NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Environmental Remediation, Region 8
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April 25, 2024

Warner Golden
Arxada
1200 Bluegrass Lakes Parkway
Alpharetta, Georgia, 30004

Re: HW-1 Groundwater Extraction and Treatment System – Draft Basis of Design Work Plan
Olin Corporation – Chemicals Group (Arch Chemicals, Inc) – 828018A
100 McKee Road, Rochester, Monroe County, New York, 14611

Warner Golden,

The New York State Department of Environmental Conservation – Division of Environmental Remediation (NYSDEC-DER) and New York State Department of Health – Bureau of Environmental Exposure Investigation (NYSDOH-BEEI), collectively referred to as the Departments, have completed their review of the "Draft Horizontal Well HW-1 – Groundwater Extraction and Treatment System – Basis of Design Work Plan" (RDWP-BoD) (electronically signed and received on 03/28/2024) as prepared by MACTEC Engineering and Geology, P.C.

In accordance with Title 6 of the New York Codes, Rules, and Regulations (NYCRR) part 375-1.6, the Departments have determined that the RDWP-BoD) substantially addresses the requirements of the State Superfund Program, and the workplan is hereby **approved**.

Please remove all draft designations, update signature pages, revise the title from "draft" to "final" and submit a final version to the Departments. Within 10 days from the date of this letter, please compile the final document with this approval as cover and place a copy in the document repository for the site. **Please note – as of January 01, 2024, all certifications for workplans and reports are required to address DER-10 and DER-31. Upon finalization of the report, the P.E. certification should the workplan conforms to both plans.**

To the maximum extent possible, DER-31 must be considered during development of the upcoming 60% and 90% Remedial Design Work Plans. The 60% Work Plan in particular should consider, analyze, and discuss green alternatives that were evaluated.

If ground breaking events will be required as part of the final, then relevant workplans need to detail soil/groundwater management, backfill, surface restoration, analytical testing, CAMP, etc.

Please contact me at Joshuah.Klier@dec.ny.gov or at (585) 226-5357 to discuss any questions or concerns regarding this letter. Thank you for your continued efforts on this project.

Sincerely,

Joshuah J. Klier

Joshuah J. Klier, G.I.T.
Assistant Geologist | Project Manager
New York State Department of Environmental Conservation
Division of Environmental Remediation
Region 8 Hazardous Waste Remediation

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Arch Chemicals, Inc.
c/o Arxada
100 Mckee Road
Rochester, NY 14611-2013
USA

May 1, 2024

Mr. Joshuah Klier
Project Manager
New York State Department of Environmental Conservation
Division of Environmental Remediation, Region 8
6274 East Avon-Lima Road
Avon, New York 14414-9519

Subject: Final Basis of Design Work Plan - HW-1 Groundwater Extraction and Treatment System, Arch Chemicals (Site #828018a) 100 McKee Rd., Rochester, NY

Dear Mr. Klier:

Enclosed is an electronic copy of the subject work plan. This work plan is intended to support the planned design and operation of a pump and treat system for horizontal well HW-1.

Should you have any questions regarding this work plan, please give me a call at (205) 960-4080.

Sincerely,

Warner Golden
Associate Director EHS
Arxada

cc: Christopher Budd, NYSDOH
Jean Robert Jean, US EPA Region 2
David Pratt, NYSDEC
Sean Keenan, MCDES
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FINAL
HORIZONTAL WELL 1 (HW-1) GROUNDWATER EXTRACTION AND TREATMENT SYSTEM

BASIS OF DESIGN WORK PLAN

ARCH CHEMICAL SITE
ROCHESTER, NY

Prepared for:

Arch Chemicals Inc.
Rochester, New York

Prepared by:

MACTEC Engineering and Geology, P.C.
Portland, Maine

Project No. US0025481.1521

MAY 2024

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MAY 2024

Submitted by:

Tom Gerhard
Project Engineer

Nelson Breton
Project Manager

Approved by:

Mark Stelmack, P.E.
Engineer of Record

I, Mark Stelmack, P.E., certify that I am currently a [NYS registered professional engineer or Qualified Environmental Professional as defined in 6 NYCRR Part 375] and that this Report [Remedial Design, Remedial Action Work Plan] was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10)

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

Arch	Arch Chemical, Inc.
COC	Contaminant of concern
CP	Commissioner Policy
DER	Department of Environmental Remediation
GAC	Granular activated carbon
GPM	Gallons per minute
GWETS	Groundwater extraction and treatment system
HMI	Human Machine Interface
HW-1	Horizontal groundwater extraction well #1
LGAC	liquid phase granular activated carbon
MACTEC	MACTEC Engineering and Geology, P.C.
MW	Monitoring well
NYSDEC	New York State Department of Environmental Conservation
OM&M	Operation, maintenance, and monitoring
PLC	Programmable Logic Control
POTW	Publicly owned treatment works
PVC	Polyvinyl chloride
ROD	Record of Decision
SCADA	Supervisory Control and Data Acquisition
Site	Arch Chemical, Inc. in Rochester NY
ug/L	micrograms per liter
VFD	Variable frequency drive
VGAC	Vapor phase granular activated carbon
VOC	Volatile organic compound
ZAP	Zinc abatement process

1.0 Introduction

1.1 Site Location

This work plan has been prepared by MACTEC Engineering and Geology, P.C. (MACTEC) on behalf of Arch Chemicals, Inc. (Arch) to document the basis of design for a proposed groundwater extraction and treatment system for horizontal well #1 (HW-1) and groundwater that may be extracted from other extraction wells at the Arch Chemicals Facility (the Site) in Rochester, New York. **Figure 1** shows the regional location of the Site.

1.2 Site Remediation Background

Groundwater contamination at the Arch Chemical facility was originally identified in the 1980's by the prior owner Olin Corporation. Since that time, a groundwater extraction and treatment system (GWETS) has been utilized to limit migration of chloropyridines and volatile organic compounds, and to treat groundwater prior to discharge to the publicly owned treatment works (POTW). A series of vertical extraction wells have been maintained as part of the GWETS. With the sale of the Site to Arch Chemicals in 1999, Arch has continued to maintain and upgrade the GWETS.

In 2019 the NYSDEC issued a new Record of Decision (ROD) to Arch selecting installation of up to two horizontal groundwater extraction wells beneath the Site as the preferred alternative for groundwater remediation (NYSDEC, 2019). This ROD subordinated a prior ROD issued to Arch in 2003 that did not include a remedial option for contaminant source removal or reduction. Groundwater extraction and treatment, utilizing horizontal wells, was selected as the preferred remedial alternative to address contaminant mass removal at the source area and containment of the groundwater contaminant plumes. The selection of horizontal wells was based on the findings from a supplemental feasibility study submitted by Arch in 2015 and finalized in 2019 (MACTEC, 2019).

The current GWETS consists of four bedrock groundwater extraction wells, subsurface conveyance piping, a subsurface collection pit (Kodak Pit), granular activated carbon for treatment of contaminants of concern, and necessary instrumentation and controls for operation of the system.

Between June and July 2021, horizontal well HW-1 was installed by Ellingson Companies utilizing directional drilling techniques, with inspection and documentation conducted by MACTEC. HW-1 well installation details are documented in a completion report prepared by MACTEC (MACTEC, 2023). A plan view of the well in the context of the site and monitoring network is included as **Figure 2.** A cross sectional profile of the well construction is shown in **Figure 3**.

MACTEC conducted a short-term variable rate pumping test in 2021 for HW-1 and a constant rate pumping test in 2022 (MACTEC, 2023). Data collected from these tests were used to formulate a plan for a pilot test to assess treatment options and evaluate the effects of pumping on the groundwater contaminant plumes. Because contaminant levels measured during the pumping tests were much higher in HW-1 than in the combined discharge from the vertical extraction wells that have been utilized over the years, the pilot test required expanded use of granular activated carbon to meet permit discharge requirements. The HW-1 pilot test was completed from July through October 2023 (MACTEC, 2024).

The pilot test system consisted of a pneumatic, surface mounted extraction pump and drop tube within HW-1, an influent equalization tank, bag filters for particulate removal, and three 2,000-pound (lb) liquid phase granular activated carbon (LGAC) vessels plumbed in series for removal of site contaminants of concern. On September 10, 2023, with NYSDEC approval, an air stripper was added to the treatment train to reduce VOC loading to the LGAC and extend the time between breakthrough of the LGAC. The pilot system proved successful at removing contaminants of concern to levels acceptable for discharge to the publicly owned treatment works (POTW), the VanLare Wastewater Treatment Facility.

The proposed full-scale groundwater treatment system described in this document will be designed to mimic or outperform the pilot test treatment system and to accept additional flow from onsite vertical extraction wells, if needed, to meet the remedial objective of containing the contaminant plumes. Additional pilot testing or modelling to include flow from onsite vertical extraction wells is not anticipated, as historic extraction well flow rates and analytical data are readily available.

1.3 Existing and Proposed Groundwater Treatment Infrastructure

The Arch facility contains an existing onsite GWETS currently comprised of four vertical extraction wells, subsurface conveyance piping, an equalization tank (Kodak Pit), LGAC for treatment of site contaminants, and pumps and controls for system operation. Treated effluent is discharged to the on-site pretreatment area where it is combined with treated process wastewater effluent before discharge to the publicly owned treatment works (POTW).

Where possible, existing treatment infrastructure will be utilized for the proposed system, which will not only save in capital costs but will decrease the carbon footprint of the project. Additional green and sustainable remediation considerations are described in Section 6.

The following existing groundwater treatment system components have been identified as potentially re-usable, and will be reevaluated for integrity and capacity during design:

- Extraction wells and existing infrastructure
- Subsurface conveyance piping
- Aboveground piping
- System pumps
- LGAC Vessels
- ZAP Building and adjacent tie-in to the Pretreatment Area

The following infrastructure elements are expected to be decommissioned or repurposed following installation of the proposed GWETS:

- Kodak Pit (to be utilized or replaced with aboveground equalization tank)

- Selected groundwater extraction wells (to be converted into groundwater monitoring wells or abandoned)

- Selected monitoring wells that may no longer be useful (to be abandoned)

2.0 Remedial Design Intent

2.1 Background

HW-1 was installed as a means of targeted contaminant extraction from the source area beneath the Arch Chemical facility. As demonstrated during the pilot test, the mass removal rate of chloropyridines and VOCs from HW-1 was greater than historic mass removal rate from all vertical extraction wells combined (MACTEC, 2024). In addition, the use of an air stripper was needed to extend the life of LGAC beds due to VOC concentrations that were significantly higher in HW-1 than in the combined influent from the existing vertical extraction wells. With the additional contaminant loading anticipated from HW-1, new treatment infrastructure is required to meet permit discharge limits. HW-1 will also require connection to the existing conveyance piping system to discharge treated effluent to the on-site Pretreatment Building that currently receives treated effluent from the vertical extraction wells.

2.2 Design Basis

The treatment technologies employed during the pilot test were demonstrated to be effective in meeting permit limit requirements, as summarized in the HW-1 Pilot Test Completion Report (MACTEC, 2024).

The intent of this design is to provide GWETS upgrades for integration of HW-1 with treatment to meet permit discharge limits while utilizing as much of the existing GWETS infrastructure as possible to minimize ground disturbance onsite.

2.3 Project Goals

The initial goal of this project is to facilitate full time operation of HW-1 and treat water extracted from HW-1 (and other vertical extraction wells if needed) to levels acceptable for discharge to the POTW. A second goal for the operation of HW-1 is to improve containment of the chloropyridine and VOC groundwater plumes.

Arch proposes to operate HW-1 indefinitely or until such time that the NYSDEC approves shutdown of the extraction system based on groundwater quality data.

2.4 Operations and Monitoring Schedule

After startup of the HW-1 treatment system, Arch anticipates an estimated 10-week commissioning period to optimize the treatment system. The system will be operated with HW-1 pumping for a minimum of 12-months while leaving other extraction wells deactivated. During this time, hydraulic influence of HW-1 on the surrounding groundwater table will be assessed and compared to that

of existing vertical extraction wells to determine if vertical extraction well usage in conjunction with HW-1 would increase the area of hydraulic control.

3.0 Proposed Groundwater Extraction and Treatment System

The following subsections summarize the preliminary proposed GWETS components and layout. The descriptions provided herein are based on existing site knowledge and results from previous testing as discussed in Subsection 1.2. During site preparation and system design, factors may appear that hinder or prevent installation of the system as described below. If this occurs, MACTEC will determine the best option that most closely meets the original design intent. These changes will be documented in the Final Engineering Report.

3.1 Additional Considerations

The following outstanding design-related issues require resolution, and as such will be investigated further prior to and during system design.

- At this time, the type of pump to be used for extraction from HW-1 is undetermined. Three different pump types are being considered as follows.
    - A pneumatic air lift pump was utilized during the full-scale pilot test and may be recommended for the full-scale system. Air lift pumps are beneficial because there is no submerged pump to foul - the pump sits on the ground surface and pulls from a drop tube with a screened interval. The drop tube can be easily removed and cleaned. This pump would required a surface mounted enclosure or subsurface utility vault for protection of the pump and components.
    - Similar to pneumatic air lift pumps, peristaltic pumps sit on the surface and extract water through a drop tube, thus having the same benefits of reduced fouling capacity. Peristaltic pumps are non-contact pumps, meaning no pump parts aside from the pump tubing contact the water. This design eliminates fouling within the pump. Peristaltic pumps would require electrical service at the wellhead, and depending on the pump dimensions, may be best installed in in a surface-mounted doghouse or subsurface vault.
    - Submersible pumps are typically used in groundwater extraction wells. These pumps sit down in the well within the water column. Water is pushed up the drop tube from the pump. An advantage of a submersible pump is that it can be sized to lift extracted water to an equalization tank at an elevation that may be beyond the air lift limit of a peristaltic pump. While these pumps also typically require little or no surface mounted infrastructure (as all infrastructure is in the well), the small intake of submersible pumps causes rapid fouling under unfavorable water conditions. Historic operation of groundwater extraction wells at Arch has indicated that pump fouling is an issue, a drawback that will require consideration.
- Currently, all subsurface extraction well conveyance lines discharge into the Kodak Pit. Water is pumped from the Kodak Pit through the treatment system by a submersible pump

located within the pit. Arch may consider replacement of the Kodak Pit with an aboveground equalization tank.

  - Replacement of the Kodak Pit with an aboveground equalization tank may require additional infrastructural modifications, as the hydraulic profile will change. Rather than discharging via gravity from the well head into a subsurface pit, extracted groundwater will need to be lifted an additional 10 to 15 feet vertically to discharge into an aboveground storage tank (assuming existing conveyance lines are 5 feet below ground surface [frost line] and the aboveground tank is between 5 and 10 feet above grade). While this differential will be accounted for during selection of the HW-1 pump, additional upgrades to existing vertical extraction wells may be required to overcome the head differential if vertical extraction wells are deemed necessary.

  - MACTEC will evaluate the usability of the existing infrastructure onsite and compatibility of that infrastructure with the proposed GWETS.

- To keep treatment equipment near the wellhead and re-utilize already impervious surfaces onsite while preventing congestion, Arch is exploring the option to locate the proposed GWETS equipment within a secondary containment area off the east end of the ZAP building, adjacent to the existing GWETS infrastructure. A decision to use this area will be based on the structural integrity of the foundation slab and ability to expand the ZAP building structure and utilities over this area (See **Figure 4**). Should this location be deemed unsuitable, another location will be proposed by Arch and investigated by MACTEC.

3.2 GWETS Location and Layout

The proposed GWETS location is shown on **Figure 4**. Arch is exploring use of the east end of the ZAP building for the proposed process equipment. This area adjacent to this building includes an existing concrete secondary containment area that has a pitched floor and floor sump, with no walls or roof. The foundation will be evaluated for structural integrity prior to design of the foundation modifications, building enclosure, and treatment system. If deemed appropriate, the ZAP building will be extended to encapsulate this area.

This location is optimal for installation of the proposed GWETS as it is adjacent to the existing treatment infrastructure located at the east end of the ZAP building. The proximity to existing infrastructure would minimize relocation of equipment and trenching for installation of proposed subsurface piping, as much of the existing subsurface conveyance piping could be reused.

Depending on the type of extraction pump selected, the GWETS may also include a remote enclosure or subsurface vault at the HW-1 wellhead to house the pump, piping, and instrumentation. The selected pump is expected to be an air-driven or electric peristaltic type lift pump, however the use of a submersible pump will also be considered.

3.3 GWETS Components and Considerations

The proposed GWETS layout is similar to that of the pilot treatment system, and includes the following components:

- Extraction well pump (type unknown, see Subsection 3.1), either submersible, surface mounted pneumatic air lift, or surface mounted peristaltic, capable of pumping 5 to 25 gallons per minute.

- Extraction well enclosure. If utilizing a surface mounted pump at the wellhead, a small enclosure will be required to house the pump, piping, flow transmitter, and pressure transmitter. This enclosure will be insulated, and an electric heater will be installed to maintain temperatures above freezing during winter months.

    - Alternatively, a subsurface vault could be installed with the pump and piping below grade. An electric heater or heat trace would be required to prevent freezing. Unlike the aboveground doghouse, entry into the vault for servicing of the pump or well would likely be considered a confined space and require additional safety and maintenance considerations for entry. Therefore, an above-grade well pump enclosure is preferred.

- Existing vertical extraction wells. Existing (in-use) vertical extraction wells BR-7A, BR-127, PW-13, and PW-15 will not operate while HW-1 is in use for the initial 12-month operating period. These wells could be reactivated if necessary during the 12-month period, but only in the event where HW-1 would need to be shut down for extended periods and with NYSDEC approval.

- New conveyance line. A new conveyance line would be installed from the HW-1 well head to the Kodak Pit or to join the existing conveyance piping at the Kodak Pit. This line may be on the ground surface and heat traced or buried below the frost line, depending on subsurface constraints.

- Kodak Pit modifications. All extraction wells currently discharge into the Kodak Pit. Proposed modifications to the Kodak Pit include either:

    - Installation of an influent header to combine the flows from all influent lines. This header would be connected to the existing Kodak Pit discharge line which leads to the ZAP Building and a new, above ground equalization tank. Once connected, the Kodak Pit would be decommissioned.

    - Inspection and lining of the Kodak Pit to ensure integrity and reuse of the Kodak pit as an equalization basis for the GWETS in the same fashion it is currently being used.

- Duplex bag filters will be installed downstream of the Kodak Pit or new equalization tank to prevent particulates from entering the air stripper and LGAC vessels. This will include two filters with one operating and one on standby at any given time, allowing operators to easily replace bag filters when blinded without interrupting system operation. Influent and effluent pressure transmitters will be installed with alarm conditions at a high differential pressure setpoint that automatically switches to the standby filter housing and alerts the operator, minimizing downtime.

- Defoamer drip feed. Foaming was observed in the air stripper during the pilot test, which required use of a defoaming agent. Installation of a defoaming drip feed prior to treatment

via air stripper is anticipated. The drip feed will be installed directly into the process line following the bag filters with an inline mixer installed downstream of the injection point.

- pH adjustment. Due to scaling (caused by high levels of calcium and magnesium (hardness)) observed within the existing groundwater treatment system piping and process equipment, pH adjustment of influent groundwater is recommended to lower the pH to keep calcium and magnesium in solution. A hydrochloric acid is recommended.

- Air stripper. An air stripper may be installed downstream of bag filters to remove VOCs from the influent groundwater. Air discharge from the air stripper will be treated through vapor phase granular activated carbon (VGAC) if deemed necessary by the NYSDEC based on air emissions levels for certain VOCs that may exceed the allowable annual emissions limits (lbs/yr) under 6 CRR-NY 212-2.2 (Table 2). Alternatively, Arch may propose air modeling to demonstrate whether vapor controls are needed.

- Process pumps. Process pumps will be installed, as needed, before the bag filters (influent) and between the air stripper sump and the lead LGAC vessel (air stripper pump). The influent process pump would be controlled by the level within an influent tank, and the air stripper pump would be controlled by the level within the air stripper sump.

- LGAC Vessels. The existing treatment system includes two 2,000 lb. LGAC vessels. The proposed system includes three vessels with minimum 2000 lb. capacity (larger vessels may be considered to reduce frequency of LGAC bed change outs). If the existing vessels are determined to be usable, they will be reused and only a single additional vessel will be procured. If deemed unsuitable for continuous operation, new vessels will be installed.

- Sump pump. If structurally viable, a floor sump will be installed at the center of the GWETS treatment area. A sump pump with a high- and low-level float for pump on/off function will be installed within the sump, with the sump pump discharging into the influent tank. The sump is intended to prevent flooding if a leak was to occur and to simplify dewatering of LGAC vessels.

3.4 GWETS Piping

Both aboveground and subsurface piping may be installed to support the proposed GWETS.

As shown on **Figure 4**, anticipated new above grade or subsurface piping will extend from the HW-1 wellhead at the east end of HW-1 to the Kodak Pit.

Existing aboveground piping is not shown on **Figure 4** as new aboveground piping will be installed within the proposed GWETS area at the east end of the ZAP building. Flexible piping will be installed between GAC vessels to facilitate replacement of vessels; rigid polyvinyl chloride (PVC) piping or other compatible rigid piping will be used in all other applications.

3.5 Instrumentation and Controls

The following instrumentation and controls will be utilized in the proposed GWETS.

- Flow meters/transmitters

    - HW-1 flow meter
    - Influent (combined extraction) flow meter
    - Process flow meter 1 (influent tank to bag filters)
    - Process flow meter 2/discharge flow meter (air stripper sump to lead LGAC)
- Pressure meters/transmitters
    - HW-1 wellhead
    - Air stripper air inlet
    - Bag filter influent and effluent, calculated differential
    - GAC vessel influent and effluent, calculated differential
- Water level sensors/floats
    - Influent tank (Kodak Pit or new equalization tank) ultrasonic level sensor (for high- and low-level alarms and process pump control)
    - Influent tank (Kodak Pit or new equalization tank) tilt float switches (for high-high and low-low alarms)
    - Air stripper sump capacitive proximity switches (to be installed on the air stripper sump sight glass, to control post air stripper process pump)
    - Sump pump tilt float switch (if foundation permits installation of floor sump)
- Water level transducers
    - HW-1 in-well submersible transducer
- pH meter/transmitter
    - Inline influent pH transmitter (to control chemical addition for pH adjustment prior to the influent tank).
- Power and VFD control panel
    - All electrical components will be powered through a high voltage control panel. Disconnects will be provided for each piece of equipment for appropriate lock out tag out (LOTO) during maintenance procedures. VFDs will be provided for extraction/process pumps and air stripper blower to maintain appropriate flowrates (water and air) through the system at all times.
- Programmable Logic Computer (PLC) with Human Machine Interface (HMI)

- A operator control panel will be constructed with a PLC, which receives input from all flow, pressure, level, and temperature transmitters, calculations (like bag filter and GAC differential pressure) and provides outputs necessary to control process equipment. All readings and control interface will be displayed locally on an HMI, a screen that provides supervisory controls and data acquisition (SCADA) display of the system, components, and all flow, pressure, level, and temperature outputs from the PLC.

- The PLC controls all process equipment and automatically reacts to changes in process conditions and alarms and can alert operators to issues remotely. The PLC will shut the system down when high pressures or high-level alarms are reached and will warn operators when approaching these values. These alarm conditions are programmable to allow operators to tune system operation.

- This interface allows operators to view real time system information and change operating setpoints of process equipment. It can also be programmed to store data for trend analysis.

- The PLC will be able to be remotely monitored and controlled via ethernet or similar data connection. This will allow alarms to be sent via text or email and allow operators to observe and make adjustments to the system during off hours.

3.6 Utilities

Utilities that are anticipated for the proposed GWETS include the following:

- Two (2) new electrical services (or extension of existing service, to be determined)
    - One electrical service will be installed within the GWETS building area
    - One electrical service will be installed (or existing service extended) to the HW-1 wellhead enclosure
- HVAC (electrical or gas, depending on ZAP building), for heat/freeze prevention during winter months
- Fire suppression, if necessary, based on facility or chemical requirements
- Potable water, for general use and equipment cleaning.

Existing ZAP building utilities will be expanded and new equipment will be installed, as needed, if existing ZAP building utilities are not capable of supplying the expanded treatment area.

4.0 Startup Performance Monitoring

An estimated 10-week (70 day) startup and commissioning period is planned to evaluate influent flow rates and contaminant concentrations and to test and tune the GWETS. The scope and schedule of environmental and operational performance monitoring is provided in this section.

Prior to startup, an operation commissioning checklist will be provided by MACTEC. This checklist will be used to ensure that all alarms and interlocks are functioning as intended prior to full ramp-up of the GWETS.

4.1 GWETS Performance Monitoring

GWETS performance monitoring consists of analytical and treatment process monitoring. Information gathered through operational monitoring during the commissioning period will be used to determine operational needs for the system and best operating setpoints and alarm conditions required to set the schedule for future operation. Treatment and process monitoring data collected will be utilized to develop a system operation, maintenance, and monitoring (OM&M) plan after the commissioning period.

4.1.1 Treatment System Analytical Monitoring

Analytical sampling from the GWETS will be performed as provided in **Table 1**.

Samples will be collected from multiple locations throughout the GWETS. Analytical data gathered from these locations will aid to confirm LGAC breakthrough and contaminant loading rates during the initial startup period when contaminant concentrations are expected to be elevated. The proposed schedule includes:

- Weeks 1 and 2: daily sampling for two weeks to identify initial influent concentrations of site COCs and other parameters which may affect treatment, and lead LGAC breakthrough frequency,

- Weeks 2 and 3: every other day sampling to continue verification of GAC replacement needs

- Months 2 through 12 – biweekly sampling to continue monitoring influent and effluent concentrations for treatment system performance.

Samples for treatment system monitoring will be analyzed at the onsite laboratory for selected VOCs and chloropyridines as noted on **Table 1**. Split samples from the HW-1 influent, air stripper effluent, and LGAC effluent will be collected on a quarterly basis for off-site analysis of VOCs and chloropyridines and selected wet chemistry parameter analyses as listed in **Appendix A.** Wet chemistry analysis is planned to assess water chemistry for system maintenance.

4.1.2 Process Monitoring

Process monitoring will consist of routine collection of system data which will be used to adjust system setpoint and processing rates to minimize downtime and operator intervention. The following information will be collected and analyzed routinely during the GWETS commissioning period.

- Flowrates, including HW-1 and combined system influent flowrates, influent tank to air stripper flowrate, and air stripper sump to GAC flowrate

- Process pump speed (Hz) if equipped with VFD
- Bag filter differential pressure
- GAC vessel differential pressure.

Some of this process monitoring data will be compiled and analyzed through the SCADA system, but operators will review operations data routinely to monitor overall system performance.

4.2 Groundwater Monitoring

Environmental monitoring to include water level and analytical monitoring is planned to gauge changes to the local groundwater flow regime as well as to assess contaminant distribution. Arch proposes to supplement the current spring and fall groundwater monitoring events with two added sampling events for a total of four quarterly monitoring events over the 12-month period after system startup. Water levels will be collected from all available wells that have been routinely measured in the spring and fall events. The well sampling schedule for the first and third quarter events will follow the current spring and fall sampling schedule. A subset of wells will be sampled during the second and fourth quarter events (see **Appendix A**). Monitoring and extraction well locations within the Site are referenced on **Figure 2**. Off-site monitoring locations that are part of the ongoing spring and fall sampling program are shown on a series of Figures in **Appendix B**.

4.2.1 Well Assessment

An assessment of existing monitoring and extraction wells will be performed after 12 months of operation to determine which wells may be suitable for longer term monitoring or extraction and which ones may be candidates for decommissioning. This assessment, including recommendations for extraction well operations (e.g. selection of wells to operate) based on findings from the initial 12-month monitoring period, will be submitted to the NYSDEC for review and approval.

5.0 Permitting and Air Emission Considerations

A building permit for construction of the ZAP building annex may be required through the City of Rochester. This will be coordinated with Arch prior to the start of construction activities. Arch will obtain other local or state permits that may be needed prior to construction.

Because elevated levels of VOCs are present in groundwater at HW-1 and the use of an air stripper is planned to support groundwater treatment, Arch will work the NYSDEC Division of Air Resources to determine whether the installation of vapor phase treatment may be required before system startup.

6.0 Green Remediation Considerations

This basis of design work plan has been developed consistent with NYSDEC's green and sustainable remediation policies, including DER-31 and CP-75. The following green remediation

considerations have been incorporated into this work plan and will be considered during system design:

- A review of existing infrastructure design and record drawings will be conducted from offsite to develop a better understanding of the existing site and proposed infrastructure. This will minimize personnel and time onsite, which will reduce greenhouse gas emissions from air and ground transportation activities.

- Existing onsite infrastructure will be re-used whenever possible. This will reduce capital costs and reduce greenhouse gas emissions by limiting required transportation and disposal of old equipment and manufacturing and transportation of new equipment.

- Where possible, existing impervious surfaces will be utilized for the new GWETS location to prevent installation of additional impervious surfaces.

- Local contractors will be utilized when necessary to reduce vehicular travel.

- The treatment system will incorporate a control system that can be accessed remotely for acquisition of logged data, monitoring/control of process operations and response to alarms. This will reduce the number of physical trips to the site/system to perform these operations thus reducing emissions associated with travel.

- All motors (pumps, blowers, etc.) will utilized variable frequency drives (VFD) for operation and control to maximize electrical efficiency.

7.0 Anticipated Schedule for Design and Construction

A review of existing conditions documentation will be performed, and a list of questions or unknowns will be developed applicable to the proposed design. Answers to these questions will be provided by Arch. A site visit will be planned to answer unanswered questions and perform site reconnaissance.

One additional pre-design site visit is anticipated for coordination with subcontractors. This is expected be held within one month of the start of design. The following is the expected project schedule from design to construction completion:

Task	Start	End
Basis of Design Work Plan	February 2024	May 2024
60 Percent Design	April 2024	July 2024
90 Percent Design	August 2024	September 2024
Contracting	October 2024	December 2024
Construction	January 2025	March 2025
Startup and 12-Month Monitoring	April 2025	March 2026

Following the completion of the 90 percent design, Arch will initiate contracting which will include preparation of a complete package of issued for construction drawings (100 percent design) with equipment specifications to include the following information:

- Existing Conditions Plan
- Groundwater Extraction and Treatment System Layout
- Proposed Piping Layout
- Process Flow Diagram
- Building/Structural Modification Details

The Final Engineering Report will be submitted to the NYSDEC within 90-days following the commissioning period.

8.0 References

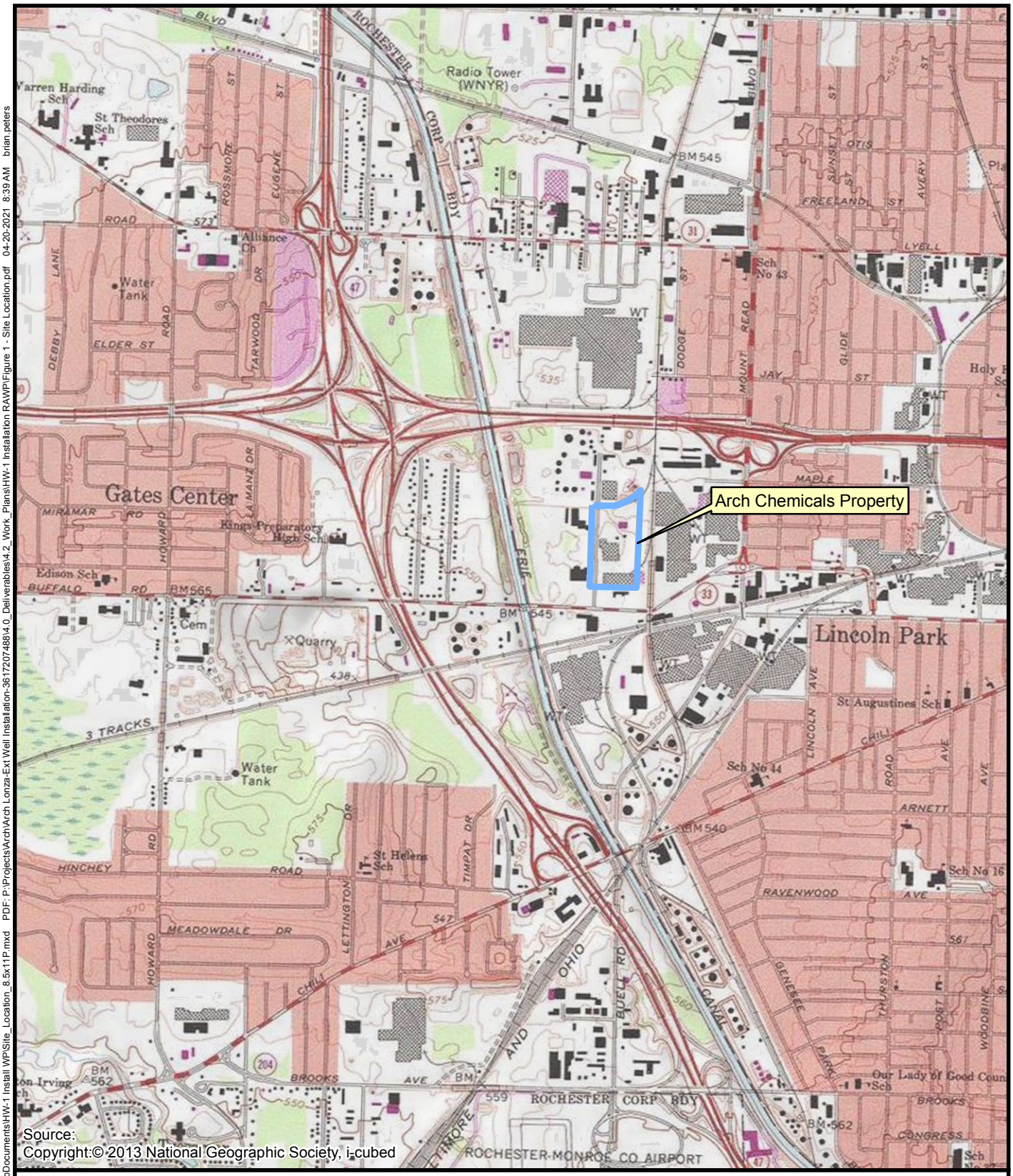
MACTEC Engineering and Geology, PC (MACTEC), 2019. Feasibility Study Report. Prepared by MACTEC Engineering and Geology, PC for Arch Chemicals, Inc., September 2019.

MACTEC Engineering and Geology, PC (MACTEC), 2023. Well Installation and Completion Report Horizontal Extraction Well HW-1. Prepared by MACTEC Engineering and Geology PC for Arch Chemicals, Inc., February 2023.

MACTEC Engineering and Geology, PC (MACTEC), 2024. Horizontal Groundwater Extraction Well HW-1 Pilot Test Completion Report. Prepared by MACTEC Engineering and Geology PC for Arch Chemicals, Inc., February 2024.

NYSDEC, 2019. Record of Decision, Arch Chemicals, Inc. Inactive Hazardous Waste Site Rochester, Monroe County, Site No. 828018A. March 2019.

FIGURES



Legend

Arch Property Boundary

0 1,000 2,000 Feet

N

Figure 1
Site Location

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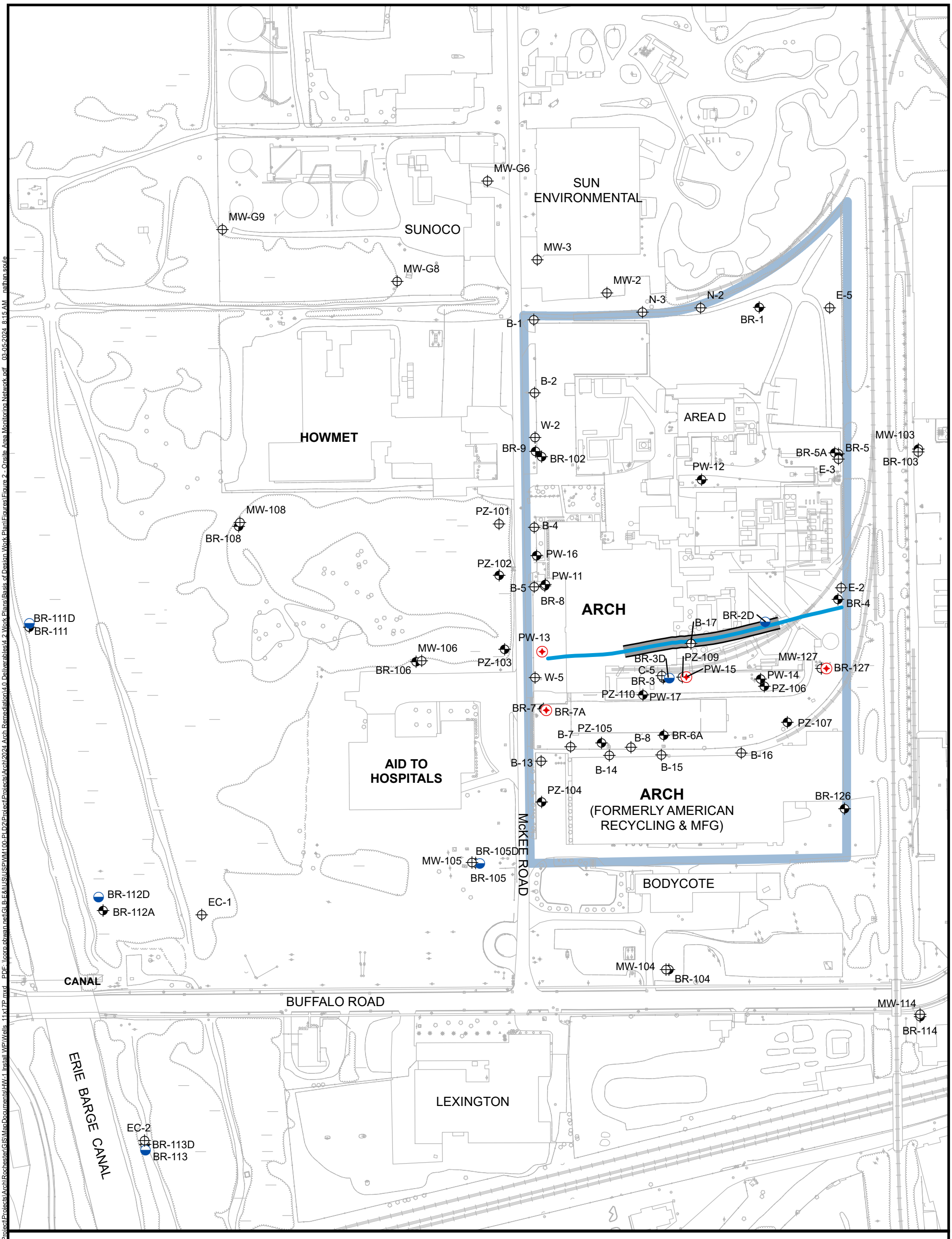
Prepared/Date: BRP 04-20-21 | Checked/Date: NMB 04-20-21

Arch Chemicals
Rochester, New York

Document: P:\Projects\Arch\Rochester\GIS\MapDocuments\HW-1 Install WP\Site_Location_8.5x11P.mxd PDF: P:\Projects\Arch\Arch Lonza-Ext Well Installation-36172074881\4.0_Deliverables\4.2_Work_Plans\HW-1 Installation RAWP\Figure 1 - Site Location.pdf 04-20-2021 8:39 AM brian.peters



Legend

- Active Pumping Well
- Overburden Monitoring Well
- Bedrock Monitoring Well
- Deep Bedrock Monitoring Well
- Installed HDD Borehole and Well
- Approximate Well Screen Placement
- Property Owned by Arch

0 100 200 Feet

N

Figure 2
Onsite Area Monitoring Network

Arch Chemicals
Rochester, NY

MACTEC

Prepared/Date: NES 03-05-24	Checked/Date: nmb 03-05-24

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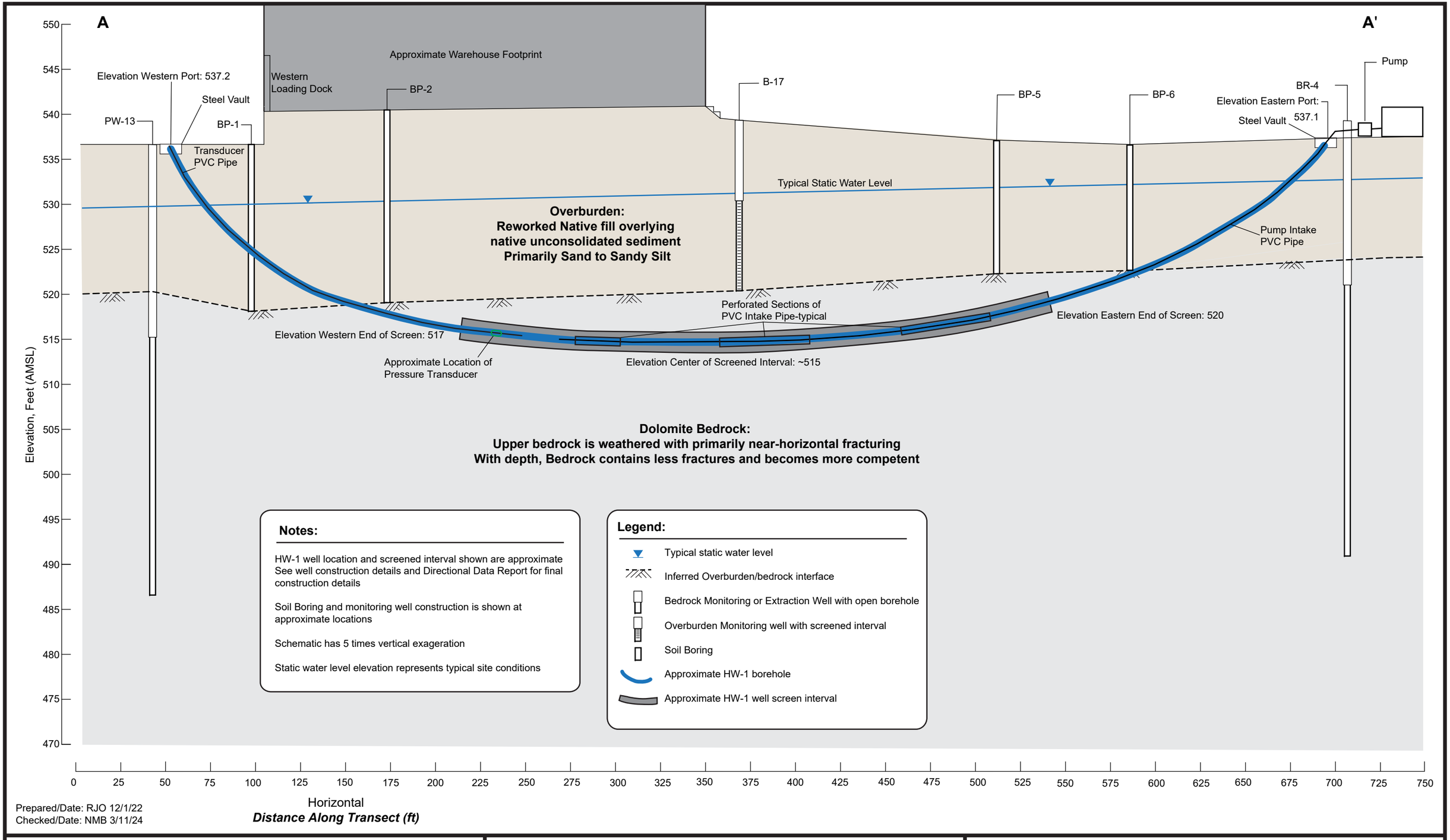
PDF: \\corp.pbwan.net\GLB-E&I\USUSPWM100-PLD2\Project\Projects\Arch\Rochester\GIS\MapDocuments\HW-1 Install WPI\Wells_11x17P.mxd



Notes:

HW-1 well location and screened interval shown are approximate See well construction details and Directional Data Report for final construction details

Soil Boring and monitoring well construction is shown at approximate locations

Schematic has 5 times vertical exaggeration

Static water level elevation represents typical site conditions

Legend:

- Typical static water level
- Inferred Overburden/bedrock interface
- Bedrock Monitoring or Extraction Well with open borehole
- Overburden Monitoring well with screened interval
- Soil Boring
- Approximate HW-1 borehole
- Approximate HW-1 well screen interval

Prepared/Date: RJO 12/1/22
Checked/Date: NMB 3/11/24

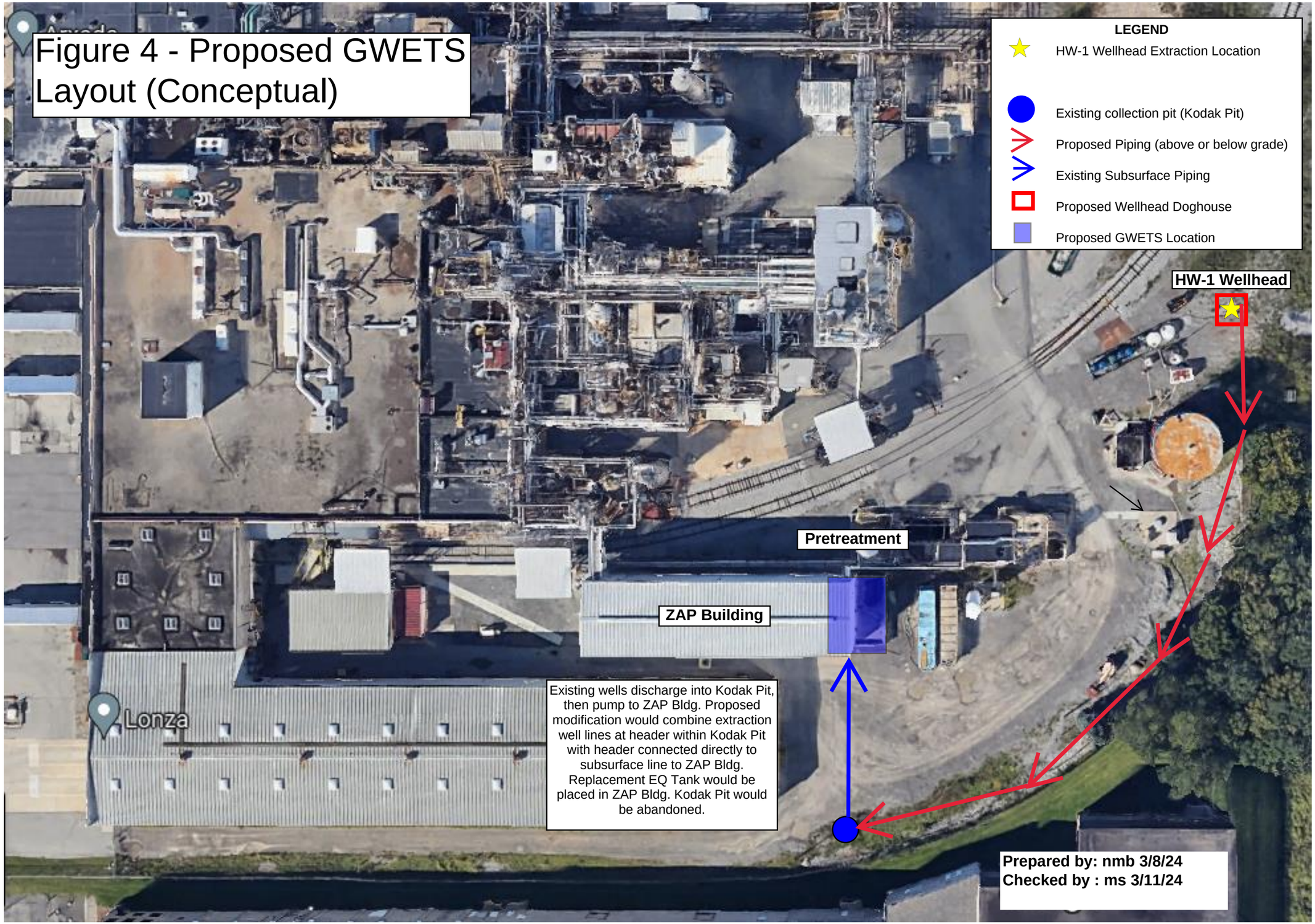
Arch Chemicals
Rochester, New York
Project US0025481.1521

MACTEC

Figure 3: HW-1 Pumping Setup
Horizontal Extraction Well HW-1 Groundwater Extraction and Treatment System Basis of Design Work Plan

HW-1Schematic-ArchRochesterb.ai

Figure 4 - Proposed GWETS Layout (Conceptual)



TABLES

Table 1
Arch HW-1 GWETS
Initial 12-Month Treatment System Analytical Schedule

Days after Startup	Sample Location				
	HW-1 Influent (SP-HW1) [1]	Post Air Stripper (SP-2000)	Post GAC 1 (SP-GAC1) [2]	Post GAC 2 (SP-GAC2) [2]	Effluent (SP-3000)
Weeks 1 and 2					
0.1	P, V	P, V	P, V	P, V	P, V
0.25	P, V, W	P, V	P, V	P, V	P, V, W
1	P, V	P, V	P, V	P, V	P, V
2	P, V	P, V	P, V	P, V	P, V
3	P, V	P, V	P, V	P, V	P, V
4	P, V	P, V	P, V	P, V	P, V
5	P, V	P, V	P, V	P, V	P, V
6	P, V	P, V	P, V	P, V	P, V
7	P, V, W	P, V	P, V	P, V	P, V, W
8	P, V	P, V	P, V	P, V	P, V
9	P, V	P, V	P, V	P, V	P, V
10	P, V	P, V	P, V	P, V	P, V
11	P, V	P, V	P, V	P, V	P, V
12	P, V	P, V	P, V	P, V	P, V
13	P, V	P, V	P, V	P, V	P, V
14 [3]	P, V, W	P, V	P, V	P, V	P, V, W
Weeks 3 and 4					
16	P, V	P, V	P, V	P, V	P, V
18	P, V	P, V	P, V	P, V	P, V
20	P, V	P, V	P, V	P, V	P, V
22	P, V	P, V	P, V	P, V	P, V
24	P, V	P, V	P, V	P, V	P, V
26	P, V	P, V	P, V	P, V	P, V
28 [3]	P, V, W	P, V	P, V	P, V	P, V, W
Months 2 thru 12*					
Bi-weekly (Days 35 thru 365)	P, V	P, V	P, V	P, V	P, V

Notes

[1] - SP-HW1 located in the HW-1 wellhead enclosure

[2] - GAC vessels will be connected with flexible hosing. SP-GAC1 and SP-GAC2 will be located on the flexible hosing connection and

[3] - Sampling frequency should only be reduced (daily to every other day, every other day to monthly) if flowrates and contaminant concentration have shown stabilization

Additional sample ports will be provided pre- and post-bag filters, but sampling during commissioning is not necessary.

P - On-Site Analysis for Pyridine, 2,6-Dichloropyridine, 2 chloropyridine

V - On-Site Analysis for Volatile Organic Compounds (chloroform, carbon tetrachloride, methylene chloride)

W- Water Chemistry (pH, alkalinity, TDS, TSS, hardness, calcium. magnesium, iron, ORP, TOC) Off-site analysis by Paradigm

* Periodic water chemistry analysis to be performed monthly from months 2 to 12 or as needed

Prepared by: NMB 3/8/24
Checked by: MS 3/11/24

APPENDIX A
MONITORING SCHEDULE

APPENDIX A

12-MONTH GROUNDWATER MONITORING SCHEDULE
ARCH CHEMICALS, INC.
ROCHESTER, NEW YORK

ARCH CHEMICALS, INC.					**MONITORING EVENT**									
MONITORING PROGRAM - 12 months -following startup of HW-1					**Q1**		**Q2**		**Q3**		**Q4**		**TOTAL**	
	Well	***zone***	***Area/Property***	***Purpose***	***Pyridines***	***VOCs***	***Pyridines***	***VOCs***	***Pyridines***	***VOCs***	***Pyridines***	***VOCs***	***Pyridines***	***VOCs***
	BR-103	BR	*Buff Business Ctr*	perimeter sentinel/trend monitoring	1	1			1	1			2	2
	MW-103	OB	*Buff Business Ctr*	perimeter sentinel/trend monitoring	1	1			1	1			2	2
OFF-SITE	BR-105	BR	RG&E ROW	perimeter sentinel/trend monitoring	1	1	1	1	1	1	1	1	4	4
WELLS	BR-105D	BR deep	RG&E ROW	perimeter sentinel/trend monitoring	1	1	1	1	1	1	1	1	4	4
	MW-106	OB	AID-HOSP	perimeter sentinel/trend monitoring	1	1	1	1	1	1	1	1	4	4
	BR-106	BR	AID-HOSP	perimeter sentinel/trend monitoring	1	1	1	1	1	1	1	1	4	4
	BR-108	BR	AID-HOSP	trend monitoring	1	1			1	1			2	2
	MW-108	OB	AID-HOSP	trend monitoring	1	1			1	1			2	2
	BR-111D	BR deep	NYSDOT	trend monitoring	1				1				2	0
	BR-112D	BR deep	NYSDOT	trend monitoring	1				1				2	0
	BR-113D	BR deep	NYSDOT	trend monitoring	1				1				2	0
	MW-114	OB	Irish Propane	trend monitoring	1	1							1	1
	BR-114	BR	Irish Propane	trend monitoring	1	1							1	1
	BR-117D	BR deep	QUARRY	trend monitoring	1								1	0
	BR-118D	BR deep	QUARRY	trend monitoring	1								1	0
	BR-122D	BR deep	QUARRY	trend monitoring	1								1	0
	BR-123D	BR deep	QUARRY	trend monitoring	1								1	0
	PZ-101	BR	AID-HOSP	perimeter sentinel/trend monitoring	1	1			1	1			2	2
	PZ-102	BR	AID-HOSP	perimeter sentinel/trend monitoring	1	1	1	1	1	1	1	1	4	4
	PZ-103	BR	AID-HOSP	perimeter sentinel/trend monitoring	1	1	1	1	1	1	1	1	4	4
ON-SITE	PZ-104	BR		perimeter sentinel/trend monitoring	1	1	1	1	1	1	1	1	4	4
WELLS	PZ-105	BR		trend monitoring	1	1			1	1			2	2
	PZ-106	BR		trend monitoring	1	1			1	1			2	2
	PZ-107	BR		perimeter sentinel/trend monitoring	1	1	1	1	1	1	1	1	4	4
	BR-104	BR		perimeter sentinel/trend monitoring	1	1			1	1			2	2
	MW-104	OB		perimeter sentinel/trend monitoring	1	1			1	1			2	2
	BR-126	BR		trend monitoring	1	1			1	1			2	2
	BR-127	BR		inactive pumping well	1	1			1	1			2	2
	BR-3	BR		trend monitoring	1	1							1	1
	BR-8	BR		trend monitoring	1	1	1	1	1	1	1	1	4	4
	BR-9	BR		former pumping well	1	1			1	1			2	2
	BR-5A	BR		trend monitoring	1	1			1	1			2	2
	BR-6A	BR		trend monitoring	1	1			1	1			2	2
	BR-7A	BR		inactive pumping well	1	1	1	1	1	1	1	1	4	4
	B-16	OB		perimeter sentinel/trend monitoring	1	1			1	1			2	2
	B-17	OB		trend monitoring	1	1							1	1
	B-7	OB		trend monitoring	1	1							1	1
	B-15	OB		perimeter sentinel/trend monitoring	1	1			1	1			2	2
	E-3	OB		trend monitoring	1	1							1	1
	MW-127	OB		perimeter sentinel/trend monitoring	1	1			1	1			2	2
	PW12	BR		trend monitoring	1	1	1	1	1	1	1	1	4	4
	PW13	BR		inactive pumping well	1	1	1	1	1	1	1	1	4	4
	PW14	OB/BR		trend monitoring	1	1			1	1			2	2
	PW15	BR		inactive pumping well	1	1			1	1			2	2
	PW16	BR		former pumping well	1	1	1	1	1	1	1	1	4	4
	PW17	BR		former pumping well	1	1			1	1			2	2
EFFLUENT	HW-1	Pumping well		HW-1 discharge before air stripper	1	1	1	1	1	1	1	1	4	4
SAMPLES	AS-EFF	Air Stripper		Effluent from air stripper	1	1	1	1	1	1	1	1	4	4
	GAC-EFF	GAC beds		Effluent from 3rd GAC bed	1	1	1	1	1	1	1	1	4	4
QUARRY/CANAL	QS-4	quarry seep	QUARRY	trend monitoring	1				1				2	0
MONITORING	QD-1	quarry ditch	DITCH	trend monitoring	1				1				2	0
	QO-2	quarry outfall	DITCH	trend monitoring	1				1				2	0
	QO-2S1	canal at outfall	CANAL	surface water monitoring	1				1				2	0
TOTAL SAMPLES					51	40	16	16	41	34	16	16	124	106

Notes:
RG&E ROW = Rochester Gas and Electric Right of Way
N/F = now or formerly
AID-HOSP = Aid to Hospitals
NYSDOT = New York State Department of Transportation
Samples will be collected for off-site laboratory analysis for VOCs (Method 8260) and chloropyridines (Method 8270)
for list of compounds that have been analyzed historically for the semi-annual groundwater monitoring program

Prepared/Date:NMB 02/12/24
Checked/Date:TNG 02/15/24

APPENDIX B
OFF-SITE SAMPLE LOCATIONS

Legend

Property Owned by Lonza

Monitoring Well

NOTES

1. Source - Topographic Quadrangle 7.5-Minute Series

N

0 250 500 Feet

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Prepared/Date: NES 03/04/24	Checked/Date: NMB 03/04/24

I-390

ERIE BARGE CANAL

HOWMET

ARCH

BUFFALO RD. BUSINESS CENTER

MW-103/BR-103

MW-108/BR-108

PZ-102

BR-111/BR-111D

BR-106/MW-106

PZ-103

MW-16

AID TO HOSPITALS

BR-112A/BR-112D

MW-105/BR-105

MW-104/BR-104

BUFFALO ROAD

MW-114/BR-114

CUMBERLAND FARMS PETROLEUM TERMINAL

BR-113/BR-113D

LEXINGTON

GENERAL RAIL SIGNAL CO.

HOWARD ROAD

DOLOMITE PRODUCTS QUARRY

BR-122D

PFAUDLER

BR-117/BR-117D

BR-118/BR-118D

BR-123D

BR-116/BR-116D

I-390

ERIE BARGE CANAL

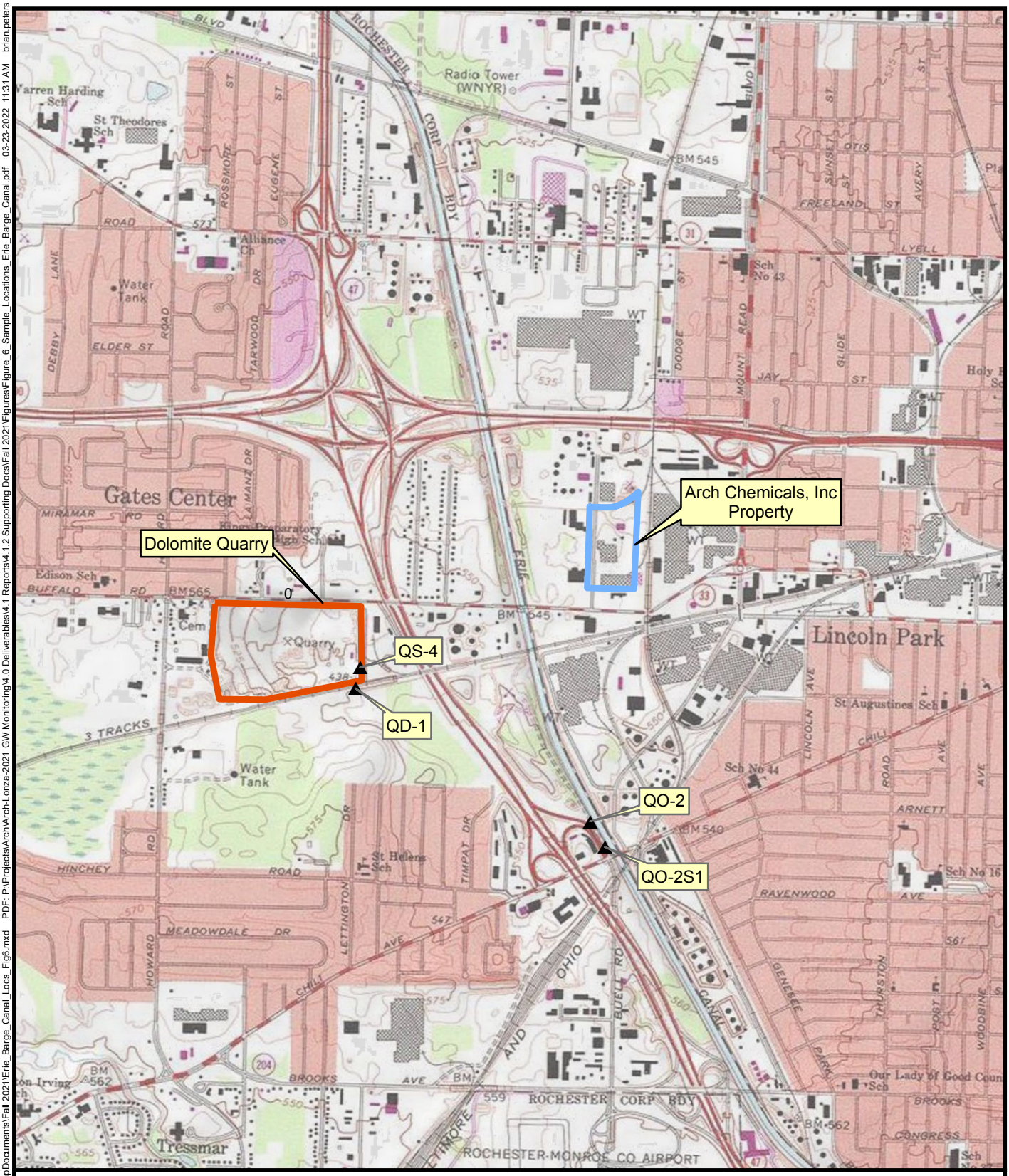
LETTINGTON DRIVE

BR-124D

Figure B.1
Off-Site Groundwater Monitoring Well Locations

Arch Chemicals, Inc.
Rochester, NY

Document: \\corp.pbwan.net\GLB-E&I\US\USPWM100-PLD2\Project\Projects\Arch\Rochester\GIS\MapDocuments\Arch_OffsiteWells.mxd PDF: \\corp.pbwan.net\GLB-E&I\US\USPWM100-PLD2\Project\Projects\Arch\2024 Arch Remediation\4.0 Deliverables\4.2 Work Plans\Basis of Design Work Plan\Figures\Figure B1 - Off-Site GW Locations.pdf 03/05/2023 11:55 AM nathan.soule



Topographic map: Copyright:© 2013 National Geographic Society, i-cubed

0 1,000 2,000 Feet

N

Legend

- Arch Chemicals, Inc. Property
- Dolomite Quarry Boundary
- ▲ Surface Water Sample Location

Figure B.2
Sample Locations
Erie Barge Canal

Arch Chemicals, Inc.
Rochester, NY

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Prepared/Date: BRP 03-23-22	Checked/Date: JAR 03-05-24

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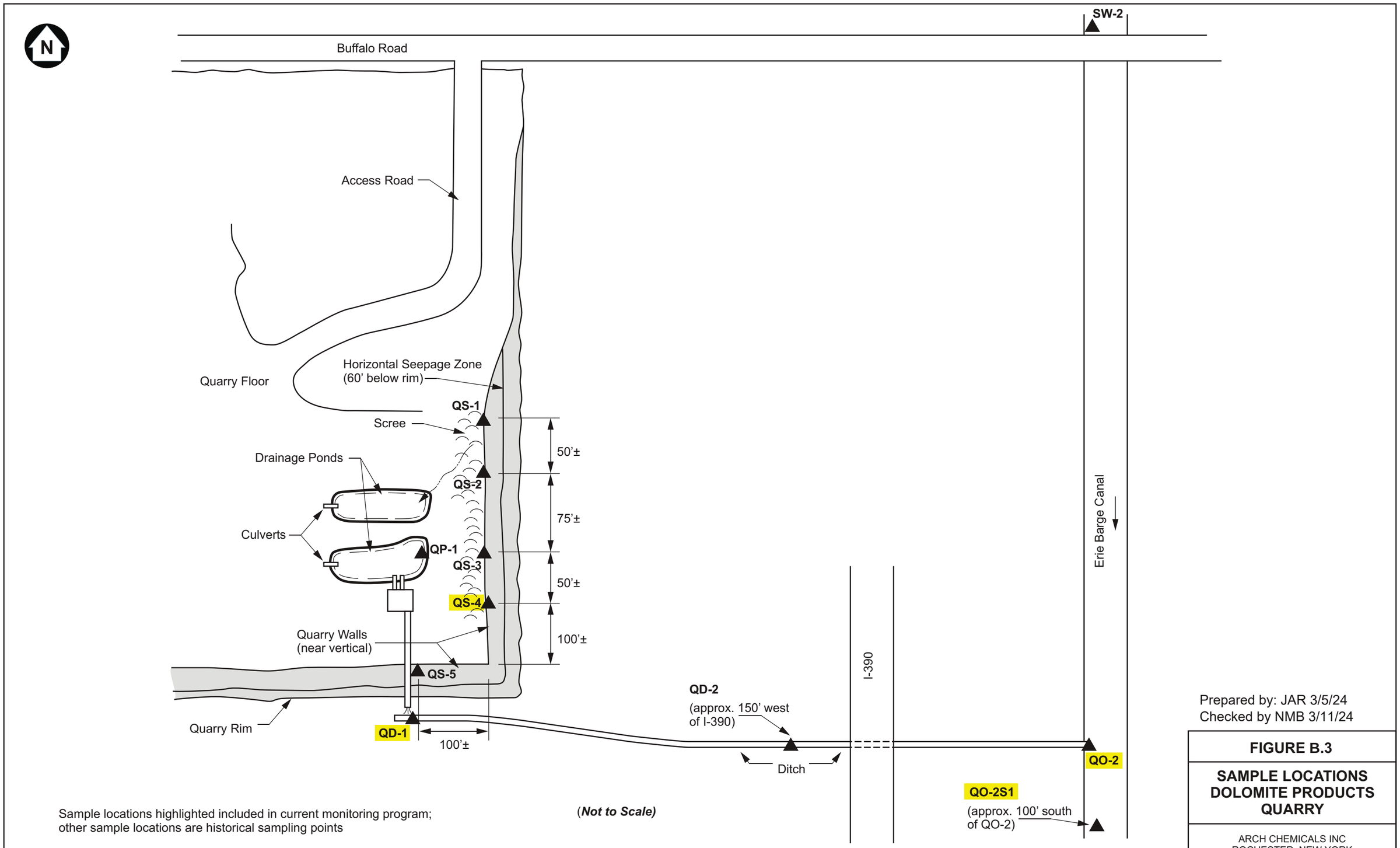

Prepared by: JAR 3/5/24
Checked by NMB 3/11/24

FIGURE B.3

SAMPLE LOCATIONS
DOLOMITE PRODUCTS
QUARRY

ARCH CHEMICALS INC
ROCHESTER, NEW YORK

W2004030a.cdr