TUSCARAWAS COUNTY METROPOLITAN SEWER DISTRICT
TUSCARAWAS COUNTY, OHIO

WILKSHIRE HILLS WTP WELL #4

ADDENDUM #2

MARCH 4, 2022

THRASHER PROJECT #101-010-01120

TO WHOM IT MAY CONCERN:

The following are clarifications and responses to questions posed by Contractors for the above-referenced project.

A. QUESTIONS AND RESPONSES

QUESTION:

1. The specs call for a gravel entrance to be constructed, and the drawings show a rig road. What exactly are we responsible for? Does it have to be removed afterwards?

RESPONSE:

The Contractor is responsible for keeping mud off the roadways and preventing sediment transport through the project site. All temporary BMP's shall be removed with the completion of the work. Contractor is only responsible for preventing sediment transport from their work activities.

2. The specs call for silt fencing to be installed. Is this required?

RESPONSE:

The Contractor is responsible for keeping mud off the roadways and preventing sediment transport through the project site. All temporary BMP's shall be removed with the completion of the work. Contractor is only responsible for preventing sediment transport from their work activities.

3. The specs call for rip rap or a dewatering pit, but I don't see it in the plans. Does this have to be installed? Removed afterwards?

RESPONSE:

The Contractor is responsible for keeping mud off the roadways and preventing sediment transport through the project site. All temporary BMP's shall be removed with the completion of the work. Contractor is only responsible for preventing sediment transport from their work activities.

4. Is water available at the plant for drilling purposes? Is this free of charge?

RESPONSE:

The County will provide access to Well #3 for on-site water. No charge will be billed to the Contractor for use of the water. Contractor shall coordinate with the TCMSD for access and use of Well #3. Contractor shall be responsible for prevention of the contamination of the well.

5. Is a test hole required?

RESPONSE:

Yes, a test hole shall be constructed as part of the work.

6. Can the existing test hole data be provided?

RESPONSE:

Please refer to the attached *Report on Test Drilling for Public Well Supply Well 4*. This report shall be used for information only. The Contractor agrees that the Owner and Engineer will not be held liable or responsible for the accuracy of any information contained in the digital report, or any conclusion, inferences, interpretations, etc. made by the contractor, which may be used in the preparation of the Contractor's bid.

7. Can other types of augers be used?

RESPONSE:

The type of auger shall be used as required in the contract documents.

8. Is a boring plan required to be provided?

RESPONSE:

A bore plan is not required. Contractor shall meet the requirements as defined in the contract documents.

Last day to ask questions shall be 72 hours from the time of bid as required in the Ohio Revised Code. If you have any questions or comments, please feel free to contact me at your earliest convenience. As a reminder, bids will be received until 1:30 p.m. on Wednesday, March 9, 2022, at the office of the Clerk of the Board of Tuscarawas County Commissioners, 125 East High Avenue, New Philadelphia, Ohio 44663. Good luck to everyone and thank you for your interest in the project.

Sincerely,
THE THRASHER GROUP, INC.

Ryan Schuster, PE
Project Manager

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Report on Test Drilling
for Public Water Supply Well 4
Tuscarawas County Metropolitan Sewer District
Bolivar, Ohio

July 2020

For

The Thrasher Group, Inc.
400 3rd St. SE, Suite #309
Canton, OH 44702

By

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Ground Water Science
Science and Planning for Earth's Most Critical Resource

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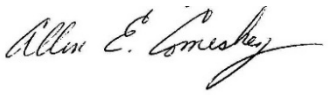
Report on Test Drilling
for Public Water Supply Well 4
Tuscarawas County Metropolitan Sewer District
Bolivar, Ohio

For

The Thrasher Group, Inc.
400 3rd St. SE, Suite #309
Canton, OH 44702

October 2019

Submitted by:



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ADDED
Addendum #2
March 4, 2022

TABLE OF CONTENTS

ADDED
Addendum #2
March 4, 2022

LIST OF FIGURES

LIST OF APPENDICES

ADDED
Addendum #2
March 4, 2022

INTRODUCTION

Smith-Comeskey Ground Water Science LLC (GWS) was contracted by The Thrasher Group, Inc. (Thrasher) of Canton, Ohio to assist with the construction and testing a new public water supply well for Tuscarawas County Metropolitan Sewer District (District) of Bolivar, Ohio. GWS provided to Thrasher a proposal dated August 16, 2019 which covered assisting with test drilling, specifications, well design, well construction oversight, and conducting step-drawdown and constant rate 24-hour tests.

This report documents the results of the test drilling phase of the project. The proposed location of the new well, Well 4, had been surveyed and staked and the task was to drill a test hole at the location to determine the nature of the aquifer and obtain split spoon samples for well screen design and estimating aquifer parameters. In addition, a 2-inch observation well is constructed for use during production well testing. The contract for drilling the test hole was awarded to Moody's of Dayton by the District.

PROCEDURE

Test Hole Drilling:
Moody's mobilized to the site late in the afternoon of June 22, 2020. The stake for Well 4 was located as well as flags marking the route of a gas line across the property. In consultation with Mike Jones of the District, it was decided to set up the rig 15 feet west of the Well 4 stake to drill the test hole and construct the observation well (Test Hole 1a).

Work commenced on the morning of June 23. The drilling method was 4.25-inch hollow stem augers with samples for sieve analysis obtained with split spoon samplers (Images 1 and 2).

Ninety feet were drilled with the remainder to be drilled the next day. The geologist log is based on grab samples from the augers at 5-foot intervals and describing the returns in the split spoons. Split spoon samples were collected at 10 and 15 feet, with more to be collected at 5-foot intervals starting at 100 feet.

Drilling continued on June 24. Drilling and split spoons progressed to 107 feet where bedrock was encountered. This represented a significant reduction in aquifer thickness as Well 3 encountered bedrock at approximately 149 feet, a difference of 40 feet. Since the intent of the District and Moody's appears to be to duplicate Well 3, it was questioned whether this would be sufficient. In consultation with Mike Jones and Moody's, it was decided to drill another test hole to the west to determine if a thicker interval of aquifer was present. A location was taped approximately 300 feet from the west property line and staked (designated Test Hole 2). Utilities were notified to clear the site.

Drilling commenced on Test Hole 2 on June 25 and proceeded to 61 feet where bedrock was encountered. Drilling and split spoons continued to 72 feet to confirm the contact. In consultation with Mike Jones it was decided to return to Test Hole 1 and collect split spoons from 50 to 100 feet. This was to allow designing and constructing a well at that location so the District can obtain whatever it will produce, if not the capacity of Well 3.

The rig was set up 15 feet east of the original staked location (30 feet east of Test Hole 1a). This second test hole we are designation Test Hole 1b for clarity. Drilling commenced on June 25 and proceeded to 50 feet where split spoons were collected at 5-foot intervals to 118 feet where bedrock was encountered. Therefore, over a distance of 30 feet, depth to bedrock changed by 11 feet. The 2-inch PVC observation well was constructed in this hole consisting of 0.010 slot screen from 98 to 118 feet, filter pack from 88 to 118 feet, and grout from 88 feet to land surface.

The Appendices present logs of the Test Holes 1a and 1b combined to illustrate intervals of split spoon sampling and observation well construction, and Test Hole 2.

Aquifer Parameter Estimates:
The sediment grain size distribution from the sieve analysis of the split spoons from Test Hole 1b were graphed and the d_{10}, d_{60}, and d_{50} values noted (Driscoll, 1986). The method of estimating hydraulic conductivity (K) by Hazen (1911) was applied utilizing the d_{10} value.

Also, the 24-hour test for Well 3 was analyzed using AQTESOLV (Duffield, G.M., 2007) to derive an addition value for aquifer transmissivity (T).

Well Performance Estimates:
Finally, an estimate of pumping water levels in the proposed Well 4 were simulated utilizing forward solutions in AQTESOLV. The simulations were based on the well design provided by Moody's consisting of a 16-inch diameter well screened from 95 to 115 feet and assuming the aquifer is unconfined at this location.

RESULTS

Aquifer Parameter Estimates:
The d_{10} (90% retained) value for each split spoon sample were as follows

feet	inches
50	0.009
60	0.008
70	0.008
80	0.009
85	0.0075
90	0.007
95	0.005
100	0.0035
105	0.0075
110	0.0075
115	0.007

These values yielded K as follows:

Feet	K (ft/day)
50	171.35
60	135.38
70	135.38
80	171.35
85	118.99
90	103.65
95	52.88
100	25.91
105	118.99
110	118.99
115	103.65

The geometric mean value for K was 102.66 ft/day. With a saturated aquifer thickness of 68 feet, that yields:

$$T = 6891 \text{ ft}^2/\text{day}.$$

The coefficient of uniformity (C_u) for each interval was calculate as d_{60}/d_{10}.

Feet	C_u (d_{60}/d_{10})
50	18.3
60	1.75
70	1.875
80	1.71

85	2.4
90	2.43
95	3.2
100	5.14
105	8.8
110	6.0
115	5.4

The smaller the value of C_u, the more uniform the sorting of the sediment. Values above 5 are somewhat meaningless as they are very poorly sorted (Driscoll, 1986). Even if the Hazen method calculates a reasonable K for the interval, the poor sorting suggests that the porosity is filled with progressively finer material which impedes the transmission of water.

The Well 3 24-hour test analysis from AQTESOLV are presented in Figure 1. Based on the data provided to the District by Moody's, a confined analysis was performed. This yielded:

$$T = 64,760\ ft^2/day$$

Which is an order of magnitude greater than that derived from the split spoons/Hazen method.

Pumping Water Level Projections:
The Well 4 design provided by Moody's anticipates an in-service withdrawal rate of 800 gpm. It follows that the 24-hour test needs to be conducted at 1200 gpm per Ohio EPA regulations. AQTESOLV was utilized to simulate the water level response of pumping the proposed well for 24 hours with T varied based on the two estimates.

Figure 2 presents the estimated drawdown based on a T = 6891 ft^2/day. After 24 hours at 1200 gpm the simulated well would experience about 32 feet of drawdown. With an estimated static water level of 55 ft. that yields a pumping water level at 87 feet, just 8 feet above the screen.

Figure 3 presents the estimated drawdown based on a T = 64, 760 ft^2/day. After 24 hours at 1200 gpm the simulated well would experience about 10 feet of drawdown. With an estimated static water level of 55 ft. that yields a pumping water level at 65 feet, 30 feet above the screen.

Finally, Figure 4 presents the estimated drawdown based on a T = 64, 760 ft^2/day with a no-flow boundary located about 200 feet to the west. This is to represent the shallow bedrock and lack of saturated aquifer encountered at Test Hole 2. After 24 hours at 1200 gpm, the simulated well would experience about 12 feet of drawdown. With an estimated static water level of 55 ft. that yields a pumping water level at 67 feet, 28 feet above the screen.

CONCLUSIONS and RECOMMENDATIONS

Depending on the actual T of the aquifer, the proposed well design should function well.

The sieve analysis for Well 3 was not examined for this report, so we do not know how it compares with the samples from Test Hole 1b. It is likely that the Hazen method has not accurately estimated the K for the aquifer and the true K is closer to that in Well 3.

However, we should note that Test Holes 1 and 2 reveal the margin of the aquifer where the materials may be finer, rather than the center of the buried valley where Wells 1, 2 and 3 are located. The coefficients of uniformity suggest that the sorting is poor which certainly impacts K.

Also, there will be some impact from the boundary to the west, though our simulation suggests it will be negligible.

Overall, we suspect the performance will be something less than Well 3, but not as low as suggested by the Hazen method estimate of K. The step-drawdown test conducted as part of the acceptance testing will reveal the actual performance and ultimate in-service withdrawal rate.

REFERENCES

Duffield, G.M., 2007, AQTESOLV v. 4.5 Professional, HydroSOLVE, Reston, VA,

Driscoll, F.G., 1986, Groundwater and Wells, 2nd ed., St. Paul, Minnesota, Johnson Division, 1089 pg.

Hazen, A., 1911, Discussion: Dams on Sand Foundations, Transactions, American Society of Civil Engineers, 73, 199

Kruseman, G.P, and de Ridder, N.A., 1991, Analysis and evaluation of pumping test data, Wageningen, The Netherlands, International Institute for Land Reclamation and Improvement, ILRI publication 47, 377 p.

Figures

Figure 1. AQTESOLV analysis of Well 3 24-hour test.

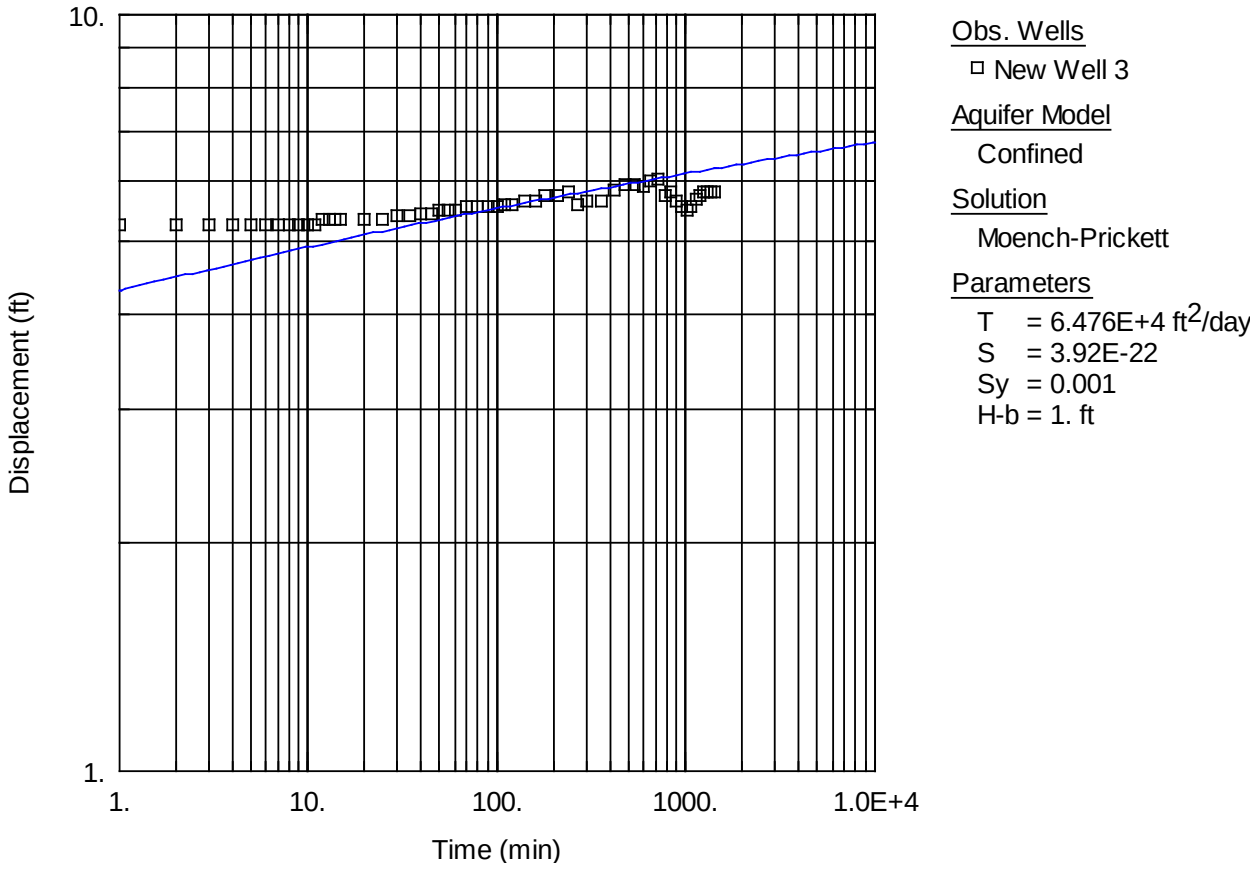


Figure 2. AQTESOLV forward solution Hazen derived T value at 1200 gpm.

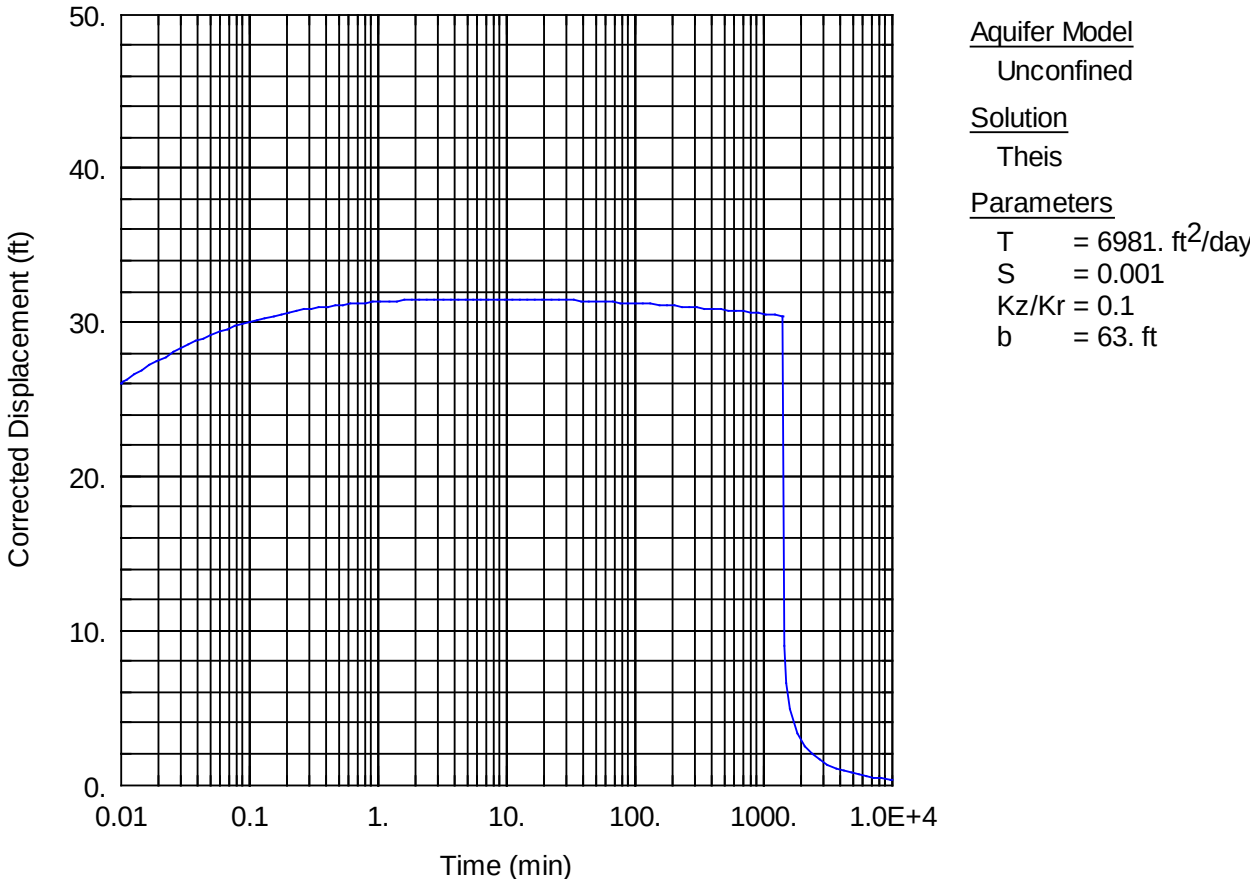


Figure 3. AQTESOLV forward solution Well 3 derived T value at 1200 gpm.

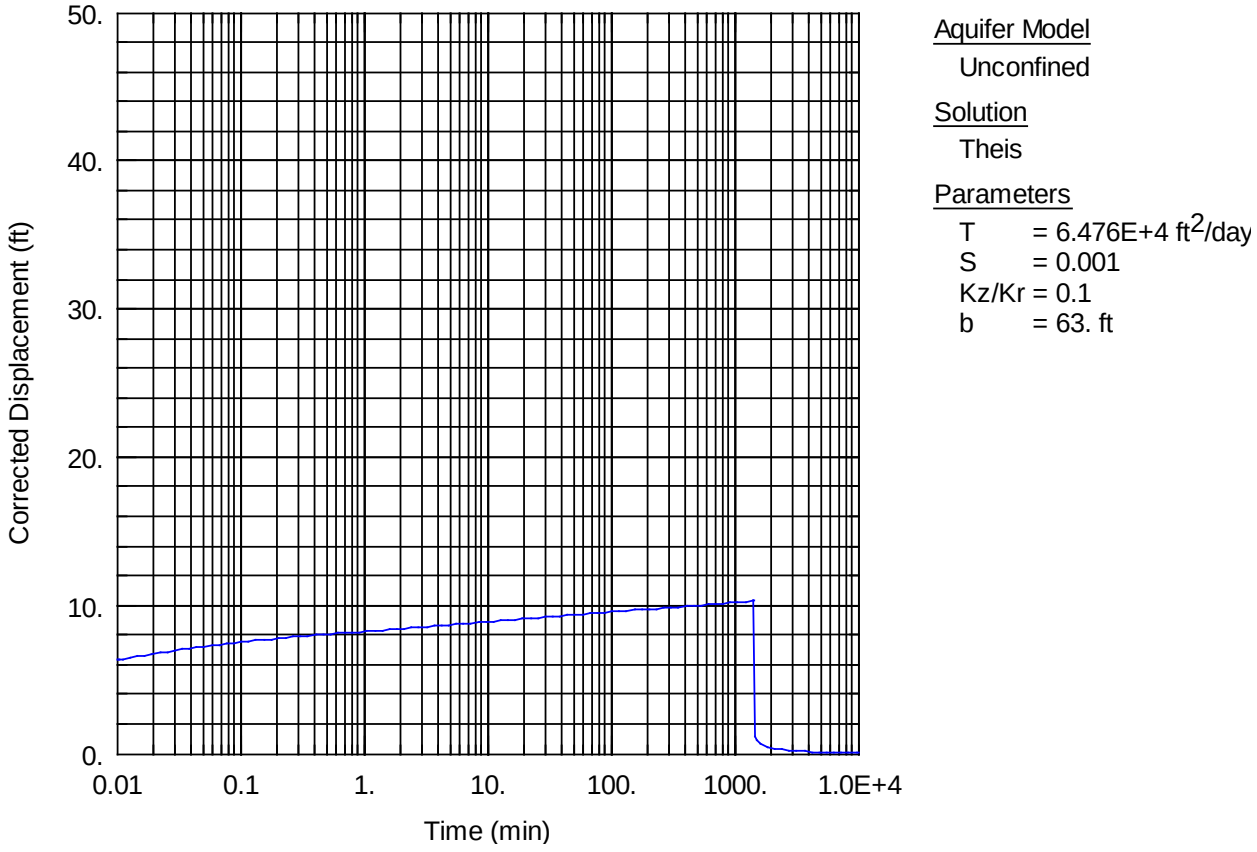
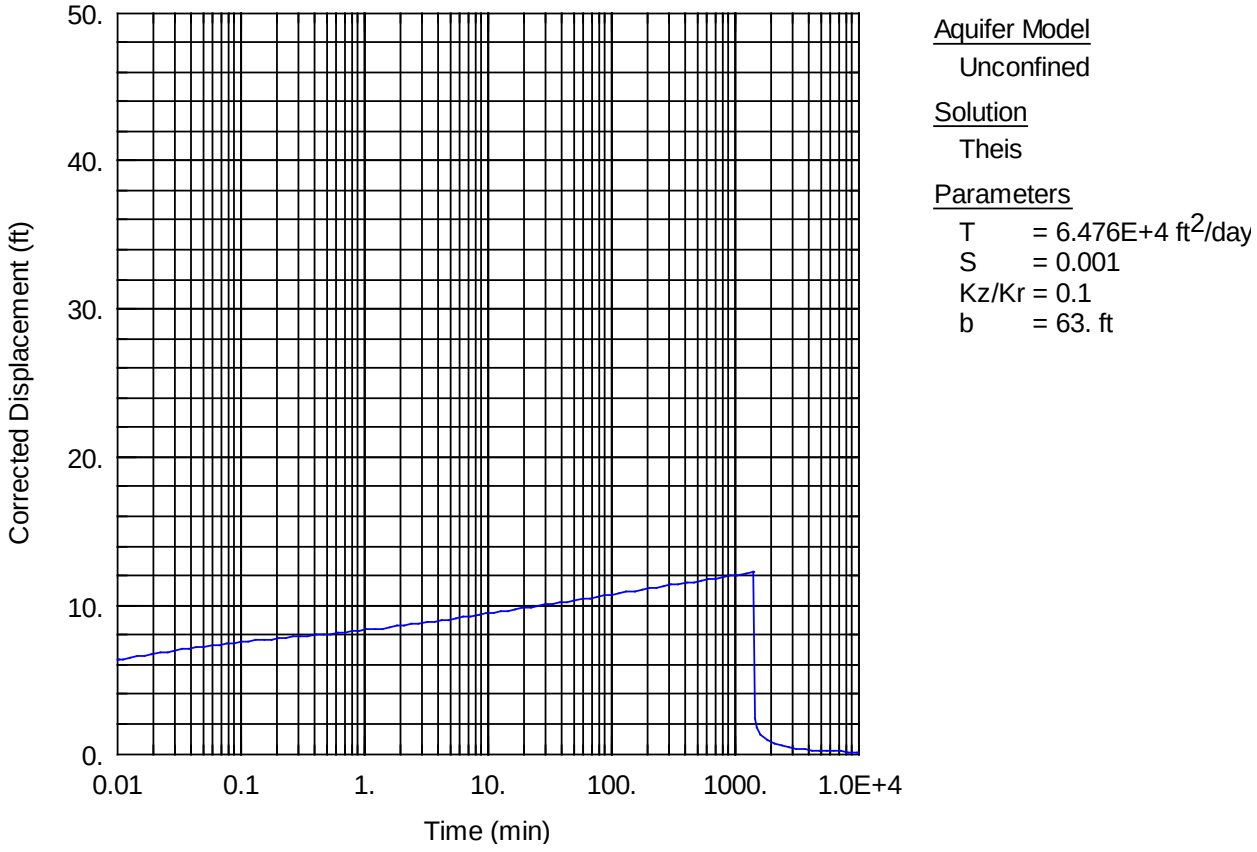


Figure 4. AQTESOLV forward solution Well 3 derived T value at 1200 gpm with no flow boundary.

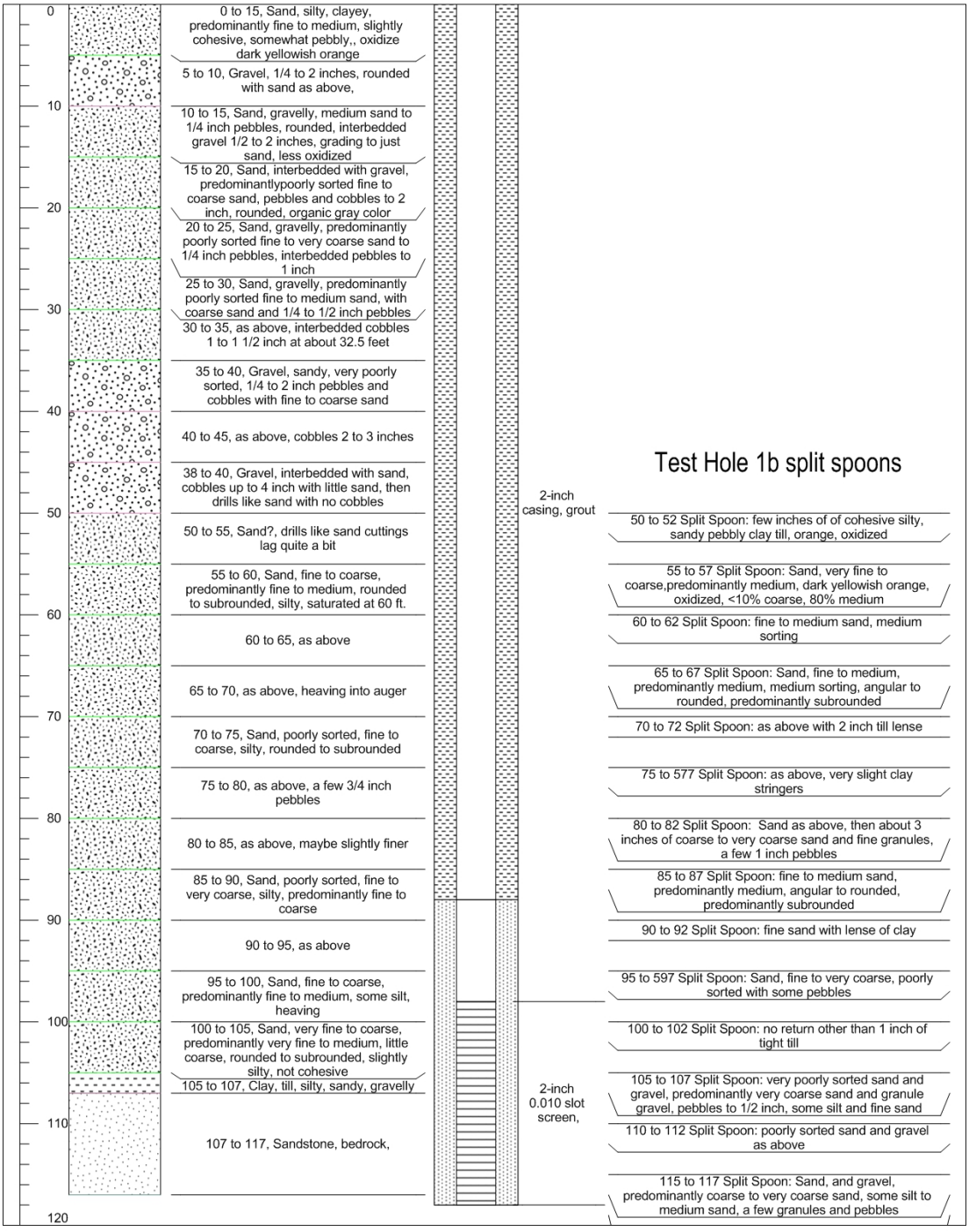


APPENDICES

Tuscarawas County Metropolitan Sewer District
New Well 4 Project

Test Hole 1a cuttings description
and Test Hole 1b observation well construction

Hole Depth: Test Hole 1a = 117,Test Hole 1b = 118 feet
Hole Diameter: 4.25 inches
Casing/Screen Diameter: 2 inches
Screen: 10 slot pvc, 98 to 118 feet
Filter Pack: 88 to 118 feet
Grout: 88 feet to land surface



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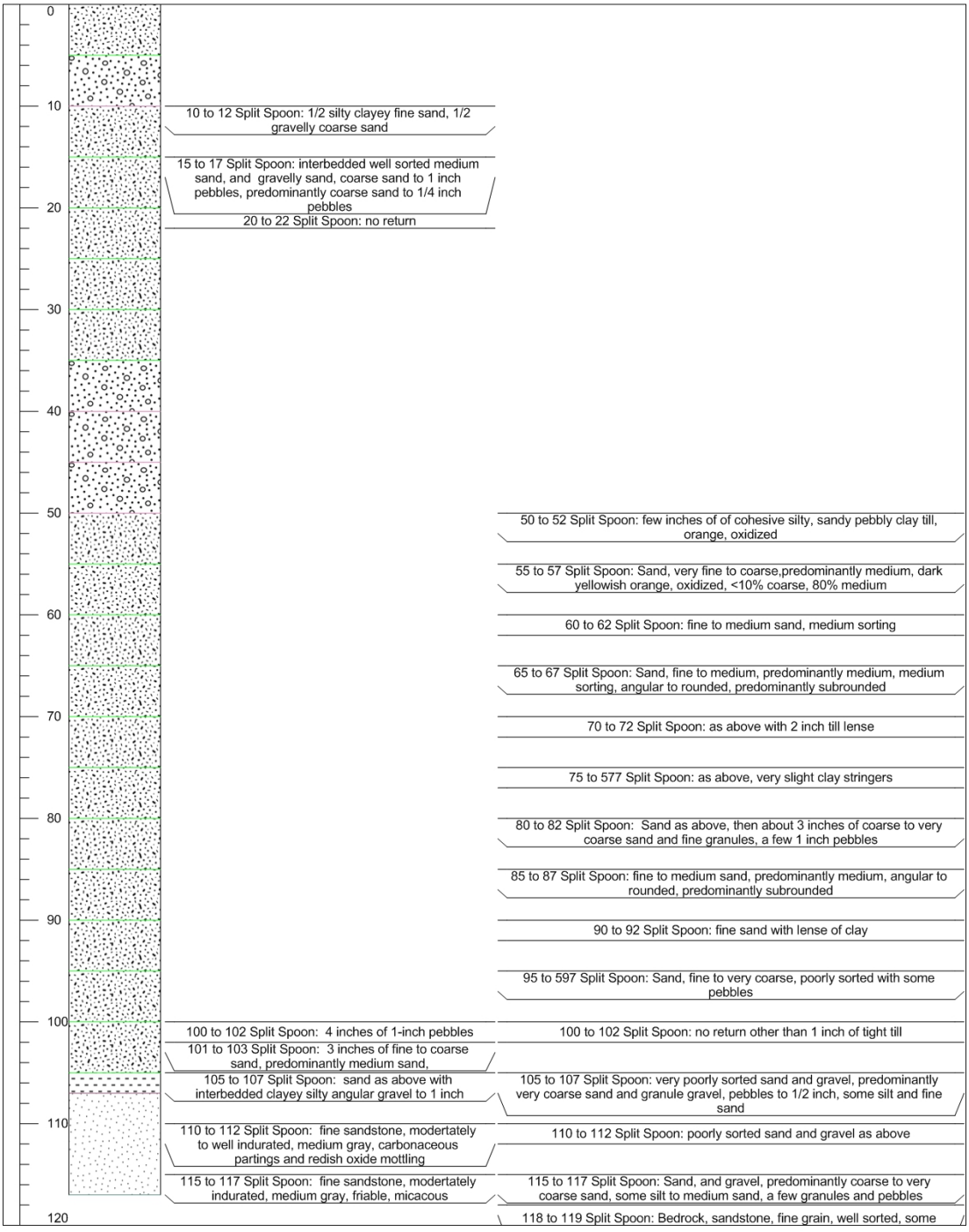
Metropolitan Sewer District
New Well 4 Project

Note: Test Hole 1a encountered bedrock at 107 ft. with total depth of 117 ft.
Test Hole 1b encountered bedrock at 118 ft. with total depth of 119 ft.

Test Hole 1a and split spoons

Test Hole 1b split spoons



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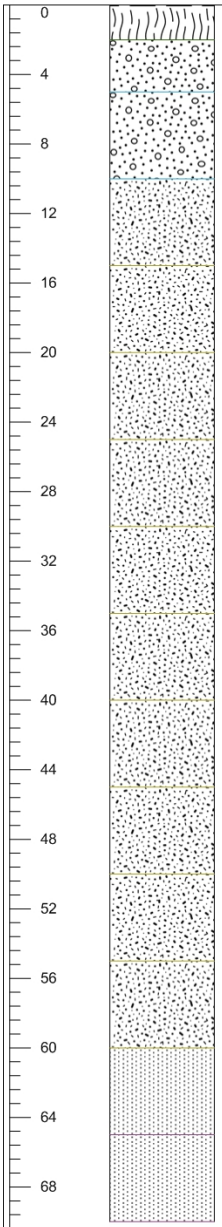
Tuscarawas County Metropolitan Sewer District
New Well 4 Project

Test Hole 2 cuttings description
and split spoon descriptions

Hole Depth: Test Hole 2, 72 feet
Hole Diameter: 4.25 inches
Casing/Screen Diameter: none
Screen: none
Filter Pack: none
Grout: none



0 to 2, Topsoil, clayey silt ,cohesive, oxidize dark yellowish orange	
2 to 5, Gravel	
5 to 10, Gravel, 1/4 to 2 inches, rounded, interbedded silty, sandy, pebbly slightly clayey till, slightly cohesive, oxidized	
10 to 15, Sand and gravel, about 55% sand, 45% gravel,sand very fine to coarse, predominantly fine to medium, gravel to 1 1/2 inches,predominantly granules, rounded, slightly silty and clay so slightly cohesive	10 to 12 Split Spoon: clayey till then gravelly sand, gravel to 1/2 inch, sand very fine to coarse, silty, predominantly very fine to fine, very poorly sorted, oxidized
15 to 20, Sand and gravel, 50% sand 50% gravel, sand fine to coarse, gravel 1/4 to 1 inch, maybe interbedded	15 to 17 Split Spoon: sand and gravell, predominantly coarse sand to fine granule gravel, some gravel to 1/4 inch, some silt to medium sand
20 to 25, Sand, predominantly coarse to very coarse, some gravel to 1/4 inch, some fine to medium sand, dark brown at 22 feet - organic	20 to 22 Split Spoon: 50% gravel 1/4 to 1 inch, 50% sand fine to coarse
25 to 30, Sand, gravelly, as above	
30 to 35, Sand, 60% medium to coarse, 40% very coarse sand and granules to 1/8 inch, some fine sand, still dark brown	
35 to 40, Sand as above to 37.5 feet, then grave	
40 to 45, Sand, predominantly medium, with some coarse to very coarse, drill as if interbedded, brown, 1 inch gravel later	
38 to 40, Sand, as above, no gravel	
50 to 55, Sand?, drills like sand cuttings lag quite a bit	
55 to 60, Sand ?, smooth drilling, then much gravel, saturated at 60 ft.	
60 to 65, hard drilling,	
65 to 70, as above	65 to 67 Split Spoon: Sandtone, very fine grain, well sorted, modertaely indurated, somewhat friable, mottled somewhat, shaley laminations
	70 to 72 Split Spoon: Sandstone ,very fine to fine, moderately indurated, somewhat friable, mottled gray and orange

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Images

1. 4.25-inch hollow stem auger.

2. Split spoon sampler.