Rose & Westra
A Division of GZA

GEOTECHNICAL
ENVIRONMENTAL
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WATER
CONSTRUCTION MANAGEMENT

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WORK PLAN – FINAL REMEDY
HOUSE STREET PROPERTY

1855 HOUSE STREET NE
Plainfield Township, Kent County, Michigan

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.

April 26, 2022, Revised May 26, 2022
File No. 16.0062961.81

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

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Revised May 26, 2022

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Ms. Karen Vorce, Project Manager
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
vorcek@michigan.gov

Re: Work Plan – Final Remedy
Wolverine World Wide, Inc. – House Street Property
Plainfield Township, Kent County, Michigan

Dear Ms. Vorce:

On behalf of Wolverine World Wide, Inc., Rose & Westra, a Division of GZA GeoEnvironmental, Inc., is submitting this cover letter and attachment in response to the referenced Consent Decree, effective February 19, 2020.

This submittal includes the Work Plan for the Final Remedy cap design identified in Paragraph 7.8 of Consent Decree No. 1:18-cv-00039-JTN-SJB, effective February 19, 2020. This Work Plan and its technical supporting documents provide a guide to the Final Remedy for the HSP. Much of the technical detail is contained in the appendices. If you have any questions, please contact us.

Very truly yours,

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

Loretta J. Powers, CHMM
Senior Project Manager

Ernest Hanna, P.E.
Senior Principal

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ljp/maw/eh/jcf

Attachment: Work Plan – Final Remedy, HSP

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ACRONYMS

AQD	Air Quality Division
AQI	Air Quality Index
bgs	Below Ground Surface
CD	Consent Decree, effective February 19, 2020 (No. 1:18-cv-0039-JTN)
CSM	*Conceptual Site Model Update and Status Report* dated February 9, 2018
CY	Cubic Yards
EGLE	Michigan Department of Environment, Great Lakes and Energy
EPA	U.S. Environmental Protection Agency
FIRM	Flood Insurance Rate Map
FS	*Revised Feasibility Study – Remedial Options, House Street Property, 1855 House Street NE, Plainfield Township, Kent County, Michigan* dated September 13, 2021; Approved Final October 28, 2021.
ft	Feet
GIS	Geographic Information Systems
HSP	House Street Property, also referred to as Site
HAPs	Hazardous Air Pollutants
LandGEM	Landfill Gas Emissions Model
KCRC	Kent County Road Commission
MDARD	Michigan Department of Agriculture and Rural Development
NAAQS	National Ambient Air Quality Standards
NE	Northeast
NOAA	National Oceanic and Atmospheric Administration
NOC	Notice of Coverage
NPDES	National Pollutant Discharge Elimination System
NWS	National Weather Service
PM	Particulate Matter
PTE	Potential To Emit
PTI	Permit to Install
QA/QC	Quality Assurance/Quality Control
R&W/GZA	Rose & Westra, a Division of GZA GeoEnvironmental, Inc.
SESC	Soil Erosion and Sedimentation Control
TPY	Tons per Year
WLSU	EGLE Wetlands, Lakes, and Streams Unit
Wolverine	Wolverine World Wide, Inc.
WP	Work Plan – Final Remedy, HSP
WRD	EGLE Water Resources Division

1.0 INTRODUCTION

On behalf of Wolverine, R&W/GZA prepared this Work Plan (WP) for the Final Remedy for the House Street Property (HSP) that was established in the revised Feasibility Study (FS), dated September 13, 2021, and approved by Michigan Department of Environment, Great Lakes, and Energy (EGLE) on October 28, 2021. The objective of this WP is to provide a scope of work and design to implement the Cap Option, which was selected as the Final Remedy, as required under Paragraph 7.8(c) of the Consent Decree (CD).

This WP is prepared pursuant to the CD and is organized into the following sections (outlined in accordance with the EGLE-Approved Checklist of Applicable Substantive Requirements of Part 115 , the "Checklist"):

SECTION 1.0 INTRODUCTION
SECTION 2.0 BACKGROUND
SECTION 3.0 PROJECT INFORMATION [SECTION A OF CHECKLIST]
SECTION 4.0 ENVIRONMENTAL ASSESSMENT INFORMATION [SECTION B OF CHECKLIST]
SECTION 5.0 HYDROGEOLOGICAL INFORMATION [SECTION C OF CHECKLIST]
SECTION 6.0 MONITORING PLAN [SECTION D OF CHECKLIST]
SECTION 7.0 ENGINEERING DESIGN DRAWINGS [SECTION E OF CHECKLIST]
SECTION 8.0 ENGINEERING PLAN [SECTION F OF CHECKLIST]
SECTION 9.0 OPERATION PLAN [SECTION G OF CHECKLIST]
SECTION 10.0 CONSTRUCTION QUALITY ASSURANCE PLAN [SECTION H OF CHECKLIST]

2.0 BACKGROUND

The HSP, located at 1855 House Street NE, Plainfield Township, Kent County, Michigan, encompasses approximately 76 acres (**Figure 1**). The HSP is currently undeveloped and, according to available information, no buildings were previously present. An electric utility right-of-way and associated high-voltage transmission lines cross the northern portion of the HSP, and a maintenance access road from House Street runs south to north across the HSP. Section 2.0 of the FS summarizes background information for the HSP, including lithology, waste materials, and hydrogeology. For ease of reference, the FS is provided as **Appendix A**.

3.0 PROJECT INFORMATION

Name and Address	House Street Property 1855 House Street NE Plainfield Township, Kent County, Michigan
Name and address of the property owners	Wolverine World Wide, Inc. 9341 Courtland Drive NE Rockford, Michigan 49351

The type of disposal area proposed	Three low-permeability caps consisting of a flexible membrane covered by 2 feet (ft) of soil and 6 inches of vegetated cover, or an EGLE-approved alternative, will be installed over delineated waste material areas. Refer to Section 4.2.1 of the FS for additional information.
A description of the type of waste	Waste consists of material placed at the HSP prior to and when it was a State of Michigan licensed and regulated disposal site until 1970. Refer to Section 2.0 of the FS and Section 6.1 of the 2018 Implementation Summary Report (R&W/GZA, 2019) for additional information. On-Site vegetation removed during construction will also be placed under the cap as described in the FS.
The number of acres	Approximately 27 acres
The design capacity of the landfill	Not applicable
Map	Refer to **Section 7.0**
Legal Description	S 1/2 SE 1/4 NW 1/4 ALSO W 2/3 E 3/4 N 1/2 S 1/2 OF SEC EX COM AT S 1/4 COR TH N 89D 10M 03S W 418.85 FT TH N 42D 16M 46S E 1771.42 FT TH N 89D 16M 44S W 1100 FT TO BEG OF THIS DESC - TH N 0D 43M 16S E 40.0 FT TH N 74D 16M 49S E 278.64 FT TH N 50D 26M 52S E 1527.46 FT TH N 19D 00M 13S E TO E&W 1/4 LINE TH ELY TO NE COR OF NW 1/4 SE 1/4 TH SLY TO SE COR OF NW 1/4 SE 1/4 TH WLY ALONG S 1/8 LINE TO BEG & EX THAT PART OF REMAINDER LYING WITHIN FOL DESC - S 660 FT OF E 660 FT OF W 928.8 FT OF NW 1/4 SE 1/4 * SEC 4 T8N R11W 76.41 A. (Taken from BSA online, Plainfield Charter Township, April 2022)

4.0 ENVIRONMENTAL ASSESSMENT INFORMATION

4.1. REQUIRED PERMITS AND LICENSES

The HSP work will be performed in accordance with applicable laws, and permits will be obtained where required. As part of this WP, R&W/GZA evaluated applicable regulations (i.e., air quality, surface water quality, groundwater quality, waste, and road right-of-way). The following sections describe the evaluation and applicability of relevant permits and licenses and identify applicable exemptions.

4.1.1. Air Quality Regulations

An air permit is not required. The following describes the air quality regulation evaluation process.

Rule 201, R 336.1201 of the Michigan Air Pollution Control Rules requires a person to obtain a Permit to Install (PTI) prior to the installation, construction, reconstruction, relocation, or modification of a process or process equipment that emits air contaminants. *Except as allowed in R 336.1202, R 336.1277 to R 336.1291, or R 336.2823(15) a person shall not install, construct, reconstruct, relocate, or modify any process or process equipment, including control equipment pertaining thereto, which may emit any of the following, unless a permit to install that authorizes such action is issued by the department*.

(a) Any air pollutant regulated by title I of the clean air act and its associated rules, including 40 C.F.R. §51.165 and §51.166, adopted by reference in R 336.1902.

(b) *Any air contaminant. "Air contaminant" means a dust, fume, gas, mist, odor, smoke, vapor, or any combination thereof.*

Pursuant to R 336.1212(g) *temporary activities related to the construction or dismantlement of …, earthworks, or other structures,* and R 336.1212(k) *Construction, repair, and maintenance of roads or other paved or unpaved areas*, are insignificant activities and do not require a PTI. Also, R 336.1285(aa) exempts *landfills and associated flares and leachate collection and handling equipment* from obtaining a PTI. Similarly, Rule 285 (336.1285(gg)) exempts *equipment used for chipping, flaking, or hogging wood or wood residues that are not demolition waste materials.*

Rule 285 does not apply if prohibited by R 336.1278 and unless the requirements of R 336.1278a have been met.

According to 278(1)(a) *Any activity that is subject to prevention of significant deterioration of air quality regulations or new source review for major sources in nonattainment areas regulations.* Based on Landfill Gas Emissions Model (LandGEM), Version 3.03, the total PTE for all landfill gases is approximately 195 tons/year. This is likely conservative, as R&W/GZA assumed all 83,000 CY of estimated waste was organic waste. Based on these estimates, 34,000 CY is a mix of soil and waste. The 195 tons/year total is below the 250 ton/year major source threshold. Therefore, while the source is located in an attainment area for all National Ambient Air Quality Standards (NAAQS), it is not a major source as defined in (1)(b) (i.e., *any activity that results in an increase in actual emissions greater than the significance levels defined in R 336.1119*). For the purpose of this rule, "activity" means the concurrent and related installation, construction, reconstruction, relocation, or modification of any process or process equipment.

According to *278(2) The exemptions specified in R 336.1280 to R 336.1291 do not apply to the construction of a new major source of hazardous air pollutants or reconstruction of a major source of hazardous air pollutants, as defined in 40 C.F.R. §63.2 and subject to §63.5(b)(3), national emission standards for hazardous air pollutants, adopted by reference in R 336.1902.* The estimated Potential To Emit (PTE) of all Hazardous Air Pollutants (HAPs) is 0.2 TPY, less than the major source threshold of 10 Tons per Year (TPY) for a single HAP or 25 TPY for all HAPs. Therefore, the HSP is not a new major source of HAPs.

According to *278(3) The exemptions specified in R 336.1280 to R 336.1291 do not apply to a construction or modification as defined in and subject to 40 C.F.R. Part 61, national emission standards for hazardous air pollutants, adopted by reference in R 336.1902.* The HSP is not an "affected facility" and, therefore, this requirement is satisfied.

The HSP will comply with Rule 278a by maintaining documentation demonstrating the applicability of the exemption. Based on the above information, the HSP is not required to obtain a PTI.

Potential air quality impacts include generation of dust during clearing and earthwork activities, volatilization during earth moving actives, generator usage, and passive venting of subsurface gases. Federal air quality regulations are administered by EGLE's Air Quality Department (AQD). The *Code Of Ordinances Charter Township of Plainfield, Chapter 16 – Environment* also contains applicable noise regulations.

Michigan Part 3 Rules limit emissions of Particulate Matter (PM). The HSP does not perform any of the regulated processes and, therefore, Part 3 Rules are not applicable. In order to prevent nuisance to area residents, a Fugitive Dust Control Plan will be developed implemented on haul roads and a truck tire wash used prior to trucks leaving the Site.

Chapter 16 Article IV of the Plainfield Charter Township Ordinance restricts noise from loud vehicles and construction. *The creation (including excavation therefore), demolition, alteration, or repair of any building and the excavation of streets and highways on Sundays, and other days, except between the hours of 7:00 a.m. and 8:00 p.m., unless a permit, therefore be first obtained from the township manager or superintendent.* Working hours will be restricted to between 7:00 a.m. and 8:00 p.m., Monday through Saturday.

No applicable Kent County regulations were identified.

4.1.2. Surface Water Quality Regulations

A National Pollutant Discharge Elimination System (NPDES) discharge permit is not required. A Soil Erosion and Sedimentation Control (SESC) permit from the County will be required, and a Notice of Coverage (NOC) application will be filed with EGLE. The following describes the surface water quality regulation evaluation process.

No surface water treatment, septic systems, discharges, or withdrawals from the Site to the waters of the State are planned. Therefore, a NPDES discharge permit is not required.

Stormwater will be retained on-Site via the stormwater retention pond or on-Site ground infiltration. Construction will disturb more than five acres. For sites disturbing five or more acres, the applicant/permittee must obtain a Part 91 Permit and submit an application for NOC to EGLE Water Resource Division (WRD). Along with the NOC application, the applicant/permittee must submit a copy of the SESC permit, approved SESC plan, Site location map, and the $400 permit fee. The Kent County Road Commission (KCRC) issues SESC permits in Kent County. An SESC permit will be obtained from KCRC and a WRD NOC will be filed with EGLE WRD.

The Plainfield Charter Township, *Chapter 28 Planning and Development, Article VI. Stormwater Management* applies to developments connecting to township stormwater drains. No paved surfaces or buildings are proposed, and stormwater will be retained on-Site.

4.1.3. Groundwater Quality

Groundwater quality regulations are not applicable. The following describes the groundwater quality regulation evaluation process.

No groundwater withdrawals for potable purposes or discharges will occur and, therefore, no applicable federal, state, county, or township regulations apply. Per Section 16.306(2) of the Plainfield Charter Township Ordinances, groundwater monitoring and remediation wells which are part of response activity or corrective action approved by EGLE or U.S. Environmental Protection Agency (EPA) are exempt from §16.303 Groundwater Use ordinances. Post-construction groundwater monitoring in the vicinity of the HSP is described in **Appendix C**.

4.1.4. Waste Regulations

During construction activity, general household rubbish will be generated. Any incidental leaks or spills, if encountered, will be cleaned using absorbent material. Contaminated media, including PPE, will be containerized, and managed according to federal and state regulations. General household rubbish will be containerized and disposed of off-Site at an appropriate facility.

Contractors will be responsible for removing all aerosol cans and universal waste, and managing it according to federal and state regulations.

No liquid waste will be generated and, therefore, Michigan Part 121 Rules do not apply.

No applicable township waste ordinances were identified.

Michigan Part 115 Solid Waste Management rules do not apply as the HSP is a remediation site and not an active landfill. Wastes were placed no later than 1978 and, therefore, it is not a new disposal site. As provided by Section §324.11506(1)(v) of the act, "other wastes regulated by statute" are exempt from Part 115 regulation. However, as determined in the CD, the HSP will comply with applicable substantive requirements of Part 115. **Appendix B** contains the EGLE Checklist for Administrative Completeness Solid Waste Landfill Construction Permit Packet, as modified and approved by EGLE to represent the applicable substantive requirements of Part 115. **Section 1.0** contains cross-reference of applicable Checklist information found within this Report.

4.1.5. Kent County Road Commission

Some of the work will involve periodic, temporary lane closures on House Street adjacent to the Site. A KCRC Permit will be obtained for work in or near the House Street right-of-way.

4.2. COMPLIANCE WITH APPLICABLE LOCATION STANDARDS

Table 1 summarizes the final remedy's compliance with applicable location standards.

TABLE 1. APPLICABLE LOCATION STANDARDS

Part 115 Requirement	Supporting Information
Rule 411 Groundwater Isolation	The depth to natural groundwater is greater than 10 feet below ground surface (ft bgs). There will be no liner system. There is no clay surface; therefore, gravity dewatering is not applicable. There will be no soil dike keyed into lower confining layer.
Rule 412 Horizontal Isolation	This rule is not applicable because the final remedy is not for a "new" disposal area. Potential nuisance conditions during construction (e.g., noise, dust, and odor) will be mitigated and managed in accordance with the specifications provided in the FS. Because the final remedy is a remedial activity, the location restrictions specified in 299.4412(4) do not apply.
Rule 413 Sensitive Areas	This rule is not applicable because the Final Remedy is not for a "new" disposal area. The location is not located within a Rule 413 sensitive area.
Rule 414 Airport Safety	The HSP is located approximately 2.75-miles southeast of the Sparta Miller Airport. Sparta Miller Airport services propeller engine planes. The nearest jet engine service is Gerald R. Ford Airport, approximately 15 miles south-southeast of the HSP (**Figure 3**).
Rule 415 Floodplains	According to Flood Insurance Rate Map (FIRM) Panel 260109 0010 B, the site is in a low flood risk area.
Rule 416 Wetlands	Not applicable, Part 303 Permit is not required as there are no mapped Part 303 wetlands on-Site according to the National Wetland Inventory Assessment performed by EGLE WRD EGLE Wetlands, Lakes, and Streams Unit (WLSU).
Rule 417 Fault Areas And Impact Zones	Not applicable, the HSP is not within 200 feet of a recorded / documented fault. Refer to Section 6.3.2 of the Engineering Report (provided as **Appendix C**).
Rule 418 Unstable Areas	Not applicable. Refer to Section 6.3.2 of the Engineering Report (provided as **Appendix C**).
Rule 419 Vertical Expansions	No vertical expansion is planned; therefore, this rule is not applicable.

4.3. COMPLIANCE WITH PERFORMANCE STANDARDS DURING CONSTRUCTION

The following sections summarize compliance with performance standards for the HSP final remedy. Additional details are provided in **Appendix C** (Engineering Report) and Attachment B of **Appendix C** (Construction Quality Assurance/Quality Control [QA/QC] Plan).

4.3.1. Surface Water

A Part 91 SESC Permit will be obtained from Kent County. An SESC Plan will be implemented to prevent runoff from leaving the Site. Long-term surface water management will include a stormwater retention pond and grading to retain all surface water on-Site. The area will be revegetated to prevent erosion in the long term. Erosion and sediment control implementation is further detailed in Section 6.5 of the Engineering Report (**Appendix C**).

4.3.2. Groundwater

Groundwater at the Site has been investigated extensively. Monitoring wells have been installed with the recorded highest water table measurements at a depth of 49.58 ft bgs. Groundwater generally flows from the northwest to the southeast with a gradient that is generally flat, less than or equal to 0.05 ft/ft. Groundwater is not expected to be encountered during construction activities.

The post-construction groundwater monitoring program is summarized in **Section 6.0** and additional details are provided in **Appendix D**.

4.3.3. Air

A Fugitive Dust Management Plan to control construction dust will be implemented. Dust management and health and safety considerations for excavations is further detailed in Section 4.1 of the Engineering Report (**Appendix C**).

4.4. SITE DESCRIPTION

A detailed description of the HSP is included in the FS. The Site will be accessed via House Street NE and Herrington Avenue NE which lead to 10 Mile Road NE. Proposed construction routes will be addressed with contractors during bid solicitation. Refer to the Design Drawings in Attachment C of **Appendix C**.

The aggregate area of the HSP caps is expected to approach approximately 27 acres of disturbed area. The volume of waste materials is estimated to be 49,000 cubic yards (CY), and soil with waste materials is estimated to be approximately 34,000 CY for a total estimated volume of 83,000 CY. The native soil in which the waste materials were disposed included sand, gravel, and clay, and the estimated volume of native or fill material over the top of the waste material is approximately 235,000 CY. Additionally, on-Site vegetation removed during construction will be placed under the caps as described in the FS. The HSP will not receive off-Site waste materials.

4.5. EXISTING ENVIRONMENT

The existing environment has been detailed in the *Conceptual Site Model Update and Status Report* (CSM) and the FS and is summarized below.

4.5.1. Topography, Land Use, and Residences

The Site is located immediately west of US-131 with ground surface elevations ranging from 740 to 800 ft. The terrain is generally hilly in the region. Ground surface elevations for the area east of the Site range from 800 to

more than 900 ft; ground surface elevations for the west to southwest of the Site ranges from 800 to 820 ft with lower terrains to the northwest and southeast. The Site is flanked by higher ground to the northeast and southwest, but ground surface generally dips to the northwest toward Clear Bottom Lake and Freska Lake, and to the southeast toward the Rogue River.

The Site is currently undeveloped and, according to available information, no buildings were previously present. The HSP was a State of Michigan licensed and regulated disposal site from the mid-1960s through 1978. Until 1970, the HSP received leather tanning byproducts, including primarily sludges from the wastewater treatment system at the former Wolverine tannery. An electric utility right-of-way and associated high-voltage transmission lines cross the northern portion of the Site, and an access road from House Street runs south to north across the Site. The bordering properties to the HSP consist of residential and undeveloped properties.

Figures 2A and **2B** depict Site topography, land use, and locations of residences near the HSP.

4.5.2. Air Quality

Kent County is in attainment with NAAQS and has an Air Quality Index (AQI) of "good." A copy of the nearest wind rose is provided in Section 2.2 of the Engineering Report (**Appendix C**).

4.5.3. Hydrology

Based on the Michigan's Major Watersheds – Sub-basins Geographic Information Systems (GIS) data (Michigan Department of Environmental Quality, 2011), the Site is situated within the Rogue River Basin (Basin No. 14F), which is part of the Lower Grand River watershed (HUC 0405006). The Rogue River basin consists of 12 sub-basins, three of which are near the Site area, as shown in Figure 3. The Site is situated on the water divide of two sub-basins: HUC 405006040080 and HUC 405006040120, both draining to the Rogue River, which discharges to the Grand River. The Site is also near sub-basin HUC 45006050050, which is part of the Grand River basin.

From 1989 to 2016, the average annual streamflow rate is approximately 260 cubic feet per second, and the average baseflow rate is approximately 210 cubic feet per second. Baseflow represents the amount of groundwater flow discharging to the surface water. Assuming 100 percent of groundwater recharge to the aquifer is discharged to the river as baseflow, the base flow rate for the sub-basin represents approximately 12 inches of annual recharge. (This assumption does not consider groundwater inflow and outflow between this aquifer and other adjacent aquifers vertically and horizontally.) Refer to Section 2.2 of the CSM for additional detailed hydrology information.

Table 2 summarizes hydrology information required under Part 115.

TABLE 2. HYDROLOGY INFORMATION REQUIRED UNDER PART 115

Part 115 Requirement	Supporting information
Magnitude of the 24-hour, 25-year storm	4.8 inches (NOAA Atlas 14 Point Precipitation Frequency Estimates)
Average annual rainfall	The average annual rainfall for Kent County is 39.4 inches and 77.6 inches of snowfall. (Climatological Report [Annual] Issued by National Weather Service (NWS) Grand Rapids, Michigan)
Maximum floodplain elevation of surface waters proximate to the HSP	According to FIRM Panel 260109 0010 B, the maximum elevation of the Grand River is approximately 622 ft.

4.5.4. Endangered and Threatened Species

According to the information available on the Michigan Department of Agriculture and Rural Development Endangered Species listings, there or no endangered or threatened species identified within Kent County, Michigan (MDARD, 2022).

4.5.5. Historic or Archaeological Sites

According to information available on file with the Michigan Department of Natural Resources data portal, there are no known historic or archaeological Sites associated with the HSP.

4.5.6. Known Sites of Environmental Contamination

The Site and surrounding area have a groundwater-use restriction. A search of EGLE's online Environmental Mapper identified the following sites of known environmental contamination within one mile of the HSP:

- 8417 Algoma Avenue NE, Rockford
- 8113 Belmont Avenue NE, Belmont
- 8057 Graphic Industrial Drive, Belmont
- 2908 10 Mile Road, Rockford

Figure 4 depicts the Part 201 and Brownfields Sites in the HSP vicinity.

4.5.7. Significant Public Resources

No significant public resources such as public water supplies, parks, or recreation areas were identified within or adjacent to the HSP. **Figure 5** depicts Type I and II public water supplies within ten miles of the Site.

4.5.8. Airports

There are no airports within 10,000 feet of the HSP. Sparta Miller Airport is the nearest airport and is approximately 2.75 miles northwest of the HSP. Sparta Miller Airport services propeller engine planes. The nearest jet engine service is Gerald R. Ford Airport, approximately 15 miles south-southeast. Refer to **Figure 3**.

4.6. ANTICIPATED ENVIRONMENTAL IMPACTS

Environmental impacts of the HSP are discussed in the FS, attached as **Appendix A**.

4.7. PROTECTIVE AND CORRECTIVE MEASURES DURING CONSTRUCTION

Protective and corrective measures during construction are detailed in the Engineering Report (**Appendix C**) and Construction QA/QC Plan (Attachment B of **Appendix C**).

5.0 HYDROGEOLOGICAL INFORMATION

HSP hydrogeological information is detailed in the CSM, R&W/GZA, 2019, and R&W/GZA, 2020. Additional information specific to the scope of this WP can be found in **Appendix C**.

6.0 MONITORING PLAN

The following summarizes the components of the post-construction monitoring for the HSP Final Remedy:

- Piezometer installation in historical perched water areas;
- Piezometer water level measurements to be completed quarterly for two years following construction completion;
- Baseline groundwater sampling from nine existing monitoring well clusters (installed as part of other investigations related to the HSP) to be completed within six months of construction completion;
- One follow-up groundwater sampling event from the nine existing monitoring well clusters sampled during the baseline event to be completed one year following the baseline event; and,
- Data evaluation and consultation with the EGLE to develop a long-term monitoring plan.

These components are detailed **Appendix D**.

7.0 ENGINEERING DESIGN DRAWINGS

Engineering design drawings for the HSP final remedy are provided in Attachment C of **Appendix C.**

8.0 ENGINEERING PLAN

The Engineering Report is provided as **Appendix C** and contains the following information required under Part 115:

- Settlement Analysis (Section 6.4).
- Slope Stability Study (Section 6.3.1).
- Typical sections showing natural soils underlying waste material as per Rule 904(4); see Design Drawings, provided in Attachment C of **Appendix C.**
- Copies of logs for new borings installed during 2022 (Attachment E of **Appendix C**). Boring logs for prior investigations were provided to EGLE as part of the investigation summary reports (e.g., R&W/GZA 2019, R&W/GZA 2020).
- Stormwater control including run-on and run-off (**Section 6.6**).
- Fugitive Dust Control Plan will be implemented during construction (**Section 4.0**). There will be no exposed waste material following construction, and exposed soils (i.e., over the cap or in adjoining areas) will be vegetated or completed as a stabilized structure (e.g., roadway, retention basin).
- Air quality and landfill gas monitoring will be completed during construction (**Section 4.1**).

The Construction QA/QC Plan is provided as Attachment B to **Appendix C** and contains the following information required under Part 115:

- Cap material storage, handling, and installation requirements (**Section 6.0**).
- Cap material specifications (**Section 6.0**).

- Ability of cap material to maintain its physical properties under varying conditions throughout the post-closure life of the HSP (**Section 6.0**).

Landfill gas monitoring is required under Part 115. Construction monitoring is described in **Section 4.3** and **Appendix C.** Post-construction monitoring for organic vapor and hydrogen sulfide will be completed during on-Site piezometer monitoring activities described in **Section 6.0**. Additional post-construction monitoring requirements will be evaluated, developed, and completed under the long-term monitoring plan (**Section 6.0**).

The following requirements under Part 115 are not applicable as construction activities are proposed to be above the water table:

- Performance analysis under varying groundwater conditions.
- Calculations that show bottom heave or blowout potential.

9.0 OPERATION PLAN

Table 3 summarizes the applicable operational components of Part 115.

TABLE 3. APPLICABLE OPERATIONAL COMPONENTS OF PART 115

Part 115 Requirement	Proposed Implementation Measure
A fill progression plan over the active life of the landfill including final slopes and elevations and including the location and description of the permanent survey benchmark to be used for elevation control.	Not applicable as fill will not be used in progression. Final elevations are provided in Attachment C of **Appendix C.**
A landscape plan that identifies and locates existing vegetation to be retained and proposed vegetation to be used for cover, screening, and other purposes.	Refer to Attachment C of **Appendix C**.
All equipment will be used at the landfill for construction and operation.	Typical equipment required for implementation of the final remedy includes excavators, dump trucks, off-road haul trucks (for on-Site use), bulldozers, and compactors. The Contractor's equipment list will be required to be submitted during the bid process. The HSP will not be operated as a disposal facility following remedy implantation. Maintenance equipment such as mowers and trimmers, and road maintenance equipment will be mobilized to the HSP as needed for routine maintenance.
The landfill's personnel requirements, including the duties, training, and authority of the responsible individual who will direct landfill operations.	Planned activities include routine mowing and visual inspection of the Site and pond quarterly, with at least two of the quarterly events completed following a rain event of 2 inches or greater.
Signs.	A sign will be placed on the access gate restricting access to authorized personnel only. Existing signage along the existing fence line will be maintained during construction and replaced as needed following construction.

Part 115 Requirement	Proposed Implementation Measure
Natural and artificial barriers.	During and after construction, site security will be maintained using temporary and permanent fencing, gates, and barriers as appropriate. Refer to Attachment C of **Appendix C**.
Traffic control.	Refer to Attachment C of **Appendix C** for a construction-phase trucking plan.
The methods will be used to control dust and blowing papers from the active fill area.	Not Applicable, no waste will be received. A Dust Control Plan will be implemented during construction as described in **Section 8.0**.
The on-Site road design and method of controlling fugitive dust.	Refer to Refer to Attachment C of **Appendix C** for access road information. Dust control during construction is described in **Section 8.0**.

10.0 CONSTRUCTION QUALITY ASSURANCE PLAN

Table 4 summarizes the applicable QA components of Part 115. The QA/QC Plan is provided as Attachment B of **Appendix C**.

TABLE 4. APPLICABLE QA COMPONENTS OF PART 115.

Applicable Part 115 Requirement	QA/QC Plan
Flexible membrane liners.	Section 6.0
Final cover systems.	Section 5.0
Structural stability and integrity of the features listed in "H.1.".	Section 5.0
Proper construction of all components of the liners, primary and secondary collection and removal system(s), and final cover system.	Section 6.0
Conformity of all materials used with design and other material specifications.	Section 6.0

11.0 ESTIMATED PRE-CONSTRUCTION SCHEDULE

The following summarizes the anticipated schedule of pre-construction activities.

- Permit submittals – within 60 days of Work Plan approval
- Bid documents provided to potential bidders – within 90 days of Work Plan approval
- Bid submittals – within 60 days of soliciting bids
- Contract award – within 90 days of bid submittal
- Construction-phase work is anticipated to begin within 90 days of award. Construction schedule to be provided with Bids and revised construction schedule to be provided with Contractor Work Plans.
- Vegetation clearing is anticipated to begin within 30 days of receipt of permits.

The current estimate for construction is approximately 30 months from the start of construction-phase work. The actual construction timeline will be determined upon contractor bid award. Within 60 days following completion

of construction of the Final Remedy land and resource use restrictions will be placed on the HSP in accordance with the CD.

12.0 REFERENCES

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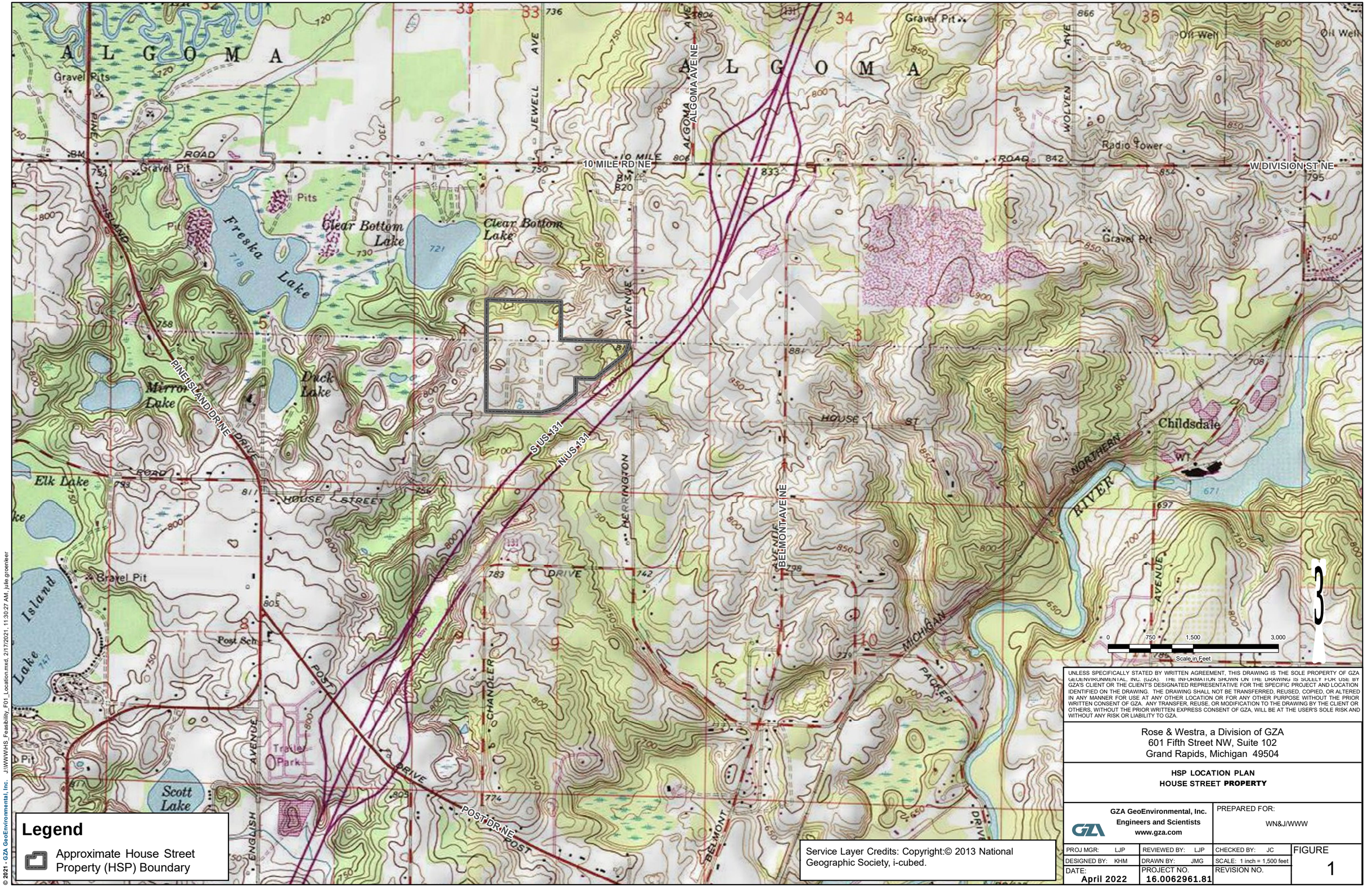
FIGURES



Legend

Approximate House Street Property (HSP) Boundary

Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed.

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

HSP LOCATION PLAN
HOUSE STREET PROPERTY

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

PREPARED FOR: WN&J/WWW

PROJ MGR: LJP	REVIEWED BY: LJP	CHECKED BY: JC	FIGURE 1
DESIGNED BY: KHM	DRAWN BY: JMG	SCALE: 1 inch = 1,500 feet	
DATE: April 2022	PROJECT NO. 16.0062961.81	REVISION NO.	

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

0 100 200 400

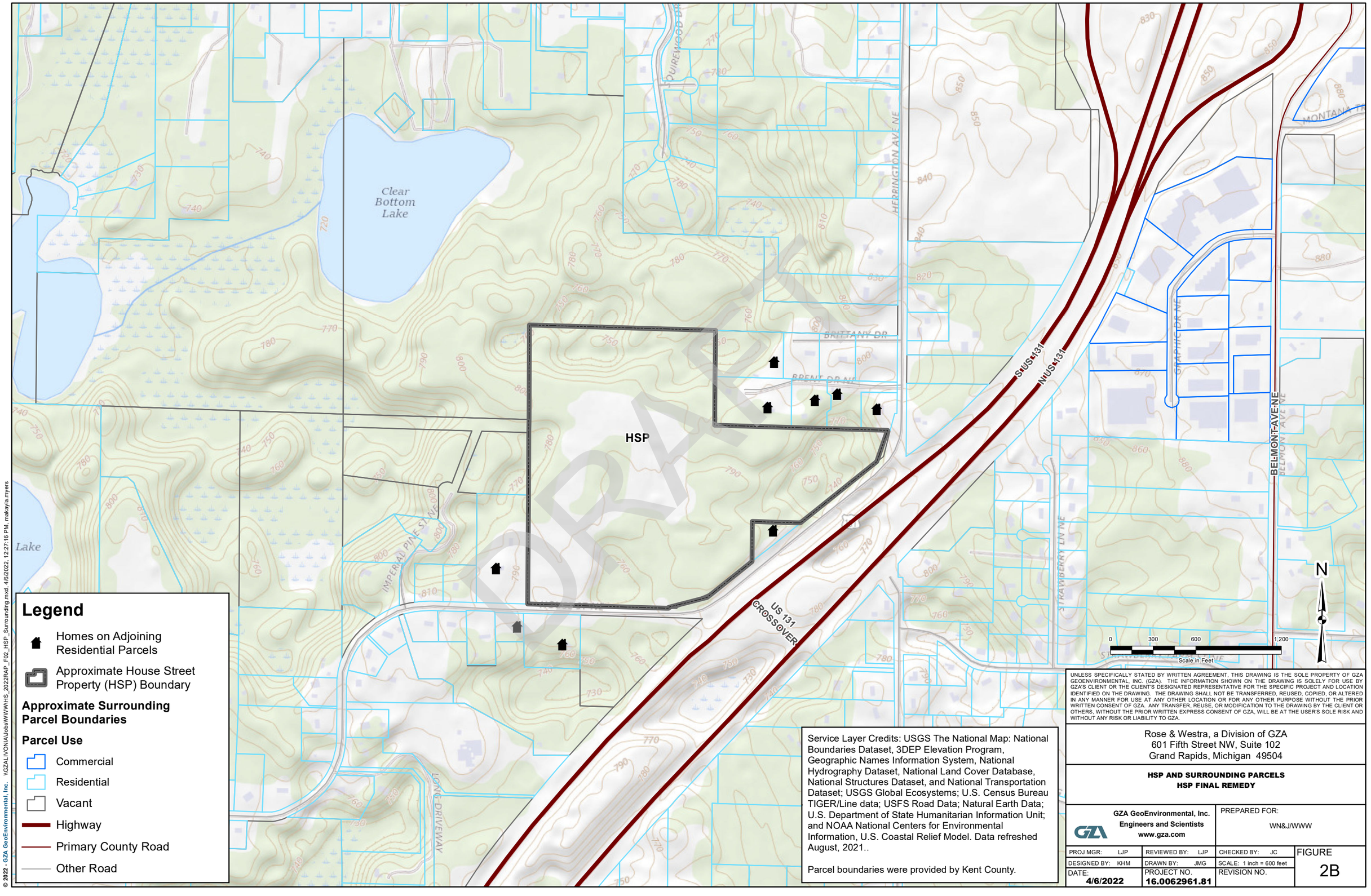
SCALE IN FEET

11x17

ROSE & WESTRA. A DIVISION OF GZA
601 FIFTH STREET NW, SUITE 102
GRAND RAPIDS, MICHIGAN 49504

HSP AND SURROUNDING PARCELS
HSP FINAL REMEDY

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		PREPARED FOR: WN&J/WWW	
PROJ MGR: LJP	REVIEWED BY: MAW	CHECKED BY: KHM	FIG/DWG 2A
DESIGNED BY: MKM	DRAWN BY: MKM	SCALE: 1 in = 200 ft	
DATE: 04/08/2022	PROJECT NO: 16.0062961.81	REVISION NO:	



Legend

- Homes on Adjoining Residential Parcels
- Approximate House Street Property (HSP) Boundary

Approximate Surrounding Parcel Boundaries

Parcel Use

- Commercial
- Residential
- Vacant
- Highway
- Primary County Road
- Other Road

Service Layer Credits: USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road Data; Natural Earth Data; U.S. Department of State Humanitarian Information Unit; and NOAA National Centers for Environmental Information, U.S. Coastal Relief Model. Data refreshed August, 2021..

Parcel boundaries were provided by Kent County.

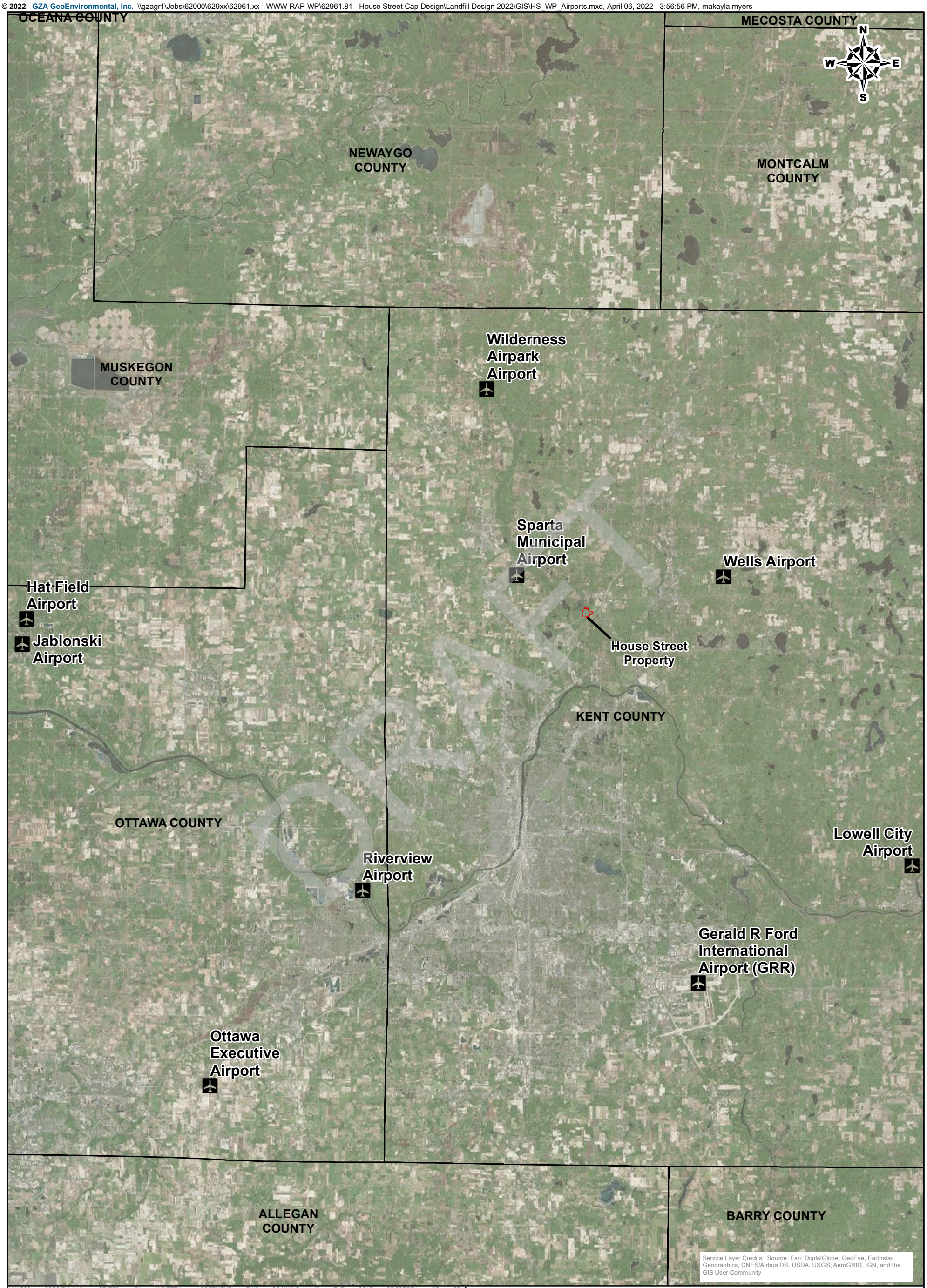
Rose & Westra, a Division of GZA
601 Fifth Street NW, Suite 102
Grand Rapids, Michigan 49504

HSP AND SURROUNDING PARCELS
HSP FINAL REMEDY

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

PREPARED FOR: WN&J/WWW

PROJ MGR: LJP	REVIEWED BY: LJP	CHECKED BY: JC	FIGURE 2B
DESIGNED BY: KHM	DRAWN BY: JMG	SCALE: 1 inch = 600 feet	
DATE: 4/6/2022	PROJECT NO. 16.0062961.81	REVISION NO.	



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SCALE IN FEET

11 X 17

HOUSE STREET FINAL REMEDY
1855 HOUSE ST
BELMONT, MI

AIRPORTS
WITHIN 30 MILES OF SITE

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

PREPARED FOR:
WN&J/WWW

PROJ MGR:	LJP	REVIEWED BY:	LJP	CHECKED BY:	TAL	FIG/DWG	3
DESIGNED BY:	MKM	DRAWN BY:	MKM	SCALE:	1 in = 20,000 ft		
DATE:	04/06/2022	PROJECT NO:	16.0062961.81	REVISION NO:		SHEET NO:	

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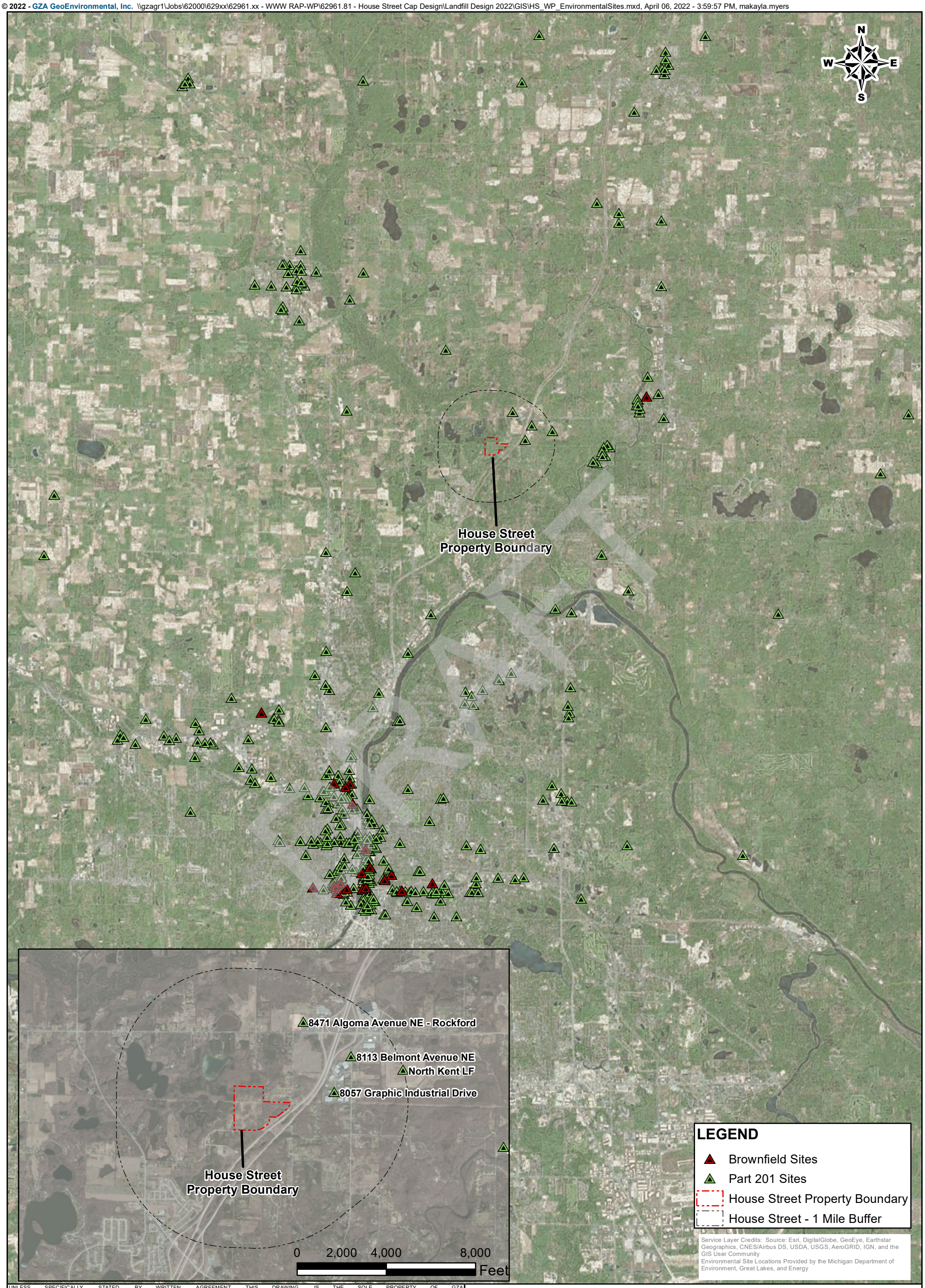

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SCALE IN FEET

11 X 17

HOUSE STREET FINAL REMEDY
1855 HOUSE ST
BELMONT, MI

KNOWN SITES OF ENVIRONMENTAL CONTAMINATION
WITHIN 10 MILES OF SITE

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

PREPARED FOR:
WN&J/WWW

PROJ MGR:	LJP	REVIEWED BY:	LJP	CHECKED BY:	TAL	FIG/DWG	4
DESIGNED BY:	MKM	DRAWN BY:	MKM	SCALE:	1 in = 10,000 ft		
DATE:	04/06/2022	PROJECT NO:	16.0062961.81	REVISION NO:		SHEET NO:	

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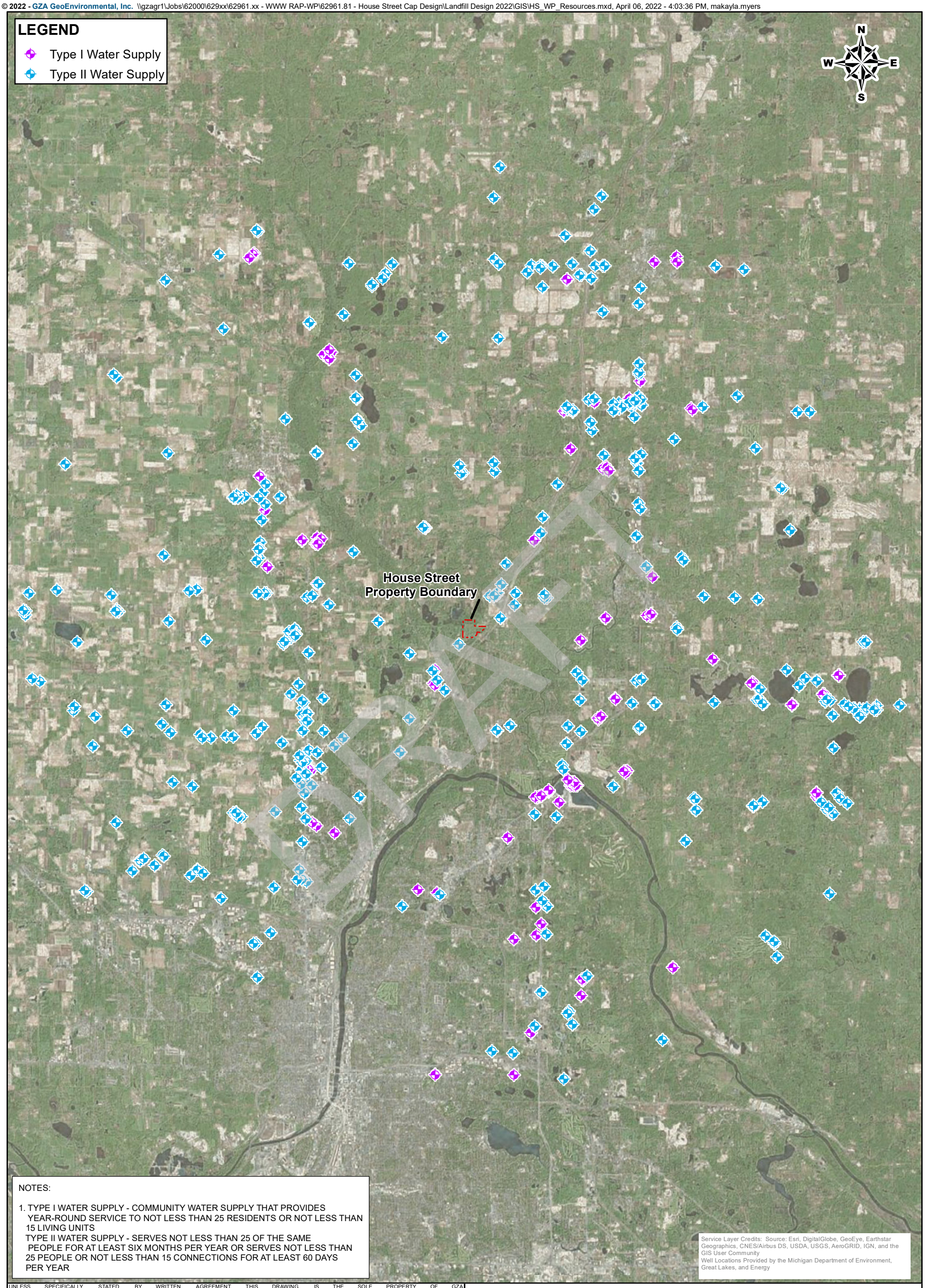

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SCALE IN FEET

11 X 17

HOUSE STREET FINAL REMEDY
1855 HOUSE ST
BELMONT, MI

SIGNIFICANT PUBLIC RESOURCES
WITHIN 10 MILES OF SITE

PREPARED BY:
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www.gza.com

PREPARED FOR:
WN&J/WWW

PROJ MGR:	LJP	REVIEWED BY:	LJP	CHECKED BY:	TAL	FIG/DWG	5
DESIGNED BY:	MKM	DRAWN BY:	MKM	SCALE:	1 in = 10,000 ft		
DATE:	04/06/2022	PROJECT NO:	16.0062961.81	REVISION NO:		SHEET NO:	

APPENDIX A

HOUSE STREET FEASIBILITY STUDY

Rose & Westra
A Division of GZA

GEOTECHNICAL
ENVIRONMENTAL
ECOLOGICAL
WATER
CONSTRUCTION MANAGEMENT

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Sent Via Email Only

September 13, 2021; Approved Final October 28, 2021
File No. 16.0062961.80

Ms. Karen Vorce, Project Manager
Grand Rapids District Office
Remediation and Redevelopment Division
Michigan Department of Environment, Great Lakes, and Energy
350 Ottawa Avenue NW, Unit 10
Grand Rapids, Michigan 49503
vorcek@michigan.gov

Re: Revised Feasibility Study – Remedial Options
Wolverine World Wide, Inc. – House Street Property
Plainfield Township, Kent County, Michigan

Dear Ms. Vorce:

On behalf of Wolverine World Wide, Inc. (Wolverine), Rose & Westra, a Division of GZA GeoEnvironmental, Inc. (R&W/GZA), is submitting this cover letter and enclosure in response to the referenced Consent Decree, effective February 19, 2020.

This submittal includes the revised Feasibility Study for remedial options identified in Paragraph 7.8 of the Consent Decree. If you have any questions, please contact us.

Very truly yours,

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

Loretta J. Powers
Senior Project Manager

Ernest Hanna
Senior Principal

Mark A. Westra
Principal

Joseph C. Foglio, CHMM
Senior Principal

ljp/maw/eh/jcf

\\Gzagr1\Jobs\62000\629xx\62961.xx - WWW RAP-WP\62961.80 - HS Feasibility Study\FS Text\Resubmittal\Approved Final Document\62961.80_FS_Rpt_Approved-F.docx

Attachment: House Street Property Feasibility Study

Rose & Westra
A Division of GZA

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REVISED FEASIBILITY STUDY – REMEDIAL OPTIONS
HOUSE STREET PROPERTY

1855 HOUSE STREET NE
Plainfield Township, Kent County, Michigan

September 13, 2021; Approved Final October 28, 2021
File No. 16.0062961.80

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

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30 Offices Nationwide
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TABLES

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APPENDICIES

ACRONYMS

bgs	Below Ground Surface
CCI	City Cost Index
CD	Consent Decree, effective February 19, 2020 (No. 1:18-cv-0039-JTN-ESC)
CFR	Code of Federal Regulations
CY	Cubic Yards
EGLE	Michigan Department of Environment, Great Lakes and Energy
FML	Flexible Membrane Liner
FS	Feasibility Study
ft	Feet
GCL	Geocomposite Clay Liner
HSP	House Street Property, also referred to as Site
NE	Northeast
OM&M	Operation, Maintenance, and Monitoring
PFAS	Per- and Polyfluoroalkyl Substances
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
PPE	Personal Protective Equipment
R&W/GZA	Rose & Westra, a Division of GZA GeoEnvironmental, Inc.
T&D	Treatment and Disposal
USEPA	United States Environmental Protection Agency
Wolverine	Wolverine World Wide, Inc.

1.0 INTRODUCTION

R&W/GZA submits this revised FS on behalf of Wolverine to select the final remedy for the HSP. This revised FS evaluates the two required options under Paragraph 7.8(a)(ii) of the CD: an approximately 30-acre cap (Cap Option) and an approximately 20-acre landfill cell (Landfill Cell Option). For reference, other remedial options that were evaluated in Wolverine's February 19, 2021, Feasibility Study are summarized in **Table 1**.

Under Paragraph 7.8(b) of the CD, "if [EGLE] does not approve of the proposed remedy in the Feasibility Study for the House Street Disposal Site, the final remedy shall be an approximately 30-acre surface cap without a bottom liner." On February 19, 2021, Wolverine submitted a Feasibility Study for the HSP. Wolverine proposed a mixed combination of remediation methods that would have (i) constructed caps to prevent infiltration in the areas of the HSP where waste is the thickest as well as areas where phytoremediation was not preferred or feasible, and (ii) preserved existing vegetation and trees to the extent possible and planted as many as 4,000 new trees to enhance greenspace and create a natural preserve setting at the HSP. EGLE did not approve Wolverine's proposed remedy. Rather than attempting to pursue this remediation proposal over EGLE's non-approval, Wolverine submits this revised FS in accordance with Paragraph 7.8(b) of the CD to implement the Cap Option as the final remedy.

EGLE provided their letter entitled *Disapproval of the House Street Property Feasibility Study Report as Required by the Wolverine World Wide, Inc. Consent Decree Court Case No. 1:18-cv-00039* on June 15, 2021. Since receipt of the disapproval, Wolverine's consultant, R&W/GZA has meet several times with EGLE staff members, including Part 115 staff, to discuss the comments in the letter as well as a path forward. Information agreed upon during those discussions is included throughout this revised FS.

2.0 BACKGROUND

The HSP, located at 1855 House Street NE, Plainfield Township, Kent County, Michigan, encompasses approximately 76 acres (**Figure 1**). The HSP is currently undeveloped and, according to available information, no buildings were previously present. An electric utility right-of-way and associated high-voltage transmission lines cross the northern portion of the HSP, and a maintenance access road from House Street runs south to north across the HSP.

Approximately the northern 12 acres and eastern 16 acres are covered in mature forest. The central portion of the HSP is a mix of grasslands, low lying vegetation, and mature woodland. Driving and walking trails are present throughout the HSP and have been for a number of years. The HSP and surrounding features are shown on **Figure 2.**

The HSP was a State of Michigan licensed and regulated disposal facility from the mid-1960s through 1978. Until 1970, the HSP received leather tanning byproducts, including primarily sludges from the wastewater treatment system at the former tannery. Waste materials were identified and characterized during investigations in 2018 and 2019 and generally consisted of a gray color with black, white, red, and brown waste materials mixed with soil.

The borehole lithology indicated that the soils in the top 20 ft are generally not stratified. Alternating layers of fine-grained and coarse-grained soil are present in individual boreholes without consistent stratification across the Site. Waste materials are also present at varying depths, including intermixed with the soils. This observation is consistent with the site history of waste material placement and filling. Native soil observed at the Site is consistent with the regional overburden geology for areas where no previous Site work had been performed.

The maximum identified depth to the bottom of known waste materials from existing grade is approximately 20 ft bgs. On-site soil borings identify up to 80 ft of primarily well-sorted sand between the bottom of the waste materials and the groundwater table. Because PFAS compounds have been detected in the groundwater, the soil column between the waste materials and groundwater would be considered a secondary source of PFOA+PFOS to groundwater.

The volume of waste materials is estimated to be 49,000 CY, and soil with waste materials is estimated to be approximately 34,000 CY for a total estimated volume of 83,000 CY. The native soil in which the waste materials were disposed included sand, gravel, and clay, and the estimated volume of native or fill material over the top of the waste material is approximately 235,000 CY. The waste materials and waste materials mixed with soil is the primary contaminant source at the HSP.

Some of the waste placed at the HSP contained PFOS and PFOA and their precursors, which are part of a larger group of PFAS. PFAS were in Scotchgard™, a waterproofing material manufactured by 3M Company, that was applied to some leather goods manufactured at the former Wolverine Tannery site in Rockford, Michigan. Some PFAS from the byproducts at the HSP entered the groundwater beneath and are migrating from the HSP.

Additional information regarding the HSP, its historical use, the physical setting (i.e., hydrology, geology, and hydrogeology), and contaminant distribution and concentrations is detailed in R&W/GZA's February 9, 2018, *Conceptual Site Model Update and Status Report* (R&W/GZA, 2018), 2018 Summary Report (R&W/GZA, 2019), 2019 Summary Report (R&W/GZA, 2020), and SOWs included in the CD.

The approximate extent of known waste material and soil with waste material on the HSP is shown on **Figure 3**.

The approximate extent of known groundwater contamination on the HSP is shown on **Figure 4**. The extent of off-site groundwater contamination, including the groundwater-surface water interface, is being further investigated and monitored per separate requirements in the CD. The estimated extent of an off-site groundwater plume is shown on **Figure 4A**.

The depth to top and thickness of the waste materials and soil with waste materials varies across the areas of waste materials on the Site. For example, the waste thickness in the south-central portion of the Site is up to 20 ft while certain areas in the central portion are less than 3 ft of thickness. Cross sections of the estimated extent of the waste materials and waste with soil relative to the water table are included as **Figures 5 and 5A-5D**, respectively. Geological cross sections were provided on Figures 4-1 through 4-3 of the *Implementation of the 2019 Work Plan – Summary Report* dated July 22, 2021 (R&W/GZA, 2021) and submitted to USEPA.

3.0 SCOPE OF ANALYSIS

Paragraph 7.8 of the CD governs the scope and content of this FS:

The Feasibility Study shall set forth and evaluate the remedy options under Part 201. At a minimum, the Feasibility Study shall include the following information:

(A) Definition of remedial objective;

(B) Analysis of each potential remedy options, including an analysis of:

(1) The performance, reliability, ease of implementation, and potential impacts of the potential remedy, including safety impacts, and control of exposure to any residual contamination;

(2) The time required to begin and complete implementation of the remedy;

(3) The cost of remedy implementation;

(4) The institutional requirements that may substantially affect implementation of the remedy; and

(5) The remedy's ability to reduce toxicity and the mobility of PFAS compounds.

(C) A proposed selected remedy based on the analysis.

4.0 ANALYSIS

4.1 DEFINITION OF REMEDIAL OBJECTIVE

Paragraph 7.8 of the CD provides in relevant part as follows:

(ii) The Feasibility Study shall evaluate the following remedy options to (1) manage solid wastes at the House Street Disposal Site and (2) reduce and control potential migration of PFAS Compounds from soils and sludges into the groundwater from the House Street disposal Site:

(A) an approximately 30-acre surface cap without a bottom liner that complies with Part 201 and meets the applicable substantive requirements of Michigan's Part 115;

(B) an approximately 20-acre surface cap over an area in which materials are consolidated and placed above a liner with leachate collection, as required, that comply with Part 201 and meet the applicable substantive requirements of Michigan's Part 115; and

(C) other alternatives that may include some combination of a smaller cap and groundwater interceptor, collection, or treatment systems that comply with Part 201 and meet the applicable substantive requirements of Michigan's Part 115.

* * *

(b) Subject to Section XVIII (Dispute Resolution for MDEQ and Defendant), if MDEQ does not approve of the proposed remedy in the Feasibility Study for the House Street Disposal Site, the final remedy shall be an approximately 30-acre surface cap without a bottom liner.

4.2 ANALYSIS OF REMEDY OPTIONS

Under Paragraph 7.8(b) of the CD, "if [EGLE] does not approve of the proposed remedy in the Feasibility Study for the House Street Disposal Site, the final remedy shall be an approximately 30-acre surface cap without a bottom liner." On February 19, 2021, Wolverine proposed a remedy (a combination of phytoremediation and targeted capping) in the draft Feasibility Study for the HSP. EGLE did not approve of that proposed remedy. Accordingly, the final remedy shall be the approximately 30-acre cap (Cap Option).

The two required options under Paragraph 7.8(a)(ii) of the CD, the Cap Option and an approximately 20-acre landfill cell (Landfill Cell Option), are analyzed below.

4.2.1 The Cap Option

Under the Cap Option, three low permeability caps consisting of a flexible membrane covered by 2 ft of soil and 6 inches of vegetated cover, or an approved alternative, will be installed over delineated waste material areas.

As depicted on **Figure 3**, the waste material and soil mixed with waste is generally defined by three areas. The northernmost area is separated from the two southern areas by power lines and an access road. The southern area is comprised of two major lobes separated by a relatively narrow area connecting the two larger areas.

The Cap Option involves constructing three individual caps as illustrated on **Figure 6**. The aggregate area of the three caps is expected to approach 27 acres. The narrow band of impacted material separating the two larger areas on the southern portion of the HSP, along with the two isolated areas and localized areas of near-surface waste materials on the boundary of the Site, will be excavated and relocated below the southern caps. Constructing three individual caps will significantly limit excavation and material handling that would be associated with construction of a single cap, thereby reducing the construction schedule and impact to adjacent property owners. Because the caps will overlap with the five areas previously capped during USEPA response actions, those five areas will be incorporated within the new capped areas.

The Cap Option will comply with Part 201, and the caps will meet all applicable substantive requirements of Part 115, including Rule 304. For example, the Cap Option will include, among other things: a system to address decomposition gasses from chipped trees, stumps, and vegetation; a final slope greater than 2% to prevent ponding and less than 25% to allow vegetative growth and limit erosional runoff; a cover comprised of a flexible geomembrane component covered by at least 2 ft of soil and 6 inches of organic soil that can support native plant growth. Sources for cover material atop the flexible geomembrane or the organic layer will be primarily obtained from areas on the HSP that have not been impacted by prior disposal operations. Should this source be insufficient, off-site cover material and organic soil will be imported.

Because stormwater conveyances are not currently present on the House Street right-of-way or on either direction of US-131 other than a drainage swale, run-off from the southern caps will be directed to a retention basin located and constructed on the southeast portion of the Site and then possibly pumped or directed to the eastern wooded portion of HSP and allowed to naturally infiltrate in an area not previously used for waste disposal. Runoff from the northern cap will naturally infiltrate with proper erosion control around the cap on the surrounding HSP. Stormwater control including the potential impact of infiltration may influence the direction of groundwater flow and will be modeled during the design. The final design will be sufficient to meet Part 115 requirements and applicable Plainfield Township requirements, if any. This runoff design may require a significant area of the HSP as well as engineering and approval of a high-water contingency.

Areas disturbed outside the capped footprints (access roads, laydown areas, areas of excavation for near surface waste materials) will be re-graded to facilitate drainage, covered with topsoil, and hydroseeded. A portion of the HSP will contain access roads to allow crews to mow and maintain the cap. Portions of the HSP will also remain fenced and secure to ensure the integrity of the caps is not compromised. This will include the capped and immediately surrounding areas.

The construction and design details of the Cap Option will be included in a work plan as specified under Paragraph 7.8(c) of the CD.

Figure 6 is a conceptual site plan for the Cap Option showing the approximate cap outlines (red outline) and limits of the work area (black outline). Areas within the black outline that are not capped would be regraded and filled after excavation and construction is complete. The stormwater retention area is shown in the southeastern portion of the HSP.

4.2.1.1 Performance

The Cap Option will limit infiltration through the waste and soil with waste material.

4.2.1.2 Reliability

The Cap Option is considered a reliable environmental remedy. Typically, geosynthetic components like those that will be used in the Cap Option have shown long-term resiliency past a 30-year post-closure period. Research at the Geosynthetic Institute infers geomembranes are capable of a lifespan of 100-years or greater (Geosynthetic Institute, GRI White Paper #6, 2011). Items that could shorten its lifespan include animal burrowing, heavy recreation, tree roots, and exposure to the weather.

Well-established means and methods for construction as well as quality control procedures will be employed to document integrity of the caps. Consolidation of the organic material through decomposition will result in settling over the long-term; however, the cap slope will be designed to accommodate some settlement. In addition, areas of the cap that reveal excess settling (i.e., collection of ponded water, topsoil discontinuity, or erosion) will be evaluated and repaired as required to maintain the integrity of the cap. More generally, maintenance activities will include establishing routine procedures to sustain vegetative growth of the organic cover layer, periodic mowing, watering in areas that have been repaired, addressing areas that may be prone to erosion during or after significant storm events, eliminating animal burrows, removing trees, and occasionally accessing and repairing or removing portions of the caps that may have been damaged.

4.2.1.3 Ease of Implementation

The Cap Option is more easily implemented than the Landfill Cell Option. Installation of the caps will require installing erosion controls prior to clearing and grubbing vegetation overlying the work areas, as well as, the temporary access roads, decontamination and laydown areas needed to construct the caps, and the additional areas need to re-contour the ground around the caps to direct runoff and drainage to control areas that will be identified in the final design. Access roads and areas under the caps will be stabilized during construction to allow heavy equipment and vehicles to operate safely. Stormwater runoff and sediment/erosion controls needed to handle water from exposed areas of impacted soil and/or waste will be installed, as well as localized areas to collect and temporarily store impacted runoff. Impacted soil on the perimeter of the capped areas will be excavated and relocated so it can ultimately be consolidated below the cap(s).

Typical earthwork equipment associated with site development and landfill construction in addition to the specialized heavy equipment necessary to backfill and compact the existing material to limit differential settlement and reduce strain on the cap will be employed throughout the construction effort.

Typical remedial construction techniques and controls will be implemented to limit exposure during handling (i.e., considerations of odor and worker exposure) by on-site workers including a construction health and safety plan, daily toolbox talks that identify the work to be completed and potential hazards. An on-site water truck will be available to minimize visible dust.

Additional information needed before final design and construction include evaluating the engineering properties of the waste and soils impacted by the waste, refining the limits of near-surface waste, refining the geotechnical characteristics of the near surface soil to determine its suitability for placement below the FML, identifying a source of on-site backfill and/or topsoil and confirming stormwater infiltration location(s) for the cap areas.

4.2.1.4 Potential Impacts

Potential impacts of the Cap Option are similar in kind to those of the Landfill Cell Option. The Cap Option will include clear cutting and grubbing at least 30 acres, likely up to 40 acres of vegetated and wooded land to accommodate approximately 27 acres of cap and re-contouring the surrounding land to facilitate drainage after construction. Construction and implementation impacts will involve typical construction safety and worker exposure, which will be mitigated by training and PPE. There will be a short-term increase in runoff and infiltration during construction when vegetation is removed. Temporary covers and water spray will be used to control dust during clearing, grubbing and waste material relocation during dry, windy weather conditions. If conditions persist, the presence of dust will be mitigated with other control measures, such as limiting a work area and/or work activity.

Measures to control noise, smell, dust, and traffic will be implemented during construction to limit impact on the surrounding property owners.

4.2.1.5 Control of Exposure to Residual Contamination

Waste (primary source) and the majority of the soil beneath the waste (secondary source) will be under a cap. Some deeper secondary source soil whose footprint may extend beyond the cap boundary will remain in areas not capped. At least portions of the HSP will remain fenced and access restricted.

4.2.1.6 Time to Implement

The Cap Option will be implemented more quickly than the Landfill Cell Option. Design and permitting work can begin immediately upon acceptance of the work plan, and the expected time to completion, inclusive of design and permitting, is approximately 30 months. This implementation time is longer than typical cap construction schedules due to significant clearing, grubbing, and grading that will be required to prepare the Site and waste areas for capping. Following acceptance of the work plan, this timeframe allows for the following: completion of final design work; regulatory review and approval of the final design; solicitation and procurement of qualified contractors; additional geotechnical testing to verify material suitability for re-use; establish soil and erosion controls, clearing, grubbing and chipping; consolidation of some soils and wastes; preparation of the subgrade, access roads and staging areas; installing the caps and landfill gas venting system as needed; and Site restoration. Long term Operation, Maintenance and Monitoring (OM&M) are not included in this estimate.

4.2.1.7 Institutional Requirements

Deed restrictions will be imposed to limit groundwater use and prevent cap damage. Additional exposure and access controls such as fencing will also be used. Cap inspection and maintenance will be required long-term.

4.2.1.8 Ability to Reduce Toxicity and Mobility of PFAS Compounds

The Cap Option will reduce mobility by reducing infiltration through on-site waste material and the soil beneath it.

4.2.1.9 Estimated Cost

Design					
Sitework & Geotech Investigation	$	65,000.00	-	$	121,000.00
Prepare Plans, Specifications & Permit Applications	$	135,000.00	-	$	250,000.00
Subtotal	**$**	**200,000.00**		**$**	**371,000.00**
Construction					
Contractor Prequalification & Procurement	$	35,000.00	-	$	40,000.00
Construction Management	$	1,200,000.00	-	$	1,440,000.00
Construction	$	13,750,000.00	-	$	16,500,000.00
Subtotal	**$**	**14,985,000.00**		**$**	**17,980,000.00**
Operation Maintenance & Monitoring (Annual)					
Cap & Grounds Maintenance	$	8,000.00	-	$	9,000.00
Groundwater Monitoring & Reporting	$	60,000.00	-	$	66,000.00
Allocation for Major Repairs (Design & Construct) *	$	35,000.00	-	$	42,000.00
Subtotal	**$**	**103,000.00**		**$**	**117,000.00**

* Presented as 1/7th cost per annum

As agreed during EGLE and R&W/GZA working calls, the estimated costs are presented at a high level, and are based on estimated quantities and assumptions regarding construction procedures. More detailed costs cannot be provided until design of the Cap Option is completed and bid out to subcontractors. These cost estimates were developed from several sources that include the on-line version of RS Means using cost data generated for either "Heavy Construction" or "Commercial New Construction," Union Labor with the CCI for Grand Rapids, Michigan, quotes from similar projects, and R&W/GZA's experience designing and executing similar remediation and/or landfill construction projects. The estimate assumes the general contractor and subcontractors who comply with Occupational Health and Safety Administration (OSHA) Hazardous Waste Operations and Emergency Response Requirements contained in CFR Part 1910.120 and the Safety and Health Regulations for Construction contained in CFR Part 1926 will be allowed to work on the HSP.

Act 451 the Natural Resources and Environmental Protection Act, Part 201 Environmental Remediation, Section 20120 requires remedial action selection factors, among other considerations to include: long-term uncertainties; cost of long-term maintenance; and the potential for future response if the alternative fails. Recognizing that the cost for these items may be undefinable based on current information and potential regulatory changes, the contingency varied for each of the cost elements. The "*Allocation for Major Repairs*" line item is based on an estimated cost to design a major repair and remove sediment from the retention basin over an average period of 7 years.

4.2.2 The Landfill Cell Option

The Landfill Cell Option will consolidate waste on-site within a containment cell that consists of a base with a double layer of FML and leachate collection, and a GCL cap / cover. Because the bottom of the cell will be constructed above soil that has likely been impacted by leaching through the waste and impacted groundwater it is defined as an "unmonitorable" unit and the double lined system will be designed to operate as both a leak detection and a leachate collection system. Based on the estimated volume of known waste and soil impacted by waste (soil between layers of waste), the current estimate is that the cell would be designed to accommodate

approximately 160,000 CY of material with a footprint of approximately 5 acres. This estimate differs from the previously reported waste and impacted soil volume of 83,000 CY, which was based on the volume of impacted soil estimated between identified pockets of waste material. The 83,000 CY estimate did not include presumably non-impacted overburden, nor did it include a definitive clean-boring point below the waste. Borings that were completed through the waste were terminated once natural soil was encountered. To conservatively estimate the volume of impacted material that would be placed inside the containment cell, we assumed approximately 2 ft of soil below the known depth of waste would be excavated and placed in the cell. This additional 2-ft excavation depth allows for the removal of additional impacted soil, installation of the primary and secondary containment, and grading the bottom of the excavation to meet the design requirements for leachate collection in a Type II landfill. To account for chipped vegetation and additional impacted material that may be encountered during excavation, the cell could readily accommodate as much as 170,000 CY of material without expanding the 5-acre footprint.

Paragraph 7.8(ii)(B) of the CD summarizes the Landfill Cell Option as:

> *(B) an approximately 20-acre surface cap over an area in which materials are consolidated and placed above a liner with leachate collection, as required, that comply with Part 201 and meet the applicable substantive requirements of Michigan's Part 115;*

At the time the CD was entered into full delineation of the Site was not complete and, as a result, the approximately 20-acre cell size assumed for the Landfill Cell Option was based on rudimentary estimates. After execution of the CD, evaluation and characterization of the Site and waste delineation continued. This additional data shows that a cell size of approximately 5 acres[1] is necessary for the estimated waste volume in order to comply with substantiative requirements of Part 115, including appropriate maximum and minimum slopes, as well as good engineering practices. A cell larger than approximately 5 acres would require significantly more construction materials, more long-term operation and maintenance, and may result in additional potential failure points in the liner and capping materials.

To construct the containment cell, at least 30 acres, likely up to 40 acres of the Site would be clear cut and grubbed; the vegetation and trees would be chipped to allow the material to be placed within the containment cell. While the containment cell is expected to be 5 acres in size, overburden soil must be removed to allow access to the waste and soil impacted by the waste. Chipped organic material would be stockpiled and maintained on Site and then placed in a localized area of the containment cell that will be designed for decaying material and gas venting. Topsoil and wood chips from areas that had not previously been used for waste disposal or did not indicate concentrations of chemical constituents greater than regulatory clean-up goals may be separately staged, stockpiled and covered so that it could be re-used on Site. Overburden soil removed to access impacted soil and waste would be similarly handled.

Considering the volume of overburden, and presumably non-impacted soil that would require temporary storage until the containment cell was constructed, additional chemical analysis for the constituents of concern would be performed to verify its justification for reuse on the Site as cover on the GCL cap. In addition to the space required to accommodate and maintain the various stockpiles of non-impacted material, additional space is required to stockpile and maintain the volume of known impacted soil while allowing room for material that may be determined to be impacted based on laboratory analysis. Sequencing the construction to limit cross contamination and double- or triple-handling of material will be time consuming.

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[1] The February 2021 draft FS submittal included a 15-acre landfill cell which was developed based on an inadvertent, erroneous waste volume calculation. The error in the volume calculations was identified by EGLE during their review.

The location of the containment cell, covering the lowest area of the HSP, was selected because the majority of impacted material is present in this part of the HSP, and the natural topography will facilitate runoff control and collection to the proposed drainage basin located north of House Street. Runoff that contacts impacted material or accumulates during cell excavation and backfilling will be collected and transferred off-site for treatment and/or disposal. Final grades of the liners (primary, secondary and cap) will be designed and installed to comply with the minimum grades required in Part 115.

Upon excavation of the cell footprint, the soil will be graded to the design elevations, inspected, and made free of rocks or debris that could damage the bottommost liner. The leak detection system with appropriate collection locations will be installed between the primary and secondary liner. The primary liner drainage layer (or primary leachate collection system) will be designed to transfer leachate through a series of pipes to recovery locations so that the head on the liner will be limited to 1 foot. Sumps will be designed and located to comply with applicable Michigan Part 115 Type II Solid Waste Landfill regulations. Stockpiled impacted material will be placed into the cell, compacted, and graded to facilitate drainage. Chipped trees and vegetation, that are not suitable for reuse, would be located in a designated area of the containment which would be designed and outfit with the equipment required to adequately vent the area. Cover material placed on top of the primary liner FML will consist of either a 1-foot or 2-foot-thick drainage layer. Cover material placed on top of the GCL within the landfill cap will consist of a 2-foot-thick drainage layer and 6 inches of soil that will facilitate growth.

A retention basin located adjacent and to the east of the containment cell will be designed to accommodate a 25- year, 24-hour rainfall storm event. It is intended to allow runoff to infiltrate over time. Leachate will be periodically collected from the primary drainage layer and the leak detection/secondary leachate collection system and transported off-site for treatment and/or disposal.

Areas disturbed outside the capped footprints (access roads, laydown areas, areas of excavation for near surface waste materials) that will not continue to be used for maintenance access will be re-graded to facilitate drainage, covered with topsoil, and hydroseeded. At a minimum the containment cell area of the HSP will remain fenced.

Figures 7 and 8 are conceptual site plans for the Landfill Cell Option.

Figure 7 illustrates the location and expected configuration of the containment cell bottom with the limits of work (limits of clearing) required to store excavated soil and waste on site during cell construction.

Figure 8 presents a conceptual site plan for the Containment with Leachate Collection Option showing the likely locations of the Cell (black contours) and limits of the work area (blue outline). Should the cell contain the projected volume of approximately 166,000 CY, the finish elevation of the cell peak will be at elevation 818 which is approximately 38 feet above House Street to the South. Areas outside of the containment cell that are within the limits of work would be regraded and recontoured to direct drainage to the stormwater retention area in the southeastern portion of the HSP.

The Landfill Cell Option will comply with Part 201, and the surface cap, liner, and leachate collection system will comply with all applicable substantive requirements of Part 115, including Rules 304, 308, and 423.

Because stormwater conveyances are not currently present on the House Street right-of-way or on either direction of US-131 other than a drainage swale, run-off from the containment cell will be directed to a retention basin located on the southeast portion of the Site and then possibly pumped or directed to the eastern wooded portion of HSP and allowed to naturally infiltrate in an area not previously used for waste disposal. Stormwater control, including the potential impact infiltration may influence on the direction of groundwater flow, will be modeled during the design. The final design will be sufficient to meet Part 115 requirements and applicable

Plainfield Township requirements, if any. This runoff design will consider those portions of the HSP that formerly contained waste and soil impacted by waste and may require a larger area for retention than conceptually shown. In addition, and if needed, engineering and approval of a high-water contingency outlet for the retention basin will be conducted.

Areas disturbed outside the containment cell's capped footprint, that will not continue to be used for site access, (access roads, laydown areas, areas of excavation for near surface waste materials) will be re-graded to facilitate drainage, covered with topsoil, and hydroseeded. A portion of the HSP will contain access roads to allow crews to mow and maintain the cap maintenance. The HSP will also remain fenced and secure to ensure the integrity of the caps is not compromised. This will include the capped and immediately surrounding areas.

4.2.2.1 Performance

The Landfill Cell Option will limit infiltration through waste and impacted soil.

4.2.2.2 Reliability

Like the Cap Option, the Landfill Cell Option is considered a reliable environmental remedy, however, USEPA 2020 describes multiple uncertainties specifically regarding landfilling PFAS-containing material, including their behavior in the landfill itself and effect on the liner systems. Laboratory studies have published results that project the longevity of the geomembranes that will be used under the conditions expected at the HSP are hundred years or greater (these studies did not include PFAS-specific evaluation). The potential for (localized) leakage of precipitation into the cell is limited to design and/or construction errors. Subsurface consolidation in areas where chipped trees and other cleared vegetation will be stored may require additional maintenance over time to remove or close gas vents once decomposition has ended and they are no longer required. Well-established means and methods exist for construction as well as Quality Control procedures to verify integrity of the FML and GCL.

4.2.2.3 Ease of Implementation

The Landfill Cell Option is significantly more difficult to implement than the Cap Option. The Landfill Cell Option will require more construction traffic and a longer construction period than required to complete the Cap Option. Suitability of subgrade below the containment cell is currently unknown and may require imported material before placing the synthetic liner, or expansion of the containment system if additional impacted material is discovered below the design depth. Removal of impacted material from the deep ravine at the southern end of the Site is likely to require use of specialty construction equipment or installation of temporary support system to limit over excavation. Simultaneous construction and storage/maintenance of waste and impacted material may require additional laydown area east of the currently delineated waste footprint. Backfilling and compacting a deep excavation to limit differential settlement and reduce strain on the FML also require specialized heavy equipment. Water collected (from precipitation) during construction and backfilling the containment cell will require a collection system and storage system along with temporary on-site storage with periodic removal and off-site disposal. Dust control during dry, windy periods to limit air borne particulates will require specialized material handling and dust control techniques which could periodically exacerbate runoff control. Stormwater control will need to be sufficient to meet Part 115 and Plainfield Township requirements, if applicable. The runoff design will consider and may require a significant area of the HSP, as well as engineering and approval of a high-water contingency as noted earlier.

Additional information that would be needed before final design and construction include confirming engineering properties of the waste material, refining the limits of waste, and confirming stormwater infiltration location.

4.2.2.4 Potential Impacts

The potential impacts of the Landfill Cell Option are similar in kind but slightly greater than the Cap Option. The Landfill Cell Option will include clear cutting and grubbing at least 30 acres, likely up to 40 acres of vegetated and wooded land with the potential to increase the clearing if additional impacted material is encountered that would require temporary storage until the containment cell construction is completed. Construction and implementation impacts will involve typical construction safety and worker exposure over a longer duration that the cap alone alternative, which will be mitigated by training and PPE. There will be a short-term increase in runoff and infiltration during construction when vegetation is removed. Temporary covers and other control measures (e.g., water) will be used to control the wind-borne spread of dust during clearing, grubbing and waste material relocation during dry, windy weather conditions.

Measures to control noise, smell, dust, and traffic will be implemented during construction to limit impact on the surrounding property owners.

4.2.2.5 Control of Exposure to Residual Contamination

Waste (primary source) will be located in a landfill cell. The soil beneath the waste (secondary source) will remain in place but generally will be at least 5 ft below grade. Portions of the HSP will remain fenced and access restricted.

4.2.2.6 Time to Implement

Design and permitting can begin immediately upon acceptance of a work plan, with construction and implementation likely up to 36 months. This does not include design and permitting process or long-term OM&M.

4.2.2.7 Institutional Requirements

Deed restrictions will be imposed to limit soil and groundwater use, and additional exposure controls such as the cell capping and fencing will be used. Cap and cell inspection and maintenance will be required long-term.

4.2.2.8 Ability to Reduce Toxicity and Mobility of PFAS Compounds

The Landfill Cell Option would contain the on-site waste and limit mobility from the primary source.

4.2.2.9 Estimated Cost

Design						
Sitework & Geotech Investigation		$	95,000.00	-	$	167,000.00
Prepare Plans, Specifications & Permit Applications		$	175,000.00	-	$	263,000.00
	Subtotal	**$**	**270,000.00**		**$**	**430,000.00**
Construction						
Contractor Prequalification & Procurement		$	35,000.00	-	$	39,000.00
Construction Management		$	1,950,000.00	-	$	2,800,000.00
Construction		$	17,500,000.00	-	$	24,500,000.00
	Subtotal	**$**	**19,485,000.00**		**$**	**27,339,000.00**

Operation Maintenance & Monitoring					
Cap & Grounds Maintenance	$	8,000.00	-	$	9,000.00
Groundwater Monitoring & Reporting	$	60,000.00	-	$	66,000.00
Leachate Collection & Off-Site T&D*	$	250,000.00	-	$	300,000.00
Allocation for Major Repairs (Design & Construct)**	$	45,000.00	-	$	54,000.00
Subtotal	**$**	**363,000.00**		**$**	**429,000.00**

* Leachate collection avg for 3 years - decline with time

** Major repairs every 7 years

As agreed during EGLE and R&W/GZA working calls, the estimated costs are presented at a high level, and are based on estimated quantities and assumptions regarding construction procedures. More detailed costs cannot be provided until design of the Landfill Cell Option was completed and bid out to subcontractors. The cost estimate was developed from several sources that include the on-line version of RS Means using cost data generated for either "Heavy Construction" or "Commercial New Construction", Union Labor with the CCI for Grand Rapids, Michigan, quotes from similar projects, and R&W/GZA's experience designing and executing similar remediation and/or landfill construction projects. The estimate assumes the general contractor and subcontractors who comply with OSHA Hazardous Waste Operations and Emergency Response Requirements contained in CFR Part 1910.120 and the Safety and Health Regulations for Construction contained in CFR Part 1926 will be allowed to work on the HSP.

Act 451 the Natural Resources and Environmental Protection Act, Part 201 Environmental Remediation, Section 20120 requires remedial action selection factors, among other considerations to include: long-term uncertainties; cost of long-term maintenance; and the potential for future response if the alternative fails. Recognizing that the cost for these items may be undefinable based on current information and potential regulatory changes, the contingency varied for each of the cost elements presented below. The "Allocation for Major Repairs" line item is based on an estimated cost to design a major repair and remove sediment from the retention basin over an average period of 7 years.

5.0 SELECTION OF FINAL REMEDY

Wolverine intends to implement the Cap Option going forward because it is feasible, reliable, and meets the performance objectives outlined in the CD.

In any event, under Paragraph 7.8(b) of the CD, "if [EGLE] does not approve of the proposed remedy in the Feasibility Study for the House Street Disposal Site, the final remedy shall be an approximately 30-acre surface cap without a bottom liner." On February 19, 2021, Wolverine proposed a remedy (a combination of phytoremediation and targeted capping) in the Feasibility Study for the HSP. EGLE did not approve of that proposed remedy. Accordingly, the final remedy shall be the approximately 30-acre cap.

6.0 REFERENCES

Geosynthetic Institute, GRI White Paper #6, Geomembrane Lifetime Prediction: Unexposed and Exposed Conditions; Koerner, Robert M., Hsuan, Y. Grace, and Koerner, George R.; February 8, 2011; https://geosynthetic-institute.org/papers/paper6.pdf

Michigan Department of Environmental Quality (MDEQ, now EGLE, 2013). Part 201 Cleanup Criteria Rules. https://www.michigan.gov/egle/0,9429,7-135-3311_4109-251790--,00.html. Effective December 30, 2013.

R&W/GZA. 2018. *Conceptual Site Model Update and Status Report*. February 9, 2018.

R&W/GZA. 2019. *HSDS Implementation of the 2018 Work Plan Summary Report.* Submitted to USEPA May 21, 2019.

R&W/GZA. 2021. *HSDS Implementation of the 2019 Work Plan Summary Report.* Submitted to USEPA July 22, 2021.

USEPA. 2020. Interim Guidance on the Destructions and Disposal of Perfluoroalkyl and Polyfluoroalkyl Substances and Materials Containing Perfluoroalkyl and Polyfluoroalkyl Substances.

TABLES

Table 1 – Summary of Initial Screening of Options

1855 House Street Site

Technology Type	Process Option	Description	Effectiveness	Implementability	Screening Comment
No Further Action					
None	None	No further action.	The no action alternative does not result in reduction of waste volume, toxicity, or mobility.	Good	Not evaluated further as it does not meet CD objectives.
Institutional Controls					
Access and Use Restrictions	Deed restrictions	Implement deed restrictions on soil and groundwater use as well as property zoning and use. May be used in conjunction with other remedial options.	Provides additional limitation to direct contact human exposure. Effectiveness relies on ability to implement and enforce. Deed restrictions do not reduce the mobility or toxicity of the PFAS compounds.	Good	Retained for likely inclusion with other actions to improve their reliability.
Containment					
On-site capping		Consolidating some waste material and then constructing an impermeable cap over affected areas. Runoff allowed to infiltrate side-gradient of waste.	Limits direct contact human exposure, reduces infiltration through the waste material on the HSP. Likely to decrease the mobility of the PFAS compounds contained with the waste materials by limiting infiltration. This alternative does not reduce the toxicity of the PFAS compounds or waste volume.	Readily implementable using standard landfill capping techniques. Challenge associated with removing vegetation and re-shaping finish grade to accommodate run-off collection.	Retained for further evaluation, as required by the CD.
On-Site containment cell		Excavation of waste materials and soil with waste material and consolidation into a containment cell constructed on-site.	Limits direct contact human exposure, reduces infiltration through the waste material on the HSP. Ceases mobility of the PFAS compounds contained with the waste materials and soil with waste material. This alternative does not reduce volume or the toxicity of the PFAS compounds but does contain them within the cell.	Moderately implementable due to the extensive handling required to excavate, stockpile and maintain waste material on-site and handle runoff during cell construction. Challenge associated with removing vegetation and re-shaping finish grade to accommodate run-off collection.	Retained for further evaluation, as required by the CD.
Collection					
Active Filtration	Groundwater pump and treat	Installation of extraction wells to pump PFAS contaminated water through filtration and activated carbon system or other suitable media. Discharge would ideally be located significantly outside of the House Street parcel itself (i.e. down- or side-gradient).	Reduces contaminant migration in groundwater. Does not address primary or secondary sources. Does not reduce the toxicity or mobility of the PFAS compounds from the source material.	Moderately implementable to construct; however, the volume of groundwater pumped and treated would be significant without a logistically possible discharge location for the treated water that is outside of the groundwater plume. On-site discharge would increase leaching PFAS from waste, waste soil mixture or PFAS-saturated vadose zone soil. Fouling of the activated carbon with co-contaminants and naturally occurring metals will shorten operational life and may in significant long-term OMM logistics and disposal of spent GAC considerations.	Not retained for further evaluation due to lack of implementable discharge area for treated water.

Table 1 – Summary of Initial Screening of Options

1855 House Street Site

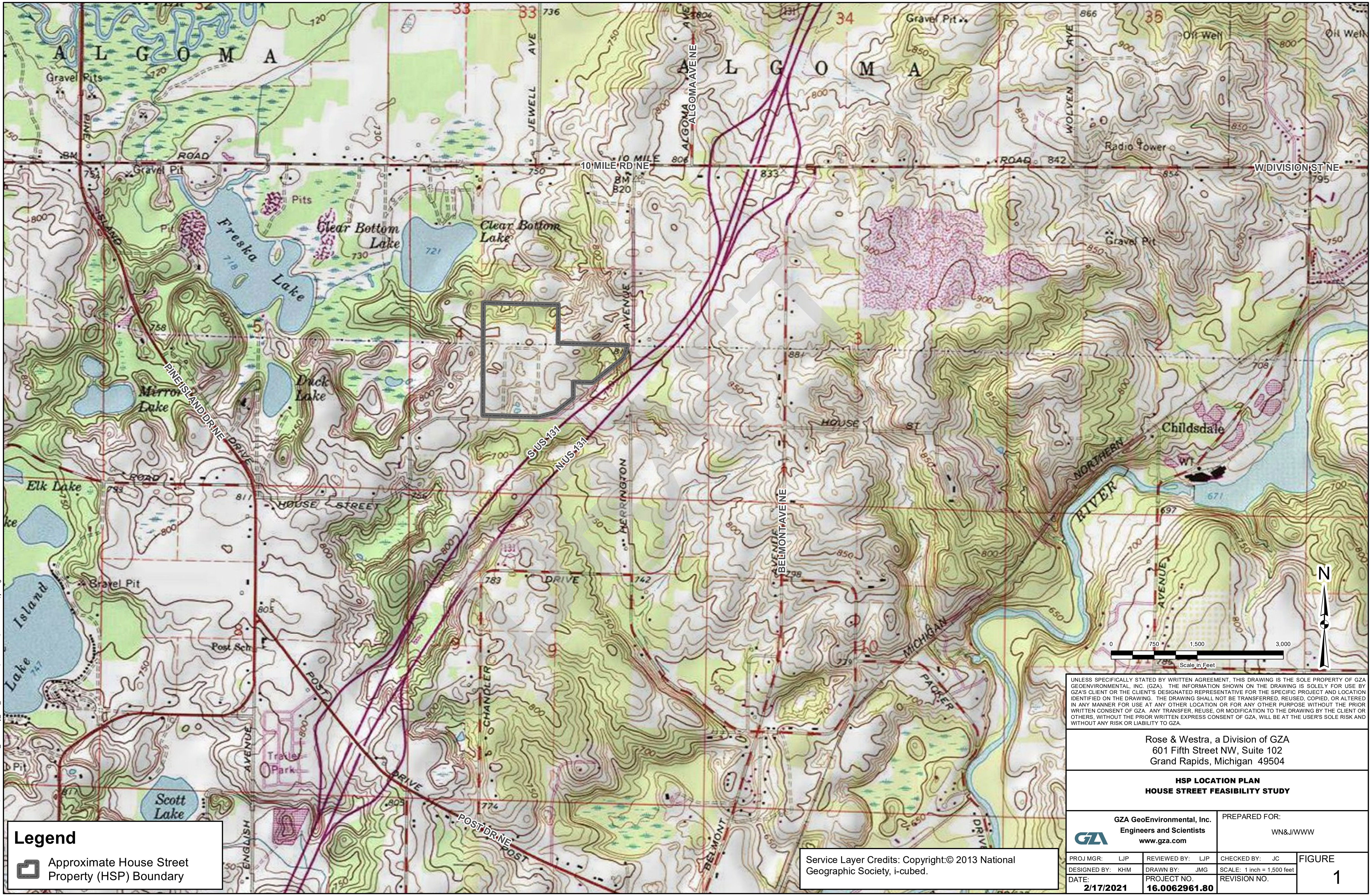
Technology Type	Process Option	Description	Effectiveness	Implementability	Screening Comment
Passive Filtration	Funnel and gate system	Construction of cutoff walls subgrade to modify groundwater flow (i.e., funnel) into a specific pattern. The groundwater is directed to a passive treatment zone (i.e., funnel). For PFAS this may be granular activated carbon.	Reduces the contaminant load in deep groundwater. Does not address primary or secondary sources. Does not reduce the toxicity or mobility of the PFAS compounds in the source area.	Exceptionally difficult to implement and maintain during operation. Saturated thickness approaching 120 vertical feet over length of capture zone for funnel system presents exceptional technical challenges as does installation of the cutoff wall on either side of the gate.	Dismissed from further evaluation due to depth to groundwater, groundwater thickness, and predominately high permeability saturated zone soil.
Deep Well Injection	Ultra-filtration. Stand alone or coupled with Reverse Osmosis (RO)	Installation of extraction wells to pump PFAS contaminated water, discharge to Class I injection wells.	Reduces contaminant migration in groundwater. Does not address primary or secondary sources. Causes significant water withdrawal from the aquifer. Does not reduce the toxicity or mobility of the PFAS compounds from the source material. If coupled with RO, discharge volume limited to a mixture of residue (with a higher PFAS concentration) and filtrate (to allow proper discharge).	Moderately implementable depending upon location of well(s) and permit compliance. Must be coupled with groundwater extraction, filtration to remove sediment, and high-pressure pumping.	Not retained for further evaluation as it would only be practicable and usable as part of the possible groundwater pump and treatment option, which is dismissed from further evaluation as discussed above.
Treatment					
In-Situ	Waste stabilization	Consolidation of near surface waste with deeper impacted areas (ravine adjacent to House Street), mixing of surrounding soil and impacted material (i.e., primary source) using laboratory verified mix to create a stabilized mass. Covering the stabilized mass with ISS swell (excess material generated during mixing) and at least 4-feet of natural material to prevent freeze/thaw cracking.	Provides limitation to direct contact human exposure, eliminates infiltration through the waste material on the HSP. Ceases mobility of the PFAS compounds contained with the waste materials and soil with waste material. This alternative does not reduce the toxicity of the PFAS compounds but does bind them in the treatment material. Limited documented use and effectiveness for PFAS compounds. Not universally accepted by regulatory agencies.	Moderately to implement in certain areas of the site, difficult in other areas. Significant logistical challenges handing and relocating swell.	Dismissed from further evaluation based on the significant time and resources necessary to conduct bench and pilot scale testing necessary to evaluate the applicability of the technology to solidify/stabilize PFAS compounds.
In-Situ	Thermal desorption treatment	In place heat treatment of waste material and soil to temperatures known to desorb or destroy PFAS compounds	Still experimental treatment for PFAS compounds. Not proven technology. Concerns of off-gassing.	Exceptionally difficult to implement and considered to be technically impractical.	Dismissed from further evaluation. Temperatures need to thermally treat 80 to 100-foot-thick column of waste and soil are technical impractical

Table 1 – Summary of Initial Screening of Options

1855 House Street Site

Technology Type	Process Option	Description	Effectiveness	Implementability	Screening Comment
In-Situ	Chemical oxidation	Injection of oxidants to neutralize or reduce toxicity of contaminants	Still experimental treatment for PFAS compounds. Not proven technology.	Poor	Dismissed from further evaluation because it has not been demonstrated for PFAS treatment, difficulty to apply and mix reagents, and cost relative to likely benefit.
Disposal					
Excavation, Transport, and Disposal	Excavation and removal of waste materials and waste material mixed with soil for transport for off-site disposal at a permitted landfill.	Excavate waste materials and waste materials mixed with soil as well as overburden and marginal soil using typical earthwork equipment. Permanently dispose of soil in a permitted landfill.	Highly effective as primary PFAS compound source is removed, eliminating mobility and toxicity. Secondary PFAS compound source remains on-site. Permitted landfills are designed and operated to contain disposed wastes. Based on the calculated volume of PFAS-impacted waste and soil, disposal will likely require more than one facility.	Readily implementable - Excavation is routine, well proven, and can commence almost at any time Subtitle D landfills are locally present if willing to accept PFAS-containing waste. However, there are TCLP exceeding soil and waste on-site. Waste/soil meeting the definition of a hazardous waste would require greater transportation distances.	Dismissed from further evaluation based on the cost, significant disturbances to the community, and lack of reasonable off-site disposal location options.
Mixed Remediation					
	Phytoremediation and Strategic Capping	Continued maintenance of existing capped areas. Additional strategic capping in select areas (i.e. potentially where the thickest waste is present). Planting of trees for phytoremediation in areas of waste not capped. Potential remains for future limited access and use.	Capping and phytoremediation will reduce stormwater infiltration and mobility of PFAS compounds from some of the waste materials (primary source).	Readily implementable. Capping exposed waste on the ravine sidewall is most disruptive and complex construction component of the work. Maintenance of the vegetation used for phytoremediation would require specialized handling and disposal.	Dismissed from further evaluation based on EGLE's rejection of this concept in the February 19, 2021, original draft FS submittal.

FIGURES



Legend

Approximate House Street Property (HSP) Boundary

Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed.

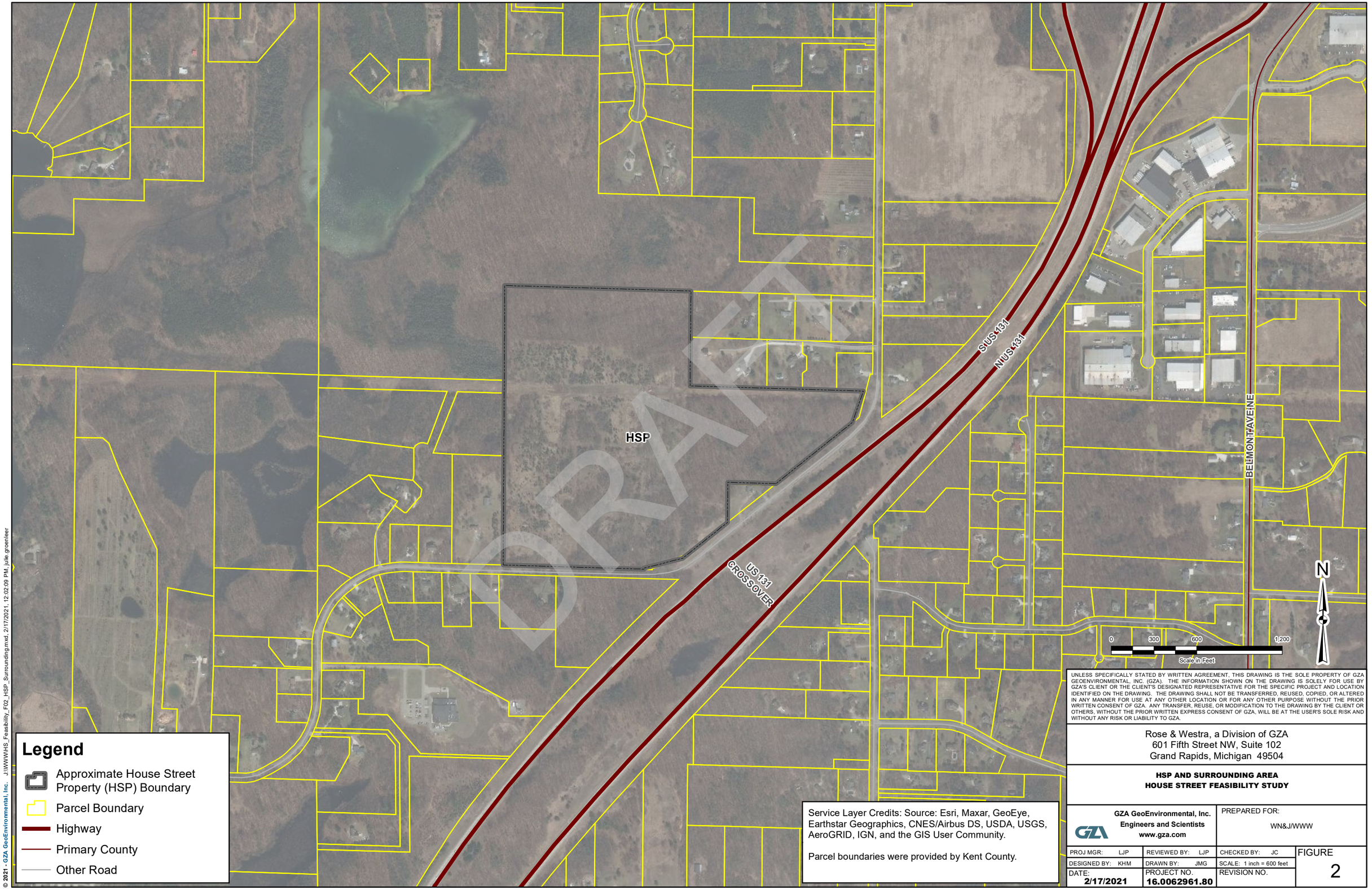
Rose & Westra, a Division of GZA
601 Fifth Street NW, Suite 102
Grand Rapids, Michigan 49504

HSP LOCATION PLAN
HOUSE STREET FEASIBILITY STUDY

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

PREPARED FOR: WN&J/WWW

PROJ MGR: LJP	REVIEWED BY: LJP	CHECKED BY: JC	FIGURE
DESIGNED BY: KHM	DRAWN BY: JMG	SCALE: 1 inch = 1,500 feet	
DATE: **2/17/2021**	PROJECT NO. **16.0062961.80**	REVISION NO.	1



Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Parcel boundaries were provided by Kent County.

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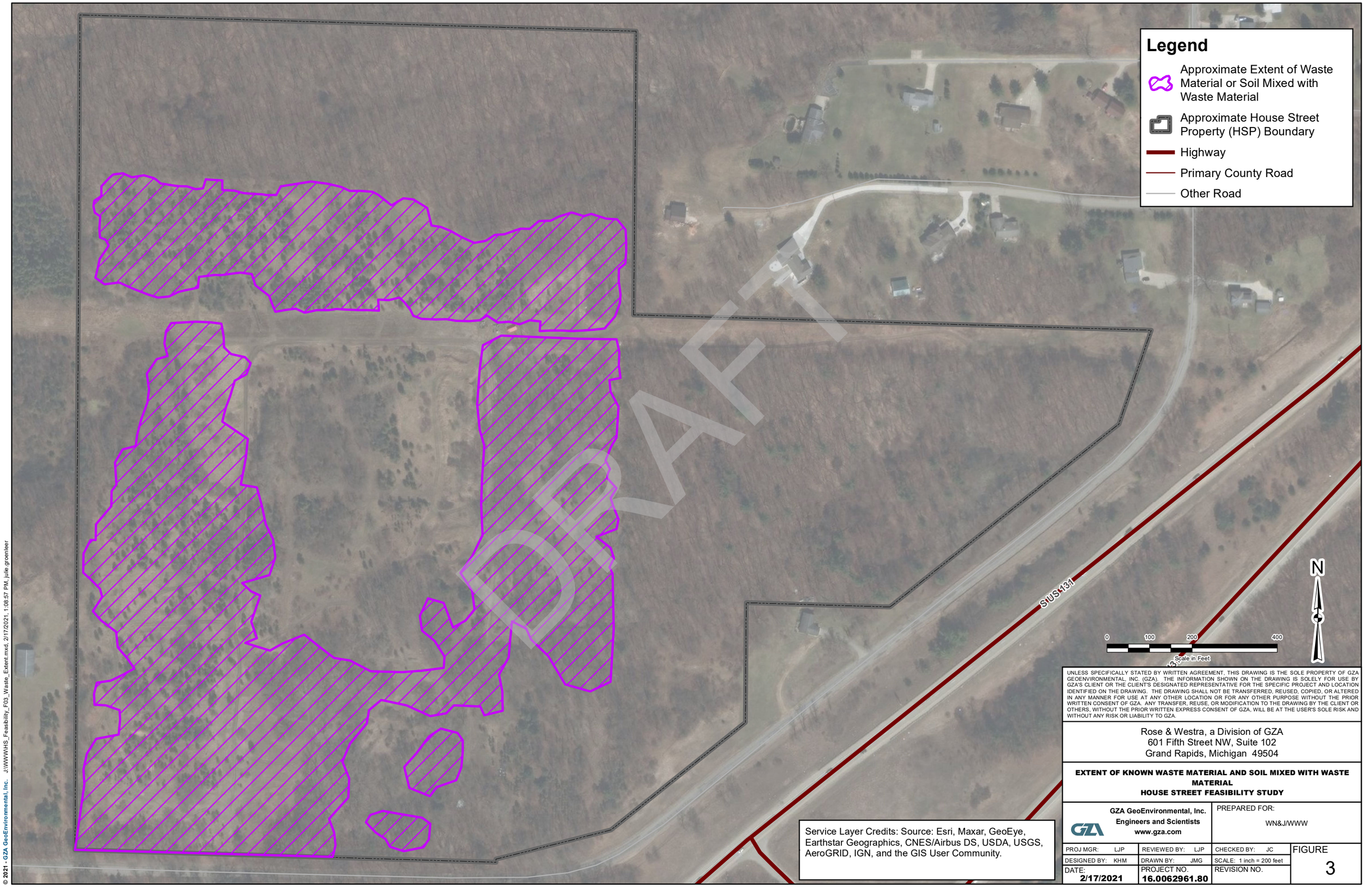
HSP AND SURROUNDING AREA
HOUSE STREET FEASIBILITY STUDY

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

PREPARED FOR:
WN&J/WWW

PROJ MGR: LJP	REVIEWED BY: LJP	CHECKED BY: JC	FIGURE 2
DESIGNED BY: KHM	DRAWN BY: JMG	SCALE: 1 inch = 600 feet	
DATE: 2/17/2021	PROJECT NO. 16.0062961.80	REVISION NO.	

 J:\WW\WH\S_Feasibility_F02_HSP_Surrounding.mxd, 2/17/2021, 12:02:09 PM, julie.groenleer



Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

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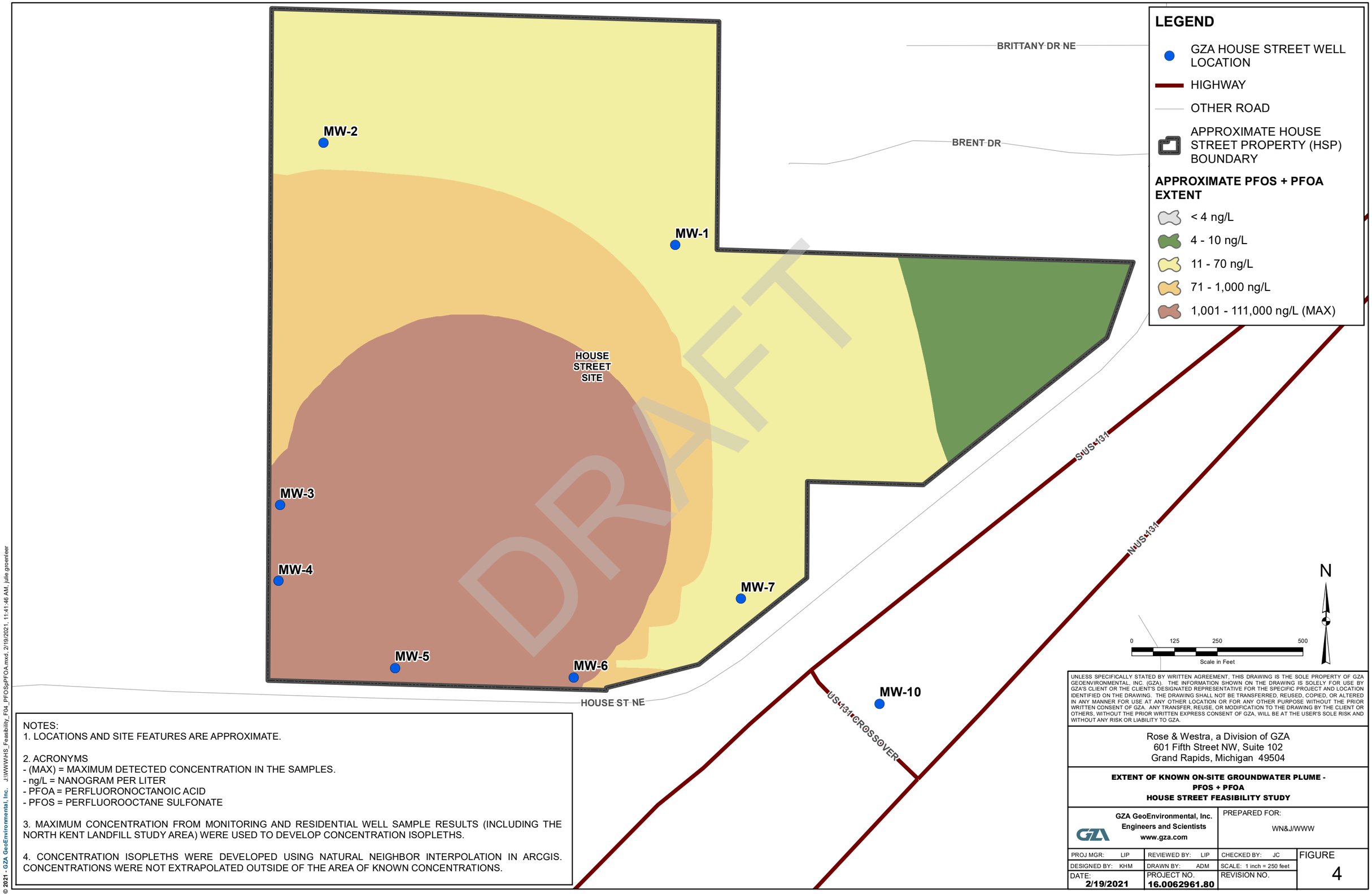
Grand Rapids, Michigan 49504

EXTENT OF KNOWN WASTE MATERIAL AND SOIL MIXED WITH WASTE MATERIAL
HOUSE STREET FEASIBILITY STUDY

GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		PREPARED FOR: WN&J/WWW	
PROJ MGR: LJP	REVIEWED BY: LJP	CHECKED BY: JC	FIGURE 3
DESIGNED BY: KHM	DRAWN BY: JMG	SCALE: 1 inch = 200 feet	
DATE: 2/17/2021	PROJECT NO. 16.0062961.80	REVISION NO.	



NOTES:
1. LOCATIONS AND SITE FEATURES ARE APPROXIMATE.

2. ACRONYMS
- (MAX) = MAXIMUM DETECTED CONCENTRATION IN THE SAMPLES.
- ng/L = NANOGRAM PER LITER
- PFOA = PERFLUORONOCTANOIC ACID
- PFOS = PERFLUOROOCTANE SULFONATE

3. MAXIMUM CONCENTRATION FROM MONITORING AND RESIDENTIAL WELL SAMPLE RESULTS (INCLUDING THE NORTH KENT LANDFILL STUDY AREA) WERE USED TO DEVELOP CONCENTRATION ISOPLETHS.

4. CONCENTRATION ISOPLETHS WERE DEVELOPED USING NATURAL NEIGHBOR INTERPOLATION IN ARCGIS. CONCENTRATIONS WERE NOT EXTRAPOLATED OUTSIDE OF THE AREA OF KNOWN CONCENTRATIONS.

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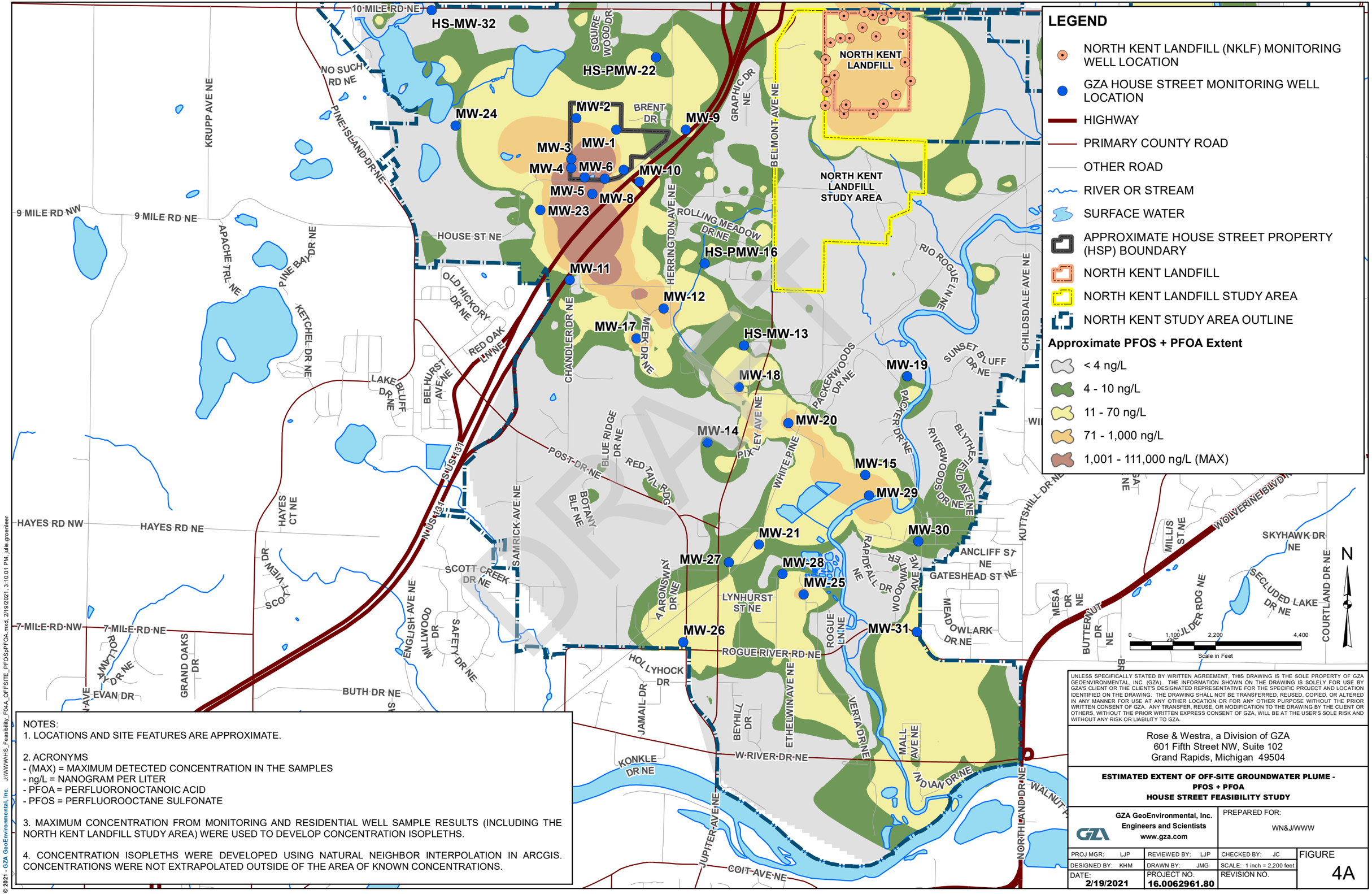
EXTENT OF KNOWN ON-SITE GROUNDWATER PLUME - PFOS + PFOA
HOUSE STREET FEASIBILITY STUDY

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

PREPARED FOR: WN&J/WWW

PROJ MGR: LIP	REVIEWED BY: LIP	CHECKED BY: JC	FIGURE 4
DESIGNED BY: KHM	DRAWN BY: ADM	SCALE: 1 inch = 250 feet	
DATE: 2/19/2021	PROJECT NO. 16.0062961.80	REVISION NO.	



NOTES:
1. LOCATIONS AND SITE FEATURES ARE APPROXIMATE.

2. ACRONYMS
- (MAX) = MAXIMUM DETECTED CONCENTRATION IN THE SAMPLES
- ng/L = NANOGRAM PER LITER
- PFOA = PERFLUORONOCTANOIC ACID
- PFOS = PERFLUOROOCTANE SULFONATE

3. MAXIMUM CONCENTRATION FROM MONITORING AND RESIDENTIAL WELL SAMPLE RESULTS (INCLUDING THE NORTH KENT LANDFILL STUDY AREA) WERE USED TO DEVELOP CONCENTRATION ISOPLETHS.

4. CONCENTRATION ISOPLETHS WERE DEVELOPED USING NATURAL NEIGHBOR INTERPOLATION IN ARCGIS. CONCENTRATIONS WERE NOT EXTRAPOLATED OUTSIDE OF THE AREA OF KNOWN CONCENTRATIONS.

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ESTIMATED EXTENT OF OFF-SITE GROUNDWATER PLUME - PFOS + PFOA
HOUSE STREET FEASIBILITY STUDY

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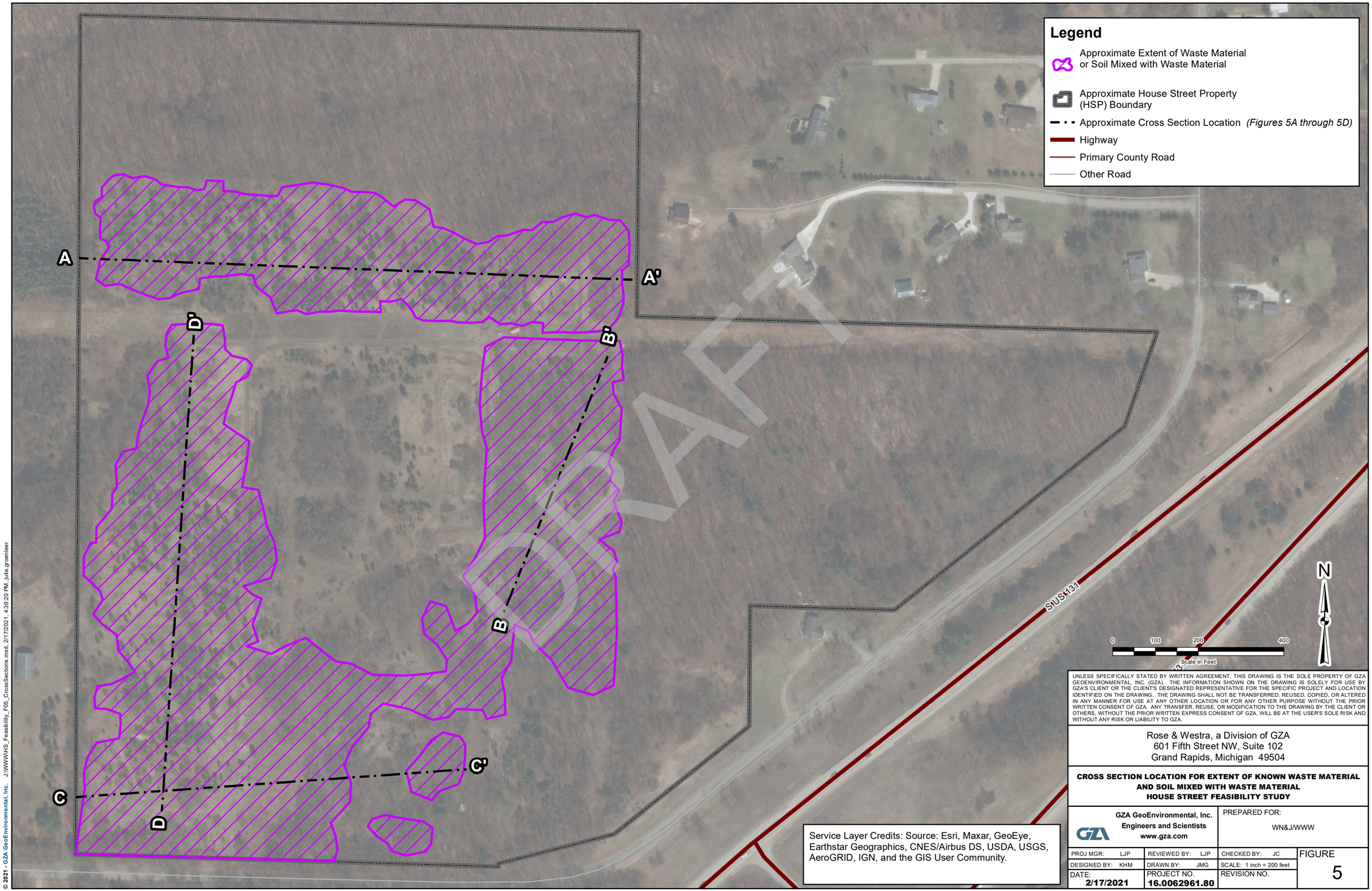
PREPARED FOR: WN&J/WWW

PROJ MGR: LJP	REVIEWED BY: LJP	CHECKED BY: JC	FIGURE 4A
DESIGNED BY: KHM	DRAWN BY: JMG	SCALE: 1 inch = 2,200 feet	
DATE: 2/19/2021	PROJECT NO. 16.0062961.80	REVISION NO.	



Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

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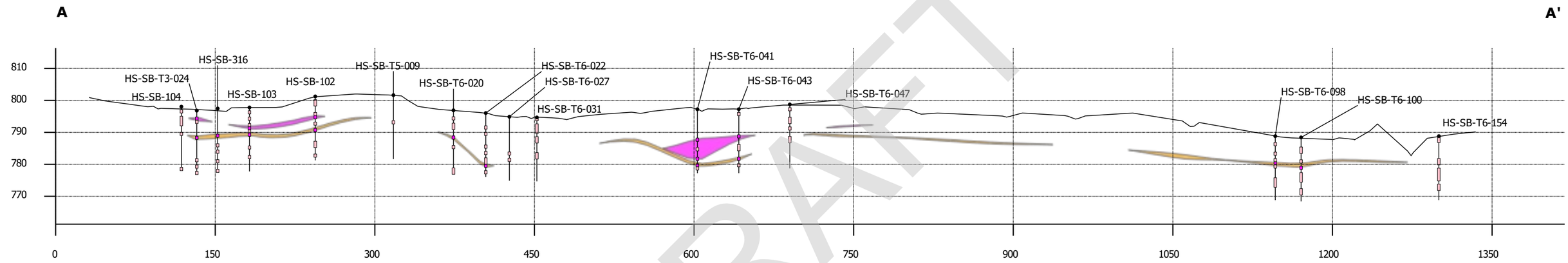
CROSS SECTION LOCATION FOR EXTENT OF KNOWN WASTE MATERIAL AND SOIL MIXED WITH WASTE MATERIAL
HOUSE STREET FEASIBILITY STUDY

GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		PREPARED FOR: WN&J/WWW	
PROJ MGR: LJP	REVIEWED BY: LJP	CHECKED BY: JC	FIGURE 5
DESIGNED BY: KHM	DRAWN BY: JMG	SCALE: 1 inch = 200 feet	
DATE: 2/17/2021	PROJECT NO. 16.0062961.80	REVISION NO.	

Figure 5A

Cross Section A - A'

View North



Legend

Observed Soil Conditions

No Waste

Waste

Modeled Waste Material

Estimated Waste Bottom

Waste

Topography

Note:

Based on measurements at permanent monitoring wells, the groundwater table at the site ranges in elevation from approximately 722 to 730 feet above mean sea level.

Location

A: 12787541, 588746

A': 12788958, 588694

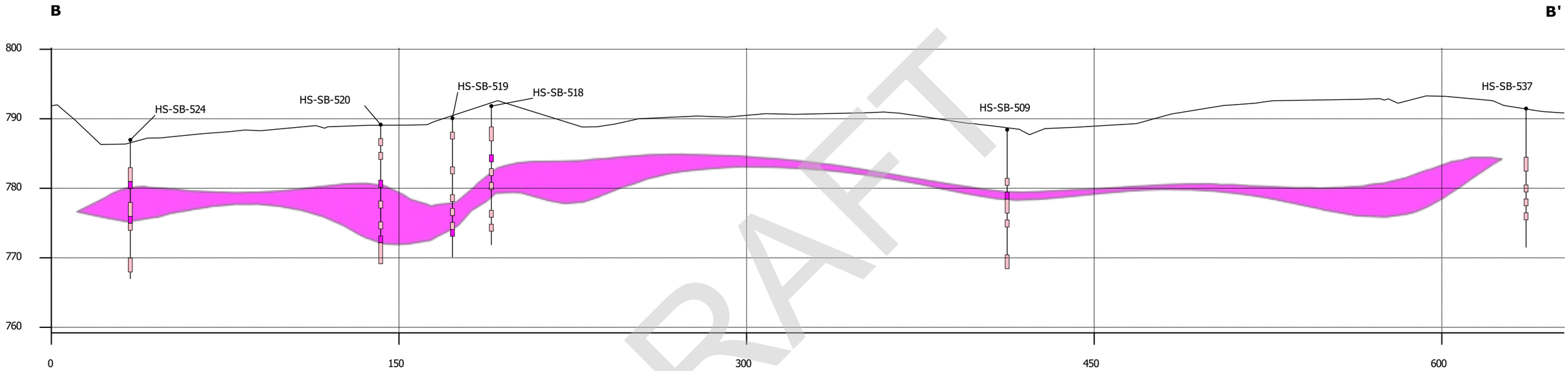
Scale: 1:1,100

Vertical exaggeration: 3x

0ft 300ft

Figure 5B
Cross Section B - B'

View West



Legend

Observed Soil Conditions

No Waste Waste

Modeled Waste Material

Waste

Topography

Note:

Based on measurements at permanent monitoring wells, the groundwater table at the site ranges in elevation from approximately 722 to 730 feet above mean sea level.

Location

B: 12788604, 587917

B': 12788801, 588539

Scale: 1:520

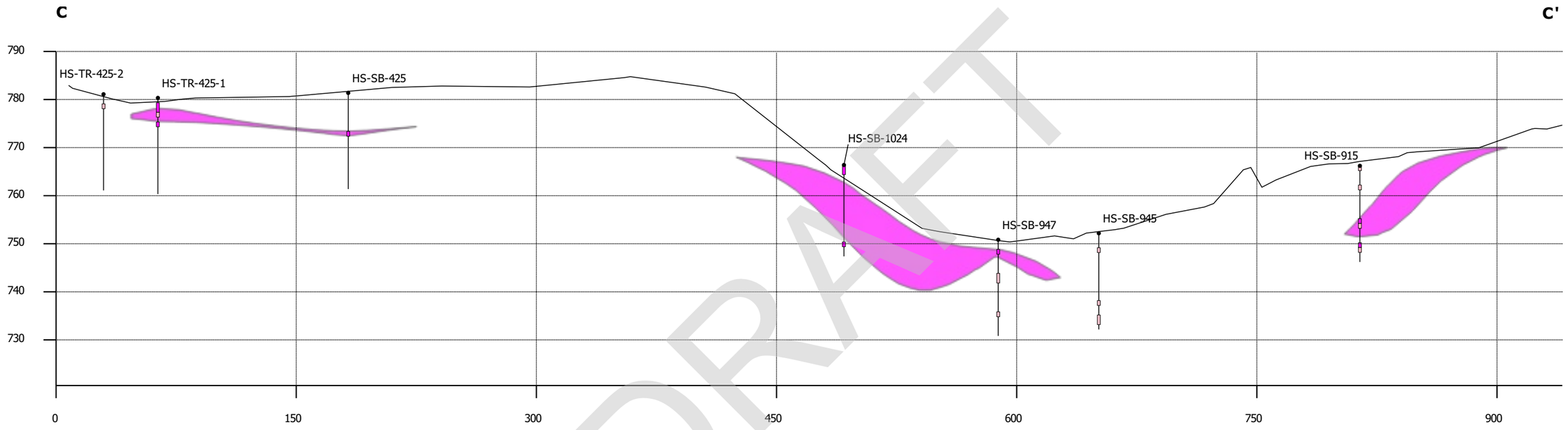
Vertical exaggeration: 3x

0ft 75ft

Figure 5C

Cross Section C - C'

View North



Legend

Observed Soil Conditions

No Waste Waste

Modeled Waste Material

Waste

Topography

Note:

Based on measurements at permanent monitoring wells, the groundwater table at the site ranges in elevation from approximately 722 to 730 feet above mean sea level.

Location

C: 12787556, 587496

C': 12788495, 587563

Scale: 1:800

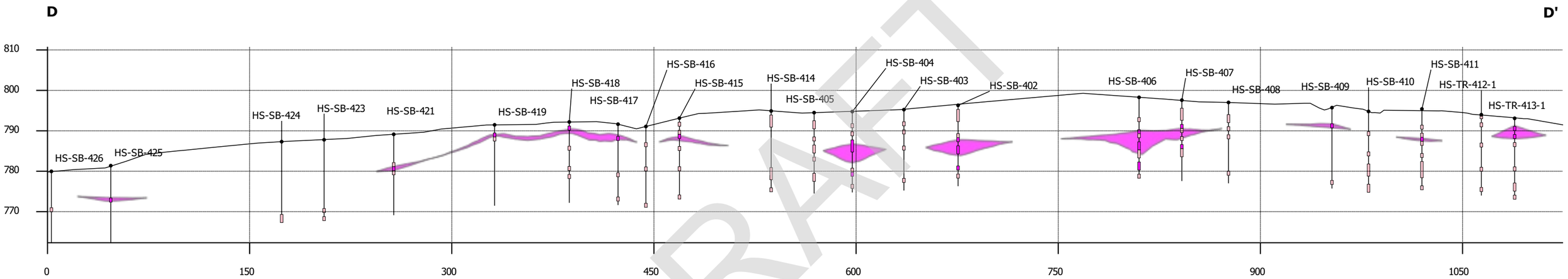
Vertical exaggeration: 3x

0ft 150ft

Figure 5D

Cross Section D - D'

View West



Legend

Observed Soil Conditions

No Waste Waste

Modeled Waste Material

Waste

Topography

Note:

Based on measurements at permanent monitoring wells, the groundwater table at the site ranges in elevation from approximately 722 to 730 feet above mean sea level.

Location

D: 12787727, 587459

D': 12787803, 588581

Scale: 1:850

Vertical exaggeration: 3x

0ft 150ft

CAP AREA CALCULATIONS		
	SQ. FT.	ACRES
NORTH CAP AREA	**257,550**	**5.9**
SOUTH CAP AREA	**908,855**	**20.9**
SOUTH CAP (EAST)	226,605	5.2
SOUTH CAP (WEST)	682,250	15.7
TOTAL CAP AREA	**1,166,405**	**26.8**

GENERAL NOTES

1. BASE MAP TOPOGRAPHY PROVIDED BY EXXEL ENGINEERING, INC.
2. STATION DATUM IS NAVD88, BASED ON GPS OBSERVATIONS USING MDOT CORS.

APPROXIMATE LIMIT OF NORTH CAP AREA

REGRADED AREA TO PROMOTE FLOW AWAY FROM CAP AREA

APPROXIMATE LIMIT OF SOUTH CAP AREA (WEST)

APPROXIMATE LIMIT OF SOUTH CAP AREA (EAST)

OVERLAND FLOW

APPROXIMATE LIMIT OF WORK

RETENTION BASIN VOLUME: 9000 CY

FILL REQUIRED TO REACH GRADE IN THIS AREA. CLEAN FILL TO BE PLACED HERE.

N

0 100 200 400

SCALE IN FEET

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Grand Rapids, Michigan 49504

CAP OPTION SITE PLAN CONCEPT
HOUSE STREET FEASIBILITY STUDY

PREPARED BY:		PREPARED FOR:	
GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		WN&J/WWW	
PROJ MGR: LJP	REVIEWED BY: LJP	CHECKED BY: JC	FIGURE 6.1
DESIGNED BY: KHM	DRAWN BY: TAK/MEA	SCALE: AS SHOWN	
DATE: 8/12/2021	PROJECT NO. 16.0062961.80	REVISION NO. 1	

LEGEND

= EXISTING CONTOURS

= PROPOSED FINAL CONTOURS (CONTAINMENT CELL & EXCAVATED WASTE AREAS)

= PROPOSED DRAINAGE PATH

= LIMITS OF WORK

= ACCESS ROAD

N

CLEAR & GRUB ENTIRE WORK LIMITS (APPROX. 45 ACRES)

NORTHERN EXCAVATED WASTE AREA

SOUTHERN EXCAVATED WASTE AREA

SOUTHERN EXCAVATED WASTE AREA

EDGE OF WASTE

EDGE OF WASTE

BOTTOM FOOTPRINT (300ft x 180ft)

EDGE OF WASTE

EDGE OF WASTE

EXIST. HAUL RD.

HOUSE STREET

APPROXIMATE LOCATION OF 5 ACRE CONTAINMENT CELL. BOTTOM EL. 736' (APPROX. 2 FEET BELOW DEEPEST CONFIRMED WASTE)
INCLUDES 30ft BUFFER FOR DRAINAGE DITCH, ANCHOR TRENCH & ACCESS RD.

0 100 200 400
SCALE IN FEET

NO.	ISSUE/DESCRIPTION	BY	DATE

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

LANDFILL CELL OPTION
COVER SYSTEM CONCEPT
HOUSE STREET FEASIBILITY STUDY

PREPARED BY:		PREPARED FOR:	
GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		WN&J/WWW	
PROJ MGR: LJP	REVIEWED BY: LJP	CHECKED BY: JCF	FIG OR DWG 7
DESIGNED BY: JCF	DRAWN BY: KJB	SCALE: 1" = 200'	
DATE: 9/7/2021	PROJECT NO. 16.0062961.80	REVISION NO. REVISION NO.	SHEET NO. X OF XX

LEGEND

= EXISTING CONTOURS

= PROPOSED FINAL CONTOURS (CONTAINMENT CELL & EXCAVATED WASTE AREAS)

= PROPOSED DRAINAGE PATH

= LIMITS OF WORK

N

CLEAR & GRUB ENTIRE WORK LIMITS (APPROX. 45 ACRES)

CENTRAL SOUTHERN AREA. TO BE USED TO STOCKPILE CLEAN TOPSOIL, CLEAN OVERBURDEN, IMPACTED SOIL & WASTE DURING CELL CONSTRUCTION.

NORTHERN EXCAVATED WASTE AREA

SOUTHERN EXCAVATED WASTE AREA

SOUTHERN EXCAVATED WASTE AREA

DRAINAGE DITCH

DRAINAGE DITCH

DRAINAGE DITCH

CULVERT

CULVERT

RETENTION BASIN

HOUSE STREET

RETENTION BASIN (ENLARGE OR REDUCE BASED ON NEED)

CLEAN FILL EXCAVATION VOLUME = (APPROX.) 122,000 CY

POTENTIAL HOLDING VOLUME = (APPROX.) 39,000 CY

CONTAINMENT CELL = 166,000 CY CAPACITY AS SHOWN. ACTUAL SIZE WILL BE BASED ON TOTAL VOLUME OF WASTE, SOIL IMPACTED BY WASTE & SECONDARY SOURCE MATERIAL EXCAVATED TO CONSTRUCT DOUBLE LINER & LEACHATE COLLECTION SYSTEM.

0 100 200 400

SCALE IN FEET

NO.	ISSUE/DESCRIPTION	BY	DATE

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

LANDFILL CELL OPTION
COVER SYSTEM CONCEPT
HOUSE STREET FEASIBILITY STUDY

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

PROJ MGR: LJP	REVIEWED BY: LJP	CHECKED BY: JCF	FIG OR DWG 8
DESIGNED BY: JCF	DRAWN BY: KJB	SCALE: 1" = 200'	
DATE: 9/7/2021	PROJECT NO. 16.0062961.80	REVISION NO. REVISION NO.	SHEET NO. X OF XX

APPENDIX A – R&W/GZA QUALIFICATION DOCUMENTATION

Proactive by Design

GZA SOLID WASTE DESIGN SERVICES
STATEMENT OF QUALIFICATIONS
December 31, 2019

GZA Solid Waste Design Services Qualifications

GZA Experience Overview

GZA has provided environmental investigation, engineering and design services on more than 500 solid waste management facilities nationwide and in several foreign countries. Solid waste management services are provided mainly by our Buffalo, New York and Providence, Rhode Island offices, with technical and field support provided by other offices in the Midwest and Northeast.

We have provided design and construction oversight services for ash containment cell liners and final cover systems at 2 coal-fired electric generating plants in western New York. In addition to our landfill-related work, we have also performed regulatory compliance work (SPCC, SWPPP, BMPs, etc.) and are currently guiding a major energy client through the New York State Brownfield Cleanup Program – showing our breadth of experience for the energy industry.

Our landfill experience covers from the investigation/evaluation phase of a project through to permitting, design, CQA and direct survey data upload for providing construction level layout and final survey certification.

Our landfill work in Rhode Island includes a number of firsts; including the first Brownfields Landfill Redevelopment (Manton Avenue Landfill/Stop & Shop Site in Providence where we used Deep Dynamic Compaction to lower grades and prepare building pads for construction); the largest actively operating landfill and Superfund site (the 330 acre Central Landfill in Johnston, RI), the first voluntary landfill assessment and closure under RIDEM's program (the Jamestown Landfill & Transfer Station in Jamestown) and geotechnical and landfill gas assessment for Rhode Island's first on-landfill solar development (Forbes Street Landfill, E. Providence, RI).

Technical expertise, innovation, and responsiveness are GZA trademarks that have earned us a national reputation as a high-quality firm. Our awareness of, and attention to, the commercial aspects of our clients' business also sets us apart from other environmental engineering firms. Specific to your needs, we have practical and proven landfill cell and closure design, ecological risk and restoration and extensive Superfund experience, and our organization makes that experience readily available. Our success on these projects is, in no small part, due to the strong relationship we have developed with EPA Region 1 and state regulators. GZA has the proven ability to overcome regulatory hurdles having demonstrated hybrid cap equivalency, negotiated two ESD's and one ROD modification at Rhode Island Superfund landfills. We note that the strength of these relations arise from respect for our technical expertise and our understanding of the regulations. We have invested significant time volunteering on numerous RIDEM task forces and our clients have benefited directly from these activities.

Detailed Project Descriptions are attached. A summary of the solid waste/remedial facilities are as follows:

"The GZA team understands National Grid's challenges and objectives, and consistently looks for ways to assist in meeting those objectives in accordance with regulatory requirements."

Elizabeth Greene, National Grid

Project Experience Relevant to Vectren Energy

1. Somerset Operating Company, LLC (fka AES Somerset, LLC), Barker, NY – Provided design and CQA services over the past 12 years for six sub-cell liners, final cover systems and sedimentation basin re-linings. Successfully obtained a Beneficial Use Determination (BUD), through the New York State DEC, to allow using coal ash for cell subgrade construction. Updated site wide SPCC, SWPPP, Spill Prevention Report and BMP. Currently providing design for: developing a final grading plan for balancing cut/fill volumes to provided proper grading to close out 35 acres of open cell area; final cover system including sizing drainage structures; quantifying available soil borrow for low permeability soil barrier.

2. NRG Dunkirk Power, Dunkirk, NY – Design and CQA services for construction of a 5.5-acre ash containment cell. Services also included a borrow source evaluation to determine the existing volume and adequacy of the borrow for use as a low permeability soil barrier.

3. NRG Energy, Huntley Station, Tonawanda, NY – Conducted an embankment stability assessment for a berm separating their settlement pond from the Niagara River. Our findings determined that the existing embankment had a low hazard classification and that no remedial construction was required. Currently providing environmental engineering services for their entry into the NYS Brownfield Cleanup Program.

4. Central Landfill, RI – Large Superfund/NPL landfill with multiple operable units; demonstrated RCRA C cap equivalency with a hybrid cap design; obtained No Action determination for OU2 thru focused human health and ecological risk evaluation.

5. Fresh Kills Landfill, Staten Island, NY – Large CERCLIS landfill closure (Phase 6/7 is 290 acres); challenges included overfilling and waste consolidation, mitigating wetland impacts, limited storm water management options; the landfill being transformed into a park.

6. McKenna Landfill, Orleans County, NY - Superfund landfill, located on the NY Barge Canal system. GZA's scope included capping alternatives evaluation; successful negotiation with numerous agencies including NYSDEC, NYS Canal Corporation and US Army Corps of Engineers.

7. Grant Gear Manufacturing facility, Norwood, MA – Superfund site, waste/soil excavation, consolidation, and capping; effective PRP advocacy in negotiations with US EPA Region 1 and Department of Justice; remedial strategy developed to result in cost-effective closure and to promote site redevelopment.

8. Allied Waste, Niagara Falls Landfill - RCRA Subtitle D Landfill 80-acre expansion involving reclamation of adjacent fill area and waste consolidation; design plans, specifications and procurement assistance; and complex construction phasing and management. Conducted a comprehensive hydrology/hydraulic study of this 370-acre site and provided design for a major re-direction of stormwater flows, incorporating 3 box culverts, and riprap drainage channels. We have provided permitting, design and CQA oversight continuously for over 30 years at this site.

9. Wyman Gordon Facility, N. Grafton, MA – PCB Risk-Based Clean-up (RBC) under EPA Region 1 TSCA. GZA consolidated PCB containing waste soils on-site and created a disposal cell with modified RCRA D cap. Clean-up goal for soil approved by EPA was an average concentration of ≤0.9 mg/kg with a maximum residual (point-by-point) concentration of 18 mg/kg.

10. Coventry Landfill, RI - CERCLIS landfill/State Superfund Site, work with large responsible party group, complex multi-media investigation, negotiated soil-only cap with State regulators, creative closure design allowing offset of closure cost thru a BUD soil program.

GZA Personnel

GZA personnel offers the talent, skills, desire, experience, and resources to provide a wide range of solid waste design and construction support services.

Senior members of GZA's Team bring over 80 years of solid waste design experience to benefit Vectren. Specifically, our personnel bring the following benefits:

- Proven successes designing and constructing complex landfill projects, including successfully demonstrating RCRA C cap equivalency using a hybrid cap design;
- In-depth regulatory experience and understanding, and a track record in developing successful working relationships with regulators;
- Pragmatic and cost-effective technical approaches that are flexible enough to address unanticipated changes and issues raised by stakeholders.
- Our proven ability to incorporate sophisticated geotechnical engineering principles into creative and cost saving designs.

Effective management on any project requires committing the right people to meet the technical, schedule, and cost challenges of the project. Effective management also requires clear and concise communication between project personnel, the Client and appropriate regulatory agencies and stakeholders. We believe GZA has the breadth of experience to provide Vectren with the highest level of quality and service to achieve the overall project goals.

Qualifications of key GZA Personnel are summarized below, with their resumes attached.

Bart A. Klettke, P.E. (NY) – Technical Design Lead. Mr. Klettke is a Principal with the firm and has over 35 years of professional experience. Klettke attained his Bachelor of Science Degree in Civil Engineering from Valparaiso University. He serves as the Solid Waste Technical Practice Lead for the entire company. He has permitted, designed, managed the construction of landfill liners and closures for many solid waste management facilities. He is experienced in performing and supervising landfill liner and closure designs, site civil designs, geotechnical investigations/designs, and CQA monitoring programs. His project experiences, highlighted on his resume, demonstrates the depth of his successes associated with solid waste facility liner design and closure engineering. His experience is illustrated in the Project Descriptions for the AES Somerset, NRG Energy, McKenna, Allied Waste and western New York landfill projects. As a Principal in the firm, he has the authority to implement the resources needed and oversee project execution to meet those needs and goals in a responsive and cost-efficient manner.

Senior members of GZA's Team bring over 80 years of solid waste design experience to benefit Vectren.

Edward Summerly, PG (RI). Edward Summerly, is a Principal with the firm and a

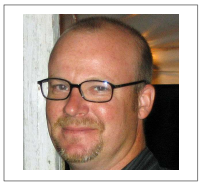
registered Professional Geologist. He holds a Bachelor of Science Degree in Geology from the University of Rhode Island and a certification in Geological Field Studies from the University of Texas. Mr. Summerly has over 30 years of experience in the environmental engineering field. He has served as technical lead on numerous large multidisciplinary projects within the solid waste industry including the Central Landfill, Fresh Kills Landfill and Coventry Landfill projects. Ed's experience includes EPA Superfund studies and remediation, landfill permitting, and geohydrologic studies, site investigations, regulatory compliance, and environmental testing at more than 30 solid waste facilities in New England, New York and the Midwest. Ed has a broad environmental background, extensive landfill engineering experience, and landfill gas design experience along with his proven management capabilities. As a Principal and Sr. Vice President in the firm, he has the authority to implement the resources need by the GZA Project Team and oversee project execution to meet those needs and goals in a responsive and cost-efficient manner.

Todd Greene, PE (RI) - Project Manager - Design Services. Mr. Greene is a Sr. Technical Consultant with GZA and has 23 years of design experience on civil, landfill and environmental engineering projects. Specific project experience includes hydrology, storm water management, site grading, landfill baseliner design and landfill construction oversight, landfill capping design and cap construction oversight, and landfill gas collection system design. Notably and as presented on the Project Descriptions, Todd served as Project Manager and lead designer on the Fresh Kills Landfill, Central Landfill and Coventry Landfill closure projects.

Ted Klettke – Project Engineer/Designer. Ted Klettke has extensive landfill design and construction oversight experience. His designs incorporate 3-dimensional surface models for direct data upload for machine-control grading and survey certification. He is proficient in Sketchup Pro 3-Dimensional Modeling to portray easily understandable visual models of site and design features such as groundwater contours, buildings, subsurface features, and aerial topography for landfill-related designs. He has produced 3-Dimensional Virtual Walkthrough Videos of several work sites for presentations to clients, contractors and regulators.

"GZA has always been a pleasure to work with. Their knowledge, expertise and attitude are second to none and GZA delivers a quality product."

Ed Hughes, Massachusetts Department of Conservation and Recreation



Michael Kress – Assistant Project Manager. Mr. Kress has over 12 years of professional experience including geotechnical engineering, construction management, contracting, project budgeting and scheduling, oversight of MGP and brownfield remediation, development of storm water management plans and construction specifications. Michael has extensive field experience in geotechnical subsurface investigations, solid waste management facility design, construction, management, and construction quality assurance monitoring. His responsibilities have included management of subsurface exploration programs, monitoring well design and observation and logging of soil and rock samples. His AutoCAD skills have been utilized in the design and layout of landfill systems, details and Site plans.

References

Edward Segali Superintendent *Fresh Kills Landfill Project*	Tully Construction Co. 127-50 Northern Boulevard Flushing, NY 11368	718.446.7000
Claude Cote, Esq. Director of Regulatory Compliance and Safety *(Kahuku Wind Energy Clean-up Project)*	Sun Edison 179 Lincoln Street/Suite 500 Boston, MA 02111	207-480-0499
Michael Gray Public Works Director *(Jamestown Landfill Closure Project)*	Town of Jamestown 93 Narragansett Ave Jamestown, RI 02835	401.423.7225
Mark Zimmerman Operations Manager *(AES Somerset Ash Containment Facility)*	Somerset Operating Co. 7725 Lake Road Barker, NY 14012	716.696.2463

Ralph Larimore Environmental Manager *Allied Waste Niagara Falls Landfill*	Republic Services 5600 Niagara Falls Blvd. Niagara Falls, NY 14304	716.371.4222
George Streit Operations Manager *(NRG Huntley and Dunkirk Facilities)*	NRG Energy, Inc. 106 Point Drive North Dunkirk, NY 14150	716.200.2797
Brian Card Director of Engineering and Operations *(Central Landfill Project)*	RIRRC 65 Shun Pike Johnston, RI 02835	401.942.1430

Proactive by Design

PROJECT DESCRIPTIONS

GZA Solid Waste Statement of Qualifications:
December 30, 2019

Project Highlights

- **Design/Contractor Bid Solicitation**
- **Relined Active Retention Basins**
- **Construction Quality Assurance**
- **Engineering Budget: $240K; Construction Budget: $5.1 Million**

AES Somerset LLC Solid Waste Disposal Area II, Phases C & D Landfill Liner & Relining of Retention Basins

BARKER, NY

GZA provided engineering design and construction quality assurance (CQA) monitoring services for construction of a 14-acre landfill cell and relining of two active retention basins for this 675 megawatt, coal-fired electric generating station on the south shore of Lake Ontario in upstate New York.

GZA modified the existing engineering reports, drawings, technical specifications and QA/QC Plan to replace the original design geosynthetic clay liner (GCL) with an HDPE geomembrane in accordance with newly imposed regulatory requirements. We performed a slope stability analysis to demonstrate that the revised design was stable.

The design for relining the 2 retention basins required removal of existing pond sediments and relining the base and side slopes with 12 inches of low permeability soil and an HDPE geomembrane. The pond configurations were altered to maximize capacity and modifications were made to the pond inlet channels and outlet structures. We developed a dewatering plan to allow bypass of stormwater inflow during basin relining.

GZA developed construction-level drawings, technical specifications and a construction QA/QC plan to sufficiently define the proposed work in soliciting contractor proposals. Drawing development included establishing a 3-D computer model of the landfill layers for direct data transfer to the contractor and certifying surveyor. The 3 lowest contractor bids were within 3% of GZA's engineer's estimate for this $5.1 million project.

GZA provided CQA monitoring during the landfill subgrade and liner construction. The CQA program included density test monitoring and collecting undisturbed tube samples of the compacted clay liner. Monitoring of the geomembrane installation required detailed construction documentation including assigning destructive sample tests, observation of non-destructive tests and placement of overlying materials.

GZA coordinated between the Owner, earthwork and geosynthetics contractors, project surveyor and the regulator on a tight project schedule to complete the project within budget. GZA reviewed contractor submittals and prepared a construction certification report documenting the landfill cell construction.

GZA was retained in 2008 by AES Somerset to provide design and CQA monitoring services for construction of SWDA II, Phases E & F East (10 acres) in 2008 and 2010. GZA prepared construction-level drawings, technical specifications and a construction QA/QC plan to solicit contractor proposals.

Project Highlights

- Design/Contractor Bid Solicitation
- Construction Quality Assurance
- Prepared Beneficial Use Determination (BUD) Application for waste materials

AES Somerset LLC Solid Waste Disposal Area II, Phases E & E East Landfill Liner

BARKER, NEW YORK

GZA provided engineering design and construction quality assurance (CQA) monitoring services for construction of a 10-acre landfill cell for this 675 megawatt, coal-fired electric generating station on the south shore of Lake Ontario in upstate New York.

GZA developed construction-level drawings, technical specifications and a construction QA/QC plan to sufficiently define the proposed work in soliciting contractor proposals. Drawing development included establishing a 3-D computer model of the landfill layers for direct data transfer to the contractor and certifying surveyor.

GZA provided CQA monitoring during the landfill subgrade and liner construction over a two year period. The CQA program included performing density testing of the subgrade and clay liner materials. Bulk samples of these materials were collected and tested for physical parameters and compared to established specifications. Undisturbed Shelby tube samples were collected from the compacted clay liner to asses permeability properties. Monitoring of the geomembrane installation required detailed construction documentation including assigning destructive sample tests, observation of non-destructive tests and placement of overlying materials.

GZA coordinated between the Owner, earthwork and geosynthetics contractors, project surveyor and the regulator on a tight project schedule to complete the project within budget. GZA reviewed contractor submittals and prepared a construction certification report documenting the landfill cell construction.

GZA prepared an application for Beneficial Use Determination (BUD) to use a coal by-product (bottom ash) to be used as subgrade material to build the foundation of the landfill. The application was submitted to and subsequently approved by the NYSDEC. The use of this waste material in future cell construction will benefit the client by reducing the cost of fill soils purchased and imported from off-site sources.

Project Highlights

- Borrow Source Evaluation
- 3-D Landfill Cell Design with Leachate Forcemain
- Construction QA Monitoring

NRG Dunkirk Power, LLC
Solid Waste Management Facility, Cell B2
POMFRET, NEW YORK

GZA provided engineering design and construction quality assurance (CQA) monitoring services for construction of a 5.5-acre landfill cell for ash waste generated from the Dunkirk coal-fired electric generating station on the southern shore of Lake Erie in upstate New York.

GZA generated engineering reports, drawings, technical specifications and QA/QC Plan for construction of a landfill liner consisting of low permeability soil and HDPE geomembrane liner in accordance with newly imposed regulatory requirements. We also performed a slope stability analysis to demonstrate that the proposed design was stable.

The general design included preparation of subgrade soil and placement of required thickness of subbase soils within the Cell B2 foot print. A minimum two feet of secondary low permeability soil followed by one foot of primary low permeability soil and HDPE geomembrane liner and associated geocomposite and granular drainage layers. Soils used for Subbase and low permeability soils were mined from a NRG borrow pit located north of Van Buren Road, north of the Site. These borrow soils were determined to be suitable for their respected usage in the proposed landfill cell B2 as part of a borrow source evaluation completed by GZA. This evaluation included completion of over 20 test pits and several soil tests for sieve, moisture/density and low permability analysis. Our evaluation identified the borrow area had a sufficient volume of soil for use as Subbase and low permeability soils needed to be processed prior to placement and included increasing moisture and screened soil to less than 1-inch.

GZA also designed a double contained HDPE leachate forcemain to replace the existing system for the soil waste management facility. This new larger volume forcemain consists of an approximate 1,800 linear feet of piping to the connected between two existing manholes at the Site for eventual discharge into the facilities sedimentation ponds.

GZA developed construction-level drawings, technical specifications and a construction QA/QC plan to sufficiently define the proposed work in soliciting contractor proposals. Drawing development included establishing a 3-D computer model of the landfill layers for direct data transfer to the contractor and certifying surveyor.

GZA provided CQA monitoring during the landfill cell and leachate forcemain construction. The CQA program included density test monitoring and collecting undisturbed tube samples of the compacted clay liner. Monitoring of the geomembrane installation required detailed construction documentation including assigning destructive sample tests, observation of non-destructive tests and placement of overlying materials. GZA also observed and documented the construction and testing of leachate collection pipies and associated manholes and the construction of the leachate forcemain pipe.

GZA coordinated between the Owner, earthwork and geosynthetics contractors, project surveyor and the regulator on a tight project schedule to complete the project within budget. GZA reviewed contractor submittals and prepared a construction certification report documenting the landfill cell construction.

Project Highlights

- Subsurface Soil Borings
- Embankment Evaluation
- Utilization of PCSTABL (version 6) Slope Stability Program

NRG- Huntley Power, LLC
Embankment Stability Assessment
TONAWANDA, NEW YORK

GZA was engaged by NRG to drill three (3) test borings to observe subsurface conditions and provide an embankment stability assessment of the facilities embankment which is situated between an on-Site ash settlement pond and the Niagara River and is located in the southern portion of the NRG Huntley Power Plant. An existing discharge pipe is present within this embankment that allows surface water to drain from the settling pond to the Niagara River. GZA completed the following scope of services for this project:

- Retained the services of our drilling subcontractor to complete three test borings at the Site for collection and classification of soil samples. Two borings were done in the embankment area on each side of the existing discharge pipe and one test boring was done in an area of presumed undisturbed soils located south of the settlement pond and discharge pipe. Ground water measurements were also made from within the drilling augers at the completion of each test boring.

- Selected overburden soil samples were tested by GZA's geotechnical laboratory for moisture content and grain size analysis (i.e., sieve and hydrometer tests). Additionally, one Shelby tube sample was collected from a layer of fine grained soils (located below the embankment and associated settlement pond) and was submitted to our soils laboratory for consolidated undrained triaxial testing and unit weight determination.

- Ground surface elevations in the area of the embankment area were measured by our subcontracted land surveyor. The ground surface elevations and locations of the three test borings were recorded, as well as, existing embankment features including rip-rap location, the shoreline of the Niagara River the settlement pond water level, and discharge pipe inverts, among others. These locations were tied into an existing Site benchmark that was provided by NRG for our use with plan and cross-section figures.

- The evaluation included an assessment of the embankment stability via the slope stability analysis program PCSTABL (Version 6) assuming circular and block failures and calculations for infinite slope analysis. The program and calculations were completed with internal friction angles and cohesion values obtained from lab test results and published values for similar materials to provide an assessment of the existing conditions at the Site.

- GZA prepared an evaluation report that summarized the findings of the completed subsurface explorations, laboratory testing program, and embankment evaluation. Our findings determined that the existing embankment would have a hazard classification of low to remote and that a more detailed stability analysis was not warranted at this time.

PROJECT PROFILE

Central Landfill- Rhode Island Resource Recovery Corporation

Johnston, Rhode Island

GZA's success on RIRRC projects at the Central Landfill is the result of a highly motivated GZA Team, technically challenging objectives and high client expectations. GZA has enjoyed a 30-year history with the Rhode Island Resource Recovery Corporation (RIRRC) as their environmental and engineering consultant. During this contract, we have undertaken more than 300 tasks, many of which are ongoing. Our services have included: general regulatory compliance consulting, monitoring and reporting of surface water (RIPDES program), groundwater (RIDEM Solid Waste Program and EPA Superfund Program), soil gas/landfill gas, radon and waste water (IWDP/DMR Program); Phase I/II Environmental Site Assessment and property acquisition support; public relations assistance; solid waste facility permitting; wetlands permitting and reconstruction; SWPPP, SPCC and BMP plan development and training; air emission permitting, monitoring, and GHG reporting; geohydrologic studies; UST/AST management and closure; ecological/habitat studies; construction support and certification to name a few.

While too numerous to list, the highlights of several are presented below.

Superfund Remedial Investigations (OU1 and OU2)

GZA has completed two remedial investigations at the facility for RIRRC under State and Federal guidelines for Superfund studies. The first, Operable Unit 1, evaluated the nature and extend of solid and hazardous waste within the source area – a 121-acre unlined landfill that operated from 1955 to 1993. The second study, Operable Unit 2, evaluated the extent of offsite contaminant migration via surface water and groundwater flow, landfill gas migration and air-borne contamination.

Project Highlights

- Provided full range of environmental engineering and regulatory compliance support services for 2,000-4,000 ton/day facility
- Landfill planning, design, permitting and expansion construction support
- Oversaw closure of 121-acre RCRA C Superfund Landfill and 33-acre RCRA D Landfill
- Designed, installed and operate two groundwater pump & treatment systems for contaminants in bedrock
- Sampling and analysis of surface water, groundwater, soil, soil gas, landfill gas and waste and evaluation of regulatory compliance
- GZA has enjoyed a 30 year history with the Rhode Island Resources Recovery Corporation as their environmental consultant
- In implementing studies and developing appropriate solutions, GZA worked actively and successfully with RIRRC, Town officials, EPA, RIDEM and local Citizens group.
- To date, GZA has logged more than two million records of chemical testing data into our database system on behalf of the RIRRC.

Central Landfill- Rhode Island Resource Recovery Corporation

Johnston, Rhode Island

Our work included:

- Surficial and borehole geophysical analysis;
- Shallow and Deep monitoring well installations;
- Groundwater, surface water, soil, sediment, air, landfill gas and waste sampling and analysis;
- Aquatic toxicity testing;
- Human health and ecological risk assessment following State and Federal guidance;
- Data evaluation, management and reporting;
- Participation in public workshops, public meetings and hearings.

Our work products, technical opinion and recommendations have consistently been accepted by the USEPA, RIDEM and the Army Corp of Engineers (ACOE).

Environmental Compliance and Monitoring

This category includes a wide variety of related and unrelated environmental tasks. Most tasks are required by RIDEM regulations, EPA Superfund or Clean Air Act mandates, or local requirements (e.g., Cranston Sewer Authority, Town of Johnston) Our services have included:

- Sampling, Testing and Reporting for the Storm Water Discharge (RIPDES)
- Sampling, Testing and Reporting of Groundwater conditions as required by RIDEM Solid Waste Regulations and EPA Superfund Requirements
- Sampling, Monitoring and Reporting of Surface Landfill Gas Emissions
- Air Emissions Permitting and Annual Inventory Reporting
- Alternative Cover Materials Testing and Evaluation
- Waste Water Monitoring and Reporting (IWDP/DMRs)
- Wetland Delineation and Permitting
- Emergency Response Actions
- Regulatory Meetings and Presentations
- Property Transaction Site Assessments

We use the Equis System by EarthSoft, a sophisticated chemical and geological information database with GIS capabilities through ArcView, to manage, analyze and report on compliance monitoring programs. To date, GZA has logged more than two million records of chemical testing data into our database system on behalf of the RIRRC.

Landfill Closures

As part of our Superfund work for RIRRC, GZA conducted feasibility studies to evaluate innovative waste capping and groundwater migration control methods. Our work formed the basis for the closure of the 121 acre unlined Phase I Landfill. GZA also acted as RIRRC's technical representative on the Phase I RCRA C cap design and installation project overseeing this multi-year/multi-million dollar project which was competed in 2006.

GZA designed the RCRA D caps for both the Phase II and III Landfill (33-acres in all). The capping systems used for these projects are suitable for active solid waste landfills (i.e., RCRA D) or hazardous waste landfill (i.e., RCRA C). They incorporate a synthetic membrane liner, low permeability soils, and sophisticated geotextile drainage systems to promote stability and prevent erosion.

Groundwater Containment System

GZA conducted state of the art bedrock fracture flow modeling using Fracman/MAFIC code to assess containment migration in waste, overburden and bedrock. This model was accepted by both EPA and RIDEM and then used by GZA to design an efficient groundwater containment pump and treatment system as part of the Superfund remedial actions. The system consists of an air operated groundwater extraction pump, an equilization tank and defoaming system, a shallow tray air stripper and 2,100 feet long double-wall conveyance piping system. GZA installed and operates the system, on behalf of RIRRC, which has removed and treated more than 6,000,000 gallons of highly contaminated groundwater.

Permitting, Design, and Construction Management of the Relocation of Cedar Swamp Brook and Associated Wetlands for Landfill Expansion

Cedar Swamp Brook was an existing waterway and associated wetland corridor located along the southerly toe of the existing 200 acre landfill. In order to expand the landfill, the relocation of approximately 7,500-feet of the existing brook channel was undertaken by the RIRRC, in two phases, to make way for a new 44-acre lined landfill (Phase

Central Landfill- Rhode Island Resource Recovery Corporation

Johnston, RI

IV) and a new 33-acre landfill (Phase V). The stage 1 permitting process had taken a serious time setback and was into its sixth year when GZA was brought on-board. Approval for the stage 1 brook relocation was obtained within three months of GZA's project involvement. GZA was then retained for the entire design and permitting process for the second stage of relocation which was completed in only 2.5 years. GZA also provided procurement services, construction oversight and management for both stages of relocation. This project involved significant habitat assessment and hydrologic modeling; stream channel relocation via bedrock blasting and removal; and installation of compensatory riparian wetlands.

Contracting Agency (Client)
Rhode Island Resource Recovery Corporation
65 Shun Pike, Johnston, RI
Mr. Michael O'Connell
Executive Director
(401) 942-1430

Date of Project:
1984 – on-going

Consulting Fees:
$5+ million

Project Team Members:
GZA GeoEnvironmental, Inc.

Principals-in-Charge:
Edward A. Summerly, P.G.

Project Managers:
Igor Runge, PhD, P.H.
Todd R. Greene, P.E.
Richard A. Carlone, P.E.
Anthony Urbano, P.E.

PROJECT PROFILE

Freshkills Landfill, Sections 6 and 7 Design/ Build Services

Staten Island, NY

Project Highlights

- Provided complete design including construction drawings for 285-acre Landfill Cap and Landfill Gas Collection and Central Alarm
- Provided value engineering services with project savings of approximately $5,000,000
- Overall Closure design and Phase 1 constructon drawings completed in 3 months
- Value engineering and re-design of proposed landfill gas collection system resulted in superior gas collection and significantly reduced emissions

GZA was retained by Tully Construction Co. to complete all engineering design task associated with the a 285-acre landfill in closure at the New York City Department of Sanitation's (DSNY's) Fresh Kills Landfill, Section 6/7 located on Staten Island, New York.

The Fresh Kills Landfill facility is owned and operated by DSNY. The Section 6/7 landfill closure project was contracted by DSNY as a construction design/build project. The closure permit documents were prepared by Malcolm Pirnie, Inc for the DSNY. The permit documents were utilized for the design/build contract documents. GZA's responsibilities were to review the permit documents and develop construction plans and details, which met the intent of the permit and complied with the New York State Department of Environmental Conservation's (NYSDEC's) landfill closure regulations, Part 360. The final construction documents were reviewed and approved by both the DSNY and NYSDEC prior to commencing with construction activities. GZA worked directly with DSNY on all closure design components and addressed NYDOS design comments as required to expedite the approval process to start construction activities.

Subsequent to the overall closure design, GZA provided value engineering services for Tully and prepared engineering calculations and design modifications to DSNY for review and approval. GZA's value engineering services included alternate geocomposite drainage layer design, develop construction sequencing plans to manage stormwater runoff during construction, landfill gas conveyance modifications to reduce head loss, promote condensate drainage, minimize system maintenance requirements, and grading modifications to reduce general fill and embankment fill quantities. These modifications streamlined the construction process and schedule, saved DSNY millions of dollars on geocomposite drainage net cost, soil material cost, increase landfill gas recovery rates and provided a better end product for our client and DSNY.

Freshkills Landfill, Sections 6 and 7
Design/ Build Services
Staten Island, NY

GZA prepared intial working drawings for the overall landfill closure design and prepared subsequent temporary working drawings, final working drawings and construction as-builts for each phase of the construction. The landfill closure was divided into five (5) phases with intial working drawings and Phase 1 temporary working drawings prepared in the winter and spring of 2006. Phase 1 construction was intiated in the spring of 2007 and Phase 5 construction was completed in Fall of 2011. GZA submitted the final construction as-built plan package to Tully and DSNY in the Spring of 2012. The overall landfill cap design incorporated future end use components as provided by DSNY, for a recreational park and future roadway expansions associated with Yukon Avenue.

GZA provided full time project Quality Control (QC) and landfill gas system construction support during Phase 1 of construction. GZA's QC engineer monitored construction and reviewed constructed portions of the landfill cap for compliance with the construction drawings and project specifications. GZA's QC engineer reviewed all material testing data associated with the project, which included analysis (both structural characteristics and environmental), geomembrane testing and pipe pressure testing. The QC engineer review construction as-builts as it pertained to the design intent and compliance with Part 360 and provided all QC data to DSNY for construction certification.

Throughout the construction process GZA attended DSNY's weekly construction meetings as requested by Tully and or DSNY to interact with DSNY and ensure the landfill cap construction is completed per GZA's construction drawings and details, address any field modifications to the design to ensure the construction process progressed efficiently and in a timely manner without interruptions.

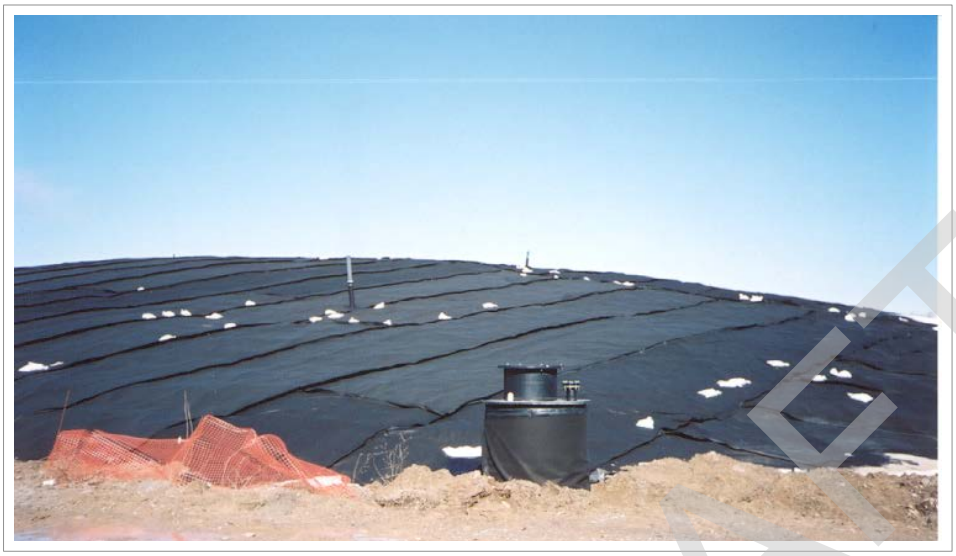
GZA's engineering design tasks included all aspects of landfill closure design including the following:

- Geotechnical and slope stability analysis;
- Geosynthetic and geomembrane design:
- Developing subgrade and finish grading plans;
- Stormwater management and conveyance (hydrologic and hydraulic design);
- Swale and downchute layout and design;
- Landfill gas collection and control systems; including custom wellhead and vault designs;
- Material quantity estimates;
- Construction drawings;
- Approval of Contractor Shop Drawings;
- Provide recommendations for construction sequencing;
- Field Construction Oversight and Construction Certification;
- On-site QC testing including pneumatic pressure testing; confirmation of pipe pitches via as-built survey;
- Provided construction recommendations for piping and vault installations and critical connections to existing header pipes and flaring systems;
- Provided construction sequencing recommendations for landfill gas header switch overs and temporary header placement to maintain active gas collection during construction activities;
- Direction of remedial measure needed to meet the design intent; and
- Project documentation.
- Worked closely with the gas system operator and developed detailed system switchover procedures to allow the continued operation of the existing systems during construction and a seamless transfer to the new systems components upon their completion.

PROJECT PROFILE

McKenna Landfill Closure

Orleans County, NY



Project Highlights

- Successful coordination and negotiation with numerous agencies including NYSDEC, NYS Canal Corporation and US Army Corps of Engineers
- Pre-design investigations allowed better determination of material quantities for remedial design
- Use of geosynthetic components reduces quantities of soil materials needed, shortened construction schedule and lessened remedial construction costs

The McKenna Landfill was listed on the New York State Registry of Inactive Hazardous Waste Sites as a Class 2 site. It is approximately 1800 feet long by 500 feet wide and consists of about 20-acres. The New York State (NYS) Barge Canal adjoins one side of the landfill. A proposed remedial action plan and "Record of Decision" were issued by the New York State Department of Environmental Conservation (NYSDEC). GZA GeoEnvironmental was retained to provide remedial design and observe, test and document remedial construction. Prior to remedial design, GZA collected additional site data through a site reconnaissance, land surveying, test pit and test boring explorations, installation of groundwater monitoring wells, landfill gas survey, wetland delineation and leachate collection/analysis.

Perimeter Clay Cutoff Wall

Our remedial design incorporated a plan to recover existing cover and fill soils for reuse. The closure design included a perimeter barrier wall system consisting of both a compacted clay wall and an 1800 lf soil-bentonite slurry wall, a geosynthetic landfill gas/leachate collection blanket, a perimeter leachate collection system, a gas venting system and a soil/geosynthetic composite final cover system. Additional analysis was done to evaluate the impacts of seasonal draining of the adjacent NYS Barge Canal on the soil-bentonite barrier wall and leachate collection system. We also made an evaluation of various final cover systems with comparative costs. In addition to remedial design, a surface water management plan, a post-closure maintenance and monitoring plan, and an environmental monitoring plan were prepared.

Following remedial design and its approval by the various agencies, GZA prepared construction contract drawings for competitive bidding. We remained involved during the bidding process through participation in the pre-bid meeting, prepared meeting minutes and contract addendum, and analyzed the bids received.

McKenna Landfill Closure

Orleans County, NY

During remedial construction, GZA provided construction administration, engineering and construction quality assurance/quality control observation and testing. This work involved soil laboratory testing (including permeability and direct shear), field testing for compaction and geomembrane seam strength, and observation of the work done for comparison to project specifications. A construction certification report was prepared and submitted to NYSDEC. Our report was approved and the Site is currently in post-closure monitoring.

PROJECT PROFILE

Grant Gear PCB Superfund Site

Norwood, MA

Project Highlights

- Excavation, consolidation, and capping
- Effective PRP advocacy in negotiations with US EPA Region 1 and Department of Justice
- Remedial strategy developed to result in cost-effective closure and to promote site redevelopment
- Brownfields Redevelopment
- Building demolition, stream diversion, sediment and soil consolidation and capping

In two distinct efforts, GZA has assisted the Potentially Responsible Parties (PRPs) with evaluation of site conditions and remedial response actions at the Norwood PCB Superfund site in Norwood, Massachusetts. In 1984, GZA assisted Grant Gear Realty Trust, a PRP that had previously operated a capacitor manufacturing business on the property, with an assessment of site conditions to evaluate the potential for off-site migration of PCBs by air and surface water transport. Using a combination of low-cost, PCB-screening techniques developed by GZA for this project and EPA-approved analytical methods, PCBs were measured in soils and sediment. Based on GZA's exposure assessment, the State of Massachusetts implemented immediate remedial measures at the site, which included installation of a temporary cap of geotextile and crushed stone over selected contaminated areas. Later, a U.S. EPA contractor prepared the RI/FS, which formed the basis of the Record of Decision (ROD).

In 1995, GZA's multi-disciplinary team of engineers and scientists was retained by three of the Potentially Responsible Parties for this Superfund Site to re-evaluate the costly, over-designed 1989 ROD. GZA developed equally protective, yet much more economical and conducive to redevelopment, remedial alternatives for the site cleanup that led to EPA's reconsideration of the ROD for the site and the amendment of the remedial plans for contaminated groundwater, soil, sediments and the on-site facility.

This work, which focused on both evaluation of site-related risks and selection of feasible remedial alternatives, was performed in response to the technical and financial impracticability of U.S. EPA's remedy specified in the 1989 ROD. U.S. EPA's initial remedy included groundwater extraction and treatment; on-site solvent extraction of PCB-contaminated soils and sediments from the adjacent Meadow Brook; and, the decontamination of machinery and surfaces in the on-site building to

Grant Gear PCB Superfund Site

Norwood, MA

remove PCBs. However, due to the high cost and difficulties with implementing the ROD as well as the initially selected remedial strategy's interference with site redevelopment, EPA considered changing the remedial strategy for site soils. GZA's work in this phase of the project included:

- Participation in negotiations with EPA and DEP regarding the remediation of this Site.
- The development of human health and ecological risk-based cleanup levels.
- The development of a defensible Maximum Acceptable Sediment Concentration (MASC) for PCBs in the sediments of a stream adjacent to this CERCLA site. The MASC was based on bioconcentration/ bioaccumulation modeling of PCBs through the food chain using raccoons as receptor organisms.
- The delineation of soil and sediment cleanup areas using risk-based target levels.
- An assessment of the need to maintain the already installed EPA groundwater extraction and treatment system.
- The development of cost-effective remedial options that would promote site reuse, including soil consolidation and capping, source removal, building demolition and long-term groundwater monitoring.
- An evaluation of feasible remedial options using CERCLA alternative evaluation criteria.
- The preparation of a detailed analysis comparing the benefits of our strategy to those of EPA's strategy.
- The development of cost estimates for the remedial strategies evaluated during the analysis.

The site remedy proposed by GZA included: extensive consolidation of contaminated soils and sediment followed by installation and maintenance of a multilayer asphalt and geotextile soil cap; removal of sludge from the building's drainage system and in-place closure; demolition of the building (containing asbestos, lead paint and PCB contamination) and capping of the building slab; and, source control coupled with long-term monitoring of contaminated site groundwater. GZA's proposed remedial strategy, which was accepted by EPA in an amended ROD, was a protective, highly implementable option, which cost-effectively promoted redevelopment of the property. This re-evaluation of the proposed CERCLA cleanup, coupled with a proactive legal strategy, resulted in substantial cost savings to the PRPs, as well as quicker attainment of site closure.

Throughout the negotiations with EPA, the PRP's utilized GZA's cost estimates for the remedial alternatives in their decision making process. They also used these estimates to seek cost recoveries under their insurance policies. GZA's willingness to perform the remediation on a fixed price basis for our cost estimate facilitated resolution of the dispute with EPA and convinced the PRP's to take the lead in performing the remediation.

GZA was subsequently contracted by the PRP's to implement the remedy to regulatory sign off on a negotiated fixed price basis. GZA prepared plans, specifications, and work plans for building demolition within one month of issuance of the Consent Agreement. We completed the building demolition by the end of 1996 within four months of Contract award, meeting one of EPA's goals. GZA developed innovative methods for managing demolition debris onsite by incorporating it into the overall cap design, which substantially lowered the project costs.

GZA then prepared the plans, specifications and work plans for the remaining work, which was conducted during 1997 and 1998. This work included:

- Diversion of the stream, utilizing pumps with a combined capacity of 18 mgd;
- Removal of the stream sediments in the "dry" using standard earthwork equipment;
- Consolidation of material onsite;
- Assessment of excavation limits utilizing field screening immunoassay techniques; and
- Capping of the contaminated material including sediments with a geotextile and 6 inches of asphalt.

In addition to the remediation, the Site has been redeveloped

Grant Gear PCB Superfund Site

Norwood, MA

as a retail facility. GZA was contracted to perform certain aspects of the redevelopment including installation of subsurface utilities and of the storm water management system to limit potential future exposure to site contaminants and development of site-grading and building plans that meet both remedial and redevelopment objectives. In addition we designed a vapor barrier to protect building occupants from potential vapor intrusion.

Following redevelopment as a retail center in 2008, the Site was delisted from the NPL in 2011.

PROJECT PROFILE

Allied Waste Niagara Falls Landfill, LLC
Sanitary Landfill VIII- Subareas A through F

Niagara Falls, NY

GZA performed a State Environmental Quality Review Act (SEQRA) permit application for an 84-acre landfill expansion. The proposed expansion involved remediation/removal of long-existing industrial fill to allow landfilling operations to continue for another 15 to 20 years. Excavation of a former on-site hazardous waste treatment facility with disposal off-site at a permitted hazardous waste facility is one of the benefits of the project. The landfill expansion effectively transformed this industrial "Brownfield" into an aesthetically pleasing "Green Space". These positive aspects of the project allowed Allied to procure the expansion permit with little to no public opposition.

Our design required removal of about 2.2 million cubic yards of waste lime from the landfill expansion footprint and disposal of the waste back into the constructed cells. About 1 million cubic yards of lime was left in-place with the landfill cells partially constructed over the lime. The design called for the surface of the lime to be graded at a steep slope (about 6 to 10 percent) to account for consolidation upon filling.

The landfill design met 6 NYCRR Part 360 regulations having a double-composite liner system consisting of primary and secondary (drainage geocomposite) leachate collection systems and two low permeability barriers covered with HDPE geomembranes.

GZA prepared contract bid documents to solicit and evaluate contractor proposals for construction of the first two Subareas A & B, in 2006. The bid documents quantified different on-site fill types for excavation and removal or use as subgrade construction material. Disposal of excavated waste into Allied's active cell occurred concurrent with regular landfill disposal activities. Costs for constructing Subarea A and the west part of Subarea B, completed in 2006-2009, came under budgeted costs and the project was completed on schedule.

Project Highlights

- Active facility, receives approximately 2,500 tons of waste per year
- SEQRA Permit Application – 84 Acre Landfill
- Large Volume Management of Existing Industrial Fill
- Design/Contractor Bid Solicitation
- Construction Quality Assurance Oversight

Contracting Agency (Client)-Allied Waste Niagara Falls Landfill Division of Republic Services

Mr. David Grenier, Division Manager,-(716) 285-3344

Date of Project: 2005 – on-going

Consulting Fee: $5,000,000

Project Team Firms:-GZA GeoEnvironmental, Inc.

Project Personnel-Bart A. Klettke (PIC), P.E., John Beninati, Ted Klettke, Dan Wulf

Allied Waste Niagara Falls Landfill, LLC
Sanitary Landfill VIII, Subareas A through F
Niagara Falls, NY

GZA performed construction quality assurance (CQA) monitoring and soils and geosynthetics laboratory testing in our Buffalo and Hopkinton, Massachusetts labs. GZA directed investigations and assigned analytical lab testing of suspected contaminated soils, including known areas having polychlorinated biphenyl (PCB) contamination. Based on these investigations, GZA directed remedial excavation and off-site disposal of the contaminated soils into a permitted hazardous waste facility. GZA prepared a final construction certification report for approval by NYSDEC.

Subsequent development of the east portion of Subarea B (7 acres) and Subarea C (18 acres) occurred on an accelerated schedule in the years 2010, 2011 and will continue thru 2012 to facilitate managing the large amounts of waste required to be excavated and placed in the newly built landfill cells. To date (Jan. 2012), over 1 million tons of waste have been relocated to facilitate new cell construction.

PROJECT PROFILE

Wyman-Gordon – West PCB Area

North Grafton, MA

Project Highlights

- PCB Risk-Based Clean-up under TSCA
- USEPA approved risk-based goals range from:
- Average of 0.9 mg/kg in surficial soil
- 18 mg/kg not to exceed
- 3+ acres of upland remediated
- 0.9 acres wetland remediated
- 7,795 tons of >100 mg/kg PCB soil shipped to hazardous waste landfill via on-site rail siding
- 5,143 yds3 of ≤100 mg/kg PCB soil consolidated beneath on-site low permeability cap
- Non-friable asbestos management and disposal effectively integrated with PCB remediation

The Wyman-Gordon facility is a large aerospace forging facility with multiple OHM sources and releases that occurred from the 1940s through the 1970s. Investigation and remediation of historic contaminant releases are being managed under the Massachusetts Contingency Plan (MCP) and the federal Resource Conservation and Recovery Act (RCRA) Corrective Action Program. The West PCB Area is a historic dumping area for industrial and laboratory refuse, forge operation by-products, and building refuse and asphalt rubble from various construction projects. The historic dump was located partially on Wyman-Gordon property and partially on an electrical power transmission corridor owned by the regional power distribution company. During the site investigation field work several empty and crushed barrels, other refuse, and black fill material were observed deposited on the edge of a wetland area. Subsequent analytical results for this area reported concentrations of PCB Aroclor 1254 as high as 1,832 mg/kg in wetland soil, and as high as 32,500 mg/kg in the upland soil/fill material. The West PCB Area also contains historic disposal pits for industrial by-products including acid waste neutralization sludge, descaling salt cake/salt sludge, and aluminum dross.

The West PCB Area remediation is being implemented under the MCP, RCRA, and as a Risk-Based Clean-up (RBC) under the federal Toxic Substances Control Act (TSCA; 40 CFR 761.61(c)). GZA secured final approvals from the US Environmental Protection Agency (USEPA) for the RBC under TSCA in October, 2014. Based on GZA's human health and environmental risk assessments for the site EPA approved clean-up goals of:

- A total PCB concentration ≤ 3.4 mg/kg for wetland soil, on a point-by-point basis.
- And average total PCB concentration of ≤0.9 mg/kg within the top three feet of upland soil within the excavation area.
- A maximum residual total PCB concentration of ≤18 mg/kg in upland soil on a point-by-point basis.

Wyman Gordon – West PCB Area

North Grafton, MA

By agreement with the property owner of the electrical power transmission corridor, the clean-up goal for upland and wetland soil on the transmission corridor was <1 mg/kg on a point-by-point basis.

GZA also secured several other permits and authorizations related to wetland protection, dewatering and water treatment and discharge, and erosion control.

The remediation program consisted of excavation of PCB contaminated soil to reach the clean-up goals, and restoration of the disturbed upland and wetland areas. PCB contaminated soil with concentrations >100 mg/kg PCBs were trucked to a rail-road siding located on a different area of the 200 acre Site, and transport by rail to the Wayne Disposal Inc. (WDI) facility in Belleville, Michigan which is licensed to accept RCRA and TSCA wastes. Excavated soil with ≤100 mg/kg PCBs were consolidated on-site and covered with an engineered low permeability cap.

The approved plan included confirmatory sampling of the excavated sub-grade and sidewalls on a 25-foot grid. The ultimate depth and extent of the excavation was based on the results of iterative confirmatory sampling rounds to show that the clean-up goals had been met.

Other aspects of the project included:

- Excavation took place under 345kV transmission lines and distribution poles. The utility approved a geotechnical pole stability analyses prepared by GZA to define a "stability cone" around each pole to define how close and deep to each pole the excavation could advance without temporary shoring of the pole structures.
- Construction of an asphalt decontamination pad and water collection sump where heavy equipment and trucks could be de-contaminated using Metal X/Pipe X detergent when moving from higher to lower contaminated portions of the site, or when moving off-site.
- Dewatering wetland excavation areas, and on-site treatment and discharge of approximately 3 million gallons of dewatering and decontamination water under a NPDES Remedial General Permit.
- Establishment of a clean-travel way and loading area to avoid decontamination of earth moving/rock trucks being used to transport PCB contaminated soil approximately 1-mile to a rail siding located on the east side of the WG facility.
- Establishment of a containment and loading area at the on-site rail siding where PCB contaminated soils could be dumped without contaminating tires of the off-loading truck, and to facilitate containment and daily clean-up of the loading area to avoid release of contaminated particulates to the surrounding area.
- Broken pieces of corrugated, cementitious, asbestos-containing building materials ("transite") were observed in the PCB contaminated fill early in the remediation project. GZA developed and gained approval for an asbestos management and monitoring plan that allowed the project to move forward with minimal disruption and added expense.
- The regulatory agencies approved the use of a low permeability cap for consolidated PCB contaminated soils which was also designed to cover the historic sub-surface disposal pits to minimize contact between hazardous materials in the pits and infiltrating storm water.

GZA performed construction over sight, and acted as the general contractor for the remediation work. The following work accomplished:

- Approximately 7,795 tons of PCB-contaminated soils with concentrations >100 mg/kg PCBs were excavated and transported by rail to the WDI facility.
- Approximately 5,143 cubic yards of soils with concentrations ≤100 mg/kg PCBs were excavated and consolidated on-Site beneath the low permeability cap.
- The one acre low permeability cap has been completed and stabilized.
- Approximately 2.1 acres of upland (not including the cap area) have been restored and stabilized.
- Approximately one acre of vegetated wetland has been restored and stabilized.

As of the end of the 2015 construction season the West PCB remediation field work was largely completed. A small area with PCBs >100 mg/kg was discovered in an unexpected location based on confirmatory sampling results. In addition, soill with PCB concentrations above the ≤1 mg/kg clean-up goal was left within the "stability cone" adjacent to the some of the powerline poles. WG and the land owner are in discussions regarding the disposition of those soils. We expect the remediation to be completed in 2016.

PROJECT PROFILE

Former Coventry Landfill
Site Investigation, Remedial Action Work Plan and Landfill Closure

Coventry, Rhode Island

GZA was selected through a quality-based competitive process by the Coventry Landfill Performing Parties Group (CLPPG) for environmental engineering services needed to evaluate and close the town landfill. The inactive landfill is included on the RI Department of Environmental Management's (RIDEM's) State Solid Waste Facilities/Landfill list and "State Sites" inventory. It is also inventoried on the USEPA's CERCLIS list (list of potential Superfund sites). As such, the Coventry Landfill is subject to numerous regulatory programs, most notably RIDEM's Solid Waste and Site Remediation Programs.

The approximately 27-acre Site is owned by the Town of Coventry, Rhode Island. The Town operated landfill accepted municipal waste and lesser amounts of commercial/industrial waste, including drum cleaning and reclamation liquids, for land-disposal between approximately 1945 and 1975.

GZA's investigation was conducted in accordance with a ***Site Investigation Work Plan***. The investigation involved the collection, screening and laboratory testing of soil, groundwater, landfill gas and soil vapor samples. In addition, GZA performed a soil vapor survey of the down-gradient neighborhood, a soil vapor extraction pilot study and a groundwater remediation pilot study. The studies found:

- The lateral The lateral extent of buried waste exceeded the previously defined waste disposal area by several acres;
- Although the existing landfill cover materials met the required minimum thickness of 2-feet, the existing site grading and storm water management systems were inadequate to prevent ponding and soil erosion;
- Groundwater quality was impacted both on-Site and off-Site in the downgradient area;
- A contaminant hot spots was identified within the waste cell;
- The SVE pilot study and landfill gas survey show the need to control methane within the waste cell to prevent off-Site migration.

Project Highlights

- Investigations and cleanup under RIDEM's Closure Policy for Inactive and Abandoned Solid Waste Landfills
- CERCLIS/State listed property
- Closure requirements address both Site Remediation & Solid Waste regulatory programs
- Off-Site contaminant migration driving groundwater remediation and vapor intrusion evaluation
- In developing our work scope, evaluating our findings and developing remedial alternatives, GZA worked actively and successfully with the CLPPG members
- A portable landfill gas flare will be installed beneficially reuse landfill methane to destroy VOCs extracted by the SVE system
- Closure will use 300,000 cubic yards of impacted soil for shaping and grading, significantly reducing landfill closure costs

Former Coventry Landfill
Site Investigation, Remedial Action Work Plan and Landfill Closure

At the conclusion of the investigative phase, GZA completed a Remedial Action Work Plan (RAWP). The RAWP was prepared to address the applicable requirements of RIDEM's Remediation Regulations, as well as their Solid Waste Regulations and Closure Policy for Inactive or Abandoned Solid Waste Landfills. The recommended and approved alternative for closure of the landfill consists of the following actions which incorporated a combination of remedial measures to address the requirements of applicable regulatory programs:

- Increase the thickness of the soil cap so that all areas of the Site that received municipal solid wastes are provided with the equivalent of a soil cap thickness of not less than two feet.
- Use approximately 300,000 cubic yards of lightly impacted controlled fill materials under a beneficial use determination (BUD) to shape the subgrade in order to establish proper design grades prior to installation of a new final clean soil cap.
- Re-graded the Site, as necessary, to meet a minimum drainage slope of 3% and maxim stable slope (i.e., 3:1) to control erosion, reduce infiltration and manage stormwater drainage.
- Installation of a soil vapor extraction system (SVE) as part of the landfill closure to address aromatic and chlorinated VOCs within the Hot Spot waste and reduce methane levels within and around the waste cell.
- Develop a revised post-closure groundwater and soil gas monitoring program.
- Modify the Site's groundwater classification to GB to be consistent with RIDEM's Rules and Regulations for Groundwater Quality.
- Protect the long-term effectiveness of the remedy by establishing an Environmental Land Use Restriction for the property.
- Assist the Town of Coventry in drafting and enacting a Groundwater Ordinance, which prohibits the use of groundwater down-gradient of the landfill as a potable water supply.

The RAWP was accepted by RIDEM and GZA developed detailed construction plans and specification for the remediation and closure. In addition to the regulatory requirement of the landfill closure scope, the Town wanted to evaluate the Site for future solar energy development. GZA is actively involved in a number of renewable energy projects involving solar power installed on landfills and our diverse technical expertise allows us to support our client's endeavors from concept through completion.

In the spring of 2014, GZA was selected by the CLPPG as the Construction Oversight/Consulting Engineer, which included construction supervision/oversight and consulting services from pre-Construction planning through completion of the Construction and post-Construction operation, maintenance, and monitoring of the SVE system. The objective of this phase of the project was to provide the Group with construction administration, contractor/construction oversight, project documentation and regulatory reporting to ensure the project is constructed in accordance with the RIDEM approved RAWP, Order of Approval and the corresponding construction specifications prepared by GZA. Our construction oversight services will provide sufficient field documentation, and construction quality assurance (CQA) to allow GZA to certify, as Engineer-of-Record, that the as-built cap and SVE systems comply with the contract documents, thus allowing the Group to obtain a Letter of Compliance and Certificate of Landfill Closure from RIDEM and removal of the Site from EPA's CERCLIS list.

Construction of the SVE system began in October of 2014 and was completed in January 2015. The landfill grading and shaping with BUD material and landfill closure began in November of 2014 and is anticipated to be completed in 2018. GZA provides ongoing BUD program oversight, engineering services and environmental compliance monitoring on the project.

Contracting Agency (Client)
Coventry Landfill Preforming Parties Group, 4801 Courthouse Street, Suite 300Williamsburg, VA

Mr. David Graham, Esq. Landfill Group Representative- (757) 259-3855

Date of Project: April 2008 – on-going
Consulting Fee: $975,500

Project Team Firms: GZA GeoEnvironmental, Inc.
Project Personnel: Edward A. Summerly, P.G. (PIC), Todd R. Greene, P.E., Mark Dalpe, Rick Carlone, P.E., Erik Beloff, Nichole Murawski

Proactive by Design

RESUMES OF KEY STAFF

GZA Solid Waste Statement of Qualifications for:
Vectren Energy

RESUME

Bart A. Klettke, P.E.

Principal/District Office Manager

Summary of Experience

Mr. Klettke has over 30 years of professional experience. He has permitted, designed and managed the construction of solid waste management facilities including coal ash containment cells, and site civil projects. He is experienced in performing and supervising CQA monitoring programs, civil site plans, and geotechnical investigations. As the Principal in Charge and Operations Manager of the Buffalo, New York office, Mr. Klettke is responsible for contracting, project budgeting, scheduling of office and field staff activities, and conducting a profitable operation.

Relevant Project Experience

Principal, Sanitary Landfill Area VIII, Allied Waste Niagara Falls Landfill, Niagara Falls, New York. Designed a 90-acre solid waste management facility including developing permit drawings and writing a design rationale report. Design required management of on-site miscellaneous fill soils to minimize relocation of soils and maximize available air space. Currently administering QA/QC monitoring program for on-going construction of landfill cells.

Principal, Sanitary Landfills V & VIII Final Closure Design, Allied Waste Niagara Falls Landfill, Niagara Falls, New York. Designed a final cover system for a 125-acre sanitary landfill having a combination soil cover and geosynthetics system. The soil cover system is required in areas having limited truck and heavy equipment traffic access at the bottom of the landfill cell, which greatly restricted placing cover soils over an alternative geosynthetic cover system. Additional design features included incorporating passive gas vent risers tied into the gas vent layer, rip-rap downchutes in interior swale areas, rip-rap drainage swales and extension of leachate clean-out access pipes.

Principal, Solid Waste Disposal Area II, Phases C - H, AES Somerset, LLC, Barker, New York. Designed a 34-acre ash monofill waste management facility and re-lining of 2 retention basins. Procured a Beneficial Use Determination (BUD) from NYSDEC to allow use of coal bottom ash for cell liner subgrade. Prepared contract documents and developed ACAD 3-dimensional surface models for construction layout of multiple layered landfill liner. Administered QA/QC programs, overseeing a field engineer and 1 to 2 technicians.

Associate Principal, NRG Dunkirk Power, Ash Landfill Cell B-2 Expansion, Pomfret, New York. Provided Principal review of the design of a 5.5-acre solid waste management cell expansion at an existing ash landfill. Prepared permit and contract documents and developed ACAD 3-dimensional surface models for construction layout of multiple layered landfill liner. Interfaced with contractor's construction manager and certifying land surveyor for construction layout including proper tie-in to existing containment cells. Quantified available variable borrow soils based upon test pit explorations and topography of borrow area.

Education

B.S., 1984, Civil Engineering,
Valparaiso University, Indiana

Registrations & Certificates

Professional Engineer – 1992
New York, #069423

Affiliations

- Member - American Society of Civil Engineers
- Member – Engineering Society of Buffalo
- Member - New York State Association for Solid Waste Management
- Member – New York State Society of Professional Engineers

Areas of Specialization

- Solid Waste Design
- Civil Site Design
- Geotechnical Engineering
- Construction Administration

Bart A. Klettke, P.E.

Principal/District Officer Manager

Project Manager, Landfill Remediation Project, Town of Hamburg, New York. Overall design responsibility for remedial closure of this solid waste management facility. Developed work plan to consolidate waste and re-grade existing landfill, and provide surface water drainage.

Project Manager, Chaffee Landfill, Waste Management of North America, Sardinia, New York. Performed design modifications for the containment berms, site access roads and surface drainage structures for this solid waste management facility. Design modifications saved client 70,000 cubic yards of earth fill. Calculated survey control for construction layout. Calculated earthwork and air-space volumes, using computer surface modeling program.

Project Manager, McKenna Landfill Remedial Closure, Waste Management of North America, Albion, New York. Developed construction drawings for remedial closure of this solid waste management facility. Calculated earthwork and construction material volumes using computer surface modeling program. Provided design interpretation, reviewed contractor submittals, reviewed payment quantities, and addressed concerns and questions by contractor. Monitored geosynthetic installations.

Project Manager, Sanitary Landfill Area V, Subarea B, BFI Waste Systems of North America, Niagara Falls, New York. Designed a 13-acre solid waste management facility including developing construction drawings, and writing technical specifications and QA/QC plan. Construction drawings were developed as 3-dimensional ACAD files to allow direct data extraction for survey layout. Calculated earthwork and material volumes, using computer surface modeling program. Coordinated with client and project surveyor in obtaining pre-construction survey data for design of this project in highly sensitive environment.

Senior Project Manager, Alltift Landfill & Ramco Steel Site, Buffalo, New York. Developed an extensive Quality Assurance/Quality Control Plan and Health & Safety Plan for the project Contractor for landfill remediation work done at this site. Managed the project budget, assigned soils and geosynthetics laboratory testing, and supervised engineering technicians in administering these plans.

Project Engineer, Sanitary Landfill Area V, Subarea A, BFI Waste Systems of North America, Niagara Falls, New York. Designed a 22-acre solid waste management facility. Developed permit drawings and QA/QC plan for approval by NYSDEC. Developed construction drawings and technical specifications. Calculated cut and fill volumes, using computer surface modeling program. Estimated construction costs to assist client in determining viability of project. During construction, managed the field activities and coordinated the contractor's earthwork efforts. Made recommendations for acceptance of subgrade and fill placement in sensitive existing fill soils. Supervised four technicians in implementing QA/QC plan. Provided design interpretation, reviewed contractor submittals, reviewed payment quantities, and addressed concerns and questions by client and NYSDEC. Wrote formal construction observation report for NYSDEC approval.

Project Engineer, Sanitary Landfill Area VI, Subareas A through D, Closure Construction, BFI Waste Systems of North America, Niagara Falls, New York. Designed closure plans, including surface water management structures, for this 45-acre solid waste management facility. Developed construction drawings, technical specifications and QA/QC plan. Managed the contractor's earthwork activity and acted as the Owner's construction manager. Supervised two to three technicians in implementing QA/QC plan. Provided contract administration, design interpretation, reviewed contractor submittals and addressed concerns and questions by client and NYSDEC.

Project Engineer, Mohawk Valley Sanitary Landfill Expansion, Waste Management of New York, Frankfort, New York. Coordinated subsurface exploration in evaluating hydrogeological conditions of a proposed landfill expansion. Work included monitoring of test boring activities, installation of multi-level groundwater monitoring wells, groundwater screening and sampling, and field permeability testing. Evaluated permeability test data and coordinated soils laboratory testing. Assisted in preparation of technical reports. All work done in accordance with New York State Department of Environmental Conservation 6 NYCRR Part 360 regulations.

Project Engineer, Ellery Sanitary Landfill, Jamestown, New York. Designed a final cover system for a 12-acre landfill cell. Design included multiple double containment leachate transfer systems, access road and surface drainage structures. Wrote technical specifications, QA/QC plan, contract documents for competitive bids; and calculated material quantities and construction costs.

RESUME

Education
B.S., 1985, Geology,
University of Rhode Island
Geological Field Methods, 1984, University of Texas at El Paso

Registrations & Certificates
Professional Geologist – 1994, Kentucky, # 1871

Affiliations
- Environmental Business Council, RI Chapter Board Member
- Solid Waste Association of North America, Landfill Gas Technical Division Member
- Association of Ground Water Scientists and Engineers
- Rhode Island Society of Environmental Professionals

Areas of Specialization
- CERCLA/RCRA/State
- Site Investigations
- Feasibility Studies
- Site Remediation
- Solid Waste & Landfill Gas

Specialized Training
- 2001, Queens University, Hydrogeology of Fractured Rock
- 1999, PSMJ Resources, Advanced Project Management Training Course
- 1997, ASTM, Risk Based Corrective Action (RBCA) Decision Making Training Course
- 1996, OSHA, Confined Space Entry Training Certification
- 1995, GSC, Contaminant Fate and Groundwater Transport Modeling Course
- 1995, EPA, Human Health Risk Assessment Guidance for Superfund Course

Edward A. Summerly, P.G.
Principal

Summary of Experience
Mr. Summerly is a Principal and Registered Professional Geologist. He serves as manager and technical lead on multi-disciplinary studies and design projects focusing on Solid Waste Management Facilities, landfill gas control and reuse, and contaminated sites requiring assessment of environmental contamination (soil, groundwater, surface water, air), human health and ecological risk management and hazardous waste remediation. His responsibilities include: technical direction, contract management, project planning, budget control, and quality assurance. Mr. Summerly has been involved with site investigations (soil, groundwater, surface water, air), environmental compliance issues, permitting, and testing at more than 30 solid waste management facilities in the northeast. He has managed several Superfund, RCRA Corrective Action and State lead studies involving remedial investigation (waste identification, groundwater, surface water and geologic characterization) groundwater contaminant migration evaluation, human health and ecological risk assessment/risk management, and public relations. Mr. Summerly has supervised and participated in the preparation and implementation of Superfund, RCRA, and State Remedial Investigation/Feasibility Studies, QAPPs, and subsequent site clean-up and Remedial Actions.

Mr. Summerly's more than 30 years of experience includes participation in RIDEM's regulatory Task Force for the redevelopment of Rhode Island's Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases and he is GZA's Technical Practice Leader for Solid Waste Services.

Solid Waste Management Facility Experience Includes :

Central Landfill, Johnston, RI
Fresh Kills Landfill, Staton Is, NY
Jamestown Landfill, Jamestown, RI
Richmond Landfill, Richmond, RI
Manton Avenue Landfill, Providence, RI
Rose Hill Landfill, South Kingstown, RI
Macera Landfill, Johnston, RI
Home Town Properties Landfill, Exeter, RI
Global Waste Recycling, Coventry, RI
Materials Recycling Facility, Johnston, RI
Plainfield Pike Recycling Facility, Johnston, RI
Tuckers Industrial Dump, Johnston, RI
Coventry Landfill, Coventry, RI
Cumberland Landfill, Cumberland, RI
Canton Landfill Solar Facility, Canton, MA
A Street Landfill Solar Facility, Johnston, RI
Kingston Landfill, Kingston, MA
Rocky Hill Landfill, East Greenwich, RI
Plainfield Landfill, Plainfield, MA
Oak Bluff Landfill, Martha's Vineyard, MA
Edgartown Landfill, Martha's Vineyard, MA
Vineyard Haven Landfill, Martha's Vineyard, MA
Tisburry Landfill, Martha's Vineyard, MA
Gay Head Landfill, Martha's Vineyard, MA
SeMass/American Ref-Fuel, West Wareham, MA
Rocky Point Landfill, Warwick, RI
Barrington Landfills 1 and 2, Barrington, RI
MOA Landfill, Atlanta, MI
Violia ES Landfill, Zion, IL
Charlestown Landfill, Charlestown, RI
Ravenbrook Landfill Solar Facility, Carver, MA
Forbes St. Landfill Solar Facility, E. Prov,, RI

Relevant Project Experience
Principal, Central Landfill Superfund Site RI/FS and RD/RA, Johnston, Rhode Island. This EPA mandated study involved evaluation of environmental conditions (air, soil, bedrock, groundwater, surface water, and sediment) at New England's largest solid waste management facility, which is also an EPA Superfund Site. Project elements included development and implementation of work plans for subsurface explorations,

Edward A. Summerly, P.G.

Principal

multi-media environmental sampling and analysis, geophysical studies and groundwater transport evaluation. The project culminated in the closure of the 121 acre Operable Unit 1 Landfill with a modified RCRA Subtitle C Cap, installation of a groundwater pump and treatment system in an identified Hot Spot and a finding of No Action Required for the Operable Unit 2 off-site area.

Principal, Fresh Kills Landfill Closure, Staten Island, NY. Mr. Summerly serves as technical lead for landfill gas collection and control on this multi-year design-build landfill closure project. This project involves closing and capping a 300 acre cell of the former Fresh Kills Landfill working as the design engineer for the construction contractor. Key elements of GZA's services are design of all closure elements including: the RCRA D synthetic membrane cap, stormwater control structures, landfill gas collection and conveyance systems, and roadways. Mr. Summerly's responsibilities also include coordination of operation of the new landfill gas collection and control systems, and integration of the new and existing gas systems with the DSNY's gas system operator who produces pipeline quality natural gas from the recovered methane for resale.

Principal, Coventry Landfill Assessment, Closure Design and Construction QA/QC, Coventry, RI. Mr. Summerly directed GZA's work on this CIRCLIS and State List landfill site which, to date, has consisted of extensive environmental investigations both on and off-site, landfill cap and closure design, remedial action planning, groundwater and landfill gas migration assessment, and meetings with State regulators. The closure design incorporates the use of 300,000 cubic yards of impacted soil from off-site sources under a Beneficial Use Determination (BUD) regulatory approval, the revenue from which will significantly reduce Site closure costs. The proposed future use of the facility is as a utility-scale solar energy farm. Final landfill closure grading and cap design integrates the needs of the solar farm to put this otherwise fallow land back into productive use.

Principal, Central Landfill Phase VI Landfill Design and Permitting, Johnston, Rhode Island. Mr. Summerly serves as contract manager and technical specialist on this 153 acre landfill expansion design and permitting project. Work to date has involved: conducting a pre-design geohydrologic investigation of the site, design of a double-composite synthetic baseliner system using HDPE, as well as a geocomposite clay liner and dual composite drainage nets to gain additional air space, leachate collection system design, operational and post-closure landfill gas collection and control system designs for regulatory compliance, gas mining for beneficial reuse, and preparation of landfill license application documents for regulatory approval.

Principal, Central Landfill Environmental Engineering General Services Contract, Johnston, Rhode Island. Mr. Summerly serves as contract manager and technical specialist on this multi-year task order contract. Work to date has involved the completion of more than 65 individual jobs/tasks with budgets ranging from $400 to $750,000 including portions of two broad based remedial investigations and feasibility studies. Other work performed under this contract has drawn upon more than 20 distinct environmental services areas such as: landfill permitting, air quality evaluation and permitting, landfill gas control, BUD soil/waste evaluation, emergency response, hazardous waste disposal, regulatory compliance auditing and monitoring, environmental monitoring, dredging, geotechnical soils testing and blast monitoring, technical support for public meetings and presentations, and environmental data interpretation and reporting.

Associate Principal, Rose Hill Landfill Superfund Site. Mr. Summerly directed GZA's work on this project which consisted of evaluating the results of a Remedial Investigation and Feasibility Study that was conducted by the EPA, for the Potentially Responsible Parties (PRP Group). The purpose of our work was to ensure that the regulatory agencies had selected the most cost-effective remedy (capping and landfill gas control) that was protective of human health and the environment. Our recommendations lead to additional field studies (completed by GZA), to better assess groundwater migration, landfill mining options, and landfill gas control. As a result of our work, the EPA and RIDEM changed the selected remedy to a more protective and cost-effective approach.

Principal, Jamestown Landfill Assessment and Closure. Mr. Summerly directed GZA's work which consisted of the completion of a site investigation work plan, site investigation, underground injection control closure, remedial action work plan preparation, landfill capping and closure design, landfill gas migration assessment, landfill capping and closure engineering oversight, site redevelopment as a Department of Public Works facility and quarterly environmental compliance monitoring of groundwater and

Edward A. Summerly, P.G.

Principal

soil gas. GZA assisted the Town in obtaining and/or evaluating off-site soils from a variety of sources which resulted in a significant reduction in landfill closure costs. This project has also included public relations work including public meetings, presentations, and participation in a citizen's advisory committee.

Principal, Barrington Landfills 1 and 2 Assessment and Closure. Mr. Summerly directed GZA's work which consisted of the completion of a multi-media site investigation, landfill gas migration assessment, survey and boundary determination, landfill capping and closure design and construction oversight. Our closure design incorporated the redevelopment of the Site as a recreational facility including two soccer fields, walking paths and paved parking.

Principal, A. Macera Landfill Assessment and Closure, Johnston, Rhode Island. Mr. Summerly directed GZA's work which consisted of the completion of a site investigation work plan, site investigation, landfill gas migration assessment, remedial action work plan preparation, landfill capping and closure design, and site redevelopment as an industrial park. As part of this closure design GZA worked with the Client and RIDEM to reduce the closed landfill footprint by 40%, and reuse excavated waste and soils in the capping project under a BUD approval. The Site reuse plan incorporates on-landfill bus parking for the Town of Johnston and passive recreation, and the recovered land has been developed into an industrial park.

Principal, Tucker's Industrial Dump Assessment and Closure Design, Johnston, Rhode Island. Mr. Summerly directed GZA's work which consisted of the completion of a site investigation work plan, site investigation, landfill gas migration assessment and control design, remedial action work plan preparation, landfill capping and closure design, and site reuse as a residential development. A significant component of this work included delineating a chlorinated solvent groundwater contaminant plume and associated vapor plume migrating from the dump below a proposed residential development.

Principal, Richmond Landfill. Mr. Summerly directs a team of environmental professionals conducting ongoing quarterly compliance monitoring of groundwater at this closed landfill and CERCLIS site. Work consists of Low Flow groundwater sampling, chemical analysis, statistical data evaluation, perimeter landfill gas monitoring for migration control, and reporting to the RIDEM's Office of Waste Management.

RESUME

Todd R. Greene, P.E.

Senior Project Manager/Senior Engineer

Summary of Experience

Mr. Greene's has 15 years of experience primarily on civil, landfill and environmental engineering projects. Specific project experience includes hydrology, stormwater management, site grading, structural steel design and analysis, landfill baseliner design and landfill construction oversight, landfill capping design and cap construction oversight, landfill gas collection system design, trouble shooting small industrial wastewater pretreatment facilities, construction layout and surveying utilizing GPS, geohydrological studies, industrial wastewater permitting, site remediation (pump and treat, bioremediation and soil vapor extraction with air sparging) and various air, water and soil sampling techniques.

Education

B.S., 1996, Civil Engineering, Norwich University

Registrations & Certificates

Professional Engineer – 2008, Rhode Island, 8567

Areas of Specialization

- Civil Engineering
- Landfill Engineering and Construction
- Construction Management & Oversight
- Stormwater Management & Design
- Hydrologic and Hydraulic Analysis
- Environmental Engineering
- Soil and Groundwater Remediation
- Groundwater Hydrology
- Solid and Hazardous Waste Disposal
- Wastewater Treatment – OWTS Design
- Topographic Survey

Relevant Project Experience

Landfill Engineering Projects

Project Manager / Project Engineer, Fresh Kills Landfill Closure, Staten Island, New York. Mr. Greene serves as project manager and lead designer to develop construction drawings and details for Section 6/7 of the Fresh Kills Landfill located in Staten Island New York. The landfill closure design included, grading, geosynthetic design, storm water conveyance and management, maintenance road layout and design, erosion control design and specification, gas collection and conveyance design. This project involves closing 285 acre cell of the former Fresh Kills Landfill under a five phase construction sequence and schedule, working as the design engineer for the construction contractor, Tully Construction. Key elements of GZA's services are design of all closure elements and preparing construction drawing submittals as follows: Initial Working Drawings and details for the 285 acre closure and Temporary and Final Working Construction drawings for each specific construction phase. Mr. Greene work directly for Tully Construction and interact and communicated with the New York Department of Sanitation (DSNY) and DSNY's engineering consult to address and incorporate site and design considerations into the project. As part of the Temporary Working Drawing submittals value engineering was conducted for the geosynthetic layering, geosynthetic drainage details, gas system and earthwork activities.

Project Manager, Central Landfill, Johnston, Rhode Island. Providing multiple general and daily engineering services for the Rhode Island Resource Recovery Corp. at the Central Landfill Facility in Johnston, RI; services include environmental, site civil, solid waste and landfill engineering services for the following tasks:

- Review and oversight of the implementation of the erosion control and sediment monitoring;
- Trash and construction material volume estimates;
- Develop grading plans;
- Property acquisition evaluations;
- Landfill planning;
- Landfill settlement and filling monitoring;
- Review, evaluate and prepare RFP / RFQ packages;
- Waste Compaction evaluation;

Todd R. Greene, P.E.

Senior Project Manager/Senior Engineer

- Construction layout;
- Construction oversight of horizontal methane extraction lines;
- Construction as-built surveys;
- Utility installation construction oversight;
- Haul road design and layout;
- Perform Topographic surveys;
- Drafting / design utilizing Autodesk Civil design series;
- GPS trouble shooting; and
- Facility design modifications and trouble shooting.

Project Manager / Project Engineer, Central Landfill, Johnston, Rhode Island. Performed multiple design and layout modifications to the tipping facility; projects included construction as-built and layout for the relocation of the tarping racks and bollards located on the northern and eastern side of the facility, performed a structural analysis to determine if the existing trash shoot areas could support the operation of knuckle booms, designed an alternative trash shoot curtain to minimize air-born litter, designed alternative trash pit covers and push wall protection plates and performed several field evaluations on the facility.

Project Manager / Project Engineer, Central Landfill, Johnston, Rhode Island. Phase V 110 Acre landfill design modification and construction drawing preparation. Project include incorporating alternative geo composites to increase landfill air space and reduce construction cost and time to the base cell area and utilizing the existing OU-1 cap construction materials for the secondary containment system to minimize construction cost of the Phase V piggy back area.

Project Manager / Project Engineer, Central Landfill, Johnston, Rhode Island. Phase II / III RCRA 30 acre capping project. Project included construction oversight of the cap subgrade and overall cap construction. In addition the project required grading and bench design modifications to minimize slope cuts and constructability issues. The project also required GPS file modification to create grid and triangulation files compatible to the corporations Gradestar GPS software and the implementation of leachate controls to dewater the caps anchor trench to expose the existing baseliner system.

Project Manager / Project Engineer, Central Landfill Phase VI Landfill Design and Permitting, Johnston, Rhode Island. Phase VI landfill expansion permit application submittal and performed associated calculations and designs corresponding with the landfill gas collection system, leachate collection and conveyance systems, base cell subgrade design and developed permitting drawings and prepared the overall landfill cell permitting submittal for RIDEM review and comment.

Project Manager, Town of Barrington Landfills 1 & 2 Site Investigation (SIR), Barrington, Rhode Island. Mr. Greene provided the Town with engineering services to conduct a site investigation at the former Barrington landfill. The site investigation included, waste delineation and characterization, characterization of cover materials, groundwater sampling and monitoring, evaluate groundwater flow direction, soil gas monitoring and proposed site redevelopment alternatives and preparation of the SIR for submittal with to RIDEM. Once the SIR was approved, GZA prepared a Remedial Action Work Plan, which has subsequently been approved by the Department. GZA services included construction drawings and specifications and full time construction oversight.

Project Manager, Town of Barrington Landfill 1 & 2 Closure Design & Construction Oversight, Barrington, Rhode Island. Mr. Greene was the project manager and certifying engineer for the closure and landfill capping of Barrington's landfills 1 & 2. The landfills were approximately 9 acres divided by a town roadway. The closure required the preparation of a Remedial Action Work Plan for review and approval by the Rhode Island Department of Environmental Managements (RIDEM). In addition Mr. Greene prepared construction drawings, details and specifications and contractor bid packages and assisted the town in contractor selection. Mr. Greene was responsible for all construction administration & management of the project through construction on behalf of the Town of Barrington. Full time construction oversight and landfill closure certification was also conducted and prepared, respectively. Value engineering was performed to obtain regulatory approval of reducing the minimum cap slope requirement from 3 to 5 percent to 1 percent, which will with beneficial re- use of the properties as recreational sports fields.

Project Manager, Town of Jamestown Landfill Closure, Jamestown, Rhode Island. Mr. Greene provided engineering services to close and cap the former town landfill. As part of the landfill closure, design plans were developed to site the Town's Department of Public Works Facility (DPW) on the landfill. Design and permitting services included the landfill closure, site grading, stormwater management, waste management plan, ELUR, water supply and sewer / ISDS design, wetlands permitting and development of a remedial action work plan. The project included providing the Town with engineering cost estimates and closure and site redevelopment

Todd R. Greene, P.E.

Senior Project Manager/Senior Engineer

alternatives. This project required a close working relationship with RIDEM's Department of Waste Management.

Project Manager, Hartford Landfill, Connecticut Resource Recovery Corporation (CRRA), Hartford, Connecticut. Mr. Green performed an operational and site audit on the Hartford landfill. The landfill operates in two separate areas: The Bulky Waste Cell and The Ash Landfill, which receives ash from CRRA's Mid Connecticut Project trash to energy plant. Engineering services include an overall evaluation of the landfill including site staff and management, filling sequencing, filling procedures, available equipment, stormwater management, daily cover practices, site erosion and sediment controls, leachate breakouts, methane extraction, overall site maintenance and long term planning. The results of the evaluation was summarized and presented to CRRA for their use to modify the landfill operation to function more efficiently and potentially extend the overall life of the landfill.

Project Manager, Hi-Lo Landfill Redevelopment, Johnston, Rhode Island. GZA's provided third party engineering review of proposed environmental remediation and closure activities associated with the Hi-Lo landfill property. In addition, we reviewed the Pocasset River flood plain maps and information as delineated by FEMA and identified potential re-development issues for the property as they pertain to the current flood plain delineation. GZA prepared an M-1 Form to request for Letter of Map Revisions based on Fill (LOMR-F) to submit to FEMA and prepared a wetland edge verification request to RIDEM.

Project Reviewer / Technical Specialist, Former Coventry Landfill, Coventry, Rhode Island. Project involved the design remedial actions and a final closure system for the former Coventry Landfill located on Arnold Road in Coventry, Rhode Island. The landfill was subject to two RIDEM regulatory programs; the Solid Waste Program (due to the former use of the properties as solid waste disposal facility) and the Site Remediation Program, and the RIDEM policy memorandum entitled "Closure Policy for Inactive or Abandoned Solid Waste Landfills". GZA develop a Remedial Action Work Plan (RAWP) and Landfill Closure Design consisting of a soil vapor extraction system, 24-inch thick soil cap and associated stormwater management system, designed in accordance with the *Rhode Island Stormwater Design and Installation Standards Manual Dated: December 2010.* The landfill closure and associated remedial activities include a Beneficial Use Determination to import slightly contaminated soils to the site to prepare the landfill cap subgrade and a Construction Stormwater Pollution Prevention Plan (SWPPP).

Project Manager, Providence & Worcester Railroad (P&W) / JM Mills Landfill / Peterson & Puritan Super Fund Site, Mendon Road to Martin Street Rail Siding. GZA provided engineering and environmental consulting services to assist P&W in obtaining RIDEM and EPA approvals to construct a new 8000 foot long railroad siding within the OU-2 area associated with the Peterson & Puritan Super Fund Site and associated JM Mills Landfill. The proposed rail side is located adjacent to the eastern edge of the JM Mills Landfill Site. GZA prepared a Field Investigation Work Plan (FIWP) for submittal to EPA and RIDEM to perform a series of test pits along the eastern perimeter of the JM Mills Landfill to delineate the extent of the buried waste within P&W's ROW and or adjacent to, the area of the proposed rail siding. Following EPA and RIDEMs approval of the FIWP, GZA conducted the test pitting program and obtained field data to delineate the extent of buried waste adjacent to the proposed rail siding. The result of the test pitting program was utilized to assess if construction of the proposed rail siding may be completed without requiring the removal of significant amounts of buried waste material and to identify construction techniques and details that would be compatible with available alternatives for a RCRA C landfill closure. Based on GZA's evaluation, EPA accepted the proposed rail siding concept and the rail siding is currently under construction.

Project Manager, Former Rocky Hill Fair Grounds Landfill Closure, East Greenwich, Rhode Island. GZA designed and prepared a corresponding remedial action work plan, which received RIDEM approval to construct a landfill cap and implementation of an Environmental Land Use Restriction (ELUR). The approved remedial action complied with the RIDEM policy memorandum entitled "Closure Policy for Inactive or Abandoned Solid Waste Landfills". The landfill closure consists of consolidating the landfill to a 0.4 acre area within the interior limits of the existing utility easement constructing a 24-inch thick engineered soil cap consisting of 6-inches of loam, 18-inches of gravel borrow (vegetative support) and an underlying high visibility permeable geotextile warning barrier. GZA prepared construction drawings, specifications and construction bid documents to solicit contractor bids to construct the proposed landfill cap. In addition GZA provided construction administration, management and field oversight services during construction. Following the completion of construction activities, a Remedial Action Closure Report was prepared in accordance with RIDEMs Remediation Regulations and Solid Waste Resubmitted to RIDEM for review and approval.

Theodore A. Klettke

Project Engineer

Summary of Experience

Mr. Klettke's experience includes both environmental and geotechnical engineering projects. He utilizes AutoCad skills to develop 3-dimensional design and layout of landfill liner and final cover systems. Other responsibilities include: Supervising landfill CQA programs and providing survey design interpretation for construction contractors and certifying surveyors, surveying, soil and groundwater site investigations, geotechnical investigations, observation and logging of subsurface explorations, and sampling of soil, groundwater, surface water, sediment, and air.

Education

B.S., 2011, Mechanical Engineering, Valparaiso University

Areas of Specialization

- CQA/CQC Monitoring and Testing
- 3-Dimensional AutoCad Landfill Design
- 3-Dimensional Sketchup Modeling
- Surface Volume Calculation
- Geosynthetics QA/QC
- Photo Documentation
- Surveying
- Geotechnical Investigations

Relevant Project Experience

Sanitary Landfill VIII, Subarea E, Allied/BFI Waste Systems of North America, Inc., Design, Niagara Falls, New York. Designed a 13-acre solid waste management facility including development of construction drawings developed as 3-dimensional ACAD files for construction layout and survey certification. Calculated earthwork and material volumes for developing accurate bid quantities. Developed 3-dimensional Sketchup Pro model and virtual tour video of a complex multi-faceted leachate cleanout and drainage pipe system, storm-water improvements, excavation cut surface, and fill grade surfaces.

Hydrogeologic and Geomembrane System Assessment of the State Licensed Disposal Area (SDA) of the Western New York Nuclear Services Center (WNYNSC), West Valley, New York. Developed 3-dimensional Sketchup Pro model and virtual tour video of groundwater in comparison to site features. Created groundwater database within excel to populate graphs and 3-dimensional model as current groundwater levels are added. Converted data to Geographic and State Planar North American Datum of 1983 (NAD83) & North American Vertical Datum of 1988 (NAVD).

NRG Dunkirk Power LLC Landfill Closure Assessment, Dunkirk, New York. Designed multiple final grading options for closure of an operational 11-acre landfill cell. Calculated earthwork and material volumes within a computer surface modeling program.

Sanitary Landfill VIII, Subarea B East, Allied/BFI Waste Systems of North America, Inc., Subgrade and Primary and Secondary Liner Construction, Niagara Falls, New York. Observed/documented daily field activities and implemented construction quality assurance (CQA) testing and documentation. Recorded observations/measurements during installation of subgrade soils, low permeability soils, high density polyethylene geomembrane (HDPE) and geocomposite material including: In-place nuclear density measurements, thin wall Shelby tube permeability sampling, placement and seam orientation for conformance with permit requirements; destructive testing of HDPE liner materials; non-destructive testing of HDPE liner materials in accordance with applicable operation/construction permits. Coordinated with contractors the job progress/schedule, tracking of quantities as well as any quality control issues. Recorded geosynthetic panel placement, seam locations, destructive sample locations and patch locations. Observed and recorded non-destructive geosynthetics liner testing.

Theodore A. Klettke

Project Engineer

Sanitary Landfill VIII, Subarea C, Allied/BFI Waste Systems of North America, Inc., Subgrade and Liner Construction CQA, Niagara Falls, New York. Performed air monitoring during the excavation of industrial fill from the landfill footprint. The work included screening the excavated fill with a photo-ionization detector (PID), 4-gas meter, and sampling the upwind and downwind air for dust particulates. Observed/documented daily field activities and implemented construction quality assurance (CQA) testing and documentation. Recorded observations/measurements during installation of subgrade soils, low permeability soils including: In-place nuclear density measurements, thin wall Shelby tube permeability sampling. Monitored, tested, sampled and documented the construction of a test pad to qualify proposed soil borrow for use as low permeability soil.

Sanitary Landfill VIII, Subarea D Permit Design, Allied Waste Niagara Falls Landfill, Niagara Falls, New York. Designed a 17-acre landfill liner system using 3-D ACAD for permit-level drawings. Developed excavation grades in area of extensive existing industrial fill, top of subgrade and landfill liner grades, and containment berm cross-sections. Determined optimal design grades to minimize relocation of existing fill and maximize airspace, and calculated excavation volumes from design work.

312 Maple Street, Village of Endicott, New York. Monitored installation of a groundwater monitoring well system. The work included the decommissioning and installation of monitoring wells to assess groundwater in top-of-clay, top-of-rock and bedrock zones. Sampled and logged overburden fill, natural soils and bedrock. Documented well installation and well development. Surveying was performed to find the elevation and location of the newly installed monitoring wells. Ground water sampling was performed at several wells around the site.

Solid Waste Disposal Area II, Cells C & D, AES Somerset. LLC Subgrade and Liner Construction, Somerset, New York. Observed/documented daily field activities and implemented construction quality assurance (CQA) during completion of two sub-areas totaling 14.5 acres. Recorded observations/measurements during installation of subgrade soils, low permeability soils, high density polyethylene (HDPE) geomembrane and geocomposite material including: In-place nuclear density measurements, thin wall Shelby tube permeability sampling, placement and seam orientation for conformance with permit requirements; destructive testing of HDPE liner materials; non-destructive testing of HDPE liner materials in accordance with applicable operation/construction permits. Coordinated with contractors regarding job progress/schedule, tracking of quantities as well as quality control issues. Recorded geosynthetic panel placement, seam locations, destructive sample locations and patch locations. Observed and recorded non-destructive geosynthetics liner testing and completed daily field progress reports.

Solid Waste Disposal Area II Cells G & H East, AES Somerset. LLC Design, Somerset, New York. Designed a 10-acre solid waste management facility including developing construction drawings developed as 3-dimensional ACAD files for construction layout. Calculated earthwork and material volumes, using a computer surface modeling program.

Enbridge Pipeline, Erosion Control Monitoring, Buffalo New York. Created AutoCad maps for each excavation site along the pipeline where the pipeline integrity was evaluated. Wrote weekly & monthly reports for active or completed dig evaluation sites & developed and updated on a daily basis, a project status sheet for past, current and future dig evaluation sites.

Buffalo State College Underground Utilities Improvement Project, Buffalo, New York. Performed pre-construction documentation of existing conditions for underground utility installations being done on the Buffalo State College campus. Work consisted of photographing & recording video of nearby buildings, sidewalks, and other structures to show their condition before work was done by the contractor. Photographs were logged in a photo page Microsoft Word document and the videos were compiled and edited within Windows Movie Maker. The photograph and video locations were plotted on a map of the campus area.

Signore Brownfield Clean-up Program Supplemental Remedial Investigation, Ellicottville, New York. Soil vapor intrusion samples were taken of the air space beneath basements of houses surrounding the Signore site. Work consisted of drilling a hole through the concrete floor of the basement and sampling the vapors below the sub-slab of the house. Air samples were also taken from the basement ambient air and the outdoor ambient air. Air samples were then sent to a lab for analysis.

Army Reserve Underground Storage Tanks & Fire Main Investigation. Surveyed temporary and permanent groundwater wells to find the elevation of each well based on a known benchmark.

Theodore A. Klettke

Project Engineer

AUTOCAD

Mr. Klettke has experience in AutoCAD design. His work consists of developing 3-dimensional surface models for developing grading plans, providing survey layout data, and calculating earthwork and landfill airspace volumes. He has been involved in the design of several solid waste management facilities in western New York.

SKETCHUP PRO 3-D DIMENSIONAL MODELING

Mr. Klettke is proficient in Sketchup Pro 3-Dimensional Modeling. His work consists of developing 3-dimensional models of site features such as groundwater contours, buildings, subsurface features, and aerial photography layered atop TIN surfaces. He has produced 3-Dimensional Virtual Walkthrough Videos of several work sites.

SURVEYING

Mr. Klettke has surveying experience working at Klettke Land Surveyors P.C. during his high school and college years. His work consisted of operating a survey total station, data collector, & level instruments. He determined if residences were within the Federal Emergency Management Administration (FEMA) flood elevation boundaries by noting and recording elevation measurements. He also drafted and prepared maps based on data collected from field notes.

Professional Experience

OSHA 40-Hour HAZWOPER Training

Certified Operator of Nuclear moisture/Density Gauge (Troxler Electronics, Inc.)

Contractor Safety Orientation at GM – Lockport Complex

NSC CPR Course

NSC First Aid Course

Michael Kress

Assistant Project Manager

Summary of Experience

Mr. Kress has over 12 years of professional experience including geotechnical engineering, construction management, contracting, project budgeting and scheduling, oversight of MGP and brownfield remediation, development of storm water management plans and construction specifications. Michael has extensive field experience in geotechnical subsurface investigations, solid waste management facility design, construction, management, construction quality assurance monitoring and in-place nuclear density testing. His responsibilities have included management of subsurface exploration programs, monitoring well design and observation and logging of soil and rock samples. His AutoCad skills have been utilized in the design and layout of landfill systems, details and Site plans.

Education

B.S., 2004, Civil Engineering, State University of New York at Buffalo
A.A.S., 1990, Civil Engineering Technology, Erie Community College, North Campus

Professional Development

- Passed Fundamental of Engineering Exam (EIT), October 2004
- OSHA 40 Hour Health & Safety Training Course – 29 CFR 1910.120
- NYSDEC Stormwater Management Training
- HAZWOPER Certification
- Troxler Nuclear Density Trained

Areas of Specialization

- Geotechnical Investigation
- Construction Management and CQA
- Stormwater Analysis and Design
- AutoCAD, MathCAD
- Landfill Design
- Soil and Rock Classification
- Geosynthetic QA/QC
- Stormwater Management Plans

Relevant Project Experience

Former Gloucester Gas Light Company MGP Facility, Gloucester, Massachusetts. Lead Field Engineer for remediation implementation involving timber pier and granite seawall demolition, mechanical and suction dredging, by divers, of 30,000 cubic yards of impacted sediment, excavation and disposal of upland impacted soils, capping in-situ materials, DNAPL collection systems, marine armor mattress installation, mechanically stabilized earth walls, re-construction of seawalls and pier systems and Site restoration.

Former Supertane Coal Tar Site, Charles Town, West Virginia. Design of soil management and impermeable cap containment structures above consolidated coal tar wastes. Design of Stormwater conveyance and containment structures, block retaining walls with associated stability analysis and site restoration. Development of Plans, Specifications and Bid Documents.

22 Cooper Street Former Coal Tar Site, Waltham, Massachusetts. Performed on-site construction oversight of field work involving, impacted material excavation and disposal and in-situ stabilization via mixing.

Former Manufactured Gas Plant (MGP) Remedial Action, Vineland, New Jersey. Assisted in development of Remedial Action Work Plans and specifications for work associated with remedial efforts at a former manufactured gas plant. Performed on-site construction oversight throughout the duration of the field work involving, sheetpile earth support, vibration and optical survey monitoring, utility relocation, impacted material excavation, groundwater management and site restoration.

Solid Waste Disposal Area II, Cells C through H, AES Somerset. L.L.C. Subgrade and Liner Construction, Somerset, New York. Developed a Beneficial Use Determination (BUD) application submitted to the NYSDEC to use a waste coal by-product as fill material in landfill subgrade construction. Observed/documented daily field activities and implemented construction quality assurance (CQA) during completion of six sub-areas totaling 40 acres. Recorded observations/measurements during installation of subgrade soils, low permeability soils, high density polyethylene geomembrane (HDPE) and geocomposite materials including: In-place nuclear density measurements, thin wall Shelby tube permeability sampling, placement and seam orientation for

Michael Kress

Assistant Project Manager

conformance with permit requirements; destructive and non-destructive testing of HDPE liner materials in accordance with applicable operation/construction permits.

Sanitary Landfill VIII, Subarea A, Allied/BFI Waste Systems of North America, Inc., Subgrade, Liner and Cap Construction, Niagara Falls, New York. Oversight and documentation of daily field activities and implemented construction quality assurance (CQA) during the installation of HDPE and linear low density polyethylene geomembrane (LLDPE), geocomposite and geosynthetic clay liner (GCL) materials including: placement and seam orientation for conformance with permit requirements; destructive and non-destructive testing of liner materials in accordance with applicable permits; recorded observations/measurements; coordinated daily installation activities with surveyor to: record location of each panel, seam location, destructive sample locations, patch locations, and tracking of quantities. Completed daily field progress reports and addressed project issues and concerns with the regulatory agency (NYSDEC) and the client.

Fresh Kills Landfill, Section 6/7 Sanitary Landfill Final Cover, New York City Department of Transportation, Staten Island, New York. Performed stormwater analysis, design of Swales, Culverts, Gabion Downchutes, Piping and Detention Basins for final closure and capping. Utilized AutoCad, FlowMaster, Win TR55, and other design programs to check/size capacity of the structures mentioned above. Performed slope stability analysis for liner components as well as overall stability. Supplied the Survey team with control points for layout of above mentioned features.

McWilliams Forge, Sanitary Sewer Re-alignment, Rockaway, New Jersey. Project oversight and quality control manager for sanitary and process wastewater system modifications with oversight and documentation of sub-contractor construction/demolition activities, scheduling progress and tracking changed conditions. When required, construction alternatives were evaluated and presented to the Site owner and sub-contractor when unforeseen conditions were identified or encountered.

First Winds Wind Farm, Buffalo, New York. Field engineer for investigation of an 8-tower wind farm expansion. Field staff responsible for oversight of the subsurface explorations, electroresistivity testing and laboratory testing; assisted in foundation and road analysis; and preparation of the geotechnical report.

Solid Waste Disposal Projects Summary

Project Name/Location	*Client*	*Remedial Investigations/ Feasibility Studies*	*Hydrogeological Investigation/ Environmental Monitoring*	*Permitting Services*	*Design Services*	*Landfill Closure/Remediation*	*Construction Administration/ Support and/or CQA*
Massachusetts							
Foxboro State Hospital Landfill Foxboro, Massachusetts	DCAMM	■			■	■	■
Lakeville State Hospital Lakeville, Massachusetts	New England Development	■	■	■	■		
E. Bridgewater Landfill East Bridgewater, Massachusetts	Browning-Ferris Industries	■		■			
Fall River Landfill Fall River, Massachusetts	Republic Services/BFI			■	■		■
Chicopee Landfill Chicopee, Massachusetts	Browning-Ferris Industries		■	■	■		■
Haverhill Ash Landfill Haverhill, Massachusetts	Ogden Industries				■		■
Hunt Road Landfill Amesbury, Massachusetts	Waste Management of North America				■		■
Millbury Ash Landfill Millbury, Massachusetts	Wheelabrator, Inc.				■		■
Plainville Landfill Plainville, Massachusetts	Laidlaw Waste Systems	■					
Canton Landfill Canton, Massachusetts	Gemma Renewable Power, LLC			■	■		■
Ravenbrook Landfill Carver, Massachusetts	Ravenbrook, Inc.		■	■	■		■
Shrewsbury Ash Landfill Shrewsbury, Massachusetts	Wheelabrator, Inc.				■		■
North Meadow Road Landfill Medfield, Massachusetts	Town of Medfield		■	■	■	■	■
Battis Road Landfill Merrimac, Massachusetts	Town of Merrimac	■	■	■	■	■	■
Martone Landfill Barre, Massachusetts	United Waste Systems	■	■	■	■	■	■
Hudson-Stow Landfill Hudson, Massachusetts	United Waste Systems	■	■	■	■	■	■
Kmito Landfill Randolph, Massachusetts	Browning-Ferris Industries	■	■	■	■	■	■
Fitchburg Landfill Fitchburg, MA	United Waste/ USA Waste/ Waste Management	■	■	■	■	■	■
Ashby Landfill Ashby, MA	Town of Ashby, MA	■		■		■	■

Project Name/Location	*Client*	*Remedial Investigations/ Feasibility Studies*	*Hydrogeological Investigation/ Environmental Monitoring*	*Permitting Services*	*Design Services*	*Landfill Closure/Remediation*	*Construction Administration/ Support and/or CQA*
Granby Landfill Granby, MA	United Waste/ USA Waste/ Waste Management	■	■	■	■	■	■
Indian Road Landfill Dudley, MA	Town of Dudley, MA		■	■	■	■	■
Certainteed Shingle Landfill Walpole, MA	Certainteed Corporation Walpole, MA	■	■	■	■	■	■
Rhode Island							
Central Landfill Johnston, Rhode Island	Rhode Island Resource Recovery Corporation	■	■	■	■	■	■
Jamestown Landfill Jamestown, Rhode Island	Town of JamestownJamestown, Rhode Island	■	■		■	■	■
Manton Avenue Landfill Providence, Rhode Island	Stop & Shop Company	■	■	■	■	■	■
A. Macera Landfill Johnston, Rhode Island	Rhode Island Resource Recovery Corporation	■	■		■		
Richmond Landfill Richmond, Rhode Island	Town of RichmondRichmond, Rhode Island		■			■	
Rose Hill Landfill South Kingston, Rhode Island	Town of South Kingston and Narragansett, Rhode Island	■	■				
Woonsocket Landfill Woonsocket, Rhode Island	RI Department of TransportationProvidence, Rhode Island	■	■		■	■	■
Former Forbes Street Landfill East Providence, Rhode Island	City of East Providence, RIEast Providence, RI	■			■		■
Middletown Town Landfill Middletown, Rhode Island	Town of MiddletownMiddletown, Rhode Island	■					
Cranston Sanitary Landfill Cranston, Rhode Island	Messina Upright Company, LLPCranston, Rhode Island	■	■				
Barrington Landfills 1 & 2 Barrington, Rhode Island	Town of BarringtonBarrington, Rhode Island	■	■		■	■	■
Tuckers Industrial Dump Johnston, Rhode Island	DAC Corporation	■	■		■	■	
Rock Point Landfill Narragansett, Rhode Island	Toll Brothers Corporation/RIDEM	■	■		■	■	
Coventry Landfill Coventry, Rhode Island	Town of Coventry/PRP Group Coventry, Rhode Island	■	■	■	■	■	■

Project Name/Location	*Client*	*Remedial Investigations/ Feasibility Studies*	*Hydrogeological Investigation/ Environmental Monitoring*	*Permitting Services*	*Design Services*	*Landfill Closure/Remediation*	*Construction Administration/ Support and/or CQA*
Rocky Hill Fair Grounds Landfill East Greenwich, Rhode Island	New England Institute of Technology Warwick, Rhode Island	■	■	■	■	■	■
Charlestown Landfill Charlestown, Rhode Island	Town of Charlestown Charlestown, Rhode Island		■				
Connecticut							
Bristol Landfill Bristol, Connecticut	Town of Bristol			■	■		
DePaulo Drive RCRA Closure Southington, Connecticut	Town of Southington		■	■	■		■
Yaworski Lagoon Superfund Canterbury, Connecticut	Pervel Industries				■		■
Vermont							
Waste USA Landfill Coventry, Vermont	Resicon, Inc.				■		
New Hampshire							
Auburn Road Landfill Londonderry, New Hampshire	Town of Londonderry		■	■		■	
Brookline Municipal Landfill Brookline, New Hampshire	Town of Brookline		■				
Charlestown Landfill Charlestown, New Hampshire	Hoyle, Tanner & Associates		■			■	
Consumat Sanco Landfill Bethlehem, New Hampshire	Consumat Sanco, Inc.		■	■		■	■
Demolition Debris Landfill Nashua, New Hampshire	RDG, Inc.		■	■		■	■
Dover Municipal Landfill Superfund Site Dover, New Hampshire	Wehran Engineer		■				
Exeter Landfill Exeter, New Hampshire	Town of Exeter			■		■	■
Franklin Ashfill Franklin, New Hampshire	Craig Musselman Associates		■				■
Franklin Sanitary Landfill Franklin, New Hampshire	City of FranklinHoyle, Tanner & Associates		■	■		■	■
Fremont Landfill Fremont, New Hampshire	Town of Fremont		■			■	

Project Name/Location	*Client*	*Remedial Investigations/ Feasibility Studies*	*Hydrogeological Investigation/ Environmental Monitoring*	*Permitting Services*	*Design Services*	*Landfill Closure/Remediation*	*Construction Administration/ Support and/or CQA*
Gilson Road Superfund Site Nashua, New Hampshire	State of New Hampshire		■	■		■	■
Hudson Municipal Landfill Hudson, New Hampshire	Town of Hudson		■	■		■	■
Industrial Casting Sand Landfill Mt. Vernon, New Hampshire	Hitchner Manufacturing, Inc.		■	■	■		
Laconia Disposal Gardens Laconia, New Hampshire	City of Laconia		■	■		■	■
Merrimack Landfill Merrimack, New Hampshire	Kimball-Chase, Inc.		■				
New Boston Municipal Landfill New Boston, New Hampshire	Town of New Boston		■	■		■	■
PSNH Ashfill Bow, New Hampshire	Public Service Co. of New Hampshire			■	■		
Roketenetz Landfill Pelham, New Hampshire	Stanley Roketenetz		■	■	■		■
Somersworth Landfill Somerworth, New Hampshire	Wehran Engineering		■				
Souhegan Regional Landfill Amherst, New Hampshire	Souhegan Regional Landfill DistrictAmherst, New Hampshire		■	■	■		■
Turnkey Landfill I, II and III Rochester, New Hampshire	Waste Management of New Hampshire		■	■	■		■
Turnkey Landfill of Danbury Danbury, New Hampshire	Turnkey Landfill of Danbury, Inc.		■	■	■		■
Unity Landfill Unity, New Hampshire	Town of Unity		■				
Washington Landfill Washington, New Hampshire	Town of Washington		■				
Windham Landfill Windham, New Hampshire	Town of Windham		■				
Four Hills Landfill Nashua, New Hampshire	City of Nashua			■			
Lebanon Landfill Lebanon, New Hampshire	Town of Lebanon			■			
Maine							
Candidate Site, Special Waste Landfill Buxton, Maine	Town of Buxton		■	■			

Project Name/Location	*Client*	*Remedial Investigations/ Feasibility Studies*	*Hydrogeological Investigation/ Environmental Monitoring*	*Permitting Services*	*Design Services*	*Landfill Closure/Remediation*	*Construction Administration/ Support and/or CQA*
City of Lewiston Landfill, Phase II Landfill Expansion Lewiston, Maine	City of Lewiston		■	■	■		■
Crossroads Landfill, Asbestos Landfill Closure Norridgewock, Maine	Waste Management Disposal Services of Maine, Inc.			■		■	■
Crossroads Landfill, Phase 3C Expansion Norridgewock, Maine	Waste Management Disposal Services of Maine, Inc.			■	■	■	■
Crossroads Landfill, Phase 10 Expansion Norridgewock, Maine	Waste Management Disposal Services of Maine, Inc.			■	■	■	■
Crossroads Landfill, Phase 1-6 Closure Plan Norridgewock, Maine	Waste Management Disposal Services of Maine, Inc.			■		■	
Crossroads Landfill, Phase 9, 11 & 12 Expansion Norridgewock, Maine	Waste Management Disposal Services of Maine, Inc.	■		■	■		
Crossroads Landfill, Phase 5 Construction Norridgewock, Maine	Waste Management Disposal Services of Maine, Inc.						■
Crossroads Landfill, Phase 7 Expansion/Closure Norridgewock, Maine	Waste Management Disposal Services of Maine, Inc.			■	■	■	■
Defense Fuel Supply Point Landfill Casco Bay Facility	U.S. Department of Defense Defense Logistics Agency		■		■	■	
Demolition Debris Landfill Scarborough, Maine	Attorneys for Present Property Owner		■				
Kiln Dust and Clinker Landfills Thomaston, Maine	Dragon Products Company		■				
Old Buxton Landfill Buxton, Maine	Maine Department of Environmental Protection		■				
Paris Utility District Sludge Landfill (AC Lawrence Disposal Site) Paris, Maine	Paris Utility District, Maine Department of Environmental Protection		■	■		■	■
Portsmouth Naval Shipyard, Solid Waste Planning/Transfer Station Permitting	U.S. Navy			■			
Rushton St. (Municipal) Landfill Sanford, Maine	Maine Department of Environmental Protection		■				

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Town of Fairfield Landfill Fairfield, Maine	Maine Department of Environmental Protection		■				
Town of Gorham Landfill Gorham, Maine	Maine Department of Environmental Protection		■				
Town of Hollis Landfill Hollis, Maine	Town of Hollis			■	■	■	■
Town of Lebanon Landfill Lebanon, Maine	Town of Lebanon		■	■		■	
Town of Norway Landfill Norway, Maine	Maine Department of Environmental Protection		■				
Town of Pittsfield Landfill Pittsfield, Maine	Town of Pittsfield		■				
Town of Vinalhaven Landfill Vinalhaven, Maine	Town of Vinalhaven		■	■			
U.S. Navy Landfill Redington Township, Maine	U.S. Navy		■	■		■	■
Wood Waste and Ash Landfills E. Wilton, Strong & Mattawamkeag, Maine	Confidential Client		■				
Midwestern States							
Evergreen Landfill Toledo, Ohio	Waste Management of North America			■	■		■
Pine Tree Acres, Inc. Lenox Township, Michigan	Town of Lenox Township		■	■	■		
Seymour Road Landfill Montrose Township, Michigan	Pollard Disposal		■				■
South Macomb Sites 9 and 9A Macomb Township, Michigan	South Macomb Disposal Authority			■	■		
MOA Landfill Atlanta, Michigan	MOA Solid Waste Management Authority		■	■	■	■	■
New York							
Freshkills Landfill Section 6/7 Staten Island, New York	Tully Construction Co., Inc.			■	■	■	■
Love Canal ICF Niagara Falls, New York	NYSDEC		■		■		■
Mohawk Valley Sanitary Landfill Frankfort, New York	Waste Management of North America		■				

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Monroe-Livingston Landfill Scottsville, New York	Waste Management of North America						■
Niagara County Refuse Disposal Landfill Lockport, New York	Niagara County Refuse Disposal District		■	■			■
Niagara Landfill Niagara, New York	Browning-Ferris Industries		■	■	■		■
Sanitary Landfill VI Niagara, New York	Browning-Ferris Industries		■	■	■		■
Sanitary Landfill VII Niagara, New York	CECOS International		■	■	■		
Sanitary Landfills I, II, III and IV Niagara, New York	Browning-Ferris Industries		■	■	■		■
Secure Chemical Management Facility No. 4 Niagara Falls, New York	CECOS International		■				■
Secure Chemical Management Facility No. 5 Niagara Falls, New York	CECOS International		■				■
New York Department Sanitation Fresh Kills Landfill Staten Island, New York	Tully Construction				■	■	■
Fountain Avenue Landfill Brooklyn, New York	FGG/Cashman				■		■
Sanitary Landfill V, Subareas A-C Niagara Fall, New York	Allied Niagara Fall Landfill			■	■	■	■
Sanitary Landfill VIII, Subareas A-D Niagara Fall, New York	Allied Niagara Fall Landfill			■	■	■	■
Pennsylvania							
Pelegrene Landfill Coral, Pennsylvania	USA Waste Services, Inc.			■	■		
Washington, DC							
Uline Arena Transfer Station Washington, DC	USA Waste Services, Inc.				■		
New Jersey							
Keegan Landfill Kearney, New Jersey	Creamer Sanzari—Joint Venture					■	■

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Bergen County Residual Ash Landfill North Arlington, New Jersey	Bergen County Utilities Authority			■	■		
Koppers Ash Landfill Kearney, New Jersey	Koppers Industries		■		■		
Salem County Utilities Authority	Salem County Utilities Authority		■	■	■		
Mississippi							
Clearview Landfill Lake, Mississippi	Chambers Waste Systems of Mississippi, Inc., Scott County, Mississippi	■	■	■	■	■	■
Jackson Transfer Station Jackson, Mississippi	USA Waste Services, Inc.				■		
Central Landfill Pearl River, Mississippi	TransAmerica			■	■		
MidSouth Landfill Hinds County, Mississippi	USA Waste Services, Inc.				■		
Florida							
C&D Landfill Central Florida	Sanifill, Inc.Norcross, Georgia						
Berman Road Landfill Okeechobee, Florida	Chambers Waste Systems of Florida, Inc., Okeechobee, Florida	■	■	■	■		■
Transfer Station Miami, Florida	Confidential Client			■			
Tennessee							
Quail Hollow Landfill Tullahoma, Tennessee	USA Waste Services, Inc.	■		■	■	■	■
Nashville Transfer Station Nashville, Tennessee	Sanifill of Tennessee, Inc.	■		■	■		
Cedar Ridge Landfill Lewisburg, Tennessee	Sanifill of Tennessee, Inc.			■	■	■	■
Georgia							
Athens Clark County Clark County, Georgia	M.R. Chasman & Associates				■		
Lawrenceville Transfer Station Lawrenceville, Georgia	USA Waste Services, Inc.			■	■		
Pine Bluff Landfill Ballground, Georgia	USA Waste Services						■

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Oakdale Road Landfill Smyrna, Georgia	USA Waste Services, Inc.			■	■	■	
R&B Landfill Banks County, Georgia	USA Waste Services, Inc.	■	■	■	■		■
Paulding County Transfer Station Hiram, Georgia	USA Waste Services, Inc.				■		
RTS Landfill Hall County, Georgia	USA Waste Services, Inc.			■	■		
Speedway Landfill Winder, Georgia	USA Waste Services, Inc.	■					
Forrest Park Transfer Station Georgia	USA Waste Services, Inc.			■	■		
South Carolina							
Solid Waste Transfer Station Fairfield County, South Carolina	USA Waste Services, Inc.			■	■		
Oak Ridge Landfill Dorchester, South Carolina	USA Waste Services, Inc.						■
Screaming Eagle Landfill Elgin, South Carolina	USA Waste Services, Inc.						■
Twin Oaks Transfer Station York County, South Carolina	USA Waste Services, Inc.				■		
North Carolina							
Anson County Landfill Anson County, North Carolina	Chambers Development		■	■	■		
Solid Waste Transfer Station Charlotte, North Carolina	Chambers Waste Systems of North Carolina			■	■		■
Virginia							
Maplewood Recycling and Disposal Facility Amelia County, Virginia	Chambers of Virginia			■	■		
Big Bethel Landfill Disposal Facility Hampton, Virginia	USA Waste of Virginia			■	■		
Maryland							
King George Landfill King George County, Maryland	USA Waste Services, Inc.			■	■		
Calvert County Transfer Station Calvert County, Maryland	USA Waste Services, Inc.			■	■		

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Calvert County Landfill Calvert County, Maryland	USA Waste Services, Inc.			■	■		
Honeygo Landfill Jessup, Maryland	USA Waste Services, Inc.			■	■		
Puerto Rico							
CDS Frog Landfill Humacao, Puerto Rico	USA Waste Services, Inc. Casquas, Puerto Rico				■		■