

TRIP REPORT

Date: October 25, 2016

To: Tim Dunaway, P.E.

From: Scott Anderson, Hydrogeologist

Subject: Summary of Soil Infiltration Tests
Doylesburg Station
Sunoco PPP
Toboyne Township, Perry County, Pennsylvania

This trip report provides results of soil infiltration tests that were completed at the Doylesburg Station located in Toboyne Township, Perry County, Pennsylvania as part of the Pennsylvania Pipeline Project (PPP) for Sunoco Logistics L.P.

1.0 PURPOSE

This report presents the field data and results of double-ring soil infiltration tests conducted to support stormwater management system design. Two deep tests (IT-3 and IT-4) were performed at the property. Test locations are listed by coordinates in World Geodetic System 84 (WGS 84) latitude and longitude format in Table 1, and locations are also illustrated on a figure attached to this report.

2.0 FIELD ACTIVITIES

The infiltration tests were conducted by Keith Simpson and Jake Marlow of Tetra Tech, Inc., on October 4, 2016. The test locations were positioned in the field using a handheld, WAAS-enabled GPS unit. Table 1 provides the coordinates of the test locations. IT-3 and IT-4 were located near the bottom of a moderately steep slope just outside of the substation fence.

The infiltration tests were performed in accordance with the procedure specified in the 2006 Pennsylvania Stormwater Best Management Practices (BMP) Manual. Double-ring tests were performed. The double-ring test locations were prepared for test locations with the assistance of a mini-excavator, with care taken to minimize disturbance of the soil surface to be tested. The double-ring infiltrometers that were used for testing consisted of 10-inch and 6-inch diameter sections of steel casing. After digging to the target depth, the test surface was leveled, and any loose soil or fallen vegetation was removed. The rings were driven a minimum of 2 inches into the soil. Infiltration test depths are provided on Table 1.

Test locations were pre-soaked for 1 hour. The tests were then conducted with measurements at 30-minute intervals, based on the observed water level drops during the second half of the presoak period. Presoak and test information was recorded on infiltration test sheets; copies of the test sheets are attached to this report.

During the testing, the weather was overcast and cool, approximately 60 degrees Fahrenheit, and no precipitation was observed during the tests. No rain for a period of 24 hours prior to testing was noted.

In addition, test pits were machine-excavated for each testing location to characterize the soil, determine the depth to bedrock, if encountered, and inspect for evidence of a seasonal high water table. The test pits were identified with the corresponding infiltration test name. The test pits were completed to two feet below the target infiltration test depth. Descriptions of the soil from the test pits were recorded by a Tetra Tech geologist on field logs, which were based on the form example in the BMP manual. Copies of the field soil logs are attached to this report.

3.0 RESULTS

3.1 SOILS DESCRIPTION

Soils encountered consisted of thin (8 to 11 inches) brown to dark brown topsoil/surface soil overlying reddish-brown, yellowish-red, and red silty clay loam and silty clay, with weathered parent material noted in the bottom horizons (silty clay horizons) of the test pits. Munsell color classifications for each horizon are provided on attached soil logs. Thin grass roots were encountered in the topsoil/surface soils. Soils were noted to be damp to moist during the excavation activities. No distinct mottling of soils was observed in test pit IT-4; however, mottling was noted at 60 inches below ground surface in test pit IT-3. Seasonal high groundwater was not observed in either test pits. Additionally, bedrock was not encountered. Since seasonally high groundwater was not encountered, the mottling observed is not likely due to the unconfined water table. Rather, the mottling observed is likely a consequence of a seasonal perched zone or slow infiltration of increased precipitation events through the finer grained soils. Table 1 summarizes the depths of the infiltration tests (test pits completed approximately 2 feet deeper than infiltration test depths).

According to United States Department of Agriculture Natural Resources Conservation Service Web Soil Survey¹ data, the soil types for the test locations are mapped as Calvin shaly silt loam (CaC soil symbol), 8 to 15 percent slopes

3.2 INFILTRATION TEST RESULTS

Table 1 summarizes the infiltration rates (inches per hour) calculated from the test data. Infiltration rates presented in Table 1 were calculated from the averaged water level drop of the last four (stabilized) readings measured in the inner ring. The tests exhibited no to very slow infiltration, utilizing a 30-minute test cycle.

¹ <http://websoilsurvey.nrcs.usda.gov/>. Accessed October 4, 2016

TABLE 1
Summary of Infiltration Test Results and Work Locations
Doylesburg Station

Location (IT-#)	Location Data ¹		Test Depth (inches)	Infiltration Test Result (inches per hour)
	LATITUDE WGS 84	LONGITUDE WGS 84		
3	40.28642	-77.61463	48	0
4	40.28659	-77.61436	36	0.031

Note

¹ Field coordinates

In consideration of the infiltration rates for design purposes, a safety factor of 3 is assumed based on the significant presence of silty clay at the test depths. The arithmetic mean of IT-A and IT-B is 0.016 inches per hour (geometric mean could not be determined due to 0 result for IT-A). With application of the safety factor of 3, the resultant recommended rate is essentially 0 inches per hour (0.0052 inches per hour).

ATTACHMENTS

SITE FIGURE

Figure 1

Infiltration Testing Locations
Doylesburg
Soil Type: Calvin Shaly Silt Loam (CaC)
Perry County, PA

Legend

- Infiltration Tests



Google Earth

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1000 ft



INFILTRATION TEST DATA SHEETS



INFILTRATION TEST DATA SHEET

Tetra Tech, Inc.

DOYLESBURG (STATION)

PROJECT NAME: SUNOCO LOGISTICS TEST AREA ID: IT-3
 PROJECT NUMBER: 112 IC05958 - 17 PERSONNEL: K. SIMPSON, J. MARLOW

TEST METHOD: Double Ring Infiltrometer Percolation
 Single Ring Infiltrometer

Location Coordinates or Description:
40.28642 N
-077.61463 W

INNER RING INSIDE DIAMETER/HEIGHT: 6" x 10"
 OUTER RING INSIDE DIAMETER/HEIGHT: 10" x 10"

PERCOLATION HOLE DIAMETER: NA (If performing an open hole perc test)
 DATE(s): 10/4/16

Distance from the bottom of the inner ring/hole to measuring point (minimum water column of 6-8 inches): 7 3/4"

MEASURING POINT: Ring Rim Indicator Mark DEPTH OF TEST: 7 3/4" 4' AGS
KS

TIME	ELAPSED TIME SINCE START OF TEST (minutes)	WATER LEVEL DROP, INNER RING OR PERCOLATION HOLE (inches)	VOLUME OF WATER ADDED AT EACH CYCLE, INNER RING (liters)	REMARKS
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PRESOAK DATA

14:17	0	-----	3.8	
14:47	30	0	0	
15:17	60	0	0	

TEST DATA: 30 MIN TEST

15:17	0 (60)	-----	—	START TEST
15:47	30 (90)	0	0	
16:17	60 (120)	0	0	
16:47	90 (150)	0	0	
17:17	120 (180)	0	0	END TEST, STABLE

NO RAIN OVER THE LAST 25 HRS.

SEE ALSO PHOTOS & SOIL LOG



INFILTRATION TEST DATA SHEET

Tetra Tech, Inc.

DOYLESBURG (STATION)

PROJECT NAME: SUNOCO LOGISTICS TEST AREA ID: IT-4
 PROJECT NUMBER: 112IC05958-17 PERSONNEL: K. SIMPSON, J. MARLOW

TEST METHOD: Double Ring Infiltrometer Percolation
Single Ring Infiltrometer

INNER RING INSIDE DIAMETER/HEIGHT: 6" X 10"
 OUTER RING INSIDE DIAMETER/HEIGHT: 10" X 10"

Location Coordinates or Description:
40.28659 N
-077.61436 W

PERCOLATION HOLE DIAMETER: NA (If performing an open hole perc test)

DATE(s): 10/4/16

Distance from the bottom of the inner ring/hole to measuring point (minimum water column of 6-8 inches): 7"

MEASURING POINT: Ring Rim Indicator Mark DEPTH OF TEST: 3' BGS

TIME	ELAPSED TIME SINCE START OF TEST (minutes)	WATER LEVEL DROP, INNER RING OR PERCOLATION HOLE (inches)	VOLUME OF WATER ADDED AT EACH CYCLE, INNER RING (liters)	REMARKS
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PRESOAK DATA

1525	0	-----	3.5	
1535	30	0	0	
1625	60	0	0	

TEST DATA 30 MIN TEST

1625	0 (80)	-----	---	START TEST
1655	30 (90)	0	0	
1725	60 (120)	1/16	0.04	(40 ML)
1755	90 (150)	0	0	
1825	120 (180)	0	0	END TEST, STABLE

NO RAIN OVER THE LAST 24 HRS

SEE ALSO PHOTOS of SOIL LOG

Doylesburg Station		Test Loc. IT-3 (Deep - 4' Deep)	10/4/2016	
Time	Elapsed Time (minutes)	Water Level Drop (in)	Volume of Water Added (L)	
1517	0	0.000	0.000	
1547	30	0.000	0.000	
1617	60	0.000	0.000	
1647	90	0.000	0.000	
1717	120	0.000	N/A	
				Infiltration Rate
				Average Stabilized Rate (in/hr)
				0.00

Doylesburg Station		Test Loc. IT-4 (Deep Test - 3' Deep)	10/4/2016	
Time	Elapsed Time (minutes)	Water Level Drop (in)	Volume of Water Added (L)	
1625	0	0.000	0.000	
1655	30	0.000	0.000	
1725	60	0.063	0.040	
1755	90	0.000	0.000	
1825	120	0.000	N/A	
				Infiltration Rate
				Average Stabilized Rate (in/hr)
				0.031

SOIL LOGS



Soil Log

Tested By: Jack Merlow

Project: Sunoco - PPP

Project No.: 112IC05958

Test Pit: Doylestown IT-3

Date: 10/4/16

Elevation: ~ 940

Equipment Used Mini Excavator

Geology: Bloomsburg and Mifflintown Formations

Soil Type: Calvin shaly silt loam (CaC)

Land Use: Maintained Grass

Weather: 60% Cloudy

Additional Comments

Mini Excavator to 72"

Horizon	Upper Boundary	Lower Boundary	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Color	Color Patterns	Pores, Roots, Rock Structure	Depth to Bedrock	Depth to Water	Comments
O/A	0"	8"	Silty Clay loam	Clay w/ trace silt and fine sand	7.5YR 4/6	Solid	Pores, Roots	-	-	Dump < 1" of Organic Debris to top soil
B	8"	53"	Silty Clay	Fine trace silt w/ clay	5YR 4/6	Solid	Few pores	-	-	Moist
C	53"	72"	Silty Clay	Clay w/ trace fine silt, weathered Bedrock	2.5YR 4/6	Mottling at 60" 2.5Y 8.5/2	No Pores Few	-	-	Moist Mottling > 60"

Horizon:	USDA Definition	Soil Textural Class	Boundary	Notes:
O	Organic debris	Use ternary diagram from US Department of Agriculture Soil Conservation Service	Use depth and classification	- No Refusal - Did Not Encounter seasonal High Groundwater - < 0.5" of Rain in Past 24 hours
A	Dark colored, mixed mineral organic matter		Classification as Follows: Abrupt	
B	Maximum accumulation of silicate clay minerals		Clear	
C	Weathered parent material		Gradual	
R	Layer of consolidated rock beneath the soil		Diffuse	

Table based on: Sample soil log located on page 12 of the Pennsylvania Stormwater Best Management Practices Manual
 USDA Definitions located from: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054308



Soil Log

Tested By: Jake Murlain

Project: Sunoco - PPP

Project No.: 112IC05958

Test Pit: Doylestown ET-4 Date: 10/4/16

Elevation: ~940

Equipment Used Mini Excavator

Geology: Bloomsburg and Mifflintown Formations Soil Type: Calvin shaly silt loam (CAC)

Land Use: Maintained Grass

Weather: 60's Cloudy

Additional Comments

Mini Excavator to 60"

Horizon	Upper Boundary	Lower Boundary	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Color	Color Patterns	Pores, Roots, Rock Structure	Depth to Bedrock	Depth to Water	Comments
O/A	0"	11"	Silty Clay	Fine silt w/ Major clay	7.5 YR 3/3	Solid	Pores, Roots	-	-	Damp to Moist
B	11"	48"	Silty clay loam	Clay w/ Fine silt and trace Fine sand	5YR 4/4	Solid	Few pores Few roots	-	-	Moist
C	48"	60"	Silty Clay	Clay w/ Fine silt weathered parent material	5YR 4/6	Solid	Few pores > 1/4" rock fragments	-	-	Moist

Horizon:	USDA Definition	Soil Textural Class	Boundary	Notes:
O	Organic debris	Use ternary diagram from US Department of Agriculture Soil Conservation Service	Use depth and classification	- Did Not Encounter Seasonal High Groundwater - No Refusal - < 0.5" of Retn in past 24 hours
A	Dark colored, mixed mineral organic matter		Classification as Follows:	
B	Maximum accumulation of silicate clay minerals		Abrupt	
C	Weathered parent material		Clear	
R	Layer of consolidated rock beneath the soil		Gradual	
			Diffuse	

Table based on: Sample soil log located on page 12 of the Pennsylvania Stormwater Best Management Practices Manual
 USDA Definitions located from: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054308