ENVIRONMENTAL ASSESSMENT OF PROPOSED GEODUCK HARVEST ALONG THE NORTHERN SHORELINE OF BLAKE ISLAND AT THE BLAKE ISLAND NORTH GEODUCK TRACT (#08400)

Commercial geoduck harvest is jointly managed by the Washington Departments of Fish and Wildlife (WDFW) and Natural Resources (DNR) and is coordinated with treaty tribes through harvest management plans. Harvest is conducted by divers from subtidal beds between the -18 foot and -70 foot water depth contours (corrected to mean lower low water, hereafter MLLW). Harvest is rotated throughout Puget Sound in five geoduck management regions. The fishery, its management, and its environmental impacts are presented in the Puget Sound Commercial Geoduck Fishery Management Plan (DNR & WDFW, 2008) and the Final Supplemental Environmental Impact Statement (WDFW & DNR, 2001). The proposed continued harvest along the northern shoreline of Blake Island is described below.

Proposed Harvest Year(s): 2022- 2023

Tract name: Blake Island North geoduck tract (Tract #08400)

Description: (Figure 1, Tract vicinity map)

The surveyed area of the Blake Island North geoduck tract is a subtidal area of approximately 146 acres (Table 1) along the northern shoreline of Blake Island in the Central Puget Sound Geoduck Management Region. The Blake Island North tract is northeast of the West Blake Island geoduck tract (#08550), and is northwest of the East Blake Island geoduck tract (#08500). This description includes the Washington Department of Health (DOH) “Approved” and “Conditionally Approved” areas. The Blake Island North tract is bounded by a line projected northwesterly from a point on the -22 foot (MLLW) water depth contour in the southwest portion of the tract at 47°32.892’ N. latitude, 122°30.241’ W. longitude (CP 1) to a point on the -70 foot (MLLW) water depth contour at 47°32.904’ N. latitude, 122°30.355’ W. longitude (CP 2); then easterly along the -70 foot (MLLW) water depth contour to a point at 47°33.066’ N. latitude, 122°29.395’ W. longitude (CP 3); then continuing easterly along the -70 foot (MLLW) water depth contour to a point at 47°32.880’ N. latitude, 122°28.969’ W. longitude (CP 4); then southwesterly to a point ¼ mile seaward of the extreme low water mark at 47°32.772’ N. latitude, 122°29.071’ W. longitude (CP 5); then westerly along the -22 foot (MLLW) water depth contour (or ¼ mile seaward of extreme low water mark, whichever is farther from shore) to a point at 47°32.916’ N. latitude, 122°29.485’ W. longitude (CP 6); then continuing westerly along the -22 foot (MLLW) depth contour to the point of origin (Figure 2).

This estimate of the tract boundary was made using GIS, and the WDFW 1996 and 1997 geoduck survey data. All contours are corrected to MLLW. Contour GIS layers from

Dale Gombert (WDFW) were generated from NOAA soundings. Shoreline data was from DNR, digitized at 1:24000 scale in 1999. The -70 foot (MLLW) water depth contour was used for the deep-water boundary, and the -22 foot (MLLW) contour, due to the presence of eelgrass observed at -20 feet (MLLW), and the marine park boundary (¼ mile seaward of the extreme low water mark on Blake Island) were used as the shallow-water boundaries. No herring spawning habitat was found to be in the vicinity of this tract. The latitude and longitude positions are reported WGS84 datum, degrees, decimal minutes. Corner latitude and longitude positions were generated using GIS, and have not been field verified to determine consistency with area estimates, landmark alignments, or water depth contours.

The delineation of the tract boundary will be field verified by DNR prior to any geoduck harvest. Any variance to the stated boundary will be coordinated between WDFW and DNR prior to geoduck harvest.

Substrate:

Geoducks are found in a wide variety of sediments ranging from soft mud to gravel. The most common sediments where geoducks are harvested are sand with varying amounts of mud and/or gravel. The specific sediment type of a bed is primarily determined by water current velocity. Coarse sediments are generally found in areas of fast currents and finer (muddier) sediments in areas of weak currents. The major impact of harvest will be the creation of small holes where the geoducks are removed. The holes fill in within a few days to several weeks and have no long-term effects. The substrate holes refill in areas with strong water currents much faster than in areas with weak water currents. Water currents tend to be moderate and variable in the vicinity of the Blake Island North tract. Currents reach a maximum flood velocity of 0.4 knots and maximum ebb velocity of 1.3 knots (Tides and Currents software; station #1691; Rich Passage, Approach, north of Blake Island).

The surface substrates within this tract are highly variable, with sand and mixtures of sand and mud predominant. Sand is the predominant substrate type on 34 transects and mud is predominant on 8 transects (total transects = 60). Gravel is the predominant substrate type on 5 transects, boulders are present on 18 transects, and cobble is present on 6 transects. The cobble and boulder substrate types tend to be located in the central portion of the “Approved” area within the tract (transect #s 10-17 of the 1997 survey, Figure 3).

Water Quality:

Water quality is good in the vicinity of Blake Island. Water mixing at this tract is affected by a convergence of currents from Colvos and Rich Passages, and the central basin of Puget Sound, which prevents stratification (water layering) and brings deeper nutrient-rich waters to the surface. As a result, the marine waters in this area are well oxygenated and productive. The following data on water quality have been provided from the Washington Department of Ecology (DOE) web site for the Elliot Bay station (ELB 015) at 47.5967° N. latitude; 122.3683° W. longitude. For 2017 (most recently completed data year available), at water depths between 18 and 70 feet, the mean reported dissolved oxygen concentration was 8.1 mg/l with a range from 5.9 mg/l to 12.9 mg/l. The mean salinity at this station in 2017 was 29.1 parts per thousand (ppt) with a range from 26.5 ppt to 30.2 ppt. The mean water temperature at this station in 2017 was 51.8° F with a range from 46.5° F to 58.1° F.

This geoduck tract status has been reviewed by the Washington Department of Health. The western portion of the tract (approximately 109 acres) has been classified as "approved", while the eastern portion of the tract (approximately 37 acres) has been classified as "conditionally approved" and is <u>closed for harvest from May 1 through September 30 each year</u> due to high vessel traffic in the vicinity of the mooring buoys located nearby.

Biota:

Geoduck:

The Blake Island North geoduck tract is approximately 146 acres. The abundance of geoducks on this tract is low, with a current estimated average density of 0.05 geoducks/sq.ft. This tract currently contains an estimated 509,622 pounds of geoducks (Table 1). On all 7 dig stations, geoducks are considered commercial quality (Table 2). Digging difficulty ranged from "easy" to "moderately difficult" to dig (1996 survey). The factors which influenced "moderately difficult" rating (dig station #47, 1996 survey) included a gravel layer, shell layer, and only moderate abundance.

The average density range from the 1996/1997 surveys is 0.00 geoducks/sq.ft. at station #15 (1997) and 0.78 geoducks/sq.ft. at station #45 (1996; Table 3). The geoducks at the Blake Island North tract are moderate for Puget Sound, averaging 1.72 pounds, while the average geoduck in Puget Sound is 2.1 pounds. The lowest average whole weight is 2.04 pounds per geoduck at dig stations #7 (1997 survey) and the highest average whole weight is 2.69 pounds per geoduck at dig station #3 (1996 survey; Table 4). Station locations, and geoduck counts corrected with siphon "show factor", are listed in Table 5.

The Blake Island North geoduck tract was first surveyed in 1970 by WDFW as two tracts. The tracts were fished in 1976-77 and about 140,000 pounds were harvested. The tract was surveyed again in 1978 by WDFW. A third survey of 146 acres (47 transects in 1996 and 22 transects in 1997) done by WDFW was used in this environmental assessment (EA). Only transects and dig stations seaward of the Blake Island Marine Park and the -22 foot (MLLW) water depth contour are used in this EA.

Geoducks are managed for long term sustainable harvest. No more than 2.7% of the fishable stocks are harvested (total fishing mortality) each year in each management region throughout Puget Sound. The fishable portion of the total Puget Sound population includes geoducks that are found in water deeper than -18 feet and shallower than -70 feet (corrected to mean lower low water - MLLW). Other geoducks which are not harvestable are found inshore and offshore of the harvest areas. Observations in south Puget Sound show that major geoduck populations continue to depths of 360 feet. Additional geoducks exist in polluted areas and are also unavailable for harvest, but continue to spawn and contribute to the total population.

The low rate of harvest is due to geoduck's low rate of natural recruitment. WDFW has studied the regeneration rate of geoducks on certain tracts throughout Puget Sound. The estimated average time to regenerate a tract to its original density, after removal of 65 percent of the geoducks, is 55 years. The recovery time for the Blake Island North tract is unknown. The research to empirically analyze tract recovery rates is continuing.

Fish:

Geoduck beds are generally devoid of rocky outcroppings and other relief features that attract and support many fish species, such as rockfish and lingcod. On geoduck tracts, the bathymetry is typically relatively flat and the substrate is typically composed of soft sediments, which provide few attachments for macroalgae associated with rockfish and lingcod. The fish observed during the survey at the Blake Island North tract (Table 6) were various flatfish; sculpins; dogfish shark; ratfish and ratfish egg cases; and skate egg cases.

WDFW marine fish managers were asked of their concerns of any possible impacts on marine fish that geoduck harvest would have. Greg Bargmann of WDFW stated that geoduck fishing would have no long-term detrimental impacts and may have some short term benefits to flatfish populations by increasing the availability of food. Dan Penttila of the WDFW Fish Management Program recommended that eelgrass beds within the harvest tract should be preserved for any spawning herring. Eelgrass has been observed along this tract to a maximum depth of -20 ft. (MLLW) during an August 7, 1996 eelgrass survey. The nearshore tract boundary will be along the -22 ft. (MLLW) water depth contour or deeper to provide a vertical buffer between eelgrass beds and geoduck harvest.

There are no identified Pacific herring spawning grounds along the northern shoreline of Blake Island (2008 Washington State Baitfish Stock Status Report). A prespawner holding area is located westerly of Blake Island in the vicinity of Manchester and Yukon Harbor. Surf smelt spawning has been identified in the vicinity of Manchester, but not along the Blake Island North tract. Surf smelt deposit adhesive, semitransparent eggs on beaches that have a specific mixture of coarse sand and pea gravel. Inside Puget Sound, surf smelt spawning is thought to be associated with freshwater seepage, where the water keeps the spawning gravel moist. Eggs are deposited near the water's edge in water a few inches deep, around the time of the high water slack. There is substantial vertical separation between surf smelt spawning (slack high tide) and water depths of proposed geoduck harvest activity on this tract (-22 ft. to -70 ft., MLLW).

Pacific sand lance spawning has been identified along the northwestern shoreline of Blake Island. The sand lance is a common but poorly understood nearshore schooling fish in Washington waters. The abundance and broad distribution of planktonic sand lance larvae throughout the bays and inlets of Puget Sound in late winter suggested that their spawning habitats and spawning activity are widespread in the region. Since 1991, WDFWs Forage Fish Unit has undertaken a systematic intertidal beach substrate sampling strategy along a significant proportion of the shoreline of the Puget Sound basin. Sand lances were first found to have deposited spawn in the upper intertidal zone in 1989 by WDFW investigators. Sand lance deposit eggs on a rather broad range of beach surface substrates, from soft, pure fine sand beaches to beaches armored with gravel up to 3 cm in diameter, although most spawning appears to occur on the finer grained substrates.

Sand lance eggs acquire a partial coat of sand grains which adhere during deposition. The sand coating may serve to assist in capillary moisture retention when the eggs are exposed during the low tide. The coated sand lance eggs are dispersed along the beach with each tide exchange. Fresh, intact sand lance spawn deposits commonly consist of small (less than 10 cm in diameter) patches of eggs, either resting in the bottom of shallow pits in the beach or scattered irregularly over a broad zone of disrupted beach surface. Such features suggest a certain degree of vigor in the sand lance mass spawning act. Spawning occurs at tidal elevations ranging from +5 feet to about the mean higher high water line. After deposition, sand lance eggs may be scattered over a wider range of the intertidal zone by wave action.

The incubation period is about four weeks. Upon hatching, larval sand lance measure about 5 mm, and are virtually transparent. Like other forage fish, larvae and juvenile sand lance are subject to predation. As larvae they are at the mercy of the local currents and tides until they are about 22 mm in length. They then "school up", adopt their adult coloration and can be found in bays and inlets throughout Puget Sound. Sand lances are somewhat unique in their generalized diurnal behavior pattern, feeding in the open water during the day and burrowing into the sand at night to avoid predation (source:

http://wdfw.wa.gov/fish/forage/lance.htm). There is substantial vertical separation between sand lance spawning (+5 ft. MLLW to mean higher high water) and proposed water depths of geoduck harvest activity on this tract (-22 ft. to -70 ft., MLLW). Geoduck harvest on the Blake Island North tract should have no detrimental impacts on Pacific herring, sand lance, or surf smelt spawning.

NOAA Fisheries Service announced on April 27, 2010 that it was listing canary and yellow eye rockfish as “threatened” and bocaccio as “endangered” under ESA (federal Endangered Species Act). The listings became effective on July 27, 2010. Historic high levels of fishing and water quality are cited as reasons that these rockfish populations are in peril and have been slow to recover. Geoduck fishery managers are tracking this process and will take actions necessary to reduce the risk of “take” of any listed rockfish species that could potentially result from geoduck harvest activity.

Two salmon populations, Puget Sound Chinook salmon and Hood Canal summer run chum salmon, were listed by the National Marine Fisheries Service on March 16, 1999 as threatened species under the federal Endangered Species Act. Critical habitat for summer run chum salmon populations include all marine, estuarine, and river reaches accessible to the listed chum salmon between Dungeness Bay and Hood Canal and within Hood Canal. The timing for summer run chum spawning is early September to mid-October. Out-migration of juveniles has been observed in Hood Canal during February and March, though out-migration may be as late as mid-April. The Blake Island North tract is outside of the critical habitat range for Hood Canal summer run chum salmon.

Critical habitat for Puget Sound Chinook salmon include all marine, estuarine and river reaches accessible to listed Chinook salmon in Puget Sound. WDFW recognizes 27 distinct stocks of Chinook salmon; 8 spring-run, 4 summer-run, and 15 summer/fall and fall-run stocks. The existence of an additional five spring-run stocks is in dispute. The majority of Puget Sound Chinook salmon emigrate to the ocean as sub-yearlings.

Major tributaries in the general vicinity of the Blake Island North geoduck tract, which support Chinook salmon runs, are the Duwamish Waterway/Green River basin and the Lake Washington basin (mouth at Shilshole Bay; with Cedar River, Issaquah Creek, and north Lake Washington tributaries and sub-basins). Three viable runs of Chinook salmon have been identified in the Duwamish Waterway/Green River basin. The status of the Spring run of Chinook salmon in the Duwamish Waterway/Green River basin is extinct. The status of the natural Summer/Fall run of Chinook salmon in the Duwamish Waterway/Green River basin is mixed native and non-native origin; a composite of wild, cultured, or unknown/unresolved production; and healthy with a 5-year geometric mean for total estimated escapement at 4,889 fish. The timing of the Duwamish River run is uncertain and has a 5-year geometric mean for total estimated escapement at 5,216 fish. The status of the Summer/Fall run in Newaukum Creek is mixed native and non-native origin; wild production; and healthy (NMFS, Appendix E, TM-35, Chinook Status Review).

The production of the Lake Washington Summer/Fall run of Chinook salmon is natural with a 5-year geometric mean for total estimated escapement at 557 fish. The status of the natural Cedar River Summer/Fall run of Chinook salmon is native origin; wild production; with a 5-year geometric mean for total estimated escapement at 377 fish. The status of the mixed Summer/Fall run of Chinook salmon in Issaquah Creek is non-native origin; a composite of wild, cultured, or unknown/unresolved production; and healthy. The status of the natural Summer/Fall run of Chinook salmon in the North Lake Washington tributaries is native origin; wild production; with a 5-year geometric mean for total estimated escapement at 145 fish (NMFS, Appendix E, TM-35, Chinook Status Review).

The geographic separation (horizontal) of this tract from known spawning tributaries and vertical separation of geoduck harvest (deeper and seaward of the -18 ft. MLLW contour) from juvenile salmon rearing areas and migration corridors (upper few meters of the water column) reduces or eliminates potential impacts to salmon populations. Charles Simenstad of the University of Washington School of Fisheries stated that the exclusionary principle of not allowing leasing/harvesting in water shallower than -18 ft. MLLW, the 2+ ft. vertically from elevation of the lower eelgrass margin, and within any regions of documented herring or forage fish spawning should under most conditions remove the influences of harvest induced sediment plumes from migrating salmon. Geoduck harvest should have no impact on salmon populations.

On May 7, 2007, NOAA Fisheries Service announced listing of Puget Sound steelhead as “threatened” under ESA. This listing includes more than 50 stocks of summer- and winter-run steelhead. Steelhead share many of the same waters as Puget Sound Chinook salmon, which are already protected by ESA, and will benefit from shared conservation strategies. There are no identified streams or rivers in the vicinity of the northern shoreline of Blake Island that support steelhead stocks. The horizontal separation between tributaries that support steelhead runs and the Blake Island North tract will assure that geoduck harvest will likely have no impact on steelhead populations.

Green sturgeon have undergone ESA review in recent years, due to depressed populations. NOAA Fisheries Service produced an updated status review on February 22, 2005 and reaffirmed that the northern green sturgeon Distinct Population Segment (DPS) warranted listing as a Species of Concern, however proposed that the Southern DPS should be listed as Threatened under the ESA. NMFS published a final rule on April 7, 2006 listing the Southern DPS as threatened (71 FR 17757), which took effect June 6, 2006. The green sturgeon critical habitat proposed for designation includes the outer coast of Washington within 110 meters (m) depth (including Willapa Bay and Grays

Harbor) to Cape Flattery and the Strait of Juan de Fuca to its United States boundary. Puget Sound proper has been excluded from this critical habitat designation. The Blake Island North geoduck tract is outside of the critical habitat range of green sturgeon and geoduck harvest at this location will have no adverse effects on ESA recovery efforts for green sturgeon populations.

Invertebrates:

Marine invertebrates, which are frequently found on geoduck beds, were also observed on this tract. The most common and obvious of these include: [1] mollusks (geoducks, horse clams, Kennerly’s venus clam, truncated mya clams, false geoducks, heart cockles, horse mussels, piddocks, spiney scallops, unidentified hardshell clams, moon snails, moon snail egg cases, and nudibranchs); [2] echinoderms (false ochre stars, spiny stars, sunflower sea stars, sand stars, short-spined stars, vermillion stars, leather stars, sun stars, rose stars, green sea urchins, and sea cucumbers), [3] cnidarians (sea pens, sea whips, burrowing anemones, striped anemones, and plumed anemones); [4] arthropods (Dungeness crabs, red rock crabs, and graceful crabs); and [5] annelid worms (chaetopterid and terebellid worms). Geoduck harvest has not been shown to have long-term adverse effects on these invertebrates. Geoduck harvest can depress some local populations of benthic marine invertebrates, however most of these populations recover within one year.

WDFW and DNR have studied the effects of geoduck harvest on the population of Dungeness crab at Thorndyke Bay in Hood Canal. The results of 4.6 years of study have shown no adverse effects on crab populations due to geoduck fishing. Dungeness crab were observed on 2 out of 60 transects during the 1996/1997 biological surveys. Dungeness crab which are present on the tract may experience peak molt in mid-April, based on data from the Kingston area (Cain, 10/15/01).

To determine the potential impacts to Dungeness crab, the percentage of substrate disturbed during fishing was calculated and compared to the entire crab habitat within the tract and shoreward of the tract to the +1 ft. level and seaward out to -330 ft. (MLLW) water depth contour (Figure 5, Potential crab habitat map). Dr. Dave Armstrong at the University of Washington has determined that Dungeness crab utilize Puget Sound bottoms from the +1 ft. level out to the -330 ft. level. The entire crab habitat along this tract is approximately 899 acres. There were about 1,214,000 harvestable geoducks in the entire 146 acre tract, from the 1996/1997 pre-fishing survey estimate. With a harvest of 65 percent, the total number harvested would be about 789,100 geoducks. Approximately 1.18 square feet of substrate is disturbed for every geoduck harvested, so 789,1000 x 1.18 = 931,138 square feet of substrate. This equals about 21.38 acres. This is about 2.4 percent of the total available crab habitat in the vicinity of this tract. Based on low observations of Dungeness crab on this tract during the pre-fishing survey, the low amount of disturbance of potential crab habitat in the vicinity of the tract, and the lack of effects observed at the Thorndyke Bay study, we conclude that any effects on Dungeness crab will be very minor, if they occur at all.

Aquatic Algae:

Large attached aquatic algae are not generally found in geoduck beds in large quantities. Light restriction often limits algal growth to areas shallower than where most geoduck harvest occurs. Aquatic algae observed during the pre-fishing geoduck survey (Table 7) include:

> Laminarian algae, Desmarestia algae, Pterygophora algae, Ulva (sea lettuce), diatom layer, and other unspecified small algae.

John Boettner and Tim Flint, from the WDFW Habitat Division, have stated that as long as geoduck fishing was restricted seaward of the eelgrass beds they have no concerns about the fishing. This was confirmed by WDFW Habitat Division who stated that the existing conditions in the fishery SEIS are sufficient to protect fish and wildlife habitat and natural resources. Eelgrass has been observed along this tract to a maximum depth of -20 ft. (MLLW), during an August 7, 1996 eelgrass survey done by WDFW divers swimming the entire shoreward boundary of the tract. A 2 foot vertical buffer will be established between observed eelgrass and the shoreward boundary of this tract. Therefore, geoduck harvest will be no shallower than the -22 ft. water depth contour (MLLW) along this tract, which should provide sufficient buffer for any eelgrass beds in the vicinity of the tract.

Marine Mammals:

Several species of marine mammals, including seals, sea lions, and river otters may be observed in the vicinity of this geoduck tract. There have also been sporadic reports of gray whales feeding near Blake Island and rare reports of humpback whales near Blake Island. Killer whales may also be observed in the vicinity of this tract, particularly between November to March. The Southern Resident stock of killer whales resides mainly in the San Juan Islands throughout spring and summer, but incursions south into Puget Sound occur more frequently during winter months (Brent Norberg, NOAA, pers. comm. 5/15/06). The Southern Resident stock of killer whales was listed as "endangered" under the federal Endangered Species Act (ESA) by the National Marine Fisheries Service on November 15, 2005. This is in addition to the designation of this stock in May 2003 as "depleted" under the Marine Mammal Protection Act. More information and a draft conservation plan for this stock can be found at the NOAA website (http://www.nwr.noaa.gov/Marine-Mammals/Whales-Dolphins-Porpoise/Killer-Whales/ESA-Act-Status/Listing-Final.cfm). Hand pick shellfish fisheries, like geoduck harvesting, are considered Category III under the Marine Mammal Authorization Program for Commercial Fisheries. This means that there is a “rare or remote” likelihood of marine mammal “take,” (Brent Norberg, NOAA, pers. comm. 5/15/06). Precautions should be taken by commercial divers, when marine mammals are in the area, to be aware of marine mammal movements and behavior to eliminate the remote risk of entanglement with diver hoses and lines.

Birds:

A variety of marine birds are common in Puget Sound and the general vicinity of this tract. The most significant of these are guillemots, murres, murrelets, grebes, loons, scoters, dabbing ducks, black brant, mergansers, buffleheads, cormorants, gulls, and terns. Blue heron, bald eagles, and osprey are also regularly observed. Geoduck harvest does not appear to have any significant effect on these birds or their use of the waters where harvest occurs. A study by DNR and the WDFW was conducted at northern Hood Canal to learn the effects of geoduck fishing on bald eagles (Watson et al., 1995). A significant conclusion of this study is that commercial geoduck clam harvest is unlikely to have any adverse impacts on bald eagle productivity.

Other uses:

Adjacent Upland Use:

The upland property adjacent to this tract is a state park, which has a “conservancy” shoreline environmental designation.

To minimize possible disturbance to adjacent use of the park, harvest vessels are not allowed shoreward of the 200 yards seaward of the ordinary high tide line (OHT). Harvest is allowed only during daylight hours and no harvest is allowed on Saturday, Sunday, or state holidays.

The only visual effect of harvest is the presence of the harvest vessels on the tract. These boats (normally 35-40 feet long) are anchored during harvest and divers conduct all harvest out of sight. Noise from boats, compressors and pumps may not exceed 50 dB measured 200 yards from the noise source, which is 5 dBA below the state noise standard.

Fishing:

The waters around this tract are not prime sport fishing areas, however, some recreational salmon fishing for blackmouth and silvers could occur seasonally in proximity to this geoduck bed. Sport fishing is open year-round for surfperch. Rockfish fishing is closed in this area. Lingcod can only be taken May 1-June 15 by hook and line or May 21 to June 15 by spearfishing. The WDFW Sport Fishing Rules pamphlet describes additional seasons, size limits, daily limits, specific closed areas, and additional rules for salmon and other marine fish species. The fishing which does occur should not create any problems for the geoduck harvesting effort in the area.

Geoduck fishing on this tract is managed in coordination with the Central Sound treaty tribes through state/tribal geoduck harvest management plans. The non-Indian geoduck fishery should not be in conflict with any concurrent tribal fisheries.

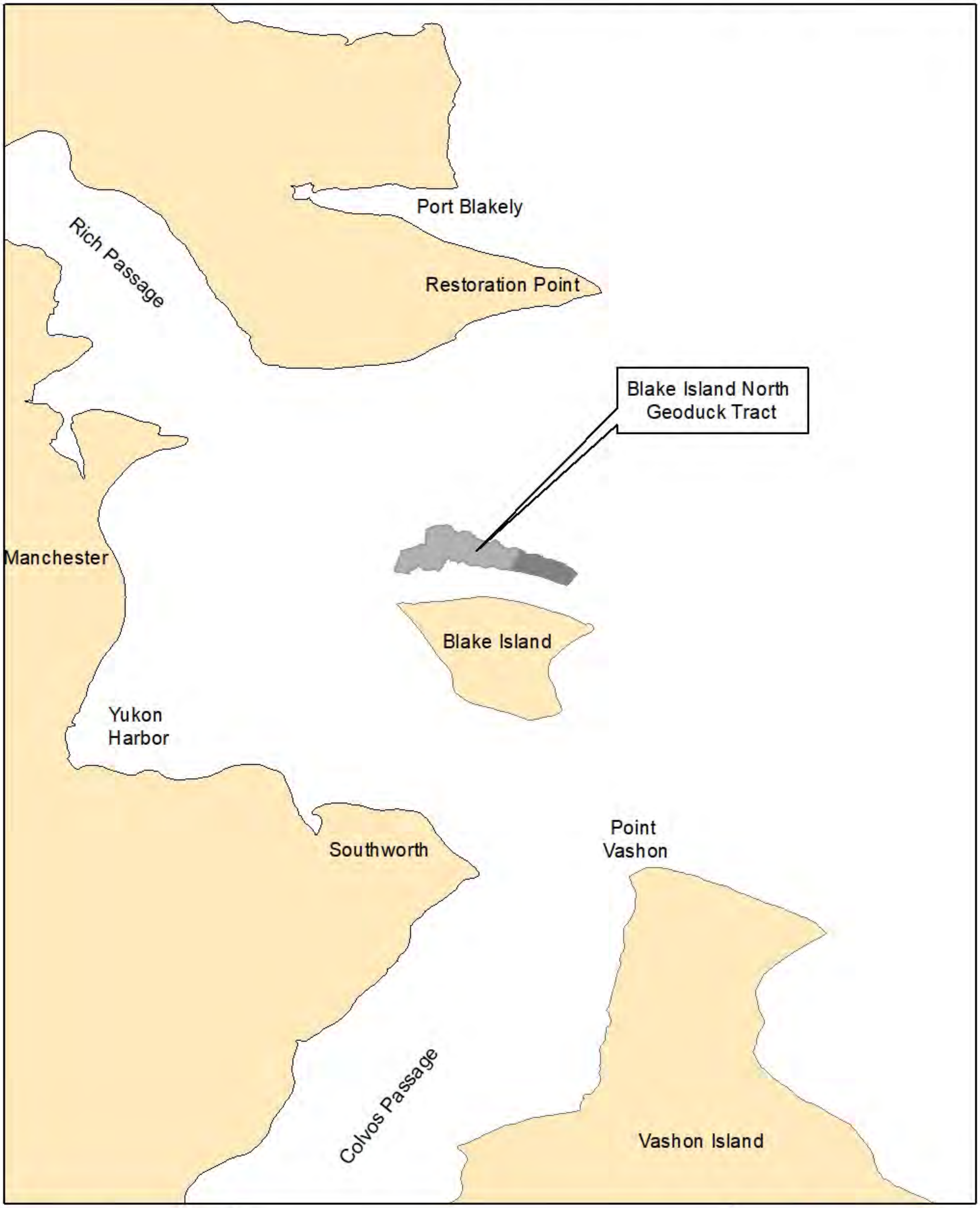
Navigation:

The Blake Island North area is used by recreational and commercial vessels traveling in Central Puget Sound and mooring at the state park. Geoduck harvesting at this site should not result in any significant navigational conflicts. The Washington Department of Natural Resources will notify the local boating community prior to any harvest.

Summary:

Commercial geoduck harvest is proposed for one tract along the northern shoreline of Blake Island. The tract was most recently surveyed in 1996 and 1997 by the WDFW, and the geoduck biomass estimate for the 146 acre harvest area is 574,303 pounds. The commercial tract is presently classified by DOH as “Approved” and “Conditionally Approved” for shellfish harvest. The Conditionally Approved area is closed to commercial harvest from May 1 through September 30 each year, due to high vessel traffic in the vicinity of the state park mooring buoys nearby. An eelgrass survey was completed, and eelgrass was observed to a maximum depth of -20 ft. (MLLW). The shoreward boundary of the tract will be set at -22 ft. (MLLW) or deeper to provide a buffer between eelgrass beds and forage fish spawning habitat and geoduck harvest. Geoduck harvest will also occur outside of the marine park, which extends ¼ mile seaward of the extreme low water mark on Blake Island. The timing of the harvest should avoid mid-April to reduce impacts to molting crab. The anticipated environmental impacts of this harvest are within the range of conditions discussed in the 2001 Final Supplemental Environmental Impact Statement for the commercial geoduck fishery. No significant impacts are expected from this harvest.

Figure 1. Vicinity Map, Blake Island North Commercial Geoduck Tract #08400

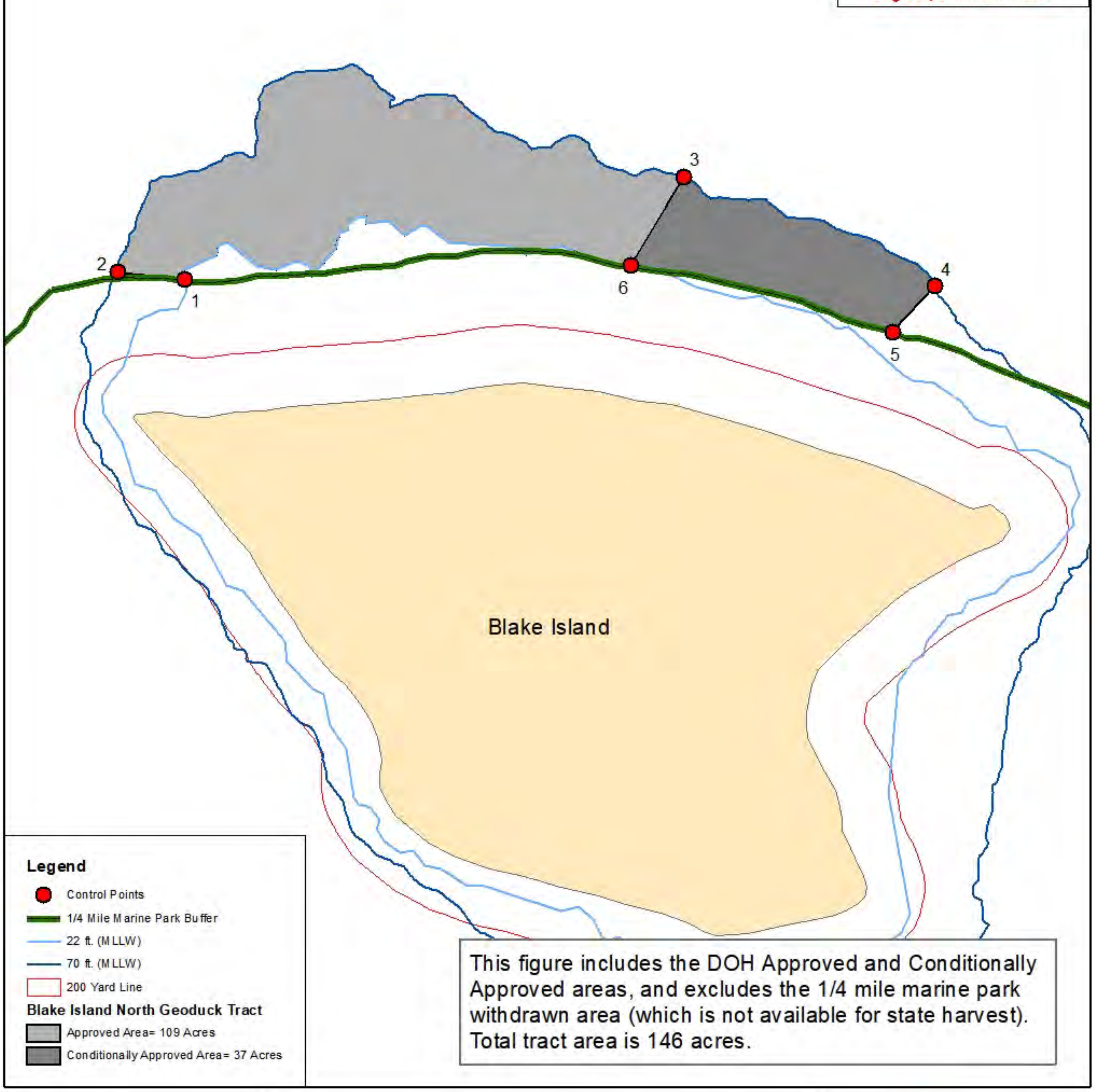


1:80,000
1 inch = 1.26 miles

Data Sources:
Projection for data is GCS_Washington Geographic System 1984,
Units: Meters. Coastline layer is from DNR, 1: 24,000 scale, created 09-20-99. Contours are from NOAA soundings.

Map Date: February 28, 2020
Map Author: O. Working
File: Data\Ocean\Geoduck

Figure 2. Control Points Map, Blake Island North Commercial Geoduck Tract #08400



Control Point	Latitude	Longitude
1	47° 32.892'	122° 30.241'
2	47° 32.904'	122° 30.355'
3	47° 33.066'	122° 29.395'
4	47° 32.880'	122° 28.969'
5	47° 32.772'	122° 29.071'
6	47° 32.916'	122° 29.485'

Coordinates are in WGS84; Degrees, Decimal Minutes

This figure includes the DOH Approved and Conditionally Approved areas, and excludes the 1/4 mile marine park withdrawn area (which is not available for state harvest). Total tract area is 146 acres.

N W E S

1:20,000
1 inch = 0.32 miles

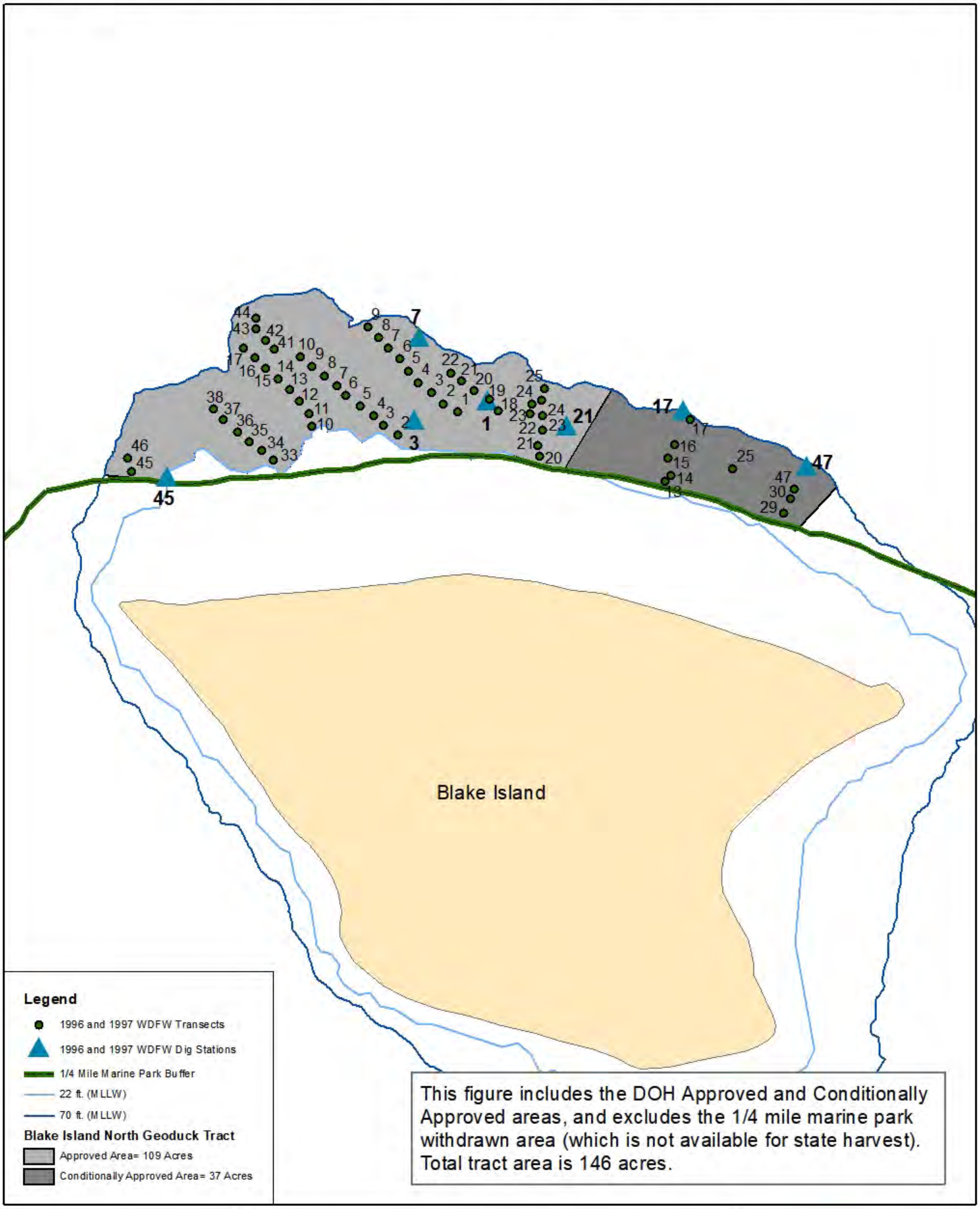
Data Sources:
Projection for data is GCS_Washington Geographic System 1984, Units: Meters. Coastline layer is from DNR, 1: 24,000 scale, created 09-20-99. Contours are from NOAA soundings.

0 0.1 0.2 0.4 0.6 Miles

Washington Department of FISH and WILDLIFE

Map Date: February 28, 2020
Map Author: O. Working
File: Data\Ocean\Geoduck

Figure 3. Transect and Dig Station Map, Blake Island North Commercial Geoduck Tract #08400



N W E S

1:20,000
1 inch = 0.32 miles

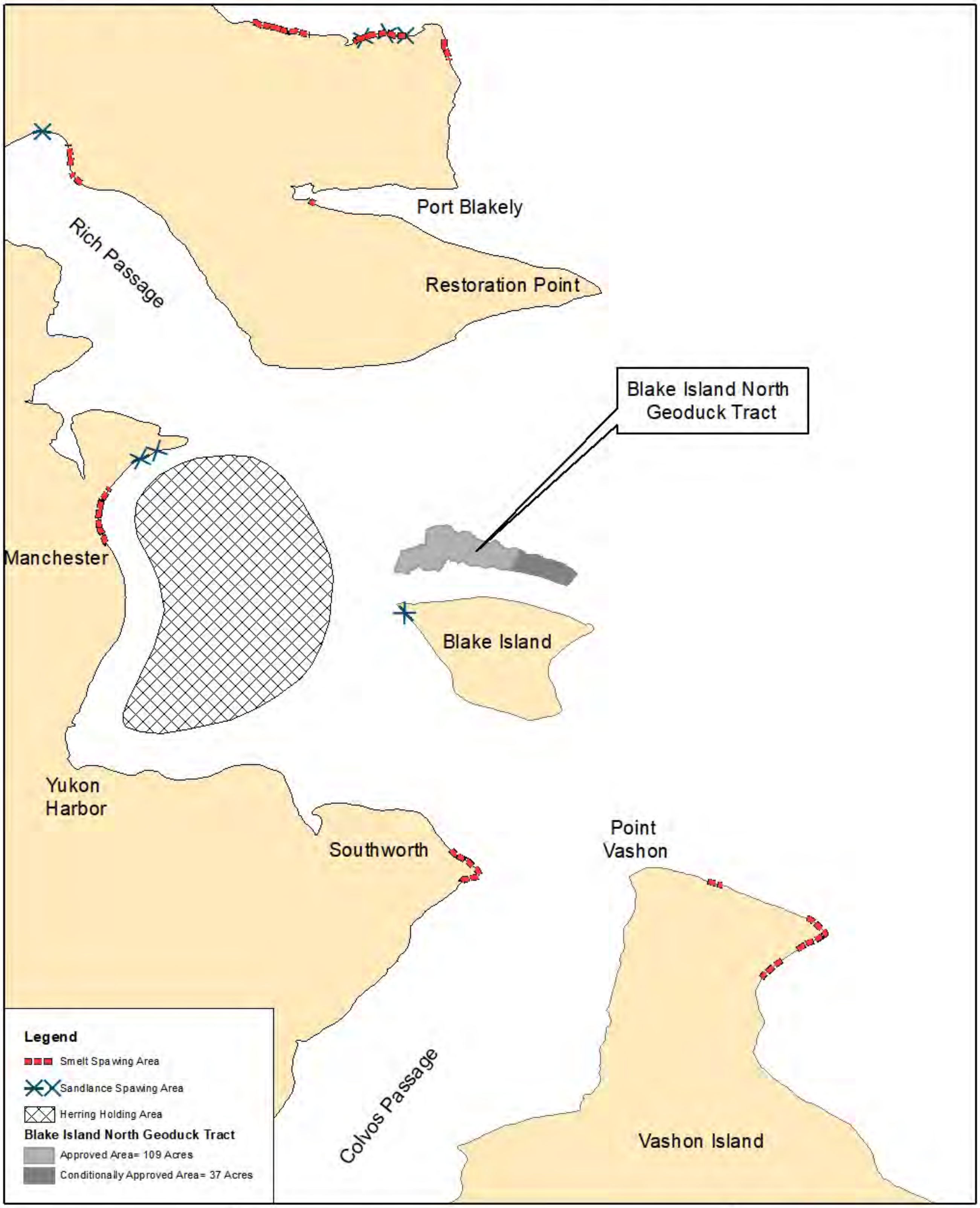
Data Sources:
Projection for data is GCS_Washington Geographic System 1984, Units: Meters. Coastline layer is from DNR, 1: 24,000 scale, created 09-20-99. Contours are from NOAA soundings.

0 0.1 0.2 0.4 0.6 Miles

Washington Department of FISH and WILDLIFE

Map Date: February 28, 2020
Map Author: O. Working
File: Data\Ocean\Geoduck

Figure 4. Fish Spawning Areas Near the Blake Island North Commercial Geoduck Tract #08400



1:80,000
1 inch = 1.26 miles

Data Sources:
Projection for data is GCS_Washington Geographic System 1984, Units: Meters. Coastline layer is from DNR, 1: 24,000 scale, created 09-20-99. Contours are from NOAA soundings.

Map Date: February 28, 2020
Map Author: O. Working
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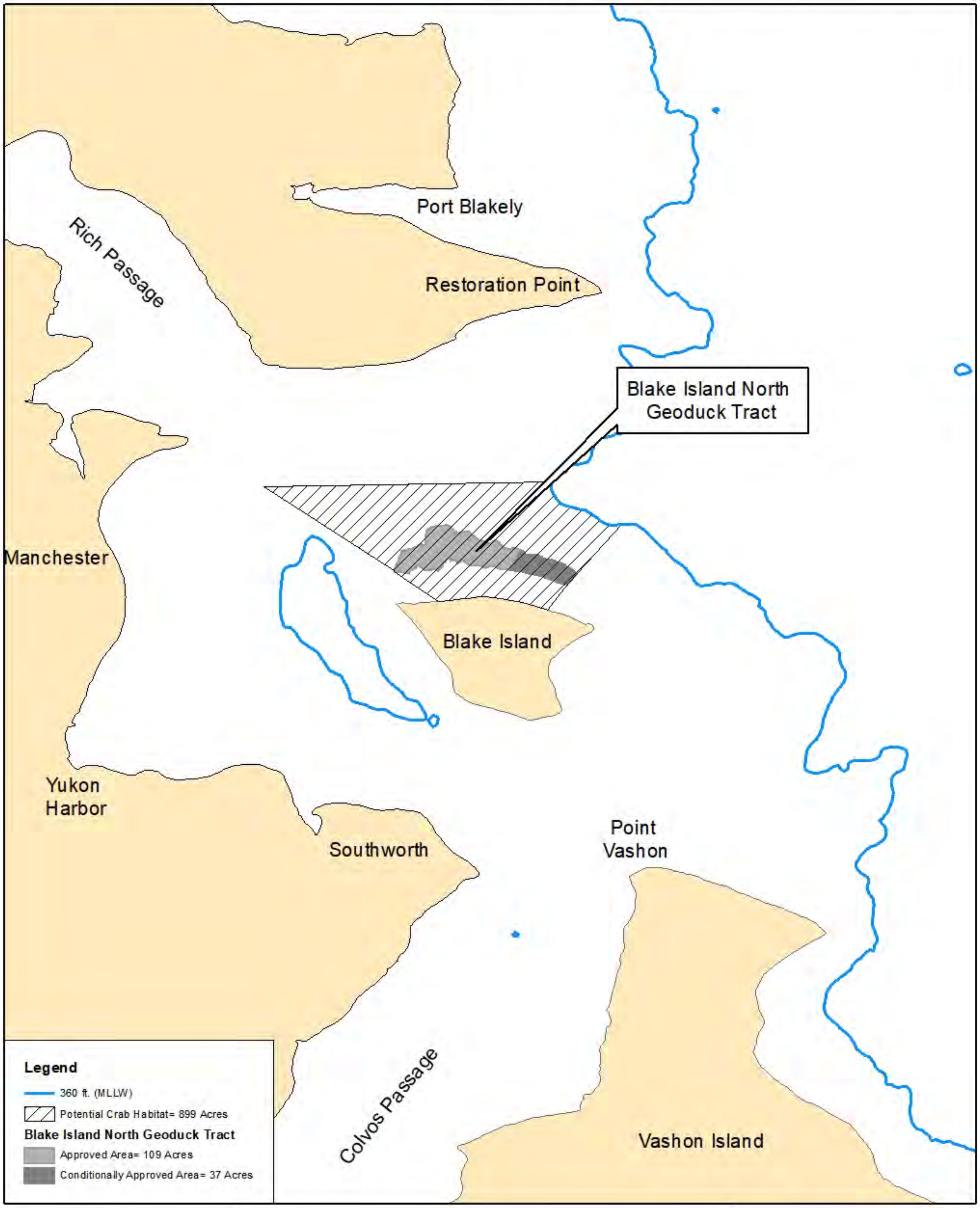
Figure 5. Dungeness Crab Habitat Map, Blake Island North Commercial Geoduck Tract #08400



N
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1:80,000
1 inch = 1.26 miles

Data Sources:
Projection for data is GCS_Washington Geographic System 1984, Units: Meters. Coastline layer is from DNR, 1: 24,000 scale, created 09-20-99. Contours are from NOAA soundings.

0 0.4 0.8 1.6 2.4 Miles

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EXPLANATION OF SURVEY DATA TABLES

The geoduck survey data for each tract is reported in seven computer-generated tables. These tables contain specific information gathered from transect and dig samples and diver observations. The following is an explanation of the headings and codes used in these tables.

Tract Summary

This table is a general summary of survey information for the geoduck tract including estimates of *Tract Size* in acres, average geoduck *Density* in animals per sq.ft., *Total Tract Biomass* in pounds with statistical confidence, and *Total Number of Geoducks*. Mass estimators are reported in average values for *Whole Weight* and *Siphon Weight* in pounds. Geoduck siphon weights are also reported in *Siphon Weight as a percentage of Whole Weight.* Biomass estimates are adjusted for any harvest that may occur subsequent to the pre-fishing survey.

Digging Difficulty

This table presents a station-by-station evaluation of the factors contributing to the difficulty of digging geoduck samples with a 5/8" inside nozzle diameter water jet. Codes for the overall subjective summary of the digging difficulty are given in the *Difficulty* column. An explanation of the codes for the dig difficulty follows:

Code	Degree of Difficulty	Description
0	Very Easy	Sediment conducive to quick harvest.
1	Easy	Significant barrier in substrate to inhibit digging.
2	Some difficulty	Substrate may be compact or contain gravel, shell or clay; most geoducks still easy to dig.
3	Difficult	Most geoducks were difficult to dig, but most attempts were successful.
4	Very Difficult	It was laborious to dig each geoduck. Unable to dig some geoducks.
5	Impossible	Divers could not remove geoducks from the substrate.

Abundance refers to the relative geoduck abundance; a zero (0) indicates that geoducks were very sparse, a one (1) indicates that they were moderately abundant and a two (2) indicates that they were very abundant. *Depth* refers to the depth that the geoducks were found in the substrate. A zero (0) indicates that they were shallow, a one (1) indicates that they were moderately deep and a two (2) indicates that they were very deep. The columns labeled *Compact*, *Gravel*, *Shell*, *Turbidity* and *Algae* refer to factors that contribute to digging difficulty by interfering with the digging process. A zero (0) in one of these columns indicates that the factor was not a problem, a one (1) indicates that the factor caused moderate difficulty and a two (2) indicates that the factor caused a significant amount of difficulty when digging. *Compact* refers to the compact or sticky nature of a muddy substrate. *Gravel* and *Shell* refer to the difficulty caused by these substrate types. *Turbidity* refers to the turbidity within the water near the dig hole caused by the digging activity. High turbidity makes it difficult to find the geoduck siphon shows. The difficulty of digging associated with turbidity varies with the amount of tidal current present. Therefore, the turbidity rating refers only to the conditions occurring when the sample was collected. *Algae* refers to algal cover, which also makes it difficult for the diver to find geoduck siphon shows. Because algal cover varies seasonally, this value only applies to the conditions when the sample was collected. The *Commercial* column gives a subjective assessment of whether or not it would be feasible to harvest geoducks on a commercial basis at the given station.

Transect Water Depths, Geoduck Densities and Substrate Observations

This table reports findings for each transect. *Start Depth* and *End Depth* (corrected to MLLW) are given for each transect. *Geoduck Density* is reported as the average number of geoducks per square foot for each 900 square foot transect. *Substrate Type* and *Substrate Rating* refer to evaluations of the substrate surface. A two (2) rating indicates that the substrate type is predominant. A one (1) rating indicates the substrate type was present.

Geoduck Weights and Proportion Over 2 Pounds

This table summarizes the size and quality of the geoducks at each of the stations where dig samples were collected. Weight values for any geoduck dig samples that were damaged during sampling to the extent that water loss occurred, are excluded from calculations. The *Number Dug* column lists the number of geoducks collected. The *Avg. Whole Weight (lbs.)* column gives the average sample weight of whole geoduck clams for each dig station. The *Avg. Siphon Weight (lbs.)* column gives the average weight of the siphons of the geoducks for each dig station. The percentage of geoducks greater than two pounds is given in the *% Greater than 2 lbs.* column.

Transect - Corrected Geoduck Count and Position Table

This table reports the diver *Corrected Count*, the geoduck siphon *Show Factor* used to correct the count, and the *Latitude/Longitude* position of the start point of each survey transect. Raw (observed) siphon counts are “corrected” by dividing diver observed counts for each transect with a siphon “show” factor (See WDFW Tech. Report FPT00-01 for explanation of show factor) to estimate the sample population density. Transect positions are reported in degrees and decimal minutes to the thousandth of a minute, datum WGS84.

Most Common and Obvious Animals Observed

This table summarizes the animals, other than geoducks, that were observed during the geoduck survey, and reports the total number of transects on which they were present (*# of Transects Where Observed)*. This is qualitative presence/absence data only, and only animals that can be readily seen by divers at or near the surface of the substrate are noted. The *Group* designation allows for the organization of similar species together in the table. Whenever possible, the scientific name of the animal is listed in *Taxonomer*, and a generally accepted *Common Name* is also listed. Many variables may make it difficult for divers to notice other animals on the tract, including but not limited to poor visibility, diver skill, animals fleeing the divers, animal size, or cryptic appearance or behavior (in crevasses or under rocks).

Most Common and Obvious Algae Observed

This table summarizes marine algae observed during the geoduck survey, and reports the total number of transects on which they were seen (*# of Transects Where Observed)*. This is qualitative presence/absence data only, and only for macro algae, with the exception of diatoms. At high densities diatoms form a "layer" on or above the substrate surface that is readily visible and obvious to divers. Other types of phytoplankton are not sampled and are rarely noted. Whenever possible, the scientific name or a general taxonomic grouping of each plant is listed in *Taxonomer*.

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Table 1. TRACT SUMMARY
Blake Island North Geoduck Tract # 08400.

Tract Name	Blake Island North
Tract Number	08400
Tract Size (acres)[a]	146
Density of geoducks/sq.ft.[b]	0.05
Total Tract Biomass (lbs.)[b]	509,622
Total Number of Geoducks on Tract	297,007
Confidence Interval (%)	25.0%
Mean Geoduck Whole Weight (lbs.)	1.72
Mean Geoduck Siphon Weight (lbs.)	0.39
Siphon Weight as a % of Whole Weight	23%
Number of 900 sq.ft. Transect Stations	60
Number of Geoducks Weighed	70

NOTE: 12 transects were not included in this biomass estimate because they were shallow of the -22 ft. (MLLW) according to diver gauge depth adjusted to MLLW, were inside of the 1/4 mile withdrawn area, or both

[a.] Tract area is based on the -22 ft. (MLLW) water depth contour due to the presence of eelgrass to depths of -20 ft. (MLLW), 1/4 mile marine park withdrawn area, the -70 ft. (MLLW) water depth contour, and includes DOH approved and conditionally approved areas

[b.] Biomass is based on the 1996 and 1997 WDFW geoduck surveys, and only transects and dig stations within the 146 acre DOH approved and conditionally approved areas were used. The pre-fishing biomass estimate was 2,010,233 pounds minus total harvest of 1,500,611 lbs. through February 22, 2022.

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Table 2: DIGGING DIFFICULTY TABLE

Blake Island North geoduck tract # 08400, 1996 and 1997 WDFW pre-fishing survey.

Year	Dig Station	Difficulty (0-5)	Abundance (0-2)	Depth (0-2)	Compact (0-2)	Gravel (0-2)	Shell (0-2)	Turbidity (0-2)	Algae (0-2)	Commercial (Y/N)
1996	3	1	1	2	0	0	0	0	0	Y
1996	17	2	2	1	1	1	1	0	0	Y
1996	21	0	2	0	0	0	0	0	0	Y
1996	45	1	2	1	1	1	0	1	0	Y
1996	47	3	1	0	0	2	1	0	0	Y
1997	7	1	2	0	1	0	0	0	0	Y
1997	1	0	2	1	0	0	1	0	0	Y

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Table 3: TRANSECT WATER DEPTHS, GEODUCK DENSITIES, AND SUBSTRATE OBSERVATIONS

Blake Island North geoduck tract # 08400, 1996 and 1997 WDFW pre-fishing survey.

		Start depth	End depth	Geoduck Density	Substrate [d]					
Year	Transect [a]	(ft.) [b]	(ft.) [b]	(no. / sq. ft.) [c]	mud	sand	gravel	shellhash	cobble	boulder
1996	2	24	26	0.0489			2			
1996	3	26	27	0.0637			2			
1996	4	27	28	0.0548		2				
1996	5	28	30	0.0415		2				
1996	6	30	33	0.0237		2				
1996	7	33	36	0.0667		1	1			
1996	8	36	38	0.0533		1	1			
1996	9	38	40	0.0148		1	1			1
1996	10	40	43	0.0059		1	1			1
1996	13	30	35	0.2267		2				1
1996	14	35	42	0.3274	1	2				1
1996	15	42	49	0.4637	1	2				
1996	16	50	58	0.4178	1	1				1
1996	17	58	65	0.3319	2	1				1
1996	20	29	37	0.1393		2				
1996	21	37	43	0.2430		2				
1996	22	43	51	0.4830		2				
1996	23	51	57	0.5867	1	2				
1996	24	57	64	0.5585	1	2				
1996	25	64	68	0.2830	2	1				
1996	29	37	45	0.1674	1	2				1
1996	30	45	53	0.0563	1	2				1
1996	33	26	30	0.0607	1	1				
1996	34	30	34	0.0800	1	1				
1996	35	34	41	0.0696	2	1				
1996	36	41	48	0.0815	2					
1996	37	49	57	0.1067	2					1
1996	38	57	62	0.1896	2					
1996	41	43	47	0.0119		1	1			1
1996	42	47	54	0.0044		1	1			1
1996	43	54	62	0.0815	1	1	1			
1996	44	61	67	0.1481	2	1	1			
1996	45	47	56	0.7837	1	1	1			
1996	46	56	63	0.3096	2	1				
1996	47	51	62	0.2415	1	1				1
1997	1	38	42	0.1807		2				
1997	2	42	43	0.2193		2				
1997	3	43	44	0.2459		2				
1997	4	44	47	0.2030		2				
1997	5	47	52	0.2252		2				
1997	6	52	57	0.2519		2				
1997	7	57	62	0.2281	1	2				

Table 3: Continued

Year	Transect [a]	Start depth (ft.) [b]	End depth (ft.) [b]	Geoduck Density (no. / sq. ft.) [c]	Substrate [d]					
					mud	sand	gravel	shellhash	cobble	boulder
1997	8	62	67	0.1807	1	2				
1997	9	67	70	0.2015	1	2				
1997	10	26	29	0.0237		2				1
1997	11	28	33	0.0311		2				1
1997	12	33	36	0.0281		2			1	1
1997	13	36	40	0.0059		2			1	1
1997	14	40	42	0.0133		2	1		1	1
1997	15	42	46	0.0000		2	1		1	1
1997	16	45	53	0.0237		1	1	1	1	
1997	17	53	64	0.0059		2	1		1	
1997	18	47	50	0.4119		2				
1997	19	50	52	0.3052		2				
1997	20	52	56	0.2563		2				
1997	21	56	58	0.2133		2				
1997	22	57	58	0.1719		2				
1997	23	51	58	0.3215		1	2			
1997	24	57	63	0.2652		1	2			
1997	25	53	61	0.2030		1	2			

[a.] 12 transects were excluded that fell shallower than -22 ft. (MLLW), or within the 1/4 mile marine park withdrawn area

[b.] All depths are corrected to mean lower low water (MLLW)

[c.] Densities were calculated using a daily siphon show factor

[d.] Substrate ratings: 1 = present; 2 = predominant; blank = not observed

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Table 4: GEODUCK SIZE AND QUALITY

Blake Island North geoduck tract # 08400, 1996 and 1997 WDFW pre-fishing survey.

Survey Year	Dig Station	Number Dug	Avg. Whole Weight (lbs)	Avg. Siphon Weight (lbs)	% Greater than 2 lbs
1996	3	11	2.69	0.57	82%
1996	17	10	2.68	0.54	0%
1996	21	11	2.49	0.50	64%
1996	45	11	2.45	0.49	9%
1996	47	11	2.33	0.47	0%
1997	1	11	2.19	0.43	45%
1997	7	10	2.04	0.39	20%

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Table 5: TRANSECT CORRECTED GEODUCK COUNT AND POSITION TABLE

Blake Island North geoduck tract # 08400, 1996 and 1997 WDFW pre-fishing survey.

Year	Transect [a]	Corrected Count	Show Factor [b]	Latitude [c]		Longitude [c]	
1996	2	44	0.75	47°	32.992	122°	29.728
1996	3	57	0.75	47°	33.009	122°	29.756
1996	4	49	0.75	47°	33.028	122°	29.774
1996	5	37	0.75	47°	33.046	122°	29.800
1996	6	21	0.75	47°	33.067	122°	29.827
1996	7	60	0.75	47°	33.085	122°	29.844
1996	8	48	0.75	47°	33.104	122°	29.867
1996	9	13	0.75	47°	33.122	122°	29.89
1996	10	5	0.75	47°	33.140	122°	29.912
1996	13	204	0.75	47°	32.903	122°	29.222
1996	14	295	0.75	47°	32.915	122°	29.211
1996	15	417	0.75	47°	32.947	122°	29.215
1996	16	376	0.75	47°	32.974	122°	29.203
1996	17	299	0.75	47°	33.021	122°	29.174
1996	20	125	0.75	47°	32.952	122°	29.459
1996	21	219	0.75	47°	32.972	122°	29.462
1996	22	435	0.75	47°	33.001	122°	29.453
1996	23	528	0.75	47°	33.028	122°	29.454
1996	24	503	0.75	47°	33.058	122°	29.455
1996	25	255	0.75	47°	33.079	122°	29.450
1996	29	151	0.75	47°	32.844	122°	28.997
1996	30	51	0.75	47°	32.871	122°	28.984
1996	33	55	0.75	47°	32.944	122°	29.964
1996	34	72	0.75	47°	32.962	122°	29.986
1996	35	63	0.75	47°	32.978	122°	30.009
1996	36	73	0.75	47°	32.997	122°	30.031
1996	37	96	0.75	47°	33.020	122°	30.058
1996	38	171	0.75	47°	33.041	122°	30.077
1996	41	11	0.75	47°	33.154	122°	29.962
1996	42	4	0.75	47°	33.170	122°	29.978
1996	43	73	0.75	47°	33.192	122°	29.996
1996	44	133	0.75	47°	33.213	122°	29.997
1996	45	705	0.75	47°	32.923	122°	30.232
1996	46	279	0.75	47°	32.948	122°	30.240
1996	47	217	0.75	47°	32.89	122°	28.977
1997	1	163	0.75	47°	33.035	122°	29.615
1997	2	197	0.75	47°	33.051	122°	29.642
1997	3	221	0.75	47°	33.072	122°	29.664
1997	4	183	0.75	47°	33.091	122°	29.689
1997	5	203	0.75	47°	33.113	122°	29.707
1997	6	227	0.75	47°	33.136	122°	29.724
1997	7	205	0.75	47°	33.156	122°	29.746
1997	8	163	0.75	47°	33.176	122°	29.765
1997	9	181	0.75	47°	33.197	122°	29.785
1997	10	21	0.75	47°	33.008	122°	29.89

Table 5: Continued

Year	Transect [a]	Corrected Count	Show Factor [b]	Latitude [c]		Longitude [c]	
1997	11	28	0.75	47°	33.032	122°	29.896
1997	12	25	0.75	47°	33.055	122°	29.915
1997	13	5	0.75	47°	33.077	122°	29.932
1997	14	12	0.75	47°	33.098	122°	29.954
1997	15	0	0.75	47°	33.117	122°	29.978
1997	16	21	0.75	47°	33.137	122°	29.999
1997	17	5	0.75	47°	33.157	122°	30.020
1997	18	371	0.75	47°	33.038	122°	29.538
1997	19	275	0.75	47°	33.059	122°	29.554
1997	20	231	0.75	47°	33.076	122°	29.583
1997	21	192	0.75	47°	33.094	122°	29.608
1997	22	155	0.75	47°	33.109	122°	29.627
1997	23	289	0.75	47°	33.031	122°	29.477
1997	24	239	0.75	47°	33.051	122°	29.474
1997	25	183	0.75	47°	32.927	122°	29.093

[a.] 12 transects were excluded that fell shallower than -22 ft. (MLLW), were inside of the 1/4 mile marine park withdrawn area, or both

[b.] A geoduck siphon "show factor" was used to correct geoduck counts observed by divers within transects

[c.] Latitude and longitude are in degrees and decimal minutes (NAD 27)

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Table 6: MOST COMMON AND OBVIOUS ANIMALS OBSERVED

Blake Island North geoduck tract # 08400, 1996 and 1997 WDFW pre-fishing survey.

# of Transects where Observed	Group	Common Name	Taxonomer
16	ANEMONE	BURROWING ANEMONE	*Pachycerianthus fimbriatus*
47	ANEMONE	PLUMED ANEMONE	*Metridium spp.*
16	ANEMONE	STRIPED ANEMONE	*Urticina spp.*
13	BIVALVE	FALSE GEODUCK	*Panomya spp.*
38	BIVALVE	HARDSHELL CLAMS	*Veneridae spp.*
2	BIVALVE	HEART COCKLE	*Clinocardium nuttalli*
11	BIVALVE	HORSE CLAM	*Tresus spp.*
24	BIVALVE	HORSE MUSSEL	*Modiolus rectus*
2	BIVALVE	KENNERLY'S VENUS	*Humilaria kennerleyi*
1	BIVALVE	PIDDOCK	Unspecified Pholadidae
1	BIVALVE	SWIMMING SCALLOPS	*Chlamys spp.*
10	BIVALVE	TRUNCATED MYA	*Mya truncata*
15	CNIDARIA	SEA PEN	*Ptilosarcus gurneyi*
1	CNIDARIA	SEA WHIP	*Stylatula elongata*
2	CRAB	DUNGENESS CRAB	*Cancer magister*
1	CRAB	GRACEFUL CRAB	*Cancer gracilis*
9	CRAB	RED ROCK CRAB	*Cancer productus*
29	CUCUMBER	SEA CUCUMBER	*Parastichopus californicus*
1	FISH	DOGFISH SHARK	*Squalus acanthias*
38	FISH	FLATFISH	Unspecified flatfish
15	FISH	RATFISH	*Hydrolagus colliei*
15	FISH	RATFISH EGG CASE	Hydrolagus colliei egg case
3	FISH	SCULPIN	Unspecified Cottidae
3	FISH EGGS	SKATE EGG CASE	Raja spp. egg case
12	GASTROPOD	MOON SNAIL	*Polinices lewisii*
19	GASTROPOD	MOON SNAIL EGGS	Polinices lewisii egg case
23	GASTROPOD	NUDIBRANCH	Unspecified nudibranch
8	SEA STAR	FALSE OCHRE STAR	*Evasterias troschelli*
4	SEA STAR	LEATHER STAR	*Dermasterias imbricata*
5	SEA STAR	ROSE STAR	*Crossaster papposus*
6	SEA STAR	SAND STAR	*Luidia foliolata*
14	SEA STAR	SHORT-SPINED STAR	*Pisaster brevispinus*
9	SEA STAR	SPINY STAR	*Hippasteria spinosa*
10	SEA STAR	SUN STAR	*Solaster spp.*
48	SEA STAR	SUNFLOWER STAR	*Pycnopodia helianthoides*
28	SEA STAR	VERMILLION STAR	*Mediaster aequalis*
1	URCHIN	GREEN URCHIN	*Strongylocentrotus droebachiensis*
32	WORM	ROOTS	Chaetopterid polychaete tubes
5	WORM	TEREBELLID TUBE WORM	*Terebellid spp.*

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Table 7: MOST COMMON AND OBVIOUS ALGAE OBSERVED

Blake Island North geoduck tract # 08400, 1996 and 1997 WDFW pre-fishing survey.

# of Transects where observed	Taxonomer
23	*Desmarestia spp.*
8	Diatoms
11	*Pterygophora californica*
1	*Laminaria spp.*
3	*Ulva spp.*
6	Unspecified

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