Rose & Westra
A Division of GZA

GEOTECHNICAL
ENVIRONMENTAL
ECOLOGICAL
WATER
CONSTRUCTION MANAGEMENT

The Widdicomb Building
601 Fifth Street NW
Suite 102
Grand Rapids, MI 49504
T: 616.956.6123
F: 616.288.3327
www.rosewestra.com
www.gza.com

Sent Via Email Only: vorcek@michigan.gov

May 9, 2023
File No. 16.0062961.01

Ms. Karen Vorce, District Supervisor
Grand Rapids District Office
Remediation and Redevelopment Division
Michigan Department of Environment, Great Lakes, and Energy
350 Ottawa Avenue NW, Unit 10
Grand Rapids, MI 49503

Re: Wolverine World Wide, Inc. Consent Decree Court Case No. 1:18-cv-00039
Revised Tannery Interceptor System Response Activity Plan

Dear Ms. Vorce:

On behalf of Wolverine World Wide, Inc. (Wolverine), Rose & Westra, a Division of GZA GeoEnvironmental, Inc. (R&W/GZA), has prepared this Revised Tannery Interceptor System Remedial Action Plan (Revised RAP) for the former Wolverine Tannery in Rockford, Michigan. On March 31, 2022, Wolverine submitted its EGLE-approved Final Tannery Interceptor System Remedial Action Plan (RAP). On December 1, 2022, Wolverine submitted a Tannery Interceptor System Remedial Action Plan Addendum (RAP Addendum) requesting EGLE approval of proposed modifications to the RAP under Paragraph 7.14(b) of the Consent Decree. EGLE disapproved Wolverine's request on March 10, 2023. Like the RAP Addendum, this Revised RAP proposes substantial expansions to the system in the EGLE-approved March 31, 2022, RAP and was submitted under Paragraph 7.14(b) of the Consent Decree to address EGLE's March 10, 2023, comments to the RAP Addendum

If you need additional information, please contact Mark Westra at 616.258.7201.

Very truly yours,

Rose & Westra, a Division of GZA GeoEnvironmental, Inc.

Jiangeng (Jim) Cai, P.E.
Associate Principal

Joseph Foglio
Senior Principal

Mark A. Westra
Principal

John Osborne
Consultant Reviewer

\\Gzagr1\Jobs\62000\629xx\62961.xx - WWW RAP-WP\62961.01 - Tannery I-R - 1 Year RAP\RAP\Revised_RAP_2023\62961.01_Tannery System RAP_05_09_2023_Draft_F.docx

Rose & Westra
A Division of GZA

Geotechnical
Environmental
Ecological
Water
Construction Management

The Widdicomb Building
601 Fifth Street NW
Suite 102
Grand Rapids, MI 49504
T: 616.956.6123
F: 616.288.3327
www.rosewestra.com
www.gza.com

REVISED TANNERY INTERCEPTOR SYSTEM RESPONSE ACTIVITY PLAN

DRAFT – FOR REVIEW ONLY

Disclaimer: This document is a DRAFT document that has not received approval from the Michigan Department of Environment, Great Lakes, and Energy (EGLE). This document was prepared pursuant to a court Consent Decree. The opinions, findings and conclusions expressed are those of the authors and not those of EGLE.

May 9, 2023
File No. 16.0062961.01

PREPARED FOR:
Wolverine World Wide, Inc.
Rockford, Michigan

Rose & Westra, a Division of GZA GeoEnvironmental, Inc.
601 Fifth Street NW | Suite 102 | Grand Rapids, MI 49504
616.956.6123

Offices Nationwide
www.gza.com

TABLE OF CONTENTS

1.0 INTRODUCTION 1
2.0 SUMMARY OF CONCEPTUAL SITE MODEL 2
2.1 SITE HISTORY 2
2.2 PRECIPITATION AND GROUNDWATER RECHARGE 3
2.2.1 Estimation of Groundwater Recharge from Published GIS Data 3
2.2.2 Estimation of Groundwater Recharge from Streamflow Data 4
2.3 REGIONAL GEOLOGY 6
2.4 SITE GEOLOGY 6
2.5 REGIONAL HYDROGEOLOGY 7
2.6 SITE HYDROGEOLOGY 7
2.7 CHEMICAL DATA 8
3.0 IN SITU EVALUATION OF SITE HYDRAULIC PROPERTIES 9
4.0 GROUNDWATER MODELING OBJECTIVES 14
5.0 SELECTED MODEL 14
6.0 REGIONAL GROUNDWATER MODEL SETUP 14
7.0 LOCAL GROUNDWATER FLOW MODEL 17
7.1 LOCAL MODEL SETUP 17
7.2 GROUNDWATER RECHARGE ESTIMATES 18
7.3 SURFACE WATER ELEVATION 18
7.4 LOCAL MODEL CALIBRATION TARGETS 20
7.5 CALIBRATION PARAMETERS 20
7.6 CALIBRATION RESULTS 21
8.0 PERFORMANCE PUMPING TESTS and design changes 27
8.1 METHODOLOGIES 27
8.2 IMPLEMENTATION 28
8.3 AQUIFER CONDITIONS 29
8.4 PUMPING RATES OVER TIME 30
8.5 DRAWDOWN IN THE AREA OF EW-2 AND EW-3 31
8.6 DRAWDOWN IN THE AREA OF TA-RW-1 33
8.7 CHALLENGES FOR AN EXTRACTION WELL SYSTEM 36
8.8 BENEFITS OF A GROUNDWATER INTERCEPTOR TRENCH SYSTEM 36
9.0 GROUNDWATER INTERCEPTOR SYSTEM EVALUATION 36
9.1 INTERCEPTOR SYSTEM DESIGN 37

TABLE OF CONTENTS

9.2 CAPTURE ZONE EVALUATION 39
9.3 CAPTURE EVALUATION WITH RELATIVELY HIGH GROUNDWATER RECHARGE 48
10.0 GROUNDWATER INTERCEPTOR AND TREATMENT SYSTEM DESCRIPTION 49
10.1 INTERCEPTOR SYSTEM 49
10.1.1 Groundwater Collection Trenches and Sumps 49
10.1.2 Collection Cisterns 50
10.1.3 Extraction Wells 51
10.1.4 Piping 51
10.1.5 Piezometers 51
10.1.6 Pumps 52
10.1.7 Pressure Transducers 52
10.1.8 Pump Protection 52
10.1.9 Equalization Tank 52
10.1.10 Data Logger 52
10.1.11 Alarm Auto Dialer 52
10.1.12 Electrical Control Panel and Treatment Building 53
10.1.13 System Process 53
10.2 PERFORMANCE PUMPING TESTS 54
10.3 GROUNDWATER TREATMENT SYSTEM 54
11.0 OPERATIONS AND MAINTENANCE (O&M) 55
11.1 PHYSICAL CONDITION INSPECTION 55
11.2 SYSTEM FLOWRATE AND PRESSURE MEASUREMENTS 56
11.3 ANTICIPATED OPERATIONS TROUBLESHOOTING 56
12.0 IMPLEMENTATION 57
13.0 SCHEDULE 57
14.0 PRE-DESIGN INVESTIGATION DATA 59
15.0 PERFORMANCE MONITORING PLAN 59
16.0 TREATMENT SYSTEM SAMPLING AND ANALYSIS 62
17.0 GROUNDWATER SAMPLING 62
18.0 BIBLIOGRAPHY 63

TABLE OF CONTENTS

TABLES IN THE BODY OF THE REPORT

TABLE 2-1: 2016 TO 2020 ANNUAL GROUNDWATER RECHARGE ESTIMATES BASED ON STREAMFLOW RECORDS AT USGS GAUGE 04118500 5

TABLE 2-2: SUMMARY OF GROUNDWATER ELEVATIONS IN DEEP ZONE MONITORING WELLS, APRIL 2019........ 8

TABLE 3-1: SUMMARY OF PUMPING TEST PERIODS........ 10

TABLE 3-2 - SUMMARY OF INTERPRETED RESULTS 13

TABLE 6-1: REGIONAL MODEL CALIBRATION PARAMETERS........ 15

TABLE 7-1: ESTIMATION OF BASE FLOW TO THE RUM CREEK SEGMENT IN LOCAL MODEL........ 20

TABLE 8-1: SUMMARY OF INITIAL PERFORMANCE PUMPING........ .28

TABLE 8-2: LIST OF PUMPING TEST OBSERVATION WELLS/PIEZOMETERS........ 28

TABLE 8-3: SUMMARY OF PUMPING TEST PERIODS........ 29

TABLE 9-1: COLLECTION DESIGN FLOW RATES........ 39

TABLE 9-2: MODEL LAYER ELEVATIONS........ 39

TABLE 10-1: PERFORMANCE MONITORING RIVER PIEZOMETERS, PAIRED TRENCH SUMPS/EXTRACTION WELLS, PAIRED PIEZOMETERS........ 53

TABLE 15-1: ROGUE RIVER MONITORING SECTIONS AND PERFORMANCE MONITORING CRITERIA 61

TABLE 15-2: BI-WEEKLY GROUNDWATER ELEVATION MEASUREMENTS AT WELLS/PIEZOMETERS BETWEEN THE TRENCHES AND THE SURFACE WATERS........ 61

TABLE 16-1: GROUNDWATER QUALITY ASSESSMENT - SAMPLING AND ANALYSIS PLAN 63

FIGURES IN THE BODY OF TEXT

FIGURE 2-1: SITE PLAN........ 2

FIGURE 2-2: ANNUAL BASEFLOW ESTIMATES (USGS GAUGE 04118500) 5

FIGURE 2-3: EXTENT OF PFOS IN GROUNDWATER 9

FIGURE 3-1: TA-RW-1 TEST DRAWDOWN AND DERIVATIVE PLOTS: (A) TA-RW-1 (B) TA-PMW-2 (C) TA-MW-2. 10

FIGURE 3-2: TA-RW-2 TEST DRAWDOWN AND DERIVATIVE PLOTS: (A) TA-RW-2 (B) TA-PMW-2 (C) TA-MW-1 11

FIGURE 3-3: TA-RW-3 TEST DRAWDOWN AND DERIVATIVE PLOTS: (A)TA-RW-3 (B) TA-PMW-3 (C) TA-PMW-6 12

FIGURE 6-1: REGIONAL MODEL DOMAIN, BOUNDARY TYPES........ 16

FIGURE 6-2: MODELED GROUNDWATER CONTOURS, REGIONAL MODEL........ 17

FIGURE 6-3: LOCAL MODEL DOMAIN 17

FIGURE 7-1: LOCATIONS OF SURFACE WATER ELEVATION MEASUREMENTS STATIONS........ 18

FIGURE 7-2: HISTORICAL SURFACE WATER ELEVATIONS 19

TABLE OF CONTENTS

FIGURE 7-3: PILOT POINTS FOR HORIZONTAL HYDRAULIC CONDUCTIVITY, MODEL LAYER 1 21

FIGURE 7-4: COMPUTED VS. OBSERVED HYDRAULIC ELEVATIONS 22

FIGURE 7-5: CALIBRATION ELEVATION RESIDUALS 24

FIGURE 7-6: GROUNDWATER CONTOURS OF THE COMPUTED ELEVATIONS VS. THE OBSERVED ELEVATIONS OF APRIL 2019... 25

FIGURE 7-7: FLOW BUDGET ZONE 26

FIGURE 8-1: PERFORMANCE PUMPING TESTS - PUMPING RATES OVER TIME 30

FIGURE 8-2: PERFORMANCE PUMPING TESTS - CORRECTED DRAWDOWNS OVER TIME AT EW-1, EW-2, AND EW-3 31

FIGURE 8-3: PERFORMANCE PUMPING TESTS - CORRECTED DRAWDOWNS OVER TIME AT EW-2/EW-3 AREA 32

FIGURE 8-4: PERFORMANCE PUMPING TESTS - GROUNDWATER ELEVATIONS OVER TIME AT EW-2/ EW-3 AREA 33

FIGURE 8-5: PERFORMANCE PUMPING TESTS - CORRECTED DRAWDOWNS OVER TIME NEAR TA-RW-1 34

FIGURE 8-6: PERFORMANCE PUMPING TESTS - GROUNDWATER ELEVATIONS OVER TIME NEAR TA-RW-1 35

FIGURE 9-1: MODEL FORWARD PARTICLE PATHLINES STARTING FROM UPGRADIENT, LAYER 1, ELEVATIONS FROM 672 TO 695 FEET. 40

FIGURE 9-2: MODELED FORWARD PARTICLE PATHLINES STARTING FROM DOWNGRADIENT, LAYER 1, ELEVATIONS FROM 672 TO 695 FEET. 41

FIGURE 9-3: MODELED FORWARD PARTICLE PATHLINES STARTING FROM UPGRADIENT, LAYER 2, ELEVATIONS FROM 653 TO 672 FEET. 42

FIGURE 9-4: MODELED FORWARD PARTICLE PATHLINES STARTING FROM DOWNGRADIENT, LAYER 2, ELEVATIONS FROM 653 TO 672 FEET. 43

FIGURE 9-5: MODELED FORWARD PARTICLE PATHLINES STARTING FROM UPGRADIENT, LAYER 3, ELEVATIONS FROM 632 TO 652 FEET. 44

FIGURE 9-6: MODELED FORWARD PARTICLE PATHLINES STARTING FROM DOWNGRADIENT, LAYER 3, ELEVATIONS FROM 632 TO 652 FEET. 45

FIGURE 9-7: MODELED FORWARD PARTICLE PATHLINES STARTING FROM UPGRADIENT, LAYER 4, ELEVATIONS FROM 608 TO 632 FEET. 46

FIGURE 9-8: MODELED FORWARD PARTICLE PATHLINES STARTING FROM DOWNGRADIENT, LAYER 4, ELEVATIONS FROM 608 TO 632 FEET. 47

FIGURE 9-9: MODEL COMPUTED PATHLINES, WEST-EAST CROSS-SECTION PROFILE... 48

FIGURE 10-1: TYPICAL TRENCH DESIGN - SECTION... 50

FIGURE 10-2: TYPICAL TRENCH DESIGN – SUMP AND TRENCH PROFILE 50

EXHIBIT

EXHIBIT 1 GROUNDWATER FLOW VISUAL

TABLE OF CONTENTS

TABLES

TABLE NO. 1 SUMMARY OF MONITORING WELL DETAILS

TABLE NO. 2 GROUNDWATER ELEVATION DATA, APRIL 2019

TABLE NO. 3 SUMMARY OF GROUNDWATER SAMPLE ANALYSIS – PFAS (2019 AND 2021)

TABLE No. 4 MODEL COMPUTED GROUNDWATER ELEVATIONS VS. OBSERVED ELEVATIONS

SHEETS

SHEET NO. 1 LOCATIONS OF CROSS SECTIONS

SHEET NO. 2 CROSS SECTION I-I'

SHEET NO. 3 CROSS SECTION II-II' AND III-III'

SHEET NO. 4 CROSS SECTION IV-IV' AND V-V'

SHEET NO. 5 CROSS SECTION VI-VI' AND VII-VII'

SHEET NO. 6 SITE PLAN, MONITORING WELL LOCATION PLAN

SHEET NO. 7 GROUNDWATER CONTOURS – SHALLOW AQUIFER, APRIL 2019

SHEET NO. 8 GROUNDWATER CONTOURS – SHALLOW AQUIFER, SEPTEMBER 2021

SHEET No. 9 PERFORMANCE PUMPING TEST EXTRACTION WELLS AND PIEZOMETERS

SHEET NO. 10 PROPOSED GROUNDWATER INTERCEPTOR TRENCHES AND EXTRACTION WELLS

SHEET NO. 11 PROPOSED PERFORMANCE MONITORING PIEZOMETERS AND TRANSECTS

SHEET NO. 12 GROUNDWATER SAMPLING LOCATIONS

APPENDICES

APPENDIX A RESPONSE COMMENTS TO EGLE's MARCH 10, 2023 LETTER

APPENDIX B PUMPING TEST GROUNDWATER ELEVATION PLOTS AND WELL LOGS

APPENDIX C PERFORMANCE PUMPING TEST WELL LOGS

APPENDIX D TREATMENT SYSTEM DESCRIPTION

1.0 INTRODUCTION

On behalf of Wolverine World Wide, Inc. (Wolverine), Rose & Westra, a Division of GZA GeoEnvironmental, Inc. (R&W/GZA), prepared this Revised Response Activity Plan (Revised RAP) for the Interceptor System at the former Wolverine Tannery, 181 North Main Street, Rockford, Michigan (Site).

On March 31, 2022, Wolverine submitted to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) the final EGLE-approved RAP under Paragraph 7.7(b)(i) of the Consent Decree. The initial design presented in the March 31, 2022, EGLE-approved RAP consisted of a network of pumping wells to induce inward hydraulic gradients and therefore preventing groundwater from venting to the surface water. The proposed system, including 14 shallow extraction wells, 3 deep extraction wells south of Rum Creek, and 5 shallow extraction wells north of Rum Creek, was a result of numerical groundwater modeling effort using a three-dimensional groundwater flow model. The three-dimensional groundwater flow model was initially described and submitted to EGLE in the February 2021 draft RAP, and further refined following EGLE's August 17, 2021 comment letter. The final EGLE-approved RAP addressed EGLE's August 17, 2021 comment letter on the February 2021 Draft RAP and EGLE's February 10, 2022 approval with conditions letter on the November 2021 revised RAP submission.

Following the EGLE-approved RAP, R&W/GZA conducted additional aquifer performance testing to further inform the system design. GZA conducted performance testing with pump tests, following RAP approval in early 2022, using three extraction wells and three piezometers north of Rum Creek. The objective of the performance testing was to evaluate the well capacity and monitor the hydraulic influence in the adjacent piezometers. The availability of the installed extraction wells provided the opportunity to conduct the performance pumping as pilot-scale testing of the extraction system effectiveness. The aquifer test data identified a lack of continuity of permeable zones which facilitate groundwater extraction and hydraulic control. In September 2022, R&W/GZA communicated to EGLE the concern, based on the results of the pump tests, that the design in the EGLE-approved RAP likely would not be effective at meeting the performance objective under the CD. In the September 27, 2022, correspondence to EGLE, R&W/GZA explained as follows:

> …these recent pumping tests indicate that successful implementation of such an extraction well system will likely be limited by aquifer heterogeneity and long-term operation and maintenance requirements. Given the practical limitations of the Site conditions, and the information gathered from recent pumping tests, we now believe a combination of groundwater pumping wells and trench collection systems will provide more reliable hydraulic control at the Site.

R&W/GZA submitted a Tannery Interceptor System Response Activity Plan Addendum (RAP Addendum), under Paragraph 7.14(b) of the Consent Decree on December 1, 2022. The RAP Addendum proposed a revised groundwater interceptor system consisting primarily of groundwater collection trenches supplemented with extraction wells. The RAP Addendum included an updated groundwater monitoring plan and implementation schedule. EGLE disapproved the RAP Addendum with comments in a letter dated March 10, 2023.

R&W/GZA is submitting this Revised RAP under Paragraph 7.14(b) of the Consent Decree to address EGLE's March 10, 2023, letter and propose substantial modifications to the system in the EGLE-approved RAP. **Sections 2.0** through **7.0** of the Final EGLE-approved RAP are included in this Revised RAP, without material changes. **Sections 8.0** through **16.0** of this Revised RAP are revised, as compared to the EGLE-approved RAP, with the updated groundwater interceptor system consisting of interceptor trenches and extraction wells. **Appendix A** includes comment-specific responses to EGLE's March 10, 2023 letter.

2.0 SUMMARY OF CONCEPTUAL SITE MODEL

The Site consists of 14.5 acres encompassing the former Wolverine Tannery property between Main Street and the Rogue River, north of Courtland Street, in Rockford, Michigan (**Figure 1**). Rum Creek flows from east to west through the central portion of the Site and discharges into the Rogue River, which flows southerly along the western Site boundary.

Figure 2-1: Site Plan

Based on Kent County LiDAR data, the Site slopes from Main Street toward the Rogue River with elevations ranging from approximately 707 feet mean sea level near the southeastern corner to 690 feet along the Rogue River. The properties surrounding the Site are a mixture of commercial (predominately south of the Site) and residential land use (east and north of the Site).

2.1 SITE HISTORY

This Site historically had a street address of 123 North Main Street, Rockford, Michigan and was developed in the late-1800s with an icehouse, lumber yard and associated coal storage located north of Courtland Street and west of Main Street. A shoe factory was constructed north of Rum Creek circa 1903, and the tannery was constructed south of Rum Creek circa 1908. The tannery eventually extended to the south and west onto formerly residential land and a lumber/coal yard, respectively. The tannery operated until 2009. In 2010 and 2011, once applicable environmental permits were obtained, it was demolished. A retail outlet store and certain paved areas remain on-Site.

During the demolition in 2010 and 2011, Wolverine collected groundwater samples from monitoring wells and piezometers under consultation with the U.S. Environmental Protection Agency (EPA) and the former Michigan Department of Environmental Quality (MDEQ) - now EGLE. Wolverine and MDEQ collected additional samples from the Site and the Rogue River during a Preliminary Assessment under CERCLA in late-2011 and early-2012.

Starting in August 2017, groundwater samples were collected from the Site monitoring wells for analysis of PFAS due to the historical usage of Scotchgard™ in the tannery operations. Scotchgard™ was manufactured by 3M Company and contained PFAS as active ingredients.

EGLE has only promulgated Part 201 Generic Cleanup Criteria (GCC) for certain PFAS for the groundwater/surface water interface (GSI) and drinking water pathways. For the GSI pathway, perfluoroalkyl sulfonic acid (PFOS) has the most restrictive criterion at 12 nanograms/liter (ng/l) or parts per trillion (ppt). The groundwater data indicated PFOS and perfluorooctanoic acid exceeded Part 201 GCC for the only applicable exposure pathway for PFAS at the Site, i.e., the GSI pathway. Because Rockford residents are on municipal drinking water and do not utilize the groundwater beneath the Site or the river water as a drinking water source, the drinking water pathway is not complete. EGLE has not promulgated Part 201 GCC for PFAS beyond the GSI and drinking water pathways.

Additional investigations were performed across the Site in 2018, 2019, and 2020. Although the EPA's UAO and AOC[1] did not specifically identify PFAS as target constituents, R&W/GZA collected 225 soil samples, 112 groundwater samples, 14 surface water samples, and 100 sediment samples for PFAS analysis in 2018. Refer to the "Final Implementation of 2018 Work Plan Summary Report, Tannery 2018 Work, Rockford, Michigan," dated January 11, 2019, prepared by R&W/GZA (R&W/GZA, 2019) for details.

In late-2019 and 2020, as part of the AOC-related activities, 14,576 cubic yards of soil and sediment were removed from nine excavation areas at the Site for disposal off-Site. These excavations were primarily backfilled with clean sand. While PFAS was not the driver for these excavations, the removal of these PFAS-containing soils from the Site reduced the PFAS source to groundwater. Specifically, 10,748 cubic yards of material, including leather scraps that may have been treated with Scotchgard™, were removed north of Rum Creek. Refer to the "Implementation of 2019 Work Plan - Summary Report - Final, Wolverine World Wide Tannery 2019-2020 Work, Rockford, Michigan," dated July 21, 2021, prepared by R&W/GZA (R&W/GZA 2021) for additional information.

2.2 PRECIPITATION AND GROUNDWATER RECHARGE

The 2016 climate data report for Grand Rapids, Michigan, downloaded from National Oceanic and Atmospheric Administration, indicates that the mean annual precipitation for the 80-year record period is approximately 36 inches. Precipitation that is not lost to surface run-off, evaporation, vegetation uptake and transpiration can percolate to the groundwater table as groundwater recharge. Groundwater recharge at the Site was evaluated based on published GIS data and streamflow records from the U.S. Geological Survey (USGS) Gauging Station No. 04118500 located in the Rogue River.

2.2.1 Estimation of Groundwater Recharge from Published GIS Data

Stream baseflow estimates provide a means of estimating groundwater recharge because water entering a stream basin discharges to the stream as baseflow. Baseflow estimates divided by the drainage areas are used as generalized groundwater recharge rate estimates. The Groundwater Inventory and Mapping Project, a

[1] Unilateral Administrative Order for Removal Actions[1] (UAO) effective February 1, 2018, and U.S. EPA Administrative Settlement Agreement and Order on Consent for Removal Actions (ASAOC) associated with the Former Wolverine Tannery and House Street Disposal site agreed upon by Wolverine and EPA on October 28, 2019.

cooperative effort between the former MDEQ, USGS Michigan Water Science Center, and Michigan State University, published estimated baseflow estimates and baseflow yields for Michigan stream segments using the technical method documented in the USGS report entitled "Base Flow in the Ground Lakes Basin" (Neff, Day, Piggott, & Fuller, 2005). Baseflow separations were performed on streamflow records for USGS stations in Michigan with more than ten years of daily streamflow records as of the year 2000. A series of multivariate linear regression models were developed to relate watershed characteristics to base flow estimates, such as land uses, annual growing days, precipitation, winter precipitation, percentage of lacustrine deposits, percentage of till, forest coverage, etc. Volumetric baseflow estimates were developed for stream segments. Based on the State-wide Base Flow of Michigan Streams GIS data (Groundwater Inventory and Map Project, 2005), the total baseflow for the entire Rogue River subbasin exiting to the Grand River is approximately 220 cubic feet per second (cfs), and the baseflow yield is approximately 0.86 feet per year (ft/yr). Baseflow yields were defined as baseflow estimates divided by the drainage areas, which are approximately equal to groundwater recharge. As such, the estimated groundwater recharge for the Rogue River drainage area is approximately 10.3 inches per year (in/yr). The total base flow for Rum Creek drainage area, exiting to the Rogue River, is approximately 9.4 cfs, and the baseflow yield is approximately 0.76 ft/yr. The estimated groundwater recharge for Rum Creek drainage area is approximately 9 in/yr.

Base Flow of Michigan Streams GIS data indicates the annual groundwater recharge estimates for the Site and its vicinity are 9 to 11 in/yr. These published baseflow and groundwater recharge estimates have their limitations because the estimates were generalized over spatial variability and temporal variability, and the estimated values are subject to uncertainties related to the baseflow separation technique used. However, the estimates provide reference values for comparison and further evaluation.

2.2.2 Estimation of Groundwater Recharge from Streamflow Data

Daily stream flow records from the USGS Gauging Station No. 04118500, located in the Rogue River near Packer Drive NE at Rockford, Michigan were evaluated. This gauging station is near the Rogue River confluence to the Grand River. Using USGS's Groundwater Toolbox software, baseflow separation using six different methods[2] was performed on the daily streamflow records from 1988 to 2020. The average baseflow estimates in cfs from the six methods were plotted below from 1988 to 2020. From 1988 to 2020, the average annual streamflow rate measured at Gauging Station No. 04118500 was approximately 270 cfs (~170 million gallons per day [MGD]), and the average baseflow rate was approximately 210 cfs (~140 MGD).

[2] Base-Flow Index (BFI) Standard, BFI Modified, Hydrograph separation program (HYSEP) Fixed Interval, HYSEP Sliding Interval, HYSEP Local Minimum, and PART methods

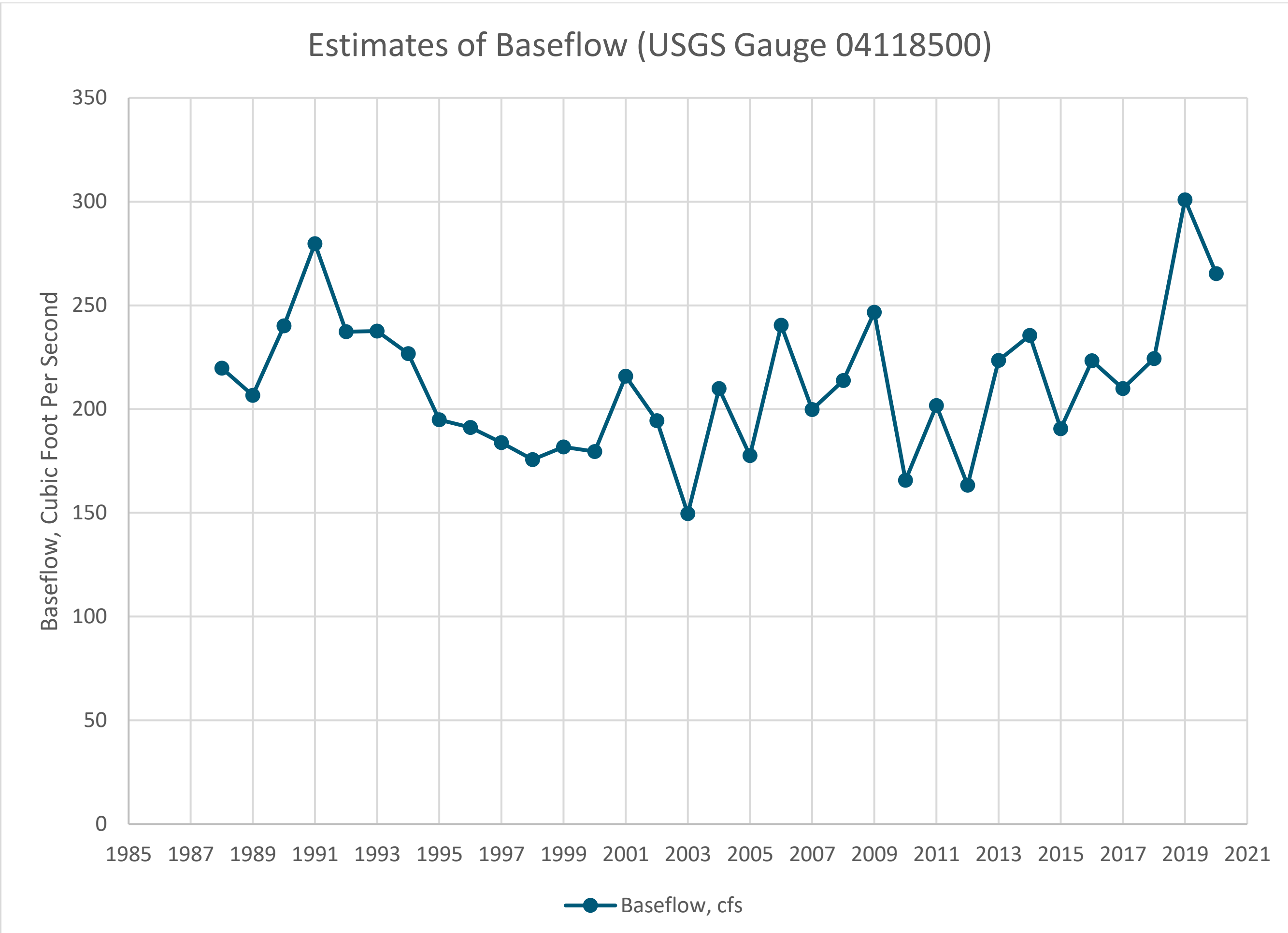


Figure 2-2: Annual Baseflow Estimates (USGS Gauge 04118500)

Based on the baseflow estimates and the drainage area, groundwater recharge for the drainage area represented by the gauging station was estimated to range from 9 to 17 in/yr, with an average of 12 in/yr from 1988 to 2020.

The annual groundwater recharge estimates for the last five years, from 2016 to 2020, are summarized below.

Year	Average Annual Groundwater Recharge Estimate, in/yr
2016	13
2017	12
2018	13
2019	17
2020	15

Table 2-1: 2016 to 2020 Annual Groundwater Recharge Estimates Based on Streamflow Records at USGS Gauge 04118500

As shown in the above table, the annual groundwater recharge estimate for 2019 is approximately 5 in/yr greater than the historical average, and in 2020, the estimate is approximately 3 in/yr greater than the historical average.

2.3 REGIONAL GEOLOGY

The unconsolidated geologic conditions in Kent County consist of a thick sequence of Pleistocene glacial deposits. The glacial deposits in the county include till, outwash, and lacustrine deposits. Till occurs in end moraines and ground moraines (till plains) interspersed on the surface throughout the County (Stramel, Wisler, & Laird, 1954). For the area near the City of Rockford and Plainfield Township, the Michigan Glacial Land systems (Groundwater Inventory and Mapping Project, 2015) indicate a proglacial outwash plain is present along the Rogue River, and end moraines are present on either side of the Rogue River extending to the "wide" near the Grand River. The ground moraine (till plain) and end moraine belong to the unstratified class of deposits, composed of fine-to- coarse-grained material, including silt, sand, gravel, and boulders.

Bedrock consisting of the Mississippian-aged sandstone (Marshall formation), shale (Michigan formation), and the Bayport limestone as well as the Pennsylvanian-aged Saginaw Formation underlay Kent County. Based on the Hydrogeologic Atlas of Michigan (Western Michigan University, Department of Geology, 1981), the top of bedrock elevation ranges from 500 to 550 feet near the City of Rockford; therefore, the overburden thickness ranges from approximately 145 feet to approximately 205 feet.

2.4 SITE GEOLOGY

R&W/GZA's investigation activities indicated unconsolidated deposits include shallow fill and alluvial disturbed soils overlying a relatively thick, unstratified sequence of sand and silt/clay which has been generally encountered at depths of 10 to 20 feet below ground surface (bgs). The fill materials typically include sand and gravel containing varying percentages of ash, brick, cinders, and other debris. Occasional peat was also encountered in borings drilled at the Site. Bedrock has not been encountered in borings drilled to date with a maximum boring depth of approximately 150 feet bgs.

Several geologic cross-sections were created based on the soil borings and well installation completed to date. **Sheet No. 1** includes the locations of the cross-sections and **Sheet Nos. 2** through **5** for geologic cross sections I-I' through VII-VII'. Groundwater monitoring well names are labeled on the cross-sections. PFOS concentrations in micrograms per liter (µg/L), or parts per billion, are posted by the monitoring well screens for discussions in the later sections. The posted PFOS concentrations were based on the groundwater quality data collected in 2018 or earlier.

Underlying the surficial layer of fill material at the Site, the predominant geologic conditions across the Site are characterized by sand and sand-and-gravel deposits with fine-grained soils, consisting of clay or silt. The thickness and texture of the fine-grained deposits vary laterally and with depth. In some boreholes, fine-grained soils were not observed, or the thickness of the fine-grained soil strata were less than those of coarse-grained soils, such as sand or gravel. Thicker and more frequent encounters of fine-grained soils tend to occur on the northern portion of the Site. In the area north of Rum Creek, fine-grained soils were encountered at approximately 5 to 8 feet bgs in the majority of the soil borings. Generally, fine-grained soil appears to be unstratified, and the distributions result in significant geologic heterogeneity throughout the unconsolidated deposits underlying the Site.

As noted in **Section 2.1**, excavations were conducted in nine areas at the Site in 2019 and 2020. Excavations were backfilled with sand or sand and gravel. Excavation depths ranged from one foot in most areas east of the White Pine Trail to 10 feet in one excavation located south of Rum Creek near Main Street (R&W/GZA 2021). Refer to the "Implementation of 2019 Work Plan - Summary Report - Final, Wolverine World Wide Tannery 2019-2020 Work, Rockford, Michigan," dated July 21, 2021, prepared by R&W/GZA (R&W/GZA 2021) for plan view and cross-sectional view of the excavation areas and depths. Since the majority of the excavations were less than or equal to 5 feet deep and located within the unsaturated zone; the relatively permeable and coarse-grained backfill materials are not expected to alter the groundwater flow pattern, and because of their limited areal coverage are not expected to materially increase areal groundwater recharge.

2.5 REGIONAL HYDROGEOLOGY

The direction of regional groundwater flow is influenced by the primary surface water features of the Rogue River and the Grand River drainage. Streamflow data from the USGS Gaging Station indicates the Rogue River is a gaining stream, a groundwater discharge zone. Therefore, the regional groundwater flow pattern within the unconsolidated deposits in the vicinity of the Site is generally westerly, with discharge occurring to the river immediately west of the Site.

2.6 SITE HYDROGEOLOGY

Groundwater monitoring wells were installed during previous investigation activities starting in 2011. **Table No. 1** summarizes the groundwater monitoring well construction information. Currently, there are 81 groundwater monitoring wells at the Site. See **Sheet No. 6** for the monitoring well location plan.

Table 2 presents the water level data collected from Site monitoring wells in April 2019. Based on the April 2019 groundwater elevations and surface water stations, groundwater contours for the shallow aquifer were interpreted. **Sheet No. 7** depicts the interpreted groundwater contours. In addition, groundwater contours interpreted from the recent September 2021 water level data are plotted in **Sheet No. 8**. As shown in **Sheet Nos. 7** and **8**, the groundwater flow direction within the upper portion of the saturated zone is generally from east-to-west, toward the Rogue River which is the primary groundwater discharge zone. Groundwater proximate to Rum Creek appears to discharge to Rum Creek. The hydraulic gradient north of Rum Creek is flatter than south of the Rum Creek. A groundwater mound is present in the central area of the Site south of Rum Creek. The groundwater mound in April 2019 is more apparent than that of September 2021, likely due to greater groundwater recharge in April 2019. The presence of the groundwater mound results in groundwater movement toward Rum Creek to the north, the Rogue River to the west, and the southwest at the southern portion of the Site. Groundwater flow patterns in the southwest corner of the Site in April 2019 appear to be less uniform than those in September 2021, due to the relatively high groundwater elevation measured at TA-MW-313A. This relatively high groundwater elevation is attributed to the fine-grained sediment observed within the well screen interval combined with the effects of the relatively high precipitation recharge in April 2019. The September 2021 groundwater contours have been refined by the additional monitoring wells south of the Site. Except for the localized variation near TA-MW-313A, the groundwater flow pattern is generally consistent from April 2019 to September 2021, confirming the 2019/2020 excavations and backfill did not materially affect the groundwater flow at the Site.

Hydraulic conductivities measured via slug testing within monitoring wells screened above the low-permeability unit range from less than 0.1 feet per day to greater than 10 feet per day. As shown in **Sheet Nos. 7** and **8**, the average hydraulic gradient is approximately 0.006. Based on the average hydraulic gradient and the range of hydraulic conductivities, the estimated groundwater seepage velocity ranges from 0.7 to 70 feet per year.

Groundwater elevations measured in the deeper monitoring wells are generally lower than those in the shallow aquifer indicating that downward hydraulic gradients dominate across the Site. Downward vertical gradients are common for unconfined aquifers. Localized exceptions to this condition were observed at the TA-MW-317B/C/D and TA-MW-311C well clusters, where artesian conditions were observed. Both well clusters are located northeast of the Site where confining fine-grained soil stratum occurs above the well screen intervals.

Several deep monitoring wells are located close to the Rogue River. Preliminary evaluation indicates groundwater flow in the deeper portions of the aquifer is to the west towards the Rogue River. The following table provides a summary of the groundwater elevations in the deep zone wells in April 2019, as compared to the surface water elevation measured in the Rogue River, 691.81 feet. Only the groundwater elevations measured at TA-MW-309C/D are close to (but still lower than) the river water elevation. The groundwater elevations in the other deep wells are more than 2 feet lower than that of the Rogue River.

Monitoring Well	Groundwater Elevations, Feet
TA-MW-301D	689.41
TA-MW-303D	689.12
TA-MW-303E	689.14
TA-MW-309C	691.68
TA-MW-309D	691.67
TA-MW-310C	689.78
TA-MW-313B	687.03
TA-MW-313C	686.90

Table 2-2: Summary of Groundwater Elevations in Deep Zone Monitoring Wells, April 2019

2.7 CHEMICAL DATA

The only applicable pathway for PFAS compounds in groundwater at the Site is the GSI. Therefore, groundwater quality data are evaluated and compared to the Part 201 GCC GSI criteria. See attached **Table 3** for a summary of the 2019 and 2021 groundwater quality data. Refer to R&W/GZA, 2019 for the groundwater quality data collected in 2018. Note the 2019/2020 excavation activities, while not driven by PFAS concentrations, removed 10,748 cubic yards of PFAS-contaminated material from the Site and thereby reduced the source material available for leaching to groundwater.

Based on spatial distribution and concentrations relative to the generic GSI criterion, PFOS is the controlling analyte designing the extent of the groundwater interceptor system.

R&W/GZA prepared summary tables and two-dimensional isoconcentration figures for compounds in groundwater that exceed GSI criteria (R&W/GZA, 2019). The extent of PFOS concentrations exceeding the GSI criteria, based on the on-Site groundwater quality data, is included as **Figure 2-3** below. **Sheet Nos. 2** through **5** present maximum PFOS concentrations (µg/L) in the groundwater monitoring wells used to construct cross-sections I-I' through VII-VII'. As shown in **Figure 2-3**, higher PFOS concentrations were in the area near Rum Creek, south of Rum Creek, and along the Rogue River. As shown in **Sheet Nos. 2** through **5**, PFOS was primarily present in the upper 10 feet of the saturated section, corresponding to approximate elevations of 680 to 690 feet.

Figure 2-3: Extent of PFOS in Groundwater

Downward migration of PFOS from the upper groundwater zone is mostly affected by the presence or absence of fine-grained deposits that impede downward migration. For example, the presence of clay and silt observed at well cluster TA-MW-303A/E limits the relatively higher PFOS concentrations to above an elevation of approximately 672 feet; the presence of clay and silt in TA-MW-313 and TA-MW-316 well clusters limit the relatively higher PFOS concentrations to above an elevation of approximately 687 feet. On the other hand, the lack of fine-grained soils or relatively thin stratum of fine-grained soil allow the vertical migration of PFOS within the groundwater. Due to the relatively thin strata of fine-grained soils in well cluster TA-MW-309, relatively higher PFOS concentrations were detected in well cluster TA-MW-309 from the shallow saturated zone to an elevation of approximately 650 feet. The vertical distribution of PFOS will be taken into consideration during the design of the groundwater interceptor system.

3.0 IN SITU EVALUATION OF SITE HYDRAULIC PROPERTIES

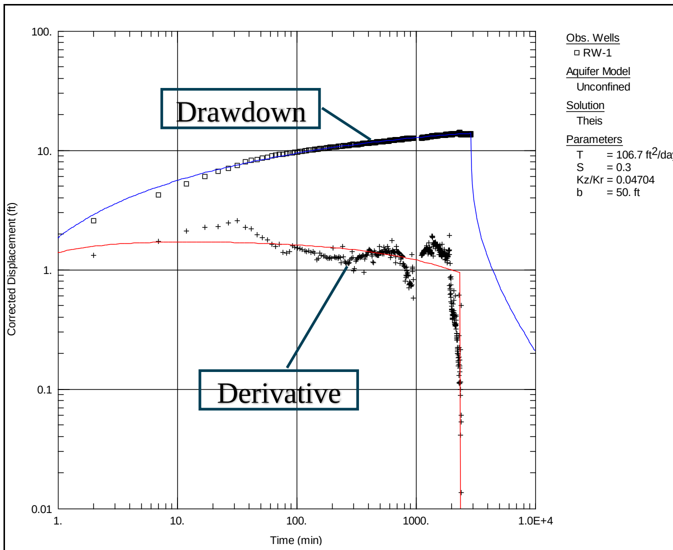
To evaluate hydraulic properties of the upper groundwater section, three pumping tests were performed at extraction wells TA-RW-1, TA-RW-2, and TA-RW-3 in May 2019. Pressure transducers were installed in the extraction wells and the nearby groundwater monitoring wells to measure water level changes before, during, and after the pumping. Barometric pressures were measured and compensated. **Sheet No. 1** indicates the locations of the existing extraction wells and the existing and former monitoring wells.

Table 3-1 provides a summary of the pump start-up, shutdown, pumping rates in gallons per minute (GPM) and the list of the monitoring wells observed to have drawdowns greater than 0.3 foot for pumping test interpretation.

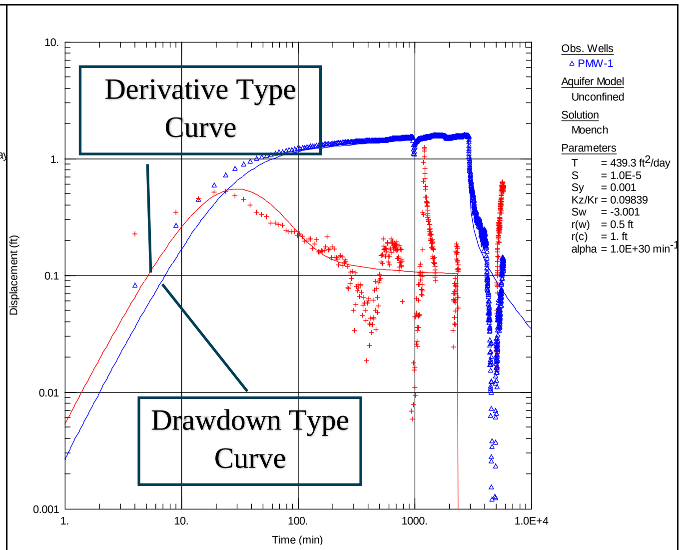
Extraction Well	Pumping Rate, GPM	Pumping Start	Pump Shut-off	List of Monitoring Wells Responding to Pumping
TA-RW-1	2.9	5/6/2019 12:00 PM	5/8/2019 12:12 PM	TA-PMW-1 and TA-MW-2
TA-RW-2	0.25	5/13/2019 12:30 PM	5/15/2019 3:50 PM	TA-PMW-2 and TA-MW-1
TA-RW-3	3.5	5/20/2019 1:32 PM	5/22/2019 2:08 PM	TA-PMW-3 and TA-PMW-6

Table 3-1: Summary of Pumping Test Periods

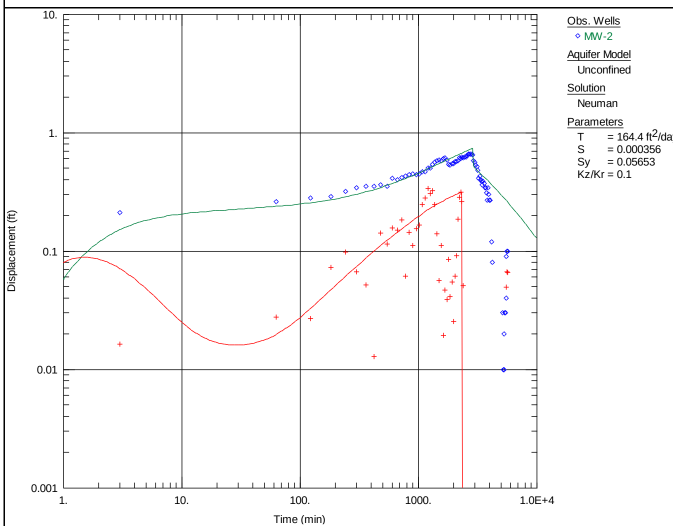
Soil boring logs and well installation logs for TA-RW-1 through TA-RW-3, and TA-PMW-1 through TA-PMW-9 and combined summary plots of the water level response data for each of the pumping tests are in **Appendix B**.



a



b



c

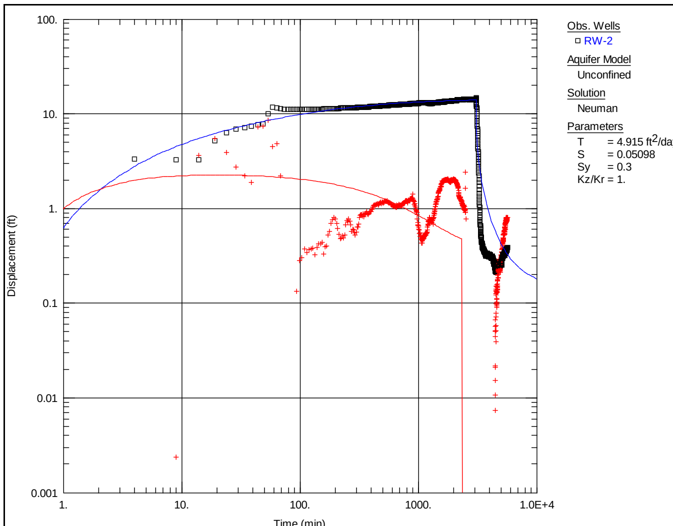
Figure 3-2(a): From 1 to 30 minutes, the derivative plot of TA-RW-1 drawdown shows a positive slope of approximately 0.25, indicating bilinear flow, which is two-dimensional flow toward a channel-like aquifer. The negative slope immediately after 30 minutes may correspond to more conductive aquifer zones, with greater hydraulic conductivity. Later on, the derivative slope continues to change but the magnitude of fluctuation become less. In average, the later derivative plot generally displays radial flow conditions.

Figure 3-2(b): The derivative plot from 20 minutes to 500 minutes indicates the effect of non-instantaneous drainage at water table.

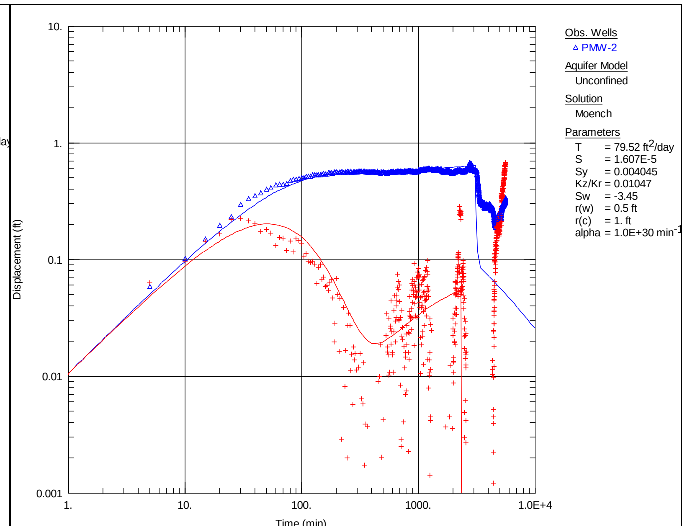
Figure 3-2(c): The derivative plot of TA-MW-2 also indicates the effect of non-instantaneous drainage at the water table. The later positive slope, however, may indicate a non-permeable boundary, suggesting limited extent of conductive zone in that direction.

Figure 3-1: TA-RW-1 Test Drawdown and Derivative Plots: (a) TA-RW-1 (b) TA-PMW-2 (c) TA-MW-2.

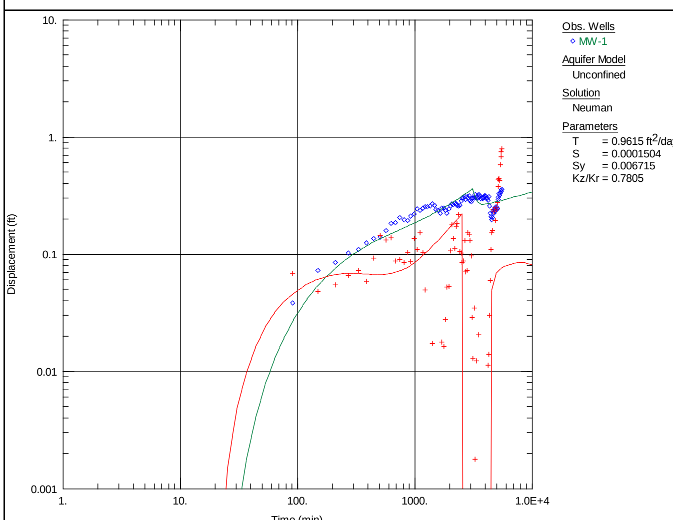
Software AQTESOLVE by HydroSOLVE, Inc. of Reston, Virginia was used to perform pumping test analysis. The drawdowns and the derivatives of the drawdowns are plotted in **Figures. 3-2** through **3-4**. **Figures 3-2(a)** through **3-2(c)** present the log-log plots of drawdowns and derivatives, along with pumping test solution matching type curves. The derivative plots indicate the effect of non-instantaneous drainage at the water table, the presence of low permeability zones limiting the cross-sectional groundwater flux areas, and potentially non-permeable boundary in the direction of TA-MW-2 as the stress of pumping propagates further.



A



b



c

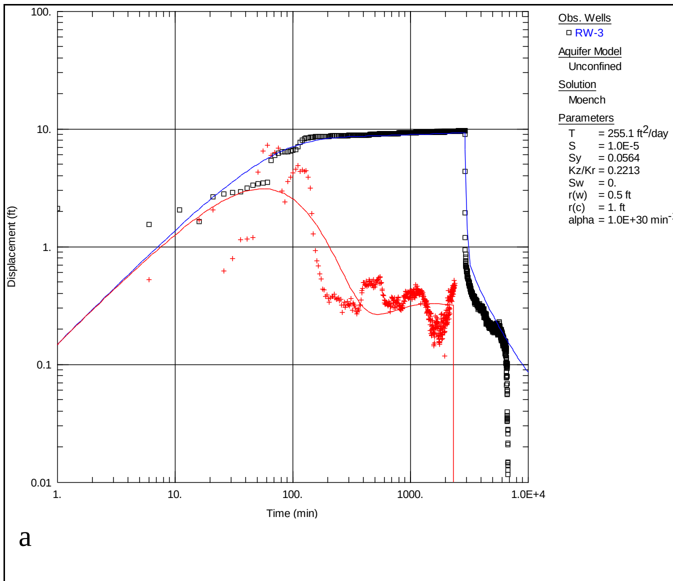
Figures 3-3(a): The derivative plot indicates the effect of non-instantaneous drainage at the water table, similar to Figure 3-3 (b). The derivatives of the early test periods (before 30 minutes) in TA-RW-2 are greater than those of the late test periods (after 500 minutes), indicating wellbore skin effect in the extraction well TA-RW-2.

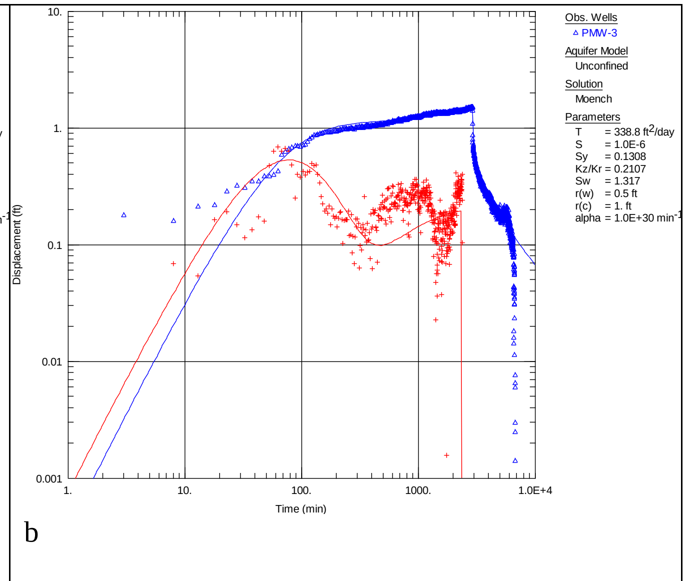
Figure 3-3(b): The derivative plot indicates the effect of non-instantaneous drainage at the water table, similar to Figure 3-2 (b).

Figure 3-3(c): The generally positive derivative plot slope in the late part of the test indicates non-permeable boundaries, suggesting limited extent of conductive zones in the direction of TA-MW-1.

Figure 3-3: TA-RW-2 Test Drawdown and Derivative Plots: (a) TA-RW-2 (b) TA-PMW-2 (c) TA-MW-1

Figures 3-3(a) through **3-3(c)** presents the log-log plots of drawdowns and derivatives, along with pumping test solution matching type curves for the TA-RW-2 test. **Figures 3-3 (a)** through **3-3 (c)** show the wellbore skin effect at the extraction well, non-instantaneous drainage at the water table, and non-homogeneous nature as the effect of pumping propagating further.





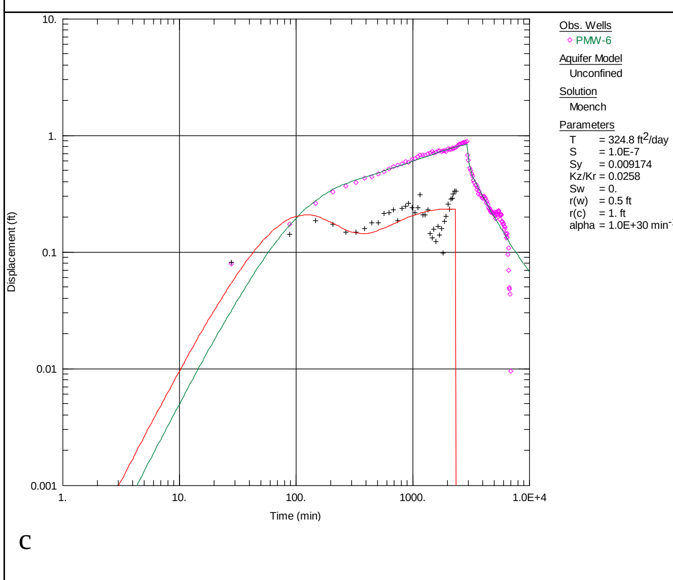


Figure 3-4(a): From 20 to 500 minutes, the derivative plot indicates the effect of non-instantaneous drainage at water table. The derivatives of the late test period (after 400 minutes) are less than those of the early test period (before 100 minutes), indicating wellbore skin effect. Later on, the derivative plot undergoes two cycles of changing from a negative slope to a positive slope, possibly indicating the lateral effects of a more conductive and then less conductive zone.

Figure 3-4 (b): The derivative plot from 100 to 400 minutes indicates the effect of non-instantaneous drainage at water table. Similar to Figure 3-2 (a), the changing slope in the late test period indicating inhomogeneity of aquifer materials or hydraulic conductivities.

Figure 3-4 (c): The derivative plot is similar to Figure 3-2 (c), exhibiting drainage at the water table and inhomogeneity.

Figure 3-2: TA-RW-3 Test Drawdown and Derivative Plots: (a)TA-RW-3 (b) TA-PMW-3 (c) TA-PMW-6

Figures 3-4 (a) through **3-4 (c)** indicate wellbore skin effect at the extraction well, non-instantaneous drainage at the water table, and non-homogeneous nature as the effect of pumping propagating further.

The drawdown and the derivative data were matched with the type curves of unconfined Neuman solutions (Neuman, 1975) or unconfined Moench solutions (Moench, 1997). The unconfined Neuman solution is appropriate for anisotropic, homogeneous, unconfined aquifer, fully or partial penetration with instantaneous drainage at the water table. The unconfined Moench solution is similar to the Neuman solution, except for the introduction of the non-instantaneous drainage parameter. The Neuman solutions were attempted for all the extraction wells and the observation wells, but for some wells where non-instantaneous drainage occurred, the Moench solutions provide a better fit to the data as shown in **Figures 3-2** through **3-6**.

Overall, the pumping test results reflect the variable hydraulic properties and general heterogeneity of the shallow groundwater flow system at the Site as observed in numerous borings drilled across the Site. **Table 3-2** provides a summary of the interpreted hydraulic conductivity, storage coefficient, specific yield, and the ratio of vertical hydraulic conductivity to horizontal hydraulic conductivity as derived from the pumping tests.

Test/Observation Well	Hydraulic Conductivity, ft/d	Storage Coefficient (dimensionless)	Specific Yield	Ratio of Vertical to Horizontal Hydraulic Conductivity (Kz/Kh)
TA-RW-1 Test				
TA-RW-1	2.1	Not Used	3.0E-01	0.05
TA-PMW-1	8.8	1.0E-05	1.0E-03	0.10
TA-MW-2	3.3	3.6E-04	5.7E-02	0.10
TA-RW-2 TEST				
TA-RW-2	0.1	Not Used	3.0E-01	1.0
TA-PMW-2	1.6	1.6E-05	4.1E-03	0.01
TA-PMW-8	0.06	3.6E-04	1.7E-02	1.0
TA-MW-1	0.02	1.5E-04	6.7E-03	0.78
TA-RW-3 TEST				
TA-RW-3	5.1	Not Used	5.6E-02	0.22
TA-PMW-3	6.8	1.0E-06	1.3E-01	0.21
TA-PMW-6	6.5	1.0E-07	9.2E-03	0.03

Table 3-2 - Summary of Interpreted Results

The interpreted hydraulic conductivity values of the TA-RW-1 and TA-RW-3 tests appear to be consistent and provide a reliable value for the coarser-grained deposits. These values are approximately one order of magnitude less than the typical values for a clean sand and gravel aquifer. The lower hydraulic conductivity values are attributed to increased percentages of finer-grained material in the well screen intervals and near the extraction wells. The interpreted hydraulic conductivity values of the TA-RW-2 test are lower than those of TA-RW-1 and TA-RW-3 because the proportion of fine-grained soil in TA-RW-2 borehole is greater than those observed near TA-RW-1 and TA-RW-3. The pumping test solutions assume a homogeneous aquifer. For the non-homogeneous aquifer at the Site, the pumping test results represent scaled-up, average values for the zone of investigation affected by the pumping stress. The interpreted hydraulic conductivity values provide a range for subsequent groundwater modeling input and calibration.

The storage coefficient values from the pumping wells were not used because observation well data generally provides a better estimate for the storage coefficient. In addition, for unconfined aquifers, the drawdown response is largely controlled by hydraulic conductivity and specific yield. The effect of elastic storage and dewatering represented by the storage coefficient is limited to the early part of the test, and generally negligible as compared to the effect of delayed water table response as represented by specific yield. For subsequent modeling input, a typical literature value of 2E-4 will be used for the storage coefficient.

The interpreted specific yields vary from 0.001 to 0.3. Fine-grained deposits typically have lower specific yield values than coarse-grained. In addition, unreasonable lower specific yield values are often obtained from unconfined pumping test solutions, such as the Neuman solution that excludes the effect of flow in the capillary fringe, while a Theis solution fitted to the late segment of the drawdown curve generally provides reliable estimates of specific yield (Kruseman & Ridder, 1994). The specific yield obtained from the TA-RW-1 test, using Theis solution, is 0.3. For subsequent modeling input, typical literature values ranging from 0.01 to 0.3 will be used.

4.0 GROUNDWATER MODELING OBJECTIVES

The objective of this modeling study was to develop a three-dimensional groundwater flow model from which initial design parameters of a groundwater interceptor system that effectively prevents Site groundwater from discharging to the Site surface water features can be developed. R&W/GZA has revised and refined the model inputs based on EGLE's comments in its letter dated August 17, 2021, the majority of which focused on technical aspects of the model as described in **Sections 5.0** through **7.0**.

5.0 SELECTED MODEL

The USGS MODFLOW, a three-dimensional finite difference numerical modeling software, was used to perform groundwater flow simulations, and USGS MODPATH to perform particle tracking. These software packages are publicly available, peer-reviewed models that are widely accepted by regulatory agencies world-wide. Aquaveo's Groundwater Modeling System software is used as the pre- and post-processor.

6.0 REGIONAL GROUNDWATER MODEL SETUP

A regional groundwater model, from Shaw Creek to the north and to Barkley Creek to the south, from the Rogue River to the west, and Wolverine Boulevard to the east, was first set up to evaluate regional groundwater flow (**Figure 6-1**). The eastern boundary near Wolverine Boulevard was prescribed as an artificial constant-elevation groundwater boundary. The location was selected based on the county-wide estimated groundwater elevation contours. Its distance to the Site is significantly greater than the Site size; therefore, boundary effects are expected to be negligible to the Site area groundwater elevation and flow. Surface water elevations were based on Kent County LiDAR data (Sanborn, 2014) and adjusted per R&W/GZA's April 2019 water level measurements collected at surface water gaging station SW-04[3] during the pumping tests. The elevations from the LiDAR data provide a set of synoptic data for the surface water elevations. The SW-04 data was used as a reference point, and the synoptic data set was adjusted based on the difference in water elevations at SW-04 between the LiDAR data and the measured data on May 5, 2019, prior to the pumping test. **Figure 6-1** provides the model domain and the input surface water boundary types and elevations.

A model grid size of 30 by 30 feet was used horizontally. The vertical model grid extends from the ground surface to an elevation of 560 feet. Six model layers were used with a layer thickness of approximately 20 feet for the top four layers, and approximately 25 feet for the fifth and sixth model layers. As an initial regional model, the model domain was assumed to be homogeneous, represented by one single value of horizontal hydraulic conductivity (Kh), vertical hydraulic conductivity (Kv), and groundwater recharge was assumed to be uniform.

The April 24, 2019 elevation data was used as calibration targets. The hydraulic conductivity and groundwater recharge were set as calibration parameters. The ranges of hydraulic conductivity were based on the pumping test results. The range of groundwater recharge was based on "Estimated of Annual Groundwater Recharge" (Groundwater Inventory and Mapping Project, 2005). The software "PEST" (Doherty, 2021), an inverse parameter estimation tool, was used with MODFLOW. PEST directs MODFLOW to run with numerous combinations of Kh, Kv, and groundwater recharge until it establishes the optimal calibration values of Kh, Kv, and groundwater recharge. The calibrated values are achieved when the sum of squared residuals between the field measured

[3] SW-04 is the same location as TA-RP-04.

groundwater elevations and model calculated groundwater elevations are minimized. **Table 6-1** provides the input ranges and the PEST calibrated values:

Parameters	Minimum Value	Maximum Value	PEST Calibrated Value
Horizontal Hydraulic Conductivity (Kh), ft/day	0.10	100	4.8
Vertical Anisotropy (Kh/Kv)	1.0	50	2.3
Groundwater Recharge, inches/year	9.0	12	12

Table 6-1: Regional Model Calibration Parameters

Figure 6-2 presents the model calculated groundwater elevation contours using the PEST calibrated value.

The regional model elevation results were transferred to a local model, which is focused on the Site area and its vicinity. The vertical model grid layers remain the same. The artificial model boundaries to the north, south and east were set as constant elevation boundaries for the local model and the groundwater elevations from the regional model at these boundaries were overlaid to the local model as constant elevation values. **Figure 6-3** presents the local model domain.

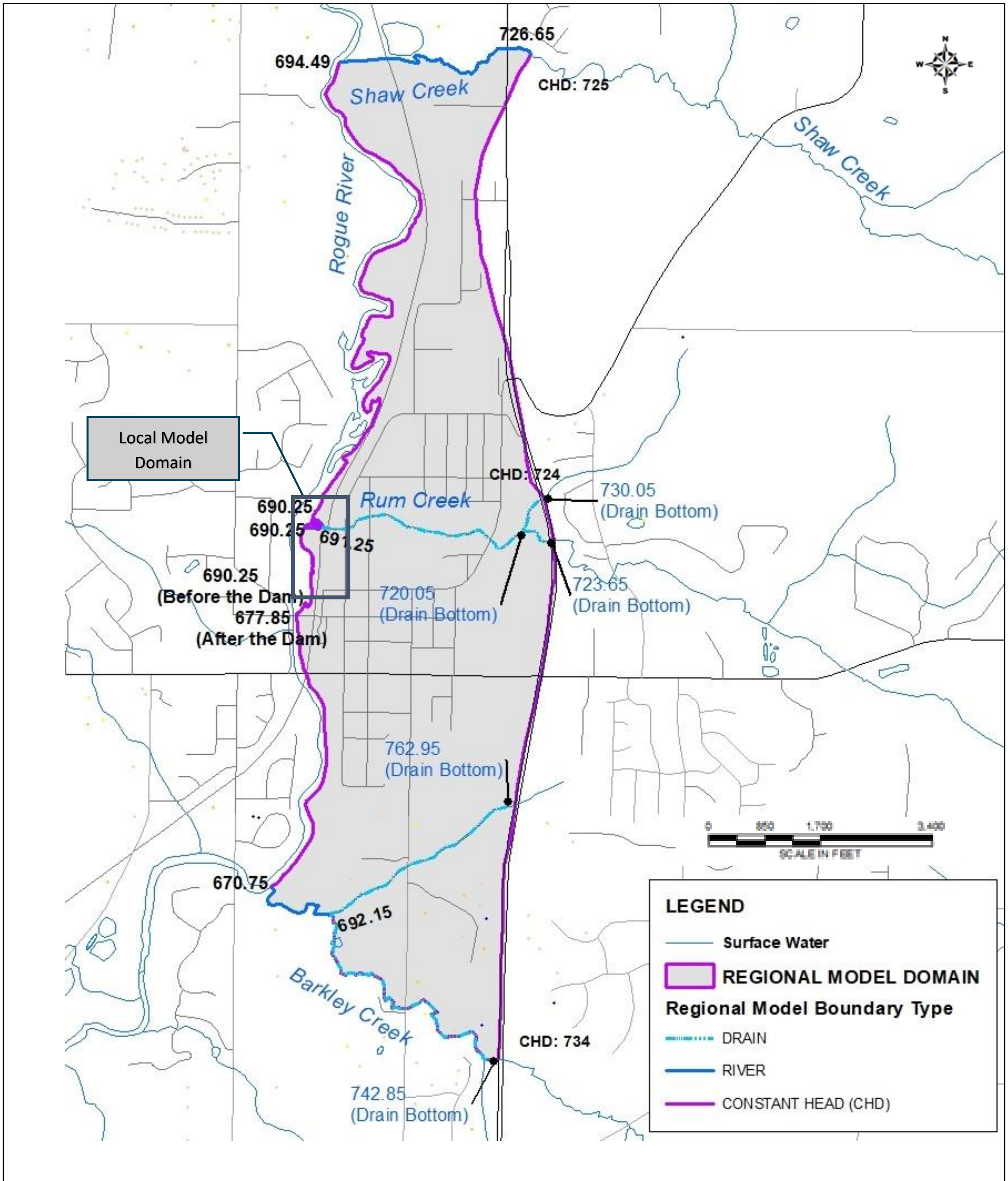


Figure 6-1:Regional Model Domain, Boundary Types

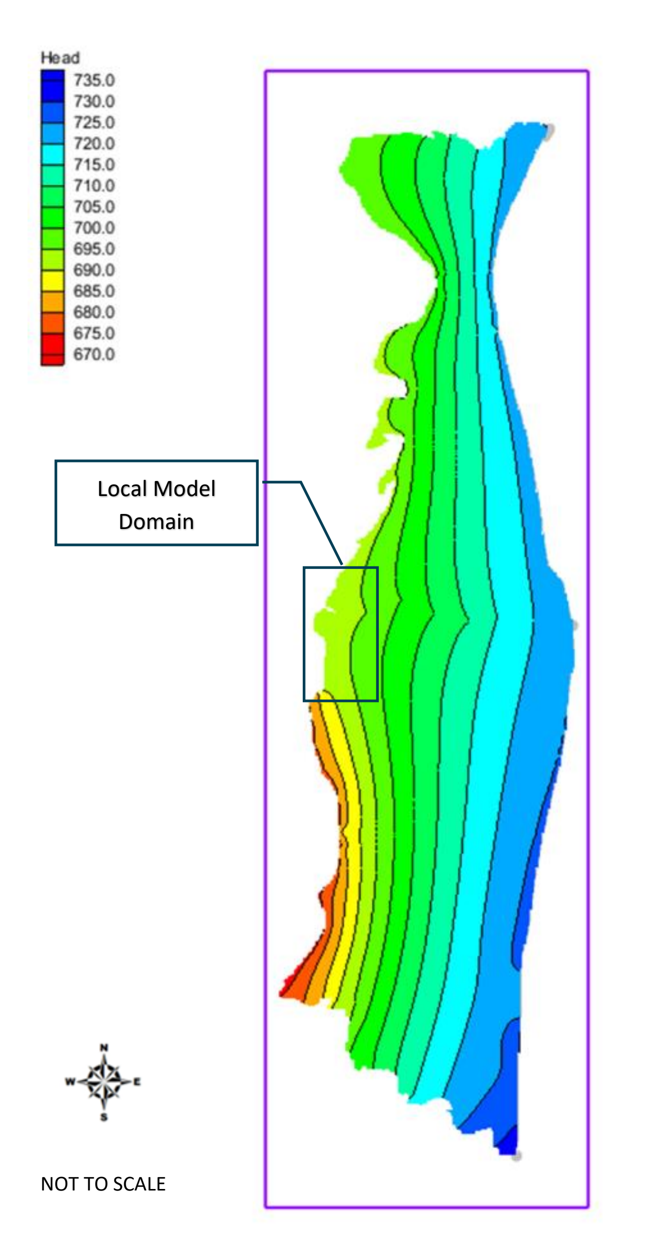


Figure 6-2: Modeled Groundwater Contours, Regional Model

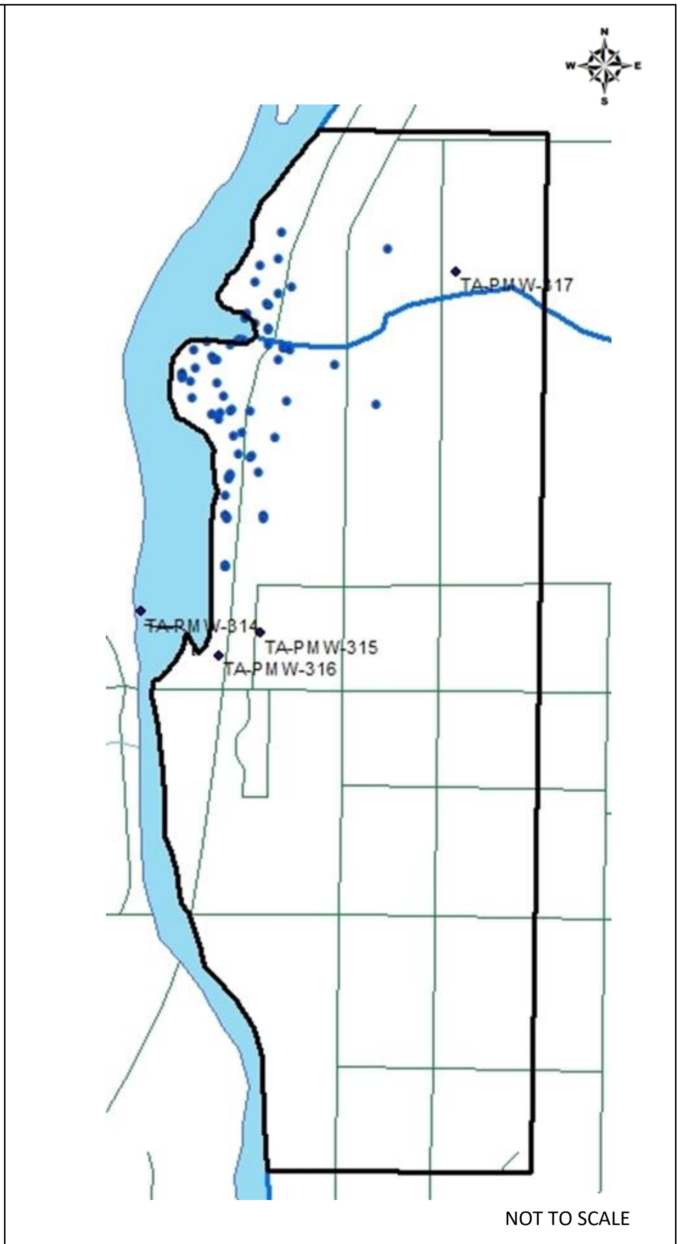


Figure 6-3: Local Model Domain

7.0 LOCAL GROUNDWATER FLOW MODEL

The local model setup, input parameters, and calibration are discussed in this Section. See **Figure 6-3** for the local model domain.

7.1 LOCAL MODEL SETUP

USGS' MODFLOW-Unstructured Grid Version (MODFLOW-USG) was used for the local model. Quadtree grids as fine as 3 feet were used in the areas close to the Rogue River and Rum Creek. The grid sizes increase outside of the focused area to reduce total cell numbers and computation time. The vertical model grid layers remain the same as the regional model, and the model layer top and bottom elevations were mapped to the local model. Groundwater elevations data were collected in April 2019 and September 2021. Considering the availability of groundwater recharge estimates for 2019, and April 2019 being a relatively wet and high groundwater recharge month, the April 2019 groundwater elevation data set was used as a conservative input for model calibration.

7.2 GROUNDWATER RECHARGE ESTIMATES

Historical annual groundwater recharge is discussed in **Section 2.2.** From the daily streamflow records at USGS Gauge 04118500, groundwater recharge in April 2019 was estimated to be approximately 19 in/yr. As discussed in **Section 2.2**, groundwater recharge for the Rum Creek drainage area was expected to be less than that of Rogue River. Therefore, groundwater recharge at the Site area is expected be slightly less than 19 in/yr in April 2019 and represents a conservative recharge figure for the Site. Note that higher recharge values in the model will translate to proportionately higher design rates for groundwater pumping to meet the hydraulic capture objective of the interceptor system.

7.3 SURFACE WATER ELEVATION

Surface water elevations for the model inputs were estimated using water level measurements at several shallow river piezometers (TA-RP-1 through TA-RP-5) in the Rogue River sediment and were measured using a staff gauge (TA-SG-RC) in Rum Creek. See **Figure 7-1** below for the locations of the measurement points.

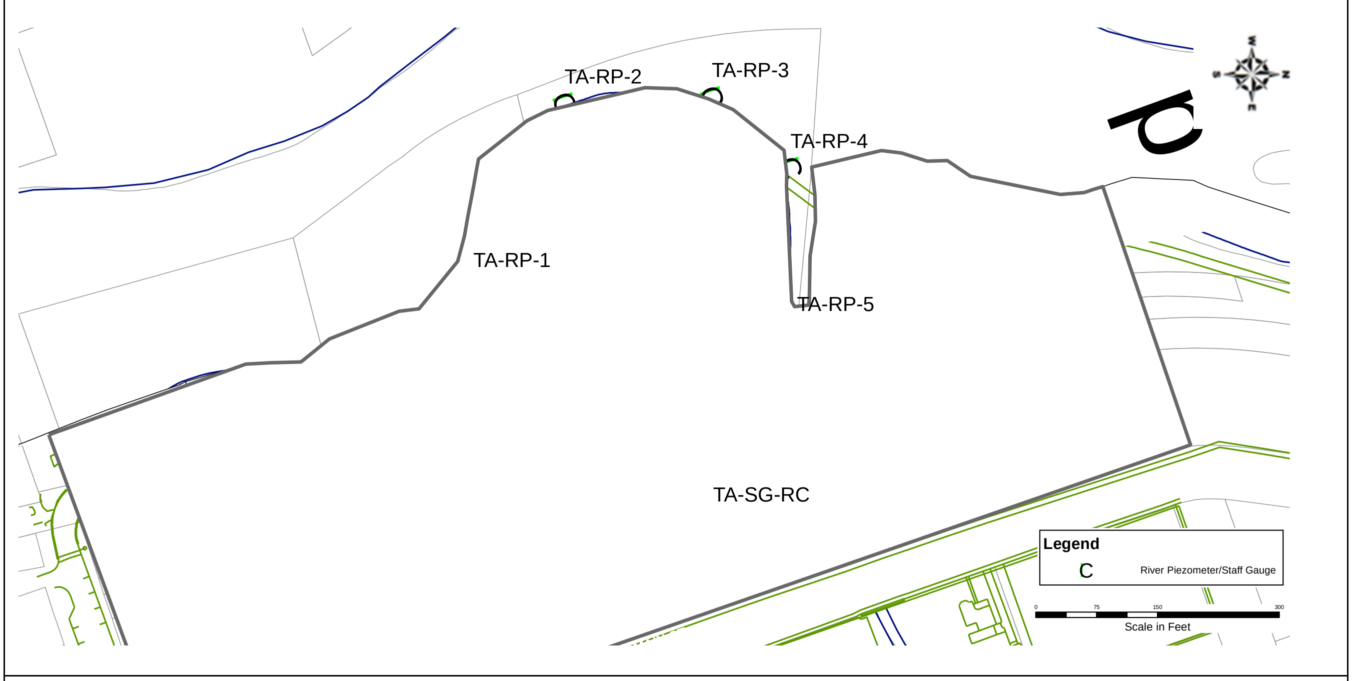


Figure 7-1: Locations of Surface Water Elevation Measurements Stations

Historical surface water elevations measured from 2013 to 2017 are plotted below:

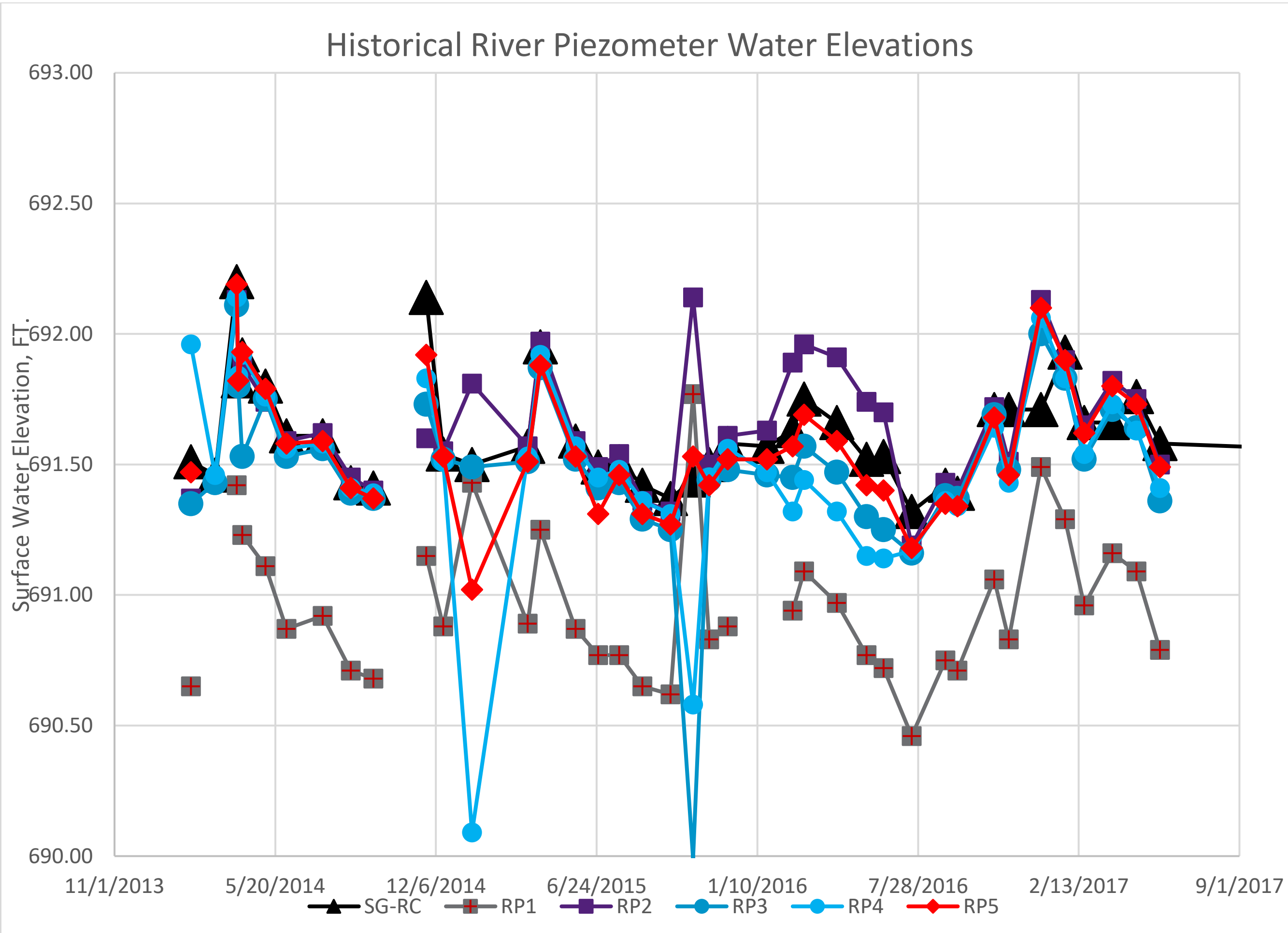


Figure 7-2: Historical Surface Water Elevations

As shown in **Figure 7-2**, the elevation readings at TA-RP-2 through TA-RP-5 show strong correlation to those of TA-SG-RC. The average surface water elevation at TA-SG-RC is approximately 0.1 foot higher than those of TA-RP-2 through TA-RP-5. The surface water elevations at TA-RP-1, the southernmost location, as expected, were lower than TA-SG-RC, and TA-RP-2 through TA-RP-5. The average surface water elevation at TA-RP-1 is approximately 0.6 foot lower than TA-SG-RC. The average differences between TA-SG-RC and other river piezometers were used to extrapolate the measurement at TA-SG-RC to the other river piezometers for the Rogue River water elevation input in the local model.

Other surface water elevations were based on Kent County LiDAR data (Sanborn, 2014) and adjusted per R&W/GZA's April 2019 water level measurements collected at the on-Site surface water gaging station in Rum Creek. The elevations from the LiDAR data provide a set of synoptic data for the surface water elevations. The SG-RC data was used as a reference point, and the synoptic data set was adjusted based on the difference in water elevations at SG-RC between the LiDAR data and the measured data in April 2019.

7.4 LOCAL MODEL CALIBRATION TARGETS

The groundwater elevations in April 2019 were used as calibration targets (See **Table No. 2**). In the absence of daily streamflow records in Rum Creek, baseflow discharged to Rum Creek was estimated and used as an approximate flow target.

A hydrologic analysis based on the Lidar bare earth elevation GIS data was performed to estimate the drainage area for the segment of Rum Creek within the local model. The actual drainage area for the segment is expected to extend beyond the model area; therefore, the base flow may be greater. But the majority of the drainage area for the segment is within the model area; therefore, the percent of error is expected to be small. The baseflow yield for Rum Creek from the State-wide Base Flow of Michigan Streams GIS data (Groundwater Inventory and Map Project, 2005), 0.76 ft/yr was multiplied by a ratio of 1.6 to reflect the relatively higher groundwater recharge in April 2019. The ratio of 1.6 was estimated from the groundwater recharge estimate of 19 in/yr for April 2019 divided by the historical average groundwater recharge of 12 in/yr estimated from the USGS Gauge from 1988 to 2020. With the estimated drainage area and the adjusted baseflow yield, the baseflow venting to Rum Creek for the segment within the model was estimated to be 5,210 cubic feet per day. This value will be used as a calibration target, along with the April 2019 groundwater elevations. The input parameters used in the estimation are summarized below.

Parameters	Symbol	Unit	Value
Estimated Drainage Area for the Rum Creek Segment in Local Model	A	Square Foot	1,563,890
Estimated Base Flow Yield for Rum Creek (Groundwater Inventory and Map Project, 2005)	Y	Ft/yr	0.76
Historical Average Groundwater Recharge (USGS Gauge)	R_{ave}	In/yr	12
April 2019 Groundwater Recharge (USGS Gauge)	R	In/yr	19
Ratio of April 2019 Groundwater Recharge to Historical Average Groundwater Recharge	R/R_{ave}	Unitless	1.6
Estimated Baseflow to the Rum Creek Segment in Local Model	Q_{base}	Cubic foot per day	5,200

Table 7-1: Estimation of Base Flow to the Rum Creek Segment in Local Model

A similar estimation for the segment of the Rogue River in the local model was not attempted because the drainage area west of the Rogue River is beyond the local model area. It is difficult to estimate the baseflow contribution from the local model area to the Rogue River segment. However, the estimated baseflow for Rum Creek is expected to provide a useful constraint to flow, and therefore improve the model calibration. In addition, the total in-flow from recharge for the Site area will be reviewed against the groundwater recharge estimates from the USGS gauge in April 2019 as another calibration check.

7.5 CALIBRATION PARAMETERS

Based on initial groundwater modeling runs and stochastic evaluation of geology, the non-homogeneous nature of the saturated zone was the controlling factor for model calibration. To improve calibration quality, pilot points of hydraulic conductivity, vertical anisotropy, and groundwater recharge were used as calibration parameters to allow for spatially varied arrays of horizontal hydraulic conductivity, vertical anisotropy, and groundwater recharge. Pilot points in the Site area were spaced at approximately 180 feet, and in the area south of the Site at approximately 360 feet to reduce computation time. See **Figure 7-3** for the pilot point locations for horizontal hydraulic conductivity in model Layer 1.

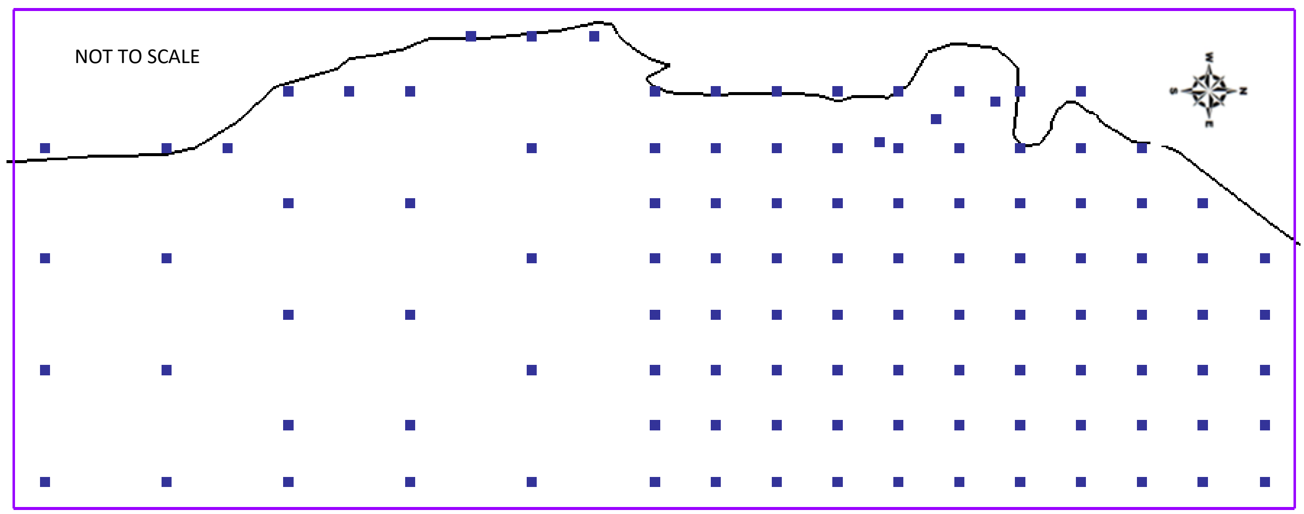


Figure 7-3: Pilot Points for Horizontal Hydraulic Conductivity, Model Layer 1

Three pilot points were added where the pumping tests were performed, TA-RW-1, TA-RW-2, and TA-RW-3, and the interpreted hydraulic conductivity at TA-PMW-1, TA-PMW-2 and TA-PMW-3 were input and the values fixed. The ranges of the pilot point values were as follow:

Parameters	Initial Value	Minimum	Maximum
Horizontal hydraulic conductivity (ft/day)	8	0.1	100
Vertical anisotropy	1	1	30
Recharge (in/yr)	12	9	20

The automated calibration software "PEST" (Doherty, 2021) was used for model calibration runs using key parameter constraints. PEST directs MODFLOW to run with numerous combinations of Kh, Kv, and groundwater recharge until the sum of squared residuals between the observed elevation or flow targets and model calculated elevations and flow rates are minimized. Manual trial and error methods were also used to adjust parameter values. Preferred homogeneous regularization was used to provide additional restrains for the PEST runs. A Singular value decomposition-assisted parameter estimation option was selected to reduce computation time.

7.6 CALIBRATION RESULTS

The computed groundwater elevations, or hydraulic heads, were compared to the observed elevations and plotted in **Figure 7-4**. See **Table No. 4** for a summary of the computed groundwater elevations versus the observed groundwater elevations. Out of the 63 observation targets, the computed elevations of 50 wells are within 1 foot of the observed elevations. For five wells, the differences between the computed and the observed elevations were more than two (2) feet, but less than three (3) feet. The list of the wells with more than 2-foot elevation differences include TA-MW-303D, TA-MW-303E, TA-MW-313A, TA-MW-313B, and TA-MW-313C. See **Figure 7-5** for the calibration elevation residual map.

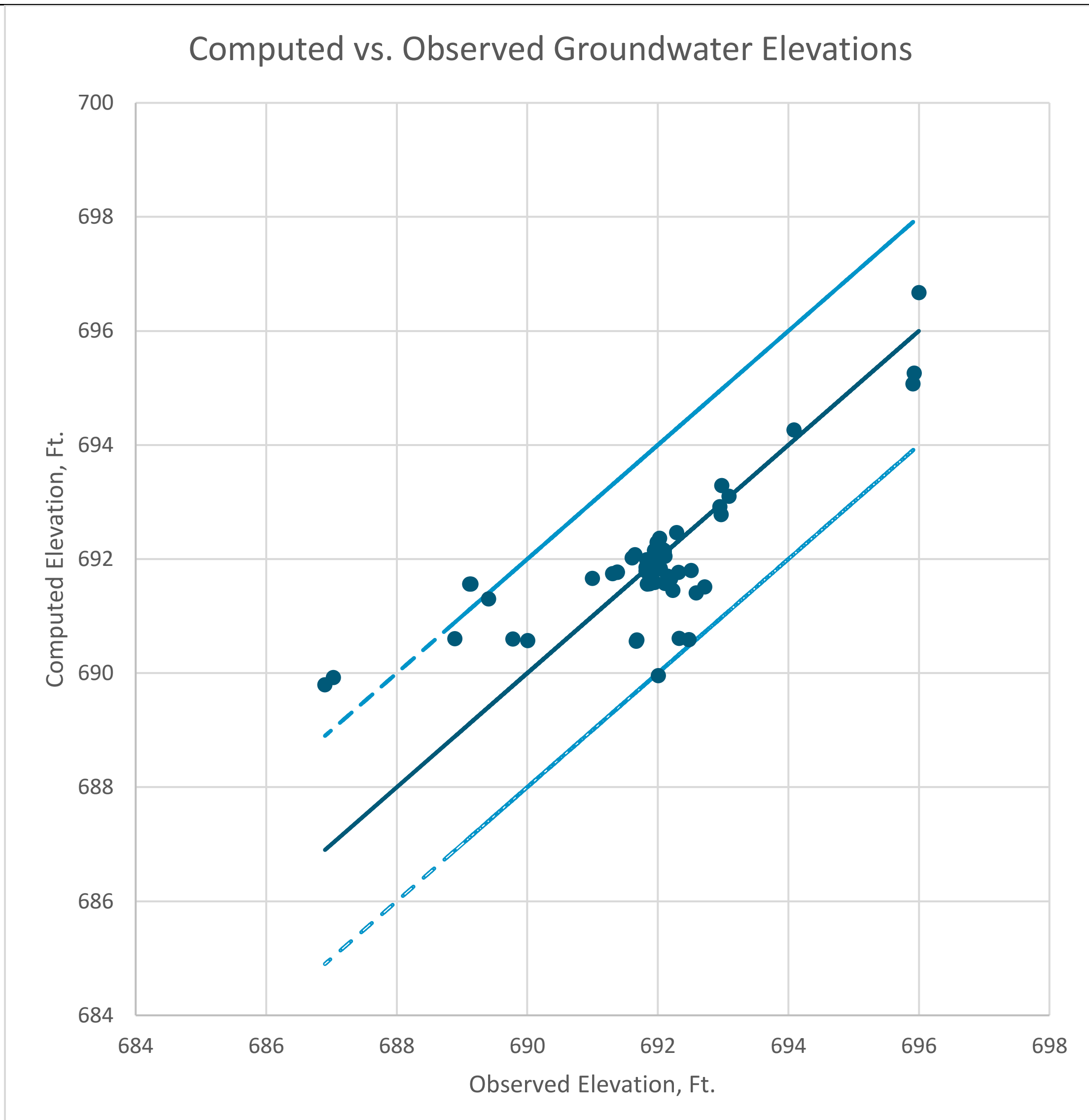


Figure 7-4: Computed Vs. Observed Hydraulic Elevations

The resulting root mean squared errors of the modeled versus observed groundwater elevations is less than 1 foot, indicating a reasonable match with the observed elevations, although some minor deviations were noted. In reviewing the comparison of modeled versus observed groundwater elevations, the greatest variations appear to correlate to geologic and hydrogeologic variations across the Site. These include the following:

- For the TA-MW-303 well cluster, the computed elevations of the shallower wells TA-MW-303A/B/C match reasonably well with the observed data. However, the higher computed elevations in TA-MW-303D/E are likely due to the well screens of TA-MW-303D/E being separated from the upper saturated zone by a stratum of fine-grained soil approximately 20 feet in thickness. The observed elevations in TA-MW-303D/E are more than 3 feet below that of wells TA-MW-303A/B. Again, the hydraulic effects of the fine-grained soil stratum near TA-MW-303 cluster were not modeled by the hydraulic conductivity arrays due to the coarse distribution of pilot points. Therefore, in the model, monitoring wells TA-MW--303D/E exhibit influence from Rogue River resulting in higher computed elevations than the observed elevations.

- For monitoring well TA-MW-313A, the majority of the well screen is within fine-grained soil resulting in poor hydraulic connection to the adjacent saturated zone and the Rogue River (See Section 2.6). The observed elevation at TA-MW-313A appears to be slightly higher than that of Rogue River in that area. Monitoring wells TA-MW-313B/C are separated from the shallow zone by a stratum of fine-grained soil approximately 30 feet in thickness. The elevations are not influenced by the Rogue River, and the measured groundwater elevations are more than 5 feet less than that of TA-MW-313A. Due to relatively coarse distribution of the pilot points, the averaged hydraulic conductivity in the model is greater than that of fine-grained soil at TA-MW-313 cluster; therefore, the model computed elevations at TA-MW-313 cluster exhibit more influence by the Rogue River than in the observed field condition, resulting in the more than 2 feet of difference in these wells.

The higher hydraulic conductivity values modeled in these two areas result in the model utilizing a greater influence of the Rogue River than observed in the field. As such, the system is conservatively designed with a higher pumping rate than may be necessary to achieve the capture objectives of the interceptor system.

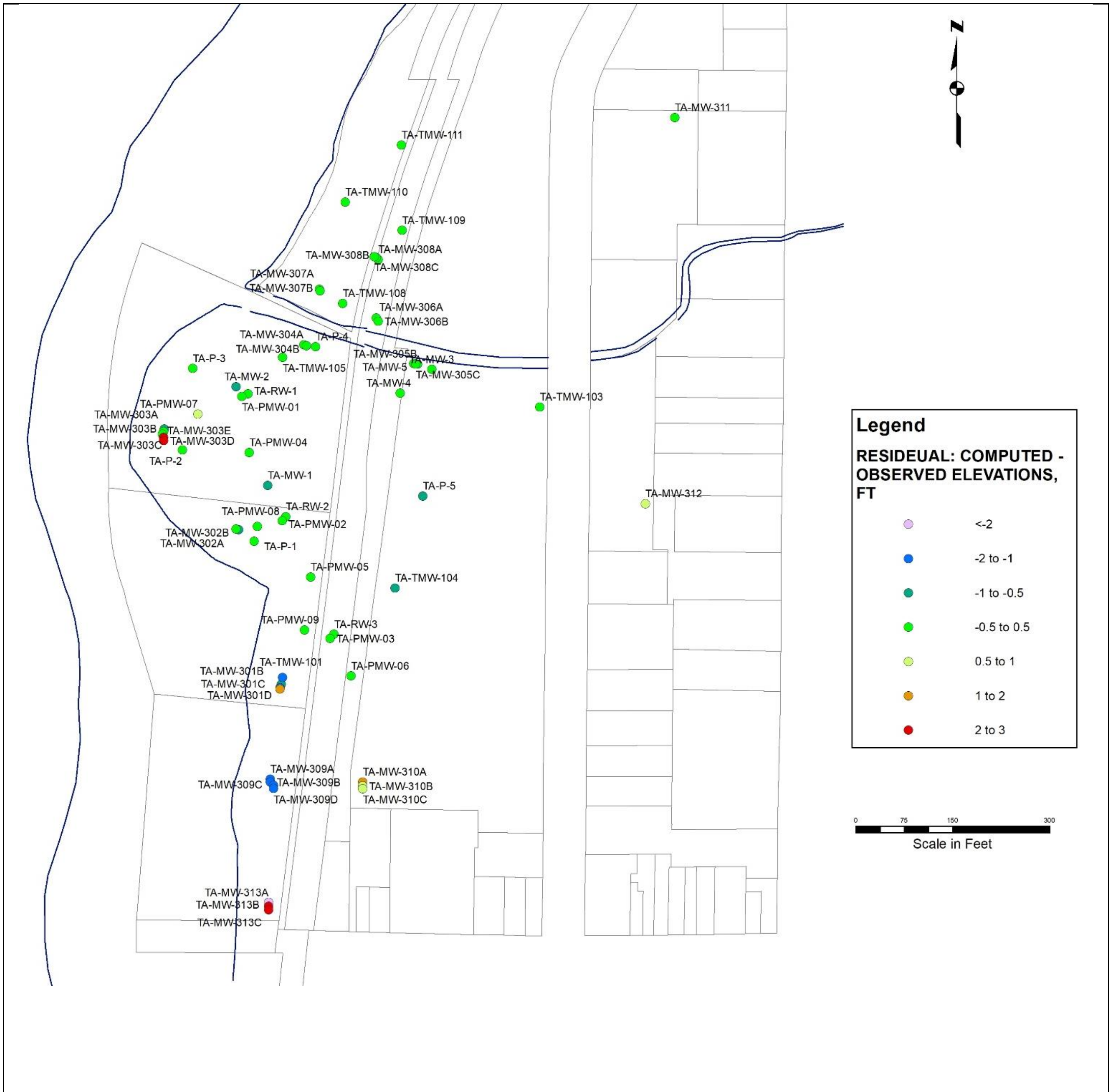


Figure 7-5: Calibration Elevation Residuals

The model computed elevations at the observation wells were used to plot groundwater contours and compare the modeled groundwater elevations to actual observed flow conditions, using SURFER® contouring software.

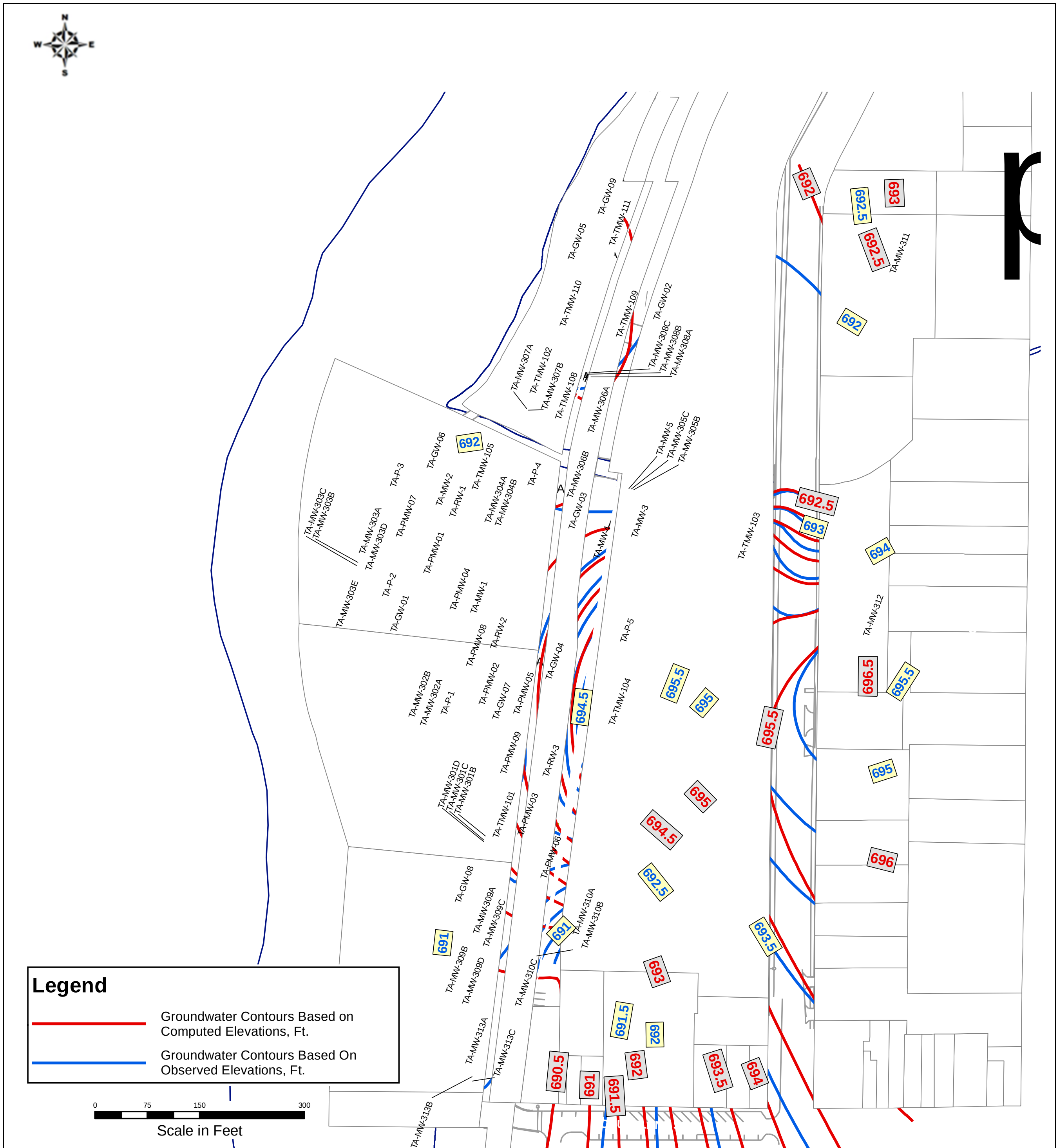


Figure 7-6: Groundwater Contours of the Computed Elevations vs. the Observed Elevations of April 2019

As shown in **Figure 7-6**, both contour maps show groundwater discharges to Rum Creek from either side of the creek, with steeper hydraulic gradient from the south. A groundwater mound in the central part of the Site south of Rum Creek, results in groundwater movement to the west and southwest toward the Rogue River.

The groundwater flow patterns in the southwest corner of the property differ slightly between the observed and the computed elevations because the observed groundwater elevation in TA-MW-313A is affected by the presence of finer-grained soil, lower hydraulic conductivity, and poor hydraulic connection to the surrounding saturated zone. Note that this localized flow pattern in the southwest corner of the Site was not observed in the September 2021 groundwater contours and may reflect a temporal condition that occurs following a period of increased recharge and groundwater elevation. Overall, the modeled groundwater contours and flow directions are generally consistent with the observed groundwater contours.

Another output of the calibrated model is the computed groundwater flow discharged to Rum Creek. Within the local model area, the model groundwater discharge to Rum Creek is approximately 4,920 cubic feet (~37,000 gallons) per day as compared to the observed estimate of 5,210 cubic feet (~39,000 gallons) per day. The modeled value is within approximately 6 percent of the targeted value.

To calculate a water mass balance or flow budget for the Site using the model, a zone matching the Site area was designated as Zone 2, and the remaining local model domain outside of Zone 2 labeled as Zone 1, as shown in **Figure 7-7**. The extent of Zone 2 was selected to include the estimated extent of PFOS exceeding GSI criteria in groundwater, which is the target for capture zone, and the extent of the extraction well coverage during design phase modeling.

Figure 7-7: Flow Budget Zone

The model calculated flow budget, or mass balance, for the Site Area (Zone 2) from all the model layers (Layer 1 through Layer 6) is summarized below.

Parameter	Flow, ft^3/d
Inflows:	
Constant Elevation (Upgradient, East Boundary	4898
River Leakage	0
Recharge	2097
Zone 1 to Zone 2	6761
Total Inflows	13756
Outflows:	
Constant Elevation (To Rogue River)	3348
River Leakage (To Rum Creek)	1032
Recharge	0
Zone 2 to Zone 1	9370
Total Outflows	13751
SUMMARY:	
Inflow - Outflow	5.5
Percent Discrepancy	0.04%

During the PEST calibration run, groundwater recharge, like hydraulic conductivity, is spatially varied with the use of pilot points. For the groundwater recharge averaged over Zone 2, the recharge volumetric flow rate (2097 ft^3/d) was divided by the Zone 2 area, and calculated to be approximately 15.2 in/yr. It is approximately 6.2 in/yr greater than the estimate from the published baseflow yield of 0.76 feet per year (9 in/yr) in Rum Creek, as estimated from the historical average of the area representing the Site. The groundwater recharge estimate of 19 in/yr from the USGS Gauge for April 2019 is approximately 7 inches more than the average groundwater recharge of 12 in/yr. Using the 7 in/yr difference as a calibration target, the calibrated groundwater recharge matches reasonably well. The groundwater recharge in the calibrated model also represents the higher end of the likely range, which provides a conservative flow estimate for the treatment system design.

8.0 PERFORMANCE PUMPING TESTS AND DESIGN CHANGES

The final EGLE-approved RAP presented information from a calibrated groundwater model that was used to evaluate and design a proposed groundwater interceptor system with 19 shallow extraction wells and three (3) deep extraction wells. Given the potential for uncertainty associated with aquifer heterogeneity, R&W/GZA performed additional aquifer performance tests in 2022 to refine the system design as part of the iterative process of data collection and system design evaluation. (Aquifer performance tests had previously been performed south of Rum Creek.)

The final EGLE-approved RAP proposed three groundwater extraction wells (EW-1, EW-2, and EW-3) and three piezometers (PZ-1, PZ-2, and PZ-3) north of Rum Creek. **Sheet No. 9** indicates the locations of the installed extraction wells, piezometers, and the monitoring well network. Soil boring and well installation logs for EW-1 through EW-3 and PZ-1 through PZ-3 are included in the attached Performance Pump Testing Well Logs (**Appendix C**).

8.1 METHODOLOGIES

To complete the performance pumping tests, electric submersible groundwater pumps (Grundfos SQ 3-inch, 1/2-horsepower, single-phase 230 VAC pump, with variable frequency drive) were used to withdraw groundwater from each of the groundwater extraction wells. Initial step- and 72-hour pump tests utilized a portable electric generator as the power source for the pumps; however, to complete the extended seven-day performance pumping, hard-wire electrical connections were utilized to power the pumps. The pumps were suspended in the wells with the bottom of the pump approximately 1 foot from the bottom of the well screen. Discharge tubing extended from the pump out of the extraction well casing and was routed to a centralized manifold where a series of valves were installed for each extraction well. The valves and sample ports installed in the discharge line for each of the pumps were used to collect volumetric measurement of flow rates. The speed of the pumps was adjusted accordingly to maintain constant pumping rates within each of the pumping wells. Discharge lines were then routed into a 21,000-gallon, steel, closed-top-storage tank. After the performance tests, the water was transported off-Site for disposal.

Each of the pumping wells and the observation wells/piezometers were equipped with pressure transducers equipped with data loggers to monitor the effects of the groundwater extraction on the hydraulic head (groundwater elevation). Static water levels were also collected periodically utilizing an electronic water level meter to verify the data collected with the pressure transducers.

8.2 IMPLEMENTATION

A step-drawdown aquifer performance test was conducted in April 2022 to evaluate the capacities and hydraulic influence of EW-1, EW-2, and EW-3. The following table provides a summary of the screen interval below ground surface (bgs), pumping durations, designed flow rates, and the sustained flow rates in gallons per minute (GPM) observed in April 2022.

Extraction Well	Screen Interval (ft bgs)	Pump Start	Pump Shutdown	Designed Flow Rate (GPM)	Sustained Flow Rate (GPM)
EW-1	4 to 14	NA	NA	3	<1
EW-2	13 to 23	4/12/2022 8:10 AM	4/14/2022 10:00 PM	3	1
EW-3	4 to 14	4/12/2022 8:10 AM	4/14/2022 10:00 PM	4	4

Table 8-1: Summary of Initial Performance Pumping

To stress the aquifer for a longer duration, a seven-day pumping test was performed on EW-2 and EW-3 north of Rum Creek and TA-RW-1 south of Rum Creek. Pressure transducers were installed in these extraction wells and the nearby groundwater monitoring wells/piezometers to measure water level changes before, during, and after the pumping. Barometric pressures were measured for data compensation. Transducers were installed in the following observation wells/piezometers:

Wells Located North of Rum Creek	Wells Located South of Rum Creek
EW-1	RP-4
EW-2 (Pumping Well)	TA-RW-1 (Pumping Well)
EW-3 (Pumping Well)	TA-MW-2
PZ-1	TA-GW-06
PZ-2	TA-PMW-07
PZ-3	TA-MW-303A
TA-MW-308B	TA-MW-303B
	TA-P-2

Table 8-2: List of Pumping Test Observation Wells/Piezometers

Table 2-3 provides a summary of the pump start, shutdown, and pumping rates.

Extraction Well	Pump Start	Pump Shutdown	Pumping Rate, GPM
EW-2	5/9/2022 12:30 PM	5/16/2022 12:50 PM	1
EW-3	5/9/2022 12:30 PM	5/16/2022 12:50 PM	3 to 4
TA-RW-1	5/9/2022 12:30 PM	5/16/2022 12:50 PM	2.5

Table 8-3: Summary of Pumping Test Periods

The following sections provide a discussion of the results from the performance pumping test.

8.3 AQUIFER CONDITIONS

Refer to **Appendix C** for boring logs for the performance pumping test well logs. Soil at EW-1 was sand and clean fill from ground surface to approximately 6.5 feet bgs, underlain by fine-grained soil (clay and silt) from 6.5 to 20 feet bgs. Groundwater was encountered at approximately 4.4 bgs. A 10-foot well screen was set to a bottom depth of approximately 14 feet bgs. Due to the presence of fine-grained soil below 6.5 feet bgs, the saturated zone was approximately 2 feet. As a result, EW-1 pumped dry during well development at a rate 1 GPM and is not suitable for groundwater extraction.

Soil at EW-2 was alternating layers of clean fill, sand, and fine-grained soil (silt and clay). Groundwater was approximately 4.2 feet bgs. A 10-foot well screen was set to a bottom depth of approximately 23 feet bgs. Of the 10-foot screen length, the total thickness of sandy soil was approximately 2 feet, and the fine-grained soil was approximately 8 feet. The limited thickness of sandy soil resulted in a reduced aquifer transmissivity at this location, low pumping potential, and limited hydraulic influence.

At EW-3, sand was observed from ground surface to approximately 9.6 feet bgs, fine-grained soil (silt and clay) from 9.6 to 18 feet bgs, sand from 18 to 21 feet bgs, fine-grained soil (silt) from 21 to 22 feet bgs, and sand from 22 to 24 feet bgs. Groundwater was approximately 5 feet bgs. A 10-foot well screen was set to a bottom depth of approximately 14 feet bgs. The top half of the well screen is within coarse-grained saturated soil and the lower half of the well screen is within fine-grained soil. Given the thickness of the coarse-grained soil in the saturated zone, EW-3 has a higher production potential to capture groundwater than either EW-1 or EW-2. However, if the water level is drawn down to near the top of the fine-grained soil stratum, the saturated thickness around the well will be reduced, resulting in decreasing groundwater flow to the well. The pumping capacity of EW-3 is limited due to the presence of fine-grained soil at 9.6 feet bgs.

Soils encountered at PZ-1 and PZ-2 (PZ-2 is more like EW-3 than EW-1 with coarse-grained soil to 9 feet) were similar to EW-1, consisting of coarse-grained soil (sand or gravel), underlain by fine-grained soil (silt and clay). Soils at PZ-3 consisted of 5 feet of coarse-grained soil (sand and gravel), underlain by 5 feet of fine-grained soil (silt and clay), and 5 feet of coarse-grained soil (sand).

During installation, EW-1 produced less than 1 GPM for periods longer than 45 minutes before pumping dry. Step pumping rate tests indicated that EW-2 sustained approximately 1 to 1.25 GPM without lowering water levels to the pump intake. EW-3 sustained approximately 4 GPM. The initial 72-hour pump step test conducted at EW-2 and EW-3 did not influence water levels at the adjacent piezometer (PZ-2) located between the two pumping wells (EW-2 and EW-3).

EW-1 and EW-2 were unable to sustain the designed flow rates presented in the final EGLE-approved RAP. The designed flow rates were based on the groundwater model, calibrated to the Site static water level data set, using hydraulic conductivity values interpreted from previous pumping tests at TA-RW-1, TA-RW-2, and TA-RW-3. Hydraulic properties between well locations or beyond the areas evaluated by the pumping tests at TA-RW-1, TA-RW-2, and TA-RW-3 are unknown. The estimated hydraulic conductivities from the calibrated model were representative of a greater scale than the localized pump test observations. As is common with many groundwater modeling scenarios, the calibrated groundwater model tends to lack the resolution to simulate specific flow conditions that are driven by localized subsurface heterogeneities such as those observed at EW-1, EW-2, and EW-3.

8.4 PUMPING RATES OVER TIME

The pumping rates over time are plotted below. Drawdowns were corrected for barometric pressure that was obtained on-Site by a barometric transducer (**Figure 8-1)**.

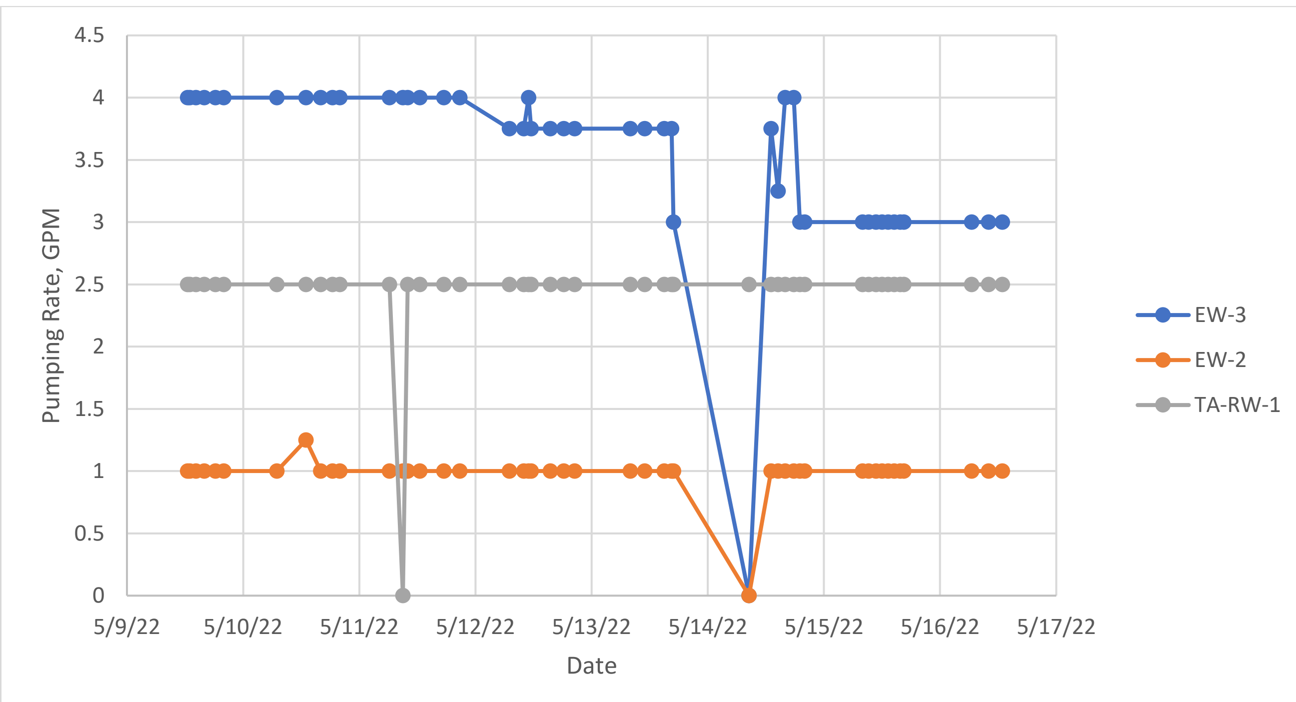


Figure 8-1: Performance Pumping Tests - Pumping Rates Over Time

The flow rates were generally constant at EW-2 and RW-1 except for power outages at RW-1 on May 11, 2022 and EW-2 and EW-3 on May 14, 2022. The pumping rates at EW-3 decreased from 4, the first 2.5 days of pumping, to 3.75 GPM and eventually to 3 GPM for most of the final two days of pumping. As the drawdown reached approximately 6 feet at EW-3 on May 12, 2022 (**Figure 8-2**), the saturated thickness became limited around EW-3 and the pumping rate was decreased to sustain continued pumping at EW-3.

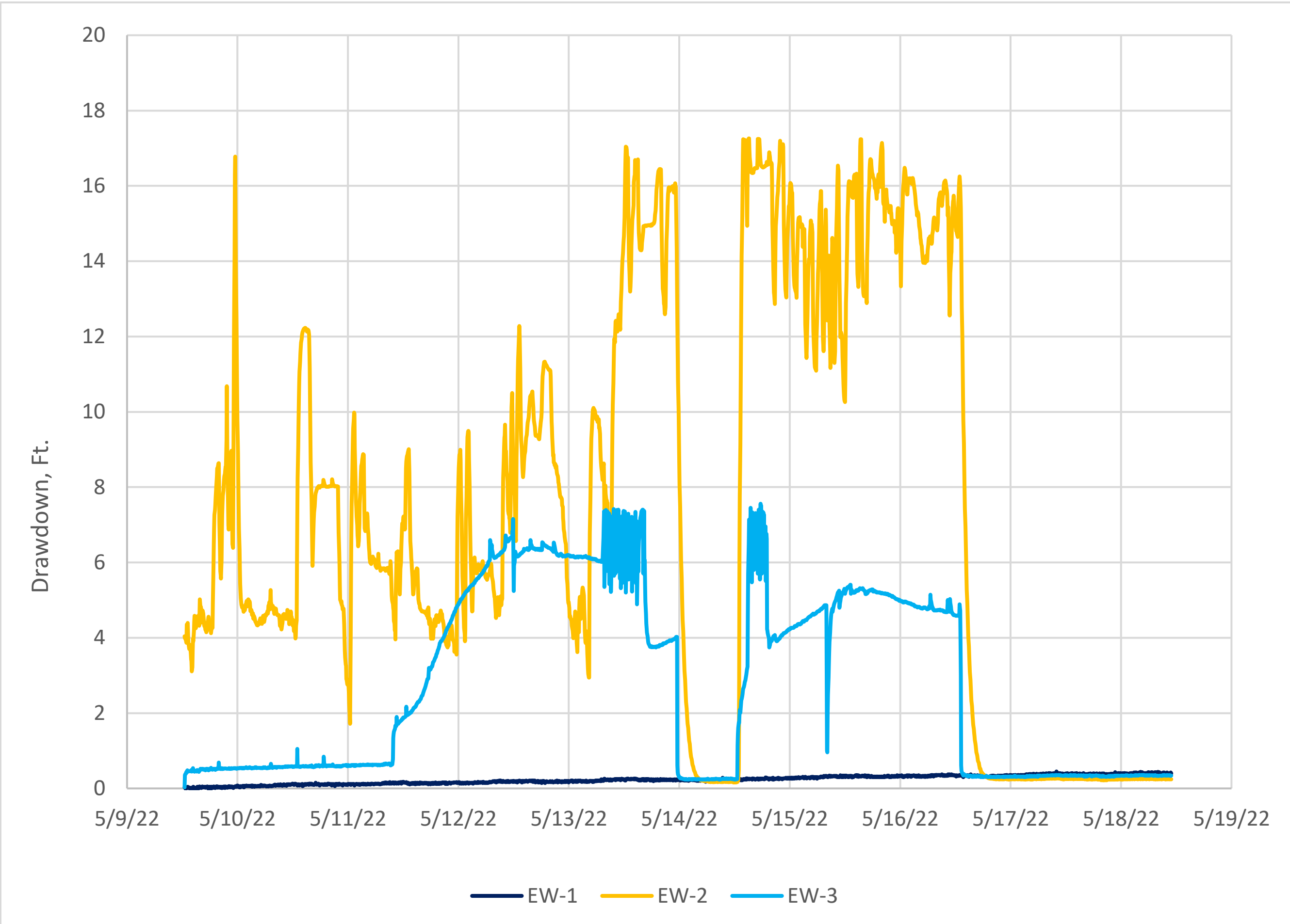


Figure 8-2: Performance Pumping Tests - Corrected Drawdowns Over Time at EW-1, EW-2, and EW-3

The drawdown at EW-2 fluctuated over the course of the performance test likely because the well screen is in alternating layers of sand and silt with varying clay content. Groundwater flow to EW-2 is primarily from three thin layers of sand, not a continuous, permeable formation. As pumping lowered the groundwater level to below one or more layers of saturated layers, the layers were hydraulically disconnected to the well and the overall saturated thickness around the well was reduced, further reducing well capacity and resulting in enhanced drawdown. As groundwater recharged these layers, groundwater flow would cascade into the wellbore, resulting in a relatively notable water level rise. As this cycle continued, the drawdown responses fluctuated.

8.5 DRAWDOWN IN THE AREA OF EW-2 AND EW-3

Drawdown responses in the piezometers near EW-2 and EW-3 are plotted below (**Figure 8-3**).

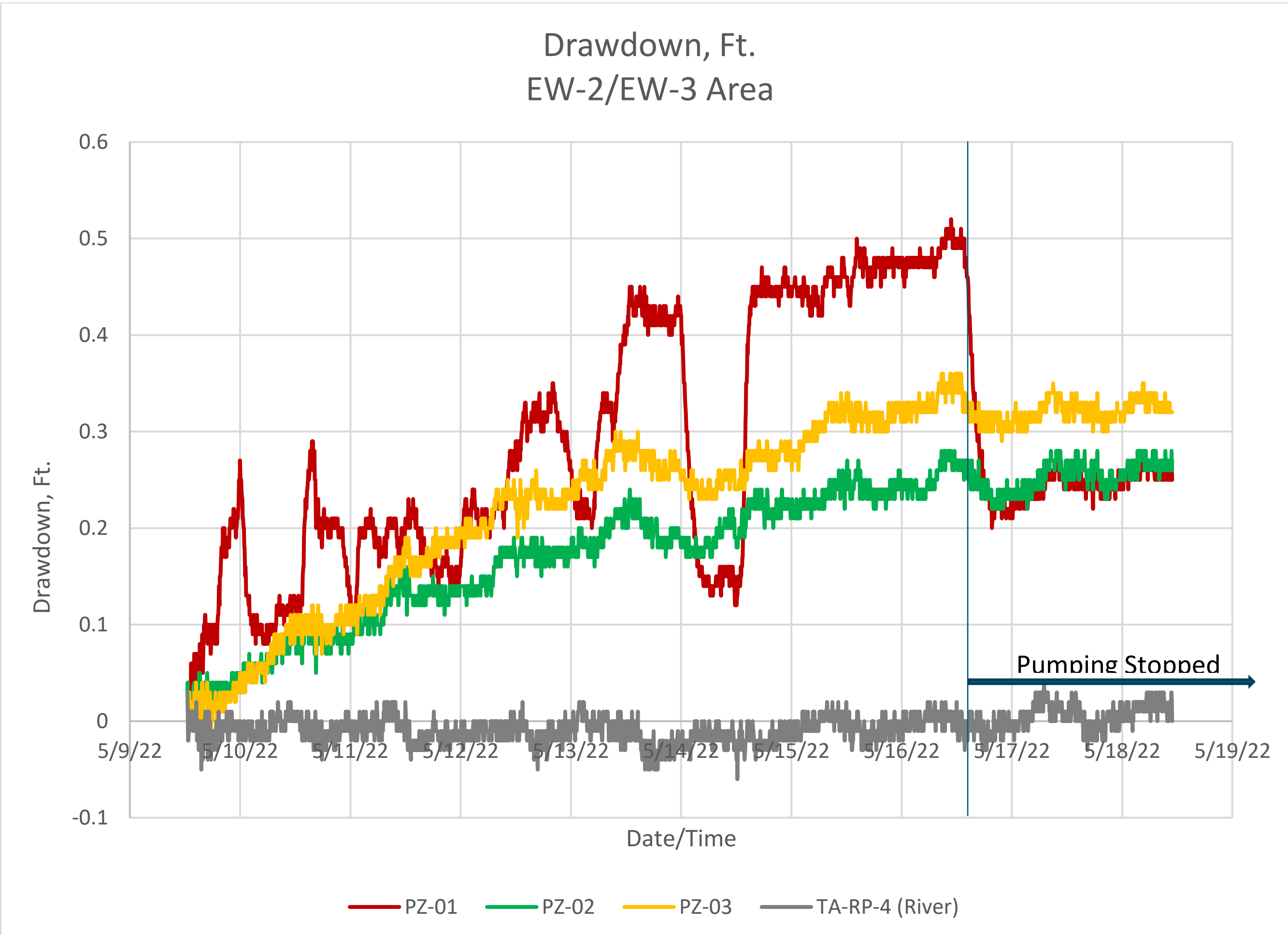


Figure 8-3: Performance Pumping Tests - Corrected Drawdowns Over Time at EW-2/EW-3 Area

The drawdown at PZ-01 was the greatest among the three piezometers. The maximum drawdown reached approximately 0.5 foot at PZ-01, approximately 0.35 foot at PZ-03, and approximately 0.27 foot at PZ-02 on May 16, 2022.

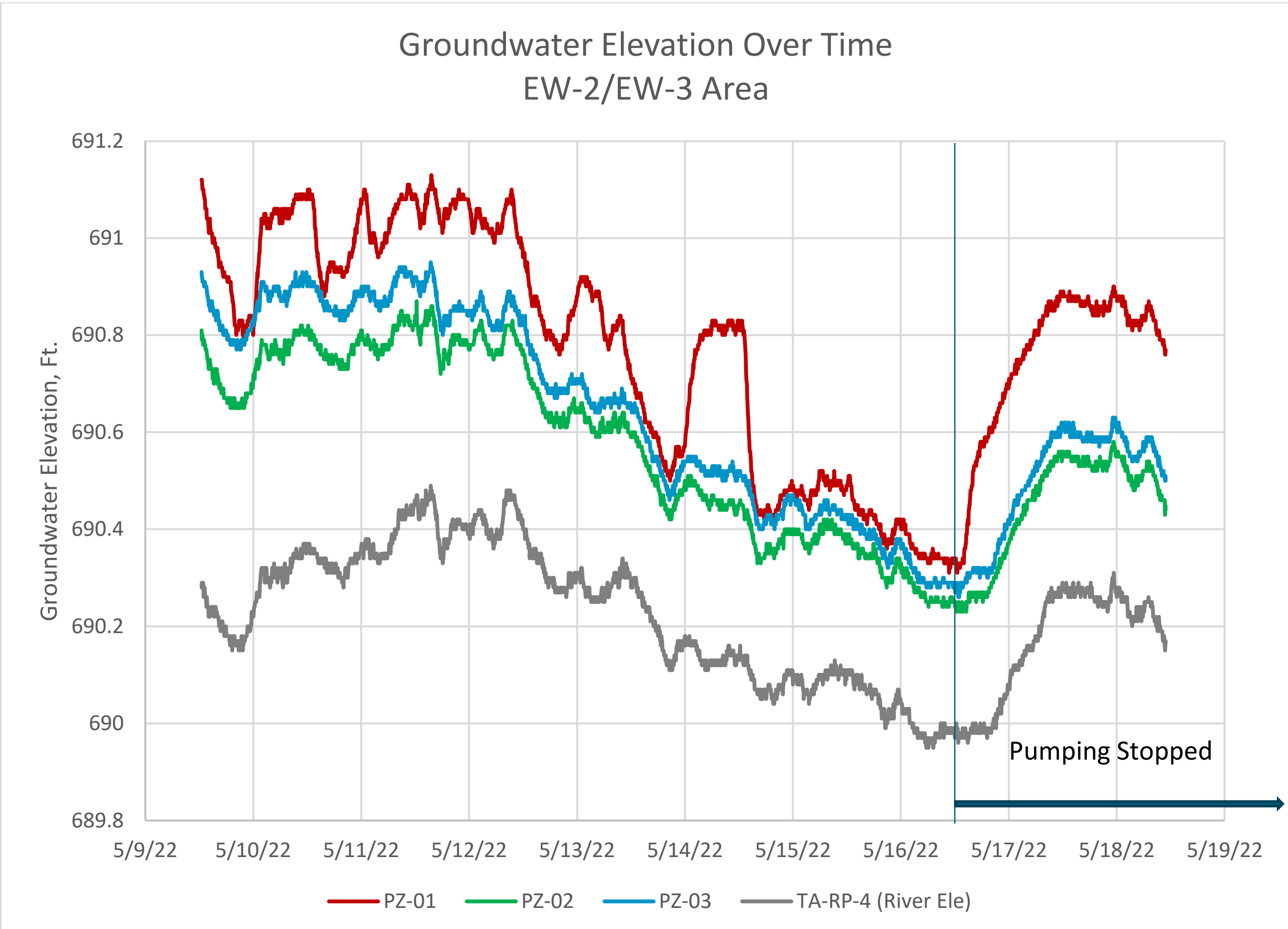


Figure 8-4: Performance Pumping Tests - Groundwater Elevations Over Time at EW-2/EW-3 Area

The groundwater elevations at PZ-01, PZ-02, and PZ-03 were still greater than the Rogue River elevation at TA-RP-4 (**Figure 8-4**). It is unclear whether pumping at EW-2 and EW-3 was able to create an inward hydraulic gradient from the GSI to the EW-2 and EW-3 area necessary to control groundwater flow from discharging to the river.

8.6 DRAWDOWN IN THE AREA OF TA-RW-1

The observation well drawdown responses near TA-RW-1 are plotted below (**Figure 8-5)**.

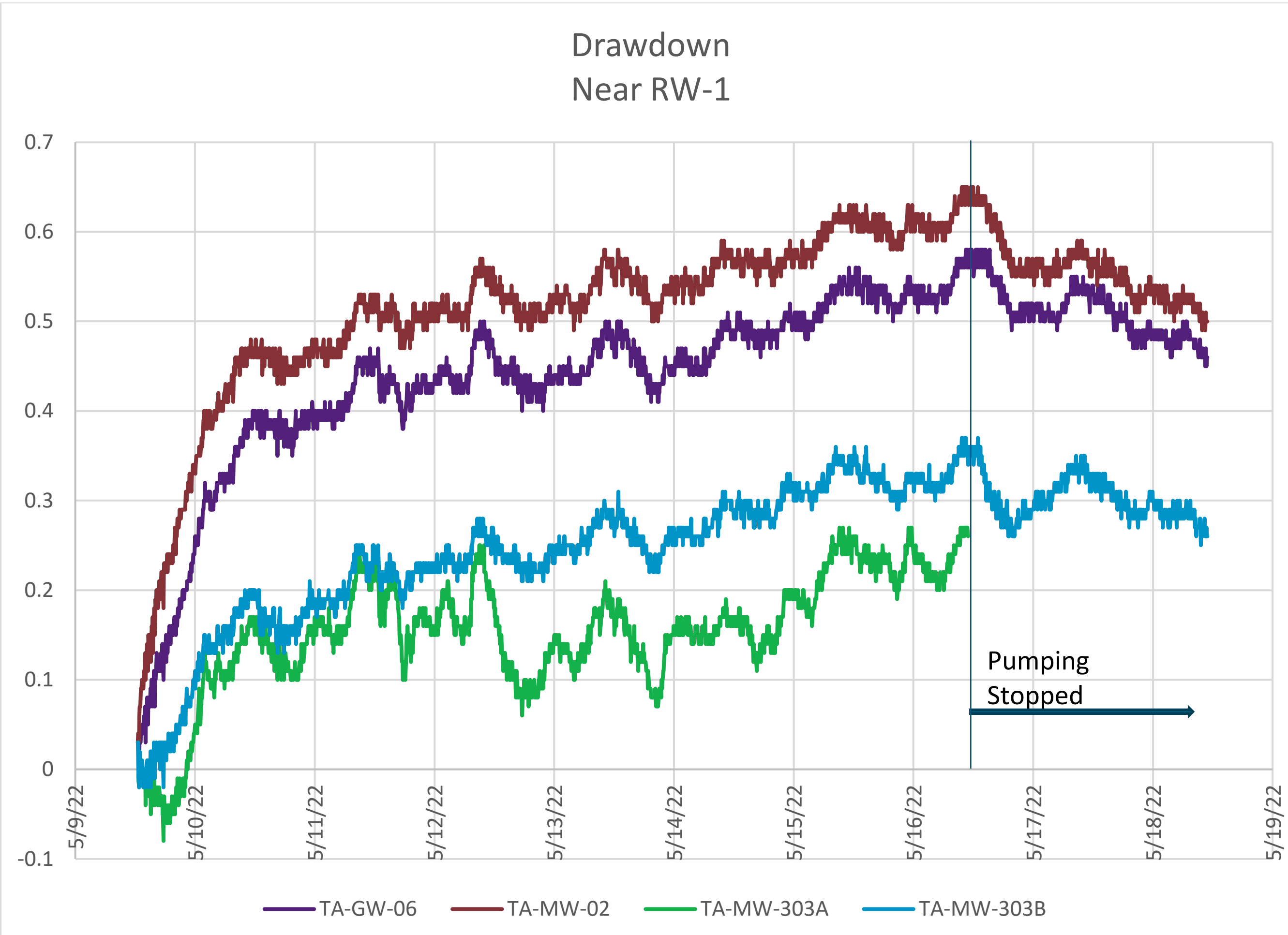


Figure 8-5: Performance Pumping Tests - Corrected Drawdowns Over Time Near TA-RW-1

The maximum drawdowns were approximately 0.65 feet at TA-MW-02, approximately 0.57 feet at TA-GW-06, approximately 0.37 feet at TA-MW-303B, and approximately 0.26 feet at TA-MW-303A on May 16, 2022.

The surface water elevations will vary along the Rogue River; therefore, the surface water elevations measured at TA-RP-4 may not represent the area immediately west of TA-RW-1. The groundwater elevation at TA-MW-303A was presumed to be the water elevation at the GSI. As shown in **Figure 8-6**, groundwater elevations at TA-GW-06, TA-MW-02, and TA-MW-303B were lower than TA-MW-303A, indicating hydraulic influence and an inward hydraulic gradient due to the pumping at TA-RW-1.

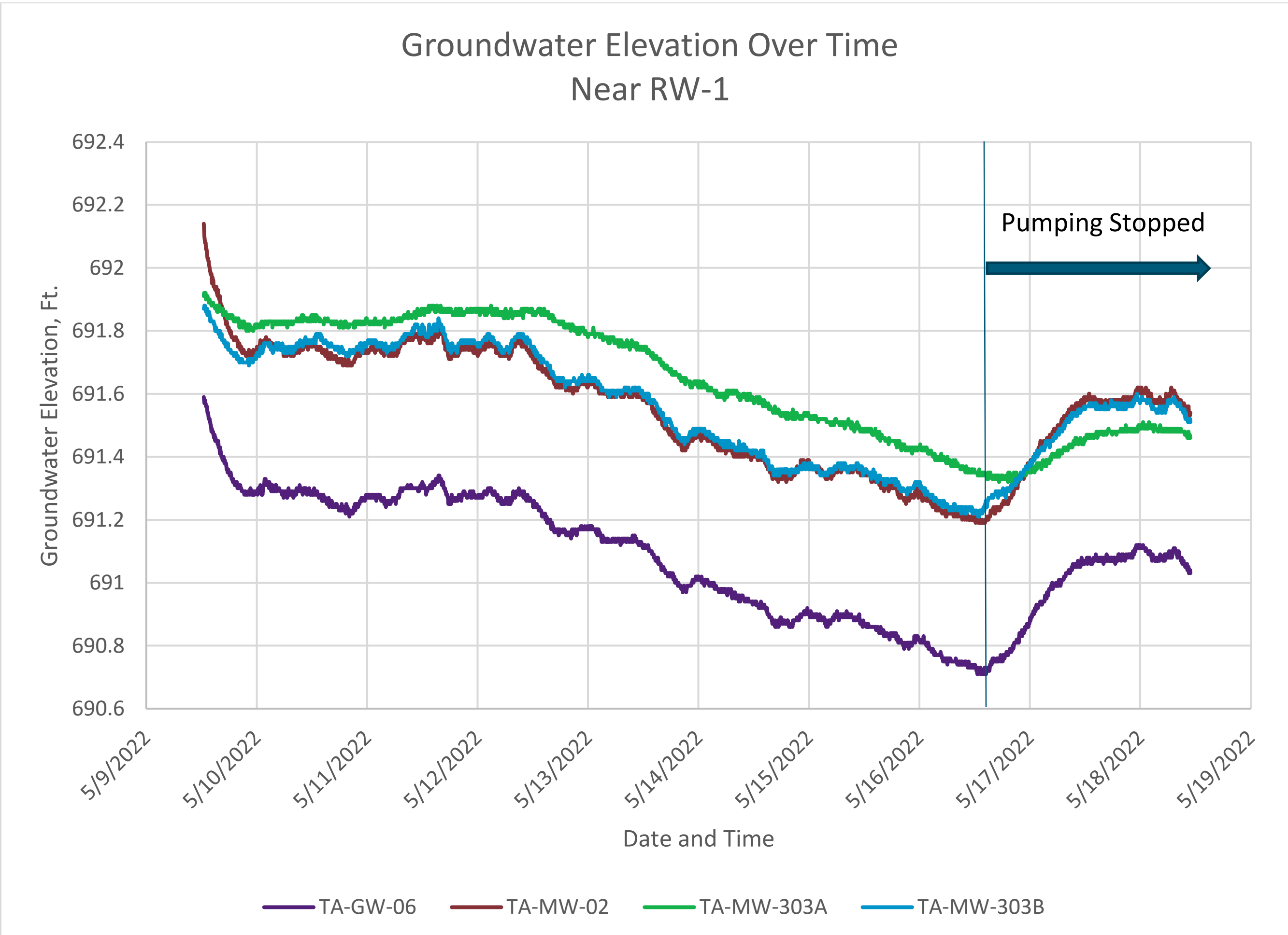


Figure 8-6: Performance Pumping Tests - Groundwater Elevations Over Time Near TA-RW-1

The performance pumping tests in April and May 2022 provided additional data for the design and implementation of the groundwater interceptor system. The data revealed that lithologies and hydraulic conductivity at the Site are more variable than prior performance tests and modeling suggested. The results of the performance pumping indicate this heterogeneity will affect the efficacy of the groundwater extraction well network proposed in the EGLE-approved RAP. Even with an expansion in the extraction well network, there is the potential that the lithologic heterogeneity, limited hydraulic conductivity and low transmissivity realized would result in inadequate well capacity and an inability to create sufficient hydraulic influence (similar to EW-1 and EW-2). On the other hand, if an extraction well intercepts a relatively permeable zone, like TA-RW-1, groundwater pumping will create measurable inward hydraulic gradients. Also note monitoring wells installed to observe and demonstrate hydraulic influence of the pumping system will also be affected by these variable conditions. While it is possible to relocate an extraction well and/or add additional extraction wells than proposed in the EGLE-approved RAP, the total number of wells could become impractical for implementation. Furthermore, based on our experience, low-capacity pumping wells with high frequency of activation and large drawdowns result in more frequent biofouling that could significantly increase the long-term operations and maintenance (O&M) requirements of the system. Overall, the drilling, re-installation, abandonment, and O&M requirements of numerous poor-performing extraction wells would be inefficient, cost prohibitive, and ultimately delay achievement of the performance objectives under the CD.

8.7 CHALLENGES FOR AN EXTRACTION WELL SYSTEM

As described above, the 2022 performance pumping tests indicated greater spatial variability of lithology and resulting hydraulic conductivity than previously measured or modeled. Due to the spatial variability, extraction wells installed in low permeability zones will result in several undesirable conditions including:

1. Lower sustainable flow rates;

2. Small lateral hydraulic influence, potentially requiring an impracticable number of extraction wells;

3. Difficulty in reliably confirming hydraulic control in nearby observation wells/piezometers, which may be installed in or near lower permeability zones; and

4. Typically, extraction wells with low-flow rates will experience large drawdowns which will introduce oxygen into the area of the well screen and require more frequent maintenance/rehabilitation than extraction wells with higher flow rates.

8.8 BENEFITS OF A GROUNDWATER INTERCEPTOR TRENCH SYSTEM

To overcome these performance concerns, the use of groundwater collection trenches in the design is proposed which results in a more uniform permeable conduit that effectively bridges subsurface heterogeneities and exploits the most permeable zones. By creating a uniform permeable conduit, more effective hydraulic control can be established across key areas of the Site. The benefits of a groundwater interceptor trench system include the following:

1. A groundwater collection trench provides a highly permeable conduit running essentially to the Rogue River. The continuous conduit overcomes the high degree of heterogeneity by intercepting thin permeable layers with limited horizontal extent while achieving more consistent hydraulic control.

2. The lateral hydraulic influence of trenches can be maintained with relatively constant pumping rates and limited drawdowns. This will improve the long-term O&M efforts that are required compared to many low-efficiency extraction wells. Basically, the more extraction wells needed to meet performance objectives, the more advantageous trenches become.

9.0 GROUNDWATER INTERCEPTOR SYSTEM EVALUATION

The 3-dimensional groundwater model described in **Section 7.0** was used to assist the design of the groundwater interceptor system. Several interceptor system design scenarios were evaluated. R&W/GZA used the following evaluation criteria:

- Technical Feasibility: It is technically feasible for the groundwater interceptor system to achieve hydraulic influence across the Site and control PFAS-impacted groundwater from discharging to Rum Creek and the Rogue River abutting the Site.

- Implementability: The system design of trenches and extraction wells is implementable in terms of system construction and treatment system flow capacity.

- Ability to measure effectiveness: The effectiveness of the groundwater interceptor system can be monitored and measured, and the operation of the system can be adjusted to achieve hydraulic control.

- Ease of long-term O&M: The long-term O&M requirement is typical of a groundwater control and treatment systems.

Because PFOS currently has the most restrictive applicable criterion, its distribution and concentration were emphasized during the groundwater interception system evaluation. PFOS is primarily present in the top 10 feet of groundwater, from elevations approximately 680 to 690 feet (approximately 5 to 15 feet bgs). The vertical extent of PFOS-containing groundwater varies, depending on lithology and location on-Site. Where an underlying fine-grained soil stratum is observed, relatively higher PFOS concentrations are limited to the top of the fine-grained soil stratum. For example, the PFOS concentration was 33,000 nanograms per liter (ng/L) at MW-303C, which is screened from elevation 672 to 677 feet, but the presence of fine-grained soil stratum from elevation 651 to 672 feet appears to limit the vertical migration of PFOS. The PFOS concentration at nested well MW-303E, which is screened from elevation 643 to 646 feet, was three orders of magnitude lower at approximately 23 ng/L. Where underlying fine-grained soil stratum is not observed, PFOS concentrations were relatively uniform at depth. For example, PFOS concentrations ranging from 13,000 to 62,000 ng/L were measured in well cluster TA-MW-309 from the shallow saturated zone to an elevation of approximately 650 feet.

9.1 INTERCEPTOR SYSTEM DESIGN

R&W/GZA conducted numerous modeling runs to balance extraction rates with effective hydraulic control while limiting induced recharge from the Rogue River and Rum Creek. Based on an evaluation of the modeling data, it was determined that a combination of groundwater collection trenches for the shallow groundwater along with a network of extraction wells, primarily in the deeper aquifer, results in better performance than either trenches or extraction wells alone. Therefore, the proposed system, while relying largely on the improved efficiency of a conventional trench design in shallow heterogenous conditions, is enhanced with extraction wells at select locations where both contaminant distribution and hydrogeologic conditions indicate wells will be effective.

The proposed trenches are located as close to the Roger River and Rum Creek as practical while limiting induced flux from the surface waters to the trenches. The trenches must also be located to avoid former concrete foundations and existing utility lines. Final placement of trenches will be determined by constraints of installation equipment and subsurface conditions. The trench bottom elevations were selected based on three key factors; 1) the vertical extent of PFOS impact observed in groundwater; 2) the lithology observed along the trench alignment; and 3) the modeled hydraulic effects of the trench pumping systems when activated. The trenches will be supplemented with extraction wells where the depth of impact and previously identified presence of more permeable deposits will render wells more effective and practical to meet the remedial objective than a conventional trench design.

In total, the groundwater interceptor system will consist of nine (9) trenches, five (5) deep extraction wells, and one (1) shallow extraction well with each component designed to address observed Site-specific contaminant distributions and/or hydrogeologic conditions. **Sheet No. 10** presents the proposed trench layout and extraction well locations. Individual components of the capture system include:

1. For the Site area north of Rum Creek, two groundwater collection trenches, Trenches 1 and 2, with permeable gravel backfill installed from approximately 693 feet to approximately 685 feet.

2. For the Site area south of Rum Creek, four groundwater collection trenches, Trenches 3, 4, 5 and 9, with permeable gravel backfill installed from approximately 693 feet to an elevation of approximately 685 feet; and three groundwater collection trenches, Trenches 6, 7 and 8, with permeable backfill installed from approximately 693 feet to approximately 670; and

3. South of Rum Creek, two shallow extraction wells screened from approximately from 690 to 670 feet, three deep extraction wells screened from elevations approximately 670 to 650 feet, and one deep extraction well screened approximately 650 to 630 feet.

Please note that during installation, some nominal variation of trench placement could occur due to subsurface conditions encountered. The proposed trench bottom elevations are shown on the geological cross-sections where PFOS concentrations in the collected groundwater samples are posted (See **Sheet Nos. 2, 3 and 4**). Trenches 1 and 2 are located north of Rum Creek, where dissolved-phase loading to the groundwater system is associated largely with shallow fill materials near the watertable and limited vertical flux due to predominantly fine-grained soil resulting in the majority of PFOS impacts in groundwater above elevation 685 feet. Top of fine-grained soil strata varied, between elevation 680 feet to elevation greater than 690 ft. The bottom elevations of Trenches 1, 2 are set at elevation 685 feet. The permeable fill of the trenches will intercept the majority of impacted groundwater present at and above elevation 685 ft. At individual locations, if PFOS impacted groundwater is present at an elevation below 685 feet due to preferential flow paths associated with coarse-grained soil, the hydraulic influence of the activated trench is expected to reverse the natural downward gradient and induce both lateral and upward groundwater flow for capture and treatment. The reversal of vertical hydraulic gradients due to pumping groundwater from the trenches is shown in the model output described in **Section 9.2** below.

Trenches 3, 4, and 5 are located south of Rum Creek. The majority of PFOS impacted groundwater samples were located above elevation 685 feet with the exception of monitoring well cluster TA-MW-305. The bottom elevations of Trenches 3, 4, and 5 are set at 685 feet. The permeable fill of the trenches will intercept the majority of impacted groundwater present at and above elevation 685 ft. As stated above, at individual locations, where PFOS impacted groundwater is present at an elevation below 685 feet due to preferential flow paths associated with coarse-grained soil, the hydraulic influence of the activated trench is expected to reverse the natural downward gradient and induce both lateral and upward flow for groundwater capture and treatment. In addition, a deep extraction well is proposed to be located near well cluster TA-MW-305 to supplement Trench 3 in the capture of impacted groundwater below elevation 685 feet.

Trenches 6, 7, and 8 are located south of Rum Creek. The majority of PFOS impacted groundwater samples were located above elevation 670 feet except monitoring well clusters TA-MW-301 and TA-MW-309, where PFOS impacted groundwater with relatively high concentrations were detected in monitoring wells below elevation 670 feet. The bottom elevations of Trenches 6, 7, and 8 are set at 670 feet. The permeable fill of the trenches will intercept the majority of impacted groundwater present at and above elevation 670 feet. At individual locations, where PFOS impacted groundwater is present at an elevation below 670 feet due to preferential flow paths associated with coarse-grained soil, the trench is expected to reverse the natural downward gradient and induce both inward and upward flow for groundwater capture and treatment. In addition, deep extraction wells DEW-1, DEW-2 and DEW-4, are proposed in this area to supplement Trenches 6, 7, and 8 in the capture of impacted groundwater below elevation 670 feet.

Trench 9 is located at the southern end of the Site. The majority of PFOS impacted groundwater samples were located above elevation 685 feet and the vertical extent is limited by the presence of fine-grained soil. Top of the fine-grained soil stratum was observed to be above elevation 685 feet. The bottom elevation of Trench 9 is set at 685 feet. The permeable fill of the trenches will intercept the majority of impacted groundwater present at and above elevation 685 ft. Due to the presence of relatively low level, but exceeding PFOS concentrations beneath the fine-grained soil stratum at TA-MW-313 cluster, a deep extraction well DEW-3, screened from elevations 652 to 632 feet, is proposed to hydraulically capture PFOS impacted groundwater below elevation 685 feet.

The model estimated flow rates of the groundwater collection trenches and extraction wells as referenced on **Sheet No. 10** are provided in the following table.

Trench / Well	Trench Bottom Elevation / Well Screen Zone, ft.	Trench Length, ft.	Flow Rate, GPM
Trench-1 (T1)	685	420	27
Trench-2 (T2)	685	161	3
Trench-3 (T3)	685	223	9
Trench-4 (T4)	685	112	6
Trench-5 (T5)	685	213	3
Trench-6 (T6)	670	246	10
Trench-7 (T7)	670	325	8
Trench-8 (T8)	670	157	2
Trench-9 (T9)	685	210	12
DEW-1	652-672	Not Applicable	3
DEW-2	652-672	Not Applicable	3
DEW-3	632-652	Not Applicable	7
DEW-4	660-680	Not Applicable	2
DEW-5	652-672	Not Applicable	2
EW-6	672-692	Not Applicable	2
Total Flow Rate			99

Table 9-1: Collection Design Flow Rates

R&W/GZA estimated these design flow rates through numerous modeling trials using various trench/well layouts and pumping rates with the goal of preventing upgradient groundwater from venting to the Rogue River and capturing groundwater between the Rogue River/Rum Creek and the trenches. During the modeling trials, R&W/GZA evaluated the model calculated groundwater contours, drawdowns, and forward particle tracking pathlines to evaluate capture zones of the trenches and wells. See **Sections 9.2 and 9.3** for a summary of the capture zone evaluation. While we believe the model provides useful design information, we expect the actual flow rates from the individual trenches and extraction wells to differ from their modeled values due to aquifer heterogeneity.

9.2 CAPTURE ZONE EVALUATION

This section provides a summary of the capture zone evaluation for the proposed groundwater interceptor system. The forward particle tracking pathlines, along with model computed groundwater contours, for model Layers 1 through 4 are depicted in **Figures 9-1** through **9-8**. The following table summarizes the approximate model layer top and bottom elevations.

Model Layer	Top Elevation, Ft.	Bottom Elevation, Ft.
1	695	672
2	672	653
3	653	632
4	632	608
5	608	584
6	584	560

Table 9-2: Model Layer Elevations

The forward particle tracking pathlines for Model Layers 5 and 6 are not presented because PFOS was not detected in groundwater deeper than elevation 610 feet. The model calculated path lines (dark blue on **Figures 9-1** through **9-8**) indicate the particle travel paths from their starting positions to the end of a particle path line which typically reflects groundwater discharge, such as to trenches, extraction wells, or surface waters. A particle pathline stops at a trench or at an extraction well when it is hydraulically captured.

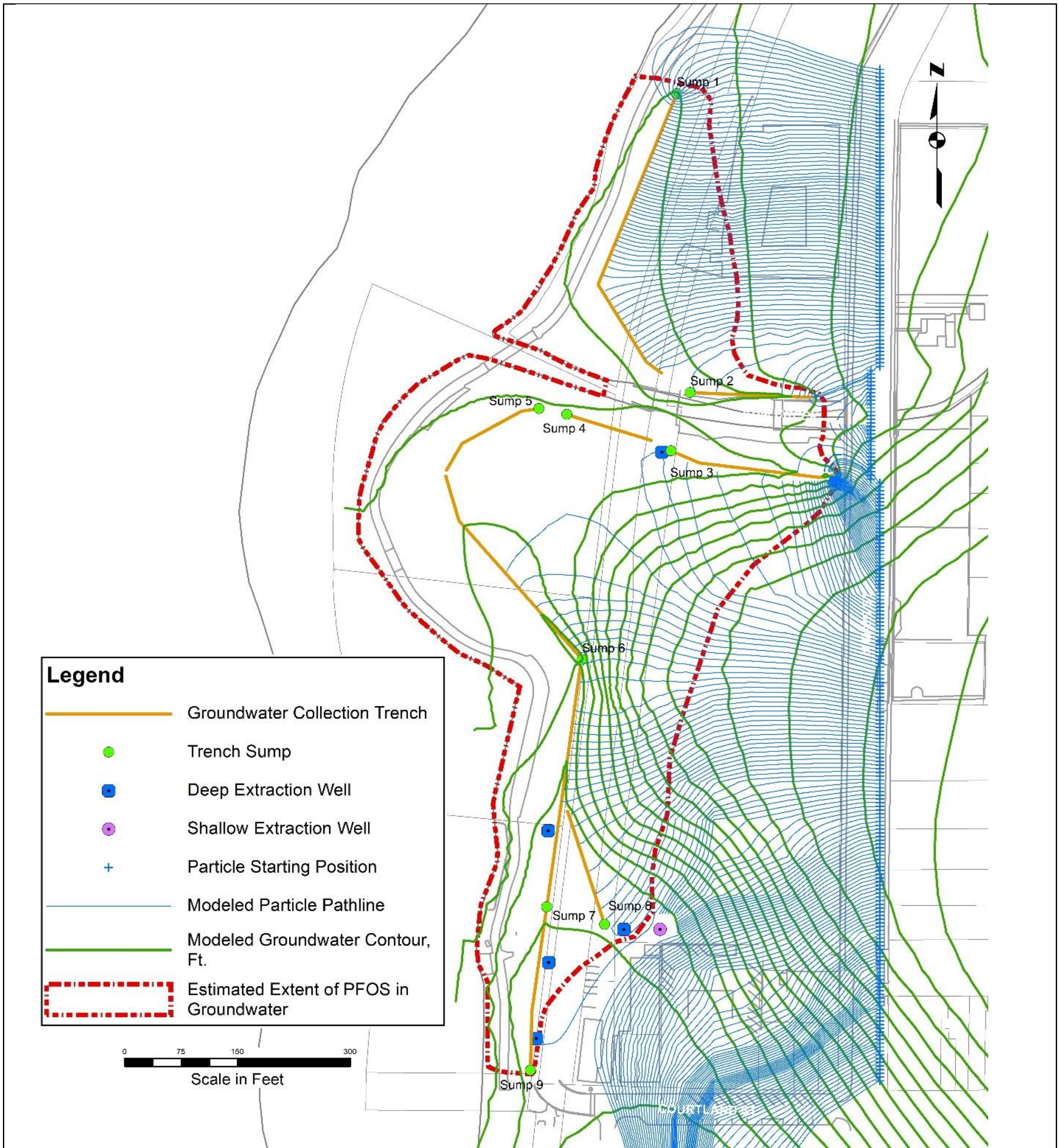


Figure 9-1: Model Forward Particle Pathlines Starting from Upgradient, Layer 1, Elevations from 672 to 695 Feet.

Figure 9-1 depicts the modeled effects of the interceptor system showing drawdowns from the trenches and extraction wells and an inward hydraulic gradient that intercepts groundwater flow to Rum Creek and Rogue River in Model Layer 1.

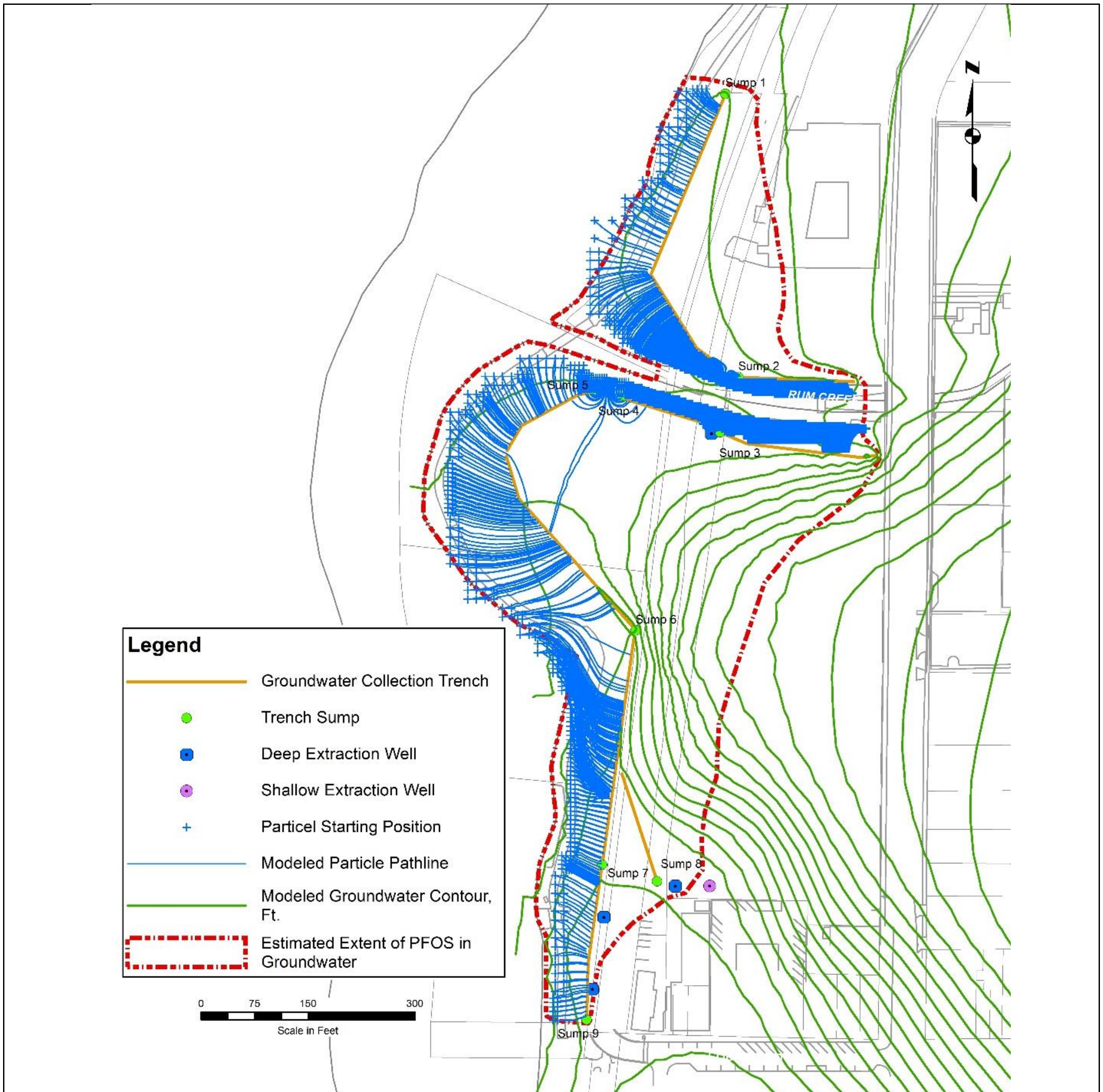


Figure 9-2: Modeled Forward Particle Pathlines Starting from Downgradient, Layer 1, Elevations from 672 to 695 Feet.

Figure 9-2 depicts the modeled effects of the interceptor system showing an inward hydraulic gradient that captures groundwater between the GSI and the trenches in Model Layer 1.

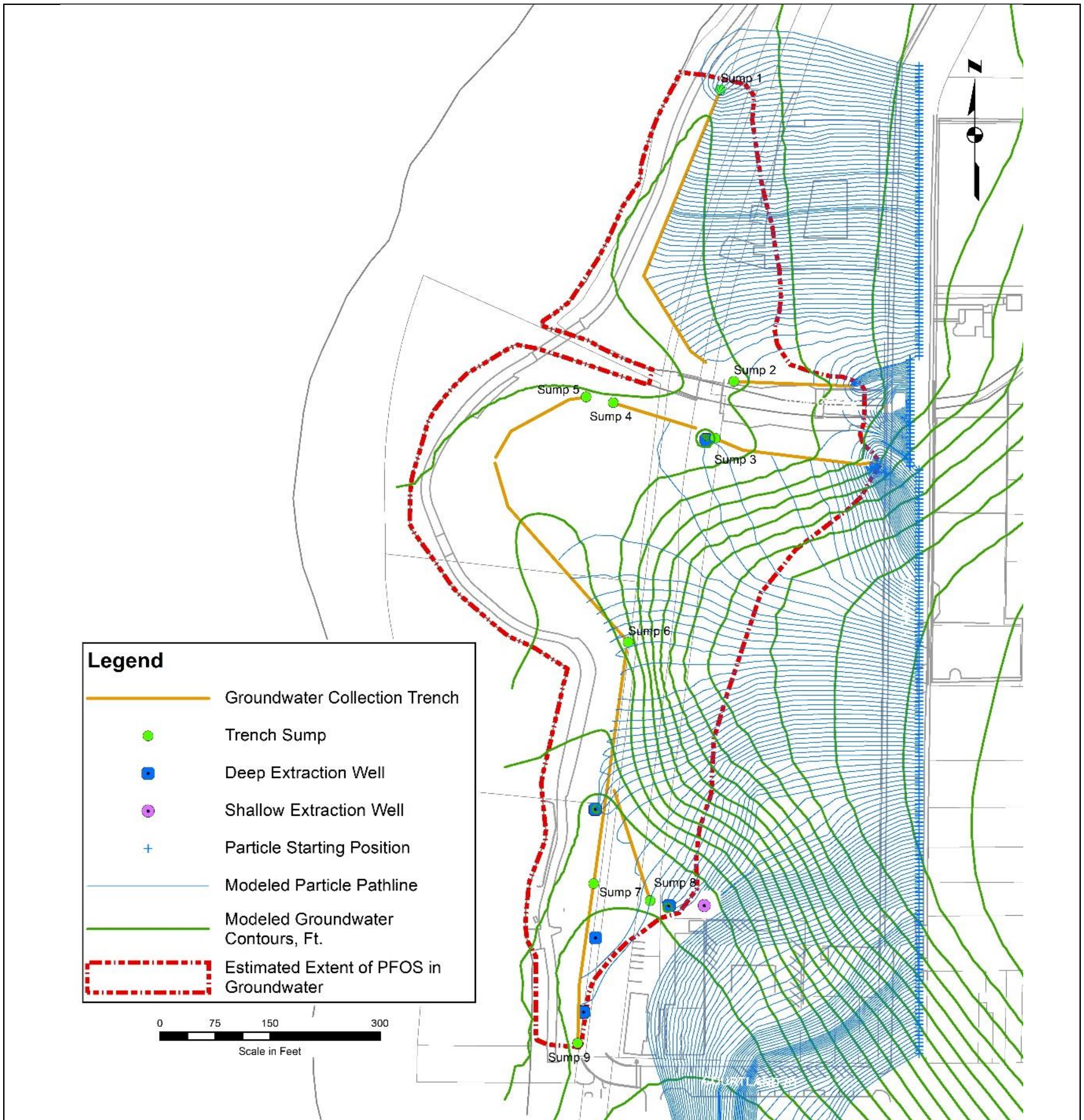


Figure 9-3: Modeled Forward Particle Pathlines Starting from Upgradient, Layer 2, Elevations from 653 to 672 feet.

As shown in **Figure 9-3**, the model shows the interceptor system will produce inward hydraulic gradients which intercept groundwater flow to Rum Creek and Rogue River in Model Layer 2.

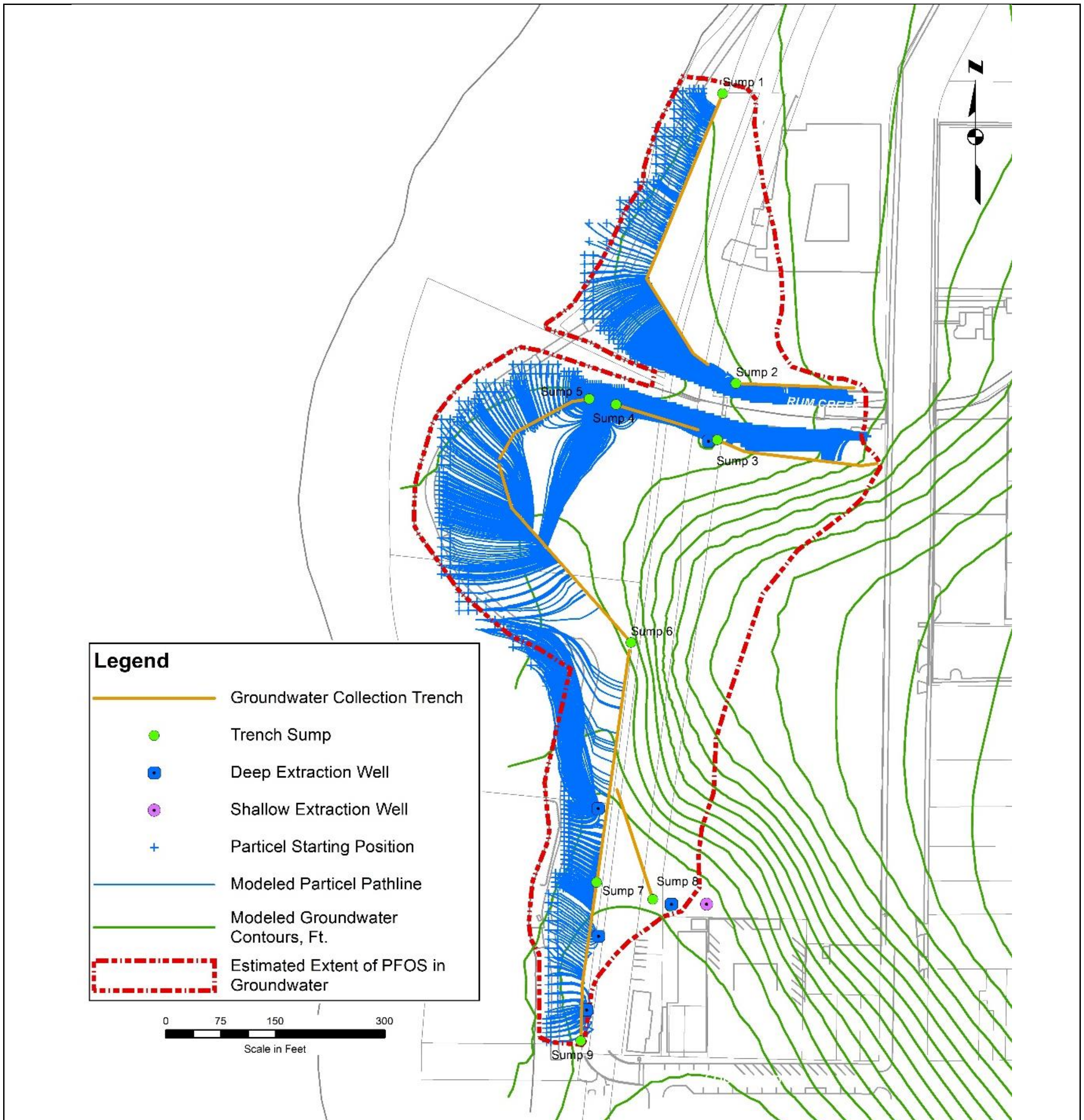


Figure 9-4: Modeled Forward Particle Pathlines Starting from Downgradient, Layer 2, Elevations from 653 to 672 feet.

As shown in **Figure 9-4**, the model shows the interceptor system will produce inward hydraulic gradients which capture groundwater between the Rogue River/Rum Creek and the trenches in Model Layer 2.

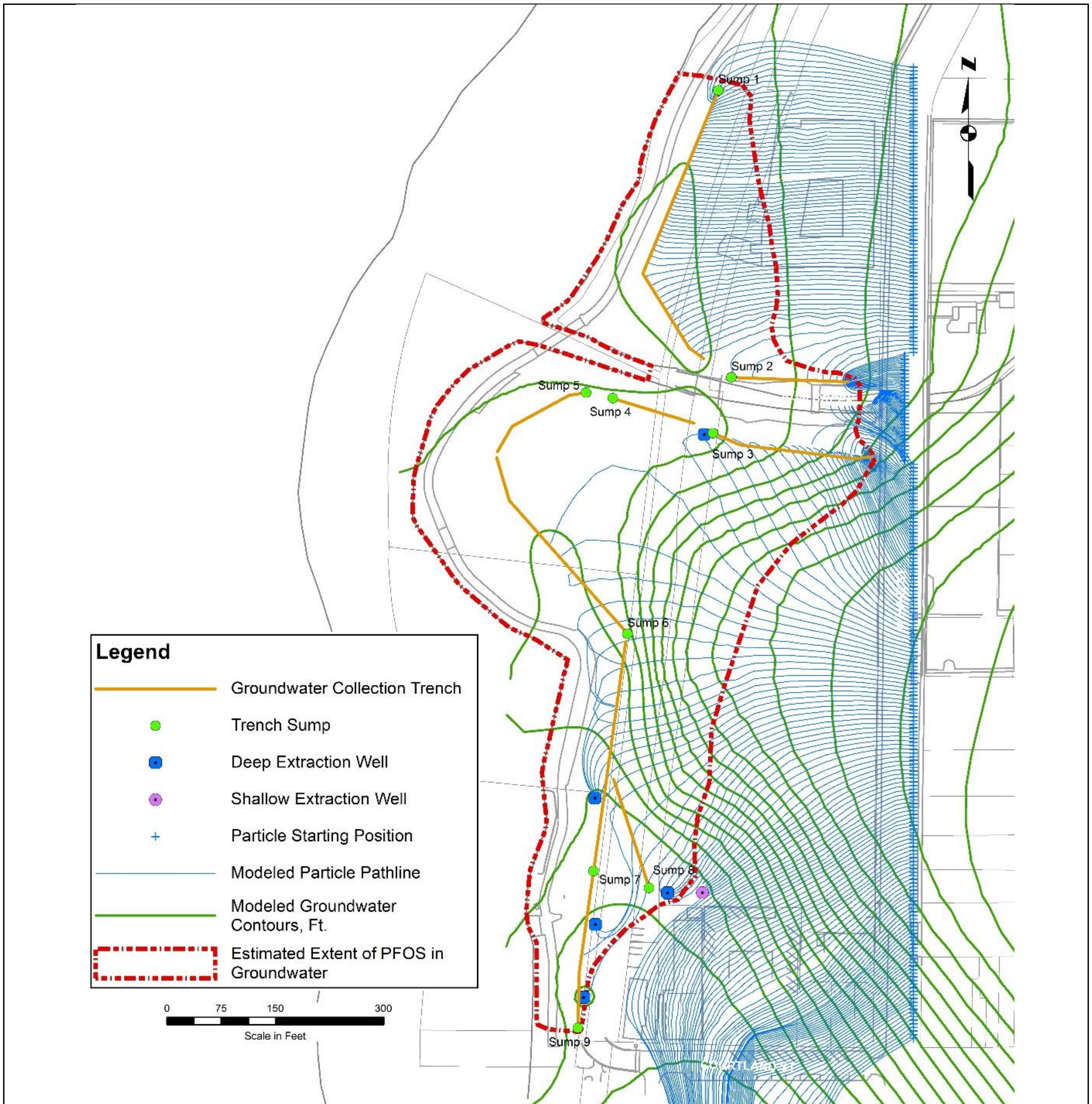


Figure 9-5: Modeled Forward Particle Pathlines Starting from Upgradient, Layer 3, Elevations from 632 to 652 Feet.

As shown in **Figure 9-5,** the model shows the interceptor system creates inward hydraulic gradients to intercept groundwater flow to Rum Creek and Rogue River in Model Layer 3.

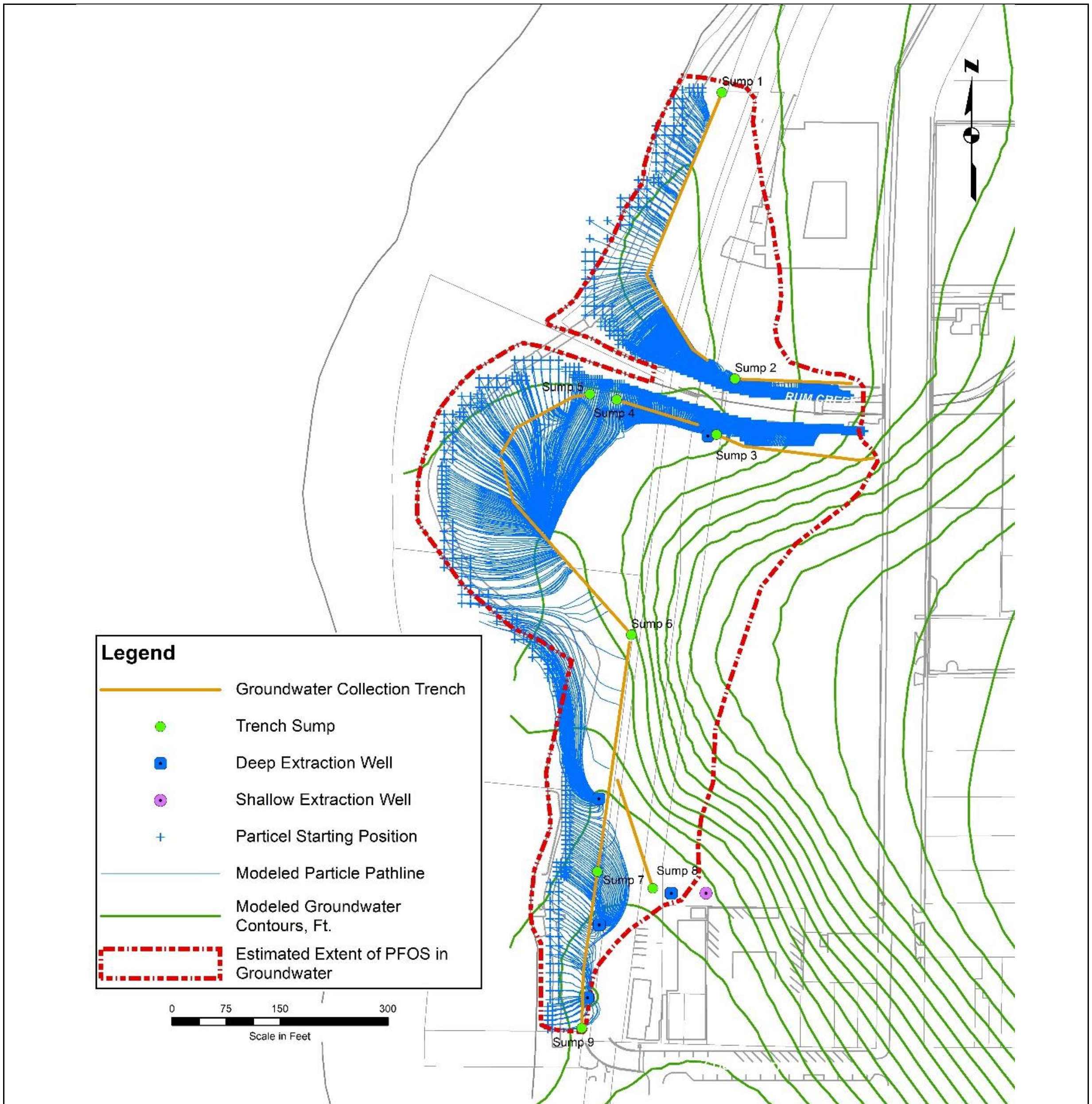


Figure 9-6: Modeled Forward Particle Pathlines Starting from Downgradient, Layer 3, Elevations from 632 to 652 feet.

As shown in **Figure 9-5,** the model shows the interceptor system creates inward hydraulic gradients which capture groundwater between the Rogue River/Rum Creek and the trenches in Model Layer 3.

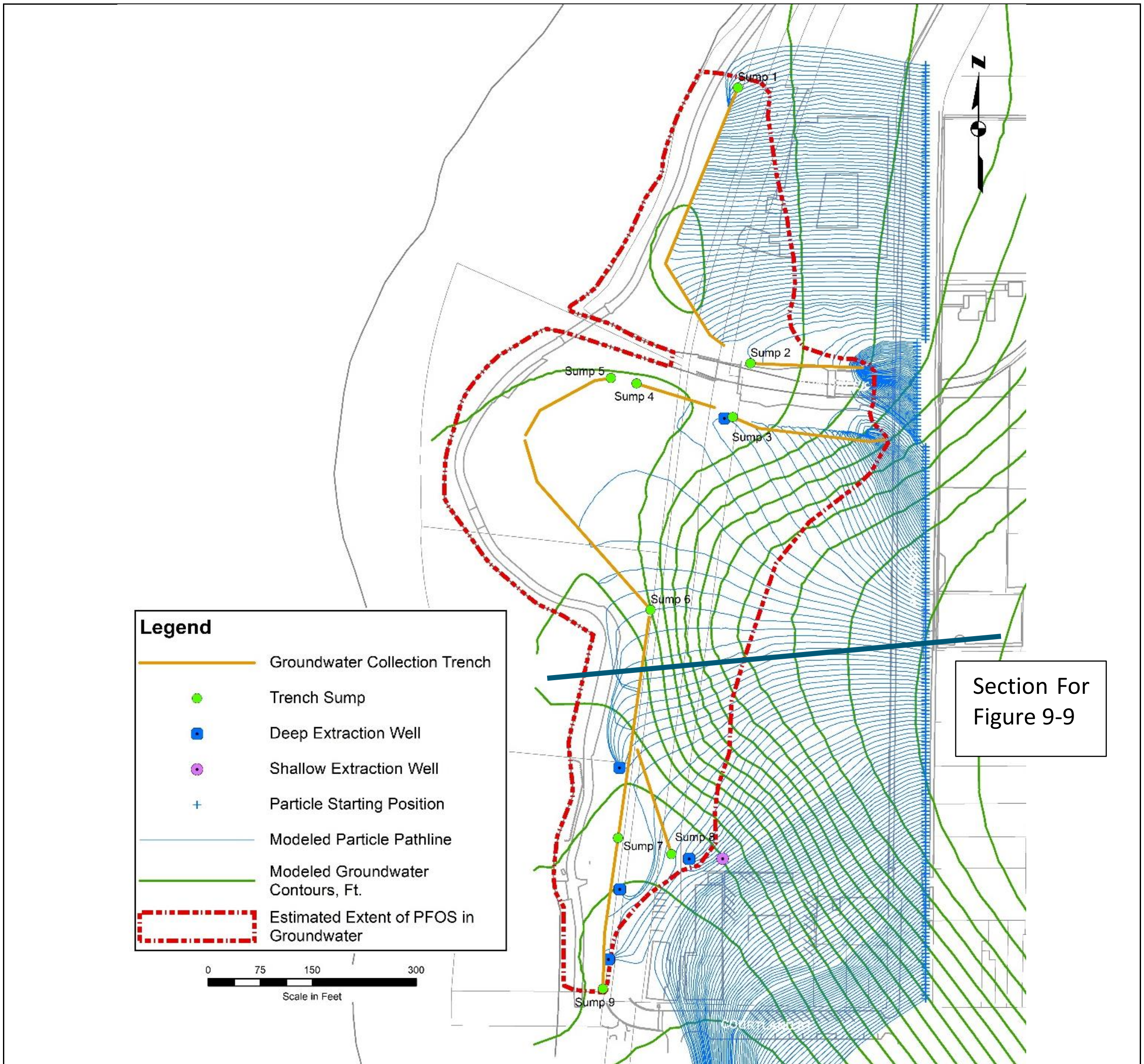


Figure 9-7: Modeled Forward Particle Pathlines Starting from Upgradient, Layer 4, Elevations from 608 to 632 feet.

Figure 9-7 shows the interceptor system is also able to create inward hydraulic gradients and intercept groundwater flow to Rum Creek and Rogue River in Model Layer 4.

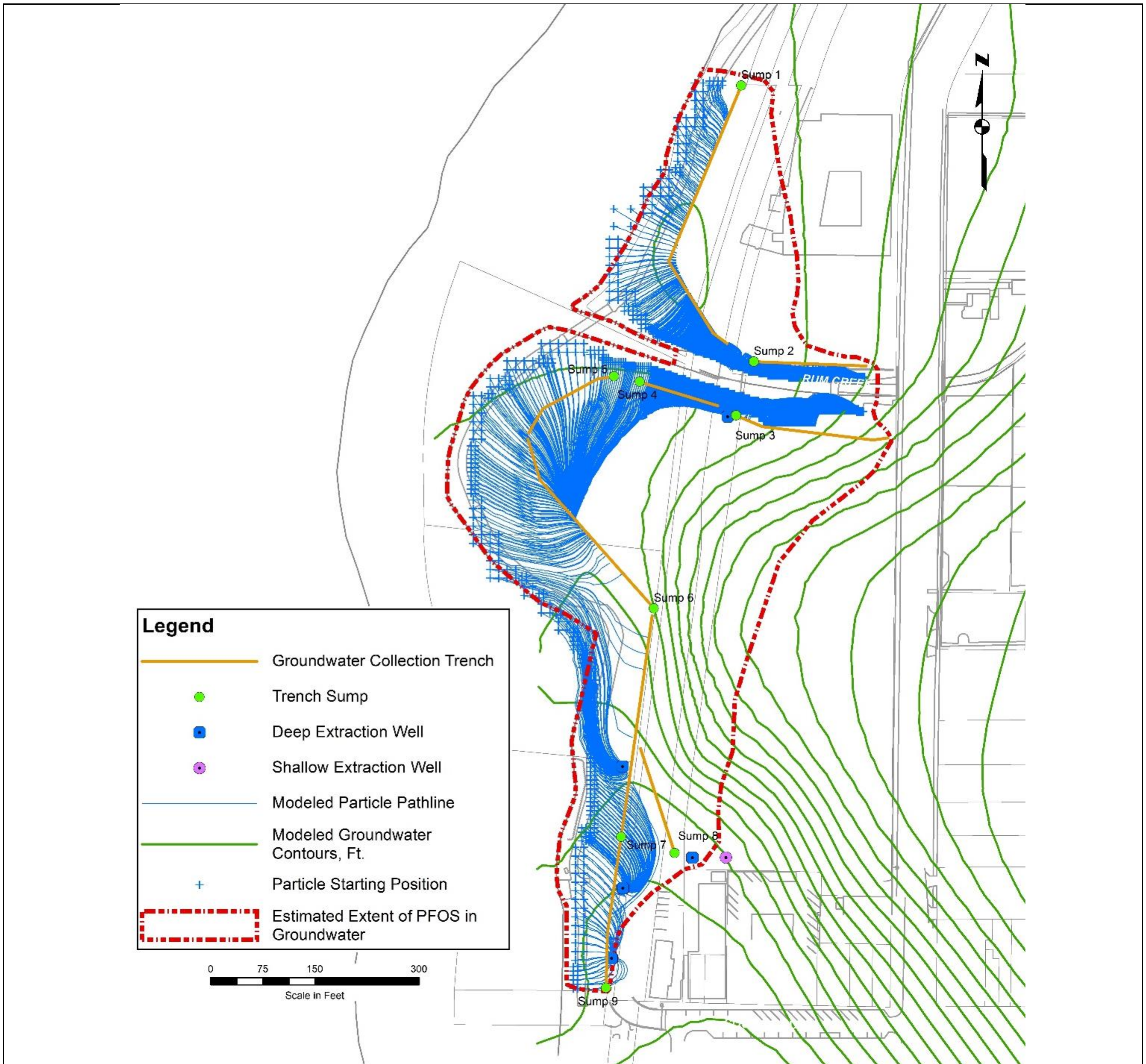


Figure 9-8: Modeled Forward Particle Pathlines Starting from Downgradient, Layer 4, Elevations from 608 to 632 feet.

Figure 9-8 shows the interceptor system is also able to create inward hydraulic gradients which capture groundwater between the Rogue River/Rum Creek and the trenches in Model Layer 4.

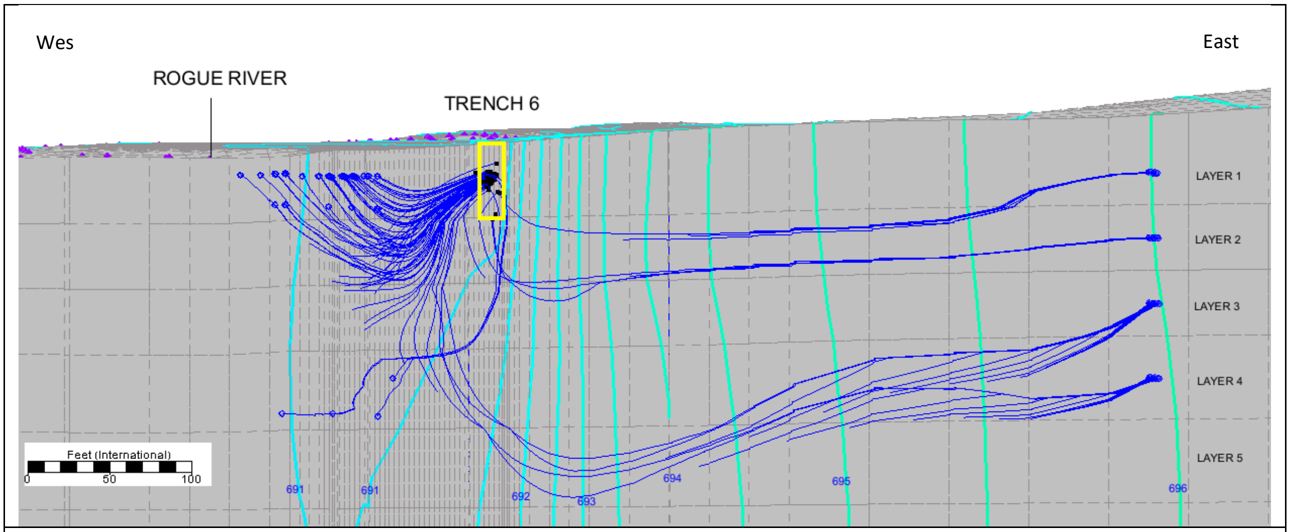


Figure 9-9: Model Computed Pathlines, West-East Cross-Section Profile

Figure 9-9 shows modeled path lines in vertical profile, the vertical capture zone reaches to Layer 4 (bottom elevation 608 feet).

The modeled particle pathlines indicate the designed trench, extraction well layout, and pumping rates are expected to provide hydraulic control of PFOS-impacted groundwater on the Site and prevent groundwater from venting to the surface water along the downgradient Site boundary.

The groundwater collection trench, extraction well layout, and design were modeled using the calibrated model, which includes approximately 15.2 in/yr groundwater recharge, representing a reasonably high end of the groundwater recharge range. The use of April 2019 groundwater recharge is conservative (i.e., results in higher groundwater extraction rates) relative to average recharge conditions. Under high recharge rates, greater groundwater pumping rates, that are within the capacity of the capture system, are needed to intercept groundwater flux and prevent groundwater from venting to the surface water.

9.3 CAPTURE EVALUATION WITH RELATIVELY HIGH GROUNDWATER RECHARGE

To evaluate modeled groundwater capture sensitivity to recharge value, the same collection trench and extraction well layout was also evaluated with a higher groundwater recharge rate. A multiplier of 1.4 was used in the recharge module of the calibrated model to simulate a groundwater recharge rate of 21.4 in/yr. This modeling result predicted a total pumping rate of 105 GPM with capture zone and flow pathlines similar to those presented in **Figures 9-1** through **9-9.**

As discussed previously, the groundwater model was calibrated to the static water level data set (see EGLE-approved RAP) and is expected to represent the aquifer at Site-scale with the heterogeneities indicated by the existing monitoring well data. The model is expected to provide improved accuracy in the evaluation of the overall system capture zone and overall pumping rate due to ability of the trench design to better average subsurface hydraulic properties across the Site. However, with the heterogeneity discussed in **Section 8.0**, the actual pumping rates from individual trench sumps and extraction wells are expected to differ from the model estimates. Therefore, the total pumping rate of the groundwater interceptor system may be less than or greater than the estimated high end pumping rate of 105 GPM.

During the investigations for this revised RAP, R&W/GZA discovered retail building has a foundation sump-pump system. During the period of additional investigation conducted as part of the aquifer evaluation, flow meters were installed on the pumps to measure average flow. The groundwater pumping rate from the building foundation sump-pump is approximately 10 GPM. This additional groundwater volume will be incorporated into the final treatment system design.

Considering the uncertainty associated with highly heterogeneous aquifers and its effect on groundwater collection system flow rates and capture zones, the groundwater interceptor trenches and extraction wells will be installed prior to the completion of the final treatment design. Performance pumping tests will be performed in the installed groundwater collection trenches and extraction wells. The data will be used to evaluate pumping flow rates, and hydraulic influences of the installed trenches and extraction wells. The collected groundwater will be treated in an interim treatment system. Treatment system design will be continued based upon the modeled flow volume included in this RAP, but final design of the treatment system will be modified and based upon the data gathered from the interceptor trench and extraction well pump testing and treatment.

10.0 GROUNDWATER INTERCEPTOR AND TREATMENT SYSTEM DESCRIPTION

The groundwater interceptor system will be a combination of groundwater collection trenches, extraction wells, sumps, and intermediary cisterns. In general, the trenches will be located to avoid existing subsurface structures and to overcome the variable permeability of differing native and fill material present adjacent to the Rogue River and Rum Creek. The locations of extraction wells were selected to address deeper impacted groundwater while avoiding damaging or relocating existing subsurface structures (i.e., the municipal sanitary sewer which runs parallel to the Rouge River). Because the extraction well and trench network south of Rum Creek is more expansive than north of the creek, the interceptor system includes multiple collection sumps. Intermediary cisterns will consolidate groundwater from several trench sumps and/or extraction wells and deliver a single discharge to the groundwater treatment building. The following sections describe generalized interceptor system components. **Sheet No. 10** shows the preliminary layout of the proposed groundwater collection trenches and extractions wells. During construction, the locations and length of trenches, wells, pipe runs, sumps, cisterns, and other components will be adjusted based upon field conditions with R&W/GZA's review and approval. Similarly, the trench depths and extraction well screen elevations may also be adjusted based on field observations.

See **Exhibit 1** for a groundwater flow visual of groundwater influence via an extraction well and groundwater collection trench.

10.1 <u>INTERCEPTOR SYSTEM</u>

The following sections describe the general component changes of the interceptor system.

10.1.1 <u>Groundwater Collection Trenches and Sumps</u>

Each groundwater interceptor trench incorporates a sump at one end, cleanouts at both ends, and a 6-inch diameter perforated drainage pipe located approximately 1-foot above the bottom of the trench. The riser is likely to be a 12-inch diameter solid pipe that intersects the perforated drain pipe; both ends of the drain pipe will extend to the surface to act as clean-outs. Each trench will be backfilled with a mixture of washed sand and pea gravel that will surround the drainage pipe and will terminate approximately 4-feet below finished grade. The top four feet will be backfilled with common fill, topped with approximately 6-inches of clean topsoil and seeded. Discharge piping from the collection sumps, will be routed in the trench footprint above the clean sand/pea gravel mix (below the frost line). Power and signal cables will also be routed in the trench footprint about 18-inches below finished grade. A conceptualized cross section of the trench is presented in **Figures 10-1** and **10-2.** Details are subject to changes during the detailed design phase.

Figure 10-1: Typical Trench Design - Section

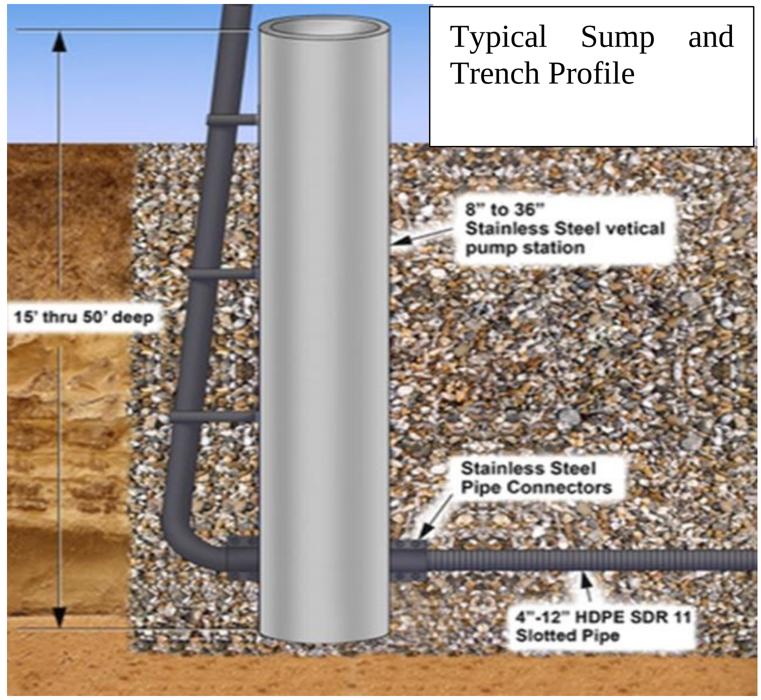


Figure 10-2: Typical Trench Design – Sump and Trench Profile Note: the depiction of the trench backfill is not accurate and will not extend to the ground surface.

Each sump location will be finished at grade surface in either a fiberglass manhole for sumps located within grassed areas or in a traffic-rated manhole for areas currently paved. All sumps will be equipped with a groundwater extraction pump, level controls, and valves. Variable speed pumps and/or variable frequency drives (VFDs) are anticipated. To the extent possible, submersible pump equipment and wetted components will be free of PFAS. Electrical service and signal cables will be routed from the treatment building to the sumps in conduit. Depending upon the location of the trench, discharge piping will be either routed directly to the treatment system or to an intermediary collection cistern.

10.1.2 <u>Collection Cisterns</u>

The current configuration calls for two underground cisterns both of which will be installed south of Rum Creek and used to consolidate groundwater from the extraction wells and trench sumps. Depending upon the groundwater elevation at each location, the cisterns will be installed on either a hold down slab or tied down using dead man-type anchors or equivalent support structure. The cisterns will be equipped with a duplex pump system to provide redundancy and to allow maintenance when the system is in operation. Water levels in each of the cisterns will be monitored and controlled by float or pressure transducers connected to the main instrumentation control panel that will regulate the flow to the treatment system. Access to the cisterns will be through flush mounted, locked vaults.

10.1.3 Extraction Wells

Both shallow and deep groundwater extraction wells will be installed south of Rum Creek. The locations and the screen intervals of the extraction wells may be adjusted during installation based on the soil conditions observed during drilling. **Sheet No. 10** includes the proposed groundwater collection trench and extraction well location plan.

Extraction wells will be sized appropriately for the pumps and necessary instrumentation. Each extraction well is expected to be constructed of stainless-steel, slotted wire-wrapped screen. Filter-pack sand will be filled to approximately 2 to 3 feet above the top of the well screen, followed by a bentonite plug. The remaining annulus will be filled with bentonite/cement grout and native soil to grade surface. During the detailed design phase, the filter-pack sand specifications and well screen slot sizes may be modified based on field observations of lithology and grain-size analyses.

10.1.4 Piping

Piping runs will be buried below the frost line to comply with standard design practice and to avoid freezing in the event of a power failure. The locations of the piping runs will be surveyed and located with tracer wire to allow ease of identification and help prevent damage during future Site work. The piping run will enter the treatment building, passing through a flow meter, flow control valve, and pressure switch. Pipes will exit from below ground inside a heat-controlled enclosure to eliminate the need for heat tracing and insulation. The portion of the force main and conduit passing under Rum Creek will be installed using horizontal directional drilling techniques. This crossing has already been permitted through EGLE (Permit No. WRP021885, expires May 26, 2025) and permit compliance will be addressed during the final design process.

10.1.5 Piezometers

To measure interceptor system performance via groundwater level elevations, 13 trench piezometers (TPZs) will be installed in the groundwater collection trenches; nine (9) deep piezometers (DPZs) will be installed to monitor the performance of the deep extraction wells; and nine (9) river piezometers (RPZs) will be installed to monitor GSI water elevations. Existing river piezometers TA-SG-RC and TA-RP-5 will be used to measure Rum Creek and Rogue River water elevations. Groundwater elevations in the trench piezometers will be compared to the creek and RPZ elevations. One existing deep monitoring well, TA-MW-309C, will be used as a deep piezometer. **Sheet No. 11** indicates a location plan for the TPZs, DPZs, and RPZs.

The TPZs will be constructed of 2-foot long screens and solid wall risers to house the pressure transducer. The bottom of the piezometer screens will be set at approximately 688 feet for TPZ-1 through TPZ-5 and TPZ-9. The bottom of the piezometer screens will be set at approximately 685 feet for TPZ-6 through TPZ-8. The DPZs will be 5-foot long screens to house the pressure transducer. The bottom of the screens for DPZ-1A, DPZ-1B, DPZ-3, and DPZ-5 will be set at approximately 670 feet, and the bottom of the screens for the remaining DPZs will be set at approximately 650 feet. The RPZs will be similar to the DPZs and installed near the shoreline, and bottom of the screens will be set at an elevation of approximately 685 feet. During piezometer installation, the screen positions, the filter-pack sand specifications and well screen slot sizes may be modified based on field observations of lithology and grain-size distribution.

10.1.6 Pumps

Pumps installed in each trench sump or EW will be connected to the discharge line using a pitless adapter. This configuration coupled with installing the discharge lines below the frost line will eliminate the need to install an additional power line in the well head containment while allowing the pump to be accessed for periodic maintenance. Each sump or EW will be equipped with a small diameter stilling well to hold a transducer that will be connected to the programmable logic controller (PLC) that will regulate the pump's operation. A check valve, flow meter, manual flow control valve, and pressure switch will be installed on each discharge manifold inside the well head containment. The manifold piping will be connected to the main piping run.

10.1.7 Pressure Transducers

Signal cables from each pressure transducer installed in the trench sumps and EWs and will be hard-wired to the control panel and will be configured to measure the water elevation. Pressure transducers will also be installed in each of the RPZs and DPZs. The groundwater elevations in the RPZs will be considered groundwater elevations at the GSI and each RPZ will be paired with trench sumps and extraction wells so that hydraulic control can be directly monitored and controlled. Water elevation data collected by the transducers will be output to the PLC which will monitor groundwater elevation and control pump operation.

10.1.8 Pump Protection

The pump will be protected with individual motor starters, variable frequency drives or similar. These components contain devices that protects the pump from over voltage, under voltage, overload, and under load.

10.1.9 Equalization Tank

Groundwater from the main piping runs will be discharged into an equalization tank prior being pumped through the treatment system. The tank will have equipment capable of sensing level. In the event the water level in the equalization tank reaches a predesignated high-level, a signal will be sent to the groundwater interceptor system PLC that shuts down the extraction well system until the water level in the equalization tank returns to a predesignated low- level, records the event in the system's database, and sends an alarm to the designated parties, typically the system Operator.

10.1.10 Data Logger

A data logger, a data acquisition and logging instrument that measures and records values necessary to continuously monitor system operation, helps create reports, and analyzes system performance, will be installed in the treatment building. The data logger will be used in conjunction with the PLC to record system operation and are typically accessible using a direct USB connection, or remotely using the internet and the appropriate security protocols and access codes.

10.1.11 Alarm Auto Dialer

The instrumentation control panel will also contain an alarm automatic dialer that will send pre-set alarm conditions and alerts to designated personnel via mobile or telephone line.

10.1.12 Electrical Control Panel and Treatment Building

An electrical control panel will be installed in the treatment building to control the groundwater extraction system. The electrical control panel will include the components necessary to power the groundwater recovery system, monitor the instrumentation (i.e., system performance), record and notify designated personnel of alarm conditions, control the pumping rate at each groundwater extraction point, and turn the entire system off if needed. To accomplish these tasks, the control panel will likely consist of the following components: electrical service panels for building operation, power control, PLC, data logger, an auto-dialer, a building leak detection sensor, and a temperature sensor. A portion of piping run, including the flow meter, and the main power disconnect switch to cut electrical power to the system will also be located inside the control building.

10.1.13 System Process

The system will generally be operated in automatic control mode with the option of a hand-control mode. A hand-control mode operation will be primarily for system troubleshooting and/or debugging.

In automatic mode, the system will operate, shutdown, or send alarm alerts according to the various operating conditions programmed into the PLC and the corresponding configuration settings.

The system's primary objective is to maintain the water elevation determined by the trench and deep PZDs at or below the corresponding water elevation measured by the RPZs. The elevation differences between the trench sumps and its corresponding RPZ will be set at a user-specified value termed as the DELTA value. During the two-year demonstration period, the system performance data will be evaluated, and DELTA values will be varied and evaluated for each extraction well. The following table provides a tentative summary of the RPZs and corresponding trench sumps, extraction wells, and PZDs.

River Piezometers RPZs (GSI)	Paired Trench Sumps/Extraction Wells	Paired Trench Piezometers / Deep Piezometers (TPZs/DPZs)
RPZ-1A	Trench Sump 1	TPZ-1A
RPZ-1B	Trench Sump 1	TPZ-1B
TA-RP-5	Trench Sump 4/Trench Sump 1	TPZ-1C, TPZ-4
TA-SG-RC	Trench Sump 2/Trench Sump 5	TPZ-2, TPZ-3
RPZ-5	Trench Sump 5	TPZ-5
RPZ-6A	Trench Sump 6	TPZ-6A
RPZ-6B	Trench Sump 6	TPZ-6B
RPZ-7A	Trench Sump 7	TPZ-7A
RPZ-7B	Trench Sump 7	TPZ-7B
RPZ-9A	Trench Sump 9	TPZ-9A
RPZ-9B	Trench Sump 9	TPZ-9B
RPZ-7B	DEW-1	DPZ-7B
RPZ-9A	DEW-2	TA-MW-309C
RPZ-9B	DEW-3	DPZ-9B

Table 10-1: Performance Monitoring River Piezometers, Paired Trench Sumps/Extraction Wells, Paired Piezometers

The objective is to maintain the groundwater elevation in the paired piezometers at or below the river piezometers. It is important to note that river elevations will temporally fluctuate during intermittent periods in response to precipitation and snow melt. These periodic conditions may result in a corresponding appearance of reversed groundwater flow or bank storage conditions; however, such conditions will not materially affect the long-term overall effects of the extraction systems to control groundwater migration to the surface water bodies.

The system components as described above are preliminary and subject to change during the detailed design phase.

10.2 PERFORMANCE PUMPING TESTS

Following the installation of groundwater interceptor trenches and extraction wells, performance pumping tests will be completed, and the collected groundwater will be treated through an interim treatment system prior to design and construction of the long-term treatment system. The interim treatment system is anticipated to be modular and temporary for the duration of the extraction well performance pumping tests as well as during final treatment system design and construction. The temporary system design will at a minimum include particulate filtration and two-stage granular activated carbon (GAC) but may include additional unit processes, such as iron pretreatment. Additional treatment technologies maybe tested in the laboratory or at pilot-scales during these performance tests.

The temporary treatment system will operate in compliance with a National Pollutant Discharge Elimination System (NPDES) permit. The NPDES permit application has been submitted to EGLE and draft permit is pending as of the date of this RAP.

Metrics of this extraction well performance testing period are anticipated to include evaluation of the following:

- Pumping rates
- Groundwater volume
- Groundwater elevations/drawdowns at trench piezometers, deep piezometers and river piezometers and adjacent monitoring wells
- Pump control
- Pump operation
- Groundwater chemistry
- NPDES Permit Compliance

The final groundwater treatment system design may be refined based upon the performance pumping test results for the installed groundwater collection trenches and extraction wells. Start-up and operation of the groundwater collection and treatment systems will be sequenced. Because of the number of groundwater recovery points (wells and trenches), start-up operations of the final system will likely proceed with a small number of pumps turned on initially (i.e., the individual extraction wells and trenches). Once the pumping rates from this smaller subset of recovery points approach steady-state, the next set of wells and/or trenches will be brought online with the same approach until all wells and trenches are started. Primary system components are expected to remain similar to **Appendix D** but will be confirmed upon completion of Final Design.

10.3 GROUNDWATER TREATMENT SYSTEM

While multiple emerging technologies are being researched and tested for PFAS treatment, R&W/GZA selected GAC sorption for the temporary and long-term treatment technology because its effectiveness has been thoroughly demonstrated and systems using GAC can be designed, constructed, and implemented promptly. In addition to numerous literature studies, the Point-of-Entry Treatment filters installed at selected homes in the House Street and Wolven-Jewell study areas demonstrate the effectiveness of the proposed GAC treatment for PFAS.

Based on estimated iron concentrations from groundwater sampling performed to date, iron removal prior to the GAC treatment appears to be appropriate, but the ultimate decision will be made during the final design process. Additional unit processes may also be incorporated into final design as informed by the bench-scale or pilot activities and temporary treatment system testing conducted during the extraction well performance pumping test. We currently anticipate the groundwater treatment system will include at a minimum:

- Groundwater equalization
- Particulate filtration (upstream of GAC)
- Two-stage GAC
- Treated effluent metering and sampling equipment

The long-term treatment system GAC vessels will be sized to accommodate flows as informed by the performance pumping test and with the expectation that flows to the treatment system will increase over time up to an expected maximum of 150 GPM. The treatment system description, a simplified process flow diagram, and a conceptual schematic of both the interceptor system and controls block diagram are included in **Appendix D**.

11.0 OPERATIONS AND MAINTENANCE (O&M)

A complete O&M Plan of the groundwater interceptor and long-term treatment system will be provided with the Completion Report. This document will include specific equipment and components used in the system. O&M will be completed on an as-needed basis during temporary treatment and system start-up to ensure proper function and maintenance of the equipment that is in use as well as NPDES-permit compliance. Generally, the system will be observed every week for proper system operation. The physical condition of the system will be observed, and various maintenance activities will be conducted in accordance with manufacturer recommendations. A description of the inspection and maintenance activities is provided below.

11.1 PHYSICAL CONDITION INSPECTION

The physical condition of the groundwater interceptor system will be evaluated during the O&M inspections. The following components of the groundwater interceptor system will be inspected to ensure proper system function:

- Trench system operations- The trenches are equipped with cleanouts for maintenance flushing of the collection pipe. Flushing of the trench segments will be completed per contractor recommendations;
- Extraction well system operations;
- Pumps and associated controls condition;
- Manifolds and piping connections;
- Cistern conditions;
- Sump conditions;
- Treatment system components conditions;
- Pre-filter housing pressure; and,
- Equalization and other tank levels.

Physical defects in the system such as cracking, splitting, corrosion, or any other physical problems with the system will be documented. An attempt will be made to repair any defects noted during the Site visits. Should significant defects be noted (i.e., pump malfunction), the system (or a portion of the system, such as the groundwater collection system) will be shut down, and corrective measures will be completed.

11.2 SYSTEM FLOWRATE AND PRESSURE MEASUREMENTS

Groundwater flow rates will be measured using in-line, totalizing flow meters incorporated into the treatment system. Baseline groundwater flow data will be collected and recorded during initial system operation. If any significant deviations from the baseline groundwater flow rates are observed during the continued O&M inspections, the system diagnosis and troubleshooting will be performed to evaluate the potential causes. Common causes for changes in groundwater flow rates may include clogged in-line filters or lines, poor system connections and/or damaged fittings, equipment (pump) inefficiency or failure, and clogging of trench slotted pipes/well screens and collection piping. Pressure measurements will be recorded.

11.3 ANTICIPATED OPERATIONS TROUBLESHOOTING

System maintenance is vital to ensure that the groundwater interceptor system is kept at optimal performance. Potential operating problems can occur during operation of the system and may include: pump failure or seizure; communication failure, electrical failure, or system freeze-up. These issues could result in stoppage of one or more of the system components. As such, periodic shutdowns of the systems for routine maintenance, system diagnosis, equipment repair or replacement, or other reasons may occur.

In the event of a system failure, an attempt will be made to identify the problem and determine if repairs can be made in the field. If repairs cannot be made in the field, O&M personnel will evaluate and determine the appropriate action required to resolve the issue. All repairs will be initiated as soon as possible after detection of the problem. In the case of an electrical problem, a licensed electrician will be notified to diagnose and repair the problem.

During cold weather months, groundwater interceptor system components could potentially freeze resulting in a shutdown. If the freezing results in the blockage of a line that cannot be thawed, the section that is blocked will be cut-out and replaced with a new section of piping or temporarily re-routed, if possible.

An inventory of supplies and replacement parts will be maintained either on-site or will be readily available from equipment suppliers includes:

- Spare Pump(s) and controller(s);
- Extra fuses for motor starters and other equipment on the control panel;
- PVC pipe and fittings;
- Cam-lock fittings and ball valves;
- Extra belts for the motors, and other materials recommended by the equipment provider/manufacturer;
- Pressure gauges; and,
- PVC sampling ports and miscellaneous equipment.

Any anomalies detected during system inspections will be noted on the inspection checklist along with the date the anomaly was corrected and a brief description of the corrective action. In the event of failure or breakdown of a critical system component that cannot be serviced or replaced with equipment maintained on-Site or readily available, the equipment manufacturer will be contacted for replacement parts.

Summaries of O&M activities of the system will be included in the annual updates to EGLE. These updates will include the results of the system inspections, flow meter readings, as well as an evaluation of system performance.

12.0 IMPLEMENTATION

To implement the work most efficiently and commence operations expeditiously, Wolverine will undertake a phased approach to complete the final system design and operation.

- **Phase One**

  Phase I consists of the installation of the interceptor system, including the trenches and extraction wells. This Phase will also include the installation of the treated water outfall to the Rogue River, over 2,000 linear feet of trenches, off-Site disposal of excavated soil, backfill of granular material, installation of six extraction wells, placement of pumps in each trench and extraction well, and routing of the electrical conduit and piping below Rum Creek using horizontal directional drilling techniques to the proposed treatment system location.

- **Phase Two**

  During this Phase, the operation and performance pilot testing of the interceptor system will be conducted and used to evaluate the groundwater flow, volume, and concentration data to optimize design, installation, and operation of a long-term treatment system. The temporary treatment and pilot testing of the installed interceptor system during Phase Two will begin following completion of Phase one and receipt of all necessary permits and approvals.. Performance testing will be completed for each of the trenches and extraction wells. During this phase, water will be treated by using a temporary, modular treatment system.

- **Phase Three**

  Phase Three includes the design, construction and transition from the temporary treatment system to the long-term treatment system. During the period of temporary treatment of Phase Two, the final treatment system design will be optimized and completed. The design will go through the bid process and construction of the building system will begin following contract award and receipt of all required permits and approvals.

13.0 SCHEDULE

The following outline generally summarizes the design, permitting, and construction tasks and durations anticipated; the reference to days is business days (Monday through Friday without weekend or holiday work).

Critical path items include revised RAP approval and Inland Lakes and Stream permit approval to install the outfall; these will provide the basis for the construction schedules. System operation and treatment will require an attainable NPDES permit. EGLE is currently evaluating both permit applications. The two-year performance monitoring described in the following section will start upon completion of the interceptor system installation and testing described in Phase Two. Note, critical path items depend upon timely agency review and approvals. When possible, work is scheduled in parallel to shorten the schedule.

- Finalize Interceptor System Design and Specifications–within 60 days of Revised RAP approval.

Note: Permitting required to install and operate the interceptor and discharge systems are on the critical path and entirely dependent upon regulatory approval within defined agency review and approval timeframes.

- NPDES Permit Submittals – NPDES Permit Application was submitted on June 22, 2022.
  - The initial EGLE review period ended January 18, 2023. Wolverine, did, however, modify the permit application in March 2023.
  - Wolverine's review and the public comment period will be completed approximately 60 days after the draft NPDES permit is issued.
  - EGLE response and revisions will be within 30 days of public comment period close.
- Inland Lakes and Streams Joint Permit Application (JPA) for Outfall Discharge.
  - JPA was submitted on April 5, 2023.
  - EGLE Permit Processing and Approval is expected within 180 Days of the JPA submission.
- Additional permits will be completed throughout the interceptor system design period for approval prior to construction.
  - Michigan Department of Natural Resources – White Pine Trail Permit
  - Michigan Department of Transportation – Work within a Right-of-Way
  - Soil Erosion and Sedimentation Control
  - Rockford Building Permits
- General Bid Process:
  - Bid Documents will be provided to potential bidders within 30 days following Final Design completion.
  - Bid submittals are anticipated to be within 30 days of solicitation.
  - Contract award will be within 45 days of bid submittal.
  - Construction-phase work is anticipated to begin within 30 days of award. Contractor's proposed schedules will be provided in their Bid Submittals and will be based on specified constraints (i.e., Department of Transportation frost laws, weather, contractor, subcontractor, material, and supply chain issues) that will be included in the Contractor's response and Contractor Work Plans.

The following schedule outlines anticipated milestone dates of project work:

Tasks	**Revised RAP Milestone**
EGLE RAP approval	• Schedule depends on approval by end of July 2023
NPDES Permit Approval	• Expected July 2023
JPA Permit Approval	• Expected on or before October 2, 2023
Finalize Interceptor System Design and Specifications	• Approximately 60 days after RAP approval. ○ Expected October 2023
Interceptor System Bid Process	• October 2023 through January 2024

Tasks	Revised RAP Milestone
Implementation:	• Phase I ○ Construct NPDES Outfall ▪ June 2024 ○ Begin Interceptor System Installation ▪ June 2024 • Phase II ○ Start Temporary Groundwater Treatment ▪ August 2024 • Phase III ○ Begin Performance Monitoring ▪ November 2024 ○ Long-term Treatment System Operational ▪ February 2026 ○ Complete Performance Monitoring – Interceptor System ▪ October 2026

14.0 PRE-DESIGN INVESTIGATION DATA

R&W/GZA has identified additional data that will be helpful to further inform the System design. Two ASTM Accelerated Column Tests were conducted to evaluate the carbon performance and useful life in the treatment process. Prior to the installation of the proposed trenches and extraction wells, vertical aquifer profiling and installation of additional nested well sets south of Rum Creek will be performed to obtain additional data on the deeper portions of the aquifer near Rum Creek. One vertical aquifer profiling boring will be performed at location between TA-GW-06 and TA-MW-304A/B. Soil samples will be collected every 5 feet to visually observe and classify the soil. Temporary wells will be installed in the coarse-grained saturated soil at an interval of 10 feet. Groundwater samples will be collected from the temporary wells and submitted for PFAS analysis. The soil boring will be advanced to a depth of approximately 80 feet bgs, until a competent fine-grained soil stratum is encountered, or upon refusal.

Additionally, we plan to conduct slug testing on deeper wells to better estimate the K values in the deeper portions of the aquifer across the Site. This work will be done concurrently with system design and permitting, and data will be utilized to evaluate whether additional deep extraction wells are warranted. EGLE will be consulted during the data evaluation following the slug testing.

15.0 PERFORMANCE MONITORING PLAN

The Performance Monitoring Plan in this Revised RAP is based on and consistent with the Performance Monitoring Plan in the EGLE-approved RAP. The EGLE-approved RAP utilizes an extraction well system; this Revised RAP proposes a combination of extraction wells and trenches. The Performance Monitoring Plan in this Revised RAP is therefore updated to reflect the proposed combination of wells and trenches.

Unlike a groundwater pump and treat system, a groundwater capture system's goal is hydraulic control through reversal of gradients. So both the capture system previously approved and the one currently proposed have the same objective: to control PFAS-containing groundwater before it enters the Rogue River and Rum Creek. Both systems are designed to achieve that objective by reversing the hydraulic gradient (i.e., making groundwater flow away from surface water rather than toward the surface water).

Whether the capture system uses trenches, wells, or a combination of trenches and wells does not affect the data needed to demonstrate its performance. Therefore, as with the performance of the system in the EGLE-approved RAP, the performance of the system in this Revised RAP will be monitored by groundwater elevation measurements to evaluate hydraulic gradient and maintain the water elevation determined by the trench and deep PZDs at or below the corresponding water elevation measured by the RPZs. Groundwater monitoring will occur as described in Section 17.

Following installation of the system, R&W/GZA will implement a performance monitoring program to evaluate the effectiveness of the system for two years of operation after Phase II completes. Following this period, the CD requires a submittal documenting the effectiveness of the system. A long-term system monitoring plan will be included in that submittal. Unless modified during the detailed design process, the performance monitoring will consist of the following:

- Prior to the system installation, quarterly groundwater elevation and surface water elevation data will be collected from existing monitoring wells/piezometers for four quarters. The data will be used to generate baseline groundwater elevation contour maps.

- Collecting groundwater elevation data from the trench sumps, trench piezometers, deep piezometers, extraction wells, and river piezometers using pressure transducers. **Table 15-1** includes the lists of the monitoring sections, piezometers, and performance criteria.

- Collecting weekly elevation data from two staff gauges in Rum Creek (TA-RP-5 and TA-SG-RC) for the first four months of system operation, with the option to discuss reduced frequency with EGLE after four months.

- Comparing and evaluating groundwater flow direction in eleven monitoring sections weekly (**Sheet No. 11** indicates the locations of the monitoring sections) to evaluate the effectiveness of groundwater collection trenches. Note that deep piezometers are not proposed between Rum Creek and Trench 2/Trench 4 due to the relatively short distance between Rum Creek and the trenches.

- Groundwater elevations measured in piezometers installed in the trenches (TPZs) will be compared to those of their corresponding river piezometers (RPZs). If groundwater elevations in the TPZs are lower than the RPZs, inward hydraulic gradients are achieved. Groundwater elevations measured in deep piezometers (DPZs) will be compared to those of their corresponding RPZs to evaluate potential underflow passing beneath the trenches. If groundwater elevations in the DPZs are lower than the RPZs, inward hydraulic gradients exist. If groundwater elevations in the TPZs or DPZs are equal to those of their corresponding RPZs, it indicates groundwater between the trenches and the surface waters is stagnant and groundwater is not venting to the surface waters.

- The monitoring sections and evaluation criteria are summarized in the following table:

Monitoring Sections	River Piezometers (GSI)	Deeper Piezometers	Paired Trench Piezometers	Performance Criteria
MS-1A	RPZ-1A	DPZ-1A	TPZ-1A	Groundwater elevations at TPZ-1A and DPZ-1A less than or equal to RPZ-1A
MS-1B	RPZ-1B	DPZ-1B	TPZ-1B	Groundwater elevations at TPZ-1B and DPZ-1B less than or equal to RPZ-1B
MS-1C and MS-4	TA-RP-5	Not used	TPA-1C, TPZ-4	Groundwater elevation at TPZ-4 and TPZ-1C less than or equal to TA-RP-5
MS-3 and MS-2	TA-SG-RC	DPZ-3	TPZ-2, TPZ-3	Groundwater elevations at TPZ-2 and TPZ-3 less than or equal to TA-SG-RC. Groundwater elevations at DPZ-3 less than the average of TA-SG-RC and TA-RP-5.
MS-5	RPZ-5	DPZ-5	TPZ-5	Groundwater elevation at TPZ-5 and DPZ-5 less than or equal to RPZ-5
MS-6A	RPZ-6A	DPZ-6A	TPZ-6A	Groundwater elevation at TPZ-6A and DPZ-6A less than or equal to RPZ-6A
MS-6B	RPZ-6B	DPZ-6B	TPZ-6B	Groundwater elevation at TPZ-6B and DPZ-6B less than or equal to RPZ-6B
MS-7A	RPZ-7A	DPZ-7A	TPZ-7A	Groundwater elevation at TPZ-7A and DPZ-7A less than or equal to RPZ-7A
MS-7B	RPZ-7B	DPZ-7B	TPZ-7B	Groundwater elevation at TPZ-7B and DPZ-7B less than or equal to RPZ-7B
MS-9A	RPZ-9A	TA-MW-309C	TPZ-9A	Groundwater elevation at TPZ-9A and TA-MW-309C less than or equal to RPZ-9A
MW-9B	RPZ-9B	DPZ-9B	TPZ-9B	Groundwater elevation at TPZ-9B and DPZ-9B less than or equal to RPZ-9B

Table 15-1: Rogue River Monitoring Sections and Performance Monitoring Criteria

- The evaluation of the monitoring sections in Table 15-1 will be performed weekly during the first four months of full system operation (i.e., after Phase II completes), with the option to discuss a reduced monitoring frequency for the remainder of the two-year testing period.

- Collecting bi-weekly groundwater elevation data from the existing monitoring wells/piezometers located between the trenches and the Rogue River/Rum Creek during the first four months of the trench system operation, with the option to discuss a reduced frequency after four months. The data will be used to evaluate the system effectiveness as a supplement to the monitoring section evaluation.

Wells/Piezometers North of Rum Creek	Wells/Piezometers South of Rum Creek	
TA-PZ-1	TA-MW-3	TA-MW-303A/B/D
TA-PZ-2	TA-MW-5	TA-GW-01
TA-PZ-3	TA-MW-305/B/C	TA-MW-302A/B
TA-MW-306A/B	TA-GW-03	TA-P-1
	TA-TMW-105	TA-GW-07
	TA-P4	TA-TMW-101
	TA-MW-304A/B	TA-MW-301B/C/D
	TA-GW-06	TA-GW-08
	TA-P-3	TA-MW-309A/B/D
		TA-MW-313A/B/C

Table 15-2: Bi-Weekly Groundwater Elevation Measurements at Wells/Piezometers Between the Trenches and the Surface Waters

- Collecting monthly groundwater elevation data from the remaining monitoring wells/piezometer at the Site. The data will be used to map groundwater elevation contours and evaluate groundwater flow.
- Monthly progress reports will be prepared and submitted to EGLE to document the system operation and performance monitoring evaluation. Site-wide groundwater contour maps and estimated water budgets will be included in the reports.

The goal of the system is to maintain the groundwater elevation determined by the trench and deep PZDs at or below the corresponding water elevation measured by the RPZs. If performance monitoring indicates the whole system, a trench, or individual extraction well is either drawing too much water from the river or creek or conversely not controlling groundwater to a level below the observed RPZ elevations, then operational modification(s) will be carried out as appropriate. This performance assessment will also consider short-term conditions such as increased surface water levels that could create temporary bank storage or similar conditions that are not indicative of steady state flow.

A long-term system monitoring plan will be included in the two-year effectiveness demonstration submittal.

16.0 TREATMENT SYSTEM SAMPLING AND ANALYSIS

Groundwater flowing into the temporary and long-term treatment system (influent) will be sampled and analyzed for PFAS. The frequency will be based on the NPDES permit and may be adjusted, in coordination with EGLE, based on the variability and anticipated time to GAC breakthrough levels driving GAC change out. The treatment system effluent will be sampled and analyzed for PFAS and other analytes required by the NPDES permit. R&W/GZA will utilize the data from the influent and effluent sampling to calculate PFAS mass that is removed from the groundwater and therefore not discharged to Rogue River. Mid-point samples, collected from sample ports located between the carbon vessels, will be collected and analyzed according to the NPDES permit. This data will be utilized to determine when the carbon beds within the treatment train need to be changed out.

17.0 GROUNDWATER SAMPLING

As discussed with EGLE, groundwater sampling will be conducted and groundwater monitoring reports will be prepared and submitted to EGLE. Groundwater sampling and analyses will be completed in accordance with analytical methods and quality assurance/quality control procedures outlined in the project Quality Assurance Project Plan (QAPP) approved by the U.S. Environmental Protection Agency in May 2018, as revised (R&W/GZA, 2019C, R&W/GZA, 2020, R&W/GZA, 2022).

A set of wells, designated as “Boundary Wells,” will be monitored quarterly for the first two years of system operation. These wells will provide temporal trends at the approximate boundaries of hydraulic influence of the groundwater collection system. **Table 16-1** provides the list of proposed Boundary Wells. Proposed Groundwater Sampling Locations are included on **Sheet No. 12**.

Additional groundwater monitoring wells and/or piezometers will be selected for quarterly sampling during the first two years to monitor groundwater PFAS concentrations. After the two-year testing period, a reduced sampling frequency, if warranted by the findings from the quarterly sampling data during the first two years, will be discussed with EGLE for the long-term monitoring plan. The following groundwater monitoring wells/piezometers will be sampled and analyzed for PFAS. The sampling procedures and laboratory analytical method will follow the approved QAPP.

Area	Monitoring Wells	Sample Frequency
North of Rum Creek–Boundary Wells	TA-MW-308B, two additional wells to be installed north of the Footwear Depot building	Quarterly for the first two years; Annually after two years.
North of Rum Creek	PZ-1, PZ-2, PZ-3, TA-MW-306A, TA-MW-306B, TA-TMW-109, TA-GW-02	Quarterly for the first two years
South of Rum Creek–Boundary Wells	TA-MW-303E, TA-MW-316D, one additional deep well in the middle of the Site.	Quarterly for the first two years; Annually after two years.
South of Rum Creek	TA-MW-3, TA-MW-304A, TA-MW-304B, TA-GW-06, TA-MW-303A, TA-MW-303B, TA-MW-303D, TA-MW-302A, TA-MW-302B, TA-MW-301B, TA-MW-301C, TA-MW-301D, TA-GW-08, TA-MW-309A, TA-MW-309B, TA-MW-309C, TA-MW-309D, TA-TMW-103, TA-MW-1, TA-GW-04, TA-P-5, TA-MW-313A, TA-MW-313B, TA-MW-313C, TA-TMW-104	Quarterly for the first two years

Table 17-1: Groundwater Quality Assessment - Sampling and Analysis Plan

In addition, groundwater elevations will be manually measured quarterly.

If groundwater PFAS concentrations decrease to concentrations less than the Part 201 GSI criteria at a location being hydraulically contained by the system, potential system modification will be evaluated to stop or reduce groundwater extraction near this location.

During the first two years of system operation, statistical trend analysis of PFAS concentration changes over time will be performed annually, after four quarterly sampling events have been completed, to evaluate potential trends at individual monitoring wells. There will be some inward gradient and pore water volume exchanges, so, as EGLE explained in its summary of public comments on the RAP Addendum, there may be some areas where PFAS concentrations can be expected to decrease and/or stabilize. But any groundwater concentration decrease will likely result in desorption from soil, reducing any measurable decreasing concentration trend. As discussed with EGLE, when the system is properly functioning significant constituent concentration changes are not expected in the short term.

Annual groundwater monitoring reports will be prepared and submitted to EGLE. The data, groundwater flow evaluation, and PFAS concentration trend analysis will be included in the annual reports. Based on the data and trend analysis, adjustments to the system, a reduced monitoring frequency, or both, if warranted by the findings, may be proposed.

18.0 BIBLIOGRAPHY

Carle, S. F. (1999). T-PROGS: Transition Probability Geostatistical Software Verison 2.1. (Version 2.1). Livermore, California, USA: Lawrence Livermore National Laboratory.

Doherty, J. (2021, January). PEST, Model-Independent Parameter Estimation, 8th Edition. Australia.

Groundwater Inventory and Map Project. (2005). *Base Flow of Michigan Streams.* Lansing: U.S. Geological Survey Michigan Water Science Center.

Groundwater Inventory and Mapping Project. (2005, August 18). Estimate of Annual Groundwater Recharge. Michigan, USA.

Groundwater Inventory and Mapping Project. (2005). *Estimate of Annual Groundwater Recharge.* Lansing: U.S. Geological Survey Michigan Water Science Center.

Kruseman, G. P., & Ridder, N. A. (1994). Analysis and Evaluation of Pumping Test Data, Second Edition. Wageningen, The Netherlands.

Michigan Department of Environment, Great Lakes, and Energy, Water Resource Division. (2010). *General Guidelines for Calculating a Water Budget.* Lansing, Michigan: EGLE-WRD.

Moench, A. (1997). Flow to a Well of Finite Diameter in a Homogeneous Anisotropic Water Table Aquifer. *Water Resrouces Reseach, 33*(6), 1397-1407.

Neff, B., Day, S. M., Piggott, A. R., & Fuller, L. M. (2005). *Base Flow in the Great Lakes Basin: U.S. Geological Survey Scientific Investigations Report 2005-5217, 23 p.* Reston, : U.S. Geological Survey.

Neuman, S. (1975). Analysis of Pumping Test Data from Anisotropic Unconfined Aquifers Considering Delayed Gravity Response. *Water Resources Reseach, 11*(2), 329-342.

R&W/GZA. (2019, January 11). Final Implementation of 2018 Work Plan Summary Report, Tannery 2018 Work. Rockford, Michigan, USA.

R&W/GZA. (2021, July 21). *Implementation of 2019 Work Plan - Summary Report - Final, Wolverine World Wide Tannery 2019-2020 Work.* Rockford, Michigan, USA.

Sanborn. (2014, August). Kent County LiDAR Campaign for the State of Michigan, Report of Survey.

U.S. Geological Survey. (2010). *SWB - A Modified Thornthwaite-Mather Soil-Water-Balance Code for Estimating Groundwater Recharge.* Reston, Virginia: U.S. Geological Survey.

Exhibit 1

PUMPING WELL
ROGUE RIVER
CURRENT WATER TABLE
Current flow direction
FUTURE WATER TABLE
Future flow direction
DRAWDOWN
Future flow direction
CONFINING UNIT

Tables

See Page 3 for Notes

TABLE 1
SUMMARY OF MONITORING WELL DETAILS
Former Tannery
Rockford, Kent County, Michigan

Well Number	Note	Depth of Well (ft bgs)	Ground Surface Elevation (ft, MSL)	Length of Screen (ft)	Top of Casing Elevation (ft, MSL)	Screen Elevation (ft, MSL)	Aquifer Zone	Construction Date
TA-GW-01		7	693.1	5	696.15	692 - 687	S	Jun-18
TA-GW-02		9.5	695.0	5	695.21	691 - 686	S	Jun-18
TA-GW-03		9	695.4	5	699.50	692 - 687	S	Jul-18
TA-GW-04		9.5	695.4	5	698.50	691 - 686	S	Jun-18
TA-GW-05	Abandoned	7	695.4	5	695.22	694 - 689	S	Jun-18
TA-GW-06		7	693.4	5	696.30	692 - 687	S	Jun-18
TA-GW-07		7	694.1	5	697.25	693 - 688	S	Jun-18
TA-GW-08		7	694.3	5	697.78	693 - 688	S	Jun-18
TA-GW-09	Abandoned	9	696.6	5	699.95	693 - 688	S	Aug-18
TA-MW-1		8.3	694.5	4.7	694.34	691 - 687	S	May-11
TA-MW-2		7.8	694.8	4.9	694.36	692 - 688	S	May-11
TA-MW-3		7	697.3	4.7	697.08	695 - 691	S	May-11
TA-MW-4		9	697.8	5	697.30	694 - 689	S	Dec-11
TA-MW-5		10	697.0	5	696.52	692 - 687	S	Dec-11
TA-MW-301B		11.3	695.1	2	694.66	686 - 684	S	Aug-13
TA-MW-301C		24.6	695.3	5	698.01	676 - 671	S	Jan-18
TA-MW-301D		71.7	695.4	5	697.99	629 - 624	D	Jan-18
TA-MW-302A		6	694.2	2.4	693.85	691 - 689	S	Aug-13
TA-MW-302B		14.4	694.2	4.8	693.87	685 - 680	S	Aug-13
TA-MW-303A		7.5	694.0	4.7	693.63	692 - 687	S	Aug-13
TA-MW-303B		14.9	694.0	4.8	693.67	684 - 680	S	Aug-13
TA-MW-303C	Abandoned	22	693.9	4.8	693.54	677 - 672	S	Aug-13
TA-MW-303D		45.5	693.9	3	696.09	652 - 649	D	Nov-17
TA-MW-303E		50.5	693.9	3	695.97	647 - 644	D	Jan-18
TA-MW-304A		5.5	694.1	2.8	693.66	692 - 689	S	Aug-13
TA-MW-304B		15	694.1	4.7	693.65	684 - 680	S	Aug-13
TA-MW-305B		16.8	697.0	4.7	696.60	685 - 681	S	Aug-13
TA-MW-305C		24.8	697.0	4.7	696.59	677 - 673	S	Aug-13
TA-MW-306A		10.2	696.5	4.6	696.24	691 - 687	S	May-14
TA-MW-306B		15.1	696.4	4.7	696.21	687 - 682	S	May-14
TA-MW-307A	Abandoned	10.2	696.5	4.6	696.08	691 - 687	S	May-14
TA-MW-307B	Abandoned	15.7	696.5	4.7	695.96	686 - 681	S	May-14
TA-MW-308A	Abandoned	7.9	696.3	4.7	696.15	694 - 689	S	May-14
TA-MW-308B		20.6	696.3	4.7	695.93	681 - 676	S	May-14
TA-MW-308C	Abandoned	26	696.2	4.7	695.85	675 - 671	S	May-14

TABLE 1
SUMMARY OF MONITORING WELL DETAILS
Former Tannery
Rockford, Kent County, Michigan

Well Number	Note	Depth of Well (ft bgs)	Ground Surface Elevation (ft, MSL)	Length of Screen (ft)	Top of Casing Elevation (ft, MSL)	Screen Elevation (ft, MSL)	Aquifer Zone	Construction Date
TA-MW-309A		9.3	696.6	5	699.30	693 - 688	S	Dec-17
TA-MW-309B		17.1	696.4	5	699.13	685 - 680	S	Dec-17
TA-MW-309C		33.6	696.2	5	698.78	668 - 663	D	Dec-17
TA-MW-309D		47.2	696.4	4.8	698.87	654 - 650	D	Dec-17
TA-MW-310A		9.5	700.0	5	699.61	696 - 691	S	Nov-17
TA-MW-310B		16.8	700.1	5	699.73	689 - 684	S	Nov-17
TA-MW-310C		50.2	700.1	3	699.73	653 - 650	D	Nov-17
TA-MW-311A		11.3	700.3	4.5	699.86	694 - 689	S	Nov-18
TA-MW-311B		25	700.3	5	699.84	681 - 676	S	May-19
TA-MW-311C		138	700.4	5	700.07	568 - 563	D	May-19
TA-MW-312		14	703.7	5	703.36	695 - 690	S	Nov-18
TA-MW-313A		10	695.8	5	695.37	691 - 686	S	Dec-18
TA-MW-313B		45	695.9	5	695.45	656 - 651	D	Dec-18
TA-MW-313C		78	695.9	5	695.05	623 - 618	D	Dec-18
TA-MW-314A		12.6	692.5	4.8	692.09	685 - 680	S	Oct-19
TA-MW-314B		29.1	692.4	4.8	691.87	669 - 664	D	Oct-19
TA-MW-314C		44.5	692.4	4.8	691.90	653 - 648	D	Oct-19
TA-MW-314D		92.4	692.3	4.8	691.87	605 - 600	D	Oct-19
TA-MW-315D		93	699.8	7	699.38	614 - 607	D	Jun-19
TA-MW-315S		11	700.0	5	699.69	694 - 689	S	Jun-19
TA-MW-316D		94	695.4	5	695.16	607 - 602	D	May-19
TA-MW-316M		40	695.5	5	695.02	661 - 656	D	May-19
TA-MW-316S		8	695.3	5.5	694.92	693 - 688	S	May-19
TA-MW-317A		9.6	NA	4.8	NA	NA	S	Aug-19
TA-MW-317B		33.9	NA	4.8	NA	NA	D	Aug-19
TA-MW-317C		82.6	NA	4.8	NA	NA	D	Aug-19
TA-MW-317D		98.5	NA	4.8	NA	NA	D	Aug-19
TA-P-1	Abandoned	8.5	694.0	4.7	693.78	691 - 686	S	May-11
TA-P-2		9.4	693.7	4.7	693.43	689 - 685	S	May-11
TA-P-3		9.3	694.2	4.6	693.93	690 - 685	S	May-11
TA-P-4		7.1	694.5	4.7	693.85	693 - 688	S	May-11
TA-P-5		8.8	700.0	4.7	699.82	696 - 692	S	May-11
TA-PMW-01		20	693.6	10	693.15	684 - 674	S	Oct-18
TA-PMW-02		17	693.6	10	693.04	687 - 677	S	Oct-18
TA-PMW-03		17	696.5	5	696.10	685 - 680	S	Oct-18

TABLE 1
SUMMARY OF MONITORING WELL DETAILS
Former Tannery
Rockford, Kent County, Michigan

Well Number	Note	Depth of Well (ft bgs)	Ground Surface Elevation (ft, MSL)	Length of Screen (ft)	Top of Casing Elevation (ft, MSL)	Screen Elevation (ft, MSL)	Aquifer Zone	Construction Date
TA-PMW-04		13	693.4	5	693.03	686 - 681	S	Oct-18
TA-PMW-05		13	694.8	5	694.40	687 - 682	S	Oct-18
TA-PMW-06		18	698.3	5	698.05	686 - 681	S	Nov-18
TA-PMW-07		18	693.4	5	692.99	681 - 676	S	Oct-18
TA-PMW-08		12	693.0	5	692.69	686 - 681	S	Oct-18
TA-PMW-09		12	694.9	5	694.60	688 - 683	S	Oct-18
TA-RW-1	Bentonite Seal Between Screens	9.6	693.6	4.5	696.10	689 - 684	S	Jan-19
TA-RW-1		24	693.6	11.5	696.10	682 - 670	S	Jan-19
TA-RW-2		19	693.5	15	697.07	690 - 675	S	Jan-19
TA-RW-3		18	696.6	7.5	699.36	687 - 679	S	Jan-19
TA-TMW-101		10.5	695.1	4.8	694.72	690 - 685	S	Jan-13
TA-TMW-102	Abandoned	10.3	696.6	4.8	696.14	692 - 687	S	Jan-13
TA-TMW-103		14.1	699.8	4.8	698.75	691 - 686	S	Jan-13
TA-TMW-104		10.4	700.5	4.9	699.99	695 - 691	S	Jan-13
TA-TMW-105		10.3	695.8	4.8	695.39	691 - 686	S	Jan-13
TA-TMW-108	Abandoned	10.1	696.7	4.7	696.44	692 - 687	S	May-14
TA-TMW-109		10.1	697.4	4.7	696.81	692 - 688	S	May-14
TA-TMW-110		10.1	696.6	4.7	696.63	692 - 687	S	May-14
TA-TMW-111	Abandoned	7.6	696.6	4.8	696.23	694 - 689	S	May-14

Notes:

1. Abbreviations include:
   "ft" denotes feet;
   "bgs" denotes below ground surface;
   "MSL" denotes mean sea level;
   "S" denotes monitoring well screened in the shallow aquifer zone;
   "D" denotes monitoring well screened in the deep aquifer zone; and
   "NA" denotes information not available.
2. Well screen elevations are rounded up to the nearest whole number.

TABLE 2
GROUNDWATER ELEVATION DATA - APRIL 2019
Former Tannery
Rockford, Kent County, MI

Well	Ground Surface Elevation (ft, MSL)	Top of Casing Elevation (ft, MSL)	Screen Elevation (ft, MSL)	April 2019 Groundwater Elevation (ft, MSL)
TA-P-1	694.0	693.78	691 - 686	691.91
TA-P-2	693.7	693.43	689 - 685	691.95
TA-P-3	694.2	693.93	690 - 685	692.15
TA-P-4	694.5	693.85	693 - 688	692.04
TA-P-5	700.0	699.82	696 - 692	695.91
TA-MW-1	694.5	694.34	691 - 687	692.51
TA-MW-2	694.8	694.36	692 - 688	692.32
TA-MW-3	697.3	697.08	695 - 691	691.99
TA-MW-4	697.8	697.3	694 - 689	692.03
TA-MW-5	697.0	696.52	692 - 687	692.01
TA-MW-301B	695.1	694.66	686 - 684	692.23
TA-MW-301C	695.3	698.01	676 - 671	692.59
TA-MW-301D	695.4	697.99	629 - 624	689.41
TA-MW-302A	694.2	693.85	691 - 689	692.2
TA-MW-302B	694.2	693.87	685 - 680	691.88
TA-MW-303A	694.0	693.63	692 - 687	692.11
TA-MW-303B	694.0	693.67	684 - 680	691.88
TA-MW-303C	693.9	693.54	677 - 672	691.84
TA-MW-303D	693.9	696.09	652 - 649	689.12
TA-MW-303E	693.9	695.97	647 - 644	689.14
TA-MW-304A	694.1	693.66	692 - 689	692.04
TA-MW-304B	694.1	693.65	684 - 680	691.92
TA-MW-305B	697.0	696.6	685 - 681	691.95
TA-MW-305C	697.0	696.59	677 - 673	691.95
TA-MW-306A	696.5	696.24	691 - 687	691.84
TA-MW-306B	696.4	696.21	687 - 682	691.83
TA-MW-307A	696.5	696.08	691 - 687	691.86
TA-MW-307B	696.5	695.96	686 - 681	691.82
TA-MW-308A	696.3	696.15	694 - 689	692.03
TA-MW-308B	696.3	695.93	681 - 676	692.08
TA-MW-308C	696.2	695.85	675 - 671	692.11
TA-MW-309A	696.6	699.3	693 - 688	692.33
TA-MW-309B	696.4	699.13	685 - 680	692.48
TA-MW-309C	696.2	698.78	668 - 663	691.68
TA-MW-309D	696.4	698.87	654 - 650	691.67

TABLE 2
GROUNDWATER ELEVATION DATA - APRIL 2019
Former Tannery
Rockford, Kent County, MI

Well	Ground Surface Elevation (ft, MSL)	Top of Casing Elevation (ft, MSL)	Screen Elevation (ft, MSL)	April 2019 Groundwater Elevation (ft, MSL)
TA-MW-310A	700.0	699.61	696 - 691	688.89
TA-MW-310B	700.1	699.73	689 - 684	690.01
TA-MW-310C	700.1	699.73	653 - 650	689.78
TA-MW-311A	700.3	699.86	694 - 689	692.98
TA-MW-312	703.7	703.36	695 - 690	696
TA-MW-313A	695.8	695.37	691 - 686	692.01
TA-MW-313B	695.9	695.45	656 - 651	687.03
TA-MW-313C	695.9	695.05	623 - 618	686.9
TA-TMW-101	695.1	694.72	690 - 685	692.72
TA-TMW-103	699.8	698.75	691 - 686	694.09
TA-TMW-104	700.5	699.99	695 - 691	695.93
TA-TMW-105	695.8	695.39	691 - 686	691.95
TA-TMW-108	696.7	696.44	692 - 687	691.89
TA-TMW-109	697.4	696.81	692 - 688	692.1
TA-TMW-110	696.6	696.63	692 - 687	691.96
TA-TMW-111	696.6	696.23	694 - 689	692.1
TA-RW-1	693.6	696.1	689 - 670	691.82
TA-RW-2	693.5	697.07	690 - 675	691.65
TA-RW-3	696.6	699.36	687 - 679	692.95
TA-PMW-01	693.6	693.15	684 - 674	691.38
TA-PMW-02	693.6	693.04	687 - 677	691.61
TA-PMW-03	696.5	696.1	685 - 680	692.97
TA-PMW-04	693.4	693.03	686 - 681	691.31
TA-PMW-05	694.8	694.4	687 - 682	692.29
TA-PMW-06	698.3	698.05	686 - 681	693.09
TA-PMW-07	693.4	692.99	681 - 676	691
TA-PMW-08	693.0	692.69	686 - 681	691.38
TA-PMW-09	694.9	694.6	688 - 683	692.07

Notes:

1. Abbreviations include:
   "ft" denotes feet; and
   "MSL" denotes mean sea level.
2. Well screen elevations are rounded up to the nearest whole number.

TABLE 3
SUMMARY OF GROUNDWATER SAMPLE ANALYSIS - PFAS
Former Tannery
Rockford, Kent County, Michigan

Location	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface[2]	TA-RW-1	TA-RW-1	TA-RW-2	TA-RW-2	TA-RW-3	TA-RW-3	TA-RW-3	TA-PMW-01	TA-PMW-01	TA-PMW-01	TA-PMW-02	TA-PMW-02	TA-PMW-02	TA-PMW-03	TA-PMW-03	TA-PMW-03
Sample Name		TA-RW-1	TA-RW-01	TA-RW-2	TA-RW-02	TA-RW-3	TA-RW-3 DUP	TA-RW-3	TA-PMW-01	TA-PMW-01	TA-PMW-01	TA-PMW-02	TA-PMW-02	TA-PMW-02	TA-PMW-03	TA-PMW-03	TA-PMW-03
Laboratory Sample ID		UE09030-001	WF25013-005	UE16023-001	WF25013-006	UE24051-001	UE24051-002	WG17016-002	UD11027-001	UF08017-002	wg16013-009	UD11027-002	UF13013-011	WF25013-009	UD11027-003	UF13013-020	WG17016-005
Sample Date		05/08/2019	06/23/2021	05/15/2019	06/23/2021	05/22/2019	05/22/2019	07/15/2021	04/10/2019	06/07/2019	07/14/2021	04/10/2019	06/10/2019	06/23/2021	04/10/2019	06/12/2019	07/15/2021
Parameter (µg/L)																	
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	0.0038	<0.0076	<0.0035	<0.0075	0.033	0.038	<0.75	0.012	0.023	<0.0079	<0.0037	<0.0035	<0.0075	0.06	0.035	<0.73
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.0037	<0.0076	<0.0035	<0.0075	<0.0038	<0.0039	<0.75	<0.0036	<0.0036	<0.0079	0.0094	0.012	<0.0075	<0.0036	<0.0035	<0.73
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	NCL	0.0049		<0.0035		<0.0038	<0.0039		<0.0036	<0.0036		<0.0037	<0.0035		<0.0036	<0.0035	
N-Methyl perfluorooctane sulfonamide (MeFOSA)	NCL	<0.0074		<0.0071		<0.0076	<0.0078		<0.0072	<0.0072		<0.0074	<0.007		<0.0073	<0.0069	
Perfluorobutane sulfonic acid (PFBS)	NA	0.28	<0.0038	0.23	0.02	2.6	2.7	1.2	1.2	2	0.056	0.52	0.69	0.53	3.8	2.9	3.8
Perfluorobutanoic acid (PFBA)	NCL	0.054	<0.0038	0.05	0.0074	0.77	0.76	0.39	0.22	0.44	0.0071	0.068	0.12	0.093	1.5	1	1.3
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.0037	<0.0038	<0.0035	<0.0037	<0.0038	<0.0039	<0.37	<0.0036	<0.0036	<0.004	<0.0037	0.0043	<0.0038	<0.0036	<0.0035	<0.36
Perfluorodecanoic acid (PFDA)	NCL	0.016	<0.0038	0.038	0.0073	0.031	0.034	<0.37	0.0044	0.0063	<0.004	0.1	0.095	0.029	0.024	0.038	<0.36
Perfluorododecanoic acid (PFDoDA)	NCL	<0.0037	<0.0038	<0.0035	<0.0037	<0.0038	<0.0039	<0.37	<0.0036	<0.0036	<0.004	<0.0037	<0.0035	<0.0038	<0.0036	<0.0035	<0.36
Perfluoroheptane sulfonic acid (PFHpS)	NCL	0.023	<0.0038	0.048	<0.0037	0.27	0.25	<0.37	0.088	0.19	0.03	0.084	0.13	0.085	0.25	0.25	<0.36
Perfluoroheptanoic acid (PFHpA)	NCL	0.059	<0.0038	0.061	0.0062	1.5	1.6	1.2	0.19	0.37	0.013	0.15	0.24	0.19	2.3	1.5	2.1
Perfluorohexane sulfonic acid (PFHxS)	NA	0.1	<0.0038	0.14	0.011	1.3	1.4	1	0.47	0.92	0.069	0.44	0.71	0.47	1.5	1.3	1.4
Perfluorohexanoic acid (PFHxA)	NA	0.1	<0.0038	0.063	0.0096	2.3	2.3	0.99	0.44	0.86	0.019	0.15	0.24	0.2	3.2	2.2	2.6
Perfluorononanoic acid (PFNA)	NA	0.0088	<0.0038	0.017	<0.0037	0.091	0.092	<0.37	0.008	0.016	<0.004	0.033	0.037	0.025	0.13	0.1	<0.36
Perfluorooctane sulfonamide (FOSA)	NCL	0.17	<0.0038	0.2	0.048	0.16	0.17	<0.37	0.023	0.026	<0.004	2.4	1.8	0.63	0.12	0.098	<0.36
Perfluorooctane sulfonic acid (PFOS)	0.011 (X)	***1.7***	<0.0038	***2.1***	***0.3***	***14***	***17***	***40***	***5.6***	***9.3***	***1.2***	***9.4***	***8.8***	***3.4***	***13***	***13***	***18***
Perfluorooctanoic acid (PFOA)	0.42 (X)	0.4	<0.0038	***0.46***	0.046	***8.2***	***9.7***	***10***	***1.1***	***1.9***	0.12	***1.7***	***2.6***	***1.5***	***12***	***8.4***	***11***
PFOA + PFOS (Calculated)	NCL	2.1	ND	2.6	0.35	22	27	50	6.7	11	1.3	11	11	4.9	25	21	29
Perfluoropentanoic acid (PFPeA)	NCL	0.036	<0.0038	0.035	0.0044	0.68	0.74	0.42	0.12	0.22	0.0053	0.068	0.11	0.084	1.2	0.69	1
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.0037	<0.0038	<0.0035	<0.0037	<0.0038	<0.0039	<0.37	<0.0036	<0.0036	<0.004	<0.0037	<0.0035	<0.0038	<0.0036	<0.0035	<0.36
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.0037	<0.0038	<0.0035	<0.0037	<0.0038	<0.0039	<0.37	<0.0036	<0.0036	<0.004	<0.0037	<0.0035	<0.0038	<0.0036	<0.0035	<0.36
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.0037	<0.0038	0.018	0.036	<0.0038	<0.0039	<0.37	<0.0036	<0.0036	<0.004	<0.0037	<0.0035	<0.0038	<0.0036	<0.0035	<0.36
Perfluoro-1-pentanesulfonate (PFPeS)	NCL	0.025	<0.0038	0.035	0.0039	0.38	0.38	<0.37	0.092	0.18	0.0055	0.14	0.2	0.13	0.52	0.41	0.49
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA		<0.0076		<0.0075			<0.75			<0.0079			<0.0075			<0.73
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL		<0.0076		0.041			<0.75			<0.0079			0.11			<0.73
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL		<0.0076		0.14			<0.75			0.044			1.7			<0.73
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL		<0.0076		<0.0075			<0.75			<0.0079			<0.0075			<0.73
Perfluorononane sulfonic acid (PFNS)	NCL	<0.0074	<0.0038	<0.0071	<0.0037	0.0092	0.0094	<0.37	<0.0072	<0.0072	<0.004	0.011	0.014	<0.0038	0.0073	<0.0069	<0.36
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	NCL		<0.0076		<0.0075			<0.75			<0.0079			<0.0075			<0.73
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	NCL		<0.0076		<0.0075			<0.75			<0.0079			<0.0075			<0.73
4,8-dioxa-3H-perfluorononanoic acid	NCL		<0.0076		<0.0075			<0.75			<0.0079			<0.0075			<0.73
Total PFAS (Calculated)	NCL	3	ND	3.5	0.68	32	37	55	9.6	16	1.6	15	16	9.2	40	32	42

TABLE 3
SUMMARY OF GROUNDWATER SAMPLE ANALYSIS - PFAS
Former Tannery
Rockford, Kent County, Michigan

Location	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface[2]	TA-P-1	TA-P-1	TA-P-1	TA-P-2	TA-P-2	TA-P-2	TA-P-2	TA-P-3	TA-P-3	TA-P-4	TA-P-4	TA-P-4	TA-P-4	TA-P-5	TA-P-5	TA-P-5
Sample Name		TA-P-1	TA-GW-P1	TA-GW-P-1	TA-P-2	TA-GW-P2	TA-GW-P-2	TA-P-2	TA-P-3	TA-GW-P3	TA-P-4	TA-GW-P4	TA-GW-P-4	TA-P-4	TA-P-5	TA-GW-P5	TA-GW-P-5
Laboratory Sample ID		UF13013-002	UH17008-002	VA09002-017	UF15001-003	UH17008-001	VA15036-024	WG17016-012	UF15001-002	UH17008-011	UF13013-008	UH17008-014	VA15036-020	WG17016-008	UF13013-001	UH21044-015	VA09002-010
Sample Date		06/11/2019	08/15/2019	01/08/2020	06/13/2019	08/15/2019	01/16/2020	07/16/2021	06/13/2019	08/16/2019	06/11/2019	08/16/2019	01/16/2020	07/16/2021	06/11/2019	08/21/2019	01/07/2020
Parameter (µg/L)																	
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	0.012	0.02	0.011	0.015	0.028	0.022	<0.73	0.045	0.071	0.011	0.098	0.011 [J]	<0.75	0.046	<0.072	0.032
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.0035	<0.0037	<0.0039	<0.0038	<0.019	<0.019	<0.73	<0.0038	<0.019	0.01	<0.074	<0.017	<0.75	0.039	<0.072	0.043
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	NCL	<0.0035	<0.0037	<0.0039	<0.0038	<0.019	<0.019		<0.0038	<0.019	<0.0036	<0.074	<0.017		<0.037	<0.072	0.019 [J]
N-Methyl perfluorooctane sulfonamide (MeFOSA)	NCL	<0.0071	<0.0074	<0.0078	<0.0076	<0.037	<0.038		<0.0075	<0.037	<0.0072	<0.15	<0.035		<0.074	<0.14	<0.039
Perfluorobutane sulfonic acid (PFBS)	NA	2.2	2.6	2	3	3.6	3.2	8	6.1	7.6	0.92	2.8	0.82	0.75	2	2.4	1.3
Perfluorobutanoic acid (PFBA)	NCL	0.49	0.72	0.41	0.39	0.63	0.35	0.77	1.1	1.4	0.18	0.76	0.13	<0.38	0.3	0.5	0.23
Perfluorodecane sulfonic acid (PFDS)	NCL	0.0067	0.0076	0.0032 [J]	<0.0038	<0.019	<0.019	<0.37	<0.0038	<0.019	0.0099	<0.074	<0.017	<0.38	<0.037	<0.072	0.0083 [J]
Perfluorodecanoic acid (PFDA)	NCL	0.012	0.0065	0.0093	0.014	<0.019	0.0072 [J]	<0.37	0.011	0.021	0.15	0.15	0.1	<0.38	0.11	0.16	0.15
Perfluorododecanoic acid (PFDoDA)	NCL	<0.0035	<0.0037	<0.0039	<0.0038	<0.019	<0.019	<0.37	<0.0038	<0.019	<0.0036	<0.074	<0.017	<0.38	<0.037	<0.072	<0.02
Perfluoroheptane sulfonic acid (PFHpS)	NCL	0.23	0.4	0.17	0.54	1.3	0.65	0.41	0.32	0.46	0.22	0.76	0.16	<0.38	1.1	1.4	0.56
Perfluoroheptanoic acid (PFHpA)	NCL	0.85	1.4	0.74	0.52	1.1	0.59	1.9	1.4	2	0.29	1.3	0.24	<0.38	0.58	0.73	0.43
Perfluorohexane sulfonic acid (PFHxS)	NA	1.3	1.7	1.1	2	4.1	2.1	1.6	3.3	3.3	0.71	1.9	0.63	0.42	1.8	1.9	0.87
Perfluorohexanoic acid (PFHxA)	NA	1.1	1.6	1.1	0.62	1.4	0.65	2.4	2.1	2.9	0.34	2	0.26	<0.38	0.96	1.2	0.64
Perfluorononanoic acid (PFNA)	NA	0.042	0.064	0.031	0.058	0.12	0.093	<0.37	0.087	0.14	0.064	0.28	0.045	<0.38	0.11	0.13	0.073
Perfluorooctane sulfonamide (FOSA)	NCL	0.33	0.18	0.23	0.055	0.039	0.061	3.5	0.035	0.055	1.2	0.96	0.82	0.95	0.74	1.1	0.69
Perfluorooctane sulfonic acid (PFOS)	0.011 (X)	***6.7***	***11***	***6.5***	***9.5***	***25***	***20***	***32***	***13***	***26***	***26***	***78***	***17***	***25***	***56***	76 [B]	***36***
Perfluorooctanoic acid (PFOA)	0.42 (X)	***6.2***	***11***	***5.7***	***6***	***13***	***6.9***	***12***	***8***	***12***	***2.5***	***8.3***	***2***	***1.8***	***6.3***	7.3 [B]	***4.1***
PFOA + PFOS (Calculated)	NCL	13	22	12	16	38	27	44	21	38	29	86	19	27	62	83	40
Perfluoropentanoic acid (PFPeA)	NCL	0.45	0.7	0.37	0.24	0.39	0.26	0.94	0.84	1.2	0.15	0.69	0.13	<0.38	0.51	0.64	0.34
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.0035	<0.0037	<0.0039	<0.0038	<0.019	<0.019	<0.37	<0.0038	<0.019	<0.0036	<0.074	<0.017	<0.38	<0.037	<0.072	<0.02
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.0035	<0.0037	<0.0039	0.0086	<0.019	<0.019	<0.37	<0.0038	<0.019	<0.0036	<0.074	<0.017	<0.38	<0.037	<0.072	<0.02
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.0035	<0.0037	<0.0039	<0.0038	<0.019	<0.019	<0.37	0.14	<0.019	<0.0036	<0.074	<0.017	<0.38	<0.037	<0.072	<0.02
Perfluoro-1-pentanesulfonate (PFPeS)	NCL	0.58	0.8	0.46	0.41	0.63	0.36	0.67	0.7	0.7	0.14	0.37	0.11	<0.38	0.29	0.31	0.17
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA							<0.73						<0.75			
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL							<0.73						<0.75			
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL							2.9						2.7			
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL							<0.73						<0.75			
Perfluorononane sulfonic acid (PFNS)	NCL	<0.0071	<0.0074	0.0028 [J]	<0.0076	<0.037	<0.038	<0.37	<0.0075	<0.037	0.12	<0.15	0.03 [J]	<0.38	0.081	<0.14	0.043
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	NCL							<0.73						<0.75			
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	NCL							<0.73						<0.75			
4,8-dioxa-3H-perfluorononanoic acid	NCL							<0.73						<0.75			
Total PFAS (Calculated)	NCL	21	32	19	23	51	35	67	37	58	33	98	22	32	71	94	46

TABLE 3
SUMMARY OF GROUNDWATER SAMPLE ANALYSIS - PFAS
Former Tannery
Rockford, Kent County, Michigan

Location	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface[2]	TA-P-5	TA-MW-1	TA-MW-1	TA-MW-1	TA-MW-1	TA-MW-2	TA-MW-2	TA-MW-2	TA-MW-2	TA-MW-3	TA-MW-3	TA-MW-3	TA-MW-3	TA-MW-4	TA-MW-4	TA-MW-4
Sample Name		TA-P-5	TA-MW-1	TA-GW-MW1	TA-MW-01	TA-MW-01-DUP	TA-MW-2	TA-GW-MW2	TA-GW-MW-2	TA-MW-2	TA-MW-3	TA-GW-MW3	TA-GW-MW-3	TA-MW-3	TA-MW-4	TA-GW-MW4	TA-GW-MW-4
Laboratory Sample ID		WG17016-009	UF08017-013	UH10014-019	WF25013-007	WF25013-008	UF19007-002	UH21044-009	VA15036-021	WG16013-012	UF08017-001	UH10014-007	VA15036-010	WG16013-002	UF19007-007	UH21044-011	VA15036-022
Sample Date		07/16/2021	06/06/2019	08/09/2019	06/23/2021	06/23/2021	06/17/2019	08/20/2019	01/16/2020	07/14/2021	06/07/2019	08/08/2019	01/14/2020	07/12/2021	06/18/2019	08/20/2019	01/16/2020
Parameter (µg/L)																	
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	<0.77	<0.0036	<0.0037	<0.0084	<0.0078	<0.69	<0.072	<0.019	<0.0074	<0.0035	<0.0037	0.011	0.035	0.21	0.33	0.24
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.77	<0.0036	<0.0037	<0.0084	<0.0078	<0.69	<0.072	0.0096 [J]	<0.15	<0.0035	<0.0037	<0.0039	<0.0075	<0.036	<0.073	<0.037
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	NCL		0.015	0.007			<0.69	<0.072	<0.019		<0.0035	<0.0037	<0.0039		0.25	0.23	0.19
N-Methyl perfluorooctane sulfonamide (MeFOSA)	NCL		<0.0073	<0.0074			<1.4	<0.14	<0.038		<0.0071	<0.0074	<0.0078		<0.071	<0.15	<0.075
Perfluorobutane sulfonic acid (PFBS)	NA	1.7	1	1.9	0.75	0.76	0.82	0.47	0.26	0.57	0.21	0.44	0.27	2	6	14	7.7
Perfluorobutanoic acid (PFBA)	NCL	<0.38	0.067	0.1	0.054	0.051	<0.69	0.091	0.052	0.092	0.028	0.1	0.06	0.71	2.8	6.7	3
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.38	0.0072	<0.0037	<0.0042	<0.0039	<0.69	<0.072	<0.019	0.0084	<0.0035	0.004	0.002 [J]	0.0049	<0.036	<0.073	0.026 [J]
Perfluorodecanoic acid (PFDA)	NCL	<0.38	0.047	0.037	0.041	0.04	<0.69	0.17	0.077	0.09	0.0077	0.0084	0.011	0.0096	<0.036	<0.073	<0.037
Perfluorododecanoic acid (PFDoDA)	NCL	<0.38	<0.0036	<0.0037	<0.0042	<0.0039	<0.69	<0.072	<0.019	<0.0037	<0.0035	<0.0037	<0.0039	<0.0037	<0.036	<0.073	<0.037
Perfluoroheptane sulfonic acid (PFHpS)	NCL	0.88	0.055	0.082	0.062	0.06	<0.69	0.25	0.1	0.12	0.029	0.12	0.07	0.12	0.68	0.86	0.54
Perfluoroheptanoic acid (PFHpA)	NCL	0.43	0.06	0.093	0.054	0.055	<0.69	0.19	0.1	0.15	0.12	0.25	0.16	0.72	4	7.3	3.6
Perfluorohexane sulfonic acid (PFHxS)	NA	0.99	0.17	0.33	0.16	0.15	<0.69	0.52	0.27	0.34	0.2	0.42	0.3	0.72	3.5	4.2	3.1
Perfluorohexanoic acid (PFHxA)	NA	0.59	0.055	0.083	0.052	0.048	<0.69	0.19	0.11	0.17	0.076	0.29	0.13	1.4	7.3	13	6.3
Perfluorononanoic acid (PFNA)	NA	<0.38	0.028	0.036	0.042	0.037	<0.69	0.098	0.042	0.046	0.0091	0.031	0.029	0.044	0.24	0.41	0.23
Perfluorooctane sulfonamide (FOSA)	NCL	0.78	0.22	0.22	0.24	0.24	0.95	1	0.47	0.6	0.17	0.31	0.14	0.26	3	1.1	1.9
Perfluorooctane sulfonic acid (PFOS)	0.011 (X)	***35***	***3***	***2.3***	***2.5***	***2.7***	***52***	53 [B]	***22***	***24***	***1.1***	***3.5***	***3.4***	***5.3***	***52***	52 [B]	***37***
Perfluorooctanoic acid (PFOA)	0.42 (X)	***3.9***	0.41	***0.75***	***0.46***	***0.46***	***2.3***	1.5 [B]	***0.83***	***1.1***	***0.76***	***3.2***	***1.9***	***4.4***	***24***	40 [B]	***19***
PFOA + PFOS (Calculated)	NCL	39	3.4	3.1	3	3.2	54	55	23	25	1.9	6.7	5.3	9.7	76	92	56
Perfluoropentanoic acid (PFPeA)	NCL	0.38	0.056	0.091	0.044	0.047	<0.69	0.087	0.055	0.076	0.026	0.11	0.064	0.69	2.3	4.4	2.3
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.38	<0.0036	<0.0037	<0.0042	<0.0039	<0.69	<0.072	<0.019	<0.0037	<0.0035	<0.0037	<0.0039	<0.0037	<0.036	<0.073	<0.037
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.38	<0.0036	<0.0037	<0.0042	<0.0039	<0.69	<0.072	<0.019	<0.0037	<0.0035	<0.0037	0.0085	0.017	<0.036	<0.073	<0.037
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.38	<0.0036	<0.0037	<0.0042	<0.0039	<0.69	<0.072	<0.019	<0.0037	<0.0035	<0.0037	<0.0039	<0.0037	2.9	<0.073	<0.037
Perfluoro-1-pentanesulfonate (PFPeS)	NCL	<0.38	0.031	0.066	0.031	0.027	<0.69	0.093	0.055	0.078	0.028	0.086	0.039	0.32	0.97	1.5	0.92
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA	<0.77			<0.0084	<0.0078				<0.0074				<0.0075			
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL	1.4			0.42	0.41				0.66				0.06			
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL	4.5			0.92	0.84				1.8				1.1			
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL	<0.77			<0.0084	<0.0078				<0.0074				<0.0075			
Perfluorononane sulfonic acid (PFNS)	NCL	<0.38	<0.0073	<0.0074	<0.0042	<0.0039	<1.4	<0.14	<0.038	0.16	<0.0071	<0.0074	0.002 [J]	0.0037	<0.071	<0.15	<0.075
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	NCL	<0.77			<0.0084	<0.0078				<0.0074				<0.0075			
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	NCL	<0.77			<0.0084	<0.0078				<0.0074				<0.0075			
4,8-dioxa-3H-perfluorononanoic acid	NCL	<0.77			<0.0084	<0.0078				<0.0074				<0.0075			
Total PFAS (Calculated)	NCL	51	5.2	6.1	5.8	5.9	56	58	24	30	2.8	8.9	6.6	18	110	150	86

TABLE 3
SUMMARY OF GROUNDWATER SAMPLE ANALYSIS - PFAS
Former Tannery
Rockford, Kent County, Michigan

Location	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface[2]	TA-MW-4	TA-MW-5	TA-MW-5	TA-MW-5	TA-GW-01	TA-GW-01	TA-GW-01	TA-GW-01	TA-GW-01	TA-GW-02	TA-GW-02	TA-GW-02	TA-GW-02	TA-GW-03	TA-GW-03	TA-GW-03
Sample Name		TA-MW-4	TA-MW-5	TA-GW-MW5	TA-MW-5	TA-GW-01	TA-GW-01	TA-GW-GW01	TA-GW-GW-01	TA-GW-01	TA-GW-02	TA-GW-02	TA-GW-GW02	TA-GW-02	TA-GW-03	TA-GW-03	TA-GW-GW03
Laboratory Sample ID		WG17016-011	UF13013-015	UH15001-010	WG16013-013	UB07090-023	UF19007-005	UH17008-015	VA09002-016	WG21079-006	UA26009-004	UF08017-012	UH10014-022	WF26013-004	UB07090-017	UF13013-007	UH17008-006
Sample Date		07/16/2021	06/10/2019	08/14/2019	07/14/2021	02/07/2019	06/17/2019	08/16/2019	01/08/2020	07/19/2021	01/24/2019	06/06/2019	08/09/2019	06/24/2021	02/07/2019	06/11/2019	08/15/2019
Parameter (µg/L)																	
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	<0.71	<0.0035	0.0044	<0.15	<0.078	0.024	<0.71	<0.19	<15	<0.0037	<0.0035	<0.0037	<0.0073	<0.036	<0.018	<0.036
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.71	<0.0035	<0.0037	<0.15	<0.078	<0.017	<0.71	<0.19	<15	<0.0037	<0.0035	<0.0037	<0.0073	<0.036	<0.018	<0.036
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	NCL		<0.0035	<0.0037		<0.078	<0.017	<0.71	<0.19		<0.0037	<0.0035	<0.0037		<0.036	<0.018	<0.036
N-Methyl perfluorooctane sulfonamide (MeFOSA)	NCL		<0.007	<0.0074		<0.16	<0.034	<1.4	<0.39		<0.0075	<0.007	<0.0074		<0.072	<0.035	<0.072
Perfluorobutane sulfonic acid (PFBS)	NA	8.5	0.061	0.11	0.17	3	4.3	14	10	18	0.82	0.66	0.73	0.66	2.4	1.6	2.1
Perfluorobutanoic acid (PFBA)	NCL	3.9	0.022	0.033	<0.074	0.19	0.55	1.5	0.71	<7.4	0.17	0.15	0.15	0.16	0.42	0.29	0.4
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.36	0.014	0.011	<0.074	<0.078	<0.017	<0.71	<0.19	<7.4	<0.0037	<0.0035	<0.0037	<0.0036	<0.036	<0.018	<0.036
Perfluorodecanoic acid (PFDA)	NCL	<0.36	0.032	0.037	<0.074	<0.078	<0.017	<0.71	<0.19	<7.4	<0.0037	<0.0035	<0.0037	<0.0036	0.3	0.3	0.47
Perfluorododecanoic acid (PFDoDA)	NCL	<0.36	<0.0035	<0.0037	<0.074	<0.078	<0.017	<0.71	<0.19	<7.4	<0.0037	<0.0035	<0.0037	<0.0036	<0.036	<0.018	<0.036
Perfluoroheptane sulfonic acid (PFHpS)	NCL	0.74	0.097	0.14	<0.074	0.5	0.96	6.2	4.3	7.5	0.025	0.026	0.029	0.033	0.24	0.23	0.35
Perfluoroheptanoic acid (PFHpA)	NCL	6.3	0.1	0.16	0.15	0.39	0.93	2.8	<0.19	<7.4	0.95	0.68	0.66	0.76	0.81	0.73	1
Perfluorohexane sulfonic acid (PFHxS)	NA	3.5	0.36	0.54	0.39	1.1	3.8	9.2	4.6	9.8	1.1	0.7	0.75	0.75	1	0.94	1.4
Perfluorohexanoic acid (PFHxA)	NA	8.3	0.095	0.16	0.15	0.28	0.95	2.5	1.1	<7.4	0.96	0.68	0.7	0.65	1	0.8	1.1
Perfluorononanoic acid (PFNA)	NA	<0.36	0.025	0.032	<0.074	0.13	0.08	<0.71	0.22	<7.4	<0.0037	<0.0035	<0.0037	<0.0036	0.11	0.11	0.17
Perfluorooctane sulfonamide (FOSA)	NCL	0.84	1.6	1.5	1.5	1	0.027	1	0.94	<7.4	<0.0037	<0.0035	<0.0037	<0.0036	0.26	0.19	0.24
Perfluorooctane sulfonic acid (PFOS)	0.011 (X)	***50***	***12***	***13***	***8.6***	***57***	***16***	***550***	***540***	830 [B]	***0.55***	***0.42***	***0.43***	***0.55***	***15***	***19***	***23***
Perfluorooctanoic acid (PFOA)	0.42 (X)	***28***	***1.2***	***1.7***	***1.3***	***4.5***	***11***	***28***	***15***	***30***	***4.5***	***4.5***	***3.6***	***3.6***	***6.9***	***5.8***	***8.1***
PFOA + PFOS (Calculated)	NCL	78	13	15	9.9	62	27	580	560	860	5.1	4.9	4	4.2	22	25	31
Perfluoropentanoic acid (PFPeA)	NCL	3.3	0.023	0.041	<0.074	0.18	0.37	1.2	0.7	<7.4	0.2	0.18	0.19	0.22	0.4	0.33	0.44
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.36	<0.0035	<0.0037	<0.074	<0.078	<0.017	<0.71	<0.19	<7.4	<0.0037	<0.0035	<0.0037	<0.0036	<0.036	<0.018	<0.036
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.36	<0.0035	<0.0037	<0.074	<0.078	<0.017	<0.71	<0.19	<7.4	<0.0037	<0.0035	<0.0037	<0.0036	<0.036	<0.018	<0.036
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.36	<0.0035	<0.0037	<0.074	<0.078	<0.017	<0.71	<0.19	<7.4	<0.0037	<0.0035	<0.0037	<0.0036	<0.036	<0.018	<0.036
Perfluoro-1-pentanesulfonate (PFPeS)	NCL	1.1	0.029	0.043	<0.074	0.33	0.53	1.7	0.96	<7.4	0.31	0.31	0.33	0.35	0.27	0.28	0.36
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA	<0.71			<0.15					<15				<0.0073			
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL	<0.71			0.15					<15				<0.0073			
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL	3.3			2.8					21				<0.0073			
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL	<0.71			<0.15					<15				<0.0073			
Perfluorononane sulfonic acid (PFNS)	NCL	<0.36	0.018	0.022	<0.074	<0.16	<0.034	<1.4	0.11 [J]	<7.4	<0.0075	<0.007	<0.0074	<0.0036	<0.072	<0.035	<0.072
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	NCL	<0.71			<0.15					<15				<0.0073			
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	NCL	<0.71			<0.15					<15				<0.0073			
4,8-dioxa-3H-perfluorononanoic acid	NCL	<0.71			<0.15					<15				<0.0073			
Total PFAS (Calculated)	NCL	120	16	18	15	69	40	620	580	920	9.6	8.3	7.6	7.7	29	31	39

TABLE 3
SUMMARY OF GROUNDWATER SAMPLE ANALYSIS - PFAS
Former Tannery
Rockford, Kent County, Michigan

Location	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface[2]	TA-GW-03	TA-GW-03	TA-GW-04	TA-GW-04	TA-GW-04	TA-GW-04	TA-GW-04	TA-GW-05	TA-GW-05	TA-GW-05	TA-GW-06	TA-GW-06	TA-GW-06	TA-GW-06	TA-GW-06	TA-GW-07
Sample Name		TA-GW-GW-03	TA-GW-03	TA-GW-04	TA-GW-04	TA-GW-GW04	TA-GW-GW-04	TA-GW-04	TA-GW-05	TA-GW-05	TA-GW-GW5	TA-GW-06	TA-GW-06	TA-GW-GW06	TA-GW-GW-06	TA-GW-06	TA-GW-07
Laboratory Sample ID		VA15036-017	WG17016-004	UB07090-022	UF19007-009	UH21044-016	VA15036-016	WG21079-003	UA26009-014	UF06020-010	UH10014-020	UB07090-020	UF13013-025	UH21044-002	VA15036-023	WG17016-010	UB07090-009
Sample Date		01/15/2020	07/15/2021	02/07/2019	06/18/2019	08/21/2019	01/15/2020	07/19/2021	01/25/2019	06/05/2019	08/09/2019	02/07/2019	06/12/2019	08/19/2019	01/16/2020	07/16/2021	02/06/2019
Parameter (µg/L)																	
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	<0.02	<0.79	0.49	0.43	0.5	0.35	<1.4	<0.004	<0.0034	<0.0037	<0.037	<0.034	<0.036	<0.019	<0.75	<0.0037
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.02	<0.79	<0.07	<0.036	<0.074	<0.075	<1.4	<0.004	<0.0034	<0.0037	<0.037	<0.034	<0.036	0.011 [J]	<0.75	<0.0037
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	NCL	<0.02		<0.07	<0.036	<0.074	<0.075		<0.004	<0.0034	<0.0037	<0.037	<0.034	<0.036	<0.019		<0.0037
N-Methyl perfluorooctane sulfonamide (MeFOSA)	NCL	<0.04		<0.14	<0.072	<0.15	<0.15		<0.0079	<0.0069	<0.0075	<0.075	<0.069	<0.072	<0.038		<0.0074
Perfluorobutane sulfonic acid (PFBS)	NA	2	2.3	11	7.9	8.3	5.9	5.5	0.3	0.15	0.28	2.2	2.3	2.6	0.73	0.94	0.13
Perfluorobutanoic acid (PFBA)	NCL	0.25	<0.39	3.1	2.8	2.6	1.6	1.4	0.038	0.018	0.031	0.45	0.49	0.58	0.15	<0.37	0.029
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.02	<0.39	<0.07	<0.036	<0.074	<0.075	<0.71	<0.004	<0.0034	<0.0037	<0.037	<0.034	<0.036	<0.019	<0.37	<0.0037
Perfluorodecanoic acid (PFDA)	NCL	0.3	0.43	<0.07	<0.036	<0.074	<0.075	<0.71	0.019	0.02	0.016	0.21	0.17	0.18	0.18	<0.37	<0.0037
Perfluorododecanoic acid (PFDoDA)	NCL	<0.02	<0.39	<0.07	<0.036	<0.074	<0.075	<0.71	<0.004	<0.0034	<0.0037	<0.037	<0.034	<0.036	<0.019	<0.37	<0.0037
Perfluoroheptane sulfonic acid (PFHpS)	NCL	0.22	<0.39	1	0.95	1.2	0.95	1	0.11	0.087	0.12	0.28	0.51	0.6	0.17	<0.37	0.041
Perfluoroheptanoic acid (PFHpA)	NCL	0.56	1.1	8.2	6.7	8.2	4.9	4	0.1	0.051	0.087	0.99	1.2	1.6	0.33	0.37	0.07
Perfluorohexane sulfonic acid (PFHxS)	NA	0.88	1.1	10	9	10	6.6	6.5	0.39	0.23	0.38	1.7	3.3	4.1	0.65	1.1	0.13
Perfluorohexanoic acid (PFHxA)	NA	0.66	0.91	14	10	9.3	6.1	4.8	0.067	0.034	0.057	1.4	1.6	1.6	0.38	0.43	0.063
Perfluorononanoic acid (PFNA)	NA	0.089	<0.39	0.23	0.28	0.27	0.27	<0.71	0.026	0.023	0.029	0.31	0.27	0.34	0.15	<0.37	0.015
Perfluorooctane sulfonamide (FOSA)	NCL	0.18	<0.39	<0.07	<0.036	<0.074	<0.075	<0.71	0.007	0.0098	0.0083	0.34	0.31	0.35	0.39	0.45	<0.0037
Perfluorooctane sulfonic acid (PFOS)	0.011 (X)	***17***	***18***	***56***	***61***	78 [B]	***63***	63 [B]	***4.5***	***4.8***	***3.9***	***27***	***23***	***29***	***21***	***25***	***3.7***
Perfluorooctanoic acid (PFOA)	0.42 (X)	***4.7***	***6.4***	***59***	***60***	67 [B]	***40***	***38***	***1***	***0.61***	***0.95***	***7.2***	***8***	***9.9***	***2.2***	***2.8***	***0.74***
PFOA + PFOS (Calculated)	NCL	22	24	120	120	150	100	100	5.5	5.4	4.9	34	31	39	23	28	4.4
Perfluoropentanoic acid (PFPeA)	NCL	0.25	0.41	4	3.6	3.3	2.1	1.9	0.027	0.014	0.026	0.59	0.62	0.7	0.18	<0.37	0.026
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.02	<0.39	<0.07	<0.036	<0.074	<0.075	<0.71	<0.004	<0.0034	<0.0037	<0.037	<0.034	<0.036	<0.019	<0.37	<0.0037
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.02	<0.39	<0.07	<0.036	<0.074	<0.075	<0.71	<0.004	<0.0034	<0.0037	<0.037	<0.034	<0.036	<0.019	<0.37	<0.0037
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.02	<0.39	<0.07	<0.036	<0.074	<0.075	<0.71	<0.004	<0.0034	<0.0037	<0.037	<0.034	<0.036	<0.019	<0.37	<0.0037
Perfluoro-1-pentanesulfonate (PFPeS)	NCL	0.25	0.43	3.6	3	3.1	2.2	2.1	0.072	0.035	0.074	0.51	0.55	0.65	0.14	<0.37	0.026
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA		<0.79					<1.4								<0.75	
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL		<0.79					<1.4								0.77	
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL		<0.79					<1.4								2.7	
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL		<0.79					<1.4								<0.75	
Perfluorononane sulfonic acid (PFNS)	NCL	0.09	<0.39	<0.14	<0.072	<0.15	0.044 [J]	<0.71	<0.0079	<0.0069	<0.0075	<0.075	<0.069	<0.072	<0.038	<0.37	<0.0074
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	NCL		<0.79					<1.4								<0.75	
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	NCL		<0.79					<1.4								<0.75	
4,8-dioxa-3H-perfluorononanoic acid	NCL		<0.79					<1.4								<0.75	
Total PFAS (Calculated)	NCL	27	31	170	170	190	130	130	6.7	6.1	6	43	42	52	27	35	5

TABLE 3
SUMMARY OF GROUNDWATER SAMPLE ANALYSIS - PFAS
Former Tannery
Rockford, Kent County, Michigan

Location	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface[2]	TA-GW-07	TA-GW-07	TA-GW-07	TA-GW-07	TA-GW-07	TA-GW-08	TA-GW-08	TA-GW-08	TA-GW-08	TA-GW-08	TA-GW-09	TA-GW-09	TA-GW-09	TA-TMW-101	TA-TMW-101	TA-TMW-101
Sample Name		TA-GW-07 DUP	TA-GW-07	TA-GW-GW7	TA-GW-GW-07	TA-GW-07	TA-GW-08	TA-GW-08	TA-GW-GW08	TA-GW-GW-08	TA-GW-08	TA-GW-09	TA-GW-09	TA-GW-GW09	TA-TMW-101	TA-GW-TMW101	TA-GW-TMW-101
Laboratory Sample ID		UB07090-014	UF06020-012	UH10014-021	VA15036-005	WF26013-002	UB07090-013	UF06020-011	UH15001-019	VA15036-008	WF26013-003	UB07090-008	UF15001-001	UH15001-009	UF19007-006	UH21044-017	VA15036-001
Sample Date		02/06/2019	06/05/2019	08/09/2019	01/13/2020	06/24/2021	02/06/2019	06/05/2019	08/12/2019	01/14/2020	06/24/2021	02/06/2019	06/13/2019	08/14/2019	06/18/2019	08/21/2019	01/13/2020
Parameter (µg/L)																	
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	<0.0036	<0.0035	<0.0039	<0.0036	<0.0075	<0.019	<0.0036	<0.0036	<0.0038	<0.0078	<0.018	<0.0037	<0.0037	<0.036	<0.075	<0.074
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.0036	<0.0035	<0.0039	<0.0036	<0.0075	<0.019	<0.0036	<0.0036	<0.0038	<0.0078	<0.018	<0.0037	<0.0037	<0.036	<0.075	<0.074
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	NCL	<0.0036	<0.0035	<0.0039	<0.0036		<0.019	<0.0036	<0.0036	<0.0038		<0.018	<0.0037	<0.0037	<0.036	<0.075	<0.074
N-Methyl perfluorooctane sulfonamide (MeFOSA)	NCL	<0.0073	<0.007	<0.0078	<0.0072		<0.038	<0.0071	<0.0072	<0.0077		<0.036	<0.0073	<0.0073	<0.072	<0.15	<0.15
Perfluorobutane sulfonic acid (PFBS)	NA	0.14	0.19	0.51	0.19	0.58	0.049	0.09	0.16	0.08	0.13	4.6	3.5	3.8	0.54	0.68	0.16
Perfluorobutanoic acid (PFBA)	NCL	0.028	0.046	0.13	0.034	0.24	<0.019	0.017	0.038	0.018	0.022	0.16	0.22	0.23	0.38	0.25	0.11
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.0036	<0.0035	<0.0039	<0.0036	<0.0038	<0.019	<0.0036	<0.0036	<0.0038	<0.0039	<0.018	<0.0037	<0.0037	<0.036	<0.075	<0.074
Perfluorodecanoic acid (PFDA)	NCL	<0.0036	<0.0035	<0.0039	<0.0036	<0.0038	<0.019	<0.0036	<0.0036	<0.0038	<0.0039	<0.018	<0.0037	<0.0037	0.043	<0.075	0.025 [J]
Perfluorododecanoic acid (PFDoDA)	NCL	<0.0036	<0.0035	<0.0039	<0.0036	<0.0038	<0.019	<0.0036	<0.0036	<0.0038	<0.0039	<0.018	<0.0037	<0.0037	<0.036	<0.075	<0.074
Perfluoroheptane sulfonic acid (PFHpS)	NCL	0.048	0.076	0.15	0.047	0.11	0.044	0.086	0.11	0.045	0.062	0.59	0.48	0.35	0.52	0.63	0.29
Perfluoroheptanoic acid (PFHpA)	NCL	0.067	0.1	0.23	0.072	0.43	<0.019	0.053	0.092	0.039	0.053	0.45	0.74	0.73	3.4	2.1	1.5
Perfluorohexane sulfonic acid (PFHxS)	NA	0.13	0.17	0.34	0.13	0.51	0.039	0.14	0.26	0.1	0.16	1.2	1.6	1.4	1.9	1.7	0.87
Perfluorohexanoic acid (PFHxA)	NA	0.062	0.099	0.25	0.073	0.58	<0.019	0.042	0.082	0.033	0.05	0.33	0.58	0.6	3	1.7	1.3
Perfluorononanoic acid (PFNA)	NA	0.014	0.023	0.033	0.018	0.024	<0.019	0.023	0.034	0.019	0.024	0.12	0.058	0.043	0.065	0.096	0.034 [J]
Perfluorooctane sulfonamide (FOSA)	NCL	0.0036	0.0058	<0.0039	<0.0036	<0.0038	<0.019	0.018	0.024	0.018	0.024	<0.018	0.0079	<0.0037	0.048	0.089	<0.074
Perfluorooctane sulfonic acid (PFOS)	0.011 (X)	***4.5***	***6.5***	***7.5***	***4.3***	***4.2***	***8.9***	***9.1***	***10***	***5.7***	***3***	***14***	***3.7***	3.3 [E]	***130***	140 [B]	***80***
Perfluorooctanoic acid (PFOA)	0.42 (X)	***0.85***	***1.1***	***1.7***	***0.7***	***2.5***	0.21	***0.81***	***1.3***	***0.5***	***0.66***	***5.9***	***7.2***	***6.1***	***61***	42 [B]	***21***
PFOA + PFOS (Calculated)	NCL	5.4	7.6	9.2	5	6.7	9.1	9.9	11	6.2	3.7	20	11	9.4	190	180	100
Perfluoropentanoic acid (PFPeA)	NCL	0.024	0.04	0.1	0.028	0.21	<0.019	0.018	0.051	0.021	0.026	0.18	0.27	0.31	0.76	0.46	0.24
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.0036	<0.0035	<0.0039	<0.0036	<0.0038	<0.019	<0.0036	<0.0036	<0.0038	<0.0039	<0.018	<0.0037	<0.0037	<0.036	<0.075	<0.074
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.0036	<0.0035	<0.0039	<0.0036	<0.0038	<0.019	<0.0036	<0.0036	<0.0038	<0.0039	<0.018	<0.0037	<0.0037	<0.036	<0.075	<0.074
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.0036	<0.0035	<0.0039	<0.0036	<0.0038	<0.019	<0.0036	<0.0036	<0.0038	<0.0039	<0.018	0.0037	<0.0037	0.11	<0.075	<0.074
Perfluoro-1-pentanesulfonate (PFPeS)	NCL	0.026	0.04	0.093	0.036	0.16	<0.019	0.027	0.056	0.022	0.041	0.2	0.44	0.48	0.33	0.31	0.11
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA					<0.0075					<0.0078						
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL					<0.0075					<0.0078						
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL					0.0081					0.016						
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL					<0.0075					<0.0078						
Perfluorononane sulfonic acid (PFNS)	NCL	<0.0073	<0.007	<0.0078	0.0051 [J]	<0.0038	<0.038	<0.0071	<0.0072	0.0054 [J]	<0.0039	<0.036	<0.0073	<0.0073	0.24	0.23	0.12 [J]
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	NCL					<0.0075					<0.0078						
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	NCL					<0.0075					<0.0078						
4,8-dioxa-3H-perfluorononanoic acid	NCL					<0.0075					<0.0078						
Total PFAS (Calculated)	NCL	5.9	8.4	11	5.6	9.6	9.2	10	12	6.6	4.3	28	19	17	200	190	110

TABLE 3
SUMMARY OF GROUNDWATER SAMPLE ANALYSIS - PFAS
Former Tannery
Rockford, Kent County, Michigan

Location	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface[2]	TA-TMW-101	TA-TMW-102	TA-TMW-102	TA-TMW-102	TA-TMW-103	TA-TMW-103	TA-TMW-103	TA-TMW-103	TA-TMW-104	TA-TMW-104	TA-TMW-104	TA-TMW-104	TA-TMW-104	TA-TMW-105	TA-TMW-105	TA-TMW-105
Sample Name		TA-TMW-101	TA-TMW-102	TA-GW-TMW102	TA-GW-TMW-102	TA-MW-103	TA-TMW-103	TA-GW-TMW103	TA-TMW-103	TA-TMW-104	TA-GW-TMW104	TA-GW-TMW104 DUP	TA-GW-TMW-104	TA-TMW-104	TA-TMW-105	TA-GW-TMW105	TA-GW-TMW-105
Laboratory Sample ID		WG21079-007	UF08017-006	UH15001-007	VA11008-001	UB07090-007	UF08017-015	UH15001-018	WG16013-003	UF08017-016	UH15001-011	UH15001-012	VA15036-013	WG17016-001	UF15001-005	UH17008-013	VA15036-014
Sample Date		07/20/2021	06/07/2019	08/13/2019	01/09/2020	02/05/2019	06/06/2019	08/12/2019	07/12/2021	06/06/2019	08/14/2019	08/14/2019	01/15/2020	07/15/2021	06/13/2019	08/16/2019	01/15/2020
Parameter (µg/L)																	
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	<0.14	<0.0038	<0.0037	0.0051	<0.0038	<0.0035	0.0052	<0.0077	<0.017	<0.019	<0.018	0.025	<0.39	<0.038	<0.035	<0.019
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.14	<0.0038	<0.0037	<0.0039	<0.0038	<0.0035	<0.0038	<0.0077	<0.017	<0.019	<0.018	<0.019	<0.39	<0.038	<0.035	<0.019
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	NCL		<0.0038	<0.0037	<0.0039	<0.0038	<0.0035	<0.0038		<0.017	<0.019	<0.018	<0.019		<0.038	<0.035	<0.019
N-Methyl perfluorooctane sulfonamide (MeFOSA)	NCL		<0.0075	<0.0074	<0.0078	<0.0076	<0.0069	<0.0077		<0.034	<0.037	<0.036	<0.038		<0.076	<0.071	<0.038
Perfluorobutane sulfonic acid (PFBS)	NA	0.4	0.6	0.56	0.53	0.3	0.22	0.44	0.82	0.56	0.71	0.71	0.65	0.6	1.3	2	1.3
Perfluorobutanoic acid (PFBA)	NCL	0.072	0.11	0.1	0.12	0.04	0.032	0.063	0.11	0.065	0.081	0.085	0.069	<0.19	0.25	0.4	0.21
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.071	<0.0038	<0.0037	<0.0039	<0.0038	<0.0035	<0.0038	<0.0038	<0.017	<0.019	<0.018	<0.019	<0.19	<0.038	<0.035	<0.019
Perfluorodecanoic acid (PFDA)	NCL	<0.071	0.0096	0.0087	0.011	0.015	0.017	0.011	0.017	0.029	0.019	0.022	0.018 [J]	<0.19	0.18	0.34	0.12
Perfluorododecanoic acid (PFDoDA)	NCL	<0.071	<0.0038	<0.0037	<0.0039	<0.0038	<0.0035	<0.0038	<0.0038	<0.017	<0.019	<0.018	<0.019	<0.19	<0.038	<0.035	<0.019
Perfluoroheptane sulfonic acid (PFHpS)	NCL	0.12	0.3	0.3	0.23	0.11	0.12	0.12	0.16	0.22	0.25	0.27	0.23	0.22	0.32	0.34	0.31
Perfluoroheptanoic acid (PFHpA)	NCL	0.22	0.43	0.46	0.41	0.19	0.15	0.23	0.39	0.24	0.32	0.31	0.24	0.29	0.5	0.87	0.44
Perfluorohexane sulfonic acid (PFHxS)	NA	0.42	1.1	1.1	0.83	0.6	0.42	0.5	0.69	0.73	0.78	0.87	0.79	0.86	1.1	1.3	0.93
Perfluorohexanoic acid (PFHxA)	NA	0.23	0.37	0.36	0.38	0.17	0.13	0.22	0.4	0.21	0.23	0.26	0.19	0.19	0.52	1	0.5
Perfluorononanoic acid (PFNA)	NA	<0.071	0.046	0.042	0.055	0.029	0.027	0.029	0.052	0.057	0.056	0.062	0.062	<0.19	0.083	0.14	0.079
Perfluorooctane sulfonamide (FOSA)	NCL	0.12	<0.0038	<0.0037	<0.0039	0.22	0.21	0.19	0.17	<0.017	<0.019	<0.018	<0.019	<0.19	0.59	0.86	0.41
Perfluorooctane sulfonic acid (PFOS)	0.011 (X)	12 [B]	***5.6***	***5.7***	***5.1***	***6***	***4.7***	***4.2***	***6.6***	***14***	***17***	***19***	***16***	***19***	***28***	***27***	***18***
Perfluorooctanoic acid (PFOA)	0.42 (X)	***2.3***	***4***	***4***	***3.4***	***2***	***1.5***	***2.2***	***3.2***	***3.4***	***3.6***	***3.7***	***3.5***	***2.7***	***4***	***6.2***	***4***
PFOA + PFOS (Calculated)	NCL	14	9.6	9.7	8.5	8	6.2	6.4	9.8	17	21	23	20	22	32	33	22
Perfluoropentanoic acid (PFPeA)	NCL	0.11	0.13	0.12	0.14	0.057	0.048	0.1	0.2	0.086	0.089	0.097	0.091	<0.19	0.26	0.41	0.22
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.071	<0.0038	<0.0037	<0.0039	<0.0038	<0.0035	<0.0038	<0.0038	<0.017	<0.019	<0.018	<0.019	<0.19	<0.038	<0.035	<0.019
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.071	<0.0038	<0.0037	<0.0039	<0.0038	<0.0035	<0.0038	<0.0038	<0.017	<0.019	<0.018	<0.019	<0.19	<0.038	<0.035	<0.019
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.071	<0.0038	<0.0037	<0.0039	<0.0038	<0.0035	<0.0038	0.3	<0.017	<0.019	<0.018	<0.019	<0.19	<0.038	<0.035	<0.019
Perfluoro-1-pentanesulfonate (PFPeS)	NCL	0.12	0.28	0.29	0.2	0.14	0.11	0.14	0.27	0.2	0.26	0.28	0.25	0.23	0.22	0.35	0.22
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA	<0.14							<0.0077					<0.39			
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL	<0.14							0.22					<0.39			
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL	0.24							0.39					<0.39			
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL	<0.14							<0.0077					<0.39			
Perfluorononane sulfonic acid (PFNS)	NCL	<0.071	<0.0075	<0.0074	<0.0078	<0.0076	<0.0069	<0.0077	<0.0038	<0.034	<0.037	<0.036	<0.038	<0.19	<0.076	<0.071	0.029 [J]
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	NCL	<0.14							<0.0077					<0.39			
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	NCL	<0.14							<0.0077					<0.39			
4,8-dioxa-3H-perfluorononanoic acid	NCL	<0.14							<0.0077					<0.39			
Total PFAS (Calculated)	NCL	16	13	13	11	9.9	7.7	8.4	14	20	23	26	22	24	37	41	27

TABLE 3
SUMMARY OF GROUNDWATER SAMPLE ANALYSIS - PFAS
Former Tannery
Rockford, Kent County, Michigan

Location	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface[2]	TA-TMW-105	TA-TMW-105	TA-TMW-108	TA-TMW-108	TA-TMW-108	TA-TMW-109	TA-TMW-109	TA-TMW-109	TA-TMW-110	TA-TMW-110	TA-TMW-111	TA-TMW-111	TA-MW-301B	TA-MW-301B	TA-MW-301B	TA-MW-301B
Sample Name		TA-GW-TMW-105 DUP	TA-TMW-105	TA-TMW-108	TA-TMW-108 DUP	TA-GW-TMW108	TA-TMW-109	TA-GW-TMW109	TA-TMW-109	TA-TMW-110	TA-GW-TMW110	TA-TMW-111	TA-GW-TMW111	TA-MW-301B	TA-GW-MW301B	TA-GW-MW-301B	TA-MW-301B
Laboratory Sample ID		VA15036-015	WG17016-006	UF08017-005	UF08017-007	UH15001-006	UF08017-004	UH15001-017	WG16013-001	UF15001-006	UH21044-010	UF08017-003	UH15001-020	UF13013-026	UH21044-001	VA15036-004	WG21079-008
Sample Date		01/15/2020	07/15/2021	06/07/2019	06/07/2019	08/13/2019	06/07/2019	08/12/2019	07/12/2021	06/14/2019	08/20/2019	06/07/2019	08/12/2019	06/12/2019	08/19/2019	01/13/2020	07/20/2021
Parameter (µg/L)																	
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	<0.019	<0.73	<0.0034	<0.0034	<0.0037	<0.0038	<0.0037	<0.01	<0.037	<0.073	<0.0034	<0.0037	<0.017	<0.018	<0.019	<1.5
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.019	<0.73	<0.0034	<0.0034	<0.0037	<0.0038	<0.0037	<0.01	<0.037	<0.073	<0.0034	<0.0037	<0.017	<0.018	<0.019	<1.5
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	NCL	<0.019		<0.0034	<0.0034	<0.0037	<0.0038	<0.0037		<0.037	<0.073	<0.0034	<0.0037	<0.017	<0.018	<0.019	
N-Methyl perfluorooctane sulfonamide (MeFOSA)	NCL	<0.037		<0.0068	<0.0068	<0.0074	<0.0076	<0.0075		<0.074	<0.15	<0.0069	<0.0074	<0.035	<0.037	<0.038	
Perfluorobutane sulfonic acid (PFBS)	NA	1.3	1.7	0.52	0.51	0.61	0.34	0.37	0.49	0.22	0.29	0.65	0.61	0.59	0.75	0.57	<0.74
Perfluorobutanoic acid (PFBA)	NCL	0.21	<0.37	0.081	0.079	0.13	0.055	0.075	0.13	<0.037	<0.073	0.11	0.11	0.16	0.21	0.25	<0.74
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.019	<0.37	<0.0034	<0.0034	<0.0037	<0.0038	<0.0037	<0.0052	<0.037	<0.073	<0.0034	<0.0037	<0.017	<0.018	<0.019	<0.74
Perfluorodecanoic acid (PFDA)	NCL	0.13	<0.37	0.011	0.011	0.0095	<0.0038	<0.0037	<0.0052	<0.037	<0.073	<0.0034	<0.0037	0.056	0.06	0.055	<0.74
Perfluorododecanoic acid (PFDoDA)	NCL	<0.019	<0.37	<0.0034	<0.0034	<0.0037	<0.0038	<0.0037	<0.0052	<0.037	<0.073	<0.0034	<0.0037	<0.017	<0.018	<0.019	<0.74
Perfluoroheptane sulfonic acid (PFHpS)	NCL	0.3	0.44	0.27	0.23	0.25	0.066	0.066	0.073	0.56	0.71	0.19	0.22	0.2	0.26	0.27	<0.74
Perfluoroheptanoic acid (PFHpA)	NCL	0.49	0.84	0.39	0.38	0.5	0.13	0.17	0.26	0.5	0.7	0.45	0.5	0.52	0.77	1.6	<0.74
Perfluorohexane sulfonic acid (PFHxS)	NA	0.88	1.3	0.93	0.94	0.93	0.26	0.22	0.28	1.5	2.1	1	1	0.68	0.91	1.1	<0.74
Perfluorohexanoic acid (PFHxA)	NA	0.54	0.76	0.29	0.33	0.4	0.13	0.19	0.32	0.3	0.47	0.33	0.3	0.69	0.79	1.6	<0.74
Perfluorononanoic acid (PFNA)	NA	0.078	<0.37	0.04	0.042	0.037	0.019	0.019	0.033	0.062	<0.073	0.026	0.031	0.047	0.055	0.058	<0.74
Perfluorooctane sulfonamide (FOSA)	NCL	0.4	0.68	<0.0034	<0.0034	<0.0037	0.05	0.07	0.056	<0.037	<0.073	<0.0034	<0.0037	0.078	0.11	0.11	<0.74
Perfluorooctane sulfonic acid (PFOS)	0.011 (X)	***18***	***28***	***5.4***	***5.3***	***3.9***	***4***	***2.9***	***3.2***	***47***	55 [B]	***3.4***	***3.5***	***28***	***33***	***37***	55 [B]
Perfluorooctanoic acid (PFOA)	0.42 (X)	***3.8***	***6.1***	***3.5***	***3.4***	***3.6***	***0.94***	***1***	***0.85***	***6.4***	7.1 [B]	***4.1***	***4.5***	***8.5***	***10***	***21***	***4.3***
PFOA + PFOS (Calculated)	NCL	22	34	8.9	8.7	7.5	4.9	3.9	4.1	53	62	7.5	8	37	43	58	59
Perfluoropentanoic acid (PFPeA)	NCL	0.21	<0.37	0.11	0.11	0.16	0.073	0.12	0.25	0.07	0.096	0.13	0.13	0.23	0.29	0.45	<0.74
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.019	<0.37	<0.0034	<0.0034	<0.0037	<0.0038	<0.0037	<0.0052	<0.037	<0.073	<0.0034	<0.0037	<0.017	<0.018	<0.019	<0.74
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.019	<0.37	<0.0034	<0.0034	<0.0037	<0.0038	<0.0037	<0.0052	<0.037	<0.073	<0.0034	<0.0037	<0.017	<0.018	<0.019	<0.74
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.019	<0.37	<0.0034	<0.0034	<0.0037	<0.0038	<0.0037	<0.0052	<0.037	<0.073	<0.0034	<0.0037	<0.017	<0.018	<0.019	<0.74
Perfluoro-1-pentanesulfonate (PFPeS)	NCL	0.21	<0.37	0.24	0.24	0.25	0.048	0.055	0.075	0.22	0.33	0.28	0.3	0.15	0.2	0.22	<0.74
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA		<0.73						<0.01								<1.5
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL		<0.73						<0.01								<1.5
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL		1.5						0.15								<1.5
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL		<0.73						<0.01								<1.5
Perfluorononane sulfonic acid (PFNS)	NCL	0.023 [J]	<0.37	<0.0068	<0.0068	<0.0074	<0.0076	<0.0075	<0.0052	<0.074	<0.15	<0.0069	<0.0074	<0.035	<0.037	0.16	<0.74
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	NCL		<0.73						<0.01								<1.5
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	NCL		<0.73						<0.01								<1.5
4,8-dioxa-3H-perfluorononanoic acid	NCL		<0.73						<0.01								<1.5
Total PFAS (Calculated)	NCL	27	41	12	12	11	6.1	5.3	6.2	57	67	11	11	40	47	64	59

TABLE 3
SUMMARY OF GROUNDWATER SAMPLE ANALYSIS - PFAS
Former Tannery
Rockford, Kent County, Michigan

Location	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface[2]	TA-MW-301C	TA-MW-301C	TA-MW-301C	TA-MW-301C	TA-MW-301D	TA-MW-301D	TA-MW-301D	TA-MW-301D	TA-MW-302A	TA-MW-302A	TA-MW-302A	TA-MW-302A	TA-MW-302B	TA-MW-302B	TA-MW-302B	TA-MW-302B
Sample Name		TA-MW-301C	TA-GW-MW301C	TA-GW-MW-301C	TA-MW-301C	TA-MW-301D	TA-GW-MW301D	TA-GW-MW-301D	TA-MW-301D	TA-MW-302A	TA-GW-MW302A	TA-GW-MW-302A	TA-MW-302A	TA-MW-302B	TA-GW-MW302B	TA-GW-MW-302B	TA-GW-MW-302B DUP
Laboratory Sample ID		UF19007-010	UH21044-018	VA15036-003	WG21079-009	UF05051-014	UH10014-018	VA15036-002	WG16013-004	UF13013-013	UH17008-003	VA09002-013	WG16013-010	UF13013-009	UH17008-004	VA09002-014	VA09002-015
Sample Date		06/18/2019	08/21/2019	01/13/2020	07/20/2021	06/03/2019	08/07/2019	01/13/2020	07/12/2021	06/10/2019	08/15/2019	01/08/2020	07/14/2021	06/11/2019	08/15/2019	01/08/2020	01/08/2020
Parameter (µg/L)																	
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	<0.072	<0.36	<0.19	<3.6	<0.0036	<0.0036	<0.0038	<0.0075	<0.0035	0.0064	<0.0038	<0.0089	0.013	<0.018	0.011	0.011
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.072	<0.36	<0.19	<3.6	<0.0036	<0.0036	<0.0038	<0.0075	<0.0035	<0.0037	<0.0038	<0.0089	<0.0035	<0.018	<0.0038	<0.0036
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	NCL	<0.072	<0.36	<0.19		<0.0036	<0.0036	<0.0038		<0.0035	<0.0037	<0.0038		<0.0035	<0.018	<0.0038	<0.0036
N-Methyl perfluorooctane sulfonamide (MeFOSA)	NCL	<0.14	<0.71	<0.37		<0.0072	<0.0072	<0.0077		<0.0071	<0.0074	<0.0076		<0.007	<0.036	<0.0076	<0.0073
Perfluorobutane sulfonic acid (PFBS)	NA	1	1.1	0.85	<1.8	<0.0036	<0.0036	<0.0038	<0.0037	1.1	2.9	0.91	2.7	2.1	1.8	2	1.9
Perfluorobutanoic acid (PFBA)	NCL	0.99	0.92	0.74	<1.8	<0.0036	<0.0036	<0.0038	<0.0037	0.095	0.34	0.084	0.13	0.54	0.37	0.47	0.47
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.072	<0.36	<0.19	<1.8	<0.0036	<0.0036	<0.0038	<0.0037	0.011	0.0053	0.013	0.023	<0.0035	<0.018	<0.0038	<0.0036
Perfluorodecanoic acid (PFDA)	NCL	0.1	<0.36	0.064 [J]	<1.8	<0.0036	<0.0036	<0.0038	<0.0037	0.052	0.033	0.057	0.079	0.016	<0.018	0.011	0.012
Perfluorododecanoic acid (PFDoDA)	NCL	<0.072	<0.36	<0.19	<1.8	<0.0036	<0.0036	<0.0038	<0.0037	<0.0035	<0.0037	0.0016 [J]	0.011	<0.0035	<0.018	<0.0038	<0.0036
Perfluoroheptane sulfonic acid (PFHpS)	NCL	1.8	2.4	1.7	<1.8	<0.0036	<0.0036	<0.0038	<0.0037	0.084	0.14	0.062	0.16	0.2	0.2	0.14	0.14
Perfluoroheptanoic acid (PFHpA)	NCL	14	16	15	3.1	<0.0036	<0.0036	0.0013 [J]	0.0056	0.12	0.31	0.11	0.28	0.87	0.66	0.63	0.63
Perfluorohexane sulfonic acid (PFHxS)	NA	8.6	10	9.9	<1.8	<0.0036	<0.0036	0.0011 [J]	<0.0037	0.31	0.58	0.25	0.7	1.2	1.1	1.1	1.1
Perfluorohexanoic acid (PFHxA)	NA	14	17	15	<1.8	<0.0036	<0.0036	0.0018 [J]	0.0053	0.11	0.34	0.1	0.22	0.84	0.73	0.66	0.68
Perfluorononanoic acid (PFNA)	NA	0.17	<0.36	0.15 [J]	<1.8	<0.0036	<0.0036	<0.0038	<0.0037	0.041	0.036	0.031	0.054	0.048	0.048	0.034	0.032
Perfluorooctane sulfonamide (FOSA)	NCL	0.072	<0.36	0.097 [J]	<1.8	<0.0036	<0.0036	<0.0038	<0.0037	0.34	0.2	0.47	0.66	0.83	1.1	0.61	0.63
Perfluorooctane sulfonic acid (PFOS)	0.011 (X)	***480***	490 [B]	***310***	150 [B]	***0.014***	0.011	***0.046***	***0.14***	***7.1***	***5.6***	***4.7***	***10***	***11***	***15***	***8.1***	***8.4***
Perfluorooctanoic acid (PFOA)	0.42 (X)	***220***	210 [B]	***150***	***47***	0.0048	<0.0018	0.018	0.072	***1***	***2.4***	***0.82***	***2.2***	***5.8***	***6.4***	***5.4***	***5.3***
PFOA + PFOS (Calculated)	NCL	700	700	460	200	0.019	0.011	0.064	0.21	8.1	8	5.5	12	17	21	14	14
Perfluoropentanoic acid (PFPeA)	NCL	2.5	2.4	1.9	<1.8	<0.0036	<0.0036	<0.0038	<0.0037	0.086	0.18	0.07	0.1	0.36	0.3	0.26	0.26
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.072	<0.36	<0.19	<1.8	<0.0036	<0.0036	<0.0038	<0.0037	<0.0035	<0.0037	<0.0038	<0.0045	<0.0035	<0.018	<0.0038	<0.0036
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.072	<0.36	<0.19	<1.8	<0.0036	<0.0036	<0.0038	<0.0037	<0.0035	<0.0037	<0.0038	0.066	<0.0035	<0.018	<0.0038	<0.0036
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.072	<0.36	<0.19	<1.8	<0.0036	<0.0036	<0.0038	<0.0037	<0.0035	<0.0037	<0.0038	<0.0045	<0.0035	<0.018	<0.0038	<0.0036
Perfluoro-1-pentanesulfonate (PFPeS)	NCL	0.92	0.99	0.79	<1.8	<0.0036	<0.0036	<0.0038	<0.0037	0.085	0.23	0.064	0.19	0.53	0.33	0.39	0.41
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA				<3.6				<0.0075				<0.0089				
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL				<3.6				<0.0075				0.042				
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL				<3.6				<0.0075				0.89				
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL				<3.6				<0.0075				<0.0089				
Perfluorononane sulfonic acid (PFNS)	NCL	0.8	0.79	1.9	<1.8	<0.0072	<0.0072	<0.0077	<0.0037	<0.0071	<0.0074	0.0066 [J]	0.013	0.0082	<0.036	0.0034 [J]	0.0037 [J]
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	NCL				<3.6				<0.0075				<0.0089				
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	NCL				<3.6				<0.0075				<0.0089				
4,8-dioxa-3H-perfluorononanoic acid	NCL				<3.6				<0.0075				<0.0089				
Total PFAS (Calculated)	NCL	740	750	510	200	0.019	0.011	0.068	0.22	11	13	7.7	19	24	28	20	20

TABLE 3
SUMMARY OF GROUNDWATER SAMPLE ANALYSIS - PFAS
Former Tannery
Rockford, Kent County, Michigan

Location	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface[2]	TA-MW-302B	TA-MW-303A	TA-MW-303A	TA-MW-303A	TA-MW-303A	TA-MW-303A	TA-MW-303A	TA-MW-303B	TA-MW-303B	TA-MW-303B	TA-MW-303B	TA-MW-303B	TA-MW-303C	TA-MW-303C	TA-MW-303C	TA-MW-303C
Sample Name		TA-MW-302B	TA-MW-303A	TA-MW-303A	TA-GW-MW303A	TA-GW-MW303A DUP	TA-GW-MW-303A	TA-MW-303A	TA-MW-303B	TA-MW-303B	TA-GW-MW303B	TA-GW-MW-303B	TA-MW-303B	TA-MW-303C	TA-MW-303C	TA-MW-303C DUP	TA-GW-MW303C
Laboratory Sample ID		WG16013-011	UB07090-021	UF08017-014	UH21044-006	UH21044-007	VA11008-007	WG21079-004	UB07090-019	UF19007-001	UH21044-004	VA11008-004	WG21079-005	UB07090-016	UF19007-003	UF19007-004	UH21044-003
Sample Date		07/14/2021	02/07/2019	06/06/2019	08/19/2019	08/19/2019	01/10/2020	07/19/2021	02/07/2019	06/17/2019	08/19/2019	01/09/2020	07/19/2021	02/07/2019	06/17/2019	06/17/2019	08/19/2019
Parameter (µg/L)																	
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	<0.0079	<0.0038	<0.035	<0.039	<0.037	<0.019	<1.4	<0.036	<0.34	<0.022	<0.019	<0.36	0.095	<0.17	0.08	0.069
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.0079	<0.0038	<0.035	<0.039	<0.037	<0.019	<1.4	<0.036	<0.34	<0.022	<0.019	<0.36	<0.037	<0.17	<0.017	<0.018
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	NCL		0.0065	<0.035	<0.039	<0.037	<0.019		<0.036	<0.34	<0.022	<0.019		<0.037	<0.17	<0.017	<0.018
N-Methyl perfluorooctane sulfonamide (MeFOSA)	NCL		<0.0075	<0.07	<0.079	<0.075	<0.038		<0.072	<0.69	<0.044	<0.038		<0.073	<0.34	<0.035	<0.036
Perfluorobutane sulfonic acid (PFBS)	NA	2.2	2.6	11	11	12	6.7	8.3	18	9	8	6.6	11	12	8	7.9	9.3
Perfluorobutanoic acid (PFBA)	NCL	0.44	0.095	0.4	0.76	0.77	0.27	<0.71	0.79	0.49	0.92	0.61	1.5	1.7	1.5	1.5	1.6
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.0039	0.0045	<0.035	<0.039	<0.037	<0.019	<0.71	<0.036	<0.34	<0.022	<0.019	<0.18	<0.037	<0.17	<0.017	<0.018
Perfluorodecanoic acid (PFDA)	NCL	0.014	0.063	0.056	<0.039	0.04	0.049	<0.71	<0.036	<0.34	<0.022	0.016 [J]	<0.18	<0.037	<0.17	<0.017	<0.018
Perfluorododecanoic acid (PFDoDA)	NCL	<0.0039	<0.0038	<0.035	<0.039	<0.037	<0.019	<0.71	<0.036	<0.34	<0.022	<0.019	<0.18	<0.037	<0.17	<0.017	<0.018
Perfluoroheptane sulfonic acid (PFHpS)	NCL	0.15	0.091	0.4	0.48	0.48	0.32	0.71	0.53	0.41	0.37	0.3	0.8	0.51	0.3	0.28	0.29
Perfluoroheptanoic acid (PFHpA)	NCL	0.68	0.094	0.52	1.1	1.2	0.44	0.85	1	0.67	1.2	0.8	1.7	1.8	1.3	1.2	1.5
Perfluorohexane sulfonic acid (PFHxS)	NA	1.3	0.27	1.1	2.7	2.5	0.98	2.2	2.6	1.6	2.8	2.5	5.8	2.5	1.8	1.8	1.8
Perfluorohexanoic acid (PFHxA)	NA	0.69	0.1	0.48	1.2	1.4	0.36	0.95	1.2	0.77	1.5	0.97	2.6	3.2	2.8	2.6	2.8
Perfluorononanoic acid (PFNA)	NA	0.039	0.046	0.087	0.071	0.073	0.068	<0.71	0.083	<0.34	0.082	0.05	<0.18	0.18	<0.17	0.11	0.12
Perfluorooctane sulfonamide (FOSA)	NCL	0.65	0.13	0.79	0.34	0.37	0.5	<0.71	0.16	<0.34	0.16	0.13	<0.18	0.36	<0.17	0.11	0.19
Perfluorooctane sulfonic acid (PFOS)	0.011 (X)	***10***	***7.5***	***37***	***32***	***32***	***27***	49 [B]	***33***	***27***	***27***	***18***	29 [B]	***33***	***18***	***19***	***23***
Perfluorooctanoic acid (PFOA)	0.42 (X)	***6***	***0.99***	***3.9***	***5.9***	***5.9***	***3.3***	***5.5***	***6.9***	***4.3***	***7.6***	***4.8***	***14***	***13***	***8.1***	***8.3***	***9.1***
PFOA + PFOS (Calculated)	NCL	16	8.5	41	38	38	30	55	40	31	35	23	43	46	26	27	32
Perfluoropentanoic acid (PFPeA)	NCL	0.29	0.074	0.32	0.53	0.53	0.21	<0.71	0.54	0.35	0.58	0.39	0.99	1.1	0.93	0.86	0.96
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.0039	<0.0038	<0.035	<0.039	<0.037	<0.019	<0.71	<0.036	<0.34	<0.022	<0.019	<0.18	<0.037	<0.17	<0.017	<0.018
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.0039	<0.0038	<0.035	<0.039	<0.037	<0.019	<0.71	<0.036	<0.34	<0.022	<0.019	<0.18	<0.037	<0.17	<0.017	<0.018
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.0039	<0.0038	<0.035	<0.039	<0.037	<0.019	<0.71	<0.036	<0.34	<0.022	<0.019	<0.18	<0.037	<0.17	<0.017	<0.018
Perfluoro-1-pentanesulfonate (PFPeS)	NCL	0.45	0.091	0.37	0.82	0.85	0.28	<0.71	0.77	0.41	0.68	0.6	1.3	0.77	0.47	0.49	0.51
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA	<0.0079						<1.4					<0.36				
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL	0.055						<1.4					<0.36				
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL	0.98						7.2					1.5				
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL	<0.0079						<1.4					<0.36				
Perfluorononane sulfonic acid (PFNS)	NCL	<0.0039	<0.0075	<0.07	<0.079	<0.075	0.017 [J]	<0.71	<0.072	<0.69	<0.044	<0.038	<0.18	<0.073	<0.34	<0.035	<0.036
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	NCL	<0.0079						<1.4					<0.36				
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	NCL	<0.0079						<1.4					<0.36				
4,8-dioxa-3H-perfluorononanoic acid	NCL	<0.0079						<1.4					<0.36				
Total PFAS (Calculated)	NCL	24	12	56	57	58	40	75	66	45	51	36	70	70	43	44	51

TABLE 3
SUMMARY OF GROUNDWATER SAMPLE ANALYSIS - PFAS
Former Tannery
Rockford, Kent County, Michigan

Location	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface[2]	TA-MW-303C	TA-MW-303D	TA-MW-303D	TA-MW-303D	TA-MW-303D	TA-MW-303D	TA-MW-303E	TA-MW-303E	TA-MW-303E	TA-MW-303E	TA-MW-303E	TA-MW-303E	TA-MW-304A	TA-MW-304A	TA-MW-304A	TA-MW-304A
Sample Name		TA-GW-MW-303C	TA-MW-303D	TA-MW-303D	TA-GW-MW303D	TA-GW-MW-303D	TA-MW-303D	TA-MW-303E	TA-MW-303E	TA-GW-MW303E	TA-GW-MW-303E	TA-MW-303E	TA-MW-303E DUP	TA-MW-304A	TA-GW-MW304A	TA-GW-MW-304A	TA-MW-304A
Laboratory Sample ID		VA11008-009	UB07090-002	UF05051-015	UH10014-017	VA11008-006	WF25013-004	UB07090-001	UF05051-016	UH07038-001	VA11008-008	WF25013-002	WF25013-003	UF15001-004	UH21044-008	VA15036-011	WG17016-007
Sample Date		01/10/2020	02/04/2019	06/03/2019	08/07/2019	01/10/2020	06/22/2021	02/04/2019	06/03/2019	08/06/2019	01/10/2020	06/22/2021	06/22/2021	06/13/2019	08/19/2019	01/14/2020	07/16/2021
Parameter (µg/L)																	
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	0.053	<0.0035	<0.0036	<0.0036	<0.0037	<0.0074	<0.0035	<0.0036	<0.0035	<0.0037	<0.0073	<0.0077	<0.036	<0.072	<0.019	<0.15
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.036	<0.0035	<0.0036	<0.0036	<0.0037	<0.0074	<0.0035	<0.0036	<0.0035	<0.0037	<0.0073	<0.0077	<0.036	<0.072	<0.019	<0.15
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	NCL	<0.036	<0.0035	<0.0036	<0.0036	<0.0037		<0.0035	<0.0036	<0.0035	<0.0037			<0.036	<0.072	<0.019	
N-Methyl perfluorooctane sulfonamide (MeFOSA)	NCL	<0.073	<0.0071	<0.0072	<0.0072	<0.0074		<0.007	<0.0071	<0.007	<0.0075			<0.073	<0.14	<0.038	
Perfluorobutane sulfonic acid (PFBS)	NA	5.7	0.022	0.048	0.085	0.067	0.098	<0.0035	<0.0036	<0.0035	<0.0037	<0.0036	<0.0039	1.1	2.1	0.61	0.92
Perfluorobutanoic acid (PFBA)	NCL	0.84	0.0042	0.0066	0.0081	0.0086	0.014	<0.0035	<0.0036	<0.0035	<0.0037	<0.0036	<0.0039	0.17	0.41	0.067	0.18
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.036	<0.0035	<0.0036	<0.0036	<0.0037	<0.0037	<0.0035	<0.0036	<0.0035	<0.0037	<0.0036	<0.0039	<0.036	<0.072	<0.019	<0.075
Perfluorodecanoic acid (PFDA)	NCL	0.0095 [J]	<0.0035	<0.0036	<0.0036	<0.0037	<0.0037	<0.0035	<0.0036	<0.0035	<0.0037	<0.0036	<0.0039	0.064	<0.072	0.027	<0.075
Perfluorododecanoic acid (PFDoDA)	NCL	<0.036	<0.0035	<0.0036	<0.0036	<0.0037	<0.0037	<0.0035	<0.0036	<0.0035	<0.0037	<0.0036	<0.0039	<0.036	<0.072	<0.019	<0.075
Perfluoroheptane sulfonic acid (PFHpS)	NCL	0.26	<0.0035	<0.0036	<0.0036	<0.0037	<0.0037	<0.0035	<0.0036	<0.0035	<0.0037	<0.0036	<0.0039	0.4	0.54	0.16	0.14
Perfluoroheptanoic acid (PFHpA)	NCL	0.84	<0.0035	0.0038	0.0048	0.005	0.0088	<0.0035	<0.0036	<0.0035	<0.0037	<0.0036	<0.0039	0.46	0.68	0.24	0.36
Perfluorohexane sulfonic acid (PFHxS)	NA	1.4	0.0035	0.0046	0.0057	0.0052	0.012	<0.0035	<0.0036	<0.0035	<0.0037	<0.0036	<0.0039	1.3	1.3	1.1	0.87
Perfluorohexanoic acid (PFHxA)	NA	1.6	0.0058	0.008	0.0084	0.012	0.019	<0.0035	<0.0036	<0.0035	<0.0037	<0.0036	<0.0039	0.43	0.93	0.19	0.27
Perfluorononanoic acid (PFNA)	NA	0.11	<0.0035	<0.0036	<0.0036	<0.0037	<0.0037	<0.0035	<0.0036	<0.0035	<0.0037	<0.0036	<0.0039	0.077	0.13	0.032	<0.075
Perfluorooctane sulfonamide (FOSA)	NCL	0.16	0.004	<0.0036	<0.0036	0.002 [J]	<0.0037	<0.0035	<0.0036	<0.0035	<0.0037	<0.0036	<0.0039	0.24	0.29	0.076	<0.075
Perfluorooctane sulfonic acid (PFOS)	0.011 (X)	***19***	***0.023***	***0.019***	***0.021***	***0.013***	***0.017***	<0.0035	<0.0036	<0.0035	<0.0037	<0.0036	<0.0039	***46***	***61***	***18***	***8.1***
Perfluorooctanoic acid (PFOA)	0.42 (X)	***5.3***	0.011	0.018	0.024	0.022	0.046	<0.0018	<0.0018	<0.0018	<0.0019	<0.0036	<0.0039	***3.6***	***4.7***	***2.2***	***2.5***
PFOA + PFOS (Calculated)	NCL	24	0.034	0.037	0.045	0.035	0.063	ND	ND	ND	ND	ND	ND	50	66	20	11
Perfluoropentanoic acid (PFPeA)	NCL	0.5	<0.0035	0.0044	0.0053	0.005	0.0075	<0.0035	<0.0036	<0.0035	<0.0037	<0.0036	<0.0039	0.16	0.34	0.069	0.15
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.036	<0.0035	<0.0036	<0.0036	<0.0037	<0.0037	<0.0035	<0.0036	<0.0035	<0.0037	<0.0036	<0.0039	<0.036	<0.072	<0.019	<0.075
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.036	<0.0035	<0.0036	<0.0036	<0.0037	<0.0037	<0.0035	<0.0036	<0.0035	<0.0037	<0.0036	<0.0039	<0.036	<0.072	<0.019	<0.075
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.036	<0.0035	<0.0036	<0.0036	<0.0037	<0.0037	<0.0035	<0.0036	<0.0035	<0.0037	<0.0036	<0.0039	<0.036	<0.072	<0.019	<0.075
Perfluoro-1-pentanesulfonate (PFPeS)	NCL	0.36	<0.0035	<0.0036	<0.0036	0.0024 [J]	0.0037	<0.0035	<0.0036	<0.0035	<0.0037	<0.0036	<0.0039	0.23	0.3	0.16	0.17
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA						<0.0074					<0.0073	<0.0077				<0.15
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL						<0.0074					<0.0073	<0.0077				<0.15
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL						<0.0074					<0.0073	<0.0077				0.17
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL						<0.0074					<0.0073	<0.0077				<0.15
Perfluorononane sulfonic acid (PFNS)	NCL	0.032 [J]	<0.0071	<0.0072	<0.0072	<0.0074	<0.0037	<0.007	<0.0071	<0.007	<0.0075	<0.0036	<0.0039	<0.073	<0.14	0.05	<0.075
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	NCL						<0.0074					<0.0073	<0.0077				<0.15
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	NCL						<0.0074					<0.0073	<0.0077				<0.15
4,8-dioxa-3H-perfluorononanoic acid	NCL						<0.0074					<0.0073	<0.0077				<0.15
Total PFAS (Calculated)	NCL	36	0.074	0.11	0.16	0.14	0.23	ND	ND	ND	ND	ND	ND	54	73	23	14

TABLE 3
SUMMARY OF GROUNDWATER SAMPLE ANALYSIS - PFAS
Former Tannery
Rockford, Kent County, Michigan

Location	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface[2]	TA-MW-304B	TA-MW-304B	TA-MW-304B	TA-MW-304B	TA-MW-305B	TA-MW-305B	TA-MW-305B	TA-MW-305C	TA-MW-305C	TA-MW-305C	TA-MW-306A	TA-MW-306A	TA-MW-306A	TA-MW-306A	TA-MW-306B	TA-MW-306B
Sample Name		TA-MW-304B	TA-GW-MW304B	TA-GW-MW-304B	TA-MW-304B	TA-MW-305B	TA-GW-MW305B	TA-MW-305B	TA-MW-305C	TA-GW-MW305C	TA-MW-305C	TA-MW-306A	TA-MW-306A DUP	TA-GW-MW306A	TA-MW-306A	TA-MW-306B	TA-GW-MW306B
Laboratory Sample ID		UF06020-009	UH10014-011	VA15036-009	wg16013-005	UF19007-008	UH21044-012	WG21079-001	UF19007-011	UH21044-013	WG21079-002	UF13013-004	UF13013-005	UH15001-005	WG16013-008	UF13013-014	UH15001-013
Sample Date		06/05/2019	08/08/2019	01/14/2020	07/13/2021	06/18/2019	08/20/2019	07/19/2021	06/18/2019	08/20/2019	07/19/2021	06/11/2019	06/11/2019	08/13/2019	07/13/2021	06/10/2019	08/14/2019
Parameter (µg/L)																	
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	0.0076	0.0065	0.01	<0.0075	0.2	0.21	<0.73	0.38	0.29	<0.75	0.006	0.0049	0.012	0.01	0.041	0.041
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.0035	<0.0037	<0.0038	<0.0075	<0.019	<0.035	<0.73	<0.036	<0.036	<0.75	<0.0034	<0.0034	<0.0035	<0.0072	<0.0036	<0.0037
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	NCL	<0.0035	<0.0037	<0.0038		<0.019	<0.035		<0.036	<0.036		<0.0034	<0.0034	<0.0035		<0.0036	<0.0037
N-Methyl perfluorooctane sulfonamide (MeFOSA)	NCL	<0.007	<0.0074	<0.0076		<0.037	<0.07		<0.072	<0.072		<0.0069	<0.0069	<0.007		<0.0073	<0.0074
Perfluorobutane sulfonic acid (PFBS)	NA	0.45	0.46	0.58	0.34	14	15	10	13	15	11	0.28	0.26	0.69	0.82	1.9	1.9
Perfluorobutanoic acid (PFBA)	NCL	0.26	0.28	0.3	0.18	4.8	4.5	3.1	5.5	5.6	4.1	0.069	0.067	0.18	0.18	0.6	0.59
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.0035	<0.0037	<0.0038	<0.0038	<0.019	<0.035	<0.37	<0.036	<0.036	<0.38	<0.0034	<0.0034	<0.0035	<0.0036	<0.0036	<0.0037
Perfluorodecanoic acid (PFDA)	NCL	0.0038	0.0053	0.0053	0.0099	<0.019	<0.035	<0.37	0.088	0.088	<0.38	0.08	0.08	0.093	0.079	0.023	0.03
Perfluorododecanoic acid (PFDoDA)	NCL	<0.0035	<0.0037	<0.0038	<0.0038	<0.019	<0.035	<0.37	<0.036	<0.036	<0.38	<0.0034	<0.0034	<0.0035	<0.0036	<0.0036	<0.0037
Perfluoroheptane sulfonic acid (PFHpS)	NCL	0.037	0.029	0.036	0.022	0.51	0.65	0.5	0.8	0.9	0.6	0.097	0.11	0.13	0.13	0.16	0.18
Perfluoroheptanoic acid (PFHpA)	NCL	0.22	0.2	0.22	0.14	8.3	8.2	4.6	8.1	10	5.4	0.12	0.12	0.25	0.34	0.9	0.8
Perfluorohexane sulfonic acid (PFHxS)	NA	0.4	0.34	0.42	0.25	5	4.6	3.8	5.7	6.1	4.5	0.27	0.29	0.52	0.64	1	1.2
Perfluorohexanoic acid (PFHxA)	NA	0.59	0.52	0.58	0.4	23	22	13	21	22	15	0.14	0.14	0.33	0.34	1.1	0.94
Perfluorononanoic acid (PFNA)	NA	0.013	0.015	0.016	0.014	0.094	0.11	<0.37	0.24	0.23	<0.38	0.062	0.062	0.091	0.086	0.064	0.068
Perfluorooctane sulfonamide (FOSA)	NCL	0.0071	0.013	0.01	0.016	<0.019	<0.035	<0.37	<0.036	<0.036	<0.38	0.23	0.22	0.15	0.17	0.038	0.091
Perfluorooctane sulfonic acid (PFOS)	0.011 (X)	***1.1***	***1***	***1.4***	***1.2***	***23***	25 [B]	20 [B]	***32***	39 [B]	29 [B]	***8.6***	***9.1***	***8.9***	***8.5***	***7.1***	***6.9***
Perfluorooctanoic acid (PFOA)	0.42 (X)	***0.8***	***0.92***	***0.98***	***0.69***	***32***	29 [B]	***20***	***42***	44 [B]	***30***	***1***	***1.1***	***2.2***	***2.6***	***6.6***	***6.4***
PFOA + PFOS (Calculated)	NCL	1.9	1.9	2.4	1.9	55	54	40	74	83	59	9.6	10	11	11	14	13
Perfluoropentanoic acid (PFPeA)	NCL	0.13	0.12	0.17	0.092	5.1	4.5	3.3	4.8	5.3	3.5	0.066	0.069	0.17	0.17	0.47	0.45
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.0035	<0.0037	<0.0038	<0.0038	<0.019	<0.035	<0.37	<0.036	<0.036	<0.38	<0.0034	<0.0034	<0.0035	<0.0036	<0.0036	<0.0037
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.0035	<0.0037	<0.0038	<0.0038	<0.019	<0.035	<0.37	<0.036	<0.036	<0.38	<0.0034	<0.0034	<0.0035	<0.0036	<0.0036	<0.0037
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.0035	<0.0037	<0.0038	<0.0038	<0.019	<0.035	<0.37	<0.036	<0.036	<0.38	<0.0034	<0.0034	<0.0035	<0.0036	<0.0036	<0.0037
Perfluoro-1-pentanesulfonate (PFPeS)	NCL	0.12	0.094	0.14	0.07	1.9	2.1	1.3	2.3	2.6	1.7	0.052	0.048	0.11	0.15	0.31	0.3
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA				<0.0075			<0.73			<0.75				<0.0072		
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL				0.013			<0.73			<0.75				0.036		
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL				0.02			<0.73			<0.75				0.063		
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL				<0.0075			<0.73			<0.75				<0.0072		
Perfluorononane sulfonic acid (PFNS)	NCL	<0.007	<0.0074	<0.0076	<0.0038	<0.037	<0.07	<0.37	<0.072	<0.072	<0.38	<0.0069	<0.0069	<0.007	0.0052	<0.0073	0.0081
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	NCL				<0.0075			<0.73			<0.75				<0.0072		
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	NCL				<0.0075			<0.73			<0.75				<0.0072		
4,8-dioxa-3H-perfluorononanoic acid	NCL				<0.0075			<0.73			<0.75				<0.0072		
Total PFAS (Calculated)	NCL	4.1	4	4.9	3.5	120	120	80	140	150	100	11	12	14	14	20	20

TABLE 3
SUMMARY OF GROUNDWATER SAMPLE ANALYSIS - PFAS
Former Tannery
Rockford, Kent County, Michigan

Location	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface[2]	TA-MW-306B	TA-MW-307A	TA-MW-307A	TA-MW-307A	TA-MW-307B	TA-MW-307B	TA-MW-307B	TA-MW-308A	TA-MW-308A	TA-MW-308A	TA-MW-308B	TA-MW-308B	TA-MW-308B	TA-MW-308C	TA-MW-308C	TA-MW-309A
Sample Name		TA-MW-306B	TA-MW-307A	TA-GW-MW307A	TA-GW-MW-307A	TA-MW-307B	TA-GW-MW307B	TA-GW-ME-307B	TA-MW-308A	TA-MW-308A	TA-GW-MW308A	TA-MW-308B	TA-GW-MW308B	TA-MW-308B	TA-MW-308C	TA-GW-MW308C	TA-MW-309A
Laboratory Sample ID		WG16013-006	UF13013-010	UH15001-002	VA11008-003	UF13013-012	UH10014-006	VA11008-002	UA26009-001	UF19007-012	UH17008-005	UA26009-002	UH07038-002	WF25013-001	UA26009-003	UH10014-016	UB07090-012
Sample Date		07/13/2021	06/10/2019	08/13/2019	01/09/2020	06/10/2019	08/08/2019	01/09/2020	01/24/2019	06/18/2019	08/15/2019	01/24/2019	08/06/2019	06/22/2021	01/24/2019	08/07/2019	02/06/2019
Parameter (µg/L)																	
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	0.013	<0.0035	<0.0036	0.014	<0.0035	<0.0036	<0.0038	<0.02	0.012	<0.018	<0.0038	<0.0038	<0.012	<0.0038	<0.0038	<0.0039
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.0075	<0.0035	<0.0036	<0.0036	<0.0035	<0.0036	<0.0038	<0.02	<0.0036	<0.018	<0.0038	<0.0038	<0.012	<0.0038	<0.0038	<0.0039
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	NCL		<0.0035	<0.0036	<0.0036	<0.0035	<0.0036	<0.0038	<0.02	<0.0036	<0.018	<0.0038	<0.0038		<0.0038	<0.0038	<0.0039
N-Methyl perfluorooctane sulfonamide (MeFOSA)	NCL		<0.007	<0.0073	<0.0073	<0.007	<0.0073	<0.0077	<0.039	<0.0072	<0.036	<0.0077	<0.0076		<0.0076	<0.0075	<0.0079
Perfluorobutane sulfonic acid (PFBS)	NA	1.2	0.52	0.62	0.79	0.21	0.22	0.19	0.54	1	0.99	<0.0038	<0.0038	<0.0062	<0.0038	<0.0038	0.3
Perfluorobutanoic acid (PFBA)	NCL	0.25	0.08	0.11	0.26	0.083	0.083	0.077	0.28	0.4	0.37	<0.0038	<0.0038	<0.0062	<0.0038	0.0057	0.047
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.0038	<0.0035	<0.0036	<0.0036	<0.0035	<0.0036	<0.0038	<0.02	<0.0036	<0.018	<0.0038	<0.0038	<0.0062	<0.0038	<0.0038	<0.0039
Perfluorodecanoic acid (PFDA)	NCL	0.02	<0.0035	<0.0036	0.0099	<0.0035	<0.0036	<0.0038	<0.02	0.012	<0.018	<0.0038	<0.0038	<0.0062	<0.0038	<0.0038	<0.0039
Perfluorododecanoic acid (PFDoDA)	NCL	<0.0038	<0.0035	<0.0036	<0.0036	<0.0035	<0.0036	<0.0038	<0.02	<0.0036	<0.018	<0.0038	<0.0038	<0.0062	<0.0038	<0.0038	<0.0039
Perfluoroheptane sulfonic acid (PFHpS)	NCL	0.12	0.26	0.25	0.21	<0.0035	<0.0036	0.0028 [J]	0.25	0.23	0.33	<0.0038	<0.0038	<0.0062	<0.0038	<0.0038	0.18
Perfluoroheptanoic acid (PFHpA)	NCL	0.45	0.41	0.46	0.55	0.081	0.083	0.073	0.86	1	1.2	<0.0038	<0.0038	<0.0062	<0.0038	<0.0038	0.13
Perfluorohexane sulfonic acid (PFHxS)	NA	0.69	0.9	0.92	0.84	0.045	0.038	0.039	0.75	1	1.1	<0.0038	<0.0038	<0.0062	<0.0038	<0.0038	0.34
Perfluorohexanoic acid (PFHxA)	NA	0.53	0.32	0.36	0.68	0.18	0.16	0.16	0.87	1.2	1.3	<0.0038	<0.0038	<0.0062	<0.0038	0.0039	0.12
Perfluorononanoic acid (PFNA)	NA	0.051	0.039	0.04	0.052	<0.0035	<0.0036	0.0011 [J]	0.09	0.091	0.11	<0.0038	<0.0038	<0.0062	<0.0038	<0.0038	0.04
Perfluorooctane sulfonamide (FOSA)	NCL	0.1	<0.0035	<0.0036	<0.0036	<0.0035	<0.0036	<0.0038	<0.02	0.016	0.037	<0.0038	<0.0038	<0.0062	<0.0038	<0.0038	0.15
Perfluorooctane sulfonic acid (PFOS)	0.011 (X)	***6.1***	***4.3***	***4.1***	***3.8***	0.011	***0.014***	***0.014***	***11***	***10***	***16***	<0.0038	<0.0038	<0.0062	0.0064	0.0075	***9***
Perfluorooctanoic acid (PFOA)	0.42 (X)	***4***	***3.4***	***4***	***4.1***	0.29	0.3	0.27	***7.8***	***9.6***	***12***	<0.0019	<0.0019	<0.0062	0.0041	0.0034	***2.3***
PFOA + PFOS (Calculated)	NCL	10	7.7	8.1	7.9	0.3	0.31	0.28	19	20	28	ND	ND	ND	0.011	0.011	11
Perfluoropentanoic acid (PFPeA)	NCL	0.23	0.12	0.14	0.25	0.072	0.068	0.062	0.8	0.9	0.98	<0.0038	<0.0038	<0.0062	<0.0038	<0.0038	0.062
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.0038	<0.0035	<0.0036	<0.0036	<0.0035	<0.0036	<0.0038	<0.02	<0.0036	<0.018	<0.0038	<0.0038	<0.0062	<0.0038	<0.0038	<0.0039
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.0038	<0.0035	<0.0036	<0.0036	<0.0035	<0.0036	<0.0038	<0.02	<0.0036	<0.018	<0.0038	<0.0038	<0.0062	<0.0038	<0.0038	0.017
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.0038	<0.0035	<0.0036	<0.0036	<0.0035	<0.0036	<0.0038	<0.02	<0.0036	<0.018	<0.0038	<0.0038	<0.0062	<0.0038	<0.0038	<0.0039
Perfluoro-1-pentanesulfonate (PFPeS)	NCL	0.16	0.23	0.26	0.24	0.022	0.021	0.021	0.12	0.21	0.2	<0.0038	<0.0038	<0.0062	<0.0038	<0.0038	0.074
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA	<0.0075												<0.012			
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL	0.058												<0.012			
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL	1												<0.012			
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL	<0.0075												<0.012			
Perfluorononane sulfonic acid (PFNS)	NCL	0.0058	<0.007	<0.0073	<0.0073	<0.007	<0.0073	<0.0077	<0.039	<0.0072	<0.036	<0.0077	<0.0076	<0.0062	<0.0076	<0.0075	<0.0079
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	NCL	<0.0075												<0.012			
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	NCL	<0.0075												<0.012			
4,8-dioxa-3H-perfluorononanoic acid	NCL	<0.0075												<0.012			
Total PFAS (Calculated)	NCL	15	11	11	12	0.99	0.99	0.91	23	26	35	ND	ND	ND	0.011	0.021	13

TABLE 3
SUMMARY OF GROUNDWATER SAMPLE ANALYSIS - PFAS
Former Tannery
Rockford, Kent County, Michigan

Location	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface[2]	TA-MW-309A	TA-MW-309A	TA-MW-309A	TA-MW-309A	TA-MW-309B	TA-MW-309B	TA-MW-309B	TA-MW-309B	TA-MW-309B	TA-MW-309C	TA-MW-309C	TA-MW-309C	TA-MW-309C	TA-MW-309C	TA-MW-309D	TA-MW-309D
Sample Name		TA-MW-309A	TA-GW-MW309A	TA-GW-MW-309A	TA-MW-309A	TA-MW-309B	TA-MW-309B	TA-GW-MW309B	TA-GW-MW-309B	TA-MW-309B	TA-MW-309C	TA-MW-309C	TA-GW-MW309C	TA-GW-MW-309C	TA-MW-309C	TA-MW-309D	TA-MW-309D
Laboratory Sample ID		UF08017-017	UH15001-001	UL19062-021	WG16013-014	UB07090-010	UF13013-006	UH15001-004	UL19062-027	WG16013-015	UB07090-011	UF13013-003	UH17008-012	UL19062-019	WG16013-016	UB07090-024	UF13013-024
Sample Date		06/06/2019	08/13/2019	12/19/2019	07/14/2021	02/06/2019	06/11/2019	08/13/2019	12/20/2019	07/14/2021	02/06/2019	06/11/2019	08/16/2019	12/19/2019	07/14/2021	02/07/2019	06/12/2019
Parameter (µg/L)																	
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	<0.0034	<0.0036	<0.004	<0.35	<0.036	<0.0035	<0.0035	<0.0037	<0.35	<0.019	<0.017	<0.018	<0.0036	<0.36	<0.037	<0.035
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.0034	<0.0036	<0.004	<0.35	<0.036	<0.0035	<0.0035	<0.0037	<0.35	<0.019	<0.017	<0.018	<0.0036	<0.36	<0.037	<0.035
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	NCL	<0.0034	<0.0036	<0.004		<0.036	<0.0035	<0.0035	<0.0037		<0.019	<0.017	<0.018	<0.0036		<0.037	<0.035
N-Methyl perfluorooctane sulfonamide (MeFOSA)	NCL	<0.0069	<0.0073	<0.0079		<0.073	<0.007	<0.007	<0.0074		<0.038	<0.035	<0.037	<0.0072		<0.074	<0.069
Perfluorobutane sulfonic acid (PFBS)	NA	0.37	0.3	0.2	0.18	0.35	0.23	0.27	0.22	0.18	0.4	0.34	0.42	0.29	0.39	0.65	0.55
Perfluorobutanoic acid (PFBA)	NCL	0.057	0.052	0.042	<0.18	0.072	0.055	0.071	0.051	<0.18	0.084	0.076	0.11	0.068	<0.18	0.16	0.13
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.0034	0.0043	<0.004	<0.18	<0.036	<0.0035	<0.0035	<0.0037	<0.18	<0.019	<0.017	<0.018	<0.0036	<0.18	<0.037	<0.035
Perfluorodecanoic acid (PFDA)	NCL	<0.0034	<0.0036	<0.004	<0.18	<0.036	0.004	0.0053	0.0039	<0.18	<0.019	<0.017	<0.018	<0.0036	<0.18	<0.037	0.038
Perfluorododecanoic acid (PFDoDA)	NCL	<0.0034	<0.0036	<0.004	<0.18	<0.036	<0.0035	<0.0035	<0.0037	<0.18	<0.019	<0.017	<0.018	<0.0036	<0.18	<0.037	<0.035
Perfluoroheptane sulfonic acid (PFHpS)	NCL	0.2	0.21	0.16	<0.18	0.25	0.17	0.2	0.14	<0.18	0.36	0.22	0.29	0.2	0.22	0.28	0.33
Perfluoroheptanoic acid (PFHpA)	NCL	0.16	0.15	0.091	<0.18	0.24	0.13	0.16	0.1	<0.18	0.29	0.22	0.3	0.19	0.26	0.82	0.42
Perfluorohexane sulfonic acid (PFHxS)	NA	0.39	0.4	0.25	<0.18	0.66	0.37	0.37	0.28	0.29	0.81	0.55	0.69	0.49	0.64	1.1	0.8
Perfluorohexanoic acid (PFHxA)	NA	0.14	0.13	0.071	<0.18	0.19	0.13	0.18	0.099	<0.18	0.28	0.24	0.33	0.18	0.24	0.85	0.48
Perfluorononanoic acid (PFNA)	NA	0.046	0.05	0.035	<0.18	0.073	0.043	0.065	0.045	<0.18	0.065	0.055	0.072	0.057	<0.18	0.062	0.079
Perfluorooctane sulfonamide (FOSA)	NCL	0.12	0.27	0.15	0.18	<0.036	0.028	0.033	0.026	<0.18	<0.019	<0.017	<0.018	<0.0036	<0.18	<0.037	<0.035
Perfluorooctane sulfonic acid (PFOS)	0.011 (X)	***7.2***	***8.7***	***5.1***	***5.2***	***26***	***9.2***	***8.6***	***9.4***	***10***	***21***	***17***	***19***	***14***	***15***	***34***	***35***
Perfluorooctanoic acid (PFOA)	0.42 (X)	***2***	***2.1***	***1.2***	***0.74***	***3.6***	***2.1***	***2.4***	***1.5***	***1.5***	***5.6***	***3.5***	***3.9***	***2.5***	***3***	***13***	***6***
PFOA + PFOS (Calculated)	NCL	9.2	11	6.3	5.9	30	11	11	11	12	27	21	23	17	18	47	41
Perfluoropentanoic acid (PFPeA)	NCL	0.077	0.076	0.057	<0.18	0.084	0.068	0.097	0.063	<0.18	0.11	0.1	0.15	0.088	<0.18	0.21	0.16
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.0034	<0.0036	<0.004	<0.18	<0.036	<0.0035	<0.0035	<0.0037	<0.18	<0.019	<0.017	<0.018	<0.0036	<0.18	<0.037	<0.035
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.0034	0.0063	<0.004	<0.18	<0.036	<0.0035	<0.0035	<0.0037	<0.18	<0.019	<0.017	<0.018	<0.0036	<0.18	<0.037	<0.035
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.0034	<0.0036	0.33	<0.18	<0.036	<0.0035	<0.0035	<0.0037	<0.18	<0.019	<0.017	<0.018	0.019	<0.18	<0.037	<0.035
Perfluoro-1-pentanesulfonate (PFPeS)	NCL	0.084	0.083	0.042	<0.18	0.13	0.081	0.092	0.066	<0.18	0.14	0.12	0.16	0.1	<0.18	0.21	0.16
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA				<0.35					<0.35					<0.36		
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL				<0.35					<0.35					<0.36		
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL				0.84					<0.35					<0.36		
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL				<0.35					<0.35					<0.36		
Perfluorononane sulfonic acid (PFNS)	NCL	0.0075	0.0097	<0.0079	<0.18	<0.073	<0.007	<0.007	<0.0074	<0.18	<0.038	<0.035	<0.037	<0.0072	<0.18	<0.074	<0.069
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	NCL				<0.35					<0.35					<0.36		
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	NCL				<0.35					<0.35					<0.36		
4,8-dioxa-3H-perfluorononanoic acid	NCL				<0.35					<0.35					<0.36		
Total PFAS (Calculated)	NCL	11	13	7.7	7.1	32	13	13	12	12	29	22	25	18	20	51	44

TABLE 3
SUMMARY OF GROUNDWATER SAMPLE ANALYSIS - PFAS
Former Tannery
Rockford, Kent County, Michigan

Location	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface[2]	TA-MW-309D	TA-MW-309D	TA-MW-309D	TA-MW-310A	TA-MW-310A	TA-MW-310A	TA-MW-310B	TA-MW-310B	TA-MW-310B	TA-MW-310B	TA-MW-310B	TA-MW-310B	TA-MW-310C	TA-MW-310C	TA-MW-310C	TA-MW-310C
Sample Name		TA-GW-MW309D	TA-GW-MW-309D	TA-TMW-309D	TA-MW-310A	TA-MW-310A	TA-GW-MW-310A	TA-MW-310B	TA-MW-310B	TA-GW-MW310B	TA-GW-MW-310B	TA-MW-310B	TA-MW-310B DUP	TA-MW-310C	TA-MW-310C	TA-GW-MW310C	TA-GW-MW-310C
Laboratory Sample ID		UH21044-005	UL19062-017	WG17016-003	UB07090-004	UF06020-004	UL19062-016	UB07090-005	UF06020-006	UH10014-005	UL19062-018	WF26013-005	WF26013-006	UB07090-006	UF06020-005	UH10014-002	UL19062-020
Sample Date		08/19/2019	12/19/2019	07/15/2021	02/05/2019	06/04/2019	12/19/2019	02/05/2019	06/04/2019	08/08/2019	12/19/2019	06/24/2021	06/24/2021	02/05/2019	06/04/2019	08/08/2019	12/19/2019
Parameter (µg/L)																	
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	<0.037	<0.0034	<0.36	<0.0039	<0.0036	<0.0038	<0.0039	<0.0036	<0.0036	<0.0039	<0.0078	<0.0075	<0.0039	<0.0036	<0.0037	<0.004
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.037	<0.0034	<0.36	<0.0039	<0.0036	<0.0038	<0.0039	<0.0036	<0.0036	<0.0039	<0.0078	<0.0075	<0.0039	<0.0036	<0.0037	<0.004
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	NCL	<0.037	<0.0034		<0.0039	<0.0036	<0.0038	<0.0039	<0.0036	<0.0036	<0.0039			<0.0039	<0.0036	<0.0037	<0.004
N-Methyl perfluorooctane sulfonamide (MeFOSA)	NCL	<0.075	<0.0069		<0.0078	<0.0072	<0.0075	<0.0078	<0.0071	<0.0073	<0.0079			<0.0078	<0.0072	<0.0073	<0.0079
Perfluorobutane sulfonic acid (PFBS)	NA	0.56	0.047	0.28	0.18	0.1	0.42	0.22	0.097	0.12	0.17	0.36	0.34	0.15	0.17	0.19	0.17
Perfluorobutanoic acid (PFBA)	NCL	0.15	0.0078	<0.18	0.037	0.024	0.072	0.045	0.024	0.029	<0.0039	0.072	0.071	0.14	0.15	0.15	0.14
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.037	<0.0034	<0.18	<0.0039	<0.0036	<0.0038	<0.0039	<0.0036	<0.0036	<0.0039	<0.0039	<0.0038	<0.0039	<0.0036	<0.0037	<0.004
Perfluorodecanoic acid (PFDA)	NCL	0.056	<0.0034	<0.18	0.021	0.023	0.049	0.043	0.045	0.052	<0.0039	0.067	0.063	<0.0039	<0.0036	<0.0037	<0.004
Perfluorododecanoic acid (PFDoDA)	NCL	<0.037	<0.0034	<0.18	<0.0039	<0.0036	<0.0038	<0.0039	<0.0036	<0.0036	<0.0039	<0.0039	<0.0038	<0.0039	<0.0036	<0.0037	<0.004
Perfluoroheptane sulfonic acid (PFHpS)	NCL	0.35	<0.0034	<0.18	0.029	0.021	0.039	0.048	0.031	0.032	<0.0039	0.049	0.049	<0.0039	<0.0036	<0.0037	<0.004
Perfluoroheptanoic acid (PFHpA)	NCL	0.78	0.0094	<0.18	0.084	0.05	0.15	0.1	0.059	0.064	0.063	0.13	0.13	0.13	0.15	0.14	0.14
Perfluorohexane sulfonic acid (PFHxS)	NA	0.98	<0.0034	0.33	0.18	0.096	0.33	0.26	0.14	0.14	0.02	0.32	0.31	0.026	0.027	0.034	0.039
Perfluorohexanoic acid (PFHxA)	NA	0.92	0.047	<0.18	0.084	0.048	0.17	0.095	0.055	0.061	0.21	0.15	0.15	0.28	0.27	0.3	0.26
Perfluorononanoic acid (PFNA)	NA	0.091	<0.0034	<0.18	0.0065	0.0063	0.0087	0.012	0.011	0.012	0.0046	0.011	0.011	<0.0039	<0.0036	<0.0037	<0.004
Perfluorooctane sulfonamide (FOSA)	NCL	<0.037	<0.0034	<0.18	0.51	0.56	0.54	0.84	0.7	0.85	<0.0039	1	0.96	<0.0039	<0.0036	<0.0037	<0.004
Perfluorooctane sulfonic acid (PFOS)	0.011 (X)	***43***	<0.0034	***13***	***1.1***	***1.1***	***1.2***	***2.5***	***2.1***	***2***	<0.0039	***1.7***	***1.8***	0.0058	0.0044	0.0037	0.0064
Perfluorooctanoic acid (PFOA)	0.42 (X)	***9.5***	0.013	***1.8***	***0.68***	***0.44***	***0.77***	***0.96***	***0.63***	***0.61***	0.12	***0.74***	***0.78***	0.12	0.18	0.24	0.22
PFOA + PFOS (Calculated)	NCL	53	0.013	15	1.8	1.5	2	3.5	2.7	2.6	0.12	2.4	2.6	0.13	0.18	0.24	0.23
Perfluoropentanoic acid (PFPeA)	NCL	0.25	0.028	<0.18	0.075	0.039	0.17	0.09	0.041	0.047	0.037	0.14	0.14	0.16	0.18	0.18	0.16
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.037	<0.0034	<0.18	<0.0039	<0.0036	<0.0038	<0.0039	<0.0036	<0.0036	<0.0039	<0.0039	<0.0038	<0.0039	<0.0036	<0.0037	<0.004
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.037	<0.0034	<0.18	<0.0039	<0.0036	<0.0038	<0.0039	<0.0036	<0.0036	<0.0039	<0.0039	<0.0038	<0.0039	<0.0036	<0.0037	<0.004
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.037	<0.0034	<0.18	<0.0039	<0.0036	<0.0038	<0.0039	<0.0036	<0.0036	<0.0039	<0.0039	<0.0038	<0.0039	<0.0036	<0.0037	<0.004
Perfluoro-1-pentanesulfonate (PFPeS)	NCL	0.21	<0.0034	<0.18	0.055	0.032	0.11	0.067	0.035	0.041	0.0097	0.093	0.094	0.055	0.063	0.075	0.068
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA			<0.36								<0.0078	<0.0075				
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL			<0.36								0.48	0.36				
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL			<0.36								1.9	1.9				
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL			<0.36								<0.0078	<0.0075				
Perfluorononane sulfonic acid (PFNS)	NCL	<0.075	<0.0069	<0.18	<0.0078	<0.0072	<0.0075	<0.0078	<0.0071	<0.0073	<0.0079	<0.0039	<0.0038	<0.0078	<0.0072	<0.0073	<0.0079
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	NCL			<0.36								<0.0078	<0.0075				
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	NCL			<0.36								<0.0078	<0.0075				
4,8-dioxa-3H-perfluorononanoic acid	NCL			<0.36								<0.0078	<0.0075				
Total PFAS (Calculated)	NCL	57	0.15	15	3	2.5	4	5.3	4	4.1	0.63	7.2	7.2	1.1	1.2	1.3	1.2

TABLE 3
SUMMARY OF GROUNDWATER SAMPLE ANALYSIS - PFAS
Former Tannery
Rockford, Kent County, Michigan

Location	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface[2]	TA-MW-310C	TA-MW-311A	TA-MW-311A	TA-MW-311A	TA-MW-311A	TA-MW-311B	TA-MW-311B	TA-MW-311B	TA-MW-311C	TA-MW-311C	TA-MW-311C	TA-MW-312	TA-MW-312	TA-MW-312	TA-MW-312	TA-MW-312
Sample Name		TA-MW-310C	TA-MW-311	TA-MW-311A	TA-GW-MW311A	TA-GW-MW-311A	TA-MW-311B	TA-GW-MW311B	TA-GW-MW-311B	TA-MW-311C	TA-GW-MW311C	TA-GW-MW-311C	TA-MW-312	TA-MW-312	TA-MW-312	TA-GW-MW312	TA-GW-MW-312
Laboratory Sample ID		wg16013-007	UA26009-007	UF06020-003	UH07038-006	UL19062-008	UF06020-002	UH10014-015	UL19062-009	UF06020-001	UH07038-007	UL19062-010	UA26009-008	UD03042-001	UF05051-017	UH15001-003	UL19062-005
Sample Date		07/13/2021	01/22/2019	06/04/2019	08/06/2019	12/17/2019	06/04/2019	08/07/2019	12/17/2019	06/04/2019	08/06/2019	12/17/2019	01/22/2019	03/15/2019	06/03/2019	08/13/2019	12/18/2019
Parameter (µg/L)																	
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	<0.0073	<0.0038	<0.0036	<0.0036	<0.0039	<0.0036	<0.0037	<0.0039	<0.0036	<0.0036	<0.0038	<0.004	<0.0036	<0.018	<0.0036	<0.0036
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.0073	<0.0038	<0.0036	<0.0036	<0.0039	<0.0036	<0.0037	<0.0039	<0.0036	<0.0036	<0.0038	<0.004	<0.0036	<0.018	<0.0036	<0.0036
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	NCL		<0.0038	<0.0036	<0.0036	<0.0039	<0.0036	<0.0037	<0.0039	<0.0036	<0.0036	<0.0038	<0.004	<0.0036	<0.018	<0.0036	<0.0036
N-Methyl perfluorooctane sulfonamide (MeFOSA)	NCL		<0.0077	<0.0071	<0.0072	<0.0078	<0.0073	<0.0074	<0.0077	<0.0071	<0.0072	<0.0076	<0.0079	<0.0071	<0.035	<0.0072	<0.0072
Perfluorobutane sulfonic acid (PFBS)	NA	0.19	0.035	0.034	0.027	0.016	<0.0036	<0.0037	<0.0039	<0.0036	<0.0036	<0.0038	<0.004	<0.0036	0.14	0.0075	0.018
Perfluorobutanoic acid (PFBA)	NCL	0.15	0.01	0.011	0.0097	0.0053	<0.0036	<0.0037	<0.0039	<0.0036	<0.0036	<0.0038	<0.004	<0.0036	0.028	<0.0036	0.004
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.0036	<0.0038	<0.0036	<0.0036	<0.0039	<0.0036	<0.0037	<0.0039	<0.0036	<0.0036	<0.0038	<0.004	<0.0036	<0.018	<0.0036	<0.0036
Perfluorodecanoic acid (PFDA)	NCL	<0.0036	<0.0038	<0.0036	<0.0036	<0.0039	<0.0036	<0.0037	<0.0039	<0.0036	<0.0036	<0.0038	<0.004	<0.0036	<0.018	<0.0036	<0.0036
Perfluorododecanoic acid (PFDoDA)	NCL	<0.0036	<0.0038	<0.0036	<0.0036	<0.0039	<0.0036	<0.0037	<0.0039	<0.0036	<0.0036	<0.0038	<0.004	<0.0036	<0.018	<0.0036	<0.0036
Perfluoroheptane sulfonic acid (PFHpS)	NCL	<0.0036	0.02	0.026	0.019	0.014	<0.0036	<0.0037	<0.0039	<0.0036	<0.0036	<0.0038	<0.004	<0.0036	0.13	0.0052	0.021
Perfluoroheptanoic acid (PFHpA)	NCL	0.16	0.014	0.016	0.013	0.0074	<0.0036	<0.0037	<0.0039	<0.0036	<0.0036	<0.0038	<0.004	<0.0036	0.058	0.0048	0.0098
Perfluorohexane sulfonic acid (PFHxS)	NA	0.047	0.035	0.044	0.032	0.018	<0.0036	<0.0037	<0.0039	<0.0036	<0.0036	<0.0038	<0.004	<0.0036	0.14	0.0096	0.025
Perfluorohexanoic acid (PFHxA)	NA	0.29	0.02	0.022	0.018	0.012	<0.0036	<0.0037	<0.0039	<0.0036	<0.0036	<0.0038	<0.004	<0.0036	0.066	0.0042	0.0089
Perfluorononanoic acid (PFNA)	NA	<0.0036	<0.0038	0.0042	<0.0036	<0.0039	<0.0036	<0.0037	<0.0039	<0.0036	<0.0036	<0.0038	<0.004	<0.0036	0.023	<0.0036	<0.0036
Perfluorooctane sulfonamide (FOSA)	NCL	<0.0036	<0.0038	<0.0036	<0.0036	<0.0039	<0.0036	<0.0037	<0.0039	<0.0036	<0.0036	<0.0038	<0.004	<0.0036	0.031	<0.0036	<0.0036
Perfluorooctane sulfonic acid (PFOS)	0.011 (X)	***0.012***	***0.64***	***1.2***	***0.69***	***0.84***	0.0038	<0.0037	<0.0039	<0.0036	<0.0036	<0.0038	0.0093	0.0098	***7.7***	***0.079***	***0.4***
Perfluorooctanoic acid (PFOA)	0.42 (X)	0.29	0.12	0.17	0.14	0.079	<0.0018	<0.0018	<0.0019	<0.0018	<0.0018	<0.0019	0.0023	0.0037	***0.71***	0.043	0.11
PFOA + PFOS (Calculated)	NCL	0.3	0.76	1.4	0.83	0.92	0.0038	ND	ND	ND	ND	ND	0.012	0.014	8.4	0.12	0.51
Perfluoropentanoic acid (PFPeA)	NCL	0.18	0.012	0.012	0.0091	0.007	<0.0036	<0.0037	<0.0039	<0.0036	<0.0036	<0.0038	<0.004	<0.0036	0.038	<0.0036	0.0049
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.0036	<0.0038	<0.0036	<0.0036	<0.0039	<0.0036	<0.0037	<0.0039	<0.0036	<0.0036	<0.0038	<0.004	<0.0036	<0.018	<0.0036	<0.0036
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.0036	<0.0038	<0.0036	<0.0036	<0.0039	<0.0036	<0.0037	<0.0039	<0.0036	<0.0036	<0.0038	<0.004	<0.0036	<0.018	<0.0036	<0.0036
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.0036	<0.0038	<0.0036	<0.0036	<0.0039	<0.0036	<0.0037	<0.0039	<0.0036	<0.0036	<0.0038	<0.004	<0.0036	<0.018	<0.0036	<0.0036
Perfluoro-1-pentanesulfonate (PFPeS)	NCL	0.074	0.0059	0.0061	0.0053	<0.0039	<0.0036	<0.0037	<0.0039	<0.0036	<0.0036	<0.0038	<0.004	<0.0036	0.02	<0.0036	0.0043
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA	<0.0073															
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL	<0.0073															
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL	<0.0073															
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL	<0.0073															
Perfluorononane sulfonic acid (PFNS)	NCL	<0.0036	<0.0077	<0.0071	<0.0072	<0.0078	<0.0073	<0.0074	<0.0077	<0.0071	<0.0072	<0.0076	<0.0079	<0.0071	<0.035	<0.0072	<0.0072
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	NCL	<0.0073															
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	NCL	<0.0073															
4,8-dioxa-3H-perfluorononanoic acid	NCL	<0.0073															
Total PFAS (Calculated)	NCL	1.4	0.91	1.5	0.96	1	0.0038	ND	ND	ND	ND	ND	0.012	0.014	9.1	0.15	0.61

TABLE 3
SUMMARY OF GROUNDWATER SAMPLE ANALYSIS - PFAS
Former Tannery
Rockford, Kent County, Michigan

Location	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface[2]	TA-MW-313A	TA-MW-313A	TA-MW-313A	TA-MW-313A	TA-MW-313B	TA-MW-313B	TA-MW-313B	TA-MW-313B	TA-MW-313C	TA-MW-313C	TA-MW-313C	TA-MW-313C	TA-MW-313C	TA-MW-314A	TA-MW-314B	TA-MW-314C
Sample Name		TA-MW-313A	TA-MW-313A	TA-GW-MW313A	TA-GW-MW-313A	TA-MW-313B	TA-MW-313B	TA-GW-MW313B	TA-GW-MW-313B	TA-MW-313C	TA-MW-313C	TA-MW-313C DUP	TA-GW-MW313C	TA-GW-MW-313C	TA-GW-MW-314A	TA-GW-MW-314B	TA-GW-MW-314C
Laboratory Sample ID		UB07090-003	UF06020-008	UH10014-014	UL19062-024	UA26009-009	UF05051-018	UH10014-012	UL19062-026	UA26009-010	UF05051-019	UF05051-020	UH10014-013	UL19062-025	VA09002-004	VA09002-001	VA09002-003
Sample Date		02/05/2019	06/05/2019	08/07/2019	12/20/2019	01/22/2019	06/03/2019	08/07/2019	12/20/2019	01/22/2019	06/03/2019	06/03/2019	08/07/2019	12/20/2019	01/06/2020	01/06/2020	01/06/2020
Parameter (µg/L)																	
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	<0.0036	<0.0035	<0.0036	<0.0036	<0.0039	<0.0036	<0.0037	<0.0039	<0.004	<0.0036	<0.0036	<0.0037	<0.0036	<0.0037	<0.0037	<0.0036
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.0036	<0.0035	<0.0036	<0.0036	<0.0039	<0.0036	<0.0037	<0.0039	<0.004	<0.0036	<0.0036	<0.0037	<0.0036	<0.0037	<0.0037	<0.0036
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	NCL	<0.0036	<0.0035	<0.0036	<0.0036	<0.0039	<0.0036	<0.0037	<0.0039	<0.004	<0.0036	<0.0036	<0.0037	<0.0036	<0.0037	<0.0037	<0.0036
N-Methyl perfluorooctane sulfonamide (MeFOSA)	NCL	<0.0072	<0.007	<0.0072	<0.0073	<0.0078	<0.0071	<0.0073	<0.0078	<0.0081	<0.0072	<0.0072	<0.0074	<0.0071	<0.0074	<0.0075	<0.0072
Perfluorobutane sulfonic acid (PFBS)	NA	0.14	0.14	0.17	0.14	0.069	0.077	0.077	0.074	0.024	0.028	0.026	0.027	0.034	0.011	0.021	0.18
Perfluorobutanoic acid (PFBA)	NCL	0.043	0.066	0.057	0.045	0.02	0.024	0.023	0.022	0.0087	0.013	0.013	0.012	0.012	0.0068	0.0081	0.017
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.0036	<0.0035	<0.0036	<0.0036	<0.0039	<0.0036	<0.0037	<0.0039	<0.004	<0.0036	<0.0036	<0.0037	<0.0036	<0.0037	<0.0037	<0.0036
Perfluorodecanoic acid (PFDA)	NCL	<0.0036	<0.0035	<0.0036	<0.0036	<0.0039	<0.0036	<0.0037	<0.0039	<0.004	<0.0036	<0.0036	<0.0037	<0.0036	<0.0037	<0.0037	<0.0036
Perfluorododecanoic acid (PFDoDA)	NCL	<0.0036	<0.0035	<0.0036	<0.0036	<0.0039	<0.0036	<0.0037	<0.0039	<0.004	<0.0036	<0.0036	<0.0037	<0.0036	<0.0037	<0.0037	<0.0036
Perfluoroheptane sulfonic acid (PFHpS)	NCL	0.038	0.081	0.061	0.043	0.0048	0.0081	0.0088	0.011	0.007	0.0036	<0.0036	<0.0037	0.0046	0.0026 [J]	0.0077	0.059
Perfluoroheptanoic acid (PFHpA)	NCL	0.14	0.25	0.18	0.16	0.034	0.037	0.033	0.03	0.019	0.018	0.018	0.022	0.027	0.0033 [J]	0.0041	0.063
Perfluorohexane sulfonic acid (PFHxS)	NA	0.34	0.6	0.41	0.36	0.12	0.12	0.1	0.092	0.03	0.021	0.021	0.025	0.034	0.0057	0.01	0.18
Perfluorohexanoic acid (PFHxA)	NA	0.13	0.21	0.16	0.14	0.037	0.047	0.041	0.041	0.022	0.03	0.03	0.032	0.037	0.005	0.007	0.068
Perfluorononanoic acid (PFNA)	NA	<0.0036	<0.0035	<0.0036	<0.0036	<0.0039	<0.0036	<0.0037	<0.0039	<0.004	<0.0036	<0.0036	<0.0037	<0.0036	0.0024 [J]	0.0016 [J]	0.0035 [J]
Perfluorooctane sulfonamide (FOSA)	NCL	<0.0036	<0.0035	<0.0036	<0.0036	<0.0039	<0.0036	<0.0037	<0.0039	<0.004	<0.0036	<0.0036	<0.0037	<0.0036	<0.0037	<0.0037	<0.0036
Perfluorooctane sulfonic acid (PFOS)	0.011 (X)	***0.23***	***0.5***	***0.37***	***0.28***	***0.019***	***0.048***	***0.048***	***0.074***	***0.082***	***0.036***	***0.034***	***0.023***	***0.042***	***0.26***	***0.5***	***0.83***
Perfluorooctanoic acid (PFOA)	0.42 (X)	***1.4***	***2.3***	***1.2***	***1.6***	0.31	0.34	0.31	0.28	0.092	0.07	0.067	0.097	0.13	0.027	0.036	***0.63***
PFOA + PFOS (Calculated)	NCL	1.6	2.8	1.6	1.9	0.33	0.39	0.36	0.35	0.17	0.11	0.1	0.12	0.17	0.29	0.54	1.5
Perfluoropentanoic acid (PFPeA)	NCL	0.07	0.14	0.093	0.076	0.027	0.029	0.031	0.032	0.011	0.022	0.022	0.022	0.024	0.005	0.0049	0.015
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.0036	<0.0035	<0.0036	<0.0036	<0.0039	<0.0036	<0.0037	<0.0039	<0.004	<0.0036	<0.0036	<0.0037	<0.0036	<0.0037	<0.0037	<0.0036
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.0036	<0.0035	<0.0036	<0.0036	<0.0039	<0.0036	<0.0037	<0.0039	<0.004	<0.0036	<0.0036	<0.0037	<0.0036	<0.0037	<0.0037	<0.0036
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.0036	<0.0035	<0.0036	<0.0036	<0.0039	<0.0036	<0.0037	<0.0039	<0.004	<0.0036	<0.0036	<0.0037	<0.0036	<0.0037	<0.0037	<0.0036
Perfluoro-1-pentanesulfonate (PFPeS)	NCL	0.091	0.15	0.12	0.097	0.029	0.03	0.025	0.022	0.011	0.0095	0.0097	0.012	0.013	0.0013 [J]	0.0026 [J]	0.031
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA																
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL																
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL																
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL																
Perfluorononane sulfonic acid (PFNS)	NCL	<0.0072	<0.007	<0.0072	<0.0073	<0.0078	<0.0071	<0.0073	<0.0078	<0.0081	<0.0072	<0.0072	<0.0074	<0.0071	<0.0074	<0.0075	<0.0072
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	NCL																
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	NCL																
4,8-dioxa-3H-perfluorononanoic acid	NCL																
Total PFAS (Calculated)	NCL	2.6	4.4	2.8	2.9	0.67	0.76	0.7	0.68	0.31	0.25	0.24	0.27	0.36	0.33	0.6	2.1

TABLE 3
SUMMARY OF GROUNDWATER SAMPLE ANALYSIS - PFAS
Former Tannery
Rockford, Kent County, Michigan

Location	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface[2]	TA-MW-314D	TA-MW-315D	TA-MW-315D	TA-MW-315D	TA-MW-315S	TA-MW-315S	TA-MW-315S	TA-MW-315S	TA-MW-316D	TA-MW-316D	TA-MW-316D	TA-MW-316M	TA-MW-316M	TA-MW-316M	TA-MW-316S	TA-MW-316S
Sample Name		TA-GW-MW-314D	TA-MW-315D	TA-GW-MW315D	TA-GW-MW-315D	TA-MW-315S	TA-GW-MW315S DUP	TA-GW-MW315S	TA-GW-MW-315S	TA-MW-316D	TA-GW-MW316D	TA-GW-MW-316D	TA-MW-316M	TA-GW-MW316M	TA-GW-MW-316M	TA-MW-316S	TA-GW-MW316S
Laboratory Sample ID		VA09002-002	UF22013-001	UH10014-001	UL19062-001	UF22013-002	UH10014-004	UH10014-003	UL19062-002	UF13013-022	UH07038-004	VA09002-008	UF13013-023	UH07038-003	VA09002-009	UF13013-021	UH07038-005
Sample Date		01/06/2020	06/21/2019	08/08/2019	12/18/2019	06/21/2019	08/08/2019	08/08/2019	12/18/2019	06/12/2019	08/06/2019	01/07/2020	06/12/2019	08/06/2019	01/07/2020	06/12/2019	08/06/2019
Parameter (µg/L)																	
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	<0.0038	<0.0035	<0.0036	<0.004	<0.0034	<0.0036	<0.0036	<0.0038	<0.0035	<0.0037	<0.0039	<0.0035	<0.0035	<0.0035	<0.0035	<0.0037
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.0038	<0.0035	<0.0036	<0.004	<0.0034	<0.0036	<0.0036	<0.0038	<0.0035	<0.0037	<0.0039	<0.0035	<0.0035	<0.0035	<0.0035	<0.0037
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	NCL	<0.0038	<0.0035	<0.0036	<0.004	<0.0034	<0.0036	<0.0036	<0.0038	<0.0035	<0.0037	<0.0039	<0.0035	<0.0035	<0.0035	<0.0035	<0.0037
N-Methyl perfluorooctane sulfonamide (MeFOSA)	NCL	<0.0076	<0.0071	<0.0073	<0.0081	<0.0069	<0.0072	<0.0071	<0.0077	<0.007	<0.0074	<0.0078	<0.007	<0.007	<0.007	<0.0071	<0.0074
Perfluorobutane sulfonic acid (PFBS)	NA	<0.0038	<0.0035	<0.0036	<0.004	0.079	0.079	0.08	0.054	<0.0035	<0.0037	<0.0039	0.048	0.054	0.043	0.0074	<0.0037
Perfluorobutanoic acid (PFBA)	NCL	<0.0038	<0.0035	<0.0036	<0.004	0.021	0.019	0.018	0.013	<0.0035	<0.0037	<0.0039	0.014	0.014	0.012	0.011	<0.0037
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.0038	<0.0035	<0.0036	<0.004	<0.0034	<0.0036	<0.0036	<0.0038	<0.0035	<0.0037	<0.0039	<0.0035	<0.0035	<0.0035	<0.0035	<0.0037
Perfluorodecanoic acid (PFDA)	NCL	<0.0038	<0.0035	<0.0036	<0.004	<0.0034	<0.0036	<0.0036	<0.0038	<0.0035	<0.0037	<0.0039	<0.0035	<0.0035	<0.0035	<0.0035	<0.0037
Perfluorododecanoic acid (PFDoDA)	NCL	<0.0038	<0.0035	<0.0036	<0.004	<0.0034	<0.0036	<0.0036	<0.0038	<0.0035	<0.0037	<0.0039	<0.0035	<0.0035	<0.0035	<0.0035	<0.0037
Perfluoroheptane sulfonic acid (PFHpS)	NCL	<0.0038	<0.0035	<0.0036	<0.004	0.084	0.085	0.091	0.075	<0.0035	<0.0037	<0.0039	0.0085	0.013	0.011	0.0088	<0.0037
Perfluoroheptanoic acid (PFHpA)	NCL	<0.0038	<0.0035	<0.0036	<0.004	0.039	0.031	0.034	0.026	<0.0035	<0.0037	<0.0039	0.021	0.023	0.018	0.013	<0.0037
Perfluorohexane sulfonic acid (PFHxS)	NA	<0.0038	<0.0035	<0.0036	<0.004	0.092	0.077	0.087	0.078	<0.0035	<0.0037	<0.0039	0.036	0.042	0.036	0.0082	<0.0037
Perfluorohexanoic acid (PFHxA)	NA	<0.0038	<0.0035	<0.0036	<0.004	0.047	0.035	0.037	0.027	<0.0035	<0.0037	<0.0039	0.036	0.038	0.028	0.021	0.0038
Perfluorononanoic acid (PFNA)	NA	<0.0038	<0.0035	<0.0036	<0.004	0.0092	0.011	0.0093	0.0076	<0.0035	<0.0037	<0.0039	<0.0035	<0.0035	0.00087 [J]	<0.0035	<0.0037
Perfluorooctane sulfonamide (FOSA)	NCL	<0.0038	<0.0035	<0.0036	<0.004	<0.0034	<0.0036	<0.0036	<0.0038	<0.0035	<0.0037	<0.0039	<0.0035	<0.0035	<0.0035	<0.0035	<0.0037
Perfluorooctane sulfonic acid (PFOS)	0.011 (X)	<0.0038	0.0069	<0.0036	***0.024***	***2.4***	***2.4***	***2.5***	***2.1***	<0.0035	<0.0037	<0.0039	***0.041***	***0.067***	***0.071***	***0.32***	***0.39***
Perfluorooctanoic acid (PFOA)	0.42 (X)	<0.0019	0.0077	0.002	0.0047	***0.43***	0.4	0.39	0.35	<0.0018	<0.0018	<0.0019	0.16	0.16	0.14	0.059	0.013
PFOA + PFOS (Calculated)	NCL	ND	0.015	0.002	0.029	2.8	2.8	2.9	2.5	ND	ND	ND	0.2	0.23	0.21	0.38	0.4
Perfluoropentanoic acid (PFPeA)	NCL	<0.0038	<0.0035	<0.0036	<0.004	0.028	0.024	0.023	0.016	<0.0035	<0.0037	<0.0039	0.029	0.032	0.024	0.022	0.0039
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.0038	<0.0035	<0.0036	<0.004	<0.0034	<0.0036	<0.0036	<0.0038	<0.0035	<0.0037	<0.0039	<0.0035	<0.0035	<0.0035	<0.0035	<0.0037
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.0038	<0.0035	<0.0036	<0.004	<0.0034	<0.0036	<0.0036	<0.0038	<0.0035	<0.0037	<0.0039	<0.0035	<0.0035	<0.0035	<0.0035	<0.0037
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.0038	<0.0035	<0.0036	<0.004	<0.0034	<0.0036	<0.0036	<0.0038	<0.0035	<0.0037	<0.0039	<0.0035	<0.0035	<0.0035	<0.0035	<0.0037
Perfluoro-1-pentanesulfonate (PFPeS)	NCL	<0.0038	<0.0035	<0.0036	<0.004	0.014	0.013	0.013	0.0096	<0.0035	<0.0037	<0.0039	0.0072	0.0087	0.0075	<0.0035	<0.0037
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA																
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL																
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL																
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL																
Perfluorononane sulfonic acid (PFNS)	NCL	<0.0076	<0.0071	<0.0073	<0.0081	<0.0069	<0.0072	<0.0071	<0.0077	<0.007	<0.0074	<0.0078	<0.007	<0.007	<0.007	<0.0071	<0.0074
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	NCL																
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	NCL																
4,8-dioxa-3H-perfluorononanoic acid	NCL																
Total PFAS (Calculated)	NCL	ND	0.015	0.002	0.029	3.2	3.2	3.3	2.8	ND	ND	ND	0.4	0.45	0.39	0.47	0.41

TABLE 3
SUMMARY OF GROUNDWATER SAMPLE ANALYSIS - PFAS
Former Tannery
Rockford, Kent County, Michigan

Location	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface[2]	TA-MW-316S	TA-MW-317A	TA-MW-317B	TA-MW-317C	TA-MW-317C	TA-MW-317D
Sample Name		TA-GW-MW-316S	TA-GW-MW-317A	TA-GW-MW-317B	TA-GW-MW-317C	TA-GW-MW-317C DUP	TA-GW-MW-317D
Laboratory Sample ID		VA09002-007	UL19062-003	UL19062-004	UL19062-012	UL19062-013	UL19062-011
Sample Date		01/07/2020	12/18/2019	12/18/2019	12/17/2019	12/17/2019	12/17/2019
Parameter (µg/L)							
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	<0.0037	<0.0039	<0.0038	<0.0037	<0.0038	<0.0038
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.0037	<0.0039	<0.0038	<0.0037	<0.0038	<0.0038
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	NCL	<0.0037	<0.0039	<0.0038	<0.0037	<0.0038	<0.0038
N-Methyl perfluorooctane sulfonamide (MeFOSA)	NCL	<0.0075	<0.0078	<0.0076	<0.0075	<0.0076	<0.0077
Perfluorobutane sulfonic acid (PFBS)	NA	0.013	0.024	<0.0038	<0.0037	<0.0038	<0.0038
Perfluorobutanoic acid (PFBA)	NCL	<0.0037	0.014	<0.0038	<0.0037	<0.0038	<0.0038
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.0037	<0.0039	<0.0038	<0.0037	<0.0038	<0.0038
Perfluorodecanoic acid (PFDA)	NCL	0.0016 [J]	<0.0039	<0.0038	<0.0037	<0.0038	<0.0038
Perfluorododecanoic acid (PFDoDA)	NCL	<0.0037	<0.0039	<0.0038	<0.0037	<0.0038	<0.0038
Perfluoroheptane sulfonic acid (PFHpS)	NCL	0.00094 [J]	0.015	<0.0038	<0.0037	<0.0038	<0.0038
Perfluoroheptanoic acid (PFHpA)	NCL	<0.0037	0.016	<0.0038	<0.0037	<0.0038	<0.0038
Perfluorohexane sulfonic acid (PFHxS)	NA	0.0022 [J]	0.024	<0.0038	<0.0037	<0.0038	<0.0038
Perfluorohexanoic acid (PFHxA)	NA	0.00096 [J]	0.03	<0.0038	<0.0037	<0.0038	<0.0038
Perfluorononanoic acid (PFNA)	NA	<0.0037	0.0078	<0.0038	<0.0037	<0.0038	<0.0038
Perfluorooctane sulfonamide (FOSA)	NCL	<0.0037	<0.0039	<0.0038	<0.0037	<0.0038	<0.0038
Perfluorooctane sulfonic acid (PFOS)	0.011 (X)	***0.13***	***1.9***	<0.0038	<0.0037	<0.0038	<0.0038
Perfluorooctanoic acid (PFOA)	0.42 (X)	0.0043	0.085	<0.0019	<0.0019	<0.0019	<0.0019
PFOA + PFOS (Calculated)	NCL	0.13	2	ND	ND	ND	ND
Perfluoropentanoic acid (PFPeA)	NCL	<0.0037	0.013	<0.0038	<0.0037	<0.0038	<0.0038
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.0037	<0.0039	<0.0038	<0.0037	<0.0038	<0.0038
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.0037	<0.0039	<0.0038	<0.0037	<0.0038	<0.0038
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.0037	<0.0039	<0.0038	<0.0037	<0.0038	<0.0038
Perfluoro-1-pentanesulfonate (PFPeS)	NCL	<0.0037	<0.0039	<0.0038	<0.0037	<0.0038	<0.0038
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA						
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL						
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL						
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL						
Perfluorononane sulfonic acid (PFNS)	NCL	<0.0075	<0.0078	<0.0076	<0.0075	<0.0076	<0.0077
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	NCL						
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	NCL						
4,8-dioxa-3H-perfluorononanoic acid	NCL						
Total PFAS (Calculated)	NCL	0.15	2.1	ND	ND	ND	ND

TABLE 3 NOTES
Former Tannery
Rockford, Kent County, Michigan

NOTES:
1. Concentration and criteria units are micrograms per Liter (µg/L) or parts per billion (ppb).
2. Michigan Part 201 Groundwater Cleanup Criteria are based on "Table 1, Groundwater: Residential and Nonresidential Part 201 Generic Cleanup Criteria and Screening Levels/Part 213 Tier I Risk Based Screening Levels," Michigan Administrative Code, Cleanup Criteria Requirements for Response Activity, Rules 299.44 and 299.49, effective December 30, 2013; updated December 21, 2020.
   Abbreviations Include:
   "NA" indicates a criterion or value is not available or, in the case of background, not applicable.
   "NCL" indicates no criterion listed in EGLE Table 1.
   Footnotes Include:
   (X) - For groundwater discharge to the Great Lakes and their connecting waters or discharge in close proximity to a water supply intake in inland surface waters, the generic GSI criterion shall be the surface water human drinking water value (HDV) listed in the table of this footnote except for those HDV indicated with an asterisk. For HDV with an asterisk, the generic GSI criterion shall be the lowest of the HDV, the wildlife value (WV), and the calculated final chronic value (FCV). Criterion listed have been updated to the HDV, WV, or FCV.
3. Bold, italic number with thick line border or italic parameter name indicates that parameter was detected above the Michigan Part 201 Groundwater Cleanup Criteria.
4. Abbreviations include:
   "< LOQ" indicates the parameter was analyzed for but not detected above the limit of quantitation (LOQ).
   Blank indicates the parameter was not analyzed for the indicated sample.
   "DUP" indicates a duplicate sample.
   "ND" indicates the parameters used in the calculation were not detected.
   "B" indicates the parameter was also detected in the method blank.
   "J" indicates the parameter was detected at a concentration less than the LOQ but greater than or equal to the detection limit (DL) and the result is estimated.
   "E" indicates the quantitation of the parameter exceeded the calibration range.

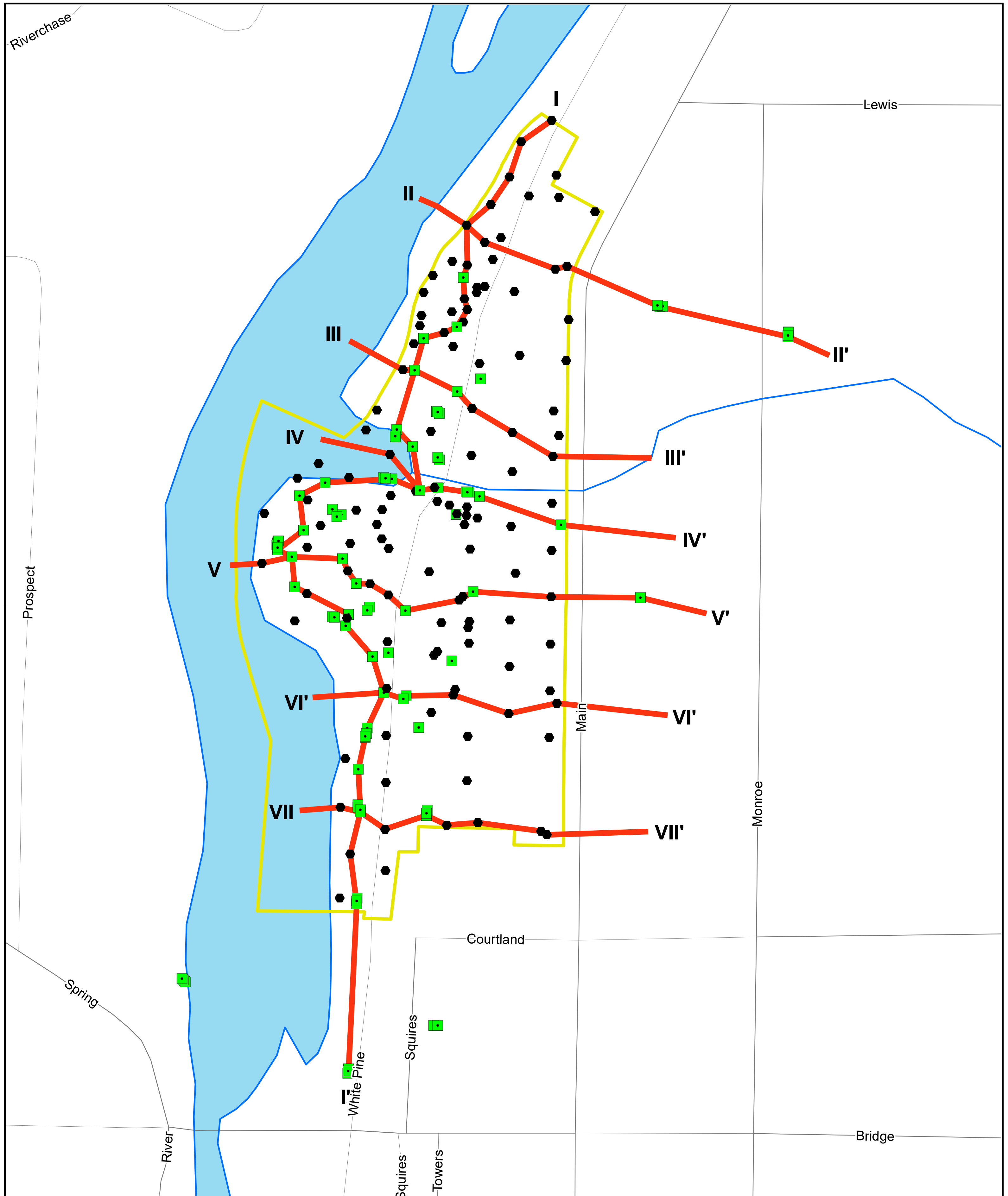
TABLE 4
MODEL COMPUTED GROUNDWATER ELEVATIONS VS. OBSERVED ELEVATIONS
FORMER TANNERY,
ROCKFORD, KENTY COUNTY, MICHIGAN

Name	**Computed, Ft**	**Observed, Ft.**	**Residual (Computed minus Observed)**
TA-P-1	691.75	691.91	-0.16
TA-P-2	691.59	691.95	-0.36
TA-P-3	691.7	692.15	-0.45
TA-P-4	691.84	692.04	-0.2
TA-P-5	695.07	695.91	-0.84
TA-MW-1	691.8	692.51	-0.71
TA-MW-2	691.77	692.32	-0.55
TA-MW-3	692.3	691.99	0.31
TA-MW-4	692.37	692.03	0.34
TA-MW-5	692.14	692.01	0.13
TA-MW-301B	691.45	692.23	-0.78
TA-MW-301C	691.41	692.59	-1.18
TA-MW-301D	691.3	689.41	1.89
TA-MW-302A	691.66	692.2	-0.54
TA-MW-302B	691.65	691.88	-0.23
TA-MW-303A	691.58	692.11	-0.53
TA-MW-303B	691.57	691.88	-0.31
TA-MW-303C	691.57	691.84	-0.27
TA-MW-303D	691.57	689.12	2.45
TA-MW-303E	691.56	689.14	2.42
TA-MW-304A	691.83	692.04	-0.21
TA-MW-304B	691.83	691.92	-0.09
TA-MW-305B	692.16	691.95	0.21
TA-MW-305C	692.15	691.95	0.2
TA-MW-306A	691.98	691.84	0.14
TA-MW-306B	691.99	691.83	0.16
TA-MW-307A	691.86	691.86	0
TA-MW-307B	691.86	691.82	0.04
TA-MW-308A	692.06	692.03	0.03
TA-MW-308B	692.06	692.08	-0.02
TA-MW-308C	692.05	692.11	-0.06
TA-MW-309A	690.61	692.33	-1.72
TA-MW-309B	690.59	692.48	-1.89
TA-MW-309C	690.58	691.68	-1.1
TA-MW-309D	690.56	691.67	-1.11
TA-MW-310A	690.61	688.89	1.72
TA-MW-310B	690.57	690.01	0.56
TA-MW-310C	690.6	689.78	0.82
TA-MW-311	693.29	692.98	0.31
TA-MW-312	696.67	696	0.67
TA-MW-313A	689.96	692.01	-2.05

TABLE 4
MODEL COMPUTED GROUNDWATER ELEVATIONS VS. OBSERVED ELEVATIONS
FORMER TANNERY,
ROCKFORD, KENTY COUNTY, MICHIGAN

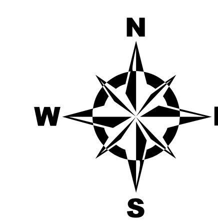
Name	Computed, Ft	Observed, Ft.	Residual (Computed minus Observed)
TA-MW-313B	689.92	687.03	2.89
TA-MW-313C	689.8	686.9	2.9
TA-TMW-101	691.51	692.72	-1.21
TA-TMW-103	694.26	694.09	0.17
TA-TMW-104	695.26	695.93	-0.67
TA-TMW-105	691.84	691.95	-0.11
TA-TMW-108	691.89	691.89	0
TA-TMW-109	692.15	692.1	0.05
TA-TMW-110	691.96	691.96	0
TA-TMW-111	692.11	692.1	0.01
TA-RW-1	691.79	691.82	-0.03
TA-RW-2	692.08	691.65	0.43
TA-RW-3	692.92	692.95	-0.03
TA-PMW-01	691.77	691.38	0.39
TA-PMW-02	692.03	691.61	0.42
TA-PMW-03	692.78	692.97	-0.19
TA-PMW-04	691.75	691.31	0.44
TA-PMW-05	692.47	692.29	0.18
TA-PMW-06	693.1	693.09	0.01
TA-PMW-07	691.66	691	0.66
TA-PMW-08	691.77	691.38	0.39
TA-PMW-09	692.17	692.07	0.1

Figures



LEGEND

- SOIL BORING
- MONITORING WELL
- WATER WELL
- SECTIONLINE
- RUM CREEK
- FORMER TANNERY SITE
- ROGUE RIVER
- MINOR ROADS AND TWO TRACKS
- MAJOR CITY ROADS
- MINOR CITY ROADS



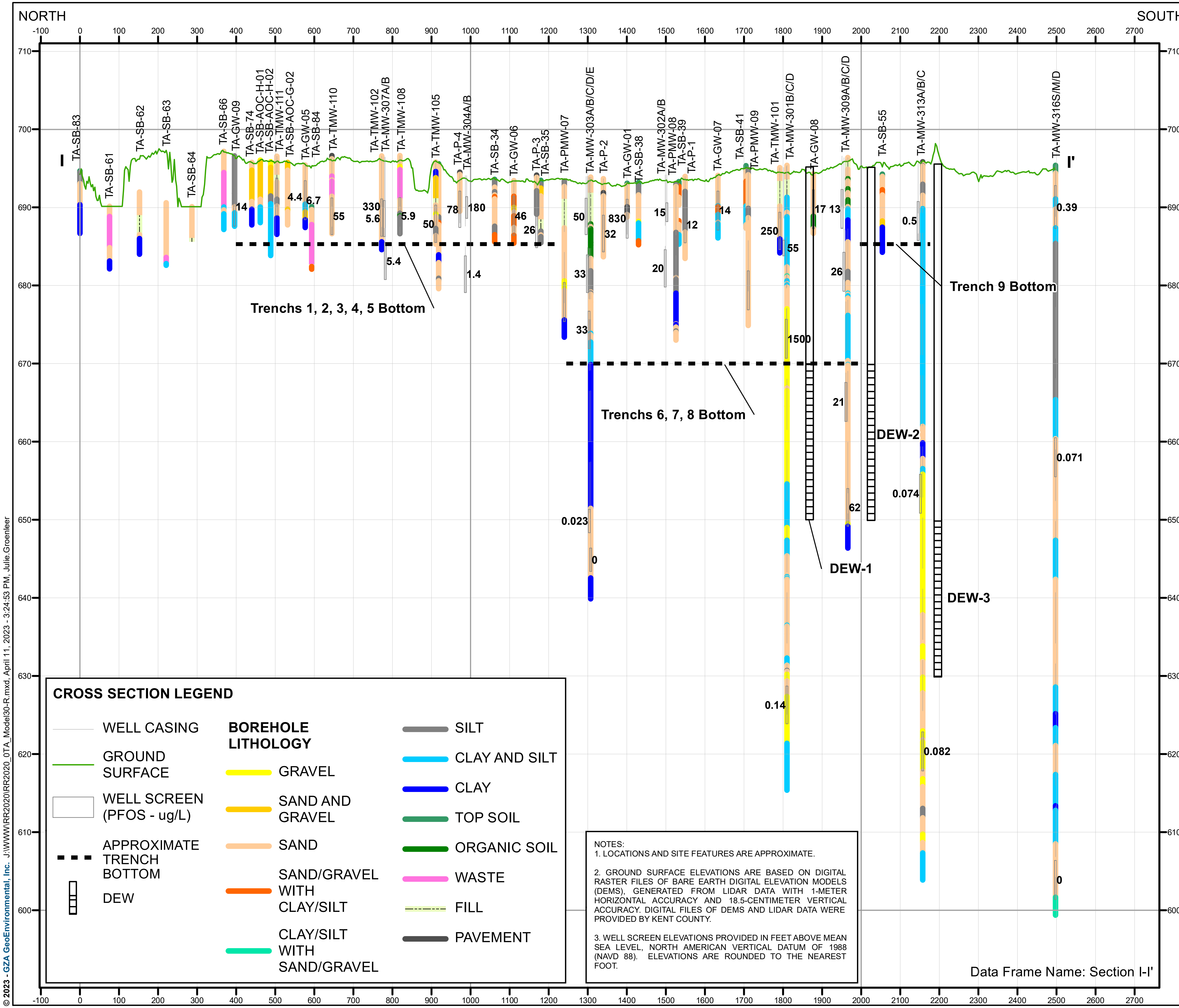
0 125 250 500

SCALE IN FEET

FORMER TANNERY
ROCKFORD, MICHIGAN

LOCATIONS OF CROSS SECTIONS

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		PREPARED FOR: WNJ/WWW	
PROJ MGR:	REVIEWED BY:	CHECKED BY:	SHEET NO. 1
DESIGNED BY:	DRAWN BY:	SCALE: 1 in = 250 ft	
DATE: 10/25/2021	PROJECT NO:	REVISION NO:	



CROSS SECTION LEGEND

- WELL CASING
- GROUND SURFACE
- WELL SCREEN (PFOS - ug/L)
- APPROXIMATE TRENCH BOTTOM
- DEW

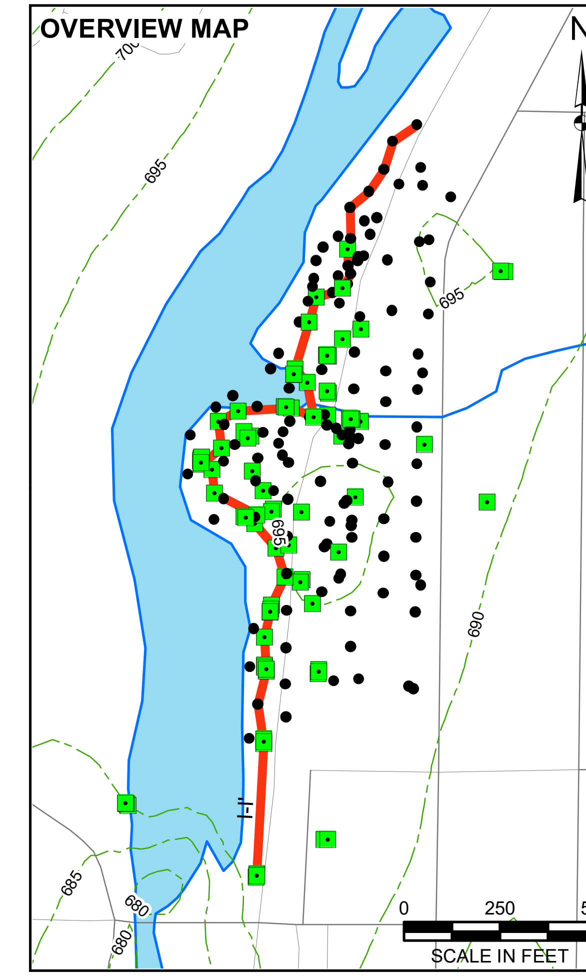
BOREHOLE LITHOLOGY

- GRAVEL
- SAND AND GRAVEL
- SAND
- SAND/GRAVEL WITH CLAY/SILT
- CLAY/SILT WITH SAND/GRAVEL
- SILT
- CLAY AND SILT
- CLAY
- TOP SOIL
- ORGANIC SOIL
- WASTE
- FILL
- PAVEMENT

NOTES:
1. LOCATIONS AND SITE FEATURES ARE APPROXIMATE.

2. GROUND SURFACE ELEVATIONS ARE BASED ON DIGITAL RASTER FILES OF BARE EARTH DIGITAL ELEVATION MODELS (DEMS), GENERATED FROM LIDAR DATA WITH 1-METER HORIZONTAL ACCURACY AND 18.5-CENTIMETER VERTICAL ACCURACY. DIGITAL FILES OF DEMS AND LIDAR DATA WERE PROVIDED BY KENT COUNTY.

3. WELL SCREEN ELEVATIONS PROVIDED IN FEET ABOVE MEAN SEA LEVEL, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88). ELEVATIONS ARE ROUNDED TO THE NEAREST FOOT.



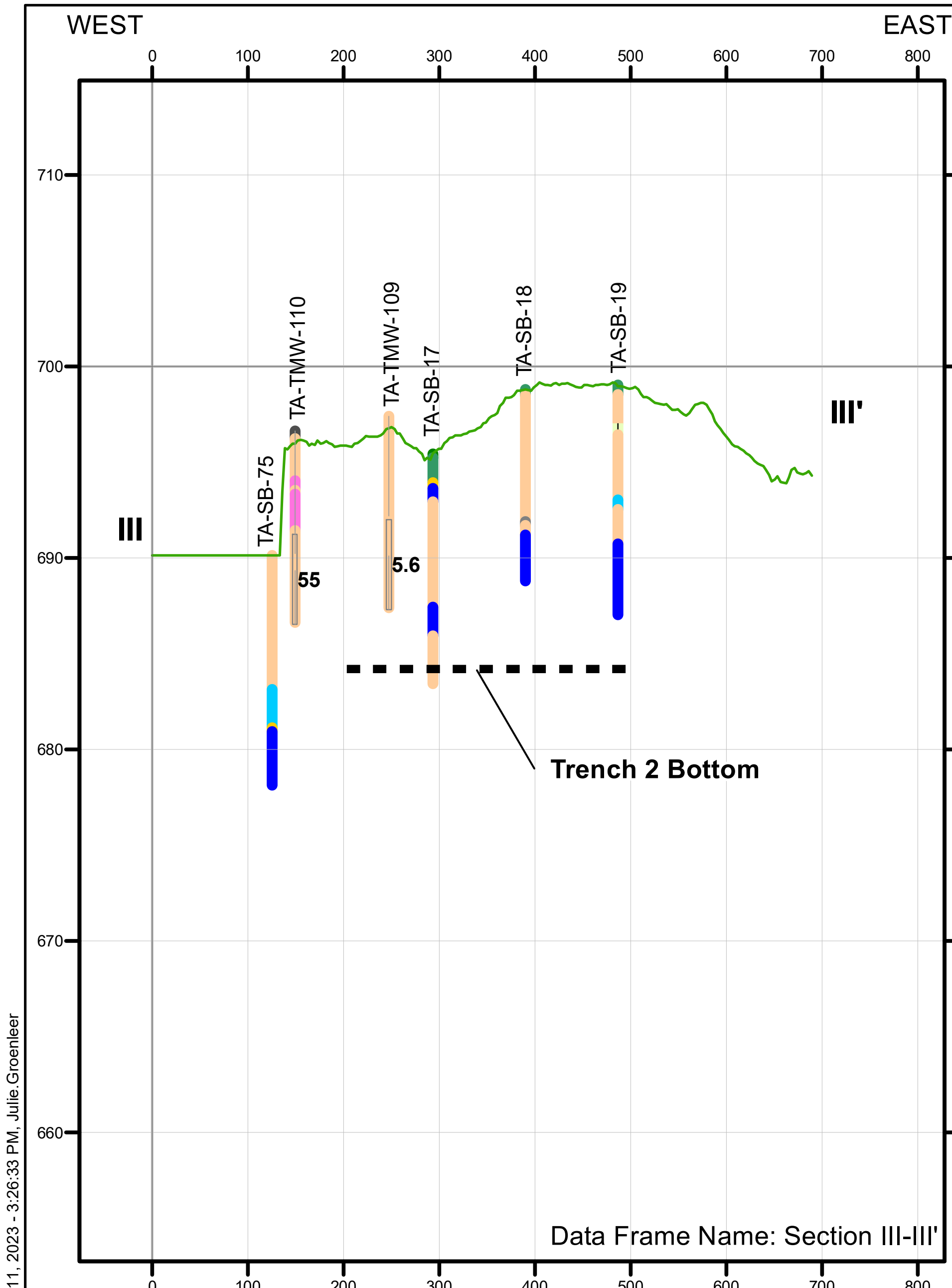
OVERVIEW MAP LEGEND

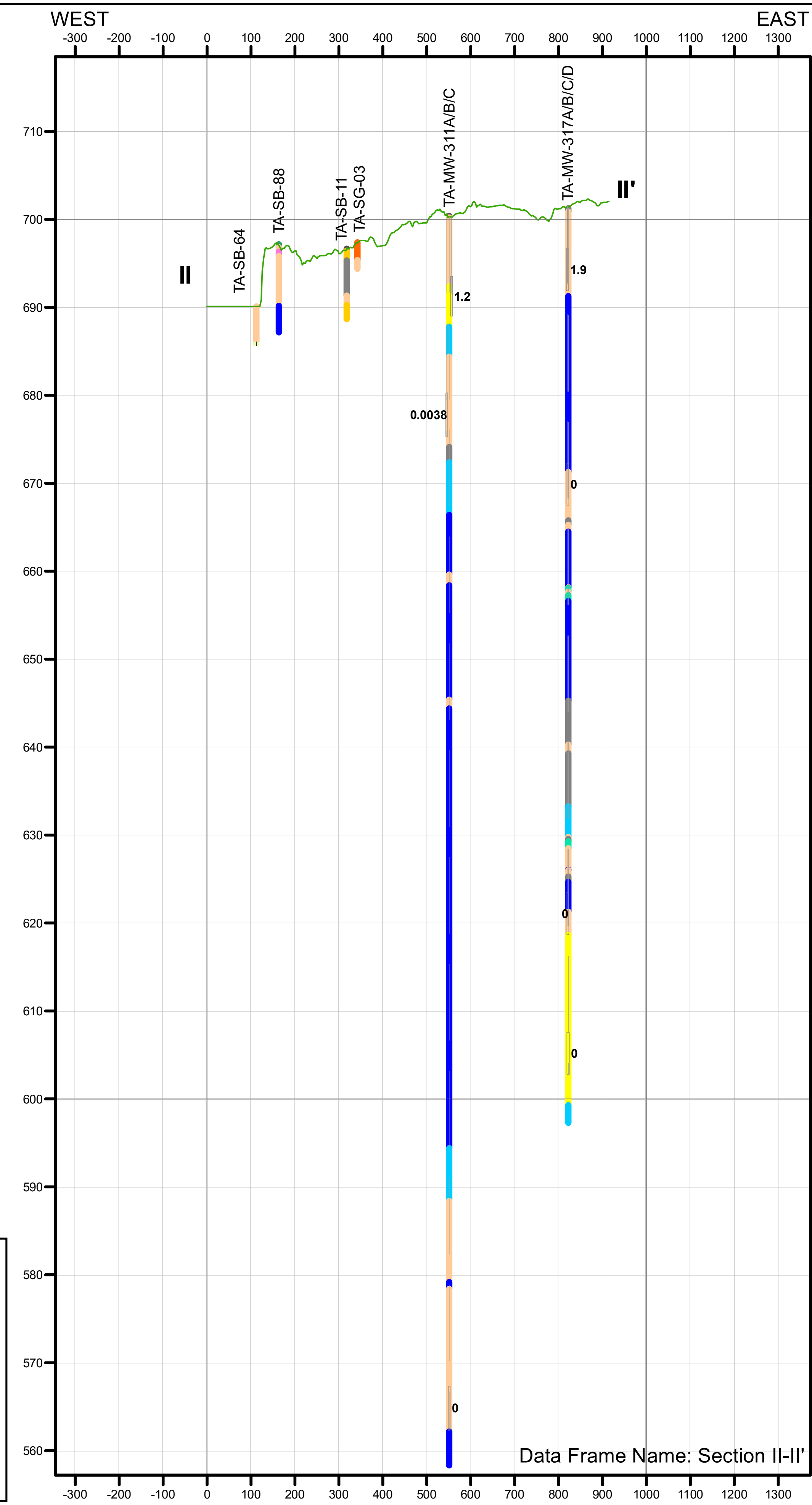
- SOIL BORING
- MONITORING WELL
- SECTIONLINE
- GROUNDWATER CONTOUR, NOVEMBER 2019
- RUM CREEK
- ROGUE RIVER
- MINOR ROADS AND TWO TRACKS
- MAJOR CITY ROADS
- MINOR CITY ROADS

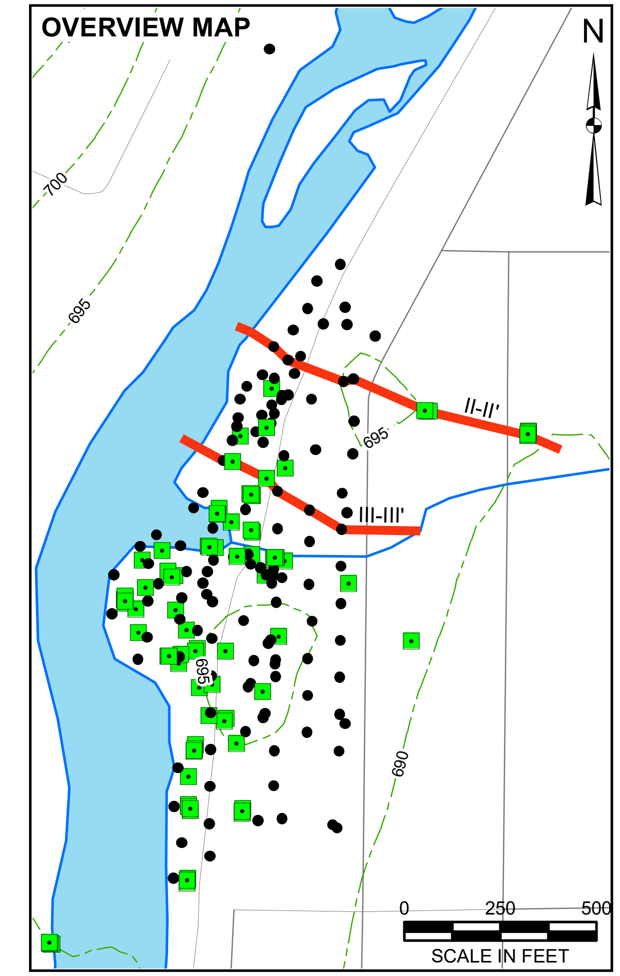
FORMER TANNERY
ROCKFORD, MICHIGAN

CROSS SECTION I-I'

PREPARED BY:		PREPARED FOR:	
GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		WNJ/WWW	
PROJ MGR: TAL	REVIEWED BY: MAW	CHECKED BY: JC	SHEET NO. 2
DESIGNED BY: JC	DRAWN BY: JC/JMG	SCALE: 1 in = 500 ft	
DATE: 04/11/2023	PROJECT NO: 16.0062961.01	REVISION NO:	







OVERVIEW MAP LEGEND

- SOIL BORING
- MONITORING WELL
- SECTIONLINE
- GROUNDWATER COUNTOUR, NOVEMBER 2019
- RUM CREEK
- ROGUE RIVER
- MINOR ROADS AND TWO TRACKS
- MAJOR CITY ROADS
- MINOR CITY ROADS

NOTES:
1. LOCATIONS AND SITE FEATURES ARE APPROXIMATE.

2. GROUND SURFACE ELEVATIONS ARE BASED ON DIGITAL RASTER FILES OF BARE EARTH DIGITAL ELEVATION MODELS (DEMS), GENERATED FROM LIDAR DATA WITH 1-METER HORIZONTAL ACCURACY AND 18.5-CENTIMETER VERTICAL ACCURACY. DIGITAL FILES OF DEMS AND LIDAR DATA WERE PROVIDED BY KENT COUNTY.

3. WELL SCREEN ELEVATIONS PROVIDED IN FEET ABOVE MEAN SEA LEVEL, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88). ELEVATIONS ARE ROUNDED TO THE NEAREST FOOT.

CROSS SECTION LEGEND

- WELL CASING
- WELL SCREEN (PFOS - UG/L)
- GROUND SURFACE
- APPROXIMATE TRENCH BOTTOM

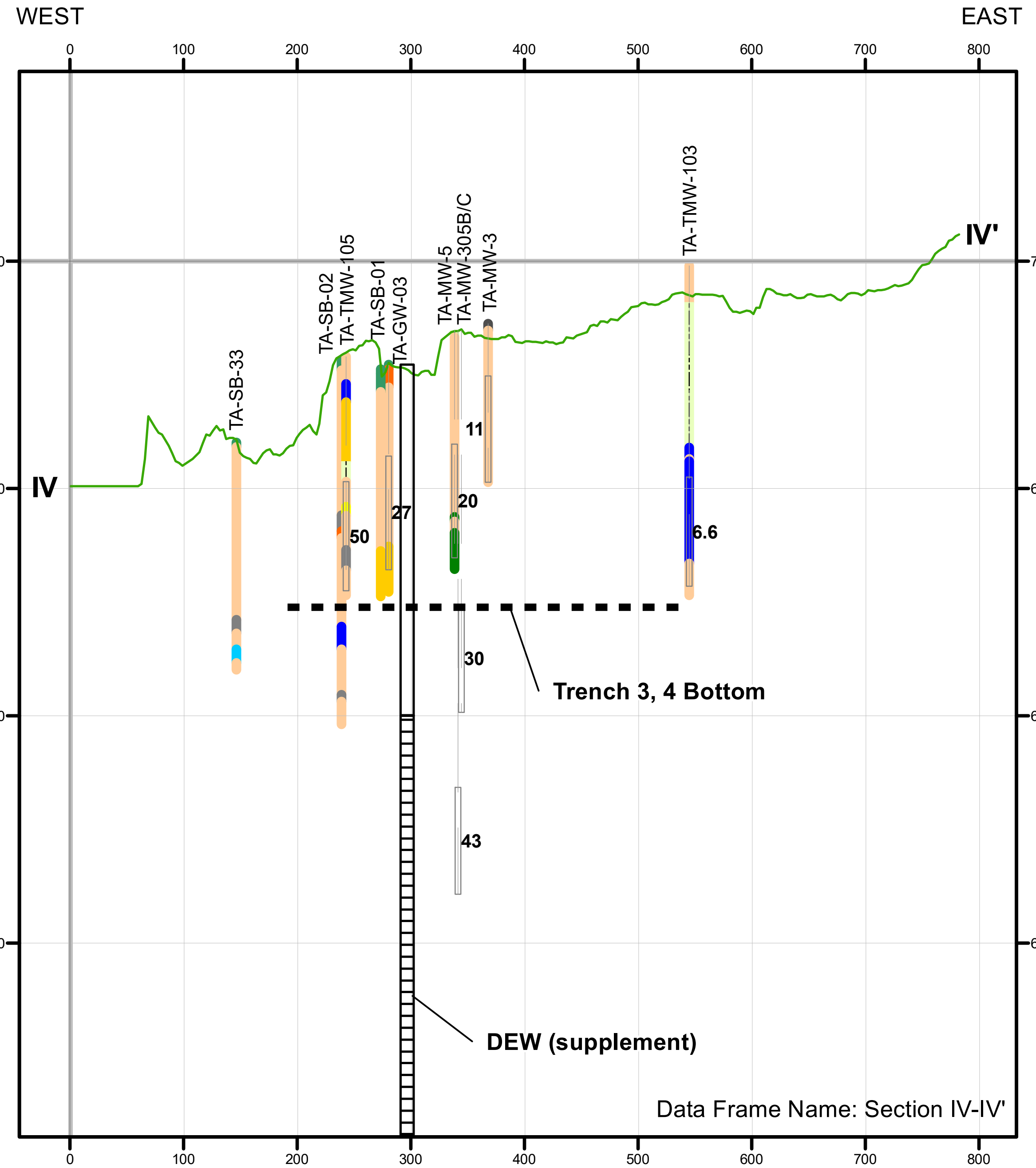
BOREHOLE LITHOLOGY

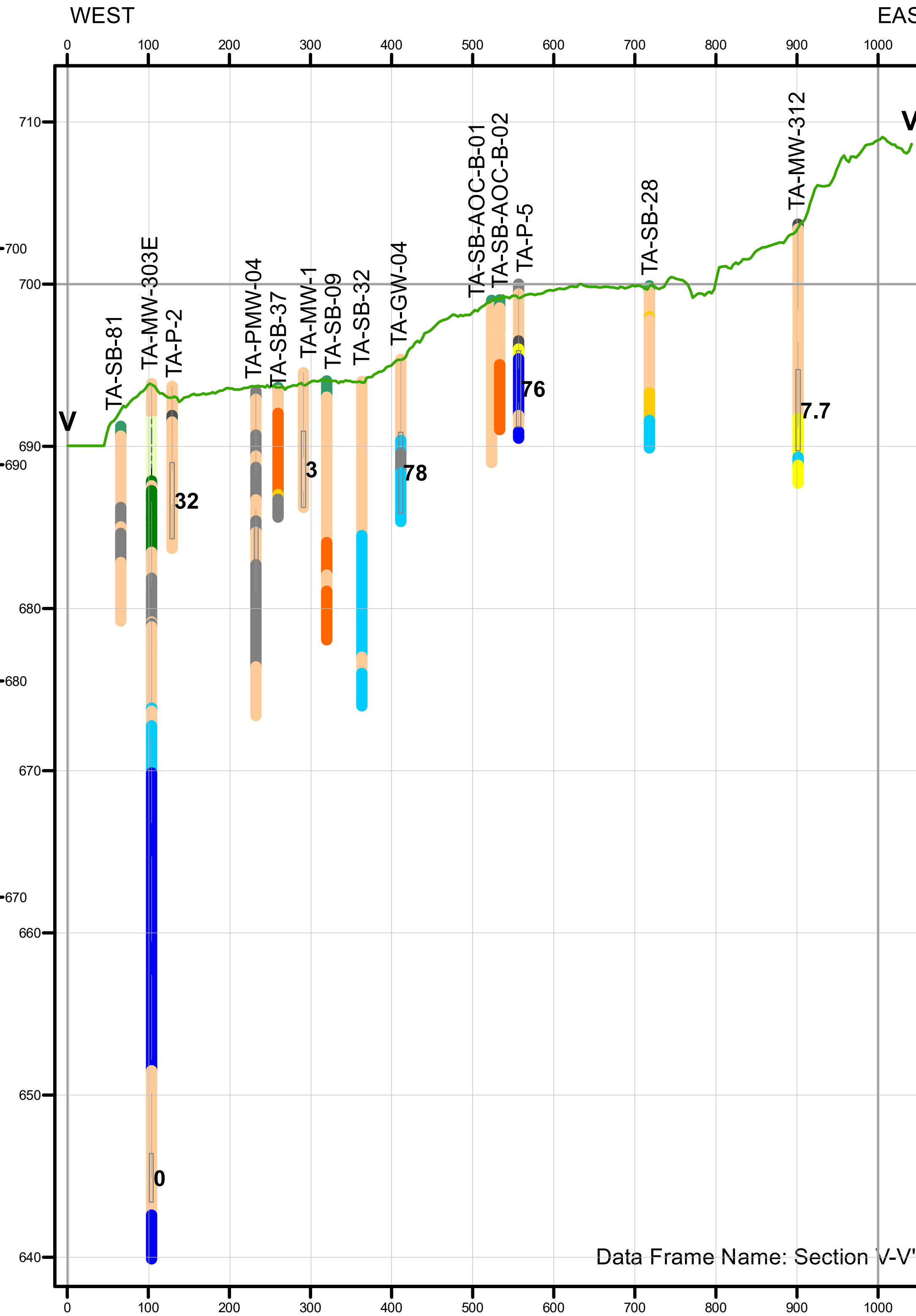
- GRAVEL
- SAND AND GRAVEL
- SAND
- SAND/GRAVEL WITH CLAY/SILT
- CLAY/SILT WITH SAND/GRAVEL
- SILT
- CLAY AND
- CLAY
- TOP SOIL
- WASTE
- FILL
- PAVEMENT

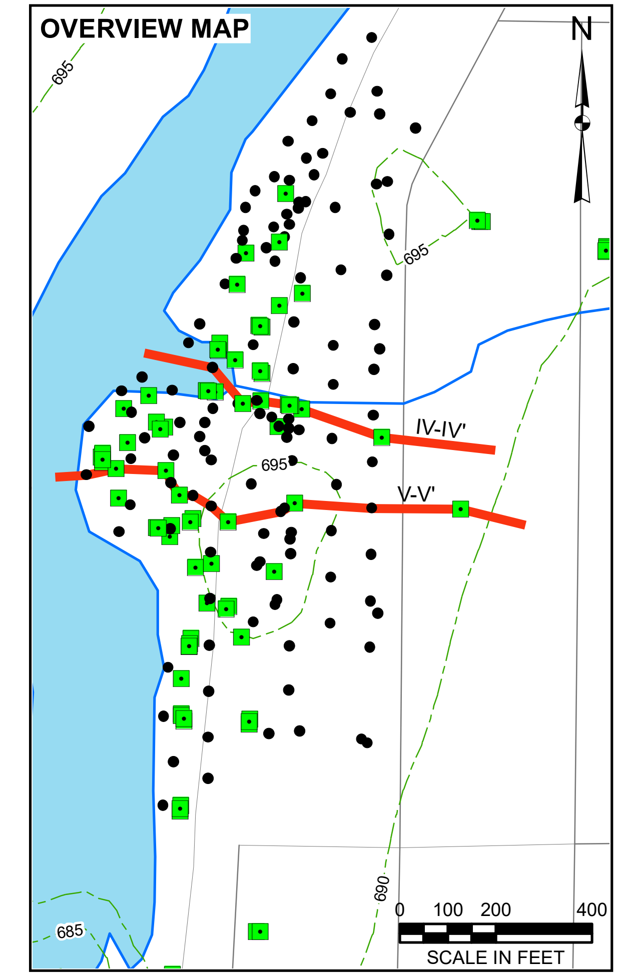
FORMER TANNERY
ROCKFORD, MICHIGAN

CROSS SECTIONS II-II' AND III-III'

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		PREPARED FOR: WNJ/WWW	
PROJ MGR: TAL	REVIEWED BY: MAW	CHECKED BY: JC	SHEET NO. 3
DESIGNED BY: JC	DRAWN BY: JC/JMG	SCALE: 1 in = 500 ft	
DATE: 04/11/2023	PROJECT NO: 16.0062961.01	REVISION NO:	







OVERVIEW MAP LEGEND

- SOIL BORING
- MONITORING WELL
- SECTIONLINE
- GROUNDWATER CONTOURS, NOVEMBER 2019
- RUM CREEK
- ROGUE RIVER
- MINOR ROADS AND TWO TRACKS
- MAJOR CITY ROADS
- MINOR CITY ROADS

CROSS SECTION LEGEND

- WELL CASING
- WELL SCREEN (PFOS - UG/L)
- GROUND SURFACE
- APPROXIMATE TRENCH BOTTOM
- DEW

BOREHOLE LITHOLOGY

- GRAVEL
- SAND AND GRAVEL
- SAND
- SAND/GRAVEL WITH CLAY/SILT
- SILT
- CLAY AND
- CLAY
- TOP SOIL
- ORGANIC SOIL
- FILL
- PAVEMENT

NOTES:
1. LOCATIONS AND SITE FEATURES ARE APPROXIMATE.

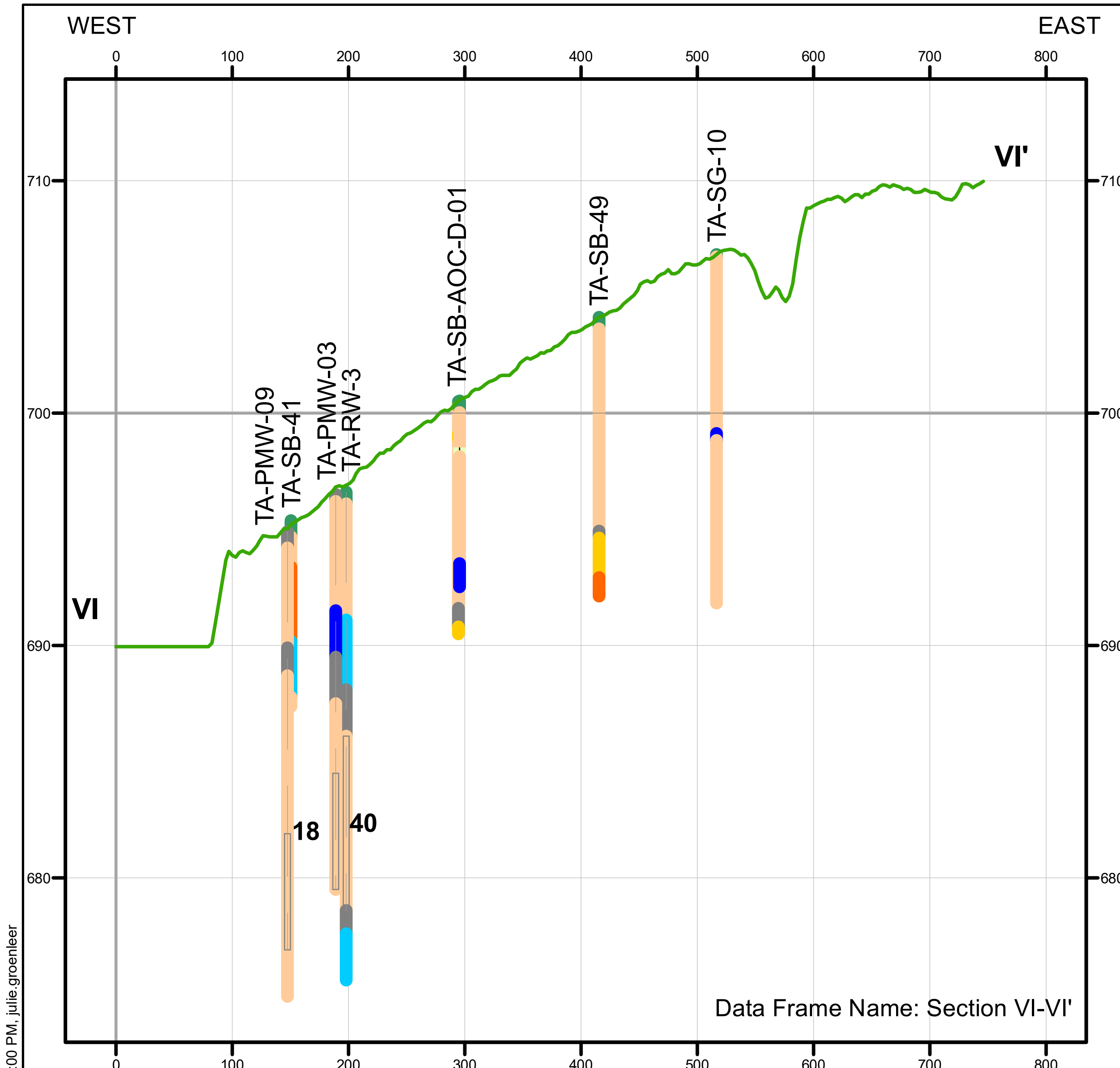
2. GROUND SURFACE ELEVATIONS ARE BASED ON DIGITAL RASTER FILES OF BARE EARTH DIGITAL ELEVATION MODELS (DEMS), GENERATED FROM LIDAR DATA WITH 1-METER HORIZONTAL ACCURACY AND 18.5-CENTIMETER VERTICAL ACCURACY. DIGITAL FILES OF DEMS AND LIDAR DATA WERE PROVIDED BY KENT COUNTY.

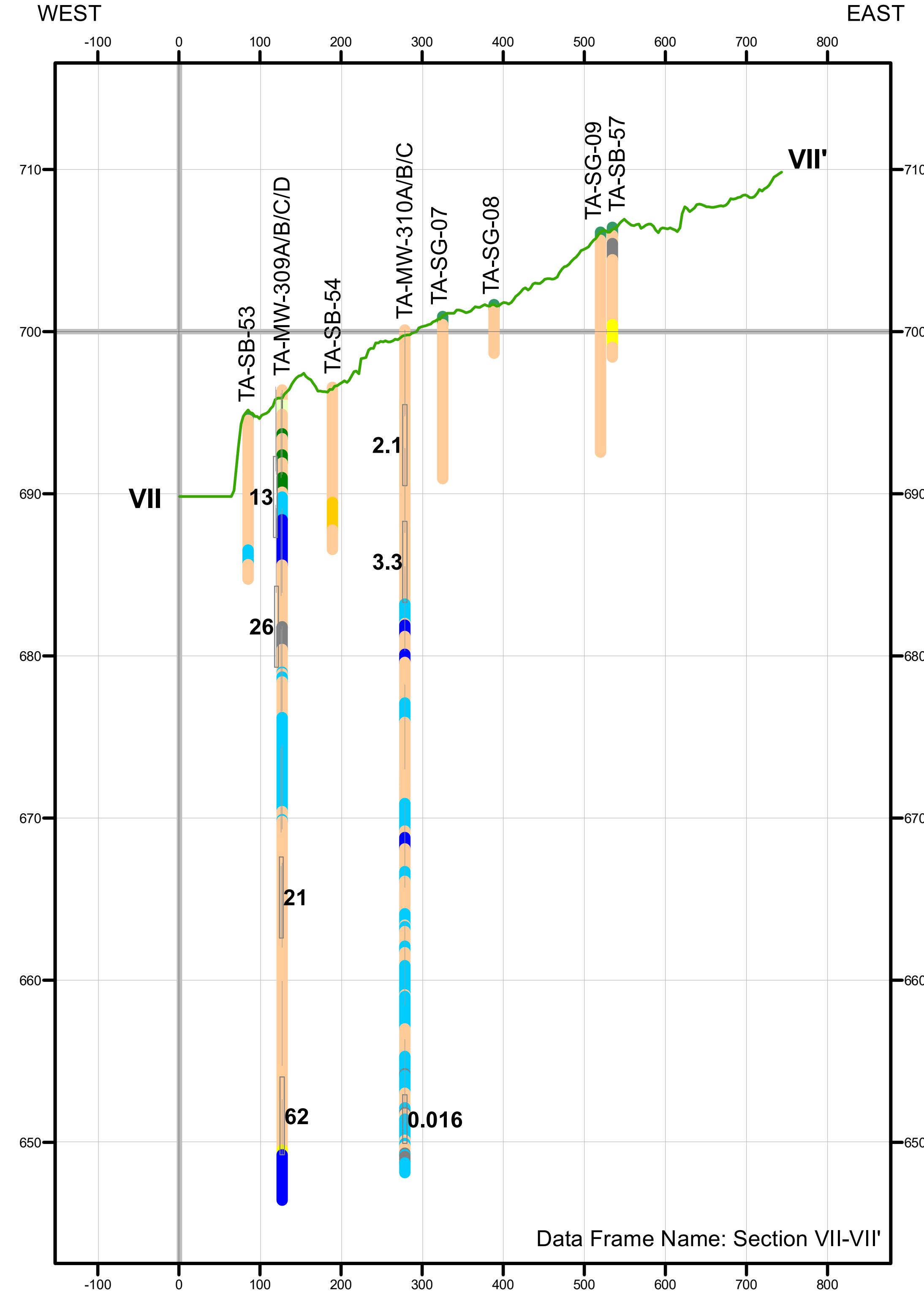
3. WELL SCREEN ELEVATIONS PROVIDED IN FEET ABOVE MEAN SEA LEVEL, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88). ELEVATIONS ARE ROUNDED TO THE NEAREST FOOT.

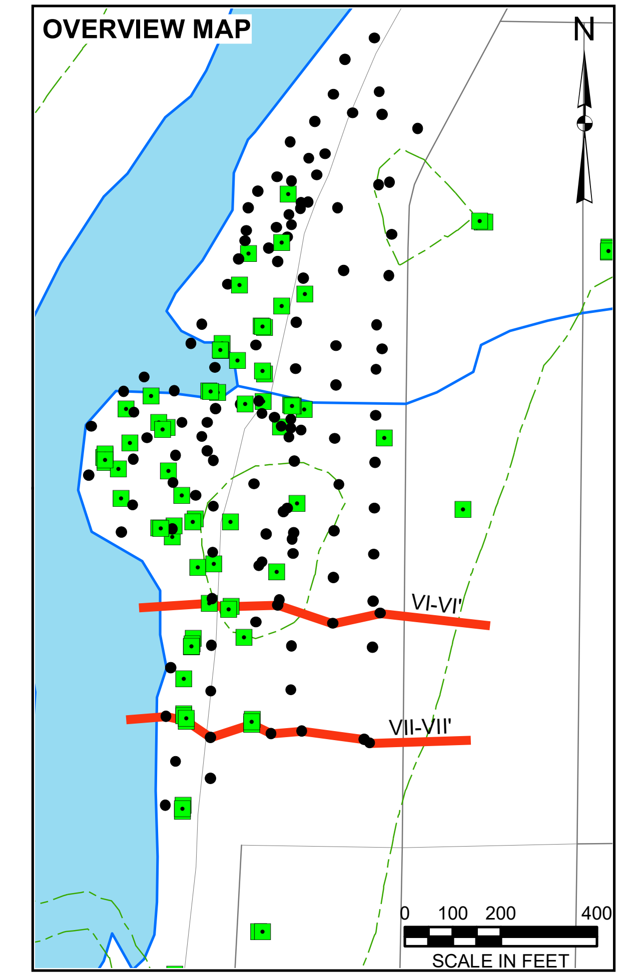
FORMER TANNERY
ROCKFORD, MICHIGAN

CROSS SECTIONS IV-IV' AND V-V'

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		PREPARED FOR: WNJ/WWW	
PROJ MGR: TAL	REVIEWED BY: MAW	CHECKED BY: JC	SHEET NO.
DESIGNED BY: JC	JC/JMG	SCALE: 1 in = 400 ft	4
DATE: 04/11/2023	PROJECT NO: 16.0062961.01	REVISION NO:	







OVERVIEW MAP LEGEND

- SOIL BORING
- MONITORING WELL
- SECTIONLINE
- GROUNDWATER CONTOURS, NOVEMBER 2019
- RUM CREEK
- ROGUE RIVER
- MINOR ROADS AND TWO TRACKS
- MAJOR CITY ROADS
- MINOR CITY ROADS

CROSS SECTION LEGEND

- WELL CASING
- WELL SCREEN (PFOS - UG/L)
- GROUND SURFACE

BOREHOLE LITHOLOGY

- GRAVEL
- SAND AND GRAVEL
- SAND
- SAND/GRAVEL WITH CLAY/SILT
- CLAY/SILT WITH SAND/GRAVEL
- SILT
- CLAY AND SILT
- CLAY
- TOP SOIL
- ORGANIC SOIL
- FILL

NOTES:
1. LOCATIONS AND SITE FEATURES ARE APPROXIMATE.

2. GROUND SURFACE ELEVATIONS ARE BASED ON DIGITAL RASTER FILES OF BARE EARTH DIGITAL ELEVATION MODELS (DEMS), GENERATED FROM LIDAR DATA WITH 1-METER HORIZONTAL ACCURACY AND 18.5-CENTIMETER VERTICAL ACCURACY. DIGITAL FILES OF DEMS AND LIDAR DATA WERE PROVIDED BY KENT COUNTY.

3. WELL SCREEN ELEVATIONS PROVIDED IN FEET ABOVE MEAN SEA LEVEL, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88). ELEVATIONS ARE ROUNDED TO THE NEAREST FOOT.

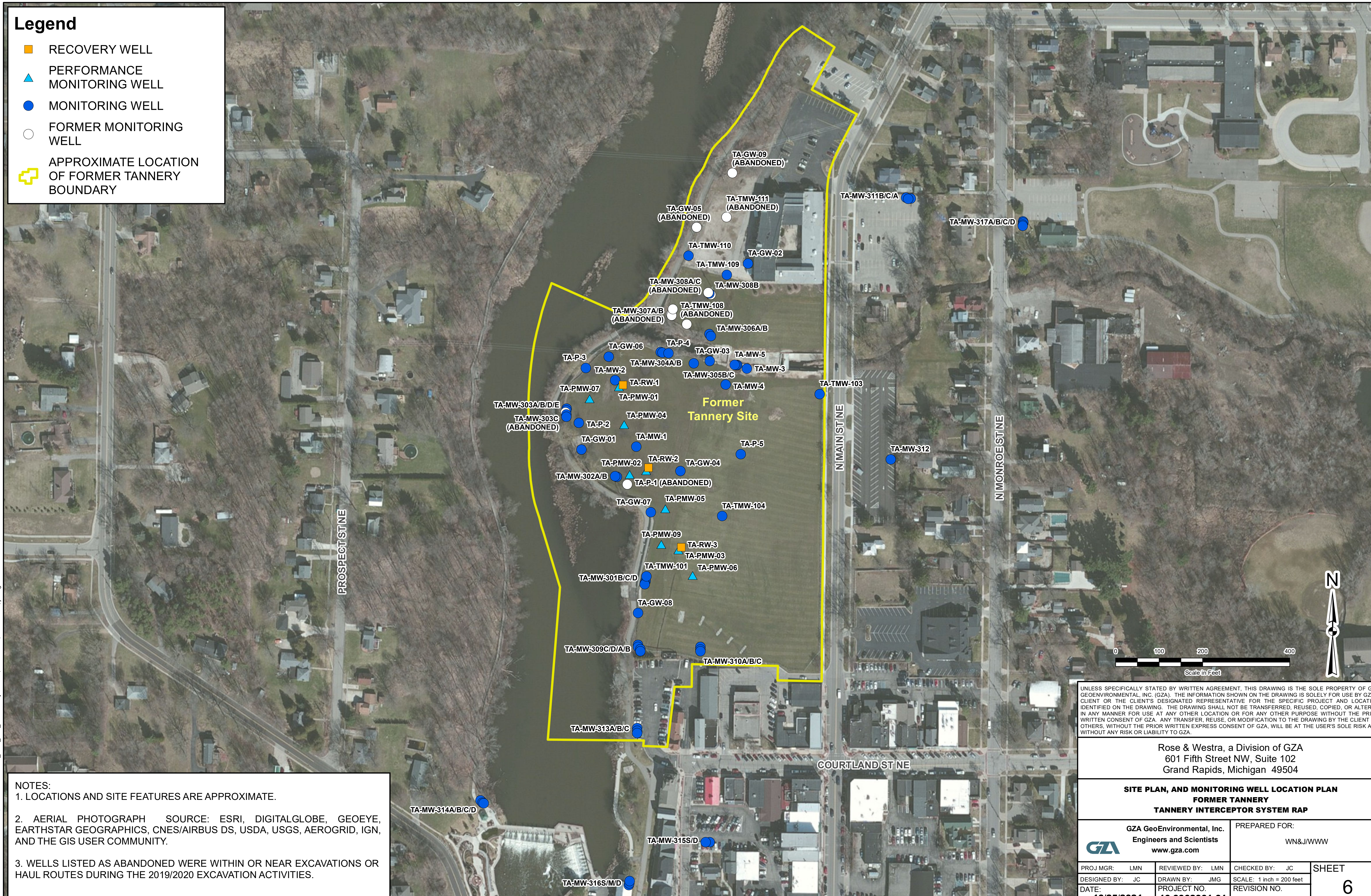
FORMER TANNERY
ROCKFORD, MICHIGAN

CROSS SECTIONS VI-VI' AND VII-VII'

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

PREPARED FOR:
WNJ/WWW

PROJ MGR: LMN	REVIEWED BY: MAW	CHECKED BY: CG	SHEET NO. 5
DESIGNED BY: JC	DRAWN BY: JC/RMG	SCALE: 1 in = 400 ft	
DATE: 10/25/2021	PROJECT NO:	REVISION NO:	



Legend

- RECOVERY WELL
- PERFORMANCE MONITORING WELL
- MONITORING WELL
- FORMER MONITORING WELL
- APPROXIMATE LOCATION OF FORMER TANNERY BOUNDARY

NOTES:
1. LOCATIONS AND SITE FEATURES ARE APPROXIMATE.

2. AERIAL PHOTOGRAPH SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY.

3. WELLS LISTED AS ABANDONED WERE WITHIN OR NEAR EXCAVATIONS OR HAUL ROUTES DURING THE 2019/2020 EXCAVATION ACTIVITIES.

Rose & Westra, a Division of GZA
601 Fifth Street NW, Suite 102
Grand Rapids, Michigan 49504

SITE PLAN, AND MONITORING WELL LOCATION PLAN
FORMER TANNERY
TANNERY INTERCEPTOR SYSTEM RAP

GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

PREPARED FOR: WN&J/WWW

PROJ MGR: LMN	REVIEWED BY: LMN	CHECKED BY: JC	SHEET
DESIGNED BY: JC	DRAWN BY: JMG	SCALE: 1 inch = 200 feet	6
DATE: 10/25/2021	PROJECT NO. 16.0062961.01	REVISION NO.	

Legend

- GROUNDWATER CONTOUR, APRIL 2019
- RECOVERY WELL
- PERFORMANCE MONITORING WELL
- MONITORING WELL
- FORMER MONITORING WELL
- APPROXIMATE LOCATION OF FORMER TANNERY BOUNDARY

NOTES:
1. LOCATIONS AND SITE FEATURES ARE APPROXIMATE.

2. AERIAL PHOTOGRAPH SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY.

3. WELLS LISTED AS FORMER WERE WITHIN OR NEAR EXCAVATIONS OR HAUL ROUTES DURING THE 2019/2020 EXCAVATION ACTIVITIES.

Rose & Westra, a Division of GZA
601 Fifth Street NW, Suite 102
Grand Rapids, Michigan 49504

GROUNDWATER CONTOURS, APRIL 2019
FORMER TANNERY
TANNERY INTERCEPTOR SYSTEM RAP

GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

PREPARED FOR:
WN&J/WWW

PROJ MGR: LMN	REVIEWED BY: LMN	CHECKED BY: JC	SHEET
DESIGNED BY: JC	DRAWN BY: JMG	SCALE: 1 inch = 200 feet	7
DATE: 10/25/2021	PROJECT NO. 16.0062961.01	REVISION NO.	

Legend

- GROUNDWATER CONTOUR, SEPTEMBER 2021
- RECOVERY WELL
- PERFORMANCE MONITORING WELL
- MONITORING WELL
- FORMER MONITORING WELL
- APPROXIMATE LOCATION OF FORMER TANNERY BOUNDARY

NOTES:
1. LOCATIONS AND SITE FEATURES ARE APPROXIMATE.

2. AERIAL PHOTOGRAPH SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY.

3. WELLS LISTED AS FORMER WERE WITHIN OR NEAR EXCAVATIONS OR HAUL ROUTES DURING THE 2019/2020 EXCAVATION ACTIVITIES.

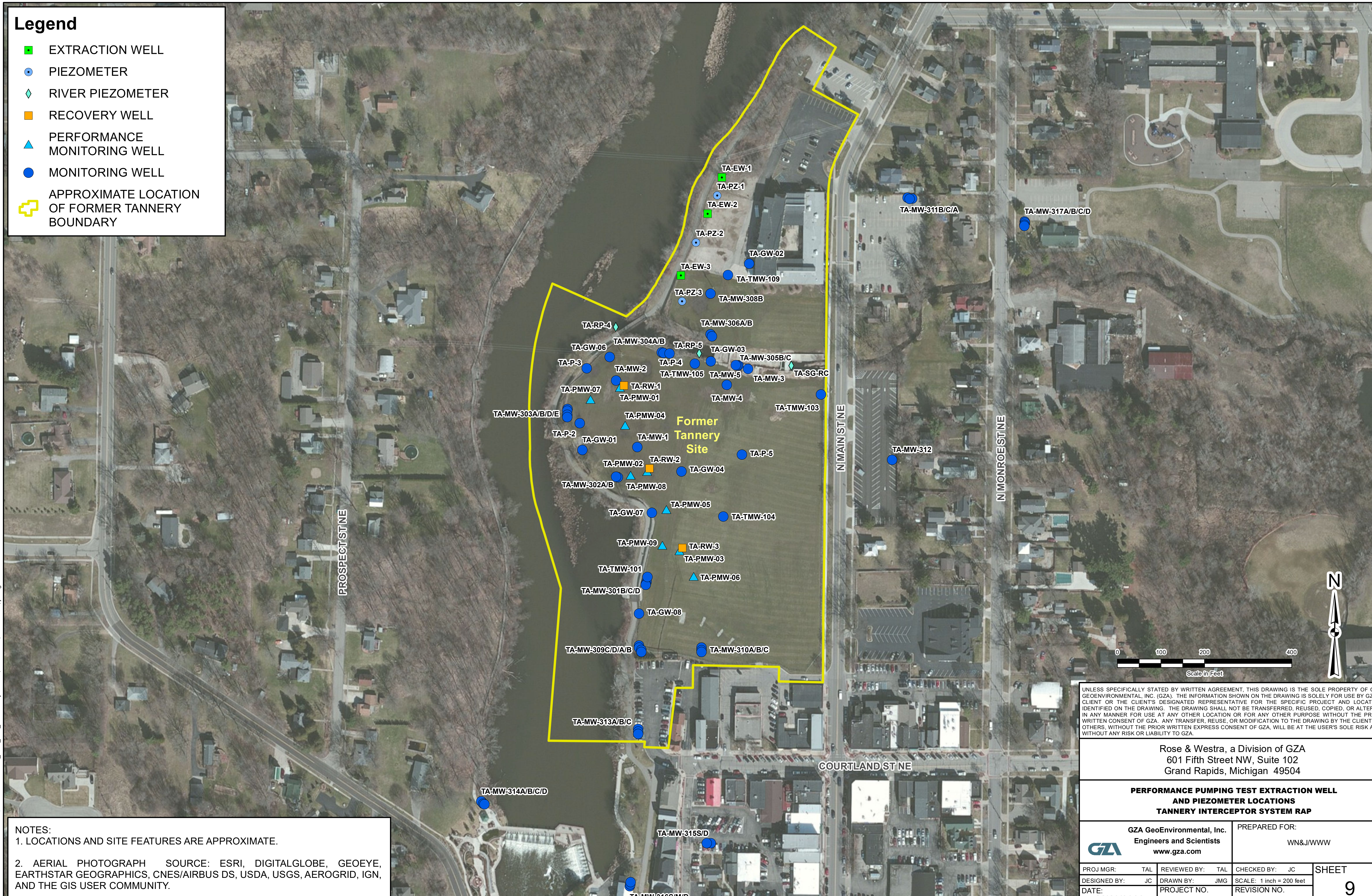
Rose & Westra, a Division of GZA
601 Fifth Street NW, Suite 102
Grand Rapids, Michigan 49504

GROUNDWATER CONTOURS, SEPTEMBER 2021
FORMER TANNERY
TANNERY INTERCEPTOR SYSTEM RAP

GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

PREPARED FOR:
WN&J/WWW

PROJ MGR: LMN	REVIEWED BY: LMN	CHECKED BY: JC	SHEET
DESIGNED BY: JC	DRAWN BY: JMG	SCALE: 1 inch = 200 feet	8
DATE: **10/25/2021**	PROJECT NO. **16.0062961.01**	REVISION NO.	



Legend

- EXTRACTION WELL
- PIEZOMETER
- RIVER PIEZOMETER
- RECOVERY WELL
- PERFORMANCE MONITORING WELL
- MONITORING WELL
- APPROXIMATE LOCATION OF FORMER TANNERY BOUNDARY

NOTES:
1. LOCATIONS AND SITE FEATURES ARE APPROXIMATE.

2. AERIAL PHOTOGRAPH SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY.

Rose & Westra, a Division of GZA
601 Fifth Street NW, Suite 102
Grand Rapids, Michigan 49504

PERFORMANCE PUMPING TEST EXTRACTION WELL AND PIEZOMETER LOCATIONS TANNERY INTERCEPTOR SYSTEM RAP

GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

PREPARED FOR: WN&J/WWW

PROJ MGR: TAL	REVIEWED BY: TAL	CHECKED BY: JC	SHEET
DESIGNED BY: JC	DRAWN BY: JMG	SCALE: 1 inch = 200 feet	9
DATE: 11/10/2022	PROJECT NO. 16.0062961.01	REVISION NO.	

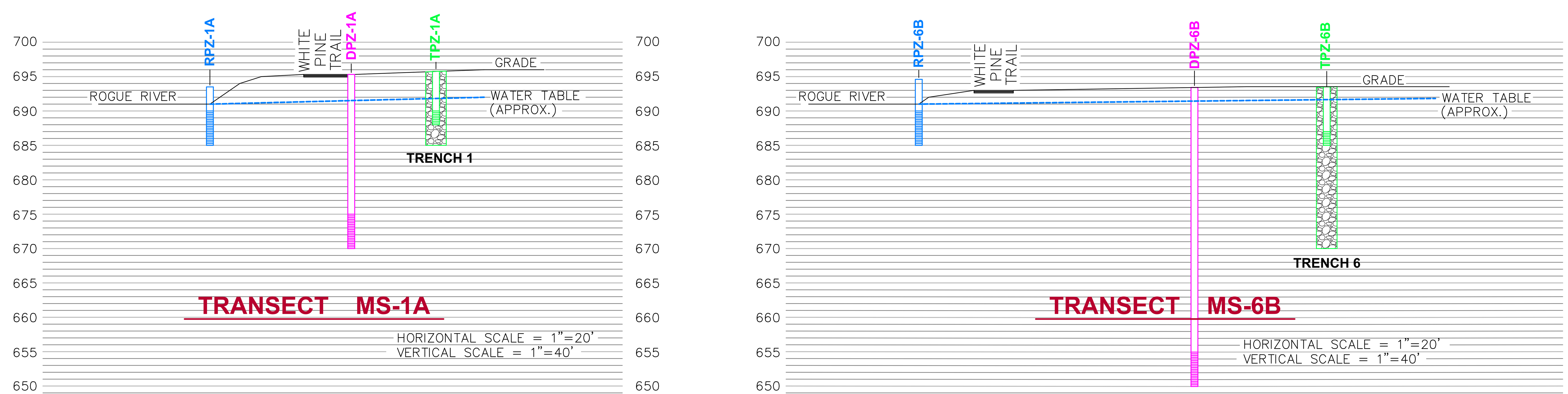
NO.	ISSUE/DESCRIPTION	BY	DATE

TANNERY SITE
MAIN STREET, ROCKFORD, MICHIGAN

PROPOSED GROUNDWATER COLLECTION TRENCHES, EXTRACTION WELLS & TREATMENT BUILDING

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com
PREPARED FOR: WWW/WN&J

PROJ MGR: TAL	REVIEWED BY: TAL	CHECKED BY: JC	SHEET
DESIGNED BY: JC	DRAWN BY: KJB	SCALE: 1" = 50'	10
DATE: 4/26/23	PROJECT NO. 16.0062961.02	REVISION NO. NA	SHEET NO.



NO.	ISSUE/DESCRIPTION	BY	DATE

TANNERY SITE
MAIN STREET, ROCKFORD, MICHIGAN

PROPOSED PERFORMANCE MONITORING PIEZOMETERS AND TRANSECTS

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com

PREPARED FOR: WWW/WN&J

PROJ MGR: TAL	REVIEWED BY: TAL	CHECKED BY: JC	SHEET
DESIGNED BY: JC	DRAWN BY: KJB	SCALE: 1" = 50'	11
DATE: 5/8/23	PROJECT NO. 16.0062961.02	REVISION NO. NA	SHEET NO.

NO.	ISSUE/DESCRIPTION	BY	DATE

TANNERY SITE
MAIN STREET, ROCKFORD, MICHIGAN

MONITORING WELL SAMPLING NETWORK

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com

PREPARED FOR: WWW/WN&J

PROJ MGR: TAL	REVIEWED BY: TAL	CHECKED BY: JC	SHEET
DESIGNED BY: JC	DRAWN BY: KJB	SCALE: 1" = 60'	12
DATE: 5/9/23	PROJECT NO. 16.0062961.02	REVISION NO. NA	SHEET NO.

Appendix A – Response Comments to EGLE's March 10, 2023 Letter

R&W/GZA RESPONSE TO EGLE March 10, 2023 COMMENTS

1 General Comments

Contamination is present between the trench and the Rogue River to the west. If particle tracking has been conducted from these areas of contamination to the trench, that modelling should be included in the Revised Tannery Interceptor System ResAP (Revised ResAP).

Response: Please see Figures 9-1 thru 9-9 in the Revised Tannery Response Activity Plan (Revised RAP) for additional particle tracking modeling output figures.

2 General Comments

Additional scenarios should be modelled prior to system installation, including how the system will accommodate peak flow periods due to storm events and higher turbidity.

Response: Modeling scenarios using higher recharge values were performed and discussed in Section 9.3 of the Revised RAP.

3 General Comments

Verify that the storm and sanitary sewer utilities are included within the groundwater model since site infrastructure can impact groundwater flow.

Response: Existing structures and utilities were considered in evaluating the proposed design and location of the system. The storm and sanitary sewer lines invert elevations were approximately 1 to 2 feet below the groundwater table typically observed at the Site. Groundwater contour maps based on groundwater elevation data collected from Site monitoring wells do not indicate effect of the utility lines. The potential effect of the utility lines acting as sources/sinks/preferential pathways is believed to be localized and is not expected to have significant effect on the Site-scale groundwater modeling effort for the interceptor system final design.

4 General Comments

a. The re-submittal of this denied ResAP should be provided to EGLE as a fully Revised ResAP (revising the March 31, 2022, version), not as an addendum report as it was provided in December 2022.

Response: The Revised Tannery RAP proposes substantial modifications to the system in the EGLE-approved March 31, 2022 Final Tannery Interceptor System and is being submitted as a fully revised version of the RAP under Paragraph 7.14(b) of the Consent Decree.

5 General Comments

Additional information should be included in the Revised ResAP regarding how the location of the trench was selected. A pilot trench may be warranted to evaluate the subsurface conditions and better understand the placement and depth of the proposed trench system prior to installation.

Response: The capture system component locations, including trenches, were selected to establish groundwater control through inward hydraulic gradients to the capture system while minimizing to the extent practical the amount of water drawn from the Rogue River/Rum Creek and the total pumping rate. A groundwater interceptor system too close to the surface waters is likely to preferentially draw the majority of water from the surface waters and would become impractical to implement. A groundwater interceptor system too far away from the surface waters would have difficulty capturing groundwater near the surface water. Numerous modeling scenarios were *performed and considered along with Site characteristics (ex. existing structures and utility lines) to locate the capture system components, including the trenches. The approximate, anticipated trench depths were selected to capture the PFOS-containing groundwater vertically, based on the vertical extent of PFOS distribution in groundwater, lithologies and hydraulic control. Where appropriate, deep groundwater extraction wells are proposed to supplement the trenches. Numerous groundwater modeling scenarios were performed to optimize the preliminary capture system design parameters including locations, depths, etc. Particle tracking modeling was also performed to evaluate capture zones (see Figures 9-1 thru 9-9 in the Revised RAP). Additional explanation is provided in Section 9 of the revised RAP.*

6 General Comments

If the trench is not continuous across the length of the Rogue River and Rum Creek, provide information on how per-and polyfluoroalkyl substances (PFAS) will be addressed in the space between the trench segments.

Response: The groundwater collection system will be functionally continuous across the length of the Site. The capture system, which includes trenches and extraction wells, will draw groundwater from the surrounding aquifer. As shown in the modeling output figures, 9-1 thru 9-9 in the Revised RAP, the space between the trenches is within the hydraulic influence of the trenches and groundwater in the space is expected to be captured by the adjacent trenches.

7 General Comments

A comparison of trench elevations and elevations of PFAS groundwater contamination is required in order to evaluate how the depth of PFAS contamination correlates with the proposed trench depths and how performance of the system will remedy each water bearing zone or aquifer.

Response: The approximate trench bottom elevations anticipated have been added to the cross-section profiles which depict lithologies and PFOS concentrations in groundwater. The final capture system component locations, depths, etc. will be selected during the final design process.

8 General Comments

Include what contingencies or actions will be taken if there is evidence of PFAS contaminated groundwater flowing under the trenches.

Response: If this condition is observed in the monitoring data, the capture system will be modified. Modifications might include operational changes such as increasing pumping rates from the capture system near the underflow to increase the hydraulic influence or physical modifications such as installing additional extraction wells to control PFOS-containing groundwater at the Site.

9 General Comments

Although a Long-term Operations and Maintenance (O&M) Plan will be included in the Completion Report, an interim O&M Plan should be included in the Revised ResAP. The interim O&M Plan should include a schedule for detecting and identifying problems and finding solutions if trench systems go down. EGLE also anticipates that this plan will include proactive measures to keep the trench system up and running, such as regular flushing of the sumps and piping.

Response: An interim O&M Plan section has been added to the Revised RAP in Section 11. Specific O&M procedures will be identified once the final design with mechanical/electrical equipment and *parts is complete. A separate interim O&M plan for the performance monitoring period can be provided upon completion of the final capture system design.*

10 Section 10.1.1 Groundwater Collection Trenches

Additional details regarding the design of the trenches should be provided in order to better understand how the design of the trenches will guarantee flow to the sumps if float switches or gravity flow (or a combination) will be relied on to maintain a lower head in the sump than in the trench.

Response: The sumps, river piezometers and trench piezometers will be equipped with pressure transducers to measure water elevations. A programmable logic controller (PLC) will be used to interpret signals from the pressure transducers to control the capture system pumps and maintain groundwater elevations at the capture system below the corresponding river piezometers. The desired groundwater elevation differences between the river piezometers and the trench sumps/piezometers will be determined after the trenches are installed and testing performed.

11 Section 10.1.1 Groundwater Collection Trenches

Clarify if variable frequency drives (VFDs) are proposed to aid in flow control.

Response: The pumps and their controls will be selected during the final design process. The design will consider various flow control types including VFDs.

12 Section 10.1.1 Groundwater Collection Trenches

Additional information is needed to document that there are a sufficient number of sumps and cisterns based on the total footprint of the trenches.

Response: Installation recommendations of trench style collection systems indicate 1 sump for every 600 linear feet of HDPE pipe. The proposed sumps are well within these recommendations. The capacity of the cisterns will be capable of maintaining the expected collection rates of groundwater and serving as a reservoir prior to transfer to the treatment system. As described in comment #10, PLCs will be used to control the pumps within the sumps to maintain a groundwater elevation lower than that of the corresponding river piezometers. Likewise, a PLC will be programmed to regulate the pumps in the cisterns to allow the pumps in the wells and trench sumps to continuously operate.

13 Section 10.1.1 Groundwater Collection Trenches

The diameter of the sumps may need to be increased to account for larger pumps, instrumentation, and cleanout capability.

Response: The size of the sumps will be determined during the final design process and will account for the selected pump sizes, controls, and necessary O&M tasks.

14 Section 10.1.1 Groundwater Collection Trenches

Provide rationale for the decision to use 10-foot screens in the sumps.

Response: The sumps will be constructed of a riser pipe connected to the horizontal HDPE slotted pipe. The bottom construction will be determined in the final design. The report text has been updated.

15 Section 10.1.1 Groundwater Collection Trenches

The trench will accumulate silts and cleanouts will be needed to keep sections flowing. These cleanouts should be mentioned and included in the Revised ResAP.

Response: Each sump is installed with a cleanout pipe, located to the exterior of the sump, to allow for the flushing of the horizontal HDPE collection pipe located in the bottom of the trench. See Section 10 of the Revised RAP.

16 Section 10.1.3 Extraction Wells

Similar to the sumps, the diameter of the extraction wells may need to be increased to account for larger pumps, instrumentation, and cleanout capability.

Response: The size of the extraction wells will be determined during the final design process and will account for the selected pump sizes, controls, and necessary O&M tasks.

17 Section 10.1.2 Collection Cisterns

Design details of the cisterns should be provided to EGLE for review as part of the Revised ResAP.

Response: The cisterns are anticipated to serve as an underground collection tank prior to transfer to the treatment building. The cistern will be equipped with a duplex pump system to provide redundancy. Levels in each of the cisterns will be controlled by float or pressure transducers to regulate the flow to the treatment system. Additional design details for the cisterns are dependent on uncertainties that will be resolved and determined in the final design process. A conceptual design is provided in Section 10.1.2 of the Revised RAP.

18 Section 10.1.5 Piezometers

Details on the depths of the piezometers should be provided to EGLE for review. Lines of evidence should also be included within the report to support the number of piezometers proposed. EGLE does not believe that five river piezometers will be sufficient to demonstrate that PFAS contaminated groundwater is not venting to the Rogue River at concentrations above criteria.

Response: Section 10.1.5 Piezometers has been updated to reflect a total of nine river piezometers. Section 10.1.5 also contains anticipated piezometer depths.

19 Section 10.1.7 Pressure Transducers

Details regarding the types of instrumentation to be used should be provided to EGLE for review. Chosen instrumentation should not contain PFAS in wetted parts.

Response: A conceptual block diagram for the instrumentation process has been included. Specifications of selected manufacturer, PLC programs, and specific equipment can be made available upon final design. To the extent practical, submerged equipment and wetted components will not contain PFAS.

20 Section 10.1.7 Pressure Transducers

Update the report text to clarify that pressure transducers will be included in the trench piezometers (TPZs) and any other paired piezometers (i.e., PZDs).

Response: The text has been updated accordingly.

21 Section 13.0 Schedule

The Revised ResAP should include a schedule containing actual dates (which EGLE understands in some cases will be based on anticipated permit issuance dates) for project deadlines for Phases I, II, and III.

Response: The schedule section of the Revised RAP (Section 13.0) has been updated with pertinent milestone dates.

22 Section 13.0 Schedule

Additional details are needed regarding the pilot testing in Phase II including the goals and metrics of the testing.

Response: The text has been updated with additional goals and metrics of the pilot testing period.

23 Section 15.0 Performance Monitoring Plan

In accordance with the approved March 31, 2022, ResAP, EGLE requests that weekly elevation data from the piezometers, TA-RP-5, and TA-SG-RC be collected during the first four months of full system operation. Additionally, the groundwater flow direction in the monitoring sections/transects should be compared and evaluated weekly in accordance with the March 31, 2022, ResAP. After the four months of weekly readings, EGLE and GZA can discuss an updated monitoring frequency for the remainder of the 2-year testing period dependent on system installation progress.

Response: Agreed. See updated text in Section 15.0 – Performance Monitoring Plan

24 Section 15.0 Performance Monitoring Plan

EGLE does not believe there are a sufficient number of points of comparison proposed to adequately monitor the effectiveness of the interceptor system. Currently, there are only nine monitoring transects which span over 2,000 linear feet of trench system. Additional monitoring points are needed to prove that groundwater is being captured by the trenches, and additional screened depths are needed to monitor that groundwater is not flowing under the trenches. The existing monitoring well network may provide additional points for comparison and/or additional piezometers will be needed.

Response: As discussed with EGLE, four additional monitoring sections are included in the Revised RAP. In addition, a deep piezometer located between the trenches and the surface waters is proposed for each monitoring section. See updated text in Section 15.0 – Performance Monitoring Plan.

25 Section 15.0 Performance Monitoring Plan

Depth to water measurements should also be collected from all existing monitoring wells located between the trench and the Rogue River, in addition to the wells located along the monitoring transects. These additional depth to water readings should be collected at least every other week for the first 4 months of the trench system operation. After the four months, EGLE and GZA can discuss any changes that may need to occur in the frequency of collection of depth to water readings in these monitoring wells.

Response: Agreed. See updated text in Section 15.0 – Performance Monitoring Plan.

26 Section 15.0 Performance Monitoring Plan

Baseline groundwater elevation map(s), showing seasonal variations, should be provided for comparison as part of the performance monitoring plan.

Response: Agreed. See updated text in Section 15.0 – Performance Monitoring Plan.

27 Section 15.0 Performance Monitoring Plan

As part of the monthly progress reports, EGLE requests site-wide gradient maps and updated water budgets to show if groundwater is stagnating across the entirety of the facility.

Response: Site-wide gradient maps and updated water budgets will be provided in the monthly progress reports. See updated text in Section 15.0 – Performance Monitoring Plan.

28 Section 15.0 Performance Monitoring Plan

Based on the significant change in the type of interceptor system being proposed at the Tannery, EGLE does not believe that gradient measurements alone will be adequate information or lines of evidence to document and prove that the trench system is meeting the objective of the Consent Decree of "preventing PFAS Compounds from entering the surface water above water quality standards issued under Part 31." Some type of targeted PFAS monitoring needs to occur to document that groundwater above criteria is not venting into surface water. This is especially important given the "highly heterogenous lithologies and hydraulic conductivities" encountered at the site as described by GZA in the Addendum Report.

Response: Section 15 of the EGLE-approved RAP provides for PFAS monitoring. Section 17 of the Revised RAP proposes additional PFAS monitoring, and Section 15 of the Revised RAP discusses demonstration of effectiveness under the Consent Decree.

29 Section 15.0 Performance Monitoring Plan

EGLE requests that non-boundary wells north and south of Rum Creek be sampled quarterly for two years as stated in the approved March 31, 2022, ResAP. North of Rum Creek these wells are PZ-1, PZ-2, PZ-3, TA-MW-306A, TA-MW-306B, TA-TMW-109, and TA-GW-02. South of Rum Creek these wells are TA MW 3, TA MW 304A, TA MW 304B, TA GW 06, TA MW 303A, TA MW 303B, TA MW 303C, TA MW 303D, TA MW 302A, TA MW 302B, TA MW 301B, TA MW 301C, TA MW 301D, TA GW 08, TA MW 309A, TA MW 309B, TA MW 309C, TA MW 309D, TA TMW 103, TA MW 1, TA GW 04, TA P 5, TA MW 313A, TA MW 313B, TA MW 313C, TA TMW 104, TA MW 301B, TA MW 301C, and TA MW 301D.

Response: This revised RAP, like the EGLE-approved RAP, proposes sampling of these wells. The groundwater sampling program is described in Section 17.0 – Groundwater Sampling. Under Section 17.0 – Groundwater Sampling, we have updated the text to sample quarterly for the non-boundary wells. Note that monitoring well TA-MW-303C was damaged, therefore not included in Section 17 – Groundwater Sampling. In Comment No. 29, monitoring wells TA-MW-301B/C/D are included in the list twice. These wells were already included in the sampling and analysis plan.

30 Section 15.0 Performance Monitoring Plan

EGLE is clarifying that a long-term groundwater sampling plan must be included in the Completion Report for EGLE approval. As previously stated in EGLE's February 10, 2022, Approval with Conditions Letter in point 6, "EGLE requests that the monitoring wells identified on Table 15-1 that are currently identified as being tested annually, be tested quarterly during the duration of the two-year testing period. After the two-year testing period, a reduced sampling frequency could then be outlined in the long-term monitoring plan."

<u>*Response: Under Paragraph 7.12(a)(3) of the Consent Decree, within six months of the demonstration of effectiveness under Paragraph 7.7(b)(i) of the Consent Decree Wolverine must submit a Completion Report that, among other things, provides for implementation of a groundwater monitoring plan. This is consistent with Section 15 of the EGLE-approved RAP and sections 15 and 17 of the Revised RAP. A long-term groundwater monitoring plan, which may include reduced sampling frequency, will be prepared and included in the Completion Report.*</u>

31 Section 15.0 Performance Monitoring Plan

Based on the design changing to a trench capture system, EGLE requests that all river piezometers installed as part of the performance monitoring also be sampled under the groundwater sampling program.

<u>*Response: As discussed in response to Comment No. 28, there is not a significant change in the objective of the trench collection system as compared to individual wells. The capture system controls PFAS-containing groundwater by reversing the hydraulic gradient (i.e., groundwater flow away from surface water rather than toward the surface water). Therefore, PFAS sampling data from the river piezometers will not be useful for performance monitoring and is not consistent with monitoring required to demonstrate achievement of the goals as stated in the CD. The river piezometers are intended to estimate the groundwater elevations. They will be installed as close to the riverbank as feasible. Pressure transducers will be installed within the river piezometers. The water quality data at the river piezometers are expected to be affected by potential unknown sources of PFAS in the surface waters. The existing groundwater monitoring wells are better suited for groundwater quality assessment in the area between the surface waters and the capture system.*</u>

32 Section 15.0 Performance Monitoring Plan

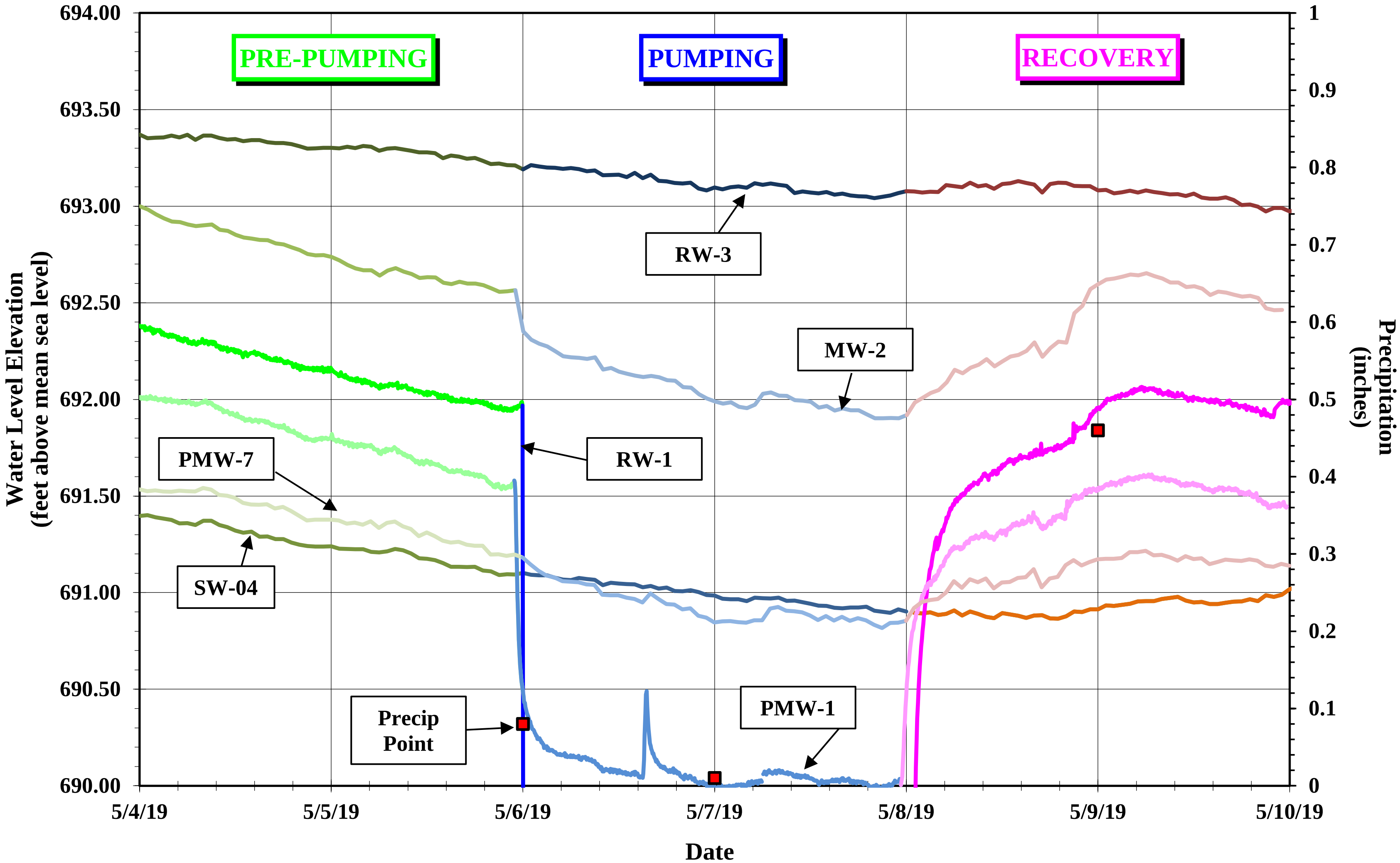
Remove the following sentences from Section 7.0: "As such, the hydraulic gradient between the Rogue River or Rum Creek and the extraction system will generally be small and groundwater velocity low resulting in few pore-water volume changes in years. It is unlikely that the constituent concentrations in the monitoring wells/piezometers will exhibit noticeable decreases in the short term; therefore, the annual sampling frequency is proposed in the long term."

EGLE does not agree with this statement since with the trench technology, there will be inward gradient and actual flushing of the pore water with river water over time for wells located between the trench and the Rogue River. As stated in EGLE's February 10, 2022, Approval with Conditions Letter, the long-term groundwater monitoring plan will be reviewed as part of the Tannery Completion Report.

Response: R&W/GZA acknowledges the sentences that EGLE has requested for deletion were included in the EGLE-approved RAP. We agree that there will be inward gradients and pore water volume exchanges. The number of pore water volume changes is much lower for this (or other) capture system because the goal is hydraulic control through reversal of gradients as opposed to a groundwater pump and treat system designed for groundwater remediation. We have revised the text to state that GZA will discuss with EGLE regarding a reduced monitoring frequency, if warranted by the findings of the quarterly sampling data in the first two years. A long-term groundwater monitoring plan will be prepared and included in the Completion Report.

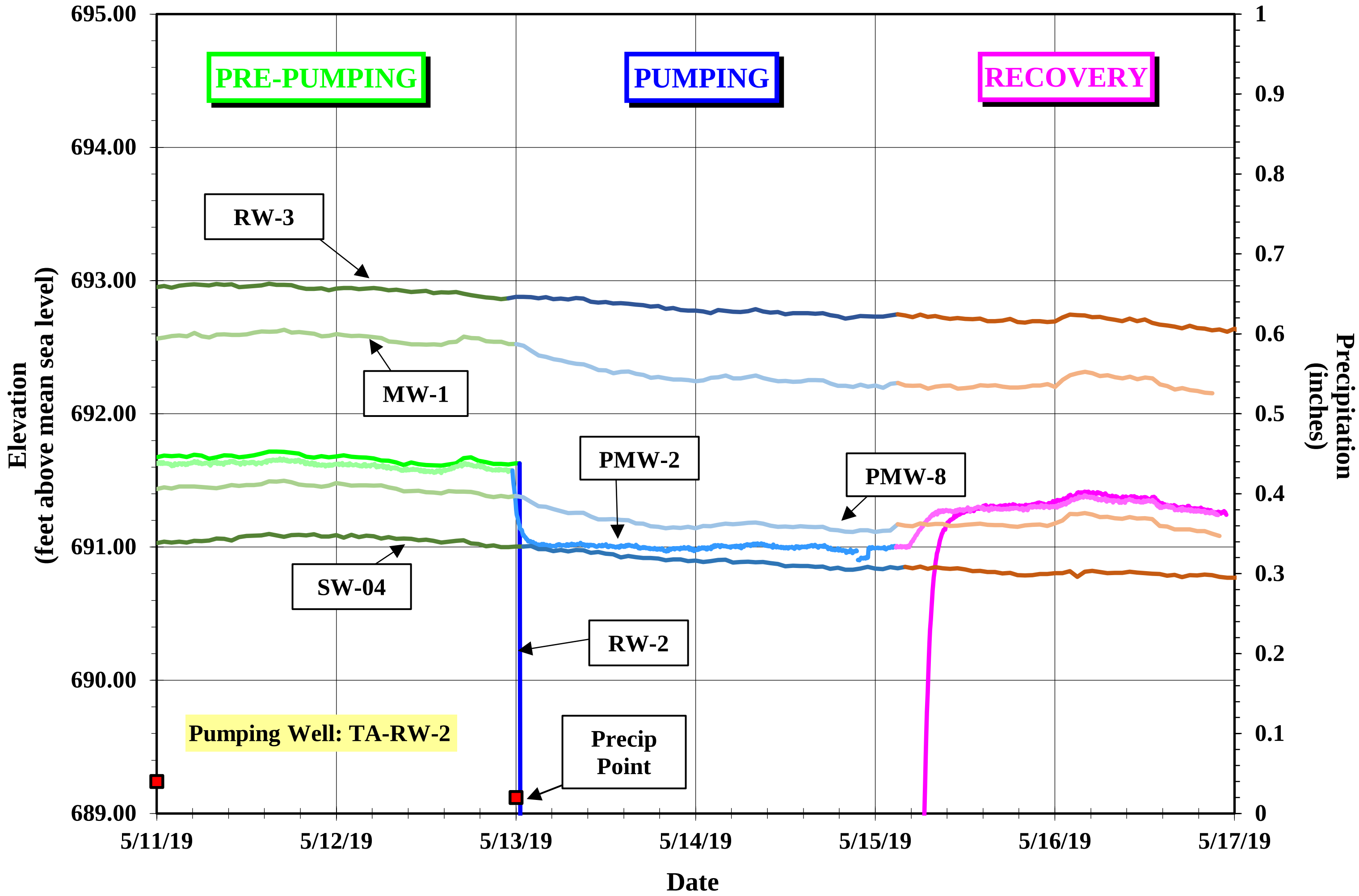
Appendix B – Pumping Test Groundwater Elevation Plots and Well Logs

TA-RW-1 Test - Combined Plot



Plot of Water Level Elevation versus Time for May 4 to May 10, 2019
Tannery Interim GW Remedy
Rockford, Michigan

TA-RW-2 Test - Combined Plot

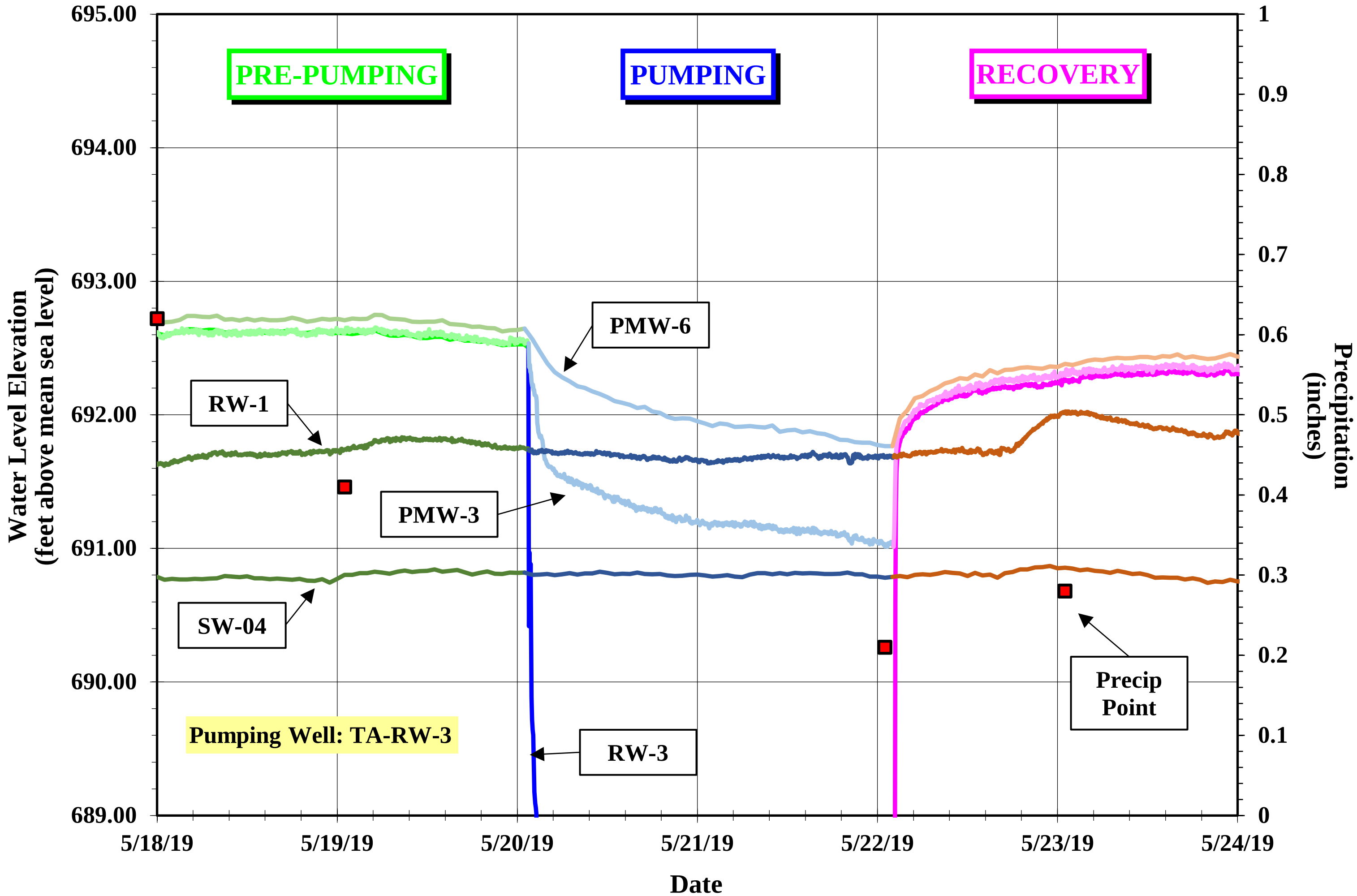


Plot of Water Level Elevation versus Time for May 11 to May 17, 2019

Tannery Interim GW Remedy

Grand Rapids, Michigan

TA-RW-3 Test - Combined Plot



Plot of Water Level Elevation versus Time for May 18 to May 24, 2019

Tannery Interim GW Remedy

Rockford, Michigan

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Wolverine World Wide, Inc.
Former Tannery
Rockford, Michigan

Boring No.: B-RW-1
Page: 1 of 2
File No.: 16.0062335.02
Check: John Morehouse

Contractor: Stearns Drilling Company
Foreman: Mike Hofferon
Logged by: Matt Bergen
Date Start/Finish: 10-24-18 / 10-24-18
Boring Location: See Survey
GS Elev.: 693.60' Datum:

	Auger/ Casing	Sampler
Type:	Hollow Stem Auger	Split Spoon
O.D. / I.D.:	8.0" / 4.25"	2.0" / 1 3/8"
Hammer Wt.:	140lbs	NA
Hammer Fall:	30.0"	NA
TOC Elev.:	NM	NA

GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
NM				

Surveyed By: NA Survey Date:

Depth	No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification	Stratum Desc.	Remarks	Equipment Installed
	1	24/17	0-2	2-9-50/5		Medium dense, brown, SILT and SAND, trace Organics (TOPSOIL). Changing at 0.6 feet to: Medium dense, brown, fine to medium SAND, little Gravel, little Silt.	TOPSOIL 0.6' SAND	1	None
2	2	24/18	2-4	16-6 3-0		Loose, brown, fine to medium SAND, some Silt, little Gravel. Changing at 2.5 feet to: Loose, brown, trace Silt. Changing at 3.0 feet to: Loose, black, fine SAND and SILT, little Gravel, trace Organic Matter (wood), wet with Sulfur like odor (FILL).	3' SAND and SILT		
4	3	24/6	4-6	1-1 1-1		Very loose, black, fine to medium SAND and SILT, some Gravel with bottom 1" Silt and Organic, wet.			
6	4	24/9	6-8	1-2 2-1		Very loose, black, fine to coarse SAND and SILT, trace Gravel, wet. Changing at 6.2 feet to: ORGANIC MATTER (wood), wet. Changing at 6.5 feet to: Soft, black, Clayey SILT with fine Sand seams, wet.	6.2' 6.5' ORGANIC MATTER Clayey SILT		
8	5	24/15	8-10	1-1 1-1		Very loose, black, fine SAND, some Silt, trace Gravel, wet. Changing at 8.8 feet to: Very loose, brown, fine SAND, some Silt, wet.	8' Silty CLAY	2	
10	6	24/15	10-12	1-3 5-6		Medium stiff, olive brown, Silty CLAY with fine Sand and Silt lenses, moist. Changing at 11.5 feet to: mottled orange and gray, fine SAND withSilt lenses, trace Gravel, wet.			
12	7	24/16	12-14	3-3 11-11		Medium dense, tan and gray, SILT and fine SAND, trace Gravel, moist.	12' SILT and SAND		
14	8	24/19	14-16	6-7 9-10		Medium dense, tan and gray, SILT and SAND, little Gravel, moist.			

REMARKS

1. Concrete in tip of spoon.
2. Black staining at 8.6 feet.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

GZA GeoEnvironmental, Inc. *Engineers and Scientists*	Wolverine World Wide, Inc. Former Tannery Rockford, Michigan	Boring No.: B-RW-1 Page: 2 of 2 File No.: 16.0062335.02 Check: John Morehouse

Depth	Sample Information: No.	Pen./Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification	Stratum Desc.	Remarks	Equipment Installed
							SILT and SAND		
16	9	24/18	16-18	8-10 10-15		Medium dense, tan and gray, SILT and fine SAND, little Gravel, moist.			
17									
18	10	24/0	18-20	4-12 14-20		Medium dense, tan and gray, SILT and fine SAND, some Gravel with 1 inch of Clay seam, moist.			
19									
20	11	24/24	20-22	10-12 16-16		Medium dense, tan and gray, SILT and fine SAND, some Gravel, moist.			
21									
22	12	24/24	22-24	4-12 26-37		Medium dense, tan and gray, fine SAND and SILT, little Gravel, moist.			
23									
24	13	24/24	24-26	14-20 24-26		Dark Tan, fine SAND with Clayey Silt seams, trace Gravel, wet.	24' SAND		
25									
26						Bottom of Borehole at 26.0 Feet	26'	3	
27									
28									
29									
30									
31									
32									

REMARKS

3. Backfilled with bentonite chips upon completion.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

GZA
GeoEnvironmental, Inc.
Engineers and Scientists

Wolverine World Wide, Inc.
Former Tannery
Rockford, Michigan

Boring No.: B-RW-2

File No.: 16.0062335.02
Check: John Morehouse

Contractor: Stearns Drilling Company
Foreman: Mike Hofferon
Logged by: Matt Bergen
Date Start/Finish: 10-24-18 / 10-24-18
Boring Location: See Survey
GS Elev.: 693.50' Datum:

	Auger/ Casing	Sampler
Type:	Hollow Stem Auger	Split Spoon
O.D. / I.D.:	8.0" / 4.25"	2.0" / 1 3/8"
Hammer Wt.:	140lbs	NA
Hammer Fall:	30.0"	NA
TOC Elev.:	NM	NA

GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
NM				

Surveyed By: NA Survey Date:

Depth	Sample Information: No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification	Stratum Desc.	Remarks	Equipment Installed
	1	24/22	0-2	4-11 12-12		Brown, SILT and fine SAND, trace Organics (TOPSOIL), moist. Changing at 0.3 feet to: Medium light brown, fine to coarse SAND, little Silt, moist. Changing at 1.2 feet to: Medium brown, fine to medium SAND, little Silt, trace Gravel, moist.	TOPSOIL 0.5' SAND		None
1									
2	2	24/22	2-4	7-8 8-7		Medium tan, fine SAND, little Silt, trace Gravel, wet with gray stained from 2.6 to 3.0 feet, wet.		1	
3									
4	3	24/18	4-6	1-2 3-3		Very light gray and black, fine SAND and SILT, wet.	4' SAND and SILT		
5									
6	4	24/14	6-8	2-3 3-2		Very light gray, fine SAND and SILT, wet.			
7									
8	5	24/20	8-10	1-1 6-11		Very light gray, fine SAND and SILT, wet. Changing at 8.4 feet to: Light gray and black, fine to medium SAND, some Silt, some Gravel, wet. Changing at 8.8 feet to: Medium stiff, black and gray, Clayey SILT, wet. Changing at 8.9 feet to: Gray and orange mottled, SILT, little fine Sand, little Gravel, moist with Clay seams, wet.	9' SILT		
9									
10	6	24/10	10-12	4-7 14-18		Red and orange mottled, SILT, little fine Sand, little Gravel, moist.			
11									
12	7	24/22	12-14	11-12 20-18		Hard, gray, SILT, little fine Sand, trace Gravel, wet.			
13									
14	8	24/20	14-16	11-15 23-26		Hard, gray, SILT, little fine Sand, little Gravel, moist.			

REMARKS

1. Groundwater was encountered at approximately 2.0 feet below ground surface.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Boring No.: B-RW-2

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Wolverine World Wide, Inc.
Former Tannery
Rockford, Michigan

Boring No.: B-RW-2
Page: 2 **of** 2
File No.: 16.0062335.02
Check: John Morehouse

Depth	Sample Information: No.	Pen./Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification	Stratum Desc.	Remarks	Equipment Installed
							SILT		
16	9	24/20	16-18	14-24 29-31		Hard, gray, SILT, some Gravel, little fine Sand, dry.			
17									
18	10	24/6	18-20	12-16 23-27		Hard, gray, SILT, little fine Sand, little Gravel, dry.			
19									
20						Bottom of Borehole at 20.0 Feet	20'	2	
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									

REMARKS

2. Backfilled with bentonite chips upon completion.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Boring No.: B-RW-2

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Wolverine World Wide, Inc.
Former Tannery
Rockford, Michigan

Boring No.: B-RW-3
Page: 1 of 2
File No.: 16.0062335.02
Check: John Morehouse

Contractor: Stearns Drilling Company
Foreman: Mike Hofferon
Logged by: Matt Bergen
Date Start/Finish: 10-25-18 / 10-25-18
Boring Location: See Survey
GS Elev.: 696.60' Datum:

	Auger/ Casing	Sampler
Type:	Hollow Stem Auger	Split Spoon
O.D. / I.D.:	8.0" / 4.25"	2.0" / 1 3/8"
Hammer Wt.:	140lbs	NA
Hammer Fall:	30.0"	NA
TOC Elev.:	NM	NA

GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
NM				

Surveyed By: NA Survey Date:

Depth	No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification	Stratum Desc.	Remarks	Equipment Installed
	1	24/17	0-2	4-6 11-11		Medium brown, SILT and SAND, trace Organic Matter, moist (FILL). Changing at 0.5 feet to: Medium tan, fine to coarse SAND, some Silt, trace Gravel, moist. Changing at 1.0 foot to: Medium brown, fine to medium SAND, some Silt, trace Gravel, moist.	TOPSOIL 0.5' SAND		None
2	2	24/11	2-4	9-12 33-23		Medium, red and brown, fine to medium SAND, little Silt, trace Gravel, moist.			
4	3	24/16	4-6	1-6 4-5		Loose, brown, fine to medium SAND, some Silt, trace Gravel, moist. Changing at 5.0 feet to: Stiff, brown, SILT & CLAY, some fine to coarse Sand, moist.	5' SILT & CLAY		
6	4	24/20	6-8	7-5 7-8		Stiff, brown, SILT & CLAY, little fine to medium Sand, moist.			
8	5	24/17	8-10	13-6 10-15		Very soft, brown, SILT & CLAY, little fine to medium Sand, moist. Changing at 8.5 feet to: Very soft, brown, SILT, some fine to medium Sand, trace Gravel, moist.	8.5' SILT		
10	6	24/17	10-12	4-14 17-21		Hard, light brown, SILT, some fine to medium Sand, trace Gravel, wet. Changing at 10.2 feet to: Dense, light brown, fine to medium SAND, little Silt, wet.	10.5' SAND	1	
13	7	24/16	13-15	6-9 18-21		Medium tan, fine to coarse SAND, little Silt, trace Gravel, wet.			

REMARKS

1. Groundwater was encountered at approximately 10.0 feet below ground surface.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Depth	No.	Pen./Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification	Stratum Desc.	Remarks	Equipment Installed
	8	24/24	15-17	8-18 24-34		Dark tan, fine to coarse SAND, little Silt, trace Gravel, wet.	SAND		
16									
17	9	24/18	17-19	6-11 25-60		Dense, tan, fine to coarse SAND, little Silt, wet. Changing at 17.8 feet to: Hard, gray, SILT, little fine to coarse Sand, trace Gravel, moist.	17.8' SILT		
18									
19	10	24/17	19-21	7-15 35-51		Hard, gray, Clayey SILT with fine Sand lenses, moist.	19' CLAY & SILT		
20									
21						Bottom of Borehole at 21.0 feet	21'	2	
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									

REMARKS

2. Backfilled with bentonite chips upon completion.

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Wolverine World Wide, Inc.
Former Tannery
Rockford, Michigan

Boring No.: TA-PMW-1
Page: 1 **of** 1
File No.: 16.0062335.02
Check: John Morehouse

Contractor: Stearns Drilling Company
Foreman: Mike Hofferon
Logged by: Matt Bergen
Date Start/Finish: 10-26-18 / 10-26-18
Boring Location: See Survey
GS Elev.: 693.60' **Datum:**

	Auger/ Casing	Sampler
Type:	Hollow Stem Auger	GeoProbe
O.D. / I.D.:	8.0" / 4.25"	NA
Hammer Wt.:	140lbs	NA
Hammer Fall:	30.0"	NA
TOC Elev.:	NM	NA

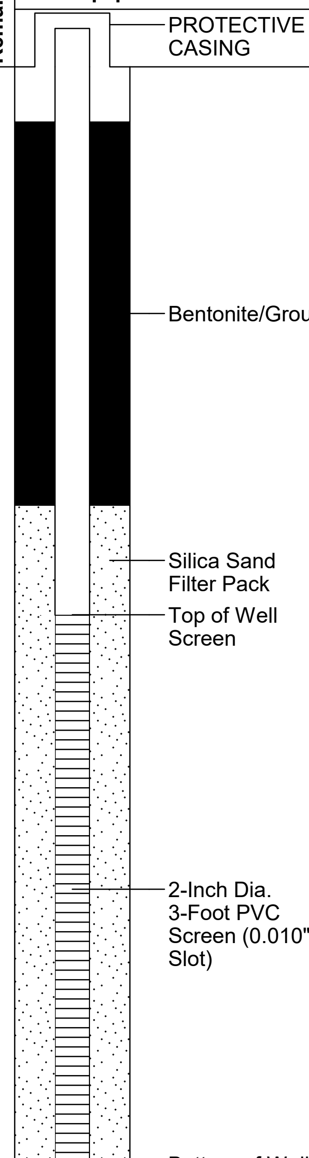
GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
NM				

Surveyed By: NA **Survey Date:**

Depth	No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification	Stratum Desc.	Remarks
0	1	24/17	0-2	2-3 14-11		Very stiff, brown, SILT, some fine Sand, trace Organic Matter (TOPSOIL). Changing at 0.9 feet to: Medium dense, light brown, fine to coarse SAND, some Gravel, trace Silt, moist.	SILT (TOPSOIL) 0.9' SAND	
5	2	24/0	5-7	WOH-WOH WOH-WOH		NO RECOVERY	5' NO RECOVERY	
7	3	24/8	7-9	1-1 1-1		Medium dense, black, SILT with fine to medium Sand lenses, trace Gravel, wet.	7' SILT	1
9	4	24/0	9-11	3-2 1-1		NO RECOVERY.	9' NO RECOVERY	
11	5	24/8	11-13	2-2 4-8		Medium stiff, olive and brown, SILT, some fine to medium Sand, some Gravel, trace Organic Matter (wood), wet.	11' SILT	
13	6	24/15	13-15	3-3 6-8		Stiff, gray, SILT, little fine to medium Sand, trace Gravel with fine Sand, seams, moist.		
15	7	24/16	15-17	5-5 7-7		Stiff, gray, SILT, some fine to medium Sand with fine Sand lenses, trace Gravel, wet.		
17	8	24/14	17-19	13-11 15-12		Very stiff, gray, SILT, little fine to medium Sand, trace Gravel, moist to wet. Changing at 17.7 feet to: Medium dense, gray, fine to coarse SAND, some Silt, trace Gravel, wet.	17.7' SAND	
19	9	12/12	19-20	5-10		Stiff, gray, Clayey SILT, little fine to medium Sand lenses, moist.	19' Clayey SILT	
20						Bottom of Borehole at 20.0 Feet	20'	2

Equipment Installed



REMARKS

1. Groundwater was encountered at approximately 7.0 feet below ground surface.
2. Monitoring well was installed in borehole upon completion. Well screen set from 10.0 to 20.0 feet below ground surface.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Boring No.: TA-PMW-1

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Wolverine World Wide, Inc.
Former Tannery
Rockford, Michigan

Boring No.: TA-PMW-2
Page: 1 of 1
File No.: 16.0062335.02
Check: John Morehouse

Contractor: Stearns Drilling Company
Foreman: Mike Hofferon
Logged by: Matt Bergen
Date Start/Finish: 10-25-18 / 10-26-18
Boring Location: See Survey
GS Elev.: 693.60' Datum:

	Auger/ Casing	Sampler
Type:	Hollow Stem Auger	GeoProbe
O.D. / I.D.:	8.0" / 4.25"	NA
Hammer Wt.:	140lbs	NA
Hammer Fall:	30.0"	NA
TOC Elev.:	NM	NA

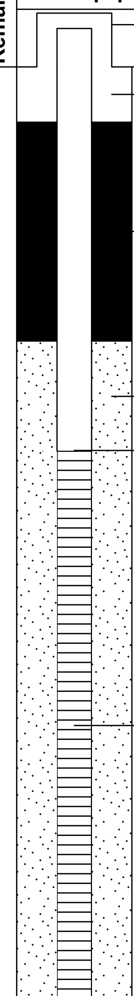
GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
NM				

Surveyed By: NA Survey Date:

Depth	No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification	Stratum Desc.	Remarks
0	1	24/21	0-2	3-10 11-13		Very stiff, brown, SILT, some fine Sand, trace Organic Matter, moist (TOPSOIL). Changing at 0.5 feet to: Medium dense, light brown, fine to coarse SAND, some Gravel, little Silt, moist. Changing at 1.1 feet to: Gray, fine SAND, some Silt, moist.	SAND (TOPSOIL) 0.5' SAND	
2	2	24/19	2-4	10-11 13-12		Medium dense, gray, fine SAND and SILT, trace Gravel, wet.		1
4	3	24/14	4-6	2-1 1-2		Very light gray, fine SAND with Silt, some black Peat from 4.7 to 4.8 feet, wet.		
6	4	24/17	6-8	WR-1 1-1		Very light gray with black layers, fine SAND and SILT, trace Gravel, wet.		
8	5	24/11	8-10	1-2 4-2		Gray with black staining, fine SAND, trace Silt, wet. Changing at 8.3 feet to: Medium stiff, olive, SILT, some fine to medium Sand, little Gravel, wet.	8.3' SILT	
10	6	24/14	10-12	5-11 16-19		Very stiff, light brown to gray, SILT, little fine to medium Sand, trace Gravel, moist.		
12	7	24/13	12-14	7-11 18-22		Very stiff, gray, Clayey SILT, little fine to medium Sand, trace Gravel, moist.		
14	8	24/23	14-16	10-14 21-23		Hard, gray, Clayey SILT, little fine to medium Sand, trace Gravel, fine Sand lenses, moist.		
16	9	12/12	16-17	13-24		Hard, gray, SILT, some fine to medium Sand, trace Gravel, moist.	17'	
17						Bottom of Borehole at 17.0 Feet		2

Equipment Installed



REMARKS

1. Groundwater was encountered at approximately 2.0 feet below ground surface.
2. Monitoring well was installed in borehole upon completion. Well screen set from 7.0 to 17.0 feet below ground surface.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Boring No.: TA-PMW-2

GZA
GeoEnvironmental, Inc.
Engineers and Scientists

Wolverine World Wide, Inc.
Former Tannery
Rockford, Michigan

Boring No.: TA-PMW-3
Page: 1 **of** 1
File No.: 16.0062335.02
Check: John Morehouse

Contractor: Stearns Drilling Company
Foreman: Mike Hofferon
Logged by: Matt Bergen
Date Start/Finish: 10-25-18 / 10-25-18
Boring Location: See Survey
GS Elev.: 696.50' **Datum:**

	Auger/ Casing	Sampler
Type:	Hollow Stem Auger	GeoProbe
O.D. / I.D.:	8.0" / 4.25"	NA
Hammer Wt.:	140lbs	NA
Hammer Fall:	30.0"	NA
TOC Elev.:	NM	NA

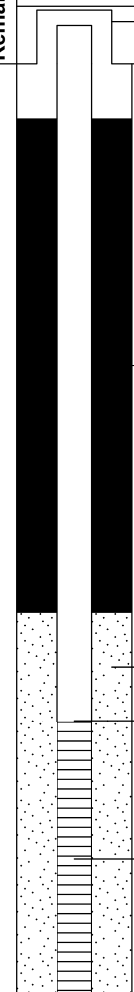
GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
NM				

Surveyed By: NA **Survey Date:**

Depth	No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification	Stratum Desc.	Remarks
0	1	24/15	0-2	4-10 18-13		Very stiff, brown, SILT, some fine Sand, trace Oganic Matter, moist (TOPSOIL). Changing at 0.3 feet to: Medium dense, brown, fine to coarse SAND and Gravel, some Silt, trace Brick, moist (FILL).	0.3' SILT (TOPSOIL) SAND (FILL)	
5	2	24/20	5-7	4-7 6-10		Stiff, light brown, Silty CLAY with Sand and Gravel, dense fine to medium Sand and Gravel seam from 5.7 to 5.9 feet, moist.	5' Silty CLAY	
7	3	24/20	7-9	5-8 10-14		Very stiff, light brown, SILT with fine to coarse Sand lenses, moist. Changing at 8.8 feet to: Medium dense, light brown, fine to coarse SAND and GRAVEL, some Silt, wet.	7' SILT	
9	4	24/18	9-11	9-16 22-30		Dense, light brown, fine to coarse SAND and Gravel, little Silt, wet.	9' SAND	1
11	5	24/19	11-13	13-32 38-47		Very dense, light brown, fine to coarse SAND and Gravel, trace Silt, red stained from 11.8 to 12.1 feet, wet. Changing at 12.1 feet to: Very dense, gray, fine to coarse SAND and Gravel, trace Silt, wet.		
13	6	24/19	13-15	3-18 23-29		Dense, gray, fine to coarse SAND and Gravel, trace Silt, wet.		
15	7	24/18	15-17	4-12 27-33		Dense, gray, fine to coarse SAND, some Silt, little Gravel, wet.		
17						Bottom of Borehole at 17.0 Feet	17'	2

Equipment Installed



REMARKS

1. Groundwater was encountered at approximately 8.8 feet below ground surface.
2. Monitoring well was installed in borehole upon completion. Well screen set from 12.0 to 17.0 feet below ground surface.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Boring No.: TA-PMW-3

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Wolverine World Wide, Inc.
Former Tannery
Rockford, Michigan

Boring No.:	TA-PMW-4
Page:	1 of 1
File No.:	16.0062335.02
Check:	John Morehouse

Contractor:	Stearns Drilling Company
Foreman:	Mike Hofferon
Logged by:	Kevin Hedinger
Date Start/Finish:	10-30-18 / 10-30-18
Boring Location:	See Survey
GS Elev.:	693.40'
Datum:	

	Auger/ Casing	Sampler
Type:	Hollow Stem Auger	GeoProbe
O.D. / I.D.:	8.0" / 4.25"	NA
Hammer Wt.:	140lbs	NA
Hammer Fall:	30.0"	NA
TOC Elev.:	NM	NA

GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
NM				

Surveyed By: NA Survey Date:

Sample Information

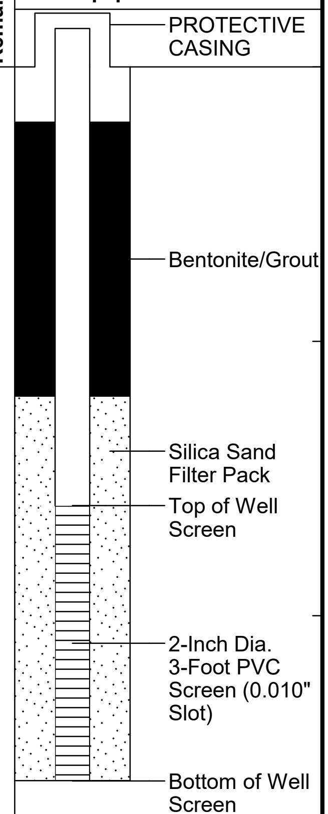
No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification
1	24/24	0-2	4-9 13-9		Loose, dark brown, SILT, moist (TOPSOIL). Changing at 1.0 foot to: Loose, gray, fine to medium SAND, some coarse Sand and Gravel, moist. Changing at 1.5 feet to: Loose, black, fine to medium SAND, some coarse Sand, with 1 inch layer of clay at 1.5 feet, moist.
2	24/12	2-4	5-5 3-4		Loose, black, fine to medium SAND, some coarse Sand, moist. Changing at 2.3 feet to: Gray, fine to medium SAND, some Gravel, some Organic Matter (wood chips), wet. Changing at 2.7 feet to: Dark brown, SILT, trace Gravel, trace fine Sand, wet.
3	24/12	4-6	1-1 3-1		Loose, fine to medium SAND, some Organic Matter (roots), some Silt, wet. Changing at 4.3 feet to: Loose, coarse SAND and GRAVEL, trace medium Sand, wet. Changing at 4.7 feet to: Soft, black, SILT, some Clay, wet.
4	24/14	6-8	1-1 1-1		Soft, black, SILT, some Clay, wet. Changing at 6.7 feet to: Loose, gray, fine SAND, wet.
5	24/12	8-10	3-3 4-2		Very loose, brown, SILT, trace Gravel, wet. Changing at 8.7 feet to: Very loose, brown, fine to medium SAND, trace Gravel, trace Silt, wet.
6	24/14	10-12	1-1 1-1		Loose, gray and brown, fine to medium SAND, trace coarse Sand with Silt inclusions, moist. Changing at 10.7 feet to: Soft, gray, SILT, trace to some Clay, trace Gravel, wet.
7	24/16	12-14	6-8 9-10		Stiff, gray, SILT, trace fine Sand, moist. Changing at 13.2 feet to: Stiff, gray, SILT, some Clay, moist.
8	24/24	14-16	7-9 11-14		Stiff, gray, SILT, some Clay, some Sand, trace Gravel, moist.
9	24/20	16-18	6-13 14-17		Stiff, gray, SILT, some Clay, some Sand, trace Gravel, moist. Changing at 17.0 feet to: Dense, gray, fine SAND, some Silt, trace Gravel, moist.
10	24/12	18-20	10-12 26-29		Dense, gray, SILT, some fine Sand, trace Gravel, moist.
					Bottom of Borehole at 20.0 Feet

Stratum Desc.

Depth	Stratum
0-0.5'	SILT (TOPSOIL)
0.5'-2.7'	SAND
2.7'-4'	SILT
4'-4.7'	SAND
4.7'-6.7'	SILT
6.7'-8'	SAND
8'-8.7'	SILT
8.7'-10.7'	SAND
10.7'-17'	SILT
17'-20'	SAND

Remarks: 1 (at approx. 2.7 ft); 2 (at bottom of borehole, 20 ft)

Equipment Installed



REMARKS

1. Groundwater was encountered at approximately 2.3 feet below ground surface.
2. Monitoring well was installed in borehole upon completion. Well screen set from 8.0 to 13.0 feet below ground surface.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Boring No.: TA-PMW-4

BORING_WELL 6233502 WWW FORMER TANNERY ROCKFORD 10_16_18.GPJ GZA_CORP.GDT 7/1/19

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Wolverine World Wide, Inc.
Former Tannery
Rockford, Michigan

Boring No.: TA-PMW-5
Page: 1 **of** 1
File No.: 16.0062335.02
Check: John Morehouse

Contractor: Stearns Drilling Company
Foreman: Mike Hofferon
Logged by: Kevin Hedinger
Date Start/Finish: 10-31-18 / 10-31-18
Boring Location: See Survey
GS Elev.: 694.80' **Datum:**

	Auger/ Casing	Sampler
Type:	Hollow Stem Auger	GeoProbe
O.D. / I.D.:	8.0" / 4.25"	NA
Hammer Wt.:	140lbs	NA
Hammer Fall:	30.0"	NA
TOC Elev.:	NM	NA

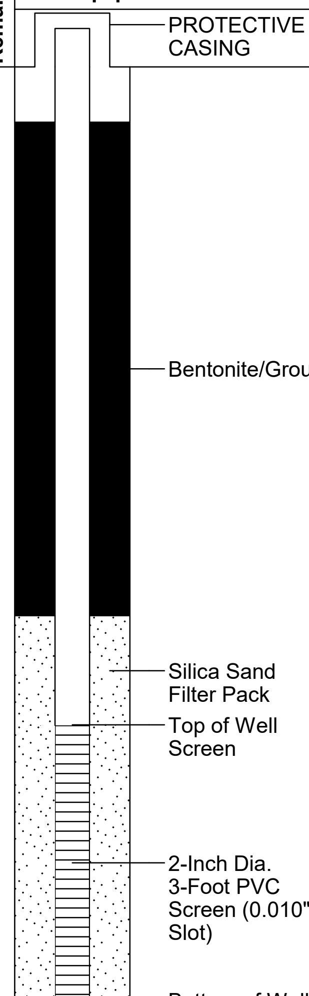
GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
NM				

Surveyed By: NA **Survey Date:**

Depth	No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification	Stratum Desc.	Remarks
0	1	24/20	0-2	4-4 8-7		Brown, SILT, moist (TOPSOIL). Changing at 0.5 feet to: Loose, brown and orange, fine SAND, moist with 1 inch layer of Gravel at 1.5 feet and 1.8 feet.	SILT; 0.5' SAND	
2	2	24/24	2-4	6-4 4-3		Loose, brown and orange, fine SAND, trace Gravel, moist. Changing at 3.2 feet to: Loose, dark brown, fine SAND, wet with Clay inclusion at 4 feet.		1
4	3	24/16	4-6	1-3 1-1		Soft, dark brown to gray, SILT, some Clay, trace Gravel, wet with Organic Matter (wood pieces) at 4.0 feet.	4' SILT	
6	4	24/14	6-8	1-1 1-3		Soft, gray, Silty CLAY, moist to wet. Changing at 7.2 feet to: Soft, gray, Silty CLAY, trace Gravel, trace fine Sand, moist to wet.	6' Silty CLAY	
8	5	24/12	8-10	3-4 4-5		Soft, brown, Silty CLAY, trace Gravel, trace Sand, moist. Changing at 8.1 feet to: Stiff, brown, Silty CLAY, trace Gravel, trace Sand, moist.		
10	6	24/20	10-12	3-6 13-16		Loose, brown and orange, fine to medium SAND, wet. Changing at 10.7 feet to: Stiff, brown and gray, Silty CLAY,trace fine Sand, trace Gravel, wet. Changing at 11.5 feet to: Loose, brown and orange, fine to medium SAND, wet.	10' SAND; 10.7' Silty CLAY	
12	7	24/20	12-14	3-9 25-31		Loose, brown, fine to medium SAND, wet.	12' SAND	
14	8	24/24	14-16	7-21 27-38		Loose, brown, fine medium SAND, wet. Changing at 15.0 feet to: Loose, brown, fine to medium SAND, trace Silt & Clay, wet.		
16	9	24/24	16-18	3-6 20-27		Loose, brown and gray, fine SAND, wet. Changing at 17.0 feet to: Loose, brown and gray, fine to medium SAND, trace Silt, wet.		
18	10	24/24	18-20	10-20 33-38		Loose, brown and gray, fine SAND, wet. Changing at 18.7 feet to: Stiff, gray, Silty CLAY, trace Gravel, wet.	18.7' Silty CLAY	
20						Bottom of Borehole at 20.0 feet	20'	2

Equipment Installed



REMARKS

1. Groundwater was encountered at approximately 3.0 feet below ground surface.
2. Monitoring well was installed in borehole upon completion. Well screen set from 8.0 to 13.0 feet below ground surface.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Boring No.: TA-PMW-5

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Wolverine World Wide, Inc.
Former Tannery
Rockford, Michigan

Boring No.: TA-PMW-6
Page: 1 **of** 1
File No.: 16.0062335.02
Check: John Morehouse

Contractor: Stearns Drilling Company
Foreman: Mike Hofferon
Logged by: Matt Bergen
Date Start/Finish: 11-1-18 / 11-1-18
Boring Location: See Survey
GS Elev.: 698.30' **Datum:**

	Auger/ Casing	Sampler
Type:	Hollow Stem Auger	GeoProbe
O.D. / I.D.:	8.0" / 4.25"	NA
Hammer Wt.:	140lbs	NA
Hammer Fall:	30.0"	NA
TOC Elev.:	NM	NA

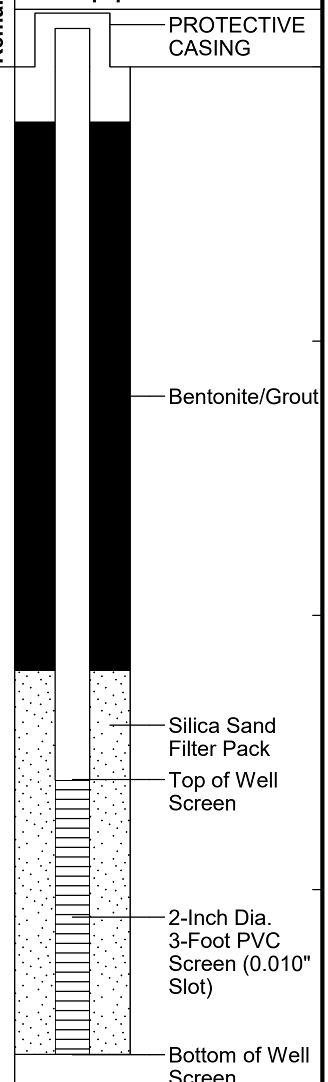
GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
NM				

Surveyed By: NA **Survey Date:**

Depth	No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification	Stratum Desc.	Remarks
	1	24/20	0-2	1-3 14-31		Brown, SILT, Organic Matter (roots), trace Clay, moist (TOPSOIL). Changing at 0.8 feet to: Loose, orange, fine to medium SAND, moist. Changing at 1.3 feet to: Loose, brown, fine to medium SAND, some Gravel, moist.	SILT (TOPSOIL) 0.8' SAND	
2	2	24/16	2-4	9-10 8-7		Loose, orange, fine to medium SAND, moist. Changing at 2.2 feet to: Loose, brown, fine to medium SAND, some Gravel, moist. Changing at 3.2 feet to: Soft, brown, SILT, some Clay, moist.	3.2' SILT	
4	3	24/17	4-6	4-3 2-4		Soft, brown, SILT, some Clay, moist. Changing at 4.2 feet to: Brown, SAND and GRAVEL, moist. Changing at 4.9 feet to: Soft, brown and orange, fine SAND, some Silt & Clay, moist to wet.	4.2' SAND and Gravel 4.9' SAND	1
6	4	24/20	6-8	5-9 12-17		Soft, brown and orange, fine SAND, some Silt & Clay, moist to wet. Changing at 6.2 feet to: loose, orange, fine SAND, some coarse Sand, wet. Changing at 6.8 feet to: Loose, gray, medium to coarse SAND, some fine Sand, some Gravel, wet.		
8	5	24/24	8-10	7-17 13-15		Loose, gray, medium to coarse SAND, some fine Sand, some Gravel, trace Silt, wet. Changing at 9.2 feet to: Loose, orange, fine to medium SAND, trace Gravel, trace Silt.		
10	6	24/20	10-12	4-13 20-27		Loose, brown, fine to medium SAND, some coarse Sand, some Gravel, trace Silt, wet.		
12	7	24/20	12-14	14-20 29-34		Loose, brown, fine to medium SAND, some coarse Sand, some Gravel, trace Silt, wet.		
14	8	24/22	14-16	19-33 30-33		Loose, brown, medium SAND, some fine to coarse Sand, trace silt, trace Gravel, wet.		
16	9	24/24	16-18	10-25 36-38		Loose, brown, medium to coarse SAND, some fine Sand, trace Gravel, wet.		
18	10	24/24	18-20	9-25 26-38		Loose, brown, medium to coarse SAND, wet.		
20						Bottom of Borehole at 20.0 Feet	20'	2

Equipment Installed



REMARKS

1. Groundwater was encountered at approximately 4.9 feet below ground surface.
2. Monitoring well was installed in borehole upon completion. Well screen set from 13.0 to 18.0 feet below ground surface.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Boring No.: TA-PMW-6

GZA
GeoEnvironmental, Inc.
Engineers and Scientists

Wolverine World Wide, Inc.
Former Tannery
Rockford, Michigan

Boring No.: TA-PMW-7
Page: 1 of 1
File No.: 16.0062335.02
Check: John Morehouse

Contractor: Stearns Drilling Company
Foreman: Mike Hofferon
Logged by: Kevin Hedinger
Date Start/Finish: 10-30-18 / 10-30-18
Boring Location: See Survey
GS Elev.: 693.40' Datum:

	Auger/Casing	Sampler
Type:	Hollow Stem Auger	GeoProbe
O.D. / I.D.:	8.0" / 4.25"	NA
Hammer Wt.:	140lbs	NA
Hammer Fall:	30.0"	NA
TOC Elev.:	NM	NA

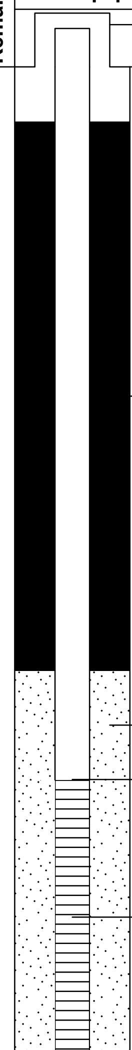
GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
NM				

Surveyed By: NA Survey Date:

Depth	No.	Pen./Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification	Stratum Desc.	Remarks
	1	24/20	0-2	2-6 19-17		Loose, dark brown, SILT, moist (TOPSOIL). Changing at 0.6 feet to: Dense, gray to brown, fine to medium SAND, some Gravel, damp.	SILT (TOPSOIL) 0.7' SAND	
2	2	24/10	2-4	5-6 7-5		Loose, gray to brown, fine to medium SAND, some Gravel, some Organic Matter (roots), wet (TOPSOIL). Changing at 2.3 feet to: CONCRETE pieces, wet.	2.3' CONCRETE Pieces	1
4	3	24/8	4-6	13-50/2"		CONCRETE pieces, wet.		
6	4	24/18	6-8	1-2 3-4		Loose, gray and brown, fine SAND, wet.	6' SAND	
8	5	24/14	8-10	1-2 2-5		Loose, gray, fine SAND, some Gravel, wet. Changing at 8.3 feet to: Loose, gray, fine SAND, wet.		
10	6	24/9	10-12	5-4 3-3		Loose, gray, fine SAND, some Gravel, wet.		
12	7	24/20	12-14	7-6 44-9		Loose, gray, SAND, wet. Changing at 12.8 feet to: Gray, GRAVEL, with loose, coarse wet Sand at 13.9 feet.	12.8' GRAVEL	
14	8	24/20	14-16	4-5 6-8		Loose, dark gray, fine SAND, trace Gravel, wet. Changing at 14.8 feet to: Loose, brown, fine SAND, some Gravel, wet.	14' SAND	
16	9	24/24	16-18	3-7 7-8		Loose, brown to orange, fine SAND, some Gravel, wet. Changing at 17.6 feet to: Stiff, gray, Silty CLAY, moist.	17.8' Silty CLAY	
18	10	24/12	18-20	4-9 10-12		Stiff, gray, Silty CLAY, moist.		
20						Bottom of Borehole at 20.0 feet	20'	2

Equipment Installed



REMARKS

1. Groundwater was encountered at approximately 2.3 feet below ground surface.
2. Monitoring well was installed in borehole upon completion. Well screen set from 13.0 to 18.0 feet below ground surface.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Boring No.: TA-PMW-7

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Wolverine World Wide, Inc.
Former Tannery
Rockford, Michigan

Boring No.: TA-PMW-8
Page: 1 **of** 1
File No.: 16.0062335.02
Check: John Morehouse

Contractor: Stearns Drilling Company
Foreman: Mike Hofferon
Logged by: Kevin Hedinger
Date Start/Finish: 10-30-18 / 10-30-18
Boring Location: See Survey
GS Elev.: 693.00' **Datum:**

	Auger/ Casing	Sampler
Type:	Hollow Stem Auger	GeoProbe
O.D. / I.D.:	8.0" / 4.25"	NA
Hammer Wt.:	140lbs	NA
Hammer Fall:	30.0"	NA
TOC Elev.:	NM	NA

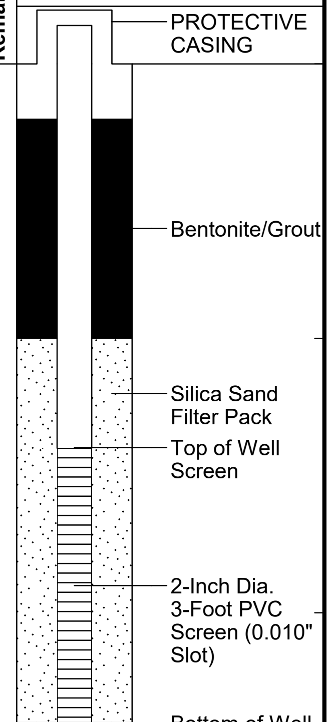
GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
NM				

Surveyed By: NA **Survey Date:**

No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification	Stratum Desc.	Remarks
1	24/18	0-2	3-8 10-10		Brown, SILT (TOPSOIL). Changing at 0.3 feet to: Loose, brown, fine to medium SAND, some Gravel, some coarse Sand, moist.	SILT (TOPSOIL) 0.3' SAND	
2	24/22	2-4	7-9 24-25		Loose, brown, fine SAND, trace Gravel, wet. Changing at 2.8 feet to: Loose, dark gray to black, fine SAND, some Gravel, wet.		
3	24/12	4-6	3-2 2-1		Loose, black, fine to medium SAND, some Silt, some Gravel, wet.		
4	24/4	6-8	0-0 0-2		Loose, gray, fine to medium SAND, wet. Changing at 7.0 feet to: Soft, black, Silt, wet.	6.2' SILT	1
5	24/10	8-10	0-2 2-2		Soft, black, SILT, some fine to coarse Sand, some Gravel, wet.		
6	24/18	10-12	5-5 6-8		Soft, gray, SILT, trace Clay, trace Peat, wet. Changing at 10.2 feet to: Stiff, gray and brown, SILT, some Clay, trace Gravel, wet.		
7	24/18	12-14	3-4 7-11		Loose, gray, fine to medium SAND, wet. Changing at 12.2 feet to: Stiff, gray, SILT, some Clay, some Gravel, moist.	12' SAND 12.2' SILT	
8	24/22	14-16	9-13 20-24		Stiff, gray, Silty CLAY, trace Gravel, moist.	14' Silty CLAY	
9	24/24	16-18	12-18 18-24		Stiff, gray, Silty CLAY, trace Gravel, moist. Changing at 17.9 feet to: Gray, fine to medium SAND, some Silt, moist.		
10	24/20	18-20	4-8 18-24		Stiff, gray, Silty CLAY, moist. Changing at 18.3 feet to: Soft, gray, fine SAND, moist. Changing at 18.8 feet to: Stiff, gray, SILT, moist. Changing at 19.0 feet to: Soft, gray, fine SAND, moist.	17.9' SAND 18' Silty CLAY 18.3' SAND 18.8' SILT 19' SAND 20'	
					Bottom of Borehole at 20.0 Feet		2

Equipment Installed



REMARKS

1. Groundwater was encountered at approximately 6.2 feet below ground surface.
2. Monitoring well was installed in borehole upon completion. Well screen set from 7.0 to 12.0 feet below ground surface.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Boring No.: TA-PMW-8

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Wolverine World Wide, Inc.
Former Tannery
Rockford, Michigan

Boring No.:	TA-PMW-9
Page:	1 of 1
File No.:	16.0062335.02
Check:	John Morehouse

Contractor:	Stearns Drilling Company
Foreman:	Mike Hofferon
Logged by:	Kevin Hedinger
Date Start/Finish:	10-31-18 / 10-31-18
Boring Location:	See Survey
GS Elev.:	694.90'
Datum:	

	Auger/ Casing	Sampler
Type:	Hollow Stem Auger	GeoProbe
O.D. / I.D.:	8.0" / 4.25"	NA
Hammer Wt.:	140lbs	NA
Hammer Fall:	30.0"	NA
TOC Elev.:	NM	NA

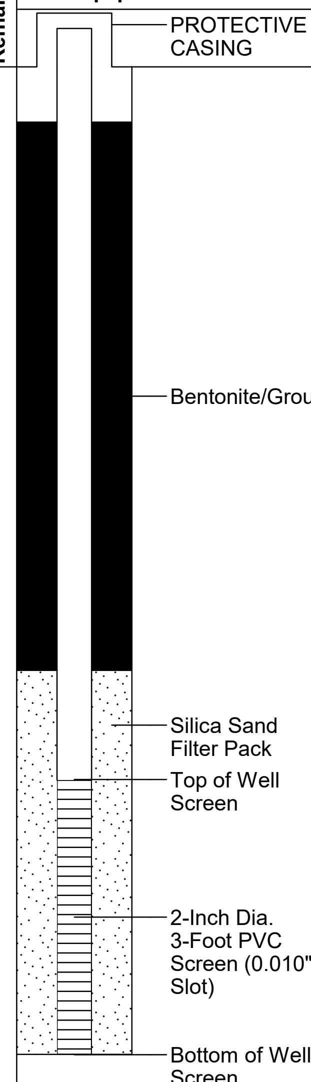
GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
NM				

Surveyed By: NA Survey Date:

Depth	No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification	Stratum Desc.	Remarks
	1	24/21	0-2	4-8 6-9		Loose, brown, SILT, some Organic Matter (roots), moist. Changing at 0.7 feet to: Loose, tan, fine to medium SAND, some Gravel, moist. Changing at 1.6 feet to: Loose, black, fine to medium SAND, some Gravel, moist.	SILT 0.7' SAND	
2	2	24/12	2-4	4-3 3-3		Loose, tan, fine to medium SAND, moist. Changing at 2.3 feet to: Loose, black, fine to medium SAND, some Gravel, wet.		1
4	3	24/22	4-6	1-1 1-1		Soft, brown, fine to medium SAND, some Silt, trace Clay, trace Gravel, wet. Changing at 5.0 feet to: Soft, gray, SILT, trace fine Sand, trace Gravel, moist.	5' SILT	
6	4	24/20	6-8	5-5 7-10		Soft, gray, SILT, trace fine Sand, trace Gravel, trace Clay, wet. Changing at 6.2 feet to: Loose, fine SAND, wet. Changing at 7.3 feet to: Loose, orange, fine to medium SAND, wet.	6.2' SAND	
8	5	24/21	8-10	2-4 6-10		Loose, brown, fine SAND, some Silt, wet.		
10	6	24/20	10-12	7-12 15-26		Loose, brown to orange, fine to medium SAND, trace Silt, trace Gravel, wet.		
12	7	24/18	12-14	12-19 23-27		Loose, orange, fine to medium SAND, some Gravel, wet.		
14	8	24/14	14-16	17-25 29-35		Loose, orange to brown, fine to medium SAND, wet.		
16	9	24/24	16-18	6-25 39-43		Loose, orange, fine to medium SAND, wet. Changing at 16.8 feet to: Loose, gray, fine SAND, wet.		
18	10	24/18	18-20	16-28 35-47		Loose, gray, fine SAND, wet.		
20						Bottom of Borehole at 20.0 Feet	20'	2

Equipment Installed



REMARKS

1. Groundwater was encountered at approximately 2.3 feet below ground surface.
2. Monitoring well was installed in borehole upon completion. Well screen set from 7.0 to 12.0 feet below ground surface.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Boring No.: TA-PMW-9

GZA
GeoEnvironmental, Inc.
Engineers and Scientists

Wolverine World Wide, Inc.
Former Tannery
Rockford, Michigan

Boring No.: TA-RW-1
Page: 1 **of** 1
File No.: 16.0062335.02
Check: John Morehouse

Contractor: Stearns Drilling Company
Foreman: Jerry H.
Logged by: Chris Melby
Date Start/Finish: 1-7-19 / 1-8-19
Boring Location:
GS Elev.: **Datum:**

	Auger/ Casing	Sampler
Type:	Hollow Stem Auger	Split Spoon
O.D. / I.D.:	8.0" / 4.25"	2.0" / 1 3/8"
Hammer Wt.:	140lbs	NA
Hammer Fall:	30.0"	NA
TOC Elev.:		NA

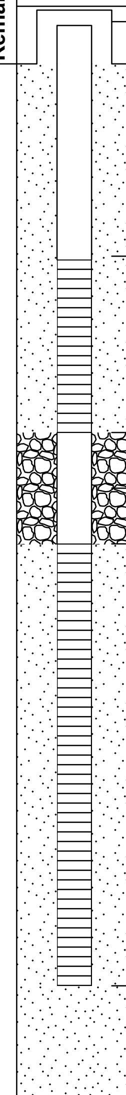
GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab

Surveyed By: **Survey Date:**

Depth	Sample Information: No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification	Stratum Desc.	Remarks
	1		0			See boring log B-RW-1 for soil descriptions.		
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27						Bottom of Borehole at 27.0 Feet		1
28								
29								

Equipment Installed



REMARKS

1. Monitoring well was installed in borehole upon completion. Well screen set from approximately 12.5 to 24.0 feet below ground surface. Well screen set from approximately 5.1 to 9.6 feet below ground surface.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Boring No.: TA-RW-1

BORING_WELL 6233502 WWW FORMER TANNERY ROCKFORD 10_16_18.GPJ GZA_CORP.GDT 7/1/19

GZA
GeoEnvironmental, Inc.
Engineers and Scientists

Wolverine World Wide, Inc.
Former Tannery
Rockford, Michigan

Boring No.: TA-RW-2
Page: 1 of 1
File No.: 16.0062335.02
Check: John Morehouse

Contractor: Stearns Drilling Company
Foreman: Jerry H.
Logged by: Chris Melby
Date Start/Finish: 1-6-19 / 1-7-19
Boring Location:
GS Elev.: Datum:

	Auger/ Casing	Sampler
Type:	Hollow Stem Auger	Split Spoon
O.D. / I.D.:	8.0" / 4.25"	2.0" / 1 3/8"
Hammer Wt.:	140lbs	NA
Hammer Fall:	30.0"	NA
TOC Elev.:		NA

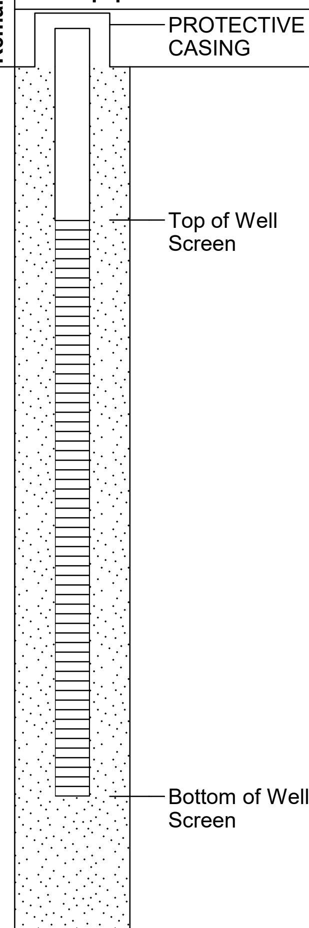
GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab

Surveyed By: Survey Date:

Depth	Sample Information: No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification	Stratum Desc.	Remarks
0	1		0			See boring log B-RW-2 for soil descriptions.		
22.5						Bottom of Borehole at 22.5 Feet		1

Equipment Installed



REMARKS

1. Monitoring well was installed in borehole upon completion. Well screen set from approximately 4.0 to 19.0 feet below ground surface.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Boring No.: TA-RW-2

BORING_WELL 6233502 WWW FORMER TANNERY ROCKFORD 10_16_18.GPJ GZA_CORP.GDT 7/1/19

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Wolverine World Wide, Inc.
Former Tannery
Rockford, Michigan

Boring No.: TA-RW-3
Page: 1 **of** 1
File No.: 16.0062335.02
Check: John Morehouse

Contractor: Stearns Drilling Company
Foreman: Jerry H.
Logged by: Chris Melby
Date Start/Finish: 1-4-19 / 1-6-19
Boring Location:
GS Elev.: **Datum:**

	Auger/ Casing	Sampler
Type:	Hollow Stem Auger	Split Spoon
O.D. / I.D.:	8.0" / 4.25"	2.0" / 1 3/8"
Hammer Wt.:	140lbs	NA
Hammer Fall:	30.0"	NA
TOC Elev.:		NA

GROUNDWATER READINGS

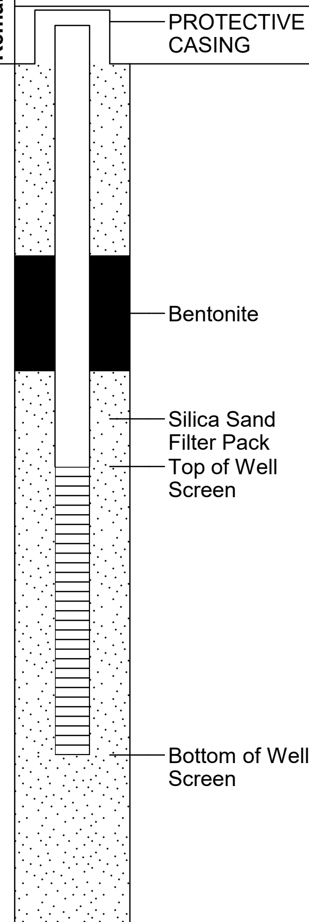
Date	Time	Depth	Casing	Stab

Surveyed By: **Survey Date:**

Depth	Sample Information: No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification	Stratum Desc.	Remarks
0–22.5	1		0			See boring log B-RW-3 for soil descriptions.		
22.5						Bottom of Borehole at 22.5 Feet		1

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29

Equipment Installed



REMARKS

1. Monitoring well was installed in borehole upon completion. Well screen set from approximately 10.5 to 18.0 feet below ground surface.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Appendix C – Performance Pumping Test Well Logs

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Wolverine World Wide, LLC
Tannery
Rockford, Michigan

Boring No.: TA-PZ-1
Page: 1 **of** 1
File No.: 16.0062961.01
Check: J. Groenleer

Contractor: Stearns Drilling Company
Foreman: D. Krause
Logged by: C. Melby
Date Start/Finish: 12-8-21 / 12-8-21
Boring Location: 594,264.9139 N; 12,804,629.842 E
GS Elev.: 695.06' **Datum:** NAD83/NAVD88

	Auger/ Casing	Sampler
Type:	Hollow Stem Auger	NA
O.D. / I.D.:	4.25"	NA
Hammer Wt.:	NA	NA
Hammer Fall:	NA	NA
TOC Elev.:	694.81'	NA

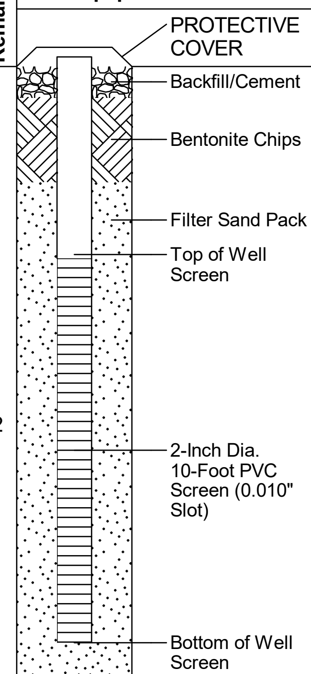
GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
12/8/21	-	4.5'	0	<15 min

Surveyed By: EXXEL **Survey Date:** 12/29/2021

Depth	No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification	Stratum Desc.	Remarks
0–4	1	48/48	0-4			GRAVEL and fine to coarse Sand (FILL), dry.	GRAVEL (FILL)	1
4							4' SILT & CLAY	
4–6	2	24/2	4-6	2-2 4-21		Medium stiff, gray, SILT & CLAY, some fine to medium Sand, dry.		
9–11	3	24/20	9-11	WOH/6"-5 8-10		Stiff, brown and gray, SILT & CLAY, some fine to medium Sand, moist to wet.		2
14–16	4	24/20	14-16	3-4 4-9		Medium stiff to stiff, brown and gray, SILT & CLAY, some fine to medium Sand, moist to wet.	16'	
16						Bottom of Borehole at 16.0 Feet		3

Equipment Installed



REMARKS

1. Soil descriptions from approximately 0.0 to 4.0 feet are based on auger cuttings.
2. Groundwater was encountered at approximately 9.0 feet below ground surface.
3. Monitoring well was installed in borehole upon completion. Well screen set from approximately 5.0 to 15.0 feet below ground suface.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Boring No.: TA-PZ-1

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Wolverine World Wide, LLC
Tannery
Rockford, Michigan

Boring No.: TA-PZ-2
Page: 1 **of** 1
File No.: 16.0062961.01
Check: J. Groenleer

Contractor: Stearns Drilling Company
Foreman: D. Krause
Logged by: C. Melby
Date Start/Finish: 12-8-21 / 12-8-21
Boring Location: 594,157.0613 N; 12,804,581.7218 E
GS Elev.: 695.47' **Datum:** NAD83/NAVD88

	Auger/ Casing	Sampler
Type:	Hollow Stem Auger	NA
O.D. / I.D.:	4.25"	NA
Hammer Wt.:	NA	NA
Hammer Fall:	NA	NA
TOC Elev.:	694.98'	NA

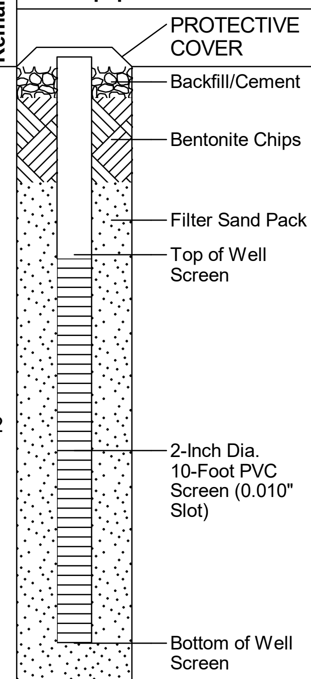
GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
12/8/21	-	4.5'	0	<15 min

Surveyed By: EXXEL **Survey Date:** 12/29/2021

Sample No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification	Stratum Desc.	Remarks
1	48/48	0-4			GRAVEL and fine to coare Sand (FILL), dry.	GRAVEL	1
2	24/10	4-6	5-6 9-6		Medium dense, gray, GRAVEL and fine to medium Sand, trace Silt, moist.		
3	24/22	9-11	4-7 9-11		Very stiff, brown, SILT& CLAY, little fine to medium Sand, moist to wet.	9' SILT & CLAY	2
4	24/20	14-16	6-10 14-14		Very stiff, brown and gray, SILT & CLAY, little fine to medium Sand, moist to wet with interbedded Sand seams and lenses.	16'	
					Bottom of Borehole at 16.0 Feet		3

Equipment Installed



REMARKS

1. Soil descriptions from approximately 0.0 to 4.0 feet are based on auger cuttings.
2. Groundwater was encountered at approximately 9.0 feet below ground surface.
3. Monitoring well was installed in borehole upon completion. Well screen set from approximately 5.0 to 15.0 feet below ground suface.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Boring No.: TA-PZ-2

BORING_WELL 62961.01 TANNERY PIEZOMETER.GPJ GZA_CORP.GDT 5/27/22

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Wolverine World Wide, LLC
Tannery
Rockford, Michigan

Boring No.: TA-PZ-3
Page: 1 **of** 1
File No.: 16.0062961.01
Check: J. Groenleer

Contractor: Stearns Drilling Company
Foreman: D. Krause
Logged by: C. Melby/T. Litwiller
Date Start/Finish: 2-7-21 / 2-8-21
Boring Location: 594,021.9799 N; 12,804,549.3323 E
GS Elev.: 694.82' **Datum:** NAD83/NAVD88

	Auger/ Casing	Sampler
Type:	Hollow Stem Auger	NA
O.D. / I.D.:	4.25"	NA
Hammer Wt.:	NA	NA
Hammer Fall:	NA	NA
TOC Elev.:	694.48'	NA

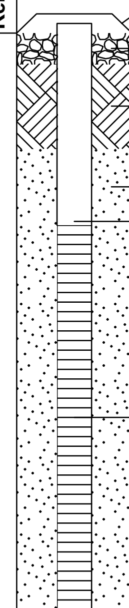
GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
12/7/21	-	6.5'	0	<15 min

Surveyed By: EXXEL **Survey Date:** 12/29/2021

Depth	Sample Information: No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification	Stratum Desc.	Remarks
1							SAND	
2–3	1	24/18	2-4	5-9 12-13		FILL: Medium dense, brown, SAND and Gravel, dry.		
4–5	2	24/18	4-6	8-10 13-10		Gray, GRAVEL, some fine to medium Sand, dry. Changing at 5.0 feet to: Gray, SILT & CLAY, moist to wet.	4' GRAVEL; 5' SILT & CLAY	1
6–7	3	24/12	6-8	3-3 7-4		Stiff, gray and brown, SILT & CLAY, some fine to medium Sand, moist to wet.		
8–9	4	24/12	8-10	2-2 1-1		Soft, gray and brown, SILT & CLAY, some fine to Sand, wet.		
10–11	5	24/8	10-12	5-7 7-10		Medium dense, brown and gray, fine to medium SAND and Silt, wet.	10' SAND	
12								
13–14	6	24/10	13-15	4-14 16-17		Medium dense to dense, brown and gray, fine to medium SAND and Silt, wet.		
15						Bottom of Borehole at 15.0 Feet	15'	2
16–29								

Equipment Installed



REMARKS

1. Groundwater was encountered at approximately 5.0 feet below ground surface.
2. Monitoring well was installed in borehole upon completion. Well screen set from approximately 5.0 to 15.0 feet below ground suface.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Wolverine World Wide, LLC
RAP
Rockford, Michigan

Boring No.: TA-EW-1
Page: 1 **of** 1
File No.: 16.0062961.02
Check: J. Groenleer

Contractor: Stearns Drilling Company
Foreman: J. Gryska
Logged by: D. Watt
Date Start/Finish: 3-16-22 / 3-18-22
Boring Location: 594,306.2106 N; 12,804,640.9216 E
GS Elev.: 695.26' **Datum:** NAD83/NAVD88

	Auger/ Casing	Sampler
Type:	Hollow Stem Auger	Split Spoon
O.D. / I.D.:	14"/10.25"	2.0" / 1 3/8"
Hammer Wt.:	140lbs	NA
Hammer Fall:	30.0"	NA
TOC Elev.:	694.76'	NA

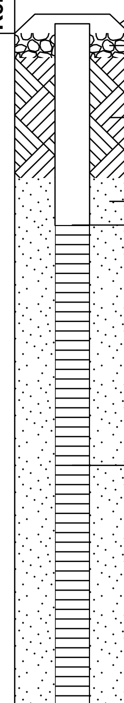
GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
3/18/22	0930	4.4'	Well	16 hrs

Surveyed By: EXXEL **Survey Date:** 3/30/2022

No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification	Stratum Desc.	Remarks
1	24/16	0-2	2-8 7-3		Dark brown, TOPSOIL. Changing at 0.8 feet to: Medium dense, brown, fine to coarse SAND, little Gravel, dry.	TOPSOIL; 0.8' SAND	
2	24/16	2-4	4-5 5-5		Loose, tan, Tannery Waste Scraps, moist (FILL). Changing at 2.5 feet to: Black, FILL, Cinders, Slag, moist.	2' FILL	
3	24/12	4-6	1-2 1-7		Very loose, brown and black, fine to medium SAND, little Silt, trace Gravel, brick Cinders, wet.	4' SAND	1
4	24/10	6-8	1-2 3-2		Loose, green and brown, fine to medium SAND, little Silt, trace Gravel, wet. Changing at 6.5 feet to: Gray and brown, CLAY & SILT, trace Sand, trace Gravel, moist.	6.5' CLAY & SILT	
5	24/16	8-10	1-2 2-6		Gray and brown, CLAY & SILT, trace Sand, trace Gravel, moist. Changing at 9.0 feet to: Brown, SILT & CLAY, trace Sand, moist.	9' SILT & CLAY	
6	24/20	10-12	2-4 6-9		Stiff, gray, CLAY & SILT, trace fine Sand, moist.	10' CLAY & SILT	
7	24/22	12-14	3-5 8-8		Stiff, gray, CLAY & SILT, trace fine Sand, moist.		
8	24/23	14-16	2-5 6-7		Stiff, gray, CLAY & SILT, trace fine Sand, moist.		
9	24/10	16-18	7-8 12-12		Very stiff, gray, SILT & CLAY, little fine to medium Sand, trace Gravel, moist.	16' SILT & CLAY	
10	24/24	18-20	3-8 12-19		Very stiff, gray, SILT & CLAY, little fine to medium Sand, trace Gravel, moist.	20'	
					Bottom of Borehole at 20.0 Feet		2

Equipment Installed



REMARKS

1. Groundwater was encountered at approximately 4.0 feet below ground surface.
2. Monitoring well was installed in borehole upon completion. Well screen was set from approximately 4.0 to 14.0 feet below ground surface.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Wolverine World Wide, LLC
RAP
Rockford, Michigan

Boring No.:	TA-EW-2
Page:	1 of 1
File No.:	16.0062961.02
Check:	J. Groenleer

Contractor:	Stearns Drilling Company
Foreman:	J. Gryska
Logged by:	D. Watt
Date Start/Finish:	3-16-22 / 3-17-22
Boring Location:	594,222.9608 N; 12,804,607.9419 E
GS Elev.:	695.10'
Datum:	NAD83/NAVD88

	Auger/ Casing	Sampler
Type:	Hollow Stem Auger	Split Spoon
O.D. / I.D.:	14"/10.25"	2.0" / 1 3/8"
Hammer Wt.:	140lbs	NA
Hammer Fall:	30.0"	NA
TOC Elev.:	694.69'	NA

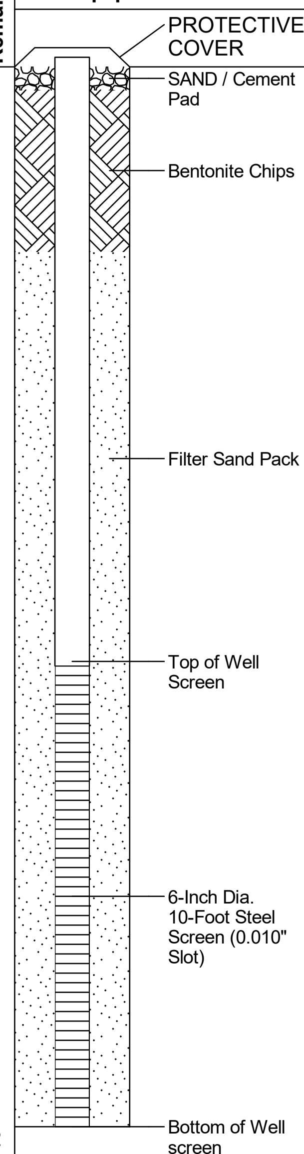
GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
3/18/22	0900	4.2'	Well	19 hrs

Surveyed By: EXXEL Survey Date: 3/30/2022

Depth	No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification	Stratum Desc.	Remarks
0-1	1	24/22	0-2	9-9 7-7		Medium dense, brown, fine to coarse SAND, little Gravel, trace Silt, moist (FILL). Changing at 0.2 feet to: Black, FILL, Cinders and Coal fragments, moist.	FILL	
2	2	24/15	2-4	4-5 4-4		Loose, black and brown, FILL, Cinders, Slag, Coal, moist.		
4	3	24/14	4-6	2-3 3-3		Loose, black and brown, FILL, Cinders, Slag, Coal, wet. Changing at 5.0 feet to: Green and brown, SILT, little fine to medium Sand, moist.	5' SILT	1
6	4	24/0	6-8	1-2 6-7		NO RECOVERY.		
8	5	24/24	8-10	9-6 9-12		Stiff to very stiff, brown, CLAY & SILT, trace fine to medium Sand, trace Gravel, moist.	8' CLAY & SILT	
10	6	24/19	10-12	5-7 9-13		Very stiff, brown, CLAY & SILT, trace fine to medium Sand, trace Gravel, moist.		
12	7	24/20	12-14	5-6 9-11		Stiff to very stiff, gray, SILT & CLAY, trace fine to medium Sand, moist. Changing at 13.5 feet to: Gray, fine SAND, little Silt, wet.	12' SILT & CLAY; 13.5' SAND	
14	8	24/24	14-16	5-8 10-14		Very stiff, gray, SILT & CLAY, trace fine to medium Sand, moist. Changing at 15.5 feet to: Medium dense, gray, fine to medium SAND, trace Silt, wet.	14' SILT & CLAY; 15.5' SAND	
16	9	24/20	16-18	7-5 10-13		Stiff to very stiff, gray, SILT & CLAY, trace fine to medium Sand, moist. Changing at 17.0 feet to: Medium dense, gray, fine to medium SAND, trace Silt, wet.	16' SILT & CLAY; 17' SAND	
18	10	24/19	18-20	4-6 11-13		Very stiff, gray, SILT & CLAY, some fine to medium Sand, moist.	18' SILT & CLAY	
20	11	24/17	20-22	10-9 13-16		Very stiff, gray, SILT & CLAY, some fine to medium Sand, moist.		
22	12	12/12	22-23	8-8		Very stiff, gray, SILT & CLAY, some fine to medium Sand, moist.		
23						Bottom of Borehole at 23.0 Feet	23'	2
24								

Equipment Installed



REMARKS

1. Groundwater was encountered at approximately 4.0 feet below ground surface.
2. Monitoring well was installed in borehole upon completion. Well screen was set from approximately 13.0 to 23.0 feet below ground surface.

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Boring No.: TA-EW-2

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Wolverine World Wide, LLC
RAP
Rockford, Michigan

Boring No.: TA-EW-3
Page: 1 **of** 1
File No.: 16.0062961.02
Check: J. Groenleer

Contractor: Stearns Drilling Company
Foreman: J. Gryska
Logged by: D. Watt
Date Start/Finish: 3-18-22 / 3-18-22
Boring Location: 594,081.4277 N; 12,804,546.8572 E
GS Elev.: 695.43' **Datum:** NAD83/NAVD88

	Auger/ Casing	Sampler
Type:	Hollow Stem Auger	Split Spoon
O.D. / I.D.:	14"/10.25"	2.0" / 1 3/8"
Hammer Wt.:	140lbs	NA
Hammer Fall:	30.0"	NA
TOC Elev.:	694.98'	NA

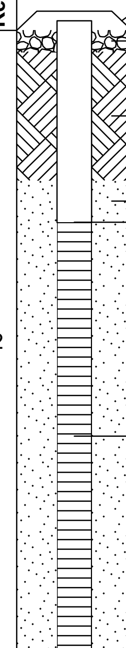
GROUNDWATER READINGS

Date	Time	Depth	Casing	Stab
3/21/22	0830	4.7'	Well	72 hrs

Surveyed By: EXXEL **Survey Date:** 3/30/2022

Depth	Sample Information: No.	Pen./ Rec. (in.)	Depth (Ft.)	Blows (/6")	Test Data	Sample Description & Classification	Stratum Desc.	Remarks
0-2	1	24/20	0-2	3-12 7-6		Medium dense, TOPSOIL. Changing at 0.8 feet to: Medium dense, brown, fine to coarse SAND, little Gravel, trace Silt, moist.	TOPSOIL; 0.8' SAND	
2-4	2	24/16	2-4	9-16 25-19		Dense, light brown, fine to coarse SAND, some Gravel, trace Silt, moist.		
4-6	3	24/12	4-6	8-11 8-8		Dense, light brown, fine to coarse SAND, some Gravel, trace Silt, moist. Changing at 5.5 feet to: Dense, light brown, fine to coarse SAND, some Gravel, trace Silt, wet.		
6-7	4	12/0	6-7	3-1-50/0"		NO RECOVERY.		1, 2
8-10	5	24/15	8-10	4-2 2-4		Loose, green and brown, fine to medium SAND, little Silt, trace Gravel, wet. Changing at 9.6 feet to: Brown, SILT & CLAY, little fine to medium Sand, trace Gravel, moist.	9.6' SILT & CLAY	
10-12	6	24/16	10-12	8-39 9-11		Hard, brown, SILT & CLAY, trace fine Sand, moist.		
12-14	7	24/22	12-14	19-11 16-20		Very stiff, brown, SILT & CLAY, trace fine Sand, moist.		
14-16	8	24/21	14-16	22-11 14-19		Very stiff, gray, SILT & CLAY, trace fine Sand, moist.		
16-18	9	24/15	16-18	18-9 13-15		Very stiff, gray, SILT & CLAY, trace fine Sand, moist.		
18-20	10	24/22	18-20	7-8 9-11		Medium dense, gray, fine SAND and Silty Clay, trace Gravel, moist.	18' SAND	
20-22	11	24/16	20-22	14-8 11-12		Medium dense, gray, fine SAND and Silty Clay, trace Gravel, moist. Changing at 21.0 feet to: Very stiff, gray, Clayey SILT, trace fine Sand, moist.	21' SILT	
22-24	12	24/20	22-24	13-10 13-13		Medium dense, gray, fine SAND and Silt & Clay, trace Gravel, moist.	22' SAND; 24'	
24						Bottom of Borehole at 24.0 Feet		3

Equipment Installed



REMARKS

1. Groundwater was encountered at approximately 5.5 feet below ground surface.
2. Spoon refusal at approximately 7.0 feet below ground surface. Driller augered past obstruction and resumed sampling.
3. Monitoring well was installed in borehole upon completion. Well screen was set from approximately 4.5 to 14.5 feet below ground surface.

Appendix D –Treatment System Description

Treatment System Description

The temporary and long-term groundwater treatment system components and capabilities will meet the pending NPDES permit conditions. PFAS treatment technologies are evolving rapidly. For the foreseeable future, two-stage granular activated carbon (GAC) will be used as the primary PFAS treatment technology. EGLE has indicated that multi-stage, GAC treatment is the Best Available Treatment technology for PFAS removal. A conceptual schematic of the interceptor system is presented in Figure 1 and a block diagram illustrating the conceptual instrumentation design is presented in Figure 2.

The long-term groundwater treatment system final design will be based on additional capture system testing results. This will include flow rate and groundwater quality results that could materially affect the long-term treatment system.

Influent Characteristics

Maximum flow rate, peak and continuous, from groundwater model: 150 gallons per minute (gpm)

Influent characteristics from groundwater model:

Parameter	Projected Influent Concentration (µg/l)
Sum of measured PFAS	27
PFOS	17
PFOA	5
PFBS	2
Ammonia (total)	3,200
Phosphorus (total)	130
Iron	2,700
Chloride	230,000
Sulfate	110,000

Treatment System Components

The temporary and long-term treatment system components will include at a minimum:

- Groundwater equalization
- Particulate filtration (upstream of GAC)
- Two-stage GAC
- Treated effluent metering and sampling equipment

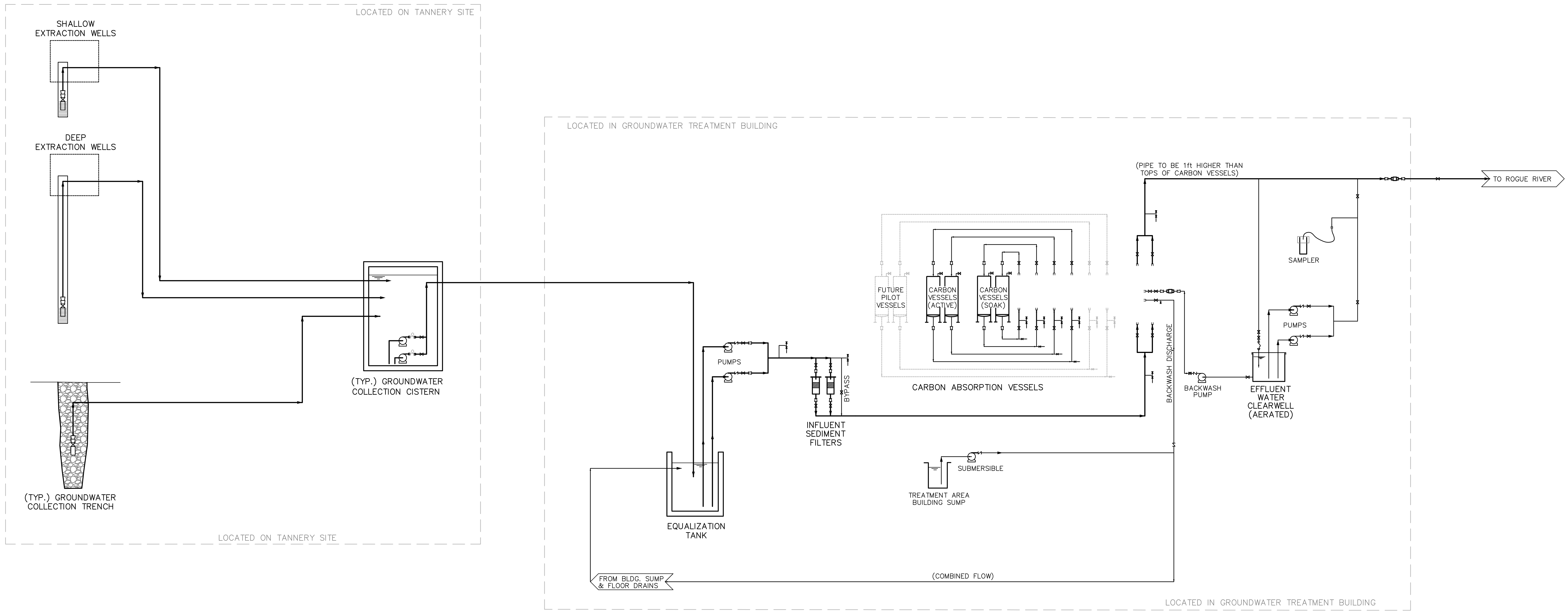
A minimum 7-minute empty-bed contact time and hydraulic loading rate between 1-10 gpm/ft^2 per GAC stage (vessel) will be maintained.

The need and cost-benefit analysis for additional treatment unit processes, such as iron removal upstream of GAC, will be evaluated during temporary treatment and subsequent long-term groundwater treatment system design. Additional PFAS treatment technologies maybe considered in addition to two-stage GAC in the future. Any significant treatment technology changes would require amending the pending NPDES permit before they could be implemented.

Influent, mid-point (in between GAC stages), and treated effluent testing will be performed according to the NPDES permit requirements.

Treatment System Description

Previously, a diffuser-style outfall was proposed to create an acute mixing zone in the Rogue River for ammonia. However, influent characteristics predicted by the updated groundwater model suggests the treated ammonia concentration will be well below acute permit limits and would not require the acute mixing zone. Therefore, the diffuser is no longer necessary or proposed. The outfall design was changed to a conventional, single pipe discharge. A joint permit application (JPA) for the proposed conventional outfall is currently under review by EGLE.



GROUNDWATER REMEDY - PROCESS FLOW DIAGRAM

NO.	ISSUE/DESCRIPTION	BY	DATE

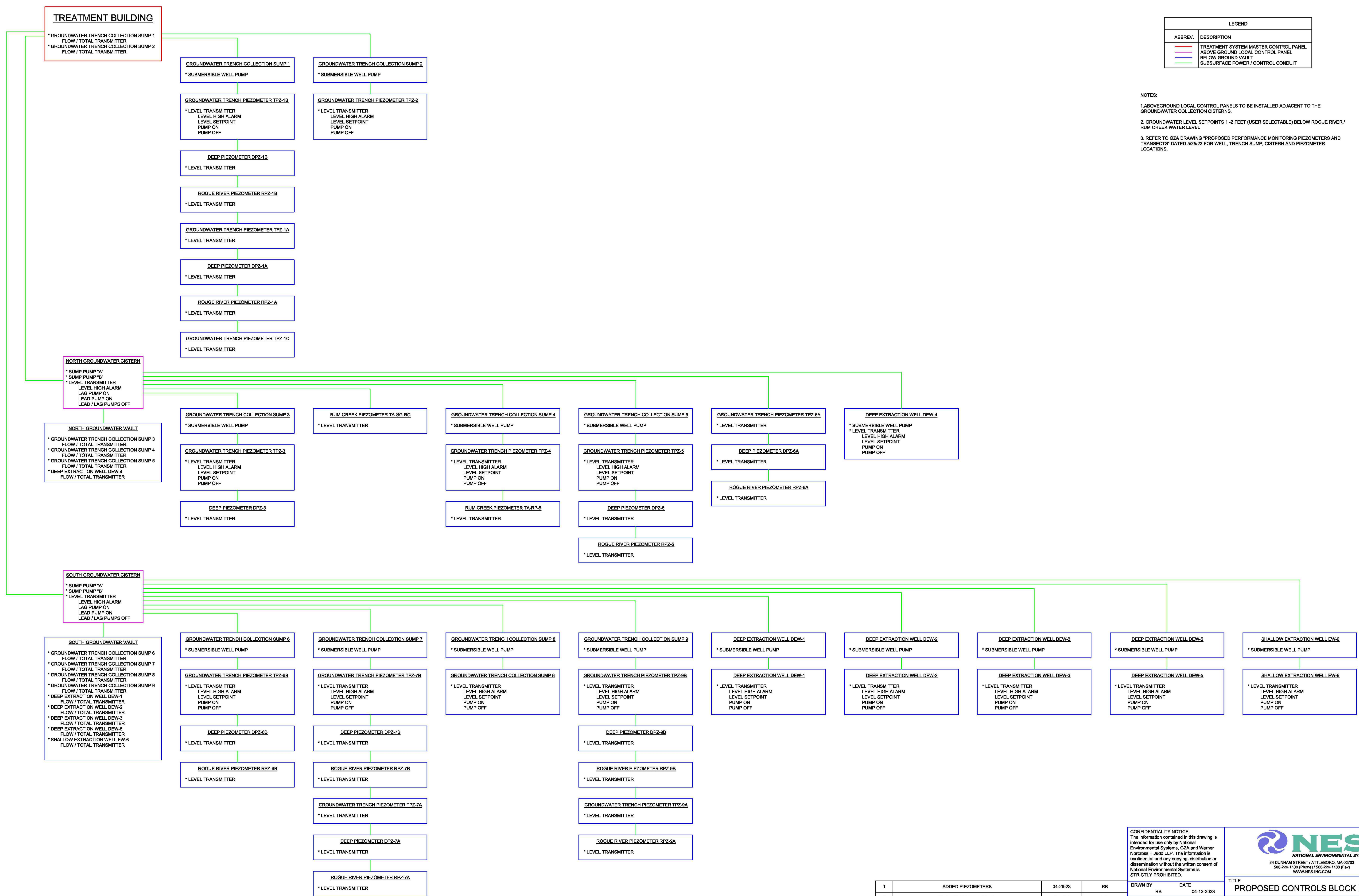
TANNERY SITE
MAIN STREET, ROCKFORD, MICHIGAN

PROCESS FLOW DIAGRAM
GROUNDWATER REMEDY

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com

PREPARED FOR: WWW/WN&J

PROJ MGR: TAL	REVIEWED BY: TAL	CHECKED BY: JC	SHEET
DESIGNED BY: JC	DRAWN BY: KJB	SCALE: NONE	1
DATE: 5/9/23	PROJECT NO. 16.0062961.02	REVISION NO. NA	SHEET NO.



LEGEND	
ABBREV.	DESCRIPTION
(red line)	TREATMENT SYSTEM MASTER CONTROL PANEL
(magenta line)	ABOVE GROUND LOCAL CONTROL PANEL
(blue line)	BELOW GROUND VAULT
(green line)	SUBSURFACE POWER / CONTROL CONDUIT

NOTES:

1.ABOVEGROUND LOCAL CONTROL PANELS TO BE INSTALLED ADJACENT TO THE GROUNDWATER COLLECTION CISTERNS.

2. GROUNDWATER LEVEL SETPOINTS 1 -2 FEET (USER SELECTABLE) BELOW ROGUE RIVER / RUM CREEK WATER LEVEL

3. REFER TO GZA DRAWING "PROPOSED PERFORMANCE MONITORING PIEZOMETERS AND TRANSECTS" DATED 5/25/23 FOR WELL, TRENCH SUMP, CISTERN AND PIEZOMETER LOCATIONS.

REV	DESCRIPTION	DATE	APPROVED
1	ADDED PIEZOMETERS	04-26-23	RB
0	NOT FOR CONSTRUCTION	04-14-23	RB

REVISIONS

DRWN BY	DATE
RB	04-12-2023
CHK BY	DATE
APPR BY	DATE

NES™ NATIONAL ENVIRONMENTAL SYSTEMS
84 DUNHAM STREET / ATTLEBORO, MA 02703
508-226-1100 (Phone) / 508-226-1180 (Fax)
WWW.NES-INC.COM

TITLE
PROPOSED CONTROLS BLOCK DIAGRAM

FORMER TANNERY SITE
MAIN STREET, ROCKFORD, MICHIGAN

JOB NO.	SCALE	SIZE	DWG NO.	SHEET	REV
22-155	NTS	D	I-3	1 OF 1	1

NO.	ISSUE/DESCRIPTION	BY	DATE

TANNERY SITE
MAIN STREET, ROCKFORD, MICHIGAN

PROPOSED CONTROLS BLOCK DIAGRAM

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

PREPARED FOR:
WWW/WN&J

PROJ MGR: TAL	REVIEWED BY: TAL	CHECKED BY: JC	SHEET
DESIGNED BY: JC	DRAWN BY: KJB	SCALE: NONE	2
DATE: 5/9/23	PROJECT NO. 16.0062961.02	REVISION NO. NA	SHEET NO.