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Wastewater Feasibility Study

ROMBAUER VINEYARDS # P19-00130-MOD
Planning Commission Hearing Date 5 August 2020

March 2019
Job No. 96-07

BARTELT ENGINEERING

ONSITE WASTEWATER DISPERSAL FEASIBILITY STUDY FOR ROMBAUER VINEYARDS WINERY 3522 SILVERADO TRAIL, NAPA COUNTY APN 021-410-025

As required by Napa County Planning, Building and Environmental Services (PBES) and at the request of Lynn S. Sletto, Esq., Bartelt Engineering has evaluated the feasibility of installing a new onsite sanitary wastewater treatment and dispersal system to serve the existing administration building, full crush winery, and tasting room located at 3522 Silverado Trail, St. Helena, CA 94574 to accommodate an increase in employee staffing levels and proposed changes to the hospitality marketing plan.

PROJECT DESCRIPTION

It is our understanding that Rombauer Vineyards Winery is proposing to increase the number of full time employees from 25 to 55 and to increase the number of part-time and seasonal employees from 9 to 26; while maintaining the existing wine production capacity at 450,000 gallons and the number of daily visitors at 400 as stated in the existing approved Use Permit (# P10-00039).

It is also our understanding that Rombauer Vineyards Winery would like to make the following changes to the approved marketing plan:

- Remove four (4) Wine Club Events per year with a maximum of 250 guests at each event
- Add five (5) Marketing Events per year with a maximum of 350 guests at each event
- Increase the number of Lunch/Dinner Event guests from forty (40) to sixty (60) guests per event.

All food served out of the tasting room "plating area" for special marketing events will be catered by an offsite company that will provide clean plates, utensils, etc. for dining and remove all dirty dishes, utensils, etc. for offsite cleaning. The small plates used for the daily food and wine pairings and wine glasses will be washed after each event using the tasting room glass dishwasher.

Table 1 summarizes the approved and proposed employee staffing plan:

TABLE 1: EMPLOYEE STAFFING PLAN SUMMARY

Description	Approved		Proposed	
	Frequency	Number of Employees	Frequency	Number of Employees
Full-time Employees	Year-round	25	Year-round	55
Part-time Employees	Year-round	0	Year-round	6
Seasonal Employees	Daily during Harvest	9	Daily during Harvest	20

Table 2 summarizes the approved and proposed marketing plan:

TABLE 2: MARKETING PLAN SUMMARY

Description	Approved		Proposed	
	Frequency	Number of Guests	Frequency	Number of Guests
Private Tours & Tastings	daily	400 per day	daily	400 per day
Food (cheese) & Wine Pairings[1]	10 per day	8 per pairing	10 per day	8 per pairing
Marketing Events[2]	1 per year	300 max	5 per year	350 max
Wine Club Events	4 per year	250 max	Removed	Removed
Wine Auction Event[1,3]	1 per year	40 max	1 per year	40 max
Barrel Tasting Event[1,3]	1 per year	40 max	1 per year	40 max
Lunch or Dinner Events[1,3]	4 per month	40 max per event	4 per month	60 max per event

[1] Number of Guests per event are included in the maximum daily visitor count of 400.

[2] Event cannot be held the same day of tours & tasting, barrel tastings, lunch/dinner events, or auction related events; portable toilets are required for all events.

[3] Events cannot be held on the same day with any other event, but can be held in conjunction with tours & tastings such that the combination is not to exceed a maximum daily visitor count of 400.

As part of our services, representatives from Bartelt Engineering have reviewed the operational methods for the winery with our Client, reviewed the parcel files at Napa County PBES, held conversations with Napa County PBES staff, performed a reconnaissance of the site to view existing conditions and conducted a site evaluation on November 8, 2018 to evaluate the feasibility of installing a new onsite sanitary wastewater dispersal system to serve the existing winery, offices, and tasting room.

This study prepared by Bartelt Engineering is provided to demonstrate that the proposed sanitary wastewater system improvements can feasibly be developed and that all sanitary wastewater can be adequately treated and dispersed onsite.

WASTEWATER FLOW CALCULATIONS

Existing Pressure Distribution Field Dispersal Capacity

Site evaluations were conducted on June 22, 1993 and May 29, 1996 by Napa Septic Tank Service and on November 4, 1998 by Bartelt Engineering. The site evaluation results showed useable soil up to 72 inches. The site evaluation conducted by Bartelt Engineering on November 4, 1998 was to verify subsurface soil conditions examined during an earlier site evaluation performed on May 29, 1996. Based on the finding of an acceptable percolation rate of 3 inches per hour at 48 inches below ground surface, a pressure distribution type wastewater disposal system was installed by Harold Smith & Sons in the summer of 1999.

- Site slope: 2% to 4%
- Soil Type: Sandy Clay Loam / Gravely Clay Loam / Gravely Loam
- Assigned Perc Rate: 3 inches/hr to 6 inches/hr, use 3 inches/hr
  Perc Rate = 3 inches/hour = 20 min/in
- From Table 3, Soil Hydraulic Loading Rates Based on Percolation Rates[4]:
  Converted perc rate = 0.657 gal/sf/day
- Total Existing Peak Estimated Wastewater Flow = 11,980 gpd*
  *(From September 1999 feasibility study prepared by Bartelt Engineering)
- Total lineal feet of pressure distribution lateral installed = 6,228 lf*
  *(From Rombauer Vineyards Septic System Design Record Drawing, dated October 1999 prepared by Bartelt Engineering)

An 18 inch deep trench was used for the pressure distributed leach lines which corresponds to 3 square feet of sidewall area per lineal foot of trench. Distribution lines were placed at grade to 3 inches below grade with 12 inches of imported fill and trench spoils placed over the trenches.

$$\text{Minimum required length of trench}^4 = \frac{11{,}980 \text{ gal/day}}{0.657 \text{ gal/sf/day}} \times \frac{1 \text{ lf}}{3 \text{ sf sidewall}} = 6{,}078 \text{ lf}$$

[4] Referenced from Napa County Regulations for Design, Construction, and Installation of Alternative Sewage Treatment Systems, 2014.

The dispersal capacity of the pressure distribution field can be calculated based on a total of 6,228 lf of leach line installed.

Pressure Distribution Dispersal Capacity =

$$(6{,}228\ lf\ of\ lateral)\ x\left(\frac{3\ sf\ sidewall}{1\ lf\ of\ lateral}\right)x(0.657\ gal/sf/day)=12{,}275\ gal/day$$

The Use Permit Modification is not proposing any changes to wine production nor is it proposing improvements to the existing process wastewater system.

Daily Winery Sanitary Wastewater Flow

The sanitary wastewater generated in gallons per day (gpd) at the facility includes both full and part-time employees, daily tours, tastings and daily food and wine pairings and can be itemized as follows:

Employees:

- (55 full-time employees) x (15.0 gpd per employee) = 825 gpd
- (6 part-time employees) x (15.0 gpd per employee) = 90 gpd
- (20 seasonal (harvest) employees) x (15.0 gpd per employee) = 300 gpd

Private Tours and Tastings:

- (400 guests/day) x (2.2 gal/guest for restroom) x (50% usage) = 440 gpd
- (400 wine glasses per day) x (2.4 gallons[5]/45 wine glasses) = 22± gpd

Food (cheese) and Wine Pairings:

- (80 small plates per day) x (2.4 gallons[6]/25 small plates) = 8± gpd

Special Marketing Event Sanitary Wastewater Flow

The sanitary wastewater generated for each special marketing event can be itemized as follows:

> ***Note:*** *This feasibility study assumes that portable toilets, offsite meal preparation and catering services are utilized during the Marketing Events regardless of the season and that 30% of the event guests and all of the catering staff are assumed to use the winery restrooms during these events. The remainder of the event guests (70%) will utilize the portable toilets.*

Marketing Events

- (350 guests) x (2.2 gal/guest for restroom usage) x (30% guest usage) = 231 gpd
- (20 outside catering staff) x (2.2 gal/staff for restroom usage) = 44 gpd
- Wine glasses are given to guests to take home

[5] Glass Dishwasher water use is 2.4 gallons per cycle for 45 wine glasses per cycle; Hobart Dishmachine SR24.

[6] Glass Dishwasher (small plates) water use is 2.4 gallon per cycle for 25 dishes per cycle; Hobart Dishmachine SR24.

Wine Auction Event (2-4 hours):

- (40 guests) x (2.2 gal/guest for restroom usage) = 88 gpd
- (5 outside catering staff) x (2.2 gal/staff for restroom usage) = 11 gpd
- (40 guests) x (4 wine glasses per guest) x (2.4 gallons[5]/45 glasses) = 9± gpd

Barrel Tasting Event (2-4 hours):

- (40 guests) x (2.2 gal/guest for restroom usage) = 88 gpd
- (5 outside catering staff) x (2.2 gal/staff for restroom usage) = 11 gpd
- (40 guests) x (1 wine glass per guest) x (2.4 gallons[7]/45 glasses) = 3± gpd

Lunch or Dinner Events (2-4 hours):

- (60 guests) x (2.2 gal/guest for restroom usage) = 132 gpd
- (5 outside catering staff) x (2.2 gal/staff for restroom usage) = 11 gpd
- (60 guests) x (4 glasses per guest) x (2.4 gallons[7]/45 glasses) = 13± gpd

Total Harvest Season and Non-Harvest Season Peak Sanitary Wastewater Flow

The total proposed harvest season peak sanitary wastewater flow is the combination of the facilities employee and marketing events sanitary wastewater flows during the months of harvest. The total proposed non-harvest season peak sanitary wastewater flow is the combination of the facilities employee and marketing events sanitary wastewater flows during the months of non-harvest.

Table 3A uses the marketing schedule to calculate the sanitary wastewater flows generated by employees and guests during daily event sequences in harvest and non-harvest seasons. Wastewater flows in the same column indicate the events may occur on the same day.

[7] Glass Dishwasher water use is 2.4 gallons per cycle for 45 wine glasses per cycle; Hobart Dishmachine SR24.

TABLE 3A: HARVEST AND NON-HARVEST SEASON DAILY SANITARY WASTEWATER FLOWS										
	Daily Occurrence									
	Harvest					Non-Harvest				
Full-time Employees	825	825	825	825	825	825	825	825	825	825
Part-time Employees	90	90	90	90	90	90	90	90	90	90
Seasonal Employees	300	300	300	300	300					
Private Tours & Tastings[8]	462		415	415	392	462		415	415	392
Food & Wine Pairings[9]	8		8	8	8	8		8	8	8
Marketing Events[10]		275					275			
Wine Auction Event[8, 11]			108					108		
Barrel Tasting Event[8, 11]				102					102	
Lunch / Dinner Events[8, 11]					156					156
Total Flow (gpd)	1,685	1,490	1,746	1,740	1,771	1,385	1,190	1,446	1,440	1,471

Table 3A shows that the greatest sanitary wastewater flow during the harvest and non-harvest seasons is generated during a typical staffing day with Tours/Tastings, Food & Wine Pairings, and Lunch or Dinner Events hosted at the winery.

Peak Sanitary Wastewater Flow

The peak sanitary wastewater flows during harvest and non-harvest periods is summarized in the following table:

TABLE 3B: HARVEST AND NON-HARVEST SEASON PEAK WASTEWATER SUMMARY			
Wastewater Source	**Harvest**		**Non-Harvest**
	(gpd)		(gpd)
Sanitary Wastewater	Employees	1,215	915
	Hospitality	556	556
Dispersal Field Capacity	1,771		1,471

[8] Number of Guests for Private Tours and Tastings is reduced when wine auction events, barrel tasting events and lunch/dinner events are held.

[9] Number of Guests per event are included in the maximum daily visitor count of 400.

[10] Event cannot be held the same day of tours & tasting, barrel tastings, lunch/dinner events, or wine auction related events; portable toilets are required for all events.

[11] Events cannot be held on the same day with any other event, but can be held in conjunction with tours & tastings such that the combination is not to exceed a maximum daily visitor count of 400.

WASTEWATER TREATMENT AND DISPERSAL METHODS

The proposed sanitary wastewater system is discussed further in the following sections. Refer to the associated Dispersal Field Exhibit prepared by Bartelt Engineering for location of the proposed primary and replacement dispersal areas.

Proposed Sanitary Wastewater Subsurface Drip Dispersal Field with Pretreatment

As summarized in Table 3B, the calculated dispersal field capacity is 1,771 gpd. This study proposes that the sanitary wastewater dispersal field be designed to have a peak daily flow of 2,500 gpd. The winery production facility, offices and tasting room sanitary wastewater would continue to gravity flow to a series of existing septic tanks. From the septic tanks, sanitary wastewater effluent will flow by gravity to a new recirculation/dose tank. From the recirculation/dose tank, stored effluent is pumped to a new Orenco AdvanTex AX Pretreatment System (or approved equal). Pretreated effluent is proposed to be dispersed through a subsurface drip field by means of a timed-dose pumping system.

Based on the site evaluation performed by Bartelt Engineering on November 8, 2018, suitable area is available onsite for a subsurface drip dispersal field. The primary dispersal area is proposed to be located near test pits #1 and #10 which has an observed depth of 48 inches with Clay Loam and Sandy Clay Loam soils. Napa County Standards require a minimum of 24 inches of acceptable soil below the bottom of the drip lines with a minimum of six (6) inches of acceptable soil cover material placed over the drip lines. For Clay Loam type soil, GeoFlow Incorporated recommends a soil hydraulic loading rate[12] of 0.60 gal/sf/day for pretreated effluent.

The minimum required primary area for the subsurface drip field is calculated below:

$$\text{Subsurface Drip Field Area} = \frac{\text{Design Flow Rate}}{\text{Hydraulic Loading Rate}} = \frac{2{,}500 \text{ gallons per day}}{0.60 \text{ gallons/ft}^2\text{/day}} = 4{,}167 \text{ ft}^2$$

Based on site slopes of 13% or less in the primary area, a two (2) foot spacing is recommended between driplines per Napa County Standards. The recommended drip field contains 42 driplines each 60± feet long. The total recommended primary area is 5,800± square feet.

Sanitary Wastewater 200% Replacement Area

The replacement area is proposed to be located near test pits #2 through #9 which had an observed depth of 36 to 70 inches with Clay Loam and Sandy Clay Loam soils. The same application rate (0.6 gal/sf/day) used for the primary area is used to size the 200% replacement area, as shown below:

$$\text{Replacement area} = 200\% \times \frac{2{,}500 \text{ gallons per day}}{0.60 \text{ gallons/ft}^2\text{/day}} = 8{,}333 \text{ ft}^2$$

[12] Referenced from *Table 1 Drip Loading Rates Considering Soils Structure* of The Subsurface Drip Dispersal and Reuse Design, Installation and Maintenance Guidelines prepared by GeoFlow Incorporated.

Based on site slopes of 13% or less in the replacement area, a two (2) foot spacing is recommended between driplines per Napa County Standards. The recommended replacement area is 11,700± square feet.

WASTEWATER TREATMENT TANK SIZING

Septic Tank(s)

The existing sanitary wastewater septic tank(s) are proposed to be utilized with the proposed improvements unless their existing condition is reported to be inadequate for continued use by a licensed contractor. Any new septic tank(s) will be sized to provide a minimum of three (3) days of hydraulic retention time during peak wastewater flows. Furthermore, the septic tank(s) will also be equipped with an effluent filter to aid in the reduction of Total Suspended Solids (TSS) and Biochemical Oxygen Demand (BOD) in the wastewater effluent stream.

Existing Septic and Sump Tanks

The existing septic and sump tanks are shown as follows:

Septic Tank Wastewater Source	Peak Flow (gpd)	Retention Time (days)	Existing Tankage Capacity (gallons)
Winery Sanitary	885	5.1	4,500
Administration Sanitary	330	4.5	1,500
Event Sanitary	556	8.1	4,500

Recirculation Tank

The proposed recirculation tank is sized to provide a minimum of one (1) day of hydraulic retention time during peak wastewater flows. Below is a summary of the recommended tank volume:

Tank Volume = 1 day x 2,500 gallons
= 2,500 gallons, 3,000 gallons recommended

Subsurface Drip Dosing Tank

The proposed dosing tank is sized to provide a minimum of a half (0.5) days of hydraulic retention time during peak wastewater flows. Below is a summary of the recommended tank volume:

Tank Volume = 0.5 days x 2,500 gpd
= 1,250 gallons, 1,500 gallons recommended

OPERATION AND MAINTENANCE

Per Napa County requirements, the sanitary wastewater system is classified as an Alternative Sewage Treatment Systems (ASTS) and therefore must have a Service Provider. The Service Provider would be assigned prior to operation and final approval of the installed wastewater system.

SUMMARY & CONCLUSIONS

Sanitary wastewater generated from the existing winery and hospitality building is anticipated to increase as a result of the proposed changes to the staff and marketing plan.

The project proposes to install a new subsurface drip dispersal field and pretreatment system to accommodate the increase in sanitary wastewater flows. This study demonstrates that all sanitary wastewater generated from the proposed increase in the number of employees and guests can feasibly be treated and dispersed onsite. Modifications to the approved wine production capacity and process wastewater system are not proposed as part of this Use Permit Modification.

Full design calculations and improvement plans will be completed after approval of the Use Permit Modification under consideration.

ATTACHMENTS

Dispersal Field Exhibit

Site Evaluation Report

REFERENCES

California Onsite Wastewater Association (COWA). "Pumping and Pressure Distribution Systems." May 1998.

Geoflow, Inc. Wastewater Design, Installation and Maintenance Guidelines. v1, 2007.

Napa County Department of Environmental Management. "Regulatons for Design, Construction, and Installation of Alternative Sewage Treatment Systems." October 22, 2014.

Telsco Industries. "Turf Irrigation Manual." By James A. Watkins. 1987.

U.S. Department of Health, Education and Welfare, Public Health Service Publication. Manual of Septic-Tank Practice. 1967.

U.S. Environmental Protection Agency. "Onsite Wastewater Treatment Systems Manual." February 2002.

Napa County Planning, Building and Environmental Services, “Napa County Onsite Wastewater Treatment Systems (OWTS) Technical Standards.” Final Draft.

Orenco Systems, Incorprated. “AdvanTex Design Criteria for Commercial Treatment Systems”. Rev.1.6. January 2016.

Napa County Department of
Environmental Management

SITE EVALUATION REPORT

Please attach an 8.5" x 11" plot map showing the locations of all test pits triangulated from permanent landmarks or known property corners. The map must be drawn to scale and include a North arrow, surrounding geographic and topographic features, direction and % slope, distance to drainages, water bodies, potential areas for flooding, unstable landforms, existing or proposed roads, structures, utilities, domestic water supplies, wells, ponds, existing wastewater treatment systems and facilities.

Permit #: E18-00860
APN: 021-410-025
(County Use Only) Reviewed by: Date:

PLEASE PRINT OR TYPE ALL INFORMATION

Property Owner Koerner Rombauer Revocable Trust and Joan K. Rombauer Marital Trust B	☐ New Construction ☐ Addition ☐ Remodel ☐ Relocation ☒ Other:
Property Owner Mailing Address 3522 Silverado Trail	☐ Residential - # of Bedrooms: Design Flow : gpd
City State Zip St. Helena, CA 94574	☒ Commercial – Type: Winery Sanitary Waste: 2,500 gpd Process Waste: gpd
Site Address/Location 3522 Silverado Trail, St. Helena, CA	☐ Other: Sanitary Waste: gpd Process Waste: gpd

Evaluation Conducted By:

Company Name Bartelt Engineering	Evaluator's Name Richard Paxton, P.E.	Signature (Civil Engineer, R.E.H.S., Geologist, Soil Scientist) Richard Paxton
Mailing Address: 1303 Jefferson Street, 200 B		Telephone Number (707) 258-1301
City State Zip Napa CA 94559		Date Evaluation Conducted November 8, 2018

Primary Area See below	Expansion Area See below
Acceptable Soil Depth: 54 & 48 in. Test pits #: 1 & 10	Acceptable Soil Depth: 36 to 70 in. Test pits #: 2, 3, 4, 5, 6, 7, 8 & 9
Soil Application Rate (gal. /sq. ft. /day): 0.6	Soil Application Rate (gal. /sq. ft. /day): 0.6
System Type(s) Recommended: Subsurface Drip	System Type(s) Recommended: Subsurface Drip
Slope: 12% to 13%. Distance to nearest water source: 100+ feet	Slope: 7% to 14%. Distance to nearest water source: 100+ feet
Hydrometer test performed? No ☐ Yes ☒ (attach results)	Hydrometer test performed? No ☐ Yes ☒ (attach results)
Bulk Density test performed? No ☒ Yes ☐ (attach results)	Bulk Density test performed? No ☒ Yes ☐ (attach results)
Groundwater Monitoring Performed? No ☒ Yes ☐ (attach results)	Groundwater Monitoring Performed? No ☒ Yes ☐ (attach results)

Site constraints/Recommendations:

A site evaluation was conducted on November 8, 2018 by Paul Bartelt, Rich Paxton, Christina Nicholson, Nick Warnock and Lucero Cervantes of Bartelt Engineering. Test pits were excavated by Taylor Bailey Construction using a 420 D CAT backhoe with a 24 inch bucket. Darrel Choate of Napa County Environmental Health visited the site to inspect soil conditions. Test pits # 1 through #11 showed suitable soil for the installation of an Alternative Sewage Treatment System (ASTS) Subsurface Drip dispersal field within the area tested with required reserve area.

Test Pit # 1 * Hydrometer Test Performed

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-30*	C	30-50	CL	M, SB	SH	VFRB	SS, P	MVF, CF	MF, CC	None
30-54*	G	30-50	SCL	M, SB	S	VFRB	SS, P	MVF, CF	FF	None
54-66		>50	Decomposing Rock Layer							None

Slope = 13%. Acceptable soil depth observed: 54 inches.
Assigned soil application rate = STE 0.25 gal/sf/day for a Conventional – Standard System
STE 0.35 gal/sf/day for ASTS
PTE 0.50 gal/sf/day for ASTS
Subsurface Drip = 0.6 gal/sf/day (per Napa County Soil Application Rates)
Subsurface Drip = 0.6 gal/sf/day (per recommended Geoflow Drip Loading Rates)

No refusal at 66 inches deep. Limiting condition found at 54 inches deep.
No groundwater observed. *See attached Soil Texture Analysis by Bouyoucos Hydrometry Method prepared by RGH Consultants, Inc. dated November 28, 2018.

Test Pit # 2 * Hydrometer Test Performed

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-24*	C	30-50	SCL	M, SB	S	VFRB	SS, P	FF	MF	None
24-64*	G	30-50	CL	M, SB	S	VFRB	SS, P	CF, CM, CC	CC	None
64-68		0-15	Decomposing Rock Layer							None

Slope = 11%. Acceptable soil depth observed: 64 inches.
Assigned soil application rate = STE 0.25 gal/sf/day for a Conventional – Standard System
STE 0.35 gal/sf/day for ASTS
PTE 0.50 gal/sf/day for ASTS
Subsurface Drip = 0.6 gal/sf/day (per Napa County Soil Application Rates)
Subsurface Drip = 0.6 gal/sf/day (per recommended Geoflow Drip Loading Rates)

Refusal at 68 inches deep. Limiting condition found at 64 inches deep.
No groundwater observed. *See attached Soil Texture Analysis by Bouyoucos Hydrometry Method prepared by RGH Consultants, Inc. dated November 28, 2018.

Test Pit # 3

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-54	G	30-50	SCL	M, SB	H	VFRB	SS, P	MVF, CF	FC, CF	None
54-67		>50	Decomposing Rock Layer							None

Slope = 10%. Acceptable soil depth observed: 54 inches.
Assigned soil application rate = STE 0.33 gal/sf/day for a Conventional – Standard System
STE 0.50 gal/sf/day for ASTS
PTE 0.75 gal/sf/day for ASTS
Subsurface Drip = 0.7 gal/sf/day (per Napa County Soil Application Rates)
Subsurface Drip = 0.6 gal/sf/day (per recommended Geoflow Drip Loading Rates)

No refusal at 67 inches deep. Limiting condition found at 54 inches deep.
No Groundwater observed.

Test Pit # 4

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-25	A	30-50	SCL	M, SB	S	FRB	SS, P	CF, CM	FF, FM	None
25-54	C	30-50	SCL	M, SB	SH	FRB	SS, P	CF, CM	FF, FM	None
54-58		0-15	C	M	VH	VF	N/A	CF	None	None

Slope = 12%. Acceptable soil depth observed: 54 inches.
Assigned soil application rate = STE 0.33 gal/sf/day for a Conventional – Standard System
STE 0.50 gal/sf/day for ASTS
PTE 0.75 gal/sf/day for ASTS
Subsurface Drip = 0.7 gal/sf/day (per Napa County Soil Application Rates)
Subsurface Drip = 0.6 gal/sf/day (per recommended Geoflow Drip Loading Rates)

No refusal at 58 inches deep. Limiting condition found at 54 inches deep.
No groundwater observed.

Test Pit # 5 * Hydrometer Test Performed

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-36*	C	30-50	SCL	M, SB	SH	VFRB	SS, P	MVF, CF	CF, FC, FM	None
36-48		>50	SCL	Decomposing Rock Layer						None

Slope = 9%. Acceptable soil depth observed: 36 inches.
Assigned soil application rate = Insufficient soil depth for a Conventional – Standard System
STE 0.50 gal/sf/day for ASTS
PTE 0.75 gal/sf/day for ASTS
Subsurface Drip = 0.7 gal/sf/day (per Napa County Soil Application Rates)
Subsurface Drip = 0.6 gal/sf/day (per recommended Geoflow Drip Loading Rates)

No refusal at 48 inches deep. Limiting condition found at 36 inches deep.
No groundwater observed. *See attached Soil Texture Analysis by Bouyoucos Hydrometry Method prepared by RGH Consultants, Inc. dated November 28, 2018.

Test Pit # 6 * Hydrometer Test Performed

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-27*	C	30-50	SCL	S, SB	SH	FRB	S, P	CF	FF	None
27-53*	G	30-50	L	M, SB	S	FRB	S, P	FVF, FF	FF, FC, FM	None
53-66*		0-15	SCL	M, SB	SH	VFRB	SS, P	CVF	FM	None

Slope = 13%. Acceptable soil depth observed: 66 inches.
Assigned soil application rate = STE 0.33 gal/sf/day for a Conventional – Standard System
STE 0.50 gal/sf/day for ASTS
PTE 0.75 gal/sf/day for ASTS
Subsurface Drip = 0.6 gal/sf/day (per Napa County Soil Application Rates)
Subsurface Drip = 0.6 gal/sf/day (per recommended Geoflow Drip Loading Rates)

No refusal at 66 inches deep.
No groundwater observed. *See attached Soil Texture Analysis by Bouyoucos Hydrometry Method prepared by RGH Consultants, Inc. dated November 28 , 2018.

Test Pit # 7

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-52	G	30-50	SCL	M, SB	SH	VFRB	SS, P	MF, CF, MVF	FF, CM, FC	None
52-66		30-50	SCL	M, SB	SH, H	FRB	SS, P	MF, MVF	None	None

Slope = 8%. Acceptable soil depth observed: 66 inches.
Assigned soil application rate = STE 0.33 gal/sf/day for a Conventional – Standard System
STE 0.50 gal/sf/day for ASTS
PTE 0.75 gal/sf/day for ASTS
Subsurface Drip = 0.7 gal/sf/day (per Napa County Soil Application Rates)
Subsurface Drip = 0.6 gal/sf/day (per recommended Geoflow Drip Loading Rates)

No refusal at 66 inches deep.
No groundwater observed.

Test Pit # 8

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-36	C	30-50	SCL	M, SB	SH	FRB	SS, P	FF	FF	None
36-54	G	15-30	SCL	M, SB	SH	FRB	SS, P	CVF, CF	FF	None
54-70		15-30	SCL	M, SB	SH	FRB	SS, P	CVF, CF	FF	None

Slope = 13%. Acceptable soil depth observed: 70 inches.
Assigned soil application rate = STE 0.33 gal/sf/day for a Conventional – Standard System
STE 0.50 gal/sf/day for ASTS
PTE 0.75 gal/sf/day for ASTS
Subsurface Drip = 0.7 gal/sf/day (per Napa County Soil Application Rates)
Subsurface Drip = 0.6 gal/sf/day (per recommended Geoflow Drip Loading Rates)

No refusal at 70 inches deep.
No groundwater observed.

Test Pit # 9 * Hydrometer Test Performed

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-50*	G	30-50	SCL	M, SB	SH, H	FRB	SS, P	MF, MVF	FC, CM, MF, MVF	None
50-66		>50	Decomposing Rock Layer							None

Slope = 7%. Acceptable soil depth observed: 50 inches.
Assigned soil application rate = Insufficient soil depth for a Conventional – Standard System
STE 0.50 gal/sf/day for ASTS
PTE 0.75 gal/sf/day for ASTS
Subsurface Drip = 0.7 gal/sf/day (per Napa County Soil Application Rates)
Subsurface Drip = 0.6 gal/sf/day (per recommended Geoflow Drip Loading Rates)

No refusal at 66 inches deep. Limiting condition found at 50 inches deep.
No groundwater observed. *See attached Soil Texture Analysis by Bouyoucos Hydrometry Method prepared by RGH Consultants, Inc. dated November 28, 2018.

Test Pit # 10 * Hydrometer Test Performed

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-26*	C	30-50	CL	M, SB	H	FRB	SS, P	MF, CM	MF, MVF, FM	None
26-48*	G	30-50	SCL	M, SB	H	FRB	SS, P	MF, MVF	None	None
48-56		>50	Granite/Decomposing Rock Layer							None

Slope = 13%. Acceptable soil depth observed: 48 inches.
Assigned soil application rate = Insufficient soil depth for a Conventional – Standard System
STE 0.35 gal/sf/day for ASTS
PTE 0.50 gal/sf/day for ASTS
Subsurface Drip = 0.6 gal/sf/day (per Napa County Soil Application Rates)
Subsurface Drip = 0.6 gal/sf/day (per recommended Geoflow Drip Loading Rates)

No refusal at 56 inches deep. Limiting condition found at 48 inches deep.
No groundwater observed. *See attached Soil Texture Analysis by Bouyoucos Hydrometry Method prepared by RGH Consultants, Inc. dated November 28, 2018.

Test Pit # 11

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-40	C	15-30	SCL	M, SB	SH, H	FRB	SS, P	MF, FM, MVF	MF, MVF, CM	None
40-54	C	0-15	Massive Clay							None
54-66		>50	Decomposing Rock Layer							None

Slope = 20%. Acceptable soil depth observed: 40 inches.
Assigned soil application rate = Insufficient soil depth for a Conventional – Standard System
STE 0.50 gal/sf/day for ASTS
PTE 0.75 gal/sf/day for ASTS
Subsurface Drip = 0.7 gal/sf/day (per Napa County Soil Application Rates)
Subsurface Drip = 0.6 gal/sf/day (per recommended Geoflow Drip Loading Rates)

No refusal at 66 inches deep. Limiting condition found at 40 inches deep.
No groundwater observed.

Table of Abbreviations

Boundary	Texture	Structure	Consistence			Pores	Roots	Mottling
			Side Wall	Ped	Wet			
A=Abrupt <1" **C**=Clear 1"-2.5" **G**=Gradual 2.5"-5" **D**=Difuse >5"	**S**=Sand **LS**=Loamy Sand **SL**=Sandy Loam **SCL**=Sandy Clay Loam **SC**=Sandy Clay **CL**=Clay Loam **L**=Loam **C**=Clay **SiC**=Silty Clay **SiCL**=Silty Clay Loam **SiL**=Silt Loam Si=Silt	**W**=Weak **M**=Moderate **S**=Strong --- **G**=Granular **PL**=Platy **Pr**=Prismatic **C**=Columnar **AB**=Angular Blocky **SB**=Subangular Blocky --- **M**=Massive **C**=Cemented	**L**=Loose **S**=Soft **SH**=Slighty Hard **H**=Hard **VH**=Very Hard **ExH**=Extremely Hard	**L**=Loose **VFRB**=Very Friable **FRB**=Friable **F**=Firm **VF**=Very Firm **ExF**=Extremely Firm	**NS**=NonSticky **SS**=Slightly Sticky **S**=Sticky **VS**=Very Sticky --- **NP**=NonPlastic **SP**=Slightly Plastic **P**=Plastic **VP**=Very Plastic	**Quantity:** **F**=Few **C**=Common **M**=Many **Size:** **VF**=Very Fine **F**=Fine **M**=Medium **C**=Coarse	**Quantity:** **F**=Few **C**=Common **M**=Many **Size:** **VF**=Very Fine **F**=Fine **M**=Medium **C**=Coarse **VC**=Very Course	**Quantity:** **F**=Few **C**=Common **M**=Many **Size:** **F**=Fine **M**=Medium **C**=Coarse **VC**=Very Course **ExC**=Extremely Coarse **Contrast:** **Ft**=Faint **D**=Distinct **P**=Prominent

Attach additional sheets as needed

Conventional Sewage Treatment System Soil Application Rates

TEXTURE	STRUCTURE		APPLICATION RATE (Gal/ft^2/day)
	Shape	Grade	STE
Coarse Sand, Sand, Loamy Coarse Sand	Single grain	Structureless	Prohibited
Sandy Loam, Loamy Sand	Massive	Structureless	Prohibited
	Platy	Weak, mod, strong	Prohibited
	Prismatic, blocky, granular	Weak	0.33
		Moderate, strong	0.5
Loam, Silt Loam, Sandy Clay Loam, Fine Sandy Loam	Massive	Structureless	Prohibited
	Platy	Weak, mod, strong	Prohibited
	Prismatic, blocky, granular	Weak	0.25
		Moderate, Strong	0.33
Clay Loam	Massive	Structureless	Prohibited
	Platy	Weak, moderate, strong	Prohibited
	Prismatic, blocky, granular	Weak, moderate	0.25
		Strong	0.33
Sandy Clay, Silty Clay Loam	Massive	Structureless	Prohibited
	Platy	Weak, moderate, strong	Prohibited
	Prismatic, blocky, granular	Weak, moderate	Prohibited
		Strong	0.25
Clay, Silty Clay	Massive	Structureless	Prohibited
	Platy	Weak, moderate, strong	Prohibited
	Prismatic, blocky, granular	Weak	Prohibited
		Moderate, strong	Prohibited

CONVENTIONAL SEWAGE TREATMENT SYSTEM SOIL APPLICATION RATES BASED ON PERCOLATION RATES	
Percolation Rate (mpi)	Application Rate (STE)
< 5 MPI	Prohibited
5 to 10 MPI	0.5
10-20 MPI	0.33
20-60 MPI	0.25
> 60 MPI	Prohibited

Alternative Sewage Treatment System Soil Application Rates

TEXTURE	STRUCTURE		APPLICATION RATE (Gal/ft^2/day)	
	Shape	Grade	STE[1]	PTE[1,2]
Coarse Sand, Sand, Loamy Coarse Sand	Single grain	Structureless	1.0	1.2
Fine Sand, Loamy Fine Sand	Single grain	Structureless	0.6	1.0
Sandy Loam, Loamy Sand	Massive	Structureless	0.35	0.5
	Platy	Weak	0.35	0.5
	Prismatic, blocky, granular	Weak	0.5	0.75
		Moderate, Strong	0.8	1.0
Loam, Silt Loam, Sandy Clay Loam, Fine Sandy Loam	Massive	Structureless		
	Platy	Weak, moderate, strong		
	Prismatic, blocky, granular	Weak, moderate	0.5	0.75
		Strong	0.8	1.0
Sandy Clay, Silty Clay Loam, Clay Loam	Massive	Structureless		
	Platy	Weak, moderate, strong		
	Prismatic, blocky, granular	Weak, moderate	0.35	0.5
		Strong	0.6	0.75
Clay, Silty Clay	Massive	Structureless		
	Platy	Weak, moderate, strong		
	Prismatic, blocky, granular	Weak		
		Moderate, strong	0.2	0.25

1. See Table 1 in the Design, Construction and Installation of Alternative Sewage Treatment Systems.
2. A higher application rate for pretreated effluent may only be used when pretreatment is not used for one foot of vertical separation credit.

MINIMUM SURFACE AREA GUIDELINES TO DISPOSE OF 100 GPD OF SECONDARY TREATED EFFLUENT FOR SUBSURFACE DRIP DISPERSAL SYSTEMS

		Soil Absorption Rates		Design Application Rate (Gal/ft^2/day)	Total Area Required Sq. ft./100 gallons per day
Soil Class	Soil Type	Est. Soil Perc. Rate minutes/inch	Hydraulic Conductivity inches/hour		
I	Coarse sand	1 – 5	>2	1.400	71.5
I	Fine sand	5 – 10	1.5 – 2	1.200	83.3
II	Sandy loam	10 – 20	1.0 – 1.5	1.000	100.0
II	Loam	20 – 30	0.75 – 1.0	0.700	143.0
III	Clay loam	30 – 45	0.5 – 0.75	0.600	167.0
III	Silt - clay loam	45 – 60	0.3 – 0.5	0.400	250.0
IV	Clay non-swell	60 – 90	0.2 – 0.3	0.200	500.0
IV	Clay - swell	90 – 120	0.1 – 0.2	0.100	1000.0

1. For design purpose, the "Soil Type" category to be used in the above table shall be based on the most restrictive soil type encountered within two feet below the bottom of the drip line.
2. Dispersal field area calculation: Total square feet area of dispersal field = Design flow divided by loading rate.

TABLE 1

DRIP LOADING RATES CONSIDERING SOIL STRUCTURE.

Table 1 is taken from the State of Wisconsin code and was prepared by Jerry Tyler.
Provided for guidelines and budgeting purposes. Refer to your local regulations and qualified soil scientists to determine best loading rates.

Soil Textures	Soil Structure	Maximum Monthly Average **BOD_5<30mg/L TSS<30mg/L** (gallons/ft²/day)	Maximum Monthly Average **BOD_5>30mg/L TSS>30mg/L** (gallons/ft²/day)
Course sand or coarser	N/A	1.6	0.4
Loamy coarse sand	N/A	1.4	0.3
Sand	N/A	1.2	0.3
Loamy sand	Weak to strong	1.2	0.3
Loamy sand	Massive	0.7	0.2
Fine sand	Moderate to strong	0.9	0.3
Fine sand	Massive or weak	0.6	0.2
Loamy fine sand	Moderate to strong	0.9	0.3
Loamy fine sand	Massive or weak	0.6	0.2
Very fine sand	N/A	0.6	0.2
Loamy very fine sand	N/A	0.6	0.2
Sandy loam	Moderate to strong	0.9	0.2
Sandy loam	Weak, weak platy	0.6	0.2
Sandy loam	Massive	0.5	0.1
Loam	Moderate to strong	0.8	0.2
Loam	Weak, weak platy	0.6	0.2
Loam	Massive	0.5	0.1
Silt loam	Moderate to strong	0.8	0.2
Silt loam	Weak, weak platy	0.3	0.1
Silt loam	Massive	0.2	0.0
Sandy clay loam	Moderate to strong	0.6	0.2
Sandy clay loam	Weak, weak platy	0.3	0.1
Sandy clay loam	Massive	0.0	0.0
Clay loam	Moderate to strong	0.6	0.2
Clay loam	Weak, weak platy	0.3	0.1
Clay loam	Massive	0.0	0.0
Silty clay loam	Moderate to strong	0.6	0.2
Silty clay loam	Weak, weak platy	0.3	0.1
Silty clay loam	Massive	0.0	0.0
Sandy clay	Moderate to strong	0.3	0.1
Sandy clay	Massive to weak	0.0	0.0
Clay	Moderate to strong	0.3	0.1
Clay	Massive to weak	0.0	0.0
Silty clay	Moderate to strong	0.3	0.1
Silty clay	Massive to weak	0.0	0.0

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Bouyoucos Hydrometer

Client:	**Bartelt Engineering**	**Sampled:**	**Not Stated**
Project:	**Rombauer**	**Received:**	**11/13/2018**
Project #:	**9147.79**	**Reported:**	**11/28/2018**
Client Project #:	**96-07**		

Sample Number	TP-1	TP-1	TP-2	TP-2	TP-5	TP-6	TP-6	TP-6
Depth	Hor. 1	Hor. 2	Hor. 1	Hor. 2	Hor. 1	Hor. 1	Hor. 2	Hor. 3
A. Oven Dry Wt.	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
B. Starting Time (hr:min)	10:00	9:58	9:56	9:54	9:52	9:50	9:48	14:54
C. Temp. @ 40 sec. (F)	65.2	65.2	65.2	65.2	65.2	65.2	65.2	64.3
D. Hydro Reading @ 40 sec.	37.0	33.5	30.0	35.5	31.0	36.0	33.0	28.5
E. Comp. Correction	-6.5	-6.5	-6.5	-6.5	-6.5	-6.5	-6.5	-6.6
F. True Density @ 40 sec. (D-E)	30.5	27.0	23.5	29.0	24.5	29.5	26.5	21.9
G. Temp. @ 2 hrs. (F)	65.0	65.0	65.0	65.0	65.0	65.0	65.0	64.9
H. Hydro Reading @ 2 hrs.	22.5	20.0	17.0	22.0	17.0	21.0	17.5	17.0
I. Comp. Correction	-6.5	-6.5	-6.5	-6.5	-6.5	-6.5	-6.5	-6.5
J. True Density @ 2 hrs. (H-I)	16.0	13.5	10.5	15.5	10.5	14.5	11.0	10.5
K. % Sand=100-((F/A) x 100)	**39.0**	**46.0**	**53.0**	**42.0**	**51.0**	**41.0**	**47.0**	**56.2**
L. % Clay= ((J/A) x 100)	**32.0**	**27.0**	**21.0**	**31.0**	**21.0**	**29.0**	**22.0**	**21.0**
M. % Silt= 100-(K+L)	**29.0**	**27.0**	**26.0**	**27.0**	**28.0**	**30.0**	**31.0**	**22.8**
N. % Retained #10=	**25.7**	**20.9**	**27.4**	**14.3**	**30.6**	**25.2**	**12.6**	**9.4**
Dry Wt. Before Wash + Tare	922.5	953.3	979.7	1137.0	1269.0	1431.9	1345.0	1049.2
Dry Wt. After Wash + Tare	311.8	279.6	341.6	249.5	459.8	438.2	256.1	188.8
Dry Wt. Passing #10	610.7	673.7	638.1	887.5	809.2	993.7	1088.9	860.4
Tare Weight	100.6	101.1	100.3	101.9	102.5	103.0	98.9	100.0
Dry Wt. Before Wash	821.9	852.2	879.4	1035.1	1166.5	1328.9	1246.1	949.2
% Passing #10	74.3	79.1	72.6	85.7	69.4	74.8	87.4	90.6
% #10	25.7	20.9	27.4	14.3	30.6	25.2	12.6	9.4

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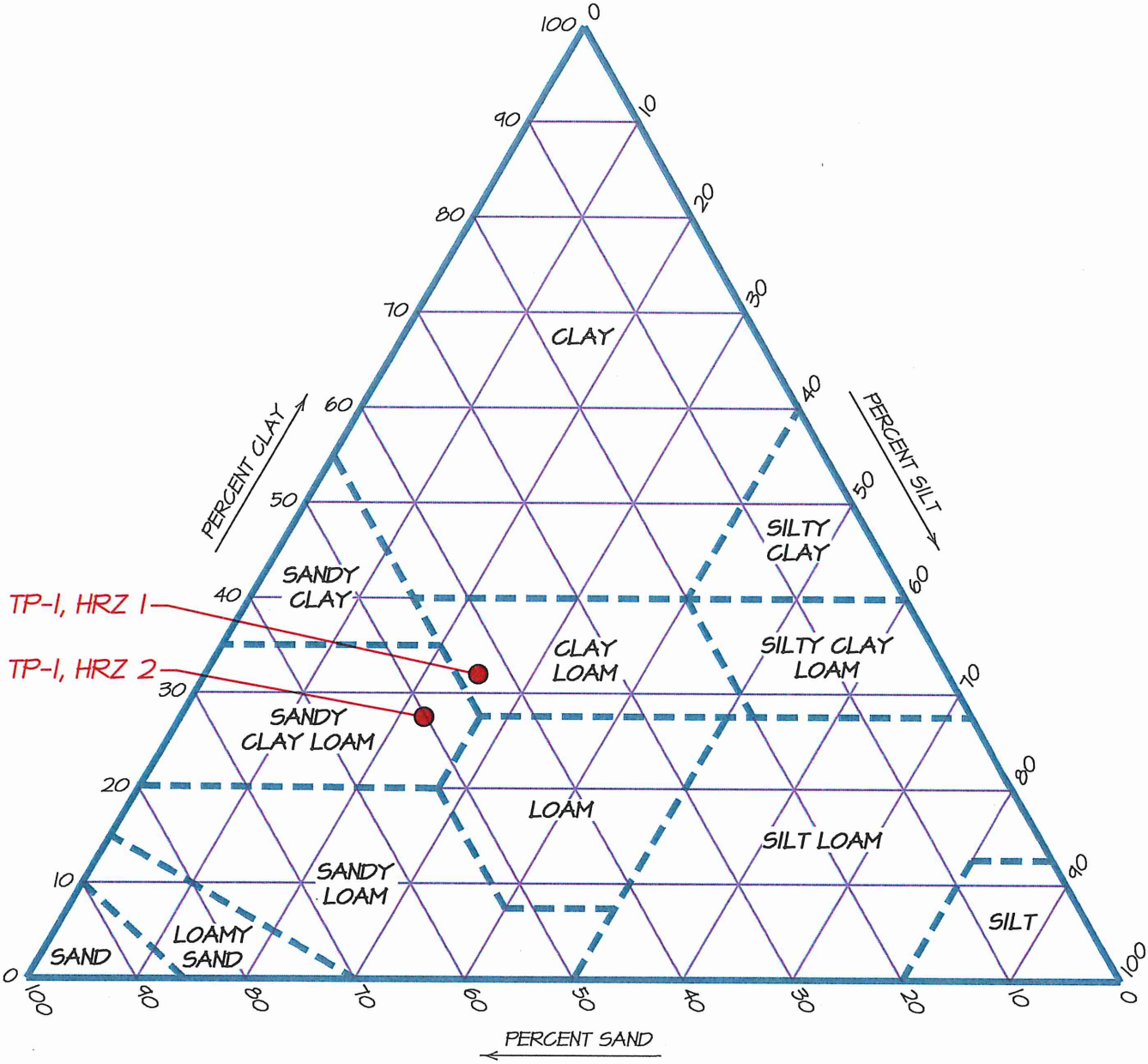
Bouyoucos Hydrometer

Client:	**Bartelt Engineering**	**Sampled:**	**Not Stated**
Project:	**Rombauer**	**Received:**	**11/13/2018**
Project #:	**9147.79**	**Reported:**	**11/28/2018**
Client Project #:	**96-07**		

Sample Number	TP-9	TP-10	TP-10					
Depth	Hor. 1	Hor. 1	Hor. 2					
A. Oven Dry Wt.	50.0	50.0	50.0					
B. Starting Time (hr:min)	14:52	14:50	14:48					
C. Temp. @ 40 sec. (F)	64.3	64.3	64.3					
D. Hydro Reading @ 40 sec.	33.5	39.0	34.5					
E. Comp. Correction	-6.6	-6.6	-6.6					
F. True Density @ 40 sec. (D-E)	26.9	32.4	27.9					
G. Temp. @ 2 hrs. (F)	64.9	64.9	64.9					
H. Hydro Reading @ 2 hrs.	18.5	24.0	19.5					
I. Comp. Correction	-6.5	-6.5	-6.5					
J. True Density @ 2 hrs. (H-I)	12.0	17.5	13.0					
K. % Sand=100-((F/A) x 100)	**46.2**	**35.2**	**44.2**					
L. % Clay= ((J/A) x 100)	**24.0**	**35.0**	**26.0**					
M. % Silt= 100-(K+L)	**29.8**	**29.8**	**29.8**					
N. % Retained #10=	**26.3**	**36.4**	**25.4**					
Dry Wt. Before Wash + Tare	1131.4	1476.1	1194.0					
Dry Wt. After Wash + Tare	373.6	602.0	380.6					
Dry Wt. Passing #10	757.8	874.1	813.4					
Tare Weight	103.4	101.7	103.4					
Dry Wt. Before Wash	1028.0	1374.4	1090.6					
% Passing #10	73.7	63.6	74.6					
% #10	26.3	36.4	25.4					

SOIL TEXTURE ANALYSIS CHART
BY BOUYOUCOS HYDROMETER METHOD



INSTRUCTIONS:

1. PLOT TEXTURE ON TRIANGLE BASED ON PERCENT SAND, SILT AND CLAY AS DETERMINED BY HYDROMETER ANALYSIS.
2. ADJUST FOR COARSE FRAGMENTS BY MOVING THE PLOTTED POINT IN THE SAND DIRECTION AN ADDITIONAL 2% FOR EACH 10% (BY VOLUME) OF FRAGMENTS GREATER THAN 2mm IN DIAMETER.
3. ADJUST FOR COMPACTNESS OF SOIL BY MOVING THE PLOTTED POINT IN THE CLAY DIRECTION AN ADDITIONAL 15% FOR SOILS HAVING A BULK-DENSITY GREATER THAN 1.7gm/cc.

NOTE:

FOR SOILS FALLING IN SAND, LOAMY SAND OR SANDY LOAM CLASSIFICATION, A BULK DENSITY ANALYSIS WILL GENERALLY NOT AFFECT SUITABILITY AND ANALYSIS IS NOT NECESSARY.

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Job No. 96-07 December 2018

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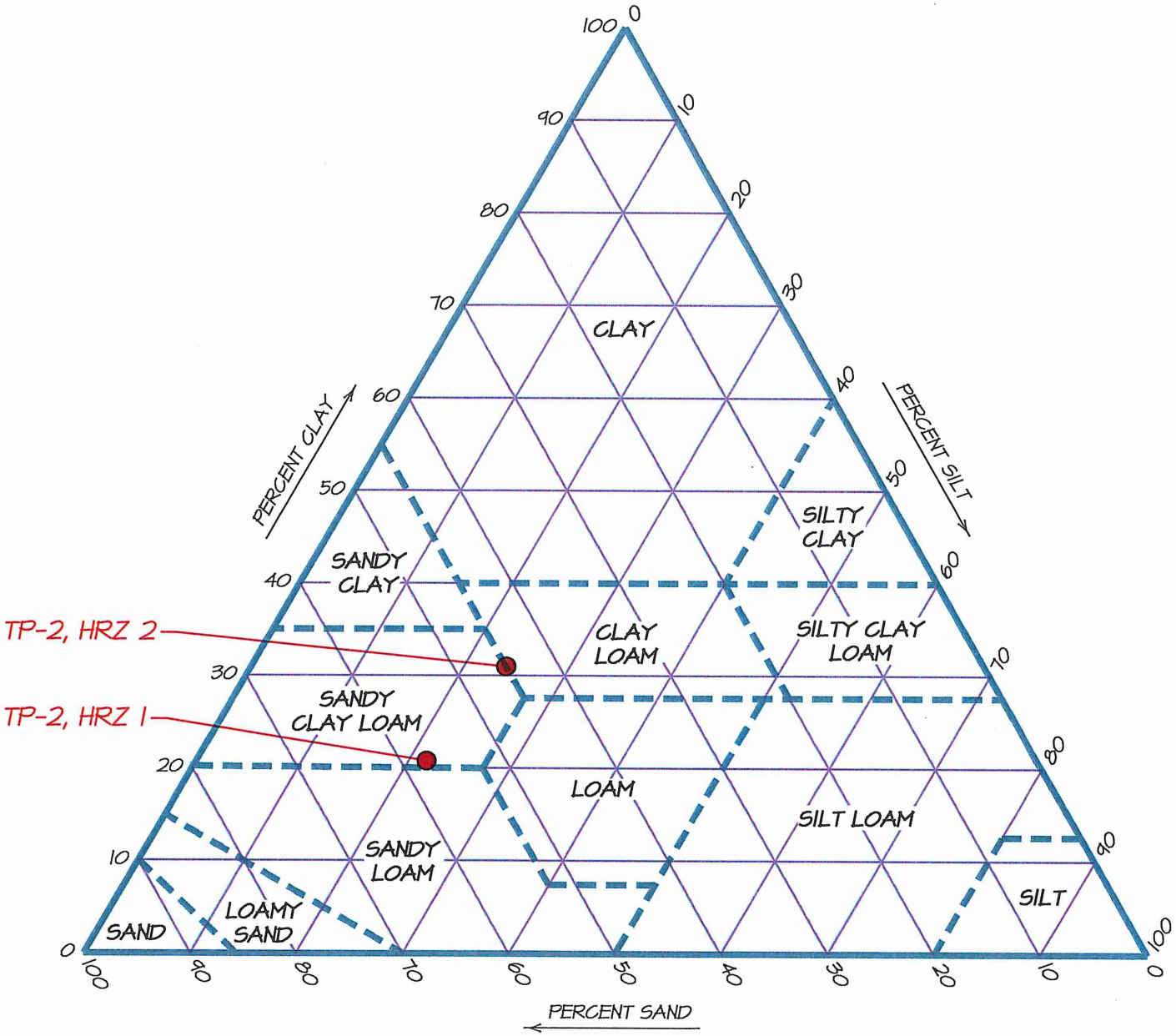

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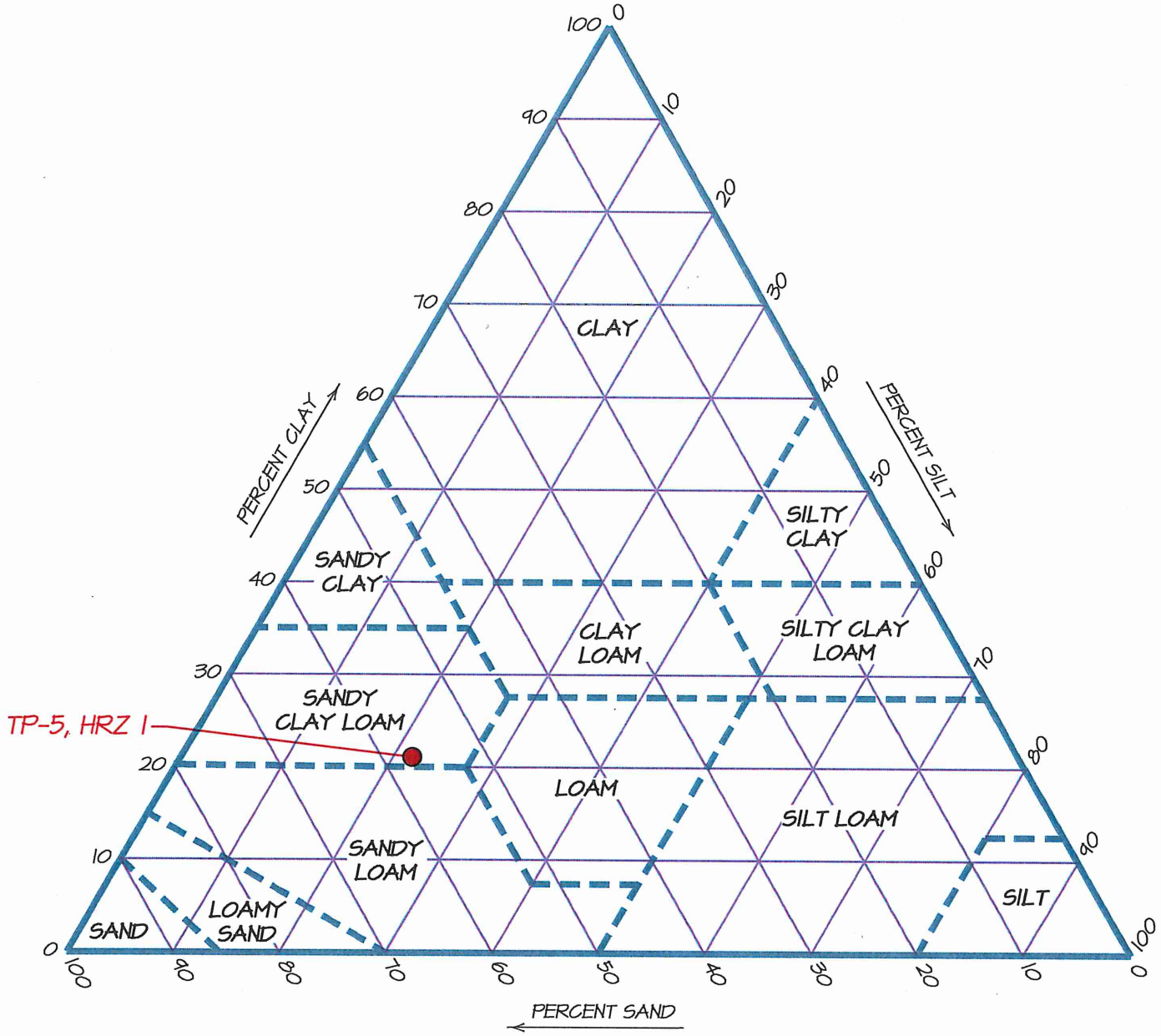

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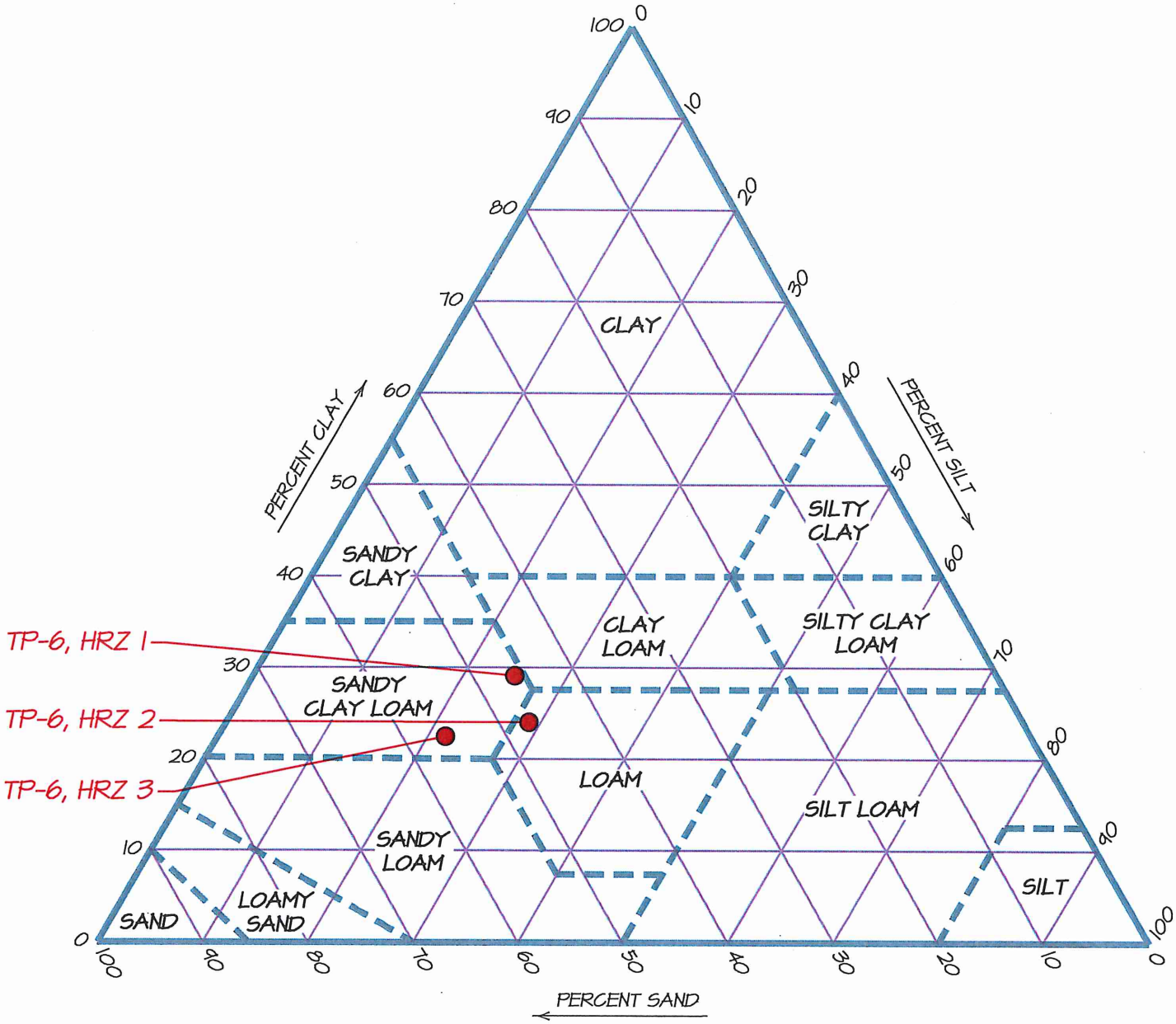

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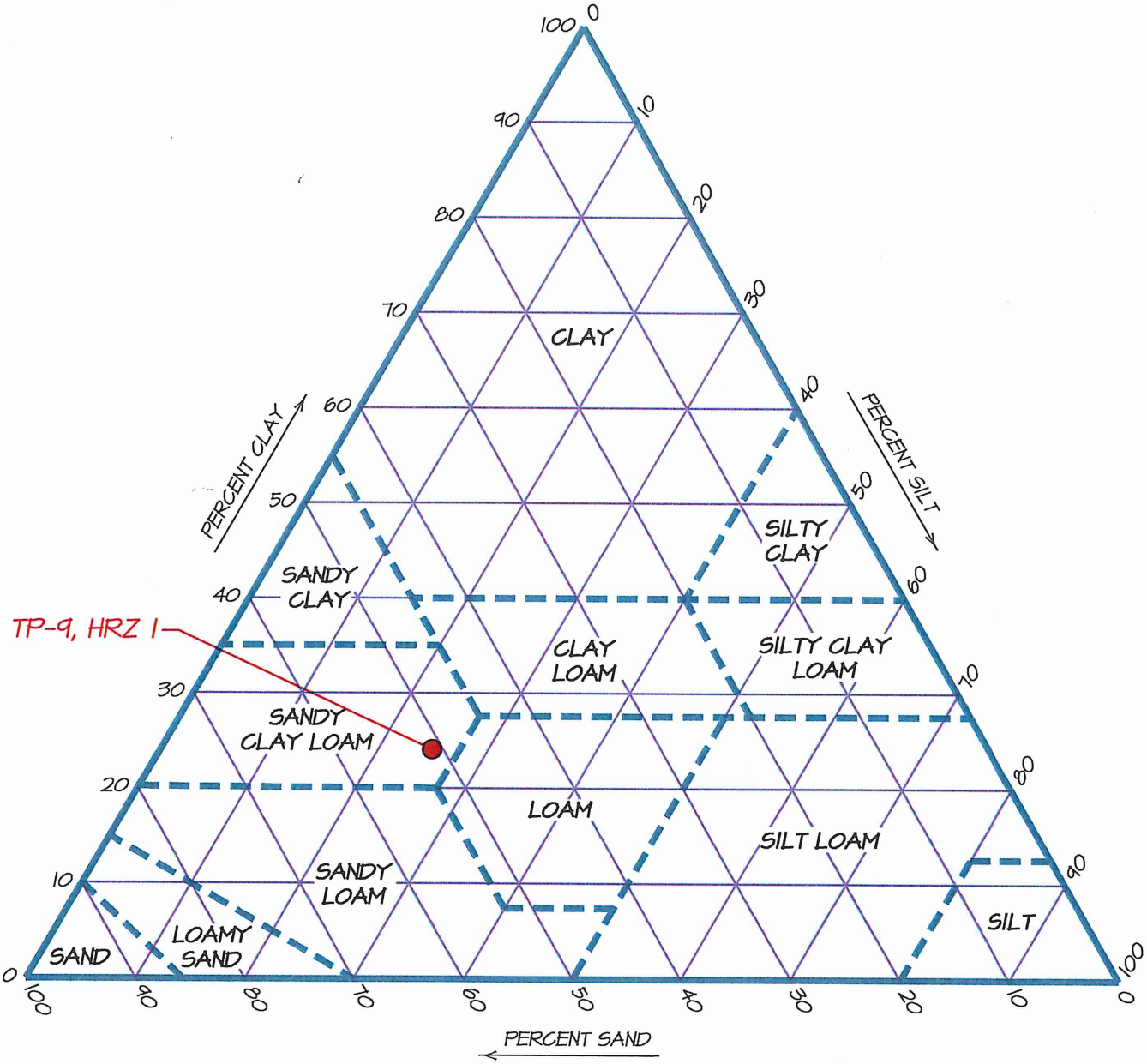

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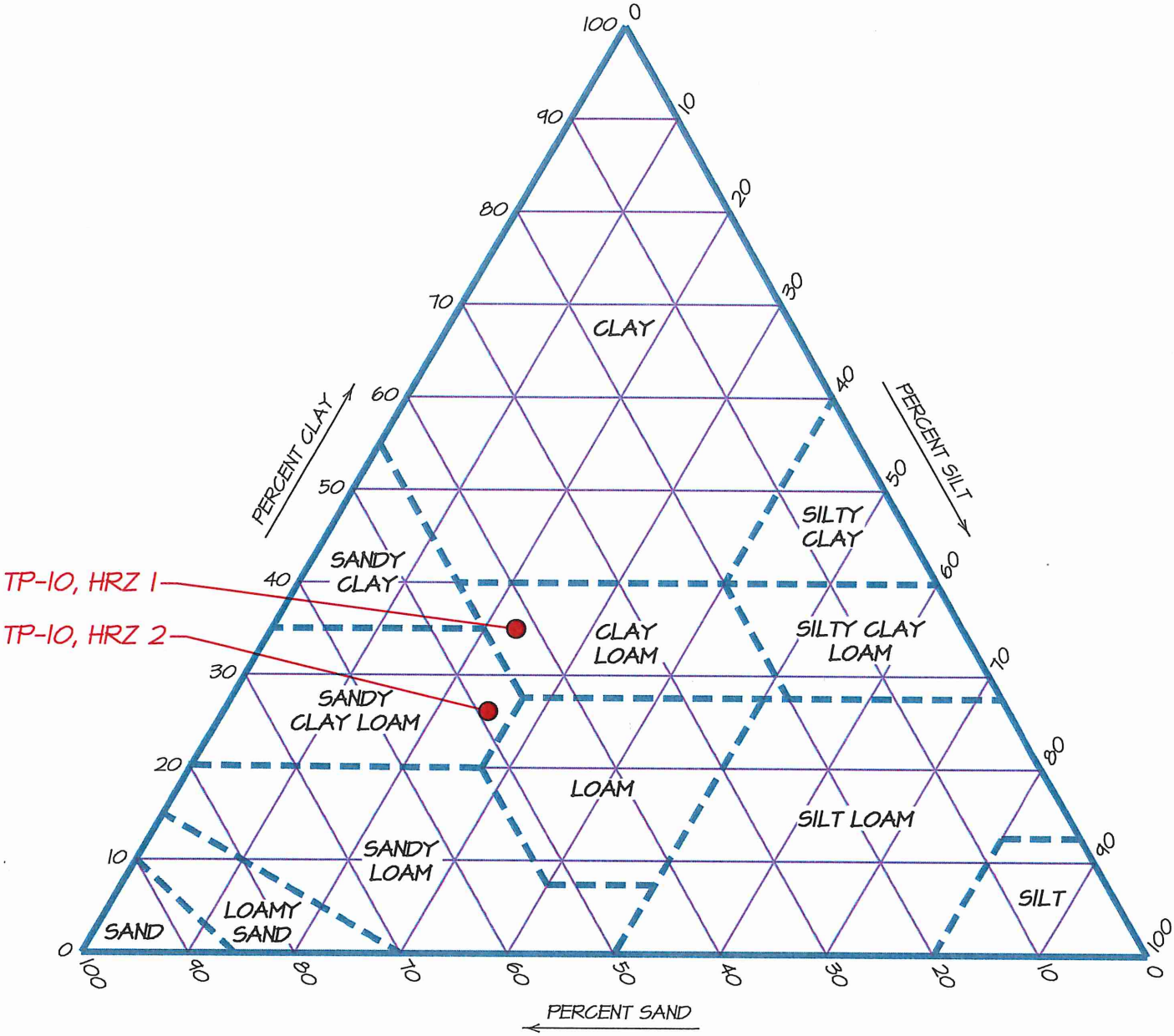
SOIL TEXTURE ANALYSIS CHART
BY BOUYOUCOS HYDROMETER METHOD



INSTRUCTIONS:

1. PLOT TEXTURE ON TRIANGLE BASED ON PERCENT SAND, SILT AND CLAY AS DETERMINED BY HYDROMETER ANALYSIS.
2. ADJUST FOR COARSE FRAGMENTS BY MOVING THE PLOTTED POINT IN THE SAND DIRECTION AN ADDITIONAL 2% FOR EACH 10% (BY VOLUME) OF FRAGMENTS GREATER THAN 2mm IN DIAMETER.
3. ADJUST FOR COMPACTNESS OF SOIL BY MOVING THE PLOTTED POINT IN THE CLAY DIRECTION AN ADDITIONAL 15% FOR SOILS HAVING A BULK-DENSITY GREATER THAN 1.7gm/cc.

NOTE:

FOR SOILS FALLING IN SAND, LOAMY SAND OR SANDY LOAM CLASSIFICATION, A BULK DENSITY ANALYSIS WILL GENERALLY NOT AFFECT SUITABILITY AND ANALYSIS IS NOT NECESSARY.

BARTELT ENGINEERING
CIVIL ENGINEERING · LAND PLANNING
1303 Jefferson Street, 200 B, Napa, CA 94559
www.barteltengineering.com
· Telephone: 707-258-1301 ·

Rombauer Vineyards
3522 Silverado Trail
Napa, CA 94574
APN 021-410-025
Job No. 96-07 December 2018

RGH CONSULTANTS

Experience is the difference

November 28, 2018

Project:	**Rombauer**	**Sampled: Not Stated**
Project #:	**9147.79**	**Received: 11/13/2018**
Client Project #:	**96-07**	**Reported: 11/28/2018**

Bartelt Engineering
1303 Jefferson Street, Ste. 200B
Napa, CA 94559

Subject: Laboratory Test Results
Soil Texture Analysis by
Bouyoucos Hydrometry Method

Dear Mr. Bartelt:

This letter transmits the results of our laboratory testing performed for the subject project. We performed a Soil Texture Analysis by the Bouyoucos Hydrometery Method with the following results:

Size/Density	TP-1 Horizon 1
+ #10 Sieve	25.7%
Sand	39.0%
Clay	32.0%
Silt	29.0%
Db g/cc	--

We trust this provides the information required at this time. Should you have further questions, please call.

Regards,

RGH GEOTECHNICAL

Sean Flinn
Laboratory Technician

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Dear Mr. Bartelt:

This letter transmits the results of our laboratory testing performed for the subject project. We performed a Soil Texture Analysis by the Bouyoucos Hydrometery Method with the following results:

Size/Density	TP-1 Horizon 2
+ #10 Sieve	20.9%
Sand	46.0%
Clay	27.0%
Silt	27.0%
Db g/cc	--

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Regards,

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Laboratory Technician

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Dear Mr. Bartelt:

This letter transmits the results of our laboratory testing performed for the subject project. We performed a Soil Texture Analysis by the Bouyoucos Hydrometery Method with the following results:

Size/Density	TP-2 Horizon 1
+ #10 Sieve	27.4%
Sand	53.0%
Clay	21.0%
Silt	26.0%
Db g/cc	--

We trust this provides the information required at this time. Should you have further questions, please call.

Regards,

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Size/Density	TP-2 Horizon 2
+ #10 Sieve	14.3%
Sand	42.0%
Clay	31.0%
Silt	27.0%
Db g/cc	--

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Dear Mr. Bartelt:

This letter transmits the results of our laboratory testing performed for the subject project. We performed a Soil Texture Analysis by the Bouyoucos Hydrometery Method with the following results:

Size/Density	TP-5 Horizon 1
+ #10 Sieve	30.6%
Sand	51.0%
Clay	21.0%
Silt	28.0%
Db g/cc	--

We trust this provides the information required at this time. Should you have further questions, please call.

Regards,

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Sean Flinn
Laboratory Technician

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Dear Mr. Bartelt:

This letter transmits the results of our laboratory testing performed for the subject project. We performed a Soil Texture Analysis by the Bouyoucos Hydrometery Method with the following results:

Size/Density	TP-6 Horizon 1
+ #10 Sieve	25.2%
Sand	41.0%
Clay	29.0%
Silt	30.0%
Db g/cc	--

We trust this provides the information required at this time. Should you have further questions, please call.

Regards,

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Sean Flinn
Laboratory Technician

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This letter transmits the results of our laboratory testing performed for the subject project. We performed a Soil Texture Analysis by the Bouyoucos Hydrometery Method with the following results:

Size/Density	TP-6 Horizon 2
+ #10 Sieve	12.6%
Sand	47.0%
Clay	22.0%
Silt	31.0%
Db g/cc	--

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Dear Mr. Bartelt:

This letter transmits the results of our laboratory testing performed for the subject project. We performed a Soil Texture Analysis by the Bouyoucos Hydrometery Method with the following results:

Size/Density	TP-6 Horizon 3
+ #10 Sieve	9.4%
Sand	56.2%
Clay	21.0%
Silt	22.8%
Db g/cc	--

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This letter transmits the results of our laboratory testing performed for the subject project. We performed a Soil Texture Analysis by the Bouyoucos Hydrometery Method with the following results:

Size/Density	TP-9 Horizon 1
+ #10 Sieve	26.3%
Sand	46.2%
Clay	24.0%
Silt	29.8%
Db g/cc	--

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Dear Mr. Bartelt:

This letter transmits the results of our laboratory testing performed for the subject project. We performed a Soil Texture Analysis by the Bouyoucos Hydrometery Method with the following results:

Size/Density	TP-10 Horizon 1
+ #10 Sieve	36.4%
Sand	35.2%
Clay	35.0%
Silt	29.8%
Db g/cc	--

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Size/Density	TP-10 Horizon 2
+ #10 Sieve	25.4%
Sand	44.2%
Clay	26.0%
Silt	29.8%
Db g/cc	--

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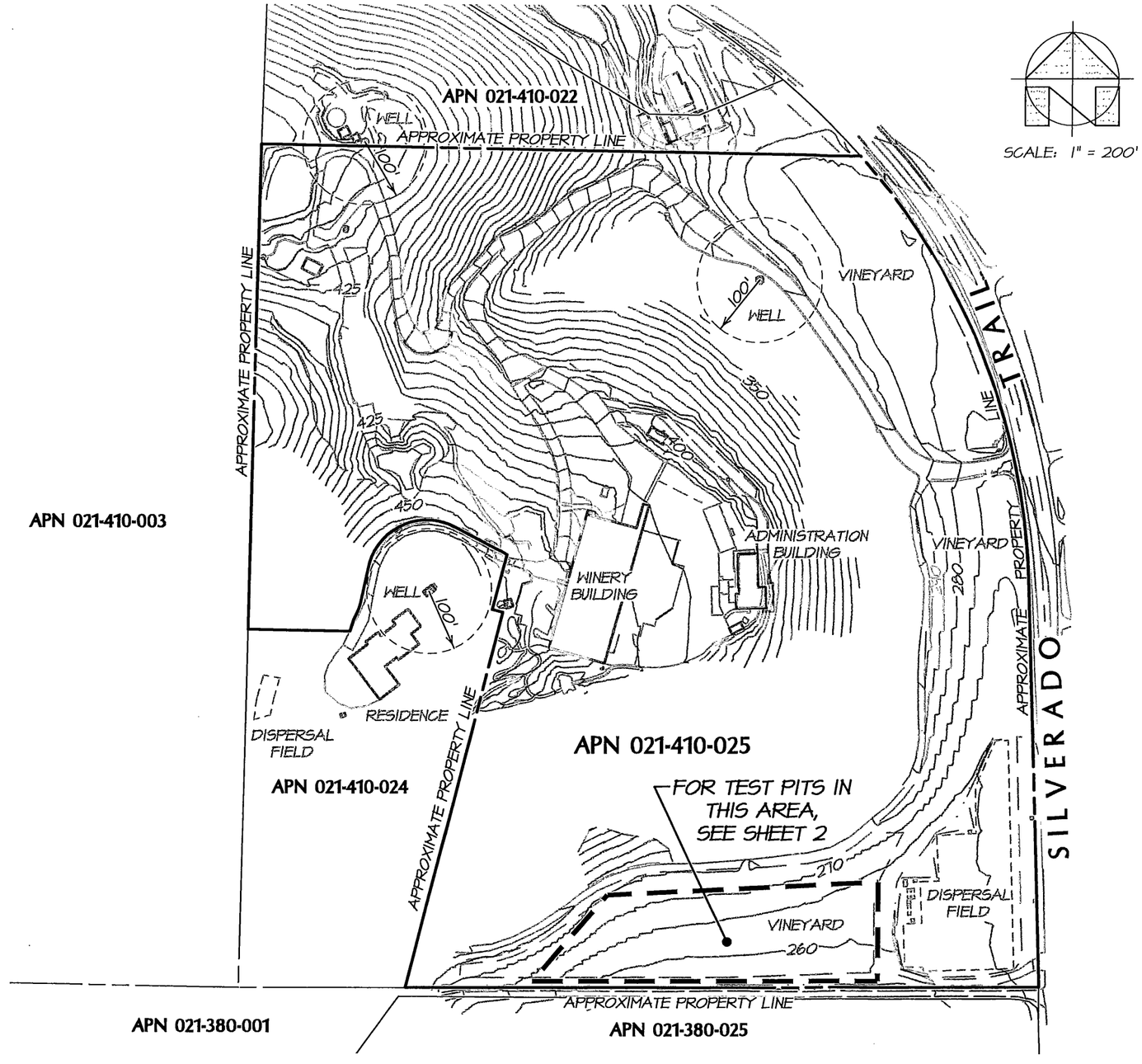
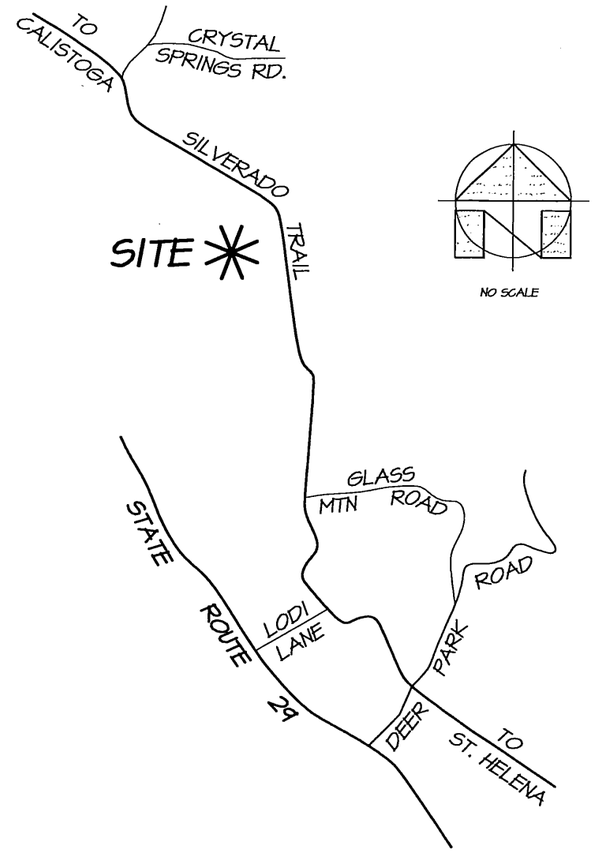


SCALE: 1" = 200'



NO SCALE

LOCATION MAP

NO SCALE

OVERALL SITE PLAN
TEST PIT EXHIBIT

SCALE: 1" = 200'

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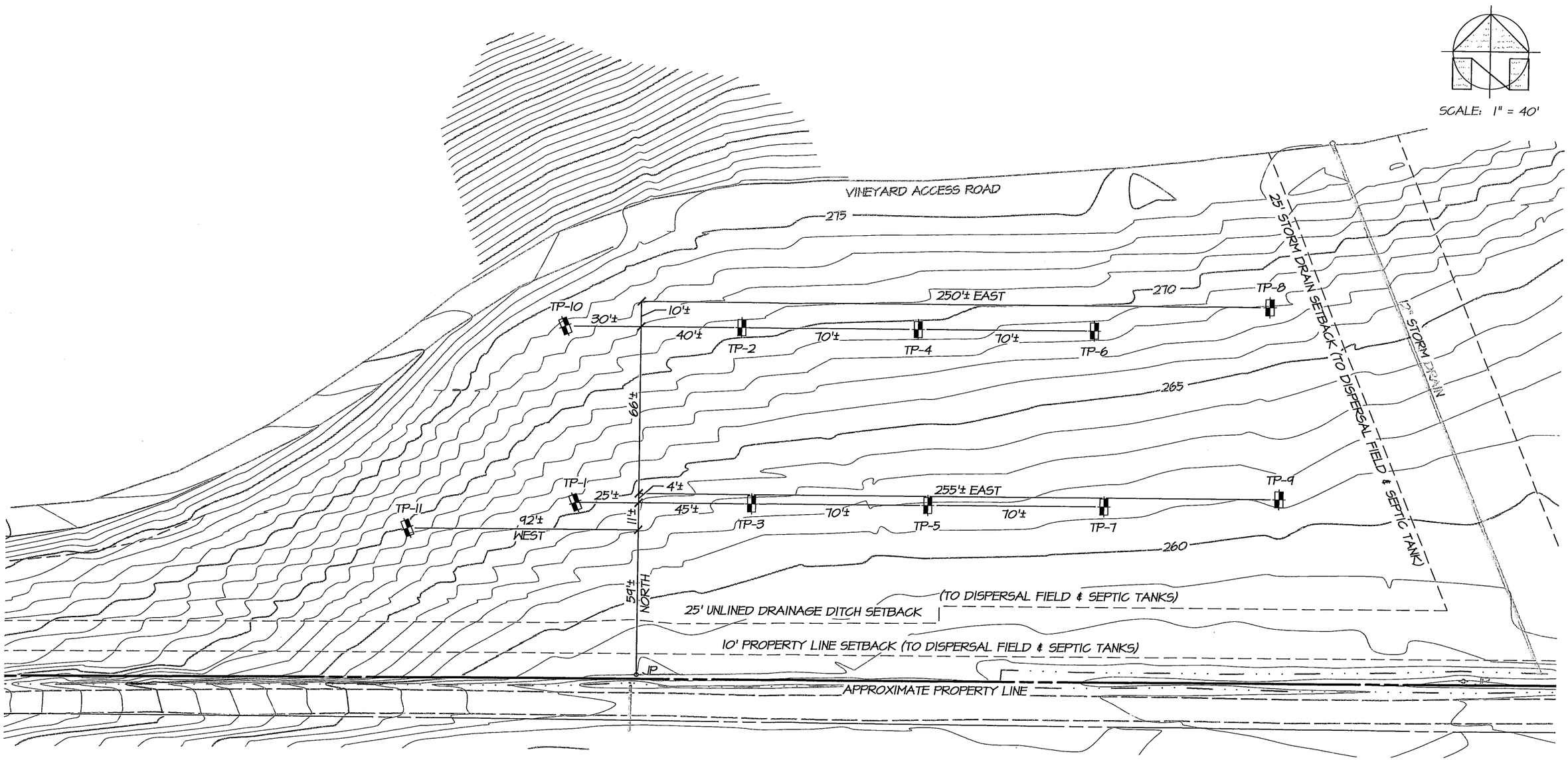
Sheet 1 of 2



TEST PIT LOCATION MAP

SCALE: 1" = 40'

TEST PIT EXPLORATION NOTES:

1. ⊏⊐ REPRESENTS TEST PIT LOCATION.
2. TEST PITS TP-1 THRU TP-11 WERE EXCAVATED BY TAYLOR BAILEY CONSTRUCTION ON NOVEMBER 8, 2018 AND WITNESSED BY A REPRESENTATIVE FROM BARTELT ENGINEERING AND NAPA COUNTY ENVIRONMENTAL HEALTH.

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