P201800287

AM/PAC

1-800-564-7372
(951) 354-6500
FAX 354-8600

TESTING PROTOCOL FOR STORM WATER INFILTRATION BEST MANAGEMENT PRACTICES PERCOLATION TESTING IN A BORING.

PROJECT NUMBER: 17-13355

DATE: JANUARY 9, 2018

JOB SITE LOCATION:

PARCELS 1-4 INCLUSIVE OF PARCEL MAP # 18954:
THE VICINITY OF THE SOUTH WEST CORNER OF HAVEN AVENUE AND SNOWDROP ROAD, RANCHO CUCAMONGA, SAN BERNARDINO COUNTY, CA.

PARENT APN: 0201-043-56-0000

PREPARED FOR:

MR. KIRK WALLACE (626) 255-6275
ALLERA PROPERTIES, LLC.
2403 CLIFF ROAD UPLAND, CA. 91784
VIA E-MAIL: wallacekirk@yahoo.com

THIS SUBMITTAL HAS BEEN PREPARED FOR THE PROJECT NOTED ABOVE. IF YOU HAVE ANY QUESTIONS PLEASE DO NOT HESITATE TO CONTACT THE UNDERSIGNED AT YOUR CONVENIENCE.

REGISTERED PROFESSIONAL ENGINEER
GEORGE E. HAWES
No. C034779
CALIFORNIA

GEORGE E. HAWES DATE: 1/9/18
REGISTERED PROFESSIONAL ENGINEER
R.C.E. C034779 LIC. EXP. 9/30/19

DAVID E. BALLINGER, PRESIDENT
AM/PAC AND ASSOCIATES, INC.

Percolation Investigation

AM/PAC AND ASSOCIATES, INC.

2900 Adams St., Suite C-35 • Riverside, CA 92504

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PROPOSED DEVELOPMENT:

THE CLIENT PROPOSES BUILDING CUSTOM HOMES ON EACH OF THE FOUR LOTS TESTED. A GRADING PLAN PREPARED BY CUBIT ENGINEERING WAS PROVIDED TO THIS OFFICE PRIOR TO TESTING. CODE COMPLIANCE REQUIRES A WQMP STORM WATER INFILTRATION PERCOLATION REPORT TO AID IN BMP DESIGN AND VERIFICATION OF THE BMP SIZING.

PURPOSE AND SCOPE OF THIS REPORT:

TO PROVIDE THE CLIENT WITH THE REQUIRED SOIL BORING AND INFILTRATION TESTING DATA NECESSARY TO COMPLY WITH THE COUNTY OF SAN BERNARDINO STORM WATER INFILTRATION BEST MANAGEMENT PRACTICES PROGRAM. THIS DATA IS REQUIRED AND USED TO VERIFY AND PROVE THE SITE SOILS EVALUATION.

METHODOLOGY OF TESTING:

TESTING WAS PERFORMED CONFORMING TO THE PUBLISHED GUIDELINES FROM THE "TECHNICAL GUIDANCE DOCUMENT FOR WATER QUALITY MANAGEMENT PLANS" COUNTY OF SAN BERNARDINO. PREPARED BY CDM SMITH, INC. DATED JUNE 7, 2013 AND APPROVED FOR USE, EFFECTIVE SEPTEMBER 19, 2013.

CITED AS APPENDIX D OF THE AFOREMENTIONED DOCUMENT IS "APPENDIX VII, INFILTRATION RATE EVALUATION PROTOCOL AND FACTOR OF SAFETY RECOMMENDATIONS". PER TABLE VII.1: RECOMMENDED INFILTRATION METHODS, METHODS FOR ESTABLISHING DESIGN INFILTRATION RATE; THE PERCOLATION TEST PROCEDURE (RIVERSIDE COUNTY DEPARTMENT OF ENVIRONMENTAL HEALTH) WAS USED.

TWO (2) PERCOLATION TESTS WERE PERFORMED IN THE IMMEDIATE AREA OF EACH OF THE FOUR PROPOSED INFILTRATION BASINS. ONE BASIN PER EACH BUILDING PARCEL. ALL TESTS WERE PERFORMED TO A TOTAL DEPTH OF 5' BELOW THE PROPOSED FINISHED GRADE. BORING DIAMETER IS 8". THE BASIN DEPTHS WERE NOTED ON THE GRADING PLAN PREPARED BY CUBIT ENGINEERING. A COPY OF THIS PLAN IS ATTACHED TO THIS REPORT.

PER SECTION VII., 1.3 "A NOTE ON "INFILTRATION RATE" VS. "PERCOLATION RATE",
THE TESTED RATE HAS BEEN CONVERTED TO AN INFILTRATION RATE USING THE PORCHET METHOD OF CONVERSION. SEE THE DATA SHEETS ATTACHED.

CONCLUSIONS AND RECOMMENDATIONS:

THE EXCAVATED AND TESTED SOILS AT THE OBSERVED DEPTHS ARE HOMOGENEOUS AND CAN BE EXPECTED TO HAVE THE SAME OR VERY SIMILAR INFILTRATION, POROUS AND ABSORPTION QUALITIES. IT SHOULD BE NOTED THAT THE PORCHET METHOD OF CONVERSION HAS A FACTOR OF SAFETY OF 3 BUILT IN TO THE CALCULATIONS.

BORING LOGS:

TEST 1:

0-5' G/M TAN, SILTY-FINE TO COARSE GRAINED SANDS, ABUNDANT ANGULAR GRAVELS, FIRM TO DENSE AND DRY.

TEST 2:

0-5' G/M TAN, SILTY-FINE TO COARSE GRAINED SANDS, ABUNDANT ANGULAR GRAVELS, DENSE AND DRY.

TEST 3:

0-5' G/M TAN, SILTY-FINE TO COARSE GRAINED SANDS, ABUNDANT ANGULAR GRAVELS, FIRM AND DRY

TEST 4:

0-5' G/M TAN, SILTY-FINE TO COARSE GRAINED SANDS, ABUNDANT ANGULAR GRAVELS, DENSE AND DRY

TEST 5:

0-5' G/M TAN, SILTY-FINE TO COARSE GRAINED SANDS, ABUNDANT ANGULAR GRAVELS, FIRM TO DENSE AND DRY.

TEST 6:

0-5' G/M TAN, SILTY-FINE TO COARSE GRAINED SANDS, ABUNDANT ANGULAR GRAVELS, DENSE AND DRY.

TEST 7:

0-5' G/M TAN, SILTY-FINE TO COARSE GRAINED SANDS, ABUNDANT ANGULAR GRAVELS, FIRM AND DRY

TEST 8:

0-5' G/M TAN, SILTY-FINE TO COARSE GRAINED SANDS, ABUNDANT ANGULAR GRAVELS, DENSE AND DRY

NO GROUNDWATER, EVIDENCE OF HIGH GROUNDWATER, SOIL MOTTLING, SOIL CONTAMINATION OR FILL MATERIAL WAS EVIDENT IN ANY SOIL BORING AT ANY DEPTH OBSERVED.

TEST DATA:

TEST 1: 30:00 MINUTES PER INCH PERCOLATION RATE.

2.0 INCHES PER HOUR

USING THE PORCHET METHOD OF CONVERSION, THIS TRANSLATES TO 0.19 INCHES PER HOUR INFILTRATION RATE.

TEST 2: 30:00 MINUTES PER INCH PERCOLATION RATE.

2.0 INCHES PER HOUR

USING THE PORCHET METHOD OF CONVERSION, THIS TRANSLATES TO 0.19 INCHES PER HOUR INFILTRATION RATE.

TEST 3: 33:33 MINUTES PER INCH PERCOLATION RATE.

3.0 INCHES PER HOUR

USING THE PORCHET METHOD OF CONVERSION, THIS TRANSLATES TO 0.28 INCHES PER HOUR INFILTRATION RATE.

TEST 4: 30:00 MINUTES PER INCH PERCOLATION RATE.

2.4 INCHES PER HOUR

USING THE PORCHET METHOD OF CONVERSION, THIS TRANSLATES TO 0.22 INCHES PER HOUR INFILTRATION RATE.

TEST 5: 30:00 MINUTES PER INCH PERCOLATION RATE.

2.0 INCHES PER HOUR

USING THE PORCHET METHOD OF CONVERSION, THIS TRANSLATES TO 0.19 INCHES PER HOUR INFILTRATION RATE.

TEST 6: 30:00 MINUTES PER INCH PERCOLATION RATE.

2.0 INCHES PER HOUR

USING THE PORCHET METHOD OF CONVERSION, THIS TRANSLATES TO 0.19 INCHES PER HOUR INFILTRATION RATE.

TEST 7: 33:33 MINUTES PER INCH PERCOLATION RATE.

3.0 INCHES PER HOUR

USING THE PORCHET METHOD OF CONVERSION, THIS TRANSLATES TO 0.28 INCHES PER HOUR INFILTRATION RATE.

TEST 8: 30:00 MINUTES PER INCH PERCOLATION RATE.

2.4 INCHES PER HOUR

USING THE PORCHET METHOD OF CONVERSION, THIS TRANSLATES TO 0.22 INCHES PER HOUR INFILTRATION RATE.

AVERAGES

26.25 MINUTES PER INCH PERCOLATION RATE

2.35 INCHES PER HOUR PERCOLATION RATE

0.22 INCHES PER HOUR PORCHET CONVERSION INFILTRATION RATE

ATTACHED TO THIS REPORT ARE SELECTED PAGES OF THE APPENDIX D REFERENCING THIS TYPE OF TESTING AND THE PROTOCOL AND PROCEDURE REQUIRED.

COPY OF SBDO GUIDELINES
APPENDIX – D, SECTION VII

APPENDIX VII. INFILTRATION RATE EVALUATION PROTOCOL AND FACTOR OF SAFETY RECOMMENDATIONS

VII.1. Introduction

Soil characterization and infiltration testing is required in order to properly size and locate stormwater management facilities. The purpose of this appendix is to provide guidance for investigating infiltration at both the project planning and design phases, as well as provide requirements for applying a factor of safety to testing results.

VII.1.1. Two phases of assessment

The role of soil characterization and infiltration testing differs with the phase of project development as described below.

Site Assessment / Project Planning Phase: Soil characterization or infiltration testing may be conducted to determine if infiltration is a potentially feasible BMP and/or where on the site infiltration is potentially infeasible. The intent of this investigation is to identify if the project site, or a portion of the site, has soils that are clearly unsuitable for infiltration. For those sites or portions of the site where soils are unsuitable, infiltration BMPs can be eliminated from consideration. The intent of this testing is not to prove definitively that infiltration is feasible. Simpler methods may be used to determine infiltration potential at this phase. The observed infiltration rate is adjusted to account for the type of test and the uncertainty of the testing method and reported as the *measured infiltration rate* for the purpose of evaluating feasibility. These methods are not appropriate to determine the *design infiltration rate*.

Site Planning / Design Phase: Where infiltration BMPs are selected, infiltration testing must be conducted to determine the *design infiltration rate* of proposed facilities, except in limited cases where infiltration rate is presumed to be sufficient as identified in Section **VII.1.2**. The required size of the proposed facilities strongly depends on the design infiltration rate; therefore, testing may be required at the preliminary site design phase to facilitate site planning. However, infiltration testing must be conducted as close to the proposed facility as possible, therefore, conducting testing after preliminary site design also has merits. Use of more sophisticated methods at this phase allows better confidence in testing and therefore a lower factor of safety on observed infiltration rates (and therefore smaller facility designs). Factors of safety are discussed in **VII.4**.

Soil characterization and infiltration testing can be considered to fulfill two functions:

1. Determine where infiltration is potentially feasible and must be considered (if other limitations, such as depth to groundwater or contamination, do not restrict infiltration). This role is satisfied through simple infiltration tests, or use of maps and available data.
2. Determine the design infiltration rate for proposed facilities. This function is satisfied through more sophisticated investigation methods, conducted by a qualified professional.

Table VII.1 provides required methods of assessing infiltration rate for each purpose.

Table VII.1: Recommended Infiltration Investigation Methods

Methods for Identifying Areas Potentially Feasible for Infiltration	• **Use of Regional Maps and "Available Data"**[1] **OR** • **Simple Open Pit Infiltration Test** **OR** • Any of the testing methods used to establish design infiltration rate (below)
Methods for Establishing Design Infiltration Rate	• **Open Pit Falling Head Procedure** • **Single Ring Infiltrometer Test** • **Double Ring Infiltrometer Test** • **Well Permeameter Method (USBR Procedure 7300-89)** • **Percolation Test Procedure** (Riverside County Department of Environmental Health) • Other analysis methods at the discretion of the project engineer and approval of the reviewing agency

[1]Available data is defined in Section **VII.2** below and does not require additional investigation.

VII.1.2. Waiver of Infiltration Testing Requirements

The infiltration testing requirements described in this appendix are not applicable for certain combinations of BMP type and general soil condition. In cases where available soils information indicates that the soils are clearly sufficient to support the level of infiltration required for proper function of the BMP and uncertainty in infiltration rate would not significantly influence the performance of the practice, it is not mandatory to conduct infiltration testing. Conditions under which infiltration testing requirements are waived include:

- **Impervious area dispersion** (See **HSC-2: Impervious Area Dispersion**): Testing requirements are waived for this BMP for all soil types. Soil amendments are required to use this practice where site soils are hydrologic soil group C or D.
- **Localized on-lot infiltration** (See **HSC-1: Localized On-Lot Infiltration**): Testing requirements are waived for this BMP for A, B, and C soil types if soil type and general drainage conditions are confirmed with site-specific information. This BMP is not suitable for D soils unless infiltration testing demonstrates that the ponded depth would drain within 24 hours.
- **Porous pavement designed to be self-retaining** (See **INF-6: Permeable Pavement (concrete, asphalt, and pavers)**): Testing requirements for this BMP are waived for A, B, and C soil types if soil type and general drainage conditions are confirmed with site-specific information. This waiver does not apply to porous pavement that accepts run-on from a tributary area larger than 50 percent of its area.
- **Bioinfiltration** (See **INF-4: Bioinfiltration Fact Sheet**). Based on the LID BMP hierarchy, this type of BMP may only be used if infiltration of the full DCV is not feasible; therefore exploratory infiltration rate assessment (Section **VII.2**) is required. However, testing to determine design infiltration rate (Section **VII.3**) is not required. See **Appendix XI** for instructions for sizing the infiltration component of a bioinfiltration BMP to achieve maximum feasible infiltration.

VII.1.3. A Note on "Infiltration Rate" vs. "Percolation Rate"

A common misunderstanding is that the "percolation rate" obtained from a percolation test is equivalent to the "infiltration rate" obtained from a single or double ring infiltrometer test. While the percolation rate is related to the infiltration rate, percolation rates tend to overestimate infiltration rates and can be off by a factor of ten or more because they incorporate both downward and horizontal fluxes of water, whereas infiltration only refers to a downward flux of water. When using borehole-type methods, the percolation rate obtained shall be converted to a reasonable estimate of the infiltration rate using the Porchet Method (aka Inverse Borehole Method) (See Example VII.1).

VII.1.4. Grading Plans

Many projects require a significant amount of grading prior to their construction. It is important to determine if the BMP will be placed in cut or fill since this may affect the performance of the BMP or even the soil. As such, preliminary site grading plans showing the proposed BMP locations are required along with section views through each BMP clearly identifying the extents of cut or fill. In addition, since it is imperative that any testing be performed at the proper elevations and locations, it is highly recommended that the preliminary site grading plans be provided to the engineer/geologist prior to any tests being performed.

VII.1.5. Cut Condition

Where the proposed infiltration BMP is to be located in a cut condition, the infiltration surface level at the bottom of the BMP might be far below the existing grade. For example, if the

VII.3.8. Percolation Test Procedure

The percolation test procedure below (per Riverside County Department of Environmental Health) should only be performed by those individuals trained and educated to perform, understand and evaluate the field conditions and tests. This would include those who hold one of the following State of California credentials and registrations: Professional Civil and Geotechnical Engineers, Certified Engineering Geologist and Certified Hydrogeologist.

The procedure for this test varies, depending on the depth of the hole to be used. Procedures for both scenarios (less than 10 feet or 10 - 40 feet deep) and diagrams (**Figure VII.15** to **Figure VII.17**) are included below. When the percolation testing has been completed, a 3 foot long surveyor's stake (lath) shall be flagged with highly visible banner tape and placed in the location of the test indicating date, test hole number as shown on the field data sheet, and firm performing the test.

VII.3.8.1. Shallow Percolation Test (less than 10 feet)

Test Preparation

1) The test hole opening shall be between 8 and 12 inches in diameter or between 7 and 11 inches on each side if square.

2) The bottom elevation of the test hole shall correspond to the bottom elevation of the proposed basin (infiltration surface). Keep in mind that this procedure will require the test hole to be filled with water to a depth of at least 5 times the hole's radius.

3) The bottom of the test hole shall be covered with 2 inches of gravel.

4) The sides of the hole shall remain undisturbed (not smeared) after drilling and any cobbles encountered left in place.

5) **Pre-soaking** shall be used with this procedure. Invert a full 5 gallon bottle (more if necessary) of clear water supported over the hole so that the water flow into the hole holds constant at a level at least 5 times the hole's radius above the gravel at the bottom of the hole. Testing may commence after all of the water has percolated through the test hole or after 15 hours has elapsed since initiating the pre-soak. However, to assure saturated conditions, testing must commence no later than 26 hours after all pre-soak water has percolated through the test hole. The use of the "continuous pre-soak procedure" is no longer accepted. When sandy soils (as described below) are present, the test shall be run immediately.

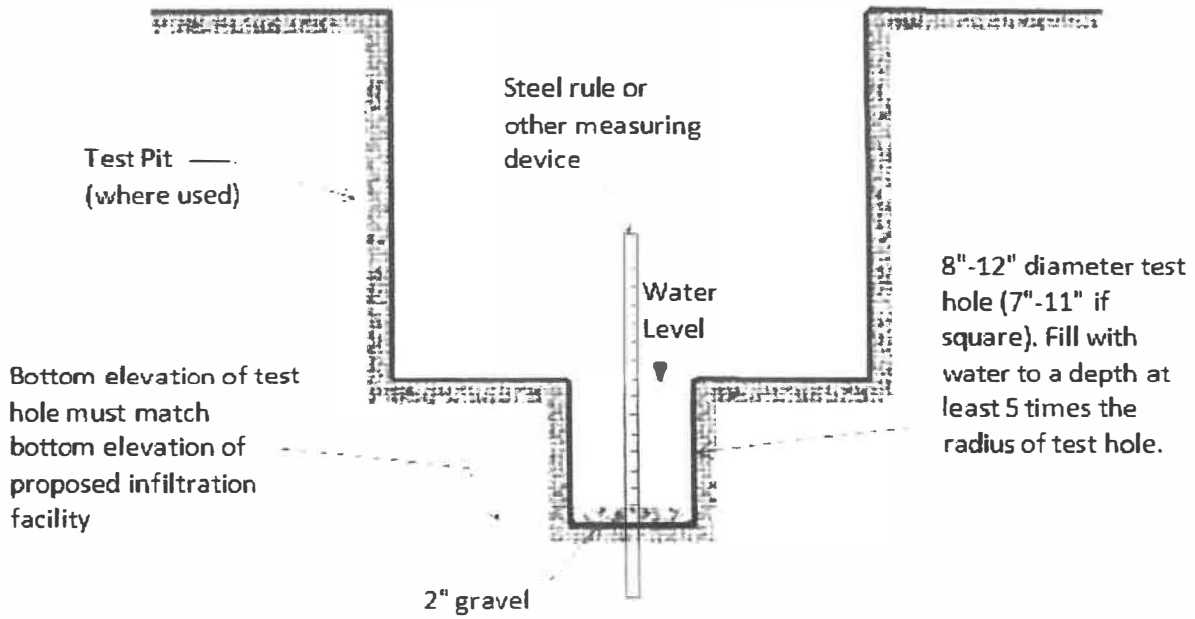
Test Procedure

Test hole shall be carefully filled with water to a depth equal to at least 5 times the hole's radius (H/r>5) above the gravel at the bottom of the test hole prior to each test interval.

- In **sandy soils**, when 2 consecutive measurements show that 6 inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Measurements shall be taken with a precision of 0.25 inches or better. The drop that occurs during the final 10 minutes is used to calculate the percolation rate. Field data must show the two 25 minute readings and the six 10 minute readings.

- In **non-sandy soils**, obtain at least twelve measurements per hole over at least six hours with a precision of 0.25 inches or better. From a fixed reference point, measure the drop in water level over a 30 minute period for at least 6 hours, refilling after every 30 minute reading. The total depth of the hole must be measured at every reading to verify that collapse of the borehole has not occurred. The drop that occurs during the final reading is used to calculate the percolation rate.

Figure VII.15. Test Pit for Shallow Percolation Test



VII.3.8.2. Deep Percolation Test (10 - 40 feet)

Test Preparation

Example VII.1: Percolation Rate Conversion Example

(Porchet Method, aka Inverse Borehole Method):

The bottom of a proposed infiltration basin would be at 5.0 feet below natural grade. Percolation tests are performed within the boundaries of the proposed basin location with the depth of the test hole set at the infiltration surface level (bottom of the basin). The Percolation Test Data Sheet (Table 5) is prepared as the test is being performed. After the minimum required number of testing intervals, the test is complete. The data collected at the final interval is as follows:

Time interval, Δt = 10 minutes
Initial Depth to Water, D_0 = 12.25 inches
Final Depth to Water, D_f = 13.75 inches
Total Depth of Test Hole, D_T = 60 inches
[13]Test Hole Radius, r = 4 inches

The conversion equation is used:

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

"H_o" is the initial height of water at the selected time interval.

$H_o = D_T - D_0 = 60 - 12.25 = 47.75$ inches

"H_f" is the final height of water at the selected time interval.

$H_f = D_T - D_0 = 60 - 13.75 = 46.25$ inches

"ΔH" is the change in height over the time interval.

$\Delta H = \Delta D = H_o - H_f = 47.75 - 46.25 = 1.5$ inches

"H_{avg}" is the average head height over the time interval.

$H_{avg} = (H_o - H_f)/2 = (47.75 - 46.25)/2 = 47.0$ inches

"I_t" is the tested infiltration rate.

$$I_t = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})} = \frac{(1.5\ in)(\frac{60\ min}{hr})(4\ in)}{(10\ \text{min})((4\ in) + 2(47\ in))} = 0.37\ in/hr$$

[13] Where a rectangular test hole is used, an equivalent radius should be determined based on the actual area of the rectangular test hole (i.e., $r = (A/\pi)^{0.5}$).

APPENDIX – B

PERCOLATION TEST DATA SHEETS AND PORCHET CONVERSION SPREAD SHEETS

Percolation Test Data Sheet

Project:	INFILTRATION	Project No:	17-13355	Date:	1-9-18
Test Hole No:	1	Tested By:	D. BALLINGER		
Depth of Test Hole, D_T:	60"	USCS Soil Classification:	G/M		

Test Hole Dimensions (inches)			Length	Width	
Diameter (if round)=	8"	Sides (if rectangular)=	—	—	

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6"? (y/n)
1	PRESOAKED		OVER NIGHT				
2							

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Other wise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth OF Water (in.)	D_f Final Depth OF Water (in.)	ΔD Change in Water Level (in.)	Percolation Rate (min./in.)
1	0810	0840	30	20	17.3	2.7	
2	0845	0915	30	20	17.5	2.5	
3	0920	0940	30	20	17.8	2.2	
4	0945	1015	30	20	18.0	2.0	
5	1020	1050	30	20	18.2	1.8	
6	1055	1125	30	20	18.5	1.5	
7	1130	1200	30	20	18.5	1.5	
8	1205	1235	30	20	18.7	1.3	
9	1240	1310	30	20	18.8	1.2	
10	1315	1345	30	20	18.9	1.1	
11	1350	1420	30	20	19.0	1.0	
12	1425	1455	30	20	19.0	1.0	30:00 MPI
13							
14							
15							

COMMENTS: R = 4", 4 × 5 = 20" OF WATER

Percolation Test Data Sheet

Project:	INFILTRATION	Project No:	17-13355	Date:	1-9-18
Test Hole No:	2	Tested By:	D. BALLINGER		
Depth of Test Hole, D_T:	60"	USCS Soil Classification:	G/m		
Test Hole Dimensions (inches)			Length	Width	
Diameter (if round)=	8"	Sides (if rectangular)=	—	—	

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6"? (y/n)
1	PRESOAKED		OVERNIGHT				
2							

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Other wise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth ~~to~~ OF Water (in.)	D_f Final Depth ~~to~~ OF Water (in.)	ΔD Change in Water Level (in.)	Percolation Rate (min./in.)
1	0813	0843	30	20	17.3	2.7	
2	0848	0918	30	20	17.6	2.4	
3	0923	0943	30	20	17.9	2.1	
4	0948	1018	30	20	18.2	1.8	
5	1023	1053	30	20	18.4	1.6	
6	1058	1128	30	20	18.6	1.4	
7	1133	1203	30	20	18.7	1.3	
8	1208	1235	30	20	18.7	1.3	
9	1243	1313	30	20	18.8	1.2	
10	1318	1348	30	20	19.0	1.0	
11	1353	1423	30	20	19.0	1.0	
12	1428	1458	30	20	19.0	1.0	30:00 mpi
13							
14							
15							

COMMENTS: R = 4", 4x5 = 20" OF WATER

Percolation Test Data Sheet

Project:	INFILTRATION	Project No:	17-13355	Date:	1-9-18
Test Hole No:	3	Tested By:	D. BALLINGER		
Depth of Test Hole, D_T:	60"	USCS Soil Classification:	GM		

Test Hole Dimensions (inches)			Length	Width	
Diameter (if round)=	8"	Sides (if rectangular)=	—	—	

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6"? (y/n)
1	PRESOAKED	OVERNIGHT					
2							

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Other wise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	ΔD Change in Water Level (in.)	Percolation Rate (min./in.)
1	0816	0846	30	20	17.3	2.7	
2	0851	0921	30	20	17.6	2.4	
3	0926	0956	30	20	17.8	2.2	
4	1000	1030	30	20	18.1	1.9	
5	1034	1104	30	20	18.4	1.6	
6	1108	1118	30	20	18.6	1.4	
7	1121	1151	30	20	18.8	1.2	
8	1156	1226	30	20	18.8	1.2	
9	1230	1300	30	20	18.9	1.1	
10	1305	1335	30	20	19.0	1.0	
11	1339	1419	30	20	19.0	1.0	
12	1424	1454	30	20	19.1	.9	33.33 mpi
13							
14							
15							

COMMENTS: R = 4"; 4 x 5 = 20" OF WATER

Percolation Test Data Sheet

Project:	INFILTRATION	Project No:	17-13355	Date:	1-9-18
Test Hole No:	4	Tested By:	D. BALLINGER		
Depth of Test Hole, D_T:	60"	USCS Soil Classification:	G/M		
Test Hole Dimensions (inches)			Length	Width	
Diameter (if round)=	8"	Sides (if rectangular)=	—	—	

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6"? (y/n)
1	PRESOAKED		OVERNIGHT				
2							

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Other wise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	ΔD Change in Water Level (in.)	Percolation Rate (min./in.)
1	0820	0850	30	20	17.4	2.6	
2	0855	0925	30	20	17.7	2.3	
3	0929	0959	30	20	18.0	2.0	
4	1004	1034	30	20	18.0	2.0	
5	1038	1108	30	20	18.4	1.6	
6	1113	1143	30	20	18.5	1.5	
7	1147	1217	30	20	18.5	1.5	
8	1223	1253	30	20	18.6	1.4	
9	1258	1308	30	20	18.8	1.2	
10	1314	1344	30	20	18.8	1.2	
11	1350	1420	30	20	19.0	1.0	
12	1425	1455	30	20	19.0	1.0	30:00 MPI
13							
14							
15							

COMMENTS: R= 4", 4×5 = 20" OF WATER

Percolation Test Data Sheet

Project:	INFILTRATION	Project No:	17-13355	Date:	1-9-18
Test Hole No:	5	Tested By:	D. BALLINGER		
Depth of Test Hole, D_T:	60"	USCS Soil Classification:	G/M		
Test Hole Dimensions (inches)			Length	Width	
Diameter (if round)=	8"	Sides (if rectangular)=	—	—	

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6"? (y/n)
1	PRESOAKED		OVERNIGHT				
2							

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Other wise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	ΔD Change in Water Level (in.)	Percolation Rate (min./in.)
1	0826	0856	30	20	17.3	2.7	
2	0900	0930	30	20	17.7	2.3	
3	0934	1004	30	20	18.0	2.0	
4	1008	1038	30	20	18.3	1.7	
5	1043	1113	30	20	18.3	1.7	
6	1117	1147	30	20	18.5	1.5	
7	1154	1224	30	20	18.5	1.5	
8	1230	1300	30	20	18.7	1.3	
9	1304	1334	30	20	18.8	1.2	
10	1340	1410	30	20	18.9	1.1	
11	1415	1445	30	20	19.0	1.0	
12	1448	1518	30	20	19.0	1.0	30:00 mpi
13							
14							
15							

COMMENTS: R = 4", 4 x 5 = 20" OF WATER

Percolation Test Data Sheet

Project:	INFILTRATION	Project No:	17-13355	Date:	1-9-18
Test Hole No:	6	Tested By:	D. BALLINGER		
Depth of Test Hole, D_T:	60"	USCS Soil Classification:	G/m		

Test Hole Dimensions (inches)			Length	Width	
Diameter (if round)=	8"	Sides (if rectangular)=	—	—	

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6"? (y/n)
1	Pre soaked		OVERNIGHT				
2							

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Other wise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	ΔD Change in Water Level (in.)	Percolation Rate (min./in.)
1	0830	0900	30	20	17.0	3.0	
2	0905	0935	30	20	17.3	2.7	
3	0940	1010	30	20	17.6	2.4	
4	1015	1045	30	20	17.9	2.1	
5	1050	1120	30	20	18.3	1.7	
6	1125	1155	30	20	18.5	1.5	
7	1159	1229	30	20	18.5	1.5	
8	1234	1304	30	20	18.7	1.3	
9	1308	1338	30	20	18.8	1.2	
10	1342	1412	30	20	19.0	1.0	
11	1416	1446	30	20	18.9	1.1	
12	1452	1522	30	20	19.0	1.0	30:00 MPI
13							
14							
15							

COMMENTS: R = 4", 4 x 5 = 20" OF WATER

Percolation Test Data Sheet

Project:	INFILTRATION	Project No:	17-13355	Date:	1-9-18
Test Hole No:	7	Tested By:	D. BALLINGER		
Depth of Test Hole, D_T:	60"	USCS Soil Classification:	G/M		

Test Hole Dimensions (inches)			Length	Width	
Diameter (if round)=	8"	Sides (if rectangular)=	—	—	

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6"? (y/n)
1	Pre-Soaked		OVERNIGHT				
2							

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Other wise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	ΔD Change in Water Level (in.)	Percolation Rate (min./in.)
1	0835	0905	30	20	17.4	2.6	
2	0909	0939	30	20	17.7	2.3	
3	0945	1015	30	20	18.0	2.0	
4	1020	1050	30	20	18.2	1.8	
5	1055	1125	30	20	18.3	1.7	
6	1130	1200	30	20	18.3	1.7	
7	1205	1235	30	20	18.6	1.4	
8	1239	1309	30	20	18.7	1.3	
9	1314	1344	30	20	18.9	1.1	
10	1350	1420	30	20	19.0	1.0	
11	1425	1455	30	20	19.0	1.0	
12	1500	1530	30	20	19.1	.9	33:33 mpi
13				-			
14							
15							

COMMENTS:

R = 4", 4 x 5 = 20" OF WATER

Percolation Test Data Sheet

Project:	INFILTRATION	Project No:	17-13355	Date:	1-9-18
Test Hole No:	B	Tested By:	D. BALLINGER		
Depth of Test Hole, D_T:	60"	USCS Soil Classification:	G/m		
Test Hole Dimensions (inches)			Length	Width	
Diameter (if round)=	8"	Sides (if rectangular)=	—	—	

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6"? (y/n)
1	PRESOAKED	OVER NIGHT					
2							

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Other wise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	ΔD Change in Water Level (in.)	Percolation Rate (min./in.)
1	0840	0910	30	20	17.3	2.7	
2	0914	0944	30	20	17.6	2.4	
3	0950	1020	30	20	17.8	2.2	
4	1024	1054	30	20	17.0	2.0	
5	1100	1130	30	20	18.2	1.8	
6	1135	1205	30	20	18.4	1.6	
7	1210	1240	30	20	18.6	1.4	
8	1245	1315	30	20	18.7	1.3	
9	1320	1350	30	20	18.7	1.3	
10	1355	1425	30	20	18.9	1.1	
11	1430	1500	30	20	19.0	1.0	
12	1506	1536	30	20	19.0	1.0	30.00 MPI
13							
14							
15							

COMMENTS: R = 4", 4 x 5 = 20" OF WATER

Porchet Method - Conversion of Percolation Rate to Infiltration Rate	Perc Test TEST 1 Average	Legend	Required Entry / Calculated Entry

Company Name: AM/PAC AND ASSOCIATES, INC. Date: 12/9/2017

Designed By: BALLINGER/HAWES County/City Case No: 17-13355

Percolation Test Conversion to Infiltration Rate

The conversion equation used is:

$$I_T(in/hr) = \frac{dH(in) \times 60\ (min/hr) \times r(in)}{dt(min) \times [r(in) + 2H_{AVG}(in)]}$$

Hole Radius	$r =$	4.00	inches
Time Interval	$dt =$	30.00	minutes
Initial height of water during selected time interval	$H_0 =$	20.00	inches
Final Height of water during selected time interval	$H_f =$	19.00	inches
Change in height of water during selected time interval	$dH =$	1.00	inches
Average head height over the selected time interval	$H_{AVG} =$	19.50	inches
Converted infiltration rate per test data	$I_T =$	0.19	inches/hour

Comments

Porchet Method - Conversion of Percolation Rate to Infiltration Rate	Perc Test TEST 2 Average	Legend	Required Entry / Calculated Entry

Company Name: AM/PAC AND ASSOCIATES, INC. Date: 12/9/2017

Designed By: BALLINGER/HAWES County/City Case No: 17-13355

Percolation Test Conversion to Infiltration Rate

The conversion equation used is:

$$I_T(\text{in/hr}) = \frac{dH(\text{in}) \times 60\ (\text{min/hr}) \times r(\text{in})}{dt(\text{min}) \times [r(\text{in}) + 2H_{AVG}(\text{in})]}$$

Hole Radius	$r =$	4.00	inches
Time Interval	$dt =$	30.00	minutes
Initial height of water during selected time interval	$H_0 =$	20.00	inches
Final Height of water during selected time interval	$H_f =$	19.00	inches
Change in height of water during selected time interval	$dH =$	1.00	inches
Average head height over the selected time interval	$H_{AVG} =$	19.50	inches
Converted infiltration rate per test data	$I_T =$	0.19	inches/hour

Comments

Porchet Method - Conversion of Percolation Rate to Infiltration Rate	Perc Test TEST 3 Average	Legend	Required Entry / Calculated Entry

Company Name: AM/PAC AND ASSOCIATES, INC. Date: 12/9/2017

Designed By: BALLINGER/HAWES County/City Case No: 17-13355

Percolation Test Conversion to Infiltration Rate

The conversion equation used is:

$$I_T(\text{in/hr}) = \frac{dH(\text{in}) \times 60\ (\text{min/hr}) \times r(\text{in})}{dt(\text{min}) \times [r(\text{in}) + 2H_{AVG}(\text{in})]}$$

Hole Radius	$r =$	4.00	inches
Time Interval	$dt =$	30.00	minutes
Initial height of water during selected time interval	$H_0 =$	20.00	inches
Final Height of water during selected time interval	$H_f =$	19.10	inches
Change in height of water during selected time interval	$dH =$	0.90	inches
Average head height over the selected time interval	$H_{AVG} =$	19.55	inches
Converted infiltration rate per test data	$I_T =$	0.17	inches/hour

Comments

Porchet Method - Conversion of Percolation Rate to Infiltration Rate	Perc Test TEST 4 Average	Legend	Required Entry / Calculated Entry

Company Name: AM/PAC AND ASSOCIATES, INC. Date: 12/9/2017

Designed By: BALLINGER/HAWES County/City Case No: 17-13355

Percolation Test Conversion to Infiltration Rate

The conversion equation used is:

$$I_T(\text{in/hr}) = \frac{dH(\text{in}) \times 60\ (\text{min/hr}) \times r(\text{in})}{dt(\text{min}) \times [r(\text{in}) + 2H_{AVG}(\text{in})]}$$

Hole Radius	$r =$	4.00	inches
Time Interval	$dt =$	30.00	minutes
Initial height of water during selected time interval	$H_0 =$	20.00	inches
Final Height of water during selected time interval	$H_f =$	19.00	inches
Change in height of water during selected time interval	$dH =$	1.00	inches
Average head height over the selected time interval	$H_{AVG} =$	19.50	inches
Converted infiltration rate per test data	$I_T =$	0.19	inches/hour

Comments

Porchet Method - Conversion of Percolation Rate to Infiltration Rate	Perc Test TEST 5 Average	Legend	Required Entry / Calculated Entry

Company Name: AM/PAC AND ASSOCIATES, INC. Date: 12/9/2017

Designed By: BALLINGER/HAWES County/City Case No: 17-13355

Percolation Test Conversion to Infiltration Rate

The conversion equation used is:

$$I_T(\text{in/hr}) = \frac{dH(\text{in}) \times 60\ (\text{min/hr}) \times r(\text{in})}{dt(\text{min}) \times [r(\text{in}) + 2H_{AVG}(\text{in})]}$$

Hole Radius	$r =$	4.00	inches
Time Interval	$dt =$	30.00	minutes
Initial height of water during selected time interval	$H_0 =$	20.00	inches
Final Height of water during selected time interval	$H_f =$	19.00	inches
Change in height of water during selected time interval	$dH =$	1.00	inches
Average head height over the selected time interval	$H_{AVG} =$	19.50	inches
Converted infiltration rate per test data	$I_T =$	0.19	inches/hour

Comments

Porchet Method - Conversion of Percolation Rate to Infiltration Rate	Perc Test TEST 6 Average	Legend	Required Entry / Calculated Entry

Company Name: AM/PAC AND ASSOCIATES, INC. Date: 12/9/2017

Designed By: BALLINGER/HAWES County/City Case No: 17-13355

Percolation Test Conversion to Infiltration Rate

The conversion equation used is:

$$I_T(\text{in/hr}) = \frac{dH(\text{in}) \times 60\ (\text{min/hr}) \times r(\text{in})}{dt(\text{min}) \times [r(\text{in}) + 2H_{AVG}(\text{in})]}$$

Hole Radius	$r =$	4.00	inches
Time Interval	$dt =$	30.00	minutes
Initial height of water during selected time interval	$H_0 =$	20.00	inches
Final Height of water during selected time interval	$H_f =$	19.00	inches
Change in height of water during selected time interval	$dH =$	1.00	inches
Average head height over the selected time interval	$H_{AVG} =$	19.50	inches
Converted infiltration rate per test data	$I_T =$	0.19	inches/hour

Comments

Porchet Method - Conversion of Percolation Rate to Infiltration Rate	Perc Test TEST 7 Average	Legend	Required Entry / Calculated Entry

Company Name: AM/PAC AND ASSOCIATES, INC. Date: 12/9/2017

Designed By: BALLINGER/HAWES County/City Case No: 17-13355

Percolation Test Conversion to Infiltration Rate

The conversion equation used is:

$$I_T(\text{in/hr}) = \frac{dH(\text{in}) \times 60\ (\text{min/hr}) \times r(\text{in})}{dt(\text{min}) \times [r(\text{in}) + 2H_{AVG}(\text{in})]}$$

Hole Radius	r =	4.00	inches
Time Interval	dt =	30.00	minutes
Initial height of water during selected time interval	H_0 =	20.00	inches
Final Height of water during selected time interval	H_f =	19.10	inches
Change in height of water during selected time interval	dH =	0.90	inches
Average head height over the selected time interval	H_{AVG} =	19.55	inches
Converted infiltration rate per test data	I_T =	0.17	inches/hour

Comments

Porchet Method - Conversion of Percolation Rate to Infiltration Rate	Perc Test TEST 8 Average	Legend	Required Entry / Calculated Entry

Company Name: AM/PAC AND ASSOCIATES, INC. Date: 12/9/2017

Designed By: BALLINGER/HAWES County/City Case No: 17-13355

Percolation Test Conversion to Infiltration Rate

The conversion equation used is:

$$I_T(\text{in/hr}) = \frac{dH(\text{in}) \times 60\ (\text{min/hr}) \times r(\text{in})}{dt(\text{min}) \times [r(\text{in}) + 2H_{AVG}(\text{in})]}$$

Hole Radius	r =	4.00	inches
Time Interval	dt =	30.00	minutes
Initial height of water during selected time interval	H_0 =	20.00	inches
Final Height of water during selected time interval	H_f =	19.00	inches
Change in height of water during selected time interval	dH =	1.00	inches
Average head height over the selected time interval	H_{AVG} =	19.50	inches
Converted infiltration rate per test data	I_T =	0.19	inches/hour

Comments

APPENDIX – C

ASSESSORS MAP COPY

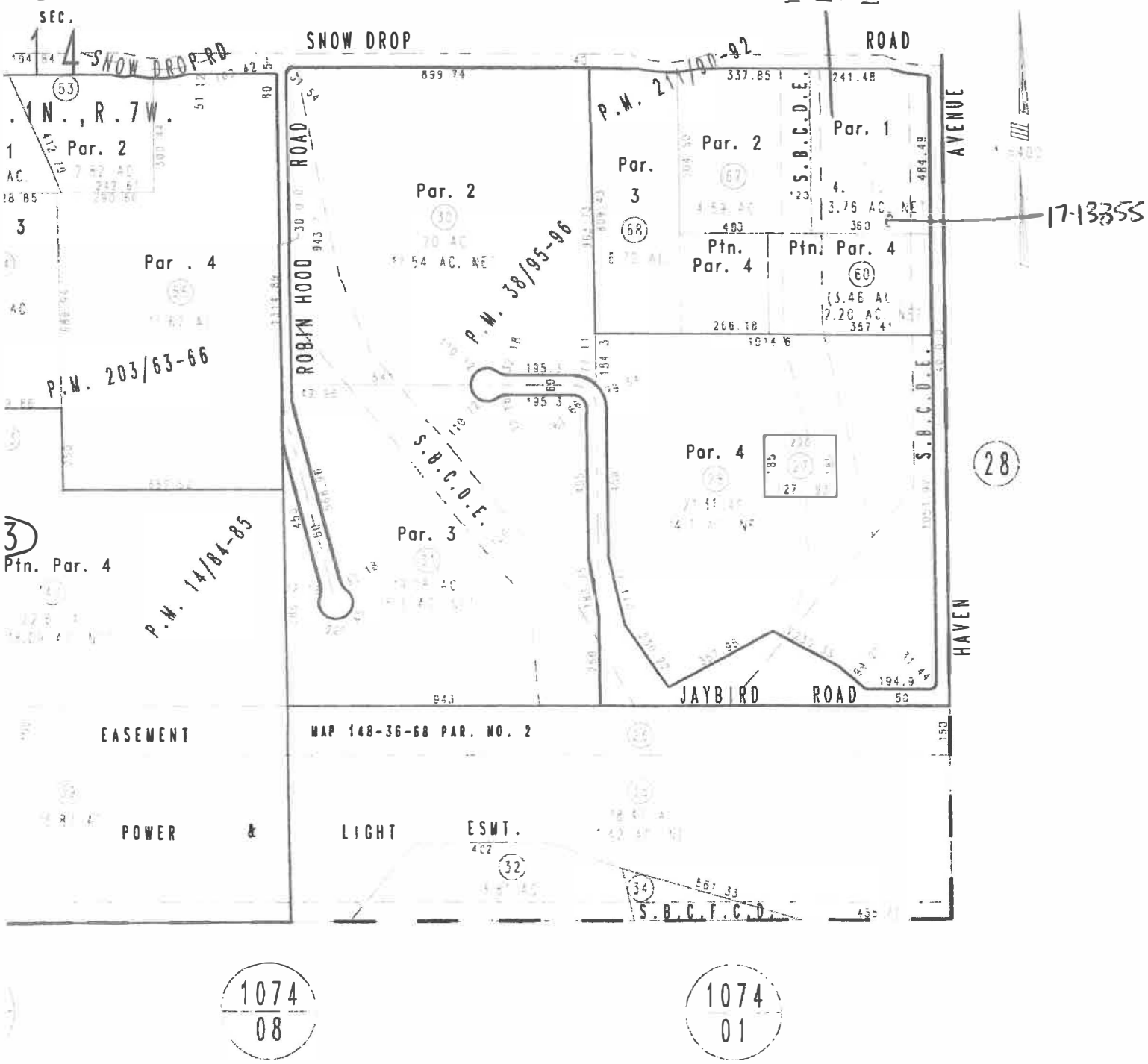
SITE PLAN BY CUBIT ENG.

., S.B.B.&M.

Alta Loma
Tax Rate Area
52021

0201 - 04

17-13322
17-13319
17-13320
17-13321



Assessor's Map
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San Bernardino County