July 23, 2019 Project No. 19746-10

Mrs. Gabriela Marks
MARKS ARCHITECTS
2643 4th Avenue
San Diego, CA 92103

Subject: **Infiltration System Design Interpretive Report, Proposed Jack in the box Restaurant & Car Wash, South of Benton Road & East of Highway 79, City of Murrieta, Riverside County, California**

In accordance with your request, CW Soils is pleased to present this infiltration system interpretive report for the proposed Jack in the box restaurant and car wash, south of Benton Road and east of Highway 79 (Winchester Road) in the City of Murrieta, Riverside County, California. The purpose of our feasibility study was to determine the onsite infiltration rates and physical characteristics of the subsurface soils within the vicinity of the proposed infiltration systems. We have provided guidelines for the design of onsite infiltration systems. This interpretive report is intended to provide onsite infiltration rates for the existing soils.

SITE DESCRIPTION

The subject property is located south of Benton Road and east of Highway 79 (Winchester Road) in the City of Murrieta, Riverside County, California. The subject property consists of undeveloped land with relatively flat terrain. Topographic relief at the subject property is relatively low.

PROPOSED DEVELOPMENT

Based on information provided by you, the proposed improvements will consist of two buildings with associated interior driveways, utilities, and on-site infiltration areas.

SUBSURFACE EXPLORATION AND INFILTRATION TESTING

SUBSURFACE EXPLORATION

Subsurface exploration at the site consisted of three exploratory excavations to a maximum depth of 16.5 feet, conducted on April 24, 2019 to evaluate the subsurface earth materials. The exploratory holes were excavated and logged, see Appendix A. The approximate locations of the exploratory excavations are shown on the attached Infiltration Location Map, Plate 1.

The soils observed during exploration were classified and logged in general accordance with the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) of ASTM D 2488.

INFILTRATION TESTING

Aardvark Permeameter testing was utilized to conduct in-situ infiltration tests within the proposed basin on May 9, 2019 to evaluate the infiltration rates in order to estimate the amount of storm water runoff that can infiltrate into the proposed systems. The testing utilizes the constant head method with extremely accurate (0.2 ml resolution) hydraulic conductivity testing under saturated conditions, for the determination of reliable in-situ infiltration rates. Automated readings are taken at 1 minute intervals until the rate becomes constant and saturated hydraulic conductivity for the particular soil has been reached. This is reflected by the flattening of the curve generated by sample test data as shown on the Water Consumption Rate graph (Plot of Water Consumption Rate vs. Time) in Appendix B. Steady Flow Rate was interpreted when the Water Consumption Rate changed less than ±5% for 3 consecutive readings.

The Aardvark Permeameter was utilized in replacement of the Guelph Permeameter as recommended by Soil Moisture Equipment Corporation, due to the higher reliability, accuracy, and ease of use. The Aardvark Permeameter is the latest version of the Guelph Permeameter.

The infiltration tests were conducted in a 3 inch diameter test holes, at a depth of 4.3 feet deep. The approximate locations of the infiltration test holes are indicated on the attached Infiltration Location Map, Plate 1. Infiltration test holes were located by property boundary measurement on the site plan and/or by using geographic features. The test holes were filled with water and allowed to stand for an extended period of time.

Relatively deep Aardvark Permeameter testing (P1 and P2) was conducted using the guidelines of the product instruction manuals. Stabilized infiltration test readings are summarized in the following table and more detailed test data recorded in the field can be found in Appendix B. The test results are anticipated to be representative of the soils found in the vicinity of the test locations.

INFILTRATION TEST SUMMARY

TEST NUMBER	TEST HOLE DIAMETER (in)	HOLE DEPTH (in)	INFILTRATION RATE (in/hr)	SOIL DESCRIPTION
P1	3	52	0.18	Clayey SAND
P2	3	52	0.15	Clayey SAND

FINDINGS

SOILS

A general description of the soils observed on site is provided below:

- Quaternary Very Old Alluvial Deposits (map symbol Qvoa): Quaternary very old alluvial deposits were encountered to the maximum depth explored of 16.5 feet. The very old alluvial deposits consist predominately of dark orange brown to moderate yellowish brown, clayey sand and silty sand along with sandy silt. These deposits were generally noted to be in a slightly moist to very moist, loose to very dense state.

GROUNDWATER

Groundwater was not observed in any of the exploratory borings (3) excavated to a maximum depth of 16.5 feet.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

The earth materials within the subject property were estimated to have somewhat consistently low infiltration properties. As a result, the recommended infiltration design rate is 0.15 in/hr.

PLAN REVIEW AND CONSTRUCTION SERVICES

This report has been prepared for the exclusive use of **MARKS ARCHITECTS** and their authorized representative. It is unlikely to contain sufficient information for other parties or other uses. CW Soils should be provided the opportunity to review the final design plans and specifications prior to construction, in order to verify that the recommendations have been properly incorporated into the project plans and specifications. If CW Soils is not accorded the opportunity to review the project plans and specifications, we are not responsibility for misinterpretation of our recommendations.

We recommend that CW Soils be retained to provide soils engineering and engineering geologic services during the grading and foundation excavation phases of work, in order to allow for design changes in the event that the subsurface conditions differ from those anticipated prior to construction.

CW Soils should review any changes in the project and modify the conclusions and recommendations of this report in writing. This report along with the drawings contained within are intended for design input purposes only and are not intended to act as construction drawings or specifications. In the event that conditions during grading or construction operations appear to differ from those indicated in this report, our office should be notified immediately, as appropriate revisions may be required.

REPORT LIMITATIONS

Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable soils engineers and geologists, practicing at the time and location this report was prepared. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

Soils vary in type, strength, and other engineering properties between points of observation and exploration. Groundwater and moisture conditions can also vary due to natural processes or the works of man on this or adjacent properties. As a result, we do not and cannot have complete knowledge of the subsurface conditions beneath the proposed project. No practical study can completely eliminate uncertainty with regard to the anticipated geologic and soils engineering conditions in connection with a proposed project. The conclusions and recommendations within this report are based upon the findings at the points of observation and are subject to confirmation by CW Soils based on the conditions revealed during grading and construction operations.

This report was prepared with the understanding that it is the responsibility of the owner, to ensure that the conclusions and recommendations contained herein are brought to the attention of the other project consultants and are incorporated into the plans and specifications. The owners' contractor should implement the recommendations in this report and notify the owner as well as our office if they consider any of the recommendations presented herein to be unsafe or unsuitable.

CW Soils appreciates the opportunity to offer our services on this project. If we can be of further assistance, please do not hesitate to contact the undersigned at your convenience.

Respectfully submitted,

CW Soils

Chad E. Welke, PG, CEG, PE
Principal Geologist/Engineer

Distribution: (4) Addressee

Attachments: Appendix A – Exploration
Appendix B – Infiltration Test Results
Plate 1 – Infiltration Location Map *(Rear of Text)*

APPENDIX A

EXPLORATION

LOG SYMBOLS & TERMS

The No. 200 Standard Sieve is about the smallest particle visible to the naked eye.					
Coarse-grained Soils >½ of materials larger than #200 sieve	**GRAVELS** Higher percentage of coarse fraction is larger than #4 sieve	Clean Gravels (less than 5% fines)		**GW**	Well-graded gravels, little or no fines
				GP	Poorly-graded gravels, little or no fines
		5 – 12% fines		**GW-GM**	Well-graded gravel with silt
				GW-GC	Well-graded gravel with clay
				GP-GM	Poorly-graded gravel with silt
				GP-GC	Poorly-graded gravel with clay
		Gravels with fines	PI < 4	**GM**	Silty Gravels
			PI > 7	**GC**	Clayey Gravels
	SANDS Higher percentage of coarse fraction is smaller than #4 sieve	Clean Sands (less than 5% fines)		**SW**	Well-graded sands, little or no fines
				SP	Poorly-graded sands, little or no fines
		5 – 12% fines		**SW-SM**	Well-graded sand with silt
				SW-SC	Well-graded sand with clay
				SP-SM	Poorly-graded sand with silt
				SP-SC	Poorly-graded sand with clay
		Sands with fines	PI < 4	**SM**	Silty Sands
			PI > 7	**SC**	Clayey Sands
			PI 4-7	**SC-SM**	Silty clayey sands
Fine-grained Soils ≥½ of materials smaller than #200 sieve	**SILTS & CLAYS** Liquid Limit Less Than 50		PI < 4	**ML**	Inorganic silts & sandy silts
			PI > 7	**CL**	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
			PI 4-7	**ML-CL**	Silts & clays of low plasticity, sandy silty clay, silty clay
	SILTS & CLAYS Liquid Limit Greater Than 50			**MH**	Inorganic silts, micaceous or diatomaceous silt, sandy silt
				CH	Inorganic clays of high plasticity, fat clays, sandy clays, gravelly clays
				OH	Organic silts and clays of medium-to-high plasticity
Highly Organic Soils				**PT**	Peat, humus swamp soils with higher organic content

Symbols	
	Ring Sample
	SPT Sample
NR	No Recovery
▽	Groundwater

Grain Size				
Description		Sieve Size	Grain Size	Approximate Size
Boulders		>12”	>12”	Larger than basketball-sized
Cobbles		3-12”	3-12”	Fist-sized to basketball-sized
Gravel	Coarse	¾-3”	¾-3”	Thumb-sized to fist-sized
	Fine	#4-¾”	0.19-0.75”	Pea-sized to thumb-sized
Sand	Coarse	#10-#4	0.079-0.19”	Rock salt-sized to pea-sized
	Medium	#40-#10	0.017-0.079”	Sugar-sized to rock salt-sized
	Fine	#200-#40	0.0029-0.017”	Flour-sized to sugar-sized
Fines		Passing #200	<0.0029”	Flour-sized and smaller

Moisture Content
Slightly Moist
Moist
Very Moist
Wet

Consistency – Fine Grained Soils			
Apparent Density	SPT (# blows/foot)	Modified CA Sampler (# blows/foot)	Field Test
Very Soft	<1	<2	Easily penetrated by thumb; exudes between thumb and fingers when squeezed in hand
Soft	2-3	3-6	Easily penetrated one inch by thumb; molded by light finger pressure
Medium Stiff	4-6	7-12	Penetrated over ½ inch by thumb with moderate effort; molded by strong finger pressure
Stiff	7-10	13-15	Indented about ½ inch by thumb but penetrated only with great effort
Very Stiff	11-20	16-30	Readily indented thumbnail
Hard	>20	>30	Indented with difficulty by thumbnail
Relative Density – Coarse Grained Soils			
Apparent Density	SPT (# blows/foot)	Modified CA Sampler (# blows/foot)	Field Test
Very Loose	<2	<4	Easily penetrated with ½ inch reinforcing rod pushed by hand
Loose	3-5	4-10	Easily penetrated with ½ inch reinforcing rod pushed by hand
Medium Dense	6-15	11-30	Easily penetrated 1-foot with ½ inch reinforcing rod driven with a 5-lb hammer
Dense	16-25	31-50	Difficult to penetrate 1-foot with ½ inch reinforcing rod driven with a 5-lb hammer
Very Dense	>25	>50	Penetrated only a few inches with ½ inch reinforcing rod driven with a 5-lb hammer

Geotechnical Boring Log B-1

Date: April 24, 2019	**Project Name: JIB - Murrieta** **Page: 1 of 1**
Project Number: 19746-10	**Logged By: CW**
Drilling Company: California Pacific	**Type of Rig: Mobile B61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): See Plate 1	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0		Bag 1 @ 0-5'				**Quaternary Very Old Alluvial Deposits (Qvoa):**
					SC	Clayey SAND; dark orange brown, moist, loose to medium dense
5	49	R-1	110.3	17.1		dense
					SM	Silty SAND; moderate yellowish brown, moist, dense, fine to medium grained
10	42	R-2	99.2	5.3		
15	22	N-1	-	2.6		fine to coarse grained
						Total Depth: 16.5 feet
						No Groundwater
20						
25						
30						

Geotechnical Boring Log B-2

Date: April 24, 2019	**Project Name: JIB - Murrieta** **Page: 1 of 1**
Project Number: 19746-10	**Logged By: CW**
Drilling Company: California Pacific	**Type of Rig: Mobile B61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): See Plate 1	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Quaternary Very Old Alluvial Deposits (Qvoa):**
					SC	Clayey SAND; dark orange brown, slightly moist to moist, medium dense
					SM	Silty SAND; moderate yellowish brown, moist, very dense, fine to coarse grained
5	50	R-1	112.5	15.8		
10						
	38	R-2	113.8	4.5		yellowish brown, dense, coarse grained
15						
	27	N-1	-	4.7		very dense
						Total Depth: 16.5 feet
						No Groundwater
20						
25						
30						

Geotechnical Boring Log B-3

Date: April 24, 2019	**Project Name: JIB - Murrieta** **Page: 1 of 1**
Project Number: 19746-10	**Logged By: CW**
Drilling Company: California Pacific	**Type of Rig: Mobile B61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): See Plate 1	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Quaternary Very Old Alluvial Deposits (Qvoa):**
					SC	Clayey SAND; dark orange brown, moist, loose to medium dense
5	35	R-1	118.4	4.2		moderate yellowish brown, dense, medium to coarse grained
10					SM	Silty SAND; moderate yellowish brown, moist, medium dense, fine grained
	23	R-2	106.3	3.2		
15					ML	Sandy SILT; brown, very moist, very stiff, abundant micas
	12	N-1	-	19.6		
						Total Depth: 16.5 feet
						No Groundwater
20						
25						
30						

APPENDIX B

INFILTRATION TEST RESULTS

Aardvark Permeameters

Location: 19746

Site: P1

Time interval between readings: 1 minute

Ksat Method: Glover Solution

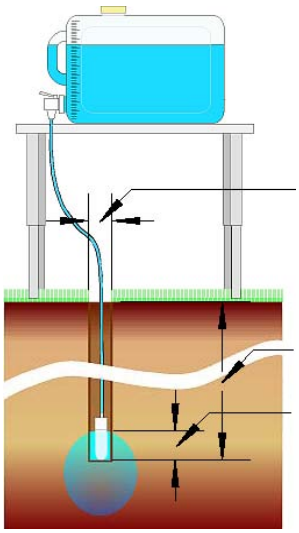
Steady Flow Rate Condition

Steady Flow Rate achieved when Water Consumption Rate changes less than

+/- 5 % for 3 consecutive readings

Steady Flow Rate:	37.923 ml/min
Temp. Adj. FR:	37.959 ml/min
Percolation Rate:	1.324 min/cm
Ksat:	0.18 Inches / hour

Notes:



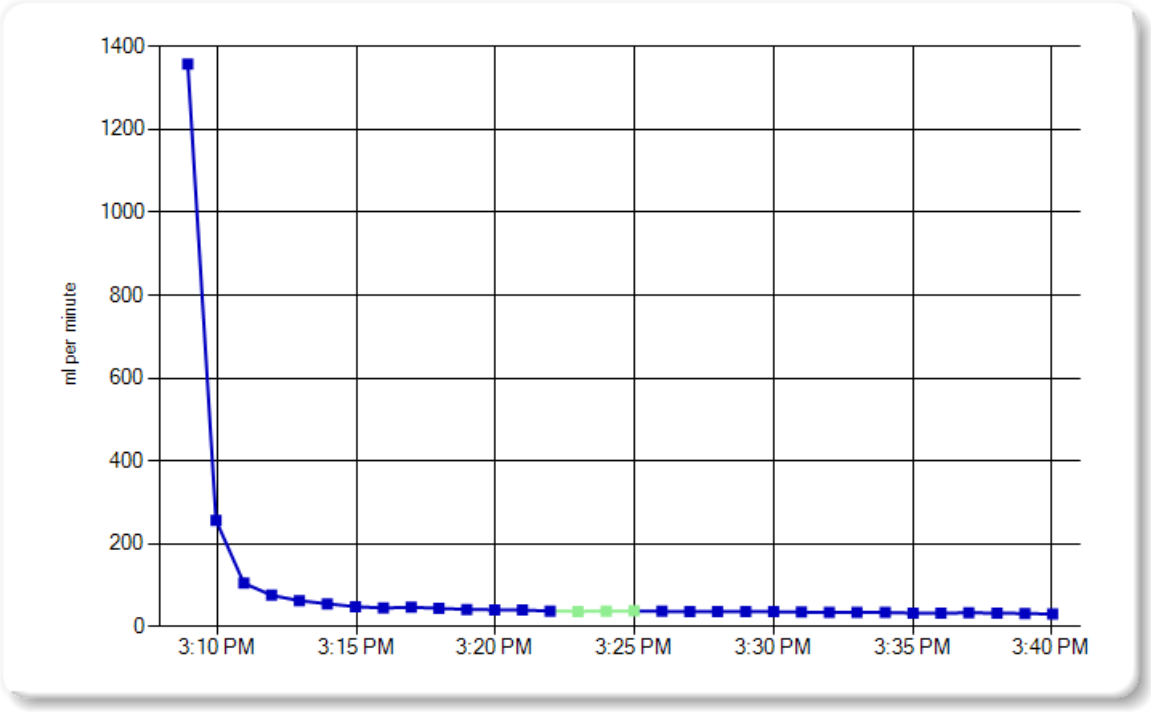
3.1 inches	Hole Diameter
60.1 º F	Water Temperature
51.2 inches	Hole Depth
16.1 inches	Water Height in Hole
	Water Table Depth

Site GPS Position

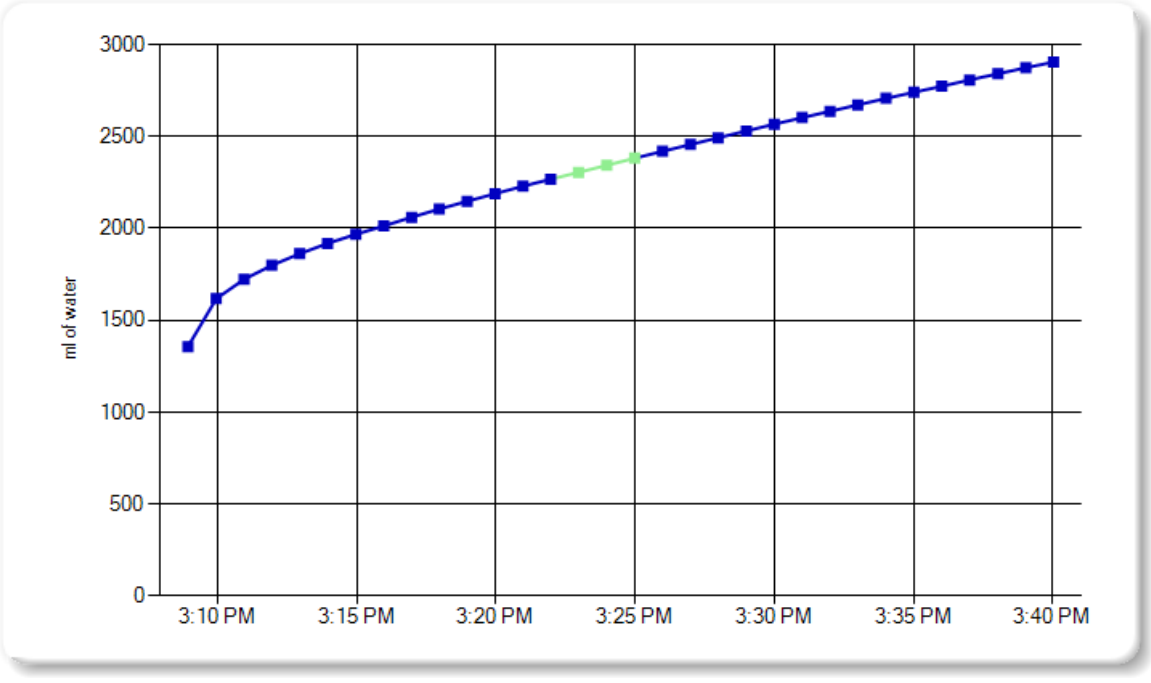
	Degrees	Minutes	Seconds	
Longitude:	0	0	0	East
Latitude:	0	0	0	North

Soil Texture-Structure Category:

Water Consumption Rate



Total Water Consumed



Time	Reservoir Water Level	Elapsed Time Interval	Interval Water Consumed	Total Water Consumed	Water Consumption Rate	Ignore Reading
3:07:56 PM	8705.4 ml					
3:08:56 PM	7348.2 ml	1 minute	1357.2 ml	1357.2 ml	1357.200 ml/min	
3:09:57 PM	7087.4 ml	1 minute	260.8 ml	1618.0 ml	256.525 ml/min	
3:10:57 PM	6982.0 ml	1 minute	105.4 ml	1723.4 ml	105.400 ml/min	
3:11:57 PM	6905.8 ml	1 minute	76.2 ml	1799.6 ml	76.200 ml/min	
3:12:57 PM	6842.6 ml	1 minute	63.2 ml	1862.8 ml	63.200 ml/min	
3:13:57 PM	6786.8 ml	1 minute	55.8 ml	1918.6 ml	55.800 ml/min	
3:14:58 PM	6737.2 ml	1 minute	49.6 ml	1968.2 ml	48.787 ml/min	
3:15:58 PM	6691.8 ml	1 minute	45.4 ml	2013.6 ml	45.400 ml/min	
3:16:58 PM	6644.4 ml	1 minute	47.4 ml	2061.0 ml	47.400 ml/min	
3:17:58 PM	6599.6 ml	1 minute	44.8 ml	2105.8 ml	44.800 ml/min	
3:18:58 PM	6557.4 ml	1 minute	42.2 ml	2148.0 ml	42.200 ml/min	
3:19:58 PM	6516.2 ml	1 minute	41.2 ml	2189.2 ml	41.200 ml/min	
3:20:58 PM	6475.6 ml	1 minute	40.6 ml	2229.8 ml	40.600 ml/min	
3:21:58 PM	6437.4 ml	1 minute	38.2 ml	2268.0 ml	38.200 ml/min	
3:22:58 PM	6400.2 ml	1 minute	37.2 ml	2305.2 ml	37.200 ml/min	
3:23:59 PM	6361.4 ml	1 minute	38.8 ml	2344.0 ml	38.164 ml/min	
3:24:59 PM	6323.0 ml	1 minute	38.4 ml	2382.4 ml	38.400 ml/min	
3:25:59 PM	6285.6 ml	1 minute	37.4 ml	2419.8 ml	37.400 ml/min	
3:26:59 PM	6248.6 ml	1 minute	37.0 ml	2456.8 ml	37.000 ml/min	
3:27:59 PM	6211.8 ml	1 minute	36.8 ml	2493.6 ml	36.800 ml/min	
3:29:00 PM	6174.6 ml	1 minute	37.2 ml	2530.8 ml	36.590 ml/min	
3:30:00 PM	6138.0 ml	1 minute	36.6 ml	2567.4 ml	36.600 ml/min	
3:31:00 PM	6102.4 ml	1 minute	35.6 ml	2603.0 ml	35.600 ml/min	
3:32:00 PM	6067.8 ml	1 minute	34.6 ml	2637.6 ml	34.600 ml/min	
3:33:00 PM	6032.8 ml	1 minute	35.0 ml	2672.6 ml	35.000 ml/min	
3:34:01 PM	5997.4 ml	1 minute	35.4 ml	2708.0 ml	34.820 ml/min	
3:35:01 PM	5964.2 ml	1 minute	33.2 ml	2741.2 ml	33.200 ml/min	
3:36:01 PM	5931.4 ml	1 minute	32.8 ml	2774.0 ml	32.800 ml/min	
3:37:01 PM	5897.2 ml	1 minute	34.2 ml	2808.2 ml	34.200 ml/min	
3:38:02 PM	5863.4 ml	1 minute	33.8 ml	2842.0 ml	33.246 ml/min	
3:39:02 PM	5831.0 ml	1 minute	32.4 ml	2874.4 ml	32.400 ml/min	
3:40:02 PM	5800.0 ml	1 minute	31.0 ml	2905.4 ml	31.000 ml/min	

Aardvark Permeameters

Location: 19746

Site: P2

Time interval between readings: 1 minute

Ksat Method: Glover Solution

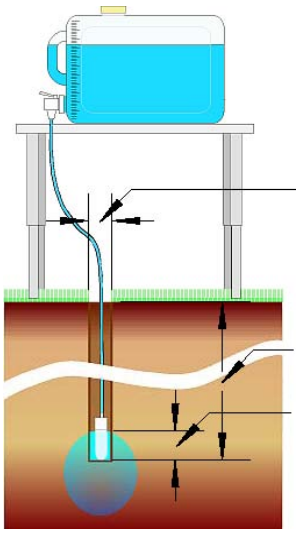
Steady Flow Rate Condition

Steady Flow Rate achieved when Water Consumption Rate changes less than

+/- 5 % for 3 consecutive readings

Steady Flow Rate:	18.800 ml/min
Temp. Adj. FR:	18.818 ml/min
Percolation Rate:	2.671 min/cm
Ksat:	0.15 Inches / hour

Notes:



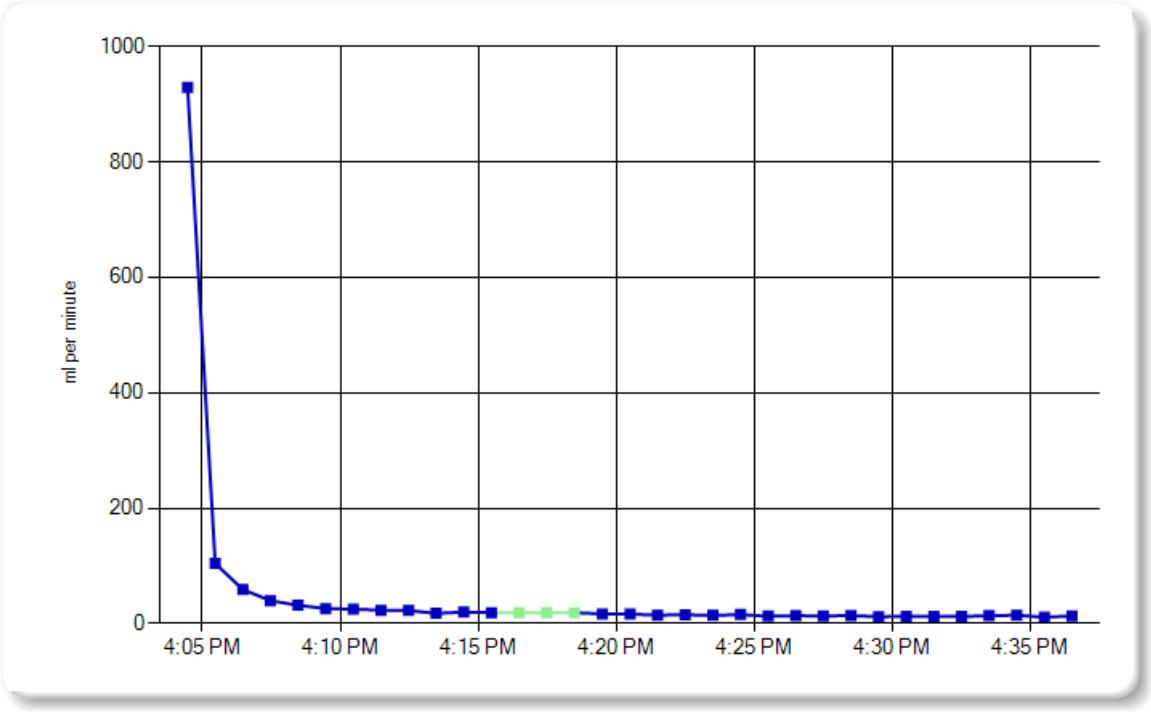
3.1 inches	Hole Diameter
60.1 º F	Water Temperature
51.2 inches	Hole Depth
11.4 inches	Water Height in Hole
	Water Table Depth

Site GPS Position

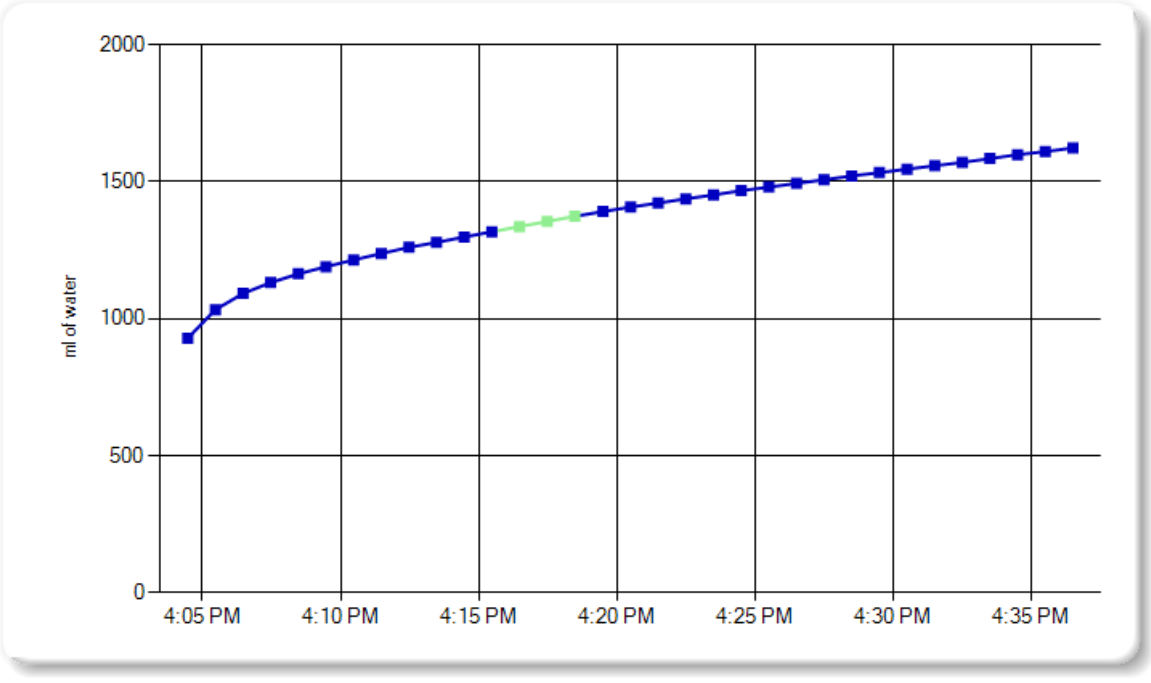
	Degrees	Minutes	Seconds	
Longitude:	0	0	0	East
Latitude:	0	0	0	North

Soil Texture-Structure Category:

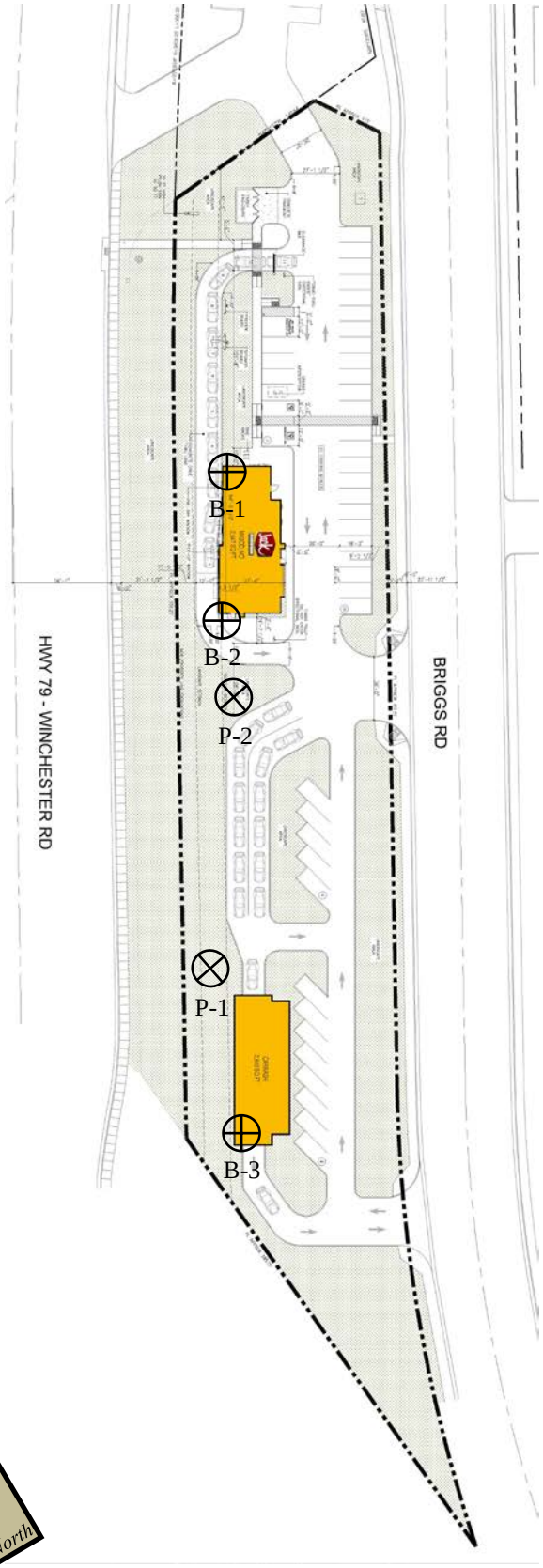
Water Consumption Rate



Total Water Consumed



Time	Reservoir Water Level	Elapsed Time Interval	Interval Water Consumed	Total Water Consumed	Water Consumption Rate	Ignore Reading
4:03:28 PM	8623.2 ml					
4:04:28 PM	7694.0 ml	1 minute	929.2 ml	929.2 ml	929.200 ml/min	
4:05:28 PM	7589.8 ml	1 minute	104.2 ml	1033.4 ml	104.200 ml/min	
4:06:28 PM	7530.8 ml	1 minute	59.0 ml	1092.4 ml	59.000 ml/min	
4:07:28 PM	7491.0 ml	1 minute	39.8 ml	1132.2 ml	39.800 ml/min	
4:08:28 PM	7459.2 ml	1 minute	31.8 ml	1164.0 ml	31.800 ml/min	
4:09:28 PM	7433.2 ml	1 minute	26.0 ml	1190.0 ml	26.000 ml/min	
4:10:28 PM	7408.2 ml	1 minute	25.0 ml	1215.0 ml	25.000 ml/min	
4:11:28 PM	7385.0 ml	1 minute	23.2 ml	1238.2 ml	23.200 ml/min	
4:12:28 PM	7362.4 ml	1 minute	22.6 ml	1260.8 ml	22.600 ml/min	
4:13:28 PM	7344.6 ml	1 minute	17.8 ml	1278.6 ml	17.800 ml/min	
4:14:28 PM	7324.6 ml	1 minute	20.0 ml	1298.6 ml	20.000 ml/min	
4:15:28 PM	7305.6 ml	1 minute	19.0 ml	1317.6 ml	19.000 ml/min	
4:16:28 PM	7286.6 ml	1 minute	19.0 ml	1336.6 ml	19.000 ml/min	
4:17:28 PM	7268.2 ml	1 minute	18.4 ml	1355.0 ml	18.400 ml/min	
4:18:28 PM	7249.2 ml	1 minute	19.0 ml	1374.0 ml	19.000 ml/min	
4:19:29 PM	7232.0 ml	1 minute	17.2 ml	1391.2 ml	16.918 ml/min	
4:20:29 PM	7215.6 ml	1 minute	16.4 ml	1407.6 ml	16.400 ml/min	
4:21:29 PM	7200.8 ml	1 minute	14.8 ml	1422.4 ml	14.800 ml/min	
4:22:29 PM	7185.4 ml	1 minute	15.4 ml	1437.8 ml	15.400 ml/min	
4:23:29 PM	7171.2 ml	1 minute	14.2 ml	1452.0 ml	14.200 ml/min	
4:24:29 PM	7155.6 ml	1 minute	15.6 ml	1467.6 ml	15.600 ml/min	
4:25:29 PM	7142.8 ml	1 minute	12.8 ml	1480.4 ml	12.800 ml/min	
4:26:29 PM	7129.0 ml	1 minute	13.8 ml	1494.2 ml	13.800 ml/min	
4:27:29 PM	7115.8 ml	1 minute	13.2 ml	1507.4 ml	13.200 ml/min	
4:28:29 PM	7101.8 ml	1 minute	14.0 ml	1521.4 ml	14.000 ml/min	
4:29:29 PM	7089.8 ml	1 minute	12.0 ml	1533.4 ml	12.000 ml/min	
4:30:29 PM	7077.2 ml	1 minute	12.6 ml	1546.0 ml	12.600 ml/min	
4:31:29 PM	7064.8 ml	1 minute	12.4 ml	1558.4 ml	12.400 ml/min	
4:32:29 PM	7052.4 ml	1 minute	12.4 ml	1570.8 ml	12.400 ml/min	
4:33:29 PM	7038.8 ml	1 minute	13.6 ml	1584.4 ml	13.600 ml/min	
4:34:29 PM	7024.2 ml	1 minute	14.6 ml	1599.0 ml	14.600 ml/min	
4:35:29 PM	7013.2 ml	1 minute	11.0 ml	1610.0 ml	11.000 ml/min	
4:36:29 PM	6999.8 ml	1 minute	13.4 ml	1623.4 ml	13.400 ml/min	



LEGEND

Locations are Approximate

Symbols

P-2 – Infiltration Test

B-3 – Exploratory Boring

REFERENCE: Marks Architects, 2019, Site Plan, dated January 16, 2019.

CW SOILS	Proposed Jack in the Box	19746-10
	INFILTRATION LOCATOION MAP	1" = 100 '
		2019
		PLATE 1