TRINITY VALLEY CONSULTING ENGINEERS, INC
Engineering – Surveying – Land Planning – Construction Management

38030 Highway 96
Orleans, CA 95556
APN: 529-111-007-000

Onsite Wastewater Treatment System Design
&
Cumulative Impact Study Report

Received 11/28/2022 HCP&B

Report Provided For:

Karuk Tribe Housing Authority
635 Jacobs Way
PO Box 1159
Happy Camp, CA 96039
530.493.1414

Report Provided By:

Trinity Valley Consulting Engineers, Inc.
67 Walnut Way
PO Box 1567
Willow Creek, California 95573
530.629.3000

Original: January 2020
Revised: September 2022
Project Number: 0236.02

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Introduction:

Trinity Valley Consulting Engineers (TVCE) was secured by the Karuk Tribe Housing Authority (KTHA) to evaluate the potential for developing Housing on the property described below. The following report is a summary of our investigation, findings, and recommendations for the development, as it relates to onsite wastewater treatment and disposal.

Site Description:

The proposed development is located on property described as the southwesterly quarter of Section 31, of Township 11 North, Range 6 East of the Humboldt Base Meridian in the unincorporated town of Orleans, County of Humboldt, State of California. The Assessor Parcel Number (APN) for the property is 529-111-007. The total parcel contains approximately 1.72 acres (according to County Records). The site is a relatively flat parcel located between the Orleans Elementary School and the Orleans Market on the north side of Highway 96. The parcel was previously developed and used as a recreational vehicle park.

Proposed Project:

The proposed project includes building eight new single-family homes. Each home is to be approximately 780 square feet and consist of two bedrooms and one bathroom. Development of the site will include demolition of the existing improvements which include an aging 1,320 square foot single family home, a 26-space recreational vehicle park, a public bathroom and laundry facility, and aging utility infrastructure.

The existing onsite wastewater treatment system configuration and condition is unknown. A new onsite wastewater treatment system is proposed to be built as part of the development. The new system will include a collection main, tankage, and leachate field per the calculations and conditions presented in this report.

Field Investigation:

TVCE personnel investigated the site on Wednesday, January 29, 2020. During the site investigation six sample pits were dug using an E35 excavator. Each sample pit was dug to a depth approximately nine feet below existing grade. Soil samples were harvested from each pit at the three, six, and nine-foot depths. Each soil sample harvested was processed in our laboratory for textural determination, percolation suitability, application rating, zone determination, and soils classification. No ground water or bedrock was encountered in any of the test pits.

A Percolation test was also performed on site during the same visit. The excavator was used to dig a test pad approximately two feet below existing grade. Three test holes were then dug in the test pad using a posthole digger. The holes were approximately eight inches in diameter and twelve inches deep. Percolation testing was performed in strict conformance with Humboldt County Wet Weather Testing of Soils protocols. Results of the percolation testing are attached to this report.

Limitations:

During the field investigation there were no observed signs of limitation such as bedrock or groundwater. Test pits # 2,3,4, and 5 mainly consisted of a river silt-like material throughout the excavation from existing grade down to the maximum 9' depth explored. Test pits # 1 and # 6 had a wider variety of material throughout the excavation going from clay-like dirt for approximately the first 6', then transitioned into a fine, sand-like material for the remaining 3'. No bedrock or large rock outcroppings were encountered during exploration. Minor concentrations of slightly denser material were encountered during digging but was such that when force was applied by the excavator the soil would give and break apart. Excavation on the site was fairly fast and easy digging.

The Karuk Tribe provided a Cultural Monitor during excavation. No culturally significant items were encountered. Given the proposed development's proximity to historically and culturally sensitive areas in the surrounding community it is assumed that all future ground disturbances will require monitoring.

Onsite Wastewater Treatment System:

The proposed development includes construction of eight, single family, two-bedroom houses. Septic loading, for design purposes, was calculated using the regulatory and industry standard rate of one-hundred fifty gallons per day (GPD) per bedroom, which resulted in a rate of 300 GPD per house for a total loading of 2,400 GPD. Based on the requirements of the NCRWQCB as well as the criteria in the Humboldt County Onsite Wastewater Treatment System Regulations and Technical Manual Section 3.8.2 the potential cumulative effects on ground and surface water must be taken into consideration for sites with proposed total loading rates above 1,500 GPD. Specifically, potential impacts of groundwater mounding and nitrate loading are to be taken into consideration.

It is worth noting that the existing site and onsite wastewater system are potentially at a higher daily flow rate than the proposed loading given: a three-bedroom house at 450 GPD, 26 RV spaces x 100 GPD = 2,600 GPD, and central comfort station at 910 GPD for a potential total loading of 3,960 GPD. The proposed improvements and development of the parcel will potentially represent a loading reduction of approximately forty percent, based on these numbers.

Groundwater Mounding

To determine the potential cumulative impacts of the proposed wastewater system and its potential effects of groundwater mounding we implemented the methods and criteria developed by the USGS as documented in the Scientific Investigation Report 2010-5102 including use of the Hantush Equation. The potential impacted area was limited to the proposed leachate field footprint including a trench bottom that extends approximately one foot beyond the centerline of pipe on each outer run of leachate line, as well as one foot beyond the end of each leachate line. Calculations provided in the attached spreadsheet were based on the following assumptions:

1. Recharge rate is based on the application rate determined for site soils during percolation testing and laboratory analysis of soils harvested from the site,

2. Specific yield is based on US Department of the Interior Geological Survey water supply paper 1662-D for Hydrologic Properties of Earth Materials,
3. Horizontal hydraulic conductivity is assumed to be 10:1 of the soil permeability per Anderson and Woessner, 1991; Pope and Watt, 2005; Modica 1996, and Cauller and Carleton, 2006,
4. Infiltration period was set at one day,
5. Thickness of the saturated zone was set to initially represent the aggregate zone beneath the leachate pipes.

The results of the potential for groundwater mounding based on the stated assumptions and within the confining parameters of the Hantush Equation present a theoretical saturated state below the aggregate zone of the leachate field of a maximum thickness of 9.78' at the center of the field (or basin). Given the proposed depth of the leachate system this would potentially represent a maximum saturated state to 11.78' below finish grade. Given the lack of evidence of present or frequent groundwater near this depth it is presumed that the resulting mounding would most likely not result in direct connection to the water table in a typical rain event year, and the potential of over saturation or horizontal migration of saturation beyond the resulting depths and distances presented in the supporting spreadsheet attached to this report should be minimal.

Nitrate Loading

According to the Environmental Earth Science publication on nitrate loading from septic systems to ground water "Nitrate (NO3), as a commonly identified groundwater and surface water pollutant, is associated with a number of adverse health and environmental impacts. Nitrate concentration higher than 10 mg/L (measured as nitrogen, EPA drinking water primary standard) in drinking water may cause methemoglobinemia, also known as blue baby syndrome. Discharge of nitrate-rich groundwater to surface water bodies can lead to fish kills, algal growth, hypoxia, eutrophication, and outbreaks of toxic bacteria…Shallow groundwater in surficial aquifers is always vulnerable to nitrate contamination, because of direct discharge of effluent from septic systems into soil. This may pose a threat to public health if drinking water supply depends on shallow domestic wells."

As part of our determination of the potential impacts of the proposed onsite septic system in relation to nitrate loading we incorporated the methods developed under the Department of Interior for ArcGIS based analysis which is dependent on the USGS Modflow-2000 ground-water flow model. Our analysis was limited to the potential impacts of the proposed septic system and did not factor other variables such as fertilizer impacts from upstream (off site) sources automotive combustion of fossil fuels, or alternate variables that are outside of the scope of this report as it relates to the proposed septic system. Given the absence of available current nitrate base datum data for the area we defaulted to EPA standard nitrogen loading rates of 11.2 grams per person per day with a projected loading of 358.4 grams per day (358.4/2,400 grams/gal = 39.45 mg/L) and a septic tank raw sewage concentrated accumulation of 78.9 mg/L (refer to attached calculations for details). Based on case studies conducted by the EPA an average of ten percent of available Nitrogen in septic tanks is retained in the sludge and scum layers. Ammonification of the wastewater in the tank should result in a ninety percent conversion of the available organic nitrogen to ammonium nitrate (nonorganic) with the remaining organic nitrogen loading in effluent to be at a concentrated accumulation of 7.1 mg/L. This is the projected nitrate level that will be delivered to the leachate

field in organic form and will require natural dispersal. The projected 7.1 mg/L is below the EPA max of 10 mg/L. The proposed leachate field should be able to convert the remaining organic nitrogen within the drain rock layer and first two feet of native soils below the drain rock layer. This denitrification process in an anoxic environment should occur prior to any leachate reaching the groundwater table.

The proposed development is on a parcel that does not harbor wells. Domestic water supply for the parcel is provided by the Orleans Community Services District and is piped into the site from sources beyond the property limits of the project. As far as we know, the adjoining parcels also do not harbor wells and they also receive their domestic water from the local municipality. The potential for the proposed onsite wastewater system having an adverse nitrate impact to the domestic water in the area is presumed to be very low given the absence of onsite water harvest for consumption and the proposed proximity of wastewater disposal system onsite in relation to the proposed domestic water conveyance and distribution system.

The subject property is located northwest of Highway 96 which, in this area, parallels the Klamath River. The southernmost property line is approximately 300'+/- away from the river's edge, and approximately 105'+/- away from the DWR Awareness Floodplain edge, as measured using Humboldt County Web GIS. Given the horizontal separation between the parcel and the rivers general and elevated conditions the probability of nitrate influence of the Klamath River by the proposed onsite sewer system is presumed to be low.

Proposed Sewage Disposal System
Refer to the attached Sewage Disposal System Submittal for calculations and details. Assumptions for the site based on soil analysis and percolation testing include: an application rate of 0.70 gallons per day per square foot and a percolation rate of sixteen minutes per inch. The leachate disposal field is proposed to have three vertical feet of washed drain rock below the perforated pipe allowing for six feet per foot of sidewall for treatment. The resulting field is proposed to include six lateral lines of no less than ninety-six feet per line.

Septic Holding Tank: Holding tank(s) to meet the minimum requirements set forth in the Humboldt County Onsite Wastewater Treatment System Regulations Technical Manual (HCOWTS) Section 4.3. Tank minimum sizing per HCOWTS Table 1. Tank volume minimum conservative sizing criteria; projected flow rate equal to 2,400 GPD x 3 = 7,200 Gallon capacity (including primary and leachate chambers).

Evaluation:
The property was previously used as a recreational vehicle park. There are buried utilities onsite including power, water, and sewer. The existing onsite wastewater system is not known and would require additional investigation of the site in order to determine what exists and in what condition. It is assumed that the new development will include new wastewater facilities and that the existing system will be demolished or abandoned in place either in whole or in part depending on the final design and layout of the proposed development.

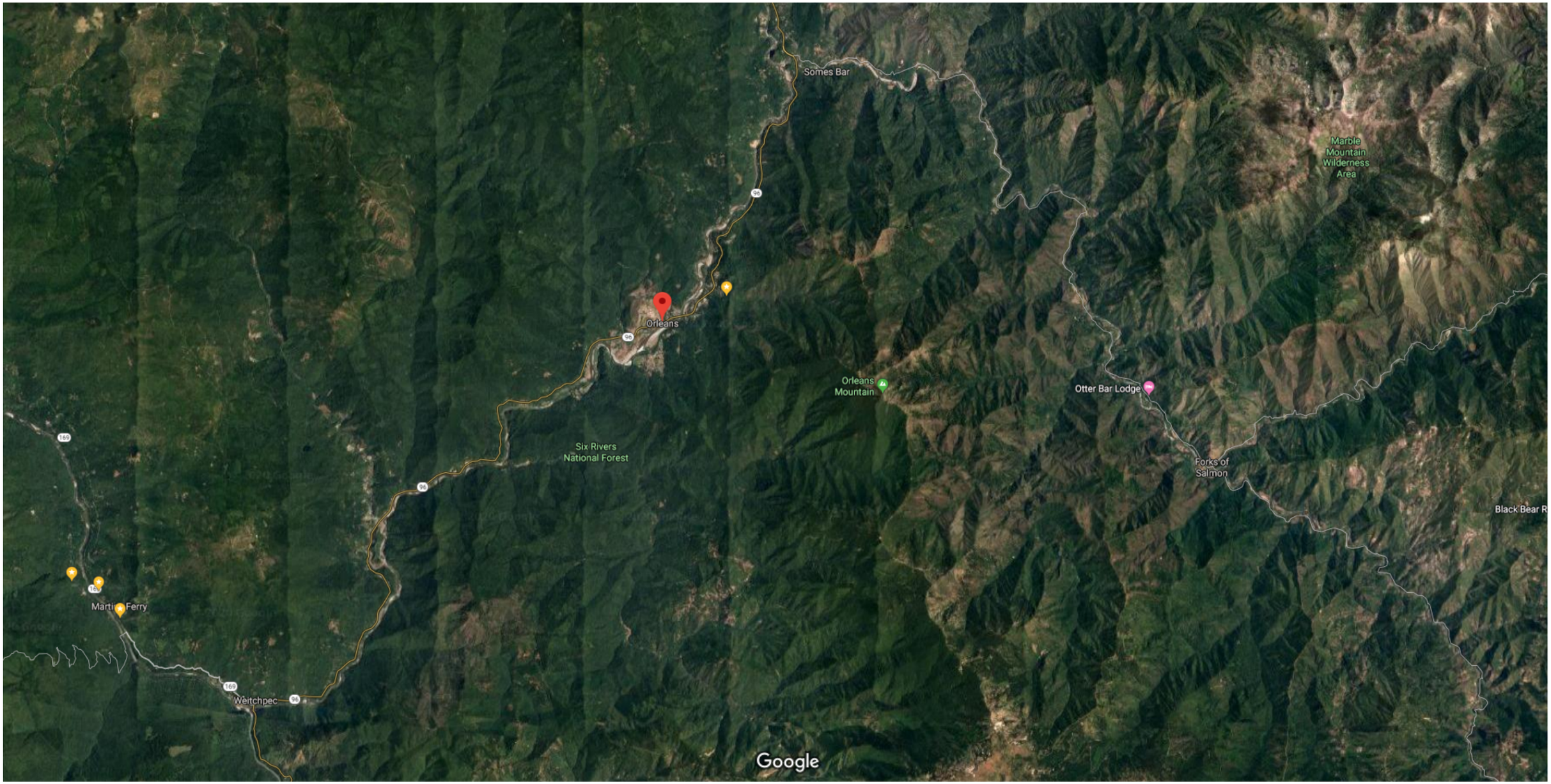
Conclusion:
Review of the site grades, soil stratigraphy, proximity to water bodies, and projected loading conditions has supported that the site is acceptable for development of a conventional onsite wastewater treatment system contingent on the limitations outlined herein and in accordance with the design criteria identified and presented in this report based on the information obtained from the site investigation, soil laboratory testing, percolation testing, and additional supporting criteria for ground water mounding and nitrification.

References:

- California Water Quality Control Plan for the North Coast Region
- Environmental Earth Science DOI 10.100 Estimation of nitrate load from septic systems to surface water bodies using an ArcGIS-based software
- Environmental Protection Agency Onsite Wastewater Treatment Manual
- Humboldt County Onsite Wastewater Treatment system (OWTS) Regulations and Technical Manual
- Uniform Plumbing Code (UPC)
- USGS Scientific Investigation Report 2010-5102
- US Department of the Interior Geological Survey Water Supply Paper 1662-D

Attachment 1
Location Map

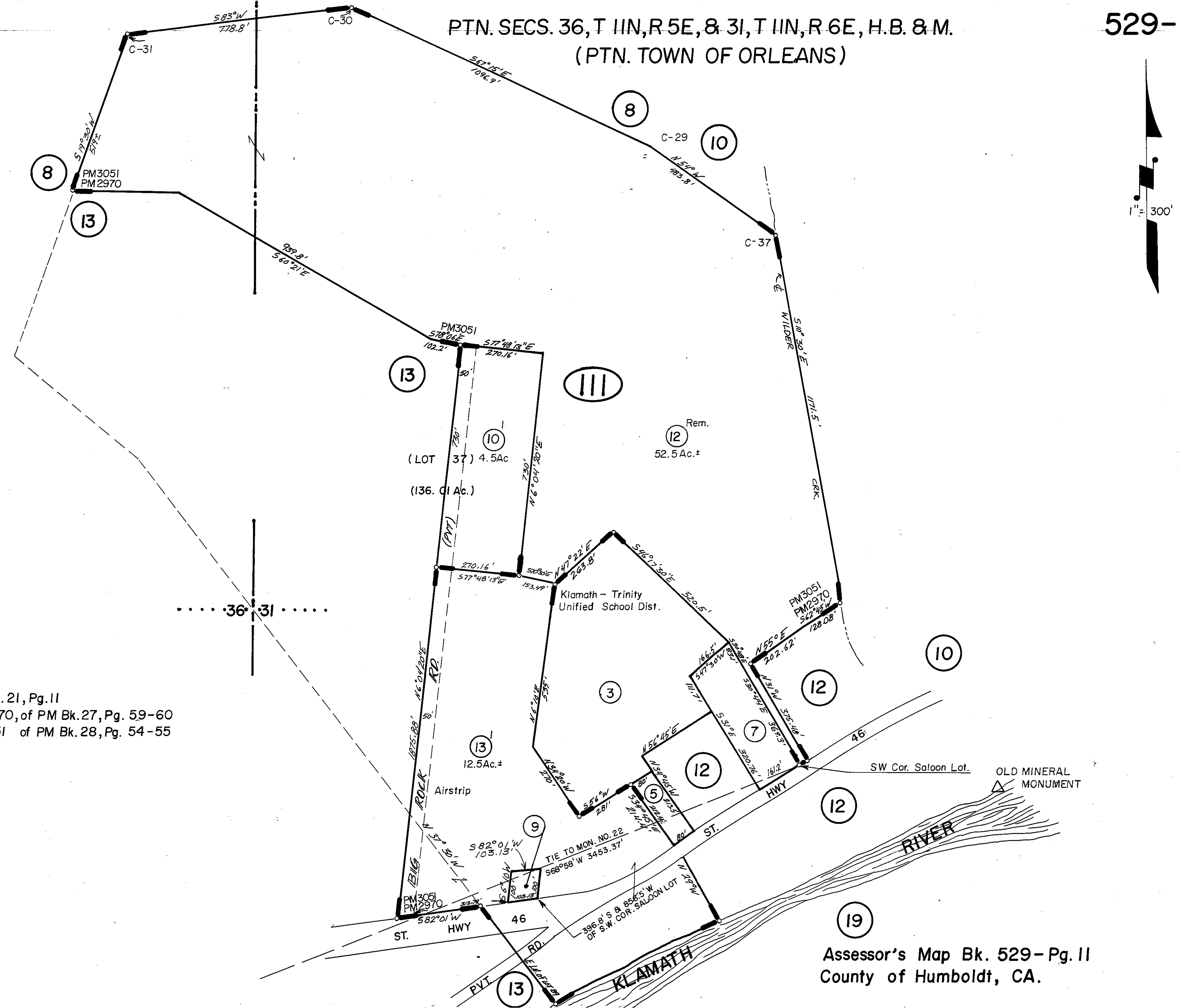
Google Maps Orleans



Imagery ©2020 TerraMetrics, Map data ©2020 Google 1 mi

Attachment 2
Assessor Parcel Map & Humboldt GIS Map

PTN. SECS. 36, T 11N, R 5E, & 31, T 11N, R 6E, H.B. & M.
(PTN. TOWN OF ORLEANS)



R.S. Bk. 21, Pg. 11
PM 2970, of PM Bk. 27, Pg. 59-60
PM 3051 of PM Bk. 28, Pg. 54-55

Assessor's Map Bk. 529 - Pg. 11
County of Humboldt, CA.

ArcGIS Web Map

Humboldt County Planning and Building Department

Printed: February 19, 2020 Web AppBuilder 2.0 for ArcGIS

Map Disclaimer:
While every effort has been made to assure the accuracy of this information, it should be understood that it does not have the force & effect of law, rule, or regulation. Should any difference or error occur, the law will take precedence.

City Boundary

Counties

Parcels (no APN labels)

0 87.5 175 350 Feet

0 0.015 0.03 0.06 Miles

RF= 1:2,257 1 in = 188 ft

N W E S

Sources: Humboldt County GIS
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Source: Esri. DigitalGlobe. GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Attachment 3
Sample Pit Location Map

NOTES:

01 ALL ~~TEST~~ TEST PITS EXCAVATED TO 9'± BELOW EXISTING GRADE. SOIL SAMPLES HARVESTED FOR EACH TEST PIT AT 3', 6', & 9'.

02 PERC TEST PAD EXCAVATED TO 2'± BELOW EXISTING GRADE. 8"ϕ HOLES DUG W/ POSTHOL DIGGER TO 12".

Scale: 1" = 20'

(E)APPROX. PROPERTY BNDRY

(E)CARPORT

(E)RESIDENCE

500.7EG

501.2EG

501.1EG

501.3EG

(E)FP

(E)WM

(E)STRUCTURE (NO SURVEY)

HEAVILY TREED AREA

PT01 PT02 PT03 TP06

(E)WEATHER STATION

60d

500.9EG

(E)DRIVEWAY(GRAVEL)

(E)SS

(E)WTR SPIGOT

501.5EG

(E)STRUCTURE

(E)MH

TP05

TP01

501.4EG

60d

(E)RESIDENCE

502.1EG

502.2EG

502.0EG

TP04

APN: 529-111-007
1.72 ACRES
38030 STATE HWY 96
ORLEANS, CA. 95556

TP02

(E)DRIVEWAY(GRAVEL)

502.4EG

TP03

(E)GRAVEL SHLDR

HIGHWAY 96

GRAVEL SHLDR

500.4EG

501.0EG

(E)GRAVEL DRIVEWAY

(E)DRIVEWAY

(E)UP

REBAR

(E)WM

(E)RESIDENCE

(E)APPROX. PROPERTY BNDRY

ORLEANS ELEMENTARY SCHOOL

01/29/2020
TEST PIT & PERCOLATION TESTING MAP

LEGEND

TP ## TEST PIT LOCATION
PT ## PERCOLATION TEST LOCATION

EXISTING SITE OVERVIEW
SCALE: 1" = 20'

1" 1/2" 0" 1"

TVCE
TRINITY VALLEY CONSULTING ENGINEERS INC.
67 WALNUT WAY
PO BOX 1567
WILLOW CREEK, CA 95573
PHONE (530) 629-3000
FAX (530) 629-3011

REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY

EXISTING SITE OVERVIEW
KARUK HOUSING
ORLEANS, CA, 95556

DRAWN BY: SG
DESIGN BY: TVCE
CHECKED BY: J. McKNIGHT, E. KEYES
DATE OF ISSUE: SEPTEMBER 21, 2019
SCALE: 1" = 40'
PROJECT NO: 1
DRAWING NO: C

Attachment 4
Textural Analysis Report

TRINITY VALLEY
CONSULTING ENGINEERS, INC
Joshua T. McKnight CE 60687

Date: 02/11/2020

Report to: Karuk Tribe Housing Authority
Post Office Box 1159
Happy Camp, CA 96039

RE: Orleans Housing Development
38030 Highway 96
Orleans, CA 95556

APN: 529-111-007 TP #'s: 1 Depth: 3', 6', 9' Sample Description: Soil

Sampled By: J. McKnight Date Tested: 02/07/2020 Date Sampled: 01/29/2020

SOILS EXAMINATION FOR SOIL PERCOLATION SUITABILITY

Textural Analysis	TP-1A	TP-1B	TP-1C
Sand:	70%	84%	84%
Clay:	08%	05%	06%
Silt:	22%	11%	10%
Zone Classification:	**2**	**1**	**1**

Bulk Density: N/A

Comments:

Zone 1 - Soils in this zone are very high in sand content. They readily accept effluent, but because of their low silt and clay content, they provide minimal filtration. These soils demand greater separation distances from ground water.

Zone 2 - Soils in this zone provide adequate percolation rates and filtration to effluent. They are suitable for use of a conventional system without further testing.

Zone 3 - Soils in this zone are expected to provide filtration of effluent, but their ability at a suitable rate is questionable. These soils require wet-weather percolation tests to verify their suitability for effluent disposal by conventional leachfield methods.

Zone 4 - Soils in this zone are unsuitable for a conventional leach field because of their severe limitations for accepting effluent.

Josh McKnight, P.E.

Soil Texture Analysis Worksheet

Name: Karuk-Orleans Housing Development

Job No.: 236.02

APN: 529-111-007

Performed By: J. McKnight

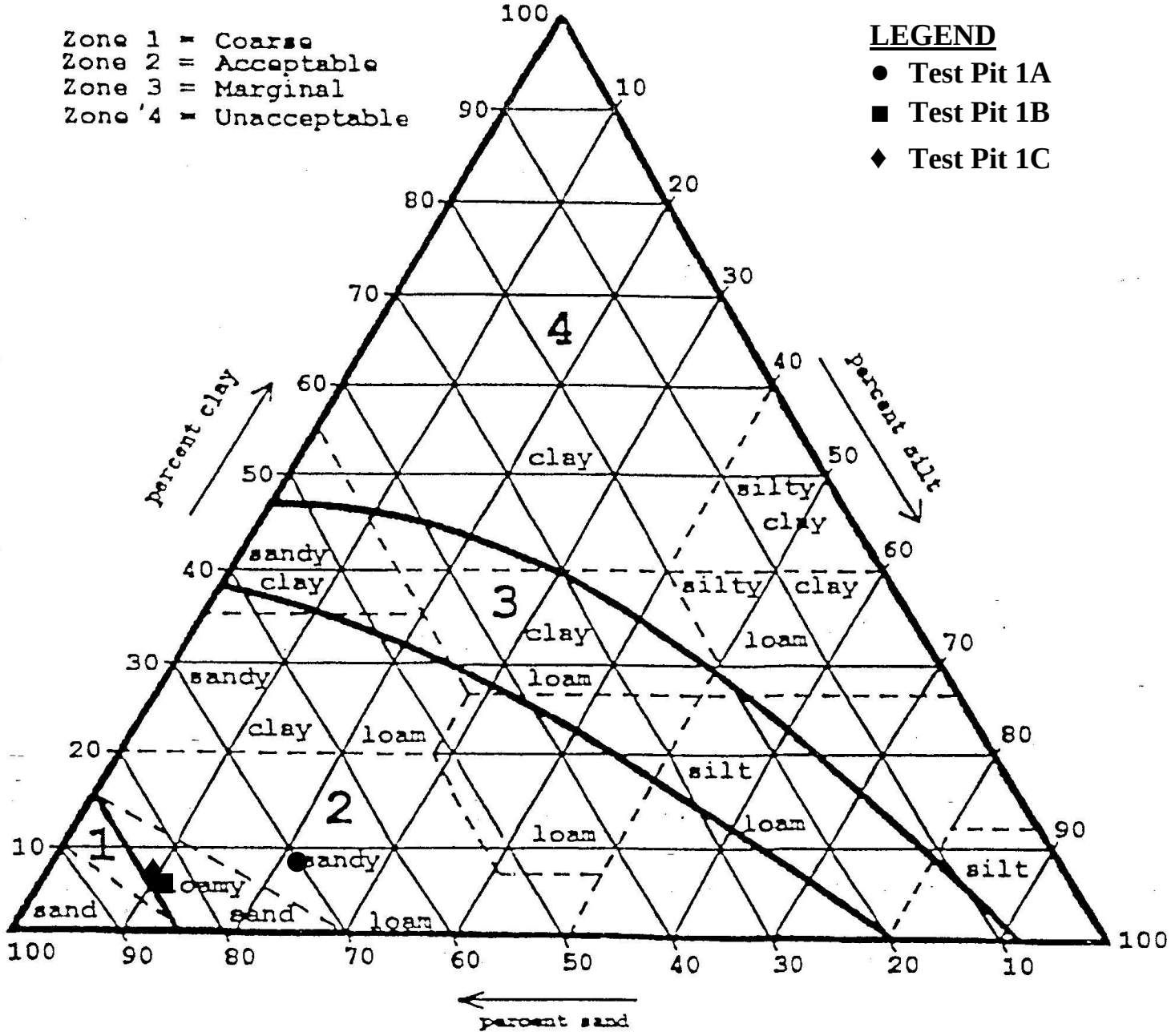
Hole #	1A	1B	1C	
Depth (ft)	3'	6'	9'	
Oven Dry Weight (g)	100	100	100	
Starting Time	945	950	930	
Temp @ 40 Sec	65	65	65	
Hydrometer Reading @ 40 sec	37	23	23	
Composite Correction	7.1	7.1	7.1	
True Density @ 40 sec	29.9	15.9	15.9	
Temp @ 2 Hours	68	69	68	
Hydrometer Reading @ 2 Hours	15	11	13	
Composite Correction	6.5	6.3	6.5	
True Density @ 2 hours	8.5	4.7	6.5	
% Sand	70	84	84	
% Clay	8	5	6	
% Silt	22	11	10	
Soil Zone	**2**	**1**	**1**	
Classification	**Sandy Loam**	**Loamy Sand**	**Loamy Sand**	

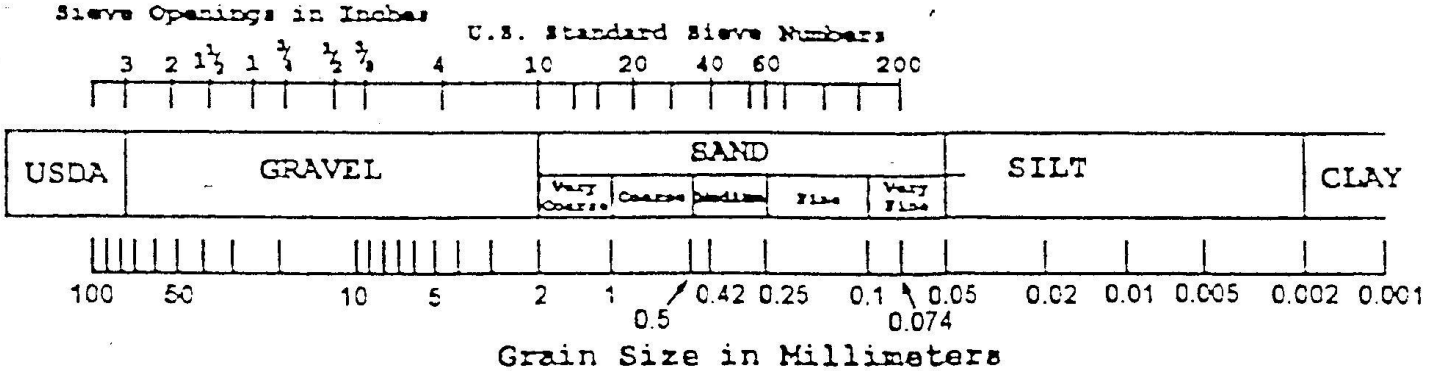
Name: Karuk-Orleans Housing Development
Job No.: 236.02

Test Pit Number	1A	1B	1C	
Percolation Rate (minutes per inch)	16	15	15	
Application Rate (gallons per day per square foot)	0.7	0.8	0.8	

Joshua T. McKnight CE 60687

Karuk Tribe Housing Authority
APN: 529-111-007
Job No. 236.02





TRINITY VALLEY
CONSULTING ENGINEERS, INC
Joshua T. McKnight CE 60687

Date: 02/11/2020

Report to: Karuk Tribe Housing Authority
Post Office Box 1159
Happy Camp, CA 96039

RE: Orleans Housing Development
38030 Highway 96
Orleans, CA 95556

APN: 529-111-007 TP #'s: 2 Depth: 3', 6', 9' Sample Description: Soil

Sampled By: J. McKnight Date Tested: 02/11/2020 Date Sampled: 01/29/2020

SOILS EXAMINATION FOR SOIL PERCOLATION SUITABILITY

Textural Analysis	TP-2A	TP-2B	TP-2C
Sand:	69%	71%	77%
Clay:	04%	10%	12%
Silt:	27%	19%	11%
Zone Classification:	**2**	**2**	**2**

Bulk Density: N/A

Comments:

Zone 1 - Soils in this zone are very high in sand content. They readily accept effluent, but because of their low silt and clay content, they provide minimal filtration. These soils demand greater separation distances from ground water.

Zone 2 - Soils in this zone provide adequate percolation rates and filtration to effluent. They are suitable for use of a conventional system without further testing.

Zone 3 - Soils in this zone are expected to provide filtration of effluent, but their ability at a suitable rate is questionable. These soils require wet-weather percolation tests to verify their suitability for effluent disposal by conventional leachfield methods.

Zone 4 - Soils in this zone are unsuitable for a conventional leach field because of their severe limitations for accepting effluent.

Josh McKnight, P.E.

Soil Texture Analysis Worksheet

Job Name: Karuk - Orleans Housing Development

Job No.: 236.02

APN: 529-111-007

Performed By: J. McKnight

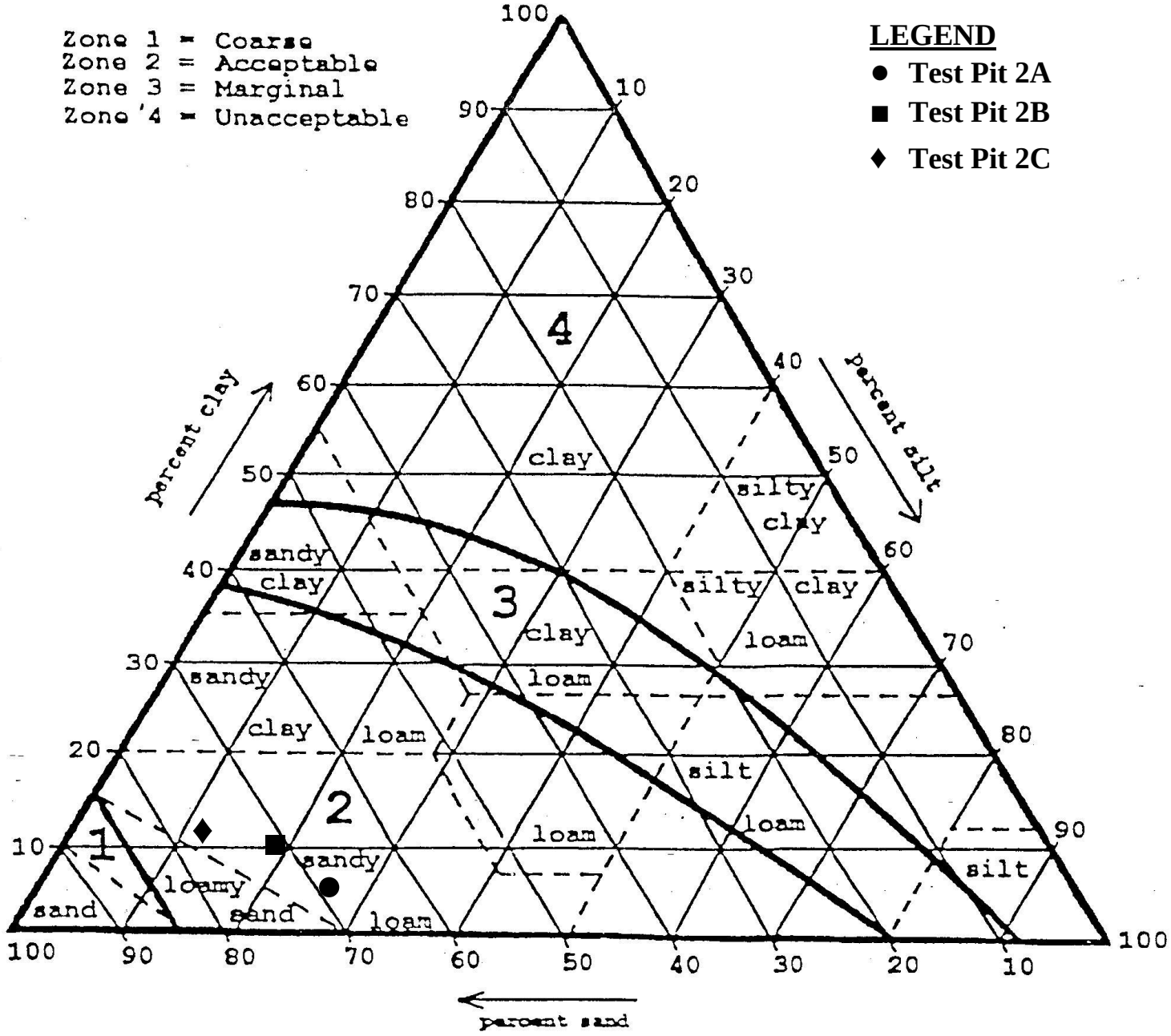
Hole #	2A	2B	2C	
Depth (ft)	3'	6'	9'	
Oven Dry Weight (g)	100	100	100	
Starting Time	1035	1040	1045	
Temp @ 40 Sec	64	64	64	
Hydrometer Reading @ 40 sec	38	36	30	
Composite Correction	7.3	7.3	7.3	
True Density @ 40 sec	30.7	28.7	22.7	
Temp @ 2 Hours	68	68	68	
Hydrometer Reading @ 2 Hours	10	17	18	
Composite Correction	6.5	6.5	6.5	
True Density @ 2 hours	3.5	10.5	11.5	
% Sand	69	71	77	
% Clay	4	10	12	
% Silt	27	19	11	
Soil Zone	**2**	**2**	**2**	
Classification	**Sandy Loam**	**Sandy Loam**	**Sandy Loam**	

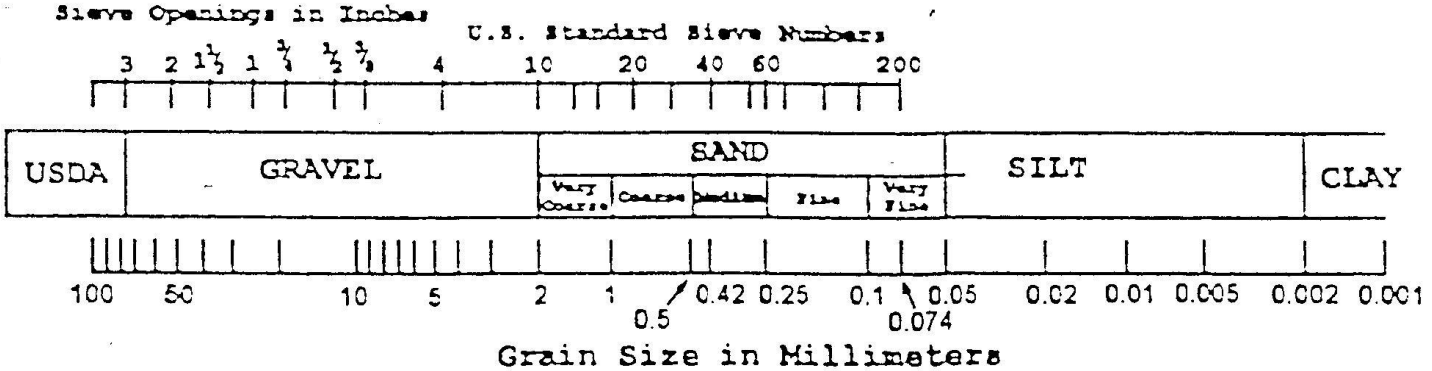
Job Name: Karuk - Orleans Housing Development
Job No.: 236.02

Test Pit Number	2A	2B	2C	
Percolation Rate (minutes per inch)	16	16	16	
Application Rate (gallons per day per square foot)	0.7	0.7	0.7	

TRINITY VALLEY
CONSULTING ENGINEERS, INC.
Joshua T. McKnight CE 60687

Karuk Tribe Housing Authority
APN: 529-111-007
Job No. 236.02





TRINITY VALLEY
CONSULTING ENGINEERS, INC
Joshua T. McKnight CE 60687

Date: 02/11/2020

Report to: Karuk Tribe Housing Authority
Post Office Box 1159
Happy Camp, CA 96039

RE: Orleans Housing Development
38030 Highway 96
Orleans, CA 95556

APN: 529-111-007 TP #'s: 3 Depth: 3', 6', 9' Sample Description: Soil

Sampled By: J. McKnight Date Tested: 02/11/2020 Date Sampled: 01/29/2020

SOILS EXAMINATION FOR SOIL PERCOLATION SUITABILITY

Textural Analysis	TP-3A	TP-3B	TP-3C
Sand:	70%	79%	79%
Clay:	06%	06%	04%
Silt:	24%	15%	17%
Zone Classification:	**2**	**2**	**2**

Bulk Density: N/A

Comments:

Zone 1 - Soils in this zone are very high in sand content. They readily accept effluent, but because of their low silt and clay content, they provide minimal filtration. These soils demand greater separation distances from ground water.

Zone 2 - Soils in this zone provide adequate percolation rates and filtration to effluent. They are suitable for use of a conventional system without further testing.

Zone 3 - Soils in this zone are expected to provide filtration of effluent, but their ability at a suitable rate is questionable. These soils require wet-weather percolation tests to verify their suitability for effluent disposal by conventional leachfield methods.

Zone 4 - Soils in this zone are unsuitable for a conventional leach field because of their severe limitations for accepting effluent.

Josh McKnight, P.E.

Soil Texture Analysis Worksheet

Job Name: Karuk-Orleans Housing Development

Job No.: 236.02

APN: 529-111-007

Performed By: J. McKnight

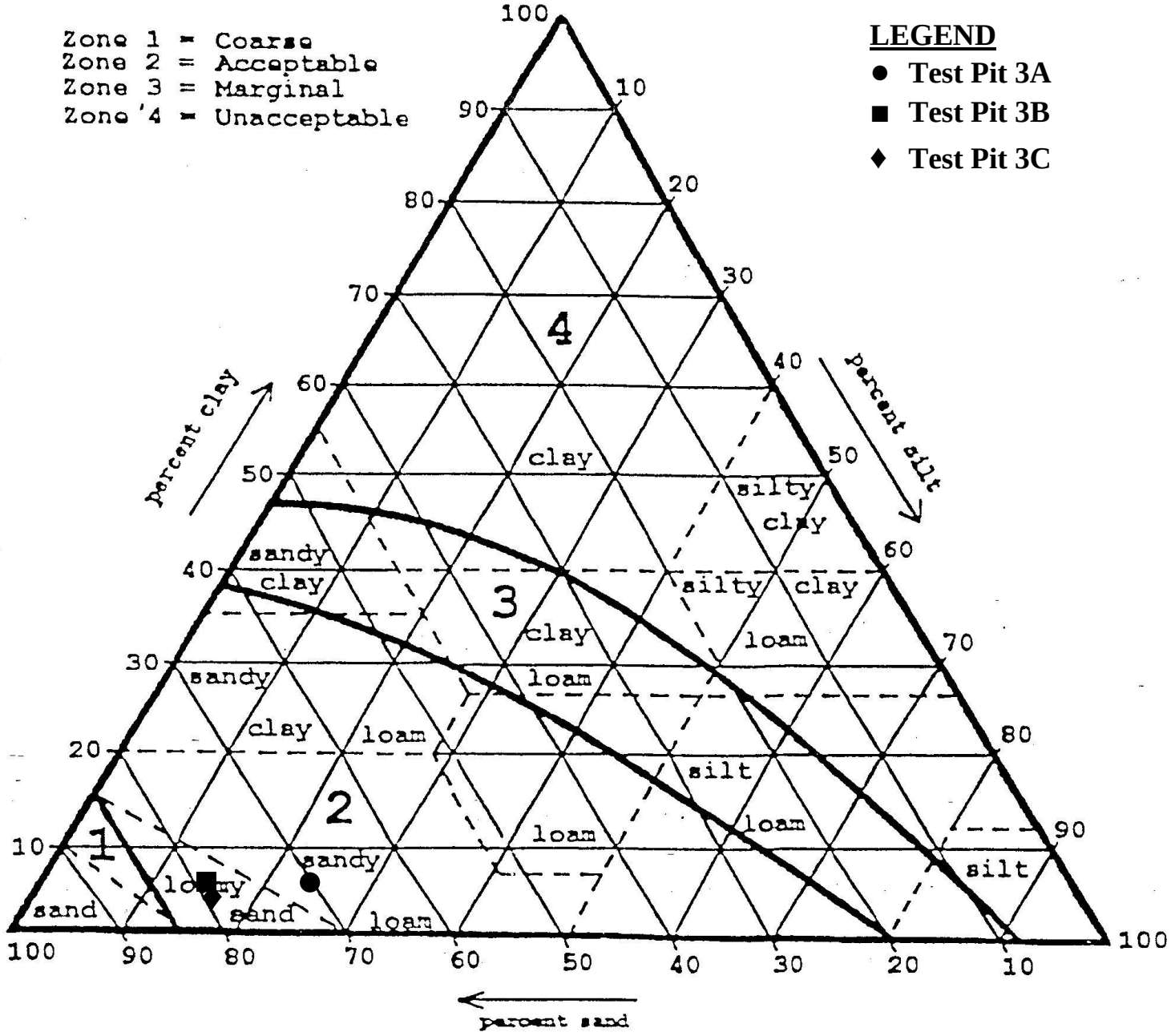
Hole #	3A	3B	3C	
Depth (ft)	3'	6'	9'	
Oven Dry Weight (g)	100	100	100	
Starting Time	1030	1050	1050	
Temp @ 40 Sec	64	64	65	
Hydrometer Reading @ 40 sec	37	28	28	
Composite Correction	7.3	7.3	7.1	
True Density @ 40 sec	29.7	20.7	20.9	
Temp @ 2 Hours	68	68	68	
Hydrometer Reading @ 2 Hours	12	12	10	
Composite Correction	6.5	6.5	6.5	
True Density @ 2 hours	5.5	5.5	3.5	
% Sand	70	79	79	
% Clay	6	6	4	
% Silt	24	15	17	
Soil Zone	**2**	**2**	**2**	
Classification	**Sandy Loam**	**Loamy Sand**	**Loamy Sand**	

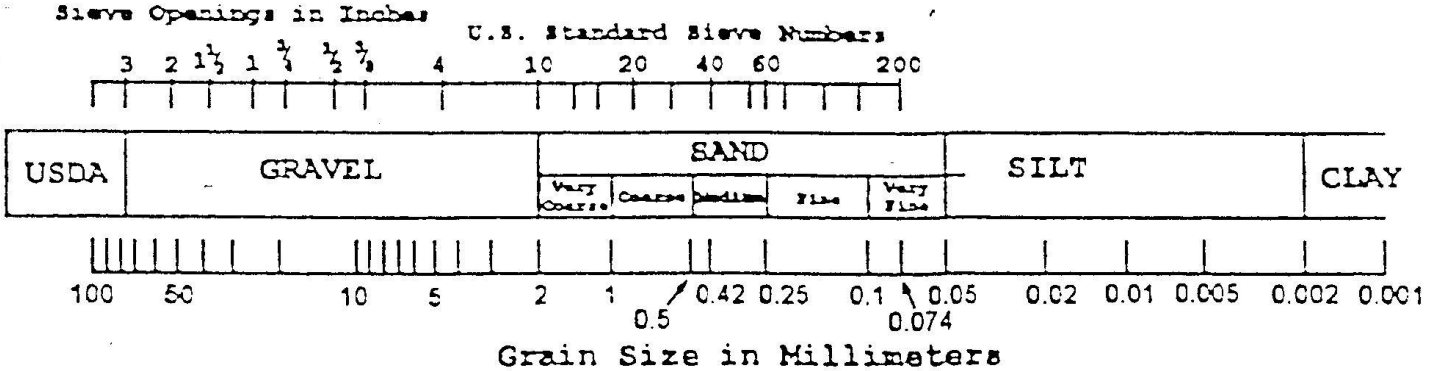
Job Name: Karuk-Orleans Housing Development
Job No.: 236.02

Test Pit Number	3A	3B	3C	
Percolation Rate (minutes per inch)	16	15	15	
Application Rate (gallons per day per square foot)	0.7	0.8	0.8	

Joshua T. McKnight CE 60687

Karuk Tribe Housing Authority
APN: 529-111-007
Job No. 236.02





TRINITY VALLEY
CONSULTING ENGINEERS, INC
Joshua T. McKnight CE 60687

Date: 02/12/2020

Report to: Karuk Tribe Housing Authority
Post Office Box 1159
Happy Camp, CA 96039

RE: Orleans Housing Development
38030 Highway 96
Orleans, CA 95556

APN: 529-111-007 TP #'s: 4 Depth: 3', 6', 9' Sample Description: Soil

Sampled By: J. McKnight Date Tested: 02/12/2020 Date Sampled: 01/29/2020

SOILS EXAMINATION FOR SOIL PERCOLATION SUITABILITY

Textural Analysis	TP-4A	TP-4B	TP-4C
Sand:	76%	80%	71%
Clay:	08%	06%	07%
Silt:	16%	14%	22%
Zone Classification:	**2**	**2**	**2**

Bulk Density: N/A

Comments:

Zone 1 - Soils in this zone are very high in sand content. They readily accept effluent, but because of their low silt and clay content, they provide minimal filtration. These soils demand greater separation distances from ground water.

Zone 2 - Soils in this zone provide adequate percolation rates and filtration to effluent. They are suitable for use of a conventional system without further testing.

Zone 3 - Soils in this zone are expected to provide filtration of effluent, but their ability at a suitable rate is questionable. These soils require wet-weather percolation tests to verify their suitability for effluent disposal by conventional leachfield methods.

Zone 4 - Soils in this zone are unsuitable for a conventional leach field because of their severe limitations for accepting effluent.

Josh McKnight, P.E.

Soil Texture Analysis Worksheet

Job Name: Karuk-Orleans Housing Development

Job No.: 236.02

APN: 529-111-007

Performed By: J. McKnight

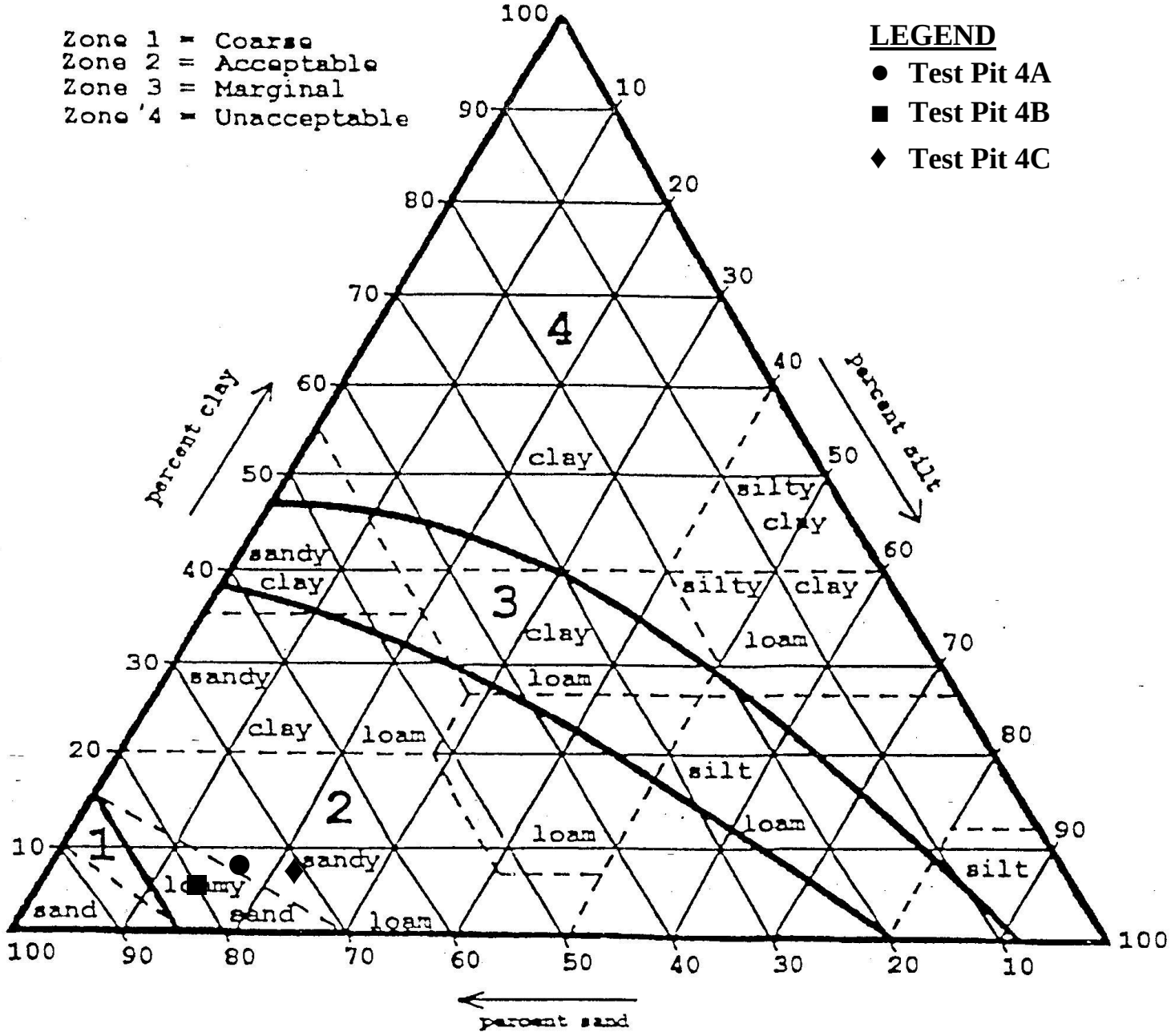
Hole #	4A	4B	4C	
Depth (ft)	3'	6'	9'	
Oven Dry Weight (g)	100	100	100	
Starting Time	1055	1100	1105	
Temp @ 40 Sec	64	64	65	
Hydrometer Reading @ 40 sec	31	27	36	
Composite Correction	7.3	7.3	7.1	
True Density @ 40 sec	23.7	19.7	28.9	
Temp @ 2 Hours	68	68	69	
Hydrometer Reading @ 2 Hours	14	12	13	
Composite Correction	6.5	6.5	6.3	
True Density @ 2 hours	7.5	5.5	6.7	
% Sand	76	80	71	
% Clay	8	6	7	
% Silt	16	14	22	
Soil Zone	**2**	**2**	**2**	
Classification	**Sandy Loam**	**Loamy Sand**	**Sandy Loam**	

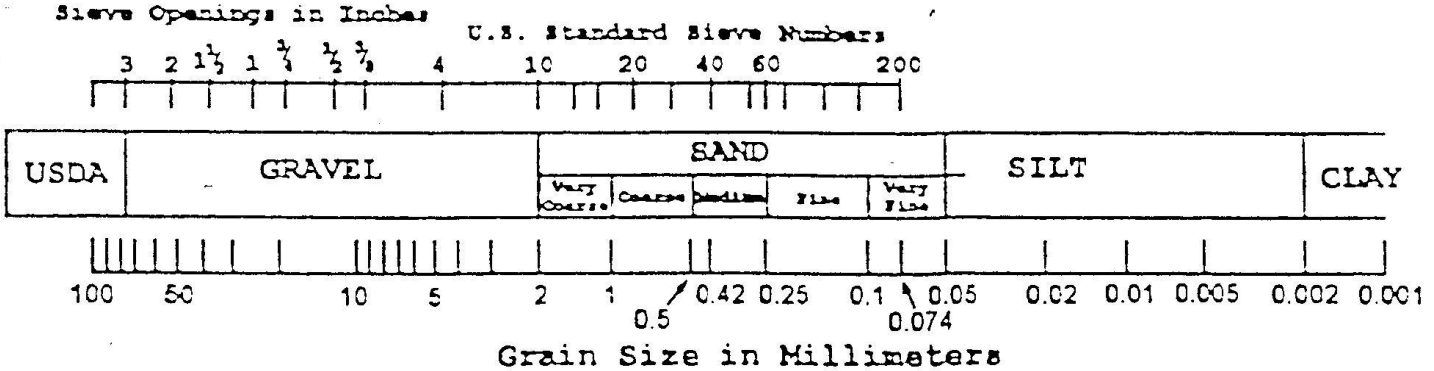
Job Name: Karuk-Orleans Housing Development
Job No.: 236.02

Test Pit Number	4A	4B	4C	
Percolation Rate (minutes per inch)	16	15	16	
Application Rate (gallons per day per square foot)	0.7	0.8	0.7	

TRINITY VALLEY
CONSULTING ENGINEERS, INC.
Joshua T. McKnight CE 60687

Karuk Tribe Housing Authority
APN: 529-111-007
Job No. 236.02





TRINITY VALLEY
CONSULTING ENGINEERS, INC
Joshua T. McKnight CE 60687

Date: 02/13/2020

Report to: Karuk Tribe Housing Authority
Post Office Box 1159
Happy Camp, CA 96039

RE: Orleans Housing Development
38030 Highway 96
Orleans, CA 95556

APN: 529-111-007 TP #'s: 5 Depth: 3', 6', 9' Sample Description: Soil

Sampled By: J. McKnight Date Tested: 02/13/2020 Date Sampled: 01/29/2020

SOILS EXAMINATION FOR SOIL PERCOLATION SUITABILITY

Textural Analysis	TP-5A	TP-5B	TP-5C
Sand:	80%	64%	83%
Clay:	06%	05%	04%
Silt:	14%	31%	13%
Zone Classification:	**2**	**2**	**2**

Bulk Density: N/A

Comments:

Zone 1 - Soils in this zone are very high in sand content. They readily accept effluent, but because of their low silt and clay content, they provide minimal filtration. These soils demand greater separation distances from ground water.

Zone 2 - Soils in this zone provide adequate percolation rates and filtration to effluent. They are suitable for use of a conventional system without further testing.

Zone 3 - Soils in this zone are expected to provide filtration of effluent, but their ability at a suitable rate is questionable. These soils require wet-weather percolation tests to verify their suitability for effluent disposal by conventional leachfield methods.

Zone 4 - Soils in this zone are unsuitable for a conventional leach field because of their severe limitations for accepting effluent.

Josh McKnight, P.E.

Soil Texture Analysis Worksheet

Job Name: Karuk-Orleans Housing Development

Job No.: 236.02

APN: 529-111-007

Performed By: J. McKnight

Hole #	5A	5B	5C	
Depth (ft)	3'	6'	9'	
Oven Dry Weight (g)	100	100	100	
Starting Time	1030	1035	1045	
Temp @ 40 Sec	66	67	64	
Hydrometer Reading @ 40 sec	27	42	24	
Composite Correction	6.9	6.5	7.3	
True Density @ 40 sec	20.1	35.5	16.7	
Temp @ 2 Hours	68	69	68	
Hydrometer Reading @ 2 Hours	13	11	10	
Composite Correction	6.5	6.3	6.5	
True Density @ 2 hours	6.5	4.7	3.5	
% Sand	80	64	83	
% Clay	6	5	4	
% Silt	14	31	13	
Soil Zone	**2**	**2**	**2**	
Classification	**Loamy Sand**	**Sandy Loam**	**Loamy Sand**	

Job Name: Karuk-Orleans Housing Development
Job No.: 236.02

Test Pit Number	5A	5B	5C	
Percolation Rate (minutes per inch)	15	16	15	
Application Rate (gallons per day per square foot)	0.8	0.7	0.8	

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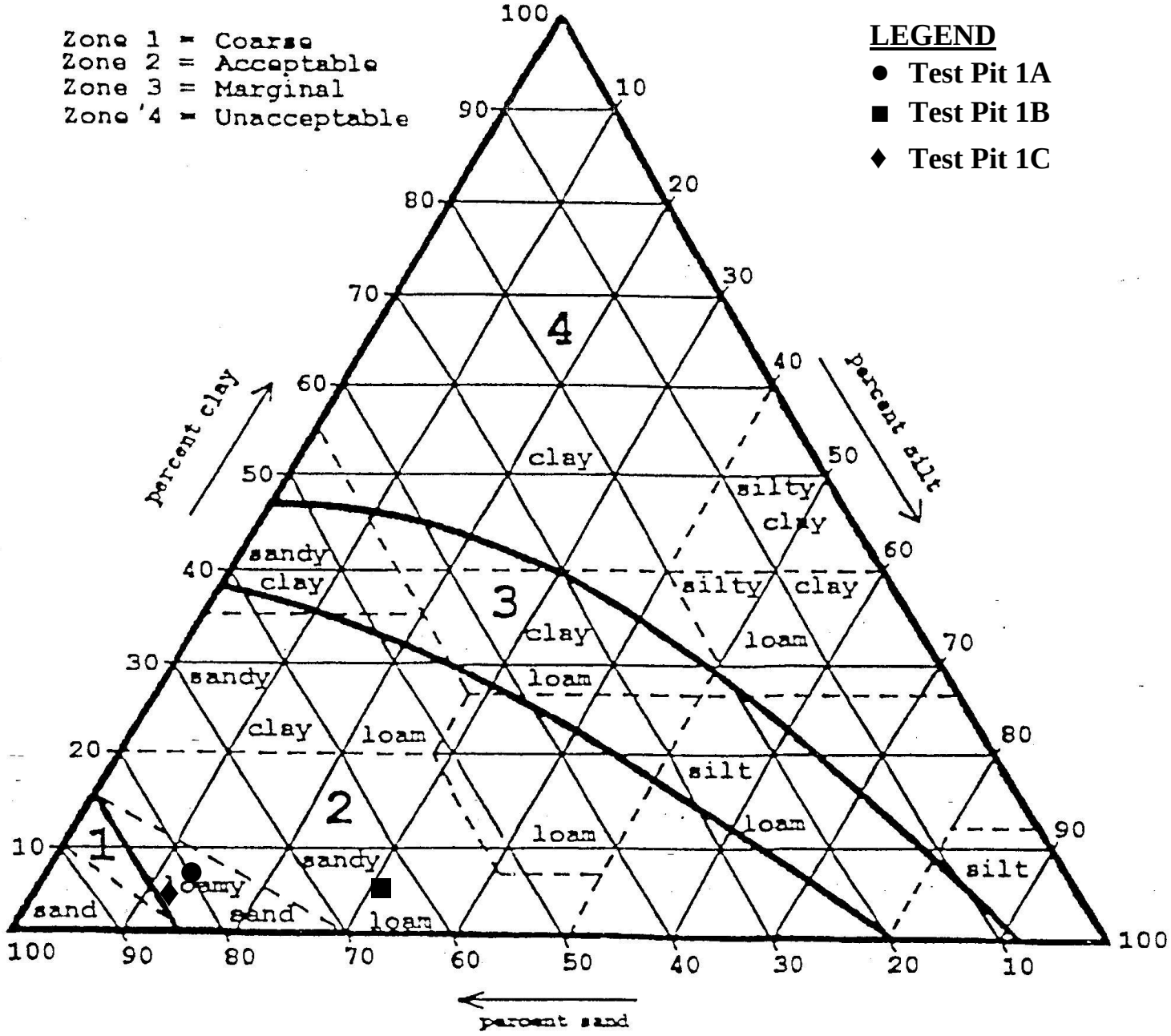
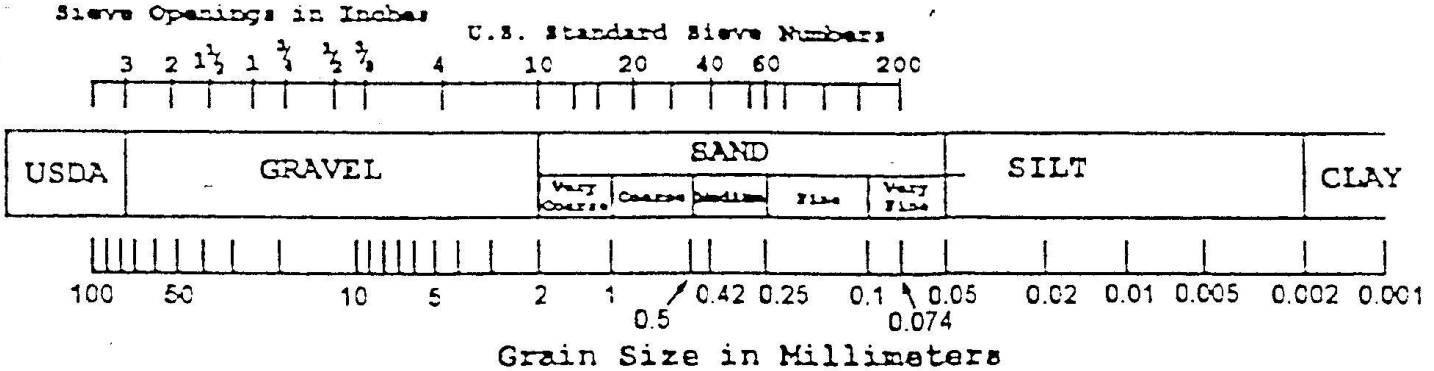
Joshua T. McKnight CE 60687

Karuk Tribe Housing Authority
APN: 529-111-007
Job No. 236.02





TRINITY VALLEY
CONSULTING ENGINEERS, INC
Joshua T. McKnight CE 60687

Date: 02/13/2020

Report to: Karuk Tribe Housing Authority
Post Office Box 1159
Happy Camp, CA 96039

RE: Orleans Housing Development
38030 Highway 96
Orleans, CA 95556

APN: 529-111-007 TP #'s: 6 Depth: 3', 6', 9' Sample Description: Soil

Sampled By: J. McKnight Date Tested: 02/13/2020 Date Sampled: 01/29/2020

SOILS EXAMINATION FOR SOIL PERCOLATION SUITABILITY

Textural Analysis	TP-6A	TP-6B	TP-6C
Sand:	67%	80%	96%
Clay:	06%	04%	01%
Silt:	27%	16%	03%
Zone Classification:	**2**	**2**	**1**

Bulk Density: N/A

Comments:

Zone 1 - Soils in this zone are very high in sand content. They readily accept effluent, but because of their low silt and clay content, they provide minimal filtration. These soils demand greater separation distances from ground water.

Zone 2 - Soils in this zone provide adequate percolation rates and filtration to effluent. They are suitable for use of a conventional system without further testing.

Zone 3 - Soils in this zone are expected to provide filtration of effluent, but their ability at a suitable rate is questionable. These soils require wet-weather percolation tests to verify their suitability for effluent disposal by conventional leachfield methods.

Zone 4 - Soils in this zone are unsuitable for a conventional leach field because of their severe limitations for accepting effluent.

Josh McKnight, P.E.

Soil Texture Analysis Worksheet

Job Name: Karuk-Orleans Housing Development

Job No.: 236.02

APN: 529-111-007

Performed By: J. McKnight

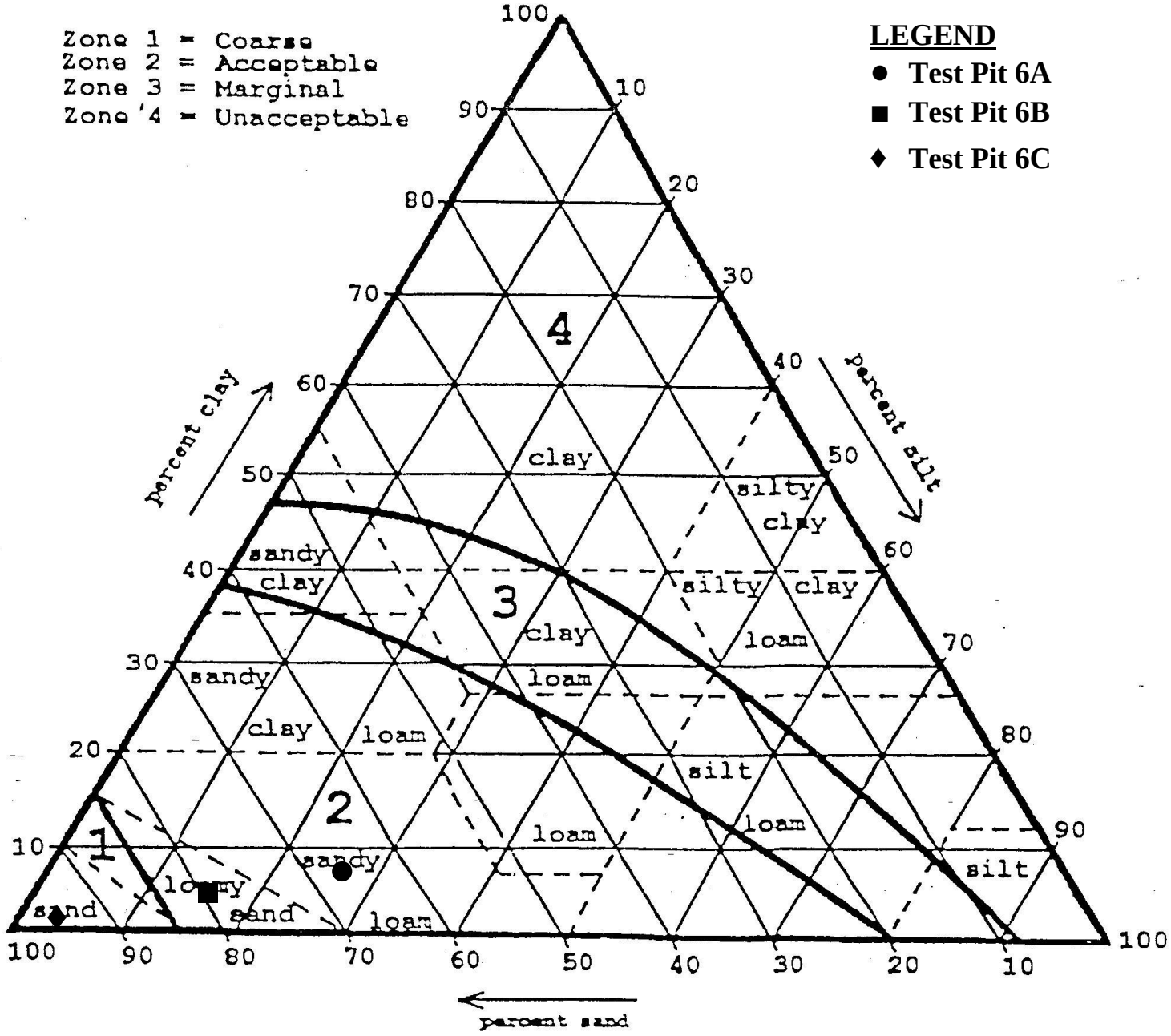
Hole #	6A	6B	6C	
Depth (ft)	3'	6'	9'	
Oven Dry Weight (g)	100	100	100	
Starting Time	1050	1040	1055	
Temp @ 40 Sec	66	67	67	
Hydrometer Reading @ 40 sec	40	27	10	
Composite Correction	6.9	6.5	6.5	
True Density @ 40 sec	33.1	20.5	3.5	
Temp @ 2 Hours	69	69	69	
Hydrometer Reading @ 2 Hours	12	10	7	
Composite Correction	6.3	6.3	6.3	
True Density @ 2 hours	5.7	3.7	0.7	
% Sand	67	80	96	
% Clay	6	4	1	
% Silt	27	16	3	
Soil Zone	**2**	**2**	**1**	
Classification	**Sandy Loam**	**Loamy Sand**	**Sand**	

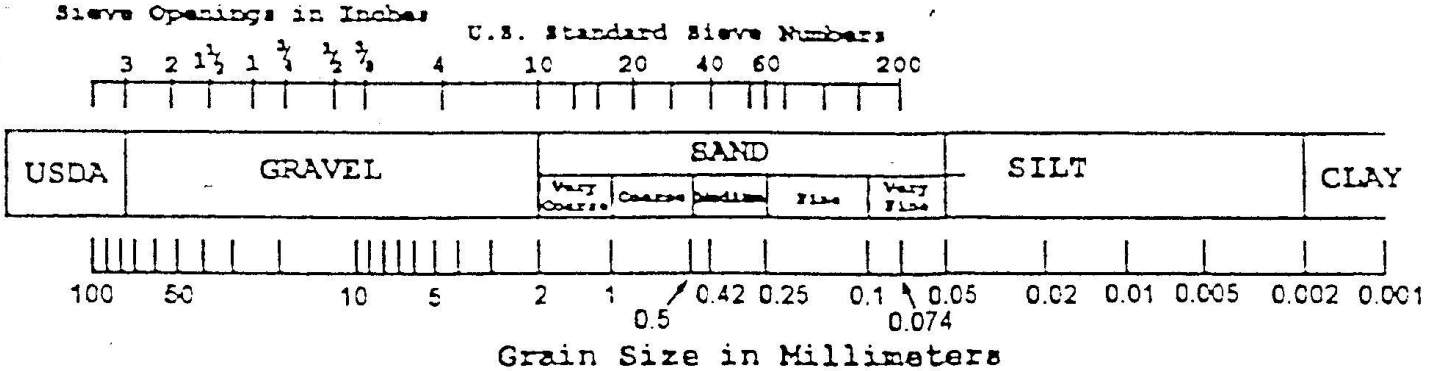
Job Name: Karuk-Orleans Housing Development
Job No.: 236.02

Test Pit Number	6A	6B	6C	
Percolation Rate (minutes per inch)	16	15	6	
Application Rate (gallons per day per square foot)	0.7	0.8	1.1	

Joshua T. McKnight CE 60687

Karuk Tribe Housing Authority
APN: 529-111-007
Job No. 236.02





Attachment 5
Sewage Disposal System Submittal

TRINITY VALLEY CONSULTING ENGINEERS INC.
67 WALNUT WAY. PO BOX 1567. WILLOW CREEK. CA 95573
P: 530.629.3000 F: 530.629.3011

SEWAGE DISPOSAL SYSTEM SUBMITTAL

Client:	Karuk Tribe Housing Authority 635 Jacobs Way, Happy Camp, CA 96039			Sheet No. :	1 of 3
				Job No. :	236.02
Project:	Orleans Home Development	Designed By:	FAM	Date:	9/14/22
Location:	Orleans, Humboldt Co., California	Checked By:	JTM	Date:	9/14/22

Type of Application: Public Disposal System

Owner: Karuk Tribe Housing Authority

APN: 529-111-007

Location: Lat 41.301768, Long -123.541227

Disposal Field Location (Minimum Offsets):

Springs / Streams: 100' +	Buildings: 10'	Top of Bank: 15'+
Property Line: 10'+	Wells: 100'	Average Slope: 2%

Soil Analysis:

Pit No.	Bulk Density	Sample Depth	Zone	USDA Texture	Field	RWQCB-NCBP Perc Rate (min/in)	RWQCB-NCBP App Rate (GPD/SF)	Orenco App Rate (GPD/SF)
TP-1A	NR	3	2	Sandy Loam		16	0.7	
TP-1B	NR	6	1	Loamy Sand		15	0.8	
TP-1C	NR	9	1	Loamy Sand		15	0.8	
TP-2A	NR	3	2	Sandy Loam		16	0.7	
TP-2B	NR	6	2	Sandy Loam		16	0.7	
TP-2C	NR	9	2	Sandy Loam		16	0.7	
TP-3A	NR	3	2	Sandy Loam		16	0.7	
TP-3B	NR	6	2	Sandy Loam		15	0.8	
TP-3C	NR	9	2	Sandy Loam		15	0.8	
TP-4A	NR	3	2	Sandy Loam		16	0.7	
TP-4B	NR	6	2	Loamy Sand		15	0.8	
TP-4C	NR	9	2	Sandy Loam		16	0.7	
TP-5A	NR	3	2	Loamy Sand		15	0.8	
TP-5B	NR	6	2	Sandy Loam		16	0.7	
TP-5C	NR	9	2	Loamy Sand		15	0.8	
TP-6A	NR	3	2	Sandy Loam		16	0.7	
TP-6B	NR	6	2	Loamy Sand		15	0.8	
TP-6C	NR	9	1	Sand		6	1.1	

NOTES:

1. Test Hole Location(s): Shown on attached layout
2. Textural Analysis - see attached
3. RWQCB-NCBP: Regional Water Quality Control Board - North Coast Basin Plan
4. Soil Profiles: See attached log(s)

SEWAGE DISPOSAL SYSTEM SUBMITTAL

Client:	Karuk Tribe Housing Authority 635 Jacobs Way, Happy Camp, CA 96039	Sheet No. :	2 of 3
		Job No. :	236.02
Project:	Orleans Home Development	Design By: FAM	Date: 9/14/22
Location:	Orleans, Humboldt Co., California	Check By: JTM	Date: 9/14/22

DESCRIPTION	COUNT	UNIT	NOTES
DESIGN FLOW			
Base Flow Rate	150	GPD	150 GPD per bedroom per day up to 3-bedrooms
Additional Bedroom Rate	75	GPD	75 GPD per bedroom for additional bedrooms
Base Minimum	300	GPD	Minimum Flow Rate
Design Bedroom Count	16	EA	(8) Two-Bedroom Units
Flow Based on Bedrooms	1425	GPD	
Total Loading (TL)	2400	GPD	(8) houses at 300 GPD per house
Average Loading	1200	GPD	
TANK SIZING			
1 Bedroom Cabin/Mobile Home	750	GAL	
2 Bedroom Residence	1200	GAL	
3-4 Bedroom Residence	1500	GAL	
All other applications 3xDaily Flow	7200	GAL	minimum tank volume req'd (Xerxes 8'x26'-1/2")
DISPOSAL FIELD SIZING			
Soils			
Zone	2		
Limiting Condition			None
Depth to Limiting Condition		FT	N/A
Percolation Rate	16	MIN/INCH	Percolation Test Results & Textural Analysis
Application Rate	0.700	GPD/SF	Table 4-2, North Coast Basin Plan - RWQCB
Minimum Required Area	3,429	SF	absorption area minimum
Graveled Trench			
Area per linear foot	6	ft	given 3' drain rock zone below leachate pipe
Minimum Total Length	571	ft	
Max lateral length	70	ft	per Hum Env. Health
Minimum Lateral Count	9	EA	(9) laterals at 63' per lateral minimum
Gravel-less Chamber Trench			
Area per linear foot	3	ft	Quick4 High Capacity Chamber - 3' wide trench
Minimum Total Length	1,143	ft	
Max lateral length	70	ft	
Minimum Lateral Count	17	EA	(17) laterals at 67' per lateral minimum

SEWAGE DISPOSAL SYSTEM SUBMITTAL

Client:	Karuk Tribe Housing Authority 635 Jacobs Way, Happy Camp, CA 96039			Sheet No. :	3 of 3
				Job No. :	236.02
Project:	Orleans Home Development	Design By:	FAM	Date:	9/14/22
Location:	Orleans, Humboldt Co., California	Check By:	JTM	Date:	9/14/22

DESCRIPTION	COUNT	UNIT	NOTES
DESIGN FLOW			
Residential - Single Family	300	gpd	Two Bedroom Home @ 150 GPD Per Bedroom
Total Loading (TL)	2400	gpd	(8) Two Bedroom @ 300 GPD Per House
Average Loading	1200	gpd	
Nitrate Loading			
Loading Rate	11.2	grams	Average grams per person per day (EPA)
	358.4	grams/day	4 people per house (max load)
	1000	mg/gram	conversion
	358400	mg/day	
	3.7854	L/gal	conversion
	9084.96	L/day	
	39.45	mg/L/day	Daily Loading
max Nitrogen Accumulation	78.90		2x Daily Loading (60 mg/L ave typ.)
Sludge/Scum reduction	7.89		10% typical (removed during tank pumping)
Ammonification	63.91		90% conversion
Reduced Organic Nitrate	7.10		EPA max 10 mg/L

Attachment 6
Soil Exploration Logs

SOIL EXPLORATION LOG - SEWAGE DISPOSAL

Project Name: KTHA-Orleans Home Development | Project No: 236.02 | Date: 1/29/2020

Test Hole #: TP-1 | Hole Diameter: 24"x72" | Excavation Method: Ha E35 Exc

Hole Elevation: NA | Groundwater Elevation: NA | Logged by: F. Masten

DESCRIPTION & REMARKS	COLOR	MOISTURE	CONSIST.	SOIL TYPE - USCS	DEPTH	PROFILE	SAMPLE TYPE / NUMBER	BLOWS / FT	WATER CONTENT %	UNIT DRY WEIGHT, PSF
Sandy Loam	Brwn	Dry		SM	-1 -2 -3		TP-1A			
Loamy Sand	Brwn	Dry		SM	-4 -5 -6		TP-1B			
Loamy Sand	Brwn	Dry		SM	-7 -8 -9		TP-1C			
					-10					

TRINITY VALLEY CONSULTING ENGINEERS
Post Office Box 1567 / Willow Creek, CA 95573 (530) 629-3000

SOIL EXPLORATION LOG - SEWAGE DISPOSAL

Project Name: KTHA-Orleans Home Development | Project No: 236.02 | Date: 1/29/2020

Test Hole #: TP-2 | Hole Diameter: 24"x72" | Excavation Method: Ha E35 Exc

Hole Elevation: NA | Groundwater Elevation: NA | Logged by: F. Masten

DESCRIPTION & REMARKS	COLOR	MOISTURE	CONSIST.	SOIL TYPE - USCS	DEPTH	PROFILE	SAMPLE TYPE / NUMBER	BLOWS / FT	WATER CONTENT %	UNIT DRY WEIGHT, PSF
Sandy Loam	Brwn	Dry		SM	-1 -2 -3		TP-2A			
Sandy Loam	Brwn	Dry		SM	-4 -5 -6		TP-2B			
Sandy Loam	Brwn	Dry		SM	-7 -8 -9		TP-2C			
					-10					

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Post Office Box 1567 / Willow Creek, CA 95573 (530) 629-3000

SOIL EXPLORATION LOG - SEWAGE DISPOSAL

Project Name: KTHA-Orleans Home Development | Project No: 236.02 | Date: 1/29/2020

Test Hole #: TP-3 | Hole Diameter: 24"x72" | Excavation Method: Ha E35 Exc

Hole Elevation: NA | Groundwater Elevation: NA | Logged by: F. Masten

DESCRIPTION & REMARKS	COLOR	MOISTURE	CONSIST.	SOIL TYPE - USCS	DEPTH	PROFILE	SAMPLE TYPE / NUMBER	BLOWS / FT	WATER CONTENT %	UNIT DRY WEIGHT, PSF
Sandy Loam	Brwn	Dry		SM	-1 -2 -3		TP-3A			
Loamy Sand	Brwn	Dry		SM	-4 -5 -6		TP-3B			
Loamy Sand	Brwn	Dry		SM	-7 -8 -9		TP-3C			
					-10					

TRINITY VALLEY CONSULTING ENGINEERS
Post Office Box 1567 / Willow Creek, CA 95573 (530) 629-3000

SOIL EXPLORATION LOG - SEWAGE DISPOSAL

Project Name: KTHA-Orleans Home Development | Project No: 236.02 | Date: 1/29/2020

Test Hole #: TP-4 | Hole Diameter: 24"x72" | Excavation Method: Ha E35 Exc

Hole Elevation: NA | Groundwater Elevation: NA | Logged by: F. Masten

DESCRIPTION & REMARKS	COLOR	MOISTURE	CONSIST.	SOIL TYPE - USCS	DEPTH	PROFILE	SAMPLE TYPE / NUMBER	BLOWS / FT	WATER CONTENT %	UNIT DRY WEIGHT, PSF
Sandy Loam	Brwn	Dry		SM	-3		TP-4A			
Loamy Sand	Brwn	Dry		Sm	-6		TP-4B			
Sandy Loam	Brwn	Dry		SM	-9		TP-4C			
					-10					

TRINITY VALLEY CONSULTING ENGINEERS
Post Office Box 1567 / Willow Creek, CA 95573 (530) 629-3000

SOIL EXPLORATION LOG - SEWAGE DISPOSAL

Project Name: KTHA-Orleans Home Development | Project No: 236.02 | Date: 1/29/2020

Test Hole #: TP-5 | Hole Diameter: 24"x72" | Excavation Method: Ha E35 Exc

Hole Elevation: NA | Groundwater Elevation: NA | Logged by: F. Masten

DESCRIPTION & REMARKS	COLOR	MOISTURE	CONSIST.	SOIL TYPE - USCS	DEPTH	PROFILE	SAMPLE TYPE / NUMBER	BLOWS / FT	WATER CONTENT %	UNIT DRY WEIGHT, PSF
Loamy Sand	Brwn	Dry		SM	-1 -2 -3		TP-5A			
Sandy Loam	Brwn	Dry		SM	-4 -5 -6		TP-5B			
Loamy Sand	Brwn	Dry		SM	-7 -8 -9		TP-5C			
					-10					

TRINITY VALLEY CONSULTING ENGINEERS
Post Office Box 1567 / Willow Creek, CA 95573 (530) 629-3000

SOIL EXPLORATION LOG - SEWAGE DISPOSAL

Project Name: KTHA-Orleans Home Development | Project No: 236.02 | Date: 1/29/2020

Test Hole #: TP-6 | Hole Diameter: 24"x72" | Excavation Method: Ha E35 Exc

Hole Elevation: NA | Groundwater Elevation: NA | Logged by: F. Masten

DESCRIPTION & REMARKS	COLOR	MOISTURE	CONSIST.	SOIL TYPE - USCS	DEPTH	PROFILE	SAMPLE TYPE / NUMBER	BLOWS / FT	WATER CONTENT %	UNIT DRY WEIGHT, PSF
Sandy Loam	Brwn	Dry		SM	-1 -2 -3			TP-6A		
Loamy Sand	Brwn	Dry		SM	-4 -5 -6			TP-6B		
Sand	Brwn	Dry		SW	-7 -8 -9			TP-6C		
					-10					

TRINITY VALLEY CONSULTING ENGINEERS
Post Office Box 1567 / Willow Creek, CA 95573 (530) 629-3000

Attachment 7
Percolation Testing Logs

PERCOLATION TEST DATA

TEST NO: 01

JOB NAME: Karuk Housing JOB NO.: 236.02 DATE: 1/29/20
A.P. NO: 529-111-007 COUNTY Humboldt BY: Frank M.
WATER SUPPLY IS: PUBLIC: X PRIVATE:
TESTING PERIOD IS: DRY WEATHER WET WEATHER X

HOLE DATA

DEPTH (FEET)	EXCAVATION DATE	EXCAVATION METHOD	HOLE SIZE
0 to -3'	1/29/20	post hole digger	8"x12"
to			
to			

TEST DEPTH: 24"-36"

PRESOAKING DATA

X NOT REQUIRED - WET WEATHER CONDITIONS
TWELVE HOUR CONTINUOUS PRESOAKING
FOUR COMPLETE REFILLINGS - SEE FOLLOWING TABLE

	1	2	3	4
START TIME				
START DATE				

SATURATION DATA

START TIME AND DATE 1/29/2020 14:05
END TIME AND DATE 1/29/2020 14:25

TEST DATA

		TIME	READING	ELAPSED TIME	DROP		TIME	READING	ELAPSED TIME	DROP
START		2:05								
READ	1	2:10		5 min	12	7				
START		2:10								
READ	2	2:15		5 min	8.5	8				
START		2:15								
READ	3	2:20		5 min	8	9				
START		2:20								
READ	4	2:25		5 min	5.5	10				
START										
READ	5					11				
START										
READ	6					12				

*TP #1 VOIDED DUE TO INCOSISTENCY

PERCOLATION TEST DATA

TEST NO: 02

JOB NAME: Karuk Housing JOB NO.: 236.02 DATE: 1/29/20
A.P. NO: 529-111-007 COUNTY Humboldt BY: Frank M.
WATER SUPPLY IS: PUBLIC: X PRIVATE:
TESTING PERIOD IS: DRY WEATHER WET WEATHER X

HOLE DATA

DEPTH (FEET)	EXCAVATION DATE	EXCAVATION METHOD	HOLE SIZE
0 to -3'	1/29/20	post hole digger	8'x12"
to			
to			

TEST DEPTH: 24"-36"

PRESOAKING DATA

X NOT REQUIRED - WET WEATHER CONDITIONS
TWELVE HOUR CONTINUOUS PRESOAKING
FOUR COMPLETE REFILLINGS - SEE FOLLOWING TABLE

	1	2	3	4
START TIME				
START DATE				

SATURATION DATA

START TIME AND DATE 1/29/2020 14:05
END TIME AND DATE 1/29/2020 14:45

TEST DATA

		TIME	READING	ELAPSED TIME	DROP		TIME	READING	ELAPSED TIME	DROP
START		2:05					2:35			
READ	1	2:10		5 min	1.5	7	2:40 AM		5 min	0.75
START		2:10								
READ	2	2:15		5 min	1	8				
START		2:15								
READ	3	2:20		5 min	0.5	9				
START		2:20								
READ	4	2:25		5 min	0.5	10				
START		2:25								
READ	5	2:30		5 min	0.75	11				
START		2:30								
READ	6	2:35		5 min	0.75	12				

STABILIZATION RATE: 0.75

PERCOLATION TEST DATA

TEST NO: 03

JOB NAME: Karuk Housing JOB NO.: 236.02 DATE: 1/29/20
A.P. NO: 529-111-007 COUNTY Humboldt BY: Frank M.
WATER SUPPLY IS: PUBLIC: X PRIVATE:
TESTING PERIOD IS: DRY WEATHER WET WEATHER X

HOLE DATA

DEPTH (FEET)	EXCAVATION DATE	EXCAVATION METHOD	HOLE SIZE
0 to -3'	1/29/30	post hole digger	8"x12"
to			
to			

TEST DEPTH: 24"-36"

PRESOAKING DATA

X NOT REQUIRED - WET WEATHER CONDITIONS
TWELVE HOUR CONTINUOUS PRESOAKING
FOUR COMPLETE REFILLINGS - SEE FOLLOWING TABLE

	1	2	3	4
START TIME				
START DATE				

SATURATION DATA

START TIME AND DATE 1/29/2020 14:20
END TIME AND DATE 1/29/2020 14:40

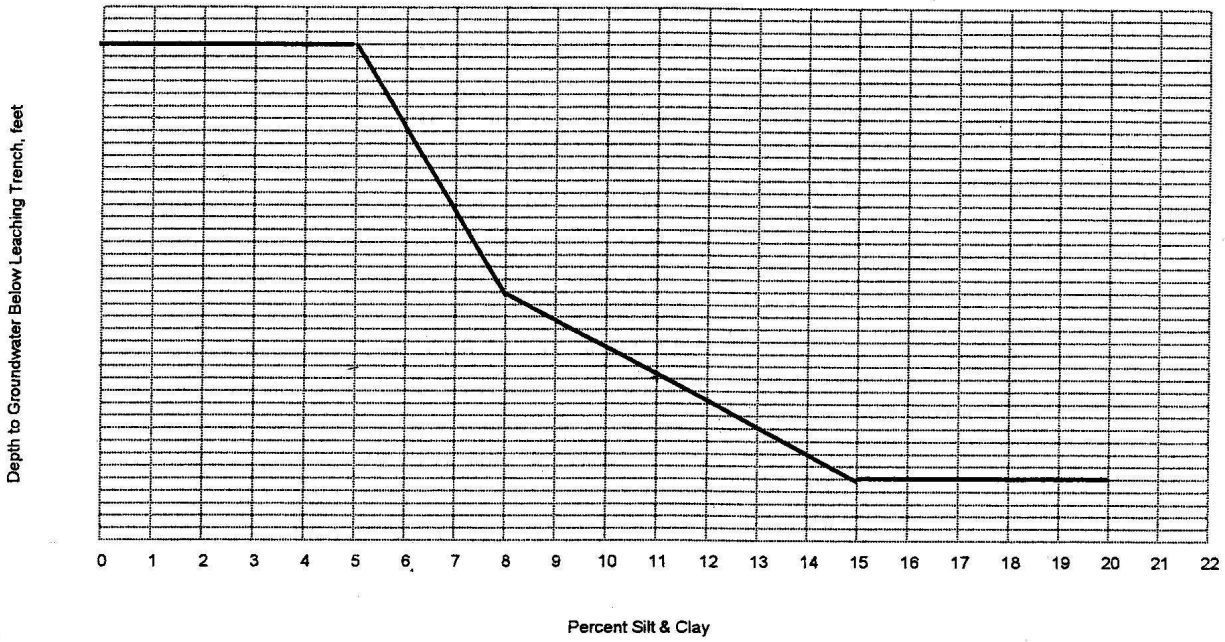
TEST DATA

		TIME	READING	ELAPSED TIME	DROP		TIME	READING	ELAPSED TIME	DROP
START		2:20								
READ	1	2:25		5 min	1.5	7				
START		2:25								
READ	2	2:30		5 min	1	8				
START		2:30								
READ	3	2:35		5 min	1	9				
START		2:35								
READ	4	2:40		5 min	1	10				
START										
READ	5					11				
START										
READ	6					12				

STABILIZATION RATE: 1

Attachment 8
North Coast Region Water Quality Control Board Table 4-1

FIGURE 4-1 MINIMUM DEPTH TO GROUNDWATER BELOW LEACHING TRENCH



Notes:

1. The Silt & Clay content shall be determined after adjustment for coarse fragments as indicated in the method set forth in Figure 4-2, and must exist for a minimum of three feet between the bottom of the leaching trench and groundwater.
2. For percolation rates slower than 5 mpi, a minimum depth to groundwater below the leaching trench shall be five feet.
3. For soils having greater than 15% Silt & Clay, lesser depths to groundwater, to a minimum depth of two feet below the leaching trench, may be granted only as a waiver or for alternative systems.

TABLE 4-1

MINIMUM SETBACK DISTANCES
(FEET)

Facility	Well	Perennially Flowing Stream [1]	Ephemeral Stream [2]	Ocean Lake or Reservoir [3]	Cut Banks, Natural Bluffs and Sharp Changes in Slope	Unstable Land Forms
Septic Tank/Sump	100	50	25	50	25	50
Leaching Field	100	100	50	100	25 [4]	50

[1] As measured from the line which defines the limit of 10 year frequency flood.
[2] As measured from the edge of the water course.
[3] As measured from the high-water line.
[4] Where soil depth or depth to groundwater below the leaching trench are less than five feet, a minimum set back distance of 50 feet shall be required.

Attachment 9
OWTS Plan

SANITARY SEWER PLAN
1"=20'

0 20 40
SCALE IN FEET

-N-

SANITARY SEWER GENERAL NOTES:

1. THE CONTRACTOR SHALL VERIFY ALL SEWER LATERAL LOCATIONS WITH THE PROJECT ENGINEER PRIOR TO CONSTRUCTION.
2. THE CONTRACTOR SHALL EXPOSE THE END OF EXISTING SEWER LINES FOR SURVEYORS TO VERIFY LOCATION AND ELEVATION PRIOR TO PLACEMENT OF NEW PIPE.
3. ANY SEWER PIPE HAVING LESS THAN 20" OF COVER MEASURED AT THE BELL WITHIN THE STREET BEFORE THE ADDITION OF BASE ROCK SHALL BE DUCTILE IRON PIPE. ALL OTHER PIPE SHALL BE PVC CONFORMING TO ASTM D3034.
4. THE CONTRACTOR SHALL PLACE AN "S" IN THE WET CONCRETE CURB TOP AT SEWER LATERAL LOCATIONS.
5. ALL SEWER SERVICES TO MANHOLES SHALL MATCH INVERT OF THE INLET PIPE TO CROWN OF THE OUTLET PIPE, UNLESS OTHERWISE NOTED.
6. ALL SEWER SERVICES TO MANHOLES SHALL BE AIR TESTED TO THE SATISFACTION OF THE ENGINEER AFTER AGGREGATE BASE AND SIDEWALK PLACEMENT. SERVICES SHALL BE BALL AND FLUSHED AND TV TESTED. PRIOR TO EXPIRATION OF THE 1 YEAR WARRANTY PERIOD.
7. SEWER MAINS AND LATERALS SHALL BE TV TESTED.
8. ALL MANHOLE RISERS SHALL BE SEALED BETWEEN RINGS WITH "RAMNECK: OR SIMILAR SEALING MATERIAL. JOINTS SHALL BE GROUTED INSIDE AND OUT.
9. DURING INSTALLATION AND BACKFILLING, ALL TRENCHES SHALL BE FREE OF WATER. ALL DEWATERING SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
10. POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS SHALL, AT A MINIMUM, CONFORM TO THE REQUIREMENTS OF ASTM DESIGNATION D3034 AS THEY APPLY TO SDR-26 PVC SEWER PIPE USING AN ELASTOMERIC GASKET JOINT IN A BELL AN SPIGOT ASSEMBLY SYSTEM.
11. POLYVINYL CHLORIDE JOINTS SHALL BE BELL AND SPIGOT USING AND ELASTOMERIC GASKET WHICH MEETS THE REQUIREMENTS OF ASTM DESIGNATION D1869. NO SOLVENT WELD JOINTS WILL BE ALLOWED.
12. ALL SANITARY SEWER PIPE INSTALLATIONS SHALL BE ACCOMPLISHED AS SPECIFIED HEREIN. PVC PIPE SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATION.
13. ALL SEWER LATERALS SHALL BE ABS SCHEDULE 40 PER ASTM F628. ABS TO BE USED FOR RESIDENTIAL LATERALS ONLY.
14. ALL LATERALS SHALL HAVE NO LESS THAN ONE CLEANOUT BETWEEN MAIN AND HOME. ALL LATERAL CLEANOUTS SHALL BE TWO-WAY, INSTALLED W/ RISERS TO FINISH GRADE IN KRISTY BOX (OR EQUIVELANT) WITH LID MARKED "SEWER".
15. ALL LATERALS AND MAINS ARE TO BE VIDEO TAPED TO THE SERVICE CLEANOUT.
16. ALL LEAKAGE TESTS SHALL BE COMPLETED AND APPROVED AFTER BACKFILLING AND PRIOR TO PLACEMENT OF PERMANENT SURFACING.
17. ALL SEWER MAINS AND LATERALS SHALL BE CLEANED AND FLUSHED, DEFLECTION TESTED AND AIR TESTED.
18. THE COMPLETE JOB SITE SHALL BE DEEMED READY FOR TELEVISION INSPECTION WHEN THE FOLLOWING WORK IS COMPLETED:
    - 18.1. ALL SEWER PIPELINES ARE INSTALLED AND BACKFILLED.
    - 18.2. ALL STRUCTURES ARE IN PLACE, ALL CHANNELING IS COMPLETE AND PIPELINES ARE ACCESSIBLE FROM STRUCTURES.
    - 18.3. ALL OTHER UNDERGROUND FACILITIES, UTILITY PIPING AND CONDUITS ARE INSTALLED.
    - 18.4. FINAL STREET SUB GRADING IS COMPLETE AND READY FOR ASPHALT CONCRETE SURFACING. PIPELINES TO BE INSPECTED HAVE BEEN PRELIMINARY BALLED AND FLUSHED OR CLEANED WITH A HIGH PRESSURE CLEANER.
    - 18.5. FINAL AIR TESTS HAVE BEEN COMPLETED AND APPROVED.
19. WHEN THE ABOVE ITEMS ARE COMPLETE, THE CONTRACTOR SHALL NOTIFY THE ENGINEER IN WRITING AS TO THE SCHEDULED DATE OF THE TELEVISION INSPECTION AND THE INSPECTION.

SEWER CONSTRUCTION NOTES:

(S01) LEACHATE DISPOSAL FIELD. REFER TO SHEET C301 FOR DETAILS. INCLUDES (3) D5 CONCRETE DISTRIBUTION BOXES, 4" PVC SDR35 SOLID CORE MANIFOLD, 4" PVC SDR35 PERFORATED LEACHATE LATERAL LINES (9)x64' = 576', (3') 2" MINUS WASHED DRAIN ROCK BELOW PERF PIPE,

(S02) 4" PVC SDR35 MANIFOLD FROM TANK TO DISTRIBUTION BOX. SLOPE=0.01 FT/FT MIN.

(S03) XERXES 8'ø x26' TANK, DUAL CHAMBER 70/30 VOLUME SPLIT SOLIDS/LEACHATE. INLET PIPE SET TO 6"ø ADAPT TO 6" PVC SDR35. OUTLET PIPE SET TO 4"ø. ADAPT TO 4" PVC SDR35. PROVIDE RISER PORTS TO FINISH GRADE.

(S04) 6"ø PVC SDR35 SEWER MAIN. SLOPE=0.005 FT/FT MIN.

(S05) 48"ø CONCRETE SS MANHOLE WITH 24"ø METAL ACCESS PORT MARKED "SEWER". ECCENTRIC CONE TYP. FOR LADDER ALIGNMENT.

(S06) INSTALL 4"ø SDR35 SS LATERAL. LATERAL SLOPE=0.01 FT/FT MIN. INSTALL 4"ø PVC TWO-WAY SS CLEAN-OUT IN CHRISTY FOB BOX WITH FOBR LID MARKED "SEWER" CLEANOUT TO BE INSTALLED WITHIN THREE FEET OF THE EXTERIOR WALL OF THE HOME.

(S07) 4"ø PVC SDR35 SEWER MAIN. SLOPE=0.01 FT/FT MIN.

TVCE
67 WALNUT WAY
PO BOX 1567
WILLOW CREEK, CA 95573
P:(530)629-3000
F:(530)629-3011

REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY
1	01/07/21	PRELIMINARY DESIGN	FAM	FAM	JTM	TVCE
2	09/15/22	REV PER HUM CO ENV. DEPT.	FAM	FAM	JTM	TVCE

KARUK TRIBE HOUSING AUTHORITY
ORLEANS HOUSING DEVELOPMENT

SANITARY SEWER PLAN

APN: 529-111-007
ORLEANS, HUMBOLDT COUNTY, CALIFORNIA

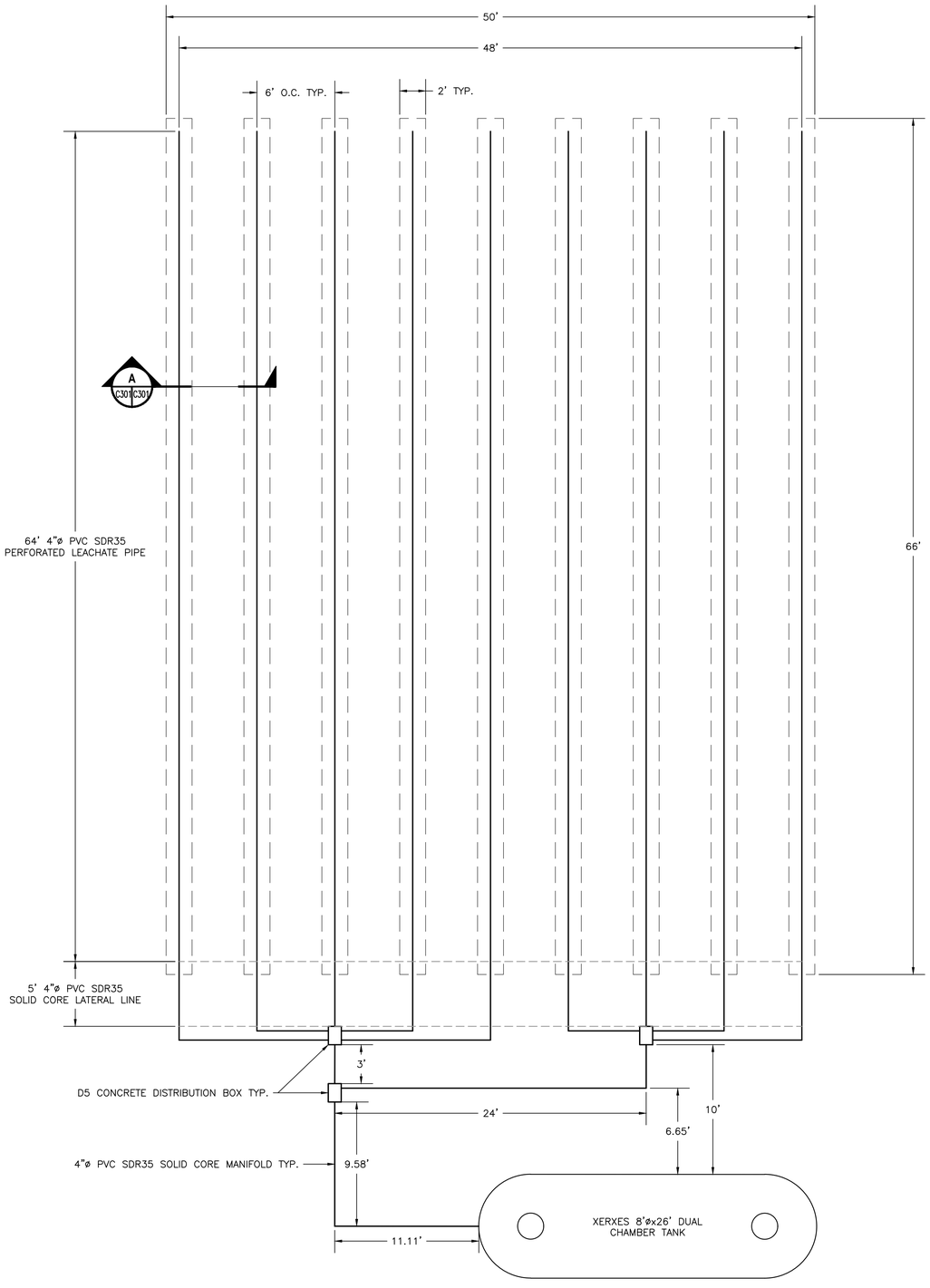
DATE OF ISSUE:
SEPTEMBER 2022

SCALE:
AS SHOWN

PROJECT NO:
0236.02

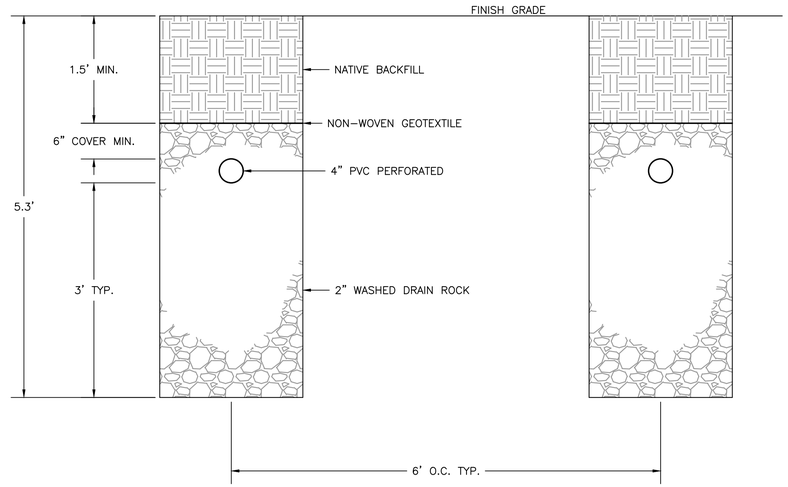
DRAWING NO:
C300

1/2" 1" 2"



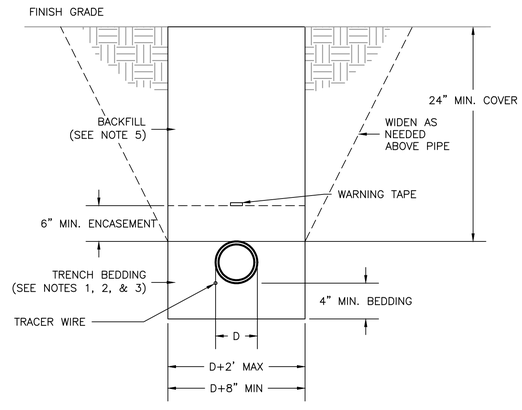
LEACHATE FIELD — PLAN VIEW
1"=10'

1
C301



LEACHFIELD TRENCH SECTION
NTS

A
C301



PIPE TRENCH NOTES:

1. BACKFILL BY HAND, COMPACT OR CONSOLIDATE TO PROVIDE SOLID BEDDING UNDER AND AROUND PIPE.
2. BEDDING MATERIAL SHALL BE SAND OR CRUSHED ROCK AND SHALL HAVE A MAXIMUM SIZE OF 1" AND BE REASONABLY GRADED FROM COARSE TO FINE WITH A MINIMUM SAND EQUIVALENT OF 28.
3. IMPORT GRAVEL BACKFILL SHALL BE STREAM GRAVEL OR CRUSHED ROCK AND BE REASONABLY WELL GRADED FROM COARSE TO FINE WITH A MAXIMUM SIZE OF 3" AND A MINIMUM SAND EQUIVALENT GREATER THAN 28.
4. JETTING WILL NOT BE ALLOWED.
5. IN ROAD CROSSINGS BACKFILL ABOVE PIPE SHALL BE ¾" MINUS CLASS 2 AGGREGATE BASE. BASE CONSOLIDATION SHALL BE 95% RELATIVE COMPACTION PER ASTM 2922. A 2-SACK CONCRETE SLURRY MAY BE USED N PLACE OF AB. USE NATIVE FILL OTHERWISE.

SUPPLY LINE TRENCH DETAIL
NTS

2
C301

TVCE
67 WALNUT WAY
PO BOX 1567
WILLOW CREEK, CA 95573
P:(530)629-3000
F:(530)629-3011

REV	DATE	DESCRIPTION	DWN BY	DSG BY	CHK BY	APP BY
1	09/15/22	REV PER HUM CO ENV DEPT.	FAM	FAM	JTM	TVCE
0	01/07/21	PRELIMINARY DESIGN	FAM	FAM	JTM	TVCE

KARUK TRIBE HOUSING AUTHORITY
ORLEANS HOUSING DEVELOPMENT

LEACHATE FIELD DETAILS

APN: 529-111-007
ORLEANS, HUMBOLDT COUNTY, CALIFORNIA

DATE OF ISSUE:
SEPTEMBER 2022

SCALE:
AS SHOWN

PROJECT NO:
0236.02

DRAWING NO:
C301

1/2" 1" 2"

Attachment 10
Hantush Groundwater Mounding Calculations

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
3.7500	***R***	**Recharge (infiltration) rate (feet/day)**
0.300	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
37.50	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
32.500	**x**	**1/2 length of basin (x direction, in feet)**
25.000	**y**	**1/2 width of basin (y direction, in feet)**
1.000	**t**	**duration of infiltration period (days)**
3.000	**hi(0)**	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

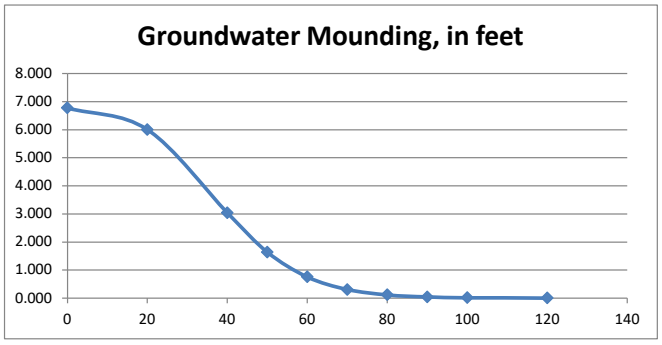
hours	days
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

9.775	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
6.775	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
6.775	**0**
6.008	**20**
3.043	**40**
1.640	**50**
0.755	**60**
0.308	**70**
0.116	**80**
0.042	**90**
0.016	**100**
0.005	**120**

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.