



**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**

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



# TRINITY VALLEY CONSULTING ENGINEERS, INC

Engineering – Surveying – Land Planning – Construction Management

## TABLE OF CONTENTS

Introduction: .....	2
Site Description: .....	2
Proposed Project: .....	2
Field Investigation: .....	2
Limitations: .....	3
Onsite Wastewater Treatment System: .....	3
Groundwater Mounding .....	3
Nitrate Loading .....	4
Proposed Sewage Disposal System .....	5
Evaluation: .....	5
Conclusion: .....	6
References: .....	7

## TABLE OF ATTACHMENTS:

1. Location Map
2. Assessor Parcel Map & Humboldt GIS Map
3. Sample Pit Location Map
4. Textural Analysis Report
5. Sewage Disposal System Submittal
6. Soil Exploration Logs
7. Percolation Testing Logs
8. North Coast Regional Water Quality Control Board Table 4-1
9. OWTS Plan
10. Hantush Groundwater Mounding Calculations

## **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 (NO<sub>3</sub>), 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 ( $358.4/2,400 \text{ grams/gal} = 39.45 \text{ mg/L}$ ) 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.

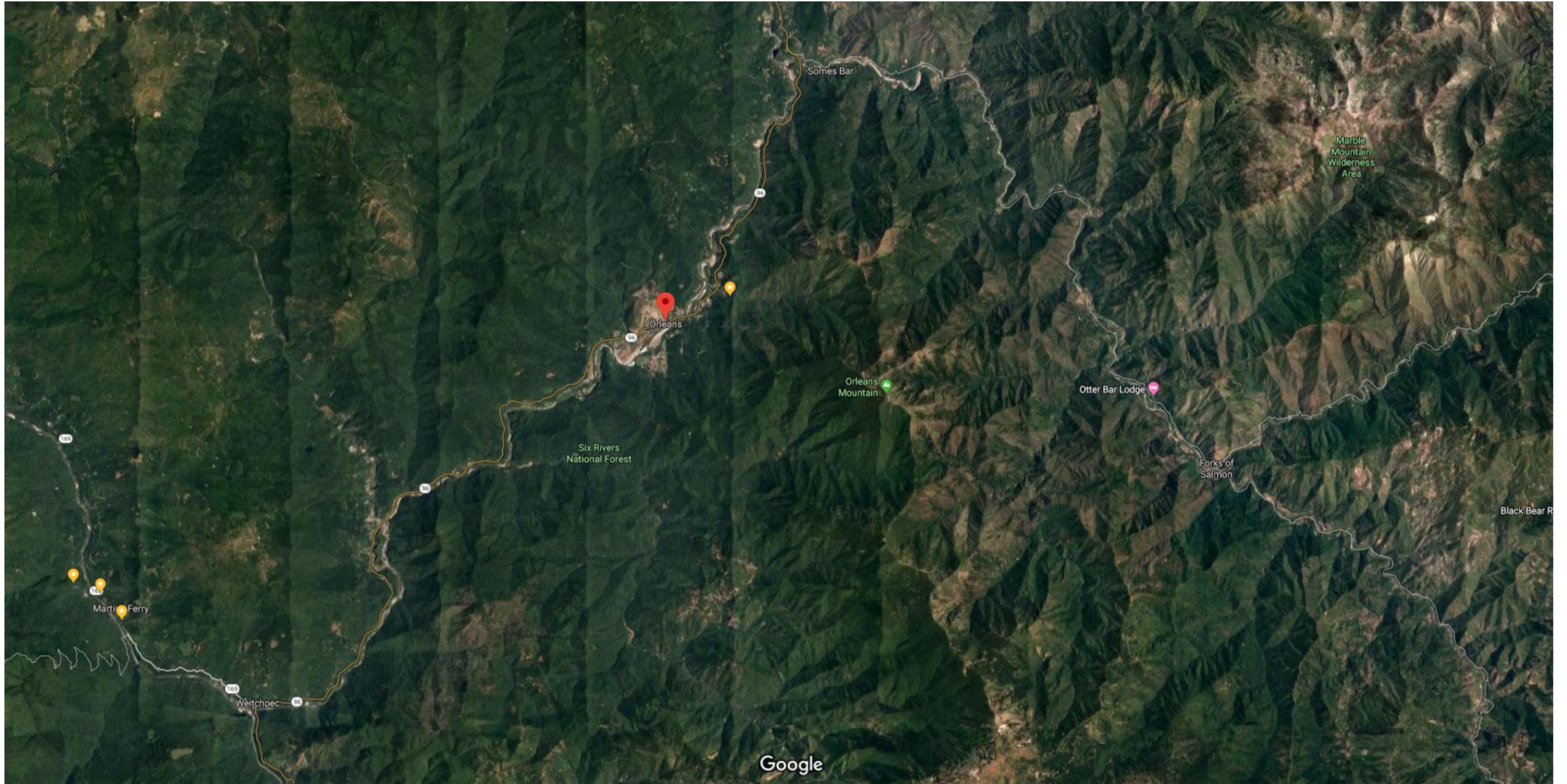


## References:

- 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*





Attachment 2  
*Assessor Parcel Map & Humboldt GIS Map*







# ArcGIS Web Map

Humboldt County Planning and Building Department

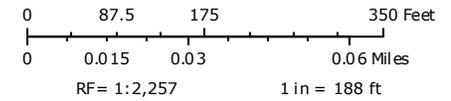
Printed: February 19, 2020

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)



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*





Attachment 4  
*Textural Analysis Report*





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:	<b>2</b>	<b>1</b>	<b>1</b>

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	<b>2</b>	<b>1</b>	<b>1</b>	
Classification	<b>Sandy Loam</b>	<b>Loamy Sand</b>	<b>Loamy Sand</b>	

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

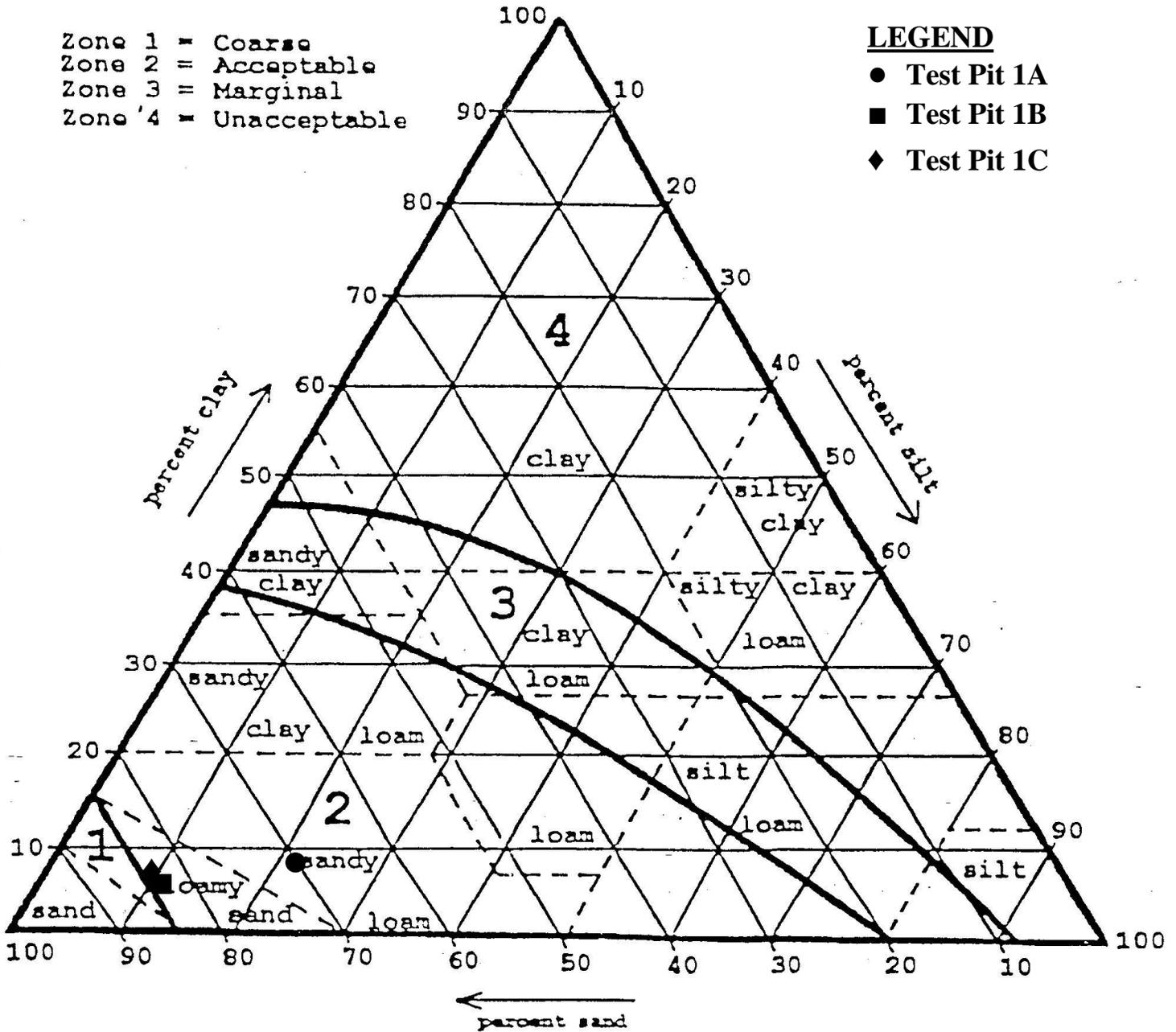
Test Pit Number	1A	1B	1C	
Percolation Rate (minutes per inch)	16	15	15	
Application Rate (gallons per day per square foot)	0.7	0.8	0.8	

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

- Zone 1 = Coarse
- Zone 2 = Acceptable
- Zone 3 = Marginal
- Zone 4 = Unacceptable

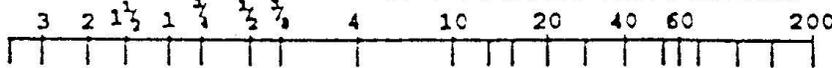
**LEGEND**

- Test Pit 1A
- Test Pit 1B
- ◆ Test Pit 1C

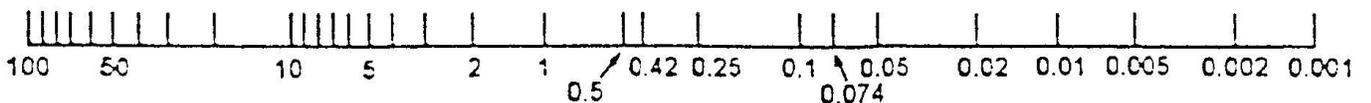


Sieve Openings in Inches

U.S. Standard Sieve Numbers



USDA	GRAVEL	SAND					SILT	CLAY
		Vary Coarse	Coarse	Medium	Fine	Vary Fine		



Grain Size in Millimeters



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:	<b>2</b>	<b>2</b>	<b>2</b>

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	<b>2</b>	<b>2</b>	<b>2</b>	
Classification	<b>Sandy Loam</b>	<b>Sandy Loam</b>	<b>Sandy Loam</b>	

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

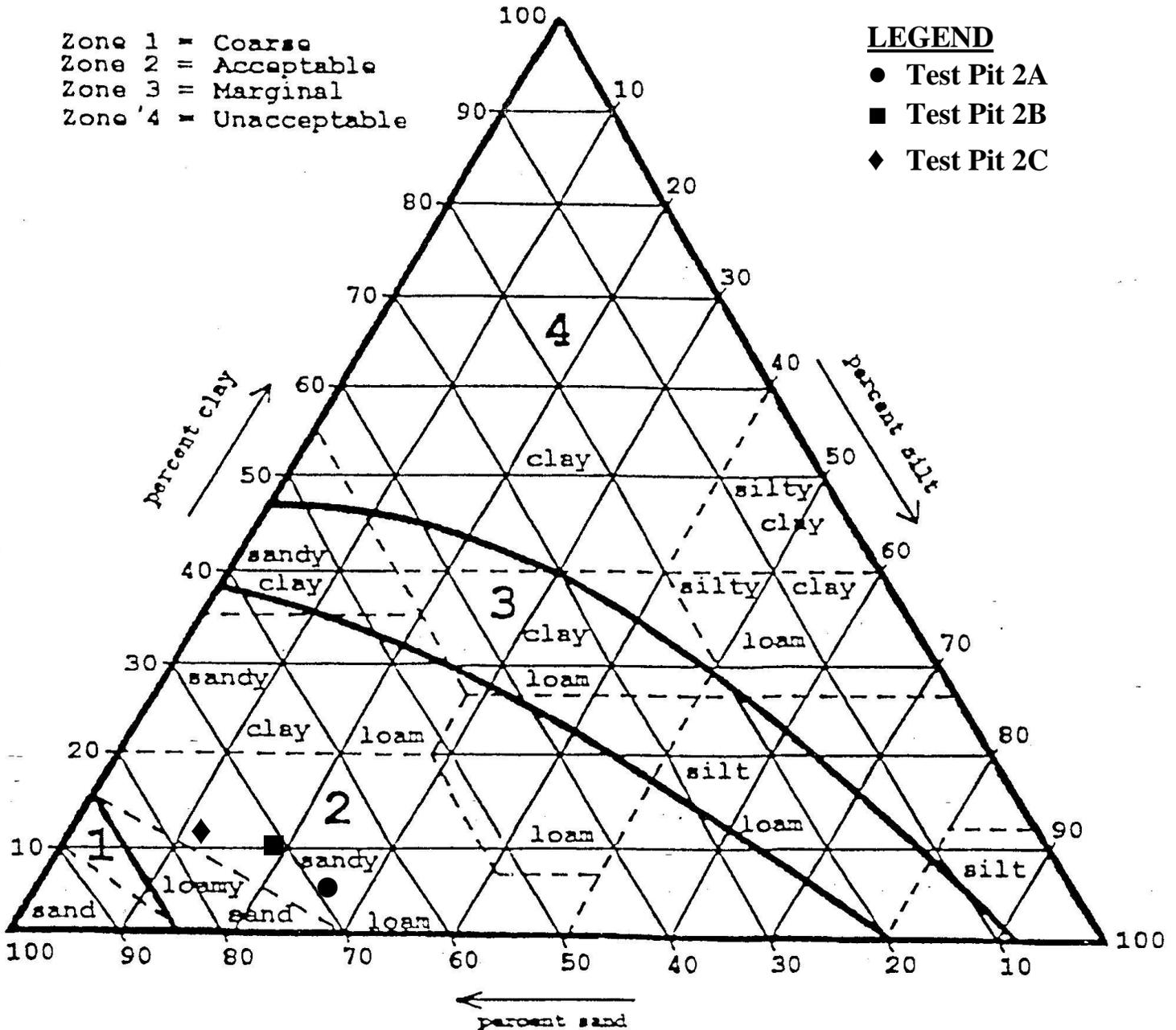
Test Pit Number	2A	2B	2C	
Percolation Rate (minutes per inch)	16	16	16	
Application Rate (gallons per day per square foot)	0.7	0.7	0.7	

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

- Zone 1 = Coarse
- Zone 2 = Acceptable
- Zone 3 = Marginal
- Zone 4 = Unacceptable

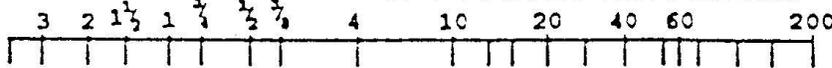
**LEGEND**

- Test Pit 2A
- Test Pit 2B
- ◆ Test Pit 2C

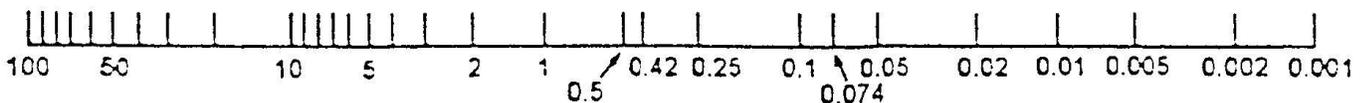


Sieve Openings in Inches

U.S. Standard Sieve Numbers



USDA	GRAVEL	SAND					SILT	CLAY
		Vary Coarse	Coarse	Medium	Fine	Vary Fine		



Grain Size in Millimeters



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:	<b>2</b>	<b>2</b>	<b>2</b>

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	<b>2</b>	<b>2</b>	<b>2</b>	
Classification	<b>Sandy Loam</b>	<b>Loamy Sand</b>	<b>Loamy Sand</b>	

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

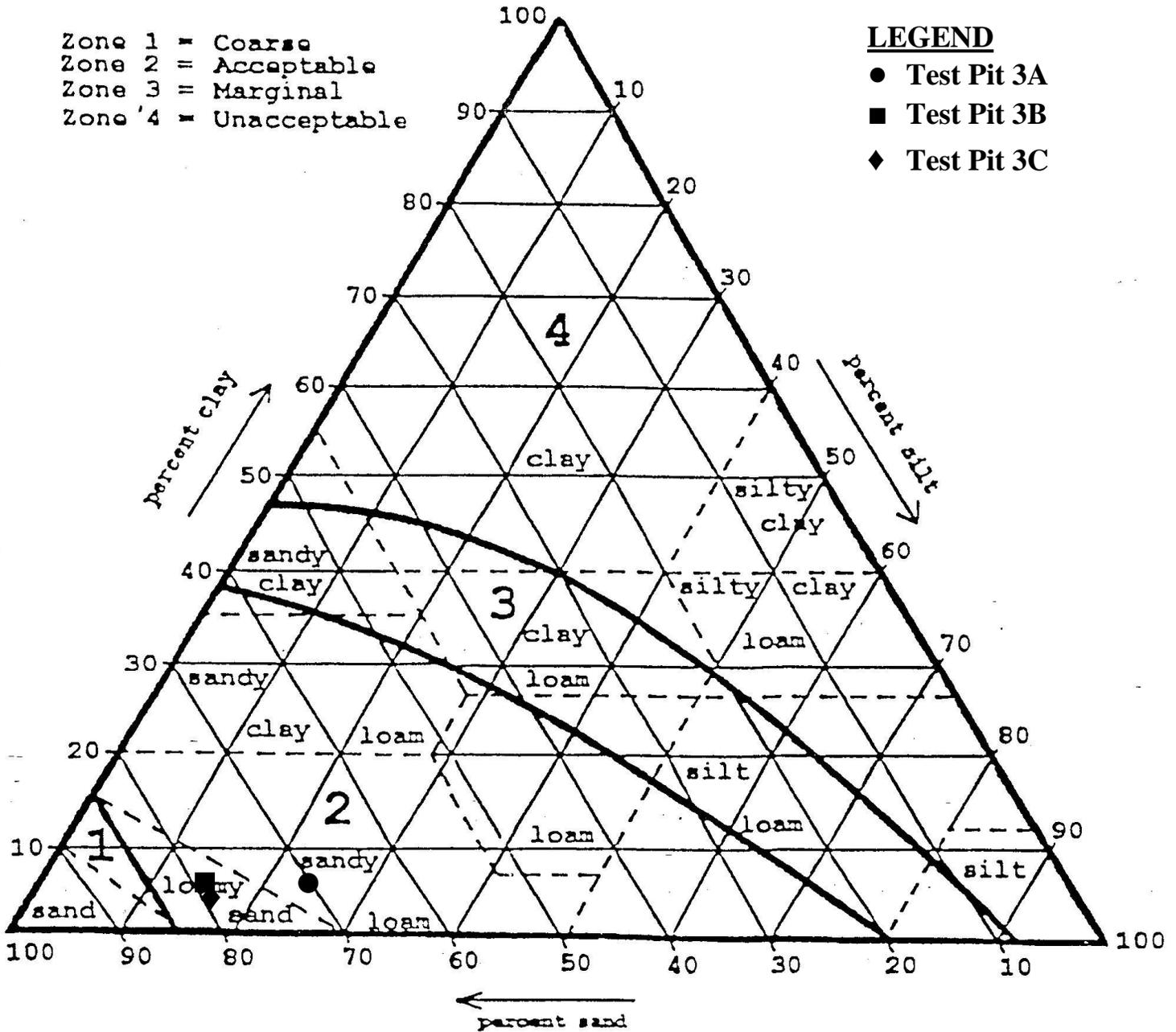
Test Pit Number	3A	3B	3C	
Percolation Rate (minutes per inch)	16	15	15	
Application Rate (gallons per day per square foot)	0.7	0.8	0.8	

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

- Zone 1 = Coarse
- Zone 2 = Acceptable
- Zone 3 = Marginal
- Zone 4 = Unacceptable

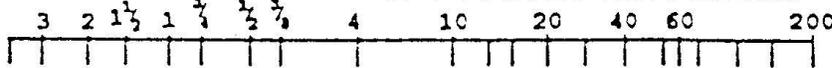
**LEGEND**

- Test Pit 3A
- Test Pit 3B
- ◆ Test Pit 3C

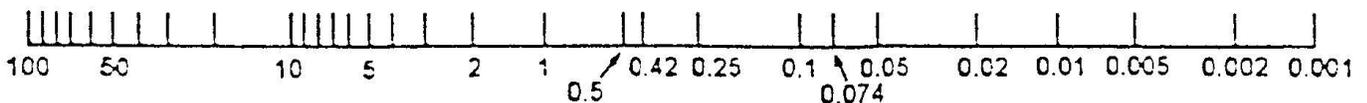


Sieve Openings in Inches

U.S. Standard Sieve Numbers



USDA	GRAVEL	SAND					SILT	CLAY
		Vary Coarse	Coarse	Medium	Fine	Vary Fine		



Grain Size in Millimeters



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:	<b>2</b>	<b>2</b>	<b>2</b>

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	<b>2</b>	<b>2</b>	<b>2</b>	
Classification	<b>Sandy Loam</b>	<b>Loamy Sand</b>	<b>Sandy Loam</b>	

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

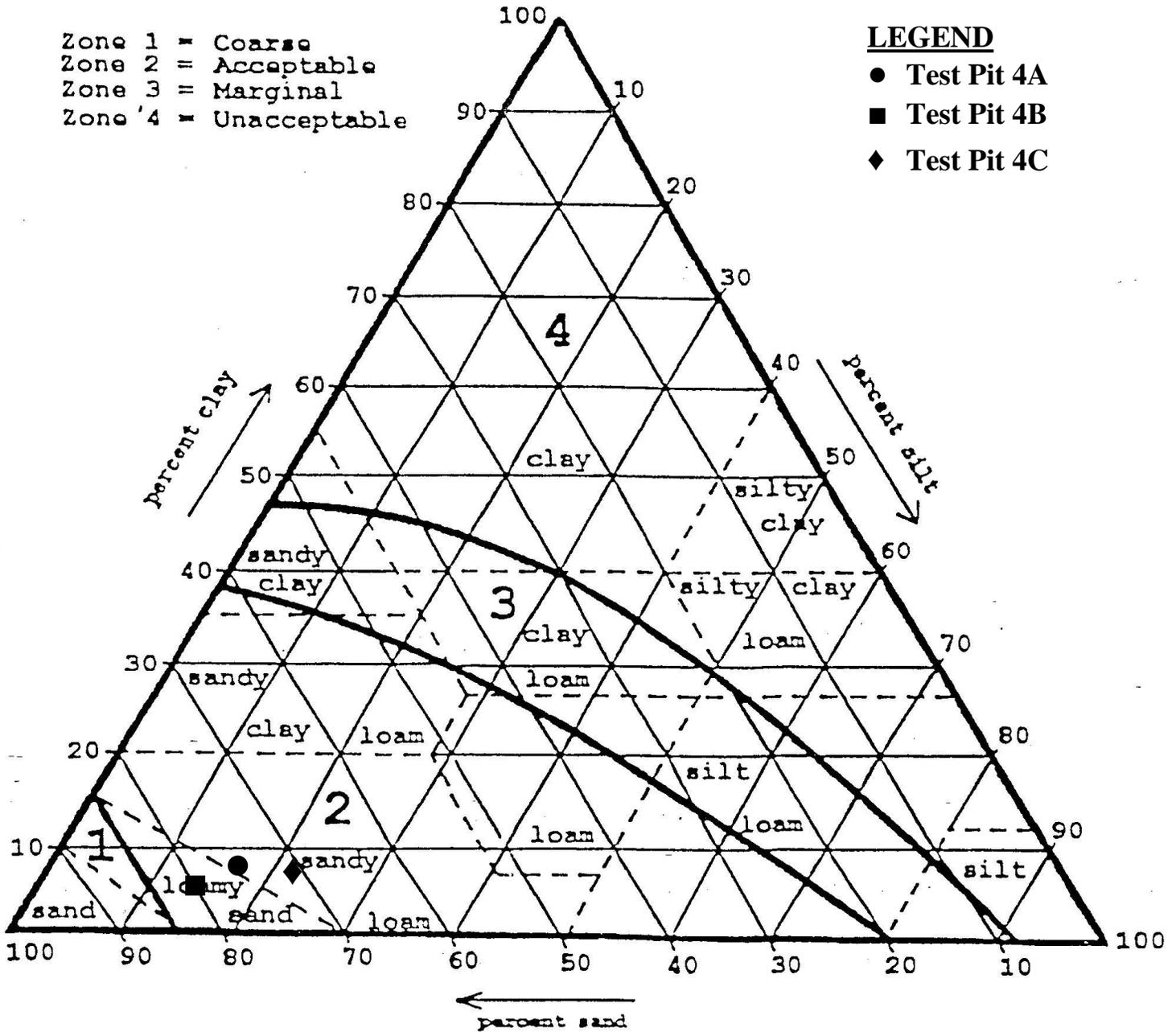
Test Pit Number	4A	4B	4C	
Percolation Rate (minutes per inch)	16	15	16	
Application Rate (gallons per day per square foot)	0.7	0.8	0.7	

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

- Zone 1 = Coarse
- Zone 2 = Acceptable
- Zone 3 = Marginal
- Zone 4 = Unacceptable

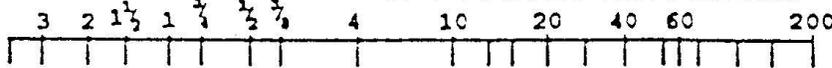
**LEGEND**

- Test Pit 4A
- Test Pit 4B
- ◆ Test Pit 4C

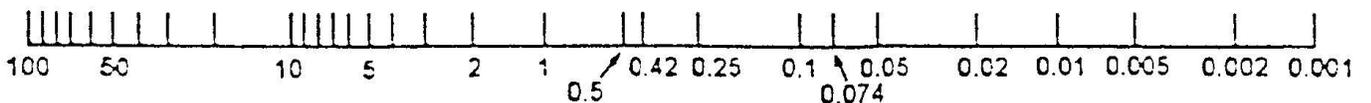


Sieve Openings in Inches

U.S. Standard Sieve Numbers



USDA	GRAVEL	SAND					SILT	CLAY
		Vary Coarse	Coarse	Medium	Fine	Vary Fine		



Grain Size in Millimeters



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:	<b>2</b>	<b>2</b>	<b>2</b>

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	<b>2</b>	<b>2</b>	<b>2</b>	
Classification	<b>Loamy Sand</b>	<b>Sandy Loam</b>	<b>Loamy Sand</b>	

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

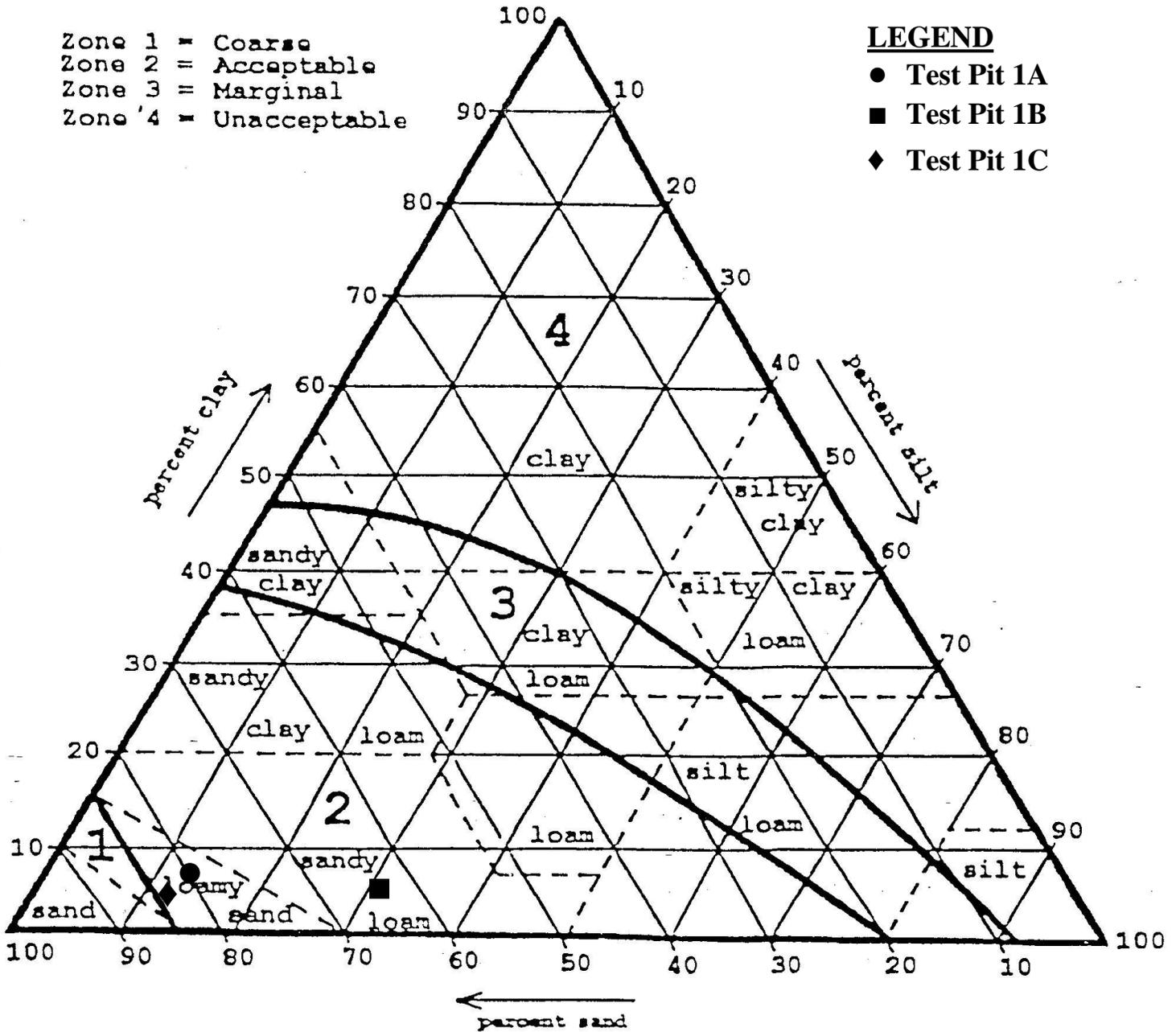
Test Pit Number	5A	5B	5C	
Percolation Rate (minutes per inch)	15	16	15	
Application Rate (gallons per day per square foot)	0.8	0.7	0.8	

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

- Zone 1 = Coarse
- Zone 2 = Acceptable
- Zone 3 = Marginal
- Zone 4 = Unacceptable

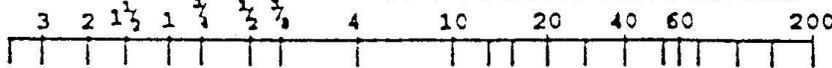
**LEGEND**

- Test Pit 1A
- Test Pit 1B
- ◆ Test Pit 1C

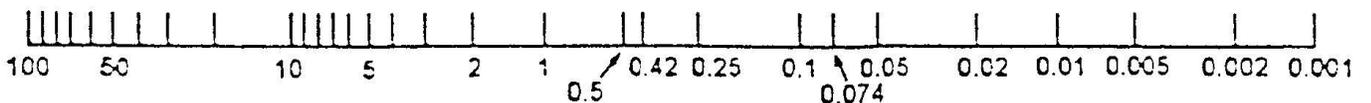


Sieve Openings in Inches

U.S. Standard Sieve Numbers



USDA	GRAVEL	SAND					SILT	CLAY
		Vary Coarse	Coarse	Medium	Fine	Vary Fine		



Grain Size in Millimeters



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:	<b>2</b>	<b>2</b>	<b>1</b>

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	<b>2</b>	<b>2</b>	<b>1</b>	
Classification	<b>Sandy Loam</b>	<b>Loamy Sand</b>	<b>Sand</b>	

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

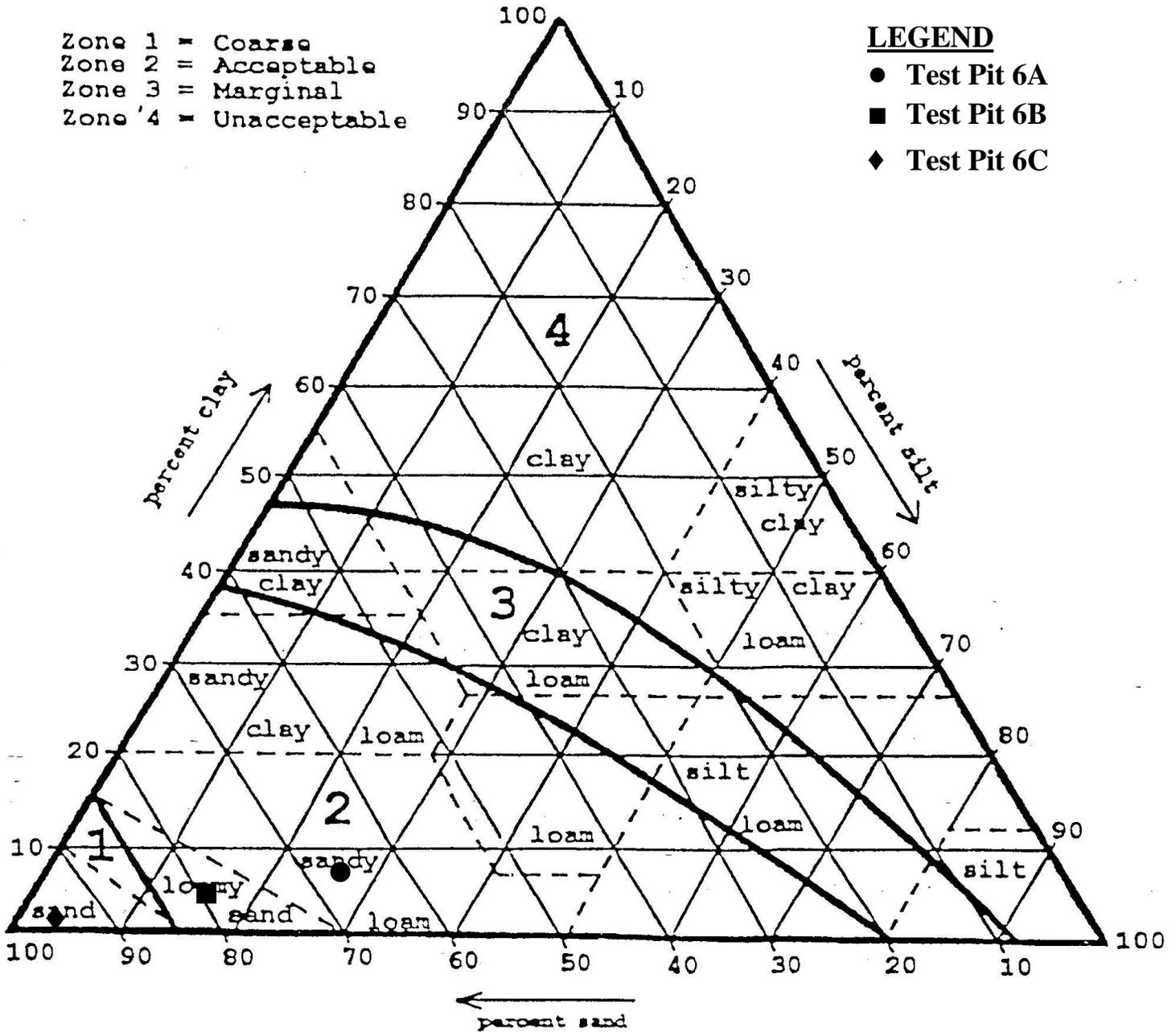
Test Pit Number	6A	6B	6C	
Percolation Rate (minutes per inch)	16	15	6	
Application Rate (gallons per day per square foot)	0.7	0.8	1.1	

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

- Zone 1 = Coarse
- Zone 2 = Acceptable
- Zone 3 = Marginal
- Zone 4 = Unacceptable

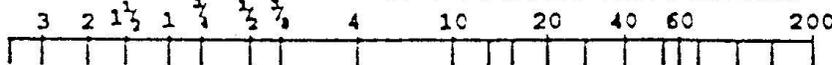
**LEGEND**

- Test Pit 6A
- Test Pit 6B
- ◆ Test Pit 6C

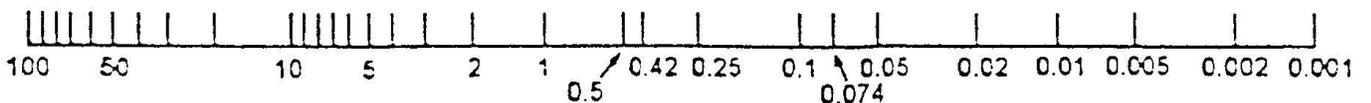


Sieve Openings in Inches

U.S. Standard Sieve Numbers



USDA	GRAVEL	SAND					SILT	CLAY
		Vary Coarse	Coarse	Medium	Fine	Vary Fine		



Grain Size in Millimeters

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		Orenco
						Perc Rate (min/in)	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
<b>DESIGN FLOW</b>			
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	
<b>Nitrate Loading</b>			
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: H&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: H&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					

**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-3

Hole Diameter: 24"x72"

Excavation Method: H&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: H&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-4A			
Loamy Sand	Brwn	Dry		Sm	-4 -5 -6		TP-4B			
Sandy Loam	Brwn	Dry		SM	-7 -8 -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: H&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: H&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 READ	1	2:05				7	2:35			
		2:10		5 min	1.5		2:40 AM		5 min	0.75
START READ	2	2:10				8				
		2:15		5 min	1					
START READ	3	2:15				9				
		2:20		5 min	0.5					
START READ	4	2:20				10				
		2:25		5 min	0.5					
START READ	5	2:25				11				
		2:30		5 min	0.75					
START READ	6	2:30				12				
		2:35		5 min	0.75					

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
<u>0 to -3'</u>	<u>1/29/30</u>	<u>post hole digger</u>	<u>8"x12"</u>
<u>to</u>	<u></u>	<u></u>	<u></u>
<u>to</u>	<u></u>	<u></u>	<u></u>

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**

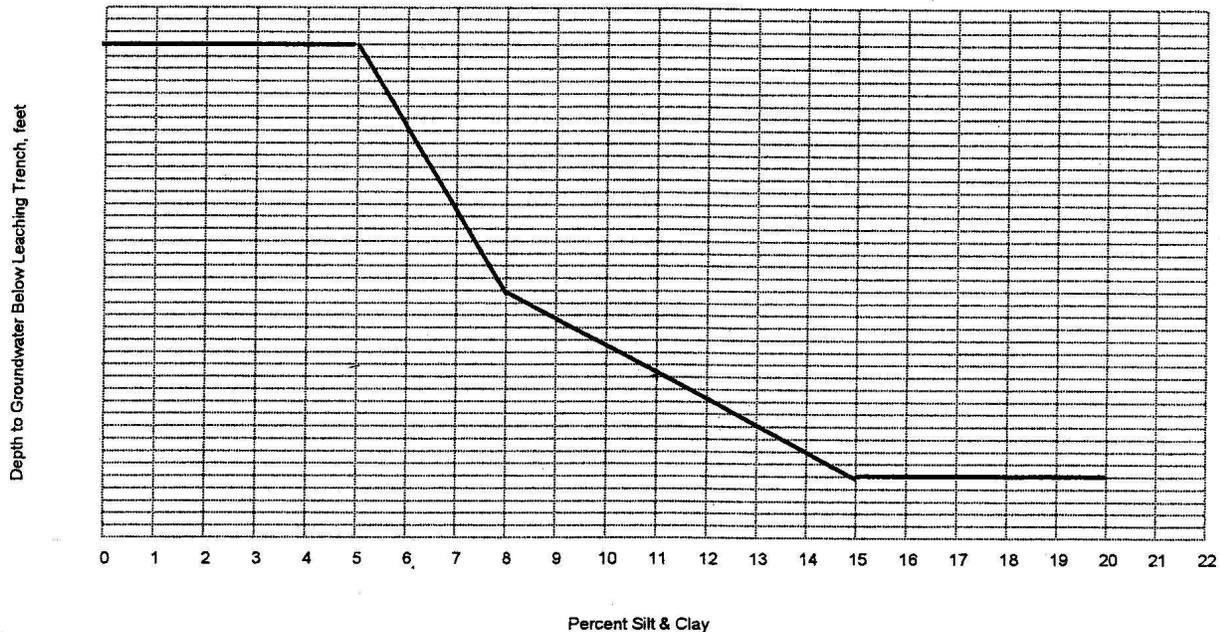
		TIME	READING	ELAPSED TIME	DROP		TIME	READING	ELAPSED TIME	DROP
START		<u>2:20</u>								
READ	<u>1</u>	<u>2:25</u>		<u>5 min</u>	<u>1.5</u>	<u>7</u>				
START		<u>2:25</u>								
READ	<u>2</u>	<u>2:30</u>		<u>5 min</u>	<u>1</u>	<u>8</u>				
START		<u>2:30</u>								
READ	<u>3</u>	<u>2:35</u>		<u>5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

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 <sup>1</sup>	Ephemeral Stream <sup>2</sup>	Ocean Lake or Reservoir <sup>3</sup>	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 <sup>4</sup>	50

<sup>1</sup> As measured from the line which defines the limit of 10 year frequency flood.

<sup>2</sup> As measured from the edge of the water course.

<sup>3</sup> As measured from the high-water line.

<sup>4</sup> 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*





67 WALNUT WAY  
PO BOX 1587  
WILLOW CREEK, CA 95573  
P:(530)629-3000  
F:(530)629-3011

**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 BALLED 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 AND SPIGOT ASSEMBLY SYSTEM.
11. POLYVINYL CHLORIDE 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 MANHOLE, 4" PVC SDR35 PERFORATED LEACHATE LATERAL LINES (9)X64' = 576', (3) 2" MINUS WASHED DRAIN ROCK BELOW PERF PIPE,
- (S02) 4" PVC SDR35 MANHOLE FROM TANK TO DISTRIBUTION BOX. SLOPE=0.01 FT/FT MIN.
- (S03) XERKES 8'x26' TANK, DUAL CHAMBER 70/30 VOLUME SPLIT SOLIDS/LEACHATE. INLET PIPE SET TO 6" ADAPT TO 6" PVC SDR35. OUTLET PIPE SET TO 4". ADAPT TO 4" PVC SDR35. PROVIDE RISER PORTS TO FINISH GRADE.
- (S04) 6" PVC SDR35 SEWER MAIN. SLOPE=0.005 FT/FT MIN.
- (S05) 48" CONCRETE SS MANHOLE WITH 24" METAL ACCESS PORT MARKED "SEWER". ECCENTRIC CONE TYP. FOR LADDER ALIGNMENT.
- (S06) INSTALL 4" SDR35 SS LATERAL. LATERAL SLOPE=0.01 FT/FT MIN. INSTALL 4" PVC TWO-WAY SS CLEAN-OUT IN CHRISTY FOB BOX WITH FOB LID MARKED "SEWER" CLEANOUT TO BE INSTALLED WITHIN THREE FEET OF THE EXTERIOR WALL OF THE HOME.
- (S07) 4" PVC SDR35 SEWER MAIN. SLOPE=0.01 FT/FT MIN.



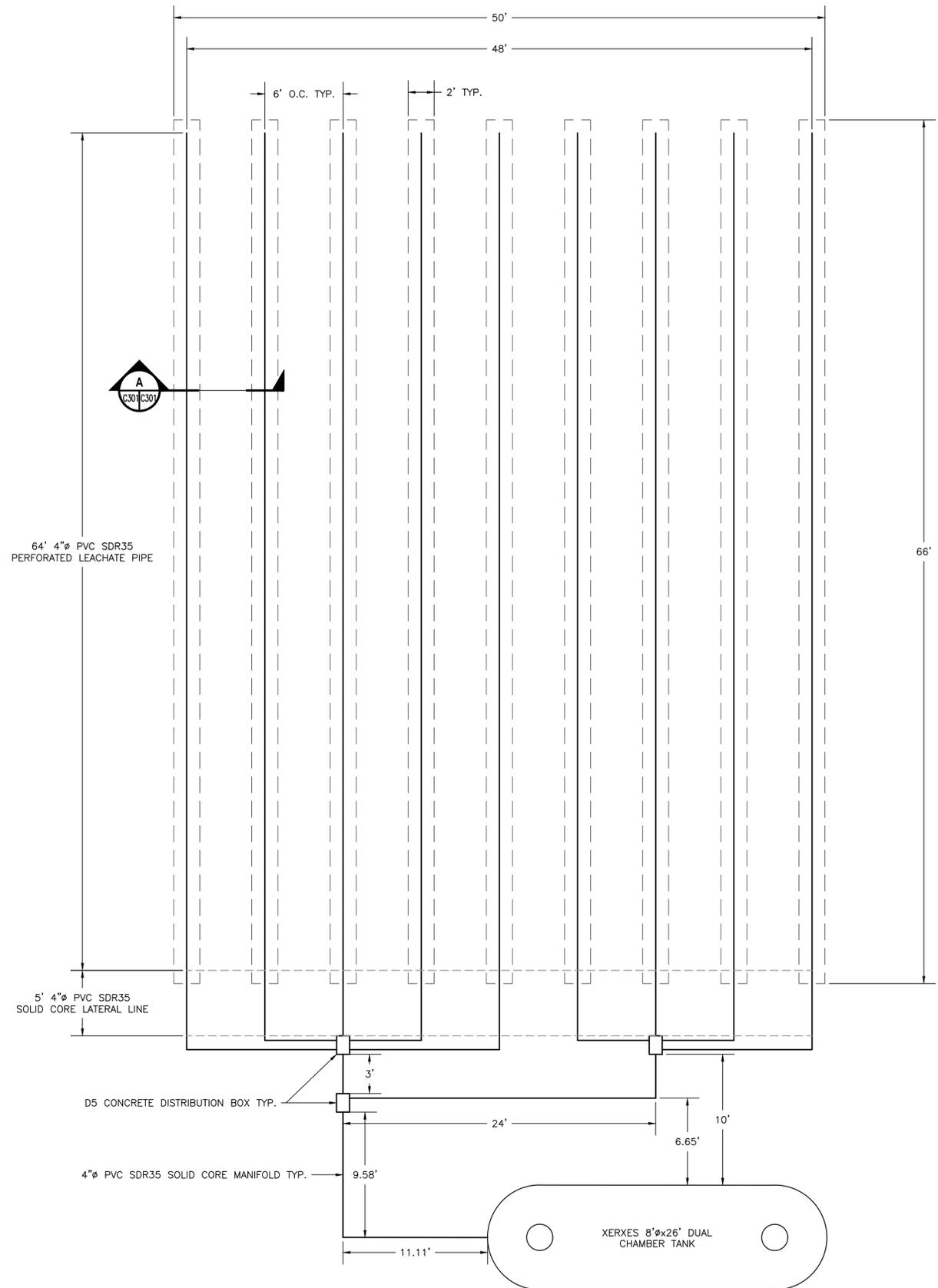
**SANITARY SEWER PLAN**  
1"=20'



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

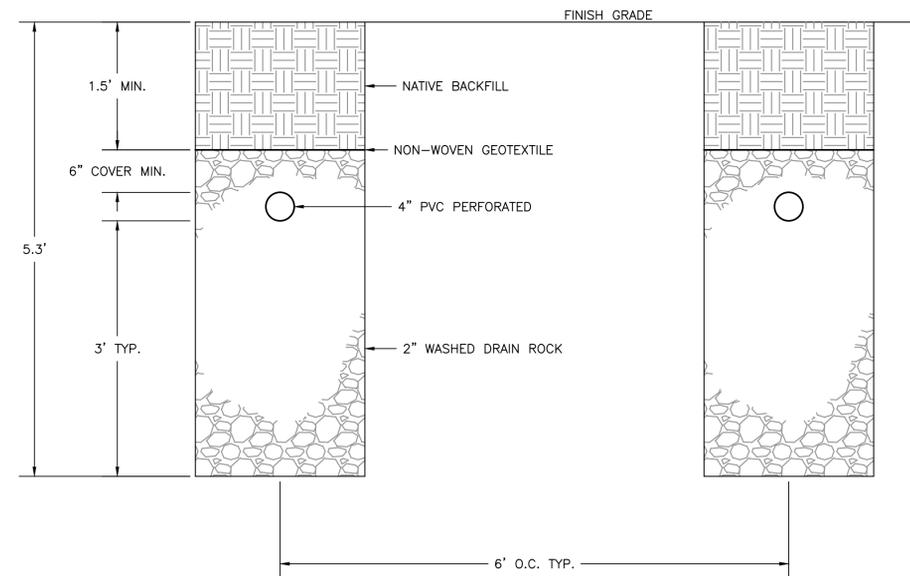
KARUK TRIBE HOUSING AUTHORITY  
ORLEANS HOUSING DEVELOPMENT  
**SANITARY SEWER PLAN**  
APN: 529-111-007  
ORLEANS, HUMBOLDT COUNTY, CALIFORNIA

DATE OF ISSUE:	SEPTEMBER 2022
SCALE:	AS SHOWN
PROJECT NO:	0236.02
DRAWING NO:	C300

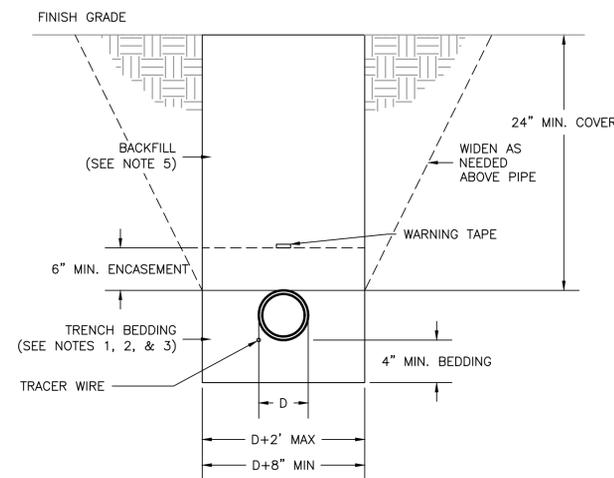


LEACHATE FIELD - PLAN VIEW

1"=10'



LEACHFIELD TRENCH SECTION  
NTS



**PIPE TRENCH NOTES:**

- BACKFILL BY HAND, COMPACT OR CONSOLIDATE TO PROVIDE SOLID BEDDING UNDER AND AROUND PIPE.
- 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.
- 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.
- JETTING WILL NOT BE ALLOWED.
- IN ROAD CROSSINGS BACKFILL ABOVE PIPE SHALL BE 3/4" MINUS CLASS 2 AGGREGATE BASE. BASE CONSOLIDATION SHALL BE 95% RELATIVE COMPACTION PER ASTM 2922. A 2-SACK CONCRETE SLURRY MAY BE USED IN PLACE OF AB. USE NATIVE FILL OTHERWISE.

SUPPLY LINE TRENCH DETAIL  
NTS

REV	DATE	DESCRIPTION	DESIGNED BY	CHECKED BY	APP. BY
1	01/07/21	PRELIMINARY DESIGN			
2	09/15/22	REV PER HUM CO ENV. DEPT.			

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

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)

Input Values		use consistent units (e.g. feet & days or inches & hours)	Conversion Table		
			inch/hour	feet/day	
3.7500	R	Recharge (infiltration) rate (feet/day)	0.67	1.33	
0.300	Sy	Specific yield, Sy (dimensionless, between 0 and 1)			
37.50	K	Horizontal hydraulic conductivity, Kh (feet/day)*	2.00	4.00	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).
32.500	x	1/2 length of basin (x direction, in feet)			
25.000	y	1/2 width of basin (y direction, in feet)	hours	days	
1.000	t	duration of infiltration period (days)	36	1.50	
3.000	hi(0)	initial thickness of saturated zone (feet)			

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)

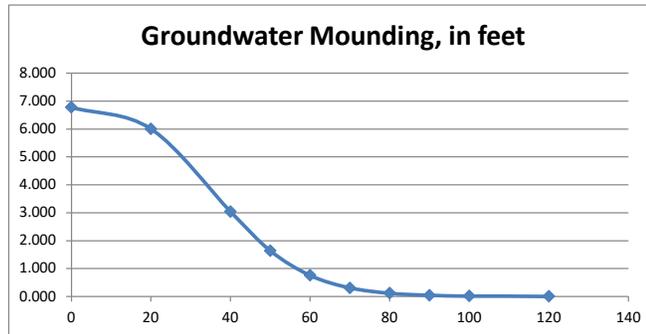
Ground-water Mounding, in feet

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.