# Appendix H

## Preliminary Hydrologic and Stormwater Analysis

# Memorandum

April 14, 2021

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|---|---|---|---|
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| CC: | John Ford, Humboldt County Planning Department | | |

**Subject: Nordic Aquafarms Preliminary Hydrologic and Stormwater Analyses, Rev. 3**

# 1. Introduction

## 1.1 Purpose

Nordic Aquafarms Inc (NAF) is proposing to build an entirely land-based aquaculture project at the former Louisiana Pulp Mill in Samoa, California. The project will be sited at the approximately 36-acre lease area and will likely be developed in two to three phases. The total facility building footprint is currently estimated at approximately 767,000 square feet (~17.6 acres) for the 5 buildings and 22,000 square feet (~0.5 acres) for the oxygen generation yard.

A hydrologic and stormwater study was performed to evaluate the impacts of the proposed construction on pre-developed stormwater characteristics and to analyze the measures proposed to mitigate those impacts. This document presents the information, methods, and results generated from that study.

## 1.2 Methodologies and Assumptions

The methodologies used in conducting the hydrologic and stormwater analyses were generated from a variety of sources including existing maps, field data, computer programs, standards, and reference manuals.

The hydrologic analyses were performed using the SCS Dimensionless Unit Hydrograph method with a 24-hour NRCS Type IA synthetic rainfall distribution. This method was used to generate site runoff hydrographs, determine peak flows, and perform infiltration pond routing analysis. The pond routing utilized the software package PondPack V8i to determine the peak flows and pond stages at various storm events. Table 1 below outlines the site-specific design parameters that were used for modeling the site hydrology.

Table 1 Design Parameters

| Coefficent | Value |
|---|---|
| Runoff Coefficient (CN): impervious[1] | 98 |
| Time of Concentration (Tc)[2] | 5 minutes |
| Infiltration Rate | 13 inches/hour |
| Design Infiltration Rate[3] | 6 inches/hour |

1: The curve number for the preliminary calculations was 98, in order to provide conservative estimates for the site runoff and potentially account for any minor design modifications as the project progresses. The final calculations will utilize composite curve numbers based on the landscape, roof top, and pavement areas.
2: The time of concentration was assumed to be 5 minutes to provide a conservative estimate of potential stormwater discharge and potentially account for any minor design modifications as the project progresses.
3: Infiltration rate was determined by the NCRS soil survey. See data in Appendix A. A design infiltration rate of 6 inches/hour was used as a conservative value to account for future sedimentation and potential reduced infiltration rates over the life of the project.

### 1.3 Agency Stormwater Criteria

This project lies within the County of Humboldt's jurisdiction but is outside the regulated Municipal Separate Storm Sewer System (MS4) permit boundaries. Thus, MS4 stormwater criteria do not apply to the project. This project, therefore, will follow the stormwater regulations that conform to the State Water Recourses Control Board's (SWRCB) Construction General Permit (CGP) post-construction requirements.

The CGP post-construction standards require that the proposed project capture and treat the stormwater generated from the 85$^{th}$ percentile 24-hour storm event. In order to minimize the potential for movement of contaminants offsite and ensure no impacts to receiving waters, the NAF facility will exceed the capture requirement for the CGP standards by designing its stormwater treatment system to provide onsite stormwater capture and infiltration up to the 100-year 24-hour storm event. The overall proposed design for the NAF facility will include stormwater treatment for the volume of water generated by the 85$^{th}$ percentile 24-hour rain fall event (See Table 2 below), and stormwater volume capture for the volume of water associated with the 100-year 24-hour storm event (Table 2).

### 1.4 Rainfall Intensity Data

The 24-hour rainfall depths used in this study were obtained from the NOAA Atlas 14, Volume 6, Version 2 Eureka WFO Woodley Island Station 04-2910 (Appendix A). Rainfall depths are summarized in Table 2 below.

Table 2 24-Hour Rainfall Depths

| Design Storm | 24-Hour Rainfall (inches) |
|---|---|
| 85$^{th}$ Percentile | 0.65 |
| 2 Year | 2.66 |

Table 2 24-Hour Rainfall Depths

| Design Storm | 24-Hour Rainfall (inches) |
|---|---|
| 5 Year | 3.53 |
| 10 Year | 4.12 |
| 25 Year | 4.92 |
| 100 Year | 6.19 |

## 2. Existing Storm Drainage Conditions

This existing site is generally flat, sloping from west to east. Most of the site is situated at an elevation of approximately 22 feet (NAVD88), with an elevation range of approximately 20-25 feet throughout the area to be developed (Appendix B, Figure B-1). Stormwater generated on the western side of the site currently drains to an existing pipe system that discharges to the ocean outfall, and stormwater generated on the eastern side of the site currently discharges to Humboldt Bay (Figure B-1).

The Humboldt Bay tidal conditions in the vicinity of the site are listed in Table 3 below. NOAA historical tidal data is included in Appendix C.

Table 3 Datum's and Observed Tides (Humboldt Bay North Spit Buoy)

| Datum | Value (ft, NAVD88) |
|---|---|
| Mean Higher High Water | 6.51 |
| Mean High Water | 5.80 |
| Mean Tide Level | 3.36 |
| Mean Sea Level | 3.36 |
| Mean Low Water | 0.91 |
| Mean Lower Low Water | -0.34 |
| Highest Tide Observed | 9.54 |

## 3. Proposed Drainage Conditions

The existing industrial buildings and surrounding hardscape areas will be demolished as a part of this project except for the two existing warehouse buildings that are nearest the bay (Figure B-2). Much of the existing stormwater piping located on the interior of the site will also be removed, with the remaining portion along the northern border of the site being used as emergency overflow piping for major storm events that produce stormwater volumes that exceed the capacity of the stormwater treatment system. For storm events up to the 100-year 24 hour storm the site has been designed to have no offsite discharge to ensure no stormwater impacts to receiving waters.

The proposed facility will result in an increase of impervious surface area from 18.8 acres to 25.9 acres (as part of a total lease area of 35.6 acres), which results in a 20% net increase of impervious surface area compared to existing site conditions.

This project is proposing three vegetated bioretention/infiltration ponds and a series of Low Impact Development (LID) facilities to manage the stormwater generated from the five separate drainage basins of the site (Figure B-2), with the goal of capturing and infiltrating all onsite stormwater up to the 100-year, 24 hour storm event. Typical cross sections of the proposed bioretention/infiltration ponds and LID facilities are included as Appendix D. Figure B-3 depicts the preliminary site grades and proposed stormwater drainage flow pathways throughout the facility.

Drainage basins 1 through 3 will utilize vegetated bioretention/infiltration ponds, and drainage basin 4 will employ a series of LID stormwater facilities in combination with infiltration trenches to provide volume capacity for storm events up to the 100-year storm event. The bioretention/infiltration ponds and trenches will be up to maximum 4’ deep, with bottom elevations ranging from 16 to 18 feet (NAVD 88), which is above typical tidal elevations in the vicinity.

An 18-inch layer of topsoil will provide stormwater treatment, for the 85$^{th}$ percentile storm event or greater, in both the bioretention/infiltration ponds and LID stormwater facilities (Appendix D). The 18-inch layer of topsoil has been selected to be in conformance with the Humboldt County Low Impact Development Guidelines (Humboldt County 2016), which require a minimum depth of Bioretention Soil Media (BSM) based on national studies.

Drainage basin 5 includes the gravel fire access road located immediately south of building 2. The fire access road has been designed to match the existing topography in the area to minimize the potential for stormwater runoff from the road. The fire access road has also been located and graded such that stormwater runoff in this basin will not impact the area within a minimum of 10 feet offset from any identified high quality dune mats.

Pond routing models have been completed for Ponds 1-3 and their performance under various storm events are summarized in Table 4 below. For the pond routing models, the site was subdivided into sub basins that correspond to the treatment ponds. Figure B-2 depicts the ponds and LIDs, sub basins, and sub basin areas for the site. Figure B-3 shows preliminary site grades and stormwater flow paths. Stormwater modeling output data is included as Appendix E.

### Table 4 Infiltration Pond Performance Summary

| Facility | Storm Event | Peak Inflow (cfs) | Surface Water Elevation (ft) (NAVD 88) | Required Storage (cf) | Proposed Pond Storage (cf) |
|---|---|---|---|---|---|
| Pond 1 | $85^{th}$ Percentile | 1.0 | 18.2 | 2,443 | 60,150 |
| | 2 Year | 5.4 | 18.9 | 14,925 | |
| | 5 Year | 7.3 | 19.2 | 20,864 | |
| | 10 Year | 8.5 | 19.5 | 25,726 | |
| | 25 Year | 10.2 | 19.8 | 33,146 | |
| | 100 Year | 12.9 | 20.4 | 45,479 | |
| Pond 2 | $85^{th}$ Percentile | 0.6 | 18.4 | 1,046 | 29,099 |
| | 2 Year | 3.0 | 19.9 | 8,625 | |
| | 5 Year | 4.0 | 20.4 | 12,721 | |
| | 10 Year | 4.7 | 20.8 | 15,978 | |
| | 25 Year | 5.7 | 21.2 | 20,761 | |
| | 100 Year | 7.2 | 21.9 | 28,279 | |
| Pond 3 | $85^{th}$ Percentile | 0.6 | 18.2 | 1,436 | 30,250 |
| | 2 Year | 3.2 | 19.1 | 8,957 | |
| | 5 Year | 4.3 | 19.5 | 13,007 | |
| | 10 Year | 5.1 | 19.8 | 16,248 | |
| | 25 Year | 6.1 | 20.2 | 20,761 | |
| | 100 Year | 7.7 | 20.9 | 28,951 | |

Tables 5 and 6 provide a summary of the basin 4 infiltration trench performance and size. The lengths shown in Table 6 account for the total length required to capture and treat the 100-year, 24-hour storm event. The total length of the trench can be broken up in sub-trenches (sized accordingly) to align with the proposed LIDs shown in Figure B-2.

### Table 5 Basin 4 100-Year Storm Event Infiltration Trench Performance Summary

| Facility | Peak Inflow (cfs) | Design Trench Outflow Rate (cfs) | Required Storage Volume (cf) | Proposed Trench Storage (cf) |
|---|---|---|---|---|
| Infiltration Trench | 13.3 | 2.85 | 39,093 | 43,374 |

### Table 6 Basin 4 Infiltration Trench Size Summary

| Facility | Length (ft) | Width (ft) | Depth (ft) | Perforated Pipe |
|---|---|---|---|---|
| Infiltration Trench | 1400 | 12 | 4 | 4 – 30 inch dia. |

Tables 7 and 8 provide a summary of the stormwater discharge and subsurface infiltration of stormwater associated with basin 5. For the purposes of this analysis a 2.25 foot wide existing sand surface buffer along the entire length of the south side of the gravel road was modeled to demonstrate infiltration of stormwater runoff associated with the 100-year storm event. The gravel access road and 2.25 foot wide buffer are located a minimum of 12 feet offset from any identified high quality dune mats.

Table 7 Basin 5 100-Year Storm Event Infiltration Buffer Performance Summary

| Facility | Peak Inflow (cfs) | Design Infiltration Buffer Outflow Rate (cfs) | Required Storage Volume (cf) | Modeled Infiltration Buffer Storage (cf) |
|---|---|---|---|---|
| Infiltration Buffer | 1.0 | 0.46 | 737 | 846 |

Table 8 Basin 5 Infiltration Buffer Size Summary

| Facility | Length (ft) | Width (ft) | Depth (ft) |
|---|---|---|---|
| Infiltration Buffer | 1140 | 2.25 | 1 |

The above hydrologic analysis demonstrates that the stormwater treatment ponds and LID infiltration trench facilities proposed for the site provide stormwater treatment and volume capacity that exceeds the 100-year storm event for each of the site's stormwater basins. As such, the proposed stormwater treatment for the site meets and exceeds the post-construction stormwater management criteria of the CGP. The above analysis also demonstrates that the high-quality dune mat area located to the south of building 2 will not be impacted by the anticipated stormwater runoff from the gravel fire access road at the site.

### 3.1 Infiltration Basin Design Considerations

The design of the storm water infiltration basins is complex and must consider several factors that influence the infiltration rate and overall ability of the basin to adequately function. These factors include near-surface soil characteristics, subsurface geology, groundwater conditions and infiltration pond configuration. Massman et al (Massman, 2003) developed an infiltration pond design manual that outlines a step by step process for infiltration basin design. The steps include:

1. Estimation of stormwater runoff that is routed to the infiltration pond,
2. Selection of pond configuration and depth,
3. Subsurface site characterization and data collection,
4. Determination of the saturated hydraulic conductivity ($K_s$),
5. Determination of the hydraulic gradient, and
6. Estimation of the infiltration pond effective infiltration rate

*Storm Water Runoff*

The storm water runoff for the entire site was calculated using the SCS Dimensionless Unit Hydrograph method with a 24-hour NRCS Type IA synthetic rainfall distribution and is presented in Appendix E. The resulting runoff hydrograph for the 100-year, 24-hour storm event had a peak flow of approximately 13.3

cubic feet per second (cfs) (at basin 4) and a total volume of 623,092 cubic feet (4,661,052 gallons). The volume of stormwater listed above doesn't include discharge from basin 5. Since basin 5 is relatively small and model analysis demonstrates that stormwater from this basin will be infiltrated by the existing sand surface buffer immediately south of the gravel fire access road, it has been excluded from the following infiltration design analysis.

*Pond Configuration and Depth*

The detention and infiltration features include 3 detention/infiltration ponds and one infiltration trench. The area and depth of the features are summarized in Table 9.

Table 9 Basin Infiltration Size Summary

| Facility | Max Depth BGS (ft) | Area ($ft^2$) |
|---|---|---|
| Pond 1 | 3 | 21,500 |
| Pond 2 | 4 | 10,200 |
| Pond 3 | 3 | 13,188 |
| Trench | 6 | 16,800 |

*Subsurface Site Characterization*

The subsurface site characterization was performed by SHN Consulting Engineers and Geologists and is summarized in the Preliminary Geotechnical Investigation Report, June 2020. Field work consisted of 13 geotechnical test borings and 6 Seismic Cone Penetrometer tests (CPT). An excerpt from the report characterizes the site as:

"*Data from the borings and SCPT probes indicates the upper 130 feet of the subsurface profile to be consistent across the project site. A thin veneer of loose surficial sandy fill overlies most of the project site. Below the fill, the subsurface profile can be divided into four primary depositional units consisting of:*

1. *loose to mostly medium dense recent and older dune deposits,*
2. *dense to very dense beach and shallow marine deposits,*
3. *medium stiff bay mud, and*
4. *very dense Hookton Formation sand and sand with silt.*

*The dune deposits are composed of clean fine sand and are present to a maximum depth of about 50 feet below existing site grades (approximate elevation of -25 feet relative to sea level). The dune deposits are in turn underlain by beach and shallow marine deposits from a depth of 40 or 50 (±) feet and continuing to 90 (±) feet. The beach and shallow marine deposits are composed of medium to coarse grained sand with occasional thin layers of subrounded fine gravel. The transition from the dune to beach deposits is readily identifiable by the sudden occurrence of medium to coarse sand and the presence of fine gravel, shell fragments and woody debris, and marked increase in the sampler penetration resistance. Underlying the beach and shallow marine deposits are much older finegrained bay deposits and granular deposits of the*

*Hookton Formation (Ogle, 1953). The depths to the varying stratums and relative densities of the materials were observed to be relatively uniform across the site."* (SHN 2020)

The infiltration basins are located in the upper stratums consisting of sand fill and recent to older dune deposits. A number of soil samples, representative of the site, were collected and grain size sieve analyses were performed. Soil sample location maps are included in Appendix F, which show that the borings were collected in areas that correspond with the "Urban land-Anthraltic" NRCS soil map units (Appendix A). The results of the sieve analysis are included in Geotechnical Report (SHN 2020).

Depth to groundwater was measured at multiple locations throughout the site and was found to be between 12 to 16 feet below the ground surface. The groundwater surface is relatively flat with very little gradient. Measurements throughout the year indicate a seasonal variation of 1 to 3 feet (SHN, 2020).

*Estimation of Saturated Hydraulic Conductivity ($K_s$ )*

In 1997 aquifer tests were conducted at the site (SHN, 2011). An excerpt from SHN's 2011 site conceptual model is as follows:

*"In 1997, aquifer tests were conducted on monitoring wells MW-4 and MW-10 in order to determine the hydraulic conductivity of the screened portion of the aquifer (first encountered groundwater), and to gain a better understanding of site aquifer characteristics. For the aquifer test conducted on monitoring well MW-4, two piezometers were installed 5 feet and 15 feet away from the pumping well, and used as water level observation points. For the aquifer pump test conducted on monitoring well MW-10, the piezometers were installed 10 feet and 20 feet away from the pumping well, and used as water level observation points. A submersible pump was installed in the pumping well prior to the start of each pump test. For each test, the pump was started, and each piezometer and the pumping well were monitored for depth to water at pre-selected time intervals. The pumping rate for the duration of each test was approximately 12 gallons per minute. Upon completion of each test, the pump was turned off, and each piezometer and the pumping well were monitored for water level recovery. Each test, including recovery monitoring, lasted approximately 12 hours.*

*Based on the results of both aquifer pump tests, it appears that the information collected from piezometers PZ-1 and PZ-3 is the most representative data, and was used to evaluate the site aquifer hydraulic characteristics. Hydraulic conductivity (K) in these two piezometers ranged from 570 feet per day (ft/day) in piezometer PZ-3, to 915 ft/day in piezometer PZ-1."* (SHN 2011)

For this analysis, a value of 743 ft/day (the average of the two most representative hydraulic conductivity values at PZ-1 and PZ-2) was used. Maps showing the locations of MW-4 and MW-10, located in the north and central portions of the facility, respectively, are included in Appendix F.

The selected value used for hydraulic conductivity is more than one order of magnitude greater than the NRCS estimated $K_s$ for soil unit 155 shown in Appendix A. Since the $K_s$ estimates from the aquifer pump tests were generated using site specific data, they will be used in this analysis.

*Estimation of Hydraulic Gradient*

The hydraulic gradient describes the driving force that causes the storm water in a pond or infiltration trench to infiltrate into the soil. The primary force causing the infiltration is gravity and capillary suction. At this site, the effects of capillary suction are minimal due to the observed grain sizes and uniform grain size distribution. Massmann et al. developed an equation to estimate the hydraulic gradient for sites with shallow groundwater and sandy soil, similar to this site. In this estimation, the effects due to the capillary suction are incorporated in the constant (138.62 or 78) and a value is not explicitly used. For sands with minimal amounts of fines capillary suction has a very minor effect upon the wetting front. They used computer simulations and regression analysis to determine an effective gradient under steady-state conditions and is calculated as:

$$gradient \approx \frac{D_{wt} + D_{pon}}{138.62(K^{0.1})}$$

Where:
K is hydraulic conductivity in ft/day
$D_{tw}$ is the depth in feet from the base of the infiltration pond to the water table
$D_{pond}$ is the depth of the storm water in the pond

A similar process for infiltration trenches was used to develop the following equation:

$$gradient \approx \frac{D_{wt} + D_{trenchj}}{78(K^{0.05})}$$

Where:
K is hydraulic conductivity in ft/day
$D_{tw}$ is the depth in feet from the base of the infiltration trench to the water table
$D_{trench}$ is the depth of the storm water in the trench

It should be noted that the Massmann et al. gradient estimation uses a basin size correction factor for ponds with bottom areas between 0.6 and 6 acres in size. For small ponds, ponds with area equal to 2/3 acre, the correction factor is equal to 1.0. All of the pond and trench areas are less than 2/3 acre, and a correction factor of 1.0 was used.

The hydraulic conductivity used in the estimation is the saturated hydraulic conductivity.

The infiltration gradients at the site were calculated for a range of depths (Table 10). With the depth to groundwater ranging from 12 to 16 feet at the site and the trench being 6 feet deep, the resulting depth to groundwater under the infiltration facility would range from 6 to 10 feet during dry periods and would decrease to 3 to 7 feet during the wet season.

**Table 10 Estimated Facility Infiltration Gradients**

| Season | Distance from bottom of feature to Groundwater (ft) | Gradient (ft/ft) | | | |
|---|---|---|---|---|---|
| | | 3 ft depth in pond | 4 ft depth in pond | 3 ft depth in trench | 4 ft depth in trench |
| Dry | 6 | 0.034 | 0.037 | 0.083 | 0.092 |
| Dry | 10 | 0.048 | 0.052 | 0.120 | 0.129 |
| Wet | 3 | 0.022 | 0.026 | 0.055 | 0.064 |
| Wet | 7 | 0.037 | 0.041 | 0.092 | 0.101 |

*Estimation of Infiltration Rate*

The infiltration rate for the facility may be estimated using Darcy's law, which is calculated by multiplying the saturated hydraulic conductivity with the hydraulic gradient. This infiltration rate is for the ideal conditions and assumes that conditions will remain constant with what was originally measured at the site. However, with use the infiltration rates may be significantly reduced due to siltation and biofouling. Siltation occurs with fine sediments are washed into the infiltration facility with the storm water runoff and biofouling occurs when vegetation and other debris wash into the facility and promotes the growth of other plants. To account for the decrease in efficiency a correction factor is applied to the Darcy's law calculation. Correction factors for biofouling and siltation were taken from Massmann et al. (Massmann, 2003) and the Federal Highway Administration Urban Design Drainage Manual and ranged from 0.2 to 0.9 for ponds and 0.6 to 0.9 for trenches. For this analysis, a value of 0.55 was selected for ponds and 0.75 for the trench. Selection of the correction factor considered the potential for biofouling/sedimentation based on observed site conditions and a moderate maintenance effort.

The infiltration rates for each detention/infiltration feature were calculated and are summarized in Table 11. In calculating the infiltration rates the most conservative values for each parameter were used. The gradient calculation used the wet season depths with the least separation between the bottom of the feature and groundwater elevation. The total maximum infiltration rate per day for each facility exceeds the stormwater expected for a 100-year event.

**Table 11 Maximum Daily Infiltration Rate by Detention/Infiltration Feature**

| Facility | Max Depth (ft) | Ks (ft/day) | Gradient (ft/ft) | Correction Factor | Infiltration q (ft/day) | Area ($ft^2$) | Infiltration Q ($ft^3$/day) | 100-Year Event Rainfall Q ($ft^3$/day) |
|---|---|---|---|---|---|---|---|---|
| Pond 1 | 3 | 743 | 0.022 | 0.55 | 9.1 | 21,500 | 196,343 | 190,681 |
| Pond 2 | 4 | 743 | 0.026 | 0.55 | 10.7 | 10,200 | 108,674 | 106,127 |
| Pond 3 | 3 | 743 | 0.022 | 0.55 | 9.1 | 13,188 | 120,436 | 113,908 |
| Trench | 4 | 743 | 0.055 | 0.75 | 30.8 | 16,800 | 517,448 | 212,376 |

### 3.2 Groundwater Mounding Considerations

Groundwater mounding has the potential to occur beneath stormwater management structures designed to infiltrate stormwater runoff. Concentrating recharge in a small area can cause groundwater mounding that affects the local water table by altering flow directions or causing groundwater to reach the surface (Colorado School of Mines, 2005). Groundwater mounding typically occurs in subsurface soils with low hydraulic conductivity.

Colorado School of Mines' guidance (2005) for assessing the potential for groundwater mounding recommends that groundwater mounding is not a concern where:

- Site soils are more permeable than fine sand
- The seasonal depth to groundwater is less than 40 feet below grade, and
- There are not any laterally continuous restrictive layers within 20 feet of the ground surface.

Historical site-specific investigations at the NAF Project Site demonstrate that the subsurface soils are extremely transmissive, fine-grained dune sands and that groundwater is unconfined and tidally influenced (SHN, 2011), with a minimum depth to groundwater of approximately 12 feet below ground surface.

Based our review of the historical data for the site in comparison to groundwater mounding assessment guidance and the infiltration assessment (Section 3.1), the site appears to have sufficient capacity to assimilate additional stormwater in excess of natural infiltration and groundwater mounding is not anticipated to occur.

### 3.3 Historical Site Contamination Considerations

The NAF Project Site was historically developed as a pulp mill in 1964, which operated until late 2008 when the pulp mill was permanently shut down. The property is currently a Brownfields site with the North Coast Regional Water Quality Control Board (RWQCB) acting as the lead agency for the ongoing investigations and cleanup of historical contamination, and overseeing the current groundwater monitoring for the site.

In this section, we look at the potential effect of the proposed stormwater management system on the residual soil and groundwater impacts at the site. For this effort, GHD reviewed the Interim Measures Work Plan (IMWP) recently developed for the site (SHN, 2020) which presents the site history and a discussion of the remaining chemicals of potential concern (COPCs) in site soils and groundwater. Figures 4 and 5 of the IMWP depict the approximate areas of residual contaminants in soil and groundwater, respectively, and also show the locations of the proposed NAF Project buildings (Appendix F).

With the exception of a small section of the LID stormwater facilities located between buildings 3 and 4 (Figure B-3), all of the stormwater basins, LID facilities, and infiltration trenches for the NAF Project are positioned outside the footprints of the COPCs in soil and groundwater as depicted on Figures 4 and 5 of the IMWP. Thus, based on the location of the vast majority of the stormwater management structures being outside of the primary areas of known contamination, and the discussions provided in Sections 3.1 and 3.2, above, the Project is anticipated to have little to no significant impact on the residual soil and groundwater plumes at this site.

## 4. References

Colorado School of Mines. (January 2005). "Guidance for Evaluation of Potential Groundwater Mounding Associated with Cluster and High-Density Wastewater Soil Absorption Systems." St. Louis, MO:National Decentralized Water Resources Capacity Development Project.

Department of Toxic Substances Control. (April 2020). "Response to Comments on McNamara and Peepe Lumber Mill Monitoring." Sacramento, CA:DTSC.

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---. (March 2020). "First Quarter 2020 Groundwater Monitoring Report, Evergreen Pulp Mill Incorporated, One TCF Drive, Samoa California, Case No. 1NHU892." Eureka, CA:SHN

---. (June 2020). "Preliminary Geotechnical Investigation Report, Proposed Nordic Aquafarms California Facility, Redwood Marin Terminal II, 364 Vance Avenue, Samoa Peninsula, Humboldt County, CA." Eureka, CA:SHN

---. (October 2020). "Interim Measures Work Plan, Former Evergreen Pulp Mill, Samoa California, Case No. 1NHU892." Eureka, CA:SHN

# Appendix A - Precipitation Frequency Data and NCRS Soil Survey Data

**NOAA Atlas 14, Volume 6, Version 2 EUREKA WFO**
**WOODLEY IS**
**Station ID: 04-2910**
**Location name: Eureka, California, USA***
**Latitude: 40.8097°, Longitude: -124.1603°**
**Elevation:**
**Elevation (station metadata): 20 ft****
* source: ESRI Maps
** source: USGS

**POINT PRECIPITATION FREQUENCY ESTIMATES**

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

## PF tabular

**AMS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]**

| Duration | Annual exceedance probability (1/years) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1/2 | 1/5 | 1/10 | 1/25 | 1/50 | 1/100 | 1/200 | 1/500 | 1/1000 |
| 5-min | **0.144** (0.126-0.165) | **0.211** (0.184-0.243) | **0.258** (0.223-0.301) | **0.323** (0.269-0.393) | **0.377** (0.306-0.469) | **0.434** (0.343-0.556) | **0.496** (0.380-0.656) | **0.586** (0.427-0.812) | **0.660** (0.463-0.951) |
| 10-min | **0.206** (0.180-0.237) | **0.302** (0.264-0.349) | **0.370** (0.320-0.431) | **0.464** (0.386-0.563) | **0.540** (0.439-0.672) | **0.623** (0.492-0.797) | **0.712** (0.544-0.940) | **0.840** (0.613-1.16) | **0.947** (0.664-1.36) |
| 15-min | **0.249** (0.218-0.287) | **0.365** (0.319-0.422) | **0.447** (0.387-0.521) | **0.561** (0.467-0.680) | **0.653** (0.531-0.813) | **0.753** (0.595-0.963) | **0.861** (0.658-1.14) | **1.02** (0.741-1.41) | **1.15** (0.803-1.65) |
| 30-min | **0.339** (0.298-0.391) | **0.498** (0.435-0.576) | **0.610** (0.528-0.711) | **0.765** (0.637-0.928) | **0.892** (0.724-1.11) | **1.03** (0.811-1.32) | **1.17** (0.898-1.55) | **1.39** (1.01-1.92) | **1.56** (1.10-2.25) |
| 60-min | **0.479** (0.419-0.552) | **0.702** (0.614-0.812) | **0.860** (0.745-1.00) | **1.08** (0.898-1.31) | **1.26** (1.02-1.56) | **1.45** (1.14-1.85) | **1.66** (1.27-2.19) | **1.95** (1.43-2.71) | **2.20** (1.54-3.17) |
| 2-hr | **0.736** (0.645-0.849) | **1.04** (0.906-1.20) | **1.25** (1.08-1.46) | **1.55** (1.29-1.88) | **1.79** (1.46-2.23) | **2.05** (1.62-2.63) | **2.34** (1.79-3.09) | **2.76** (2.01-3.82) | **3.10** (2.17-4.47) |
| 3-hr | **0.938** (0.822-1.08) | **1.30** (1.13-1.50) | **1.55** (1.34-1.81) | **1.91** (1.59-2.32) | **2.20** (1.79-2.74) | **2.52** (1.99-3.22) | **2.86** (2.18-3.77) | **3.35** (2.44-4.64) | **3.77** (2.64-5.43) |
| 6-hr | **1.36** (1.19-1.56) | **1.83** (1.60-2.12) | **2.17** (1.88-2.53) | **2.64** (2.20-3.20) | **3.02** (2.45-3.75) | **3.43** (2.71-4.39) | **3.87** (2.96-5.11) | **4.51** (3.29-6.24) | **5.04** (3.53-7.25) |
| 12-hr | **1.93** (1.69-2.22) | **2.57** (2.25-2.97) | **3.02** (2.61-3.52) | **3.63** (3.02-4.40) | **4.12** (3.34-5.12) | **4.64** (3.66-5.93) | **5.19** (3.97-6.85) | **5.98** (4.36-8.28) | **6.62** (4.64-9.53) |
| 24-hr | **2.66** (2.38-3.03) | **3.53** (3.15-4.04) | **4.12** (3.66-4.75) | **4.92** (4.23-5.84) | **5.54** (4.67-6.71) | **6.19** (5.11-7.67) | **6.88** (5.53-8.73) | **7.84** (6.07-10.3) | **8.61** (6.45-11.7) |
| 2-day | **3.45** (3.09-3.94) | **4.62** (4.13-5.29) | **5.40** (4.79-6.21) | **6.42** (5.52-7.62) | **7.21** (6.08-8.72) | **8.02** (6.62-9.93) | **8.86** (7.13-11.3) | **10.0** (7.76-13.2) | **10.9** (8.20-14.9) |
| 3-day | **3.89** (3.48-4.43) | **5.24** (4.68-5.99) | **6.13** (5.43-7.05) | **7.29** (6.26-8.65) | **8.17** (6.89-9.89) | **9.07** (7.48-11.2) | **10.0** (8.04-12.7) | **11.3** (8.72-14.8) | **12.2** (9.18-16.7) |
| 4-day | **4.27** (3.82-4.87) | **5.79** (5.17-6.62) | **6.77** (6.00-7.79) | **8.05** (6.92-9.55) | **9.02** (7.60-10.9) | **10.00** (8.24-12.4) | **11.0** (8.84-14.0) | **12.4** (9.56-16.3) | **13.4** (10.1-18.2) |
| 7-day | **5.42** (4.85-6.18) | **7.44** (6.64-8.51) | **8.73** (7.74-10.0) | **10.4** (8.91-12.3) | **11.6** (9.78-14.0) | **12.8** (10.6-15.9) | **14.1** (11.3-17.9) | **15.7** (12.2-20.7) | **17.0** (12.8-23.1) |
| 10-day | **6.36** (5.69-7.25) | **8.78** (7.84-10.0) | **10.3** (9.13-11.9) | **12.2** (10.5-14.5) | **13.7** (11.5-16.5) | **15.1** (12.4-18.7) | **16.5** (13.3-21.0) | **18.4** (14.2-24.2) | **19.8** (14.9-27.0) |
| 20-day | **8.88** (7.95-10.1) | **12.3** (10.9-14.0) | **14.3** (12.7-16.5) | **16.9** (14.5-20.1) | **18.8** (15.8-22.7) | **20.6** (17.0-25.5) | **22.4** (18.0-28.5) | **24.8** (19.2-32.7) | **26.6** (19.9-36.1) |
| 30-day | **11.0** (9.88-12.6) | **15.1** (13.5-17.3) | **17.6** (15.6-20.3) | **20.7** (17.8-24.6) | **22.9** (19.3-27.7) | **25.1** (20.7-31.0) | **27.2** (21.8-34.5) | **29.9** (23.1-39.4) | **31.9** (23.9-43.3) |
| 45-day | **14.3** (12.8-16.3) | **19.4** (17.4-22.2) | **22.5** (20.0-25.9) | **26.3** (22.6-31.2) | **28.9** (24.4-35.0) | **31.5** (26.0-39.0) | **34.0** (27.3-43.2) | **37.2** (28.8-49.0) | **39.5** (29.6-53.8) |
| 60-day | **16.9** (15.1-19.3) | **22.8** (20.3-26.0) | **26.2** (23.2-30.2) | **30.4** (26.1-36.1) | **33.4** (28.2-40.4) | **36.3** (29.9-44.9) | **39.0** (31.4-49.5) | **42.5** (32.9-56.0) | **45.0** (33.8-61.3) |

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of annual maxima series (AMS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and annual exceedance probability) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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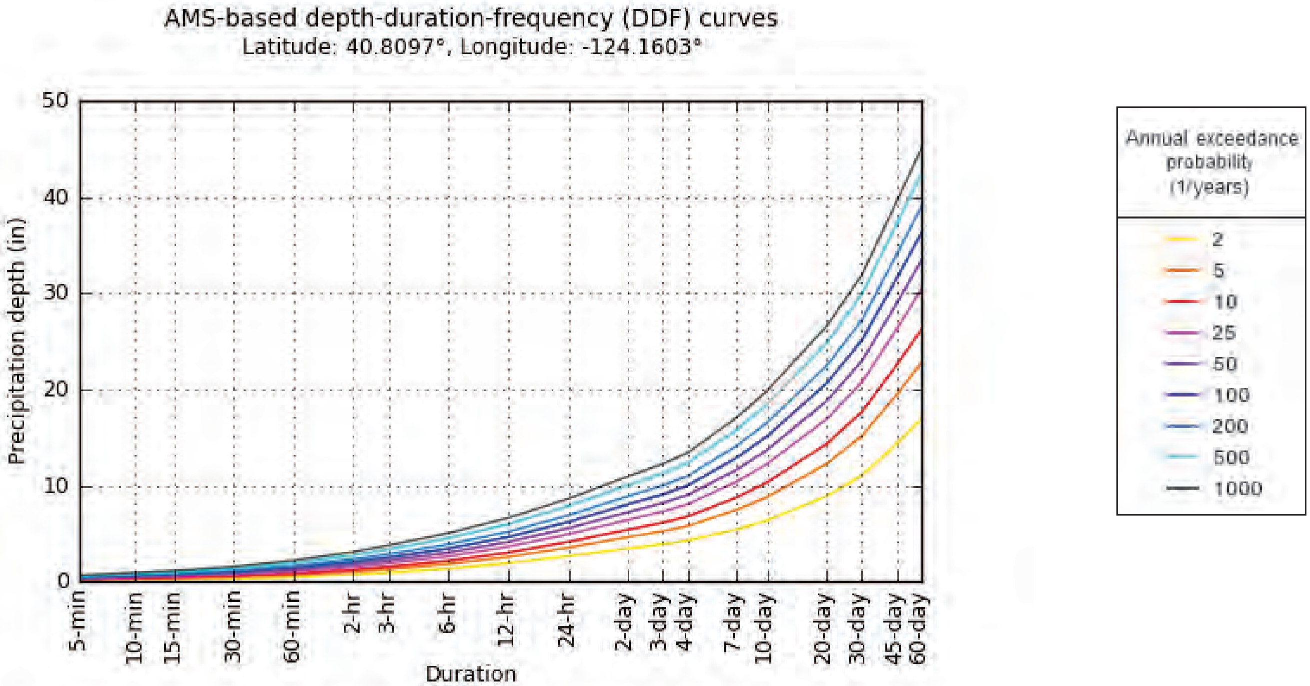
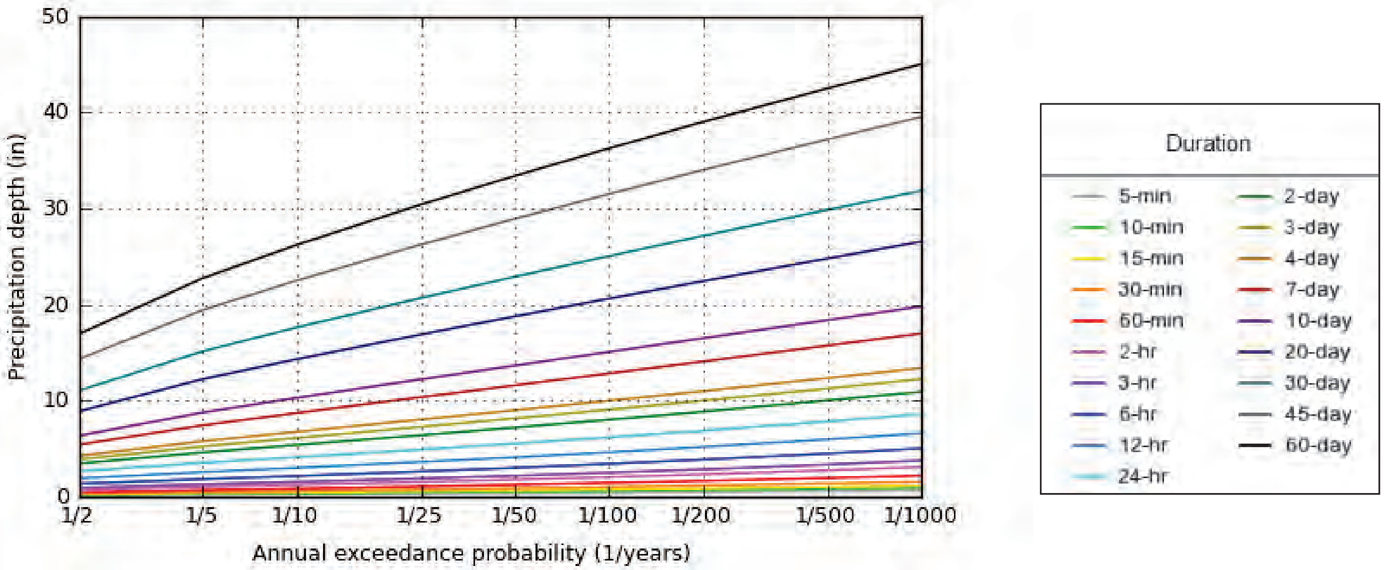
## PF graphical




NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Mon Jun 29 21:35:59 2020

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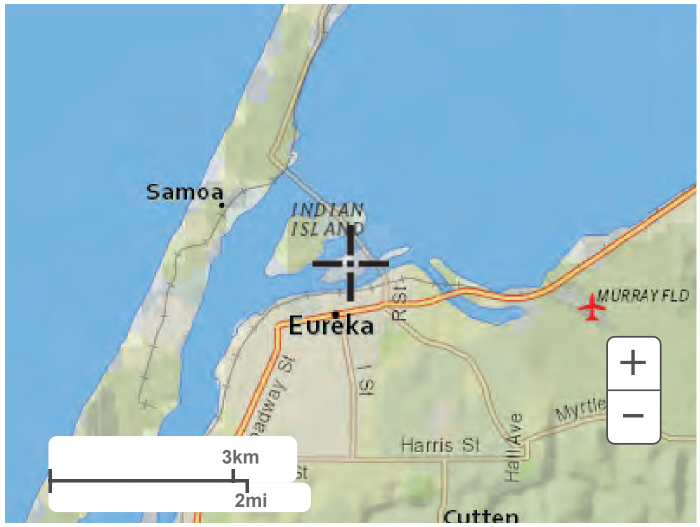
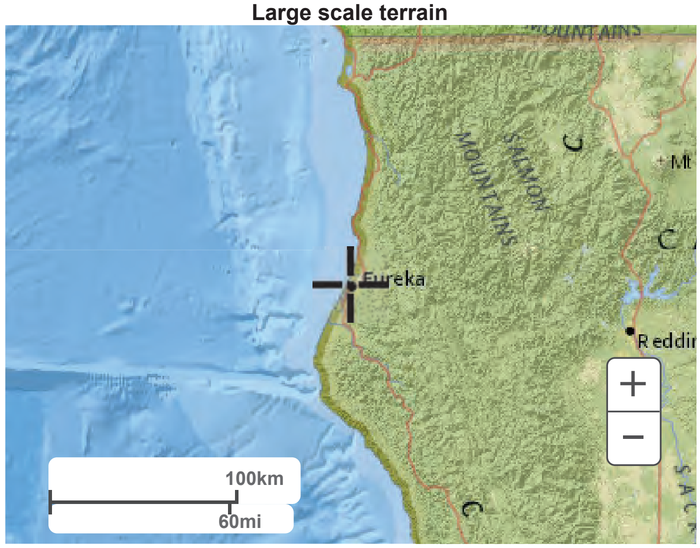
## Maps & aerials

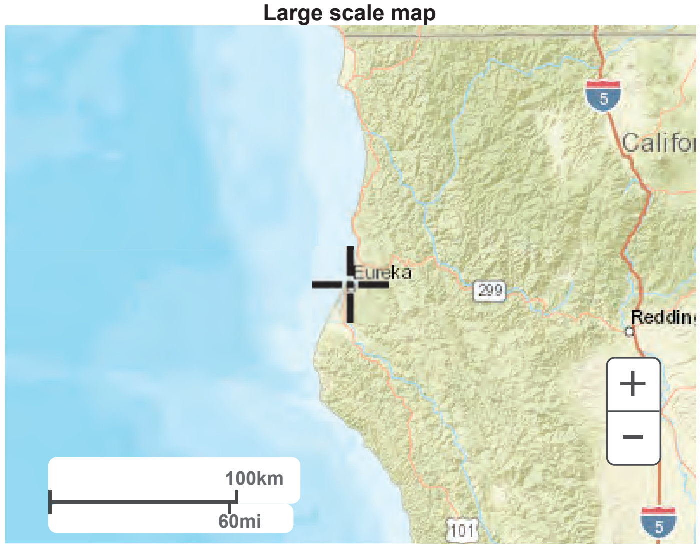
**Small scale terrain**



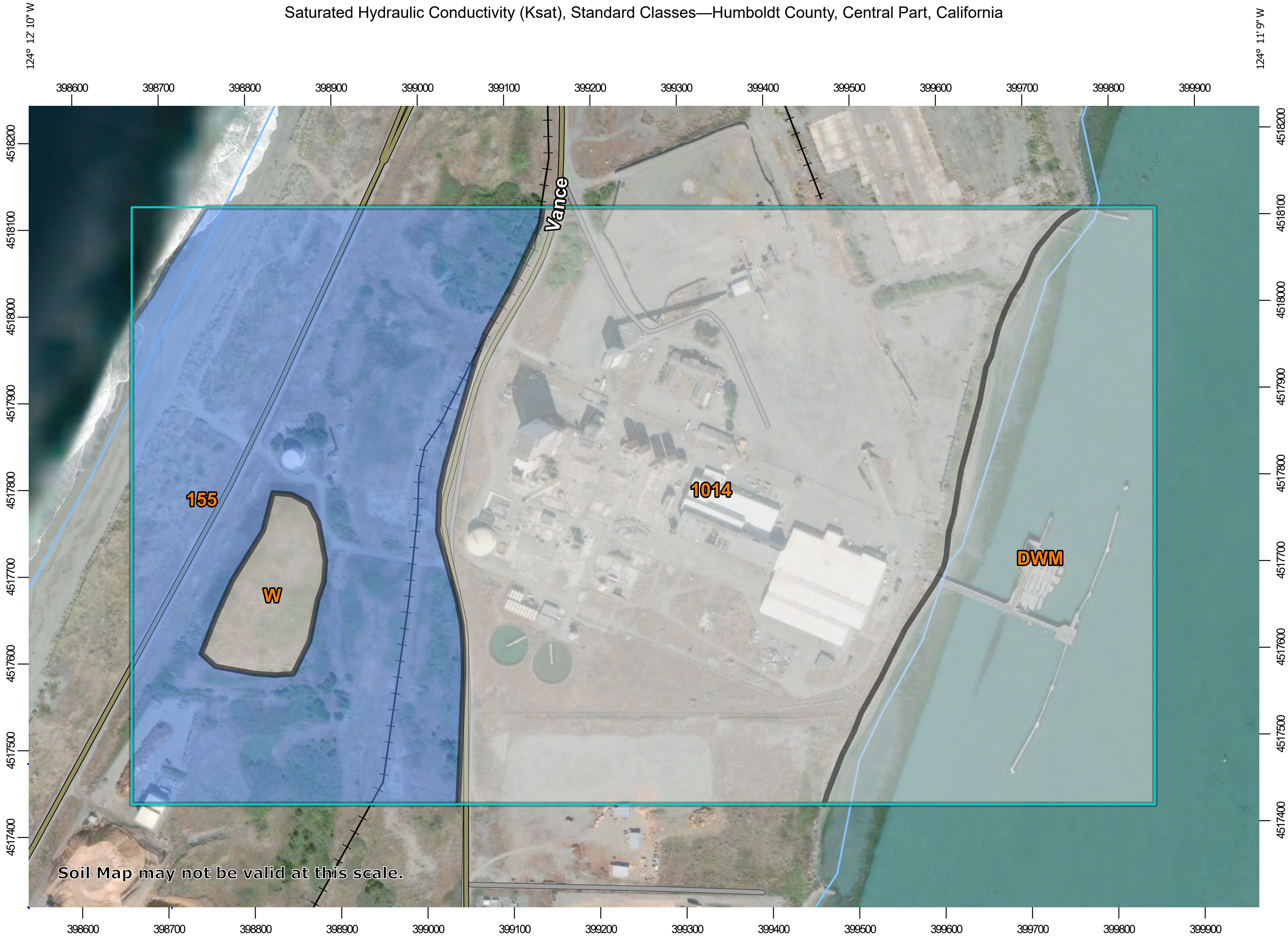

Large scale terrain




Large scale map




Large scale aerial




Map Scale: 1:6,510 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 50, 100, 200, 300

Feet: 0, 300, 600, 1200, 1800

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

## MAP LEGEND

**Area of Interest (AOI)**

Area of Interest (AOI)

**Soils**

**Soil Rating Polygons**

- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

**Soil Rating Lines**

- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

**Soil Rating Points**

- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

**Water Features**

- Streams and Canals

**Transportation**

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

**Background**

- Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Humboldt County, Central Part, California
Survey Area Data: Version 5, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 31, 2009—Oct 11, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Saturated Hydraulic Conductivity (Ksat), Standard Classes

| Map unit symbol | Map unit name | Rating (micrometers per second) | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| 155 | Samoa-Clambeach complex, 0 to 50 percent slopes | 92.0000 | 60.8 | 30.0% |
| 1014 | Urban land-Anthraltic Xerorthents association, 0 to 2 percent slopes | | 94.1 | 46.5% |
| DWM | Water, marine | | 41.5 | 20.5% |
| W | Water | | 4.7 | 2.3% |
| **Totals for Area of Interest** | | | **202.5** | **100.0%** |

## Description

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits. The classes are:

Very low: 0.00 to 0.01

Low: 0.01 to 0.1

Moderately low: 0.1 to 1.0

Moderately high: 1 to 10

High: 10 to 100

Very high: 100 to 705

## Rating Options

*Units of Measure:* micrometers per second

*Aggregation Method:* Dominant Component

*Component Percent Cutoff: None Specified*

*Tie-break Rule:* Fastest

*Interpret Nulls as Zero:* No

*Layer Options (Horizon Aggregation Method):* Depth Range (Weighted Average)

*Top Depth:* 12

*Bottom Depth:* 60

*Units of Measure:* Inches

# Appendix B – Site Maps

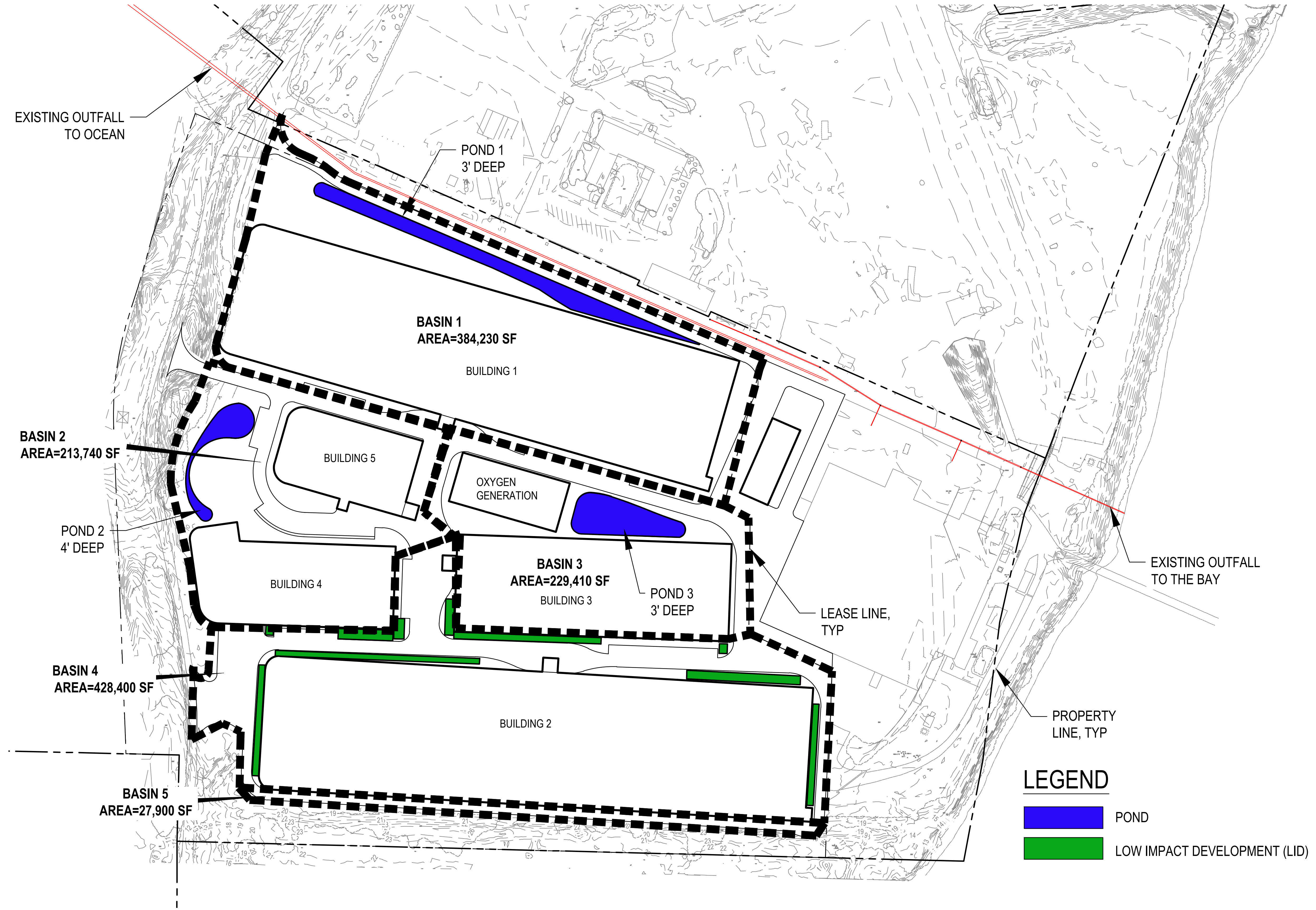

NORDIC AQUAFARMS
AQUACULTURE FACILITY

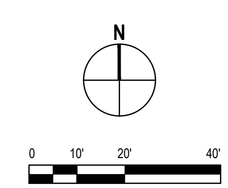
FIGURE B-1
EXISTING SITE MAP

GHD

Project No.: 11207226
Date: 4/14/2021
REV-3

Filename: N:\US\Eureka\Projects\561\11207226\Digital_Design\ACAD 2020\Figures\11207226_Prelim Storm Basins.dwg
Plot Date: 16 April 2021 - 3:41 PM



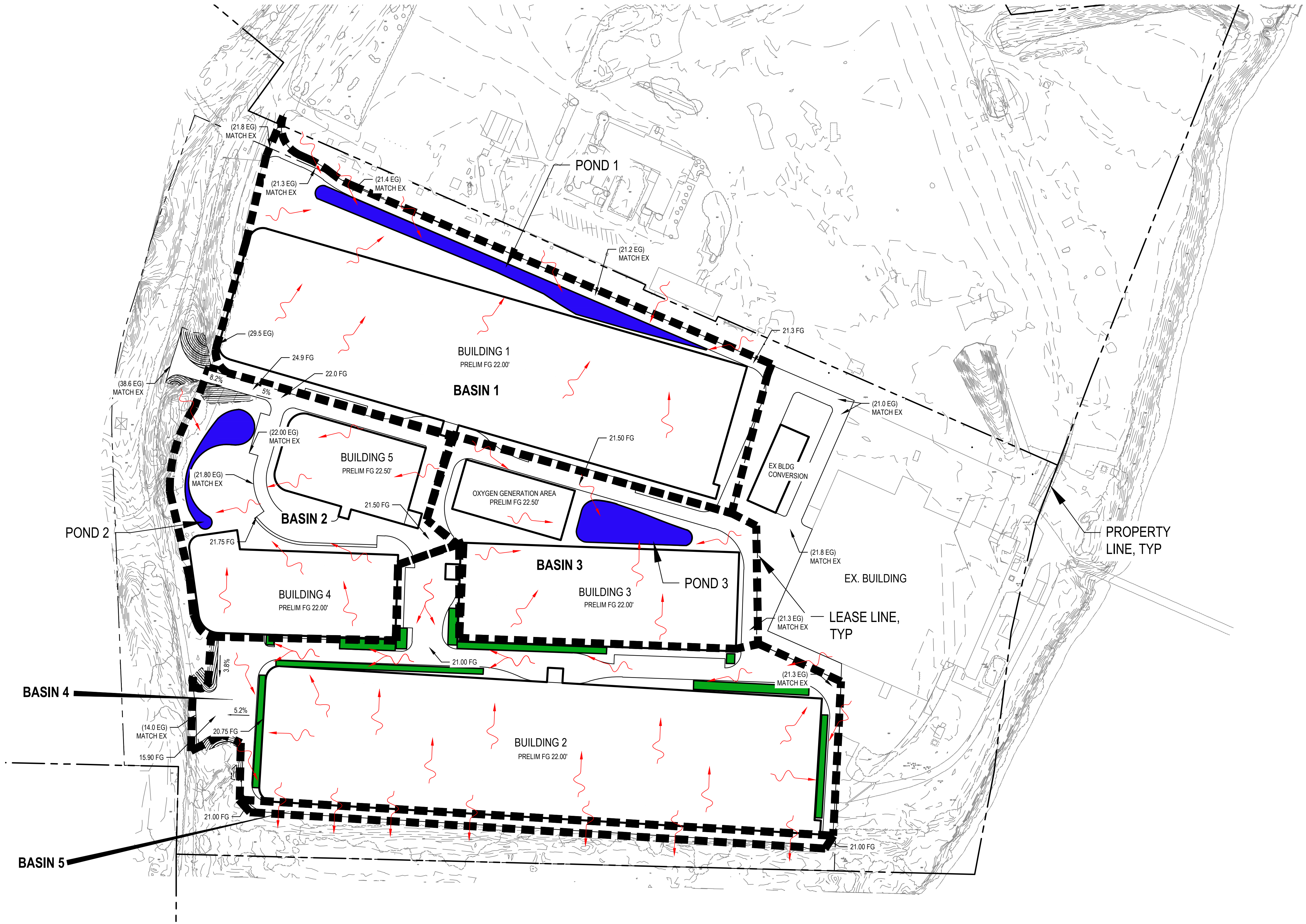

GHD

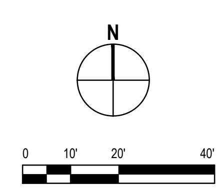
NORDIC AQUAFARMS
AQUACULTURE FACILITY

FIGURE B-2
PRELIMINARY STORM DRAINAGE BASIN MAP

Project No.: 11207226
Date: 4/14/2021
REV-3

Filename: N:\US\Eureka\Projects\561\11207226\Digital_Design\ACAD 2020\Figures\11207226_Prelim Storm Basins.dwg
Plot Date: 15 April 2021 - 9:58 AM




**NORDIC AQUAFARMS AQUACULTURE FACILITY**

**FIGURE B-3**
**PRELIMINARY SITE GRADING**

Project No.: **11207226**
Date: **4/14/2021**
**REV-3**

Filename: N:\US\Eureka\Projects\561\11207226\Digital_Design\ACAD 2020\Figures\11207226_Prelim Storm Basins.dwg
Plot Date: 16 April 2021 - 4:07 PM

# Appendix C - NOAA Historical Tides Elevations

# Datums for 9418767, North Spit CA

**NOTICE:** All data values are relative to the NAVD88.

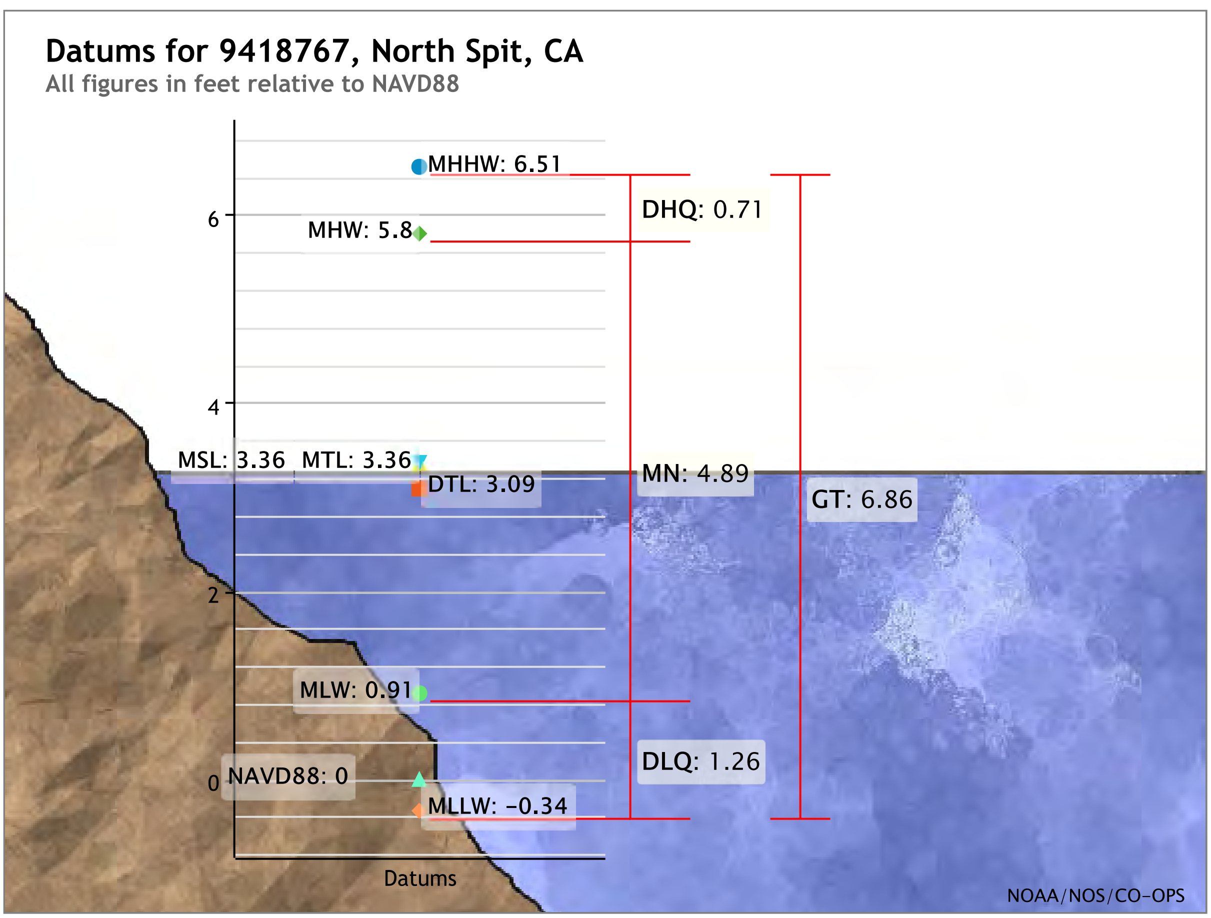
## Elevations on NAVD88

**Station:** 9418767, North Spit, CA
**Status:** Accepted (Sep 30 2011)
**Units:** Feet
**Control Station:**
**T.M.:** 0
**Epoch: (/datum_options.html#NTDE)** 1983-2001
**Datum:** NAVD88

| Datum | Value | Description |
|---|---|---|
| MHHW (/datum_options.html#MHHW) | 6.51 | Mean Higher-High Water |
| MHW (/datum_options.html#MHW) | 5.80 | Mean High Water |
| MTL (/datum_options.html#MTL) | 3.36 | Mean Tide Level |
| MSL (/datum_options.html#MSL) | 3.36 | Mean Sea Level |
| DTL (/datum_options.html#DTL) | 3.09 | Mean Diurnal Tide Level |
| MLW (/datum_options.html#MLW) | 0.91 | Mean Low Water |
| MLLW (/datum_options.html#MLLW) | -0.34 | Mean Lower-Low Water |
| NAVD88 (/datum_options.html) | 0.00 | North American Vertical Datum of 1988 |
| STND (/datum_options.html#STND) | -14.89 | Station Datum |
| GT (/datum_options.html#GT) | 6.86 | Great Diurnal Range |
| MN (/datum_options.html#MN) | 4.89 | Mean Range of Tide |
| DHQ (/datum_options.html#DHQ) | 0.71 | Mean Diurnal High Water Inequality |

| Datum | Value | Description |
|---|---|---|
| DLQ (/datum_options.html#DLQ) | 1.26 | Mean Diurnal Low Water Inequality |
| HWI (/datum_options.html#HWI) | 7.63 | Greenwich High Water Interval (in hours) |
| LWI (/datum_options.html#LWI) | 1.18 | Greenwich Low Water Interval (in hours) |
| Max Tide (/datum_options.html#MAXTIDE) | 9.54 | Highest Observed Tide |
| Max Tide Date & Time (/datum_options.html#MAXTIDEDT) | 12/31/2005 18:54 | Highest Observed Tide Date & Time |
| Min Tide (/datum_options.html#MINTIDE) | -3.24 | Lowest Observed Tide |
| Min Tide Date & Time (/datum_options.html#MINTIDEDT) | 01/20/1988 02:18 | Lowest Observed Tide Date & Time |
| HAT (/datum_options.html#HAT) | 8.52 | Highest Astronomical Tide |
| HAT Date & Time | 12/31/1986 19:00 | HAT Date and Time |
| LAT (/datum_options.html#LAT) | -2.73 | Lowest Astronomical Tide |
| LAT Date & Time | 05/25/1990 14:12 | LAT Date and Time |

| Tidal Datum Analysis Periods |
|---|
| 01/01/1983 - 12/31/2001 |



Showing datums for

9418767 North Spit, CA

Datum

NAVD88

Data Units ◉ Feet

○ Meters

Epoch ◉ Present (1983-2001)

○ Superseded (1960-1978)

Submit

Show nearby stations

## Products available at 9418767 North Spit, CA

### TIDES/WATER LEVELS

Water Levels (/waterlevels.html?id=9418767)

NOAA Tide Predictions (/noaatidepredictions.html?id=9418767)

Harmonic Constituents (/harcon.html?id=9418767)

Sea Level Trends (/sltrends/sltrends_station.shtml?id=9418767)

Datums (/datums.html?id=9418767)

Bench Mark Sheets (/benchmarks.html?id=9418767)

Extreme Water Levels

Reports (/reports.html?id=9418767)

### METEOROLOGICAL/OTHER

Meteorological Observations (/met.html?id=9418767)

Water Temp/Conductivity

### PORTS®

Humboldt Bay PORTS® (/ports/index.html?port=hb)

PORTS® product page for North Spit (/ports/ports.html?id=9418767)

### OPERATIONAL FORECAST SYSTEMS

This station is not a member of OFS

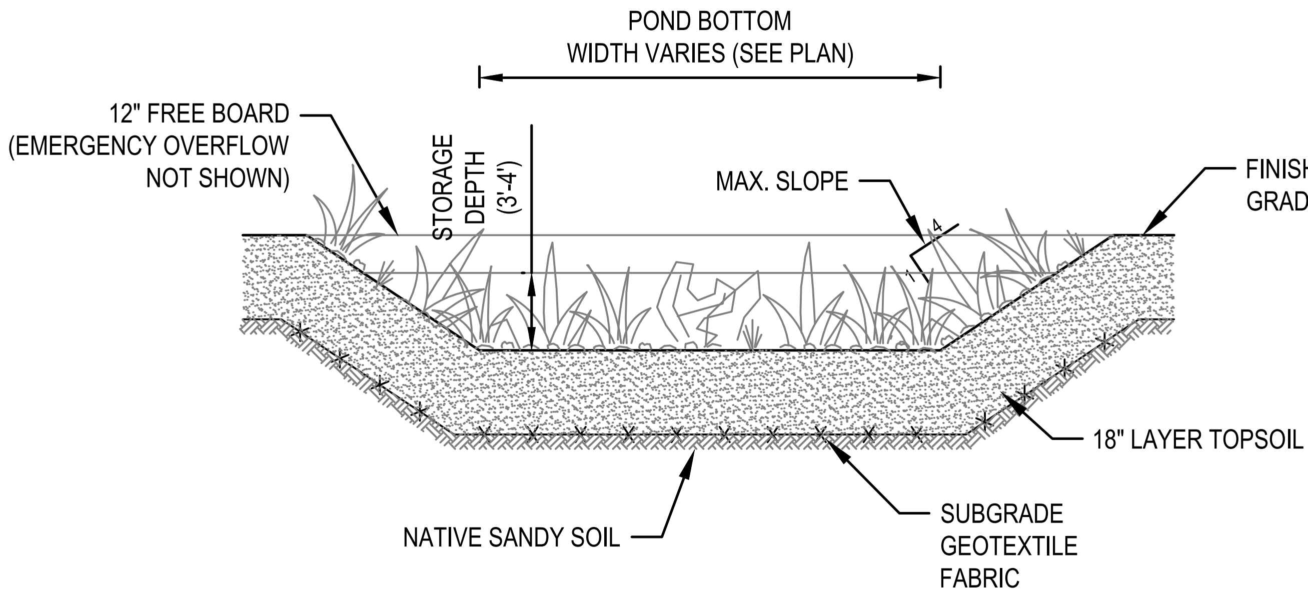
**INFORMATION**

Station Home Page (/stationhome.html?id=9418767)

Data Inventory (/inventory.html?id=9418767)

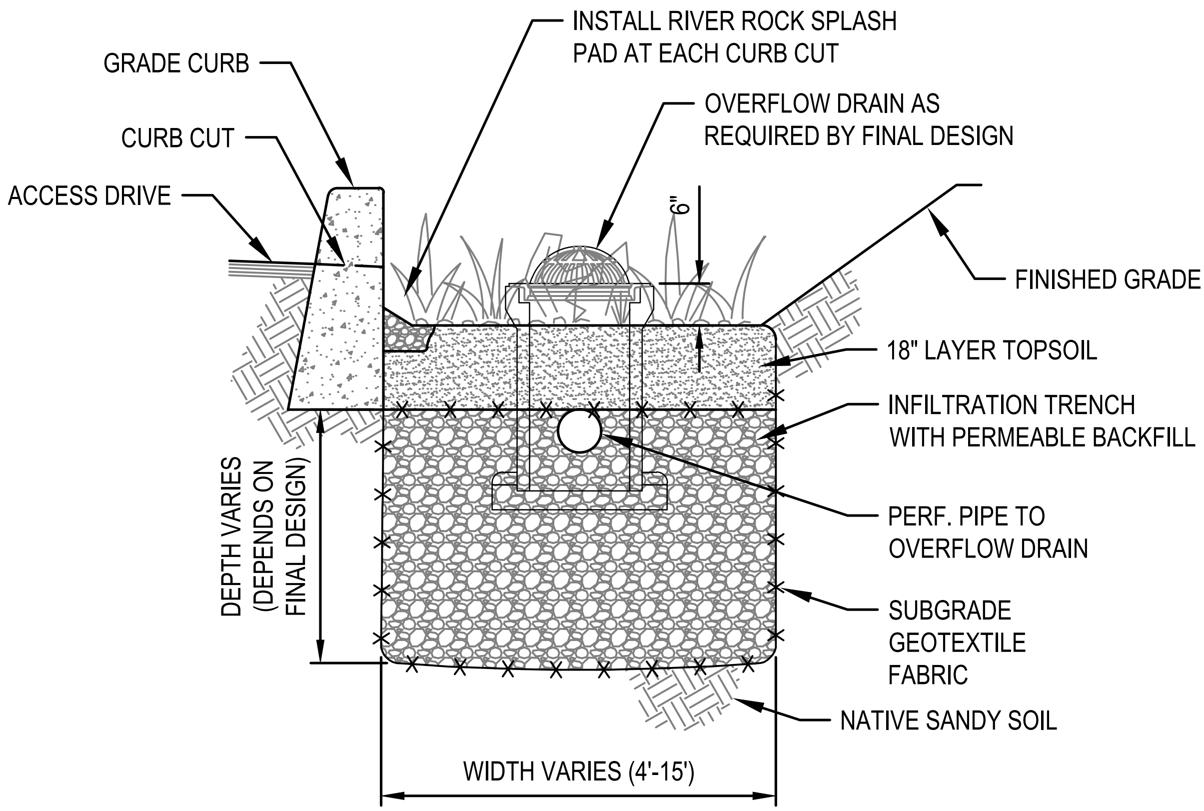
Measurement Specifications (/measure.html)

# Appendix D - Typical Pond and LID Cross Sections




# 1 TYPICAL VEGETATED INFILTRATION POND SECTON

N.T.S.

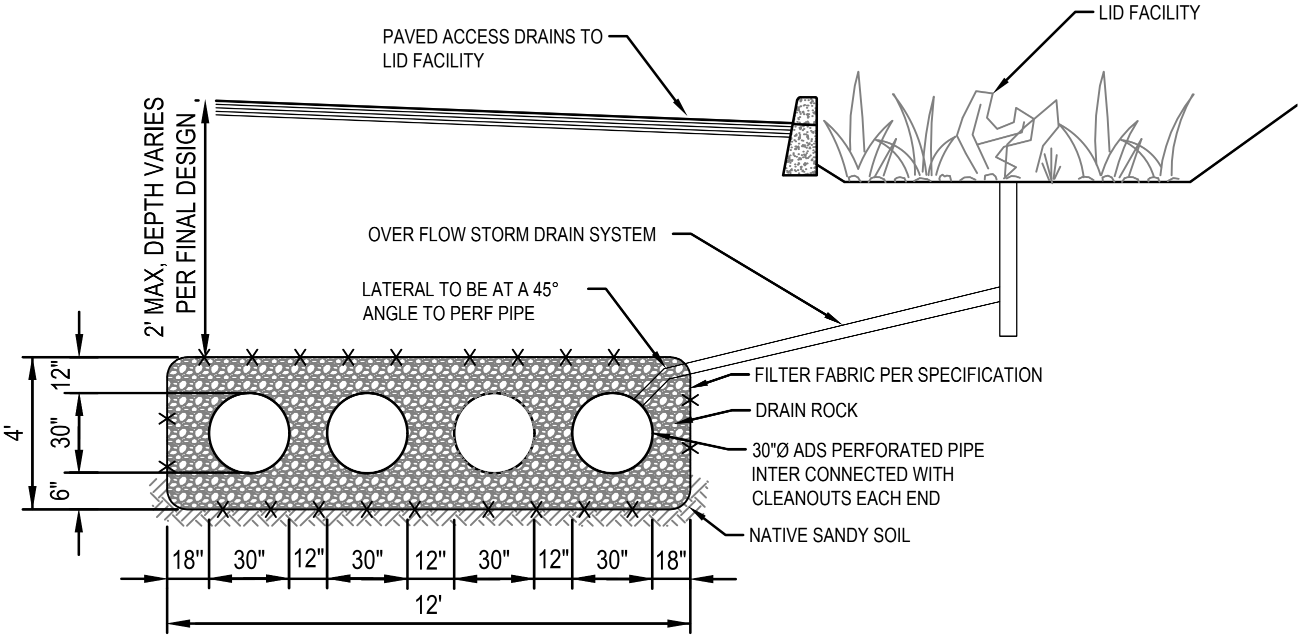



# 2 TYPICAL LID SECTION

N.T.S.

| | | |
|---|---|---|
| **NORDIC AQUAFARMS<br>AQUACULTURE FACILITY**<br><br>**FIGURE D-1<br>PRELIMINARY TYPICAL STORM WATER POND<br>AND BIORETENTION FACILITY CROSS SECTIONS** | Project No.<br>Report No.<br>Date | **11207226**<br>**REV-3**<br>**4/14/2021** |

Filename: N:\US\Eureka\Projects\561\11207226\Digital_Design\ACAD 2020\Figures\11207226_Fig_D_1_2_Typ Pond Cross Sections.dwg
Plot Date: 18 April 2021 - 8:00 AM
Source:




# 3 OVER FLOW INFILTRATION TRENCH

**N.T.S.**

# Appendix E – Stormwater Modeling Data

# Scenario Calculation Summary

## Scenario Summary

| | |
|---|---|
| ID | 50 |
| Label | 85th Percentile |
| Notes | |
| Active Topology | Base-Active Topology |
| Hydrology | Base-Scssbuh Runoff |
| Rainfall Runoff | Humboldt 85th |
| Physical | Base-Volume |
| Initial Condition | Base Initial Condition |
| Boundary Condition | Base-Boundary Conditions |
| Infiltration and Inflow | Base-Infiltration |
| Output | Base Output |
| User Data Extensions | Base User Data Extensions |
| PondPack Engine Calculation Options | Nordic 2 yr |

## Output Summary

| | | | |
|---|---|---|---|
| Output Increment | 0.050 hours | Duration | 35.000 hours |

## Rainfall Summary

| | | | |
|---|---|---|---|
| Return Event Tag | 1 | Rainfall Type | Time-Depth Curve |
| Total Depth | 0.7 in | Storm Event | 85th Percentile |

## Executive Summary (Nodes)

| Label | Scenario | Return Event (years) | Truncation | Hydrograph Volume (ft³) | Time to Peak (hours) | Peak Flow (ft³/s) | Maximum Water Surface Elevation (ft) | Maximum Pond Storage (ft³) |
|---|---|---|---|---|---|---|---|---|
| Basin 1 | 85th Percentile | 1 | None | 14,748.00 | 7.950 | 1.0260 | (N/A) | (N/A) |
| Basin 2 | 85th Percentile | 1 | None | 8,270.00 | 7.950 | 0.5707 | (N/A) | (N/A) |
| Basin 3 | 85th Percentile | 1 | None | 8,876.00 | 7.950 | 0.6126 | (N/A) | (N/A) |
| Pond-1 (IN) | 85th Percentile | 1 | None | 14,748.00 | 7.950 | 1.0260 | (N/A) | (N/A) |
| Pond-1 (OUT) | 85th Percentile | 1 | None | 0.00 | 0.000 | 0.0000 | 18.16 | 2,443.00 |
| Pond-2 (IN) | 85th Percentile | 1 | None | 8,270.00 | 7.950 | 0.5707 | (N/A) | (N/A) |
| Pond-2 (OUT) | 85th Percentile | 1 | None | 0.00 | 0.000 | 0.0000 | 18.38 | 1,046.00 |
| Pond-3 (IN) | 85th Percentile | 1 | None | 8,876.00 | 7.950 | 0.6126 | (N/A) | (N/A) |
| Pond-3 (OUT) | 85th Percentile | 1 | None | 0.00 | 0.000 | 0.0000 | 18.19 | 1,436.00 |

# Scenario Calculation Summary

## Executive Summary (Nodes)

| Label | Scenario | Return Event (years) | Truncation | Hydrograph Volume (ft³) | Time to Peak (hours) | Peak Flow (ft³/s) | Maximum Water Surface Elevation (ft) | Maximum Pond Storage (ft³) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

## Executive Summary (Links)

| Label | Type | Location | Hydrograph Volume (ft³) | Peak Time (hours) | Peak Flow (ft³/s) | End Point | Node Flow Direction |
|---|---|---|---|---|---|---|---|

# Scenario Calculation Summary

## Scenario Summary

| | |
|---|---|
| ID | 27 |
| Label | Humboldt 2 yr |
| Notes | |
| Active Topology | Base-Active Topology |
| Hydrology | Base-Scssbuh Runoff |
| Rainfall Runoff | Humboldt 2 yr |
| Physical | Base-Volume |
| Initial Condition | Base Initial Condition |
| Boundary Condition | Base-Boundary Conditions |
| Infiltration and Inflow | Base-Infiltration |
| Output | Base Output |
| User Data Extensions | Base User Data Extensions |
| PondPack Engine Calculation Options | Nordic 2 yr |

## Output Summary

| | | | |
|---|---|---|---|
| Output Increment | 0.050 hours | Duration | 35.000 hours |

## Rainfall Summary

| | | | |
|---|---|---|---|
| Return Event Tag | 2 | Rainfall Type | Time-Depth Curve |
| Total Depth | 2.7 in | Storm Event | TypeIA 24hr (2 yr) |

## Executive Summary (Nodes)

| Label | Scenario | Return Event (years) | Truncation | Hydrograph Volume (ft³) | Time to Peak (hours) | Peak Flow (ft³/s) | Maximum Water Surface Elevation (ft) | Maximum Pond Storage (ft³) |
|---|---|---|---|---|---|---|---|---|
| Basin 1 | Humboldt 2 yr | 2 | None | 77,893.00 | 7.900 | 5.4177 | (N/A) | (N/A) |
| Basin 2 | Humboldt 2 yr | 2 | None | 43,374.00 | 7.900 | 3.0138 | (N/A) | (N/A) |
| Basin 3 | Humboldt 2 yr | 2 | None | 46,554.00 | 7.900 | 3.2347 | (N/A) | (N/A) |
| Pond-1 (IN) | Humboldt 2 yr | 2 | None | 77,893.00 | 7.900 | 5.4177 | (N/A) | (N/A) |
| Pond-1 (OUT) | Humboldt 2 yr | 2 | None | 0.00 | 0.000 | 0.0000 | 18.91 | 14,925.00 |
| Pond-2 (IN) | Humboldt 2 yr | 2 | None | 43,374.00 | 7.900 | 3.0138 | (N/A) | (N/A) |
| Pond-2 (OUT) | Humboldt 2 yr | 2 | None | 0.00 | 0.000 | 0.0000 | 19.88 | 8,625.00 |
| Pond-3 (IN) | Humboldt 2 yr | 2 | None | 46,554.00 | 7.900 | 3.2347 | (N/A) | (N/A) |
| Pond-3 (OUT) | Humboldt 2 yr | 2 | None | 0.00 | 0.000 | 0.0000 | 19.08 | 8,957.00 |

# Scenario Calculation Summary

## Executive Summary (Nodes)

| Label | Scenario | Return Event (years) | Truncation | Hydrograph Volume (ft³) | Time to Peak (hours) | Peak Flow (ft³/s) | Maximum Water Surface Elevation (ft) | Maximum Pond Storage (ft³) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

## Executive Summary (Links)

| Label | Type | Location | Hydrograph Volume (ft³) | Peak Time (hours) | Peak Flow (ft³/s) | End Point | Node Flow Direction |
|---|---|---|---|---|---|---|---|

# Scenario Calculation Summary

## Scenario Summary

| | |
|---|---|
| ID | 37 |
| Label | Humboldt 5 yr |
| Notes | |
| Active Topology | Base-Active Topology |
| Hydrology | Base-Scssbuh Runoff |
| Rainfall Runoff | Humboldt 5 yr |
| Physical | Base-Volume |
| Initial Condition | Base Initial Condition |
| Boundary Condition | Base-Boundary Conditions |
| Infiltration and Inflow | Base-Infiltration |
| Output | Base Output |
| User Data Extensions | Base User Data Extensions |
| PondPack Engine Calculation Options | Nordic 5 yr |

## Output Summary

| | | | |
|---|---|---|---|
| Output Increment | 0.050 hours | Duration | 35.000 hours |

## Rainfall Summary

| | | | |
|---|---|---|---|
| Return Event Tag | 5 | Rainfall Type | Time-Depth Curve |
| Total Depth | 3.5 in | Storm Event | TypeIA 24hr (5 yr) |

## Executive Summary (Nodes)

| Label | Scenario | Return Event (years) | Truncation | Hydrograph Volume (ft³) | Time to Peak (hours) | Peak Flow (ft³/s) | Maximum Water Surface Elevation (ft) | Maximum Pond Storage (ft³) |
|---|---|---|---|---|---|---|---|---|
| Basin 1 | Humboldt 5 yr | 5 | None | 105,669.00 | 7.900 | 7.2792 | (N/A) | (N/A) |
| Basin 2 | Humboldt 5 yr | 5 | None | 58,840.00 | 7.900 | 4.0493 | (N/A) | (N/A) |
| Basin 3 | Humboldt 5 yr | 5 | None | 63,154.00 | 7.900 | 4.3461 | (N/A) | (N/A) |
| Pond-1 (IN) | Humboldt 5 yr | 5 | None | 105,669.00 | 7.900 | 7.2792 | (N/A) | (N/A) |
| Pond-1 (OUT) | Humboldt 5 yr | 5 | None | 0.00 | 0.000 | 0.0000 | 19.23 | 20,864.00 |
| Pond-2 (IN) | Humboldt 5 yr | 5 | None | 58,840.00 | 7.900 | 4.0493 | (N/A) | (N/A) |
| Pond-2 (OUT) | Humboldt 5 yr | 5 | None | 0.00 | 0.000 | 0.0000 | 20.42 | 12,721.00 |
| Pond-3 (IN) | Humboldt 5 yr | 5 | None | 63,154.00 | 7.900 | 4.3461 | (N/A) | (N/A) |
| Pond-3 (OUT) | Humboldt 5 yr | 5 | None | 0.00 | 0.000 | 0.0000 | 19.50 | 13,007.00 |

# Scenario Calculation Summary

## Executive Summary (Nodes)

| Label | Scenario | Return Event (years) | Truncation | Hydrograph Volume (ft³) | Time to Peak (hours) | Peak Flow (ft³/s) | Maximum Water Surface Elevation (ft) | Maximum Pond Storage (ft³) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

## Executive Summary (Links)

| Label | Type | Location | Hydrograph Volume (ft³) | Peak Time (hours) | Peak Flow (ft³/s) | End Point | Node Flow Direction |
|---|---|---|---|---|---|---|---|

# Scenario Calculation Summary

## Scenario Summary

| | |
|---|---|
| ID | 40 |
| Label | Humboldt 10 yr |
| Notes | |
| Active Topology | Base-Active Topology |
| Hydrology | Base-Scssbuh Runoff |
| Rainfall Runoff | Humboldt 10 yr |
| Physical | Base-Volume |
| Initial Condition | Base Initial Condition |
| Boundary Condition | Base-Boundary Conditions |
| Infiltration and Inflow | Base-Infiltration |
| Output | Base Output |
| User Data Extensions | Base User Data Extensions |
| PondPack Engine Calculation Options | Nordic 10 yr |

## Output Summary

| | | | |
|---|---|---|---|
| Output Increment | 0.050 hours | Duration | 35.000 hours |

## Rainfall Summary

| | | | |
|---|---|---|---|
| Return Event Tag | 10 | Rainfall Type | Time-Depth Curve |
| Total Depth | 4.1 in | Storm Event | TypeIA 24hr (10 yr) |

## Executive Summary (Nodes)

| Label | Scenario | Return Event (years) | Truncation | Hydrograph Volume ($ft^3$) | Time to Peak (hours) | Peak Flow ($ft^3/s$) | Maximum Water Surface Elevation (ft) | Maximum Pond Storage ($ft^3$) |
|---|---|---|---|---|---|---|---|---|
| Basin 1 | Humboldt 10 yr | 10 | None | 124,531.00 | 7.900 | 8.5346 | (N/A) | (N/A) |
| Basin 2 | Humboldt 10 yr | 10 | None | 69,342.00 | 7.900 | 4.7476 | (N/A) | (N/A) |
| Basin 3 | Humboldt 10 yr | 10 | None | 74,426.00 | 7.900 | 5.0957 | (N/A) | (N/A) |
| Pond-1 (IN) | Humboldt 10 yr | 10 | None | 124,531.00 | 7.900 | 8.5346 | (N/A) | (N/A) |
| Pond-1 (OUT) | Humboldt 10 yr | 10 | None | 0.00 | 0.000 | 0.0000 | 19.47 | 25,726.00 |
| Pond-2 (IN) | Humboldt 10 yr | 10 | None | 69,342.00 | 7.900 | 4.7476 | (N/A) | (N/A) |
| Pond-2 (OUT) | Humboldt 10 yr | 10 | None | 0.00 | 0.000 | 0.0000 | 20.79 | 15,978.00 |
| Pond-3 (IN) | Humboldt 10 yr | 10 | None | 74,426.00 | 7.900 | 5.0957 | (N/A) | (N/A) |
| Pond-3 (OUT) | Humboldt 10 yr | 10 | None | 0.00 | 0.000 | 0.0000 | 19.81 | 16,248.00 |

# Scenario Calculation Summary

## Executive Summary (Nodes)

| Label | Scenario | Return Event (years) | Truncation | Hydrograph Volume (ft³) | Time to Peak (hours) | Peak Flow (ft³/s) | Maximum Water Surface Elevation (ft) | Maximum Pond Storage (ft³) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

## Executive Summary (Links)

| Label | Type | Location | Hydrograph Volume (ft³) | Peak Time (hours) | Peak Flow (ft³/s) | End Point | Node Flow Direction |
|---|---|---|---|---|---|---|---|

# Scenario Calculation Summary

## Scenario Summary

| | |
|---|---|
| ID | 43 |
| Label | Humboldt 25 yr |
| Notes | |
| Active Topology | Base-Active Topology |
| Hydrology | Base-Scssbuh Runoff |
| Rainfall Runoff | Humboldt 25 yr |
| Physical | Base-Volume |
| Initial Condition | Base Initial Condition |
| Boundary Condition | Base-Boundary Conditions |
| Infiltration and Inflow | Base-Infiltration |
| Output | Base Output |
| User Data Extensions | Base User Data Extensions |
| PondPack Engine Calculation Options | Nordic 25 yr |

## Output Summary

| | | | |
|---|---|---|---|
| Output Increment | 0.050 hours | Duration | 35.000 hours |

## Rainfall Summary

| | | | |
|---|---|---|---|
| Return Event Tag | 25 | Rainfall Type | Time-Depth Curve |
| Total Depth | 4.9 in | Storm Event | TypeIA 24hr (25 yr) |

## Executive Summary (Nodes)

| Label | Scenario | Return Event (years) | Truncation | Hydrograph Volume (ft³) | Time to Peak (hours) | Peak Flow (ft³/s) | Maximum Water Surface Elevation (ft) | Maximum Pond Storage (ft³) |
|---|---|---|---|---|---|---|---|---|
| Basin 1 | Humboldt 25 yr | 25 | None | 150,046.00 | 7.900 | 10.2328 | (N/A) | (N/A) |
| Basin 2 | Humboldt 25 yr | 25 | None | 83,511.00 | 7.900 | 5.6923 | (N/A) | (N/A) |
| Basin 3 | Humboldt 25 yr | 25 | None | 89,634.00 | 7.900 | 6.1096 | (N/A) | (N/A) |
| Pond-1 (IN) | Humboldt 25 yr | 25 | None | 150,046.00 | 7.900 | 10.2328 | (N/A) | (N/A) |
| Pond-1 (OUT) | Humboldt 25 yr | 25 | None | 0.00 | 0.000 | 0.0000 | 19.84 | 33,146.00 |
| Pond-2 (IN) | Humboldt 25 yr | 25 | None | 83,511.00 | 7.900 | 5.6923 | (N/A) | (N/A) |
| Pond-2 (OUT) | Humboldt 25 yr | 25 | None | 0.00 | 0.000 | 0.0000 | 21.24 | 20,474.00 |
| Pond-3 (IN) | Humboldt 25 yr | 25 | None | 89,634.00 | 7.900 | 6.1096 | (N/A) | (N/A) |
| Pond-3 (OUT) | Humboldt 25 yr | 25 | None | 0.00 | 0.000 | 0.0000 | 20.22 | 20,761.00 |

# Scenario Calculation Summary

## Executive Summary (Nodes)

| Label | Scenario | Return Event (years) | Truncation | Hydrograph Volume (ft³) | Time to Peak (hours) | Peak Flow (ft³/s) | Maximum Water Surface Elevation (ft) | Maximum Pond Storage (ft³) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

## Executive Summary (Links)

| Label | Type | Location | Hydrograph Volume (ft³) | Peak Time (hours) | Peak Flow (ft³/s) | End Point | Node Flow Direction |
|---|---|---|---|---|---|---|---|

# Scenario Calculation Summary

## Scenario Summary

| | |
|---|---|
| ID | 46 |
| Label | Humboldt 100 yr |
| Notes | |
| Active Topology | Base-Active Topology |
| Hydrology | Base-Scssbuh Runoff |
| Rainfall Runoff | Humboldt 100 yr |
| Physical | Base-Volume |
| Initial Condition | Base Initial Condition |
| Boundary Condition | Base-Boundary Conditions |
| Infiltration and Inflow | Base-Infiltration |
| Output | Base Output |
| User Data Extensions | Base User Data Extensions |
| PondPack Engine Calculation Options | Nordic 100 yr |

## Output Summary

| | | | |
|---|---|---|---|
| Output Increment | 0.050 hours | Duration | 35.000 hours |

## Rainfall Summary

| | | | |
|---|---|---|---|
| Return Event Tag | 100 | Rainfall Type | Time-Depth Curve |
| Total Depth | 6.2 in | Storm Event | TypeIA 24hr (100 yr) |

## Executive Summary (Nodes)

| Label | Scenario | Return Event (years) | Truncation | Hydrograph Volume (ft³) | Time to Peak (hours) | Peak Flow (ft³/s) | Maximum Water Surface Elevation (ft) | Maximum Pond Storage (ft³) |
|---|---|---|---|---|---|---|---|---|
| Basin 1 | Humboldt 100 yr | 100 | None | 190,681.00 | 7.900 | 12.9198 | (N/A) | (N/A) |
| Basin 2 | Humboldt 100 yr | 100 | None | 106,127.00 | 7.900 | 7.1871 | (N/A) | (N/A) |
| Basin 3 | Humboldt 100 yr | 100 | None | 113,908.00 | 7.900 | 7.7140 | (N/A) | (N/A) |
| Pond-1 (IN) | Humboldt 100 yr | 100 | None | 190,681.00 | 7.900 | 12.9198 | (N/A) | (N/A) |
| Pond-1 (OUT) | Humboldt 100 yr | 100 | None | 0.00 | 0.000 | 0.0000 | 20.39 | 45,479.00 |
| Pond-2 (IN) | Humboldt 100 yr | 100 | None | 106,127.00 | 7.900 | 7.1871 | (N/A) | (N/A) |
| Pond-2 (OUT) | Humboldt 100 yr | 100 | None | 0.00 | 0.000 | 0.0000 | 21.92 | 28,279.00 |
| Pond-3 (IN) | Humboldt 100 yr | 100 | None | 113,908.00 | 7.900 | 7.7140 | (N/A) | (N/A) |
| Pond-3 (OUT) | Humboldt 100 yr | 100 | None | 0.00 | 0.000 | 0.0000 | 20.89 | 28,951.00 |

# Scenario Calculation Summary

## Executive Summary (Nodes)

| Label | Scenario | Return Event (years) | Truncation | Hydrograph Volume (ft³) | Time to Peak (hours) | Peak Flow (ft³/s) | Maximum Water Surface Elevation (ft) | Maximum Pond Storage (ft³) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

## Executive Summary (Links)

| Label | Type | Location | Hydrograph Volume (ft³) | Peak Time (hours) | Peak Flow (ft³/s) | End Point | Node Flow Direction |
|---|---|---|---|---|---|---|---|

## 100 YEAR STORMWATER CALCULATION MATRIX - SANTA BARBARA HYDROGRAPGH METHOD

Date: **4/14/2021**

Given: **Project =** **NORDIC AQUAFARMS AQUACULTURE FACILITY**

**Area =** 9.83 acres

**Pt =** 6.2 inches **100-Year / 24 Hour Storm**

**dt =** 10 min.

**Tc =** 5 min. (Post-Developed Site Conditions)

| **PERVIOUS Parcel** | | **IMPERVIOUS Parcel** | |
|---|---|---|---|
| **Area =** | 0 acres | **Area =** | 9.83 acres |
| **CN =** | 49 | **CN =** | 98 |
| **S =** | 10.41 | **S =** | 0.20 |
| **0.2S =** | 2.08 | **0.2S =** | 0.04 |

Compute Developed Conditions Runoff hydrograph

Column (3) = SCS Type IA Rainfall Distribution
Column (4) = Col. (3) x Pt = 10 year - 24 Hour Hyetograph at this location.
Column (5) = Accumulated Sum of Col. (4)
Column (6) = [If P <= 0.2S] = 0; Note, use PERVIOUS Area "S" value.
[If P > 0.2S] = (Col.(5) - 0.2S)^2/(Col.(5) + 0.8S); Using the PERVIOUS Area "S" value.
Column (7) = Col.(6) of Present Time Step - Col.(6) of Previous Time Step
Column (8) = Same method as for Col.(6), except use the IMPERVIOUS Area "S" value.
Column (9) = Col.(8) of the present time step - Col.(8) of the previous time step.
Column (10) = ((PERVIOUS area / Total area) x Col.(7)) + ((IMPERVIOUS area / Total area) x Col.(9))
Column (11) = (60.5 x Col.(10) x Total Area) / 10 (dt = 10 minutes)
Routing Constant, w = dt / (2Tc + dt) = 0.5000
Column (12) = Col.(12) of Previous Time Step + (w x [Col.(11) of Previous Time Step
+ Col.(11) of Present Time Step - (2 x Col.(12) of Previous Time Step)])

| (1) Time Increment | (2) Time min. | (3) Rainfall distribution % of Pt | (4) Incremental Rainfall in. | (5) Accumulated Rainfall in. | Pervious Area (6) Accumulated Runoff in. | Pervious Area (7) Incremental Runoff in. | Impervious Area (8) Accumulated Runoff in. | Impervious Area (9) Incremental Runoff in. | (10) Total Runoff in. | (11) Instant hydrograph cfs | (12) design hydrograph cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 10 | 0.0040 | 0.0248 | 0.0248 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0 | 0.000 |
| 2 | 20 | 0.0040 | 0.0248 | 0.0496 | 0.0000 | 0.0000 | 0.0004 | 0.0000 | 0.0000 | 0.0 | 0.000 |
| 3 | 30 | 0.0040 | 0.0248 | 0.0744 | 0.0000 | 0.0000 | 0.0047 | 0.0044 | 0.0044 | 0.3 | 0.130 |
| 4 | 40 | 0.0040 | 0.0248 | 0.0992 | 0.0000 | 0.0000 | 0.0130 | 0.0082 | 0.0082 | 0.5 | 0.376 |
| 5 | 50 | 0.0040 | 0.0248 | 0.1240 | 0.0000 | 0.0000 | 0.0241 | 0.0111 | 0.0111 | 0.7 | 0.575 |
| 6 | 60 | 0.0040 | 0.0248 | 0.1488 | 0.0000 | 0.0000 | 0.0374 | 0.0133 | 0.0133 | 0.8 | 0.725 |
| 7 | 70 | 0.0040 | 0.0248 | 0.1736 | 0.0000 | 0.0000 | 0.0523 | 0.0150 | 0.0150 | 0.9 | 0.841 |
| 8 | 80 | 0.0040 | 0.0248 | 0.1984 | 0.0000 | 0.0000 | 0.0687 | 0.0163 | 0.0163 | 1.0 | 0.931 |
| 9 | 90 | 0.0040 | 0.0248 | 0.2232 | 0.0000 | 0.0000 | 0.0861 | 0.0174 | 0.0174 | 1.0 | 1.004 |
| 10 | 100 | 0.0040 | 0.0248 | 0.2480 | 0.0000 | 0.0000 | 0.1044 | 0.0183 | 0.0183 | 1.1 | 1.062 |
| 11 | 110 | 0.0050 | 0.0310 | 0.2790 | 0.0000 | 0.0000 | 0.1283 | 0.0239 | 0.0239 | 1.4 | 1.256 |
| 12 | 120 | 0.0050 | 0.0310 | 0.3100 | 0.0000 | 0.0000 | 0.1531 | 0.0248 | 0.0248 | 1.5 | 1.450 |
| 13 | 130 | 0.0050 | 0.0310 | 0.3410 | 0.0000 | 0.0000 | 0.1787 | 0.0256 | 0.0256 | 1.5 | 1.500 |
| 14 | 140 | 0.0050 | 0.0310 | 0.3720 | 0.0000 | 0.0000 | 0.2049 | 0.0262 | 0.0262 | 1.6 | 1.541 |
| 15 | 150 | 0.0050 | 0.0310 | 0.4030 | 0.0000 | 0.0000 | 0.2317 | 0.0267 | 0.0267 | 1.6 | 1.575 |
| 16 | 160 | 0.0050 | 0.0310 | 0.4340 | 0.0000 | 0.0000 | 0.2588 | 0.0272 | 0.0272 | 1.6 | 1.604 |
| 17 | 170 | 0.0060 | 0.0372 | 0.4712 | 0.0000 | 0.0000 | 0.2919 | 0.0331 | 0.0331 | 2.0 | 1.794 |
| 18 | 180 | 0.0060 | 0.0372 | 0.5084 | 0.0000 | 0.0000 | 0.3255 | 0.0336 | 0.0336 | 2.0 | 1.984 |
| 19 | 190 | 0.0060 | 0.0372 | 0.5456 | 0.0000 | 0.0000 | 0.3595 | 0.0339 | 0.0339 | 2.0 | 2.008 |
| 20 | 200 | 0.0060 | 0.0372 | 0.5828 | 0.0000 | 0.0000 | 0.3937 | 0.0343 | 0.0343 | 2.0 | 2.029 |
| 21 | 210 | 0.0060 | 0.0372 | 0.6200 | 0.0000 | 0.0000 | 0.4283 | 0.0345 | 0.0345 | 2.1 | 2.047 |
| 22 | 220 | 0.0060 | 0.0372 | 0.6572 | 0.0000 | 0.0000 | 0.4631 | 0.0348 | 0.0348 | 2.1 | 2.063 |
| 23 | 230 | 0.0070 | 0.0434 | 0.7006 | 0.0000 | 0.0000 | 0.5039 | 0.0408 | 0.0408 | 2.4 | 2.250 |
| 24 | 240 | 0.0070 | 0.0434 | 0.7440 | 0.0000 | 0.0000 | 0.5450 | 0.0411 | 0.0411 | 2.4 | 2.438 |
| 25 | 250 | 0.0070 | 0.0434 | 0.7874 | 0.0000 | 0.0000 | 0.5863 | 0.0413 | 0.0413 | 2.5 | 2.451 |
| 26 | 260 | 0.0070 | 0.0434 | 0.8308 | 0.0000 | 0.0000 | 0.6278 | 0.0415 | 0.0415 | 2.5 | 2.463 |
| 27 | 270 | 0.0070 | 0.0434 | 0.8742 | 0.0000 | 0.0000 | 0.6694 | 0.0416 | 0.0416 | 2.5 | 2.473 |

| (1) Time Increment | (2) Time min. | (3) Rainfall distri-bution | (4) Incre-mental Rainfall in. | (5) Accumu-lated Rainfall in. | Pervious Area (6) Accumu-lated Runoff in. | Pervious Area (7) Incre-mental Runoff in. | Impervious Area (8) Accumu-lated Runoff in. | Impervious Area (9) Incre-mental Runoff in. | (10) Total Runoff in. | (11) Instant hydro-graph cfs | (12) design hydro-graph cfs | design hydro-graph less Q infill cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28 | 280 | 0.0070 | 0.0434 | 0.9176 | 0.0000 | 0.0000 | 0.7112 | 0.0418 | 0.0418 | 2.5 | 2.482 | |
| 29 | 290 | 0.0082 | 0.0508 | 0.9684 | 0.0000 | 0.0000 | 0.7603 | 0.0491 | 0.0491 | 2.9 | 2.704 | |
| 30 | 300 | 0.0082 | 0.0508 | 1.0193 | 0.0000 | 0.0000 | 0.8096 | 0.0493 | 0.0493 | 2.9 | 2.926 | |
| 31 | 310 | 0.0082 | 0.0508 | 1.0701 | 0.0000 | 0.0000 | 0.8590 | 0.0494 | 0.0494 | 2.9 | 2.935 | |
| 32 | 320 | 0.0082 | 0.0508 | 1.1210 | 0.0000 | 0.0000 | 0.9085 | 0.0495 | 0.0495 | 2.9 | 2.942 | |
| 33 | 330 | 0.0082 | 0.0508 | 1.1718 | 0.0000 | 0.0000 | 0.9581 | 0.0496 | 0.0496 | 3.0 | 2.948 | |
| 34 | 340 | 0.0082 | 0.0508 | 1.2226 | 0.0000 | 0.0000 | 1.0078 | 0.0497 | 0.0497 | 3.0 | 2.954 | |
| 35 | 350 | 0.0095 | 0.0589 | 1.2815 | 0.0000 | 0.0000 | 1.0655 | 0.0577 | 0.0577 | 3.4 | 3.194 | 0.343 |
| 36 | 360 | 0.0095 | 0.0589 | 1.3404 | 0.0000 | 0.0000 | 1.1232 | 0.0578 | 0.0578 | 3.4 | 3.435 | 0.583 |
| 37 | 370 | 0.0095 | 0.0589 | 1.3993 | 0.0000 | 0.0000 | 1.1811 | 0.0579 | 0.0579 | 3.4 | 3.440 | 0.589 |
| 38 | 380 | 0.0095 | 0.0589 | 1.4582 | 0.0000 | 0.0000 | 1.2390 | 0.0579 | 0.0579 | 3.4 | 3.445 | 0.594 |
| 39 | 390 | 0.0095 | 0.0589 | 1.5171 | 0.0000 | 0.0000 | 1.2970 | 0.0580 | 0.0580 | 3.5 | 3.449 | 0.598 |
| 40 | 400 | 0.0095 | 0.0589 | 1.5760 | 0.0000 | 0.0000 | 1.3551 | 0.0581 | 0.0581 | 3.5 | 3.453 | 0.602 |
| 41 | 410 | 0.0134 | 0.0831 | 1.6591 | 0.0000 | 0.0000 | 1.4371 | 0.0820 | 0.0820 | 4.9 | 4.166 | 1.315 |
| 42 | 420 | 0.0134 | 0.0831 | 1.7422 | 0.0000 | 0.0000 | 1.5192 | 0.0821 | 0.0821 | 4.9 | 4.881 | 2.030 |
| 43 | 430 | 0.0134 | 0.0831 | 1.8253 | 0.0000 | 0.0000 | 1.6013 | 0.0822 | 0.0822 | 4.9 | 4.886 | 2.035 |
| 44 | 440 | 0.0180 | 0.1116 | 1.9369 | 0.0000 | 0.0000 | 1.7118 | 0.1105 | 0.1105 | 6.6 | 5.731 | 2.880 |
| 45 | 450 | 0.0180 | 0.1116 | 2.0485 | 0.0000 | 0.0000 | 1.8224 | 0.1106 | 0.1106 | 6.6 | 6.577 | 3.726 |
| 46 | 460 | 0.0340 | 0.2108 | 2.2593 | 0.0030 | 0.0030 | 2.0316 | 0.2092 | 0.2092 | 12.4 | 9.513 | 6.662 |
| 47 | 470 | 0.0540 | 0.3348 | 2.5941 | 0.0240 | 0.0211 | 2.3643 | 0.3327 | 0.3327 | 19.8 | 16.121 | 13.270 |
| 48 | 480 | 0.0270 | 0.1674 | 2.7615 | 0.0417 | 0.0176 | 2.5308 | 0.1665 | 0.1665 | 9.9 | 14.853 | 12.002 |
| 49 | 490 | 0.0180 | 0.1116 | 2.8731 | 0.0559 | 0.0142 | 2.6419 | 0.1111 | 0.1111 | 6.6 | 8.259 | 5.408 |
| 50 | 500 | 0.0134 | 0.0831 | 2.9562 | 0.0678 | 0.0119 | 2.7246 | 0.0827 | 0.0827 | 4.9 | 5.765 | 2.914 |
| 51 | 510 | 0.0134 | 0.0831 | 3.0392 | 0.0807 | 0.0129 | 2.8073 | 0.0827 | 0.0827 | 4.9 | 4.922 | 2.071 |
| 52 | 520 | 0.0134 | 0.0831 | 3.1223 | 0.0946 | 0.0139 | 2.8901 | 0.0828 | 0.0828 | 4.9 | 4.923 | 2.072 |
| 53 | 530 | 0.0088 | 0.0546 | 3.1769 | 0.1043 | 0.0097 | 2.9445 | 0.0544 | 0.0544 | 3.2 | 4.079 | 1.228 |
| 54 | 540 | 0.0088 | 0.0546 | 3.2314 | 0.1144 | 0.0101 | 2.9988 | 0.0544 | 0.0544 | 3.2 | 3.234 | 0.383 |
| 55 | 550 | 0.0088 | 0.0546 | 3.2860 | 0.1249 | 0.0105 | 3.0532 | 0.0544 | 0.0544 | 3.2 | 3.235 | 0.384 |
| 56 | 560 | 0.0088 | 0.0546 | 3.3406 | 0.1358 | 0.0109 | 3.1075 | 0.0544 | 0.0544 | 3.2 | 3.235 | 0.384 |
| 57 | 570 | 0.0088 | 0.0546 | 3.3951 | 0.1472 | 0.0113 | 3.1619 | 0.0544 | 0.0544 | 3.2 | 3.235 | 0.384 |
| 58 | 580 | 0.0088 | 0.0546 | 3.4497 | 0.1589 | 0.0117 | 3.2163 | 0.0544 | 0.0544 | 3.2 | 3.236 | 0.385 |
| 59 | 590 | 0.0088 | 0.0546 | 3.5042 | 0.1711 | 0.0121 | 3.2707 | 0.0544 | 0.0544 | 3.2 | 3.236 | 0.385 |
| 60 | 600 | 0.0088 | 0.0546 | 3.5588 | 0.1836 | 0.0125 | 3.3251 | 0.0544 | 0.0544 | 3.2 | 3.236 | 0.385 |
| 61 | 610 | 0.0088 | 0.0546 | 3.6134 | 0.1965 | 0.0129 | 3.3795 | 0.0544 | 0.0544 | 3.2 | 3.237 | 0.385 |
| 62 | 620 | 0.0088 | 0.0546 | 3.6679 | 0.2098 | 0.0133 | 3.4339 | 0.0544 | 0.0544 | 3.2 | 3.237 | 0.386 |
| 63 | 630 | 0.0088 | 0.0546 | 3.7225 | 0.2235 | 0.0137 | 3.4883 | 0.0544 | 0.0544 | 3.2 | 3.237 | 0.386 |
| 64 | 640 | 0.0088 | 0.0546 | 3.7770 | 0.2375 | 0.0140 | 3.5427 | 0.0544 | 0.0544 | 3.2 | 3.237 | 0.386 |
| 65 | 650 | 0.0072 | 0.0446 | 3.8217 | 0.2492 | 0.0118 | 3.5872 | 0.0445 | 0.0445 | 2.6 | 2.943 | |
| 66 | 660 | 0.0072 | 0.0446 | 3.8663 | 0.2612 | 0.0120 | 3.6318 | 0.0445 | 0.0445 | 2.6 | 2.649 | |
| 67 | 670 | 0.0072 | 0.0446 | 3.9110 | 0.2735 | 0.0122 | 3.6763 | 0.0445 | 0.0445 | 2.6 | 2.649 | |
| 68 | 680 | 0.0072 | 0.0446 | 3.9556 | 0.2859 | 0.0125 | 3.7208 | 0.0445 | 0.0445 | 2.6 | 2.649 | |
| 69 | 690 | 0.0072 | 0.0446 | 4.0002 | 0.2986 | 0.0127 | 3.7653 | 0.0445 | 0.0445 | 2.6 | 2.650 | |
| 70 | 700 | 0.0072 | 0.0446 | 4.0449 | 0.3116 | 0.0129 | 3.8099 | 0.0445 | 0.0445 | 2.6 | 2.650 | |
| 71 | 710 | 0.0072 | 0.0446 | 4.0895 | 0.3247 | 0.0132 | 3.8544 | 0.0445 | 0.0445 | 2.6 | 2.650 | |
| 72 | 720 | 0.0072 | 0.0446 | 4.1342 | 0.3381 | 0.0134 | 3.8990 | 0.0445 | 0.0445 | 2.7 | 2.650 | |
| 73 | 730 | 0.0072 | 0.0446 | 4.1788 | 0.3517 | 0.0136 | 3.9435 | 0.0445 | 0.0445 | 2.7 | 2.650 | |
| 74 | 740 | 0.0072 | 0.0446 | 4.2234 | 0.3655 | 0.0138 | 3.9880 | 0.0445 | 0.0445 | 2.7 | 2.650 | |
| 75 | 750 | 0.0072 | 0.0446 | 4.2681 | 0.3796 | 0.0140 | 4.0326 | 0.0445 | 0.0445 | 2.7 | 2.650 | |
| 76 | 760 | 0.0072 | 0.0446 | 4.3127 | 0.3938 | 0.0143 | 4.0771 | 0.0445 | 0.0445 | 2.7 | 2.650 | |
| 77 | 770 | 0.0057 | 0.0353 | 4.3481 | 0.4053 | 0.0114 | 4.1124 | 0.0353 | 0.0353 | 2.1 | 2.374 | |
| 78 | 780 | 0.0057 | 0.0353 | 4.3834 | 0.4168 | 0.0116 | 4.1477 | 0.0353 | 0.0353 | 2.1 | 2.098 | |
| 79 | 790 | 0.0057 | 0.0353 | 4.4187 | 0.4286 | 0.0117 | 4.1829 | 0.0353 | 0.0353 | 2.1 | 2.098 | |
| 80 | 800 | 0.0057 | 0.0353 | 4.4541 | 0.4404 | 0.0118 | 4.2182 | 0.0353 | 0.0353 | 2.1 | 2.099 | |
| 81 | 810 | 0.0057 | 0.0353 | 4.4894 | 0.4524 | 0.0120 | 4.2535 | 0.0353 | 0.0353 | 2.1 | 2.099 | |

| (1) Time Increment | (2) Time min. | (3) Rainfall distri- bution | (4) Incre- mental Rainfall in. | (5) Accumu- lated Rainfall in. | Pervious Area (6) Accumu- lated Runoff in. | (7) Incre- mental Runoff in. | Impervious Area (8) Accumu- lated Runoff in. | (9) Incre- mental Runoff in. | (10) Total Runoff in. | (11) Instant hydro- graph cfs | (12) design hydro- graph cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 82 | 820 | 0.0057 | 0.0353 | 4.5248 | 0.4645 | 0.0121 | 4.2887 | 0.0353 | 0.0353 | 2.1 | 2.099 |
| 83 | 830 | 0.0057 | 0.0353 | 4.5601 | 0.4767 | 0.0122 | 4.3240 | 0.0353 | 0.0353 | 2.1 | 2.099 |
| 84 | 840 | 0.0057 | 0.0353 | 4.5954 | 0.4890 | 0.0123 | 4.3593 | 0.0353 | 0.0353 | 2.1 | 2.099 |
| 85 | 850 | 0.0057 | 0.0353 | 4.6308 | 0.5015 | 0.0125 | 4.3946 | 0.0353 | 0.0353 | 2.1 | 2.099 |
| 86 | 860 | 0.0057 | 0.0353 | 4.6661 | 0.5141 | 0.0126 | 4.4298 | 0.0353 | 0.0353 | 2.1 | 2.099 |
| 87 | 870 | 0.0057 | 0.0353 | 4.7015 | 0.5268 | 0.0127 | 4.4651 | 0.0353 | 0.0353 | 2.1 | 2.099 |
| 88 | 880 | 0.0057 | 0.0353 | 4.7368 | 0.5397 | 0.0128 | 4.5004 | 0.0353 | 0.0353 | 2.1 | 2.099 |
| 89 | 890 | 0.0050 | 0.0310 | 4.7678 | 0.5510 | 0.0114 | 4.5313 | 0.0309 | 0.0309 | 1.8 | 1.970 |
| 90 | 900 | 0.0050 | 0.0310 | 4.7988 | 0.5625 | 0.0115 | 4.5623 | 0.0309 | 0.0309 | 1.8 | 1.841 |
| 91 | 910 | 0.0050 | 0.0310 | 4.8298 | 0.5741 | 0.0116 | 4.5932 | 0.0309 | 0.0309 | 1.8 | 1.841 |
| 92 | 920 | 0.0050 | 0.0310 | 4.8608 | 0.5857 | 0.0116 | 4.6242 | 0.0309 | 0.0309 | 1.8 | 1.841 |
| 93 | 930 | 0.0050 | 0.0310 | 4.8918 | 0.5974 | 0.0117 | 4.6551 | 0.0309 | 0.0309 | 1.8 | 1.841 |
| 94 | 940 | 0.0050 | 0.0310 | 4.9228 | 0.6093 | 0.0118 | 4.6861 | 0.0309 | 0.0309 | 1.8 | 1.841 |
| 95 | 950 | 0.0050 | 0.0310 | 4.9538 | 0.6212 | 0.0119 | 4.7170 | 0.0310 | 0.0310 | 1.8 | 1.842 |
| 96 | 960 | 0.0050 | 0.0310 | 4.9848 | 0.6332 | 0.0120 | 4.7480 | 0.0310 | 0.0310 | 1.8 | 1.842 |
| 97 | 970 | 0.0050 | 0.0310 | 5.0158 | 0.6453 | 0.0121 | 4.7789 | 0.0310 | 0.0310 | 1.8 | 1.842 |
| 98 | 980 | 0.0050 | 0.0310 | 5.0468 | 0.6574 | 0.0122 | 4.8099 | 0.0310 | 0.0310 | 1.8 | 1.842 |
| 99 | 990 | 0.0050 | 0.0310 | 5.0778 | 0.6697 | 0.0123 | 4.8408 | 0.0310 | 0.0310 | 1.8 | 1.842 |
| 100 | 1000 | 0.0050 | 0.0310 | 5.1088 | 0.6821 | 0.0124 | 4.8718 | 0.0310 | 0.0310 | 1.8 | 1.842 |
| 101 | 1010 | 0.0040 | 0.0248 | 5.1336 | 0.6920 | 0.0099 | 4.8966 | 0.0248 | 0.0248 | 1.5 | 1.658 |
| 102 | 1020 | 0.0040 | 0.0248 | 5.1584 | 0.7020 | 0.0100 | 4.9213 | 0.0248 | 0.0248 | 1.5 | 1.473 |
| 103 | 1030 | 0.0040 | 0.0248 | 5.1832 | 0.7121 | 0.0101 | 4.9461 | 0.0248 | 0.0248 | 1.5 | 1.473 |
| 104 | 1040 | 0.0040 | 0.0248 | 5.2080 | 0.7222 | 0.0101 | 4.9709 | 0.0248 | 0.0248 | 1.5 | 1.473 |
| 105 | 1050 | 0.0040 | 0.0248 | 5.2328 | 0.7323 | 0.0102 | 4.9956 | 0.0248 | 0.0248 | 1.5 | 1.473 |
| 106 | 1060 | 0.0040 | 0.0248 | 5.2576 | 0.7425 | 0.0102 | 5.0204 | 0.0248 | 0.0248 | 1.5 | 1.473 |
| 107 | 1070 | 0.0040 | 0.0248 | 5.2824 | 0.7528 | 0.0103 | 5.0452 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 108 | 1080 | 0.0040 | 0.0248 | 5.3072 | 0.7631 | 0.0103 | 5.0699 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 109 | 1090 | 0.0040 | 0.0248 | 5.3320 | 0.7735 | 0.0104 | 5.0947 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 110 | 1100 | 0.0040 | 0.0248 | 5.3568 | 0.7839 | 0.0104 | 5.1194 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 111 | 1110 | 0.0040 | 0.0248 | 5.3816 | 0.7944 | 0.0105 | 5.1442 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 112 | 1120 | 0.0040 | 0.0248 | 5.4064 | 0.8049 | 0.0105 | 5.1690 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 113 | 1130 | 0.0040 | 0.0248 | 5.4312 | 0.8155 | 0.0106 | 5.1937 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 114 | 1140 | 0.0040 | 0.0248 | 5.4560 | 0.8261 | 0.0106 | 5.2185 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 115 | 1150 | 0.0040 | 0.0248 | 5.4808 | 0.8368 | 0.0107 | 5.2433 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 116 | 1160 | 0.0040 | 0.0248 | 5.5056 | 0.8476 | 0.0107 | 5.2680 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 117 | 1170 | 0.0040 | 0.0248 | 5.5304 | 0.8583 | 0.0108 | 5.2928 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 118 | 1180 | 0.0040 | 0.0248 | 5.5552 | 0.8692 | 0.0108 | 5.3176 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 119 | 1190 | 0.0040 | 0.0248 | 5.5800 | 0.8801 | 0.0109 | 5.3424 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 120 | 1200 | 0.0040 | 0.0248 | 5.6048 | 0.8910 | 0.0109 | 5.3671 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 121 | 1210 | 0.0040 | 0.0248 | 5.6296 | 0.9020 | 0.0110 | 5.3919 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 122 | 1220 | 0.0040 | 0.0248 | 5.6544 | 0.9130 | 0.0110 | 5.4167 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 123 | 1230 | 0.0040 | 0.0248 | 5.6792 | 0.9241 | 0.0111 | 5.4414 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 124 | 1240 | 0.0040 | 0.0248 | 5.7040 | 0.9352 | 0.0111 | 5.4662 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 125 | 1250 | 0.0040 | 0.0248 | 5.7288 | 0.9464 | 0.0112 | 5.4910 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 126 | 1260 | 0.0040 | 0.0248 | 5.7536 | 0.9576 | 0.0112 | 5.5157 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 127 | 1270 | 0.0040 | 0.0248 | 5.7784 | 0.9689 | 0.0113 | 5.5405 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 128 | 1280 | 0.0040 | 0.0248 | 5.8032 | 0.9802 | 0.0113 | 5.5653 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 129 | 1290 | 0.0040 | 0.0248 | 5.8280 | 0.9916 | 0.0114 | 5.5901 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 130 | 1300 | 0.0040 | 0.0248 | 5.8528 | 1.0030 | 0.0114 | 5.6148 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 131 | 1310 | 0.0040 | 0.0248 | 5.8776 | 1.0144 | 0.0115 | 5.6396 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 132 | 1320 | 0.0040 | 0.0248 | 5.9024 | 1.0260 | 0.0115 | 5.6644 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 133 | 1330 | 0.0040 | 0.0248 | 5.9272 | 1.0375 | 0.0116 | 5.6891 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 134 | 1340 | 0.0040 | 0.0248 | 5.9520 | 1.0491 | 0.0116 | 5.7139 | 0.0248 | 0.0248 | 1.5 | 1.474 |

| | | | | | Pervious Area | | Impervious Area | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) Time Increment | (2) Time min. | (3) Rainfall distri-bution | (4) Incre-mental Rainfall in. | (5) Accumu-lated Rainfall in. | (6) Accumu-lated Runoff in. | (7) Incre-mental Runoff in. | (8) Accumu-lated Runoff in. | (9) Incre-mental Runoff in. | (10) Total Runoff in. | (11) Instant hydro-graph cfs | (12) design hydro-graph cfs |
| 135 | 1350 | 0.0040 | 0.0248 | 5.9768 | 1.0608 | 0.0116 | 5.7387 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 136 | 1360 | 0.0040 | 0.0248 | 6.0016 | 1.0724 | 0.0117 | 5.7635 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 137 | 1370 | 0.0040 | 0.0248 | 6.0264 | 1.0842 | 0.0117 | 5.7882 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 138 | 1380 | 0.0040 | 0.0248 | 6.0512 | 1.0960 | 0.0118 | 5.8130 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 139 | 1390 | 0.0040 | 0.0248 | 6.0760 | 1.1078 | 0.0118 | 5.8378 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 140 | 1400 | 0.0040 | 0.0248 | 6.1008 | 1.1197 | 0.0119 | 5.8626 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 141 | 1410 | 0.0040 | 0.0248 | 6.1256 | 1.1316 | 0.0119 | 5.8873 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 142 | 1420 | 0.0040 | 0.0248 | 6.1504 | 1.1435 | 0.0120 | 5.9121 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 143 | 1430 | 0.0040 | 0.0248 | 6.1752 | 1.1555 | 0.0120 | 5.9369 | 0.0248 | 0.0248 | 1.5 | 1.474 |
| 144 | 1440 | 0.0040 | 0.0248 | 6.2000 | 1.1676 | 0.0120 | 5.9616 | 0.0248 | 0.0248 | 1.5 | 1.474 |

Total Volume of Runoff = 212375.647 cu. ft.

(Found by summing this column and multiplying by 600. 600 is the conversion required to convert SUM(Q) in cfs to total volume in cubic feet as follows:

V = SUM(Q) x dt

(cu.ft.) = (cu.ft/s) x (10 min.) x (60 s/min.)

## INFILTRATION TRENCH BASIN 4 SIZING CALCULATIONS (100 YEAR STORM EVENT)

**FLOW RATES AND VOLUMES:**

k= 6.00 in/hr = 0.000139 ft/sec

Sum of Incremental Flow Rates = 65.16 cfs
Required Storage Volume = 39093 cf

**TRENCH SIZING:**

L = 1400 ft
W = 12 ft
H = 4 ft
Wetted Area = 20527.68 sf

Q trench= 2.851 cfs (outflow from trench)

VOID RATIO = 0.60

**TRENCH VOL = 40594 cf** > 39093 CF **OK**

**EQUIVALENT VOID RATIO:**

Pipe Size = 30 in
No. of Pipes = 4
Void Ration Pipe = 1.00 = 100%
Void Ratio Rock = 0.33 = 33.0%

A pipe = 19.64 sf (cross sectional)
A rock = 28.36 sf (cross sectional)
A total = 48 sf (cross sectional)

Volume pipe = 27489.9 cf
Volume rock = 39,710 cf
Volume total = 67,200 cf

**Equivalent Void Ratio = 0.60 = 60%**

**SUMMARY:**

**Trench: L = 1400 ft**
**W = 12 ft**
**H = 4 ft**
**No. of Pipes = 4 30 inch dia pipe**

**100 YEAR STORMWATER CALCULATION MATRIX - SANTA BARBARA HYDROGRAPGH METHOD**

Date: **4/14/2021**

Given: **Project =** **NORDIC AQUAFARMS AQUACULTURE FACILITY**

**Area =** 0.62 acres

**Pt =** 6.2 inches **100-Year / 24 Hour Storm**

**dt =** 10 min.

**Tc =** 5 min. (Post-Developed Site Conditions)

| **PERVIOUS Parcel** | | | **IMPERVIOUS Parcel** | | |
|---|---|---|---|---|---|
| **Area =** | 0 | acres | **Area =** | 0.62 | acres |
| **CN =** | 49 | | **CN =** | 98 | |
| **S =** | 10.41 | | **S =** | 0.20 | |
| **0.2S =** | 2.08 | | **0.2S =** | 0.04 | |

Compute Developed Conditions Runoff hydrograph

Column (3) = SCS Type IA Rainfall Distribution
Column (4) = Col. (3) x Pt = 10 year - 24 Hour Hyetograph at this location.
Column (5) = Accumulated Sum of Col. (4)
Column (6) = [If P <= 0.2S] = 0; Note, use PERVIOUS Area "S" value.
[If P > 0.2S] = (Col.(5) - 0.2S)^2/(Col.(5) + 0.8S); Using the PERVIOUS Area "S" value.
Column (7) = Col.(6) of Present Time Step - Col.(6) of Previous Time Step
Column (8) = Same method as for Col.(6), except use the IMPERVIOUS Area "S" value.
Column (9) = Col.(8) of the present time step - Col.(8) of the previous time step.
Column (10) = ((PERVIOUS area / Total area) x Col.(7)) + ((IMPERVIOUS area / Total area) x Col.(9))
Column (11) = (60.5 x Col.(10) x Total Area) / 10 (dt = 10 minutes)
Routing Constant, w = dt / (2Tc + dt) = 0.5000
Column (12) = Col.(12) of Previous Time Step + (w x [Col.(11) of Previous Time Step
+ Col.(11) of Present Time Step - (2 x Col.(12) of Previous Time Step)])

| | | | | | Pervious Area | | Impervious Area | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) Time Increment | (2) Time min. | (3) Rainfall distri-bution % of Pt | (4) Incre-mental Rainfall in. | (5) Accumu-lated Rainfall in. | (6) Accumu-lated Runoff in. | (7) Incre-mental Runoff in. | (8) Accumu-lated Runoff in. | (9) Incre-mental Runoff in. | (10) Total Runoff in. | (11) Instant hydro-graph cfs | (12) design hydro-graph cfs |
| 1 | 10 | 0.0040 | 0.0248 | 0.0248 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0 | 0.000 |
| 2 | 20 | 0.0040 | 0.0248 | 0.0496 | 0.0000 | 0.0000 | 0.0004 | 0.0000 | 0.0000 | 0.0 | 0.000 |
| 3 | 30 | 0.0040 | 0.0248 | 0.0744 | 0.0000 | 0.0000 | 0.0047 | 0.0044 | 0.0044 | 0.0 | 0.008 |
| 4 | 40 | 0.0040 | 0.0248 | 0.0992 | 0.0000 | 0.0000 | 0.0130 | 0.0082 | 0.0082 | 0.0 | 0.024 |
| 5 | 50 | 0.0040 | 0.0248 | 0.1240 | 0.0000 | 0.0000 | 0.0241 | 0.0111 | 0.0111 | 0.0 | 0.036 |
| 6 | 60 | 0.0040 | 0.0248 | 0.1488 | 0.0000 | 0.0000 | 0.0374 | 0.0133 | 0.0133 | 0.0 | 0.046 |
| 7 | 70 | 0.0040 | 0.0248 | 0.1736 | 0.0000 | 0.0000 | 0.0523 | 0.0150 | 0.0150 | 0.1 | 0.053 |
| 8 | 80 | 0.0040 | 0.0248 | 0.1984 | 0.0000 | 0.0000 | 0.0687 | 0.0163 | 0.0163 | 0.1 | 0.059 |
| 9 | 90 | 0.0040 | 0.0248 | 0.2232 | 0.0000 | 0.0000 | 0.0861 | 0.0174 | 0.0174 | 0.1 | 0.063 |
| 10 | 100 | 0.0040 | 0.0248 | 0.2480 | 0.0000 | 0.0000 | 0.1044 | 0.0183 | 0.0183 | 0.1 | 0.067 |
| 11 | 110 | 0.0050 | 0.0310 | 0.2790 | 0.0000 | 0.0000 | 0.1283 | 0.0239 | 0.0239 | 0.1 | 0.079 |
| 12 | 120 | 0.0050 | 0.0310 | 0.3100 | 0.0000 | 0.0000 | 0.1531 | 0.0248 | 0.0248 | 0.1 | 0.091 |
| 13 | 130 | 0.0050 | 0.0310 | 0.3410 | 0.0000 | 0.0000 | 0.1787 | 0.0256 | 0.0256 | 0.1 | 0.095 |
| 14 | 140 | 0.0050 | 0.0310 | 0.3720 | 0.0000 | 0.0000 | 0.2049 | 0.0262 | 0.0262 | 0.1 | 0.097 |
| 15 | 150 | 0.0050 | 0.0310 | 0.4030 | 0.0000 | 0.0000 | 0.2317 | 0.0267 | 0.0267 | 0.1 | 0.099 |
| 16 | 160 | 0.0050 | 0.0310 | 0.4340 | 0.0000 | 0.0000 | 0.2588 | 0.0272 | 0.0272 | 0.1 | 0.101 |
| 17 | 170 | 0.0060 | 0.0372 | 0.4712 | 0.0000 | 0.0000 | 0.2919 | 0.0331 | 0.0331 | 0.1 | 0.113 |
| 18 | 180 | 0.0060 | 0.0372 | 0.5084 | 0.0000 | 0.0000 | 0.3255 | 0.0336 | 0.0336 | 0.1 | 0.125 |
| 19 | 190 | 0.0060 | 0.0372 | 0.5456 | 0.0000 | 0.0000 | 0.3595 | 0.0339 | 0.0339 | 0.1 | 0.127 |
| 20 | 200 | 0.0060 | 0.0372 | 0.5828 | 0.0000 | 0.0000 | 0.3937 | 0.0343 | 0.0343 | 0.1 | 0.128 |
| 21 | 210 | 0.0060 | 0.0372 | 0.6200 | 0.0000 | 0.0000 | 0.4283 | 0.0345 | 0.0345 | 0.1 | 0.129 |
| 22 | 220 | 0.0060 | 0.0372 | 0.6572 | 0.0000 | 0.0000 | 0.4631 | 0.0348 | 0.0348 | 0.1 | 0.130 |
| 23 | 230 | 0.0070 | 0.0434 | 0.7006 | 0.0000 | 0.0000 | 0.5039 | 0.0408 | 0.0408 | 0.2 | 0.142 |
| 24 | 240 | 0.0070 | 0.0434 | 0.7440 | 0.0000 | 0.0000 | 0.5450 | 0.0411 | 0.0411 | 0.2 | 0.154 |
| 25 | 250 | 0.0070 | 0.0434 | 0.7874 | 0.0000 | 0.0000 | 0.5863 | 0.0413 | 0.0413 | 0.2 | 0.154 |
| 26 | 260 | 0.0070 | 0.0434 | 0.8308 | 0.0000 | 0.0000 | 0.6278 | 0.0415 | 0.0415 | 0.2 | 0.155 |
| 27 | 270 | 0.0070 | 0.0434 | 0.8742 | 0.0000 | 0.0000 | 0.6694 | 0.0416 | 0.0416 | 0.2 | 0.156 |

| | | | | | Pervious Area | | Impervious Area | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) Time Increment | (2) Time min. | (3) Rainfall distri-bution | (4) Incre-mental Rainfall in. | (5) Accumu-lated Rainfall in. | (6) Accumu-lated Runoff in. | (7) Incre-mental Runoff in. | (8) Accumu-lated Runoff in. | (9) Incre-mental Runoff in. | (10) Total Runoff in. | (11) Instant hydro-graph cfs | (12) design hydro-graph cfs | design hydro-graph less Q infill cfs |
| 28 | 280 | 0.0070 | 0.0434 | 0.9176 | 0.0000 | 0.0000 | 0.7112 | 0.0418 | 0.0418 | 0.2 | 0.156 | |
| 29 | 290 | 0.0082 | 0.0508 | 0.9684 | 0.0000 | 0.0000 | 0.7603 | 0.0491 | 0.0491 | 0.2 | 0.170 | |
| 30 | 300 | 0.0082 | 0.0508 | 1.0193 | 0.0000 | 0.0000 | 0.8096 | 0.0493 | 0.0493 | 0.2 | 0.184 | |
| 31 | 310 | 0.0082 | 0.0508 | 1.0701 | 0.0000 | 0.0000 | 0.8590 | 0.0494 | 0.0494 | 0.2 | 0.185 | |
| 32 | 320 | 0.0082 | 0.0508 | 1.1210 | 0.0000 | 0.0000 | 0.9085 | 0.0495 | 0.0495 | 0.2 | 0.185 | |
| 33 | 330 | 0.0082 | 0.0508 | 1.1718 | 0.0000 | 0.0000 | 0.9581 | 0.0496 | 0.0496 | 0.2 | 0.186 | |
| 34 | 340 | 0.0082 | 0.0508 | 1.2226 | 0.0000 | 0.0000 | 1.0078 | 0.0497 | 0.0497 | 0.2 | 0.186 | |
| 35 | 350 | 0.0095 | 0.0589 | 1.2815 | 0.0000 | 0.0000 | 1.0655 | 0.0577 | 0.0577 | 0.2 | 0.201 | |
| 36 | 360 | 0.0095 | 0.0589 | 1.3404 | 0.0000 | 0.0000 | 1.1232 | 0.0578 | 0.0578 | 0.2 | 0.216 | |
| 37 | 370 | 0.0095 | 0.0589 | 1.3993 | 0.0000 | 0.0000 | 1.1811 | 0.0579 | 0.0579 | 0.2 | 0.217 | |
| 38 | 380 | 0.0095 | 0.0589 | 1.4582 | 0.0000 | 0.0000 | 1.2390 | 0.0579 | 0.0579 | 0.2 | 0.217 | |
| 39 | 390 | 0.0095 | 0.0589 | 1.5171 | 0.0000 | 0.0000 | 1.2970 | 0.0580 | 0.0580 | 0.2 | 0.217 | |
| 40 | 400 | 0.0095 | 0.0589 | 1.5760 | 0.0000 | 0.0000 | 1.3551 | 0.0581 | 0.0581 | 0.2 | 0.218 | |
| 41 | 410 | 0.0134 | 0.0831 | 1.6591 | 0.0000 | 0.0000 | 1.4371 | 0.0820 | 0.0820 | 0.3 | 0.263 | |
| 42 | 420 | 0.0134 | 0.0831 | 1.7422 | 0.0000 | 0.0000 | 1.5192 | 0.0821 | 0.0821 | 0.3 | 0.308 | |
| 43 | 430 | 0.0134 | 0.0831 | 1.8253 | 0.0000 | 0.0000 | 1.6013 | 0.0822 | 0.0822 | 0.3 | 0.308 | |
| 44 | 440 | 0.0180 | 0.1116 | 1.9369 | 0.0000 | 0.0000 | 1.7118 | 0.1105 | 0.1105 | 0.4 | 0.361 | |
| 45 | 450 | 0.0180 | 0.1116 | 2.0485 | 0.0000 | 0.0000 | 1.8224 | 0.1106 | 0.1106 | 0.4 | 0.415 | |
| 46 | 460 | 0.0340 | 0.2108 | 2.2593 | 0.0030 | 0.0030 | 2.0316 | 0.2092 | 0.2092 | 0.8 | 0.600 | 0.139 |
| 47 | 470 | 0.0540 | 0.3348 | 2.5941 | 0.0240 | 0.0211 | 2.3643 | 0.3327 | 0.3327 | 1.2 | 1.016 | 0.555 |
| 48 | 480 | 0.0270 | 0.1674 | 2.7615 | 0.0417 | 0.0176 | 2.5308 | 0.1665 | 0.1665 | 0.6 | 0.936 | 0.475 |
| 49 | 490 | 0.0180 | 0.1116 | 2.8731 | 0.0559 | 0.0142 | 2.6419 | 0.1111 | 0.1111 | 0.4 | 0.521 | 0.060 |
| 50 | 500 | 0.0134 | 0.0831 | 2.9562 | 0.0678 | 0.0119 | 2.7246 | 0.0827 | 0.0827 | 0.3 | 0.363 | |
| 51 | 510 | 0.0134 | 0.0831 | 3.0392 | 0.0807 | 0.0129 | 2.8073 | 0.0827 | 0.0827 | 0.3 | 0.310 | |
| 52 | 520 | 0.0134 | 0.0831 | 3.1223 | 0.0946 | 0.0139 | 2.8901 | 0.0828 | 0.0828 | 0.3 | 0.310 | |
| 53 | 530 | 0.0088 | 0.0546 | 3.1769 | 0.1043 | 0.0097 | 2.9445 | 0.0544 | 0.0544 | 0.2 | 0.257 | |
| 54 | 540 | 0.0088 | 0.0546 | 3.2314 | 0.1144 | 0.0101 | 2.9988 | 0.0544 | 0.0544 | 0.2 | 0.204 | |
| 55 | 550 | 0.0088 | 0.0546 | 3.2860 | 0.1249 | 0.0105 | 3.0532 | 0.0544 | 0.0544 | 0.2 | 0.204 | |
| 56 | 560 | 0.0088 | 0.0546 | 3.3406 | 0.1358 | 0.0109 | 3.1075 | 0.0544 | 0.0544 | 0.2 | 0.204 | |
| 57 | 570 | 0.0088 | 0.0546 | 3.3951 | 0.1472 | 0.0113 | 3.1619 | 0.0544 | 0.0544 | 0.2 | 0.204 | |
| 58 | 580 | 0.0088 | 0.0546 | 3.4497 | 0.1589 | 0.0117 | 3.2163 | 0.0544 | 0.0544 | 0.2 | 0.204 | |
| 59 | 590 | 0.0088 | 0.0546 | 3.5042 | 0.1711 | 0.0121 | 3.2707 | 0.0544 | 0.0544 | 0.2 | 0.204 | |
| 60 | 600 | 0.0088 | 0.0546 | 3.5588 | 0.1836 | 0.0125 | 3.3251 | 0.0544 | 0.0544 | 0.2 | 0.204 | |
| 61 | 610 | 0.0088 | 0.0546 | 3.6134 | 0.1965 | 0.0129 | 3.3795 | 0.0544 | 0.0544 | 0.2 | 0.204 | |
| 62 | 620 | 0.0088 | 0.0546 | 3.6679 | 0.2098 | 0.0133 | 3.4339 | 0.0544 | 0.0544 | 0.2 | 0.204 | |
| 63 | 630 | 0.0088 | 0.0546 | 3.7225 | 0.2235 | 0.0137 | 3.4883 | 0.0544 | 0.0544 | 0.2 | 0.204 | |
| 64 | 640 | 0.0088 | 0.0546 | 3.7770 | 0.2375 | 0.0140 | 3.5427 | 0.0544 | 0.0544 | 0.2 | 0.204 | |
| 65 | 650 | 0.0072 | 0.0446 | 3.8217 | 0.2492 | 0.0118 | 3.5872 | 0.0445 | 0.0445 | 0.2 | 0.185 | |
| 66 | 660 | 0.0072 | 0.0446 | 3.8663 | 0.2612 | 0.0120 | 3.6318 | 0.0445 | 0.0445 | 0.2 | 0.167 | |
| 67 | 670 | 0.0072 | 0.0446 | 3.9110 | 0.2735 | 0.0122 | 3.6763 | 0.0445 | 0.0445 | 0.2 | 0.167 | |
| 68 | 680 | 0.0072 | 0.0446 | 3.9556 | 0.2859 | 0.0125 | 3.7208 | 0.0445 | 0.0445 | 0.2 | 0.167 | |
| 69 | 690 | 0.0072 | 0.0446 | 4.0002 | 0.2986 | 0.0127 | 3.7653 | 0.0445 | 0.0445 | 0.2 | 0.167 | |
| 70 | 700 | 0.0072 | 0.0446 | 4.0449 | 0.3116 | 0.0129 | 3.8099 | 0.0445 | 0.0445 | 0.2 | 0.167 | |
| 71 | 710 | 0.0072 | 0.0446 | 4.0895 | 0.3247 | 0.0132 | 3.8544 | 0.0445 | 0.0445 | 0.2 | 0.167 | |
| 72 | 720 | 0.0072 | 0.0446 | 4.1342 | 0.3381 | 0.0134 | 3.8990 | 0.0445 | 0.0445 | 0.2 | 0.167 | |
| 73 | 730 | 0.0072 | 0.0446 | 4.1788 | 0.3517 | 0.0136 | 3.9435 | 0.0445 | 0.0445 | 0.2 | 0.167 | |
| 74 | 740 | 0.0072 | 0.0446 | 4.2234 | 0.3655 | 0.0138 | 3.9880 | 0.0445 | 0.0445 | 0.2 | 0.167 | |
| 75 | 750 | 0.0072 | 0.0446 | 4.2681 | 0.3796 | 0.0140 | 4.0326 | 0.0445 | 0.0445 | 0.2 | 0.167 | |
| 76 | 760 | 0.0072 | 0.0446 | 4.3127 | 0.3938 | 0.0143 | 4.0771 | 0.0445 | 0.0445 | 0.2 | 0.167 | |
| 77 | 770 | 0.0057 | 0.0353 | 4.3481 | 0.4053 | 0.0114 | 4.1124 | 0.0353 | 0.0353 | 0.1 | 0.150 | |
| 78 | 780 | 0.0057 | 0.0353 | 4.3834 | 0.4168 | 0.0116 | 4.1477 | 0.0353 | 0.0353 | 0.1 | 0.132 | |
| 79 | 790 | 0.0057 | 0.0353 | 4.4187 | 0.4286 | 0.0117 | 4.1829 | 0.0353 | 0.0353 | 0.1 | 0.132 | |
| 80 | 800 | 0.0057 | 0.0353 | 4.4541 | 0.4404 | 0.0118 | 4.2182 | 0.0353 | 0.0353 | 0.1 | 0.132 | |
| 81 | 810 | 0.0057 | 0.0353 | 4.4894 | 0.4524 | 0.0120 | 4.2535 | 0.0353 | 0.0353 | 0.1 | 0.132 | |

| (1) Time Increment | (2) Time min. | (3) Rainfall distri-bution | (4) Incre-mental Rainfall in. | (5) Accumu-lated Rainfall in. | Pervious Area (6) Accumu-lated Runoff in. | (7) Incre-mental Runoff in. | Impervious Area (8) Accumu-lated Runoff in. | (9) Incre-mental Runoff in. | (10) Total Runoff in. | (11) Instant hydro-graph cfs | (12) design hydro-graph cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 82 | 820 | 0.0057 | 0.0353 | 4.5248 | 0.4645 | 0.0121 | 4.2887 | 0.0353 | 0.0353 | 0.1 | 0.132 |
| 83 | 830 | 0.0057 | 0.0353 | 4.5601 | 0.4767 | 0.0122 | 4.3240 | 0.0353 | 0.0353 | 0.1 | 0.132 |
| 84 | 840 | 0.0057 | 0.0353 | 4.5954 | 0.4890 | 0.0123 | 4.3593 | 0.0353 | 0.0353 | 0.1 | 0.132 |
| 85 | 850 | 0.0057 | 0.0353 | 4.6308 | 0.5015 | 0.0125 | 4.3946 | 0.0353 | 0.0353 | 0.1 | 0.132 |
| 86 | 860 | 0.0057 | 0.0353 | 4.6661 | 0.5141 | 0.0126 | 4.4298 | 0.0353 | 0.0353 | 0.1 | 0.132 |
| 87 | 870 | 0.0057 | 0.0353 | 4.7015 | 0.5268 | 0.0127 | 4.4651 | 0.0353 | 0.0353 | 0.1 | 0.132 |
| 88 | 880 | 0.0057 | 0.0353 | 4.7368 | 0.5397 | 0.0128 | 4.5004 | 0.0353 | 0.0353 | 0.1 | 0.132 |
| 89 | 890 | 0.0050 | 0.0310 | 4.7678 | 0.5510 | 0.0114 | 4.5313 | 0.0309 | 0.0309 | 0.1 | 0.124 |
| 90 | 900 | 0.0050 | 0.0310 | 4.7988 | 0.5625 | 0.0115 | 4.5623 | 0.0309 | 0.0309 | 0.1 | 0.116 |
| 91 | 910 | 0.0050 | 0.0310 | 4.8298 | 0.5741 | 0.0116 | 4.5932 | 0.0309 | 0.0309 | 0.1 | 0.116 |
| 92 | 920 | 0.0050 | 0.0310 | 4.8608 | 0.5857 | 0.0116 | 4.6242 | 0.0309 | 0.0309 | 0.1 | 0.116 |
| 93 | 930 | 0.0050 | 0.0310 | 4.8918 | 0.5974 | 0.0117 | 4.6551 | 0.0309 | 0.0309 | 0.1 | 0.116 |
| 94 | 940 | 0.0050 | 0.0310 | 4.9228 | 0.6093 | 0.0118 | 4.6861 | 0.0309 | 0.0309 | 0.1 | 0.116 |
| 95 | 950 | 0.0050 | 0.0310 | 4.9538 | 0.6212 | 0.0119 | 4.7170 | 0.0310 | 0.0310 | 0.1 | 0.116 |
| 96 | 960 | 0.0050 | 0.0310 | 4.9848 | 0.6332 | 0.0120 | 4.7480 | 0.0310 | 0.0310 | 0.1 | 0.116 |
| 97 | 970 | 0.0050 | 0.0310 | 5.0158 | 0.6453 | 0.0121 | 4.7789 | 0.0310 | 0.0310 | 0.1 | 0.116 |
| 98 | 980 | 0.0050 | 0.0310 | 5.0468 | 0.6574 | 0.0122 | 4.8099 | 0.0310 | 0.0310 | 0.1 | 0.116 |
| 99 | 990 | 0.0050 | 0.0310 | 5.0778 | 0.6697 | 0.0123 | 4.8408 | 0.0310 | 0.0310 | 0.1 | 0.116 |
| 100 | 1000 | 0.0050 | 0.0310 | 5.1088 | 0.6821 | 0.0124 | 4.8718 | 0.0310 | 0.0310 | 0.1 | 0.116 |
| 101 | 1010 | 0.0040 | 0.0248 | 5.1336 | 0.6920 | 0.0099 | 4.8966 | 0.0248 | 0.0248 | 0.1 | 0.104 |
| 102 | 1020 | 0.0040 | 0.0248 | 5.1584 | 0.7020 | 0.0100 | 4.9213 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 103 | 1030 | 0.0040 | 0.0248 | 5.1832 | 0.7121 | 0.0101 | 4.9461 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 104 | 1040 | 0.0040 | 0.0248 | 5.2080 | 0.7222 | 0.0101 | 4.9709 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 105 | 1050 | 0.0040 | 0.0248 | 5.2328 | 0.7323 | 0.0102 | 4.9956 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 106 | 1060 | 0.0040 | 0.0248 | 5.2576 | 0.7425 | 0.0102 | 5.0204 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 107 | 1070 | 0.0040 | 0.0248 | 5.2824 | 0.7528 | 0.0103 | 5.0452 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 108 | 1080 | 0.0040 | 0.0248 | 5.3072 | 0.7631 | 0.0103 | 5.0699 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 109 | 1090 | 0.0040 | 0.0248 | 5.3320 | 0.7735 | 0.0104 | 5.0947 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 110 | 1100 | 0.0040 | 0.0248 | 5.3568 | 0.7839 | 0.0104 | 5.1194 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 111 | 1110 | 0.0040 | 0.0248 | 5.3816 | 0.7944 | 0.0105 | 5.1442 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 112 | 1120 | 0.0040 | 0.0248 | 5.4064 | 0.8049 | 0.0105 | 5.1690 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 113 | 1130 | 0.0040 | 0.0248 | 5.4312 | 0.8155 | 0.0106 | 5.1937 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 114 | 1140 | 0.0040 | 0.0248 | 5.4560 | 0.8261 | 0.0106 | 5.2185 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 115 | 1150 | 0.0040 | 0.0248 | 5.4808 | 0.8368 | 0.0107 | 5.2433 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 116 | 1160 | 0.0040 | 0.0248 | 5.5056 | 0.8476 | 0.0107 | 5.2680 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 117 | 1170 | 0.0040 | 0.0248 | 5.5304 | 0.8583 | 0.0108 | 5.2928 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 118 | 1180 | 0.0040 | 0.0248 | 5.5552 | 0.8692 | 0.0108 | 5.3176 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 119 | 1190 | 0.0040 | 0.0248 | 5.5800 | 0.8801 | 0.0109 | 5.3424 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 120 | 1200 | 0.0040 | 0.0248 | 5.6048 | 0.8910 | 0.0109 | 5.3671 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 121 | 1210 | 0.0040 | 0.0248 | 5.6296 | 0.9020 | 0.0110 | 5.3919 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 122 | 1220 | 0.0040 | 0.0248 | 5.6544 | 0.9130 | 0.0110 | 5.4167 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 123 | 1230 | 0.0040 | 0.0248 | 5.6792 | 0.9241 | 0.0111 | 5.4414 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 124 | 1240 | 0.0040 | 0.0248 | 5.7040 | 0.9352 | 0.0111 | 5.4662 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 125 | 1250 | 0.0040 | 0.0248 | 5.7288 | 0.9464 | 0.0112 | 5.4910 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 126 | 1260 | 0.0040 | 0.0248 | 5.7536 | 0.9576 | 0.0112 | 5.5157 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 127 | 1270 | 0.0040 | 0.0248 | 5.7784 | 0.9689 | 0.0113 | 5.5405 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 128 | 1280 | 0.0040 | 0.0248 | 5.8032 | 0.9802 | 0.0113 | 5.5653 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 129 | 1290 | 0.0040 | 0.0248 | 5.8280 | 0.9916 | 0.0114 | 5.5901 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 130 | 1300 | 0.0040 | 0.0248 | 5.8528 | 1.0030 | 0.0114 | 5.6148 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 131 | 1310 | 0.0040 | 0.0248 | 5.8776 | 1.0144 | 0.0115 | 5.6396 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 132 | 1320 | 0.0040 | 0.0248 | 5.9024 | 1.0260 | 0.0115 | 5.6644 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 133 | 1330 | 0.0040 | 0.0248 | 5.9272 | 1.0375 | 0.0116 | 5.6891 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 134 | 1340 | 0.0040 | 0.0248 | 5.9520 | 1.0491 | 0.0116 | 5.7139 | 0.0248 | 0.0248 | 0.1 | 0.093 |

| (1) Time Increment | (2) Time min. | (3) Rainfall distri-bution | (4) Incre-mental Rainfall in. | (5) Accumu-lated Rainfall in. | Pervious Area (6) Accumu-lated Runoff in. | (7) Incre-mental Runoff in. | Impervious Area (8) Accumu-lated Runoff in. | (9) Incre-mental Runoff in. | (10) Total Runoff in. | (11) Instant hydro-graph cfs | (12) design hydro-graph cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 135 | 1350 | 0.0040 | 0.0248 | 5.9768 | 1.0608 | 0.0116 | 5.7387 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 136 | 1360 | 0.0040 | 0.0248 | 6.0016 | 1.0724 | 0.0117 | 5.7635 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 137 | 1370 | 0.0040 | 0.0248 | 6.0264 | 1.0842 | 0.0117 | 5.7882 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 138 | 1380 | 0.0040 | 0.0248 | 6.0512 | 1.0960 | 0.0118 | 5.8130 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 139 | 1390 | 0.0040 | 0.0248 | 6.0760 | 1.1078 | 0.0118 | 5.8378 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 140 | 1400 | 0.0040 | 0.0248 | 6.1008 | 1.1197 | 0.0119 | 5.8626 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 141 | 1410 | 0.0040 | 0.0248 | 6.1256 | 1.1316 | 0.0119 | 5.8873 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 142 | 1420 | 0.0040 | 0.0248 | 6.1504 | 1.1435 | 0.0120 | 5.9121 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 143 | 1430 | 0.0040 | 0.0248 | 6.1752 | 1.1555 | 0.0120 | 5.9369 | 0.0248 | 0.0248 | 0.1 | 0.093 |
| 144 | 1440 | 0.0040 | 0.0248 | 6.2000 | 1.1676 | 0.0120 | 5.9616 | 0.0248 | 0.0248 | 0.1 | 0.093 |

Total Volume of Runoff = 13385.020 cu. ft.

(Found by summing this column and multiplying by 600. 600 is the conversion required to convert SUM(Q) in cfs to total volume in cubic feet as follows:

V = SUM(Q) x dt

(cu.ft.) = (cu.ft/s) x (10 min.) x (60 s/min.)

## INFILTRATION TRENCH BASIN 5 SIZING CALCULATIONS (100 YEAR STORM EVENT)

**FLOW RATES AND VOLUMES:**

k= 6.00 in/hr = 0.000139 ft/sec

Sum of Incremental Flow Rates = 1.23 cfs
Required Storage Volume = 737 cf

**TRENCH SIZING:**

| | | | |
|---|---|---|---|
| L = | 1140 | ft | (length of roadway) |
| W = | 2.25 | ft | |
| H = | 1 | ft | |
| Wetted Area = | 3318.89 | sf | |
| Q trench= | 0.461 | cfs | (outflow from trench) |
| VOID RATIO = | 0.33 | | |
| **TRENCH VOL =** | **846** | **cf** | > 737 CF **OK** |

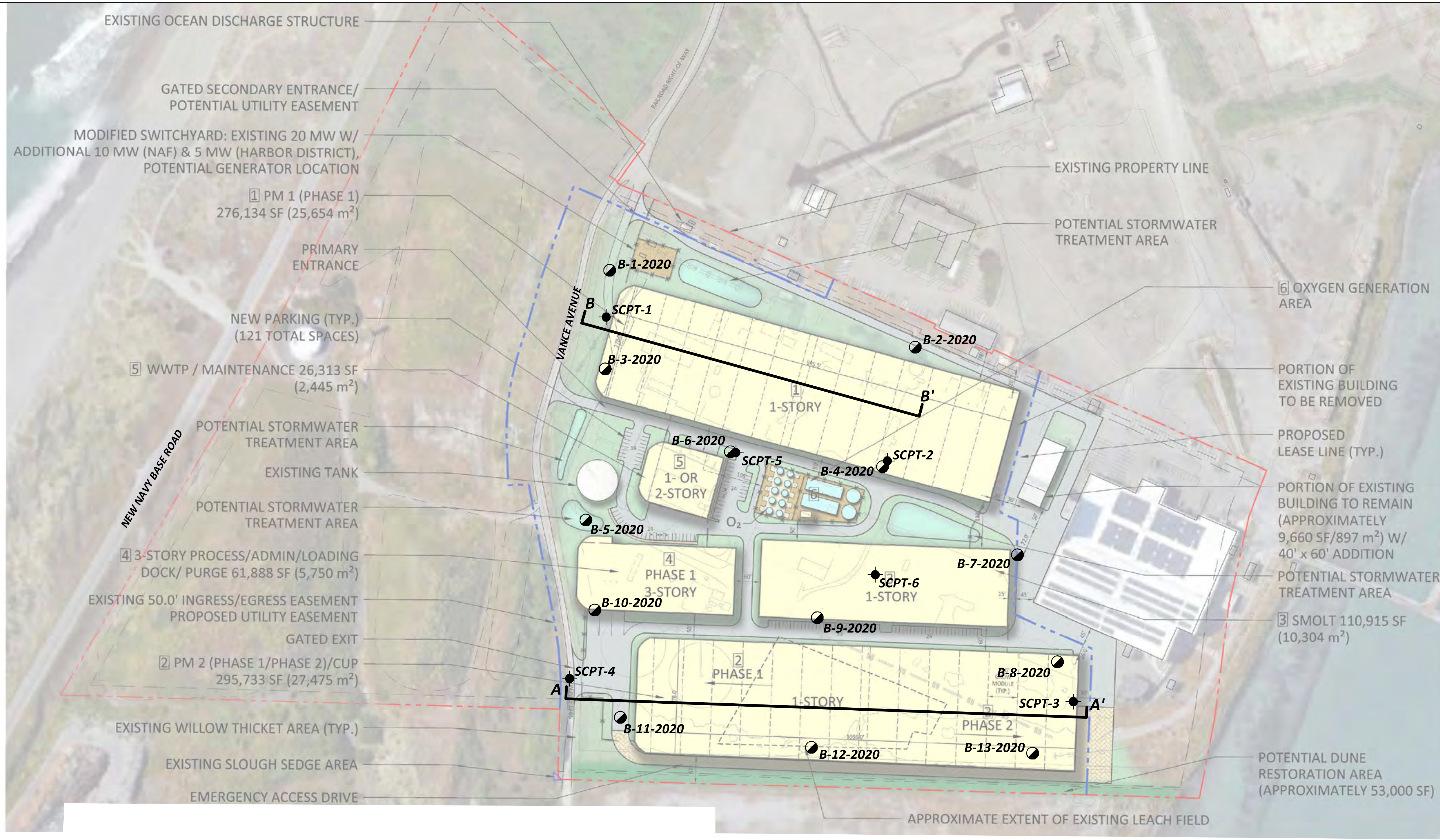
**EQUIVALENT VOID RATIO:**

| | | | | |
|---|---|---|---|---|
| Pipe Size = | 0 | in | | |
| No. of Pipes = | 0 | | | |
| Void Ration Pipe = | 1.00 | = | 100% | |
| Void Ratio Rock = | 0.33 | = | 33.0% | |
| A pipe = | 0.00 | sf | (cross sectional) | |
| A rock = | 2.25 | sf | (cross sectional) | |
| A total = | 2.25 | sf | (cross sectional) | |
| Volume pipe = | 0.0 | cf | | |
| Volume rock = | 2,565 | cf | | |
| Volume total = | 2,565 | cf | | |
| **Equivalent Void Ratio =** | **0.33** | **=** | **33%** | |

**SUMMARY:**

| | | | |
|---|---|---|---|
| **Trench:** | **L =** | **1140** | **ft** |
| | **W =** | **2.25** | **ft** |
| | **H =** | **1** | **ft** |
| **No. of Pipes =** | | **0** | **0 inch dia pipe** |

# Appendix F – Additional Site Figures




**BASEMAP FROM NORDIC AQUAFRAMS, "CONCEPT SITE PLAN, NORDIC AQUAFARMS, SAMOA, CALIFORNIA", DATED JUNE 11, 2020**

## EXPLANATION

- *SEISMIC CONE PENETROMETER TEST LOCATIONS*
- *GEOTECHNICAL BORING LOCATIONS*
- A A' *GEOLOGIC SECTION LINE*

1"=250'±

0 250

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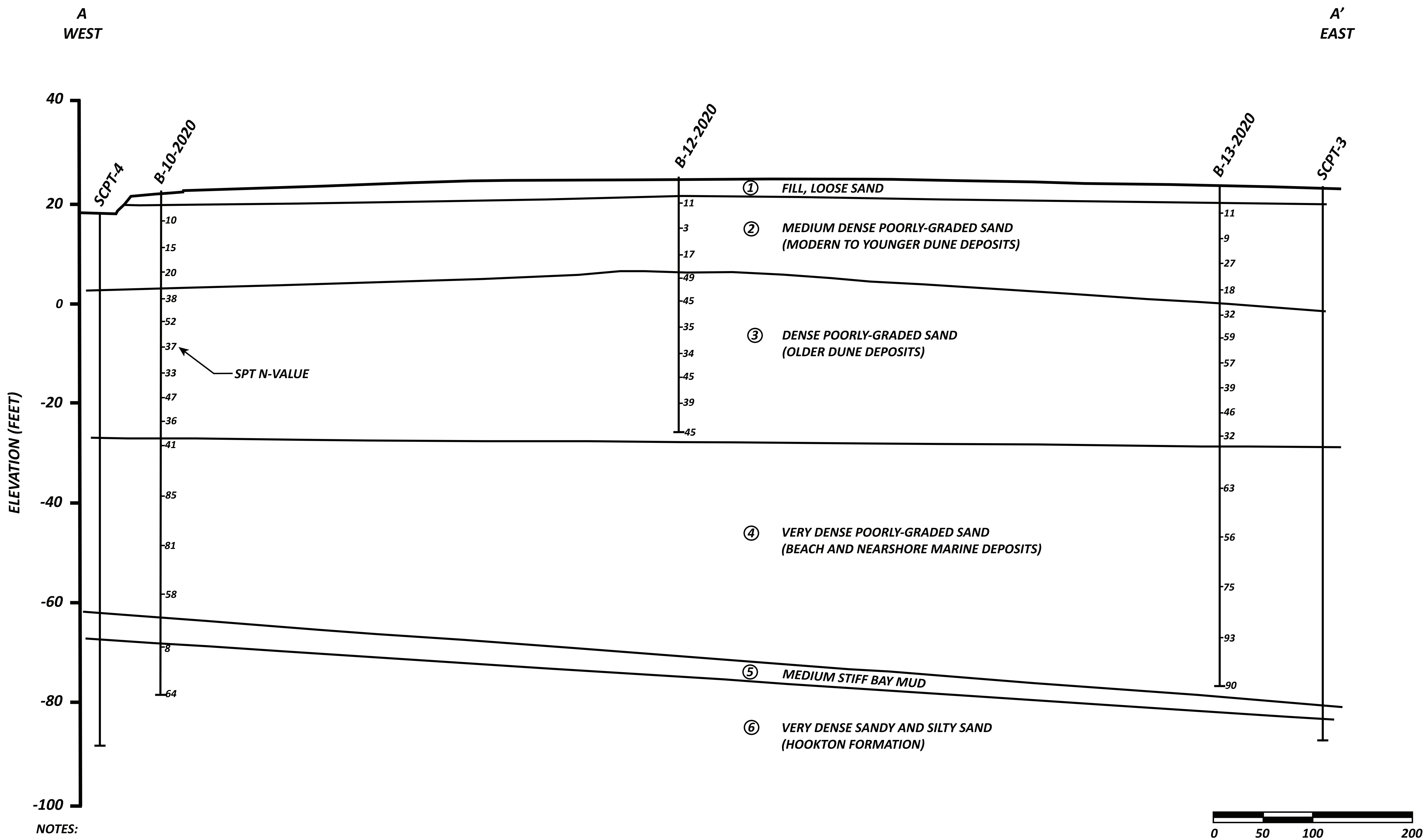
| | | |
|---|---|---|
| SHN | Nordic Aquafarms California, LLC.<br>Geotechnical Investigation Report<br>Samoa Peninsula, Humboldt County, California | **Proposed Building Locations with Geotechnical Exploration Locations**<br>SHN 019146.010 |
| | June 2020 / Figure3_BuildingLocations | **Figure 3** |

Path: \\eureka\projects\2019\019146-NAF-Assessmnt\010-Geotech-Inv\GIS\PROJ_MXD\Figure3_BuildingLocations.mxd User Name: psundberg DATE: 6/23/20, 4:15PM




NOTES:

1) SEE FIGURE 3 FOR LOCATION OF CROSS SECTION.
2) CROSS SECTION REPRESENTS IDEALIZED CONDITIONS BASED ON LIMITED SUBSURFACE DATA.
3) SEE APPENDICIES 2 & 3 FOR GEOTECHNICAL BORING & SCPT LOGS, RESPECTIVELY

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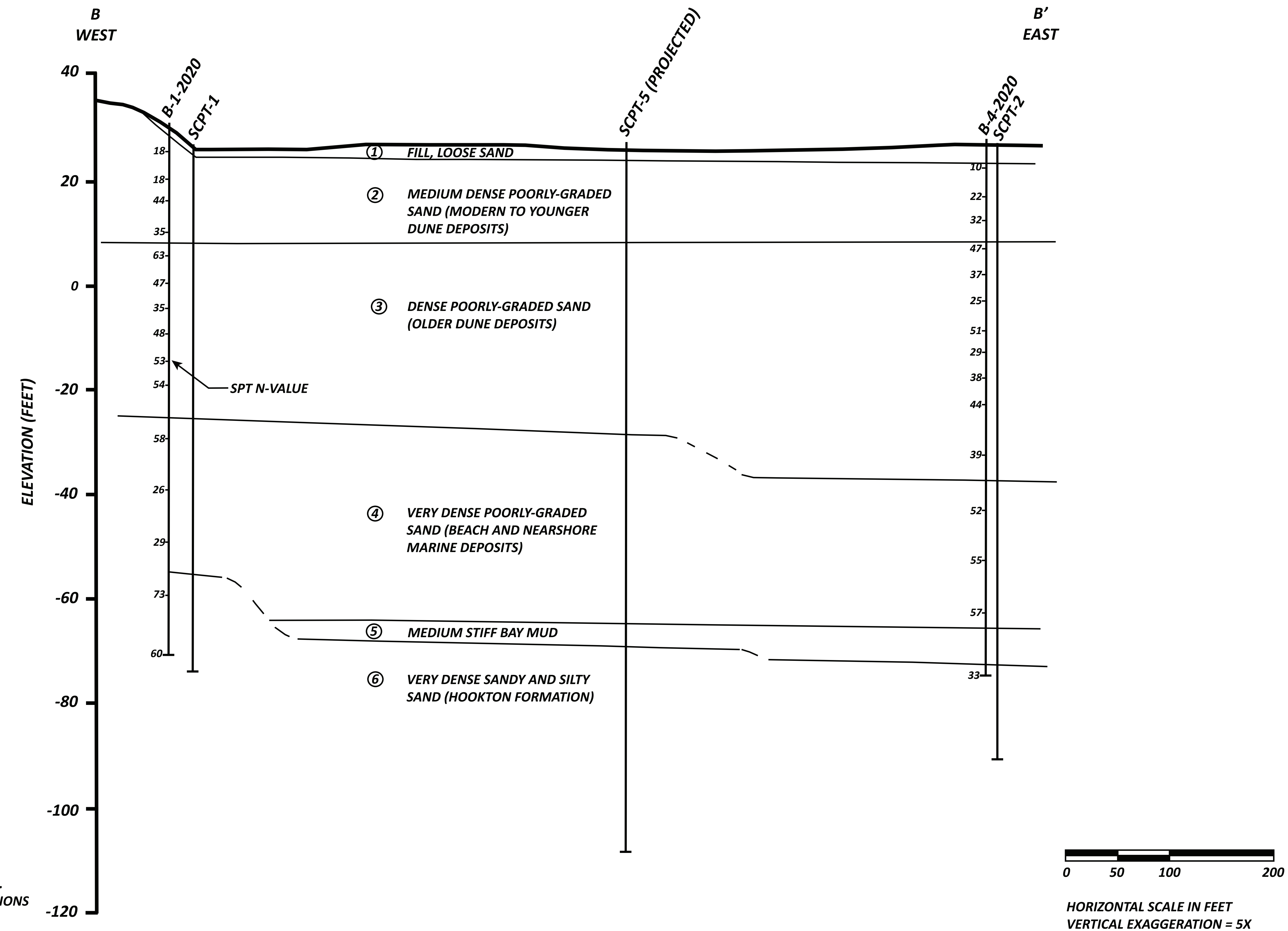
**Geologic Section A-A'**

SHN 019146.010

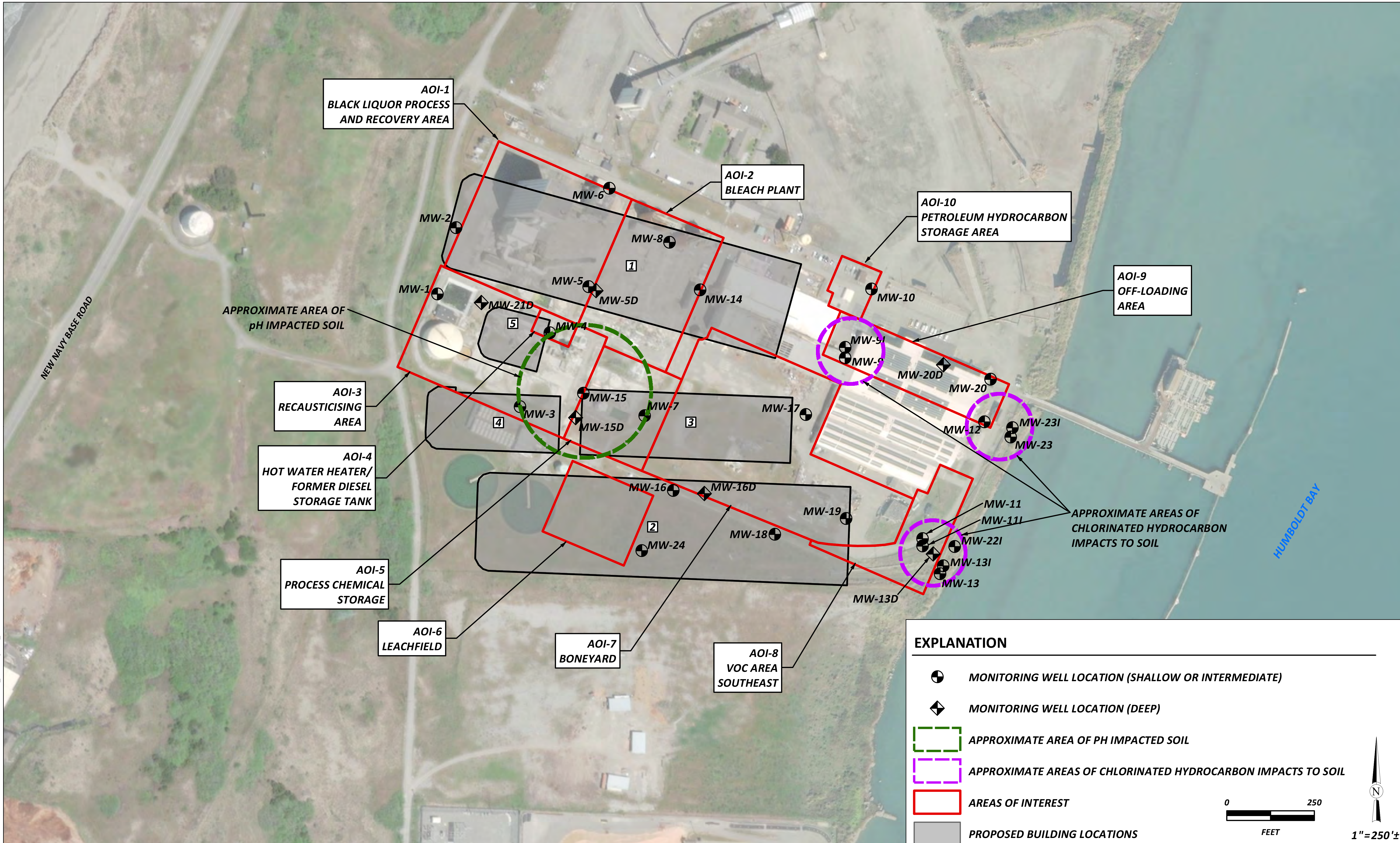
May 2020 | Figure6_GeologicCrossSectionAA | **Figure 6**




NOTES:
1) SEE FIGURE 3 FOR LOCATION OF CROSS SECTION.
2) CROSS SECTION REPRESENTS IDEALIZED CONDITIONS BASED ON LIMITED SUBSURFACE DATA.
3) SEE APPENDICIES 2 & 3 FOR GEOTECHNICAL BORING & SCPT LOGS, RESPECTIVELY.

| | | |
|---|---|---|
| SHN | Nordic Aquafarms California, LLC.<br>Geotechnical Investigation Report<br>Samoa Peninsula, Humboldt County, California | **Geologic Section B-B'**<br>SHN 019146.010 |
| | May 2020 / Figure7_GeologicCrossSectionBB | **Figure 7** |

Path: \\eureka\projects\2019\019146-NAF-Assessmnt\010-Geotech-Inv\GIS\FIGURES\Figure7_GeologicCrossSectionBB.ai User Name: psundberg DATE: 5/22/20, 1:30PM




NOTE: ALL LOCATIONS ARE APPROXIMATE
SERVICE LAYER CREDITS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

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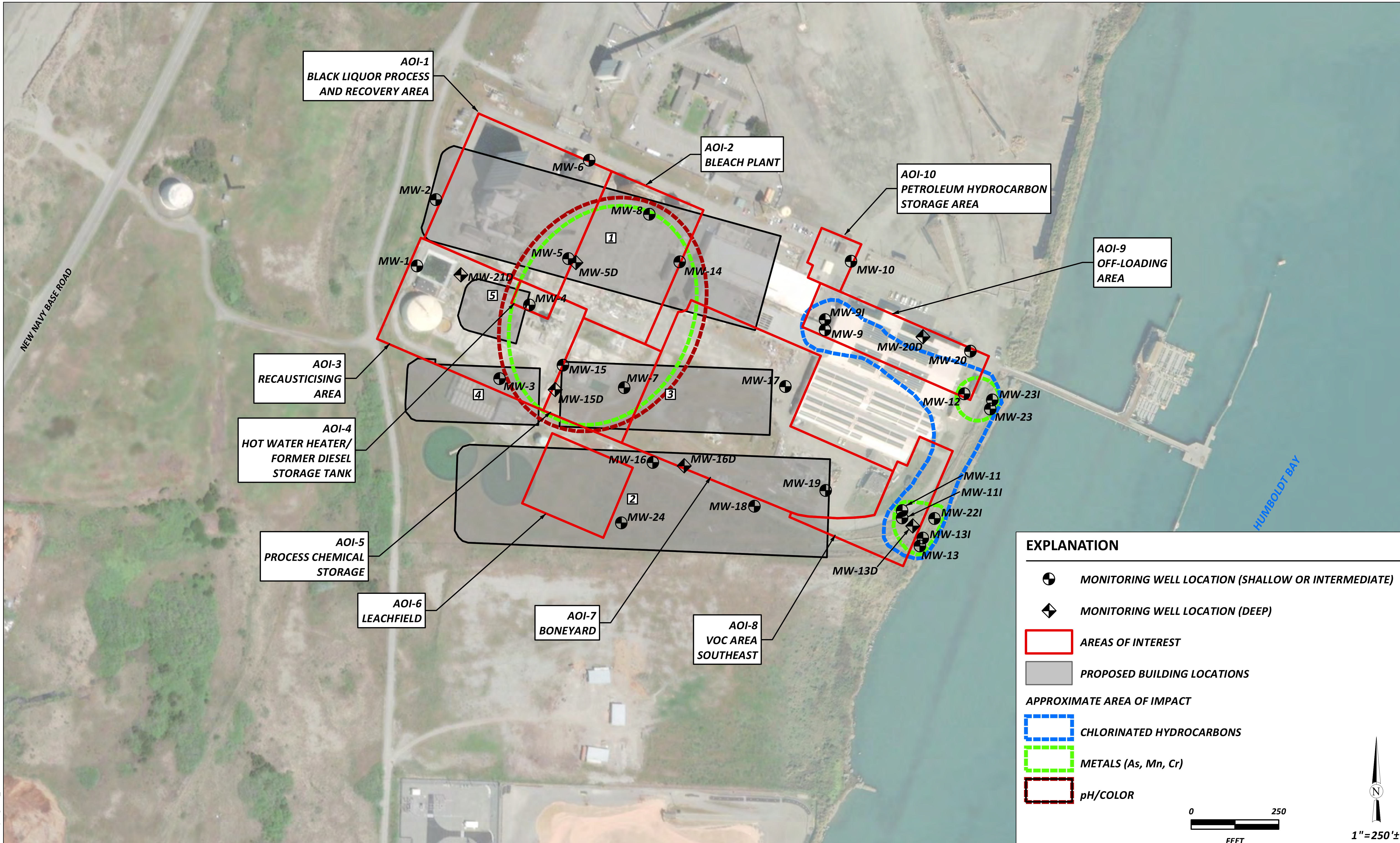
Interim Measures Work Plan
Samoa Peninsula, Humboldt County, California

Contaminants of Potential Concern in Soil
SHN 019146.050

October 2020 | Figure4_ContaminentsOfConcern1 | Figure 4

Path: \\eureka\projects\2019\019146-NAF-Assessmnt\050-Enviro\GIS\PROJ_MXD\Figure4_ContaminentsOfConcern1.mxd User Name: Harri DATE: 10/16/20, 8:40PM




NOTE: ALL LOCATIONS ARE APPROXIMATE
SERVICE LAYER CREDITS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Path: C:\Users\Harri\Desktop\Figure5_ContaminentsOfConcernGW.mxd User Name: Harri DATE: 10/15/20, 9:36PM

| | | |
|---|---|---|
| Nordic Aquafarms California, LLC. | Interim Measures Work Plan | Samoa Peninsula, Humboldt County, California |

Contaminants of Potential Concern in Groundwater

SHN 019146.050

October 2020 | Figure5_ContaminentsOfConcernGW | Figure 5