

McDowell & Associates

Geotechnical, Environmental & Hydrogeological Services • Materials Testing & Inspection

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October 7, 2025

K&M Investments
1035 Colliers Court
Oakland Township, Michigan 48363

Job No. 25-442

Attention: Mr. Mike Lekocaj

Subject: Infiltration Study
Proposed Stormwater Management System
1150 East Avon Road
Rochester Hills, Michigan

Dear Mr. Lekocaj:

In accordance with your request, we have performed an Infiltration Study at the subject site. The purpose of this study is to evaluate infiltration capabilities of the subsoils relative to the proposed stormwater management system. Our findings are presented below.

It has been proposed to incorporate an “infiltration to the ground” component to the stormwater management system for the development. Therefore, test pit excavations were performed in general accordance with the county criteria. The excavations were performed by Holsbeke Construction, and the infiltration tests were conducted by McDowell & Associates’ personnel: Ahmad Srour.

Field Work & Laboratory Testing

Four Test Pits, designated as TP-1 through TP-4, were excavated in the approximate locations indicated on the accompanying Test Pit Location Plan and were extended to depths ranging from eight feet (8’) to ten feet (10’) below the existing ground surface. Descriptions of the soil and groundwater conditions encountered in the test pits may be found on the Test Pit Log sheets which accompany this report.

Following completion of the test pit excavations, each test pit was prepared for infiltration testing with double ring infiltrometers. Infiltration test preparation consisted of excavating a soil bench adjacent to each primary test pit excavation. The test pits were benched at depths ranging from three feet six inches (3’6”) to five feet six inches (5’6”) below the existing ground surface. Due to the encountered groundwater level being at or above the presumed stormwater management invert, the test pits were performed above the presumed depth. On the benched soil, two double ring infiltrometers with open bottoms were embedded into the soil at a depth of about two inches (2”) into the soil bench. Extra care was exercised to maintain a good seal between the steel tubing and in-situ soils to prevent loss of test water. Following installation of the one or two infiltrometers, a thin needle-punch geotextile filter was placed above the soil in the inner ring of each infiltrometer, and the pipes were filled with about five inches (5”) of potable water to initiate the “soak period”. Additional information pertaining to infiltration test depths, infiltrometer configurations and soak period durations may be found on the accompanying Test Pit Log sheets.

Once the appropriate soak period duration was maintained in each infiltrometer, the casings were refilled with potable water and the infiltration test was initiated. Throughout the course of testing, water level readings within the inner ring of the infiltrometers were obtained and recorded at specific time intervals. It should be noted that water level readings were taken to the nearest sixteenth of an inch (1/16"). Water level readings from each infiltration test may be found on the Test Pit Log sheets.

A representative soil sample was obtained at the test locations. Laboratory tests for moisture content and grain-size distribution were performed on the grab samples obtained from the infiltration test locations. Test results are provided on the accompanying Sieve Analysis sheet.

Soil descriptions and depths shown on the test pit logs are approximate indications of change from one soil type to another and are not intended to represent an area of exact geologic change or stratification. Due to their manner(s) of deposition, the transition from one soil type to the next may be gradual rather than abrupt. Also, the site has existing structures and shows some signs of modification which could indicate fill and soil conditions different from those encountered at the test pit locations.

Groundwater Conditions

Groundwater was encountered in each of the test pits at depths ranging from five feet six inches (5'6") to eight feet six inches (8'6"). After a period of about an hour, all of the test pits were found to have caved in due to instability of the loose granular soils. It should be noted that short-term groundwater observations may not provide a reliable indication of the depth of the water table. Water levels in granular soils fluctuate with seasonal and climatic changes as well as the amount of rainfall in the area immediately prior to the measurements. It should be expected that groundwater fluctuations could occur on a seasonal basis.

Infiltration Test Results & Recommendations

It is understood that the proposed project consists of installing an underground detention system with an invert extending roughly eight feet (8') below the existing ground surface. To be suitable for infiltration, it is understood that a minimum infiltration rate of 0.24 in/hr is required by the county along with a minimum clearance between the invert of the proposed stormwater management system and the seasonal high water table of at least two feet (2').

Based on the indications from the test pits, it appears that the proposed underground detention system is not suitable for infiltration at the proposed depth due to a relatively high water table. The tests performed above proposed depth resulted in average unfactored infiltration rates ranging from 14.49 in/hr to 48.40 in/hr. It is our recommendation that a minimum factor of safety of two or a maximum infiltration rate of 10.0 in/hr be utilized for design. Considering this, Test Pits TP-1 through TP-3 would result in design infiltration rates of 10.0 in/hr and TP-4 would result in a design rate of 7.2 in/hr.

It is recommended that any proposed infiltration surface be visually inspected upon excavation to verify that appropriate soils are present. This would be done to ensure that significant variations in either soil texture or soil type do not exist at locations other than those actually tested by the test pits.

Conclusions

It should be noted that the test pits performed on this date were backfilled with uncompacted material. If future structures are to be constructed so that pavements are to be supported by the uncompacted fill from the test pits, the test pit locations should be re-excavated and filled with compacted material. Therefore, you may wish to have the test pit locations placed on any development plans.

An infiltration investigation was performed at the site via test pit excavations. Recommendations for infiltration rates at specific areas of the site have been presented herein. Experience indicates that actual subsurface conditions at the site could vary from those found at the four test pits made at specific locations. It is, therefore, essential that McDowell & Associates be notified of any variation of soil conditions to determine their effects on the recommendations presented in this report.

If you have any questions or need additional information, please do not hesitate to call.

Very truly yours,

McDOWELL & ASSOCIATES



David Quintal, P.E.
Senior Engineer



Loran Stenzel-Sebastian
Staff Geologist

LS/jb

Enclosures: Test Pit Log sheets (4 pp)
 Sieve Analysis sheet (1 p)
 Test Pit Location Plan (1 p)



Test Pit Log

Test Pit #: 1

Job Number: 25-442

Date: 10/1/2025

Project: Infiltration Study

Weather: Temperature > 32 degrees

Location: 1150 East Avon Road
Rochester Hills, Michigan

Ground Elev.: N/A

Soil Stratigraphy:	Pipe Installation #1
0'0" - 0'8" Moist dark brown sandy TOPSOIL with roots 0'8" - 8'6" Moist brown fine SAND with trace of silt and oxidized sand layers 8'6" - 9'0" Wet gray silty fine to medium SAND	Soil Depth: <u>5'6"</u> Inner Pipe Dia.: <u>0'6"</u> Outer Pipe Dia.: <u>0'10"</u> Embedment: <u>0'2"</u> Stick-up: <u>0'5"</u>
	Pipe Installation #2
	Soil Depth: <u>5'6"</u> Inner Pipe Dia.: <u>0'6"</u> Outer Pipe Dia.: <u>0'10"</u> Embedment: <u>0'2"</u> Stick-up: <u>0'5"</u>
	Pipe Distance: <u>3'0"</u>

Groundwater Observations
Groundwater Encountered at: <u>8'6"</u>
Groundwater after 1 hr: <u>caved-in</u>

Soak Period (Pipe #1)	Soak Period (Pipe #2)
Start Date: _____ Notes: <u>minutes: seconds</u> Time: <u>6:37</u> Water Drop: <u>5.00</u> inches Notes: _____ Time: <u>6:43</u> Water Drop: <u>5.00</u> inches Notes: _____	Start Date: _____ Notes: <u>minutes: seconds</u> Time: <u>6:50</u> Water Drop: <u>5.00</u> inches Notes: _____ Time: <u>7:16</u> Water Drop: <u>5.00</u> inches Notes: _____

Test Period (Pipe #1)	Test Period (Pipe #2)
Time: <u>6:54</u> Water Drop: <u>5.00</u> inches Notes: _____ Time: <u>7:05</u> Water Drop: <u>5.00</u> inches Notes: _____ Time: <u>7:14</u> Water Drop: <u>5.00</u> inches Notes: _____ Time: <u>7:21</u> Water Drop: <u>5.00</u> inches Notes: _____ Time: _____ Water Drop: _____ inches	Time: <u>7:24</u> Water Drop: <u>5.00</u> inches Notes: _____ Time: <u>7:33</u> Water Drop: <u>5.00</u> inches Notes: _____ Time: <u>7:41</u> Water Drop: <u>5.00</u> inches Notes: _____ Time: <u>7:50</u> Water Drop: <u>5.00</u> inches Notes: _____ Time: _____ Water Drop: _____ inches
<u>Average of last 4 readings = 5.00 inches in 7.14 minutes</u> <u>Unfactored infiltration rate = 42.02 in/hr</u>	<u>Average of last 4 readings = 5.00 inches in 7.62 minutes</u> <u>Unfactored infiltration rate = 39.37 in/hr</u>



Test Pit Log

Test Pit #: 2

Job Number: 25-442

Date: 10/1/2025

Project: Infiltration Study

Weather: Temperature > 32 degrees

Location: 1150 East Avon Road
Rochester Hills, Michigan

Ground Elv.: N/A

Soil Stratigraphy:	Pipe Installation #1
0'0" - 0'9" Moist dark brown sandy TOPSOIL with roots 0'9" - 7'8" Moist brown fine SAND with trace of silt and oxidized sand layers 7'8" - 10'0" Wet gray silty fine to medium SAND	Soil Depth: <u>4'6"</u> Inner Pipe Dia.: <u>0'6"</u> Outer Pipe Dia.: <u>0'10"</u> Embedment: <u>0'2"</u> Stick-up: <u>0'5"</u>
	Pipe Installation #2
	Soil Depth: <u>4'6"</u> Inner Pipe Dia.: <u>0'6"</u> Outer Pipe Dia.: <u>0'10"</u> Embedment: <u>0'2"</u> Stick-up: <u>0'5"</u>
Groundwater Observations	
Groundwater Encountered at: <u>7'8"</u> Groundwater after 1 hr: <u>caved-in</u>	
Pipe Distance: <u>3'0"</u>	

Soak Period (Pipe #1)	Soak Period (Pipe #2)
Start Date: _____ Notes: <u>minutes: seconds</u> Time: <u>4:46</u> Water Drop: <u>5.00</u> inches Notes: _____ Time: <u>5:31</u> Water Drop: <u>5.00</u> inches Notes: _____	Start Date: _____ Notes: <u>minutes: seconds</u> Time: <u>4:58</u> Water Drop: <u>5.00</u> inches Notes: _____ Time: <u>5:42</u> Water Drop: <u>5.00</u> inches Notes: _____

Test Period (Pipe #1)	Test Period (Pipe #2)
Time: <u>5:52</u> Water Drop: <u>5.00</u> inches Notes: _____ Time: <u>6:01</u> Water Drop: <u>5.00</u> inches Notes: _____ Time: <u>6:11</u> Water Drop: <u>5.00</u> inches Notes: _____ Time: <u>6:19</u> Water Drop: <u>5.00</u> inches Notes: _____ Time: _____ Water Drop: _____ inches <u>Average of last 4 readings = 5.00 inches in 6.10 minutes</u> <u>Unfactored infiltration rate = 49.18 in/hr</u>	Time: <u>6:05</u> Water Drop: <u>5.00</u> inches Notes: _____ Time: <u>6:16</u> Water Drop: <u>5.00</u> inches Notes: _____ Time: <u>6:23</u> Water Drop: <u>5.00</u> inches Notes: _____ Time: <u>6:29</u> Water Drop: <u>5.00</u> inches Notes: _____ Time: _____ Water Drop: _____ inches <u>Average of last 4 readings = 5.00 inches in 6.30 minutes</u> <u>Unfactored infiltration rate = 47.62 in/hr</u>



Test Pit Log

Test Pit #: 3

Job Number: 25-442

Date: 10/1/2025

Project: Infiltration Study

Weather: Temperature > 32 degrees

Location: 1150 East Avon Road
Rochester Hills, Michigan

Ground Elev.: N/A

Soil Stratigraphy:	Pipe Installation #1
0'0" - 0'4" Moist dark brown sandy TOPSOIL with roots	Soil Depth: <u>5'0"</u>
0'4" - 8'0" Moist brown fine SAND with trace of silt and occasional gravel and cobbles	Inner Pipe Dia.: <u>0'6"</u>
8'0" - 9'0" Wet gray silty fine to medium SAND	Outer Pipe Dia.: <u>0'10"</u>
	Embedment: <u>0'2"</u>
	Stick-up: <u>0'5"</u>
	Pipe Installation #2
	Soil Depth: <u>5'0"</u>
	Inner Pipe Dia.: <u>0'6"</u>
	Outer Pipe Dia.: <u>0'10"</u>
	Embedment: <u>0'2"</u>
	Stick-up: <u>0'5"</u>
	Pipe Distance: <u>3'0"</u>

Groundwater Observations
Groundwater Encountered at: <u>8'0"</u>
Groundwater after 1 hr: <u>caved-in</u>

Soak Period (Pipe #1)	Soak Period (Pipe #2)
Start Date: _____	Start Date: _____
Notes: <u>minutes: seconds</u>	Notes: <u>minutes: seconds</u>
Time: <u>6:52</u> Water Drop: <u>5.00</u> inches	Time: <u>5:32</u> Water Drop: <u>5.00</u> inches
Notes: _____	Notes: _____
Time: <u>7:36</u> Water Drop: <u>5.00</u> inches	Time: <u>6:40</u> Water Drop: <u>5.00</u> inches
Notes: _____	Notes: _____

Test Period (Pipe #1)	Test Period (Pipe #2)
Time: <u>8:12</u> Water Drop: <u>5.00</u> inches	Time: <u>6:52</u> Water Drop: <u>5.00</u> inches
Notes: _____	Notes: _____
Time: <u>8:23</u> Water Drop: <u>5.00</u> inches	Time: <u>7:03</u> Water Drop: <u>5.00</u> inches
Notes: _____	Notes: _____
Time: <u>8:32</u> Water Drop: <u>5.00</u> inches	Time: <u>7:12</u> Water Drop: <u>5.00</u> inches
Notes: _____	Notes: _____
Time: <u>8:40</u> Water Drop: <u>5.00</u> inches	Time: <u>7:20</u> Water Drop: <u>5.00</u> inches
Notes: _____	Notes: _____
Time: _____ Water Drop: _____ inches	Time: _____ Water Drop: _____ inches
<u>Average of last 4 readings = 5.00 inches in 8.45 minutes</u>	<u>Average of last 4 readings = 5.00 inches in 7.11 minutes</u>
<u>Unfactored infiltration rate = 35.50 in/hr</u>	<u>Unfactored infiltration rate = 42.19 in/hr</u>



Test Pit Log

Test Pit #: 4

Job Number: 25-442

Date: 10/1/2025

Project: Infiltration Study

Weather: Temperature > 32 degrees

Location: 1150 East Avon Road
Rochester Hills, Michigan

Ground Elev.: N/A

Soil Stratigraphy:	Pipe Installation #1
0'0" - 1'6" Moist dark brown sandy TOPSOIL with roots 1'6" - 5'6" Moist variegated silty fine to medium SAND 5'6" - 8'0" Wet variegated sandy SILT	Soil Depth: <u>3'6"</u> Inner Pipe Dia.: <u>0'6"</u> Outer Pipe Dia.: <u>0'10"</u> Embedment: <u>0'2"</u> Stick-up: <u>0'5"</u>
	Pipe Installation #2
	Soil Depth: <u>3'6"</u> Inner Pipe Dia.: <u>0'6"</u> Outer Pipe Dia.: <u>0'10"</u> Embedment: <u>0'2"</u> Stick-up: <u>0'5"</u>
	Pipe Distance: <u>3'0"</u>

Groundwater Observations	
Groundwater Encountered at:	<u>5'6"</u>
Groundwater after 1 hr:	<u>6'6"</u>

Soak Period (Pipe #1)	Soak Period (Pipe #2)
Start Date: _____ Notes: <u>minutes: seconds</u> Time: <u>17:00</u> Water Drop: <u>5.00</u> inches Notes: _____ Time: <u>18:00</u> Water Drop: <u>5.00</u> inches Notes: _____	Start Date: _____ Notes: <u>minutes: seconds</u> Time: <u>17:43</u> Water Drop: <u>5.00</u> inches Notes: _____ Time: <u>18:29</u> Water Drop: <u>5.00</u> inches Notes: _____

Test Period (Pipe #1)	Test Period (Pipe #2)
Time: <u>10:00</u> Water Drop: <u>2.75</u> inches Notes: _____ Time: <u>10:00</u> Water Drop: <u>2.69</u> inches Notes: _____ Time: <u>10:00</u> Water Drop: <u>2.63</u> inches Notes: _____ Time: <u>10:00</u> Water Drop: <u>2.56</u> inches Notes: _____ Time: _____ Water Drop: _____ inches	Time: <u>10:00</u> Water Drop: <u>2.31</u> inches Notes: _____ Time: <u>10:00</u> Water Drop: <u>2.19</u> inches Notes: _____ Time: <u>10:00</u> Water Drop: <u>2.13</u> inches Notes: _____ Time: <u>10:00</u> Water Drop: <u>2.06</u> inches Notes: _____ Time: _____ Water Drop: _____ inches
<u>Average of last 4 readings = 2.66 inches in 10 minutes</u> <u>Unfactored infiltration rate = 15.96 in/hr</u>	<u>Average of last 4 readings = 2.17 inches in 10 minutes</u> <u>Unfactored infiltration rate = 13.02 in/hr</u>

SIEVE ANALYSIS

Test Pit	Sample Depth (ft)	Moisture Content (%)	% Passing #4 Sieve	% Passing #10 Sieve	% Passing #40 Sieve	% Passing #100 Sieve	% Passing #200 Sieve
1	5.5	2.7	94.5	92.1	87.0	27.3	9.4
2	4.5	4.9	98.7	98.3	95.7	26.6	7.8
3	5.0	1.9	91.8	88.4	82.2	12.0	3.7
4	3.5	19.0	100.0	100.0	99.9	20.2	3.5

