Thomas Harder & Co.
Groundwater Consulting

May 20, 2021

Mr. Pat Hoban, PG, QSD
Principal Geologist
Weber, Hayes & Associates
120 Westgate Drive
Watsonville, California 95076

Re: Transport Modeling
Former Clusters Storage Yard
Watsonville, California

Dear Mr. Hoban,

The transport modeling presented here presents forecasts of both travel time and future concentrations of lead, total petroleum hydrocarbons as diesel (TPH-d), total petroleum hydrocarbons as motor oil (TPH-mo), and naphthalene (the 'chemicals of interest' or 'COIs') in groundwater at the subject property located at 511 Ohlone Parkway in Watsonville, California (see Figure 1 and Figure 2 in **Attachment A**).

It is our understanding that the current redevelopment plan for the property includes the burial of soil impacted with the COIs ('the burial envelope'; see **Attachment B**) and subsequent installation of an engineered clean cap/cover at the ground surface. Based on the configuration of the burial envelope and groundwater levels at a nearby site, it is our understanding that the base of the burial envelope will be 15 to 20 feet above the water table[1] (i.e., 'the separation distance' or 'travel distance').

Modeling Approach

The transport modeling accounts for migration from the base of the burial envelope through the underlying 15- to 20-foot thick unsaturated zone due to advection and dispersion and subsequent dilution in the saturated zone due to groundwater advection. This is accomplished by linking an unsaturated zone transport model to a saturated zone dilution model. Although the impacted soils

[1] It is our further understanding that groundwater occurs under unconfined conditions.

will extend laterally (in plan-view) over an "L-shaped" area of approximately 17,000 square feet (i.e., approximately 0.4 acres; Weber, Hayes & Associates, Inc. [WH&A, 2021] and as shown herein in **Attachment B**), a one-dimensional approach is used to provide a conservative analysis and for the sake of simplicity.

Model Equations

The unsaturated zone model is the solution to the advection-dispersion equation provided by Ogata and Banks (1961).

$$C(z,t) = \frac{C_0}{2}\left(erfc\left[\frac{z-v_z t}{2\sqrt{D_z t}}\right] + exp\left[\frac{v_z z}{D_z}\right] erfc\left[\frac{z+v_z t}{2\sqrt{D_z t}}\right]\right) \quad \text{[Eqn. 1]}$$

where:

$C(z,t)$ = concentration at distance 'z' from the source at time 't' after COI-impacted soils are buried and capped (COI-specific value in micrograms per liter [μg/L]);

C_0 = source concentration (COI-specific value in μg/L);

erfc = complimentary error function (mathematical operator);

z = vertical distance (feet [ft]);

v_z = advective flow rate (ft/year);

t = time (years);

D_z = dispersion coefficient (ft^2/year); and

exp = exponential function (mathematical operator).

This widely-used solution is published in numerous hydrogeologic textbooks (e.g., Fetter, 1993; Freeze and Cherry, 1979; Domenico and Schwartz, 1990; and Weidemeier et al., 1999, to list just a few) and assumes a constant (non-depleting) aqueous-phase source (the impacted soils containing the COIs) that impinges over time on the initially unimpacted unsaturated zone soils separating the overlying impacted soils from the underlying water table.

Because z is chosen to be the distance between the bottom of the source and the water table for this analysis, C(z,t) is the concentration in unsaturated zone pore water at the unsaturated zone/saturated zone interface (i.e., $C(z,t) = C_{wt}$) and, because the source is assumed to be constant, $C_{wt} = C_0$ for large values of t. The value of C_{wt} is then used to calculate the concentration in groundwater (C_{gw}) using the U.S. Environmental Protection Agency (USEPA) dilution-attenuation factor (DAF) method (USEPA, 1996a):

$$C_{gw} = \frac{C_{wt}}{DAF} \quad \text{[Eqn. 2]}$$

where:

C_{gw} = concentration in groundwater directly beneath the source (COI-specific value in µg/L);

C_{wt} = concentration in unsaturated zone pore water directly beneath the source at the unsaturated zone/saturated zone interface at time 't' after COI-impacted soils are buried and capped (COI-specific value in micrograms per liter [µg/L]); and

DAF = saturated zone dilution attenuation factor (unitless).

Model Inputs

C_0 (source concentration): The concentrations of the COIs in soil have been the subject of numerous investigations documented by Weber, Hayes & Associates (WH&A, 2021). Based on information provided by WH&A regarding the planned grading and filling, and associated removal of impacted soils, **Table 1** was prepared to list the samples and COI concentrations representative of soils that will comprise the burial envelope. Using the USEPA statistical software ProUCL (USEPA, 2015), the 95% upper confidence level (95% UCL) of the mean wet weight concentrations in soil within the burial envelope are as follows:

- Lead: 140 milligrams per kilogram (mg/kg);
- TPH-d: 71 mg/kg;
- TPH-mo: 496 mg/kg; and
- Naphthalene: 0.008 mg/kg.

Geotechnical laboratory reports are included as **Attachment C**. Based on the results shown in these reports, the average moisture content and associated percent solids were calculated to be 0.195 gram/gram and 83.7%, respectively.[2] The 95% UCLs on a dry weight basis, as required for the model, are therefore:

- Lead: 168 milligrams per kilogram (mg/kg);
- TPH-d: 85 mg/kg;
- TPH-mo: 593 mg/kg; and
- Naphthalene: 0.009 mg/kg.

These dry weight concentrations in soil are used to derive the COI-specific values for C_0 as follows:

$$C_0 = \frac{C_{soil}}{K_d} \times CF \qquad \text{[Eqn. 3]}$$

[2] The average moisture content and porosity on a volumetric basis are 31.1% and 42.2%, respectively. The average saturation is therefore 74.2%, which is reasonable given the generally fine-grained nature of Site soils and the proximity of the Site to the adjacent Watsonville Slough immediately to the east and the Struve Slough approximately 0.3 miles to the west.

where:

C_0 = aqueous-phase source concentration (COI-specific value in µg/L);

C_{soil} = sorbed-phase source concentration (concentration in soil) (COI-specific value in mg/kg);

K_d = soil-water partition coefficient (L/kg); and

CF = conversion factor (1000 µg/mg).

The mean K_d value for soil/soil water from USEPA (2005) for lead is 5012 cm^3/g (log K_d = 3.7). For the organic COIs (i.e., TPH-d, TPH-mo, and naphthalene), K_d is calculated as the product of K_{oc} (the organic carbon-water partition coefficient) and f_{oc} (fraction organic carbon). The K_{oc} values for TPH-d, TPH-mo, and naphthalene based on USEPA (2021a) are as follows:

- TPH-d: 1,265 cm^3/g;
- TPH-mo: 16,345 cm^3/g; and
- Naphthalene: 1,544 cm^3/g.

The K_{oc} value for TPH-d is based on the log average value for 'Total Petroleum Hydrocarbons (Aliphatic Medium)' (i.e., log 796 cm^3/g = ~2.9) and 'Total Petroleum Hydrocarbons (Aromatic Medium)' (i.e., log 2011 cm^3/g = ~3.3) consistent with USEPA (2021b) with the assumption that TPH-d contains approximately 12 to 20 carbon atoms. The K_{oc} value for TPH-mo is based on the log average value for 'Total Petroleum Hydrocarbons (Aliphatic High)' (i.e., log 4818 cm^3/g = ~3.7) and 'Total Petroleum Hydrocarbons (Aromatic High)' (i.e., log 55450 cm^3/g = ~4.7) consistent with USEPA (2021b) with the assumption that TPH-mo contains approximately 18 to 34 carbon atoms.

Using an average f_{oc} value (see **Attachment C**[3]) of 0.0036 g/g, the K_d values for TPH-d, TPH-mo, and naphthalene are as follows:

- TPH-d: 4.6 cm^3/g;
- TPH-mo: 59 cm^3/g; and
- Naphthalene: 5.6 cm^3/g.

Substituting the C_{soil} and K_d values for each COI into **Eqn. 3** yields the following values of C_0 used in the model:

- Lead: 33 µg/L;
- TPH-d: 18,700 µg/L;
- TPH-mo: 10,100 µg/L; and

[3] The laboratory report from Waypoint Analytical included in **Attachment C** reports 'organic matter' as a percent. The f_{oc} as used in transport modeling is adjusted (scaled down) by a factor of 1.724 consistent with Fetter (1993).

- Naphthalene: 1.6 µg/L.

z (vertical distance): This is the distance between the bottom of the COI-impacted soils and the underlying water table. Based on the proposed burial envelope and historical depths to groundwater, the value of z used as input to the model is the average of 15 and 20 feet (i.e., 17.5 feet).

v_z (advective flow rate): This value is based on a conservative precipitation-based model, the conservative assumption that the proposed cap/cover will impede only 50% of the precipitation, and accounts for the widely accepted concept that the COIs strongly sorb to soil.

The precipitation-based model of Connor et al. (1997) as presented in Weidemeier et al.(1999) is as follows:

$$I_{sand} = 0.0018P^2 \qquad \text{[Eqn. 4a]}$$

$$I_{silt} = 0.0009P^2 \qquad \text{[Eqn. 4b]}$$

$$I_{clay} = 0.00018P^2 \qquad \text{[Eqn. 4c]}$$

where:

I_{sand}, I_{silt}, and I_{clay} = infiltration rate for sand, silt, and clay soil types, respectively (centimeter/year [cm/yr]); and

P = annual precipitation (cm/yr).

Given the average annual precipitation for Watsonville of 23.5 inches per year as reported at www.usclimatedata.com and equally weighting the sand, silt, and clay fractions based on review of the boring logs (**Attachment A**) for the soils to be buried and capped, the infiltration rate is calculated to be 0.7 inches per year. This value is equivalent to roughly 3% of the annual rainfall, which is in reasonable agreement with values reported by Wood (1999) and Maxey and Eakin (1949) as cited by Dettinger (1989).

The infiltration rate is then used to calculate v_z, which accounts for the tendency of the COIs to sorb to soil as follows:

$$v_z = \frac{I}{R} \qquad \text{[Eqn. 5a]}$$

where:

I = infiltration rate (cm/yr); and

R = retardation factor (unitless);

$$v_z = \frac{I}{1+\frac{\rho_b}{\theta_w}K_d} \quad \text{[Eqn. 5b]}$$

where:

ρ_b = dry bulk density (g/cm^3);

θ_w = moisture content (water-filled porosity) (cm^3/cm^3); and

I and K_d are as defined above.

The values for ρ_b and θ_w (1.59 g/cm^3 and 0.311 cm^3/cm^3, respectively) are average values based on site-specific data for unsaturated zones soils between the COI-impacted soils and the water table (**Attachment C**). When these values are used along with the COI-specific K_d values and the value of I above, the COI-specific values of R for the COIs are calculated to be:

- Lead: 26,000;
- TPH-d: 24;
- TPH-mo: 300; and
- Naphthalene: 30.

Thus, the COIs are predicted to migrate downward towards the water table at rates ranging from 24 to 26,000 times slower than the rate of the conservatively calculated infiltration rate. To put these values in perspective, plots of travel distance versus time for each of the COIs are presented in **Figure 1**. As shown in this figure, the time required for the COIs to migrate from the base of the impacted zone over the 17.5-foot distance to the underlying water table (i.e., the 'travel time')[4] is predicted to exceed 1,000 years for all COIs. While predictions this far into the future are of course uncertain, the overriding point is that the COIs are predicted to migrate at a rate so low as to not warrant concern.

t (time): Given the slow migration rates presented above, the values of t are set to large values (i.e., greater than 1,000 years) for all COIs so that model-predicted concentrations can be readily viewed on concentration versus time graphs.

D_z (dispersion coefficient): The value of D_z accounts for the combined effect of mechanical dispersion, which is due to contaminant spreading due to advection, and molecular diffusion, which is contaminant spreading due to concentration gradients as follows:

$$D_z = D^*_{eff} + D_m \quad \text{[Eqn. 6a]}$$

where:

D_m = mechanical dispersion (ft^2/yr); and

[4] The travel time (t_{trav}) can be calculated as z/v_z. It is also the time at which $C(z,t)/C_0 = 0.5$ as predicted using **Eqn. 1**.

D^*_{eff} = retardation factor (unitless).

The expanded form of **Eqn. 6a** that shows how D^*_{eff} and D_m and are calculated in the model is:

$$D_z = \underbrace{\frac{D_w \frac{\theta_w^{10/3}}{n^2}}{R}}_{D^*_{eff}} + \underbrace{\propto v_z}_{D_m} \quad \text{[Eqn. 6b]}$$

where θ_w, R, and v_z are previously defined and:

D_w = aqueous-phase diffusion coefficient (ft^2/yr);

n = porosity (ft^3/ft^3); and

α = dispersivity (ft).

USEPA lists values of D_w in their regional screening level database (USEPA, 2021a) for all COIs except for lead. Given the generally narrow range of this parameter for all compounds listed in USEPA's database, a conservatively high upward rounded average value of 0.34 ft^2/year (1E-05 cm^2/sec) is used for all COIs. The value of n (0.422 ft^3/ft^3) is an average value based on site-specific data for unsaturated zones soils between the COI-impacted soils and the water table (**Attachment C**). α is a scale-dependent parameter and is calculated as follows (Xu and Eckstein, 1995) as cited in Weidemeier et al. (1999) and USEPA (1996b):

$$\propto = 3.2808 \times 0.83 \times log[z]^{2.414} \quad \text{[Eqn. 6c]}$$

where z (17.5 ft) is defined as above thus resulting in a value of α of 1.3 ft.

Using these equations, the values of D^*_{eff}, D_m, and D_z are calculated to be 1.5E-06 ft^2/year, 2.9E-06 ft^2/year, and 4.4E-06 ft^2/year, respectively.

<u>DAF (saturated zone dilution attenuation factor):</u> The DAF is calculated using the equation provided by USEPA (USEPA, 1996a):

$$DAF = 1 + \frac{K \times i \times MZD}{I \times L} \quad \text{[Eqn. 7a]}$$

where:

K = hydraulic conductivity of the saturated zone (ft/year);

i = hydraulic gradient (ft/ft);

MZD = mixing zone depth (ft);

I = infiltration rate (ft/year; defined above in units of cm/year);

L = source length parallel to direction of groundwater flow (ft);

where:

$$MZD = \sqrt{0.0112L^2} + b\left(1 - exp\left[\frac{-LI}{Kib}\right]\right) \qquad \text{[Eqn. 7b]}$$

where b is the thickness of the saturated zone in meters. In fact, **Eqn. 7b** requires that all parameters be expressed in meters and years. The values of the **Eqn. 7b** parameters are as follows:

- L = 40 meters based on the 17,000 square foot area to be backfilled with COI-impacted soil;
- b = 3.05 meters (10 ft) based on professional judgment;
- I = 0.018 meters/year based on the value of I presented previously (0.7 inches/year);
- K = 560 meters/year (5 ft/day) based on professional judgment for the fine-grained sands generally identified in the deeper soil samples (**Attachment C**); and
- i = 0.028 meter/meter based on an approximate mid-range value[5] reported for the MF Farming site, which is located immediately south of the Site and on the same side of the Watsonville Slough (Trinity Source Group, 2015).

When these values are used as input and with the restriction that MZD must be $\leq$ b as noted by USEPA, MZD is calculated to be 3.05 meters and the DAF is calculated to be 68.

Model Results

Using **Eqn. 2** along with the C_0 values listed above (33 µg/L, 18700 µg/L, 10100 µg/L, and 1.6 µg/L for lead, TPH-d, TPH-mo, and naphthalene, respectively) as the C_{wt} values because the source is conservatively assumed to be constant and transport is conservatively assumed to be exclusively one-dimensional in the downward direction, the maximum model-predicted values of C_{gw} (at very large values of t as shown below) are as follows:

Lead: $$C_{gw,max} = \frac{33\ \mu g/L}{68} = 0.5\frac{\mu g}{L} \qquad \text{[Eqn. 8a]}$$

TPH-d: $$C_{gw,max} = \frac{18{,}700\ \mu g/L}{68} = 275\frac{\mu g}{L} \qquad \text{[Eqn. 8b]}$$

TPH-mo: $$C_{gw,max} = \frac{10{,}100\ \mu g/L}{68} = 149\frac{\mu g}{L} \qquad \text{[Eqn. 8c]}$$

Naphthalene: $$C_{gw,max} = \frac{1.6\ \mu g/L}{68} = 0.02\ \mu g/L \qquad \text{[Eqn. 8d]}$$

[5] Reported hydraulic gradient values range from 0.02 (February 2014) to 0.056 (maximum value reported in June 2015). The value of 0.028 used here was the most recent minimum value reported in June 2015. The MF Farming site was closed by the Santa Cruz County Health Services Agency on October 23, 2015.

The 'MCL Priority'[6] values for lead, TPH-d, and naphthalene as published by the Regional Water Quality Control Board in their Environmental Screening Level (ESL) Summary Table[7] are 15 µg/L, 200 µg/L, and 0.17 µg/L, respectively. There is no value published for TPH-mo but the TPH-HOP ESL of 410 µg/L is used here as a surrogate for the sake of comparison as shown in the table below.

COI	**<u>Maximum</u> model-predicted concentration in groundwater ($C_{gw,max}$; µg/L)**	**'MCL Priority' ESL (µg/L)**
Lead	0.5	15
TPH-d	275	200
TPH-mo	149	410
Naphthalene	0.02	0.17

The fact that the values of $C_{gw,max}$ are all less than the MCL Priority ESLs and/or that these concentrations will not occur until an inordinantly long time into the future as shown on **Figure 2** (lead), **Figure 3a** and **Figure 3b** (TPH-d), **Figure 4** (TPH-mo), and **Figure 5** (naphthalene) are compelling lines of evidence that the proposed plan to bury and cap/cover COI-impacted soils to the prescribed depth above the water table is protective of groundwater.

<u>Closing</u>

The proposed burial and engineered cap/cover system as modeled herein shows that migration of the COIs towards the water table will occur at exceedingly slow rates thus leading to exceedingly long times for which the system will not impact groundwater. Given that MCLs will not be exceeded for all COIs except for TPH-d, and then only after the very long model-predicted travel times presented herein, any impact is projected to be inconsequential.

While we recognize that uncertainties undoubtedly exist when projecting where a solute will be located so far into the future, following the reasoning used by USEPA as cited in National Research Council (1990), the modeling here puts some reasonable bounds on where the solute will <u>not</u> be located. As such, it is reasonable to conclude that any engineered system that will not adversely impact the resource of interest (i.e., groundwater) for so many years should be considered sufficiently designed and protective.

[6] 'MCL Priority' values as listed in the ESL Summary Table provides all available California maximum contaminant level (MCL) values. If no MCL values are available, the lower of the cancer and noncancer tapwater direct exposure levels is listed.
[7] https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/esl.html

We appreciate the opportunity to provide consulting services to Weber, Hayes & Associates. If you have any questions, please contact me at 949 795-0855 (cell), 714 779-3875 (office), or via electronic mail at jimvdw@thomashardercompany.com.

Sincerely,

Jim Van de Water

Jim Van de Water, P.G., C.HG.
Principal Hydrogeologist

Table

1: COI Concentrations

Figures

1: Model-Predicted Travel Distances for COIs vs. Time
2: Model-Predicted Concentration of Lead vs. Time and Model-Predicted Travel Time
3a: Model-Predicted Concentration of TPH-d vs. Time and Model-Predicted Travel Time
3b: Model-Predicted Concentration of TPH-d vs. Time
4: Model-Predicted Concentration of TPH-mo vs. Time and Model-Predicted Travel Time
5: Model-Predicted Concentration of Naphthalene vs. Time and Model-Predicted Travel Time

Attachments

A: Location Map and Vicinity Map
B: Location of Burial Envelope
C: Geotechnical Soil Analysis

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TABLE

TABLE 1
COI Concentrations
~ within burial envelope ~

UPDATED Sample ID	ORIGINAL Consultant ID		Depth (ft)	Lead (mg/kg)	TPH-diesel (mg/kg)	TPH-motor oil (mg/kg)	Naphthalene (mg/kg)
B-2(t)	TB-2		0.5	--	--	--	--
B-3(t)	TB-3		2.5	--	--	--	--
B-3(t)	TB-3		4	--	--	--	--
B-6(t)	TB-6		0.75	--	--	--	--
B-7(t)	TB-7		0.5	--	--	--	--
B-8(t)	TB-8		1.5	--	--	--	--
B-8(t)	TB-8		2.5	--	--	--	--
B-8(t)	TB-8		4	--	--	--	--
B-9(t)	TB-9		0.5	40	--	--	--
B-9(t)	TB-9		1.5	--	--	--	--
B-9(t)	TB-9		2.5	--	--	--	--
B-9(t)	TB-9		4	--	--	--	--
T-1(t)	Area 1	T4	4	--	--	--	--
T-2(t)		T6	3.5	20	<1.2	85	<0.005
T-3(t)		T9	2	29	94	240	<0.005
T-4(t)		T10	1	6.8	<1.2	32	<0.005
T-5(t)		T11	1.5	--	--	--	--
T-6(t)		T12	1	76	<1.2	250	<0.005
T-7(t)	Area 2	T6	1	8.6	<1.2	<6.5	<0.005
T-8(t)		T12	2	22	<2.4	400	<0.005
T-9(t)		T15	2	55	<2.4	510	<0.005
T-10(t)	Area 3	T1	3	--	--	--	--
T-11(t)	Area 5	T1	6	3,200	<6	680	<0.005
T-12(t)		T3	2	1,100	<2.4	800	<0.005
T-13(t)		T5	3	--	--	--	--
T-14(t)		T10	4	16	<1.2	18	<0.005
T-17(t)	Area 8	T1	2	120	<2.3	51	<0.005
B-10(w)	SB-1		2	13	<1.2	22	--
B-11(w)	SB-2		0.5	110	670	5500	--
B-11(w)	SB-2		2	9.9	4.8	39	<0.005
B-12(w)	SB-3		2	17	<1.2	29	--
B-13(w)	SB-4		2	14	6.2	38	<0.005
B-14(w)	SB-5		0.5	23	60	820	<0.005
B-14(w)	SB-5		2	6.9	8.9	63	<0.005
B-15(w)	SB-6		0.5	32	15	170	<0.005
			2	7.5	<1.2	<6.5	<0.005
B-16(w)	SB-7		0.5	13	6.5	63	--
			2	11	<1.2	<6.5	--
B-17(w)	SB-8		0.5	17	53	750	--
			2	9.5	4.9	51	--
B-18(w)	SB-9		0.5	38	110	1300	--
			2	8	10	98	--
B-19(w)	SB-10		0.5	15	7.1	48	--
			2	8.6	<1.2	<6.5	--
B-20(w)	SB-11		0.5	24	12	150	--
			2	12	<1.2	21	--
B-22(w)	SB-13		0.5	17	7.1	64	--
			2	8.3	<1.2	19	--
B-23(w)	SB-14		0.5	12	150	1600	--
			2	13	<1.2	<6.5	--
B-24(w)	SB-15		0.5	8.1	10	140	--
			2	9.6	<1.2	28	--

TABLE 1

COI Concentrations

~ within burial envelope ~

UPDATED Sample ID	ORIGINAL Consultant ID	Depth (ft)	Lead (mg/kg)	TPH-diesel (mg/kg)	TPH-motor oil (mg/kg)	Naphthalene (mg/kg)
B-25(w)	DP-1	2	9.1	<1.2	<6.5	--
B-26(w)	DP-2	2	9.4	<1.2	<6.5	--
B-27(w)	DP-4	2	9	5.2	14	0.023
B-28(w)	DP-5	2	5.9	<1.2	<6.5	--
B-29(w)	DP-6	2	7.5	5.6	23	<0.0050
B-30(w)	DP-7	2	8.8	7.3	42	--
B-31(w)	DP-8	2	23	5.8	33	--
B-33(L)	CL-1	1	9.9	--	--	--
		3	6.2	--	--	--
B-34(L)	CL-2	2	9.8	--	--	--
		3	7.7	--	--	--
B-35(L)	CL-3	2	5.7	--	--	--
		3	5.9	--	--	--
B-36(L)	CL-4	4	7.1	--	--	--
B-40(L)	R-1	0.5	8.6	--	--	--
		2	7.8	--	--	--
B-41(L)	R-2	0.5	6.9	--	--	--
B-41(L)	R-2	2	5.5	--	--	--
B-41(L)	R-2	3	5.2	--	--	--
B-42(L)	R-3	1	5.4	--	--	--
B-42(L)	R-3	3	5.9	--	--	--
B-43(L)	GZ-1	2	9.4	--	--	--
B-43(L)	GZ-1	3	5.1	--	--	--
B-44(L)	GZ-2	1	44	--	--	--
		3	9.8	--	--	--
B-45(L)	BC-1	3	13	--	--	--
		5	9	--	--	--
		7	33	--	--	--
B-46(L)	BC-2	3	21	--	--	--
		5	25	--	--	--
		7	8.9	--	--	--
B-47(L)	BC-3	3	11	--	--	--
		5	9.3	--	--	--
		7	17	--	--	--
B-48(L)	BC-4	3	17	--	--	--
		5	6.5	--	--	--
		7	7.6	--	--	--
B-49(L)	CZ-1	2	1	--	--	--
		4	10	--	--	--
B-50(L)	CZ-2	1	6.9	--	--	--
		3	6.8	--	--	--
		7	7.7	--	--	--
		11	7.9	--	--	--
B-51(L)	CZ-3	2	8.2	--	--	--
B-52(L)	G+G-1	2	8	<1	<50	--
		4	10	<1	<50	--
		6	77	160	1200	--
B-53(L)	G+G-2	2	6.8	--	--	--
		4	6.5	--	--	--
		6	3.9	--	--	--
B-54(L)	G+G-3	0.5	7	--	--	--
		2	6.4	--	--	--

TABLE 1

COI Concentrations

~ within burial envelope ~

UPDATED Sample ID	ORIGINAL Consultant ID	Depth (ft)	Lead (mg/kg)	TPH-diesel (mg/kg)	TPH-motor oil (mg/kg)	Naphthalene (mg/kg)
B-55(L)	G+G-4	2	6	1.7	<50	--
B-55(L)	G+G-4	3	9.1	<1	<50	--
B-56(L)	G+G-5	2	5.1	--	--	--
		4	5.1	--	--	--
B-57(L)	G+G-6	2	7.2	--	--	--
		4	5.3	--	--	--
B-58(L)	G+G-7	2	8.2	--	--	--
		3.5	11	--	--	--
B-59(L)	G-1	2	42	--	--	--
		3	5.2	--	--	--
B-60(L)	G-2	2	14	--	--	--
		3	14	--	--	--
B-61(L)	G-3	0.5	11	--	--	--
		2	11	--	--	--
		3	13	--	--	--
B-62(L)	G-4	2	9	--	--	--
		3	7.4	--	--	--
B-63(L)	G-5	2	16	--	--	--
		4	15	--	--	--
		6	6.2	--	--	--
B-64(L)	G-6	2	6.1	--	--	--
		4	24	--	--	--
		6	10	--	--	--
B-65(w)	G&G# - 1a,1b,1c	0.5	49	68*	310	--
		2	70	<1	<13	--
B-65a(w)	G&G 1a	2	25	110	360	--
B-65b(w)	G&G 1b	2	89	19	78	--
B-65c(w)	G&G 1c	2	50	11	33	--
B-66(w)	G&G# - 2a,2b,2c	0.5	40	--	--	--
		2	43	21	86	--
B-67(w)	G&G# - 3a,3b,3c	2	20	<1	<13	--
B-68(w)	G&G# - 4a,4b,4c	2	66	<1	<13	--
B-68a(w)	G&G 4a	2	260	--	--	--
B-68b(w)	G&G 4b	2	150	--	--	--
B-68c(w)	G&G 4c	2	25	--	--	--
B-69(w)	G&G# - 5a,5b,5c	0.5	32	<1	<13	--
B-69(w)	G&G# - 5a,5b,5c	2	17	<1	<13	--
B-69a(w)	G&G 5a	0.5	37	--	--	--
B-69c(w)	G&G 5c	0.5	69	--	--	--
B-70(w)	G&G (discrete #1)	0.5	--	110	510	--
B-70(w)	G&G (discrete #1)	2	--	130	980	--
B-70(w)	G&G (discrete #1)	4	--	1.5	<13	--
B-71(w)	EB-1	20	--	<1	<13	--
B-71(w)	EB-1	40	--	1.1	<13	--
B-72(w)	Gonzalez# - 1a, 1b, 1c	0.5	17	6.1	30	--
		2	14	1.6	<13	--
B-73(w)	Gonzalez# - 2a, 2b, 2c	0.5	100	8.8	58	--
		2	16	1.6	<13	--
B-73a(w)	Gonzalez 2a	0.5	33	--	--	--
B-73b(w)	Gonzalez 2b	0.5	120	--	--	--
B-73c(w)	Gonzalez 2c	0.5	85	--	--	--
B-74(w)	Clusters# - 1a,1b,1c	0.5	16	<1	<13	--
		2	20	6.4	31	--

TABLE 1

COI Concentrations

~ within burial envelope ~

UPDATED Sample ID	ORIGINAL Consultant ID	Depth (ft)	Lead (mg/kg)	TPH-diesel (mg/kg)	TPH-motor oil (mg/kg)	Naphthalene (mg/kg)
B-75(w)	Clusters# - 2a,2b,2c	0.5	16	3.2	16	--
		2	17	<1	<13	--
B-77(w)	Chaz #- 1a,1b,1c	0.5	34	31	250	--
		2	100	4.5	35	--
B-77a(w)	Chaz 1a	2	280	--	--	--
B-77b(w)	Chaz 1b	2	36	--	--	--
B-77c(w)	Chaz 1c	2	19	--	--	--
B-78(w)	Chaz # - 2a,2b,2c	0.5	26	15	130	--
		2	38	5.3	48	--
B-79(w)	Gerrys #- 1a,1b,1c	0.5	29	45	200	--
		2	28	12	57	--
B-80(w)	Gerrys #- 2a,2b,2c	0.5	17	<1	<13	--
		2	21	62	200	--
B-80a(w)	Gerrys 2a	2	--	<1	<13	--
B-80b(w)	Gerrys 2b	2	--	190	600	--
		4	--	2	<13	--
B-80c(w)	Gerrys 2c	2	--	3.2	16	--
B-81(w)	Gerrys # - 3a,3b,3c	0.5	130	170	670	--
		2	19	<1	<13	--
B-81a(w)	Gerrys 3a	0.5	46	--	--	--
		2	--	--	--	--
B-81b(w)	Gerrys 3b	0.5	110	--	--	--
		2	--	--	--	--
B-81c(w)	Gerrys 3c	0.5	15	--	--	--
		2	--	--	--	--
B-82(w)	Gerrys # - 4a,4b,4c	0.5	47	33	130	--
		2	20	<1	<13	--
B-82a(w)	Gerrys 4a	2	--	--	--	--
B-82b(w)	Gerrys 4b	2	--	--	--	--
B-82c(w)	Gerrys 4c	2	--	--	--	--
B-83(w)	Gerry's Discrete	0.5	--	1.7	<13	--
B-83(w)	Gerry's Discrete	2	--	110	390	--
B-83(w)	Gerry's Discrete	4	--	4.5	<13	--
B-84(w)	EB-2	20	--	--	--	--
B-84(w)	EB-2	40	--	--	--	--
B-85(w)	JV # - 1a,1b,1c	0.5	60	8.6	<13	--
		2	22	2.1	<13	--
B-85a(w)	JV 1a	0.5	48	--	--	--
B-85b(w)	JV 1b	0.5	16	--	--	--
B-85c(w)	JV 1c	0.5	17	--	--	--
B-86(w)	Residence #- 1a,1b,1c	0.5	15	12	56	--
		2	18	34	140	--
B-87(w)	Residence # (discrete)	0.5	--	14	22	--
B-87(w)	Residence # (discrete)	2	--	500	1400	--
B-87(w)	Residence # (discrete)	4	--	1.5	<13	--
B-88(w)	Bay City # - 1a,1b,1c	0.5	28	6.3	33	--
		2	18	1.5	15	--
B-89(w)	Bay City # - 2a,2b,2c	0.5	44	8.9	54	--
		2	48	9.4	64	--

"<" denotes COI not detected at reporting limit shown
"--" Sample not analyzed for the given COI

FIGURES

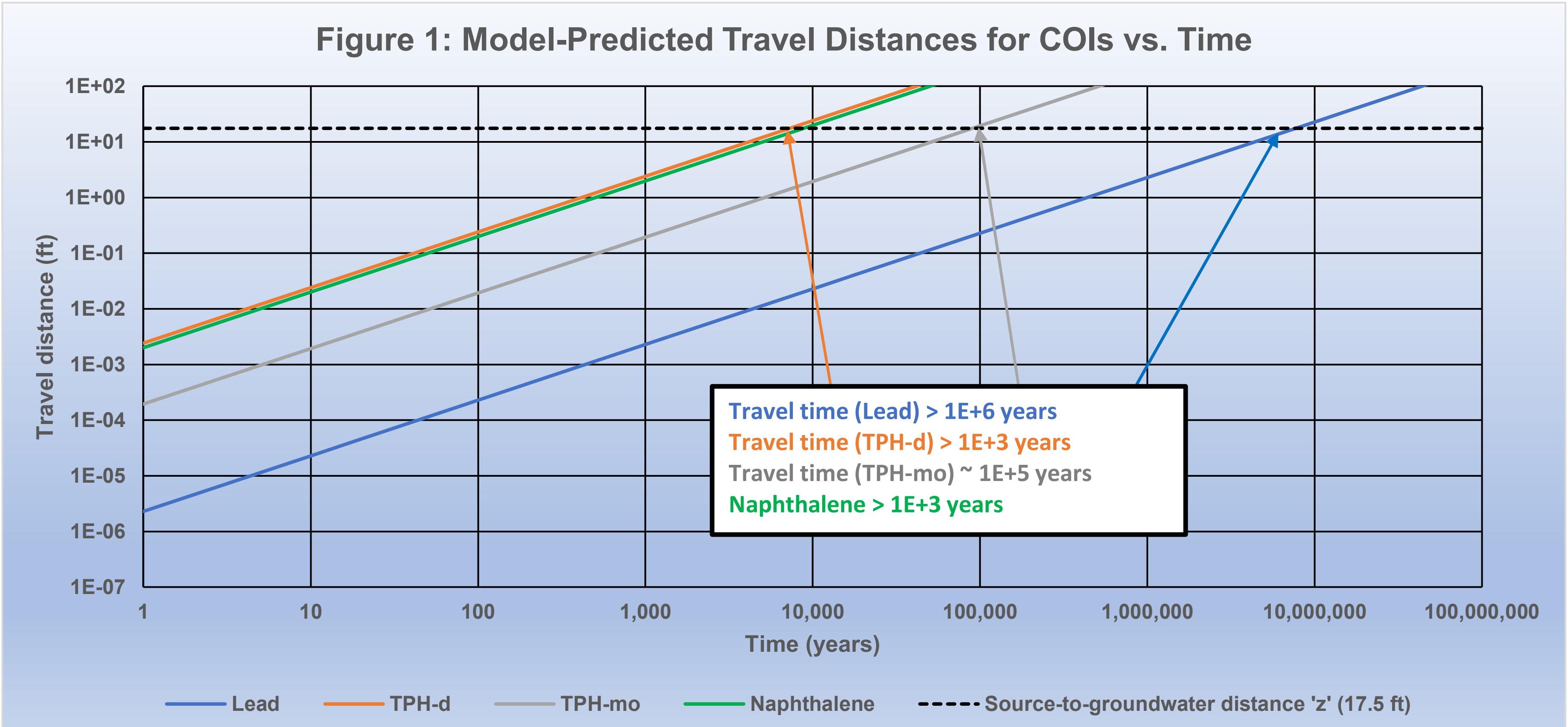


Figure 1: Model-Predicted Travel Distances for COIs vs. Time
1E+02
1E+01
1E+00
1E-01
1E-02
1E-03
1E-04
1E-05
1E-06
1E-07
Travel distance (ft)
1
10
100
1,000
10,000
100,000
1,000,000
10,000,000
100,000,000
Time (years)
Travel time (Lead) > 1E+6 years
Travel time (TPH-d) > 1E+3 years
Travel time (TPH-mo) ~ 1E+5 years
Naphthalene > 1E+3 years
Lead
TPH-d
TPH-mo
Naphthalene
Source-to-groundwater distance 'z' (17.5 ft)

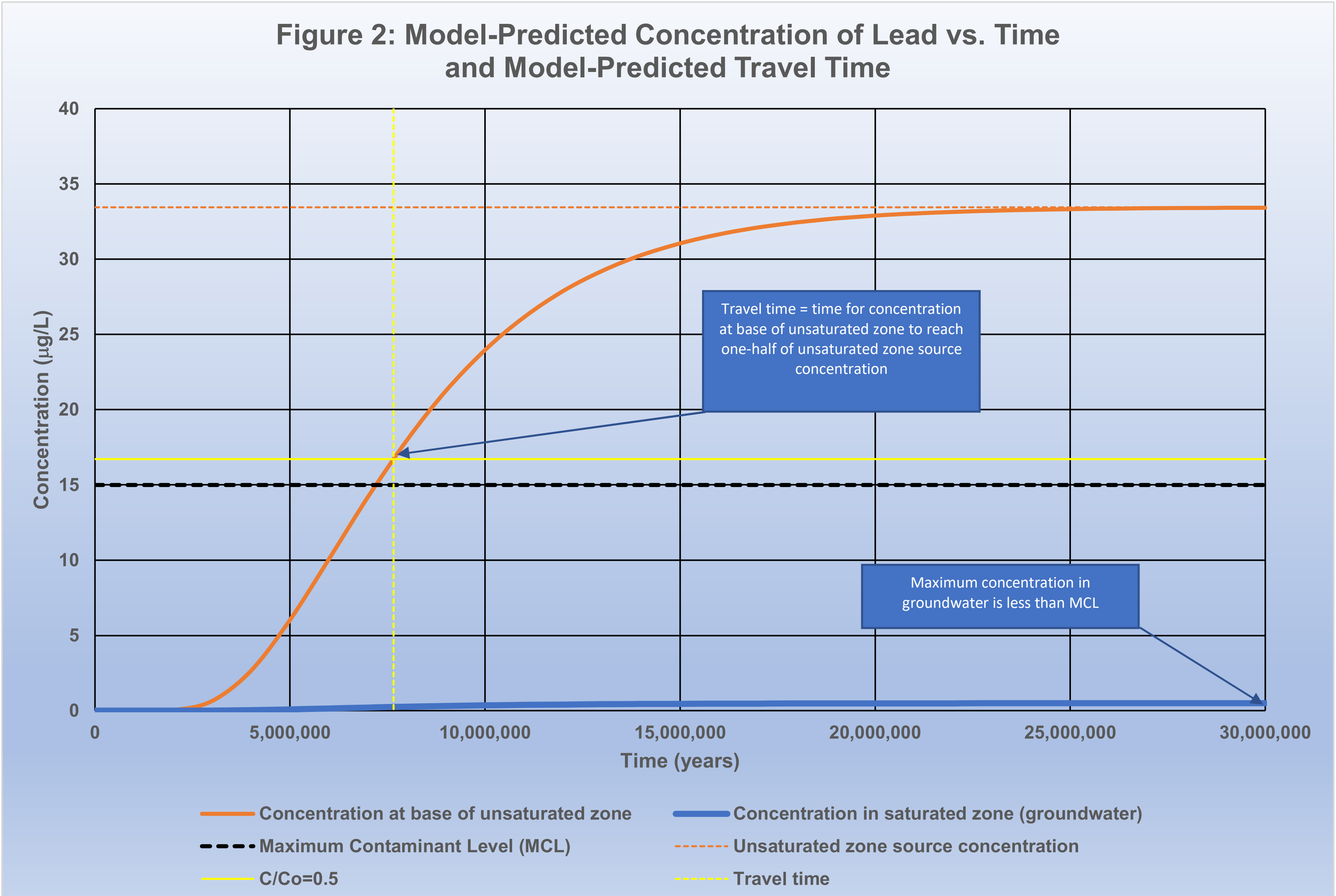


Figure 2: Model-Predicted Concentration of Lead vs. Time
and Model-Predicted Travel Time
Concentration (μg/L)
40
35
30
25
20
15
10
5
0
0
5,000,000
10,000,000
15,000,000
20,000,000
25,000,000
30,000,000
Time (years)
Travel time = time for concentration at base of unsaturated zone to reach one-half of unsaturated zone source concentration
Maximum concentration in groundwater is less than MCL
Concentration at base of unsaturated zone
Concentration in saturated zone (groundwater)
Maximum Contaminant Level (MCL)
Unsaturated zone source concentration
C/Co=0.5
Travel time

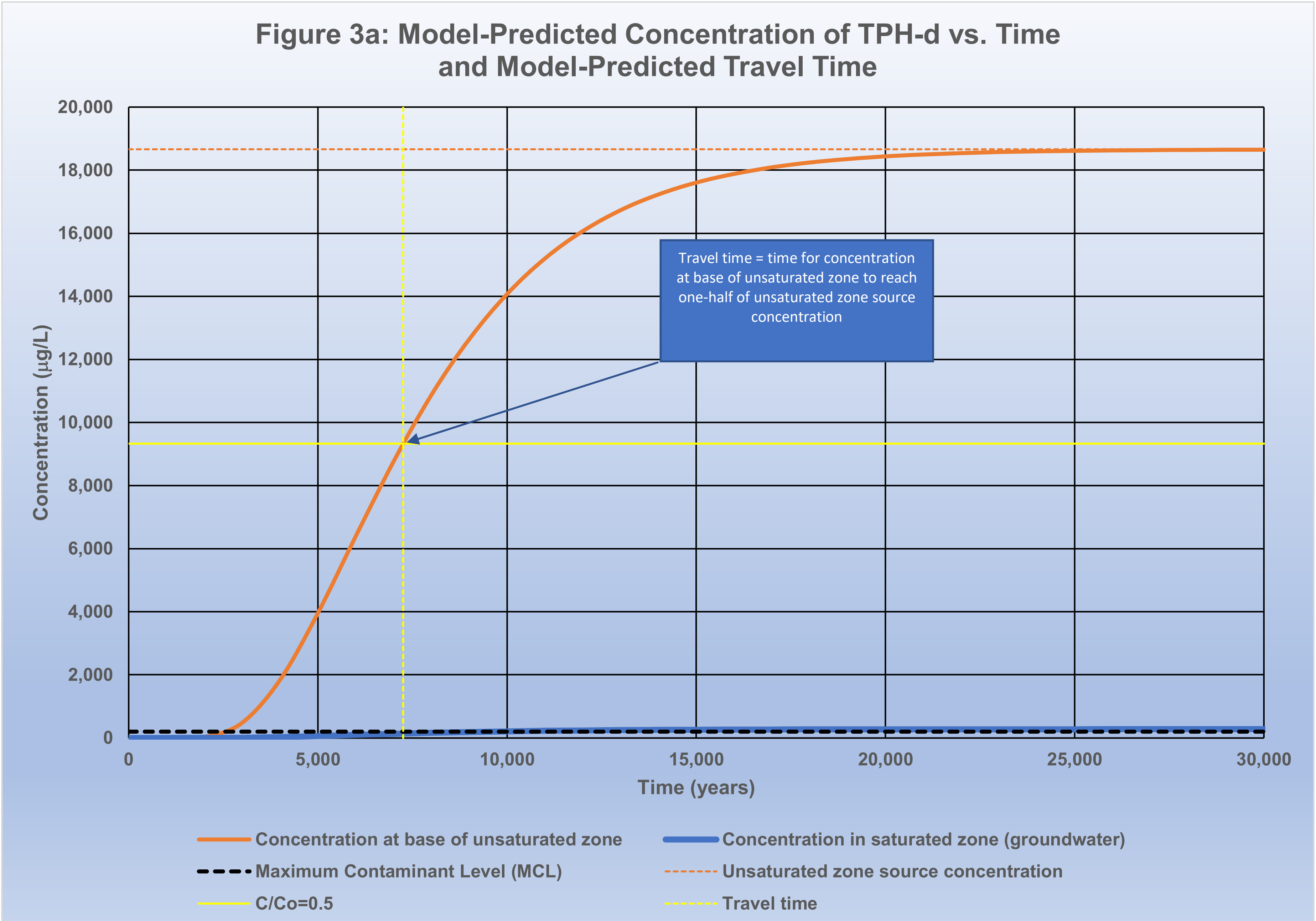


Figure 3a: Model-Predicted Concentration of TPH-d vs. Time
and Model-Predicted Travel Time
Concentration (µg/L)
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
0
5,000
10,000
15,000
20,000
25,000
30,000
Time (years)
Travel time = time for concentration at base of unsaturated zone to reach one-half of unsaturated zone source concentration
Concentration at base of unsaturated zone
Concentration in saturated zone (groundwater)
Maximum Contaminant Level (MCL)
Unsaturated zone source concentration
C/Co=0.5
Travel time

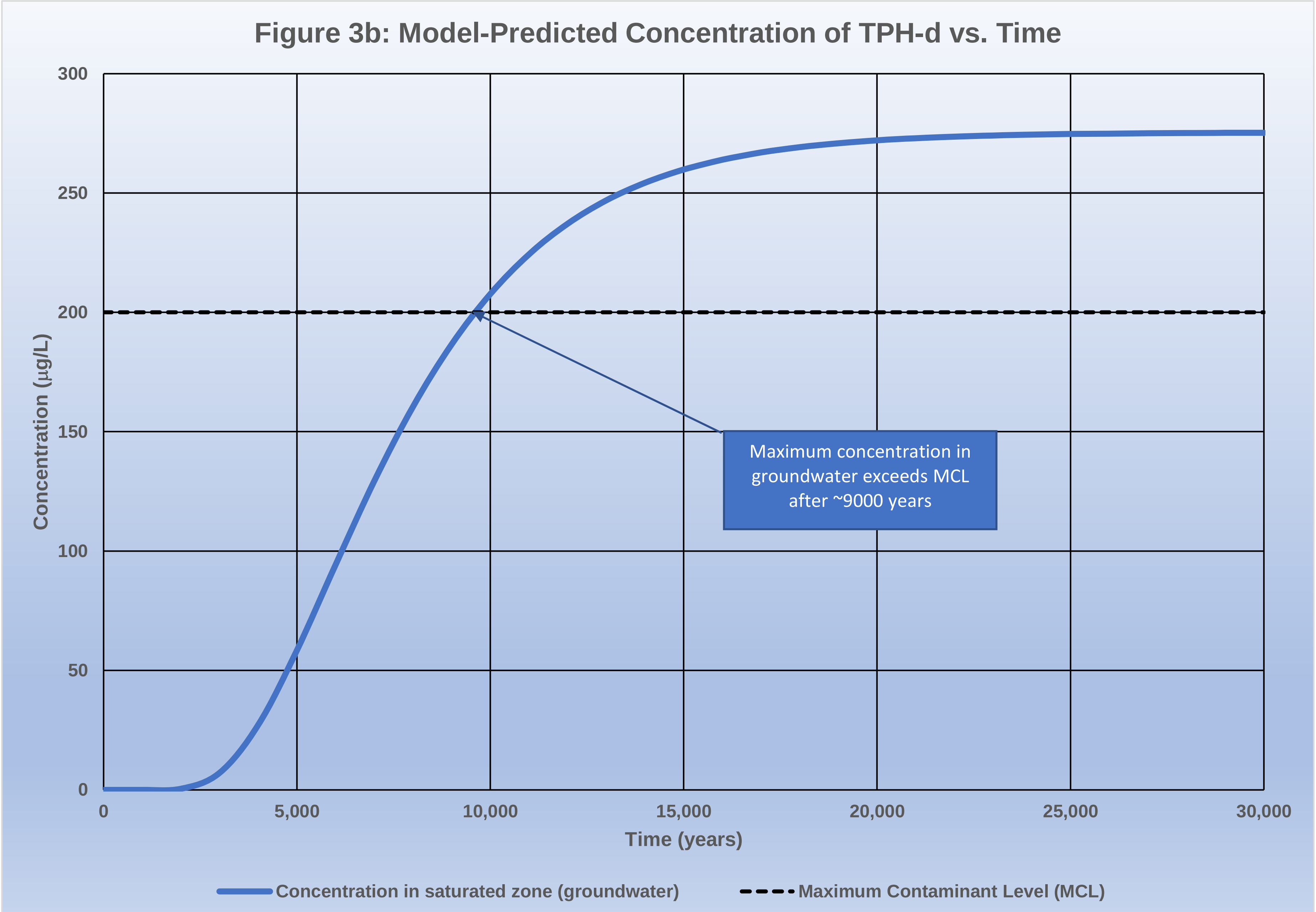


Figure 3b: Model-Predicted Concentration of TPH-d vs. Time
300
250
200
150
100
50
0
Concentration (µg/L)
0
5,000
10,000
15,000
20,000
25,000
30,000
Time (years)
Maximum concentration in groundwater exceeds MCL after ~9000 years
Concentration in saturated zone (groundwater)
Maximum Contaminant Level (MCL)

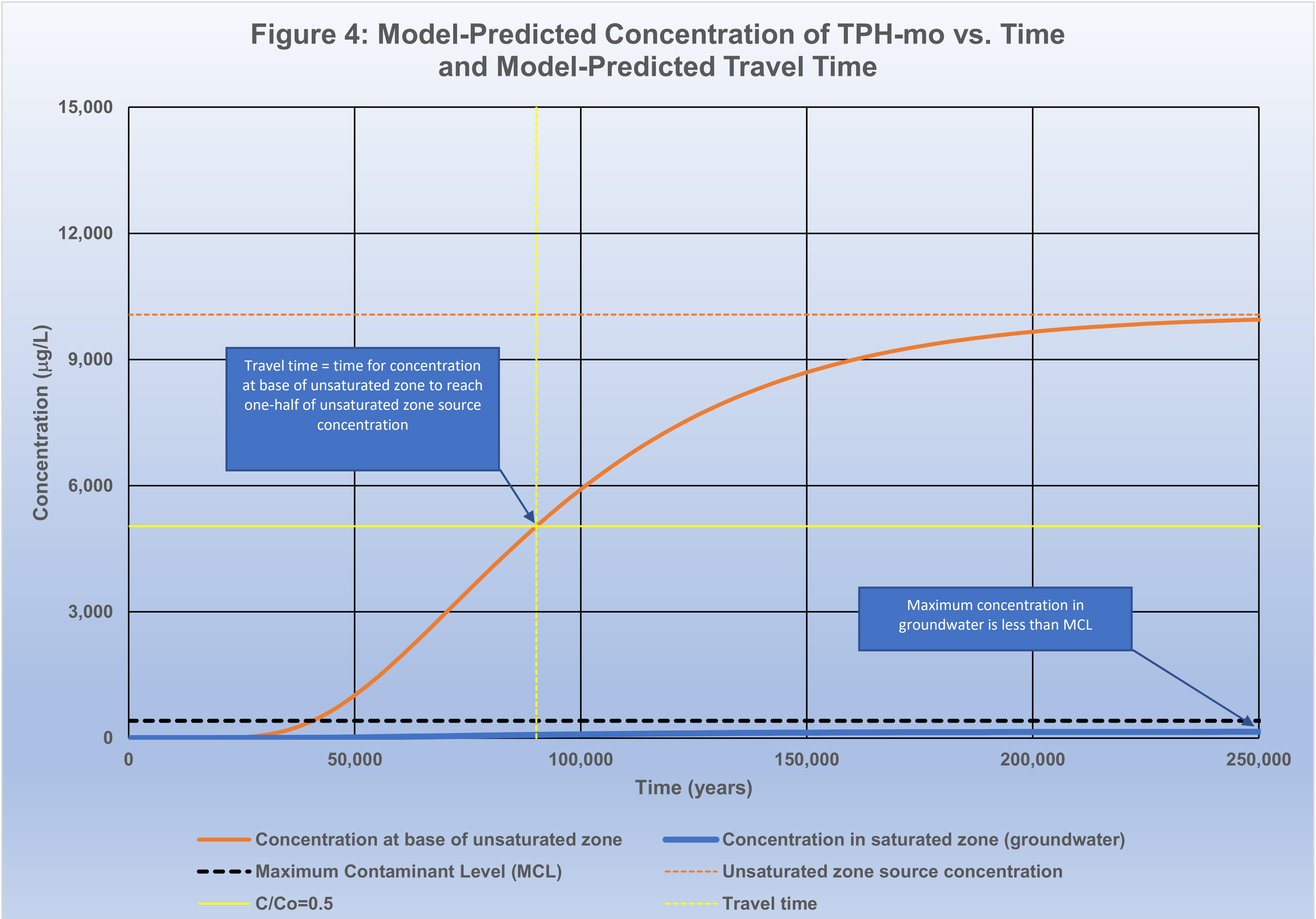


Figure 4: Model-Predicted Concentration of TPH-mo vs. Time
and Model-Predicted Travel Time
Concentration (µg/L)
15,000
12,000
9,000
6,000
3,000
0
0
50,000
100,000
150,000
200,000
250,000
Time (years)
Travel time = time for concentration at base of unsaturated zone to reach one-half of unsaturated zone source concentration
Maximum concentration in groundwater is less than MCL
Concentration at base of unsaturated zone
Concentration in saturated zone (groundwater)
Maximum Contaminant Level (MCL)
Unsaturated zone source concentration
C/Co=0.5
Travel time

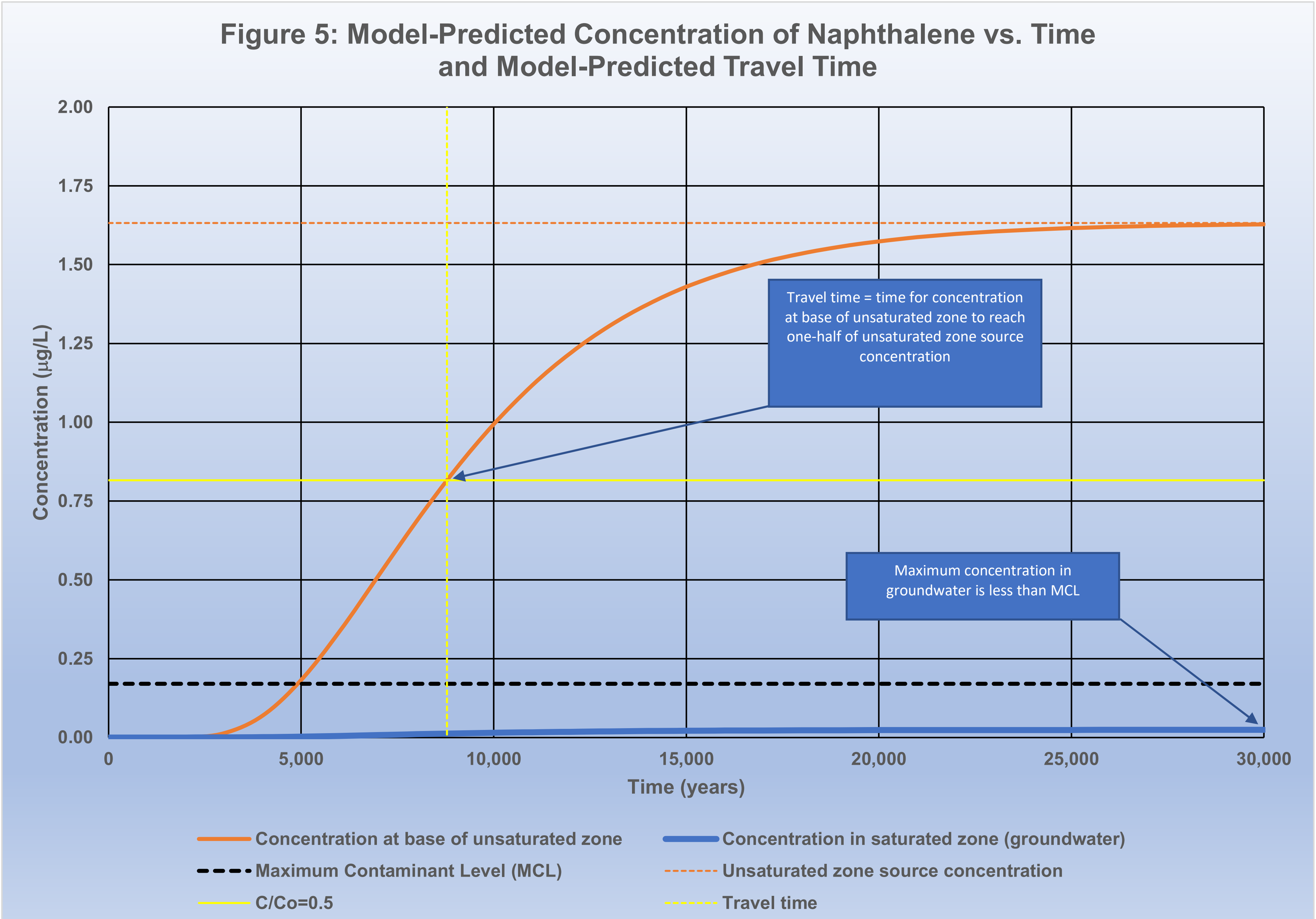


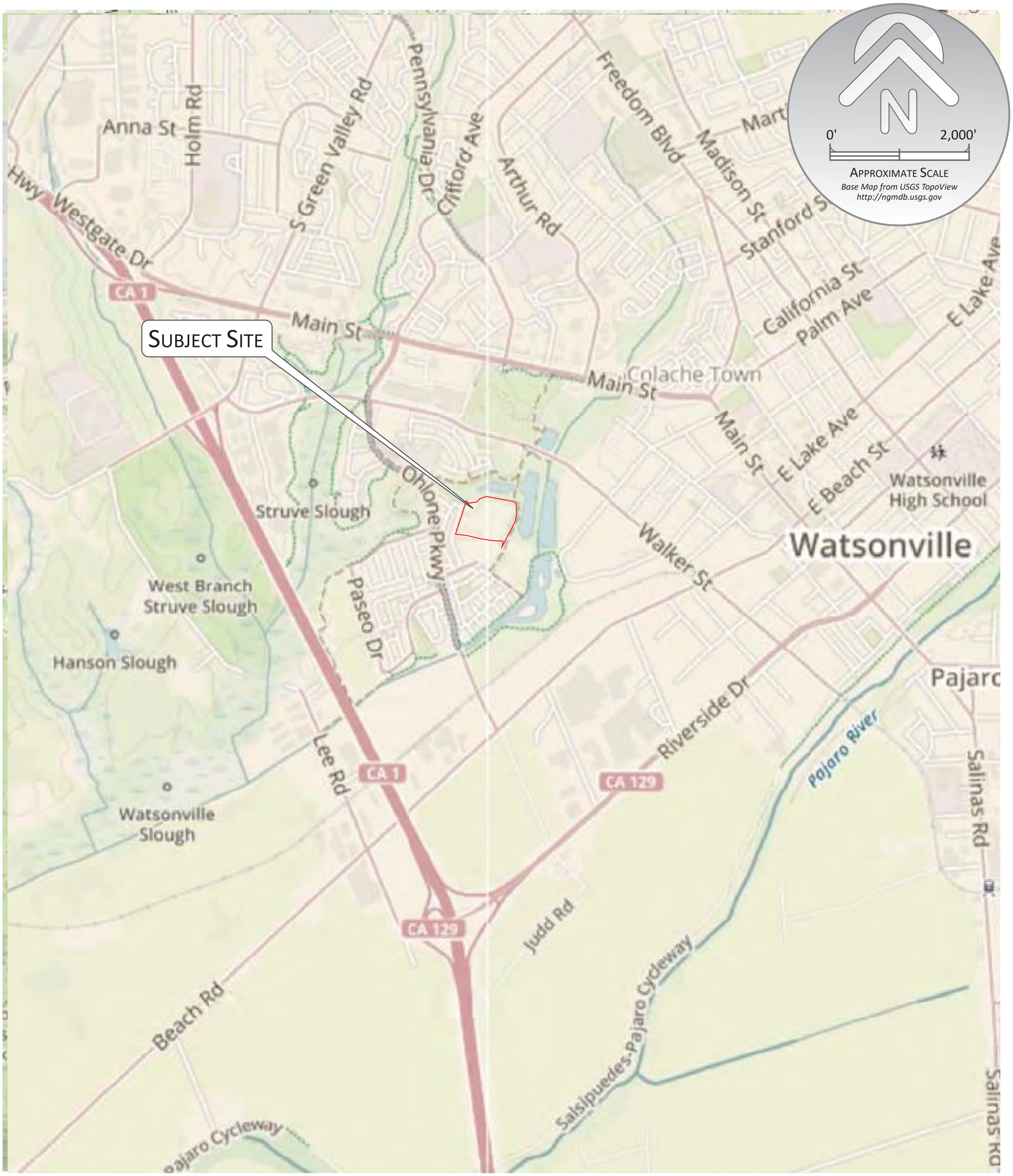
Figure 5: Model-Predicted Concentration of Naphthalene vs. Time
and Model-Predicted Travel Time
Concentration (µg/L)
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
0
5,000
10,000
15,000
20,000
25,000
30,000
Time (years)
Travel time = time for concentration at base of unsaturated zone to reach one-half of unsaturated zone source concentration
Maximum concentration in groundwater is less than MCL
Concentration at base of unsaturated zone
Concentration in saturated zone (groundwater)
Maximum Contaminant Level (MCL)
Unsaturated zone source concentration
C/Co=0.5
Travel time

ATTACHMENT A

Figure 1: Location Map

Figure 2: Vicinity Map

~ from Weber, Hayes & Associates (2021) ~



Weber, Hayes & Associates
Hydrogeology and Environmental Engineering
120 Westgate Drive, Watsonville, CA
831.722.3580 / www.weber-hayes.com

Location Map
Remedial Action Plan

Site: Clusters Storage yard
Address: 511 Ohlone Parkway, Watsonville, CA

Date: July 2017

Revisions/Notes:

Figure 1
Project 2X623

Figure 2
Project 2x623

Vicinity Map
Remedial Action Plan

Site: Clusters Junkyard
Address: 511 Ohlone Parkway, Watsonville, CA

Date: July 2017

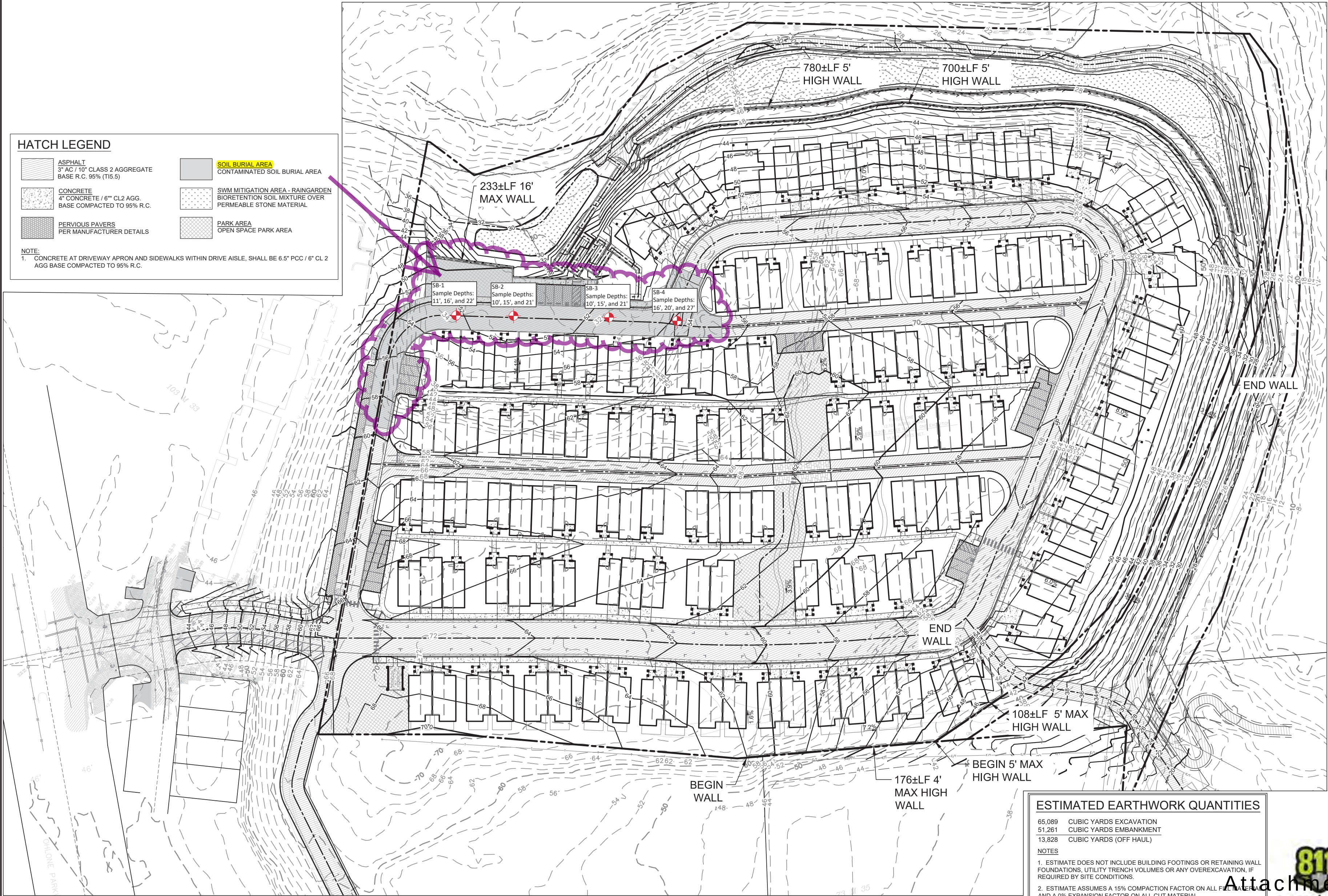
Revisions/Notes:

Weber, Hayes & Associates
Hydrogeology and Environmental Engineering
120 Westgate Drive, Watsonville, CA
831.722.3580 / www.weber-hayes.com

ATTACHMENT B

Location of Burial Envelope

~ provided by Weber, Hayes & Associates ~



PRELIMINARY GRADING PLAN

GRAPHIC SCALE: 1 INCH = 40 FEET

ESTIMATED EARTHWORK QUANTITIES

65,089	CUBIC YARDS EXCAVATION
51,261	CUBIC YARDS EMBANKMENT
13,828	CUBIC YARDS (OFF HAUL)

NOTES

1. ESTIMATE DOES NOT INCLUDE BUILDING FOOTINGS OR RETAINING WALL FOUNDATIONS, UTILITY TRENCH VOLUMES OR ANY OVEREXCAVATION, IF REQUIRED BY SITE CONDITIONS.
2. ESTIMATE ASSUMES A 15% COMPACTION FACTOR ON ALL FILL MATERIAL AND A 0% EXPANSION FACTOR ON ALL CUT MATERIAL.
3. PRIOR TO COMMENCEMENT OF WORK CONTRACTOR SHALL CONFIRM THAT ESTIMATES ARE CORRECT.

811 Know what's below. Call before you dig.

RAMSEY CIVIL ENGINEERING INC
CIVIL ENGINEERING
LAND PLANNING
PROJECT MANAGEMENT
CONSTRUCTION SUPPORT
QSD AND QSP SERIVCES

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SANTA CRUZ, CA 95065
TEL (831) 462-2905
www.ramseycivilengineering.com

REGISTERED PROFESSIONAL ENGINEER DAVID RAMSEY NO. C73735 CIVIL STATE OF CALIFORNIA

DAVID RAMSEY DATE
RCE# 73735

APN# 018-372-14

PLAN TYPE
RESIDENTIAL SUBDIVISION

PRELIMINARY GRADING PLAN
HILLCREST SUBDIVISION
510 OHLONE PARKWAY, WATSONVILLE, CA 95076

REVISION BLOCK: NUMBER | BY | DESCRIPTION | DATE

DRAWN BY:	DMR
DESIGNED BY:	DMR
DATE:	12/14/2020
SCALE:	AS NOTED
PROJECT NO:	20-021
SHEET	VE 2.0


Soil Burial
Location
(topographic trough)

ESTIMATED BURIAL VOLUMES

NOTES:

1. BURIAL AREA = 17,088 SQUARE FEET (ALL UNDER IMPERVIOUS SURFACES)
2. DEPTH FROM BOTTOM OF CONTAMINATED SOILS TO HIGH WATER MARK (ELEV 11) = 15' MIN.
3. TOP BURIAL TAKEN TO BOTTOM ROAD SUBBASE.
4. ASSUMES 15% COMPACTION FACTOR AT 6" LIFTS COMPACTED TO 90% MIN.
5. CUT MATERIAL (NON CONTAMINATED), NOTED BELOW, TO BE USED ELSEWHERE ONSITE.

7,724 CUBIC YARDS EXCAVATION TO BOTTOM BURIAL (ELEV. 26)

18,111 CUBIC YARDS CONTAMINATED FILL

SHADED AREA - CONTAMINATED SOIL BURIAL SITE (17,100± SF @ 35±' DEPTH) GROUND WATER AT ELEV 11' MSL

PHASING PLAN

- 1 PHASE 1 - 30 UNITS
  LOMA VISTA /STREET A (STA: 1+00 - 16+43) STREET C (STA:7+00 - 10+56)
- 2 PHASE 2 - 29 UNITS
  STREET B (STA: 5+00 - 7+29)
- 3 PHASE 3 - 27 UNITS
- 4 PHASE 4 - 27 UNITS
  STREET B (STA: 1+00 - 5+00)
- 5 PHASE 5 - 30 UNITS
  STREET A (STA: 1+00 - 7+00)

UNIT BREAKDOWN PER PHASE

	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	TOTAL/UNIT
UNIT A	2	2	0	0	2	6
UNIT C2	14	12	13	10	12	61
UNIT G	5	6	4	6	6	27
UNIT F	3	5	4	5	4	20
UNIT D	6	4	6	6	6	29
TOTALS	30	29	27	27	30	143

PLAN VIEW

40' 0 20' 40' 80'
GRAPHIC SCALE: 1 INCH = 40 FEET

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SANTA CRUZ, CA 95065
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www.ramseycivilengineering.com

REGISTERED PROFESSIONAL ENGINEER DAVID RAMSEY NO. C73735 CIVIL STATE OF CALIFORNIA

DAVID RAMSEY DATE
RCE# 73735

APN# 018-372-14

PLAN TYPE
RESIDENTIAL SUBDIVISION

SITE PLAN: PHASING & UNIT LAYOUT
HILLCREST SUBDIVISION
510 OHLONE PARKWAY, WATSONVILLE, CA 95076

NUMBER	BY	DESCRIPTION	DATE

REVISION BLOCK

DRAWN BY:	DMR
DESIGNED BY:	DMR
DATE:	12/14/2020
SCALE:	AS NOTED
PROJECT NO:	20-021
SHEET:	VE 1.0

ATTACHMENT C

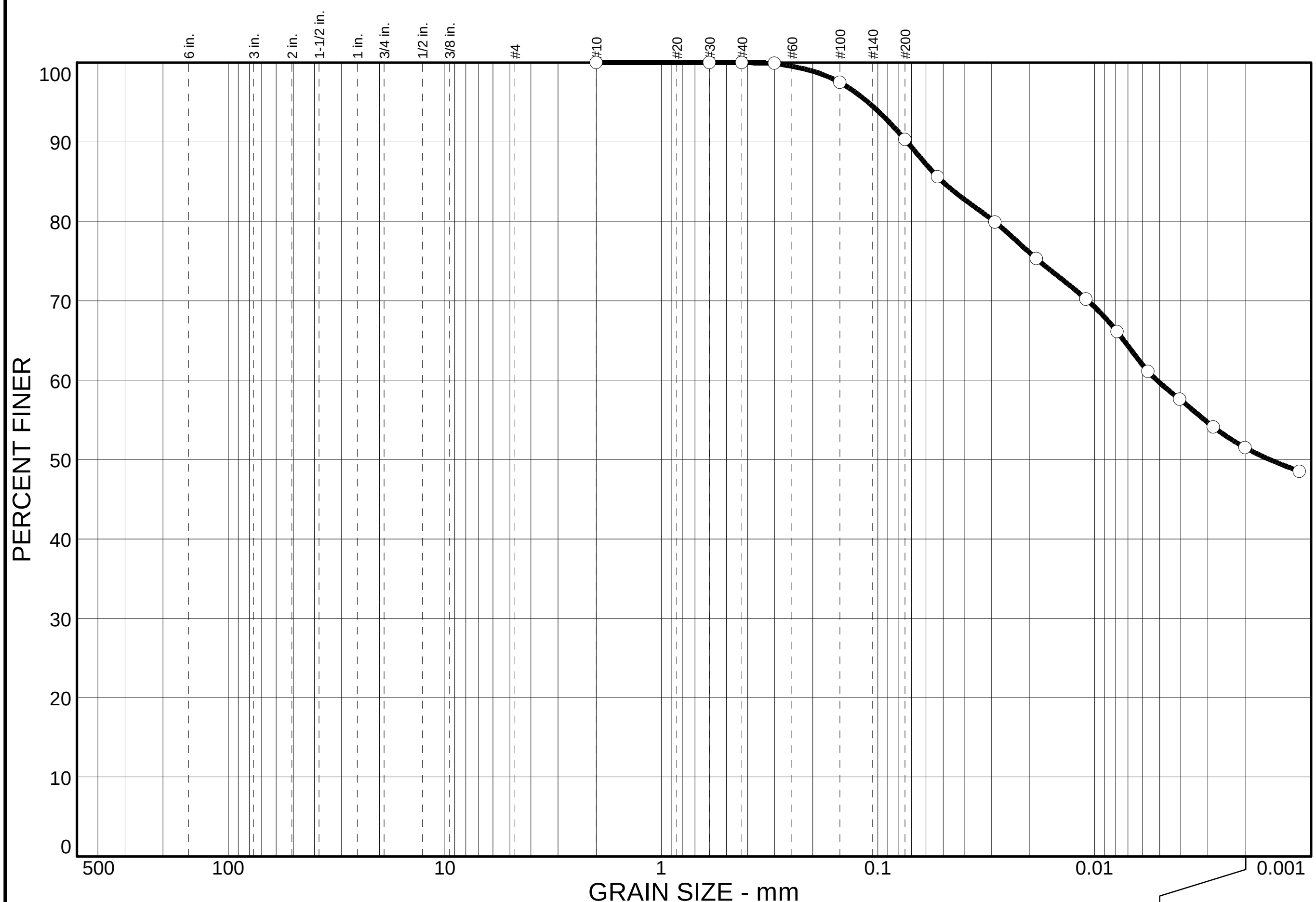
Geotechnical Soil Analysis

~ provided by Weber, Hayes & Associates ~

Geotechnical Soil Quality
Laboratory Analytical Results and Chain of Custody

- **Particle Size Distribution Report Cooper Testing Laboratory**
- **Waypoint Analytical**
- **Moisture-Density-Porosity Report**
- **Specific Gravity by Pycnometer**
- **Corrosivity Tests**
- **Chain of Custody**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	9.7	38.9	51.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#30	100.0		
#40	100.0		
#50	99.9		
#100	97.5		
#200	90.3		
#270	85.6		
0.0288 mm.	79.9		
0.0186 mm.	75.3		
0.0109 mm.	70.2		
0.0079 mm.	66.1		
0.0057 mm.	61.1		
0.0040 mm.	57.6		
0.0028 mm.	54.1		
0.0020 mm.	51.5		
0.0011 mm.	48.5		

* (no specification provided)

Soil Description

Olive Gray CLAY

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0503 D_{60}= 0.0052 D_{50}= 0.0016
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

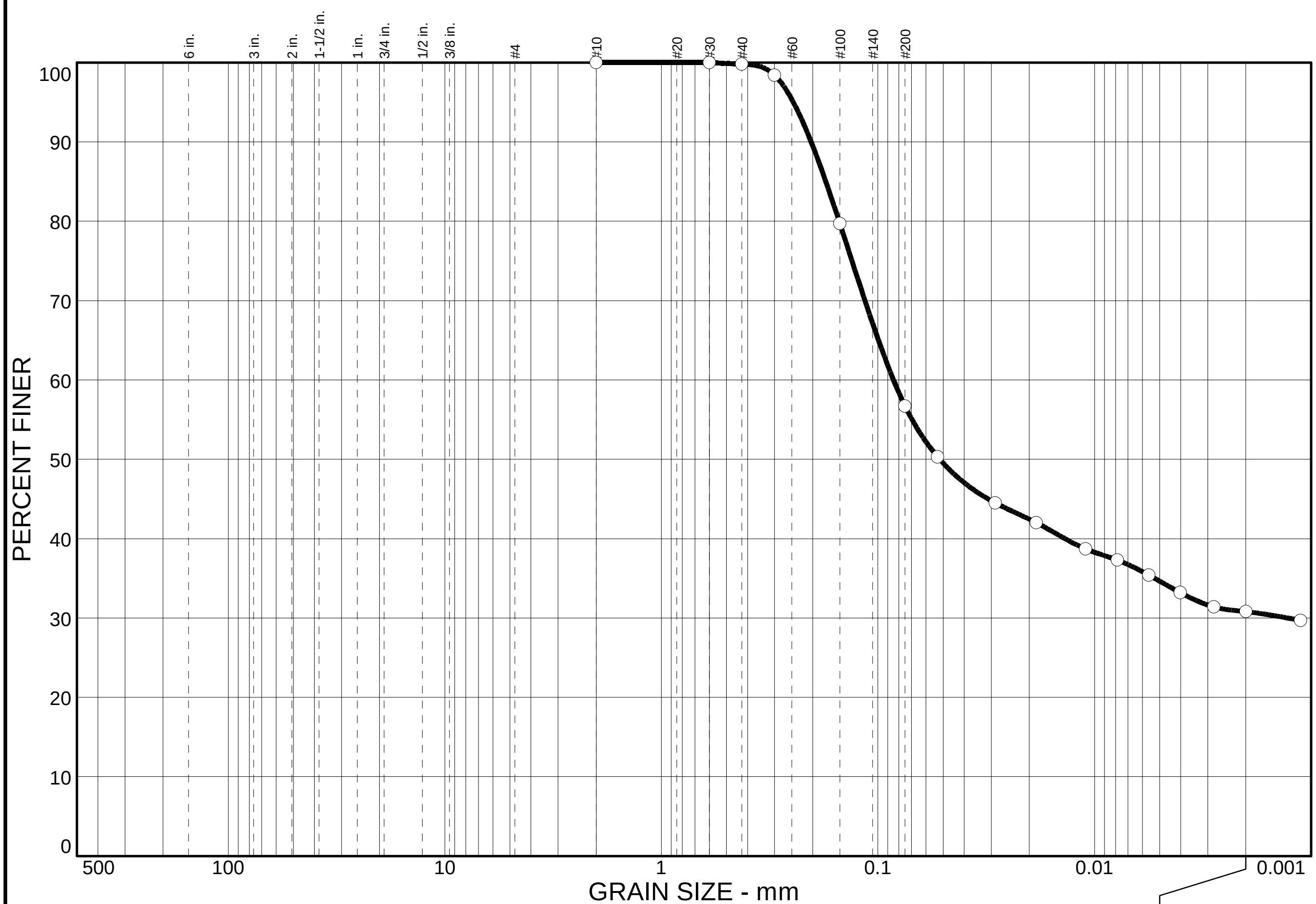
Sample No.: **Source of Sample:** SB-1-d11 **Date:** 2/23/21
Location: **Elev./Depth:** 11'

COOPER TESTING LABORATORY

Client: Weber, Hayes & Associates
Project: 510 Ohlone Parkway, Watsonville, CA. - 2t038

Project No: 407-024 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	43.3	25.9	30.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#30	100.0		
#40	99.8		
#50	98.4		
#100	79.7		
#200	56.7		
#270	50.3		
0.0287 mm.	44.5		
0.0185 mm.	42.0		
0.0110 mm.	38.7		
0.0078 mm.	37.3		
0.0056 mm.	35.4		
0.0040 mm.	33.2		
0.0028 mm.	31.4		
0.0020 mm.	30.8		
0.0011 mm.	29.7		

* (no specification provided)

Soil Description

Dark Yellowish Brown Sandy CLAY

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.174 D_{60}= 0.0848 D_{50}= 0.0519
D_{30}= 0.0013 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

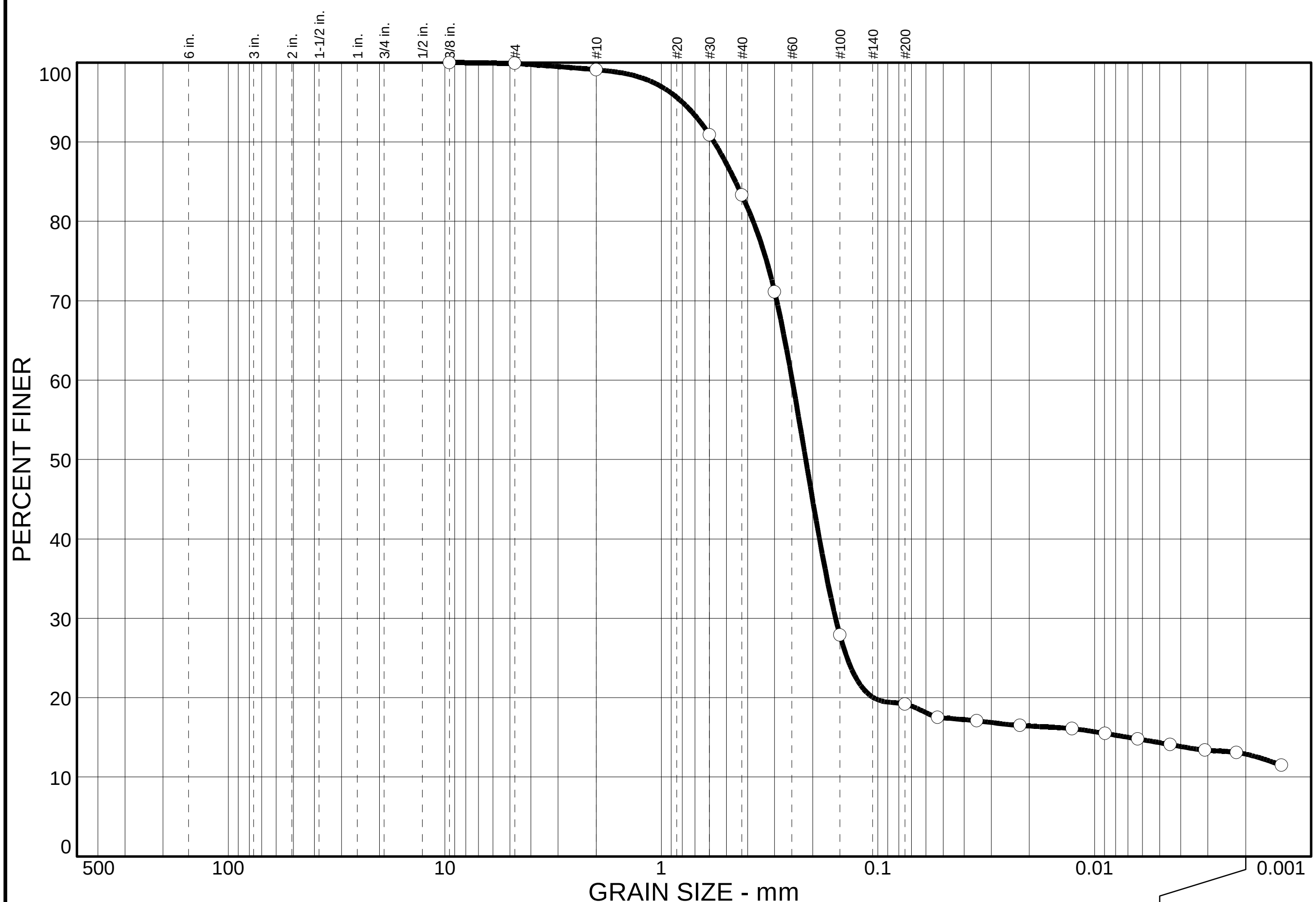
Sample No.: **Source of Sample:** SB-1-d16 **Date:** 2/23/21
Location: **Elev./Depth:** 16'

COOPER TESTING LABORATORY

Client: Weber, Hayes & Associates
Project: 510 Ohlone Parkway, Watsonville, CA. - 2t038

Project No: 407-024 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.1	80.7	6.3	12.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8 in.	100.0		
#4	99.9		
#10	99.1		
#30	90.9		
#40	83.3		
#50	71.1		
#100	27.9		
#200	19.2		
#270	17.5		
0.0350 mm.	17.1		
0.0221 mm.	16.5		
0.0127 mm.	16.1		
0.0089 mm.	15.5		
0.0063 mm.	14.8		
0.0045 mm.	14.1		
0.0031 mm.	13.4		
0.0022 mm.	13.1		
0.0014 mm.	11.5		

* (no specification provided)

Soil Description

Dark Yellowish Brown Silty SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.455 D_{60}= 0.249 D_{50}= 0.216
D_{30}= 0.157 D_{15}= 0.0070 D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

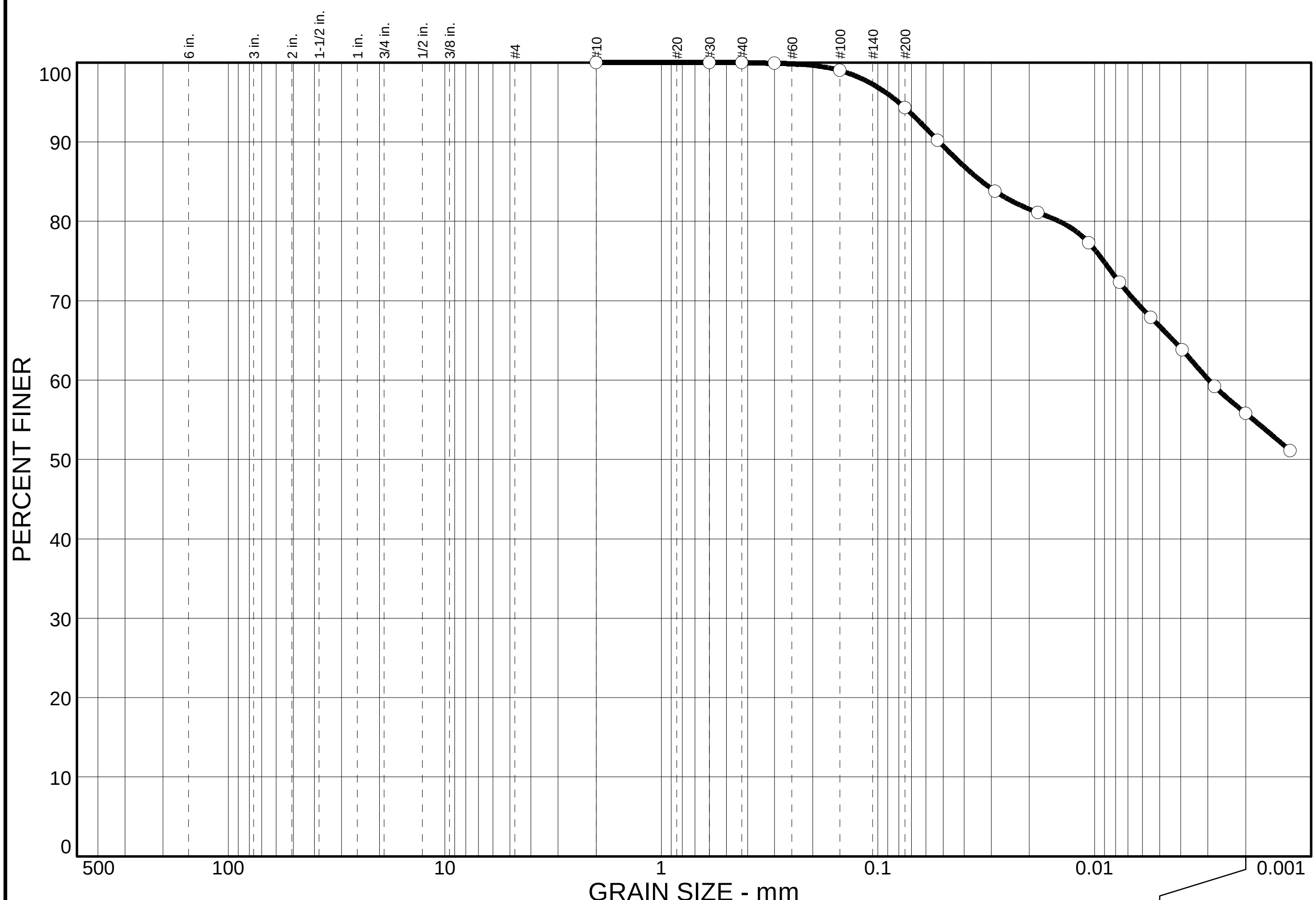
Sample No.: **Source of Sample:** SB-1-d22 **Date:** 2/24/21
Location: **Elev./Depth:** 22'

COOPER TESTING LABORATORY

Client: Weber, Hayes & Associates
Project: 510 Ohlone Parkway, Watsonville, CA. - 2t038

Project No: 407-024 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	5.7	38.5	55.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#30	100.0		
#40	100.0		
#50	99.9		
#100	99.0		
#200	94.3		
#270	90.2		
0.0288 mm.	83.8		
0.0183 mm.	81.1		
0.0106 mm.	77.3		
0.0077 mm.	72.3		
0.0055 mm.	67.9		
0.0039 mm.	63.8		
0.0028 mm.	59.2		
0.0020 mm.	55.8		
0.0012 mm.	51.1		

* (no specification provided)

Soil Description

Very Dark Brown CLAY

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0331 D_{60}= 0.0030 D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

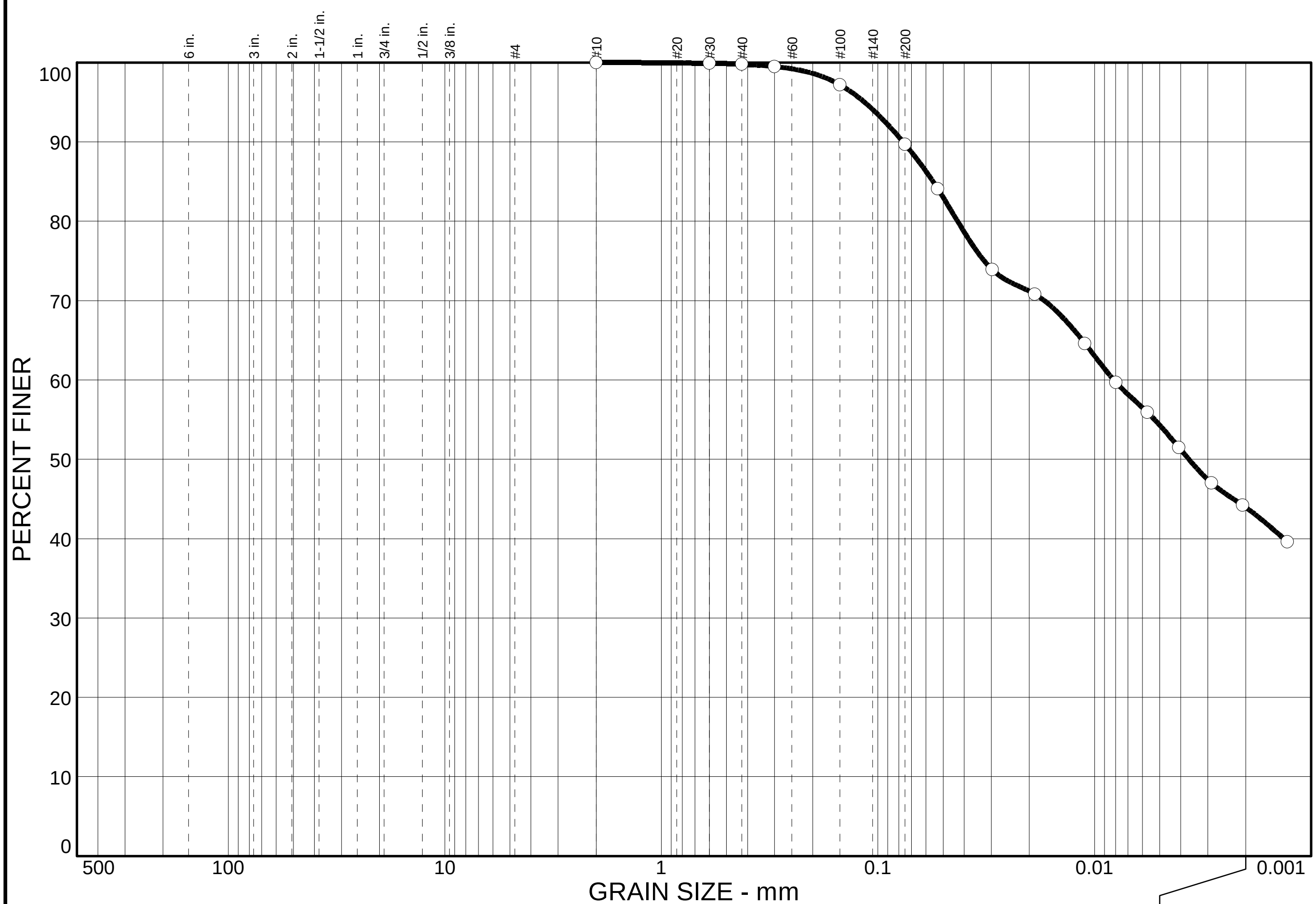
Sample No.: **Source of Sample:** SB-2-d10 **Date:** 2/25/21
Location: **Elev./Depth:** 10'

COOPER TESTING LABORATORY

Client: Weber, Hayes & Associates
Project: 510 Ohlone Parkway, Watsonville, CA. - 2t038

Project No: 407-024 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	10.3	45.8	43.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#30	99.9		
#40	99.8		
#50	99.5		
#100	97.2		
#200	89.7		
#270	84.1		
0.0297 mm.	73.9		
0.0188 mm.	70.8		
0.0111 mm.	64.6		
0.0080 mm.	59.7		
0.0057 mm.	55.9		
0.0041 mm.	51.5		
0.0029 mm.	47.0		
0.0021 mm.	44.2		
0.0013 mm.	39.6		

* (no specification provided)

Soil Description

Very Dark Grayish Brown CLAY

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0557 D_{60}= 0.0082 D_{50}= 0.0037
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

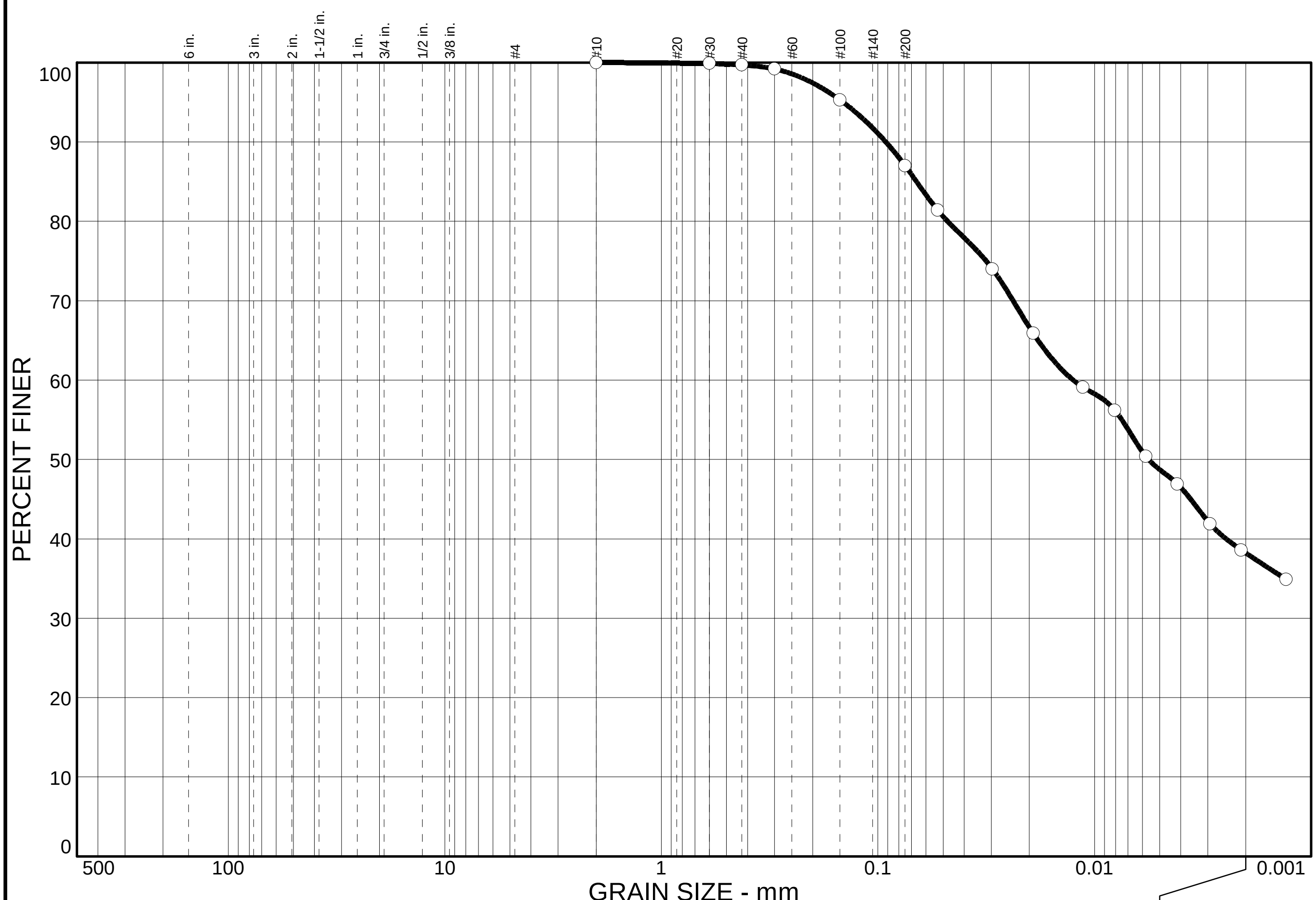
Sample No.: **Source of Sample:** SB-2-d15 **Date:** 2/25/21
Location: **Elev./Depth:** 15'

COOPER TESTING LABORATORY

Client: Weber, Hayes & Associates
Project: 510 Ohlone Parkway, Watsonville, CA. - 2t038

Project No: 407-024 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	13.0	48.8	38.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#30	99.9		
#40	99.7		
#50	99.2		
#100	95.3		
#200	87.0		
#270	81.4		
0.0296 mm.	74.0		
0.0192 mm.	65.9		
0.0113 mm.	59.1		
0.0081 mm.	56.2		
0.0058 mm.	50.4		
0.0041 mm.	46.9		
0.0029 mm.	41.9		
0.0021 mm.	38.6		
0.0013 mm.	34.9		

* (no specification provided)

Soil Description

Dark Grayish Brown CLAY

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0664 D_{60}= 0.0125 D_{50}= 0.0056
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

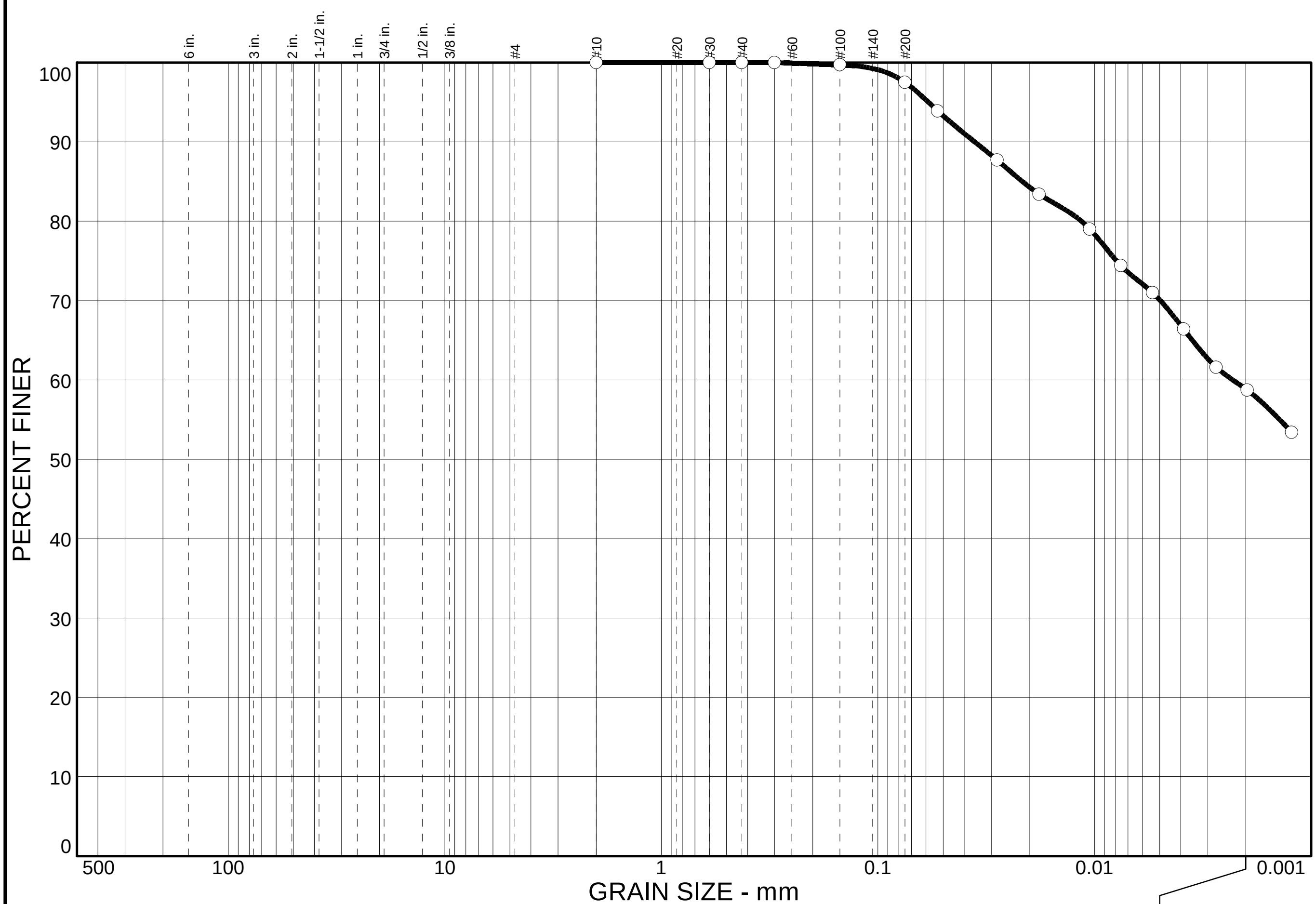
Sample No.: **Source of Sample:** SB-2-d21 **Date:** 2/25/21
Location: **Elev./Depth:** 21'

COOPER TESTING LABORATORY

Client: Weber, Hayes & Associates
Project: 510 Ohlone Parkway, Watsonville, CA. - 2t038

Project No: 407-024 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	2.5	38.7	58.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#30	100.0		
#40	100.0		
#50	100.0		
#100	99.7		
#200	97.5		
#270	93.9		
0.0282 mm.	87.7		
0.0180 mm.	83.4		
0.0105 mm.	79.0		
0.0076 mm.	74.4		
0.0054 mm.	71.0		
0.0039 mm.	66.4		
0.0027 mm.	61.6		
0.0020 mm.	58.7		
0.0012 mm.	53.4		

* (no specification provided)

Soil Description

Very Dark Grayish Brown CLAY

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0215 D_{60}= 0.0023 D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

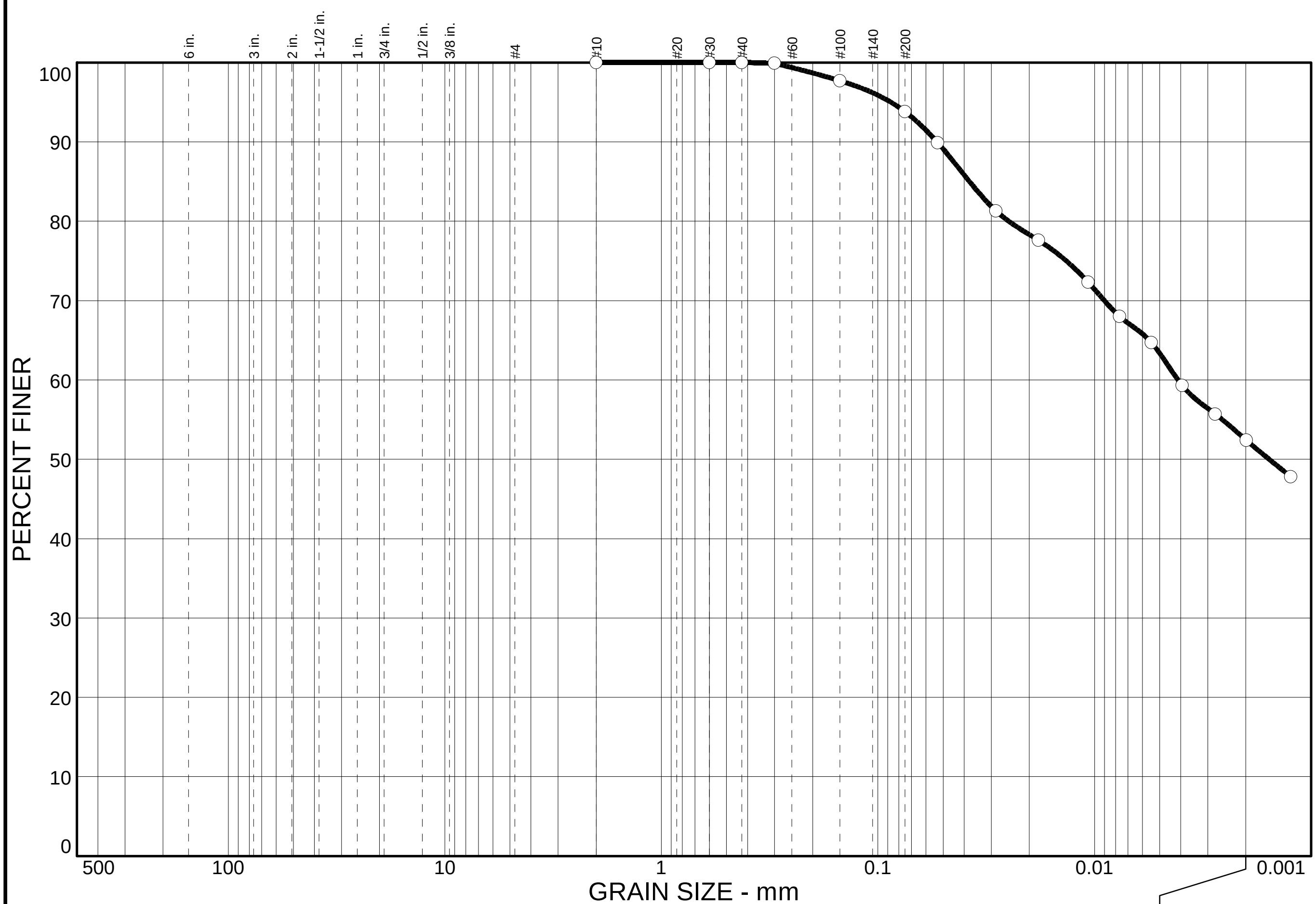
Sample No.: **Source of Sample:** SB-3-d10 **Date:** 2/25/21
Location: **Elev./Depth:** 10'

COOPER TESTING LABORATORY

Client: Weber, Hayes & Associates
Project: 510 Ohlone Parkway, Watsonville, CA. - 2t038

Project No: 407-024 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	6.2	41.4	52.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#30	100.0		
#40	100.0		
#50	99.9		
#100	97.7		
#200	93.8		
#270	89.9		
0.0285 mm.	81.3		
0.0182 mm.	77.6		
0.0107 mm.	72.3		
0.0077 mm.	68.0		
0.0055 mm.	64.7		
0.0039 mm.	59.3		
0.0028 mm.	55.7		
0.0020 mm.	52.4		
0.0012 mm.	47.8		

* (no specification provided)

Soil Description

Dark Grayish Brown CLAY

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0378 D_{60}= 0.0041 D_{50}= 0.0016
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

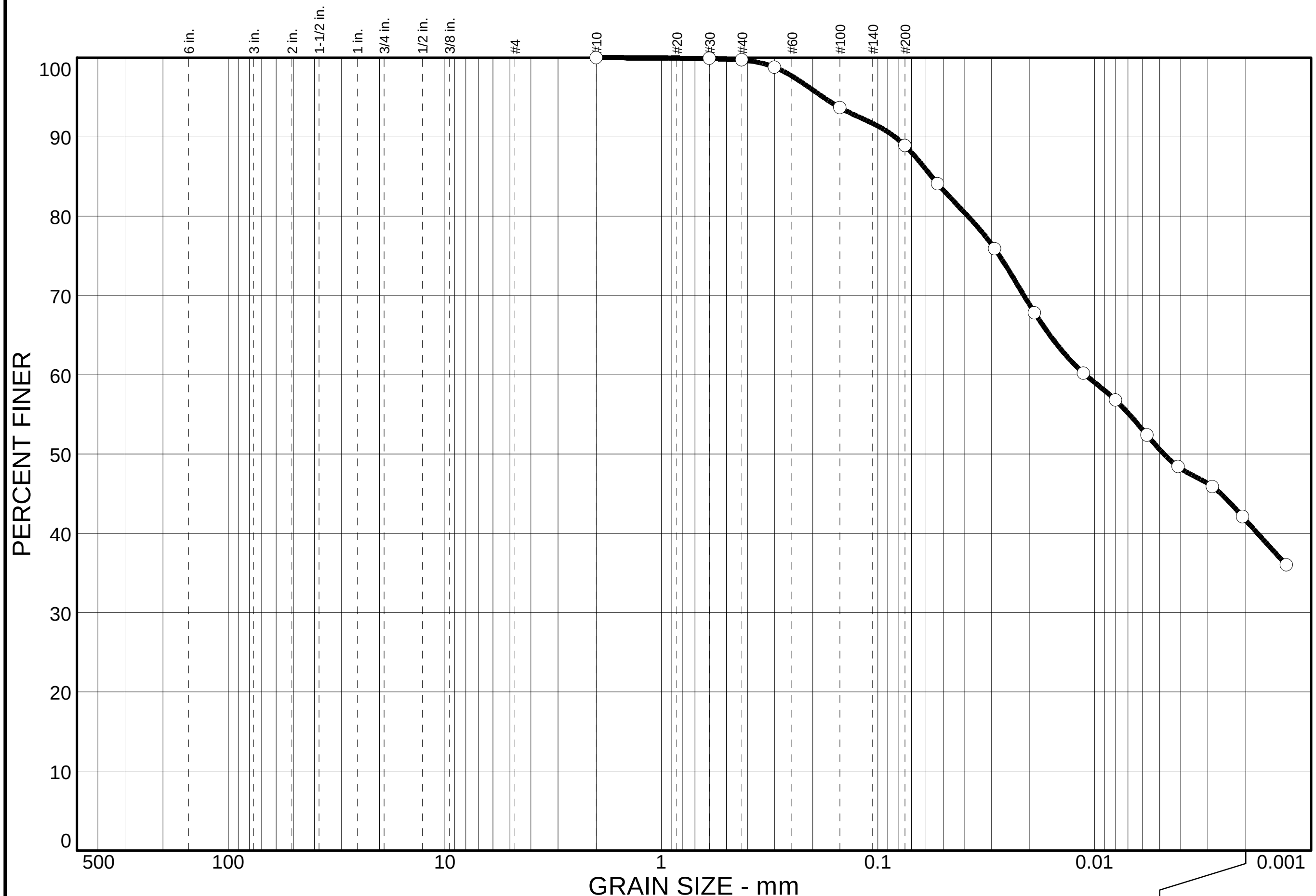
Sample No.: **Source of Sample:** SB-3-d15 **Date:** 2/25/21
Location: **Elev./Depth:** 15'

COOPER TESTING LABORATORY

Client: Weber, Hayes & Associates
Project: 510 Ohlone Parkway, Watsonville, CA. - 2t038

Project No: 407-024 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	11.1	47.3	41.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#30	99.9		
#40	99.7		
#50	98.8		
#100	93.7		
#200	88.9		
#270	84.1		
0.0289 mm.	75.9		
0.0189 mm.	67.8		
0.0112 mm.	60.2		
0.0080 mm.	56.8		
0.0057 mm.	52.4		
0.0041 mm.	48.4		
0.0029 mm.	45.9		
0.0021 mm.	42.1		
0.0013 mm.	36.0		

* (no specification provided)

Soil Description

Dark Brown CLAY

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0565 D_{60}= 0.0110 D_{50}= 0.0048
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Sample No.: **Source of Sample:** SB-3-d21 **Date:** 2/24/21
Location: **Elev./Depth:** 21(Tip-6")

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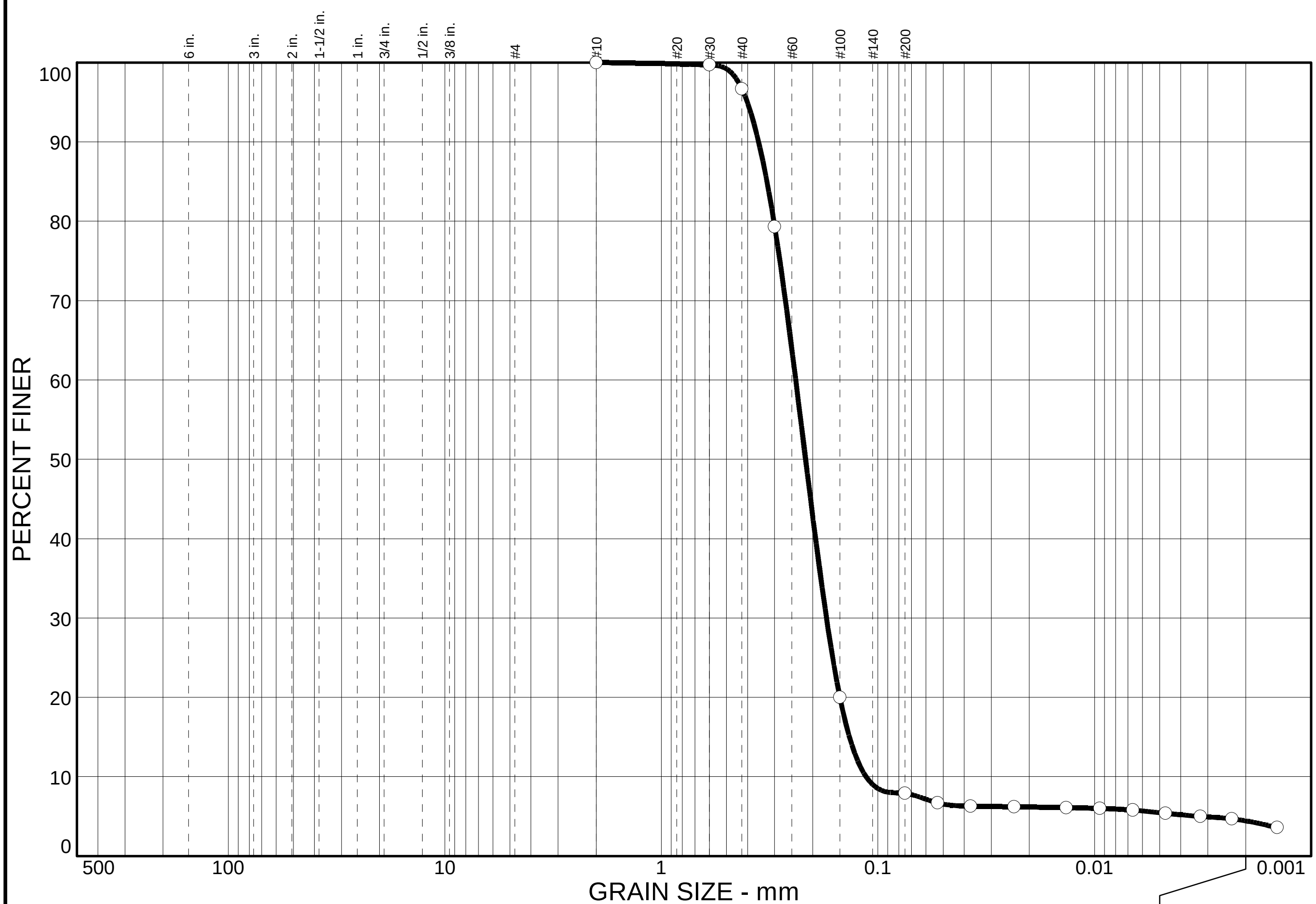
Client: Weber, Hayes & Associates
Project: 510 Ohlone Parkway, Watsonville, CA. - 2t038

Project No: 407-024 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	92.1	3.5	4.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#30	99.7		
#40	96.7		
#50	79.3		
#100	20.0		
#200	7.9		
#270	6.7		
0.0373 mm.	6.3		
0.0235 mm.	6.2		
0.0135 mm.	6.1		
0.0095 mm.	6.0		
0.0067 mm.	5.8		
0.0047 mm.	5.4		
0.0032 mm.	5.0		
0.0023 mm.	4.7		
0.0014 mm.	3.6		

* (no specification provided)

Soil Description

Dark Yellowish Brown Poorly Graded SAND w/ Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.326 D_{60}= 0.240 D_{50}= 0.216
D_{30}= 0.173 D_{15}= 0.135 D_{10}= 0.114
C_u= 2.11 C_c= 1.10

Classification

USCS= AASHTO=

Remarks

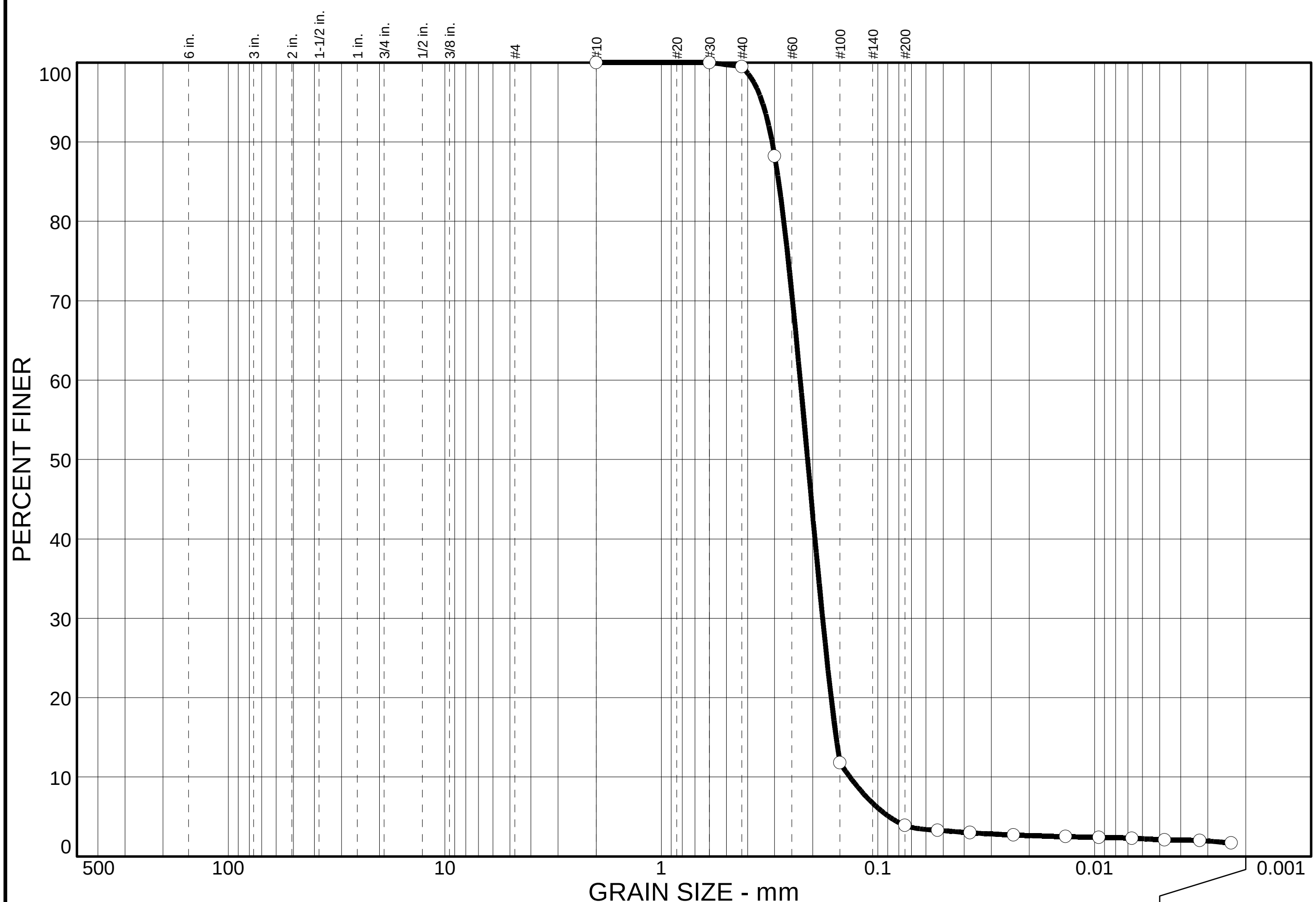
Sample No.: **Source of Sample:** SB-4-d16 **Date:** 2/24/21
Location: **Elev./Depth:** 16'

COOPER TESTING LABORATORY

Client: Weber, Hayes & Associates
Project: 510 Ohlone Parkway, Watsonville, CA. - 2t038

Project No: 407-024 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	96.1	3.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#30	100.0		
#40	99.5		
#50	88.2		
#100	11.8		
#200	3.9		
#270	3.3		
0.0376 mm.	3.0		
0.0237 mm.	2.7		
0.0136 mm.	2.5		
0.0095 mm.	2.4		
0.0067 mm.	2.3		
0.0047 mm.	2.1		
0.0033 mm.	2.0		
0.0023 mm.	1.7		

* (no specification provided)

Soil Description

Dark Yellowish Brown Poorly Graded SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.288 D_{60}= 0.229 D_{50}= 0.212
D_{30}= 0.180 D_{15}= 0.156 D_{10}= 0.135
C_u= 1.70 C_c= 1.05

Classification

USCS= AASHTO=

Remarks

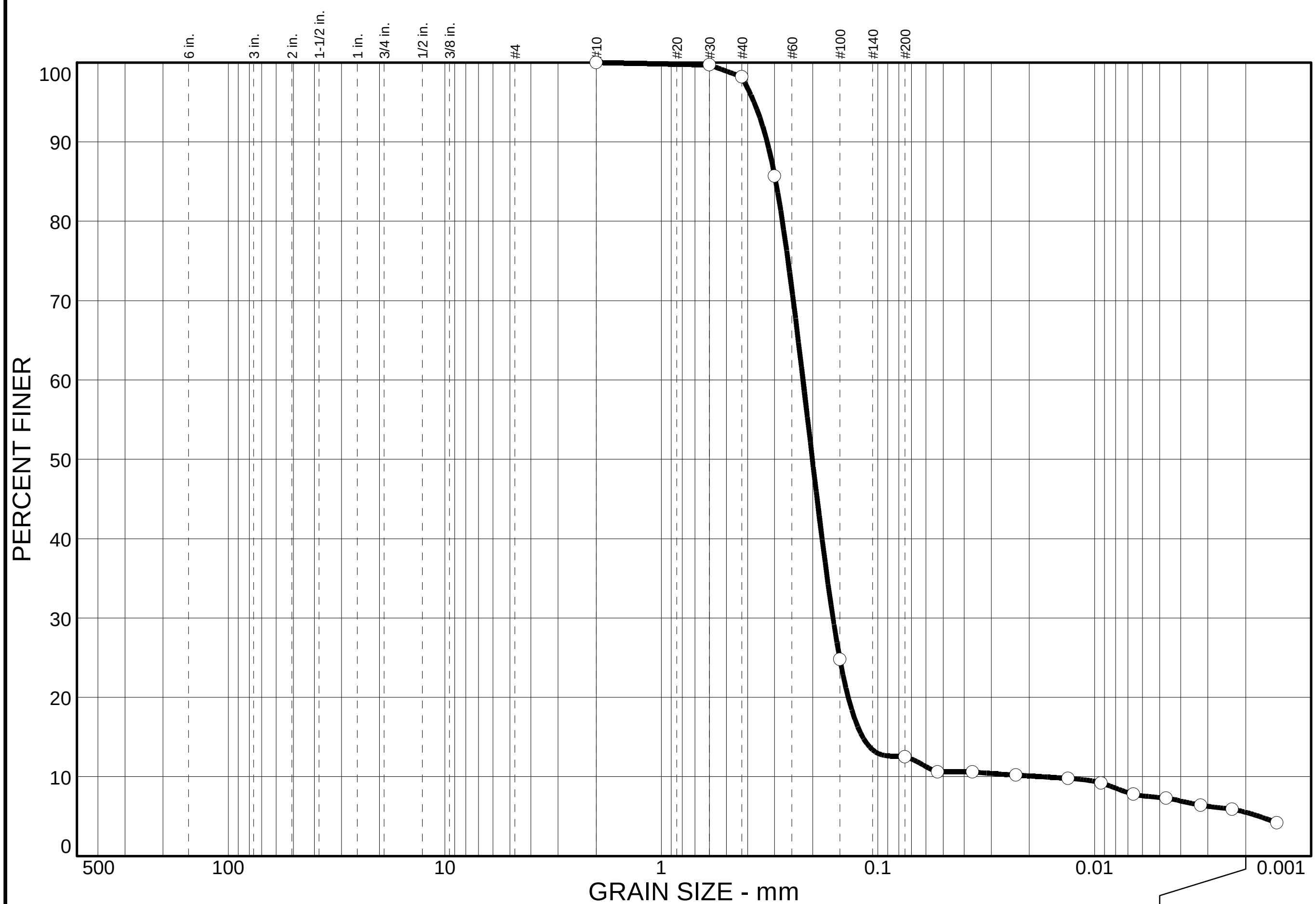
Sample No.: **Source of Sample:** SB-4-d20 **Date:** 2/24/21
Location: **Elev./Depth:** 20'

COOPER TESTING LABORATORY

Client: Weber, Hayes & Associates
Project: 510 Ohlone Parkway, Watsonville, CA. - 2t038

Project No: 407-024 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	87.5	7.0	5.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#30	99.7		
#40	98.2		
#50	85.7		
#100	24.8		
#200	12.5		
#270	10.6		
0.0366 mm.	10.6		
0.0230 mm.	10.2		
0.0133 mm.	9.8		
0.0093 mm.	9.2		
0.0066 mm.	7.8		
0.0047 mm.	7.3		
0.0032 mm.	6.4		
0.0023 mm.	5.9		
0.0014 mm.	4.2		

* (no specification provided)

Soil Description

Dark Yellowish Brown Sandy SILT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.297 D_{60}= 0.222 D_{50}= 0.201
D_{30}= 0.161 D_{15}= 0.118 D_{10}= 0.0175
C_u= 12.73 C_c= 6.72

Classification

USCS= AASHTO=

Remarks

Sample No.: **Source of Sample:** SB-4-d27 **Date:** 2/24/21
Location: **Elev./Depth:** 27'

COOPER TESTING LABORATORY

Client: Weber, Hayes & Associates
Project: 510 Ohlone Parkway, Watsonville, CA. - 2t038

Project No: 407-024 **Figure**

Report Number
21-057-0009

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REPORT OF ANALYSIS

Lab Number: 22539
Sample ID: SB-1-d11

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst
Organic Matter (Titration) , %	0.90		WALK-BLACK	03/02/2021 12:53	AAB

Method Reference:
Methods of Soil Analysis, Part 3 - Chemical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, pages 995-996.
Comments:

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REPORT OF ANALYSIS

Lab Number: 22540
Sample ID: SB-1-d16

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst
Organic Matter (Titration) , %	0.46		WALK-BLACK	03/02/2021 12:53	AAB

Method Reference:
Methods of Soil Analysis, Part 3 - Chemical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, pages 995-996.
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Date Received: 02/26/2021

REPORT OF ANALYSIS

Date Sampled:

Lab Number: 22541

Sample ID: SB-1-d22

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst
Organic Matter (Titration) , %	0.27		WALK-BLACK	03/02/2021 12:53	AAB

Method Reference:
Methods of Soil Analysis, Part 3 - Chemical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, pages 995-996.

Comments:

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Project: 510 Ohlone Parkway
Watsonville, CA
Project #: 407-024

REPORT OF ANALYSIS

Lab Number: 22542
Sample ID: SB-2-d10

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst
Organic Matter (Titration) , %	1.89		WALK-BLACK	03/02/2021 12:53	AAB

Method Reference:
Methods of Soil Analysis, Part 3 - Chemical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, pages 995-996.
Comments:

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Date Received: 02/26/2021

Date Sampled:

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Project #: 407-024

REPORT OF ANALYSIS

Lab Number: 22543

Sample ID: SB-2-d15

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst
Organic Matter (Titration) , %	0.60		WALK-BLACK	03/02/2021 12:53	AAB

Method Reference:
Methods of Soil Analysis, Part 3 - Chemical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, pages 995-996.

Comments:

Report Number
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Date Received: 02/26/2021

Date Sampled:

Project: 510 Ohlone Parkway
Watsonville, CA
Project #: 407-024

REPORT OF ANALYSIS

Lab Number: 22544
Sample ID: SB-2-d21

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst
Organic Matter (Titration) , %	0.71		WALK-BLACK	03/02/2021 12:53	AAB

Method Reference:
Methods of Soil Analysis, Part 3 - Chemical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, pages 995-996.

Comments:

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Date Received: 02/26/2021
Date Sampled:

Project: 510 Ohlone Parkway
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Project #: 407-024

REPORT OF ANALYSIS

Lab Number: 22545
Sample ID: SB-3-d10

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst
Organic Matter (Titration) , %	0.80		WALK-BLACK	03/02/2021 12:53	AAB

Method Reference:
Methods of Soil Analysis, Part 3 - Chemical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, pages 995-996.

Comments:

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Watsonville, CA
Project #: 407-024

Report Date: 03/02/2021
Date Received: 02/26/2021

REPORT OF ANALYSIS

Date Sampled:

Lab Number: 22546
Sample ID: SB-3-d15

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst
Organic Matter (Titration) , %	0.47		WALK-BLACK	03/02/2021 12:53	AAB

Method Reference:
Methods of Soil Analysis, Part 3 - Chemical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, pages 995-996.
Comments:

Report Number
21-057-0009

Account Number
15024

Send To: Cooper Testing Labs, Inc.
937 Commercial St
Palo Alto, CA 94303

4741 East Hunter Ave. Suite A
Anaheim, CA 92807
Main 714-282-8777 ° Fax 714-282-8575
www.waypointanalytical.com

Purchase Order:

Project: 510 Ohlone Parkway
Watsonville, CA
Project #: 407-024

Report Date: 03/02/2021
Date Received: 02/26/2021

REPORT OF ANALYSIS

Date Sampled:

Lab Number: 22547
Sample ID: SB-3-d21

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst
Organic Matter (Titration) , %	0.75		WALK-BLACK	03/02/2021 12:53	AAB

Method Reference:
Methods of Soil Analysis, Part 3 - Chemical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, pages 995-996.
Comments:

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Project: 510 Ohlone Parkway
Watsonville, CA
Project #: 407-024

Report Date: 03/02/2021

Date Received: 02/26/2021

REPORT OF ANALYSIS

Date Sampled:

Lab Number: 22548

Sample ID: SB-4-d16

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst
Organic Matter (Titration) , %	0.18		WALK-BLACK	03/02/2021 12:53	AAB

Method Reference:
Methods of Soil Analysis, Part 3 - Chemical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, pages 995-996.

Comments:

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Purchase Order:

Report Date: 03/02/2021

Date Received: 02/26/2021

Date Sampled:

Project: 510 Ohlone Parkway
Watsonville, CA
Project #: 407-024

REPORT OF ANALYSIS

Lab Number: 22549

Sample ID: SB-4-d20

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst
Organic Matter (Titration) , %	0.25		WALK-BLACK	03/02/2021 12:53	AAB

Method Reference:
Methods of Soil Analysis, Part 3 - Chemical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, pages 995-996.

Comments:

Report Number
21-057-0009

Account Number
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Purchase Order:
Report Date: 03/02/2021
Date Received: 02/26/2021
Date Sampled:

Project: 510 Ohlone Parkway
Watsonville, CA
Project #: 407-024

REPORT OF ANALYSIS

Lab Number: 22550
Sample ID: SB-4-d27

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst
Organic Matter (Titration) , %	0.23		WALK-BLACK	03/02/2021 12:53	AAB

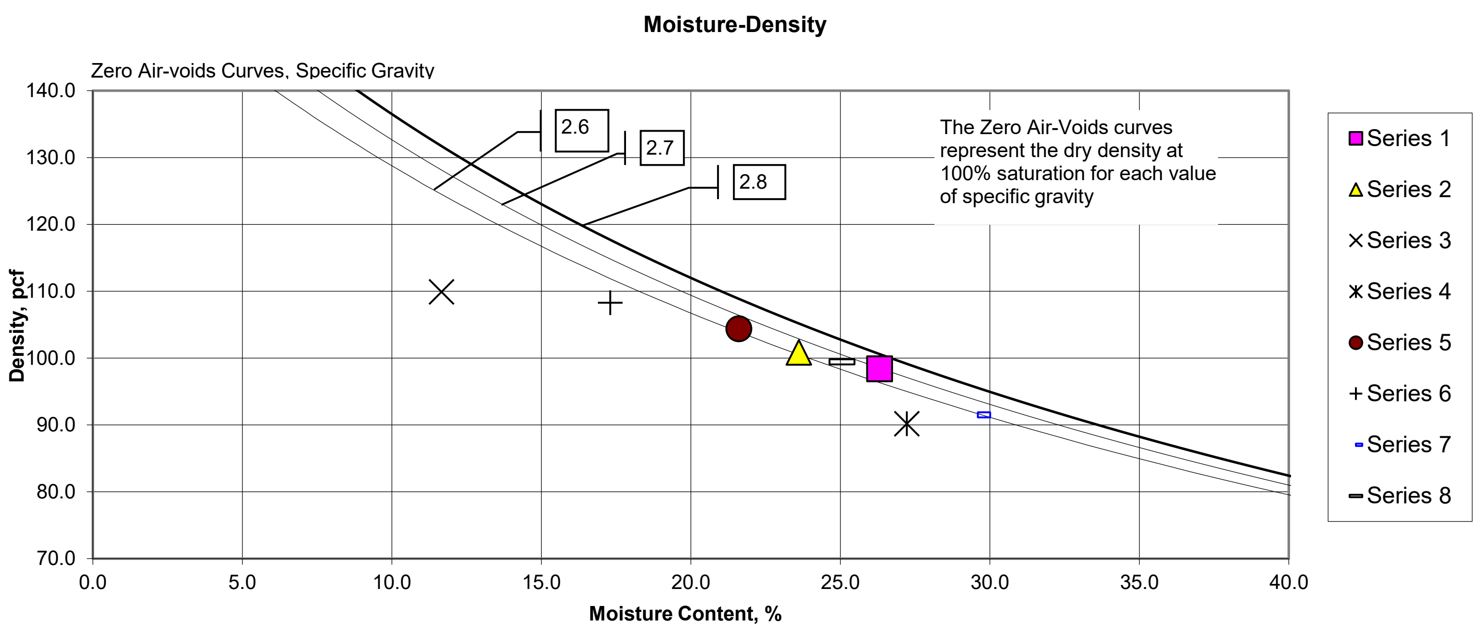
Method Reference:
Methods of Soil Analysis, Part 3 - Chemical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, pages 995-996.
Comments:

Moisture-Density-Porosity Report
Cooper Testing Labs, Inc. (ASTM D7263b)

CTL Job No: 407-024a **Project No.** 2t038 **By:** RU
Client: Weber, Hayes & Associates **Date:** 02/19/21
Project Name: 510 Ohlone Parkway, Watsonville, CA. **Remarks:**

Boring:	SB-1-d11	SB-1-d16	SB-1-d22	SB-2-d10	SB-2-d15	SB-2-d21	SB-3-d10	SB-3-d15
Sample:								
Depth, ft:	11	16	22	10	15	21	10	15
Visual Description:	Olive Gray CLAY	Dark Yellowish Brown Sandy CLAY	Dark Yellowish Brown Silty SAND	Very dark Brown CLAY	Very Dark Grayish Brown CLAY	Dark Grayish Brown CLAY	Very Dark Grayish Brown CLAY	Dark Grayish Brown CLAY
Actual G_s	2.77	2.74	2.72	2.71	2.72	7.74	2.74	2.75
Assumed G_s								
Moisture, %	26.3	23.6	11.7	27.2	21.6	17.3	29.6	25.1
Wet Unit wt, pcf	124.3	124.7	122.7	114.7	126.9	127.0	118.6	124.4
Dry Unit wt, pcf	98.4	100.9	109.9	90.2	104.4	108.3	91.6	99.4
Dry Bulk Dens.pb, (g/cc)	1.58	1.62	1.76	1.44	1.67	1.73	1.47	1.59
Saturation, %	95.8	92.7	58.1	84.1	93.4	38.6	93.1	94.6
Total Porosity, %	43.2	41.1	35.3	46.7	38.6	77.6	46.6	42.2
Volumetric Water Cont,Θw,%	41.4	38.1	20.5	39.3	36.1	30.0	43.4	39.9
Volumetric Air Cont., Θa,%	1.8	3.0	14.8	7.4	2.5	47.6	3.2	2.3
Void Ratio	0.76	0.70	0.55	0.88	0.63	3.46	0.87	0.73
Series	1	2	3	4	5	6	7	8

Note: All reported parameters are from the as-received sample condition unless otherwise noted. If an assumed specific gravity (Gs) was used then the saturation, porosities, and void ratio should be considered approximate.



Moisture-Density Lab Worksheet

CTL Job No.:	407-024a	**Date:**	2/19/21
Client:	Weber, Hayes & Associates	**By:**	RU
Project Name:	510 Ohlone Parkway, Watsonville, CA		
Project No.:	2t038		

Boring:	SB-1-d11	SB-1-d16	SB-1-d22	SB-2-d10	SB-2-d15	SB-2-d21	SB-3-d10	SB-3-d15
Sample:								
Depth, ft.:	11	16	22	10	15	21	10	15
Density Data								
Height, in.:	2.96	2.97	2.98	2.96	2.96	2.96	2.97	2.96
Diameter, in.:	2.86	2.84	2.88	2.87	2.87	2.82	2.87	2.86
Determined Sp. Grav.:	2.774	2.743	2.719	2.709	2.723	7.737	2.744	2.753
Assumed Sp. Grav.:	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Total Wt of Soil& Tare, g:	888.63	884.17	893.76	844.95	906.36	884.64	866.65	889.05
Tare, g:	268.41	268.41	268.31	268.26	268.26	268.22	268.23	268.26
Total Wet Wt of Soil, g:	620.22	615.76	625.45	576.69	638.1	616.42	598.42	620.79
Moisture Content Data								
Tare No.:								
Wet Wt. Of Soil & Tare, g:	176.43	193	160.76	182.01	175.99	185.3	197.04	167.83
Dry Wt of Soil & Tare, g:	143.4	159.16	145.7	146.69	147.71	165.6	164.56	137.54
Tare, g:	17.9	15.86	16.61	16.98	16.86	51.75	54.82	16.66
Visual Classification:	Olive Gray CLAY	Dark Yellowish Brown Sandy CLAY	Dark Yellowish Brown Silty SAND	Very dark Brown CLAY	Very Dark Grayish Brown CLAY	Dark Grayish Brown CLAY	Very Dark Grayish Brown CLAY	Dark Grayish Brown CLAY

COOPER TESTING LABORATORY

The following information is intended to provide some more detailed information about each of the parameters presented in the accompanying report. For additional information on this subject we recommend a general soil mechanics text book.

SPECIFIC GRAVITY - The specific gravity is equivalent to the particle density. It is defined as the ratio of the density of the soil solids to the density of water at 20°C. It is used to calculate the phase relationships of soils, such as void ratio and degree of saturation. If a specific gravity test was not run on a sample then an assumed specific gravity value is used to calculate an estimated saturation.

MOISTURE CONTENT - The moisture content as reported here is based on a gravimetric measurement and not a volumetric measurement. The moisture content is defined as the weight of water in a specimen (g) divided by the oven-dry weight of the specimen (g) and expressed as a percentage.

WET UNIT WEIGHT - The wet unit weight is equivalent to the total unit weight or the wet bulk density and is typically reported in units of pounds per cubic foot (pcf) although it can also be reported in units of grams per cubic centimeter (g/cm^3). It is defined as the total wet weight of the sample (wt. of soil plus wt. of water) divided by the total volume (volume of solids plus the volume of voids).

DRY UNIT WEIGHT - The dry unit weight is equivalent to the dry bulk density and is typically reported in units of pounds per cubic foot (pcf) although it can also be reported in units of grams per cubic centimeter (g/cm^3). It is defined as the total dry weight of the sample divided by the total volume (volume of solids plus the volume of voids).

SATURATION - The degree of saturation (S) is defined as the ratio of the volume of water in a sample to the volume of voids (pore space). It can be expressed either as a percentage or as a decimal. A saturation of zero would indicate an oven-dry state. All of the voids are filled with air. A saturation of 100% would indicate that all of the voids in the sample are filled with water and there is no air in the soil. It is theoretically impossible to have saturation values greater than 100%. If a specific gravity test is not run on a sample then an assumed specific gravity value is used to calculate an estimated saturation.

TOTAL POROSITY - The total porosity is a measure of how porous the sample is or how much of the bulk sample volume is pore space. It is defined as the ratio of the volume of voids (pore space) to the total volume (volume of solids plus the volume of voids). It can be expressed either as a percentage or as a decimal. Interestingly, clays typically have a higher porosity than sands although the size of the voids tends to be much smaller in clays resulting in the typically very low hydraulic conductivity values for clays relative to sands

TOTAL POROSITY vs. EFFECTIVE POROSITY - While the total porosity is defined as the volume of voids/ the bulk volume of the sample(volume of voids plus volume of solids) not all of the void space contributes in a significant way to the flow of water. Some of the voids are isolated, are too small or are filled with water which is adsorbed to the clay minerals or other grains. Effective porosity is basically defined as the volume of voids that contribute in a significant way to the flow of water divided by the bulk volume of the soil. The effective porosity can approach the total porosity in the case of clean coarse sands and can approach zero in the case of clays but it is always less than the total porosity.

VOLUMETRIC WATER CONTENT - Volumetric Water Content (θw) is the same as Water-filled Porosity. It is defined simply as the percent of the total volume of the sample that is occupied by water.

VOLUMETRIC AIR CONTENT - Volumetric Air Content (θa) is the same as Air-filled Porosity. It is defined simply as the percent of the total volume of the sample that is occupied by air.

VOID RATIO - The void ratio is related to the porosity as a measure of how much void space is in the sample. It is defined as the ratio of the volume of void space in a sample to the total volume (volume of solids plus the volume of voids).

INITIAL and FINAL SAMPLE STATES - For some tests such as the hydraulic conductivity or triaxial shear tests the sample is saturated as part of the test procedure. The reports for these types of tests will provide results for sample parameters in both the "Initial" and "Final" sample conditions. These parameters include wet and dry densities, moisture contents, porosities etc. The "Initial" state is the as-received state. If the sample was undisturbed then the intitial sample parameters will reflect the condition of the in-situ condition of the soil. The "Final" state is the at-test state. In this state, water may have been added to the sample to saturate it. The sample may have also been consolidated as part of the test (hydraulic conductivity, air permeability and triaxial/direct shear strength testing only). This would cause an increase in sample density and related values from the as-received state. If the sample was consolidated the report would indicate this as well as the consolidation stress applied.

SAMPLE DISTURBANCE - Some soil parameters are significantly affected by the density and arragement of the soil particles. These parameters include density, porosity(total and effective), volumetric air and water contents, hydraulic conductivity, air permeability, strength, void ratio etc. For these analyses the goal is to test samples that are as representative of the in-situ soil conditions as possible. The way in which samples are collected determines the degree of disturbance the sample experiences. Typically, the larger the sample diameter the less disturbed the sample is and the more representative it is of the in-situ condition. Cooper Testing Labs recommends a minimum sample diameter of 2 inches for any testing that calls for undisturbed specimens such as those listed above. Although we recommend against using direct push sampling to obtain undisturbed samples we realize that there are time when there are no other options. In this case we recommend limiting the push length to a maximum of 12 inches when "undisturbed" samples are desired. This will help to minimize the sample disturbance.

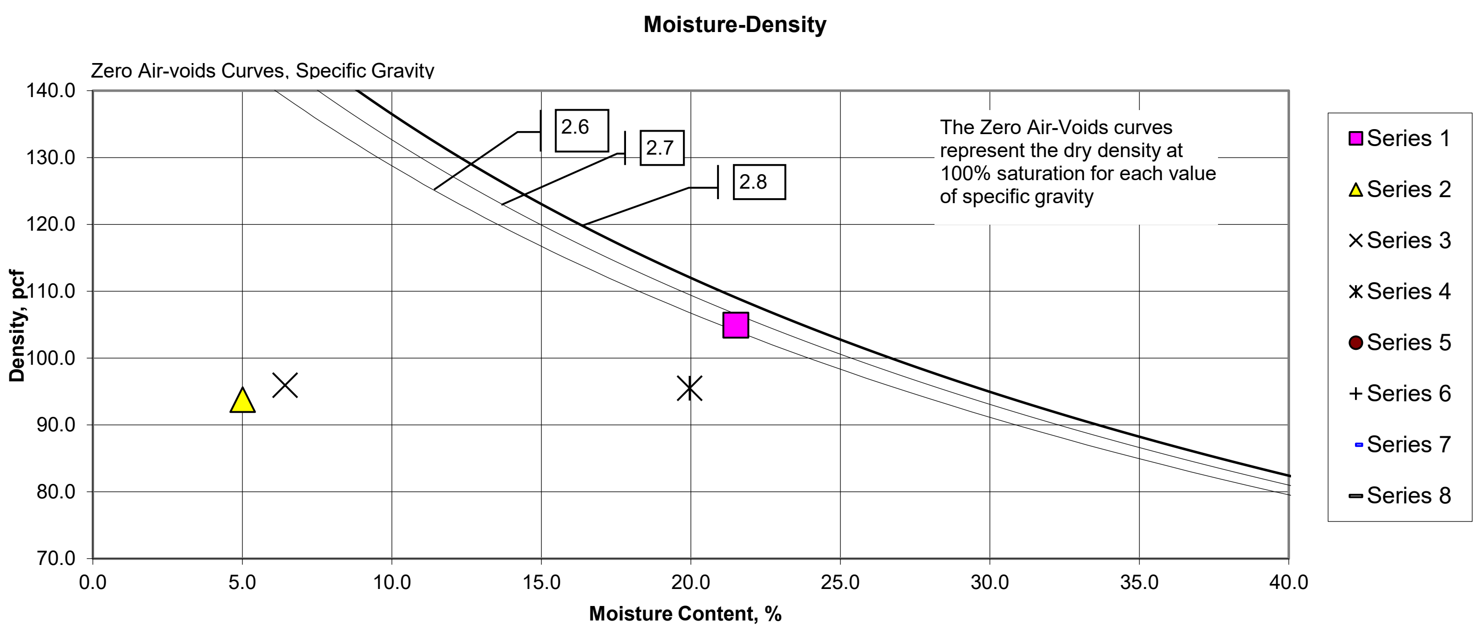
Moisture-Density-Porosity Report
Cooper Testing Labs, Inc. (ASTM D7263b)

COOPER TESTING LABORATORY

CTL Job No: 407-024b **Project No.** 2t038 **By:** RU
Client: Weber, Hayes & Associates **Date:** 02/19/21
Project Name: 510 Ohlone Parkway, Watsonville, CA. **Remarks:**

Boring:	SB-3-d21	SB-4-d16	SB-4-d20	SB-4-d27				
Sample:								
Depth, ft:	21	16	20	27				
Visual Description:	Dark Brown CLAY	Dark Yellowish Brown Poorly Graded SAND w/ Silt	Dark Yellowish Brown Poorly Graded SAND	Dark Yellowish Brown Sandy SILT				
Actual G_s	2.71	2.71	2.75	2.70				
Assumed G_s								
Moisture, %	21.5	5.0	6.4	20.0				
Wet Unit wt, pcf	127.5	98.5	102.1	114.6				
Dry Unit wt, pcf	104.9	93.8	96.0	95.5				
Dry Bulk Dens.pb, (g/cc)	1.68	1.50	1.54	1.53				
Saturation, %	94.9	16.9	22.4	70.4				
Total Porosity, %	38.1	44.6	44.0	43.3				
Volumetric Water Cont,Θw,%	36.1	7.5	9.9	30.5				
Volumetric Air Cont., Θa,%	2.0	37.1	34.2	12.8				
Void Ratio	0.61	0.80	0.79	0.76				
Series	1	2	3	4	5	6	7	8

Note: All reported parameters are from the as-received sample condition unless otherwise noted. If an assumed specific gravity (Gs) was used then the saturation, porosities, and void ratio should be considered approximate.



Moisture-Density Lab Worksheet

CTL Job No.:	407-024b				**Date:**	2/19/21		
Client:	Weber, Hayes & Associates				**By:**	RU		
Project Name:	510 Ohlone Parkway, Watsonville, CA							
Project No.:	2t038							
Boring:	SB-3-d21	SB-4-d16	SB-4-d20	SB-4-d27				
Sample:								
Depth, ft.:	21	16	20	27				

Density Data

Height, in.:	2.97	2.97	2.97	2.97				
Diameter, in.:	2.86	2.87	2.86	2.87				
Determined Sp. Grav.:	2.711	2.708	2.745	2.697				
Assumed Sp. Grav.:	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Total Wt of Soil& Tare, g:	906.59	764.84	779.71	846.02				
Tare, g:	268.22	268.22	268.22	268.19				
Total Wet Wt of Soil, g:	638.37	496.62	511.49	577.83				

Moisture Content Data

Tare No.:								
Wet Wt. Of Soil & Tare, g:	145.76	203.54	135.19	194.37				
Dry Wt of Soil & Tare, g:	122.96	197.23	128.04	170.81				
Tare, g:	16.96	71.21	16.76	52.77				
Visual Classification:	Dark Brown CLAY	Dark Yellowish Brown Poorly Graded SAND w/ Silt	Dark Yellowish Brown Poorly Graded SAND	Dark Yellowish Brown Sandy SILT				

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COOPER TESTING LABORATORY

Specific Gravity by Pycnometer
ASTM D 854

CTL Job#:	407-024a	**Project Name:**	510 Ohlone Parkway, Watsonville, CA. 95076	**Date:**	02/24/21
Client:	Weber,Hayes & Associates	**Project No.:**	2t038	**Run By:**	MD
				Checked	DC

Boring:	SB-1-d11	SB-1-d16	SB-1-d22	SB-2-d10	SB-2-d15	SB-2-d21	SB-3-d10	SB-3-d15
Sample:								
Depth, ft.:	11	16	22	10	15	21	10	15
Pan No.:								
Soil Description (visual)	Olive Gray CLAY	Dark Yellowish Brown Sandy CLAY	Dark Yellowish Brown Silty SAND	Very Dark Brown CLAY	Very Dark Grayish Brown CLAY	Dark Grayish Brown CLAY	Very Dark Grayish Brown CLAY	Dark Grayish Brown CLAY
Pycnometer ID:	P02	P03	P02	P03	P04	P05	P02	P03
Mass of Clean, Dry Pycnometer (g):	158.06	158.92	158.06	158.92	158.78	155.02	158.06	158.92
Mass of Pycnometer, Soil, and Water (g):	723.85	728.18	719.78	721.42	721.42	716.34	722.94	720.48
Temperature of Slurry (°C):	19.2	19.2	20.8	20.8	20.8	20.8	20.2	20.2
Tare ID:								
Mass of Tare (g):	166.30	169.74	161.59	163.54	161.83	167.03	165.41	297.81
Mass of Dry Soil and Tare (g):	271.59	281.11	261.91	265.25	263.62	266.10	270.08	397.02
Mass of Dry Soil (g):	105.29	111.37	100.32	101.71	101.79	99.07	104.67	99.21
Mass of Pycnometer and Water at Test Temp (g):	656.52	657.42	656.35	657.25	657.01	653.47	656.41	657.31
Specific Gravity @ Test Temp:	2.774	2.743	2.719	2.709	2.723	2.737	2.744	2.753
Specific Gravity @ 20 °C:	**2.774**	**2.743**	**2.719**	**2.709**	**2.723**	**2.736**	**2.744**	**2.753**

COOPER TESTING LABORATORY

Specific Gravity by Pycnometer
ASTM D 854

CTL Job#:	407-024b	**Project Name:**	510 Ohlone Parkway, Watsonville, CA. 95076	**Date:**	02/25/21
Client:	Weber, Hayes & Associates	**Project No.:**	2t038	**Run By:**	MD
				Checked	DC

Boring:	SB-3-d21	SB-4-d16	SB-4-d20	SB-4-d27				
Sample:								
Depth, ft.:	21	16	20	27				
Pan No.:								
Soil Description (visual)	Dark Brown CLAY	Dark Yellowish Brown Poorly Graded SAND w/ Silt	Dark Yellowish Brown Poorly Graded SAND	Dark Yellowish Brown Sandy SILT				
Pycnometer ID:	P04	P05	P02	P03				
Mass of Clean, Dry Pycnometer (g):	158.78	155.02	158.06	158.92				
Mass of Pycnometer, Soil, and Water (g):	718.76	720.65	719.30	720.26				
Temperature of Slurry (°C):	20.2	20.2	21.1	21.1				
Tare ID:								
Mass of Tare (g):	165.05	163.83	165.54	161.62				
Mass of Dry Soil and Tare (g):	262.80	270.25	264.60	261.81				
Mass of Dry Soil (g):	97.75	106.42	99.06	100.19				
Mass of Pycnometer and Water at Test Temp (g):	657.07	653.53	656.32	657.22				
Specific Gravity @ Test Temp:	2.711	2.708	2.746	2.697				
Specific Gravity @ 20 °C:	**2.711**	**2.708**	**2.745**	**2.697**				

Corrosivity Tests

COOPER TESTING LABORATORY

CTL Job No:	407-024	**Project No.:**	2t038	IC Ions to test for:	Both
Client:	Weber, Hayes & Associates	**Date:**	2/17/2021		
Project Name:	510 Ohlone Parkway	**By:**	PJ		

Boring:	SB-3-d10	SB-3-d15	SB-3-d21	SB-4-d16	SB-4-d20	SB-27-d27
Sample:						
Depth, ft:	10	15	21	16	20	27
Soil Description:	Very Dark Grayish Brown CLAY	Dark Grayish Brown CLAY	Dark Brown CLAY	Dark Yellowish Brown Poorly Graded SAND w/ Silt	Dark Yellowish Brown Poorly Graded SAND	Dark Yellowish Brown Sandy SILT
EXTRACTION						
Extraction Flask No.						
Wt. of wet soil (g)						
Vol of water (ml)	300	300	300	300	300	300
% H_2O of Extracted Sample:						
Pan No.						
Pan wt. (g)						
Total wet wt. (g)						
Total dry wt (g)						
ORP / SULFIDE TESTS						
Beaker No.						
ORP, E_H (NHE) (Rmv)						
ORP Test Temp, ^{O}C						
Sulfide						
ASTM RESISTIVITY **- As Received**						
Small Dial Reading						
Large Dial Reading						
Temp. ^{o}C						
ASTM RESISTIVITY **- 100% Saturation**						
Bowl No.						
Small Dial Reading						
Large Dial Reading						
Temp. ^{o}C						
pH TEST						
pH measurement #1	7.26	7.27	7.38	7.53	7.27	7.54
pH measurement #2	7.25	7.32	7.41	7.61	7.34	7.51
pH measurement #3	7.25	7.43	7.39	7.61	7.41	7.48
CHLORIDE AND SULFATE TESTING						
IC Ions to test for:	Both	Both	Both	Both	Both	Both
Vial No.						
CHLORIDE						
Meas. conc(mg Cl^-/L)						
SULFATE						
Meas. conc(mg SO_4^{-2}/L)						
Comments:						

COOPER TESTING LABORATORY

Corrosivity Tests

CTL Job No:	407-024	**Project No.:**	2t038	IC Ions to test for:	Both
Client:	Weber, Hayes & Associates	**Date:**	2/17/2021		
Project Name:	510 Ohlone Parkway	**By:**	PJ		

Boring:	SB-1-d11	SB-1- d16	SB-1-d22	SB-2-d10	SB-2-d15	SB-2-d21
Sample:						
Depth, ft:	11	16	22	10	15	21
Soil Description:	Olive Gray CLAY	Dark Brown Sandy CLAY	Dark Yellowish Brown Silty SAND	Very Dark Brown CLAY	Very Dark Grayish Brown CLAY	Dark Grayish Brown CLAY
EXTRACTION						
Extraction Flask No.						
Wt. of wet soil (g)						
Vol of water (ml)	300	300	300	300	300	300
% H_2O of Extracted Sample:						
Pan No.						
Pan wt. (g)						
Total wet wt. (g)						
Total dry wt (g)						
ORP / SULFIDE TESTS						
Beaker No.						
ORP, E_H (NHE) (Rmv)						
ORP Test Temp, ^{O}C						
Sulfide						
ASTM RESISTIVITY **- As Received**						
Small Dial Reading						
Large Dial Reading						
Temp. ^{o}C						
ASTM RESISTIVITY **- 100% Saturation**						
Bowl No.						
Small Dial Reading						
Large Dial Reading						
Temp. ^{o}C						
pH TEST						
pH measurement #1	7.35	7.31	7.67	6.96	7.37	7.20
pH measurement #2	7.29	7.32	7.53	6.90	7.08	7.20
pH measurement #3	7.25	7.30	7.53	6.91	7.01	7.19
CHLORIDE AND SULFATE TESTING						
IC Ions to test for:	Both	Both	Both	Both	Both	Both
Vial No.						
CHLORIDE						
Meas. conc(mg Cl^-/L)						
SULFATE						
Meas. conc(mg SO_4^{-2}/L)						
Comments:						

COOPER TESTING LABORATORY

Corrosivity Tests

CTL Job No:	407-024	**Project No.:**	2t038	IC Ions to test for:	Both
Client:	Weber, Hayes & Associates	**Date:**	2/17/2021		
Project Name:	510 Ohlone Parkway	**By:**	PJ		

Boring:						
Sample:						
Depth, ft:						
Soil Description:						
EXTRACTION						
Extraction Flask No.						
Wt. of wet soil (g)						
Vol of water (ml)	300	300	300	300	300	300
% H_2O of Extracted Sample:						
Pan No.						
Pan wt. (g)						
Total wet wt. (g)						
Total dry wt (g)						
ORP / SULFIDE TESTS						
Beaker No.						
ORP, E_H (NHE) (Rmv)						
ORP Test Temp, ^{O}C						
Sulfide						
ASTM RESISTIVITY **- As Received**						
Small Dial Reading						
Large Dial Reading						
Temp. ^{o}C						
ASTM RESISTIVITY **- 100% Saturation**						
Bowl No.						
Small Dial Reading						
Large Dial Reading						
Temp. ^{o}C						
pH TEST						
pH measurement #1						
pH measurement #2						
pH measurement #3						
CHLORIDE AND SULFATE TESTING						
IC Ions to test for:	Both	Both	Both	Both	Both	Both
Vial No.						
CHLORIDE						
Meas. conc(mg Cl^-/L)						
SULFATE						
Meas. conc(mg SO_4^{-2}/L)						
Comments:						

COOPER TESTING LABORATORY

Corrosivity Tests Summary

CTL # 407-024 **Date:** 2/19/2021 **Tested By:** PJ **Checked:** PJ
Client: Weber, Hayes & Associates **Project:** 510 Ohlone Parkway **Proj. No:** 2t038
Remarks:

Sample Location or ID			Resistivity @ 15.5 °C (Ohm-cm)			Chloride	Sulfate		pH	ORP		Sulfide	Moisture	Soil Visual Description
			As Rec.	Min	Sat.	mg/kg	mg/kg	%		(Redox)		Qualitative	At Test	
						Dry Wt.	Dry Wt.	Dry Wt.		E_H (mv)	At Test	by Lead	%	
Boring	**Sample, No.**	**Depth, ft.**	ASTM G57	Cal 643	ASTM G57	ASTM D4327	ASTM D4327	ASTM D4327	ASTM G51	ASTM G200	Temp °C	Acetate Paper	ASTM D2216	
SB-1-d11	-	11	-	-	-	-	-	-	7.3	-	-	-	-	Olive Gray CLAY
SB-1- d16	-	16	-	-	-	-	-	-	7.3	-	-	-	-	Dark Brown Sandy CLAY
SB-1-d22	-	22	-	-	-	-	-	-	7.6	-	-	-	-	Dark Yellowish Brown Silty SAND
SB-2-d10	-	10	-	-	-	-	-	-	6.9	-	-	-	-	Very Dark Brown CLAY
SB-2-d15	-	15	-	-	-	-	-	-	7.2	-	-	-	-	Very Dark Grayish Brown CLAY
SB-2-d21	-	21	-	-	-	-	-	-	7.2	-	-	-	-	Dark Grayish Brown CLAY
SB-3-d10	-	10	-	-	-	-	-	-	7.3	-	-	-	-	Very Dark Grayish Brown CLAY
SB-3-d15	-	15	-	-	-	-	-	-	7.3	-	-	-	-	Dark Grayish Brown CLAY
SB-3-d21	-	21	-	-	-	-	-	-	7.4	-	-	-	-	Dark Brown CLAY
SB-4-d16	-	16	-	-	-	-	-	-	7.6	-	-	-	-	Dark Yellowish Brown Poorly Graded SAND w/ Silt
SB-4-d20	-	20	-	-	-	-	-	-	7.3	-	-	-	-	Dark Yellowish Brown Poorly Graded SAND
SB-27-d27	-	27	-	-	-	-	-	-	7.5	-	-	-	-	Dark Yellowish Brown Sandy SILT

407-024

2/12

WHA
Weber, Hayes & Associates
120 Westgate Drive, Watsonville 95060
(831) 722-3580

Chain of Custody

Laboratory: Pace Analytical

Site Name & Location: 510 Ohlone Parkway, Watsonville, CA 95076

Geotracker ID: N/A

WHA Job #: 21038

Sampler Name: Ryan Nyberg

Email report to: Lab@weber-hayes.com

Also Email report to: ryan@weber-hayes.com ; pat@weber-hayes.com

Turnaround Time (work days: check one): O = NORMAL O = 1 Day RUSH O = 2 Day RUSH O = 3 Day RUSH

Sample Identification WHA ID #	Sample Info: Depth (ft)	Date/Time	Matrix. (Soil-GW-Air)	Sample Containers: Metal Liner	Shelby Tube	Glass Jar (8oz)	Analysis Requested (check those that apply): Vadose Zone Package 2 (Method: FOC by Walkley black)	pH (by ASTM G51/CT 643/AASHTOT289)						Notes To Lab
SB-1-d 11	11	2/12/2021	Soil		1		X	X						
SB-1-d 16	16	2/12/2021	Soil		1		X	X						
SB-1-d 22	22	2/12/2021	Soil		1		X	X						
SB-2-d 10	10	2/12/2021	Soil		1		X	X						
SB-2-d 15	15	2/12/2021	Soil		1		X	X						
SB-2-d 21	21	2/12/2021	Soil		1		X	X						
SB-3-d 10	10	2/12/2021	Soil		1		X	X						
SB-3-d 15	15	2/12/2021	Soil		1		X	X						
SB-3-d 21	21	2/12/2021	Soil		1		X	X						
SB-4-d 16	16	2/12/2021	Soil		1		X	X						
SB-4-d 20	20	2/12/2021	Soil		1		X	X						
SB-4-d 27	27	2/12/2021	Soil		1		X	X						

Released By: [signature] Ryan Nyberg PRINT NAME	Date & Time: 2/12-2021 @ 1300 SAMPLE CONDITION: AMBIENT / REFRIGERATED	Received By: PRINT NAME:
Released By: PRINT NAME:	Date & Time: SAMPLE CONDITION: AMBIENT / REFRIGERATED	Received By: PRINT NAME:
Released By: PRINT NAME:	Date & Time: SAMPLE CONDITION: AMBIENT / REFRIGERATED	Received By: PRINT NAME:

Additional Notes to Lab: Lab Manager instructed to specify FOC by Walkley black since the default organic test method is TOC by ASTM D2974.