PERCOLATION REPORT
FOR PROPOSED STORM WATER BASINS

Prepared For
Meta Housing Corporation

Proposed
Two Retention Basins
Southwest corner of Avenue Q-12 and 25th Street East
Palmdale, Los Angeles County, California
APN: 3018-027-036

BRUIN GEOTECHNICAL SERVICES, INC.
44732 Yucca Avenue
Lancaster, California 93534

Job No: 20-229
December 28, 2020

BRUIN
GEOTECHNICAL
SERVICES INC.
est. 2004

SOIL AND MATERIAL
TESTING AND INSPECTIONS

December 28, 2020 J.N. 20-229

Mr. Scott Nakaatari
Meta Housing Corporation
11150 West Olympic Blvd., Ste. 620
Los Angeles, CA 90064

Project: **Proposed Retention Basins**
Vicinity of Avenue Q-12 and 25th Street East, Palmdale, Los Angeles County, California
APN: 3018-027-036

Subject: **Percolation Testing for Proposed Storm Water Basins**

Dear Mr. Nakaatari:

Presented herewith are the results of the percolation testing performed as requested for the referenced project. The purpose of the percolation testing program was to determine soil percolation characteristics relative to the proposed storm drain water retention system. It is our understanding the subject site will be developed as Multi-Family Three Stories Apartment Buildings with Associated Parking Spaces and landscape areas. This report concludes the scope of work per our agreement.

Site Description

The subject site, herein after referred to as Site, is located at the southeast corner of Avenue Q-12 and 25th Street East in Palmdale, Los Angeles County, California. The rectangular-shaped parcel consists of approximately 8.39 acres. At the time of our investigation, the Site vegetation consisted of a light covering of annual weeds and shrubs and a moderate to dense covering of juniper bushes. Dirt trails traversed the Site in many directions. The aforementioned site description is intended to be illustrative and is specifically not intended for use as a legal description of the Site.

The Site is located in a semi-developed area of Palmdale, with single-family and multi-family developments in the vicinity of the subject site. The parcels immediately east were undeveloped, vacant land. The parcel to the north contains a multi-family

complex, and the parcels south and west of the site are single-family residential subdivisions.

Access to the Site is from 25th Street East or Avenue Q-12, both of which are paved roads.

The Site topography is relatively flat and level with a general slope to the east with drainage by sheet flow at approximately one to two (1-2) percent across the Site. The approximate elevation of the Site is approximately 2,657 feet above mean sea level.

Proposed Storm Water Basins

At the time of writing this report, the proposed drainage for the project site is under development. It is our understanding the final plans will propose a drainage system that includes a combination of sheet flow across the parking lot and storm drain features (gutters, catch basins drains, etc.) at localized areas of the site to collect stormwater generated by impervious areas and ultimately draining into the proposed water retention basins. Each proposed retention basins have an anticipated invert elevation approximately 10 below ground surface (bgs).

Field Procedures

The field-testing program was performed on October 27, 2020 and consisted of drilling two (2) borings utilizing a CME 75 drill rig with eight (8)-inch hollow stem auger to a depth of thirty (30) feet below existing ground surface. The boring location plan is presented in Appendix A.

The soil was logged during drilling and classified in accordance with the Unified Soil Classification System. No groundwater was encountered during drilling. The soil consisted of silty sand (SM) and poorly graded sand (SP). The boring logs are presented in Appendix B.

The Geotechnical and Materials Engineering Division of Los Angeles County Department of Public Works provides the Low Impact Development Storm-water Infiltration (GS200.2) as a guideline for testing procedures, calculation for infiltration, and percolation rates for large projects. Test procedures are in general conformity with GS200.2 and approved by the City of Palmdale.

Subsequent to drilling the test holes, a 4-inch O.D. perforated plastic pipe was placed at the center of the boring holes. Then, the annular space between the pipe and the boring wall was backfilled with gravel to prevent caving when adding water to the pipe.

On October 28, 2020, the total depth of the holes was measured and documented. The test holes were then filled with water to 10 feet below existing grade, the proposed approximate invert elevation of the retention system ("initial water level"), utilizing a 1.5-inch hose.

The test holes were again filled with water to the initial water level. The total volume of water required to fill the hole was documented. After 15 minutes, the water depth was measured and documented, and the holes were again filled to the initial water level. The total depth of the test holes was measured and documented. The water level drop did not exceed ten (10) feet below the initial water level. The time intervals between readings was set to 30 minutes. The testing was performed a minimum of six (6) hours and until at least 1 hour after flow rate into boring had stabilized (the percolation rate stabilized for three (3) consecutive readings).

The procedures on the GS200.2 requires a graph showing the cumulative volume (gal) vs. time (hr.) which is used to find the slope of the line for each boring test hole. After generating the graph and analyzing the tabulated data obtained in the field (shown in Appendix C) the cumulative volume of water used at times 4.5 and 6.5 hours were used to calculate the stabilized flowrate for each test boring. To account for the reduction of the diameter size of the boring during testing, the volume of water absorbed by the eight (8) inch diameter hole was adjusted to a larger volume based on the ratio of the sidewall surface areas, and the surface area of percolation was increased to eighteen (18) inch diameter hole in order to calculate the raw infiltration rate. Refer to Appendix D.

The raw infiltration rate calculations and reduction factors as outlined in GS200.2 have been incorporated into the Design Infiltration Rate, as shown in Appendix D. This percolation test method is in general accordance with low impact development standards for infiltration testing in Southern California, and general conformance with Los Angeles County GS200.2

GS200.2 require the application of safety factors related to the type of test method, site variability, number of tests performed and maintenance/siltation conditions.

Results

Coefficient of Permeability

Reduction factors must be applied to the measured percolation rates, per requirements of GS200.2, to determine the design values that will represent the long-term performance of the proposed infiltration BMP's. The calculations are presented below.

Infiltration design calculations

Under the section named "reduction factors" of GS200.2, there is a table showing the range of values that may be used for each factor applicable to the project for the calculation of the reduction factor. The raw infiltration rates were reduced depending on the factors selected from the "reduction factors" table from GS 200.2, based on our overall understanding of the project, and applied as shown below:

- Test-specific reduction factor (Boring Percolation Test), $RF_T = 2$
- Site variability, number of tests performed, thoroughness of subsurface investigation, $FR_V = 1$
- Long-term siltation, plugging and maintenance, $RF_S = 1$

Total Reduction Factor, $RF = RF_T * RF_V * RF_S = 2*1*1 = 2$

The calculated reduction factor (RF) was applied to the raw infiltration rates obtaining the design infiltration rate of the retention basin. Furthermore, they are compared to the minimum infiltration rate suggested by GS200.2 guidelines to show their compliance, as indicated in Appendix D.

For the proposed infiltration basin, the design infiltration rates obtained from boring holes 1 and 2 are calculated to be 2.88 and 3.11 inches per hour respectively, which meet the minimum percolation design infiltration rate of 0.3 in/hr.

Conclusions

Based on the infiltration testing performed as indicated in this report, it is our professional opinion that the proposed retention basin is feasible from a geotechnical standpoint. **The slowest infiltration rate of 2.88 in/hr. may be utilized for the proposed retention basin design.**

Limitations

This report presents the results of the percolation test performed at the referenced location only to aid in design of the proposed basin. Appropriate safety factors shall be incorporated into the design. Based on Bruin GSI's current knowledge, no known barriers to groundwater flow (i.e. bedrock etc.) or problems associated with "mounding" are known to exist in the site vicinity. The opinions provided in this report are based on data from the field-testing program and our professional experience. Hydro-geologic conditions will vary with subsurface conditions, precipitation, geologic setting, and site topography.

This office should be notified if the proposed development changes and is other than indicated in this report.

This report has been prepared for the exclusive use of our client in conformance with generally accepted engineering practices. No reproduction or use of the report other than as indicated herein shall be allowed.

This report does not guarantee the issuance of building or grading permits.

Closure

We trust this report provides the information required at this time. Please direct any questions to this office. We appreciate the opportunity to provide our services.

Respectfully Submitted,
Bruin Geotechnical Services Inc.

Ryan D. Duke P.E.

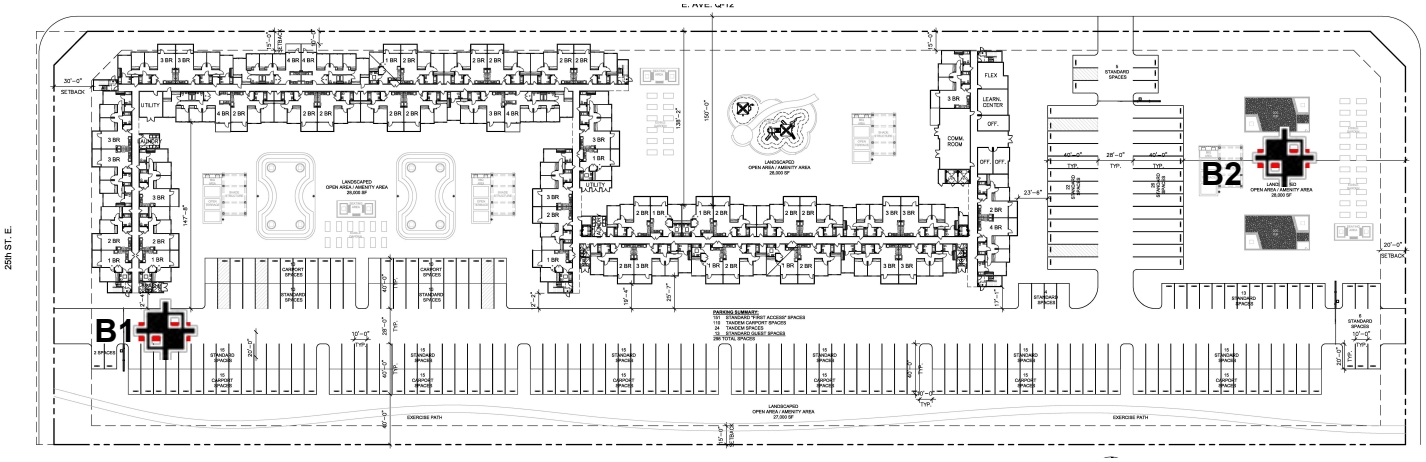
RDD/mes

APPENDIX A

PLOT MAP

Boring Location Map

N.T.S.



B1 = Denotes Approximate Boring Location

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Project:

Meta Housing Corporation
APN 3018-027-036
Northeast Corner of Avenue Q-12 and 25th Street East, Palmdale, Los Angeles County, California
APN: 3018-027-036

Job Number:	**Date:**
20-229	12/2/2020

APPENDIX B

BORING LOG
SOIL CLASSIFICATION KEY

BRUIN
GEOTECHNICAL SERVICES INC

Date(s) drilled	10/27/2020	**LOG OF BORING 1**	
Drilling Contractor	GP Drilling	**Page 1 of 1**	
Drilling Method	Hollow Stem Auger		
Drill Rig Type	CME 75	Logged By	DM
Drill Bit Size/Type	8"	Checked By	MS
Sampling Method(s)	N/A	Total Depth of Borehole	30' bgs
Groundwater	None Encountered	Boring Location	See Figure 2
Borehole Backfill	Native/ Cuttings	Notes:	
Hammer Data	140#, 30" drop		

Client: Meta Housing Corporation
Project Number: 20-229
Project Location: Palmdale

Depth	Sample	USCS	Graphic Log	Material Description	Penetration Resistance (Blows/6")	Dry Unit Weight pcf	Water Content %
5'		SM		Yellowish brown silty fine to medium sand w/ coarse sand & occ. #4-3/8" gravel Cemented Very dense, moist	31-43		
10'		SM/SP		Yellowish brown slightly silty fine to coarse sand w/#4 gravel & occ. 3/8" gravel Dense, slightly moist	17-31		
15'		SM/SP		Yellowish brown slightly silty fine to medium sand w/occ. coarse sand Medium dense, slightly moist	18-24		
20'							
25'		SP		Olive brown fine to medium sand w/coarse sand & occ. 3/8" gravel Dense, slightly moist	30-36		
30'							
				Boring terminated at 30'bgs. No groundwater encountered. No caving.			

BRUIN GEOTECHNICAL SERVICES INC

Date(s) drilled	10/27/2020	**LOG OF BORING 2**	
Drilling Contractor	GP Drilling	**Page 1 of 1**	
Drilling Method	Hollow Stem Auger		
Drill Rig Type	CME 75	Logged By	DM
Drill Bit Size/Type	8"	Checked By:	MS
Sampling Method(s)	N/A	Total Depth of Borehole	30' bgs
Groundwater	None Encountered	Boring Location:	See Figure 2
Borehole Backfill	Native/ Cuttings	Notes:	
Hammer Data	140#, 30" drop		

Client: **Meta Housing Corporation**

Project Number: **20-229**

Project Location: **Palmdale**

Depth	Sample	USCS	Graphic Log	Material Description	Penetration Resistance (Blows/6")	Dry Unit Weight pcf	Water Content %
5'		SM		Yellowish brown silty fine sand w/occ medium sand & occ coarse sand Dense, moist			
10'		SM		increase in gravel (1/2" gravel) Dense, moist			
15'		SP		Grey brown, slightly silty fine to coarse sand w/ #4 - 3/8" gravel Dense, slightly moist			
20'							
25'				Increase in gravel (1" gravel) Dense, slightly moist			
30'							
				Boring terminated at 30' bgs. No Groundwater encountered. No caving.			

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Soils Key

SOIL CLASSIFICATION KEY

Major Divisions					Typical Names
Coarse Grained Soils 50% or more larger than #200 sieve	**Gravels** More than half coarse-fraction is larger than No. 4 sieve size	Clean gravels with little or no fines	GW		Well graded gravels, gravel-sand mixtures
			GP		Poorly graded gravels, gravel-sand mixtures
		Gravel with over 12% fines	GM		Silty gravels, poorly graded gravel-sand-silt mixtures
			GC		Clayey gravels, poorly graded gravel-sand-clay mixtures
	Sands More than half coarse-fraction is smaller than No. 4 sieve size	Clean sands with little or no fines	SW		Well graded sands, gravelly sands
			SP		Poorly graded sands, gravelly sands
		Sands with over 12% fines	SM		Silty sands, poorly graded sand-silt mixtures
			SC		Clayey sands, poorly graded sand-clay mixtures
Fine Grained Soils 50% or more smaller than #200 sieve	**Silts and Clays** Liquid limit less than 50		ML		Inorganic silts, rock flour, clayey silts
			CL		Inorganic clays of low to medium plasticity, sandy clays, silty clays
			OL		Organic clays and organic silty clays of low plasticity
	Silts and Clays Liquid limit greater than 50		MH		Inorganic silts, micaceous or diatomaceous fine sandy/silty soils, elastic silts
			CH		Inorganic clays with high plasticity, fat clays
			OH		Organic clays of medium to high plasticity, organic silts
Highly Organic Soils			Pt		Peat and other highly organic soils

CLASSIFICATION SYSTEM BASED ON UNIFIED SOIL CLASSIFICATION SYSTEM

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Key to Excavation Log

Depth	Sample	USCS	Graphic Log	Material Description	Blow Count /ft	Dry Unit Weight pcf	Water Content %
1	2	3	4	5	6	7	8

COLUMN DESCRIPTIONS

1. Depth: depth in feet below the ground surface.
2. Sample: type of sample taken at depth incurred
3. USCS: USCS symbol of the subsurface material.
4. Grading Log: graphic depiction of the subsurface material encountered.
5. Material Description: description of the material encountered. May include consistency, moisture color, and other descriptive text.
6. Blow Count/ft: number of blows to advance driven sampler one foot (or distance shown) beyond seating interval using the hammer identified on the boring log.
7. Dry Unit Weight pcf: dry weight per unit volume of soil sample measured in laboratory, in pounds per cubic foot.
8. Water Content %: water content of the soil sample, expressed as a percentage of fry weight sample.

FIELD AND LABORATORY TEST ABBREVIATIONS

DIST= Disturbed
N/A= Not Analyzed
CHEM= Chemical tests to assess corrosivity

- California Split Spoon
- Standard Penetration Test
- Bulk Sample
- Grab Sample

GENERAL NOTES

1. Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

APPENDIX C

PERCOLATION TEST RESULTS

BORING PERCOLATION TEST CALCULATIONS
(GS200.2)

DATA CALCULATIONS:

BORING No.	STABILIZED FLOWRATE		SURFACE AREA OF PERCOLATION				RAW INFILTRATION RATE [FT/HR]
	[GAL/HR] **	[CF/HR]	DIA., [FT]	RADIUS, [FT]	HEIGHT, [FT]	S.A., [SF]	
1	344.3	46.0	1.50	0.75	20	96.0	0.48
2	372.1	49.7	1.50	0.75	20	96.0	0.52

** Increased volume to account for reduction of boring diameter during testing.

REDUCTION FACTORS:

REDUCTION FACTORS (GS200.2)			RF
RF_t	RF_v	RF_s	
2	1	1	2

DESIGN INFILTRATION RATE :

CALCULATED DESIGN INFILTRATION RATE		GS200.2 MIN. DESIGN INFILT. RATE	CRITERIA MET?
[FT/HR]	[IN/HR]	[IN/HR]	
0.240	2.88	0.3	YES
0.259	3.11	0.3	YES

APPENDIX D

PERCOLATION TEST CALCULATIONS

BORING PERCOLATION FIELD LOG

PER GS200.2

PROJECT NAME: METAHOUSING JOB No.: 20-229
TESTED BY: MF
LIQUID DESCRIPTION: CLEAN TAP WATER LOCATION: PALMDALE, CA
MEASUREMENT METHOD: WATER SOUNDER
DATE: 11/5/2020

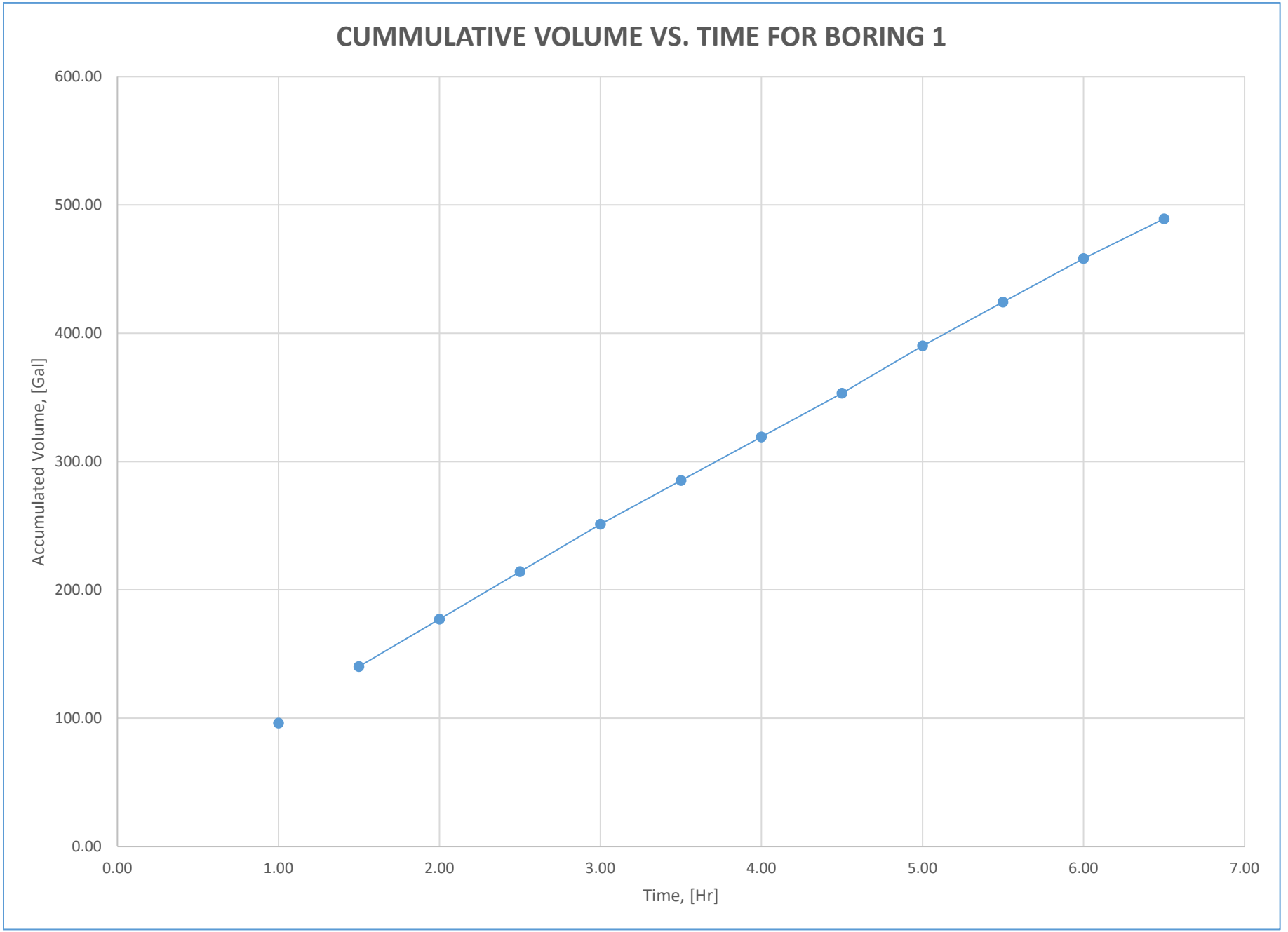
TIME INTERVAL STANDARD
START TIME FOR STANDARD: 9:27 AM TOTAL BORING V = 52 GAL.

BORING # 1

DIAMETER OF BORING, FT: 0.67 DIA. P. PIPE, IN.: 4
DEPTH OF EXCAVATION, FT: 30
DEPTH OF INVERT OF BMP, FT: 10
DEPTH OF WATER TABLE: OVER 100'
DEPTH TO INI. WATER DEPTH: 10 FT
WATER REMAINING IN EXCAV.? YES
STD. TIME BETWEEN READINGS: 30 MIN.

							VOLUME [GAL] VS. TIME [HR]		
READING NO.	TIME START/END (HH:MM)	ELAPSED TIME (MIN)	WATER METER READINGS (START/END)	V, [GAL] ADDED	WATER SURFACE ELEVATION (FT)	WATER SURFACE ELEVATION DROP, Δ (FT)	CUMMULATIVE TIME, HR.	CUMULATIVE VOLUME, GAL.	
Presoak	8:55	30	3007497	52	10	17	0.50	52.22	
	9:25		3007549		27				
1	9:27	30	3007549	44	10	17	1.00	96.22	
	9:57		3007593		27				
2	9:59	30	3007593	44	10	14	1.50	140.22	
	10:29		3007637		24				
3	10:30	30	3007637	37	10	14	2.00	177.22	
	11:00		3007674		24				
4	11:03	30	3007674	37	10	14	2.50	214.22	
	11:33		3007711		24				
5	11:36	30	3007711	37	10	13	3.00	251.22	
	1:20		3007748		23				
6	12:09	30	3007748	34	10	13	3.50	285.22	
	12:39		3007782		23				
7	12:42	30	3007782	34	10	13	4.00	319.22	
	1:12		3007816		23				
8	1:15	30	3007816	34	10	14	4.50	353.22	*
	1:45		3007850		24				
9	1:48	30	3007850	37	10	13	5.00	390.22	
	2:18		3007887		23				
10	2:18	30	3007887	34	10	13	5.50	424.22	
	2:48		3007921		23				
11	2:50	30	3007921	34	10	12	6.00	458.22	
	3:20		3007955		22				
12	3:22	30	3007955	31	10	12	6.50	489.22	*
	3:52		3007986		22				

* CUMULATIVE VOLUME USED TO DETERMINE RAW INFILTRATION RATE


CUMMULATIVE VOLUME VS. TIME FOR BORING 1
600.00
500.00
400.00
300.00
200.00
100.00
0.00
Accumulated Volume, [Gal]
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
Time, [Hr]

BORING PERCOLATION FIELD LOG

PER GS200.2

PROJECT NAME: METAHOUSING JOB No.: 20-229
TESTED BY: MF
LIQUID DESCRIPTION: CLEAN TAP WATER LOCATION: PALMDALE, CA
MEASUREMENT METHOD: WATER SOUNDER
DATE: 11/5/2020

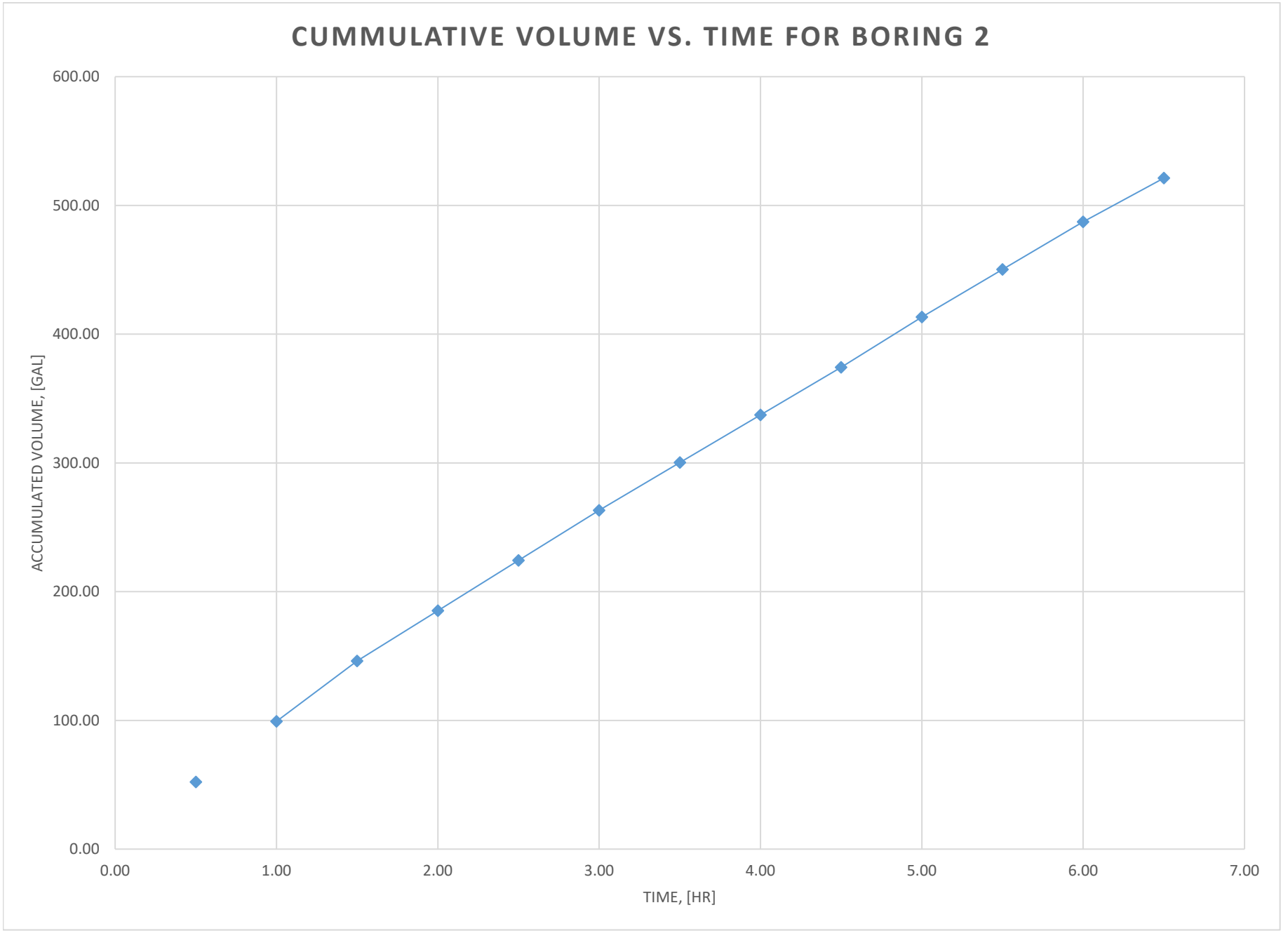
TIME INTERVAL STANDARD
START TIME FOR STANDARD: 9:32 AM TOTAL BORING V = 52 GAL.

BORING # 2

DIAMETER OF BORING, FT: 0.67 DIA. P. PIPE, IN.: 4
DEPTH OF EXCAVATION, FT: 30
DEPTH OF INVERT OF BMP, FT: 10
DEPTH OF WATER TABLE: OVER 100'
DEPTH TO INI. WATER DEPTH: 10 FT
WATER REMAINING IN EXCAV.? YES
STD. TIME BETWEEN READINGS: 30 MIN.

							VOLUME [GAL] VS. TIME [HR]		
READING NO.	TIME START/END (HH:MM)	ELAPSED TIME (MIN)	WATER METER READINGS (START/END)	V, [GAL] ADDED	WATER SURFACE ELEVATION (FT)	WATER SURFACE ELEVATION DROP, Δ (FT)	CUMMULATIVE TIME, HR.	CUMULATIVE VOLUME, GAL.	
Presoak	9:00	30	3007986	52	10.00	18	0.50	52.22	
	9:30		3008038		28.00				
1	9:32	30	3008038	47	10.00	18	1.00	99.22	
	10:02		3008085		28.00				
2	10:04	30	3008085	47	10.00	15	1.50	146.22	
	10:34		3008132		25.00				
3	10:37	30	3008132	39	10.00	15	2.00	185.22	
	11:07		3008171		25.00				
4	11:08	30	3008171	39	10.00	15	2.50	224.22	
	11:38		3008210		25.00				
5	11:40	30	3008210	39	10.00	14	3.00	263.22	
	12:10		3008249		24.00				
6	12:40	30	3008249	37	10.00	14	3.50	300.22	
	1:10		3008286		24.00				
7	1:12	30	3008286	37	10.00	14	4.00	337.22	
	1:42		3008323		24.00				
8	2:08	30	3008323	37	10.00	15	4.50	374.22	*
	2:38		3008360		25.00				
9	2:40	30	3008360	39	10.00	14	5.00	413.22	
	3:10		3008399		24.00				
10	3:12	30	3008399	37	10.00	14	5.50	450.22	
	3:42		3008436		24.00				
11	3:44	30	3008436	37	10.00	13	6.00	487.22	
	4:14		3008473		23.00				
12	4:16	30	3008473	34	10.00	13	6.50	521.22	*
	4:46		3008507		23.00				

* CUMULATIVE VOLUME USED TO DETERMINE RAW INFILTRATION RATE


CUMMULATIVE VOLUME VS. TIME FOR BORING 2
600.00
500.00
400.00
300.00
200.00
100.00
0.00
ACCUMULATED VOLUME, [GAL]
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
TIME, [HR]