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Sent via Electronic Mail

May 11, 2025

Mr. George Jacob
U.S. Environmental Protection Agency, Region II
Emergency and Remedial Response Division
Central New York Remediation Section
290 Broadway, 20th Floor
New York, NY 10007-1866

Subject: York Oil Superfund Site
Moira, New York
Submission of Revised Augmented Bioavailable Absorbent Media (BAM) Injection Work Plan & Response to Comments

Dear Mr. Jacob:

Attached for your review and approval, please find our responses to agencies' comments on the February 1, 2025 Augmented Bioavailable Absorbent Media (BAM) Injection Work Plan. In addition, we have included for your review and approval a revised Augmented Bioavailable Absorbent Media (BAM) Injection Work Plan.

Please contact me if you have any questions.

Sincerely,

Bruce Thompson
Project Coordinator
de maximis inc.

cc: Todd Furnia, Arconic
Nicole Hinze, NYSDEC

Enclosures

USEPA and NYSDEC comments on Augmented Bioavailable Absorbent Media (BAM)™ Work Plan dated February 1, 2025

<u>General Comments:</u>

1. Agencies need more details to better conceptualize the described PRB installation. Are the bio injections being called a PRB here while PRB has a specific meaning and specific design?
   <u>Response:</u> *Yes, the bio injections are referred to as a PRB in the Work Plan. A PRB was defined in the Work Plan as line(s) of injection points across the width of the plume, perpendicular to the groundwater flow direction. In this strategy, the remediation utilizes the natural permeability in the buried channel, it relies on injecting reactive materials into the plume, and due to its location, it serves as a barrier, where contaminated groundwater enters the barrier and treated groundwater leaves the barrier. The Work Plan discusses two potential configurations of the PRB, which have been revised in response to Specific Comment 4.*

2. Parts of the report are written in first person (we, our) – suggest revising occurrences (i.e., Section 2.5 pg. 9 par 6: "we updated the conceptual site model" to "the conceptual site model was updated").
   <u>Response:</u> *Text will be revised accordingly.*

3. Please specify how investigation derived waste generated during Phase 1 will be managed.
   <u>Response:</u> *Investigative derived waste (IDW) will be containerized and characterized / sampled to determine proper off-site disposal*

4. Need further discussion on Augmented BAM Injection Decision Tree and YO-117DR Installation.

   <u>Response:</u> *In response to Specific Comment 4, the Augmented BAM Injection Decision Tree and report text have been revised to clarify that Augmented BAM will be injected along the interval of contamination. The following additional text will be added to the YO-117DR installation section: if Phase 1 results collected from B-06 indicate an unmonitored zone with groundwater concentrations above OU2 ROD decision levels both above and below the current screened interval of YO-117D, up to three monitoring wells will be installed. If Phase 1 results collected from B-06 indicate an unmonitored zone with groundwater concentrations above OU2 ROD* *decision levels either above or below the current screened interval of YO-117D, up to two monitoring wells will be installed. If Phase 1 results collected from B-06 do not indicate unmonitored zones with groundwater concentrations above OU2 ROD decision levels either above or below the current screened interval of YO-117D, one monitoring well will be installed.*

Specific Comments:

1. Section 3.2.2 par. 2: This paragraph states that YO-117S and YO-117D are nested (i.e., in the same borehole), but also suggests they are installed a few feet apart. Both are not likely to be true. Figure 11 shows YO-117D as an independent well. Please revise all occurrences of nested language where the actual intent is a paired or clustered wells (See Section 3.2.4, 4.3, among others).
   Response: *Text will be revised accordingly.*

2. Section 3.3.2 bullet 1: A possible explanation for the lack of increase of BTEX in other wells is that they are on different flow paths – the only well in the paleochannel preferential flow path is the YO-117 wells.

   Response: *It is possible there are other explanations for these anomalous concentration trends. This is why we are proposing additional site investigation activities. To avoid confusion, bullet 1 in the "reagent injection induced mobilization of site contaminants is refuted by the following information" section will be removed.*

3. Section 4.1 par. 2: In addition to screening soil samples with a PID and performing LNAPL shake test, soil samples with elevated PID readings or observed NAPL should be submitted for lab analysis.

   Response: *Agreed, samples with elevated PID readings will be submitted to the laboratory for chemical analysis.*

4. Section 4.1 par. 4 and Figure 17: This paragraph suggests that BAM will only be injected in locations where GW COCs exceed ROD goals. USEPA suggests that at a minimum, the vertical extent of injections spans the entire interval of contamination, regardless of potential clean samples in between. PRBs typically cover the entire contaminated interval from water table to confining layer to minimize the possibility of creating new flow paths due to changes in permeability

that will divert contaminants around the PRB. For this reason, the horizontal extent of each injection point should also overlap.

Response: *Text will be updated to clarify that BAM injections (i.e., the PRB) will span the interval of contamination. Vertical and horizontal groundwater gradients at the site have remained relatively consistent over time. Thus, there is currently no evidence to suggest that changes in permeability will divert contaminants around the PRB, therefore injections spanning the interval of contamination should be sufficient. The ROI assumed for BAM injections is 10 ft. This is smaller than the assumed ROI of 14 ft used in the PlumeStop™ Injection design in 2021 and thus should provide sufficient overlap.*

5. Section 4.2 par 1: Monitoring wells identified for abandonment need to be presented and approved by USEPA/NYSDEC prior to abandonment. Supporting rationale should include whether or not the well is part of the LTM and COC trend analysis.

Response: Please see Table 3 and Figure 19 for a list and location, respectively, of proposed wells to be abandoned. The proposed wells to be abandoned are not part of the long-term monitoring program nor part of the long-term monitoring COC trend analysis.

6. Section 4.3 par. 2: How was it determined that the Augmented BAM injections will not need to utilize enhanced permeability emplacement, like previous injections?

Response: *Enhanced Permeability Emplacement (EPE) was used at the York Oil Site as a pilot study associated with the injection well installation process in 2015. These injection wells were used to inject LactOil® in 2015 and PlumeStop™ in 2018. In 2021, the conceptual site model was updated, and the reworked till was identified as the zone of enhanced transport (higher hydraulic conductivity). Eight new injection wells were installed and screened in the reworked till in 2021 and 2022. EPE was not used in the 2021 injection well installation process. In 2022, PlumeStop™ was injected into the 8 new monitoring wells. COC concentrations in downgradient monitoring wells were reduced overall following the 2022 PlumeStop™ Injection, indicating that EPE is not needed. Furthermore, EPE is thought to be the most likely mechanism for damage to YO-117D and minimizing potential damage to additional monitoring wells is an important consideration.*

7. Section 4.3 par 1: If the PRB location needs to be moved further south because of LNAPL or other elevated contamination, Agencies request the installation of an additional monitoring well upgradient of the PRB in the area of LNAPL or elevated concentrations in addition to YO-117DR downgradient of the PRB.

<u>Response:</u> *If the PRB location is moved further south due to the presence of LNAPL or elevated contamination, an additional monitoring well will be installed upgradient of the PRB.*

Work Plan for Augmented Bioavailable Absorbent Media (BAM)^{TM} Injection

York Oil Superfund Site
Moira, NY

Prepared for:

de maximis, inc.

de maximis, inc.

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Prepared By:

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TABLES

FIGURES

APPENDICES

1. INTRODUCTION

The York Oil facility is located in Moira, Franklin County, New York (Figure 1). The facility was constructed in the 1950s by the York Oil Company, which processed used oils collected from service stations, car dealers, and industrial facilities. The oils, some of which contained polychlorinated biphenyls (PCBs) and solvents, were processed to remove impurities and resold to other businesses. The oil recycling operation was discontinued in the mid-1960s. The property was then used by Pierce Brothers Oil Services, Inc., for used oil storage. The collected oils were stored or processed in eight aboveground storage tanks, three earthen-dammed settling lagoons, and at least one underground storage tank.

The Site was added to the National Priorities List (NPL) in September 1983 (Figure 2). For investigation and remediation purposes, the Site was divided into two operable units (OUs): the "Site Proper" and the "Contamination Pathways" (OU1 and OU2, respectively). In February 1988, EPA signed a Record of Decision (ROD) selecting a source control remedy for the “Site Proper”. The OU1 ROD required excavation, treatment, and on-site disposal of contaminated soils and sediments, installation of deep groundwater draw-down wells at the edges of the site to collect the sinking plume of phenol-contaminated groundwater; installation of shallow dewatering wells to collect contaminated groundwater and oil during excavation, and treating these liquids prior to discharging the treated groundwater in accordance with state environmental requirements; removing and transporting contaminated tank oils to an EPA-approved facility to be incinerated; cleaning and demolishing the empty storage tanks; and inspecting the site every five years to assure that human health and the environment continue to be protected. The OU1 ROD was followed by the OU1 Unilateral Administrative Order (UAO) in April of 1994 and the OU1 Consent Decree (CD) in August of 1996. The OU1 remedy construction was completed in 2005.

The Contamination Pathways studies resulted in a ROD issued in September 1998. The OU2 ROD required excavation of lead- and PCB-contaminated sediments from the Western Wetland and Northwestern Wetland, followed by solidification/stabilization and on-site disposal; natural attenuation of the solvents in groundwater in the Southern Wetland; institutional controls (ICs) to prevent the installation and use of groundwater wells in the Southern Wetland; and long-term groundwater monitoring. The OU2 ROD was followed by the OU2 UAO in December 1998 and the OU2 CD in November 2000. The OU2 remedy construction was completed in 2002.

Operation of the OU1 groundwater treatment system (GWTS) started in December 2001. Phenol was not found in the influent; the target compounds were volatile organic compounds (VOCs), principally cis-1,2-dichloroethene (cDCE). Alternatives to continued operation of the GWTS were evaluated in 2009, resulting in shut down of the GWTS in favor of in situ treatment.

2.0 HISTORIC IN SITU TREATMENT METHODS

An investigation was conducted in spring 2009 of the former lagoon area immediately upgradient from the GWTS, which revealed ~2,000 cubic yards of subsurface soil containing total petroleum hydrocarbons (TPH). In addition to the TPH, some soil samples contained cDCE and tetrachloroethene (also called perchloroethene, or “PCE”). PCE degrades to cDCE through an intermediate product, trichloroethene (TCE). PCE and TCE have partitioned into the TPH and were postulated to be dissolving into groundwater. TPH could potentially serve as an electron donor that facilitates biological degradation to cDCE. Previous analysis of monitored natural attenuation (MNA) data identified the lack of electron donor as a limiting factor for successful biological degradation of cDCE, so approaches to increase electron donor were utilized.

2.1 *In Situ* Chemical Reduction (ISCR)

An evaluation of feasible alternatives was performed, and EHC® was identified as a preferred *in situ* remedial option for OU-1 groundwater. EHC® is a patented combination of controlled-release carbon, and zero valent iron (ZVI) particles used for stimulating *in situ* chemical reduction (ISCR) of otherwise persistent organic compounds in groundwater.

The EHC® process was proposed to USEPA at a meeting in February 2009, and a full-scale pilot study was proposed in July 2009 and approved by USEPA in August 2009. In September 2009, the groundwater extraction and treatment system was shut down and the system was drained for long-term inactivation.

Phase I of the *in situ* chemical reduction pilot study was completed in October 2009 with the installation of a 200-foot-long EHC®-amended permeable reactive barrier (PRB) at a targeted depth of 6 to 35 ft. bgs. Quarterly groundwater sampling was initiated following EHC® injection. Post-injection groundwater level measurements near the PRB did not indicate any changes to the direction of groundwater flow. Groundwater sampling was reduced to semiannual during 2012.

As part of the *In Situ* Chemical Reduction Pilot Study, five new monitoring wells (YO-117S, YO-117D, YO-118, YO-119, and YO-120) were installed in October 2009.

2.2 ISCR – Phase II

In October 2011, in a letter to USEPA, on behalf of Alcoa, *de maximis* proposed a Phase II to the *in situ* chemical reduction pilot study, with the goal of enhancing the performance of the PRB through application of additional EHC®. The EHC® was to be injected using direct push technology (DPT), with locations spaced closer together compared to Phase I to ensure creation of a continuous treatment zone. In addition, the barrier would extend further to the west to create a greater influence on the YO-12 well cluster area. The total length of the PRB would be approximately 240 ft. and extend to a depth of 6 to 43 ft. bgs. To address the recent detections of benzene, toluene, ethylbenzene and xylene (BTEX) compounds immediately downgradient of the prior EHC® injection area, *de maximis* recommended that an EHC® product containing a sulfate salt be used to further stimulate the degradation of BTEX by anaerobic oxidation via sulfate reduction.

From October 31 to November 1, 2011, Paragon Environmental Construction, Adventus, *de maximis* and CDM Smith were onsite to perform the Phase II EHC® injection via DPT. Numerous attempts were made to direct push to 43 ft. bgs that were ultimately unsuccessful due to subsurface conditions (cobble layer). One injection point was drilled to depth, but the EHC® could not be injected because the injection tip would not open. Once the injection tip was retrieved it was evident the cobble layer had damaged the injection tip, rendering the rod unusable.

After two field days of unsuccessful attempts, the Phase II EHC® injection was abandoned. Adventus, *de maximis*, Alcoa and CDM Smith decided to explore new avenues for possible EHC® injection in spring 2012. Meanwhile, the December 2011 groundwater sampling round indicated only one well where the OU-1 cleanup levels were exceeded. Based on the difficulties encountered during the October 2011 injection attempt and the subsequent improvements in groundwater quality, semi-annual groundwater monitoring was extended through 2014.

2.3 In Situ Bioremediation via Enhanced Reductive Dechlorination

On November 6th, 2015, on behalf of Alcoa, *de maximis* proposed a Work Plan to USEPA to inject LactOil® at the York Oil Superfund Site. The lack of an electron donor was targeted as a limiting factor for successful biodegradation of cDCE. From November through December 2015, five new wells were installed in OU-1. YO-121, YO-122, YO-123, and YO-124 are overburden wells used for injection of LactOil®. YO-125R, a bedrock well, is used for monitoring.

An environmental fracturing process was used to emplace enhanced permeability sand lenses out to a target radius of approximately 15 to 20 ft. from the injection boreholes. The permeability enhancement injection process (environmental fracturing) caused a "tensile parting" of the soil to emplace a sand and guar mixture in a planar lens extending out from the injection borehole. Once the guar breaks down or is extracted during well development, the sand-filled lens remains to provide a high permeability injection pathway that can be used multiple times to inject electron donor to sustain a biological treatment zone between OU1 and OU2.

The use of injection wells means that instead of the solid / slurry EHC, a liquid reagent was used and approximately 1,400 gallons of a 5% solution of LactOil® was injected using hydraulic fracturing into the subsurface in the fall of 2015. This is equivalent to 5,000 pounds. Groundwater monitoring occurred in 2016 and 2017 to evaluate the effectiveness of this treatment. The following conclusions were made based on these data:

- *In Situ* Bioremediation Treatment Pilot Study - Results indicate reducing conditions were achieved within the injection zone, and a reduction in cDCE has been observed in downgradient wells with the exception of YO-111D and YO-117D. With the change to more reducing conditions, it appears the environment continues to support enhanced biodegradation of cDCE and vinyl chloride (VC). In fact, ethene concentrations were at all-time highs in YO-117D in 2017.
- As of the end of 2017, the added electron donor was still providing total organic carbon (TOC) thereby providing the desired reducing conditions and resulting in complete reductive dechlorination to ethene.
- Recent OU-1 groundwater results have been below OU-1 ROD cleanup levels; therefore, OU-1 groundwater standards have been satisfied. Under the OU-1 ROD and Consent Decree, further treatment is not required.
- Increases in BTEX compounds have been observed at some monitoring wells since the injection of EHC®, most notably at downgradient locations YO-12RX, YO-14X, and YO-117D. Several factors potentially associated with the injections could be causing these conditions, including enhanced preferential pathways and changes in redox conditions and/or co-solubility. As BTEX compounds are readily aerobically biodegradable, the extent of these impacts is expected to be very limited once these contaminants have migrated beyond the injection zone.

2.4 *In Situ* Treatment with PlumeStop™

In October 2018, in a letter to USEPA, on behalf of Alcoa, de maximis proposed a Work Plan to inject PlumeStop™, a colloidal liquid activated carbon (LAC), at the York Oil Superfund Site. PlumeStop™ was chosen to proactively address increasing BTEX concentrations in the upgradient portion of the OU2

Southern Wetlands, as well as cDCE. The LAC component of PlumeStop^{TM} is primarily intended to target BTEX. CVOCs also sorb to the LAC and both the BTEX and cVOCs are ultimately expected to biodegrade, freeing binding sites for continuing sorption and degradation.

In November 2018, 8,800 pounds of PlumeStop^{TM} LAC was injected using the four existing injection wells installed in 2015: YO-121, YO-122, YO-123, and YO-124 (Figure 3). These injection wells are spaced approximately 30 ft apart and are screened from 19 to 39 feet below ground surface (ft bgs). Groundwater monitoring occurred in 2019 and 2020 to evaluate the effectiveness of this treatment. The following conclusions were made based on these data:

- 2018 *In Situ* PlumeStop^{TM} Treatment - Results indicate enhanced sorption and biodegredation within the injection zone, and a consistent reduction in cVOCs and BTEX has been observed in all downgradient wells except YO-117D. cVOC and BTEX concentrations decreased initially following 2018 treatment at YO-117D but have increased since the May 2019 sampling event.
- Decreasing cVOC and BTEX concentrations at the downgradient wells throughout 2019 and 2020 can be attributed to sorption to PlumeStop^{TM} and natural attenuation.
- The current injection wells are missing/applying only a small amount of PlumeStop^{TM} to YO-117D, which is ~55 ft downgradient of the injection wells. However, PlumeStop^{TM} is reaching YO-58, which is ~265 ft downgradient of the injection wells. Thus, a re-conceptualization of the site hydrogeology was needed to understand why concentrations in YO-117D remain elevated.

2.5 Conceptual Site Model Update and *In Situ* Treatment with PlumeStop^{TM}

In an effort to further address the increasing trend of VOC concentrations near the YO-117S/ YO-117D cluster, additional in-situ chemical reduction (ISCR) (e.g., PlumeStop^{TM} , a liquid activated carbon) was proposed along the former railroad corridor in the vicinity of the YO-117S/YO-117D cluster. The *Conceptual Site Model Update and Work Plan for PlumeStop^{TM} Injection* was approved by EPA via email on October 13, 2021.

As part of the conceptual site model (CSM) update, the primary hydrogeologic and contaminant transport data available for the site was reviewed. The hydrogeologic data review involved examining lithologic logs at the site and published geologic reports and evaluating groundwater elevation data and slug test data. The contaminant transport data review consisted of analyzing concentration trend data and conducting a breakthrough curve (BTC) analysis. Following the data review, the CSM was updated as follows:

- The site contains a glaciofluvial paleochannel, which heads southeast along the edge of the landfill and then turns due south near the OU1/OU2 boundary,
- The paleochannel is filled with reworked till and fill/alluvium; the base of the paleochannel is defined by the top of the consolidated till,
- The paleochannel shape dictates the groundwater flow direction in the reworked till,
- The reworked till is a zone of enhanced transport (higher hydraulic conductivity (K)),
- Contamination is highest in the reworked till (cVOCs and BTEX), and
- YO-117D is located within a paleochannel and is screened in the reworked till.

In coordination with the CSM update, a remedial strategy was designed to target the reworked till within the paleochannel. Eight additional injection wells designated as IP-2, IP-3, IP-4, IP-5, IP-6, IP-7, IP-8, and IP-9 were installed at the site and screened in the reworked till and three additional soil borings were completed between October 25th and November 11th , 2021, and between April 4th and April 13th , 2022. The injection wells were constructed with a 4-inch diameter schedule 80 PVC solid casing and a stainless-steel wire wrapped, 0.020” slot well screen.

Regenesis Remediation Services (RRS) completed an in-situ injection application of PlumeStop™ Liquid Activated Carbon® into ten injection wells at the site between May 18th and May 24th , 2022. These wells included the eight new injection wells listed above and two existing injection wells designated as YO-123 and YO-124. A total of 16,000 pounds of PlumeStop™ was mixed with water and injected as a 23,598-gallon slurry. This was followed by an injection of 450 pounds (4,500 gallons) of calcium chloride, which serves as a parking agent for the PlumeStop™ . Additional details regarding injection well installation and Plumestop™ injection are provided in the 2022 Annual Report.

OU2 monitoring wells were sampled in November 2023, eighteen (18) months after PlumeStop™ injection. Groundwater sampling results at the majority of monitoring wells including YO-117D indicate a significant decline in cVOCs including TCE, cDCE, trans-1,2-DCE, 1,1-Dichloroethane (1,1-DCA), 1,2-DCA, and VC between October 2021 and November 2023. Notably, concentrations of cDCE, trans-1,2-DCE, 1,2-DCA, and VC at YO-117D declined to levels below the OU2 ROD cleanup levels after Plumestop™ Injection, thereby demonstrating that Plumestop™ Injection was effective in remediating cVOCs in groundwater at the site. Concentrations of TCE and 1,1-DCA at YO-117D were already below OU2 ROD cleanup levels in 2021 and have continued to remain below the OU2 ROD cleanup levels. The sampling results also indicate a decline in benzene concentration at the majority of monitoring wells where benzene has historically been detected including YO-117S after Plumestop™ injection. However, benzene concentrations at YO-117D are still above the OU2 ROD cleanup levels. Ethylbenzene concentrations declined in groundwater samples collected at monitoring wells YO-14X and YO-117S. Xylene concentrations declined after Plumestop™ injection and were no longer detected at monitoring well YO-117S. Groundwater concentrations for ethylbenzene, toluene, and xylenes increased slightly at YO-117D and remain above OU2 ROD cleanup levels.

As discussed above, cVOC concentrations in site groundwater significantly decreased following PlumeStop™ injection. The most notable decrease occurred at YO-117D where total cVOCs decreased from 223.8 ug/L to 3.2 ug/L between October 2021 and November 2023. BTEX concentrations in groundwater declined or remained stable over the same period at all monitoring wells except YO-117D. Over this period, total BTEX concentrations at YO-117D increased from 386 ug/L to 470 ug/L.

Remediation agents, such as PlumeStop™ , which rely on activated carbon as the main active ingredient are typically effective at remediating BTEX, due to the highly sorptive nature of these chemicals. These remediation agents are typically less effective at remediating cVOCs. Thus, the results at YO-117D are somewhat unexpected.

To better understand observed cVOC and BTEX concentrations at YO-117D the conceptual site model was updated to reflect recent data collection and available data was reviewed to establish possible explanations of the PlumeStop™ results.

3.0 RECENT SITE CONCEPTUAL SITE MODEL UPDATES AND DATA REVIEW

3.1 Conceptual Site Model Updates

Additional hydrogeologic data were collected as part of the 2021 and 2022 site work. Detailed lithology logs were prepared for the nine injection wells and three soil borings. These lithology logs were used to refine the paleochannel delineation both spatially (Figure 4) and at depth (Figures 5, 6 and 7). Screening level groundwater samples were collected from a subset of the injection well borings and soil borings prior to installation or abandonment, respectively (Table 1). These results indicate that cVOC and BTEX groundwater concentrations within the reworked till are highest at IP-3, IP-4, and IP-5, which lie in the deepest portion of the paleochannel. At IP-9 and SB-12, the other locations where groundwater samples were collected, cVOC and BTEX groundwater concentrations are below OU2 ROD cleanup levels.

3.2 Data Reviewed to Establish Possible Explanations of PlumeStop™ Results

3.2.1. Time Series Concentration Data at YO-117D

Time series concentration data from YO-117D was reviewed from October 2009 to November 2023 (Figure 8). EHC® was injected upgradient of YO-117D in September 2009. Following injection, Ketones increased at YO-117D and remained elevated through September 2010. From November 2010 to October 2015, total cVOC concentrations increased by approximately 293 ug/L and total BTEX concentrations increased by approximately 28 ug/L. In November 2015, four new permanent injection wells were installed upgradient of YO-117D: YO-121, YO-122, YO-123 and YO-124. Prior to completion, pneumatic fracturing and proppant injection were performed to enhance distribution of injected reagent. In December 2015, LactOil was injected into the new permanent injection wells. Following LactOil Injection, total cVOC concentrations decreased to 23.82 ug/L by October 2018. However, over this same period total BTEX concentrations sharply increased by approximately 407 ug/L. In November 2018, PlumeStop™ was injected into the four permanent injection wells. Following this PlumeStop™ injection, there was an immediate decline in cVOC and BTEX concentrations. cVOC concentrations decreased from approximately 24 ug/L to 12 ug/L between October 2018 and May 2019 and total BTEX concentrations declined by 202 ug/L over this same period. From May 2019 to November 2023, total BTEX concentrations have continued to increase at YO-117D, where a concentration of 470 ug/L was detected in November 2023. PlumeStop™ was injected in May 2022 into a new set of injection wells installed in 2021 and 2022. Following PlumeStop™ injection a significant decline in cVOCs was observed, while total BTEX concentrations increased. YO-117D has exhibited anomalous BTEX concentrations in response to historical LactOil remediation and recent PlumeStop™ injection.

Percentages of Benzene, Toluene, and Xylenes were also evaluated at YO-117D. Results from 34 sampling events between October 2009 and November 2023 were plotted on a ternary diagram (Figure 9). Samples collected between October 2009 and September 2010 fall along Time Arrow 1 and exhibit decreasing benzene concentrations and increasing toluene concentrations over the period. Xylenes concentrations remained stable. Samples collected between November 2010 and October 2015 fall along Time Arrow 2 and show decreasing toluene concentrations and increasing benzene and xylenes concentrations. Both time arrows represent the period following EHC injection. Time Arrow 1 correlates with the period of elevated Ketones in YO-117D, and Time Arrow 2 covers the period post elevated Ketones and pre-fracking. Samples collected between April 2016 and October 2022 represent the post-fracking period and results are clustered, but distinctly different in composition from both time arrows. This cluster includes data collected both pre and post 2018 PlumeStop^{TM} injection. A second PlumeStop^{TM} injection event was completed in May 2022 in newly installed injection wells. However, preliminary travel time calculations indicate PlumeStop^{TM} may not have reached YO-117D and other monitoring wells by the October 2022 sampling event. Thus, the post PlumeStop^{TM} period contains only a sample collected in November 2023.

3.2.2 BTEX Concentrations at YO-117S and YO-117D

Total BTEX concentrations in YO-117S and YO-117D were similar between October 2009 and March 2012 (Figure 10). From March 2012 through October 2015, total BTEX concentrations slowly increased at YO-117D and decreased at YO-117S. Following October 2015 total BTEX concentrations increased at a much more rapid rate at YO-117D, reaching a peak of 482 ug/L in November 2020. Over this same period total BTEX concentrations at YO-117S remained low, less than 20 ug/L.

YO-117S and YO-117D are installed only a few feet apart and are paired wells. YO-117S is screened from 14 to 19 ft bgs and YO-117D is screened from 27 to 32 ft bgs. This data indicates that in the location of YO-117D, total BTEX concentrations are greater at depth.

3.2.3 Permanent Injection Well Installation and Remediation

In November 2015, YO-121, YO-122, YO-123 and YO-124 were installed upgradient of YO-117D. Prior to completion, pneumatic fracturing and proppant injection were performed to enhance distribution of reagent injection. During fracking of YO-122, slurry surfaced within one foot of the boring. This was likely caused by the creation of a vertical preferential pathway. Other unintentional preferential pathways may have potentially been created during fracking. The locations of these preferential pathways are not known and YO-117D is only 50 ft downgradient. IP-2, IP-3, IP-4, IP-5, IP-6, IP-7, IP-8, and IP-9 were installed at the site between October 25th and November 11th , 2021, and between April 4th and April 13th , 2022. Three soil borings SB-10, SB-11, and SB- 12 were also completed during this time. During drilling, hydrocarbon odor was noted near the water table at approximately 7 ft bgs at IP-4, IP-5, IP-6, IP-7, IP-8. IP-9, SB-11, and SB-12. Hydrocarbon odor was also noted below the water table at approximately 27 to 29 ft bgs in IP-4 and IP-5.

PlumeStop^{TM} was injected into ten injection wells at the site between May 18th and May 24th , 2022. These wells included the eight new injection wells listed above and two existing injection wells designated as YO-123 and YO-124. During injection, PlumeStop^{TM} was observed in the annular space of YO-117D above ground surface (Figure 11).

3.2.4 Vertical Groundwater Gradients

Vertical groundwater gradients were calculated at paired well locations using November 2023 groundwater elevation data displayed on Figures 12 and 13 and listed in Table 2. Downward gradients were observed between the shallow zone and the reworked till, between the shallow zone and bedrock, and between the reworked till and bedrock at all locations except YO-116S and YO-116D, where an upward gradient was observed. This upward gradient has also been observed in historic groundwater monitoring data. The average downward gradient was approximately 0.05 ft/ft.

3.3 cVOC and BTEX Concentrations at YO-117D

Several scenarios were reviewed to determine possible explanations for the observed decrease in cVOC and increase in BTEX concentrations at YO-117D and were evaluated using available site data.

3.3.1 YO-117D has been Compromised

YO-117D may have been compromised and, if so, this could explain the observed decrease in cVOC and increase in BTEX concentrations in this well following 2022 PlumeStop™ injection. This possibility relies on several pieces of site data and is supported by:

1) Observed PlumeStop™ in the annular space of YO-117D during PlumeStop™ injection.
2) Anomalous cVOC and BTEX concentrations observed in YO-117D following installation of permanent injection wells in late 2015.
3) Fracking of permanent injection wells provides a mechanism for damage to YO-117D, which is only ~ 50 ft downgradient of fracked locations. Additionally, fracking provides a potential pathway for higher BTEX concentrations to YO-117D (figure 4-4).
4) During drilling a hydrocarbon odor was noted in several injection points around the water table, ~7 ft bgs and from approximately 27 to 29 ft bgs in IP-4 and IP-5.
5) Notable change in Benzene, Toluene, and Xylene composition at YO-117D post fracking.

There is currently no available site data which refutes the possibility that YO-117D has been compromised.

3.3.2 Vertical Downward Groundwater Gradient

Downward groundwater gradients may explain the observed decrease in cVOCs and increase in BTEX concentrations in YO-117D post PlumeStop™ injection. This possibility is based on the fact that vertical groundwater gradients at the site are predominantly downward as measured historically and in 2023 and is supported by the following information:

1) Both pre and post 2022 PlumeStop™ injection, cVOC and BTEX concentrations are higher in YO-117D than in YO-117S.
2) Both pre and post 2022 PlumeStop™ injection, BTEX concentrations are higher in YO-14X than in YO-14ALX.

The downward groundwater gradients possibility is contradicted by the following information:

1) Does not explain the significant increase in BTEX concentrations at YO-117D from October 2015 to November 2023.
2) Cannot explain the observed PlumeStop™ in the annular space of YO-117D during PlumeStop™ injection.
3) Does not explain why Benzene, Toluene, and Xylene compositions would change over time.

3.3.3 Reagent Injection resulted in the mobilization of Site Contaminants

Reagent injections of EHC, LactOil, and PlumeStop™ may have resulted in the mobilization of site contaminants. The process of injecting reagent increases pressure in the injection area and may lead to pressure induced flow. Reagents often do not have the same density as water and thus, reagent injection may result in density driven flow. Furthermore, biodegradation may result in the creation and then consumption of metabolic byproducts, which may become mobile. Therefore, reagent injection may have resulted in the decrease in cVOC and increase in BTEX concentrations observed in YO-117D post 2022 PlumeStop™ injection. This possibility relies on observed changes in contaminant concentrations following reagent injection events at YO-117D and other monitoring wells and is supported by the following information:

1) Elevated concentrations of Ketones observed following EHC injection in OU2 monitoring wells including YO-14ALX, YO-117S, and YO-117D.
2) Elevated BTEX concentrations following LactOil injection and 2022 PlumeStop™ injection in YO-117D.
3) Changing composition of Beneze, Toluene, Xylene following reagent injection events.

The reagent injection induced mobilization of site contaminants is refuted by the following information:

1) Cannot explain the observed PlumeStop™ in the annular space of YO-117D during PlumeStop™ injection.

Currently available site data suggests that YO-117D has been compromised, which informs the current conceptual site model (Figure 14). The presence of a hydrocarbon odor near the water table at most injection well and soil boring locations drilled in 2021 and 2022 suggests the possible impact of site related contaminants near the water table in this area. In addition, the presence of a hydrocarbon odor at IP-4 and IP-5 from approximately 27 to 29 ft bgs suggests the possible impacts to groundwater at depth, but above the screen interval of YO-117D. Groundwater monitoring data for YO-117D indicates the presence of cVOCs within the screened interval. YO-117D may have been compromised during drilling of injection wells and this may result in a pathway in the well annular space for contaminants to migrate downward and into the well screen, causing elevated BTEX concentrations.

4.0 AUGMENTED BIOAVAILABLE ABSORBENT MEDIA (BAM™) INJECTION WORK PLAN

This work plan relies on a phased approach to identify and treat areas just south of the OU1/OU2 boundary where groundwater COC concentrations exceed OU2 ROD cleanup levels. As part of this work, YO- 117D will be abandoned and reinstalled to assess the effectiveness of treatment. This approach involves the following phases:

- Phase I: Delineation of COC Concentrations
- Phase 2: Abandonment of Historically Monitored Wells
- Phase 3: Augmented Bioavailable Absorbent Media (BAM) Injection
- Phase 4: Abandon and Reinstall YO-117D

The anticipated schedule allows for site work to take place as a single mobilization in early summer of

2025. Phases 1 and 2 will take place concurrently, immediately followed by Phases 3 and 4.

4.1 Phase I: Delineation of COC Concentrations

Phase I focuses on delineating COC concentrations within the deepest portion of the paleochannel both spatially and at depth. In this phase, six soil borings will be drilled with a rotosonic rig: a transect of five soil borings just south of the OU1/OU2 boundary in the location of the planned PRB and a singular soil boring drilled approximately 20 feet south of YO-117D (Figures 15 and 16). The singular soil boring south of YO-117D will also be used to constrain the paleochannel in this location. If this soil boring does not intersect the paleochannel, this boring will be relocated laterally.

All soil borings will be drilled to the top of consolidated till. Continuous soil samples starting at ground surface will be hydrogeologically logged to identify the overburden, reworked till, and top of consolidated till at each boring. Soil samples will be screened with a photo ionization detector (PID) to identify zones with higher relative VOC concentrations. Soil samples will be inspected for evidence of a sheen and for the presence of a hydrocarbon odor. Soil samples with an elevated PID reading or an observed sheen will be submitted to the laboratory for chemical analysis. Soil/water shake tests will be performed if a hydrocarbon odor is observed or if deemed necessary by field personnel. If an LNAPL sheen is observed on the soil or during a soil/water shake test, the boring will be relocated approximately five to 25 feet to the south and redrilled following the same protocol discussed above. Investigation Derived Waste (IDW) generated during Phase I will be containerized and characterized/sampled to determine proper off-site disposal.

The de maximis field representative will keep a record of PID readings, the presence of a hydrocarbon odor and/or sheen, and a detailed lithologic log during drilling. Depth discrete water quality samples, i.e. grab samples, will be collected every five feet starting at the water table, until the top of consolidated till is reached. These samples will be sent to Pace Analytical for analytical results. Pace Analytical will analyze for VOCs via 8260. Upon completion, each boring will be abandoned with bentonite.

Groundwater analytical results will be compared to OU2 ROD cleanup levels for each boring to determine locations and depth intervals for Augmented BAM™ Injection. If groundwater analytical results fall below OU2 ROD cleanup levels for all COCs in all groundwater samples collected in a given transect boring, Augmented BAM™ will not be injected in this location. If groundwater analytical results exceed OU2 ROD cleanup levels for any COCs in any groundwater samples, Augmented BAM™ will be injected along the full interval of contamination at this location. The number of injection points, locations of injection points, and the associated injection intervals will be defined by the locations and by the minimum and maximum depths where analytical results exceed OU2 ROD cleanup levels (Figure 17) If there are no exceedances, a minimum of three injection points will be drilled. The groundwater analytical results from B-06, the boring drilled approximately 20 feet south of YO-117D will be used to determine the screen interval(s) for the replacement well(s) (YO-117DR, YO-117DR1, etc.; Figure 18).

4.2 Phase 2: Abandonment of Historically Monitored Wells

Initial monitoring wells were installed at the Site in the mid-1980s as part of the OU1 RI/FS. Additional monitoring wells have been installed at the Site in each subsequent decade. Many of these older monitoring wells are not included in the current monitoring program and are unlikely to be needed for future site monitoring. Therefore, as many of these monitoring wells as practicable should be abandoned, recognizing some of them may not be found or readily accessible. Monitoring wells identified for abandonment (See table 3 & Figure 19) will be abandoned using the materials and specifications required by New York State Department of Environmental Conservation and USEPA. Following monitoring well abandonment, EPA will be provided a list of monitoring wells that were abandoned.

4.3 Phase 3: Augmented Bioavailable Absorbent Media (BAM) Injection

BAM™ augmented with zero valent iron (ZVI), guar gum, and a mixture of gypsum and Epsom salts will be applied just south of the OU1/OU2 boundary to address chlorinated solvents and petroleum hydrocarbons in offsite groundwater. BAM is produced from biomass waste and is mostly composed of stable carbon in diverse particle sizes. BAM has a high cation exchange capacity, a half-life of more than 100 years, and is designed to sorb contaminants. ZVI will help promote chemical reduction of chlorinated solvents, guar gum will assist with suspending the ZVI, and the gypsum Epsom salts mixture will provide sulfate to the system over both short term and longer term timescales to stimulate sulfate reducing bacteria. In naturally reducing conditions as have been observed at the site, this approach will promote anaerobic biological oxidation of petroleum compounds. This multifaceted approach will allow for the sorption and degradation of COCs in offsite groundwater.

Augmented BAM™ will be injected using the direct sonic injection (DSI) approach, a proprietary injection technique developed by Redox Tech. The DSI approach was chosen because minimal waste is generated compared to traditional rotosonic methods and permanent injection wells are not required. The DSI method involves advancing a 3.75 inch diameter coring rod rotosonically using water as the drilling fluid. Once the first injection interval of two to three feet is reached, a three-way valve is used to switch from water to injectate and the desired volume is injected. The coring rod is then advanced to the next injection interval and the desired volume is then injected. This process is repeated until the injection point is completed. The injection point is then abandoned with bentonite. IDW generated during injection will be containerized and characterized/sampled to determine proper off-site disposal.

Augmented BAM™ will be injected in a PRB perpendicular to the groundwater flow direction. The length, width, and depth of the PRB will be determined using the iterative approach described above in Section 4.1. The PRB will be at most 100 feet long and will likely not exceed a depth of 33 feet. If groundwater analytical results exceed OU2 ROD cleanup levels for any COCs in groundwater samples at all five reconnaissance borings, the PRB may contain a single row of up to five injection points (20-foot width) and will span the depth interval of contamination. If groundwater analytical results exceed OU2 ROD cleanup levels for any COCs in groundwater samples at three out of five reconnaissance borings, the PRB may contain two rows of injection points with up to three injection points in the upgradient row and two injection points in the downgradient row (40-foot width) and will span the depth interval of contamination. If a single row of injection points is used, injection locations will be approximately five feet from the corresponding soil boring. If two rows of injection points are used, the upgradient row will be approximately five feet from the corresponding soil borings and the downgradient row will be placed approximately 20 feet south and approximately 10 feet east of the corresponding upgradient injection point. Augmented BAM™ will be injected into each point to span the depth interval of contamination as determined by Phase 1 results.

The exact quantity of Augmented BAM™ injected will depend on Phase 1 results. However, if Augmented BAM™ is injected to cover the maximum soil volume anticipated, the slurry will contain approximately:

- Six tons of BAM™
- 5,000 pounds of ZVI plus 200 pounds of guar

- Two tons of gypsum and 5000 pounds of Epsom Salts

The amendments will be mixed with potable water to form about 11,500 gallons of injectate, which is equivalent to ~6% of the pore volume assuming a porosity of 0.4.

4.4 Phase 4: Abandon and Reinstall YO-117D

As discussed in the conceptual site model update above, it is probable that YO-117D has been compromised and therefore should be reinstalled. Depending on Phase I results, YO-117D may be re-installed south of the current location. If LNAPL is detected at B-02, B- 03, or B-06, injection locations will be shifted south, beyond the extent of LNAPL. This will require YO-117DR to be shifted south of the new injection wells. If groundwater analytical results at B-06 significantly exceed OU2 ROD clean up levels, YO-117DR may be moved south in an attempt to delineate the benzene plume extent. If YO-117DR is shifted south as a result of a LNAPL detection at B-02, B-03, or B-06, an additional monitoring well will be installed upgradient of the PRB in the area of LNAPL or elevated concentrations. The YO-117DR screen length will be five to 10 feet with the exact length determined by Phase 1 results. Additional clustered wells may be installed at the YO-117DR location if Phase 1 results indicate unmonitored zones with groundwater concentrations above OU2 ROD decision levels. For example, if Phase 1 results collected from B-06 indicate an unmonitored zone with groundwater concentrations above OU2 ROD decision levels both above and below the current screened interval of YO-117D, up to three monitoring wells will be installed. If Phase 1 results collected from B-06 indicate an unmonitored zone with groundwater concentrations above OU2 ROD decision levels either above or below the current screened interval of YO-117D, up to two monitoring wells will be installed. If Phase 1 results collected from B-06 do not indicate unmonitored zones with groundwater concentrations above OU2 ROD decision levels either above or below the current screened interval of YO-117D, one monitoring well will be installed (see Figure 18 for example scenarios).

Tables

Table 1: Screening Level Groundwater Quality Results

Well	Well Depth (ft bgs)	Sample Date	PCE	TCE	cis-1,2-DCE	Vinyl Chloride	1,1-DCA	1,2-DCA	2-Butanone	4-Methyl-2-Pentanone	Acetone	Benzene	Ethyl-benzene	Toluene	Xylenes	TVOC	cVOCs	BTEX	Ketones
IP-2																			
IP-3	37	11/16/2021	<0.18	<0.18	0.75 J	0.58 J	<0.70	0.63	<1.9	1.2 J	7.8	3.9	1.6 J	12	7.2	36	2	**25**	9
IP-4	38	11/16/2021	<9.0	<8.8	94 J	64	<35.0	<6.6	6,000	<50.0	9,900	24 J	<35.0	<35.0	<35.0	16,082	**158**	**24**	15,900
IP-5	38	4/5/2022	<0.18	0.30 J	6.6	2.8	<0.70	0.97	<1.9	<1.0	3.5 J	7.2	<0.70	<0.70	<1.40*	21	**11**	**7**	4
IP-6	35	4/6/2022	0.28 J	<0.18	6.0	0.76 J	<0.70	0.29 J	4.6 J	<1.0	14	0.26 J	<0.70	<0.70	<1.40*	26	**7**	0	19
IP-7																			
IP-8																			
IP-9	27	10/28/2021	<0.18	<0.18	<0.70	<0.07	1.30 J	0.63	<1.9	<1.0	4.5 J	2.1	<0.70	<0.70	<1.40*	9	2	2	5
SB-12	--	10/27/2021	<0.18	<0.18	<0.70	<0.07	<0.70	<0.50	5.3	<1.0	24	0.18 J	<0.70	1.1 J	<1.40*	31	0	1	29

Notes:
All analytical results are in µg/L.
Injection wells shaded in grey were not sampled.
<XX = Analyte was not detected at the method detection limit (MDL) of XX µg/L.
-- SB-12 was not completed as an injection well.
*MDL for Xylenes was calculated by summing the MDLs for p/m-Xylene and o-Xylene.

Table 2: 2023 Groundwater Elevation Data

Well	Well Depth (ft bgs)		Top of Riser Elevation (ft amsl)	Depth to Water (ft btoc)	Water Elevation (ft amsl)	Vertical Head Difference (feet)	Direction of Vertical Gradient
OU-1							
YO-29SX	20.5	S	381.48	7.8	373.68	0.24	Downward
YO-29DX	36	D	381.09	7.65	373.44		
YO-30SX	18	S	395.82	7.57	388.25	0.41	Downward
YO-30DX	49	D	395.52	7.68	387.84		
YO-110S	20	S	382.21	6.13	376.08	0.09	Downward
YO-110D	36	D	382.2	6.21	375.99		
YO-118	19.2	S	381.5	9.66	371.84	--	--
YO-119	2.8	S	381.73	9.94	371.79	--	--
YO-120	19.5	S	381.28	8.78	372.5	--	--
YO-121	46	D	379.11	7.79	371.32	--	--
YO-122	41	D	379.74	8.5	371.24	--	--
YO-123	43	D	380.7	9.49	371.21	--	--
YO-124	41	D	380.71	9.95	370.76	--	--
OU-2							
YO-12AX	14.5	S	375.14	4.02	371.12	1.77	Downward
YO-12RX	56.45	D	374.94	5.59	369.35		
YO-14ALX	21.4	S	375.07	4.15	370.92	0.17	Downward
YO-14X	34.6	D	375.04	4.29	370.75		
YO-56A	30.3	S	374.43	5.19	369.24	1.45	Downward
YO-56D	55.8	D	375.27	7.48	367.79		
YO-57A	27.4	S	374.48	5.29	369.19	1.19	Downward
YO-57	43.4	D	374.33	6.33	368		
YO-58A	25.8	S	372.72	4.77	367.95	0.06	Downward
YO-58	40	D	372.2	4.31	367.89		
YO-101S	15.5	S	370.28	3.05	367.23	0.47	Downward
YO-101R	52	D	369.81	3.05	366.76		
YO-102S	15	S	373.38	3.13	370.25	4.17	Downward
YO-102R	56	D	373.29	7.21	366.08		
YO-111D	56.7	D	373.97	8.62	365.35	--	--
YO-112D	51	D	374.8	9.42	365.38	--	--
YO-113D	57.3	D	375.76	10.38	365.38	--	--
YO-114R	64	D	374.25	8.84	365.41	--	--
YO-115R	59	D	370.1	4.63	365.47	--	--
YO-116S	22	S	375.29	5.15	370.14	-1.85	Upward
YO-116D	43.05	D	375.53	3.54	371.99		
YO-116R	62.5	D	375.03	5.38	369.65	--	--
YO-117S	21.45	S	375.32	4.25	371.07	0.46	Downward
YO-117D	32	D	375.17	4.56	370.61		
YO-125R	44	D	370.61	5.2	365.41	--	--

Notes:
ft bgs = feet below ground surface.
ft amsl = feet above mean sea level.
ft btoc = feet below top of casing.

Table 3: Proposed Wells for Abandonment

Monitoring Well ID	Date Completed	Survey Coordinates		Location	Depth of Well (feet)	Screen		
		Easting	Northing			Top (feet)	Bottom (feet)	Length (feet)
MW-1	9/9/1999	533677.80	4963240.00	OU1	43.75	23.50	38.50	15.00
YO-1R	4/11/1985	533688.89	4963289.10	OU1	46.80	42.50	47.00	4.50
YO-2	11/7/1984	533563.48	4963198.61	Railroad	24.80	14.50	24.50	10.00
YO-2R	4/5/1985	533538.08	4963192.26	Railroad	56.00	53.00	56.00	3.00
YO-3	11/9/1984	533704.00	4963347.09	OU1	28.50	7.97	12.97	5.00
YO-5	11/13/1985	533916.73	4963318.52	Railroad	31.40	19.64	24.64	5.00
YO-5R	1/16/1985	533914.32	4963303.39	Railroad	46.20	44.00	46.00	2.00
YO-6	11/15/1984	533625.42	4963344.71	Moira City Property	22.00	12.96	17.96	5.00
YO-7	11/28/1984	533596.85	4963293.91	OU1	48.50	43.58	48.58	5.00
YO-8	11/28/1984	533511.24	4963217.79	OU1	16.00	11.00	16.00	5.00
YO-9A	11/19/1984	533663.64	4963249.54	OU1	6.20	1.00	6.00	5.00
YO-11	11/27/1984	533352.49	4963149.52	OU1	18.00	13.00	18.00	5.00
YO-12U	1/14/1985	533623.95	4963217.79	Railroad	17.50	14.50	17.50	3.00
YO-12L	1/14/1985	533624.78	4963217.27	Railroad	33.50	31.50	33.50	2.00
YO-12R	4/3/1985	533623.95	4963217.79	Railroad	53.50	51.00	53.50	2.50
YO-13R	4/14/1985	533623.48	4963469.59	Other	84.00	83.00	84.00	1.00
YO-14AU	1/15/1985	533671.57	4963232.08	Railroad	8.00	3.00	8.00	5.00
YO-14AL	1/15/1985	533671.57	4963232.08	Railroad	19.00	14.00	19.00	5.00
YO-14	12/10/1984	533671.57	4963232.08	Railroad	32.20	29.50	32.00	2.50
YO-15	11/16/1984	533630.88	4963273.27	OU1	14.00	9.00	14.00	5.00
YO-16U	11/29/1984	533661.26	4963294.78	OU1	13.00	8.00	13.00	5.00
YO-16L	11/29/1984	533661.26	4963294.78	OU1	21.90	17.00	21.90	4.90
YO-18L	12/28/1984	533582.53	4963224.01	OU1	15.00	NA	NA	NA
YO-18U	12/28/1984	533582.53	4963224.01	OU1	32.60	10.00	15.00	5.00
YO-21U	12/6/1984	534288.21	4963423.29	Other	22.00	NA	NA	NA
YO-21L	12/6/1984	534288.21	4963423.29	Other	42.50	NA	NA	NA
YO-22L	1/8/1985	534206.71	4963194.69	Other	31.00	NA	NA	NA
YO-22U	1/8/1985	534206.71	4963194.69	Other	18.00	NA	NA	NA
YO-25	12/5/1984	534282.91	4963078.27	Other	26.00	NA	NA	NA
YO-26	1/11/1985	533915.90	4962363.59	Other	52.00	NA	NA	NA
YO-26AL	1/14/1985	533914.32	4962360.41	Other	18.00	15.50	18.00	2.50
YO-26AU	1/14/1985	533915.90	4962363.59	Other	8.00	5.00	8.00	3.00
YO-28	4/2/1985	532890.52	4963435.28	Other	76.50	75.50	76.50	1.00
YO-28A	4/2/1985	532891.01	4963431.85	Other	12.00	7.50	12.00	4.50
YO-29	12/12/1984	533746.34	4963299.47	OU1	33.50	25.62	30.62	5.00
YO-30	1/7/1985	533667.49	4963399.48	Moira City Property	53.00	47.80	52.80	5.00

YO-30L	1/7/1985	533667.49	4963399.48	Moira City Property	52.80	NA	NA	NA
YO-30U	1/7/1985	533667.49	4963399.48	Moira City Property	17.00	NA	NA	NA
YO-57S	NA	533700.53	4963162.79	Other	9.50	NA	NA	NA
YO-58S	NA	533700.53	4963162.79	Other	9.90	NA	NA	NA
YO-103S	3/3/1993	533196.91	4963097.14	Railroad	17.00	7.00	17.00	10.00
YO-103R	3/6/1993	533196.91	4963097.14	Railroad	66.50	56.50	66.50	10.00
YO-104S	3/7/1993	533142.79	4963270.05	Other	15.20	5.00	15.00	10.00
YO-105S	3/6/1993	534219.12	4963106.54	Other	15.20	5.00	15.00	10.00

Notes:

1. Wells listed are not included in the current monitoring program for the York Oil Site.
2. Easting and Northing Coordinates are in UTM Zone 18 North Meters

NA = information not available

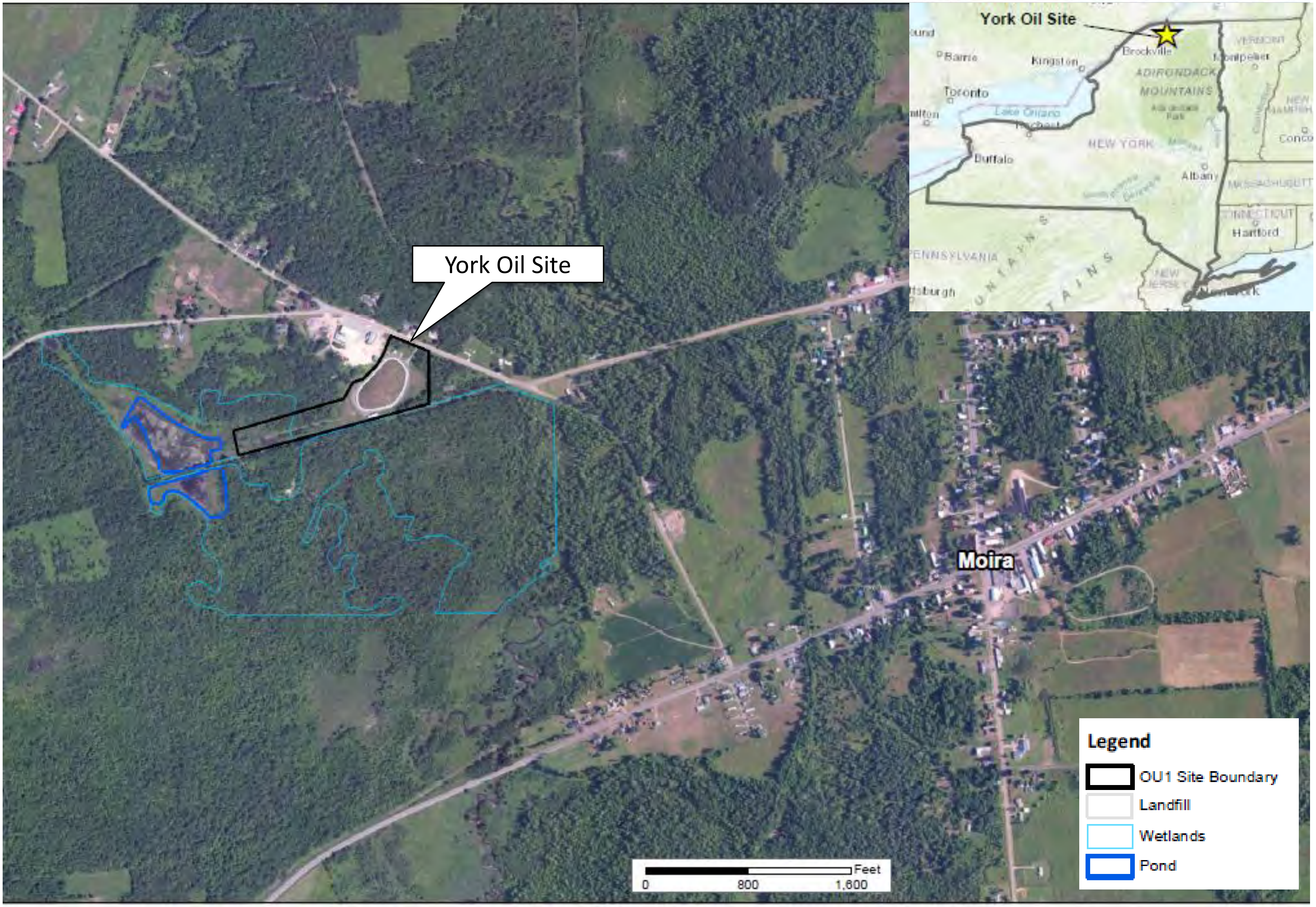


Figure 1– Site Location Map
York Oil Site
Moira, NY

Job Number: 21-05
Prepared by: SMP
Date: July 2024

HRS Water Consultants

Remediation Timeline

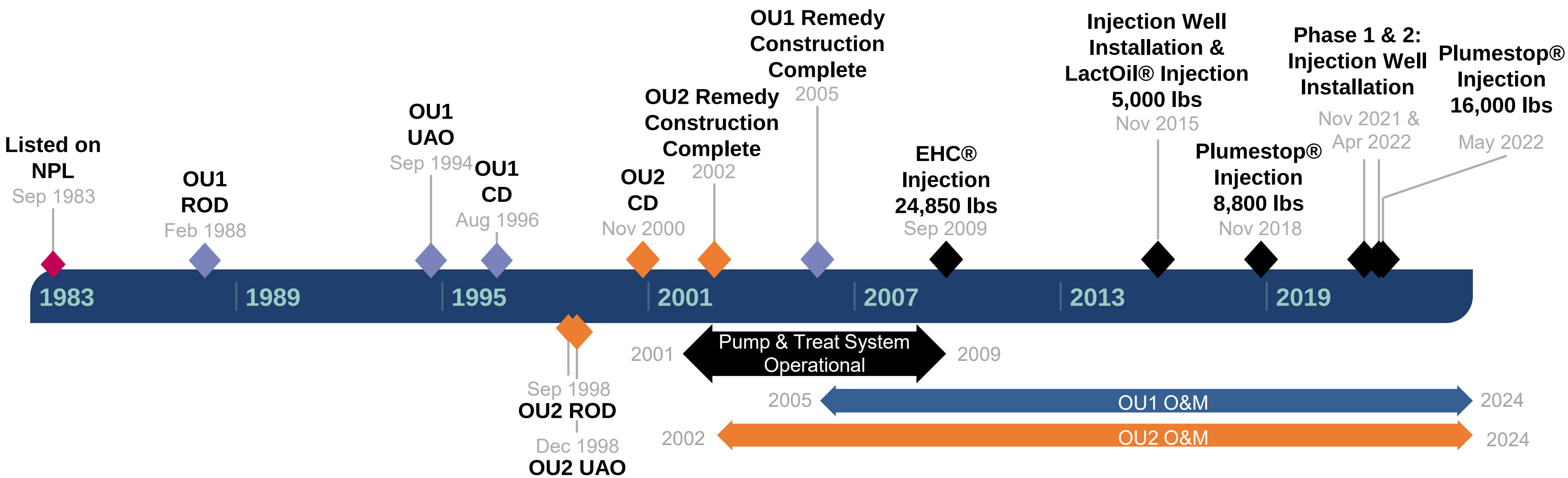


Figure 2: Remediation Timeline
York Oil Site
Moira, NY

Job Number: 21-05
Prepared by: SMP
Date: July 2024

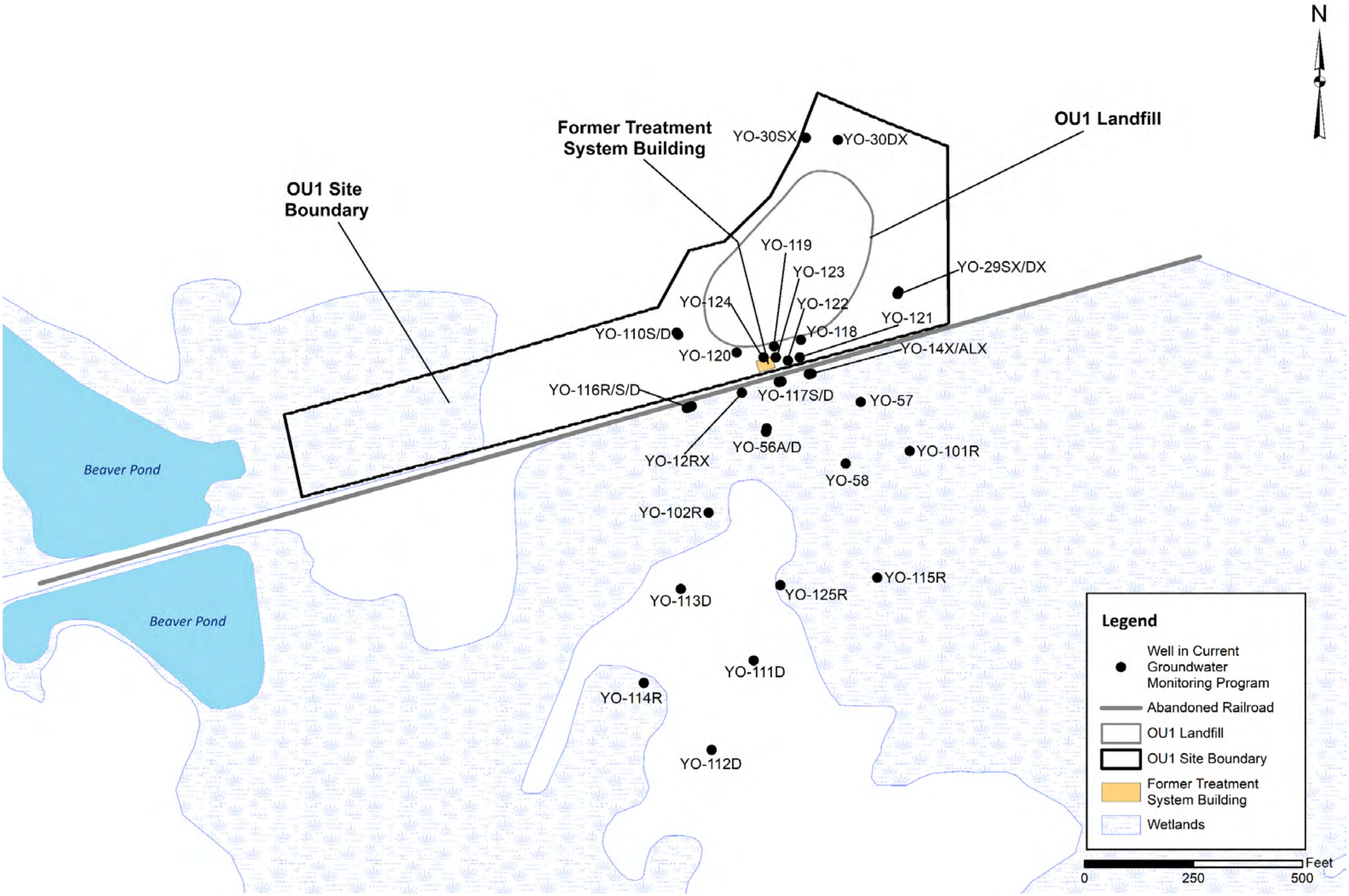


Figure 3: Site Map with Monitored Wells
York Oil Site
Moira, NY

Job Number: 21-05
Prepared by: SMP
Date: July 2024

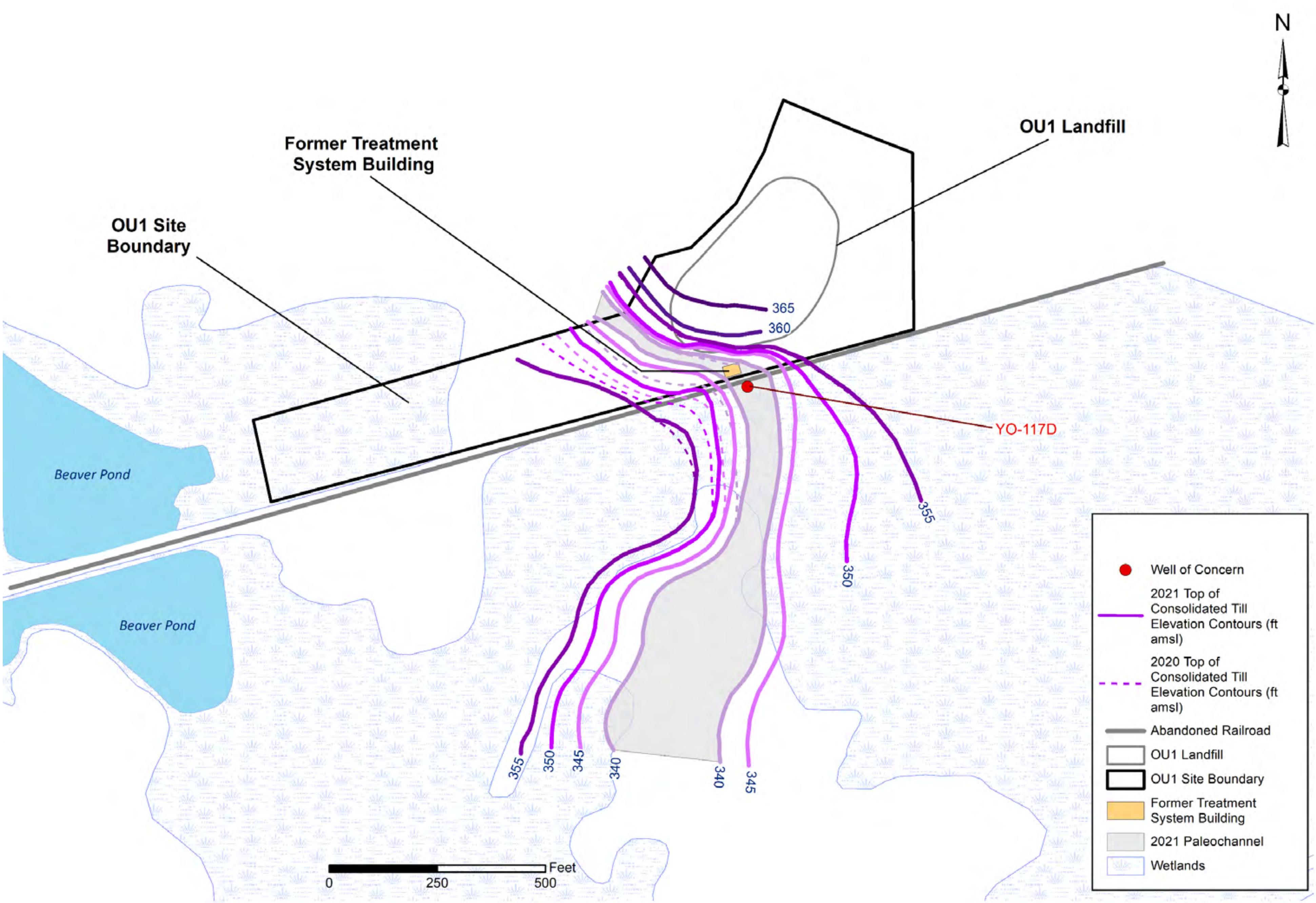


Figure 4: Consolidated Till Elevations (Updated 2022)
York Oil Site
Moira, NY

Job Number: 21-05
Prepared by: SMP
Date: July 2024

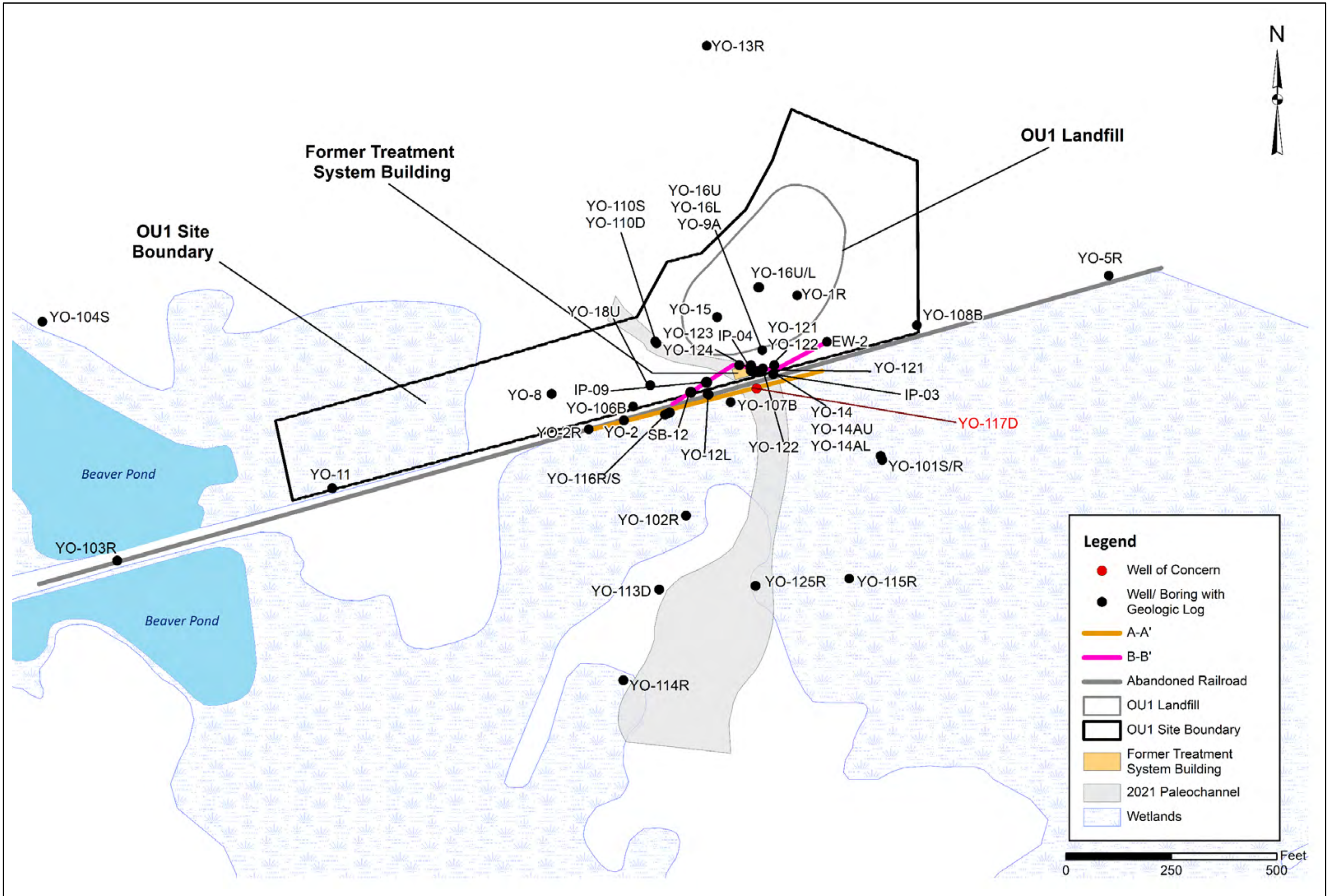
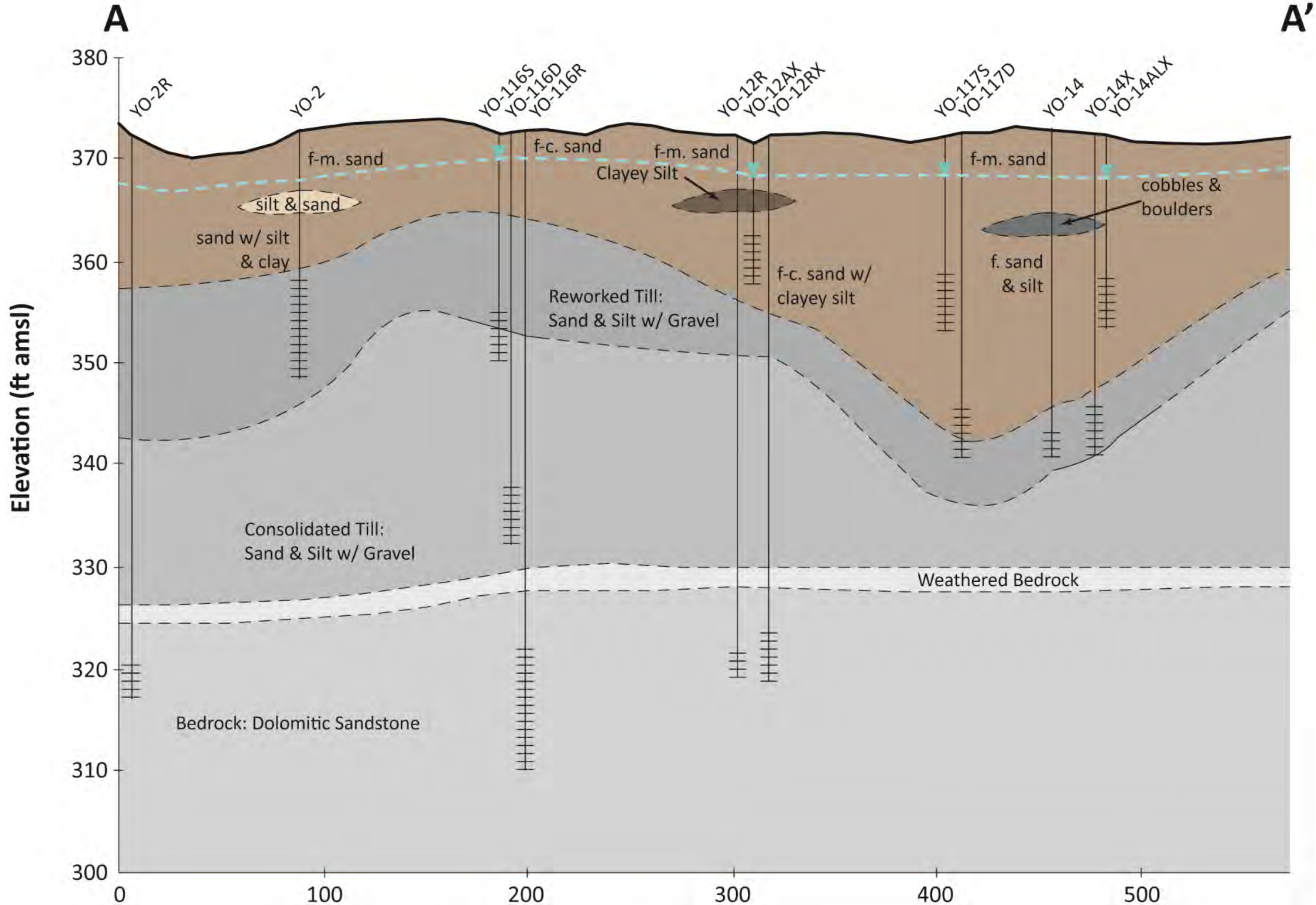


Figure 5: Site Map with Cross Sections
York Oil Site
Moira, NY

Job Number: 21-05
Prepared by: TDR
Date: January 2022

HRS Water Consultants



Note: Vertical Exaggeration = 5x

Figure 6: Cross Section A-A' (Updated 2022)
York Oil Site
Moira, NY

Job Number: 21-05
Prepared by: FBM
Date: January 2022

HRS Water Consultants

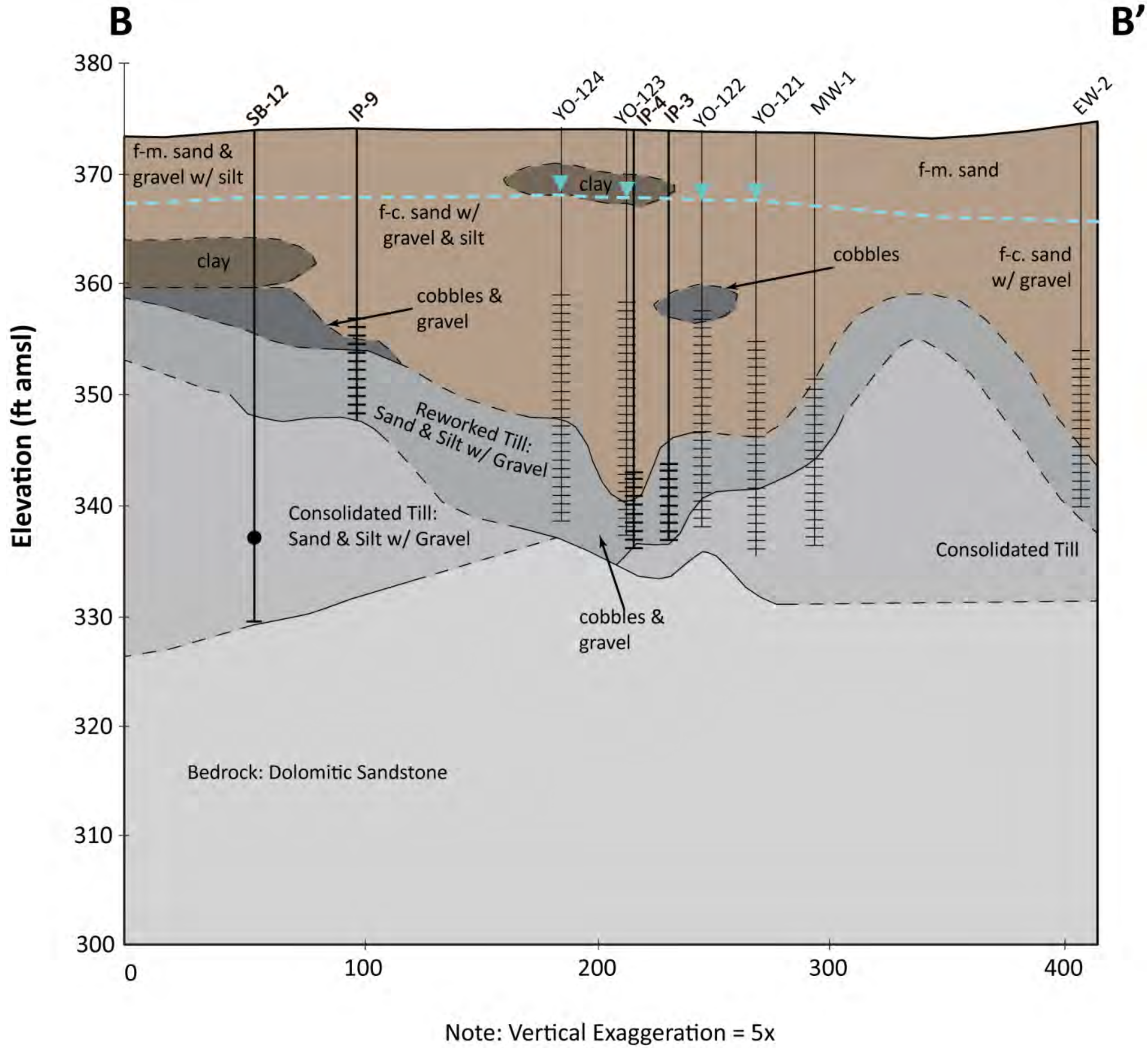


Figure 7: Cross Section B-B' (Updated 2022)
York Oil Site
Moira, NY

Job Number: 21-05
Prepared by: FBM
Date: January 2022

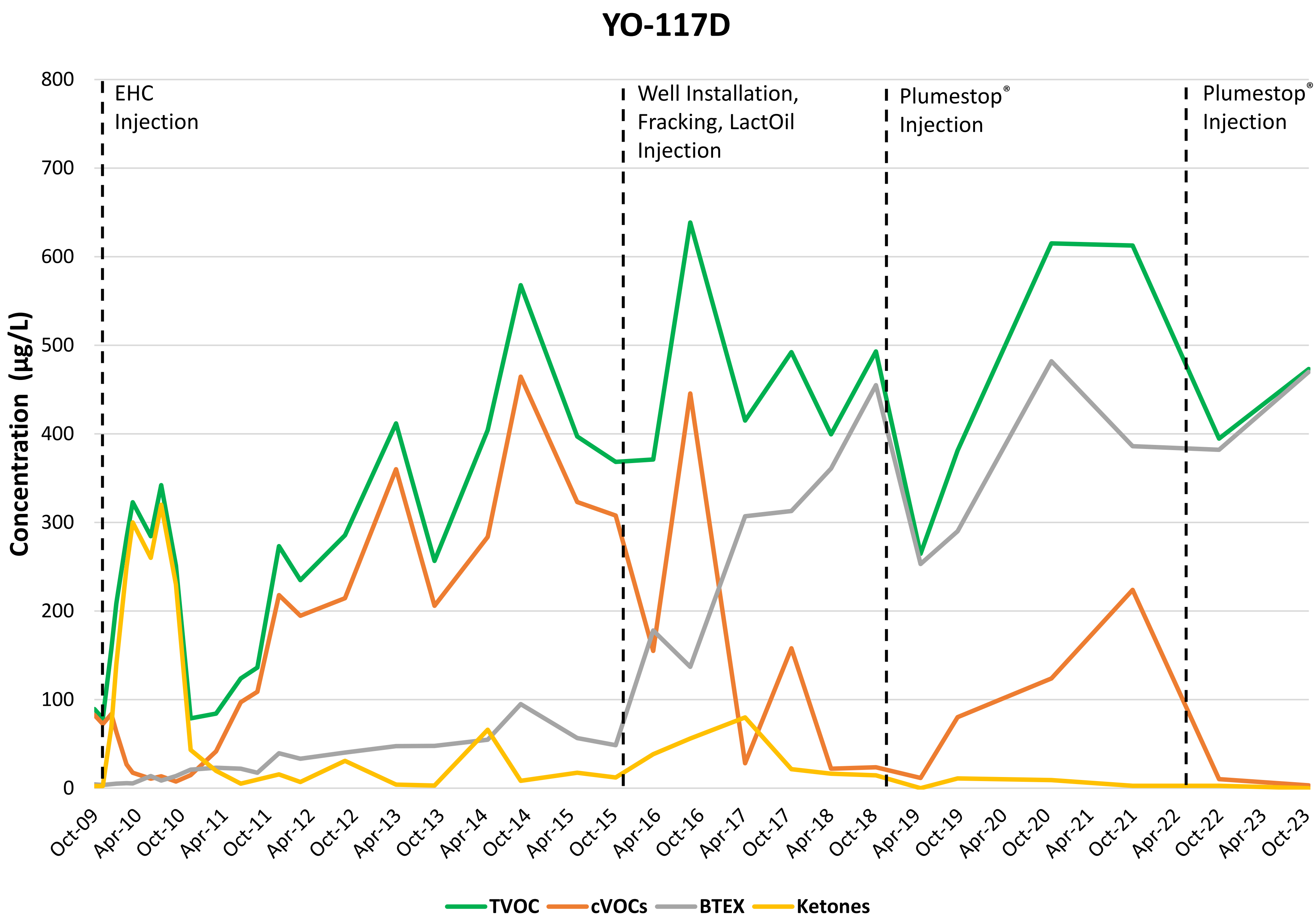


Figure 8: YO-117D Concentration Trend Chart
York Oil Site
Moira, NY

Job Number: 21-05
Prepared by: FBM
Date: March 2024

Sampling Date	Diagram Value
Oct-2009	1
Nov-2009	2
Dec-2009	3
Jan-2010	4
Mar-2010	5
Mar-2010	6
Jun-2010	7
Jul-2010	8
Sep-2010	9
Nov-2010	10
Mar-2011	11
Jun-2011	12
Sep-2011	13
Dec-2011	14
Mar-2012	15
Sep-2012	16
Apr-2013	17
Sep-2013	18
May-2014	19
Sep-2014	20
May-2015	21
Oct-2015	22
Apr-2016	23
Sep-2016	24
Apr-2017	25
Nov-2017	26
Apr-2018	27
Oct-2018	28
May-2019	29
Oct-2019	30
Nov-2020	31
Oct-2021	32
Oct-2022	33
Nov-2023	34

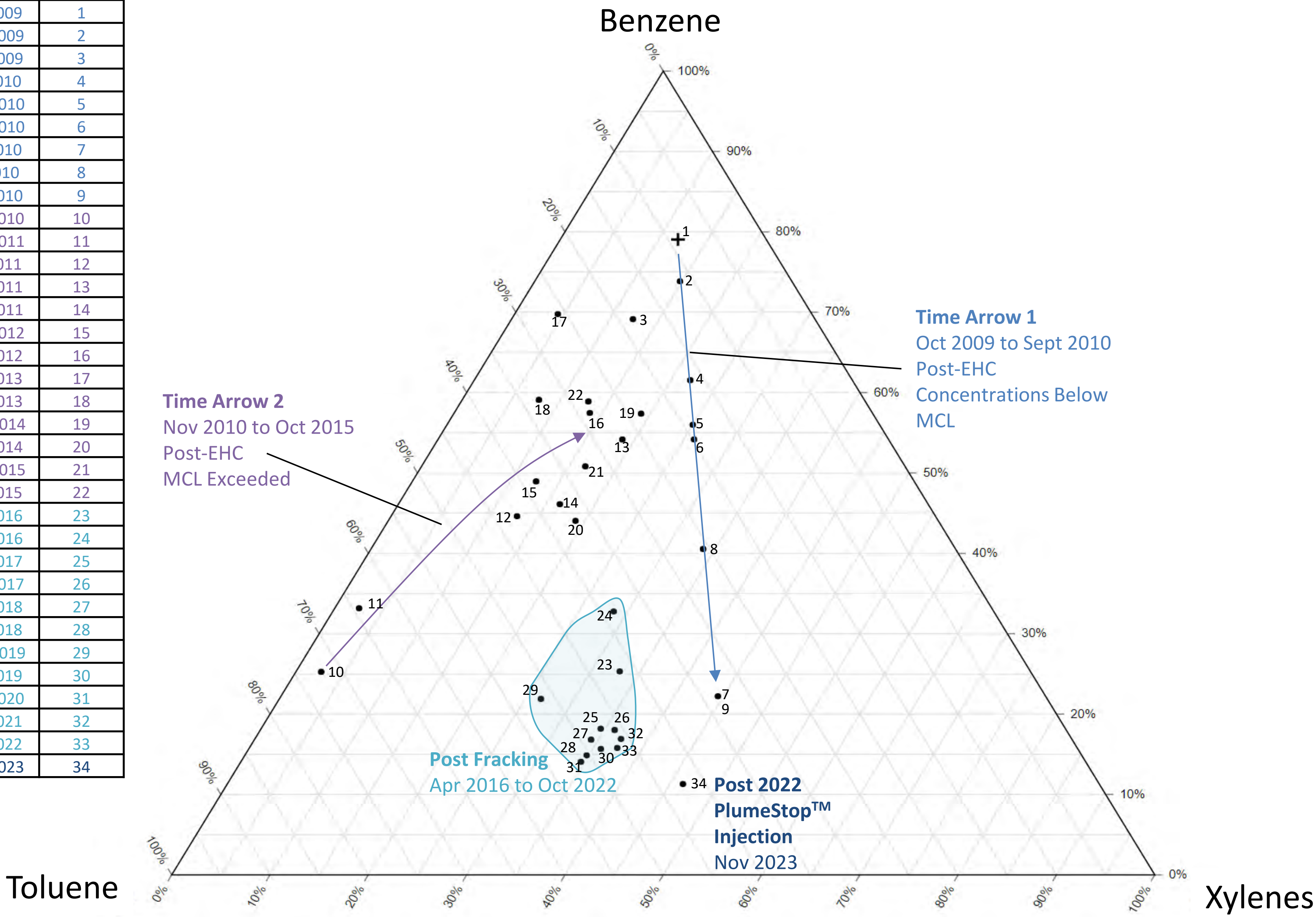


Figure 9: YO-117D B, T, and X Ternary Diagram
York Oil Site
Moira, NY

Job Number: 21-05
Prepared by: FBM
Date: March 2024

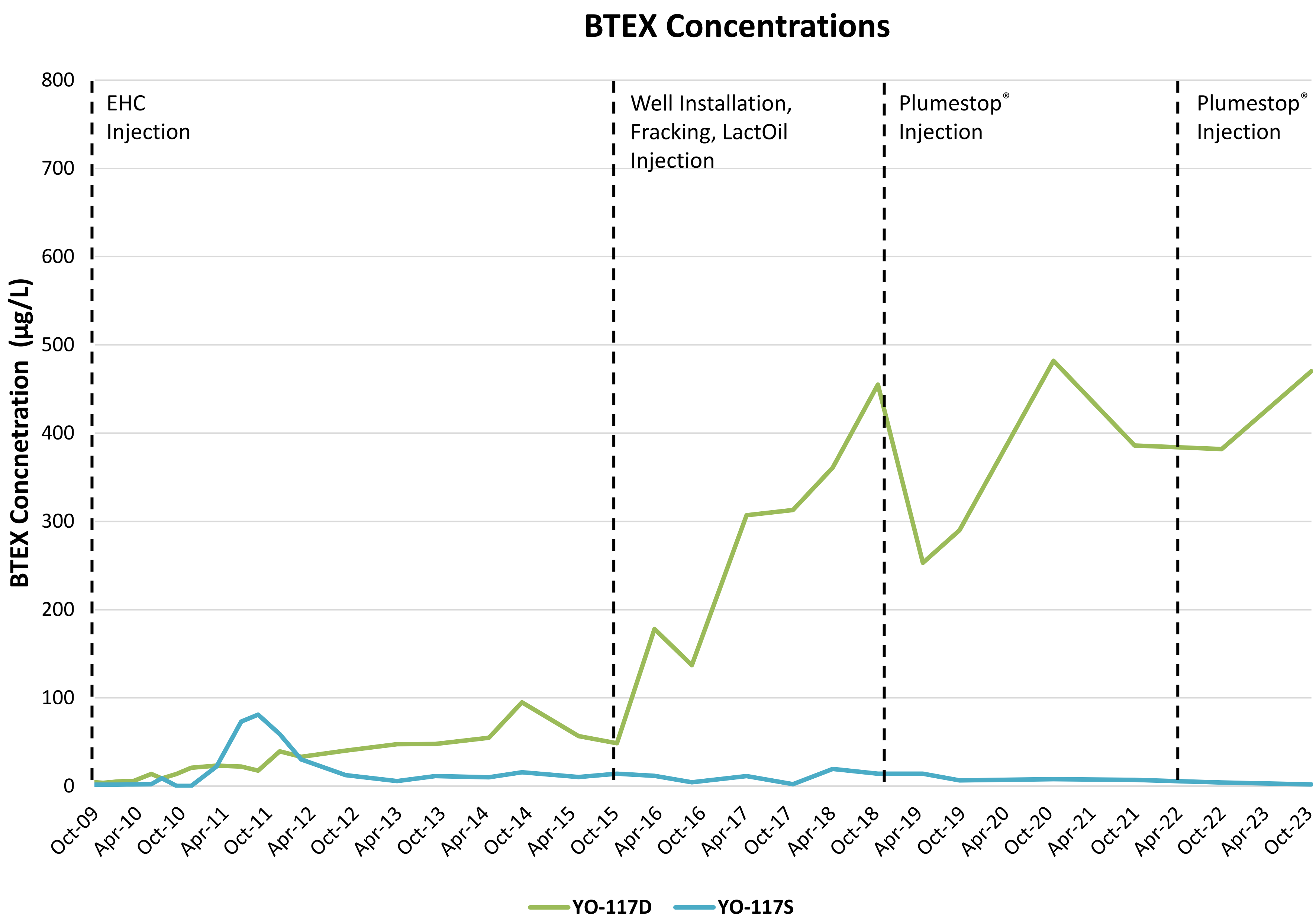
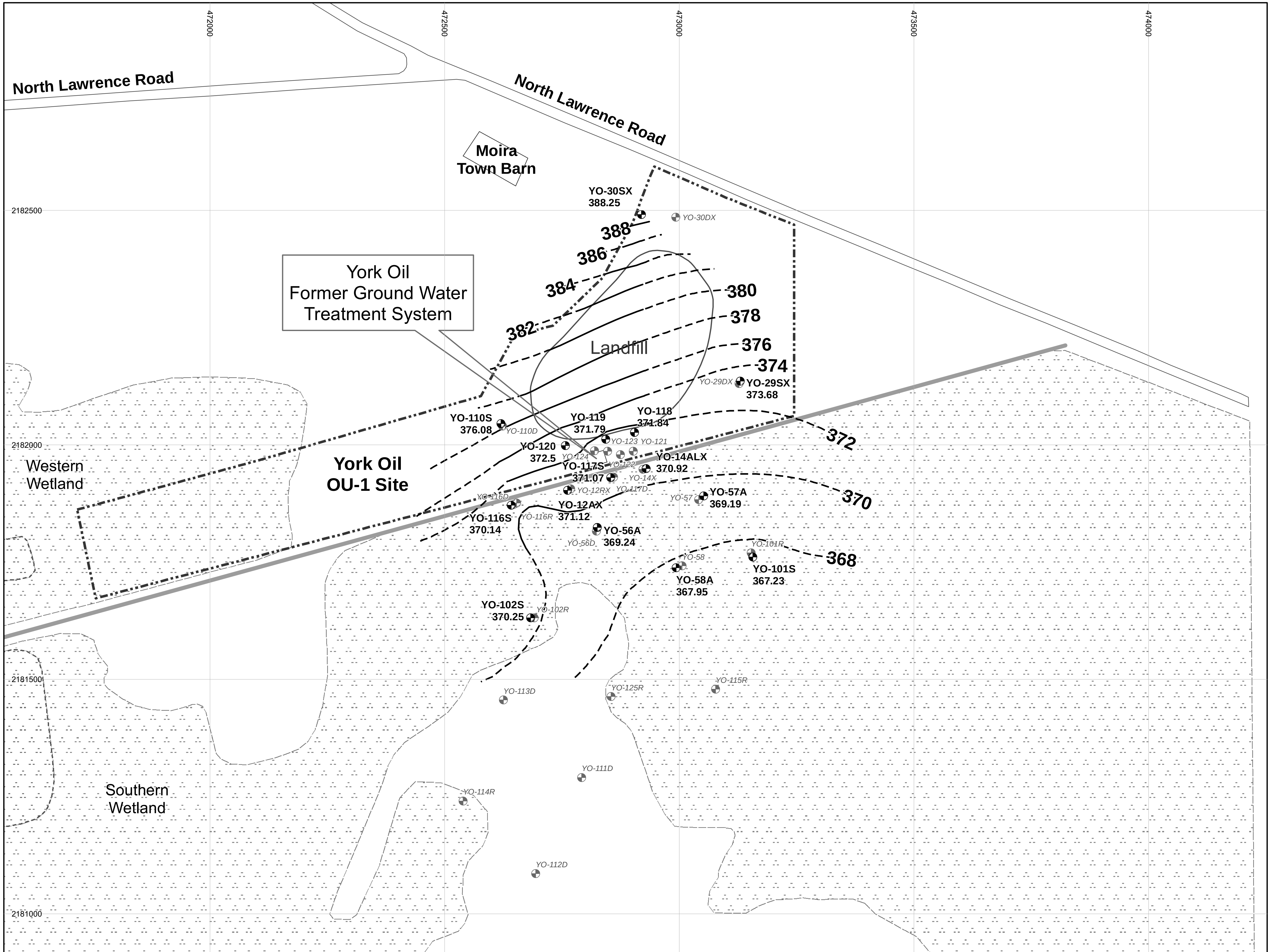


Figure 10: Total BTEX Concentrations at YO-117S and YO-117D
York Oil Site
Moira, NY

Job Number: 21-05
Prepared by: FBM
Date: March 2024

Figure 11: Photograph of PlumeStop™ in YO-117D Annular Space
York Oil Site
Moira, NY

Job Number: 21-05
Prepared by: FBM
Date: March 2024



Path: R:\Projects\DEF\demax-1547\3058-York Oil\DataAnalysis\GISData\Projects\Report_Figures_2023\Fig_3-1_GW_Shallow_2023.mxd

Figure 12

Fall 2023 Shallow Groundwater Level Contours

York Oil Superfund Site
Moira, New York

Legend

- Groundwater Contour (Calculated)
- Groundwater Contour (Estimated)
- OU-1 Site Boundary
- Abandoned Railroad Grade
- Wetlands

Notes:

Groundwater Elevations are in feet above Mean Sea Level

1 inch = 200 feet

Feet 0 100 200

N

Name: Fig_3-1_GW_Shallow_2023
Plot Date: 1/9/2024
Author: jcullum
Project No.: 1547-3058
Reviewed by: AH

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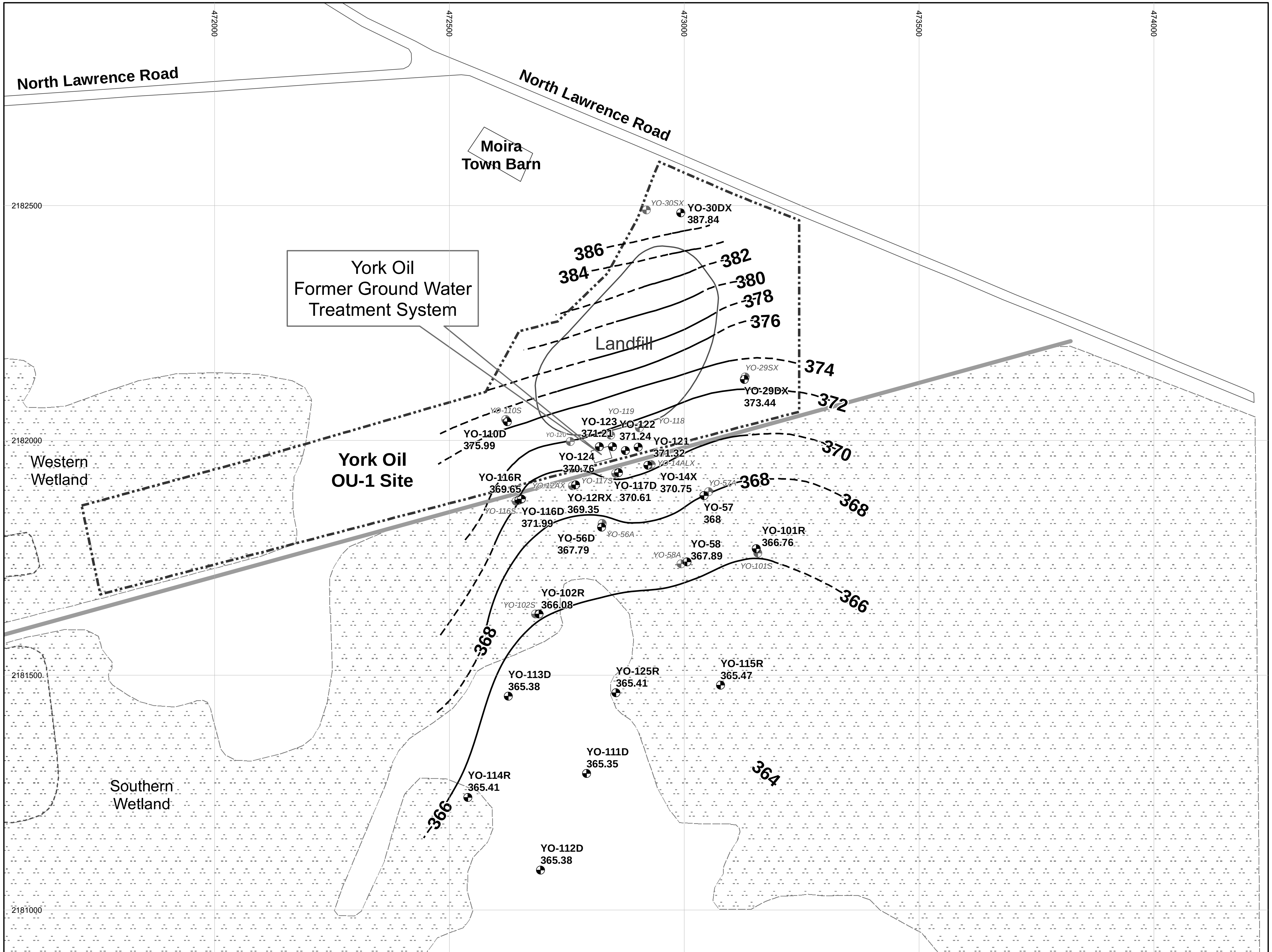

Figure 13

Fall 2023 Deep Groundwater Level Contours

York Oil Superfund Site
Moira, New York

Legend

OU-1 Site Boundary
Abandoned Railroad Grade
Wetlands

Notes:

Groundwater Elevations are in feet above Mean Sea Level

1 inch = 200 feet

Feet 0 100 200

N

Name: Fig_3-2_GW_Deep_2023
Plot Date: 1/9/2024
Author: jcullum
Project No.: 1547-3058
Reviewed by: AH

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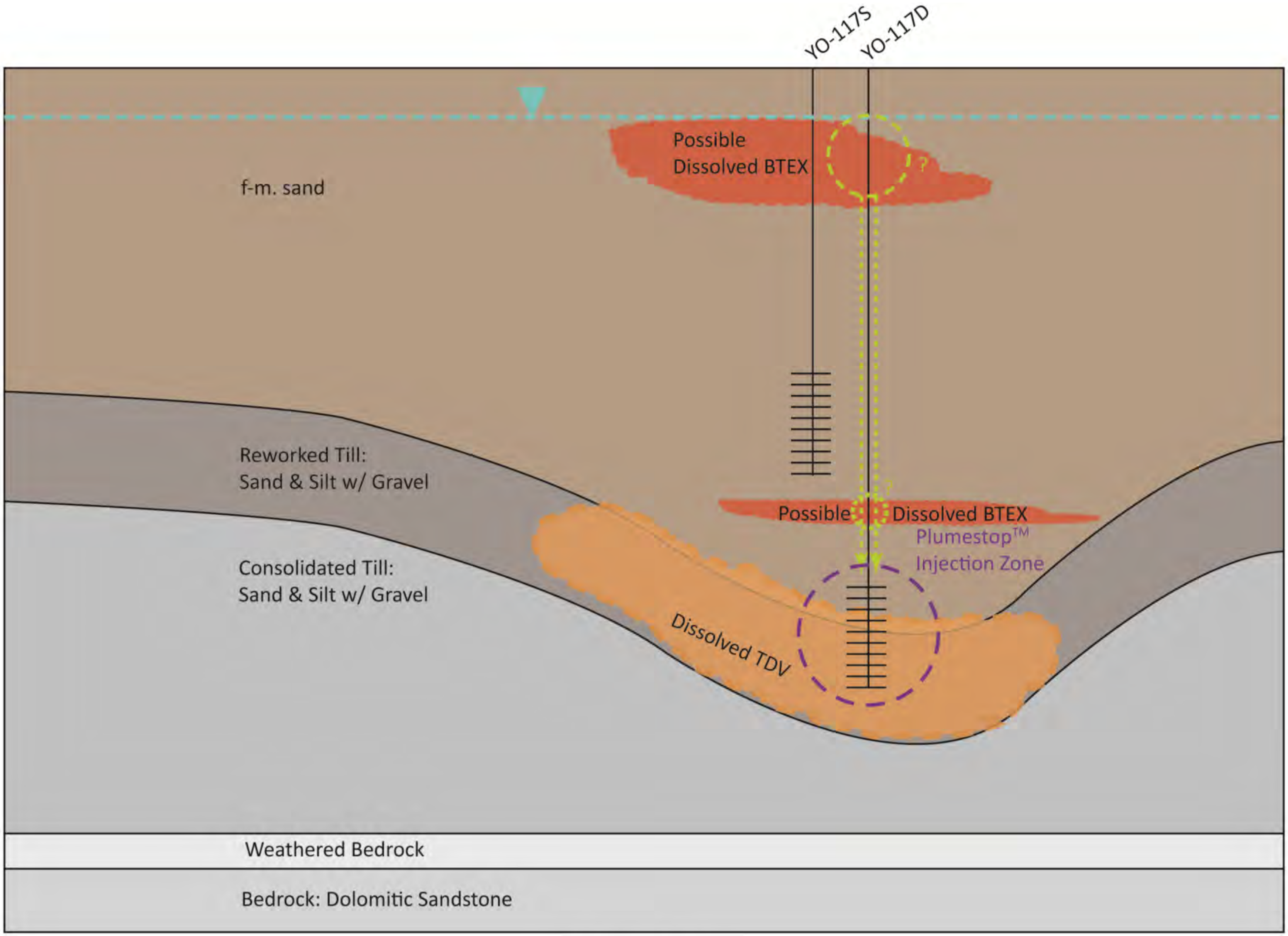
Path: R:\Projects\DEF\demax-1547\3058-York Oil\DataAnalysis\GIS\DataProjects\Report_Figures_2023\Fig_3-2_GW_Deep_2023.mxd



Note: Not to Scale

Figure 14: Site Conceptual Model near YO-117S and YO-117D
York Oil Site
Moira, NY

Job Number: 21-05
Prepared by: FBM
Date: March 2024

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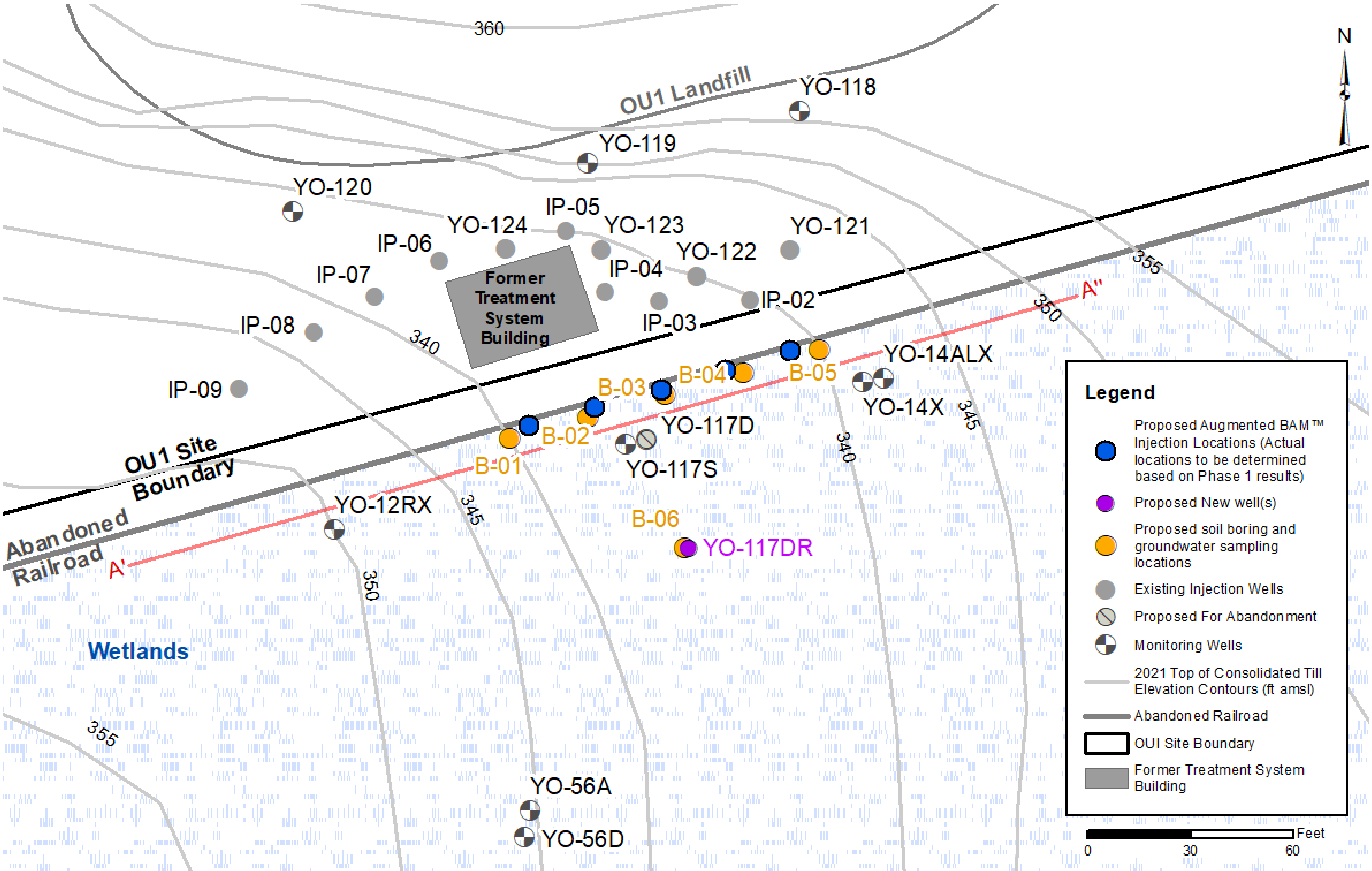

Figure 15: Proposed 2024 Work Plan – Map View
York Oil Site
Moira, NY

Job Number: 21-05
Prepared by: SMP
Date: July 2024

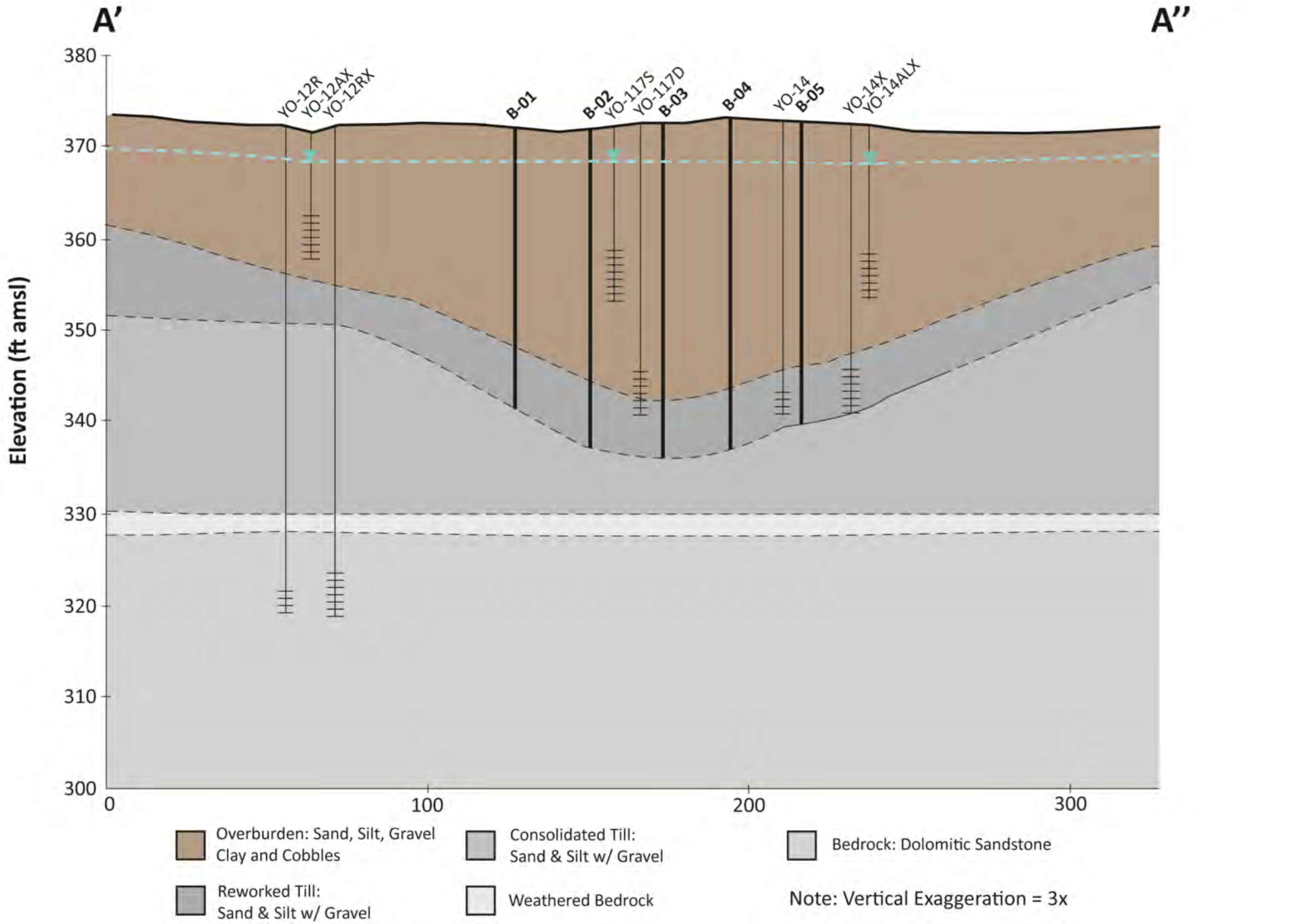

Figure 16: Proposed 2024 Work Plan – Cross Section
York Oil Site
Moira, NY

Job Number: 21-05
Prepared by: SMP
Date: July 2024

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Augmented BAM™ Injection Decision Tree

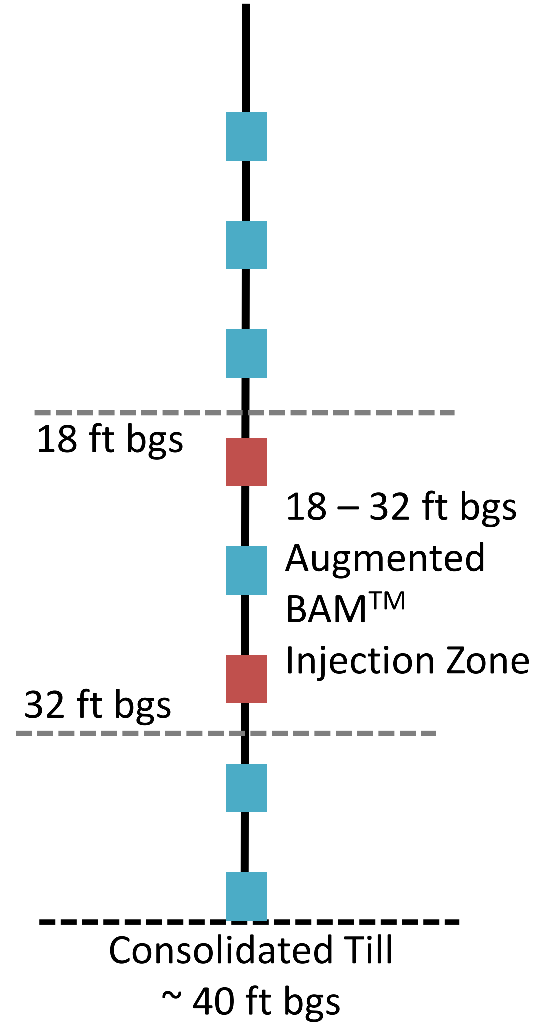
Evaluate each boring separately

Determine at which depth(s) groundwater analytical results exceed OU2 ROD cleanup levels.

- Yes, Augmented BAM™ will be injected into the interval of contamination between the minimum and maximum depths where groundwater analytical results exceed OU2 ROD cleanup levels.
- No, Augmented BAM™ will not injected.

B-01

Hypothetical Results



Groundwater Sample (below ROD Cleanup Level for COC(s))

Groundwater Sample (above ROD Cleanup Level for COC(s))

Figure 17: Augmented BAM™ Injection Decision Tree
York Oil Site
Moira, NY

Job Number: 21-05
Prepared by: FBM
Date: April 2025

YO-117DR Installation Decision Tree

Evaluate analytical data from B-06

Determine at which depth(s) groundwater analytical results exceed OU2 ROD cleanup levels. Ascertain the number of monitoring well(s).

- 1, YO-117D replaced
- 2, YO-117D replaced and second monitoring well may be installed
- 3, YO-117D replaced and two more monitoring wells may be installed

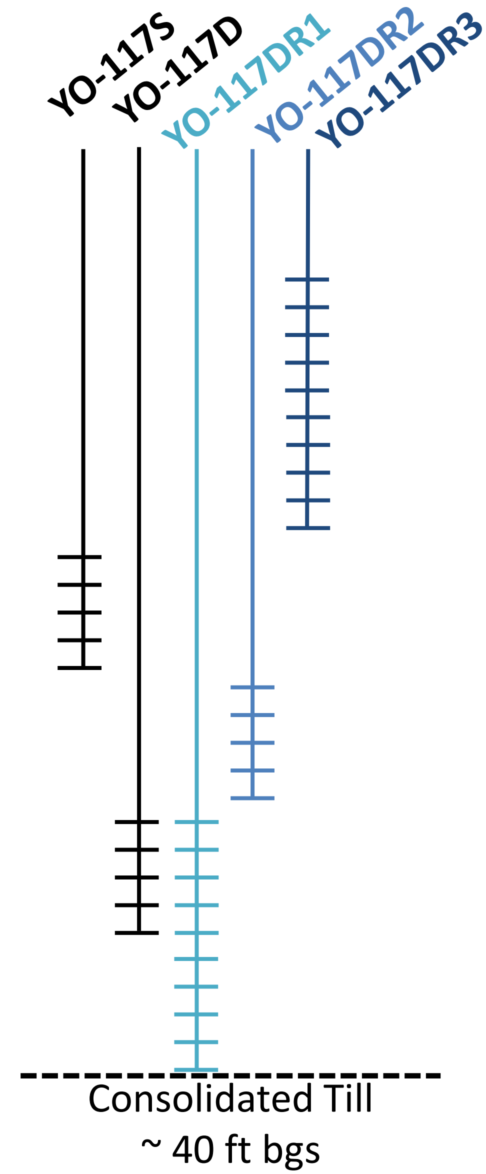


Figure 18: YO-117DR Installation Decision Tree
York Oil Site
Moira, NY

Job Number: 21-05
Prepared by: FBM
Date: April 2025

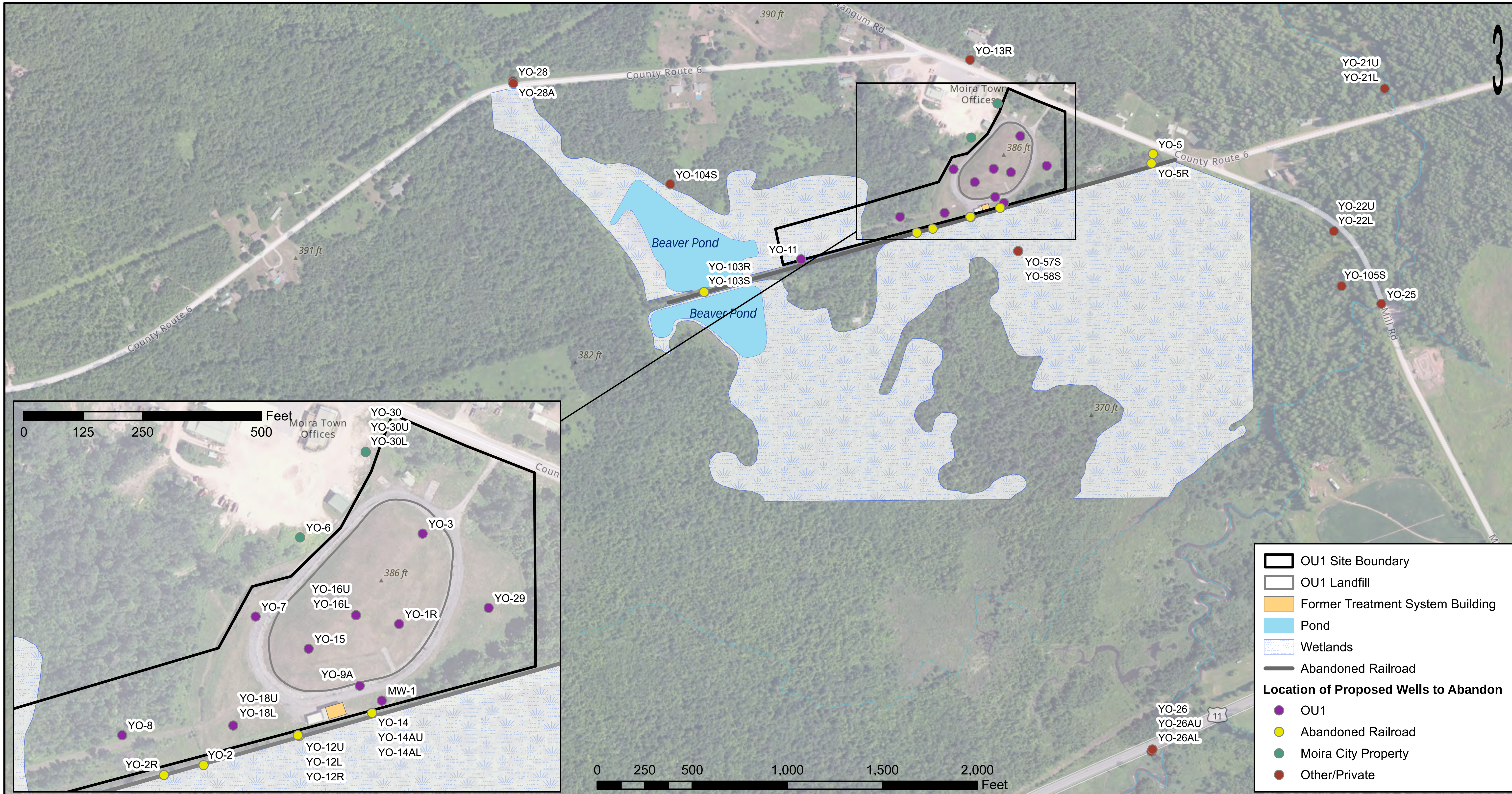


Figure 19: Proposed Wells for Abandonment
York Oil Site
Moira, NY

Job Number: 21-05
Prepared By: SPB
Date: May 2025
Projection: UTM 18N
File Name:2025AbandonWells

1:6,000
0 500 1,000 Feet

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