

**REPORT OF INFILTRATION FEASIBILITY STUDY,
TENTATIVE TRACT MAP NO. 20525, APN 0394-031-02, 03, 04
NORTHEAST CORNER OF
MOJAVE DRIVE AND AMETHYST ROAD
CITY OF VICTORVILLE
SAN BERNARDINO COUNTY, CALIFORNIA**

PROJECT NO.: 1448-01
REPORT NO.: 3

APRIL 21, 2022

SUBMITTED TO:

MOJAVE AMETHYST 40, L.P.
17802 LAKESIDE HAVEN DRIVE
CYPRESS, TEXAS 77433

PREPARED BY:

HILLTOP GEOTECHNICAL, INC.
786 SOUTH GIFFORD AVENUE
SAN BERNARDINO, CA 92408



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April 21, 2022

Mojave Amethyst 40, L.P.
17802 Lakeside Haven Drive
Cypress, Texas 77433

Project No.:1448-01
Report No.: 3

Attention: Mr. Gregory Christmas, Managing Member

Subject: **Report of Infiltration Feasibility Study, Tentative Tract Map No. 20525, APN 0394-031-02, 03, 04, Northeast Corner of Mojave Drive and Amethyst Road, City of Victorville, San Bernardino County, California.**

- References:
1. **Ludwig Engineering Associates, Inc.**, January 2022, *Tentative Tract Map No. 20525, APN 0394-031-02, 03, 04, Scale 1" = 100'*.
 2. **San Bernardino County**, May 19, 2011, *Technical Guidance Document Appendices, Appendix VII, Infiltration Rate Evaluation Protocol and Factor of Safety Recommendations, VII-1 through VII-36.*
 3. **Hilltop Geotechnical, Inc.**, April 21, 2022, *Report of Preliminary Geotechnical / Geologic Study, Tentative Tract Map No. 20525, APN 0394-031-02, 03, 04, Northeast Corner of Mojave Drive and Amethyst Road, City of Victorville, San Bernardino County, California.* Project No.: 1448-01, Report No.: 2.

In accordance with your request, **Hilltop Geotechnical, Inc.** has performed infiltration tests on the proposed water catch basins on the southeastern and northwestern portion of the subject site in the City of Victorville, San Bernardino County, California. Submitted herein are results of the findings and conclusions.

**REPORT OF INFILTRATION FEASIBILITY STUDY,
TENTATIVE TRACT MAP NO. 20525, APN 0394-031-02, 03, 04
NORTHEAST CORNER OF
MOJAVE DRIVE AND AMETHYST ROAD
CITY OF VICTORVILLE
SAN BERNARDINO COUNTY, CALIFORNIA**

LOCATION OF THE PROJECT SITE

This report presents the results of our infiltration testing conducted on the subject site for two (2) locations on the southeast and northwest portions of the property. The site is located on the northeast corner of Mojave Drive and Amethyst Road in the City of Victorville, San Bernardino County, California. The general location of the subject site is indicated on the 'Site Location Map,' Figure No. 1.

SITE DESCRIPTION

The site was generally vacant with no structures. At the time of the field study, the site contained moderate vegetation of various sized Mojave Desert shrubs and weeds such as creosote bushes and cholla bushes. On-site drainage was accomplished by sheet flow toward the northwest and northeast.

LOCATION OF INFILTRATION TESTING

Infiltration testing was conducted in the locations specified on the infiltration test location plan provided by Ludwig Engineering on the southeast portion and northwest portion of the site at depths of approximately 2 feet and 13 feet below the existing site grades respectively, which correspond to the proposed bottom elevations of the proposed infiltration basins. One test at the southeast portion of the site was conducted using a double ring infiltrometer. Due to the dense nature of the materials encountered, the rings were pushed into the ground using a truck mounted drill rig approximately 3.75 inches in the southeast test pit. The other test at the northwest portion utilized a boring excavated by a drill rig to a depth of 13 feet below ground surface. The approximate infiltration test locations are shown on the 'Infiltration Test Location Plan,' Plate No. 1.

SOIL CHARACTERISTICS OF THE SUBJECT SITE

- The soil characteristics for the subject site are defined as moderate to fast.

- There was no visible evidence of shallow groundwater or impervious bedrock materials.
- Groundwater was not encountered in the exploratory excavations performed by **HGI**, Reference No. 3 to the maximum depth explored of approximately 16.5 feet below existing ground surface. Current depth to groundwater data for the site area was available through the **USGS internet web site** (<https://maps.waterdata.usgs.gov/mapper>). The depth to groundwater in USGS Well No. 005N004W30E002S, located approximately 2.6 miles southeast of the site, was 330.2 feet below surface on May 7, 2018. The surface elevation of this well is approximately 238 feet lower (topographically) than that of the site. Based on this information, the current depth to static groundwater beneath the site is estimated to be greater than fifty feet and should not be considered a factor for infiltration system design.
- Tests performed agreed with visual evidence.
- The natural slope of the ground surface above the proposed water infiltration areas are less than a 2.0 percent gradient.
- Soil conditions for the on-site, water infiltration systems were acceptable in both tested areas.

Soil Profile

- Percolation Test No. 1: Infiltration test (P-1) was in the southeastern portion of the site and was tested in native alluvial deposits at a depth of approximately 2 feet. Alluvium was encountered to the maximum testing depth of 13 feet at this location. The alluvium encountered was a light brown, fine to medium sand with trace of gravel (SM). The bottom of the test was classified in general accordance with the Unified Soil Classification System as a SM. No water was encountered within the subsurface at the tested depth.
- Percolation Test No. 2: Infiltration test (P-2) was conducted at a depth of 13 feet below the existing site grade in the northwest portion of the subject site. A truck mounted drill rig was used for the excavation and backfill process. Alluvium extended from the surface to the bottom testing depth of 13 feet and was classified as a light brown, silty, fine to coarse sand (SM) that contained trace amounts of gravel. The bottom of the test was classified in general accordance with the Unified Soil Classification System as a SM.

- After testing was conducted the borings were backfilled with excavated materials.
- No large plants or roots were encountered in the infiltration test areas.
- There were no wet or saturated soils at depth encountered in the infiltration test areas.
- No groundwater was encountered within our infiltrometer test areas.

INFILTRATION TEST USING DOUBLE RING INFILTROMETER TESTING PROCEDURES

Testing was performed in general accordance with the latest version of the ASTM D3385 procedures. This method consists of driving two (2) open cylinders, one inside the other, into the ground, partially filling the rings with water, maintaining the water at a constant level, and measuring the volume of water required to maintain the constant level. The steel rings used for this project had nominal inside diameters of 12.25 inches and 23.75 inches. The volume of water added to the inner ring to maintain a constant liquid level was the measure of the volume of liquid that infiltrates into the soil. The volume infiltrated during timed intervals was converted to an incremental infiltration velocity expressed in centimeters per hour, and the results were plotted on a graph versus elapsed time, as shown on Plate Nos. 2 & 4 attached to the rear of this report.

Test locations and depths were identified and selected per Reference No 1, 'Precise Grading Plan.' The drill rig was used to excavate the testing location to an approximate depth of 2 feet with the bottom of the excavation having an area of similar diameter of the rings. The outer and inner infiltrometer rings were then pushed into the ground using the drill rig to an approximate depth of 4 inches and 4.5 inches into the subsurface. Upon excavation, hand tools were used to prepare a smooth, flat test site free of loose, disturbed, and smeared soils.

Clear municipal water was poured into the rings while using an open palmed hand to prevent splashing and disturbance of the soil boundary. The pre-

selected water test depth was approximately 6.0 inches (15.24cm). Water levels were maintained within 5.0 millimeters of this depth during the test by periodic additions from 1000 milliliter graduated cylinder. No significant wind occurred on the day of testing.

PERCOLATION TEST RESULTS VIA DOUBLE-RING INFILTRMETER

The calculated average and steady state rates of the inner-ring infiltration rates and outer-ring infiltration rates can be found below in the tabled results.

	Average Inner Ring Infiltration Rate		Average Outer Ring Infiltration Rate	
	cm/hr	in/hr	cm/hr	in/hr
P-1	15.05	5.93	14.16	5.51

	Steady State Inner Ring Infiltration Rate		Steady State Outer Ring Infiltration Rate	
	cm/hr	in/hr	cm/hr	in/hr
P-1	5.79	2.28	5.92	2.33

TEST PIT PERCOLATION TEST PROCEDURES

Testing was performed in general accordance with the most current Technical Guidance Document Appendices for infiltration rate evaluation protocol. This method consisted of drilling an 8" diameter bore hole using a hollow stem truck-mounted auger. The bottom of the test hole was chosen to represent the proposed bottom elevation of the infiltration surface. The bottom of the test hole was filled with 2 inches of gravel before placing a 3" sleeved PVC perforated pipe. The test hole was pre-soaked by filling the hole with clear water from a 250-gallon water tank and observed while the water infiltrated the surface. The water was allowed to drop and recorded for approximately 25 minutes for 2 readings. After the two 25-minute readings, it was determined the sandy soil

test procedures would follow due to the water level change exceeding 6 inches in both 25-minute readings. Therefore, testing was performed for a minimum of one hour. Readings were taken in 10-minute intervals. The water level and depth of boring were read after each reading with the tape measure from the outside of the casing at a fixed location, then recorded on the percolation data sheet.

PERCOLATION TEST RESULTS

Detailed percolation test results, in general accordance with San Bernardino County Technical Guidance Document Appendix VII, are included in Appendix 'A' as Plate Nos. 3 and 5. Following are tabulated results of the percolation testing:

Conversion of Percolation Test Result to an Infiltration Rate (I_t) was calculated from the following equation:

$$I_t = \frac{\Delta H(60r)}{\Delta t(r+2H_{avg})}$$

Where

I_t - tested infiltration rate

ΔH - change in height over the time interval (inches).

r - test hole radius (inches).

Δt - time interval (minutes).

H_{avg} - average head height over the time interval (inches).

Table 1 - Infiltration Test Results

Infiltration Test Hole No.	Initial Test Hole Depth (to bottom of hole)	Soil Classification	Infiltration Rate (in/hr.)	Recommended Infiltration Design Rate w/ a safety factor of 2.
P-2	13.0	SM	1.04	0.52

DISCUSSION

The site was located within an area characterized by silty fine to medium grained sands. The rates presented above are generally consistent with the soil classifications in each area tested. Slightly faster infiltrometer rates were obtained in infiltration test P-1 likely due to the depth of the test in relation to the degree of cementation. Given most of the site is underlain by silty sands, the rates were moderate to fast. From our exploratory excavations from Reference No. 3 and the findings of this study, the soil conditions appear to be finer grained with an increase of finer grained particles at from the surface grade to approximately fifteen feet.

Field infiltration tests are subject to many factors that affect the infiltration rate, including soil texture, the condition of the soil surface, soil-moisture tension or the degree of saturation, the temperature of the water and soil, the percentage of entrapped air in the soil, and the head of the applied water.

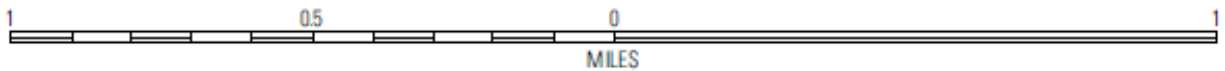
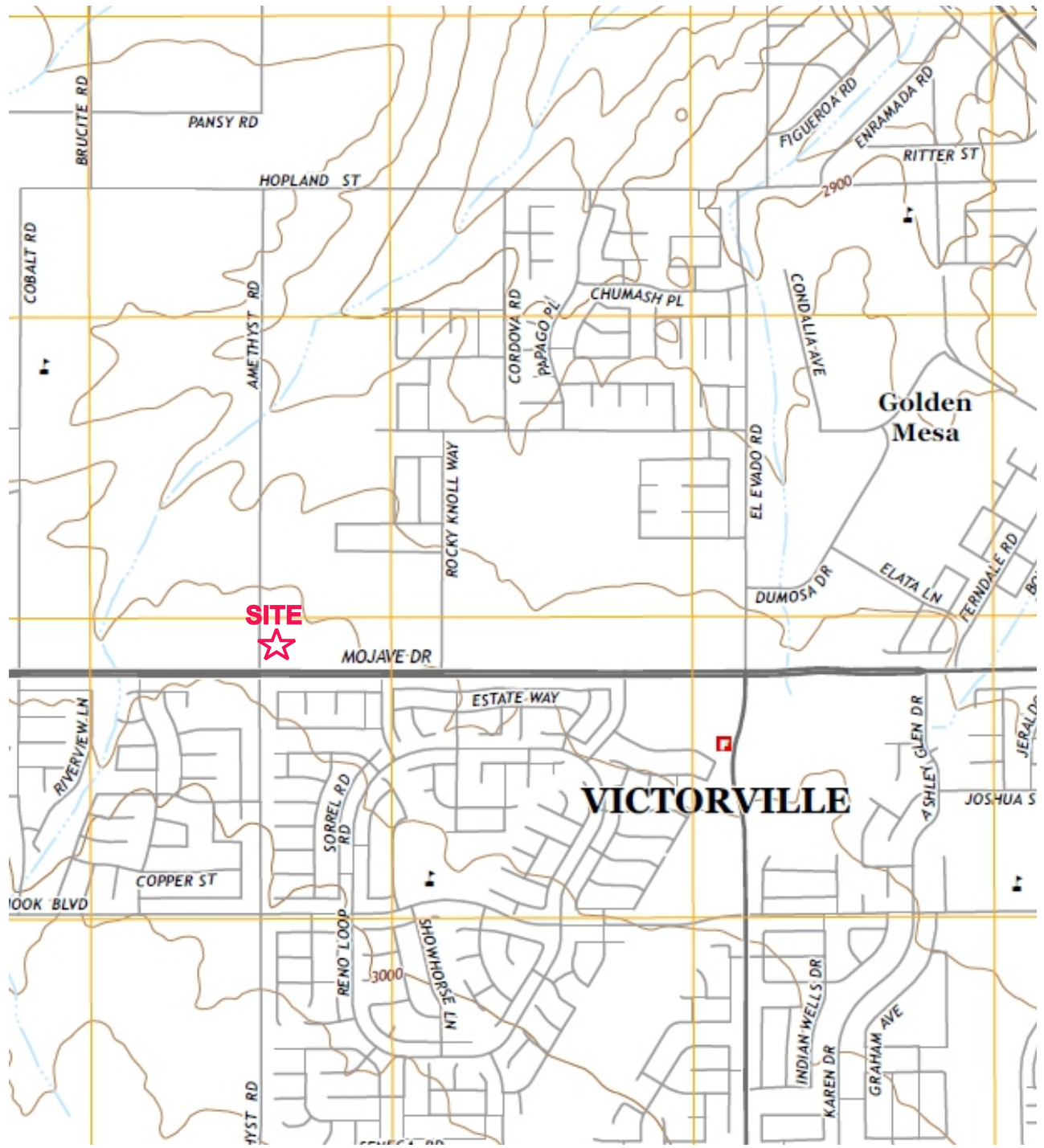
INFILTRATION BASIN RECOMMENDATIONS

Infiltration testing in the proposed infiltration areas indicated infiltration rates that appear to be consistent with respect to their respective on-site soil classification. The design infiltration rate of **1.14 inches/hour** at test location P-1 is recommended. The design infiltration rate of **0.52 inches/hour** at test location P-2 is recommended. The Project Civil Engineer should evaluate this information for final infiltration design.


Caution should be used in determining a percolation rate for any proposed infiltration basin or structure. Eventual siltation, water-borne silt from irrigation and precipitation runoff, and the accumulation of organic material in surface soils due to landscape grass and plant growth, can drastically reduce percolation rates over time. We recommend that suitable methods to prevent siltation be considered in the project design.

CLOSURE

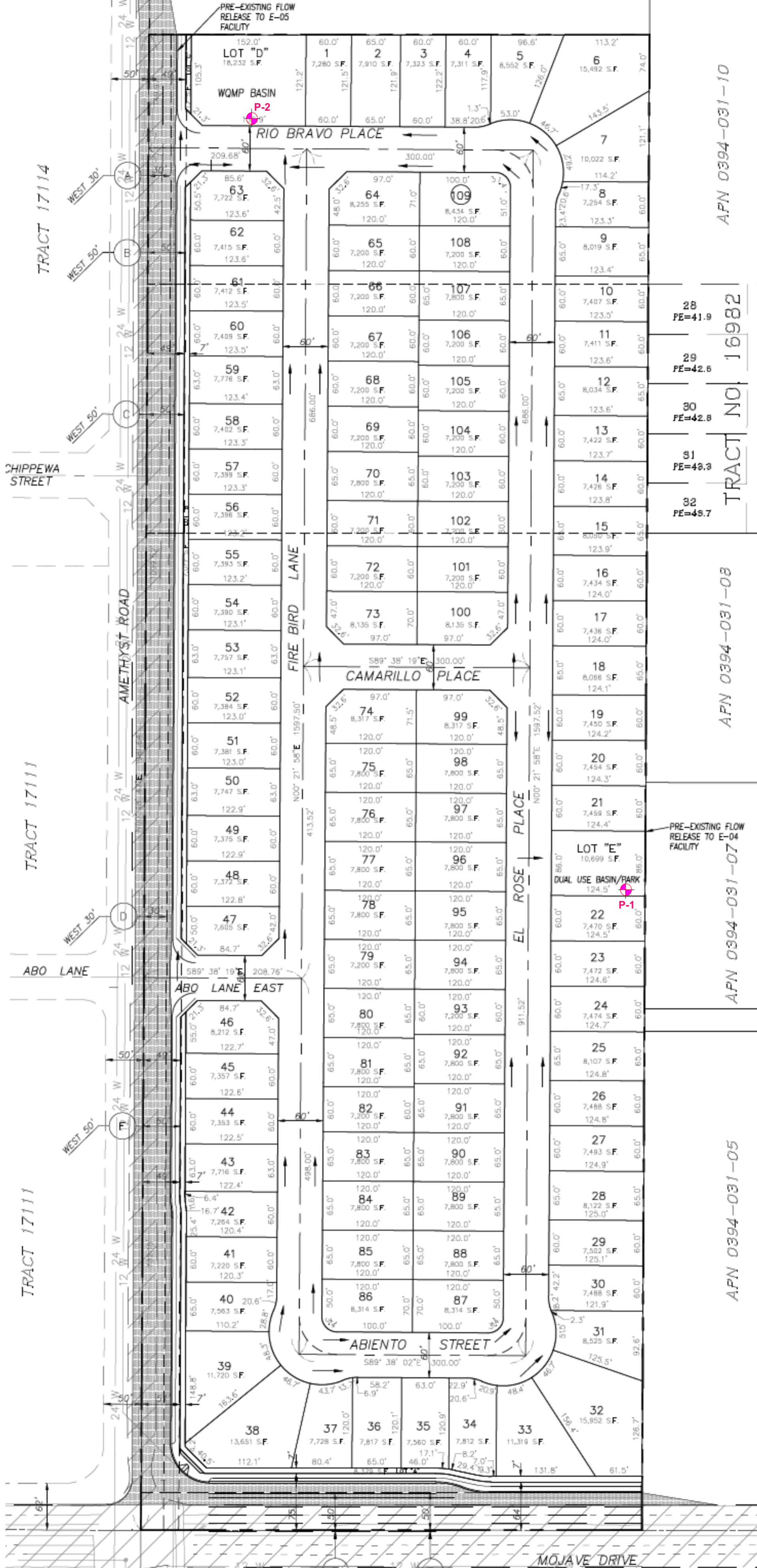
Findings of this report were prepared in accordance with generally accepted professional engineering principles and practice in the field of soil mechanics. The conclusions are based on results of field exploration and testing. If conditions are encountered during construction that appear to be different than those indicated by this report, this firm should be notified.



Source: Copied from USGS Topo Map- Victorville, Quadrangle 2015

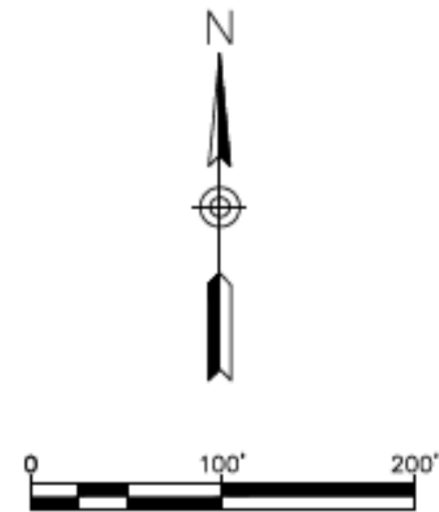
 <p>HILLTOP GEOTECHNICAL INCORPORATED</p>	<p>SITE LOCATION MAP</p> <p>Northeast Corner of Mojave Drive and Amethyst Road APN 0394-031-02, 03, 04, Victorville, CA 92394</p>	
	By: MC	Date: 3/2022
	Project No.: 1448-01.1	Figure 1

APN 0394-031-01



Legend

P-1 Infiltration Test Location



TRACT 14085

TRACT 16446



INFILTRATION TEST LOCATION APN: 0394-031-02,-03,-04, Northeast Corner of Mojave Dr. and Amethyst Road, Victorville	
By: MC	Date: 4/2022
Project No.: 1448-01.3	PLATE NO. 1

INFILTRMETER TEST **P-1** DATE OF TEST 18-Mar-22 DEPTH OF
PROJECT IDENTIFICATION: 1448-01.3 AREA(CM2) LIQUID (CM)
TEST LOCATION: 2 feet bgs East INNER 760 INNER 40.6
LIQUID USED: Municipal H2O OUTER 2856.7 OUTER 40.6
TESTED BY AB LIQUID LEVEL MAINTAINED USING: X MANUAL ADDITIONS (VISUAL)
DEPTH TO WATER TABLE: INNER RING AVERAGE RATE CM/H **15.05** IN/H **5.93**
OUTER RING AVERAGE RATE CM/H **13.98** IN/H **5.51**

Note: Inner ring potential gopher hole.

Increment No.	DATE	TIME START= 08:50 AM HR: MM	ELAPSED TIME/ INCREMENT MIN	FLOW READINGS		LIQUID TEMP. F	INCREMENTAL INFILTRATION RATE		INCREMENTAL INFILTRATION RATE		GROUND TEMP = 87 F @ DEPTH OF 12 INCHES AIR TEMP, WEATHER
				INNER FLOW CM3	OUTER FLOW CM3		INNER CM/H	ANNULAR CM/H	INNER IN/H	ANNULAR IN/H	
1	18-Mar-2022	9:40	15	5,500	17,500	76	28.95	24.50	11.41	9.65	70, Sunny
2	18-Mar-2022	10:00	15	5,000	16,500	77	26.32	23.10	10.37	9.10	70, Sunny
3	18-Mar-2022	10:20	15	4,400	15,000	77	23.16	21.00	9.12	8.28	70, Sunny
4	18-Mar-2022	10:40	15	3,600	13,300	78	18.95	18.62	7.47	7.34	73, Sunny
5	18-Mar-2022	11:10	30	6,600	21,800	78	17.37	15.26	6.84	6.01	74, Sunny
6	18-Mar-2022	11:40	30	4,800	19,500	79	12.63	13.65	4.98	5.38	78, Sunny
7	18-Mar-2022	12:40	60	5,900	21,200	80	7.76	7.42	3.06	2.92	82, Sunny
8	18-Mar-2022	13:40	60	4,700	17,600	82	6.18	6.16	2.44	2.43	84, Sunny
9	18-Mar-2022	14:40	60	3,900	14,800	83	5.13	5.18	2.02	2.04	90, Sunny
10	18-Mar-2022	15:40	60	3,100	14,100	85	4.08	4.94	1.61	1.94	85, Sunny

	CM/H Annular	CM/H Inner	IN/H Annular	IN/H Inner
Steady State Rates:	5.92	5.79	2.33	2.28



PERCOLATION DATA SHEET

Project Name: Mojave & Amethyst 40, L.P.

Project Number: 1448-01.3

Test Hole Number: P-2

Date Tested: 3/18/22

Depth of Boring in feet: 13.0

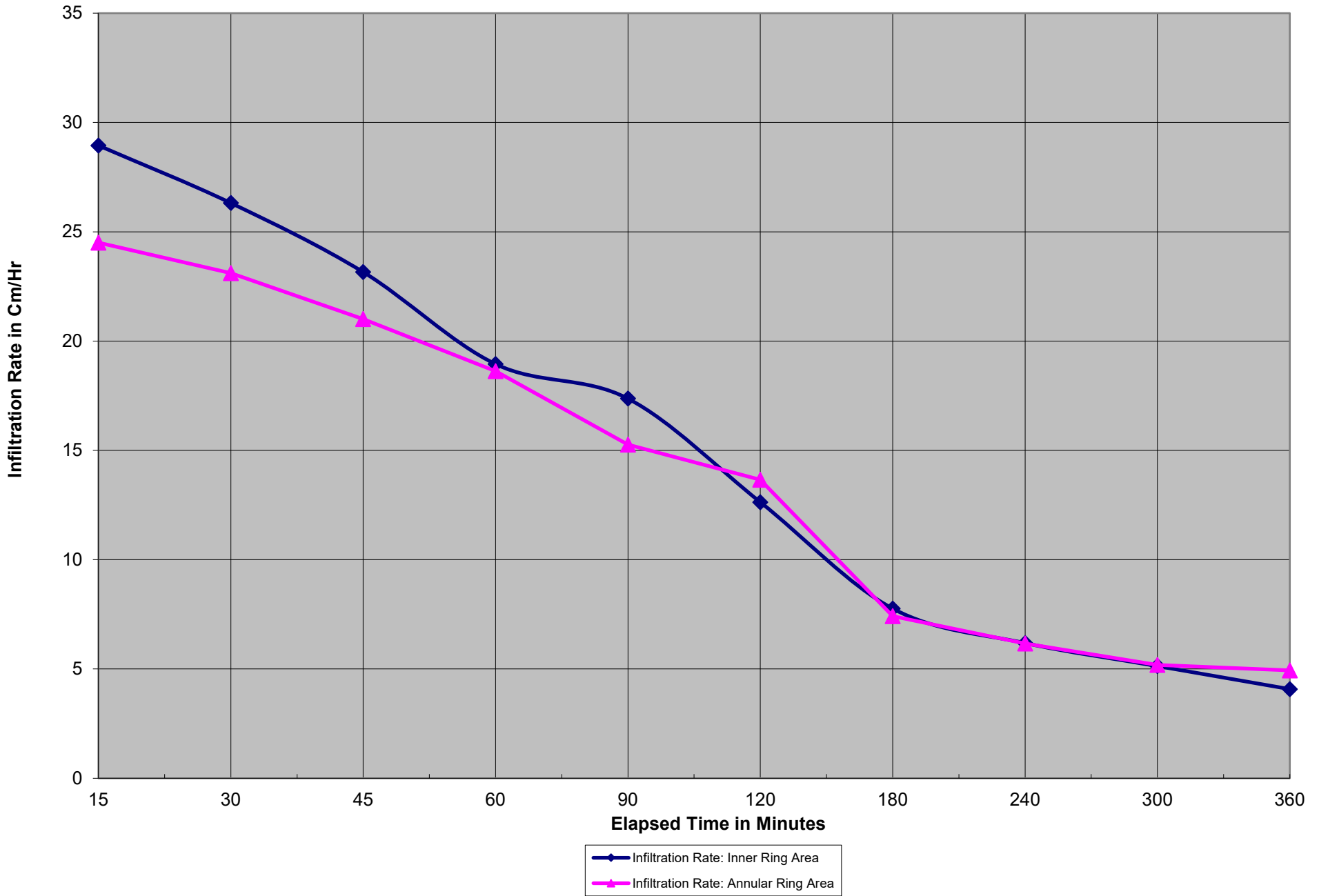
Tested By: AB

Radius of boring feet: 0.33

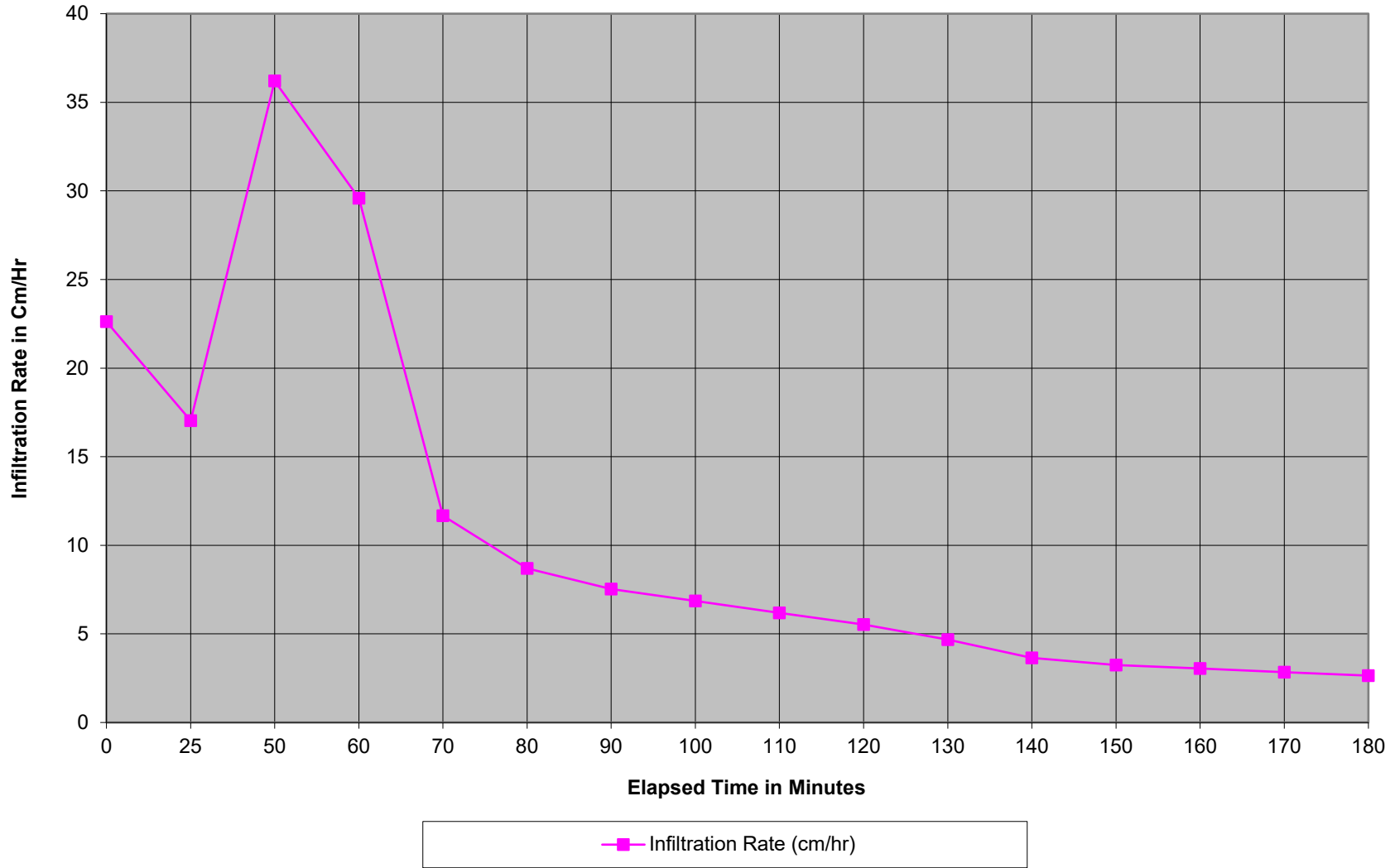
Hours Presaturation 0.83

Depth of Bottom (ft) Outer	Time Initial	Time Final	Time Interval (minutes)	Depth of Water - Initial (ft)	Depth of Water - Final (ft)	Change in Water Level (ft)	H _{average} (ft)	Rate, It (In/Hr)	Rate, It (Cm/Hr)
13.00	0:00	0:25	25.0	3.00	13.00	10.00	5.00	8.91	22.62
13.00	0:00	0:25	25.0	3.00	11.55	8.55	5.73	6.70	17.03
13.00	0:00	0:10	10.0	3.00	10.75	7.75	6.13	14.25	36.20
13.00	0:00	0:10	10.0	3.00	9.80	6.80	6.60	11.65	29.59
13.00	0:00	0:10	10.0	5.00	7.70	2.70	6.65	4.59	11.66
13.00	0:00	0:10	10.0	5.00	7.10	2.10	6.95	3.42	8.70
13.00	0:00	0:10	10.0	5.00	6.85	1.85	7.08	2.97	7.53
13.00	0:00	0:10	10.0	5.00	6.70	1.70	7.15	2.70	6.85
13.00	0:00	0:10	10.0	5.00	6.55	1.55	7.23	2.44	6.19
13.00	0:00	0:10	10.0	5.00	6.40	1.40	7.30	2.18	5.53
13.00	0:00	0:10	10.0	5.00	6.20	1.20	7.40	1.84	4.68
13.00	0:00	0:10	10.0	5.00	5.95	0.95	7.53	1.44	3.65
13.00	0:00	0:10	10.0	5.00	5.85	0.85	7.58	1.28	3.24
13.00	0:00	0:10	10.0	5.00	5.80	0.80	7.60	1.20	3.04
13.00	0:00	0:10	10.0	5.00	5.75	0.75	7.63	1.12	2.84
13.00	0:00	0:10	10.0	5.00	5.70	0.70	7.65	1.04	2.65

Infiltration Graph via Double Rings: Infiltration Rate vs. Time P-1



Infiltration Graph via Percolation Test: Infiltration Rate vs. Time





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SUBSURFACE EXPLORATION LOG BORING NO. P-1

Project Name:	Mojave & Amethyst 40, L.P.			Logged By:	AB
Project No.	1448-01.3	Date:	3/18/2022	Elevation:	2940 ± 25
Type of Rig:	Hollow-Stem Auger	Drive Wt.:	140 lb	Depth of Boring (ft.):	2.0
Drill Hole Dia.:	8 in.	Drop:	30 in.		

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft ³)	Moisture Content (%)	Lithology	Groundwater	Description
1								ALLUVIUM (0 to 2'): Silty fine to medium sand, trace gravel; Slightly moist; Dark yellowish brown; Medium dense.
2								Bottom of excavation 2 feet.
3								No groundwater encountered.
4								Converted to P-1, backfilled when testing completed.
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample
N.R. - No Recovery



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SUBSURFACE EXPLORATION LOG

BORING NO. P-2

Project Name: Mojave & Amethyst 40, L.P.
 Project No. 1448-01.3 Date: 3/18/2022 Logged By: AB
 Type of Rig: Hollow-Stem Auger Drive Wt.: 140 lb Elevation: 2940 ± 25
 Drill Hole Dia.: 8 in. Drop: 30 in. Depth of Boring (ft.): 13.0

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft ³)	Moisture Content (%)	Lithology	Groundwater	Description
1								ALLUVIUM (0 to 13') Silty fine to medium sand, trace gravel; Slightly moist; Dark yellowish brown; Medium dense.
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
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17								
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22								
23								
24								
25								

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample
 N.R. - No Recovery