KOURY
ENGINEERING
& TESTING, INC.

GEOTECHNICAL & SEISMIC ENGINEERING,
CONSTRUCTION INSPECTION &
MATERIALS TESTING SERVICES

KOURY ENGINEERING & TESTING, INC.

April 16, 2019
Project No. 17-1025

Mr. John R. Burroughs, LEED AP, President
Commerce Construction Co., L.P.
13191 Crossroads Parkway North 6th Floor
City of Industry, CA 91746

Subject: Limited Borrow Site Feasibility Study
Alternative Borrow Site 5
Southwest Corner of Hereford Drive and Hellman Avenue
City of Chino, California

Dear Mr. Burroughs:

Presented herein are our preliminary findings and conclusions regarding the suitability of the Borrow Site 5 soils to be used as engineered fill to balance the grade for the 95 Acres OC Prado site construction located on the southeast corner of Bickmore Avenue and Mountain Avenue in the City of Chino.

Based on the conceptual grading plan, the proposed irregular-shaped Borrow Site 5 covers an area of about 723,000 square feet or roughly 16.6 acres. The site is bounded by Hereford Drive to the north, Walters Street to the west, Cucamonga Creek to the south and Hellman Avenue to the east. A Site Vicinity Map with approximate ground contour elevations is presented in Appendix A as Figure A-1.

Field Exploration and Laboratory Testing for Feasibility Study

The field exploration program for the feasibility study consisted of excavating ten test pits on March 13, 2019. A rubber tire mounted backhoe was used to excavate the 10 test pits ranging in depths from about 11 to 17 feet below the existing ground surface. The locations of the test pits are shown on the Field Exploration Map, Figure A-2, presented in Appendix A. Bulk samples were obtained from the test pits for laboratory testing.

Laboratory tests, including moisture content, #200 sieve wash, expansion index, maximum density, pocket penetrometer, and corrosivity were performed to aid in the classification of the materials encountered and to evaluate their engineering properties. Sulfates, chlorides, resistivity, and PH tests (corrosivity tests) were also performed on selected samples. The results of pertinent laboratory tests are presented on the boring logs in Appendix B, and/or in Appendix C.

Site Geology

The site is located within the Upper Santa Ana River Valley, which consists of a series of coalescing alluvial fans formed by streams flowing out of the San Gabriel Mountains to the north. The valley lies within the Peninsular Ranges geomorphic province, which is characterized by alluviated basins, elevated erosion surfaces, and northwest-trending mountain ranges bounded by northwest trending faults. The site, which is located within the Chino Basin, is underlain by sediments deposited by the Santa Ana River and its tributaries such as the Chino Creek.

Morton and Miller (2006) show the site to be underlain by very old alluvial-fan deposits (See Figure A-3 in Appendix A). The sediments encountered during the subsurface investigation consisted predominantly of clay.

Surface Site Conditions

Access to the site is presently via Hellman Avenue at the northeast corner of the site. The site is roughly rectangular in area: extending about 1200 feet in the east-west direction and 1250 feet in the northerly direction.

The site was previously used as dairy farm and cattle raising. The site is presently vacant, and the previously existing buildings and cattle shelters have been removed. However, few of the slabs on grade, foundations, fence posts, and most likely some underground utilities are still in place. At the time of the field exploration in March 2019, most of the site exposed bare ground. There was a few trees and shrubs along Hellman Ave and around the seasonal water ponds.

The south side of the site contains a 4 to 6-foot-deep water detention basin; the basin has an entry ramp in the northeast corner. Little vegetation and trash were found within the basin.

The site generally slopes gently from north to south with elevations ranging for the most part from about 555 to 545 feet. Along the east property line, within the southeast portion of the site, there is a gentle slope descending about 8 to 11 feet to the Cucamonga Creek.

In its present state, the site has been cleared of all past structures such as buildings, shelters, and above ground ancillary facilities; however, it appears that several foundations, slabs on grade, and underground conduits are still in place. There are overhead powerlines present onsite, trending north-south, west of Hellman Ave and roughly 60 feet into the property. The dominant features of the site are the many small berms and unpaved roads that were constructed across the site. Many of the berms appear to have been constructed by pushing onsite soils into piles. Most of the berms have heights in the range of 1 to 2 feet and consist of relatively loose undocumented fill.

Within the site area, there are several small piles of construction debris roughly 10 feet in diameter consisting of crushed concrete, rebar and trash.

Soil Conditions

The subsurface soil profile consists generally of artificial fill underlain by alluvial deposits. For the most part, the fill is generally on the order of 1 to 3 feet in thickness. The deeper fills appear to be associated with previous improvements that were demolished. The fill derived from onsite shallow soils consists predominantly of lean clay with sand and sandy lean clay, and includes fat clay. clayey sand, silty sand, and construction debris.

The alluvium soils consist predominantly of stiff to very stiff medium plastic to high plastic sandy clay and clay with sand. Some discrete layers of silty sand and poorly graded sand with silt were encountered in Test Pit 1 from 14½ to 17 feet, Test Pit 3 from 12½ to 14½ feet, and Test Pit 8 from 14 to 16½ feet.

The moisture contents of clay soils are highly variable, ranging from about 16½ to 49½ percent with an average of about 28 percent while the sand material moisture contents range from about 10 to 37 percent with an average of about 19 percent. Based on two maximum density tests performed and prior experience with similar soils, many of the clay sample moisture contents are about 7 to 20 percent above optimum for the soils sampled at depths between 4 and 13 feet below the ground surface.

Table 1 – Maximum Density Test Results

Test Pit Number	TP8 @ 4-4.5	TP2 @ 1.5-2
Maximum Dry Density (pcf)	97.1	81.3
Optimum Moisture Content (%)	23.4	36.4

The fine contents range from about 50 to 98 percent with an average of about 77 percent for clay and from about 8 to 42 percent with an average of about 25½ percent for the sand. The average relatively low fine contents of the clay soils are attributed to the presence of concretions (hard matter formed by precipitation of mineral cement between particles), which was observed in many of the clay samples. The pocket penetrometer tests indicate unconfined compression strength on the order of 1 to 4.5 tsf with an average of about 2.6 tsf.

The site soil expansion potential ranges from very low to very high. Table 2 presents the data for 12 tests sampled at depths ranging from 1 to 5.5 feet. These tests indicate expansion index variation from 19 to 174. Within the upper 4 feet, the test data obtained to date indicate expansion indices ranging between 19 and 98 and moisture contents between about 12 and 47 percent with an average of about 30 percent. Except for Test Pit 2, at depths of 4 to 4½ feet and Test Pit 4 at depths of 5 to 5½ feet, all the expansion index tests performed on samples at depths greater than 3½ feet indicated expansion indices greater than 65. The sample collected at Test Pit 3 between the depths of 4.8 and 5.2 feet indicated a very high expansion potential.

The moisture contents of the clay below a depth of 4 feet range predominantly between 24 and 49 percent with an average of about 30 percent. On average, this moisture content is about 6 to 12½ percent above optimum.

Table 2 – Expansion Index Test Results

Test Pit	TP-1	TP-1	TP-2	TP-2	TP-3	TP-4	TP-5	TP-5	TP-7	TP-7	TP-8	TP-10
Depth (ft)	**0-1**	**3.7-4**	**1.5-2**	**4-4.5**	**4.8-5.2**	**5-5.5**	**1-1.5**	**2.5-3**	**1-1.5**	**3.5-4**	**4-4.5**	**4.5-5.5**
Expansion	43	98	52	38	174	34	39	39	19	60	80	66
Moisture	23.4	19.1	42.0	49.4	33.1	42.9	22.0	24.0	26.0	22.0	31.7	44.0
Fines	54	83	89	93	95	77	83	77	87	85	59	89

Groundwater

No groundwater was encountered in the excavated test pits.

Corrosivity

The corrosivity tests performed indicates that the site soils are generally severely corrosive to ferrous metal. In addition, test result from Test Pit 2 reveal that the soil has a moderate sulfate exposure or Class S1 exposure category in accordance with ACI 318-14, Table 19.3.1.1. The corrosivity test results are summarized in the following Table 3.

Table 3 - Corrosion Test Results

Boring	Depth (ft)	Minimum Resistivity (ohm-cm)	pH	Soluble Sulfate Content (ppm)	Soluble Chloride Content (ppm)
TP-2	1.5-2.0	304	8.2	1360	700
TP-6	1.5-2.0	491	8.3	654	270

The test results from Test Pit 2 reveal a moderate sulfate exposure, which if imported, will require concrete special design considerations in accordance with ACI 318, Table 19.3.2.1 if this soil is placed against concrete.

Conclusions and Recommendations

Based on the data collected from the field to date, it appears feasible to import some material from Borrow Site 5 to use at the OC Prado site. Soil with high expansion potential was encountered at all depths throughout the soil profile. However, with proper blending and processing, it appears that mainly the upper 4 feet of soils could be suitable for foundation support. The deeper soils generally have higher moisture contents, higher plasticity and are deemed to have higher expansion potential than the soil at 4 feet and shallower, and therefore are less desirable to be used as fill. If need be, after proper processing and dry back, these deeper materials could be used as general fill in parking lots and driveway areas at the OC Prado site.

CLOSURE

The findings and recommendations presented in this report were based on the results of our field and laboratory investigations, combined with professional engineering experience and judgment. The report was prepared in accordance with generally accepted engineering principles and practice. We make no other warranty, either expressed or implied. Subsurface variations between and beyond the test pits should be anticipated. Samples obtained during this investigation will be retained in our laboratory for a period of 45 days from the date of this report and will be disposed after this period.

Should you have any questions concerning this submittal, or the recommendations contained herewith, please do not hesitate to call our office.

Respectfully submitted,

KOURY ENGINEERING & TESTING, INC

Jacques B. Roy, PE, GE
Principal Engineer

Distribution: 1. Addressee (a pdf copy via e-mail)
2.File (B)

APPENDICES

Appendix A: Maps and Plans

Vicinity Map – Figure A-1
Field Exploration Map – Figure A-2
Geology Map – Figure A-3

Appendix B: Field Exploratory Test Pits

Test Pits 1 through 10

Appendix C: Laboratory Test Results

REFERENCES

1. California Division of Mines and Geological Survey, 1998, Seismic Hazard Zone Report 045 for the Prado Dam 7.5 Minute Quadrangle, California.

2. California Division of Mines and Geological Survey, 2003, Earthquake Fault Zones, Prado Dam Quadrangle, May 1, 2003.

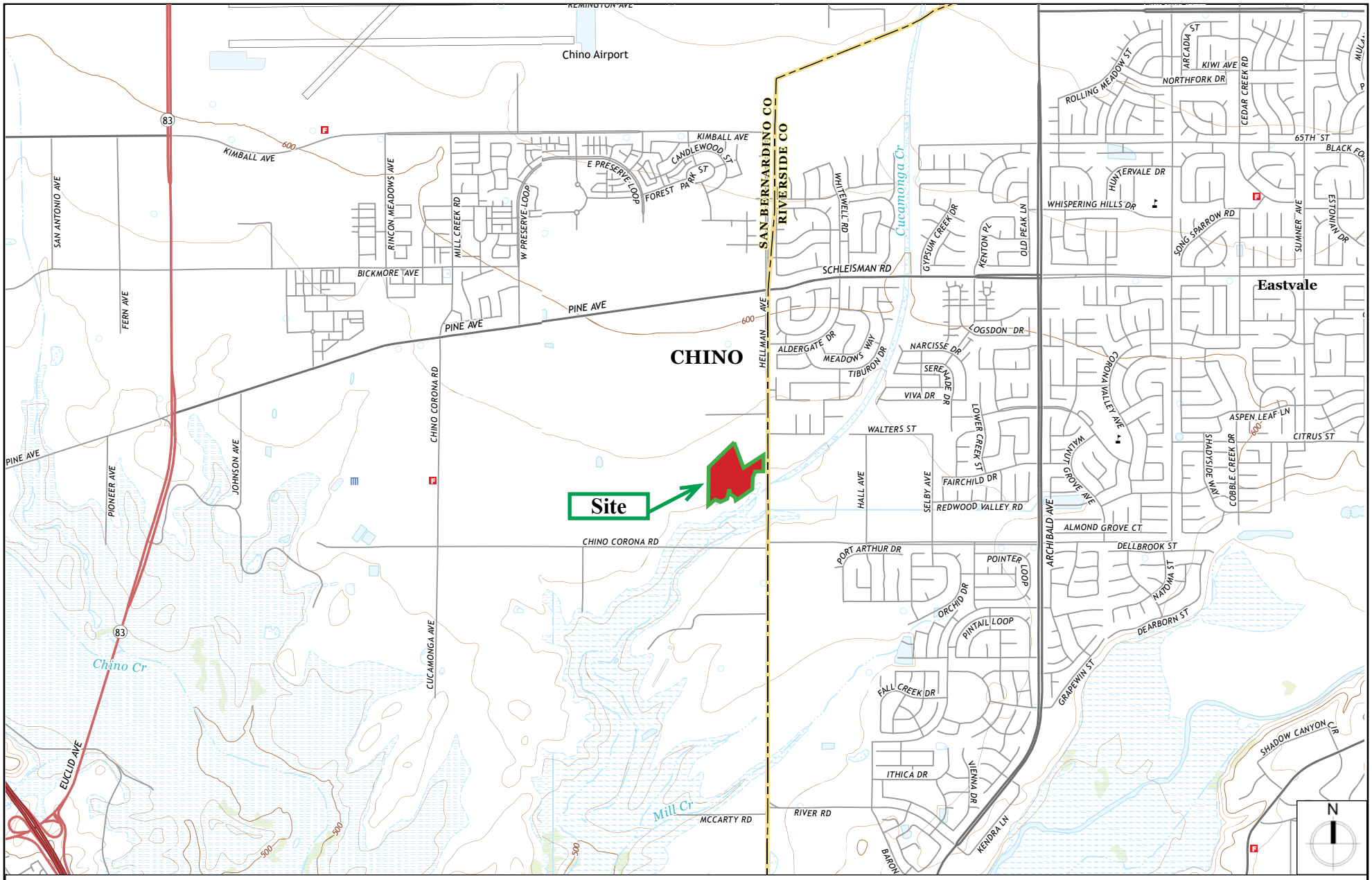
3. City of Chino General Plan, Safety Element, 2010, Final Report.

4. US Army Corps of Engineers, Geotechnical Investigations, Engineering Manual EM 1110-1-1804, dated 8/26/86.

5. US Army Corps of Engineers, Laboratory Soils Testing, Engineering Manual EM 1110-2-1906, dated 8/26/86.

APPENDIX A

Maps and Plans



Reference: USGS Topographic Map, Prado Dam & Corona Quadrangles, California, 7.5 Minute Series 2015 - Contour Interval 20 feet, NAVD of 1988

0 1/2 1 Mile

KOURY ENGINEERING & TESTING, INC.	Project Name: **Alternative Borrow Site # 5**	Project No.: **17-1025** Date: **April 2019**	Drawing Title: **Vicinity Map**	Figure: **A-1**

BORROW SITE #5
(16.6 Ac. Disturbed)

LEGACY PARK ST

A RD

TP-1
TP-2
TP-3
TP-4
TP-5
TP-6
TP-7
TP-8
TP-9
TP-10

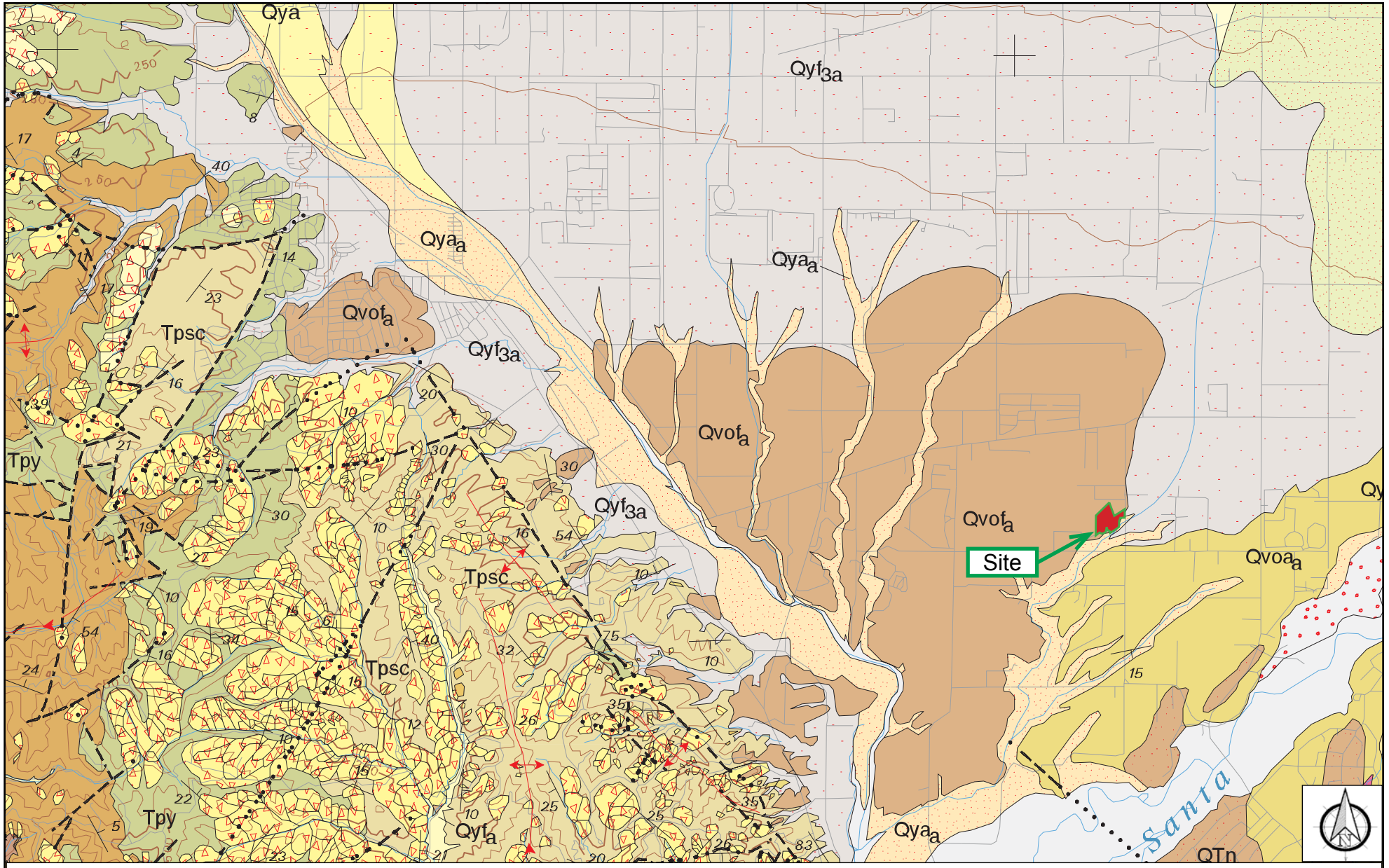
0 600 1200’

N

Legend

TP-10 Approximate Field Exploration Points & Number

KOURY ENGINEERING & TESTING, INC.	**Project Name:** Alternative Borrow Site # 5	**Project No.:** 17-1025 **Date:** April 2019	**Drawing Title:** Field Exploration Points	**Figure:** A-2



LEGEND

Qvof — Very old alluvial-fan deposits

Qya — Young axial channel deposits

0 1 2 Mile

Reference: Geologic Map of the San Bernardino & Santa Ana 30´x60´ Quadrangle California-Version 1.0 Compiled by Douglas M. Morton and Fred K. Miller, 2006

KOURY ENGINEERING & TESTING, INC.

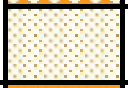
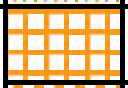
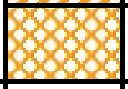
Project Name:	Project No.:	Drawing Title:	Figure:
Alternative Borrow Site # 5	17-1025	Geology Map	A-3
	Date: April 2019		

APPENDIX B

Field Exploratory Test Pits

KEY TO LOGS

SOILS CLASSIFICATION

MAJOR DIVISIONS			GRAPHIC LOG	USCS SYMBOL	TYPICAL NAMES
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVELS MORE THAN 50% OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS LESS THAN 5% FINES		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES MORE THAN 12% FINES		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS 50% OR MORE OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS LESS THAN 5% FINES		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES MORE THAN 12% FINES		SM	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS 50% OR MORE OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT IS 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
	SILTS AND CLAYS LIQUID LIMIT IS 50 OR MORE			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR GRAVELLY ELASTIC SILTS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT AND OTHER HIGHLY ORGANIC SOILS

GRAIN SIZES

SILT AND CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		
SIEVE SIZES	#200	#40	#10	#4	3/4"	3"	12"

KEY TO LOGS (continued)

SPT/CD BLOW COUNTS VS. CONSISTENCY/DENSITY					
FINE-GRAINED SOILS (SILTS, CLAYS, etc.)			**GRANULAR SOILS (SANDS, GRAVELS, etc.)**		
CONSISTENCY	***BLOWS/FOOT**		**RELATIVE DENSITY**	***BLOWS/FOOT**	
	SPT	**CD**		**SPT**	**CD**
SOFT	0-4	0-4	VERY LOOSE	0-4	0-8
FIRM	5-8	5-9	LOOSE	5-10	9-18
STIFF	9-15	10-18	MEDIUM DENSE	11-30	19-54
VERY STIFF	16-30	19-39	DENSE	31-50	55-90
HARD	over 30	over 39	VERY DENSE	over 50	over 90

* CONVERSION BETWEEN CALIFORNIA DRIVE SAMPLERS (CD) AND STANDARD PENETRATION TEST (SPT) BLOW COUNT HAS BEEN CALCULATED USING "FOUNDATION ENGINEERING HAND BOOK" BY H.Y. FANG. (**VALUES ARE FOR 140 Lbs HAMMER WEIGHT ONLY**)

DESCRIPTIVE ADJECTIVE VS. PERCENTAGE	
DESCRIPTIVE ADJECTIVE	**PERCENTAGE REQUIREMENT**
TRACE	1 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
AND	35 - 50%

*THE FOLLOWING "DESCRIPTIVE TERMINOLOGY/ RANGES OF MOISTURE CONTENTS" HAVE BEEN USED FOR MOISTURE CLASSIFICATION IN THE LOGS.

APPROXIMATE MOISTURE CONTENT DEFINITION	
DEFINITION	**DESCRIPTION**
DRY	Dry to the touch; no observable moisture
SLIGHTLY MOIST	Some moisture but still a dry appearance
MOIST	Damp, but no visible water
VERY MOIST	Enough moisture to wet the hands
WET	Almost saturated; visible free water

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Project No. : 17-1025
Project Name : Borrow Site 5

Boring No. : TP-1
Sheet : 1 of : 1

Drilling Method : Backhoe
Sampling Method : Bulk
Hammer Weight :
Location : See Figure A-2

Ground Elevation:
Drilling Co. : Bill Bastedo
Date Drilled : 3/13/19

Sample No.	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per 6"	Depth (ft)	Sample Location	Graphic Log	Soil Type (USCS)	Description	Additional Tests
1	23.4			0	⊠		CL	**FILL:** **Sandy Lean CLAY;** pockets of clayey sand, stiff, moist, very dark brown	#200 Wash Fines = 54% EI = 43
2	19.3				⊠			**ALLUVIUM:** **Lean CLAY with SAND;** stiff to very stiff, moist, dark yellowish brown	Fines = 81% PP = 2.5 tsf
3	19.1				⊠				Fines = 83% PP = 4.5 tsf EI = 98
4	23.0			5	⊠			**Lean to Fat CLAY with SAND;** stiff, moist, dark brown	Fines = 84% PP= 1.75-2.4 tsf
5	26.2				⊠		CL/CH	**Lean to Fat CLAY**; very stiff, moist to very moist, dark yellowish brown	#200 Wash Fines = 93% PP=2.5-3 tsf
6	26.8			10	⊠			**Lean to Fat CLAY with SAND**; stiff, moist to very moist, olive brown	#200 Wash Fines= 79% PP=2.0 tsf
7	40.0				⊠		CH	**Fat CLAY**; layers of silty sand, firm, moist to very moist, olive gray	#200 Wash Fines = 92%
8	11.3			15	⊠		SP-SM	**Poorly Graded SAND with SILT**; fine to coarse, pockets of gray clay, moist to very moist, dark yellowish brown	#200 Wash Fines = 12%
9	17.0				⊠				#200 Wash Fines = 8%
				20				End of test pit @ 16' 9" No groundwater encountered	
				25					
				30					
				35					
				40					

Bulk ⊠ CD ■ SPT ⊠

Boring Log

KOURY ENGINEERING & TESTING, INC.

Project No. : 17-1025
Project Name : Borrow Site 5

Boring No. : TP-2

Sheet : 1 of : 1

Drilling Method : Backhoe
Sampling Method : Bulk
Hammer Weight :
Location : See Figure A-2

Ground Elevation:
Drilling Co. : Bill Bastedo
Date Drilled : 3/13/19

Sample No.	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per 6"	Depth (ft)	Sample Location	Graphic Log	Soil Type (USCS)	Description	Additional Tests
1	34.2			0	⊠		CL/CH	Cobbles at the surface and 8 inches of sand	Fines = 64%
2	42.0				⊠			**FILL: Sandy Lean to Fat CLAY**; organic inclusions, stiff, moist, very dark brown	PP = 3-4 tsf Corrosion EI = 52 Fines = 89% PP = 3.5 tsf
3	49.4			5	⊠		CH	**ALLUVIUM:** **Fat CLAY**; very stiff, moist, very dark gray	#200 Wash Fines = 93% PP = 4.5 tsf EI = 38
4	24.7			10	⊠		CL/CH	**Lean to Fat CLAY**; very stiff, moist, mottled gray with brown inclusions	Fines = 92% PP = 4.0 tsf
5	27.2				⊠			dark gray with rusty brown pockets	Fines = 83% PP = 2-2.5 tsf
				15				End of test pit @ 12' 6" No groundwater encountered	
				20					
				25					
				30					
				35					
				40					

Bulk ⊠ CD ■ SPT ⊠

Boring Log

KOURY ENGINEERING & TESTING, INC.

Project No. : 17-1025
Project Name : Borrow Site 5

Boring No. : TP-3

Sheet : 1 of : 1

Drilling Method : Backhoe
Sampling Method : Bulk
Hammer Weight :
Location : See Figure A-2

Ground Elevation:
Drilling Co. : Bill Bastedo
Date Drilled : 3/13/19

Sample No.	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per 6"	Depth (ft)	Sample Location	Graphic Log	Soil Type (USCS)	Description	Additional Tests
				0			CL	Gravel, cobbles, and construction debris **FILL: Lean CLAY with SAND**; some organic, stiff, moist, dark brown	#200 Wash Fines = 83% PP=2.5-2.75 tsf
1	32.7				☒				
							CL/CH	**ALLUVIUM: Lean to Fat CLAY with SAND**; trace concretions, stiff, moist, dark brown	#200 Wash Fines = 80% PP = 1.5 tsf
2	22.7				☒				
3	33.1			5	☒		CH	**Fat CLAY**; firm to stiff, moist to very moist, mottled dark yellowish brown with dark brown	EI = 174 Fines = 95% PP = 1.0 tsf
4	28.1				☒				#200 Wash Fines = 90% PP=1.5-1.75 tsf
5	25.0				☒		CL	**Lean CLAY with SAND**; firm, moist, dark grayish brown (mostly silt)	Fines = 83% PP = 0.5 tsf
6	38.0			10	☒		CH	**Fat CLAY**; stiff, moist to very moist, grayish brown	#200 Wash Fines = 98% PP = 1.75 tsf
							SM	**Silty SAND;** fine to coarse, lumps of sandy clay, dark yellowish brown	#200 Wash Fines = 13%
7	10.3				☒				
8	33.6			15	☒		ML	**SILT**; very stiff, trace of organic, moist to very moist, pockets of dark clay and oxidation	Fines = 89% PP = 2.5 tsf
								End of test pit @ 15' 5" No groundwater encountered	
				20					
				25					
				30					
				35					
				40					

Bulk ☒ CD ■ SPT ☒

Boring Log

KOURY ENGINEERING & TESTING, INC.

Project No. : 17-1025
Project Name : Borrow Site 5

Boring No. : TP-4

Sheet : 1 of : 1

Drilling Method : Backhoe
Sampling Method : Bulk
Hammer Weight :
Location : See Figure A-2

Ground Elevation:
Drilling Co. : Bill Bastedo
Date Drilled : 3/13/19

Sample No.	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per 6"	Depth (ft)	Sample Location	Graphic Log	Soil Type (USCS)	Description	Additional Tests
1	16.5			0	⊠		SC	Cobbles, boulders, and concrete at surface **FILL: Clayey SAND;** trace of concretions, trace of gravel, moist, very dark brown	#200 Wash Fines = 19%
2	45.7				⊠		CL/CH	**ALLUVIUM: Sandy Lean to Fat CLAY**; trace of organic, moist, stiff, very dark brown	#200 Wash Fines = 65% PP = 3-4 tsf
3	42.9			5	⊠				Fines = 77% PP = 2.5 tsf EI = 34
4	26.3				⊠		CL	**Lean CLAY with SAND;** firm, moist, dark grayish brown (mostly silt)	#200 Wash Fines = 84% PP = 2.5-3 tsf
5	24.0			10	⊠				#200 Wash Fines = 83% PP = 2.0 tsf
6	25.2				⊠		CL/CH	**Sandy Lean to Fat CLAY**; trace of organics, rootlets, moist, very dark greenish gray	#200 Wash Fines = 73% PP = 2-2.5 tsf
				15				End of test pit @ 13' 6" No groundwater encountered	
				20					
				25					
				30					
				35					
				40					

Bulk ⊠ CD ■ SPT ⊠

Boring Log

KOURY ENGINEERING & TESTING, INC.

Project No. : 17-1025
Project Name : Borrow Site 5

Boring No. : TP-5

Sheet : 1 of : 1

Drilling Method : Backhoe
Sampling Method : Bulk
Hammer Weight :
Location : See Figure A-2

Ground Elevation:
Drilling Co. : Bill Bastedo
Date Drilled : 3/13/19

Sample No.	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per 6"	Depth (ft)	Sample Location	Graphic Log	Soil Type (USCS)	Description	Additional Tests
1	46.8			0	⊠		CL/CH	**Topsoil**; **Sandy Lean to Fat CLAY;** trace of organics, very dark brown	Fines = 50%
2	22.0				⊠		CL	**FILL: Lean CLAY with SAND;** trace of concretions, very moist, very dark brown	EI = 39 Fines = 83% PP = 3-3.2 tsf
3	24.0				⊠		CL/CH	**ALLUVIUM:** **Lean to Fat CLAY with SAND**; trace of concretions, stiff, moist to very moist, pale brown	EI = 39 Fines = 77% PP = 2-2.5 tsf
4	21.8			5	⊠		CH	**Fat CLAY**; concretions, stiff, moist to very moist, pale brown	#200 Wash Fines = 87% PP = 1.5 tsf
5	30.0			10	⊠		CL/CH	**Lean to Fat CLAY with SAND**; stiff, moist, dark yellowish brown	#200 Wash Fines = 76% PP = 1.5 tsf
6	16.6				⊠		CL	**Sandy CLAY;** firm, moist, yellowish brown to very dark brown	Fines = 50%
				15				End of test pit @ 13' 5" No groundwater encountered	
				20					
				25					
				30					
				35					
				40					

Bulk ⊠ CD ■ SPT ⊠

Boring Log

KOURY ENGINEERING & TESTING, INC.

Project No. : 17-1025
Project Name : Borrow Site 5

Boring No. : TP-6

Sheet : 1 of : 1

Drilling Method : Backhoe
Sampling Method : Bulk
Hammer Weight :
Location : See Figure A-2

Ground Elevation:
Drilling Co. : Bill Bastedo
Date Drilled : 3/13/19

Sample No.	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per 6"	Depth (ft)	Sample Location	Graphic Log	Soil Type (USCS)	Description	Additional Tests
				0			SM	Gravel, cobbles, concrete, wood, asphalt pieces at surface **FILL: Silty SAND;** trace of gravel and topsoil	
1	32.9				⊠		CL/CH	**ALLUVIUM:** **Lean to Fat CLAY**; pockets of silty sand, stiff, moist, brown with pale brown	Corrosion Fines = 85% PP = 4.0 tsf
2	20.3			5	⊠		CL	**Lean CLAY with SAND**; very stiff, moist, mottled brown	Fines = 75% PP = 3.5-4.5 tsf
3	21.0				⊠				#200 Wash Fines = 77%
4	23.2				⊠			**Sandy Lean CLAY;** very stiff, moist, olive brown	Fines = 62% PP=2.75-4.2 tsf
5	23.1			10	⊠				Fines = 61% PP=2.5-2.75 tsf
								End of test pit @ 11' No groundwater encountered	
				15					
				20					
				25					
				30					
				35					
				40					

Bulk ⊠ CD ■ SPT ⊠

Boring Log

KOURY ENGINEERING & TESTING, INC.

Project No. : 17-1025
Project Name : Borrow Site 5

Boring No. : TP-7

Sheet : 1 of : 1

Drilling Method : Backhoe
Sampling Method : Bulk
Hammer Weight :
Location : See Figure A-2

Ground Elevation:
Drilling Co. : Bill Bastedo
Date Drilled : 3/13/19

Sample No.	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per 6"	Depth (ft)	Sample Location	Graphic Log	Soil Type (USCS)	Description	Additional Tests
1	36.8			0	⊠		SC	Patchy grass over clayey sand topsoil, trace of organic	#200 Wash Fines = 42%
2	26.0				⊠		CL	**ALLUVIUM**: **Lean CLAY**; abundant concretions, very stiff, moist, brown	EI = 19 Fines = 87% PP = 4.5 tsf
3	22.0				⊠				Fines = 85% PP = 2.5-3 tsf EI = 60
4	25.8			5	⊠				Fines = 88%
5	27.3				⊠		CL/CH	**Lean to Fat CLAY with SAND;** firm to stiff, moist to very moist, light olive brown	#200 Wash Fines = 77% PP = 1-1.25 tsf
6	19.7			10	⊠		CL	**Sandy Lean CLAY;** firm to stiff, moist, light olive brown	Fines = 54%
7	22.4				⊠				Fines = 60% PP = 2.5 tsf
				15				End of test pit @ 15' No groundwater encountered	
				20					
				25					
				30					
				35					
				40					

Bulk ⊠ CD ■ SPT ⊠

Boring Log

KOURY ENGINEERING & TESTING, INC.

Project No. : 17-1025
Project Name : Borrow Site 5

Boring No. : TP-8

Sheet : 1 of : 1

Drilling Method : Backhoe
Sampling Method : Bulk
Hammer Weight :
Location : See Figure A-2

Ground Elevation:
Drilling Co. : Bill Bastedo
Date Drilled : 3/13/19

Sample No.	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per 6"	Depth (ft)	Sample Location	Graphic Log	Soil Type (USCS)	Description	Additional Tests
1	12.6			0			SC	Retention basin slope **FILL: Clayey SAND;** layers of sandy clay, moist, trace of gravel, concretions and organic	#200 Wash
2	44.1								Fines = 33% Fines = 74%
3	42.0						CL/CH	**ALLUVIUM:** **Lean to Fat CLAY with SAND**; trace of organic, stiff, moist, dark gray (max density 97.1 pcf @ 23.4% moisture)	Fines = 84% PP=3.75 tsf
4	31.7			5					EI = 80 Fines = 59% PP = 3.5-4 tsf
5	27.8								Fines = 83% PP = 2.5-3 tsf
6	26.3						CL	**Sandy Lean CLAY;** stiff, moist to very moist, concretions, olive brown with dark brown inclusions	PP = 1-1.5 tsf Fines = 68%
7	23.1			10					#200 Wash Fines = 50% PP = 2.0 tsf
8	28.5								Fines = 71.3% PP = 2-2.2 tsf
9	16.1			15			SM	**Silty SAND;** fine to medium, lumps of clay, moist to very moist, dark yellowish brown	Fines = 40%
10	17.5								Fines = 22%
				20				End of test pit @ 16' 6" No groundwater encountered	
				25					
				30					
				35					
				40					

Bulk ☒ CD ■ SPT ☒

Boring Log

KOURY ENGINEERING & TESTING, INC.

Project No. : 17-1025
Project Name : Borrow Site 5

Boring No. : TP-9

Sheet : 1 of : 1

Drilling Method : Backhoe
Sampling Method : Bulk
Hammer Weight :
Location : See Figure A-2

Ground Elevation:
Drilling Co. : Bill Bastedo
Date Drilled : 3/13/19

Sample No.	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per 6"	Depth (ft)	Sample Location	Graphic Log	Soil Type (USCS)	Description	Additional Tests
				0				**FILL: Sandy Lean CLAY**	
1	31.6				⊠			**ALLUVIUM: Lean CLAY with SAND;** stiff, moist, dark yellowish brown	Fines = 76% PP = 2.5 tsf
2	21.0				⊠				Fines = 85% PP=2.75-3.5 tsf
3	20.3			5	⊠		CL	**Sandy Lean CLAY;** concretions, stiff, moist to very moist, yellowish brown	Fines = 69%
4	18.5				⊠			**Lean CLAY with SAND;** concretions, moist, olive brown with white	#200 Wash Fines = 82%
5	19.3			10	⊠			**Sandy Lean CLAY;** caliche stringers, very stiff, moist, light olive brown with white specs	Fines = 74% PP = 3-4 tsf
6	17.9				⊠				Fines = 60%
								End of test pit @ 11' 6" No groundwater encountered	
				15					
				20					
				25					
				30					
				35					
				40					

Bulk ⊠ CD ■ SPT ⊠

Boring Log

KOURY ENGINEERING & TESTING, INC.

Project No. : 17-1025
Project Name : Borrow Site 5

Boring No. : TP-10

Sheet : 1 of : 1

Drilling Method : Backhoe
Sampling Method : Bulk
Hammer Weight :
Location : See Figure A-2

Ground Elevation:
Drilling Co. : Bill Bastedo
Date Drilled : 3/13/19

Sample No.	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per 6"	Depth (ft)	Sample Location	Graphic Log	Soil Type (USCS)	Description	Additional Tests
1	36.0			0	⊠		SC	**FILL: Clayey SAND;** topsoil, trace of organics, moist, dark brown	#200 Wash Fines = 41%
2	30.8				⊠		CL/CH	**ALLUVIUM:** **Sandy Lean to Fat CLAY;** trace of organic, very moist, very dark grayish brown	#200 Wash Fines = 57%
3	44.0			5	⊠		CH	**Fat CLAY**; stiff, moist to very moist, black	#200 Wash Fines = 89% PP = 4.0 tsf EI = 66
4	28.5				⊠				Fines = 88% PP = 1-1.5 tsf
5	24.0			10	⊠		CL	**Lean CLAY with SAND;** stiff, moist to very moist, dark grayish brown	Fines = 76% PP = 2.0 tsf
6	24.8				⊠				PP=1.75-2.2 tsf
				15				End of test pit @ 13' No groundwater encountered	
				20					
				25					
				30					
				35					
				40					

Bulk ⊠ CD ■ SPT ⊠

APPENDIX C

Laboratory Test Results

EXPANSION INDEX TESTS

DENSITY AND MOISTURE CONTENT DATA - EI TEST

Location/ Elevation	TP 1 @ 0-1'		TP 1 @ 3.75-4'		TP 2 @ 1.5-2'		TP 5 @ 2.5-3'	
USCS Symbol								
Normal Load (psf)								
SAMPLE CONDITION	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Wt Specimen & Ring (gr)	726.100		753.180		657.110		720.710	
Wt. of ring (gr)	364.10		367.40		366.64		367.31	
Wt. Specimen (gr)	362.000		385.780		290.470		353.400	
Specimen diameter (in)	4.010		4.010		4.010		4.010	
Specimen radius (cm)	5.09		5.09		5.09		5.09	
Area of Specimen (cm^2)	81.479		81.479		81.479		81.479	
Init. Spec. height (in)	1.0005	N/A	1.0030	N/A	1.0030	N/A	1.0030	N/A
Height change (final)(in)	N/A	0.0427	N/A	0.0983	N/A	0.0520	N/A	0.0389
Adjusted Spec.height(in)	1.00	0.9578	1.00	0.9047	1.00	0.9510	1.00	0.9641
" " (cm)	2.541	2.433	2.548	2.298	2.548	2.416	2.548	2.449
Specimen Volume (cm^3)	207.061		207.578		207.578		207.578	
Moist Density (pcf)	109.15		116.02		87.36		106.29	
MOISTURE CONTENT								
Wt. moist soil+tare(gr)	445.45	445.45	482.74	482.74	276.47	276.47	442.91	442.91
Wt. dry soil+tare(gr)	402.84	402.84	441.09	441.09	239.60	239.60	397.43	397.43
Wt. of tare(gr)	83.45	83.45	96.96	96.96	96.96	96.96	90.02	90.02
Wt. dry soil (gr)	319.39	319.39	344.13	344.13	142.64	142.64	307.41	307.41
Wt. of water (gr)	42.61	42.61	41.65	41.65	36.87	36.87	45.48	45.48
M/C (%)	13.34	13.34	12.10	12.10	25.85	25.85	14.79	14.79
DRY DENSITY (pcf)	96.3		103.5		69.4		92.6	
% Saturation* (48%-52%)	48.0		52.0		48.9		48.7	
*Assumes Gs =	2.7		2.7		2.7		2.7	
EXPANSION INDEX =	43		98		52		39	
Potential Expansion *(per ASTM 4829-08)*	Low		High		Medium		Low	

KOURY ENGINEERING & TESTING, INC.	Project Name: Borrow Site 5	Project No.: 17-1025 Date: 04-15-2019	Run by: QA:

Lab:

EXPANSION INDEX TESTS

DENSITY AND MOISTURE CONTENT DATA - EI TEST

Location/ Elevation	TP 2 @ 4-4.5'		TP 7 @ 3.5-4'		TP 8 @ 4-4.5'		TP 7 @ 1-1.5'	
USCS Symbol								
Normal Load (psf)								
SAMPLE CONDITION	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Wt Specimen & Ring (gr)	649.030		744.340		705.390		700.250	
Wt. of ring (gr)	366.37		366.31		366.44		363.90	
Wt. Specimen (gr)	282.660		378.030		338.950		336.350	
Specimen diameter (in)	4.010		4.010		4.010		4.010	
Specimen radius (cm)	5.09		5.09		5.09		5.09	
Area of Specimen (cm^2)	81.479		81.479		81.479		81.479	
Init. Spec. height (in)	0.9955	N/A	1.0000	N/A	1.0020	N/A	1.0020	N/A
Height change (final)(in)	N/A	0.0381	N/A	0.0598	N/A	0.0800	N/A	0.0189
Adjusted Spec.height(in)	1.00	0.9574	1.00	0.9402	1.00	0.9220	1.00	0.9831
" " (cm)	2.529	2.432	2.540	2.388	2.545	2.342	2.545	2.497
Specimen Volume (cm^3)	206.026		206.957		207.371		207.371	
Moist Density (pcf)	85.65		114.04		102.04		101.26	
MOISTURE CONTENT								
Wt. moist soil+tare(gr)	375.45	375.45	475.25	475.25	431.23	431.23	416.46	416.46
Wt. dry soil+tare(gr)	315.22	315.22	435.34	435.34	382.96	382.96	367.22	367.22
Wt. of tare(gr)	92.79	92.79	97.22	97.22	92.28	92.28	80.11	80.11
Wt. dry soil (gr)	222.43	222.43	338.12	338.12	290.68	290.68	287.11	287.11
Wt. of water (gr)	60.23	60.23	39.91	39.91	48.27	48.27	49.24	49.24
M/C (%)	27.08	27.08	11.80	11.80	16.61	16.61	17.15	17.15
DRY DENSITY (pcf)	67.4		102.0		87.5		86.4	
% Saturation* (48%-52%)	48.7		48.8		48.4		48.7	
*Assumes Gs =	2.7		2.7		2.7		2.7	
EXPANSION INDEX =	38		60		80		19	
Potential Expansion *(per ASTM 4829-08)*	Low		Medium		Medium		Very Low	

KOURY ENGINEERING & TESTING, INC.	Project Name: Borrow Site 5	Project No.: 17-1025 Date: 04-15-2019	Run by: QA:	Lab:

EXPANSION INDEX TESTS

DENSITY AND MOISTURE CONTENT DATA - EI TEST

Location/ Elevation	TP 10 @ 4.5-5.5'		TP 3 @ 4.8-5.2'		TP 4 @ 5-5.5'		TP 5 @ 1-1.5'	
USCS Symbol								
Normal Load (psf)								
SAMPLE CONDITION	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Wt Specimen & Ring (gr)	688.900		714.510		665.470		744.140	
Wt. of ring (gr)	366.61		366.48		366.64		364.14	
Wt. Specimen (gr)	322.290		348.030		298.830		380.000	
Specimen diameter (in)	4.010		4.010		4.010		4.010	
Specimen radius (cm)	5.09		5.09		5.09		5.09	
Area of Specimen (cm^2)	81.479		81.479		81.479		81.479	
Init. Spec. height (in)	1.0020	N/A	1.0000	N/A	1.0000	N/A	1.0030	N/A
Height change (final)(in)	N/A	0.0659	N/A	0.1744	N/A	0.0339	N/A	0.0396
Adjusted Spec.height(in)	1.00	0.9361	1.00	0.8256	1.00	0.9661	1.00	0.9634
" " (cm)	2.545	2.378	2.540	2.097	2.540	2.454	2.548	2.447
Specimen Volume (cm^3)	207.371		206.957		206.957		207.578	
Moist Density (pcf)	97.03		104.99		90.14		114.29	
MOISTURE CONTENT								
Wt. moist soil+tare(gr)	408.59	408.59	440.82	440.82	382.28	382.28	472.30	472.30
Wt. dry soil+tare(gr)	355.77	355.77	390.75	390.75	325.40	325.40	429.76	429.76
Wt. of tare(gr)	86.30	86.30	92.79	92.79	83.45	83.45	92.30	92.30
Wt. dry soil (gr)	269.47	269.47	297.96	297.96	241.95	241.95	337.46	337.46
Wt. of water (gr)	52.82	52.82	50.07	50.07	56.88	56.88	42.54	42.54
M/C (%)	19.60	19.60	16.80	16.80	23.51	23.51	12.61	12.61
DRY DENSITY (pcf)	81.1		89.9		73.0		101.5	
% Saturation* (48%-52%)	49.1		51.8		48.5		51.5	
*Assumes Gs =	2.7		2.7		2.7		2.7	
EXPANSION INDEX =	66		174		34		39	
Potential Expansion *(per ASTM 4829-08)*	Medium		Very High		Low		Low	

KOURY ENGINEERING & TESTING, INC.	Project Name: Borrow Site 5	Project No.: 17-1025 Date: 04-15-2019	Run by: QA:	Lab:

We are a key member of the construction team while safeguarding the public. We improve operational logistics and provide superior quality control through the continuing development of our engineering staff and technical expertise, utilization of classroom training and field supervisors, thus defining the industry standard.

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