TRIP REPORT
MORGANTOWN ROAD VALVE SITE – INFILTRATION TESTING

1.0 PURPOSE

This Trip Report presents the field data and results of double-ring soil infiltration tests conducted to support the design of a stormwater management system at the Morgantown Road Valve site located in Robeson Township, Berks County, Pennsylvania, as part of the Pennsylvania Pipeline Project (PPP) for Sunoco Pipeline, LP. Four shallow tests (IT-A through IT-D) were performed at the site. The test locations are listed by coordinates (latitude and longitude) in Table 1 and shown on the attached figure.

2.0 FIELD ACTIVITIES

The infiltration tests were conducted by Mark Mengel and Jim Coffman of Tetra Tech, Inc., on October 13, 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. All four tests were located in a wooded area, ranging approximately 20-150 feet south of Morgantown Road.

The infiltration tests were performed in accordance with the procedure specified in the 2006 Pennsylvania Stormwater Best Management Practices (BMP) Manual. The test locations were prepared with hand tools, and care was taken to minimize disturbance of the soil surface to be tested. Double-ring infiltrometers were used for testing and consisted of 10-inch diameter and 6-inch diameter sections of steel casing, each 10 inches in height. After digging to the target depth, the test surface was leveled, and loose soil and debris were removed. The rings were driven a minimum of 2 inches into the soil. The infiltration test depths are presented in Table 1.

Test locations were pre-soaked for 1 hour. The tests were then conducted with measurements at 10-minute or 30-minute intervals, based on the observed water level drops during the last half of the pre-soak period. Pre-soak and test information was recorded on infiltration test data sheets; copies of the test data sheets are attached to this report.

During the testing, the weather was overcast, approximately 55 degrees Fahrenheit, and no precipitation was observed during the time of testing. Additionally, less than 0.5 inches of precipitation was observed 24 hours prior to testing.

A hand auger was utilized to characterize the soil, determine the depth to bedrock, if encountered, and inspect for evidence of the seasonal high water table near the test areas. This was completed from the ground surface down to two feet below the target infiltration test depth. Descriptions of the soil were documented on field logs, which were based on the form example in the BMP manual. Copies of the soil logs are attached to this report.

3.0 RESULTS

3.1 Soil Description

Soils encountered generally consisted of a dark brown (7.5YR 3/2) sandy loam topsoil/surface layer which ranged in thickness from 6 inches (IT-C and IT-D) to 27 inches (IT-A and IT-B). In test units IT-C and IT-D an illuvial layer was found from approximately 6-27 inches below ground surface and consisted of a dark yellowish brown (10YR 4/4) loamy sand in which clay increased with depth. Rock content within the soil profile consisted of many rock fragments ranging up to large cobbles and small boulders. Bedrock was not encountered.

Seasonal high water was not observed at the testing location, nor was any mottling observed.

According to United States Department of Agriculture Natural Resources Conservation Service Web Soil Survey data, the soil type for the test locations is mapped as follows:

- Joanna Loam - (JpD soil symbol) with 8-25 percent slopes; with medium runoff and is well drained.

3.2 Infiltration Tests 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 average water level drop of the last four stabilized readings measured in the inner ring.

The pre-soak test results for IT-A and IT-B (shallow) indicated a very high infiltration rate, requiring 5 minute test cycles; whereas, the pre-soak test results for IT-C and IT-D (shallow) indicated a high infiltration rate, requiring 10 minute test cycles.

Table 1
Summary of Infiltration Test Results
Morgantown Road Valve
Robeson Township, Berks County, PA
Sunoco PPP

Test Location (IT-)	Location Data		Test Depth (inches)	Infiltration Test Result (inches/hour)
	LATITUDE	LONGITUDE		
IT-A (shallow)	40.1887322°	- 075.8815041°	3	28.31
IT-B (shallow)	40.1889117°	- 075.8817738°	4	24.94
IT-C (shallow)	40.1890367°	- 075.8817888°	4	15.66
IT-D (shallow)	40.1889250°	- 075.8815602°	3	17.63

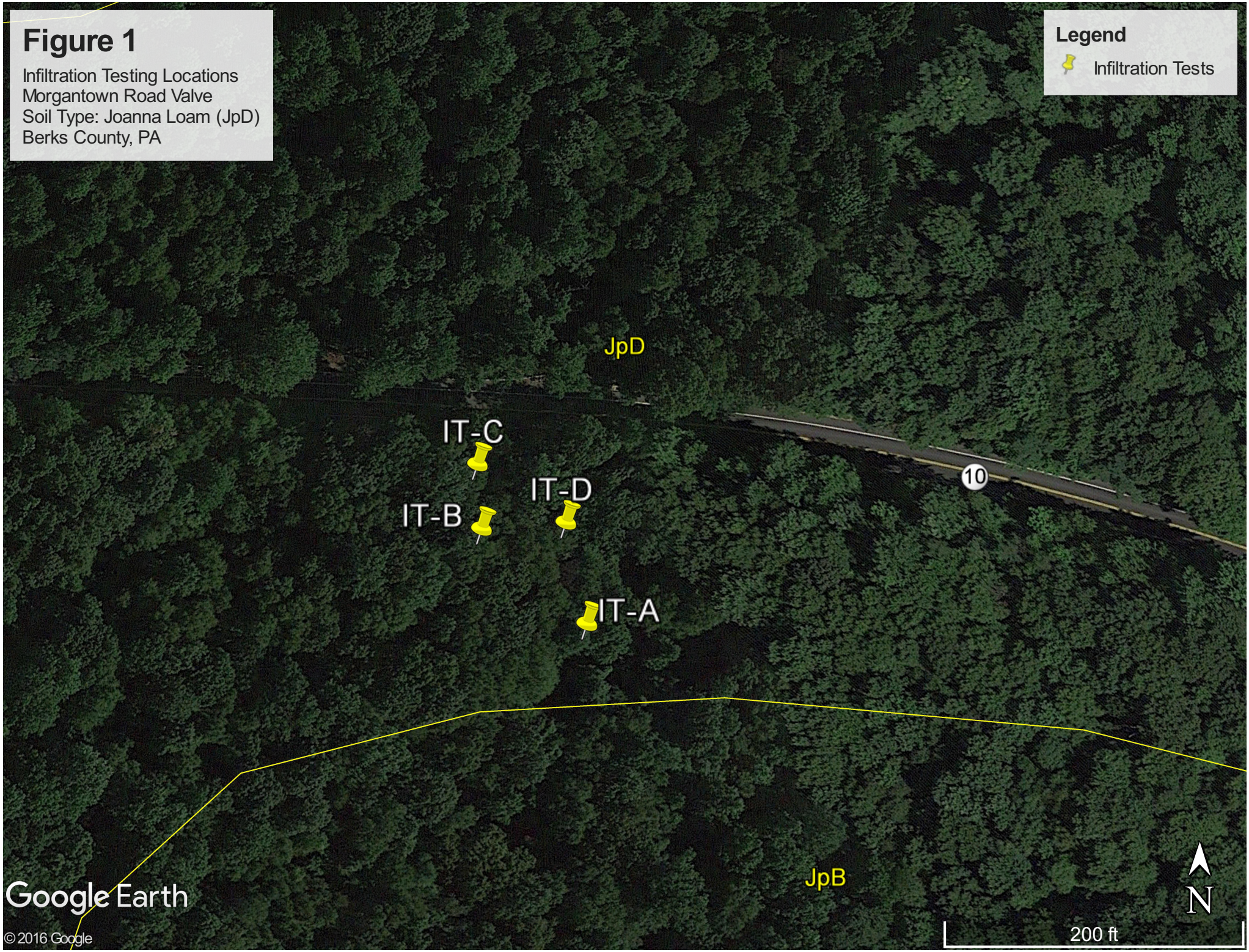
Figure 1
Infiltration Testing Locations
Morgantown Road Valve
Soil Type: Joanna Loam (JpD)
Berks County, PA
Legend
Infiltration Tests
JpD
IT-C
IT-D
IT-B
IT-A
10
JpB
N
200 ft
Google Earth
© 2016 Google

ATTACHMENTS

SOIL LOGS

TETRA TECH

Soil Log

Tested By: J. Coffman **Project:** Sunoco Mariner E2 **Project No.:** 112IC05958

Test Pit: A (Morgantown Rd) **Date:** 10/13/16 **Elevation:** **Equipment Used:** hand auger

Geology: soil **Soil Type:** silty sand **Land Use:** wooded/undeveloped **Weather:** Cloudy 60s

Additional Comments

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
A	0"	27"	silty sand	many rock frags (55) cobble & boulder size	DK Brn 7.5YR 3/2	solid	tree roots	—	—	lightly 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	
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

TETRA TECH

Soil Log

Tested By: J. Coffman **Project:** Sunoco Mariner E2 **Project No.:** 112IC05958

Test Pit: B (Morgantown Rd) **Date:** 10/13/16 **Elevation:** _____ **Equipment Used** hand auger

Geology: soil **Soil Type:** silty sand **Land Use:** wooded/undeveloped **Weather:** Cloudy 60s

Additional Comments _____

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
A	0"	27"	silty sand	many rock fragg (ss) cobble & boulders	Dk Bwn 7.5YR 3/2	Solid, nomottling	tree roots	—	—	lightly 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	
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

TETRA TECH

Soil Log

Tested By: J. Coffman
Test Pit: C (Morgantown Rd) Date: 10/13/16
Geology: Soil Soil Type: Sand

Project: Sunoco Mariner E2 Project No.: 112RC05958
Elevation:
Land Use: wooded/undeveloped Equipment Used hand auger
Weather: Cloudy 60s

Additional Comments

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
A	0"	6"	silty sand	many rock frags (SS cobbles boulders)	DK Brn 7.5YR 3/2	solid color, no mottling	tree roots	—	—	lightly moist
B	6"	8"	loamy sand	"	Red-Brn 10R 4/4	"	"	—	—	"
B	8"	27"	clayey sand	"	"	"	"	—	—	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	
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

TETRA TECH

Soil Log

Tested By: J. Coffman
Test Pit: D (Morgantown Rd) Date: 10/13/16
Geology: Soil Soil Type: Sand

Project: Sunoco Mariner E2 Project No.: 112IC05958
Elevation: Equipment Used: hand auger
Land Use: wooded/undeveloped Weather: Cloudy 60s

Additional Comments

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
A	0	6"	silty Sand	many rock frag (ss) cobble & boulders, 2"	DK Brn 7.5YR 3/2	soil: no mottling	free roots	—	—	Lightly moist
B	6"	27"	loamy Sand	"	Red-Brn 10R 4/4	"	"	—	—	"

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	
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

INFILTRATION TEST DATA SHEETS

INFILTRATION TEST DATA SHEET

Tetra Tech, Inc.

PROJECT NAME: SUNOCO MORGANTOWN RD
PROJECT NUMBER: 112C05958
TEST AREA ID: Morgantown IT-A
PERSONNEL: Mark Mengel

TEST METHOD: (Double Ring Infiltrometer) Percolation
(Single Ring Infiltrometer)

Location Coordinates or Description:
40.1887322
-075.8815041

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

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

DATE(s): 10/13/16 Rainfall within last 24 hrs < 0.5"

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"

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
PRESOAK DATA				
1439	0	----------	4.2 L	dropped 4" After 5 min Refilled;
1509	30	dry	4.2 L	2.1 L - 1449 Refill Another 2.1L;
1539	60			1500 Added 2.1 L (9" drop);
				1506 dry Refilled
				1519 6" Refilled (3L)
TEST DATA				
1625		----------		1527 6" Refilled (3L)
1630	5	2 8/16	1.4 L	1532 4" drop (Add 2.1 L)
1635	10	2 7/16	1.4 L	
1640	15	2 6/16	1.3 L	
1645	20	2 5/16	1.3 L	END OF TEST
1650	25	2 5/16	-	" " "

INFILTRATION TEST DATA SHEET

Tetra Tech, Inc.

PROJECT NAME: Sunoco Mariner E 2 TEST AREA ID: Morgantown Rd b ✗
PROJECT NUMBER: 112IC05958 PERSONNEL: J Coffman

TEST METHOD: (Double Ring Infiltrometer) Percolation
Single Ring Infiltrometer

INNER RING INSIDE DIAMETER/HEIGHT: 6 11
OUTER RING INSIDE DIAMETER/HEIGHT: 10 11

Location Coordinates or Description: woods, slight slope
40.18891M
-075.8817730

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

DATE(s): 10/13/16 Rainfall within last 24 hrs < 0.5"

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: 4"

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
PRESOAK DATA				
1458	0	----------	4.2	15:03 - WL @ 3" - ref.11 (2.1L)
				15:07 - WL @ 3 9/16 - ref.11 1.9L
1528	30	3 3 3/16	17	15:12 - WL @ 2" - ref.11 2.7L
				15:16 WL @ 3" - ref.11 2.2L
~~1558~~	Break to get more water			15:19 " " @ 3" ref.11 2.2L
				15:23 WL @ 3" ref.11 2.2L
1622	30	3 3 3/16	4.2	15:27 WL @ 2" ref.1/ 2.7L
1652	60	14	7.8	15:38 WL drop ~~1 9/16"~~ 2 13/16
TEST DATA				16:30 WL @ 3" ref.11 2.2L
1652	0	----------		16:36 WL @ 4" ref.11 1.7L
				16:48 WL @ 3" ref.11 2.2L
1657	5	2 0/16	0.9	16:52 WL @ 4" ref.11 1.7L
1702	10	2 2/16	0.8	
1707	15	2 0/16	0.8	
1712	20	2 2/16	1.0	
1717	25	2 1/16	—	end of test

INFILTRATION TEST DATA SHEET

Tetra Tech, Inc.

PROJECT NAME: Sunoco Mariner E2 TEST AREA ID: Morgantown Rd C
PROJECT NUMBER: 112Ic05458 PERSONNEL: J. Coffman

TEST METHOD: (Double Ring Infiltrometer) Percolation
Single Ring Infiltrometer

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

Location Coordinates or Description:
woods, slight slope
40.1890367
-075.8817888

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

DATE(s): 10/13/16 Rainfall within last 24 hr: <0.5"

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: 4"

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
PRESOAK DATA				
1506	0	----------	4.2	15:11 WL @ 3" ref. 11 2.3L
1536	30	1 9/16	10	15:16 WL @ 4" " " 1.7L
~~1606~~	Break to get more water			15:19 WL 4" " "
				15:22 WL 4" ref. 11 1.7L
1620	30			15:27 WL 3" ref. 11 2.3L
				15:36 WL 4 3/16 break to get H2O
1650	60	9 10/16	5.6	16:29 WL @ 4" ref. 11 1.7L
TEST DATA				16:38 WL @ 4" ref. 11 1.7L
				16:48 WL @ 4" ref. 11 1.7L
				16:50 drop down = 10/16 0.5L added
1650	0	----------		
~~1660~~ 1700	10	2 11/16	1.4L	
1718	20	2 10/16	1.4L	
1720	30	2 9/16	1.3L	
1730	40	2 9/16	—	end of test

INFILTRATION TEST DATA SHEET

Tetra Tech, Inc.

PROJECT NAME: Sunoco PPP Morgantown RD
PROJECT NUMBER: 112IC05958
TEST AREA ID: Morgantown Rd IT-D
PERSONNEL: Mark Mengel

TEST METHOD: ~~Double Ring Infiltrometer~~ Percolation
Single Ring Infiltrometer

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

Location Coordinates or Description:
40.1889250
-075.8815602

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

DATE(s): 10/13/16 Rainfall within last 24 hrs < 0.5"

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"

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
PRESOAK DATA				
1447	0	----------	4.2	1453 Added 2.1 L (9" drop)
1517	30	4 9/16	5 L	1505 Added 3.4 L (4+" drop)
1547	60			1527 Added 3 L (4+" drop)
				1534 4" drop (Added 2.1L)
				1539 4" drop (Added 2.1L)
TEST DATA				
1700	0	----------	4.2 L	
1710	10	3 0/16	1.5L	
1720	20	3 0/16	1.5L	
1730	30	2 14/16	1.4L	
1740	40	2 14/16	–	END OF TEST