INFILTRATION TESTING RESULTS
PROPOSED RESIDENTIAL DEVELOPMENT
COUNTY OF SAN DIEGO TRACT NO. 5573
VISTA AREA, SAN DIEGO COUNTY, CALIFORNIA
APNS 181-180-56, -84 AND -86

FOR

MS. MARGARET TOMLINSON AND MS. HOLLY MARSHALL
c/o BHA, INC.
5115 AVENIDA ENCINAS, SUITE L
CARLSBAD, CALIFORNIA 92008-4387

W.O. 6814-A1-SC **RE-REVISED FEBRUARY 22, 2017**

GeoSoils, Inc.

Geotechnical • Geologic • Coastal • Environmental

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Re-Revised February 22, 2017

W.O. 6814-A1-SC

Ms. Margaret Tomlinson and Ms. Holly Marshall
c/o **bHA Inc.**
5115 Avenida Encinas, Suite L
Carlsbad, California 92008-4387

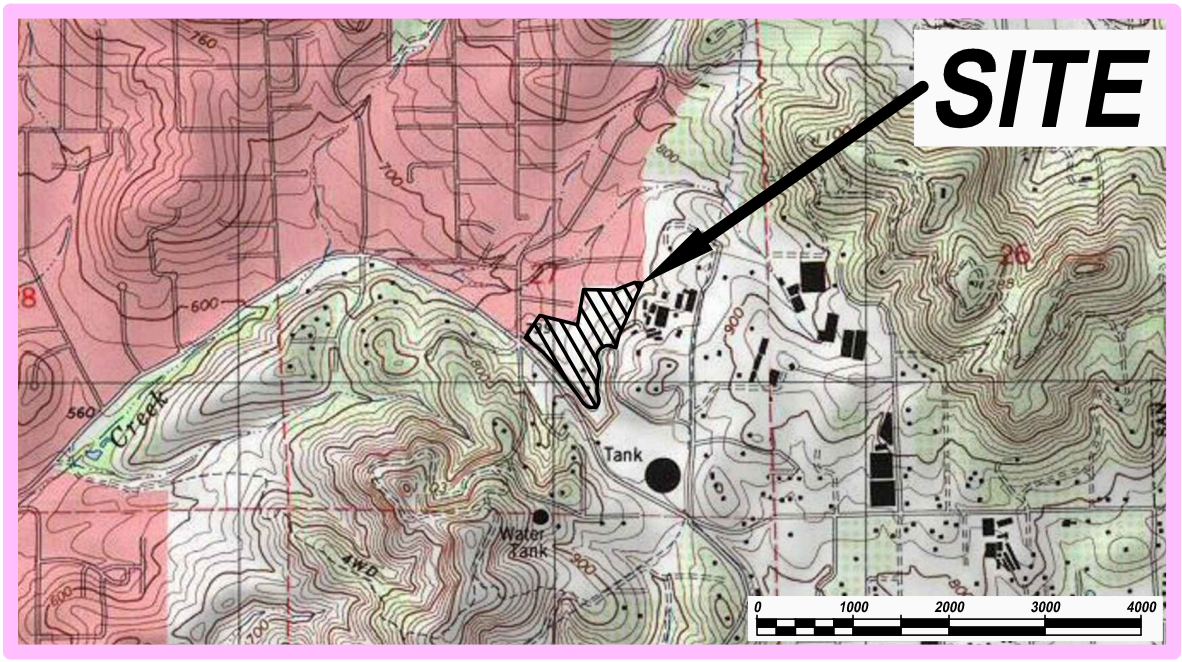
Subject: Infiltration Testing Results, County of San Diego Tract No. 5573, Vista Area, San Diego County, California, APNs 181-180-84 & 86, and 181-180-56

Dear Mr. Bradley and Ms. Crawford:

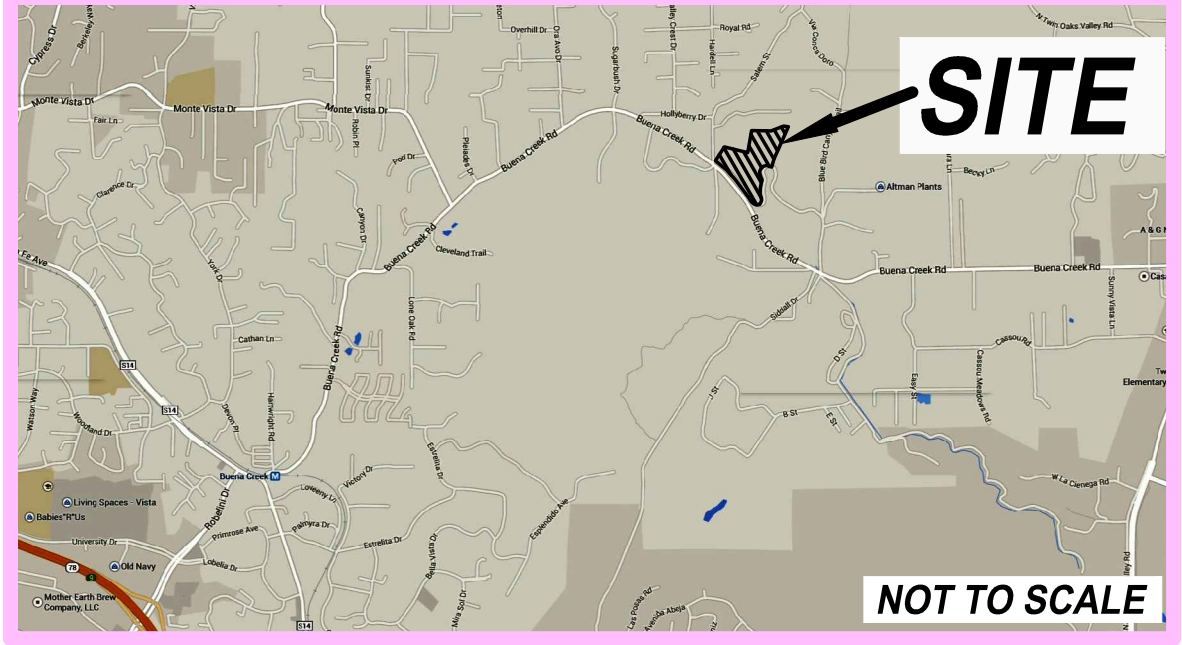
In accordance with your request and the Client's authorization, GeoSoils, Inc. (GSI) is providing the results of our infiltration testing for the design of the planned storm water treatment basin at the subject site. The location of the site is shown on Figure 1 (Site Location Map). The purpose of this study was to evaluate the infiltration rate of earth materials that would be exposed at the planned infiltration surface elevation within the aforementioned basin. The scope of our services has included a review of the referenced documents and plans (see Appendix A), the excavation of three (3) exploratory test borings for logging, groundwater depth, and subsequent infiltration testing utilizing the borehole percolation test method (see Appendix B), analysis of field test data (see Appendix C), and preparation of this summary report. GSI has also re-revised City of Vista Worksheet C.4-1, which is included in Appendix D. Based on the above and discussions presented herein, it is our opinion that storm water "Partial Infiltration" into the onsite soils is feasible from a geotechnical viewpoint, provided our recommendations are properly implemented.

PROPOSED DEVELOPMENT

Based upon our review of the preliminary grading plans prepared by bHA, Inc. (BHA, 2017a, 2017b, and 2016), GSI understands that proposed development consists of preparing the parcels for the construction of 13 new lots with typical residential construction, potentially including a swimming pool with associated underground utility improvements. BHA (2017a, 2017b, and 2016) shows that onsite storm water is to be conveyed into one (1) earthen basin for treatment, located near the westerly northern property line. Based on our review of BHA (2017a, 2017b, and 2016), GSI estimates that the elevation of the infiltration surface is approximately 716.5 feet (Datum = National Geodetic Vertical Datum of 1929 [NGVD29]) or approximately 2 feet below the existing grade.



Base Map: TOPO!® ©2003 National Geographic, U.S.G.S. San Marcos Quadrangle, California -- San Diego Co., 7.5 Minute, dated 1996, current, 1999.



Base Map: Google Maps, Copyright 2014 Google, Map Data Copyright 2014 Google

GeoSoils, Inc.

W.O. 6814-A1-SC

SITE LOCATION MAP

Figure 1

N

FIELD INVESTIGATION

The field investigation, performed in preparation of this report, occurred on September 6 and 7, 2016, and consisted of the excavation of three (3) exploratory test borings with a John Deere 319D skid steer in the approximate footprint of the planned storm water treatment basin. Boring IB-1 was excavated ±16 feet below existing grade, 10 feet below the approximate elevation of the planned infiltration surface. Borings IB-2 and IB-3 were excavated 6½ to 7 feet below existing grade near the approximate elevation of the planned infiltration surface. The Infiltration Borings were logged by GSI staff who also performed infiltration testing with a borehole percolation test method in general accordance with City of Vista BMP Design Manual Guidelines (COVBMPDM, 2016). A log of the Infiltration Borings is provided in Appendix B. The approximate location of the Infiltration Borings are shown on Figure 2, which uses BHA (2016) as a base. The results of the infiltration testing are provided in Appendix C.

SITE GEOLOGIC UNITS

General

The earth material units that were observed and/or encountered at the subject site consist of surficial deposits of Quaternary-age colluvium overlying Quaternary-age older alluvium. A general description of each material type is presented as follows, from youngest to oldest.

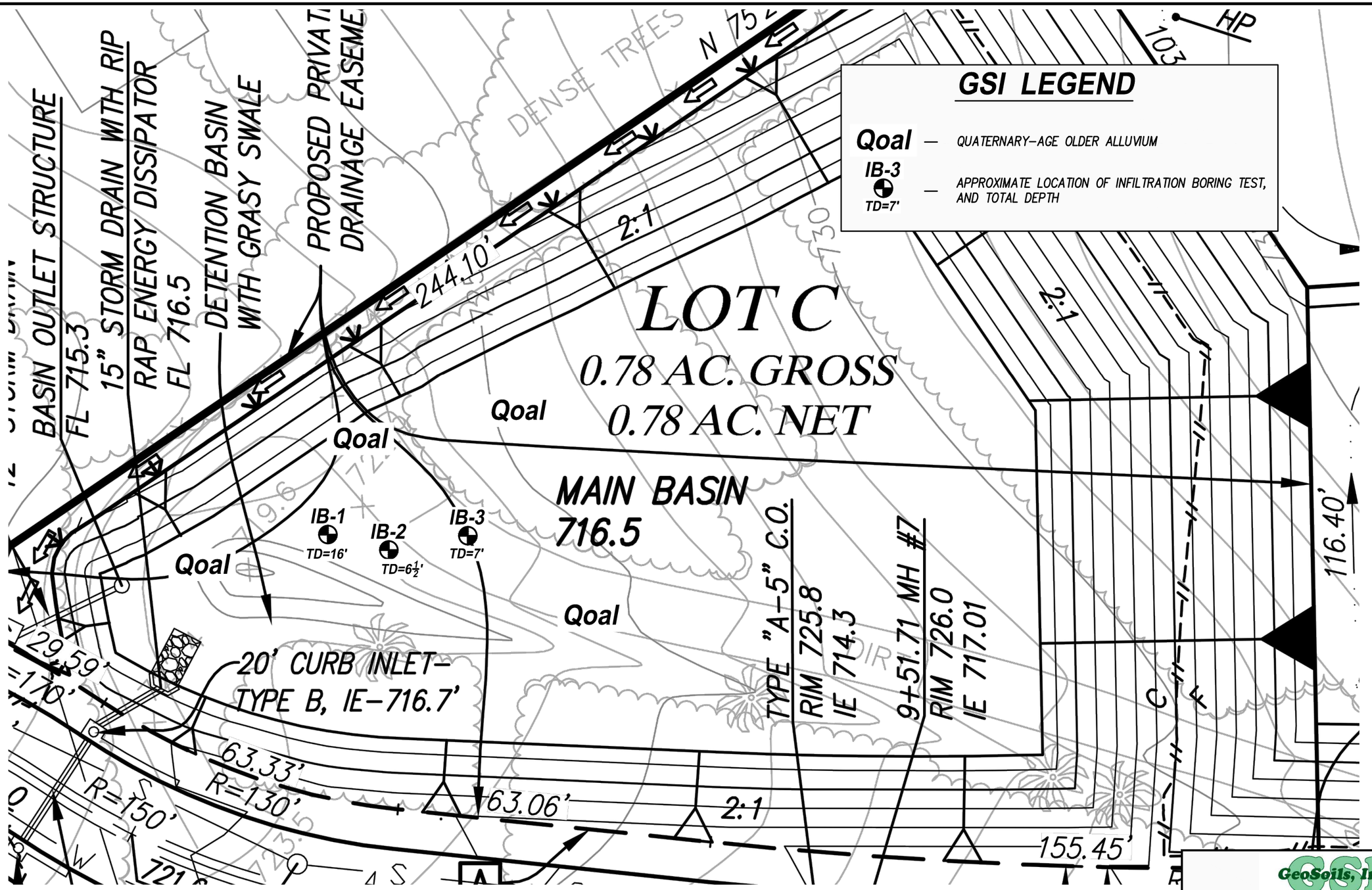
Quaternary-age Colluvium (Not Mapped)

As observed, colluvium consists of dark brown, moist to damp, loose within the upper foot and becomes medium dense, and silty sand with trace clay. Where encountered in our borings, the thickness of this unit was on the order of 3 feet thick.

Quaternary-age Older Alluvium (Map Symbol - Qoal)

Quaternary-age older alluvium underlie the entire site near the surface and at depth. Where encountered, these alluvial deposits generally consisted of moist, medium dense and becomes dense near 13 feet below existing grade, dark yellowish brown silty sand.

Further geologic site information is found in GSI's preliminary geotechnical evaluation (GSI, 2015).



BASE MAP PROVIDED BY:

bHA, Inc.
land planning, civil engineering, surveying
5115 AVENIDA ENCINAS
SUITE 215
CARLSBAD, CA. 92008-4387
(760) 931-8700

ALL LOCATIONS ARE APPROXIMATE

This document or efile is not a part of the Construction Documents and should not be relied upon as being an accurate depiction of design.

GRAPHIC SCALE
20 0 10 20 40
1" = 20'

GeoSoils, Inc.

INFILTRATION BORING LOCATION MAP

Figure 2

W.O. 6814-A1-SC	DATE: 10/16	SCALE: 1" = 20'

GROUNDWATER

GSI did not encounter the regional groundwater table nor evidence of perched water during our field exploration. The elevation of the groundwater table at the subject site is anticipated to generally be coincident with, or lower than the flowline of Buena Creek to the northwest of the site. According to the United States Geological Survey, the flowline of this creek in vicinity to the project site is approximately 700 feet NGVD29, or approximately ±10 feet or more below the lowest site elevation. Buena Creek is likely a perched alluvial aquifer and the groundwater elevation within this aquifer likely fluctuates depending on contributions from precipitation and irrigation. The regional groundwater table is likely coincident with sea level, based on the available data.

Seeps, springs, or other indications of subsurface water were not noted on the subject property during the time of our field investigation. However, perched water seepage may occur locally (as the result of heavy precipitation and/or irrigation, or damaged wet utilities) along zones of contrasting permeabilities/densities (fill/bedrock deposit contacts, sandy/clayey fill lifts, etc.) or along geologic discontinuities, or bedding. This potential should be anticipated and disclosed to all interested/affected parties.

FIELD INFILTRATION TESTING

Three (3) borehole percolation tests were conducted within the proposed basin. The approximate surface elevation for Infiltration Boring IB-1, Infiltration Boring IB-2, and Infiltration Boring IB-3 were ±722½ feet NGVD29, ±723 feet NGVD29, and ±723½ feet NGVD29, respectively. Infiltration testing was performed in general accordance with the City BMP Guidelines (COVBMPD, 2016), by a geologist from our firm. The field infiltration test data is provided in Appendix C. Procedures for testing are outlined briefly below:

BOREHOLE PERCOLATION/INFILTRATION TEST PROCEDURE

1. GSI excavated approximately ±5 to 6½ feet below existing grade, where the proposed onsite infiltration surface is proposed and 10 feet deeper than the basin infiltration surface elevation is proposed, respectively.

2. Water was poured to an approximate height of five time the radius from the top of the proposed basin elevation, and left overnight (24-hour period).

3. The following day, testing began and water level was recorded at a ¼-inch accuracy.

4. The final test was used as the infiltration rate.

Test Holes:

1. Two test locations were installed at approximate proposed improvement elevations between ±1 and ±10 feet.

2. Percolation hole diameter - 7 inches.

3. After the removal of all loose material, approximately 2 inches of gravel was placed on the bottom of the excavation.

4. A perforated pipe was then installed within the percolation hole to facilitate accurate field measurements and prevent caving during testing and the pre-soak period.

Pre-Soaking: Water filled each test hole as mentioned above, where the pre-soak period continued overnight.

Testing: The following day (after pre-soak), readings were recorded at intervals of 10 minutes and 30 minutes depending on the Sandy Soil Criteria Test (per COVBMPD). Due to the observed high infiltration rates, testing within Infiltration Boring IB-2 was concluded after 60 minutes at 10 minute intervals, and after repeatable rates were acquired. Infiltration Boring IB-3 exhibited low infiltration rates, where testing concluded after 360 minutes at 30-minute intervals.

Locations: The location of the infiltrometer tests were site specific and chosen to give a general representation of the anticipated infiltration rate of the earth materials in relation the proposed infiltration basin at its planned location.

Accuracy: All measurements within the infiltration borings were read to the nearest ¼ inch.

Test Results: The results of the infiltration testing is summarized in the following table and in Appendix C. It is our opinion that the relatively low infiltration rate (within the colluvial deposits) and relatively high infiltration rates (within the older alluvial deposits) acquired from the testing are due to the nature of onsite soils.

LOCATION	INFILTRATION RATE (in/hr)
IB-2	12.35
IB-3	1.56

CONCLUSIONS

The above infiltration rates indicates that infiltration of storm water runoff into the onsite earth materials is likely to elevate the potential for groundwater mounding in the Quaternary-age older alluvium, which has a strong potential to adversely affect lower lying improvements, both onsite and offsite, and down topographic gradient, absent mitigation and significantly constrained lower infiltration rates/volume of water. The colluvial deposits within the upper strata, consistent with the infiltration surface in the planned basin, have an infiltration rate greater than 0.5 inches per hour, thus, also providing a potential boundary for groundwater mounding with the underlying sediments. However, for design, GSI would be amenable to utilizing a limiting upper boundary infiltration rate of 0.04 in/hr for "Partial Infiltration," since that amount is similar to what could be expected to occur from precipitation, and is very close to 0.00. Thus, the results of our re-revised City of Vista Worksheet C.4-1 is feasibility screening category "Partial Infiltration." The re-revised Worksheet C.4-1 is provided in Appendix D, reflecting this condition.

RECOMMENDATIONS

Recommendations for basin liners and subdrains, as well as other criteria, are included in GSI (2015); however, provided that the constrained lower infiltration rate is utilized by the project engineer in their design ("amended soil"), the liners may be omitted on the bottom of the biofiltration basin (BMP-1 [BHA, 2017a]) vegetated swale (BMP-2), and tree wells (BMP-4). This will require a 6-inch cutoff wall with a 2-sack mix slurry-embedded liner on the sides, extending to a depth of 3 feet from the bottom of the basin/tree well. Although not embedded in slurry, the liner should continue up the sides of the basins, and above the zone of innundation, and laterally a minimum of 6-12 inches into the soil at the point where it terminates near the surface. Superjacent curbs and flatwork to basins, tree wells, and permeable pavements will require thickened edges/footings, that extend 12 inches below the bottom of the basin/tree well/permeable pavment section, or distress to such improvements will occur. Owing to the "amended soil" proposed at the biofiltration basin toe of slope (BMP-1 and BMP-2), some settlement/sloughing/erosion should be expected in these areas, requiring periodic and regular maintenance. With regard to the proposed permeable pavement (BMP-3), Tencate (Mirafi) RS380i geotextile should be placed between the check layer and the reservoir layer, and lapped up the sides of the subgrade by ½ to 1 inch.

Subdrain outlets should be shown on the plans. Storm drain backfill within basins (including stand pipes) or permeable pavement areas, and to 5 feet outside, should consist of a two-sack mix of slurry. Other utilities transecting the permeable pavement subgrade will likely require similar treatment.

LIMITATIONS

The materials encountered on the project site and utilized for our analysis are believed representative of the area; however, soil and bedrock materials vary in character between excavations and natural outcrops or conditions exposed during mass grading. Site conditions may vary due to seasonal changes or other factors.

Inasmuch as our study is based upon our review and engineering analyses and field test data, the conclusions and recommendations are professional opinions. These opinions have been derived in accordance with current standards of practice, and no warranty, either express or implied, is given. Standards of practice are subject to change with time. GSI assumes no responsibility or liability for work or testing performed by others, or their inaction; or work performed when GSI is not requested to be onsite, to evaluate if our recommendations have been properly implemented. Use of this report constitutes an agreement and consent by the user to all the limitations outlined above, notwithstanding any other agreements that may be in place. In addition, this report may be subject to review by the controlling authorities. Thus, this report brings to completion our scope of services for this portion of the project.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to contact our office.

Respectfully submitted,

GeoSoils, Inc.

John P. Franklin
Engineering Geologist, CEG 1340

David W. Skelly
Civil Engineer, RCE 47857

JPF/DWS/jh

Enclosure: Appendix A - References
Appendix B - Infiltration Pit Logs
Appendix C - Infiltration Data Sheets
Appendix D - Re-Revised City of Vista Worksheet C.4-1

Distribution: (1) Addressee (via email)
(2) bHA, Inc., Attn: Mr. Rod Bradley and Mr. Bruce Rice (2 wet signed)

APPENDIX A

REFERENCES

APPENDIX A

REFERENCES

Allen, V., Connerton, A., and Carlson, C., 2011, Introduction to infiltration best management practices (BMP), Contech Construction Products, Inc., professional development series, dated December.

American Society for Testing and Materials (ASTM), 2003, Standard test method for infiltration rate of soils in field using double-ring infiltrometer, Designation D 3385-03, dated August.

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_____, 2016, Tentative subdivision map, County of San Diego Tract No. 5573, 4 sheets, 40-scale, dated April 1.

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City of Vista, 2016, City of Vista BMP Design Manual for permanent site design, storm water treatment, and hydromodification management, storm water requirements for development applications, dated February.

GeoSoils, Inc., 2015, Preliminary geotechnical evaluation, County of San Diego Tract No. 5573, Vista Area, San Diego County, California, APNs 181-180 -56, -84 and -86, W.O. 6814-A-SC, dated February 4.

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.

APPENDIX B

INFILTRATION BORING LOGS

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions			Group Symbols	Typical Names
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels 50% or more of coarse fraction retained on No. 4 sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravel with	GM	Silty gravels gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands more than 50% of coarse fraction passes No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils 50% or more passes No. 200 sieve	Silts and Clays Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			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 greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, mucic, and other highly organic soils

CONSISTENCY OR RELATIVE DENSITY

CRITERIA

Standard Penetration Test

Penetration Resistance N (blows/ft)	Relative Density
0 - 4	Very loose
4 - 10	Loose
10 - 30	Medium
30 - 50	Dense
> 50	Very dense

Standard Penetration Test

Penetration Resistance N (blows/ft)	Consistency	Unconfined Compressive Strength (tons/ft^2)
<2	Very Soft	<0.25
2 - 4	Soft	0.25 - .050
4 - 8	Medium	0.50 - 1.00
8 - 15	Stiff	1.00 - 2.00
15 - 30	Very Stiff	2.00 - 4.00
>30	Hard	>4.00

3" 3/4" #4 #10 #40 #200 U.S. Standard Sieve

Unified Soil Classification	Cobbles	Gravel		Sand			Silt or Clay
		coarse	fine	coarse	medium	fine	

MOISTURE CONDITIONS

Dry	Absence of moisture: dusty, dry to the touch
Slightly Moist	Below optimum moisture content for compaction
Moist	Near optimum moisture content
Very Moist	Above optimum moisture content
Wet	Visible free water; below water table

MATERIAL QUANTITY

trace	0 - 5 %
few	5 - 10 %
little	10 - 25 %
some	25 - 45 %

OTHER SYMBOLS

C Core Sample
S SPT Sample
B Bulk Sample
__ Groundwater
Qp Pocket Penetrometer

BASIC LOG FORMAT:
Group name, Group symbol, (grain size), color, moisture, consistency or relative density. Additional comments: odor, presence of roots, mica, gypsum, coarse grained particles, etc.

EXAMPLE:
Sand (SP), fine to medium grained, brown, moist, loose, trace silt, little fine gravel, few cobbles up to 4" in size, some hair roots and rootlets.

File:Mgr: c;\SoilClassif.wpd

PLATE B-1

BORING LOG

GeoSoils, Inc.

W.O. 6814-A1-SC

PROJECT: Tomlinson
Vista Tract 5573

BORING IB-1 *SHEET* 1 *OF* 1

DATE EXCAVATED 9-6-16

SAMPLE METHOD: 140 Lb. Hammer @ 30" Drop

Standard Penetration Test

Undisturbed, Ring Sample

Groundwater

Depth (ft.)	Sample: Bulk	Sample: Undisturbed	Sample: Blows/ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Description of Material
				SC/CL				QUATERNARY-AGE COLLUVIUM: @ 0' CLAYEY SAND to SANDY CLAY, dark brown, dry, loose,; porous, desiccated.
			65	SM				QUATERNARY-AGE OLDER ALLUVIUM: @ 3' SILTY SAND with traces of CLAY, dark brown, moist to damp, dense; no recovery.
5								@ 7' SILTY SAND, dark yellowish brown, moist, medium dense.
10								@ 13' As per 7', becomes dense.
15								Total Depth = 16' No Groundwater Encountered Backfilled 9/7/16
20								
25								

BORING LOG

GeoSoils, Inc.

W.O. 6814-A1-SC

PROJECT: Tomlinson
Vista Tract 5573

BORING IB-2 *SHEET* 1 *OF* 1

DATE EXCAVATED 9-6-16

SAMPLE METHOD: 140 Lb. Hammer @ 30" Drop

Standard Penetration Test

Undisturbed, Ring Sample

Groundwater

Depth (ft.)	Sample: Bulk	Sample: Undisturbed	Sample: Blows/ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Description of Material
				SC/CL				QUATERNARY-AGE COLLUVIUM: @ 0' CLAYEY SAND to SANDY CLAY, dark brown, dry, loose; porous, desiccated.
5				SM				QUATERNARY-AGE OLDER ALLUVIUM: @ 3' SILTY SAND with traces of CLAY, dark brown, moist to damp, dense.
								Total Depth = 6½' No Groundwater Encountered Backfilled 9/7/16
10								
15								
20								
25								

BORING LOG

GeoSoils, Inc.

W.O. 6814-A1-SC

PROJECT: Tomlinson
Vista Tract 5573

BORING IB-3 *SHEET* 1 *OF* 1

DATE EXCAVATED 9-6-16

SAMPLE METHOD: 140 Lb. Hammer @ 30" Drop

Standard Penetration Test

Undisturbed, Ring Sample

Groundwater

Depth (ft.)	Sample: Bulk	Sample: Undisturbed	Sample: Blows/ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Description of Material
				SC/CL				QUATERNARY-AGE COLLUVIUM @ 0' CLAYEY SAND to SANDY CLAY, dark brown, dry, loose; porous, desiccated.
5				SM				QUATERNARY-AGE OLDER ALLUVIUM @ 3' SILTY SAND with traces of CLAY, dark brown, moist to damp, dense.
								Total Depth = 7' No Groundwater Encountered Backfilled 9/7/16
10								
15								
20								
25								

APPENDIX C

INFILTRATION DATA SHEETS

Infiltration Data Sheet

Project:	Tomlinson	W.O. Number:	6814-A1-SC
Test Hole No.:	IB-2	Date Excavated:	9/6/16
Test Hole Depth (ft.):	7 Hole Radius(in.): 3.5	Soil Classification	SM/SC
Check for Sandy Soil Criteria Tested by:	ATS	Date: 9/7/2016	Presoak: 9/6/16
Actual Percolation Tested by:	ATS	Date:	9/7/16

Sandy Soil Criteria Test

Trial No.	Time	Time Interval (Min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Δ in Water Level	Greater than or equal to 6"
1	9:35 10:05	30	30	5	25	YES
2	10:13 10:43	30	37	7	30	YES

Use: Normal Sandy (Circle One) Soil Criteria

Time	Time Interval (min)	Total Elapsed Time (Min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Δ in Water Level (Inches)	Infiltration Rate (inch/hour)
10:48 10:58	10	10	31	17	14	16.80
10:58 11:08	10	20	17	11 1/4	5 3/4	13.05
11:11 11:21	10	30	27	16	11	15.93
11:21 11:31	10	40	16	11	5	12.35
12:05 12:15	10	50	15 1/2	11	4 1/2	11.81
12:17 12:27	10	60	17	12	5	12.35

Plate No. C-1

Infiltration Data Sheet

Project:	Tomlinson			W.O. Number:	6814-A1-SC
Test Hole No.:	IB-3			Date Excavated:	9/6/16
Test Hole Depth (ft.):	7	Hole Radius(in.):	3.5	Soil Classification	SM/SC
Check for Sandy Soil Criteria Tested by:		ATS		Date: 9/7/2016	Presoak: 9/6/16
Actual Percolation Tested by:		ATS		Date:	9/7/16

Sandy Soil Criteria Test

Trial No.	Time	Time Interval (Min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Δ in Water Level	Greater than or equal to 6"
1	9:48 10:18	30	18	20 1/2	2 1/2	NO
2	10:20 10:45	25	19	21	2	NO

Use: Non-Sandy (Circle One) Soil Criteria

	Time	Time Interval (min)	Total Elapsed Time (Min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Δ in Water Level (Inches)	Infiltration Rate (inch/hour)
First Hour	10:49 11:19	30	30	20 1/4	24 3/4	4 1/2	3.94
	11:21 11:51	30	60	21	22 1/4	1 1/4	1.84
Second Hour	11:52 12:22	30	90	22 3/4	24	1 1/4	1.84
	12:23 12:53	30	120	23 1/2	24 3/4	1 1/4	1.84
Third Hour	12:58 13:28	30	150	13	14 1/4	1 1/4	1.84
	13:28 13:58	30	180	14 1/4	15 1/2	1 1/4	1.84
Fourth Hour	13:58 14:28	30	210	15 1/2	16 3/4	1 1/4	1.84
	14:32 15:02	30	240	14	19	5	4.12
Fifth Hour	15:02 15:32	30	270	19	21	2	2.55
	15:36 16:06	30	300	12 1/2	19	6 1/2	4.55
Sixth Hour	16:06 16:36	30	330	19	20 1/2	1 1/2	2.10
	16:36 17:06	30	360	20 1/2	21 1/2	1	1.56

APPENDIX D

CITY OF VISTA RE-REVISED WORKSHEET C.4-1

Re-Revised Worksheet C.4-1: Categorization of Infiltration Feasibility Condition

Categorization of Infiltration Condition			Worksheet C.4-1
Part 1 - Full Infiltration Feasibility Screening Criteria **Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?**			
Criteria	**Screening Question**	**Yes**	**No**
1	**Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.	X	
Provide basis: Yes. GSI (2016) has evaluated the infiltration rate of natural surface soils as close to 1.56 to 12.35 in/hr,(Hydrologic Soil Group C/D). Areas for development will also result in the removal of natural surface soils, exposing medium dense to dense Quaternary-age Older Alluvium. The resultant infiltration rates for these much denser materials are expected to be close to 12.0 in/hr. Site soils where the proposed basin is to be constructed have relatively high permeability at depth below basin surface grade. See text of GSI (2015) for other related discussions and references. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
2	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		X
Provide basis: No. There is an increased potential for the creation of perched groundwater (mounding) conditions along zones of contrasting permeabilities, including shallow cut/fill contacts, and transitions between interbeds of older alluvial sediments. Utility trenches can potentially act as french drains and provide conduits for the movement of excessive moisture beneath the structure(s), further exacerbating slope instability, as well as potentially causing settlement in onsite and offsite trench backfill. Future perched groundwater conditions may develop along interbeds, and should be anticipated. The permeability of the older alluvium will tend to result in the lateral migration of water and saturated conditions at, or near the surface, increasing the potential for distress to foundations, floor slabs, and slope instability, etc. See text of GSI (2015) for other related discussions and references. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

Re-Revised Worksheet C.4-1 Page 2 of 4			
Criteria	**Screening Question**	**Yes**	**No**
3	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensible evaluation of the factors presented in Appendix C.3.	X	
Provide basis: Yes. The site has previously been utilized for agriculture, and the presence of organochlorine pesticides (OCP) has been documented (GSI, 2014). OCP was found to be below California Human Health Screening Levels (CHHSL) for residential development onsite. Storm water pollutants do not appear to be a factor in regard to CHHSLs. The regional groundwater table is not considered a factor in the development of this site. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
4	**Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as a change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		X
Provide basis: No. The infiltration rate is greater than 0.5 inches per hour. The site currently drains onsite and runoff appears to be drained through a natural channel. The regional groundwater table is not considered a factor in the development of this site, however, increased discharge of contaminated groundwater, albeit with low levels of OCB, may not be precluded. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
Part 1 Result*	In the answers to rows 1-4 are "**Yes**" a full infiltration design is potentially feasible. The feasibility screening category is **Full Infiltration** If any answer from row 1-4 is "**No**", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design. Proceed to Part 2		**No**

* To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by [City Engineer] to substantiate findings.

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Part 2 - Partial Infiltration vs. No Infiltration Feasibility Screening Criteria

Would infiltration of water in an appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?

Criteria	Screening Question	Yes	No
5	**Do soil and geologic conditions allow for infiltration in any appreciable rate or volume?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.	X	

Provide basis:

Yes. GSI (2016) has evaluated the infiltration rate of natural surface soils as close to 1.56 to 12.35 in/hr (Hydrologic Soil Group C/D). Areas for development will also result in the removal of natural surface soils, exposing medium dense to dense Quaternary-age Older Alluvium. The resultant infiltration rates for these much denser materials are expected to be close to 12.0 in/hr. Site soils where the proposed basin is to be constructed have relatively high permeability at depth below basin surface grade. See text of GSI (2015) for other related discussions and references.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.

6	**Can infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.	X	

Provide basis:

Yes, provided that thickened edges for superjacent flatwork and impermeable liners are installed along the sides of the proposed vegetated swale and biofiltration basin per the recommendations in the body of the this document. Infiltration may occur at a rate of 0.04 inches/hour (with appropriate safety factors) without significantly increasing the risk of geotechnical hazards. The development of future perched groundwater conditions by virtue of storm water infiltration cannot be entirely precluded and may require mitigation in the form of subdrains should it manifest. See text of GSI (2015) for other related discussions and references

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.

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Criteria	**Screening Question**	**Yes**	**No**
7	**Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: Yes. The site has previously been utilized for agriculture, and the presence of organochlorine pesticides (OCP) has been documented (GSI, 2014). OCP was found to be below California Human Health Screening Levels (CHHSL) for residential development onsite. Storm water pollutants do not appear to be a factor in regard to CHHSLS. The regional groundwater table is not considered a factor in the development of this site. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
8	**Can infiltration be allowed without violating downstream water rights?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: Downstream water rights are considered a legal matter and typically do not fall within the purview of geotechnical engineering. However, GSI is not aware of any significant downstream water rights issues of concern on the adjoining properties. Given the Ksat value of 0.04 in/hr to be utilized for design of site BMPs, infiltration should not significantly affect downstream water rights, from a geotechnical perspective. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
Part 2 Result*	If all answers from row 5-8 are yes then partial infiltration design is potentially feasible. The feasibility screening category is **Partial Infiltration.** If any answer from row 5-8 is no, then infiltration of any volume is considered to be **infeasible** within the drainage area. The feasibility screening category is **No Infiltration.**		**Partial Infiltration**

* To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by Agency/Jurisdictions to substantiate findings.