NorCal Engineering

Soils and Geotechnical Consultants
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September 28, 2016 Project Number 19134-16

Transition Properties LP
P.O. Box 1010
Blue Jay, California 92317

Attn.: Mr. Art Day

RE: **Soils Infiltration Study** - Existing Industrial Development - Located at 8008 Church Avenue, in the City of Highland, California

Dear Mr. Day:

Pursuant to your request, this firm has performed a Soils Infiltration Study for the above referenced project in accordance with your approval of proposal dated September 8, 2016. The purpose of this study is to evaluate the feasibility of an on-site drainage disposal system for the existing development. The scope of work included the following: 1) site reconnaissance; 2) subsurface geotechnical exploration; 3) percolation testing; 4) engineering analysis of field and laboratory data; and 5) preparation of a report. It is proposed to construct an on-site drainage disposal system consisting of shallow detention basins.

Site Description

The subject property is situated within the 8800 block and west side of Church Avenue, in the City of Highland. The generally rectangular-shaped parcel is elongated in an east to west direction with topography of the relatively level property descending slightly from front to rear on the order of a few feet. The site is currently an unoccupied industrial development consisting of three metal buildings and surrounding storage yard on the approximate 7-acre subject property as shown on the attached Site Plan.

Methodology and Procedures

A truck mounted Simco 2800 Drill Rig equipped with a 6-inch hollow stem auger was used to excavate the exploratory borings. The measurements were obtained by using a tape measure with 1/16-inch divisions and a watch. The location of the tests and exploratory borings are shown on the attached Site Plan. A total of two (2) exploratory borings to depths of 5 and 10 feet below ground surface (bgs) were performed in order to establish general percolation rates. In general, the site was found to be underlain by fill and alluvial soils consisting of a light brown, gravelly, fine to coarse grained sands with cobbles. These soils were observed to be medium dense and damp. No groundwater was encountered and slight caving occurred to the depth of our borings.

Detailed description of the subsurface soils is shown on the attached boring logs in Appendix B. The percolation holes were then carefully filled with clean water and refilled after two 30-minute readings. Each test hole was conducted for additional readings at 10 minute intervals. These borings were immediately backfilled with the excavated soils and compacted.

Groundwater Information

The depth of groundwater is expected to be in excess of 150 to 200 feet within the vicinity area based on review of ground water maps of the Upper Santa Ana River Basin. (Carson and Matti, 1982). A review with the State of California Department of Water Resources of nearby water wells within 0.5 mile from the subject site revealed current groundwater levels in excess of 200 feet. The exposed sidewalls of our borings did not reveal any evidence (mottling, etc.) that groundwater had been near the surface.

Results of Field Percolation Tests

Based upon the results of our testing, the soils encountered in the planned on-site drainage disposal system area exhibit the following percolation rates. The design infiltration rate was computed using a reduction factor – R_f based on the field measurements with our calculations given in Appendix B. The final design infiltration rates are listed below for the two borings at depths of 5 and 10 feet, respectively.

Test No.	Depth	Infiltration Rate
B-1	5'	13.0 in/hr
B-2	10'	11.4 in/hr

The correction factors CF_t, CF_v and CF_s are given below based on soils in the upper 10 feet from our field tests.

a) $CF_t = R_f$ = 1.38 to 2.38 for our field percolation test holes.

b) CF_v = 1.0 based on uniform soils encountered in the two borings for percolation tests.

c) CF_s = 2.0 for long-term siltation, plugging and maintenance. The subsurface soils are likely to have some plugging and regular maintenance of storm water discharge devices is required.

Conclusions

The use of an on-site disposal system by means of a shallow infiltration system appears to be geotechnically feasible for future development. Based upon the results of our testing, the subsurface soils encountered in the proposed on-site drainage disposal system to a depth of 10 feet shall utilize a design infiltration rate of 6 in/hr. All systems must meet the latest city and/or county specifications and California Regional Water Quality Control Board (CRWQCB) requirements.

It is our opinion that the site is suitable for stormwater infiltration without increasing the potential of settlement of proposed and existing structures located either on or adjacent to the subject site. In addition, the potential for hydro-consolidation and the susceptibility for any ground settlements are considered very low.

Foundations shall be set back a minimum distance of 10 feet from the drainage disposal system and the bottom of footing shall be a minimum of 10 feet from the expected zone of saturation. The boundary of the zone of saturation may be assumed to project downward from the top of the permeable portion of the disposal system at an inclination of 1 to 1 or flatter, as determined by the soils engineer.

Closure

The recommendations and conclusions contained in this report are based upon the soil conditions uncovered in our test excavations. No warranty of the soil condition between our excavations is implied. NorCal Engineering should be notified for possible further recommendations if unexpected to unfavorable conditions are encountered during construction phase.

This firm should have the opportunity to review the final plans to verify that all our recommendations are incorporated. This report and all conclusions are subject to the review of the controlling authorities for the project. Our representative should be present during construction to certify that such recommendations are complied within the field.

This geotechnical investigation has been conducted in a manner consistent with the level of care and skill exercised by members of our profession currently practicing under similar conditions in the Southern California area. No other warranty, expressed or implied is made.

We appreciate this opportunity to be of service to you. If you have any further questions, please do not hesitate to contact the undersigned.

Respectfully submitted,
NORCAL ENGINEERING

Keith D. Tucker
Project Engineer
R.G.E. 841

REGISTERED PROFESSIONAL ENGINEER
KEITH D. TUCKER
No. 841
Exp. 12/31/16
GEOTECHNICAL
STATE OF CALIFORNIA

Scott D. Spensiero
Project Manager

List of Appendices
(in order of appearance)

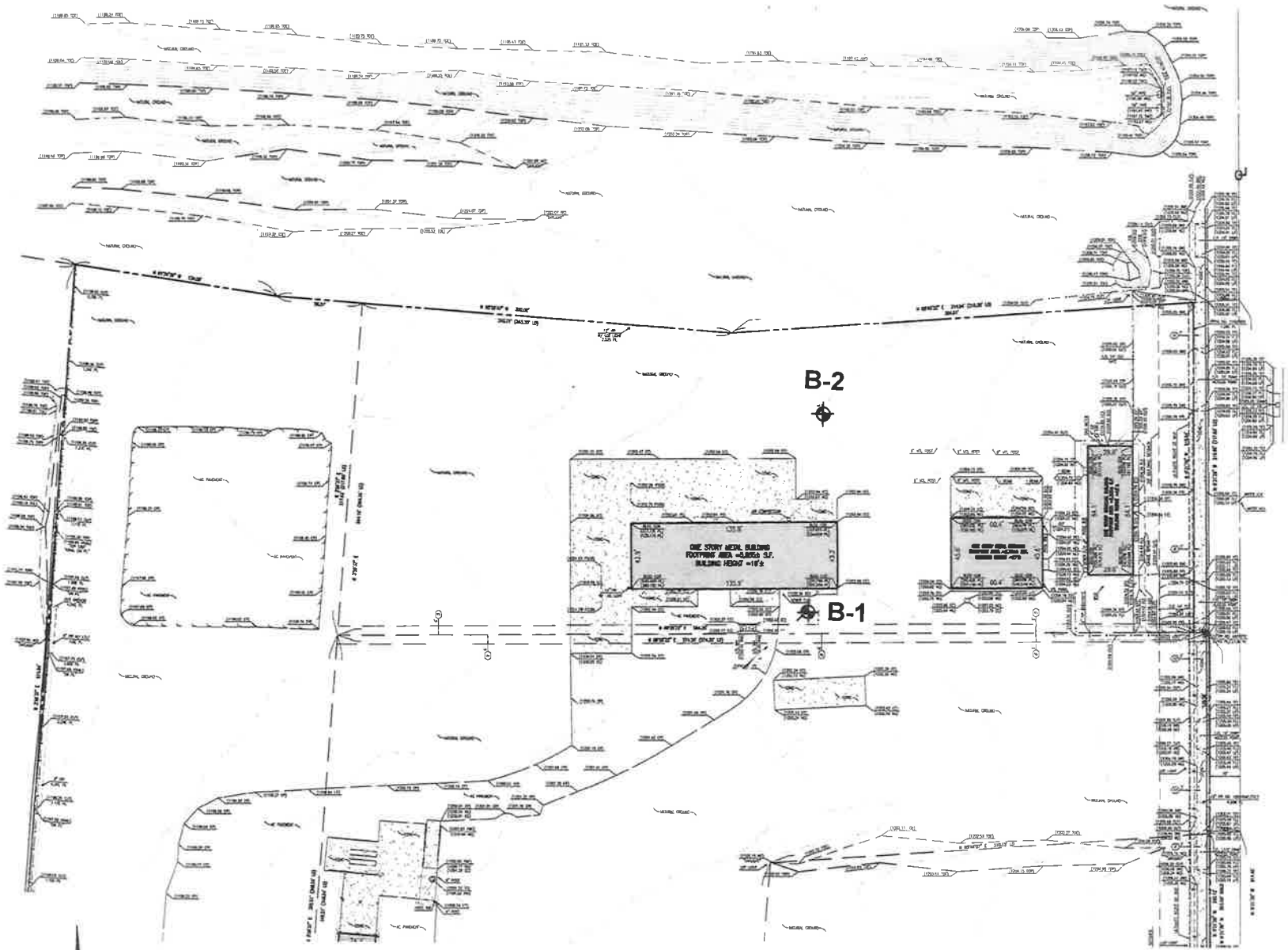
Appendix A

- Site Plan

Appendix B

- Log of Borings B-1 and B-2
- Percolation Field Test Data
- Percolation Test Calculations

Appendix A



0 15 30 60 90

1 INCH = 100 FEET

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PROJECT 19134-16

DATE SEPTEMBER 2016

SITE PLAN

Appendix B

MAJOR DIVISION			GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL. SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SAND (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVEL-LY SANDS, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINE (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

UNIFIED SOIL CLASSIFICATION SYSTEM

KEY:

- ■ Indicates 2.5-inch Inside Diameter. Ring Sample.
- ⊠ Indicates 2-inch OD Split Spoon Sample (SPT).
- ⧅ Indicates Shelby Tube Sample.
- ◫ Indicates No Recovery.
- ◧ Indicates SPT with 140# Hammer 30 in. Drop.
- ⊠ Indicates Bulk Sample.
- ◩ Indicates Small Bag Sample.
- ◨ Indicates Non-Standard
- ⧓ Indicates Core Run.

COMPONENT PROPORTIONS

DESCRIPTIVE TERMS	RANGE OF PROPORTION
Trace	1 - 5%
Few	5 - 10%
Little	10 - 20%
Some	20 - 35%
And	35 - 50%

COMPONENT DEFINITIONS

COMPONENT	SIZE RANGE
Boulders	Larger than 12 in
Cobbles	3 in to 12 in
Gravel	3 in to No 4 (4.5mm)
Coarse gravel	3 in to 3/4 in
Fine gravel	3/4 in to No 4 (4.5mm)
Sand	No. 4 (4.5mm) to No. 200 (0.074mm)
Coarse sand	No. 4 (4.5 mm) to No. 10 (2.0 mm)
Medium sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074 mm)

MOISTURE CONTENT

DRY	Absence of moisture, dusty, dry to the touch.
DAMP	Some perceptible moisture; below optimum
MOIST	No visible water; near optimum moisture content
WET	Visible free water, usually soil is below water table.

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N -VALUE

COHESIONLESS SOILS		COHESIVE SOILS		
Density	N (blows/ft)	Consistency	N (blows/ft)	Approximate Undrained Shear Strength (psf)
Very Loose	0 to 4	Very Soft	0 to 2	< 250
Loose	4 to 10	Soft	2 to 4	250 - 500
Medium Dense	10 to 30	Medium Stiff	4 to 8	500 - 1000
Dense	30 to 50	Stiff	8 to 15	1000 - 2000
Very Dense	over 50	Very Stiff	15 to 30	2000 - 4000
		Hard	over 30	> 4000

Transition Partners 19134-16	Log of Boring B-1

Boring Location: Church Avenue, Highland	
Date of Drilling: 9/22/16	Groundwater Depth: None Encountered
Drilling Method: Simco 2800HS	
Hammer Weight: 140 lbs	Drop: 30"
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples		Laboratory		
			Type	Blow Counts	Moisture	Dry Density	Relative Compaction
0		FILL Silty (fine to coarse grained) SAND Brown, medium dense, dry; slightly silty with gravel					
		NATURAL Gravelly (fine to coarse grained) SAND Light brown to brown, medium dense, damp; slightly silty with cobbles					
5		GWT not encountered Boring completed at depth of 5'					
10							
15							
20							
25							
30							
35							

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\19134-16.log Date: 9/23/2016

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Transition Partners 19134-16	Log of Boring B-2
Boring Location: Church Avenue, Highland	
Date of Drilling: 9/22/16	Groundwater Depth: None Encountered
Drilling Method: Simco 2800HS	
Hammer Weight: 140 lbs	Drop: 30"
Surface Elevation: Not Measured	

GWT not encountered

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Relative Compaction
0		FILL Silty (fine to coarse grained) SAND Brown, medium dense, dry; slightly silty with gravel					
		NATURAL Gravelly (fine to coarse grained) SAND Light brown to brown, medium dense, damp; slightly silty with cobbles					
5							
10		Boring completed at depth of 10'					
15							
20							
25							
30							
35							

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\19134-16.log Date: 9/23/2016

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CLIENT: Transition Partners
PROJECT NO.: 19134-16
NAME OF TESTER: D.R.
DATE TESTED: 9/22/16
CAVING:
STRATA PECULIARITIES:

TEST HOLE NO.: 1
DEPTH OF HOLE: 5'
DIAMETER OF TEST HOLE: 8"
DATE EXCAVATED: 9/22/16

Sandy Soil Criteria Test

Time	Trial No.	T1	H1	H2	D
11:55					
12:22	1	27.0	0	60.0	60.0
12:22					
12:47	2	24.0	0	60.0	60.0

____ Soil Criteria

Time	Trial No.	T1	H1	H2	D
12:47					
12:57	10	10	0	57.5	57.5
12:57					
1:07	10	20	0	56.0	56.0
1:07					
1:17	10	30	0	57.5	57.5
1:17					
1:27	10	40	0	56.5	56.5
1:27					
1:37	10	50	0	57.0	57.0
1:37					
1:47	10	60	0	57.0	57.0
1:47					
1:57	10	70	0	57.0	57.0
1:57					
2:07	10	80	0	57.0	57.0
2:07					
2:17	10	90	57.0	60.0	3.0

T1 - Time Interval (min.)
TE - Total Elapsed Time (min.)
H1 - Initial Water Level
H2 - Final Water Level (in.)
d - Change in H20 Level (in.)

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CLIENT: Transition Partners
PROJECT NO.: 19134-16
NAME OF TESTER: D.R.
DATE TESTED: 9/22/16
CAVING:
STRATA PECULIARITIES:

TEST HOLE NO.: 2
DEPTH OF HOLE: 10'
DIAMETER OF TEST HOLE: 8"
DATE EXCAVATED: 9/22/16

Sandy Soil Criteria Test

Time	Trial No.	T1	H1	H2	D
10:50					
11:18	1	28.0	0	120.0	120.0
11:18					
11:46	2	28.0	0	120.0	120.0

____ Soil Criteria

Time	Trial No.	T1	H1	H2	D
11:46					
11:56	10	10	0	110.0	110.0
11:56					
12:06	10	20	0	111.0	111.0
12:06					
12:16	10	30	0	110.5	110.5
12:16					
12:26	10	40	0	109.0	109.0
12:26					
12:36	10	50	0	110.0	110.0
12:36					
12:46	10	60	0	110.5	110.5
12:46					
12:56	10	70	0	109.0	109.0
12:56					
1:06	10	80	0	110.0	110.0
1:06					
1:16	10	90	110.0	115.0	5.0
1:16					
1:26	10	100	115.0	119.0	4.0

T1 - Time Interval (min.)
TE - Total Elapsed Time (min.)
H1 - Initial Water Level
H2 - Final Water Level (in.)
d - Change in H20 Level (in.)

SOIL INFILTRATION RATE CALCS ⇒ Auger Boring

Location:	B-1	B-2
• Depth =	5.0'	10.0'
• Hole Dia. =	8"	8"
• Drop = Δd	3"	9"
• Time = Δt Interval	10 min	20 min
• Preadjusted Perc. Rate	18 in/hr	27 in/hr
• Initial Water Depth = d_1	3"	10"
• Reduction Factor = R_f	1.38	2.38
• INFILTRATION RATE	13 in/hr	11.4 in/hr

$$\text{Infiltration Rate} = \frac{\text{Pre adjusted Perc. Rate}}{\text{Reduction Factor}}$$

$$\text{Reduction Factor} = R_f = \left[\frac{2 \cdot d_1 - \Delta d}{\text{Dia.}}\right] + 1$$

KEITH D. TUCKER
Consulting Engineer

DATE