Appendix L
Supplemental Soils and Anthropogenic Disturbance Investigation of Potential ESHA Memo

Technical Memorandum

Draft for Review

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Subject:	Supplemental Soils and Anthropogenic Disturbance Investigation of Potential ESHA		

1. Introduction

1.1 Summary

This Technical Memorandum reports the results of a soils and anthropogenic disturbance investigation and summarizes previous relevant botanical and other studies to inform potential Environmentally Sensitive Habitat Area (ESHA) designation(s) at the Samoa Peninsula Land-based Aquaculture Project (Project) proposed by Nordic Aquafarms California, LLC. (NAFC). Previous botanical studies consisted of seasonally appropriate floristic surveys for special status plants, vegetation mapping, and assessment of Sensitive Natural Communities and 1-parameter wetlands, which are thoroughly discussed in a previous technical memorandum (GHD 2021a). Dark eyed gilia (*Gilia millefoliata*), a CNPS-listed 1B.2 rare plant, and Sensitive Natural Communities (State Rank S3) occur within the Area of Potential Effect (APE). This investigation evaluates abiotic conditions and historic disturbance onsite to help inform the Coastal Commission's determination of potential ESHA. Soil substrates, landforms, and previous anthropogenic disturbance are discussed in this memo to supplement previous botanical studies and help determine whether these areas qualify or do not quality as ESHA.

1.2 Project Description

The Project would be located at the site of the former Freshwater Tissue Samoa Pulp Mill located on the Samoa Peninsula in the unincorporated community of Samoa in Humboldt County, California. The Project would include brownfield redevelopment with demolition of existing pulp mill infrastructure and construction of a sustainable land-based finfish aquaculture facility. The land-based finfish aquaculture facility and associated infrastructure would cover approximately 36 acres.

The Project is located within Assessor Parcel Number (APN) 401-112-021 and is owned by the non-profit Humboldt Bay Development Association, Inc. (HBDA), then leased to the Humboldt Bay Harbor, Recreation and Conservation District (HBHRCD).

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The Project is located in the California Coastal Zone, with primary permitting jurisdiction with the Humboldt County Local Coastal Program. The Project Site has a land use designation of Industrial, Coastal Dependent (MC) and is zoned Industrial/Coastal Dependent. The Project is considered to be principally permitted by the County of Humboldt due to the proposed land uses under the Project. Prior to development for use as a pulp mill over 50 years ago, the location on the Samoa peninsula historically consisted of mobile coastal dunes. The natural topography of the Project area has been extensively altered, and the remaining habitat on the site has been subject to regular anthropogenic disturbance based on review of historic aerial photography and site condition observations. The industrially developed Project site is bordered by Humboldt Bay to the east, four large (over 45 feet tall) ash and wood chip landfill mounds to the west, highly disturbed industrial areas to the south, and developed area to the north. In approximately 1997, the landfill mound area was extensively altered as part of the approved landfill closure plan and a 12–24-inch layer of dredge material from Humboldt Bay was compacted to $1X10^{-6}$ cm/sec and was placed over the mounds as a protective cover. As a condition from the State Water Board, the landfill mounds and surrounding area are monitored quarterly and regularly mowed to ensure that the landfill cap retains its impermeable design integrity.

2. Regulatory Setting

2.1 Environmentally Sensitive Habitat Areas

Environmentally Sensitive Habitat Areas (ESHAs) (a.k.a., Environmentally Sensitive Areas) are defined by the Coastal Commission as follows:

> *"Environmentally sensitive area" means any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could be easily disturbed or degraded by human activities and developments.* (Pub. Resources Code, § 30107.5)

The Coastal Commission's ESHA category is broadly defined, and it includes habitat for special status species and other areas that provide important ecosystem functions. The Coastal Commission's designation of ESHA generally includes vegetation alliances listed as Sensitive Natural Communities with an S1- S3 ranking. The Coastal Commission and local counties or municipalities associated with the Local Coastal Program (LCP) are the jurisdictional agencies that exert authority in identifying and protecting ESHA in the course of project activities. In guidance issued in 2013, the Coastal Commission stated the following:

> *Pursuant to Section 30107.5, in order to determine whether an area constitutes an ESHA, and is therefore subject to the protections of Section 30240, the Commission has asked if either of the following conditions have been met:*
>
> *1) There are rare species or habitat in the subject area;*
>
> *2) There are especially valuable species or habitat in the area, which is determined based on:*
>
> *a) whether any species or habitat that is present has a special nature, OR*
>
> *b) whether any species or habitat that is present has a special role in the ecosystem*

When the Commission has found that either of these two conditions is met, it has assessed whether the habitat or species meeting these conditions is easily disturbed or degraded by human activities and developments. If they are, the Commission has found the area to be ESHA. It should be noted that even disturbed or degraded habitats may constitute ESHA depending on the level of disturbance (Coastal Commission 2013, p 5-6).

Coastal Commission guidance from 2013 also advises to "consider using the following resources in order to assess whether an area should be considered ESHA:

- *The list of rare, threatened or endangered species prepared under the California or Federal Endangered Species Act,*
- *The list of "fully protected species" or "species of special concern" by the California Department of Fish and Wildlife (CDFW)*
- *The list of "1b" species prepared by the California Native Plant Society.*
- *The CDFW List of California Terrestrial Natural Communities Recognized by the California Natural Diversity Database.* (Coastal Commission 2013, p 6).

The Humboldt Bay Area Plan of the Humboldt County LCP specifically states the following under the heading *Identification of Environmentally Sensitive Habitats*:

a. Environmentally sensitive habitats within the Humboldt Bay Planning Area include:

(1) Wetlands and estuaries, including Humboldt Bay and the mouth of the Mad River.

(2) ***Vegetated dunes along the North Spit*** *to the Mad River and along the South Spit.*

(3) Rivers, creeks, gulches, sloughs and associated riparian habitats, including Mad River Slough, Ryan Slough, Eureka Slough, Freshwater Slough, Liscom Slough, Fay Slough, Elk River, Salmon Creek, and other streams.

(4) Critical habitats for rare and endangered species listed on state or federal lists

(Humboldt County Board of Supervisors 2014, p 43).

This Technical Memo evaluates habitat based on the above listed considerations from the Coastal Commission guidance (2013) and LCP, including (1) the presence of rare species and habitat, (2) habitat value, (3) whether the resources are easily disturbed or degraded, and (4) whether the area consists of vegetated dunes subject to ESHA protection under the Humboldt Bay Area Plan.

2.2 Federally Listed, State Listed and CNPS Rare Species

Special status plant species under Federal jurisdiction include those listed as endangered, threatened, or as candidate species by the Fish and Wildlife Service (USFWS) under the U.S. Endangered Species Act (ESA). Special status plant species under State jurisdiction include those listed as Endangered, Threatened, or as candidate species by the CDFW under the California Endangered Species Act (CESA). Plant species on California Native Plant Society's (CNPS) California Rare Plant Ranking (CRPR) Lists 1 and 2 are considered eligible for state listing as Endangered or Threatened pursuant to the California Fish and Game Code and

CDFW has oversite of these special status plant species as a trustee agency. As part of the CEQA process, such species should be considered as they meet the definition of Threatened or Endangered under Sections 2062 and 2067 of the California Fish and Game Code.

2.3 Sensitive Natural Communities

CDFW provides oversight of communities listed as Sensitive Natural Communities, based on state rarity rankings. The natural communities are broken down to alliance level for vegetation types according to A Manual of California Vegetation (Sawyer et al. 2009). CDFW considers alliances and associations with a S1 to S3 rank to be Sensitive (CDFW 2019).

3. Methods

3.1 Supplemental Soils and Anthropogenic Disturbance Investigation

On February 25, 2021 GHD's Certified Professional Soil Scientist Misha Schwarz and Certified Consulting Botanist Kelsey McDonald investigated soils and evidence of previous anthropogenic disturbance in the undeveloped portion of the property south and west of the former mill in the vicinity of the rare plant population and Sensitive Natural Communities (hereafter referred to as the study area). Rough visual estimates of absolute percent cover of gravel, coarse dredge spoils and other non-native substrates and surface conditions were noted on a map while traversing the site along a serpentine path west-to-east north of the fence line and east-to-west south of the fence line (Appendix A, Figure 1). Soil pits ~14-20 inches deep were dug using hand shovels in disturbed dune mat north of the fence, higher quality dune mat south of the cyclone fence, and the European beach-grass dominated sand berm (also south of the fence). Structures within the area and other signs of previous anthropogenic disturbance were marked with an Eos Arrow 100 Submeter Global Positioning System (GPS) Receiver with Global Navigation Satellite System (GNSS) and an iPad running ArcGIS Collector software in the WGS84 datum. Historical aerial imagery sourced from the Historic Atlas of Humboldt Bay and the Eel River Delta (Laird 2008) and Google Earth were also investigated to establish a timeline of disturbance and development of landforms onsite (Appendix B).

3.2 Previous Special Status Plant Surveys

GHD conducted surveys for special status plant species and vegetation mapping during the spring and summer of 2020 (March 24-July 27) following *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* by the California Natural Resource Agency (CDFW 2018) and *General Rare Plant Survey Guidelines by the Endangered Species Recovery Program* (USFWS 2002). Dark-eyed gilia, a CNPS-listed (1B.2) special status plant was first observed in flower on May 5, 2020. Population sampling using a systematic sampling in $1m^2$ quadrats within the bounds of the largest population polygon provided the basis for calculating population size over the total polygon area. Direct counts determined the number of individuals in small outlier clumps separated from the main population. For full methods, please see the botanical survey technical memorandum (GHD 2021a).

3.3 Previous Vegetation Mapping and Assessment

Vegetation was mapped to the Alliance level according to *A Manual of California Vegetation* (Sawyer et al. 2009). Vegetation Rapid Assessments were completed to characterize the dune mat community and adjacent areas that were strongly dominated by non-native species. The quality of dune-associated vegetation habitats was quantitatively assessed by collecting percent cover vegetation data in randomized 1m^2 plots, and higher-quality dune mat patches were primarily designated based on the relative dominance of native dune mat species, undulating topography, and lower overall vegetative cover. Absolute percent cover was estimated for all species and bare areas at each 1m^2 plot, and these values were used to calculate relative cover of native and non-native species. Areas with coastal willow (*Salix hookeriana*) and other wetland indicator plants were also investigated in the spring of 2020 for a dominance of hydrophytic species, hydric soils and hydrology. For full methods, please see the botanical survey technical memorandum (GHD 2021a).

4. Results

4.1 Supplemental Soils and Anthropogenic Disturbance Investigation

4.1.1 Soil Substrates

Gravel and coarse dredge spoils with shells were scattered in varying densities over most of the study area, primarily west, south and south east of the clarifiers. (Appendix A, Figure 1). Surface substrates appeared to be as much as 90 percent absolute cover of coarse dredge spoils with crushed shells and gravel at the southeastern extent of the study area. The coarse sand and clam shells likely indicate that the substrate was sourced from the entrance channel or marine environment (see Photo Index in Appendix C). Surface substrates in dune mat communities north of the fence consisted of as much as roughly 50 percent cover of gravel and 50 percent sand substrate along the access road north of the fence and around a pit southwest of the clarifiers (Appendix A, Figure 1). Gravel was inconsistently scattered across the study site, and gravel and other non-native substrates may have been mixed across the surface by driving or grading. Soil pits dug within ~16 inches of the surface consistently showed fine sand deposits mixed with a minor amount of fine organic material on the north side of the fence and along a sand berm that runs along the south side of the fence. Gravel was less prevalent in subsurface sands (typically <1% gravel at 4-16 inches depth) than it was on the surface layer. A soil pit dug at the southeast corner of the study area showed mixed native sand deposits with non-native coarser sands and fine gravel that are unlikely to be aeolian sand deposits and are more likely sourced from entrance channel or marine/estuarine dredge spoils.

A previous geotechnical investigation report by SHN in support of the Project (2020) (included as Appendix D) similarly characterized surface conditions in the study area as “sand fill and dune sediments that have been previously graded and filled to create a level surface, as well as the existing subsurface wastewater disposal field.” SHN (2020) describes subsurface conditions based on bore holes as follows:

> *Approximately 5 feet to as much as 15 feet of fill material was encountered in several of the geotechnical borings during the current site investigation. Fill materials encountered in the borings consist of a mix of sand and fine gravel with abundant shell fragments, which distinguishes it from the underlying native dune sediments. It is believed that the fill materials were derived from dredge*

spoils removed from the shipping channel at the location of the current docking facility and elsewhere within Humboldt Bay.

In general, SHN describe the presence of six stratums (SHN 2020). Stratum 1, as defined by the 2020 SHN study, is comprised of loose poorly graded sand fill, present over most of the proposed aquaculture facility Project site, varying in thickness from about 2 feet (61 cm below surface [cmbs]) to as much as about 17 feet (518 cmbs) in central boring B-7. Within the study area, poorly-graded sand fill was noted to a depth of 2.5 feet in western boring B-11, 12 feet in central boring B-12, and 15 feet in eastern B-13. SHN interprets this fill material as having been derived as dredge spoils from the nearby shipping channel based on the amount of shell fragments mixed with medium to coarse sand and fine gravel. They interpret that the fill materials were hydraulically emplaced during the initial grading and development of the site in the early 1960s. Please see Appendix D for additional details from SHN's geotechnical report.

A previous field investigation for the Cultural Resources Report (Roscoe and Associates 2020) also discussed soils onsite. Cultural resource investigations included the manual excavation of thirteen 10 cm-auger units placed on the east side of study area. Auger Units were excavated to a maximum depth of 370 cmbs, approximately 12 feet. Please see Appendix E for the auger locations. A table with details describing the soils and other materials found in each auger unit is presented in Appendix D of the Cultural Resources Report. In general, the majority of soils within the Roscoe subsurface testing area are sand, containing varying amounts of round pebbles, silt nodules, and fragmented shell, below a superficial layer of organic material, consistent with SHN's 2020 geotechnical study, indicating disturbance and filling of the site.

4.1.2 Current Anthropogenic Disturbance Features

Anthropogenic structures and disturbances were mapped by GPS, including a large pit with gravel, railroad tie wood piles, pipes, and concrete subsurface structures (Appendix A, Figure 1, Appendix C). The existing leach field and reserve leach field are depicted on Figure 1 based on imagery and design drawings. The lower-quality degraded dune mat on the site shows tire tracks for maintenance access and additional gravel around the clarifiers, fence line, and pipes (Appendix A, Figure 2). A concrete block driveway through a gate in the cyclone fence divides two vegetated sand berms running parallel to the cyclone fence on the south side. The eastern sand berm near Humboldt Bay is highly stabilized and is clearly constructed with no evidence of natural processes. The western sand berm along the cyclone fence is also constructed and highly stabilized by European beachgrass and yellow bush lupine; however, this structure fades and flattens to a more natural-looking dune topography near the southwestern corner of the study area. The west side of the study area features a cyclone fence on top of a steep, stabilized cut face with native and non-native vegetation types. Anthropogenic disturbances onsite also overlap with the dark-eyed gilia population boundaries (Appendix A, Figure 3). The proposed permanent and temporary impacts associated with Project are also shown in relationship to dark-eyed gilia and anthropogenic disturbance observations in Appendix A, Figure 3.

4.1.3 Historical Aerial Imagery Analysis

Historical aerial imagery provides evidence of repeated disturbance at the site dating back to 1965 imagery, which shows widespread grading and development and coincides with the opening of the Kraft paper pulp mill by Georgia-Pacific California (Roscoe and Associates 2020). Earlier imagery from 1958 shows a natural

dune complex with open moving parabolic dunes in the center of the site in the approximate location of the leach field and clarifiers, with stabilized dune forest and scrub at the eastern and western extents of the site (Appendix B Figure 1). Please see Historical Aerial Imagery in Appendix B for a timeline of disturbance onsite. The Humboldt Bay Harbor District reported that when they acquired the property in 2014 the southern portion of the property was largely used by the previous property owners as storage and for miscellaneous debris/scrap piles. The Harbor District has been clearing the site of metal and debris/scrap in preparation for development.

4.1.4 Landforms and Natural Processes

The majority of the study area has been roughly graded to a flat surface, and has been subject to repeated disturbance throughout the course of facilities maintenance onsite. The sand berm along the southern fence line did not exist prior to approximately 1965, which is when the grading and development onsite began (see Appendix B, Figure 1). The sand berm is a constructed feature that has been highly stabilized by European beachgrass and other vegetation (see Site Photos 12-16 in Appendix C). A soil pit dug to approximately 16 inches in the central area of the sand berm along the southern fence line showed only fine sand substrate with a minor amount of fine organics, matching soil pits north of the fence line. The sand berm consists of native sand substrates that were pushed into a uniform ridge, likely in preparation for hydraulic placement of dredge material south of the berm that can be seen in historical photos starting 1973 (see Appendix B, Figure 4).

Higher quality dune mat occurs on the southwestern margins of the berm and in the previously graded area near the powerlines where more open sand can be found intermixed with dredge spoils. Dredge spoils are prevalent south of the berm in the study area (Appendix A). The highest quality, least anthropogenically disturbed patch of dune mat occurs on the southwest corner of the property south of the cyclone fence line (Site Photos 19-21 in Appendix C). This patch may have avoided significant grading over the years based on aerial imagery (Appendix B), but it may have been disturbed by vegetation removal because it appears to have been part of a stabilized dune scrub area in imagery showing thicker vegetation from 1965 and 1958 (Appendix B, Figures 1 and 2). The higher-quality dune mat occurs in an area that appears to contain more naturally undulating dune topography. However, sand movement appears to be low, based on the prevalence of lichens and mosses which have formed crusts on the sand (Appendix C Photos 19 and 20). This patch of higher-quality native-dominated dune mat is surrounded by non-native invasive European beachgrass swards to the west, non-native invasive yellow bush lupine scrub to the south and east, and highly disturbed graded dune mat to the north.

A high-peaked stabilized cut face also stretches along the west side of the site, east of Vance Avenue, and the small coastal willow thicket and coastal brambles (*Rubus ursinus* Alliance) occur along the western fence line (Appendix C, Photos 22 and 23). The high-peaked cut face along Vance Avenue was likely formerly part of a stabilized dune forest or scrub area that was highly disturbed in the process of grading and developing on both sides of the ridge. The current Vance Avenue alignment was created prior to 1948.

Coastal dunes are typically defined by the natural formation process of aeolian sand deposition that occurs oriented with dominant wind direction from the north-northwest along the Humboldt Bay coastline, and they typically have undulating topography. The flattened central portion of the study area and current sand berms/cut faces bordering the south and west sides of the site were anthropogenically formed in

coordination with the development of the Kraft paper mill onsite starting in 1965, expansion of the site and the spreading of dredge spoils in the 1970s, and other subsequent anthropogenic disturbances associated with previous land use (see Historical Aerial Imagery in Appendix B). Throughout the last 55 years, the property has been consistently disturbed by grading, development, operation, and maintenance. Although the site still supports native dune plants, natural dune landforms have been highly altered, and processes have been disrupted by anthropogenic disturbance and invasive species. Landforms onsite (including the sand berm, poorly graded sand, and cut faces) were formed by human development, and may not be geomorphologically defined as "dunes."

4.2 Previous Botanical Studies

4.2.1 Special Status Plant Surveys Summary

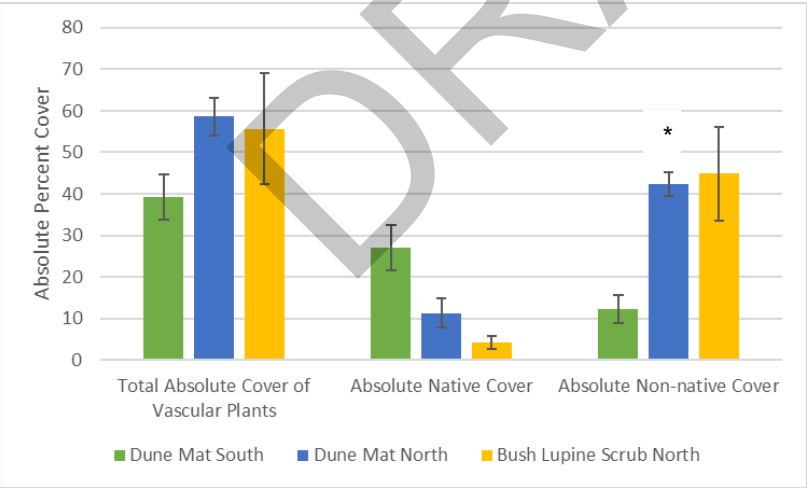
Dark-eyed gilia was detected in flower on May 5, 2020 in the degraded dune habitat within the study area on the southern side of the Project site. Dark-eyed gilia is protected under CEQA as a CNPS-listed 1B.2 rare plant. The 1B.2 rank indicates that it is rare or endangered throughout its range, which extends from Northern California into Southern Oregon, and it is fairly endangered within California. NatureServe also ranks dark-eyed gilia as Imperiled globally (G2) and within the state of California (S2). An estimated population of approximately 100,000 dark-eyed gilia plants occurs within the study area. Dark-eyed gilia had a clustered distribution scattered from the area west of the clarifiers across the southern end of the property and extending south beyond the edge of the study area. The highest density of the rare plants occurred north of the fence along the disturbed access road and in a couple of small patches near the clarifiers. Systematic sampling of the main population macroplot (n=146) showed an average density of 17 (± SE of 7) plants per $1m^2$ quadrat area in the area north of the fence, resulting in an estimate of ~60,000 individuals north of the fence over the ~3700 m^2 area. Sampling the macroplot south of the fence showed an average density of 7 dark-eyed gilia plants (± SE of 2) per $1m^2$ quadrat, resulting in an estimate of ~40,000 individuals in the ~5,600 m^2 macroplot within the APE south of the fence.

This annual species appears to favor areas that are intermittently disturbed with lower non-native vegetation cover, such as in the access road north of the fence, and the population appeared to be sparser and patchily distributed closer to the former pulp mill and clarifiers, and absent from the leach field area (Appendix A, Figure 3). Some small but dense patches also occurred in open tire tracks through the sand around the clarifiers. Dark-eyed gilia also occurred at moderate density in clusters throughout the dune mat community south of the fence. Dark-eyed gilia was present but stunted in areas where shell and gravel have been distributed north of the power-poles and south of the berm. Dark-eyed gilia onsite was often observed to be associated with native dune mat species such as seaside buckwheat (*Eriogonum latifolium*), yellow sand verbena (*Abronia latifolia*), sand mat (*Cardionema ramosissimum*), beach strawberry (*Fragaria chiloensis*), and dune knotweed (*Polygonum paronychia*), disturbance-associated native miniature lupine (*Lupinus bicolor*), as well as many non-native invasive species such as ripgut brome (*Bromus diandrus*), sheep sorrel (*Rumex acetosella*), and English plantain (*Plantago lanceolata*).

4.2.2 Previous Vegetation Assessment and Mapping Summary

Dune mat (*Abronia latifolia-Ambrosia chamissonis* Alliance) (G3 S3)

Areas with less than 10% absolute shrub cover and characteristic presence of dune mat species keyed to the *Abronia latifolia-Ambrosia chamissonis* Alliance in *A Manual of California Vegetation* (MCV). Dune mat is a Sensitive Natural Community with NatureServe ranked as Vulnerable globally (G3) and within the state of California (S3). Much of the APE contains dune mat species at diagnostic levels with a prevalence of non-native species, especially north of the fence line (Figure 1). Dune mat within the study area was primarily characterized by yellow sand verbena, seaside buckwheat, dune knotweed, beach strawberry, and sandmat. Rare dark-eyed gilia, which typically occurs in stabilized dunes, was also widespread in this community. Previous leveling of the natural dune topography, continued anthropogenic disturbance, introduction of non-natural gravel and dredge spoils, construction of the leach field, and the introduction of invasive non-native species have degraded dune mat communities in the area. Much of the study area was highly invaded by non-native grasses and forbs, including ripgut brome, sweet vernal grass (*Anthoxanthum odoratum*) and sheep sorrel. The area south of the cyclone fence contains a low sand berm structure, and patches of higher quality dune mat were mapped in areas that have >50% relative native cover, undulating topography, and lower overall vegetative cover are found in the southwest corner of the study area. In contrast, dune mat plots north of the fence near the current footprint of the pulp mill, showed diagnostic levels of native dune species (11% absolute cover), but they are dominated by non-native species (76% relative cover of non-native species) (Figure 1). A total of 6.8 acres of the study area was mapped as dune mat based on the presence of characteristic plant species (Sawyer et al. 2009), and an additional 0.34 acres was mapped as high-quality dune mat (Appendix A, Figure 2).



*Error bars represent standard error.

Figure 1. Mean Absolute Percent Cover by Vegetation Type in Dune Habitats

Yellow bush lupine scrub (*Lupinus arboreus* Alliance)

Areas dominated by invasive yellow bush lupine in the shrub layer were mapped as yellow bush lupine scrub. These areas contained high absolute cover of non-native species and very few native plants. Species commonly associated with yellow bush lupine scrub within the study area included ripgut brome, sweet vernal grass, and velvetgrass (*Holcus lanatus*) among many other non-native weedy species. Yellow bush lupine is encroaching into areas currently mapped as dune mat, with many seedlings occurring at the transition zone between yellow bush lupine and dune mat communities. A total of 2.18 acres of yellow bush lupine scrub was mapped (Appendix A, Figure 2).

European beach grass swards (*Ammophila arenaria* Semi-Natural Stand)

European beach grass has invaded a great deal of the remaining dune/sand berm topography within the study area, and it is widespread in dunes in the surrounding areas. European beach grass swards were mapped according to MCV online membership rules and only include areas with >80% relative cover of European beach grass. European beach grass swards covered 0.70 acres of the APE (Appendix A, Figure 2).

Coastal willow thickets (*Salix hookeriana* Alliance) (G4 S3)

Coastal willow thickets are dominated my mature coastal willow, with lower cover of other shrub species such as coyote brush (*Baccharis pilularis*). Coastal willow thickets are a Sensitive Natural Community with a state rank of S3. Coastal willow thickets primarily occurred in swale topography along Vance Avenue, and Brewer's rush (*Juncus breweri*) was common in the understory. Coastal willow thickets covered 0.27 acres of the APE (Appendix A Figure 2).

Coastal brambles (*Rubus ursinus* Alliance) (G4 S3)

Coastal brambles are a Sensitive Natural Community with a state rank of S3. Coastal brambles within the APE primarily consisted of mixed native shrubs, co-dominated by California blackberry with coast silk tassel (*Garrya elliptica*), coyotebrush, and wax myrtle (*Morella californica*). A mixture of native and non-native species occurred in the herbaceous layer. SHN identified and mapped coastal brambles within the study area for the Samoa Peninsula Wastewater Project in 2018, and this spatial data was incorporated into current vegetation mapping and confirmed in the field. Coastal brambles occurred in a single 0.20 acre patch along the roadside cut bank east of Vance Avenue on a cut slope (Appendix A, Figure 2).

5. Conclusion

The purpose of this investigation was to evaluate factors that inform designations of ESHA by the Coastal Commission, Coastal Act and LCP, including the presence of rare species and communities, habitat value, and potential for further degradation. The study area north of the fence is former coastal dune habitat that has been anthropogenically leveled. This graded area is surrounded by vegetated sand berms on the south side of the property and a cut area on the west side of the study area, and non-native gravel and coarse dredge spoil substrates are scattered across much of the surface. Other structures and signs of anthropogenic disturbance such as wood piles, leach field, and pipes were mapped within dune communities onsite (Appendix A). Historical aerial imagery shows widespread grading dating back to 1965 and regular

disturbance related to maintaining the mill site (Appendix B). Although the top 16 inches of subsurface soils across most of the site appear to be predominantly sand substrates, they are intermixed with gravel and dredge materials that show a history of mixing by grading, development, and other human disturbances (Appendix C). SHN boring holes 11, 12 and 13 depict “fill” over the area south of the clarifiers (Appendix D). Current landforms within the study area have been predominantly formed by human activity rather than a natural process of aeolian sand deposition, and no longer meet the geomorphological definition of a “dune.” The alteration of the topography can be seen in historical aerial imagery (Appendix B) and observations of current site conditions that provide evidence of development and grading onsite (Appendix A, Appendix C).

Although the natural dune topography has been removed, dune mat plants, including the rare dark-eyed gilia, have persisted in this highly altered and highly invaded habitat. Rare annual dark eyed gilia onsite is densest and appears to be thriving in areas of intermittent anthropogenic disturbance along the fence line access road, whereas it is largely absent from stabilized areas of dense invasive vegetation. Sensitive Natural Communities within the study area include dune mat (G3, S3), coastal willow thickets (G4, S3), and coastal brambles (G4, S3). Dark-eyed gilia, dune mat, and a small area of coastal brambles are likely to be impacted by the Project. Dune mat quality varies in the study area, and some higher-quality patches south of the fence were characterized by a dominance of native dune mat species, lower total vascular plant cover, and undulating topography. The roughly 1,700 square-foot southwestern-most patch of higher-quality dune mat along the fence line is the only higher-quality dune habitat within the Project footprint that does not show clear evidence of grading (but appears to have been altered by scrub vegetation removal), based on site investigations and aerial imagery (Appendix B). The westernmost patch of less-disturbed, higher-quality dune mat is fragmented from other natural native-dominated dune mat communities and surrounded by invasive European beachgrass and yellow bush lupine.

Table 1. Summary of ESHA Criteria as Applied to the Project Site

ESHA Criteria	Disposition Based on Evidence Provided
Rare species or habitat in the subject area	Both CNPS-listed rare plants and Sensitive Natural Communities are present in the subject area.
Valuable species or habitat in the area because of their special nature or role in an ecosystem	Resources onsite are considered lower value habitat because they have been fragmented, invaded, and anthropogenically disturbed over the last 50 plus years.
Easily disturbed or degraded by human activities and developments	The natural dune complex that existed onsite prior to 1965 has been highly altered by grading, development, and invasive species. Remaining native-dominated dune mat patches are fragmented, and rare annual dark eyed gilia onsite is densest in areas of intermittent anthropogenic disturbance along the fence line access road. Habitat onsite does not consist of a relatively intact or pristine landscape that would be easily disturbed or degraded beyond its current condition.
Vegetated dunes subject to ESHA protection under the Humboldt Bay Area Plan	Current vegetated sand berms and cut faces that support dune plants onsite are the result of human activities, and they are not naturally formed by the process of aeolian sand deposition that typically defines dune geomorphology.

In conclusion, although both rare plants and vegetation communities occur onsite, the habitat has been highly altered and degraded by human disturbance and invasive species. The patches of remaining higher-quality dune mat are isolated patches that are fragmented from natural, native-dominated dunes. Based on the current highly degraded status of the former dune complex onsite, it would not be suitably characterized as a relatively intact or pristine habitat that would be easily disturbed or degraded beyond its current condition. Dune mat communities and the dark-eyed gilia population on the North Spit of Humboldt Bay would be better protected by restoring contiguous dune habitat with intact dune structures and long-term protection within natural resource conservation areas offsite. Please see the Restoration and Monitoring Plan (GHD 2021b) for proposed mitigation under CEQA for potential impacts to rare dark eyed gilia and sensitive vegetation communities, including offsite restoration within contiguous protected dune habitat.

References

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Appendices

A. Map Figures

1. Anthropogenic Soil Disturbance Investigation
2. Disturbances by Vegetation Type
3. Special Status Plant Species and Disturbances

B. Historical Aerial Imagery Investigation

C. Site Photo Index

D. Geotechnical Investigation Report (SHN 2020)

E. **Boring Map from Archaeological and Historical Resource Investigation Report (Roscoe and Associates 2020)**

Paper Size ANSI A

0 100 200 300

Feet

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Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

GHD

Nordic Aquafarms California, LLC
Samoa Peninsula Sustainable Aquaculture Development Project
Samoa, Humboldt County, California

Soil Substrates and Anthropogenic Disturbances

Project No. **11205607**
Revision No. **3**
Date **March 2021**

FIGURE 1

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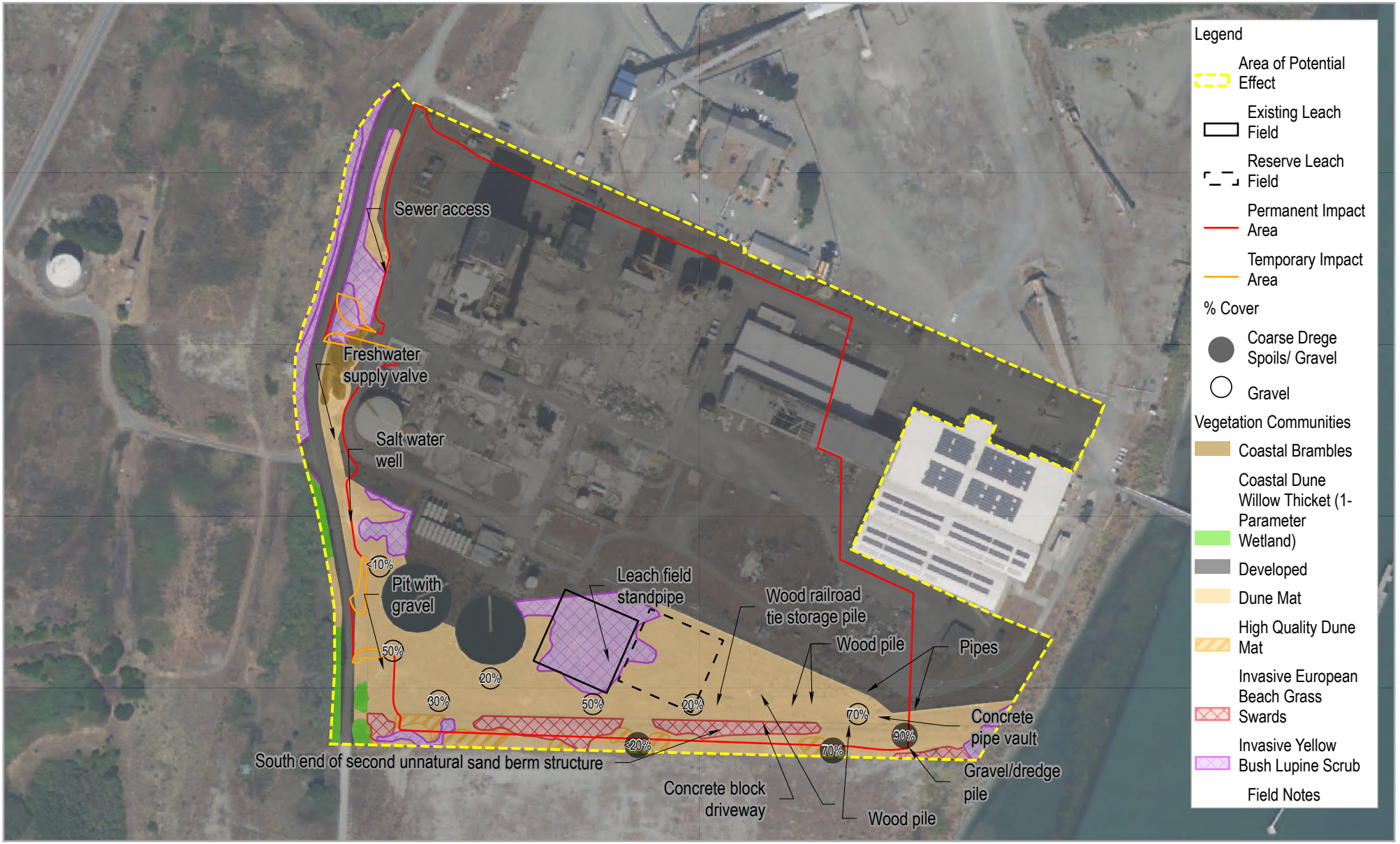
Print date: 02 Mar 2021 - 18:36

Data source: . Created by: jlopez4



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GHD

Nordic Aquafarms California, LLC
Samoa Peninsula Sustainable Aquaculture Development Project
Samoa, Humboldt County, California

Project No. **11205607**
Revision No. **4**
Date **March 2021**

Disturbances by Vegetation Type

FIGURE 2

\\ghdnet\ghd\US\Eureka\Projects\561\11205607\GIS\Maps\Deliverables\11205607_CCCMemo\11205607_CCCMemo.aprx-11205607_001_Vegetation
Print date: 11 Mar 2021 - 12:57

Data source: NAIP Imagery 2018, . Created by: jlopez4

Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

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GHD

Nordic Aquafarms California, LLC
Samoa Peninsula Sustainable Aquaculture Development Project
Samoa, Humboldt County, California

Special Status Plant Species and Disturbances

Project No. **11205607**
Revision No. **3**
Date **March 2021**

FIGURE 3

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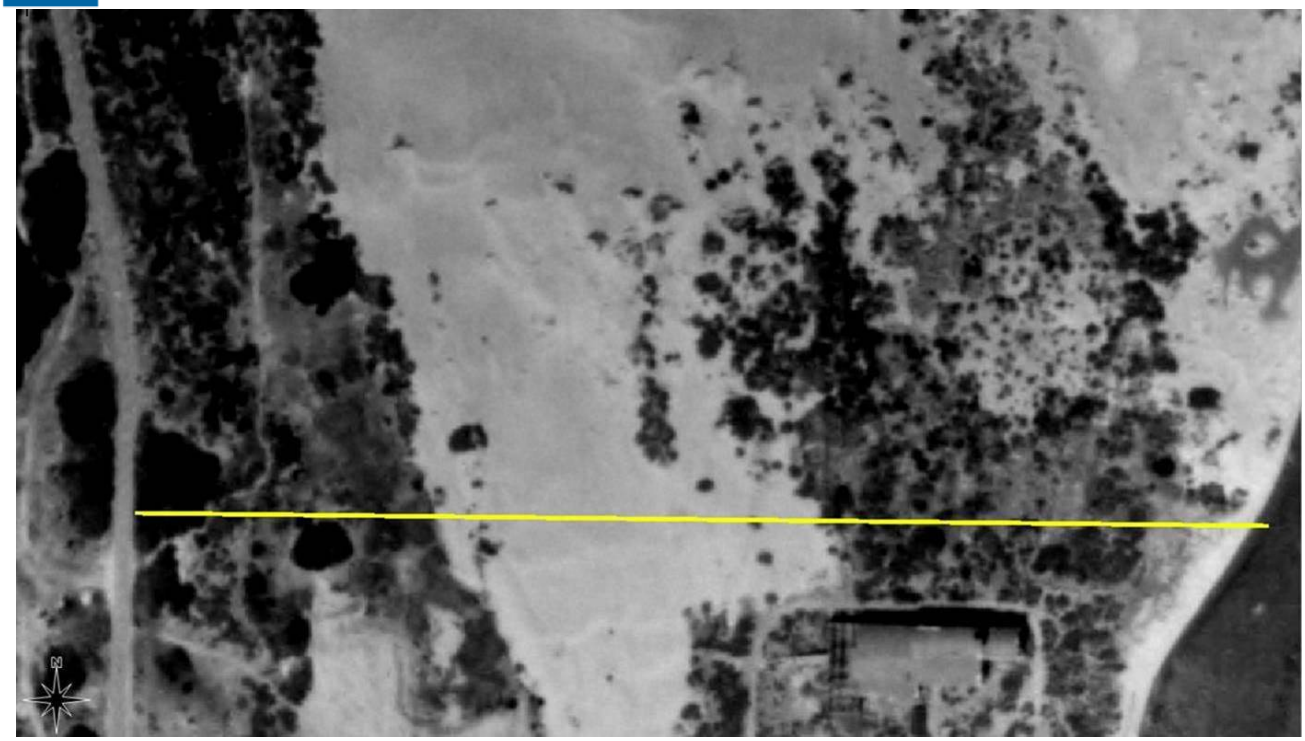

Figure 1. Aerial imagery from 1958 shows naturally moving parabolic dunes oriented with the dominant wind direction through the center of the site and stabilized dune forest, scrub, and hollows on the margins. The yellow reference line shows the approximate location of the current southern cyclone fence line on the property.

Figure 2. Imagery from 1965 shows grading and clearing through much of the center and east side of the site up to the approximate southern property boundary.

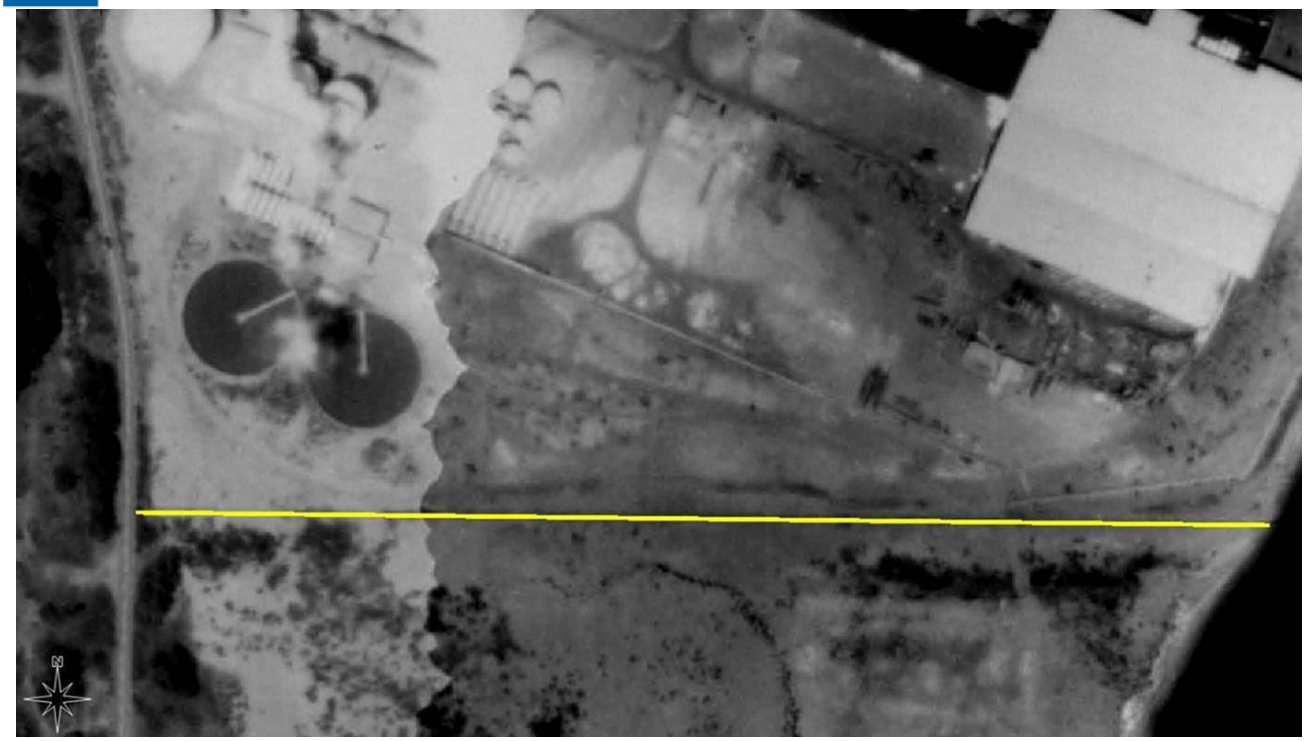

Figure 3. Imagery from 1970 shows additional grading on the west side of the site around the clarifiers that were installed during this period, and substantial vegetation removal south of the current fence line.

Figure 4. Imagery from 1973 shows clear formation of the berm along the southern fence line, and apparent hydraulic spreading of dredge spoils south of the berm within the study area.

Figure 5. Imagery from 1977 shows vegetation stabilizing the berm along the southern fence line and the faint signature of parallel rail spur lines on the eastern portion of the study area.

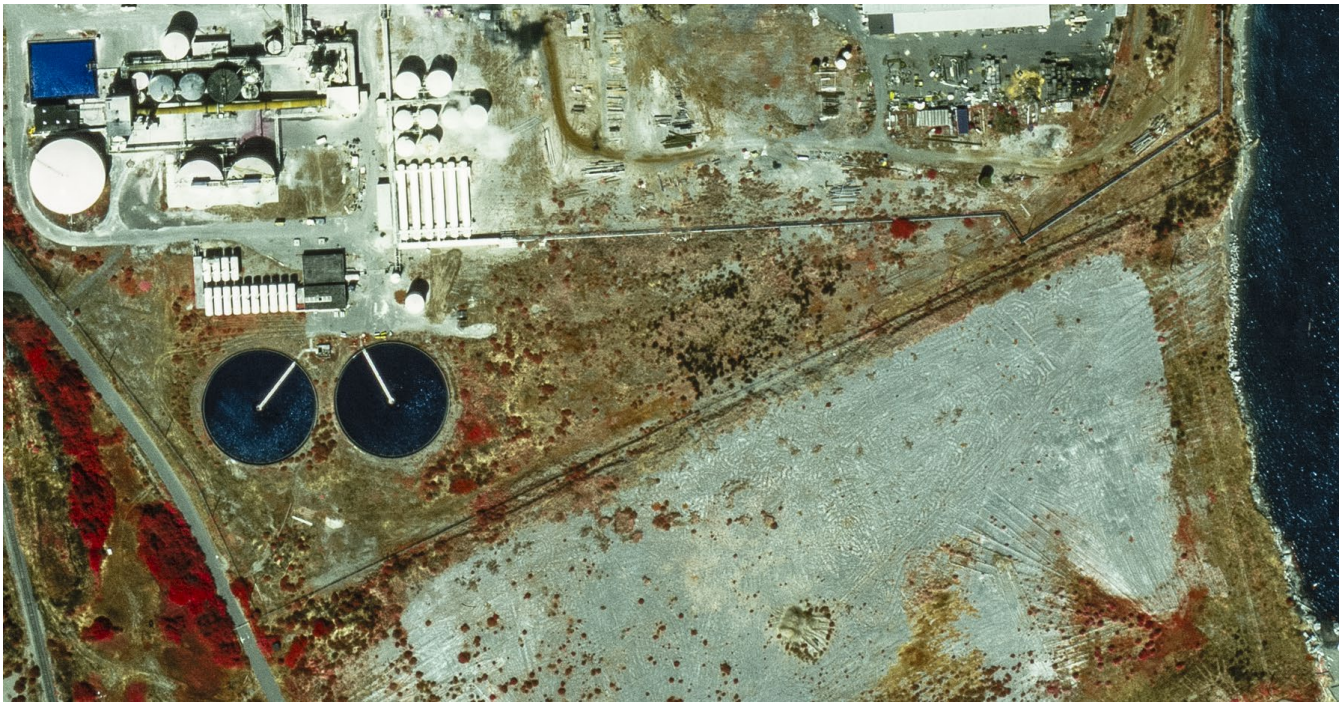

Figure 6. Imagery from 1983 shows increased vegetation growth along the berm, rail spur lines, and dredge spoils to the south.

Figure 7. Imagery from 1990 shows increased vegetation growth stabilizing the graded site.

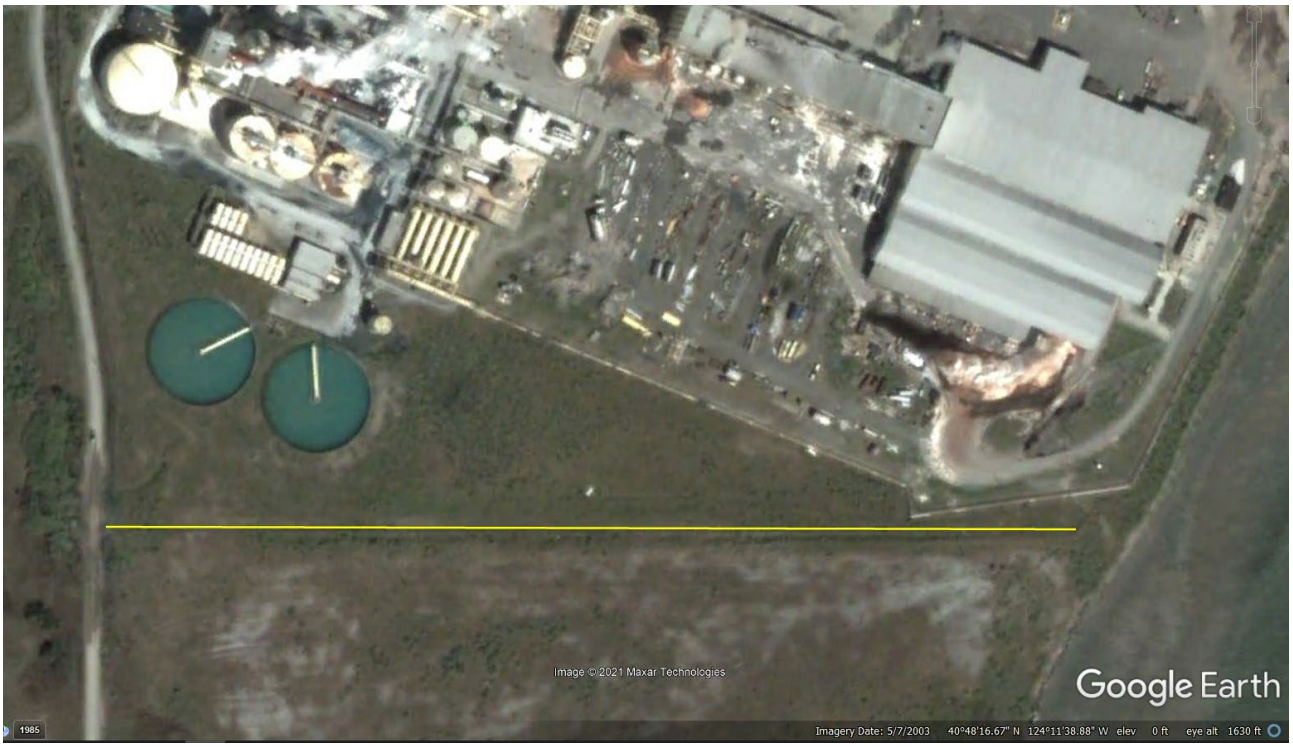

Figure 8. Color imagery from 2003 shows the vegetated sand berm structure along the southern fence line.

Figure 9. Imagery from 2009 shows additional grading and disturbance on both sides of the southern fence line and pit near the clarifiers. The former rail lines are removed and the first debris pile appears.

Figure 10. Imagery from 2012 shows grading around the fence gate between the sand berms and the current locations of railroad tie debris piles.

Figure 11. Imagery from 2016 shows tire tracks and some additional grading near the southwest corner.

Figure 12. Imagery from 2018 shows similar conditions to current-day and provides suitable contrast to detect the yellow-green signature of yellow bush lupine, peach tint of dune mat with widespread ripgut brome and other invasive grasses, and lighter European beachgrass.

Figure 13. SHN's imagery from 2021 shows current vegetated conditions with signs of anthropogenic disturbances such as the leach field and debris piles as discussed in Appendix A.

Appendix C. Site Photo Index

Photo 1. Soil investigation 2/25/21.

Photo 2. Scattered gravel in degraded dune mat near the clarifiers.

Photo 3. Pit with gravel.

Photo 4. Gravel surrounding pit.

Photo 5. Scattered gravel in the access road along the fence line.

Photo 6. Railroad tie wood piles.

Photo 7. Pipes.

Photo 8. Gravel and dredge spoils mixed with sand on the east side of the APE

Photo 9. Gravel and disturbance north of the fence line.

Photo 10. Dredge pile with European beachgrass.

Photo 11. Dredge spoils spread south of the sand berms.

Photo 12. Stabilized eastern sand berm south of cyclone fence.

Photo 13. Second sand berm with European beachgrass.

Photo 14. Second sand berm along the cyclone fence line.

Photo 15. Grading and dredge debris south of the sand berm.

Photo 16. Gate driveway with concrete blocks.

Photo 17. Approximately 90% coarse dredge spoils and gravel on the southeastern end of the property.

Photo 18. Coarse dredge sand and fine gravel intermixed with native dune deposits south of berm.

Photo 19. The least anthropogenically disturbed higher quality dune mat on the southwest corner of the property had sand substrates with high cover of non-vascular species, indicating low sand mobility.

Photo 20. A crust of lichens and mosses along the fence line indicates a relatively stable area with low sand movement.

Photo 21. The highest quality dune mat on the property against the fence line is surrounded by previously disturbed areas dominated by invasive species.

Photo 22. The cut face on the west side of the property has high peaks and supports a patch of coastal brambles as well as many invasive species.

Photo 23. Coastal brambles with California blackberry and coast silk tassel as well as non-native species in the herbaceous layer near the proposed entrance.


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Nordic Aquafarms Project
Roscoe and Associates - February 2020
Area of Potential Effect
P-12-000078 (CA-HUM-20)
Auger Units (02/2020)
0
200
400 Feet
0
50
100 Meters
Scale 1:2,500
2016 Air Photo/ Township 5N, Range 1W,
Sections 20, 21 (Humboldt B.M.)