report will provide a description of habitat types identified in the study area. The report will be qualitative, and will include visual images captured from the underwater video system. It will also include maps of habitat assemblages. The report will focus on identifying habitats that may potentially be used by rockfish, and other Essential Fish Habitat species that may potentially occur in the nearshore.

Both reports will include the study methods and any deviations from the proposed protocol, results, and a discussion of the data. The discussion will likely include recommendations for further monitoring and statistical approaches for comparing data during future monitoring efforts.

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