Groundwater
& Environmental Services, Inc.

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June 24, 2014

Mr. Brian Sadowski, Project Manager
New York State Department of Environmental Conservation
270 Michigan Avenue
Buffalo, New York 14203-2999

RE: Iroquois Gas/Westwood Pharmaceuticals Site
100 Forest Avenue, Buffalo, New York 14213
Site No. 9-15-141A
Feasibility Study Report

Dear Mr. Sadowski:

On behalf of Bristol-Myers Squibb Company (BMS), Groundwater & Environmental Services, Inc. (GES) is submitting the attached revised *Feasibility Study Report* (FS Report). This report has been updated and revised per the correspondence and comments from Glenn May of the Department, which were submitted via email on May 8, 2014 to Douglas Morrison of BMS. This FS Report was prepared by GES in compliance with current NYSDEC regulations and in conformance with *DER-10 Technical Guidance for Site Investigation and Remediation* to develop and evaluate remedial alternatives for the Site. The FS Report will assist in the preparation of an amended ROD for the site.

If you have any questions or concerns regarding this correspondence, please contact me at (800) 220-3069, extension 4050.

Sincerely,
GROUNDWATER & ENVIRONMENTAL SERVICES, INC.

Devin T. Shay
Senior Project Manager

Enclosure

cc: Glenn May, NYSDEC
Dan Darragh, Cohen & Grigsby
Douglas Morrison, BMS
John Alonzo, de maximis

Feasibility Study Report

IROQUOIS GAS/WESTWOOD PHARMACEUTICAL
100 Forest Avenue
Buffalo, New York
(NYSDEC Site No. 9-15-141A)

SUBMITTED TO:

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION DIVISION OF ENVIRONMENTAL REMEDIATION

SUBMITTED BY:

BRISTOL-MYERS SQUIBB COMPANY

GES

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EXECUTIVE SUMMARY

On January 28, 2014, representatives of Bristol-Myers Squibb (BMS), de maximis, inc. (de maximis), National Fuel Gas (NFG), and Groundwater and Environmental Services, Inc. (GES) met with the New York State Department of Environmental Conservation (NYSDEC) to discuss the findings of the *Supplemental Investigation Report*, dated December 5, 2013. At this meeting, it was agreed that the existing remedy for hydraulic control at the site was not sufficient to prevent groundwater seepage to the creek and would need to be enhanced. The NYSDEC requested that BMS submit an updated Feasibility Study (FS) in accordance with *DER-10 Technical Guidance for Site Investigation and Remediation*, to address the need for hydraulic control and evaluate remedial alternatives consistent with what was discussed at the meeting. GES has prepared this FS on behalf of BMS in response to this request, which evaluates select remedial options. The final recommendation of the installation of an interceptor trench is outlined as the preferred remedial alternative.

SECTION 1
INTRODUCTION

1.1 INTRODUCTION

Groundwater & Environmental Services, Inc. (GES), on behalf of Bristol-Myers Squibb Company (BMS), has prepared this *Feasibility Study* (FS) *Report* for the Iroquois Gas/Westwood Pharmaceuticals property (the Site) located at 100 Forest Avenue in the City of Buffalo, Erie County, New York (**Figure 1**). The New York State Department of Environmental Conservation (NYSDEC) identification number for the Site is 9-15-141A. A Record of Decision (ROD), presenting a remedial program for the Site, was issued by the NYSDEC on March 28, 1994. This FS Report was prepared subsequent to January 21, 2014, approval of the *Supplemental Investigation Report* submitted to the NYSDEC by GES on December 5, 2013 and the resulting meeting between representatives from the NYSDEC, BMS, GES, de maximis, and National Fuel Gas (NFG) which took place on January 28, 2014. The considerations and expectations of the NYSDEC resulting from this meeting, as documented in the Meeting Summary and Anticipated Future Actions Letter submitted by GES on February 6, 2014, indicate that an amended ROD for the Site is necessary to comply with NYSDEC regulations. This FS Report was prepared by GES to develop and evaluate remedial alternatives for the Site in compliance with current NYSDEC regulations and in conformance with *DER-10 Technical Guidance for Site Investigation and Remediation*.

1.2 BACKGROUND INFORMATION

During August and September 2011, NFG was present on the Site at the request of the NYSDEC to complete bank stabilization related activities adjacent to Scajaquada Creek and clear vegetation from the creek bank to improve access to the sheet pile barrier wall located along the creek bank. On September 8, 2011, NYSDEC was notified by NFG that groundwater with non-aqueous phase liquid (NAPL) was observed seeping through a lifting hole in the sheet pile wall. In response, NFG cleaned out the area behind the wall in the area of the lifting hole and filled the void with hydraulic cement.

As a result of the NFG bank work, the sheet pile wall is now accessible for visual inspection and a number of groundwater seeps have been observed. The southernmost seep occurred at Pile 13 (i.e. Seep 13). The northernmost seep occurred at Pile 32. There was also seeping observed at Pile 30. The approximate locations of these seeps are shown on the Site Map provided as **Figure 2**.

On April 17, 2013, NYSDEC collected samples from the seeps at Piles 13 and 32. GES, on behalf of BMS, collected split samples with NYSDEC. The samples were submitted for laboratory analysis of target compound list (TCL) volatile organic compounds (VOCs) via United States Environmental Protection Agency (USEPA) Method 8260B. A summary of the VOCs detected in samples collected by NYSDEC and GES from both seep locations samples is provided on **Table 1**. Elevated VOC concentrations were observed in both samples.

Based on this information, NYSDEC requested a meeting to discuss potential future actions. This meeting took place on May 9, 2013, at the NYSDEC Region 9 office. The meeting was attended by Greg Sutton, Glenn May and Brian Sadowski of NYSDEC, John Alonzo of de maximis, (BMS' representative) and Steven Leitten of GES (BMS' consultant). During the meeting, NYSDEC indicated that the recently submitted *Periodic Review Report* (PRR) would be rejected based on the current environmental conditions existing at the Site (the NYSDEC rejection letter was received on June 4, 2013). In the May 30, 2013 rejection letter, NYSDEC requested a Corrective Measures Work Plan.

In order to more fully understand the nature of the seeps, creek inspections were increased in frequency from monthly to weekly for a period of approximately two months. Weekly inspections were initiated the week of May 13, 2013, and continued through the week of July 1, 2013. The frequency of inspections then reverted back to monthly in August 2013.

In order to ensure maximum groundwater recovery by the remedial system and in the interest of routine maintenance, all the down-well extraction pumps were removed from the extraction wells and cleaned during the week of May 20, 2013. No mechanical malfunctions were found during cleaning and no significant increases in groundwater/dense non-aqueous phase liquid (DNAPL) recovery were noted following cleaning of the pumps.

During the creek inspections, if seeps were identified, a qualitative evaluation of the flow rate was completed. The results of the qualitative flow rate estimates are summarized in **Table 2**. Furthermore, additional sampling of the seep water was conducted in order to confirm laboratory analytical results obtained during the April 17, 2013, original sampling event. Samples from seeps located at Pile 13 and Pile 32 were collected under similar conditions as the first sample collection event (i.e. within 3 days of a significant rain event) on June 4, 2013. A total of two additional sampling events were conducted during dry conditions (i.e. no precipitation for more than five days) on June 26 and July 15, 2013. Please note, during the dry sampling events there was insufficient flow from Pile 32 to sample, therefore, the water discharging at Pile 30 was sampled. This sample was collected from approximately 16 feet south of the Pile 32 sample location. All samples collected were analyzed for TCL VOCs via USEPA Method 8260B. A summary of detected compounds from the additional sampling events is shown in **Table 1**.

On July 31, 2013, an *Amended Supplemental Investigation Work Plan* was submitted to NYSDEC to satisfy the requirements set forth in the NYSDEC PRR rejection letter.

On August 15, 2013, BMS received the formal NYSDEC approval letter of the work scope presented in the *Amended Supplemental Investigation Work Plan*.

During September and October 2013, BMS implemented the assessments/action items outlined in the August 15, 2013 *Amended Supplemental Investigation Work Plan*.

GES, on behalf of BMS, submitted the *Supplemental Investigation Report* to the NYSDEC on December 5, 2013. This report documented the environmental investigation activities completed at the Site, to evaluate the existing groundwater conditions on the Site and investigate the existing groundwater collection system. The results of the investigation indicated that the existing configuration of remediation system on the Site cannot produce sufficient drawdown of the water table to create an inward hydraulic gradient from the sheet pile wall along Scajaquada Creek.

On January 21, 2014, BMS received the formal NYSDEC approval letter for the *Supplemental Investigation Report*. BMS requested a meeting to discuss recommendations for remedial alternatives including an evaluation of potential modifications to the existing remediation system on the Site and/or alternate remedial measures. The meeting took place on January 28, 2014, at the NYSDEC Region 9 office. The meeting was attended by Greg Sutton, Glenn May and Brian Sadowski of NYSDEC, Doug Morrison of BMS, John Alonzo of de maximis, (BMS' representative), Tanya Alexander and Jim Clark of NFG, and Vincent Maresco and Steven Leitten of GES (BMS' consultant). During the meeting, NYSDEC indicated that an amended ROD will be necessary for the Site in order to comply with recent NYSDEC regulations. Additionally, NYSDEC indicated that a formal FS Report and a Site Management Plan are required to satisfy an amended ROD.

On February 6, 2014, GES, on behalf of BMS, submitted a Meeting Summary and Anticipated Future Actions letter documenting NYSDEC comments and considerations discussed during the January 28, 2014 meeting.

SECTION 2
SITE DESCRIPTION AND HISTORY

2.1 SITE SETTING

The Site encompasses approximately 8.8 acres in a mixed industrial/residential area of Buffalo, New York. A Site Location Map is provided as **Figure 1**. The Scajaquada Creek is located adjacent to the western property boundary. An inactive industrial facility (Buffalo Structural Steel) is located directly to the north of the property. Unused industrial buildings and residential homes border the Site to the south. Residential buildings border the eastern side of the property. The average elevation at the Site is approximately 580 feet above mean sea level. The topography of the Site and surrounding property is predominantly flat. However, a narrow, steep slope is present along the western property boundary extending down to Scajaquada Creek. Two 100,000-square-foot warehouses and a remedial system operations building, which is approximately 900 square feet in size, exist on the property. The Site is accessible by two locked access gates located along the western and southern property boundaries. The existing site structures and current layout of the facility are depicted on **Figure 2**.

The subsurface soils in the southern portion of the Site reportedly consist of silty clay extending from the ground surface to 60 feet below grade (ROD, 1994). In the northern portion of the Site, the subsurface material consists of a layer of undifferentiated fill extending to a maximum depth of 32 feet below grade. This fill layer is underlain by silty clay, which also extends to a depth of approximately 60 feet below grade. The silty clay layer is underlain by silt and gravel extending from approximately 60 to 80 feet below grade across the entire Site. Bedrock at the Site is present at approximately 80 feet below grade (ROD, 1994).

2.2 SITE HISTORY

The Site originally operated as a manufactured gas plant (MGP) from approximately 1897 through 1955. Iroquois Gas (now National Fuel Gas) owned and operated the plant from 1925 through 1955, and continued gas storage at the location until 1972. Iroquois Gas removed and/or demolished several of the structures present on the property in 1968. Waste materials, including heavy tars, sludges, coal, coke, and demolition debris were buried on the Site during this period. In 1972, Westwood Pharmaceuticals (now Bristol-Myers Squibb Company, Inc.) purchased the property and demolished the remaining structures present. A 100,000 square foot warehouse (Building 6) was constructed on the southern portion of the Site (**Figure 2**). In 1985, a second 100,000 square foot warehouse (Building 9) was constructed immediately to the north of Building 6 (**Figure 2**). Current records indicate that the Site is owned by the Industrial Realty Group, LLC.

In 1985, potential environmental impacts to the subsurface, including oily residues were observed as the result of the Building 9 construction related activities being performed at the location. Between 1986 and 1988, environmental investigations revealed impacted soil and groundwater were present in the fill material underlying the property. Impacts were not found in the lowermost sand and gravel layer. Non-aqueous phase liquids (NAPLs) were also confirmed to be present in soil and fill material near Scajaquada Creek (ROD, 1994). As a result, in 1989, NYSDEC listed the Site in the Registry of Inactive Hazardous Waste Sites.

In 1992 and 1993, Westwood Pharmaceuticals completed, under NYSDEC oversight, a Remedial Investigation/Feasibility Study (RI/FS) to define the nature and extent of any contamination resulting from previous activities performed at the Site and to develop potential remedial alternatives for the Site. The final remedial objectives, per the ROD issued by the NYSDEC in 1994, were divided into terrestrial and riparian components with Westwood Pharmaceuticals assuming obligations related to the terrestrial remedy and NFG assuming obligations related to the riparian remedy. Based on NYSDEC review of the RI/FS, the selected terrestrial remedy included the following:

- A clay cap to contain the source area contaminants;
- Sheet piling barrier wall (installed at the crest of Scajaquada Creek bank by NFG) for migration control;
- Extraction wells for gradient control;
- Groundwater and DNAPL treatment by oil/water separation, filtration, and activated carbon or equivalent;
- In-situ biotreatment system of soil and groundwater to enhance the remediation process, if found to be effective[1]; and
- Long-term monitoring, land use restrictions and fencing.

As part of the agreement between NFG and Westwood Pharmaceuticals, NFG has agreed to maintain the sheet piling barrier wall.

The selected riparian remedy included the following:

- Excavation of contaminated sediments originating from the Site;
- Fencing and use restriction in the stretch of the Creek under excavation for the duration of the work;
- Construction on the Site and use of a temporary storage and dewatering facility for the excavated sediments;
- Pre-treatment and disposal of wastewater from the dewatering operation;
- Off-site transport of the dewatered sediments for thermal destruction or disposal by other approved and suitable methods consistent with Federal/State regulations; and
- Post sediment removal confirmatory sampling.

[1] The results of engineered bioremediation testing completed at the Site have demonstrated that the technology is ineffective due to separate phase impacts in the subsurface, limited microbial activity and extensive subsurface heterogeneity. It was demonstrated that short-circuiting of injected fluids and inhibited delivery of oxygen and nutrients could occur as a result of the application of this technology (Evaluation of Engineered and Intrinsic Bioremediation, Iroquois Gas/Westwood Site, Buffalo, GeoTrans, Inc. New York, December 18, 2002).

Remediation goals for the remedial program were established under the overall goal of meeting all standard, criteria, guidance (SCGs) and protecting human health and the environment. The specific remedial goals for the Site include:

- Reduce, control, or eliminate the contamination present within the soils/waste on the Site;
- Eliminate the threat to surface waters by eliminating any future contaminated surface run-off from the contaminated soils on the Site;
- Eliminate the threat to the environment, fish, and wildlife and public health by remediating contaminated sediments originating from the Site to background conditions;
- Eliminate the potential for direct human or animal contact with the contaminated soils on the Site;
- Reduce or eliminate migration of contaminated groundwater and NAPL to the environment;
- Prevent, to the extent practicable, migration of contaminants from the Site to groundwater; and
- Provide for attainment of New York State SCGs for groundwater quality.

Throughout the investigative and remedial phases of the terrestrial remedy, a total of 14 monitoring wells, 12 piezometers, and 6 extraction wells were installed for monitoring, sampling, and groundwater recovery purposes (**Figure 2**). Current remedial operations for the Site include operation and maintenance of the groundwater extraction system and maintenance of the surface control barrier (cap).

Presently, the environmental monitoring system for groundwater and surface water includes the following:

- Groundwater extraction wells EW3 through EW8. These wells were installed to hydraulically control and contain the movement of contaminated groundwater to prevent migration and potential discharge into Scajaquada Creek; and
- Piezometers P1 through P6. These were installed to measure the hydraulic gradient between the recovery wells and Scajaquada Creek and to monitor the performance of the extraction well system.

In accordance with the Operation and Maintenance (O&M) Manual, groundwater and surface water gauging was performed weekly for the first 6 months of system operation and was then reduced to a quarterly performance.

Implementation, operation and maintenance of the existing remedial groundwater treatment system at the Site began in 1997. In 2005, GES was retained by BMS to take over O&M activities at the Site.

SECTION 3
SUPPLEMENTAL GROUNDWATER INVESTIGATION SUMMARY

3.1 EVALUATION OF THE NATURE AND EXTENT OF IMPACTS

GES completed environmental investigation activities on the Site from September 13, 2013, through October 30, 2013, to investigate the nature and extent of existing impacts to groundwater on the property and investigate the efficiency of the existing groundwater recovery system. Additional aquifer testing activities were also completed with the purpose of evaluating viable remedial alternatives applicable to the Site. The investigation activities included precipitation/weather monitoring, well development, elevation survey data collection, groundwater liquid level data collection, dissolved phase analytical data collection and a series of pumping and formational response tests.

On Friday, September 13, 2013, the remediation system on the Site was shut down to allow the groundwater system to return to nearly static conditions. On September 16, 2013, GES completed a synoptic liquid level gauging event to examine the hydraulic gradients under non-pumping conditions. A site-wide groundwater sampling event was also completed from September 16 to September 18, 2013 to evaluate dissolved-phase VOCs conditions with the goal of determining the plume chemistry across the Site. Upon completion of gauging and sampling, GES conducted pumping and formational response testing. The pumping tests were completed on September 30, 2013. At this time, the groundwater system was again allowed to return to nearly static conditions for a period of 24 hours, while additional elevation data from both the Site monitoring wells and Scajaquada creek were collected. The remediation system was restarted on October 4, 2013. Groundwater and surface water data was collected throughout the system re-start process. A final synoptic liquid level gauging event was completed several weeks after the remedial system was restarted to further evaluate the hydraulic gradients at the Site. A description of environmental investigation methods utilized during the groundwater investigation and a detailed discussion of the investigation results is provided in the *Supplemental Investigation Report* submitted to the NYSDEC on December 5, 2013.

3.2 CURRENT SITE CONDITIONS

The groundwater elevation data gathered during the synoptic groundwater gauging event completed on the Site on September 16, 2013, after 3 days of non-pumping conditions, indicates that the groundwater flow system in the northwest corner of the Site is complex. Under static conditions, a southwest groundwater gradient is established that indicates groundwater is flowing into the Site from the north. A summary of the groundwater elevation data for the gauging event is provided on **Table 3**. A groundwater contour map indicating groundwater flow direction at the Site during gauging is provided as **Figure 3**.

The synoptic gauging event also revealed a residual induced gradient from the outermost extraction wells (i.e., EW3 and EW8) towards the inner extraction wells (i.e., EW5 and EW6). This suggests the system is somewhat effective at influencing the groundwater gradient at the Site. Additionally, it could be concluded the groundwater system reacts slowly to pumping conditions because this effect was apparent up to 3 days after the system was shut down. Lower heads were observed in 9 of 12 monitoring wells following system operation between October 4 and October 30, 2013, suggesting the potential for hydraulic influence of the system as measured over an extended period of time.

The results of the groundwater sampling completed from September 16 to September 18, 2013, indicate that dissolved-phase impacts to groundwater are limited to the northern portion of the Site. A summary of groundwater analytical results for the sampling event is provided in **Table 4**. A map presenting total VOC isoconcentrations in groundwater is provided as **Figure 4**. It is apparent from the analytical data that the maximum impacts to groundwater are present along the northern border of Building 9 (in the vicinity of piezometers PF6, PF4, P5 and P6). The total VOC concentration in groundwater collected from piezometer PF6, located near the northeast corner of Building 9, was 19,500 micrograms per liter (µg/L). The total concentration of VOCs in groundwater collected from piezometer PF4, located near the northwest corner of Building 9, was 5,435 µg/L. The total concentrations of VOCs in groundwater collected from piezometers P5 and P6, which are located just to the west of Building 9, were 3,192 µg/L and 12,735 µg/L, respectively. GES could not locate historical groundwater analytical data for piezometers P5 and P6, which are located downgradient of the extraction system, and therefore, could not determine if these impacts were present at the time of system installation in 1997. By comparison, groundwater analytical data for quarterly sampling events completed during the 1992 Remedial Investigation (GeoTrans, 1993) show substantially higher BTEX concentrations in wells B6, B7, MWF2, MWF3, MWF4, and MWF5 than those detected in the same wells in 2013. BTEX concentrations are currently 3 to 10 times lower than those concentrations detected in 1992. The reduction in contaminant concentrations over this time and plume contraction is likely the result of mass removal through operation of the existing groundwater extraction wells and biodegradation as the constituents naturally attenuate in the subsurface.

It should be noted that the total VOC concentrations at wells EW8 and B7 were uncharacteristically low relative to the total VOC concentrations of nearby wells. The low concentrations create the appearance of “pinching-in” the isocontours presented on **Figure 4**. This could be an effect of the inward hydraulic gradient that is discussed above. Impacted groundwater is drawn toward the middle of the extraction system and clean water infiltrates the margins of the impacted area. This would also suggest the remedial system is somewhat effective at influencing the groundwater gradient on the property.

The data collected during the pilot test investigation, as well as historical data, indicate that piezometer P3 and well EW3 constitute the southern extent of groundwater impacts exceeding NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 *Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations*. Therefore future remedial and containment efforts should focus on the portion of the Site to the north of piezometer P3 and well EW3.

3.3 CREEK INSPECTIONS

At the request of NYSDEC, GES completed additional creek inspections from September 17 through October 4, 2013, to evaluate any changes in the volume or pattern of seeps observed adjacent to Scajaquada Creek due to the shutdown of the remediation system. No additional seeping, beyond what had been previously observed, developed after the system was shut down on September 13, 2013. This is evidenced by the seeps gradually diminishing in flow volume through September 20, 2013. A summary of creek inspection results is provided on **Table 2**.

There was a sizable increase in the volume of the observed seeps on September 23, 2013 (**Table 2**). The increase in seep volume follows a significant rain event in which 3.52 inches of cumulative precipitation was recorded to have accumulated from 2:30 AM to 7:30 PM on September 21, 2013. Relative and cumulative rainfall data from September 16 to October 4, 2013, may be referenced on **Figure 5**. Additionally, the pressure transducers in place at the conclusion of the pumping test of EW8 on September 20, 2013, (i.e., EW8, EW7, B8, MWF5 and MWF4) were left in place throughout the period of precipitation and recorded corresponding groundwater elevation changes during the rain event. **Figure 6** shows the effect the rain event had on the water levels in these wells. The cumulative rise in groundwater elevation in the wells, when compared to groundwater elevations measured in the well prior to the rain event, was 1.27 feet. Wells EW7, EW8 and B8 display similar response curves that exhibit a relatively quick response to the infiltration of rainwater. In comparison, wells MWF4 and MWF5, which are located near the northern property boundary of the Site, display a slower and more gradual response to influx of precipitation.

The volume of the seep flows were observed to diminish following the September 21, 2013, rain event (**Table 2**) until the final inspection on October 4, 2013. During this inspection, a notable increase in the volume of the seep flow was again observed. This increase in flow followed a rain event in which 0.81 inches of rainfall was recorded from 10:00 PM on October 3, 2013, through 3:30 AM on October 4, 2013 (**Figure 5**). This suggests the flows of the observed seeps are closely related to rain events and are not effectively controlled via the existing extraction system operating on the property. It should be noted, however, the volume of flow at the seeps located closer to the center of the extraction system (i.e., Seeps 14, 16 and 17) tend to diminish faster than those further away (i.e., Seeps 13, 30 and 32), which could be related to the inward groundwater gradient discuss above in Section 3.2.

3.4 SYSTEM PUMPING TEST

GES performed pre-test pumping at the Site from September 17 to September 19, 2013, to establish the optimum pumping rates for the extraction wells and piezometer included in the pumping test. A summary of the pre-test pumping data is provided on **Table 5**. With the exception of the well PF2, located approximately 12 feet from well EW3, observation wells were generally greater than 20 feet away from the pumping well. In general, very little water was able to be extracted during pre-test pumping activities (i.e., approximately 100 gallons of water per day), as our sustainable pumping rates were between 0.05 and 0.5 gallons per minute (GPM). Additionally, during nearly all the tests, little to no drawdown was recorded in the surrounding observations wells (i.e., 0.1 feet or less). During pre-test pumping at well EW5, a drawdown of 0.6 feet was observed in well B7 (**Table 5**). However, this occurrence was an exception.

Sustainable pumping rates for piezometers P5 and P6 were approximately 0.06 and 0.03 GPM, resulting in approximately 5 feet and 2 feet of drawdown, respectively. Well EW8 exhibited a sustainable rate similar to piezometers P5 and P6 (i.e., 0.06 GPM), resulting in approximately 6 feet of drawdown. These rates are somewhat lower than the remaining extraction well pumping rates, which ranged from 0.125 GPM in wells EW3, EW4 and EW6 to 0.15 GPM in wells EW5 and EW7. These pumping rates resulted in approximately 4 feet, 5 feet, 5 feet, 7 feet and 4 feet of drawdown in wells EW3, EW4, EW5, EW6 and EW7, respectively. The lower pumping rates in P5 and P6 could be attributed to lack of well development. Well

EW8, however, was developed and displayed a similar, low pumping rate. The variability in pumping rates is likely the result of variations in the composition of the subsurface in the vicinity of each well.

It is of interest that the greatest pumping rates were observed at wells EW5 and EW7, which are located near the center of the extraction system. The ability to draw more water from these wells could be a contributing factor to the inward gradient previously discussed.

The system pumping test was completed from September 20 to September 30, 2013. Individual pumping test data is provided on **Figure 6** through **Figure 14**. The pumping tests were performed to determine if immediate effects to the surrounding water table could be observed in the monitoring wells, thus determining if there was ready influence from short-term pumping. The pumping from the individual extraction wells had little to no effect on drawdown at surrounding observation wells during the short testing period. The first few tests (i.e., P6, P5, EW7 and EW8) were conducted as 8-hour pumping events. Since no significant drawdown was observed in the surrounding monitoring wells, the pumping duration was increased to approximately 29 hours for the EW3 pumping test with the goal of determining if a longer duration of pumping would result in drawdown in any of the surrounding observation wells. During the EW3 pumping test, a steady drawdown of at least 9 feet from the static water level was achieved (approximately 50% of the aquifer thickness) and was maintained for the duration of the test. As is evident from the data presented on **Figure 10**, no drawdown was observed at any of the surrounding observation wells. Wells EW3 and PF2 are 12 feet apart, making them the closest pumping and observation well pair on the Site. Theoretically, drawdown was most likely to be observed at PF2 during the EW3 pumping test due to the duration of the test and the proximity of the pumping well. However, no elevation change was observed at PF2 during the test (**Figure 10**).

It can be reasonably concluded from the individual pumping tests that the hydraulic system does not respond rapidly to pumping induced changes in water table elevations in the individual extraction wells. In their current configuration, the data collected indicates that the extraction wells have a short-term capture zone of less than 12 feet, despite drawdown in the pumping wells of up to 9 feet. This is evidenced by the lack of observed drawdown in PF2 during the pumping test at well EW3. The exception, as mentioned in the pre-test pumping discussion above, is the EW5 test in which a drawdown of 0.6 feet was observed in B7 which is located approximately 40 feet away from EW5. This result is unique since no drawdown was observed in PF3 which is located approximately 20 feet from EW5. This result, however, could be attributed to potential preferential pathways that have developed due to heterogeneous material comprising the subsurface (fill).

An important observation made during the 2013 tests conducted at well P5 and EW7 indicates that the water levels in these wells were not able to be pumped down to an elevation below the elevation of Scajaquada Creek. This may be additional evidence of subsurface heterogeneities or indicative of a well construction issue. This observation should be further considered during the development of remedial goals as a creek elevation-based criteria for hydraulic control may not be a true indicator of success.

The variability of the pumping rates established in the pre-testing phase of the pilot test suggest a heterogeneous subsurface. The pumping data and historic site investigation findings both support the conclusion that the subsurface is comprised of heterogeneous fill deposits. The variability of well recovery rates after pumping was stopped further supports this conclusion. Previous environmental investigations have confirmed fill material comprises much of the area of concern in the northern portion of the Site. Therefore, the proposed remedial design will need to account for this variability in the subsurface.

3.5 PUMPING TEST GROUNDWATER SAMPLING

GES completed post-test sampling of groundwater at the conclusion of the last pumping test performed at each location to evaluate the VOC concentrations from the wells. A summary of the groundwater analytical results resulting from post-test sampling is provided on **Table 6**. The post-test data was compared to the analytical data resulting from the site-wide groundwater sampling event completed on September 16 through 18, 2013 (**Table 4**). No discernable pattern of change in VOC concentration is apparent between pre- and post-test data. The post-test samples collected from wells P6 and EW7 displayed the largest decrease in total VOC concentrations when compared to initial sample results. The VOC concentrations in groundwater from wells EW3, EW4 and EW5 were approximately the same in both pre- and post-test samples. Wells EW6 and EW8 showed an increase in VOC concentrations in post-test samples. This would suggest wells P6 and EW7 were drawing water from less impacted areas under pumping conditions while wells EW6 and EW8 were drawing water from more impacted areas under pumping conditions. While these observations are provided for in the data, there is no trend that has to be further investigated or considered in the pending design.

3.6 MONITORED SYSTEM RE-START

GES completed a monitored system re-start on September 30, 2013 with the goal of observing the short-term effects of the startup of the system and the effects of depressing the water table at the extraction wells from near-static conditions. All of the remedial system extraction wells were included in the re-start to observe the effects of combined pumping on the surrounding observation wells. The resulting groundwater elevation data (**Figure 15**) indicates that there was minor drawdown in the observation wells over the course of the two-day monitoring period. This drawdown was not sufficient to lower the groundwater levels in piezometers P2 through P6 to a level lower than the surface elevation of the creek during this short-term evaluation period. The long-term target determining the design criteria for the remediation system is to lower the water table in these wells to an elevation below that of the creek. The groundwater elevation data collected at the conclusion of the monitored system re-start, shown in **Figure 16**, indicates the overall groundwater gradient remains towards the creek with little to no short-term observed effect from the pumping at the extraction wells. Longer term effects from pumping are difficult to quantify or observe due the combined effects of atmospheric pressure changes, changes in creek elevation, and precipitation events. A summary of the groundwater elevation data collected at the conclusion of the monitored system re-start is provided as **Table 7**.

3.7 ADDITIONAL SYNOPTIC LIQUID LEVEL GAUGING EVENT

GES completed an additional synoptic groundwater gauging event on October 30, 2013, to observe if the hydraulic gradients at the Site would change as a result of long-term pumping conditions. The groundwater elevation data collected during this event are summarized on

Table 8. A groundwater contour map depicting the groundwater elevation information is provided on **Figure 17.** The groundwater elevation data collected at the monitoring wells indicates that the water table elevation decreased at 9 of the 12 wells commonly gauged between the October 4 and October 30, 2013 events. The magnitude of this decrease at the monitoring wells averaged 0.60 feet between these 2 dates. However, during this same time period, the creek stage decreased by 1.34 feet, so it is difficult to deduce whether or not the changes in the water table elevation in the monitoring wells can be related to long-term pumping effects, creek stage changes, or a combination of both. A review of the groundwater contour maps indicate that there were no significant changes in the groundwater gradient when compared to the conditions present at the conclusion of the monitored system re-start.

SECTION 4
REMEDIAL GOALS AND REMEDIAL ACTION OBJECTIVES

4.1 REMEDIAL GOALS

The remedial goals for the Site, as listed in the 1994 ROD, include the following:

- Reduce, control, or eliminate the contamination present within the soils/waste on the Site;
- Eliminate the threat to surface waters by eliminating any future contaminated surface run-off from the contaminated soils on the Site;
- Eliminate the threat to the environment, fish, and wildlife and public health by remediating contaminated sediments originating from the Site to background conditions;
- Eliminate the potential for direct human or animal contact with the contaminated soils on the Site;
- Reduce or eliminate migration of contaminated groundwater and NAPL to the environment;
- Prevent, to the extent practicable, migration of contaminants from the Site to groundwater; and
- Provide for attainment of New York State SCGs for groundwater quality.

For the purposes of this FS, the remedial goals being specifically addressed are to "Reduce or eliminate migration of contaminated groundwater and NAPL to the environment" and "Provide for attainment of New York State SCGs for groundwater quality". All of the remaining goals are adequately addressed by the previous remedial actions and institutional controls currently in place. These remedial actions have included the installation and maintenance of a sheet pile barrier wall, the excavation and removal of impacted sediments associated with the Creek, the construction of a storm water management system, installation and maintenance of the clay cap, and installation of fencing for site control. As these remedial actions have been in place and successful since 1997, this FS is focused on measures to enhance or replace the existing groundwater pump and treat system.

4.2 REMEDIAL ACTION OBJECTIVES

The primary objective of this FS Report is to complete a detailed evaluation of the viable remedial alternatives applicable to the remedial goals for the Site that require addressing, as stated above, and to select an appropriate remediation alternative based on the likely effectiveness, the ease of implementation and potential implementation risks of the remedial method. The development of remedial action objectives (RAOs) is intrinsic to the overall remedial alternatives development and evaluation process. RAOs are identified to provide the basis for developing and selecting the appropriate remedial alternative to achieve site conditions that are protective of public health and the environment. Site-specific RAOs are established based on the type of contaminated media, the type of contaminants present, and the concentration of any contaminants present and potential receptors. All RAOs developed for the Site were made in accordance with the *DER-10 Technical Guidance for Site Investigation and Remediation* (DER-10), last amended on May 3, 2010, as issued by NYSDEC. Applicable standards, criteria and guidance (SCGs) for the Site, as defined by the NYSDEC (ROD, 1994) were considered during the development of the site-specific RAOs.

Based on remedial activities already completed on the Site by NFG and Westwood Pharmaceuticals, in accordance with the ROD issued on March 18, 1994 by NYSDEC, RAOs for soil, sediment and surface water have been met by the responsible parties and do not need to be addressed as part of the scope of this FS Report.

The collection and evaluation of data in September and October of 2013, as reported in the *Supplemental Investigation Report* illustrated that the remediation system, in its current configuration, was not attaining complete hydraulic control of the groundwater plume. Enhancement of this system or a new approach is necessary to meet the RAOs for groundwater VOCs at the Site.

During the meeting of January 28, 2014, the NYSDEC requested that BMS evaluate a potential vapor intrusion concern for Building 9. RAOs for soil vapor are summarized below at the request of the NYSDEC. A vapor intrusion mitigation system was incorporated in the design and construction of the slab for Building 9. Further details regarding this design and installation are included in Section 4.2.2.

<table>
<tr><th colspan="3">SITE-SPECIFIC REMEDIAL ACTION OBJECTIVES SUMMARY</th></tr>
<tr><th>Media</th><th>Constituent(s) of Concern</th><th>Remedial Action Objectives</th></tr>
<tr><td>Groundwater</td><td>VOCs</td><td><u>RAOs for Public Health Protection:</u>
• Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.
• Prevent contact with, or inhalation of volatiles, from contaminated groundwater.
<u>RAOs for Environmental Protection:</u>
• Restore groundwater aquifer to pre-disposal/pre-release conditions, to the extent practicable.
• Prevent the discharge of contaminants to surface water.
• Remove the source of ground or surface water contamination through removal or treatment.</td></tr>
<tr><td>Soil Vapor</td><td>VOCs</td><td><u>RAOs for Public Health Protection:</u>
• Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at a site.</td></tr>
</table>

4.2.1 Groundwater and Seep Conditions

The evaluation of the existing groundwater and seep conditions at the Site is not limited to sampling locations that display exceedances of the established NYSDEC TOGS 1.1.1 criteria. All potential impacts to groundwater, including compounds with analytical concentrations that fall below existing NYSDEC TOGS 1.1.1 Guidance Values and compounds that have no existing criteria, are also monitored and have been included in the evaluation of the existing conditions. The groundwater analytical data for samples collected from site wells during the period from September 16 to September 18, 2013, indicates that the highest concentrations of total VOCs were present in groundwater from wells located in the northern portion of the Site. A contour map depicting total VOC isoconcentrations for this sampling event is provided as **Figure 4.** It is apparent from the analytical data that the maximum impacts to groundwater are present in the vicinity of piezometers PF6, PF4, P5 and P6. The total VOC concentration in groundwater collected from piezometer PF6, located near the northeast corner of Building 9, was 19,500 micrograms per liter (µg/L). The total concentration of VOCs in groundwater collected from piezometer PF4, located near the northwest corner of Building 9, was 5,435 µg/L. The total concentrations of VOCs in groundwater collected from piezometers P5 and P6, which are located just to the west Building 9, were 3,192 µg/L and 12,735 µg/L, respectively. Overall, exceedances of NYSDEC TOGS 1.1.1 Groundwater Standards were observed for acetone, benzene, cis-1,2-dichloroethene, ethylbenzene, isopropyl benzene, tetrachloroethene, toluene, trichloroethene and total xylenes in groundwater from Site wells that were sampled during the monitoring event. In addition, two compounds were detected at concentrations below TOGS 1.1.1 Guidance values. The compound chloroform was detected in groundwater from a single location (B6) at a concentration of 3.1 µg/L. Vinyl chloride was detected at a single location (EW3) at a concentration of 1.1 µg/L. Methylcyclohexane, which does not have an established Guidance Value, was detected in groundwater from three well locations at concentrations ranging from approximately 0.74 µg/L to 4.4 µg/L. Monitoring of all detected compounds in groundwater will continue in order to ensure that any changes in the concentrations of contaminants or migration of impacted groundwater are immediately observed and appropriate actions are implemented in a timely manner. The detections and exceedances observed as a result of this recent groundwater sampling event, as well as available historical groundwater data, indicate that piezometer P3 and well EW3 constitute the southern extent of all groundwater impacts observed at the Site. A groundwater analytical data summary for the September 16 to September 18, 2013 sampling event is provided on **Table 4**.

Samples were also collected and analyzed from the seeps at the sheet pile barrier wall to characterize potential impacts in this area. The sample collected from Seep 32 on June 4, 2013 revealed exceedances of TOGS 1.1.1 Guidance Values for benzene (630 µg/L), ethylbenzene (470 µg/L), isopropylbenzene (28 µg/L) and total xylenes (140 µg/L). The results of the seep analysis revealed detections for cyclohexane, methylcyclohexane and toluene that fell below TOGS 1.1.1 Guidance Values or had no established criteria. Chloroform was not detected in the Seep 32 sample collected in June. The results from the sample collected from Seep 13 on August 15, 2013 indicated an exceedance of the TOGS 1.1.1 Guidance Value for chloroform (7.4 µg/L) and a detection for benzene (0.47 µg/L) that was below the established Guidance Value. The compounds cyclohexane, ethylbenzene, isopropylbenzene, methylcyclohexane, toluene and total xylenes were not detected in the Seep 13 sample collected in August. The results from the sample collected from Seep 30 on August 15, 2013 indicate exceedances of the TOGS 1.1.1

Guidance Values for benzene (670 µg/L), ethylbenzene (46 µg/l), isopropylbenzene (24 µg/L) and total xylenes (24 µg/L). The compounds cyclohexane, methylcyclohexane and toluene were present in this sample at concentrations that fell below TOGS 1.1.1 standards or had no established criteria. Chloroform was not detected in the Seep 30 sample collected in August. The sheet pile wall will continue to be inspected for seeps. An analytical data summary for the seep sampling events is provided on **Table 1**.

4.2.1.1 RAOs for Public Health Protection

The first listed RAO for public health protection regarding groundwater at the Site is to prevent ingestion of groundwater with contaminant levels exceeding drinking water standards. Groundwater at the Site is not currently used as a potable water source therefore, this RAO is not considered applicable to the Site at the time of this FS Report. Available information indicates that the only institutional control currently established for the property is the Declaration of Covenants and Restrictions implemented for the location by the State of New York on August 8, 1995. Additional deed restrictions regarding groundwater use limitations and/or permits may be warranted or required at the discretion of appropriate agencies (NYSDEC and NYSDOH).

The second listed RAO for public health protection regarding groundwater at the Site is to prevent contact with, or inhalation of volatiles, from contaminated groundwater. There is a potential for exposure to impacted groundwater via direct contact or inhalation of volatiles by environmental, construction and/or excavation workers. The groundwater elevation data collected on September 16, 2013 from the wells and piezometers on the Site indicated that the average depth to groundwater on the Site is 14.6 feet below grade. This depth range minimizes the likelihood of casual exposure to groundwater on the Site. However, any remedial actions/technologies for groundwater must address the following RAO: prevent direct contact (i.e. incidental ingestion, inhalation and dermal contact) with contaminated groundwater above the acceptable risk levels for human receptors. These exposure pathways could be mitigated via personal protective equipment and institutional controls. Trespasser casual exposure to contaminants at either the seeps or from contact or inhalation of groundwater-sourced volatiles is prevented by the institutional control of the fence, restricted site access, and limited access to the seeps along the creek (a boat would be required to access the creek bank.)

4.2.1.2 RAOs for Environmental Protection

The first listed RAO for environmental protection regarding groundwater is to restore the groundwater aquifer to pre-disposal/pre-release conditions, to the extent practicable. The goal of this FS Report is to evaluate applicable remedial technologies and select the most appropriate environmental remedy for the Site, in that the implementation of a selected remedy will minimize and/or remove existing impacts to groundwater. Any decrease in the overall concentration VOCs on the Site will aid in the restoration of groundwater to pre-release conditions. The applicable remedial technology selected for the Site must address, to the extent practicable, the RAO to restore groundwater at the Site to pre-release conditions.

The second listed RAO for environmental protection regarding groundwater at the Site is to prevent the discharge of contaminants to existing surface water bodies. The discharge of groundwater, in the form of seeps from the sheet pile barrier wall, located adjacent to Scajaquada Creek, is intermittently observed at the Site. The potential exists for impacted groundwater to reach the sheet pile barrier wall and/or Scajaquada Creek via subsurface migration due to a lack of hydraulic control. Therefore, the selected remedial technology must address the RAO to achieve hydraulic control and successfully mitigate the potential for groundwater to discharge into Scajaquada Creek.

The third listed RAO for environment protection regarding groundwater is to remove the source of ground or surface water contamination in order to mitigate the migration of the source of contaminants. As per the ROD (NYSDEC 1994), the Site was capped and a sheet pile barrier wall was installed along the western boundary of the Site to stop the migration of impacted groundwater and/or separate phase impacts. These measures meet the goal of contamination reduction control and elimination of source migration. The applicable remedial technology selected for the Site must address, to the extent practicable, the RAO to restore groundwater at the Site to pre-release conditions.

4.2.2 Soil Vapor

4.2.2.1 RAOs for Public Health Protection

The first listed RAO for public health protection regarding soil vapors on the Site is to mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at a site. During the meeting of January 28, 2014, the NYSDEC requested that BMS evaluate a potential vapor intrusion concern for Building 9, which is the only structure on the Site proximal to delineated contaminants. BMS believes that a vapor intrusion mitigation system was incorporated in the design of the slab for Building 9. At this time, BMS is currently seeking as-built drawings for the building that depict how this system was installed. BMS has collected anecdotal and visual evidence for the existence of this system, however. A previous BMS employee at the facility recently told BMS that he recalls that a passive ventilation system was installed in the slab at the request of the NYSDEC. BMS has also located a construction change order document from Siegfried Construction (the Building 9 construction contractor), that notes the installation of the subsurface venting. Visual evidence of the vapor mitigation system includes the identification of approximately 50 plastic pipes installed in the building slab, at approximate 10-foot on-center intervals, which is visible outside the building on two sides of the slab. BMS will continue with an internal search for construction as-builts showing the design of the vapor mitigation system. At this time, we believe this is sufficient evidence for the existence of the vapor mitigation system and thus the RAOs for soil vapor are currently met. Based on the proposed use(s) anticipated for the Site, it is anticipated that this subsurface venting system will remain in place. This potential RAO, although technically applicable to the Site, has already been addressed.

SECTION 5
IDENTIFICATION OF TECHNOLOGIES AND DEVELOPMENT OF ALTERNATIVES

5.1 GENERAL RESPONSE ACTIONS

The existing terrestrial remedy for the site, as documented and approved in the 1994 ROD includes the following:

- A clay cap to contain the source area contaminants;
- Sheet piling barrier wall (installed at the crest of Scajaquada Creek bank by NFG) for migration control;
- Extraction wells for gradient control;
- Groundwater and DNAPL treatment by oil/water separation, filtration, and activated carbon or equivalent;
- In-situ biotreatment system of soil and groundwater to enhance the remediation process, if found to be effective; and
- Long-term monitoring, land use restrictions and fencing.

All of the remedial actions stated above are currently in place and effective, with the exception of gradient control. Based on this, the FS Report addresses groundwater as the contaminated media and groundwater gradient control as the only remedy in place that requires a change in response action. Other media were not evaluated, as this document was prepared in response to the impacted groundwater remedy, defined in the 1994 ROD, that has been implemented between 1997 and the present. Currently, the in-place remedies for other media pertaining to the terrestrial component of remedial objectives, as described in the March 1994 ROD are intact and effective.

Given the focus of this document on groundwater, the General Response Actions that may apply include:

- Barrier technology;
- In-situ treatment;
- Ex-situ treatment; and
- Removal or treatment of sources of groundwater contamination.

5.1.1 Presumptive Remedies

GES reviewed and considered the NYSDEC Program Policy *DER 15: Presumptive and Proven Remedial Technologies* to streamline the selection of an appropriate remedy that can successfully achieve the RAOs for the Site. This document was rescinded by the Department in 2013, however it identifies technologies that are appropriate for use at the Site. For groundwater VOC contamination, presumptive remedies include:

- Extraction and treatment;
- Air stripping;

- Treatment via granular activated carbon;
- Chemical/ultraviolet oxidation;
- Separate phase recovery;
- Air sparging;
- In-well air stripping;
- Bioremediation

The conclusions of the environmental and aquifer testing activities presented in the *Supplemental Investigation Report* (GES, 2013) indicated that deficiencies in the impacted groundwater remedy, defined in the 1994 ROD and implemented at the Site between 1997 and the present, resulted from inadequate control of the hydraulic gradient in the area of the Site with the greatest impacts to groundwater. This shortcoming has resulted in intermittent shifts of the hydraulic gradient toward Scajaquada Creek. The goal of a compliant remedy that will meet the RAOs described in Section 4, is to prevent potential discharge of impacted groundwater. With this objective in mind, extraction and treatment is an applicable presumptive remedy. An extraction and treatment approach also has the benefit of including the recovery of any separate phase impacts, if present. The existing remedy in place is an extraction and treatment technology using a network of pumping wells to extract groundwater, treat it via granular activate carbon, and discharge the treated groundwater to the municipal sewer in accordance with a permit from the Buffalo Sewer Authority (BSA). As the shortcoming in this remedy has been shown to be the ability of the pumping wells to fully capture the groundwater plume, it will be necessary to enhance or modify the existing remedy to increase its effectiveness.

5.2 DEVELOPMENT OF ALTERNATIVES

Based on the identification of the general response actions and the technologies considered as part of the presumptive remedies, the remedial alternatives proposed for consideration include the following:

a. No action beyond the existing remedies in place;

b. Engineering and institutional controls with existing remedial response in place;

c. Air sparging with soil vapor extraction, coupled with engineering and institutional controls;

d. In-situ chemical oxidation, coupled with engineering and institutional controls;

e. Vacuum enhanced groundwater extraction and treatment, coupled with engineering and institutional controls;

f. Groundwater interceptor trench, coupled with engineering and institutional controls.

Each of these alternatives will be analyzed in the following section. The above listing of remedial alternatives being evaluated are all predicated upon an evaluation of the storm water infiltration control. As suggested by the pumping test data, storm events are able to affect the water bearing unit rather quickly. Thus the project success can likely be enhanced by the evaluation and potential implementation of additional storm water infiltration control mechanisms. These control actions may include various tasks such as: evaluation of storm water conveyance structures, investigating the potential for roof drain discharge to the target area, evaluating the capping of additional currently uncapped areas, or other actions that can minimize infiltration into the target area of the site.

Additionally, options c, d, e, and f above all are predicated on the concept of discontinued use of the current network of recovery wells. At this stage of alternative analysis it is the project intent to continue the use of the above grade water treatment components in all options involving water recovery; however; the bottom four options all have the common theme of discontinuing the use of the existing recovery wells in favor of the alternative remedial technology being evaluated.

SECTION 6
ANALYSIS OF ALTERNATIVES

As stated previously, representatives from BMS, de maximis, NFG and GES met with the NYSDEC on January 28, 2014, to review the groundwater plume assessment and system pumping data collected during September and October of 2013. As part of this discussion, information on the preliminary identification and screening of applicable remedial technologies was presented. This initial evaluation identified air sparging and soil vapor extraction (SVE), in-situ chemical oxidation (ISCO), vacuum enhanced groundwater extraction (VEGE), and groundwater recovery via interceptor trench (with treatment) as the most viable site-specific remedial technologies considering the existing site conditions and limitations.

A detailed technological evaluation of each of the above-listed technologies was conducted according the screening guidance described by the NYSDEC in Section 4.3 of the DER-10 *Technical Guidance for Site Investigation and Remediation*. The screening evaluation criteria are divided into three groups based on the primary role of the given criteria as it relates to remedy selection.

The threshold criteria, which include overall protection of human health and the environment and regulatory compliance, define the statutory requirements that must be met for an alternative to be considered an eligible remedy.

The primary balancing criteria outline the technical criteria that the selected remedy must meet and includes the implementability, short- and long-term effectiveness, reduction of toxicity, mobility or volume, land use considerations and cost effectiveness. The evaluation criterion for land use for the Site was applied to the detailed screening evaluations for each remedial technology equally and is not considered a defining criteria for the remedy selection process in this FS Report. The Site is currently utilized as an industrial facility. It is anticipated that the Site will remain an industrial facility and transfer of property ownership will be subject to the Declaration of Covenants and Restrictions implemented for the location by the State of New York on August 8, 1995. A deed restriction will need to be obtained from the current property owner.

The final group of criteria, the modifying criteria, includes State agency acceptance and community acceptance of the selected remedy. These criteria are commonly assessed formally after a period of public comment. However, community acceptance is taken into account during the screening process to the extent it is known at the time of the evaluation. There has been no community input solicited regarding any aspect of the recent investigation activities that have taken place at the Site or any proposed remedy pertaining to this FS Report. However, none of the technologies under consideration would incur risks that would be problematic to the local community. Therefore, the community acceptance criterion will be considered highly acceptable for all of the applicable remedial technologies that are addressed in this FS Report. A description of the evaluation criteria considered and ranking system utilized during the process of screening the viable remedial technologies for the Site is provided in the detailed evaluation of remedial alternative summarized on **Table 9.** A detailed discussion of the viable remedies relative to the FS screening criteria is discussed in the following sections.

6.1 NO ADDITIONAL ACTION (CONTINUE EXISTING REMEDY)

6.1.1 Identification and Description

The "no additional action" alternative as presented in this document is defined as continuation of the existing remedy in place without modification or enhancement. In this scenario, the existing groundwater recovery system would continue to be operated as is. All other remedies in place would remain and no changes to the long-term operation and maintenance plan would be conducted.

6.1.2 Screening and Analysis

"No additional action" was evaluated as a remedial alternative. This alternative is readily implementable and has been deployed since 1997. A detailed evaluation of the alternative is presented on **Table 9**. Implementing no additional remedial measures has the potential to provide overall protection of the public health and the environment, succeed in reducing the toxicity, mobility and volume of hazardous waste and result in long-term effectiveness because the existing remedial technology that is in place at the Site bears this potential. The remedy would continue to reduce the concentration and volume of contaminants in the source area. However, because the effectiveness of the existing remedy is limited by the nature of the subsurface at the Site and does not enable full hydraulic control, the potential for the total prevention of environmental impacts to groundwater is low.

The remedy would be somewhat likely to provide compliance with the RAOs established as part of this FS Report. The existing fence, restricted site access and limited access to the creek bank would continue to successfully mitigate potential inhalation and/or dermal contact. The remedy would continue to result in an overall decrease of the concentration of VOCs on the Site. However, the existing lack of full hydraulic control would not prevent the off-site migration of contaminants and, therefore, could not meet the SCG for surface water or the SCG for groundwater to the best extent practicable.

The short-term effectiveness of the technology would be high because there is no need for implementation of a physical remedy, for a guarantee of technical effectiveness or for the addition of institutional controls. The remedy would not have any additional costs. Because this remedy cannot establish hydraulic control at the Site and prevent the off-site migration of contaminants, it is not recommended as an effective remedy for the Site. Further, this alternative is not compliant with the requirement for institutional and engineering controls such as a Site Management Plan (SMP).

6.2 INSTITUTIONAL CONTROLS (CONTINUE EXISTING REMEDY)

6.2.1 Identification and Description

Institutional controls include adherence to governmental regulations and/or enforcement actions, permit implementation and/or additional informational devices for the public that can minimize environmental exposure risks. Institutional controls do not include active remedial measures. However, the implementation of institutional controls can potentially enhance the effectiveness of engineering controls by minimizing or preventing the potential for human contact with contaminants over an extended period and preventing environmental exposure risks. An institutional control, such as Site Management Plan (SMP), will identify the controls required, including well developed standard operating procedures, scheduled environmental oversight and appropriate personal protective equipment, that are needed to continue operating, maintaining and monitoring the existing remedial system on the Site. Supplemental land use restrictions, applied in conjunction with continued operation of the existing remediation system and the institutional controls that are currently in place, could potentially ensure compliance with groundwater and soil vapor related RAOs for Public Health Protection by contact prevention, therefore mitigating environmental exposure risks to the best extent practicable.

6.2.2 Screening and Analysis

The establishment of additional institutional controls was evaluated as a remedial alternative. The remedy is an established and proven remedial alternative that is readily implementable at the Site. A detailed evaluation of the alternative is presented on **Table 9**. The implementation of additional institutional controls would further provide protections against potential exposures to the public. However, because the effectiveness of the existing remedy is limited by the nature of the subsurface at the Site and does not enable full hydraulic control, the potential for the total prevention of environmental impacts to groundwater is low. In summary, no institutional control exists that could prevent the risk or impacts associated with groundwater migration.

6.3 AIR SPARGING AND SOIL VAPOR EXTRACTION

6.3.1 Identification and Description

Air sparging with soil vapor extraction is typically an effective remedy at sites with groundwater VOC contamination. Air sparging is a remediation technique that uses the injection of compressed air into impacted groundwater to enhance partitioning of VOCs into the vapor-phase, effectively "stripping" them from the impacted groundwater. With this technology, atmosphere air is injected into a network of sparging wells. The injected air volatilizes VOCs in the groundwater and the vapors travel to the unsaturated zone. Once in the unsaturated zone, the VOC vapors are captured by the SVE system, which consists of a network of vapor extraction wells to which a vacuum is applied. This remedy is most effective for groundwater VOCs when the subsurface deposits are relatively homogeneous and consist of coarse grained materials such as sand. Air sparging is typically not effective in finer grained sediments such as silts and clays.

6.3.2 Screening and Analysis

Air sparging and soil vapor extraction was evaluated for use as a remedial alternative at the subject Site. This remedy is readily implementable at the Site. However, due to the heterogeneous nature of the subsurface at the Site, it is likely preferred zones of vapor flow and/or preferred pathways could develop in the vadose zone. In addition, any locally stratified areas that may exist in the subsurface would also limit the effectiveness of the technology. The heterogeneous nature of the subsurface could potentially make the ability to control and extract the vapors very unpredictable. This could lead to impacted sparge vapor migrating outside of the vapor extraction control area. The separate phase impacts present in the subsurface could create groundwater mounding and also cause the impacts to migrate to unanticipated locations. This technology is also limited by its failure to meet the remedial objective of hydraulic control of the groundwater plume.

The air sparging and soil vapor extraction remedy was screened as a remedial alternative for the Site according to the criteria required by NYSDEC guidance. A detailed evaluation of the remedy relative to the defined evaluation criteria is provided on **Table 9**. It is not likely that the remedy would provide overall protection of the public health and the environment, succeed in reducing the toxicity, mobility and volume of hazardous waste or result in long-term effectiveness because the heterogeneous nature of the subsurface and the presence of separate phase impacts would limit the overall effectiveness of the technology. This would also limit the degree to which the remedy could reduce the concentration and volume of contaminants in the source area. Subsurface heterogeneities would limit control of the application of the technology and could result in contaminant migration. In addition, the remedy does not address the lack of control of the impacted groundwater plume. Hydraulic control of the plume is necessary to mitigate the migration of contaminants to the surrounding environment.

It is not likely that the remedy would provide compliance with the RAOs established as part of this FS Report. The migration of contaminants could lead to discharge to surface water and result in contact with or inhalation of contaminants. It is also unlikely that the SCGs outlined for the Site by the NYSDEC (ROD, 1994) would be met if this remedy was implemented at the Site. Because the effectiveness of the technology would be limited, the reduction of contaminant concentrations in groundwater would be minimal. In addition, the lack of hydraulic control could result in the migration of impacted materials.

Implementation of the remedy would be problematic due to existing utilities proximal to the proposed location of the remedy and the general layout of existing structures (buildings, piezometer, and wells) located on the Site. Implementation and the short-term effectiveness of the technology is likely to be problematic because the heterogeneous composition of the subsurface and presence of contaminants could pose exposure risks. In addition, the technical reliability of the remedy is questionable at this Site because the effectiveness of the technology will likely be limited by the subsurface conditions.

The air sparging and soil vapor extraction remedy will have moderate indirect capital costs, which will include engineering, design and pilot testing, and high direct capital costs for construction and implementation. The operation and maintenance costs for the remedy will be relatively low. The detailed evaluation of this technology indicates that it is not recommended as an effective remedy for the Site.

6.4 IN-SITU CHEMICAL OXIDATION

6.4.1 Identification and Description

In-situ chemical oxidation (ISCO) is a proven and reliable technology for rapid remediation of dissolved phase VOCs. ISCO typically involves the pressurized injection of an oxidant such as hydrogen peroxide into the saturated zone via a network of injection wells. The oxidant spreads through the formation and oxidizes the VOCs that are in contact with it. This technology typically is most effective in homogeneous, coarser grained formations, as it requires the oxidant to spread uniformly in the subsurface.

6.4.2 Screening and Analysis

ISCO is readily implementable and was evaluated for use at the subject Site. It is likely that the heterogeneous nature of the material in the subsurface would cause the degree of effective contact between the selected oxidant and any contaminants of concern to vary. Locally stratified areas or other irregularities in the composition of the subsurface would make controlling the delivery of the selected oxidant very unpredictable. Additionally, any oxidant used would have to be compatible with the downgradient barrier wall existing on the Site in order to avoid potential deterioration, leaks or failure. It should also be noted that Scajaquada Creek, a potential receptor, is located proximal to the area that this technology would be implemented. ISCO technology is not typically implemented in close proximity to surface water receptors. This technology is also limited by its failure to meet the remedial objective of hydraulic control of the groundwater plume.

The ISCO remedy was screened as a remedial alternative for the Site according to the criteria required by NYSDEC guidance. A detailed evaluation of the remedy relative to the defined evaluation criteria is provided on **Table 9**. It is not likely that the remedy would provide overall protection of the public health and the environment, succeed in reducing the toxicity, mobility and volume of hazardous waste or result in long-term effectiveness because the heterogeneous nature of the subsurface and the presence of separate phase impacts would limit the overall effectiveness of the technology. Like the air sparge and soil vapor extraction remedy, the degree to which the remedy could reduce the concentration and volume of contaminants in the source area would likely be reduced. The technology involves the injection of chemicals in the subsurface and the subsurface heterogeneities present would again limit control of the application of the technology and could result in the migration of the injected chemical and/or contaminants. The injection of chemicals could potentially cause deterioration or failure of the sheet pile barrier wall present on the western side of the Site located adjacent to the creek. In addition, the remedy does not address the control of the impacted groundwater plume. Hydraulic control of the plume is necessary to mitigate the migration of contaminants to the surrounding environment.

It is not likely that the remedy would provide full compliance with the RAOs established as part of this FS Report. The migration of injected chemicals or contaminants could lead to discharge to surface water and result in contact with or inhalation of contaminants. It is also unlikely that the SCGs outlined for the Site by the NYSDEC (ROD, 1994) would be met if this remedy was implemented. Because the effectiveness of the technology would be limited, the reduction of contaminant concentrations in groundwater would be minimal. Finally, like the air sparge and soil vapor extraction technology evaluated above, the lack of hydraulic control could result in impacts to groundwater or surface water.

Implementation of the remedy would be problematic due to existing utilities proximal to the proposed location of the remedy and the general layout of existing structures (buildings, piezometer, and wells) located on the Site. Implementation and the short-term effectiveness of the technology is likely to be problematic because the heterogeneous composition of the subsurface and presence of contaminants could pose exposure risks. In addition, the technical reliability of the remedy is questionable at this Site because the effectiveness of the technology will likely be limited by the subsurface conditions.

The ISCO remedy will have moderate indirect capital costs, which will include engineering, design and pilot testing, and high direct capital costs for construction and implementation. The operation and maintenance costs for the remedy will be relatively low. The detailed evaluation of the ISCO remedy for the Site indicates that it is not recommended as an effective remedy for the Site.

6.5 VACUUM ENHANCED GROUNDWATER EXTRACTION

6.5.1 Identification and Description

Vacuum enhanced groundwater extraction uses a combination of soil vapor extraction, and groundwater extraction and treatment technologies. With this technique, a vacuum is applied to a well to extract soil vapor, while groundwater is simultaneously recovered by an independent pumping system. The applied vacuum can promote enhanced liquid recovery rates, while groundwater recovery exposes additional unsaturated zone deposits for vapor recovery. Groundwater extracted from the subsurface is then treated in the same way as with traditional groundwater extraction and treatment systems, and extracted vapors are treated in the same way as with traditional SVE systems. The application of VEGE technology can be very effective in removing separate-phase product and has the ability to decrease the time required to successfully remediate a site. Disadvantages of VEGE include high capital and operating costs, and more complex operation and maintenance requirements.

6.5.2 Screening and Analysis

VEGE is an implementable solution for the Site and could potentially meet the requirements for hydraulic control of the groundwater plume. This approach would be similar to the current remedy in place for groundwater, with the addition of SVE. The successful application of vacuum to the extraction wells could potentially, increase the groundwater recovery rates and decrease the overall amount of time required to complete remediation of the Site. However, the results of the pumping tests conducted suggest that an expansion of the recovery well network would likely be necessary to attain hydraulic control of the plume. This would require installation of new recovery wells, and the long-term, increasingly complex, operation and maintenance of an increased number of submersible pumps. As the system complexity increases, the likelihood of operational downtime increases, which potentially leads to the intermittent performance of the hydraulic control component. Additionally, the remediation time frame may also be extended due to gaps in system operation due to maintenance issues.

The VEGE remedy was screened as a remedial alternative for the Site according to the criteria required by NYSDEC guidance. A detailed evaluation of the remedy relative to the defined evaluation criteria is provided on **Table 9**. Like the remedy that is currently in place for the Site, the application of VEGE technology has the potential to provide overall protection of the public health and the environment, succeed in reducing the toxicity, mobility and volume of hazardous waste and result in long-term effectiveness. However, like the previous remedies that have been evaluated, the heterogeneous nature of the subsurface and the presence of separate phase impacts would limit the overall effectiveness of the technology. The remedy would reduce the concentration and volume of contaminants in the source area. However, based on the results of the preliminary pumping tests completed at the Site, the success of the technique will likely be constrained by the subsurface heterogeneities. Non-uniform zones of influence could limit the application of the technology to preferential pathways, which could result inconsistent contaminant recovery rates. While hydraulic control of the plume is certainly attainable with this technology, the number of recovery wells required to do so may make long-term operation and maintenance inefficient.

The remedy would be likely to provide compliance with the RAOs established as part of this FS Report. The RAOs for Public Health Protection could be met by applying VEGE technology in conjunction with existing and additional institutional controls. In the event that exposure pathways developed as a result of lack of full control of the application of VEGE technology, contact or inhalation of groundwater-sourced volatiles would then be mitigated by means of contact prevention.be prevented by the institutional controls currently in place with the existing remedy at the Site. The existing fence, restricted site access, and limited access to the creek bank would successfully mitigate any potential public health concerns. The remedy would be somewhat likely to provide compliance with the RAOs for Environmental Protection. The remedy would result in a decrease of the overall concentration of VOCs on the Site. The application of VEGE technology could prevent contaminant discharge and off-site migration of impacted materials. The VEGE remedy would provide a component of hydraulic control at the Site. The achievement of full hydraulic control could prevent off-site migration of contaminants, which would meet the SCG for surface water and meet the SCG for groundwater to the best extent practicable.

Implementation and the short-term effectiveness of the technology are likely to be problematic because of the complexity of operating a multi-well VEGE system, the heterogeneous composition of the subsurface and presence of contaminants could pose exposure risks. Also, the technical reliability of the remedy is questionable at this Site because the effectiveness of the technology will likely be limited by the subsurface conditions.

The VEGE remedy will have high indirect capital costs, which will include engineering, design and pilot testing, and moderate direct capital costs for construction and implementation. The operation and maintenance costs for the remedy will be relatively high. The detailed evaluation of the VEGE remedy for the Site indicates that it is not recommended as an effective remedy for the Site.

6.6 GROUNDWATER RECOVERY VIA INTERCEPTOR TRENCH WITH TREATMENT

6.6.1 Identification and Description

Groundwater extraction conducted with an interceptor trench involves the installation of an engineered trench to a depth designed to capture groundwater as it flows perpendicular to the trench. The trench is backfilled with a material that is more porous and conductive than the surrounding formation, thereby causing the preferential flow of water from the formation to the trench. Typically a drain pipe is installed at the base of the trench, which drains to a sump or sumps. Groundwater that collects in the sump(s) is pumped to a treatment system. The advantage of an interceptor trench is that a constant groundwater head can be maintained across the flow path in a linear fashion thereby minimizing the potential for contaminant bypass.

6.6.2 Screening and Analysis

Groundwater extraction via an interceptor trench is an implementable solution at the Site. Due to the heterogeneity of the materials in the subsurface, a trench system oriented perpendicular to the dominant groundwater flow direction at the Site and encompassing the vertical extent of impacted groundwater will intercept any preferential flow paths and ensure control of the hydraulic gradient. Installation of an interceptor trench does present both physical and administrative challenges based on the existing layout of the Site and the characteristics of surrounding properties. The process of installing the trench will also generate trench spoils which will require proper handling and disposal. However, this technology is typically very effective as a hydraulic control mechanism.

The interceptor trench remedy was screened as a remedial alternative for the Site according to the criteria required by NYSDEC guidance. A detailed evaluation of the remedy relative to the defined evaluation criteria is provided on **Table 9**. It is highly likely that the remedy would provide overall protection of the public health and the environment, succeed in reducing the toxicity, mobility and volume of hazardous waste and result in long-term effectiveness. Because the trench will be designed to intercept preferential contaminant flow paths to capture impacts, both the volume and concentration of contaminants are likely to decrease over an extended time frame. In addition, the remedy will achieve hydraulic control of impacted groundwater. This will successfully mitigate the migration of impacted materials.

The remedy is also highly likely to provide compliance with the established RAOs being addressed in this FS Report. Establishment of hydraulic control of site groundwater will mitigate groundwater migration, providing compliance with the Public Health Protection RAOs. The prevention of contaminant discharge will also achieve the RAOs for Environmental Protection to the best extent practicable. The existing groundwater treatment system in place at the Site was designed to meet the SCGs outlined by the NYSDEC in the Record of Decision for the Site in 1994. The interceptor trench remedy is fundamentally a more effective alternative to the existing system that was put in place to meet these SCGs. The implementation of the interceptor trench remedy will provide the best potential to achieve full hydraulic control at the Site. This will result in the minimization of off-site migration of contaminants to successfully meet the SCG for surface water. The remedy will also meet the SCG for groundwater to the best extent practicable at the Site.

The technical reliability of the technology is well established and a proven means of containment and remediation. However, further study of the subsurface characteristics at the Site will be needed to gain a better understanding of the existing groundwater flow variations and to ensure that implementation of the technology will not draw significant flows inwards from the creek. Implementation of the interceptor trench remedy is likely to be complicated by existing utilities proximal to the proposed location of the remedy and the general layout of existing structures (buildings, piezometers, wells) located on the Site. Implementation and the short-term effectiveness of the technology will need to consider and address the heterogeneous composition of the subsurface and presence of contaminants could pose exposure risks (a Health and Safety Plan will need to be followed during installation).

The interceptor trench remedy will have low indirect capital costs and high direct capital costs for construction and implementation. The operation and maintenance costs for the remedy will be low to moderate. The detailed evaluation of the interceptor trench with treatment remedy for the Site indicates that it is likely to be effective in meeting the remediation goals for the Site. Further evaluation and potential use of this technology at the Site is recommended.

6.7 SUMMARY OF REMEDIAL ALTERNATIVES

The viable remedial alternatives identified as potential technologies that could meet the RAOs for the Site include no additional actions (continue the existing remedy), additional institutional controls (continue the existing remedy), air sparging and soil vapor extraction (SVE), ISCO, VEGE and groundwater recovery via interceptor trench with treatment. A summary of the probability of success, likelihood of ROD compliance and limitations of the identified and screened technologies is provided below in the table on the following page.

SUMMARY OF REMEDIAL ALTERNATIVES					
	Evaluation Ranking Screening Score[a]	**Probability of Success**	**ROD Compliance**	**Limitations**	**Conclusion**
No Additional Action (Continue Existing Remedy)	**30**	Low	Incomplete	• Heterogeneous subsurface characteristics limit effectiveness • No Hydraulic control	Not Recommended
Institutional Controls (Continue Existing Remedy	**32**	Low	Incomplete	• Heterogeneous subsurface characteristics limit effectiveness • No Hydraulic control	Not Recommended
Air Sparge & Soil Vapor Extraction	**27**	Low	Incomplete	• Heterogeneous subsurface characteristics limit effectiveness • Separate phase impacts present in the subsurface • No hydraulic control	Not Recommended
In-Situ Chemical Oxidation	**23**	Low	Incomplete	• Heterogeneous subsurface characteristics limit effectiveness • Proximity to Scajaquada Creek • Potential integrity impact to barrier wall • No hydraulic control	Not Recommended
Vacuum Enhanced Groundwater Recovery	**29**	Low	Incomplete	• High operating costs • Complex operation and maintenance requirements • Potential for lack of full hydraulic control	Not Recommended
Interceptor Trench with Treatment	**39**	High	Yes	• Installation challenges due to site access and site characteristics • Administrative challenges due to Site location and the nature of surrounding property	**Recommended**

Notes:
[a]Evaluation Ranking Screening Score indicates the total score from the overall score indicated on the Detailed Evaluation of Remedial Alternatives summary provided as **Table 9**. A higher score is indicative of a more optimal remedial response approach.

6.8 INSTITUTIONAL AND ENGINEERING CONTROLS

The existing remedy, as outlined in the approved ROD, includes an impermeable clay cap, land use restriction (Declaration of Covenants and Restrictions, 1995), and fencing. A Declaration of Covenants and Restriction was implemented for the Site by the State of New York on August 18, 1995. The covenant ensures that any successor in ownership of the property will share the environmental liability with BMS. However, available information indicates that no other land use restrictions exist for the location. The recommended remedy of the interceptor trench would require all approved institutional and engineering controls to remain. In addition, we believe that none of the alternatives discussed above, if deployed, could potentially lead to the lifting of any of the controls in place. These assumptions are based on the existing institutional and engineering controls that exist for the Site. These assumptions may change at the discretion of the NYSDEC and/or NYSDOH if further review of the existing controls or deed restriction language indicates that revisions are necessary. One control that will be added is the development of an SMP, which would identify the controls required, including well developed standard operating procedures, scheduled environmental oversight and appropriate personal protective equipment, that are needed to continue operating, maintaining and monitoring the remediation system.

The chain-link fencing may require temporary removal during the installation of the interceptor trench, which would be repaired or replaced at the completion of the construction phase. Surface disturbance of the existing grade and grass covered area will also be necessary during installation of the selected remedy. The excavated area will be brought back to the existing grade and the location of the installation will be restored to pre-excavation conditions at the completion of construction.

SECTION 7
RECOMMENDED ALTERNATIVE

7.1 INTERCEPTOR TRENCH WITH TREATMENT AND ENGINEERING AND INSTITUTIONAL CONTROLS

The recommended alternative is an interceptor trench where collected groundwater would be conveyed to the on-site treatment system (the treatment system would incorporate the same design concept, technology, and philosophy as is currently employed; the existing groundwater treatment system functions appropriately). The interceptor trench will be oriented perpendicular to the dominant groundwater flow direction at the Site and intersect the vertical extent of impacted groundwater, intercepting groundwater flowing towards the sheet pile wall and creek. The selected remedy will also ensure control of the hydraulic gradient. Installation of an interceptor trench does present both physical and administrative challenges based on the existing layout of the Site and the characteristics of surrounding properties. The process of installing the trench will also generate trench spoils which will require proper handling and disposal. However, this technology is an established and proven remediation measure and is typically very effective as a hydraulic control mechanism.

7.2 PROPOSED REMEDIAL SYSTEM DESIGN

The trench would be located downgradient of the impacted area in the northern portion of the Site and installed perpendicular to the dominant groundwater flow direction. It would be situated at a north-northeast angle running approximately parallel to the sheet pile wall that is installed adjacent to Scajaquada Creek. The conceptual interceptor trench layout is present on the Conceptual Interceptor Trench Location Map provided as **Figure 18**.

A final engineering design for the interceptor trench has not been completed. Per DER-10, a Remedial Action Work Plan (RAWP) will be prepared describing the conceptual design of the selected remedy. Details regarding the location and depth in addition to construction details will be part of the RAWP. A pre-design investigation should be conducted to establish the exact depth of the clay unit and any necessary geotechnical information. The final design will be presented to the NYSDEC following discussions and planning between the engineering team and an experienced installation subcontractor selected to perform the work. As an initial conceptual approach, the interceptor trench may be approximately 260 feet in length. The proposed location and depth of the trench would ensure that it crosses the most implementable horizontal and vertical extent of any impacted material that could potentially migrate towards Scajaquada Creek. A slotted, high density and chemically resistant pipe would be set at the base of the interceptor trench and connected to a sump or sumps. One or more pumping stations, consisting of sumps fitted with pumping apparatus, may be installed along the slotted collection pipe in the interceptor trench. Vertical risers, extending from the interceptor trench to grade, would contain the pumping apparatus and act as maintenance access ports. A relatively coarse aggregate, such as pea gravel would be backfilled in the trench and around the installed piping. This material would maintain the alignment of the installed piping and provide a porous medium which will encourage the movement of intercepted impacted groundwater and NAPL. Impacted groundwater and/or separate phase impacts would collect under gravity flow and be pumped to a temporary staging location at grade. Recovered material would continue to be treated on Site.

The excavated area at grade would be restored to its existing condition when the trench and associated collection apparatus are successfully installed.

7.3 CONSTRAINTS TO CONSIDER FOR REMEDIAL DESIGN

There are both physical and administrative constraints that will need to be considered prior to implementation of the selected remedy for the site. To the north of the site there is a large building that runs the length of the property. This building is only a few feet north of the property boundary. The steepness of the creek bank poses constructability issues. The site is bounded to the west by the grassy area in which piezometers P2 through P6 are installed very close to the top of the creek bank proximal to Scajaquada Creek. As discussed above in Section 3.2, remedial efforts to the south are not warranted, based on data collected at the existing piezometers and wells (i.e., north of P3 and EW3) that define and bound the limits of groundwater impact requiring action. Building 9 will limit access along the eastern side of the Site. In addition, both underground and overhead utilities are present that will minimize remedial efforts on the eastern side of the Site (**Figure 2**).

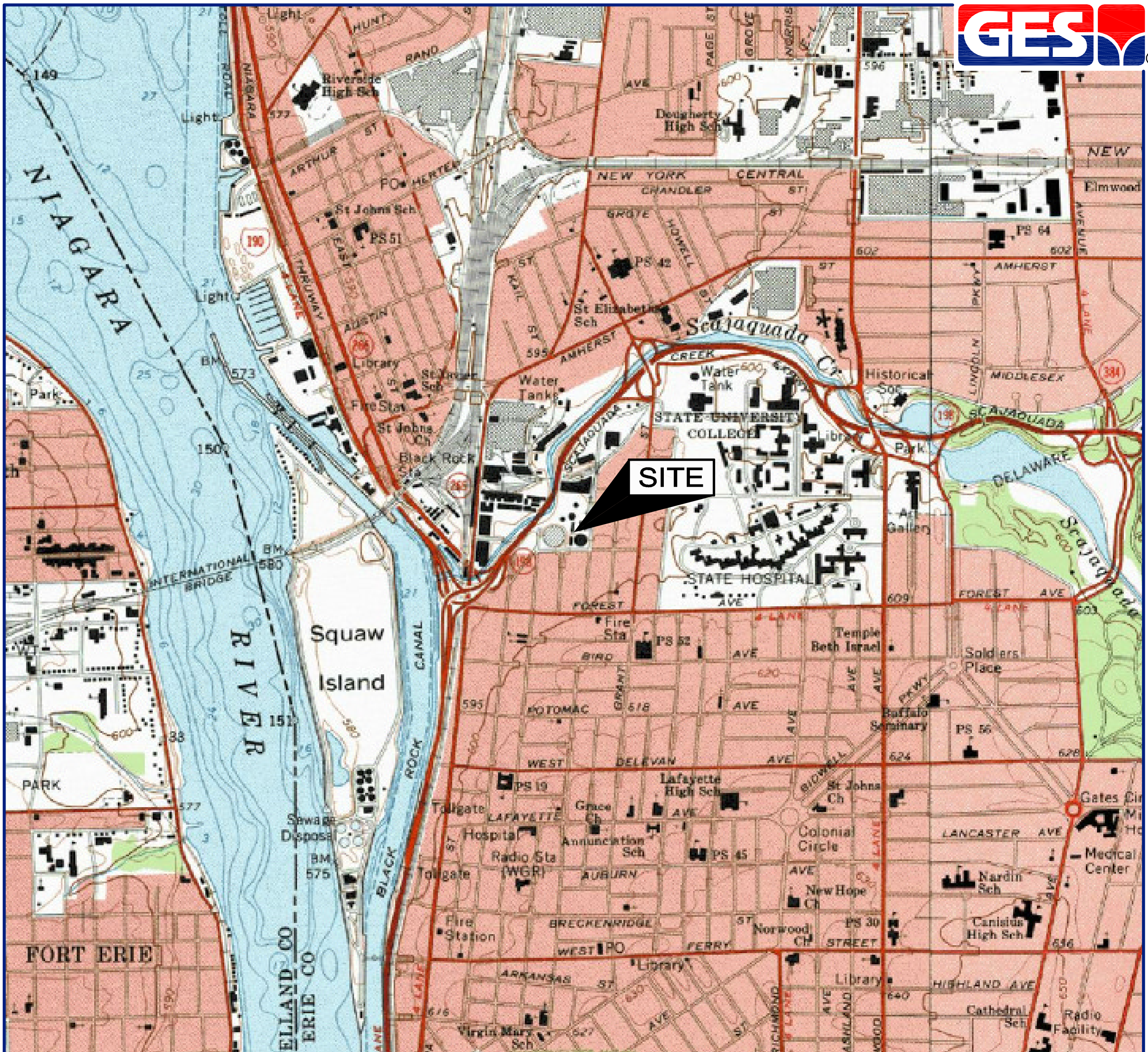
In addition to the aforementioned physical constraints, there are also administrative constraints. At this time, it is unknown if there is an owner of record of the grassy area west of the property line near the creek bank. This is the area in which piezometers P2 through P6 are located. This small piece of property does not appear on tax maps of the area and thus an owner of record is not currently known. Therefore, it is not entirely clear as to what Access Agreements may be required or if any construction permits would be necessary to work in this area. Once an owner is identified, Access Agreements will need to be obtained in order to effectuate any studies and/or remedial response measures in this area.

Additionally, the groundwater treatment system components may also play a constraining role as they were designed for the existing recovery technology and methodology. At present, the current treatment system has a daily discharge limit of 3,600 gallons per day (2.5 GPM) as set by the discharge permit issued by BSA. We believe the current treatment system is designed to handle an average flow of up to approximately 7,200 gallons per day (5 GPM), which should be sufficient to handle the water recovered via the conceptual interceptor trench. Throughout the design of the modified remedial solutions, attention will be paid to these constraints and any necessary modification to the discharge permit and or remedial equipment will be identified. Any such modifications may require amendments to the site's BSA discharge permit as well as potential upgrades to the groundwater treatment system.

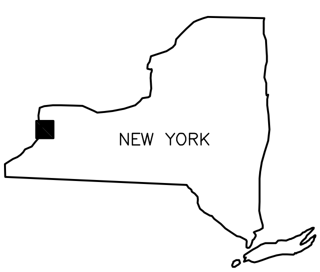
SECTION 8
CONCLUSIONS

GES has prepared this FS Report on behalf of BMS for the Iroquois Gas/Westwood Pharmaceuticals property located at 100 Forest Avenue in the City of Buffalo, Erie County, New York (NYSDEC #9-15-141A). The remedial goals, remedial action objectives, assessment of existing Site conditions and identification, screening and analysis of the selected remedial technologies evaluated as part of this FS Report were completed in accordance with current NYSDEC regulations and in conformance with *DER-10 Technical Guidance for Site Investigation and Remediation*. The primary objective of this FS Report was to complete a detailed evaluation of the viable remedial alternatives applicable to the Site and to select an appropriate remediation alternative based on the likely effectiveness, the ease of implementation and potential implementation risks of the remedial method. Technologies identified for screening included no additional actions (continue the existing remedy), additional institutional controls (continue the existing remedy), air sparging and soil vapor extraction, in-situ chemical oxidation, vacuum enhanced groundwater extraction, and groundwater recovery via interceptor trench (with treatment). Based on the analysis of alternatives which would achieve the RAOs for the site, the recommended alternative is discontinuing the use of the existing recovery wells in favor of an interceptor trench with groundwater treatment and engineering/institutional controls. This remedy was found to be the most appropriate alternative to achieve the remedial goals for the location. The recommended remedial alternative is expected to minimize groundwater seepage to the creek and will achieve hydraulic control of impacted groundwater. The interceptor trench remedy is highly likely to comply with the established RAOs being addressed in this FS Report and the SCGs outlined by the NYSDEC in the ROD for the Site in 1994.

FIGURES



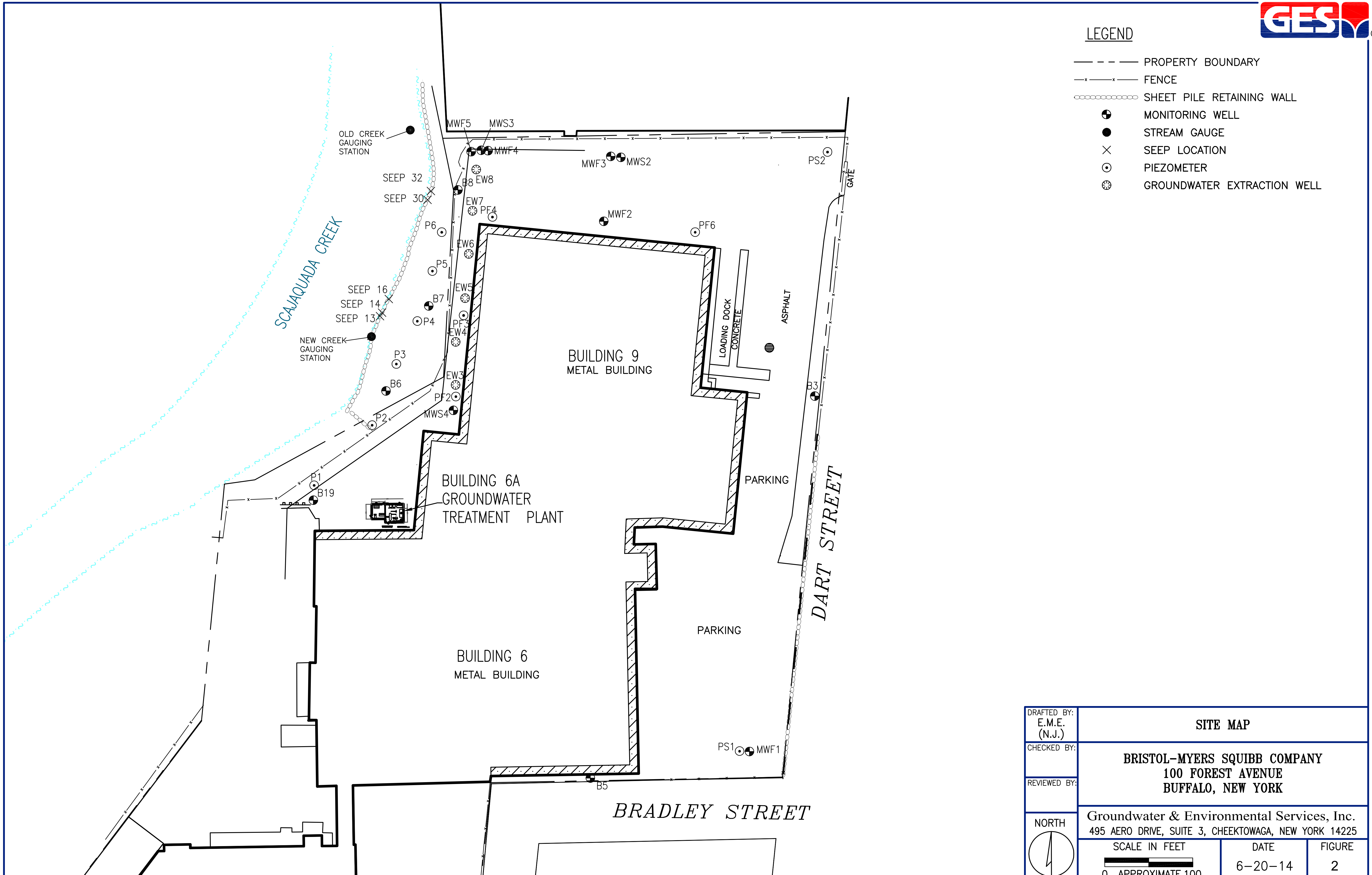
SOURCE: USGS 7.5 MINUTE SERIES
TOPOGRAPHIC QUADRANGLE 1965
BUFFALO, NORTHWEST
CONTOUR INTERVAL = 10'



QUADRANGLE LOCATION

DRAFTED BY: E.M.E. (N.J.)	SITE LOCATION MAP
CHECKED BY:	BRISTOL-MYERS SQUIBB COMPANY 100 FOREST AVENUE BUFFALO, NEW YORK
REVIEWED BY:	
NORTH	Groundwater & Environmental Services, Inc. 158 SONWIL DRIVE, CHEEKTOWAGA, NEW YORK 14225

SCALE IN FEET	DATE	FIGURE
0 — 2000	2-24-14	1



DRAFTED BY: E.M.E. (N.J.)

CHECKED BY:

REVIEWED BY:

SITE MAP

BRISTOL-MYERS SQUIBB COMPANY
100 FOREST AVENUE
BUFFALO, NEW YORK

Groundwater & Environmental Services, Inc.
495 AERO DRIVE, SUITE 3, CHEEKTOWAGA, NEW YORK 14225

SCALE IN FEET	DATE	FIGURE
0 APPROXIMATE 100	6-20-14	2

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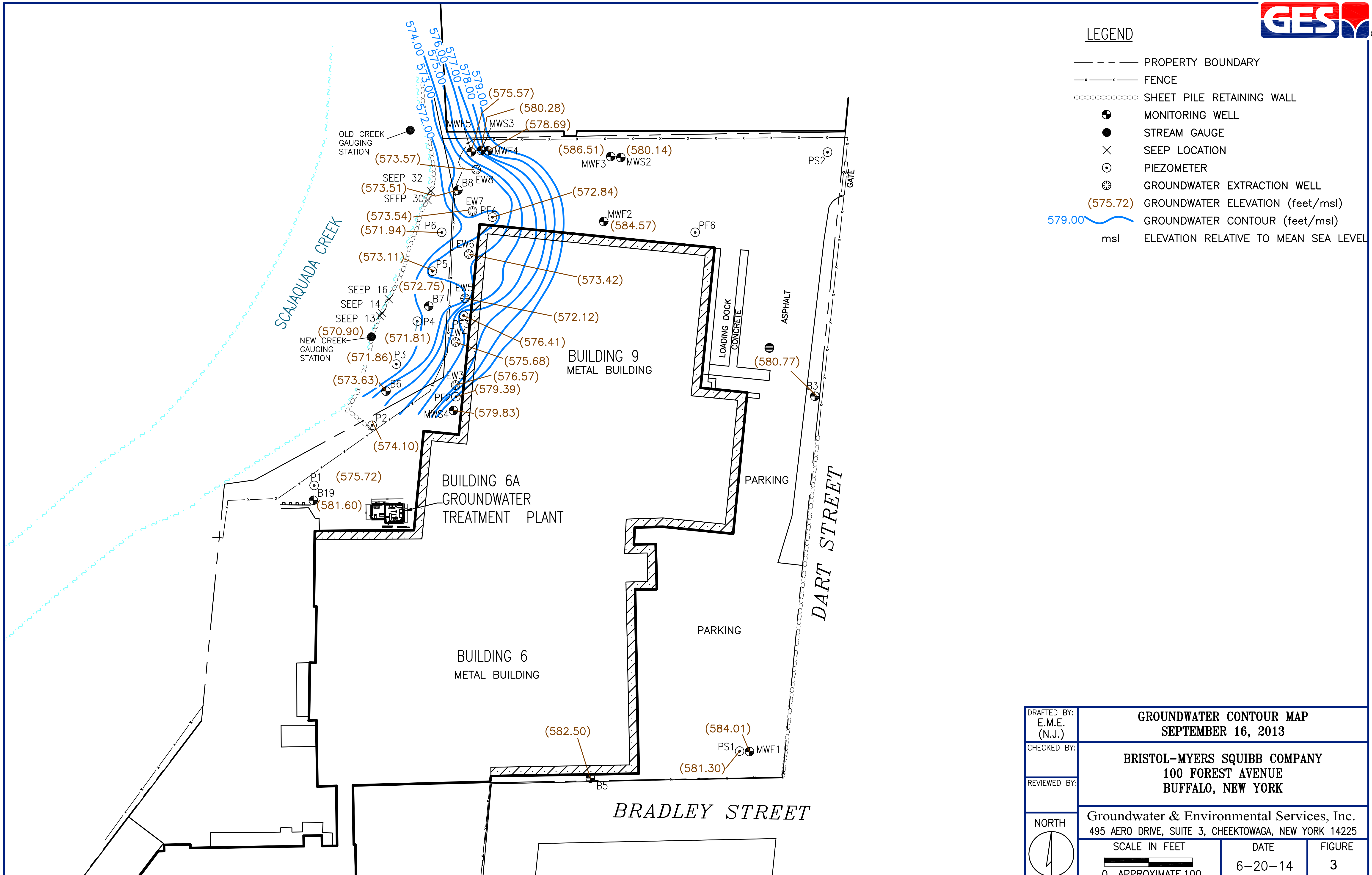

DRAFTED BY: E.M.E. (N.J.)

CHECKED BY:

REVIEWED BY:

GROUNDWATER CONTOUR MAP
SEPTEMBER 16, 2013

BRISTOL-MYERS SQUIBB COMPANY
100 FOREST AVENUE
BUFFALO, NEW YORK

Groundwater & Environmental Services, Inc.
495 AERO DRIVE, SUITE 3, CHEEKTOWAGA, NEW YORK 14225

DATE 6-20-14

FIGURE 3

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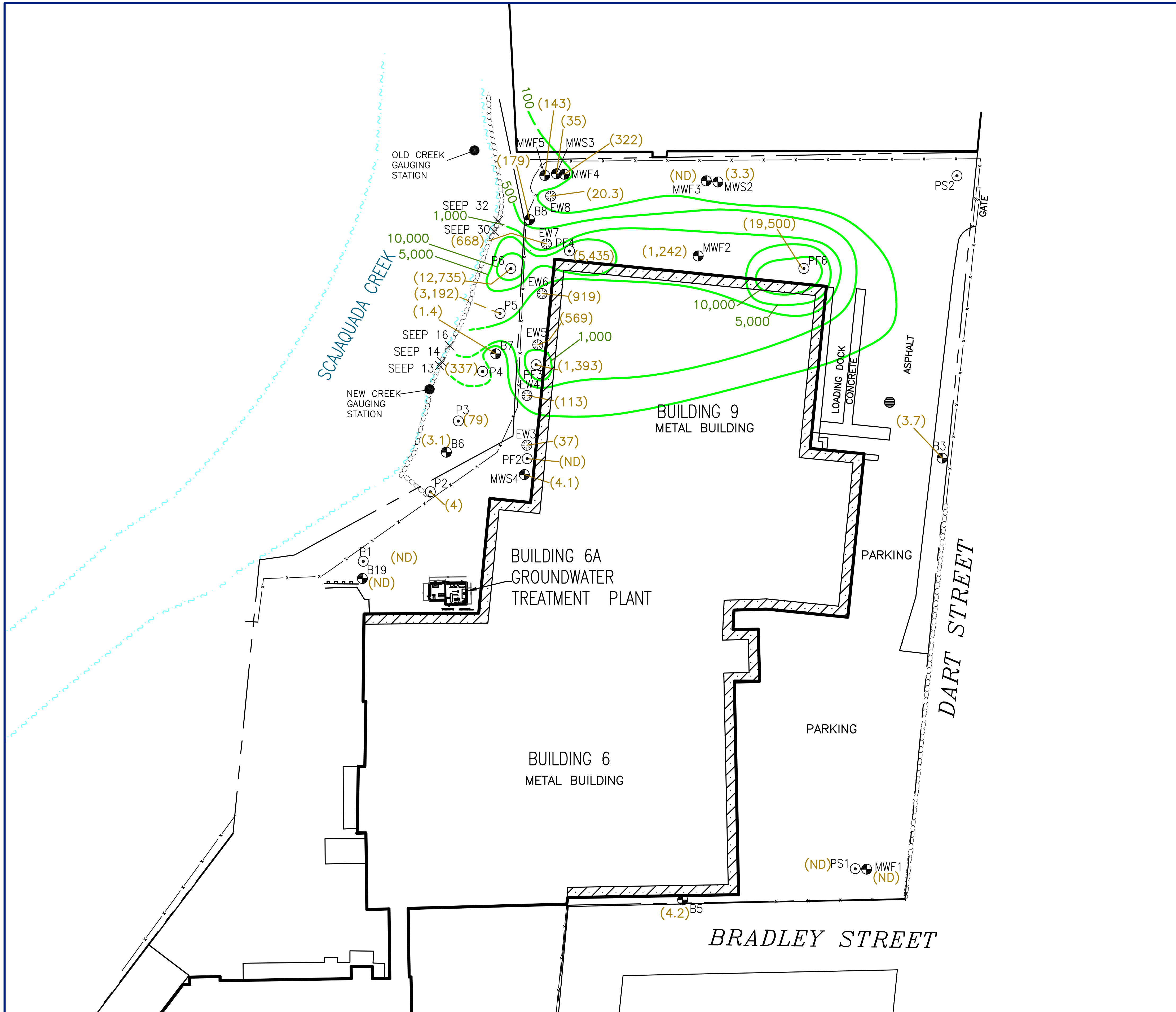

GES®

LEGEND

	PROPERTY BOUNDARY
	FENCE
	SHEET PILE RETAINING WALL
	MONITORING WELL
	STREAM GAUGE
	SEEP LOCATION
	PIEZOMETER
	GROUNDWATER EXTRACTION WELL
(19,500)	VOCs CONCENTRATION (ug/L)
5,000	VOCs CONCENTRATION CONTOUR(ug/L) (DASHED WHERE INFERRED)
VOCs	VOLATILE ORGANIC COMPOUNDS
(ug/L)	MICROGRAMS PER LITER
ND	NOT DETECTED

DRAFTED BY: E.M.E. (N.J.)	ISOCONCENTRATION–VOC MAP SEPTEMBER 16–18, 2013
CHECKED BY:	BRISTOL–MYERS SQUIBB COMPANY 100 FOREST AVENUE BUFFALO, NEW YORK
REVIEWED BY:	
NORTH	Groundwater & Environmental Services, Inc. 495 AERO DRIVE, SUITE 3, CHEEKTOWAGA, NEW YORK 14225

SCALE IN FEET	DATE	FIGURE
0 APPROXIMATE 100	6–20–14	4

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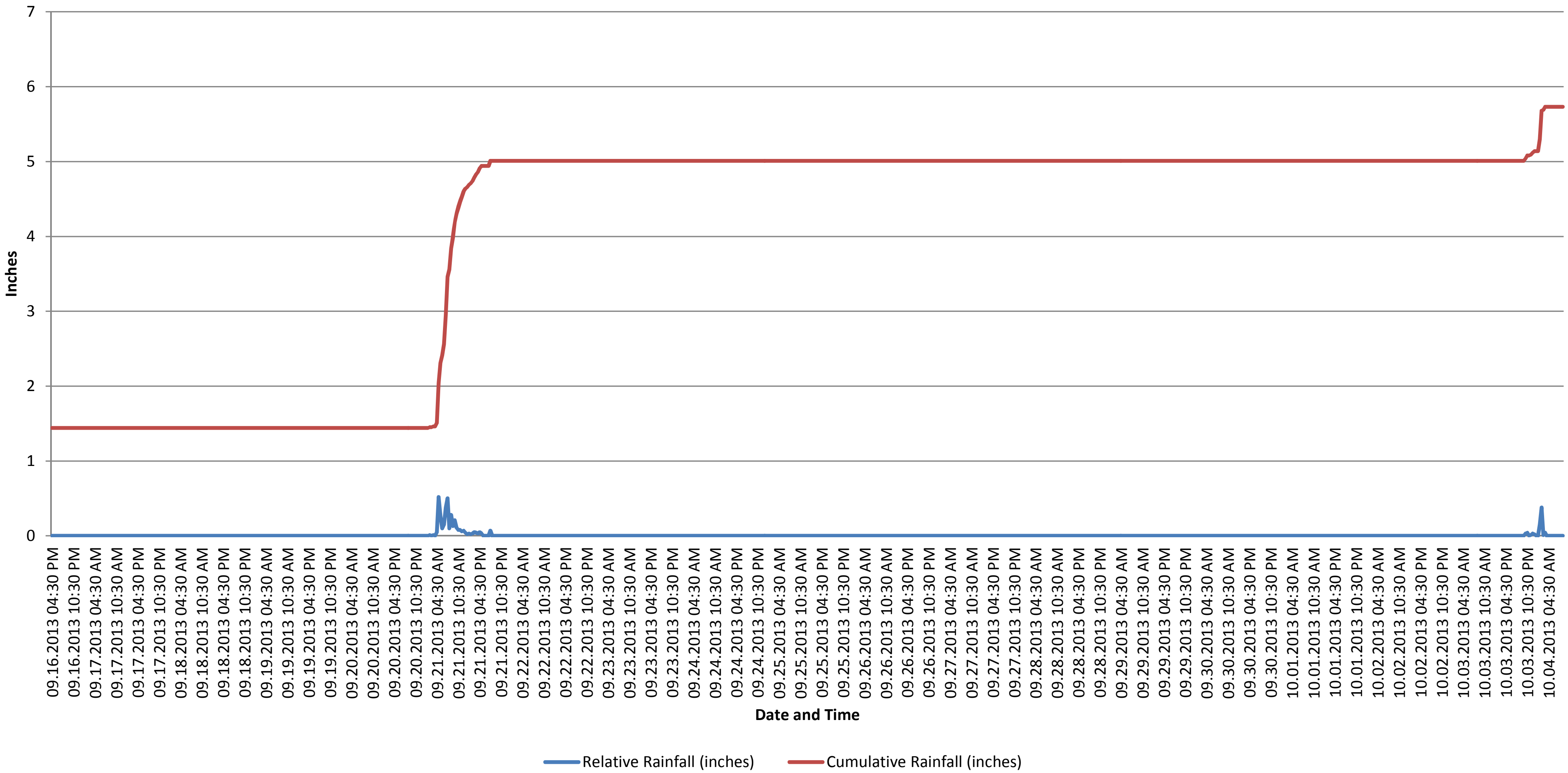
Figure 5
Relative and Cumulative Rainfall
September 16 to October 4, 2013



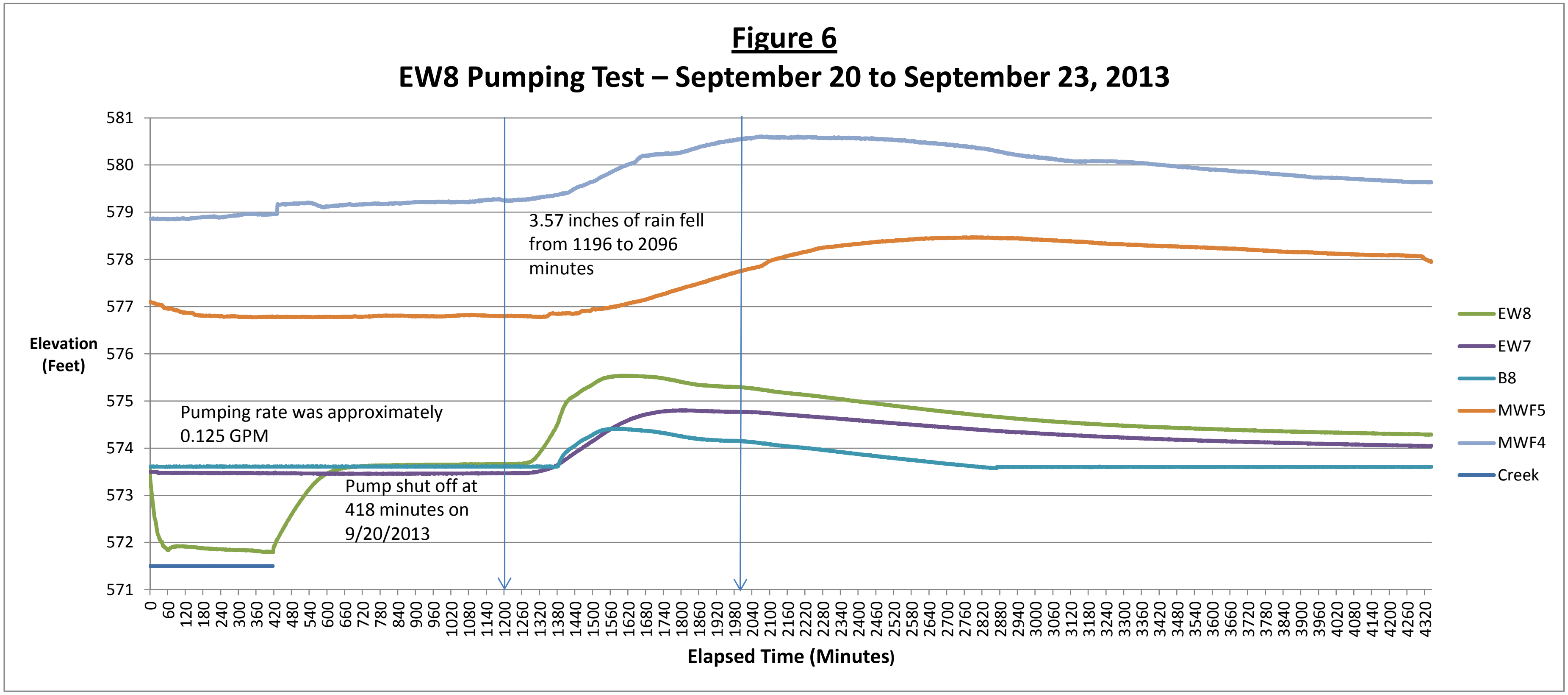


Figure 6
EW8 Pumping Test – September 20 to September 23, 2013
Elevation (Feet)
Elapsed Time (Minutes)
3.57 inches of rain fell from 1196 to 2096 minutes
Pumping rate was approximately 0.125 GPM
Pump shut off at 418 minutes on 9/20/2013
EW8
EW7
B8
MWF5
MWF4
Creek

Figure 7

P6 Pumping Test – September 18, 2013

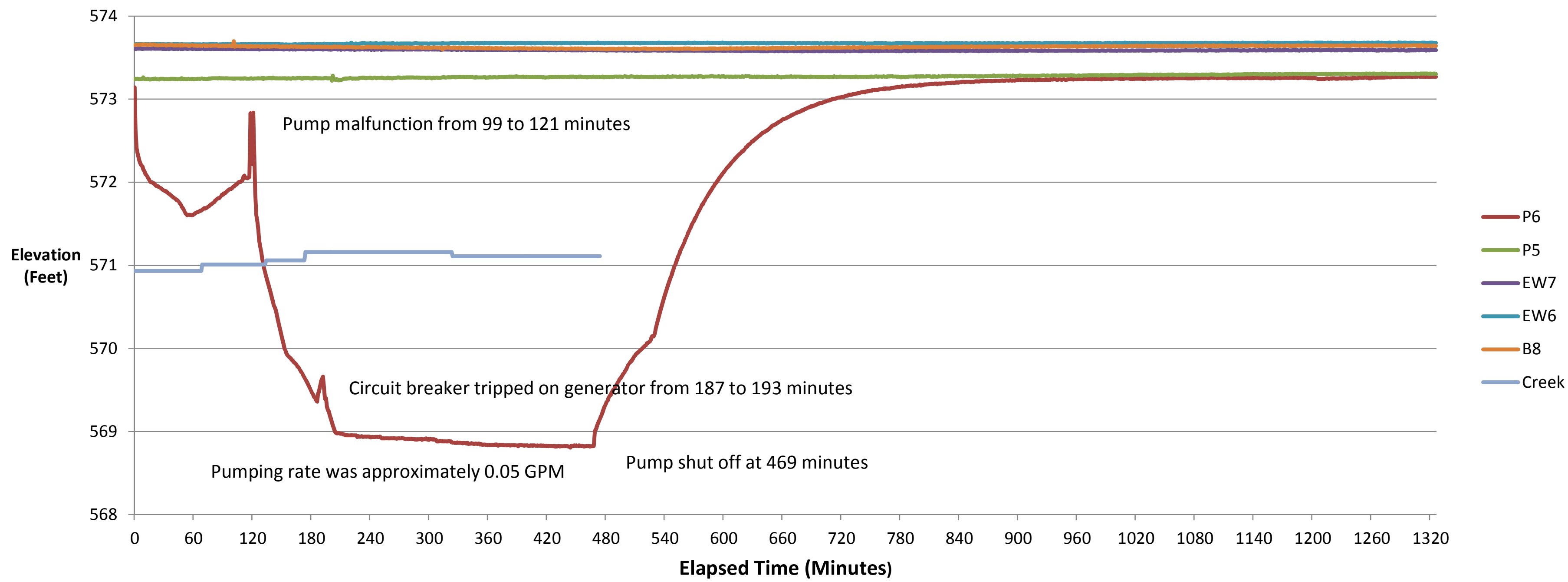
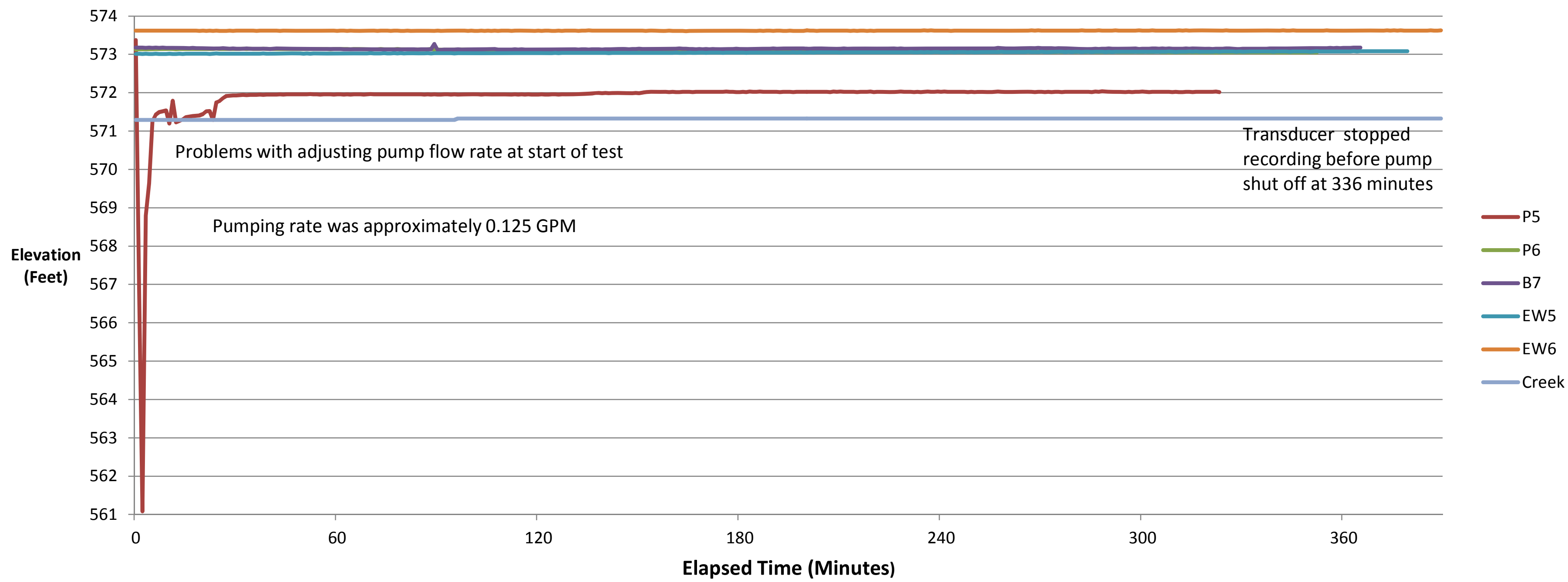


Figure 8

P5 Pumping Test – September 19, 2013



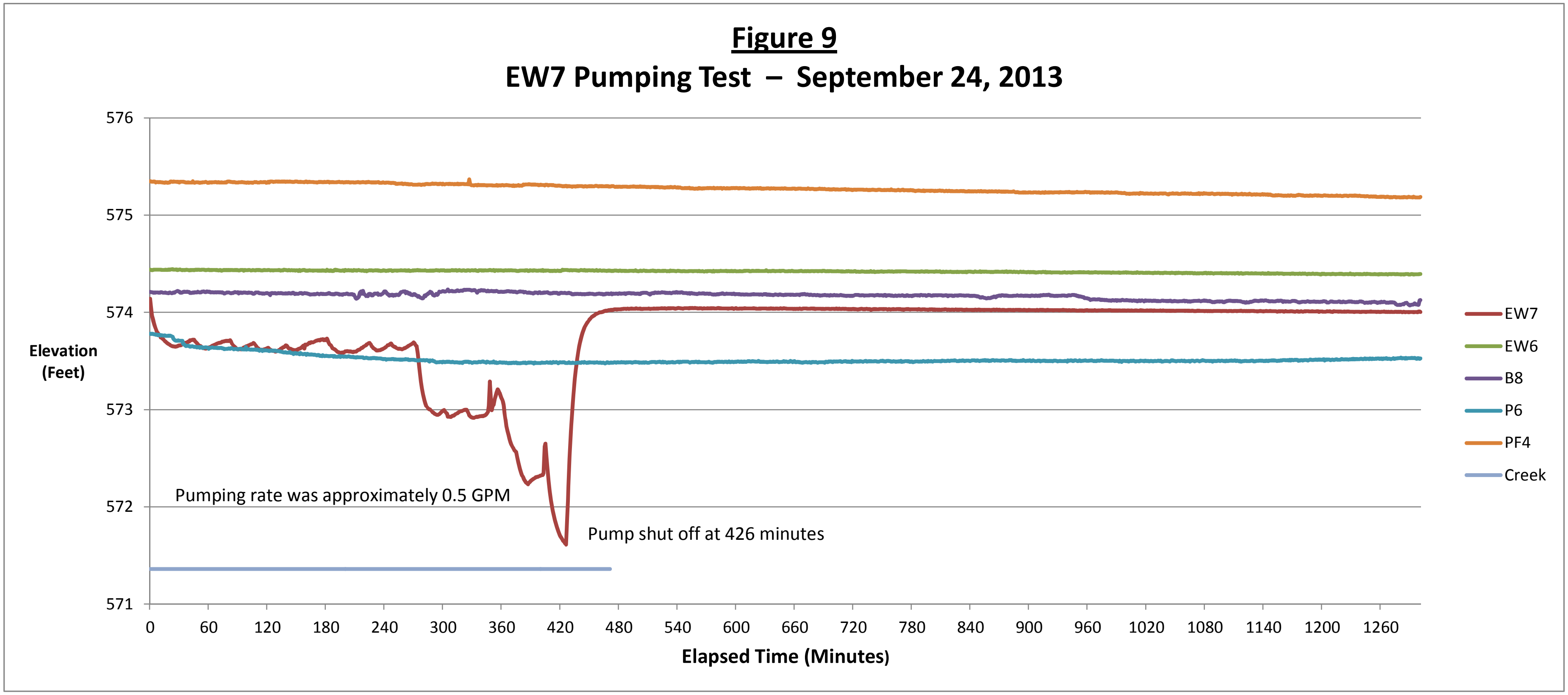


Figure 9
EW7 Pumping Test – September 24, 2013
576
575
574
573
572
571
Elevation (Feet)
0
60
120
180
240
300
360
420
480
540
600
660
720
780
840
900
960
1020
1080
1140
1200
1260
Elapsed Time (Minutes)
EW7
EW6
B8
P6
PF4
Creek
Pumping rate was approximately 0.5 GPM
Pump shut off at 426 minutes

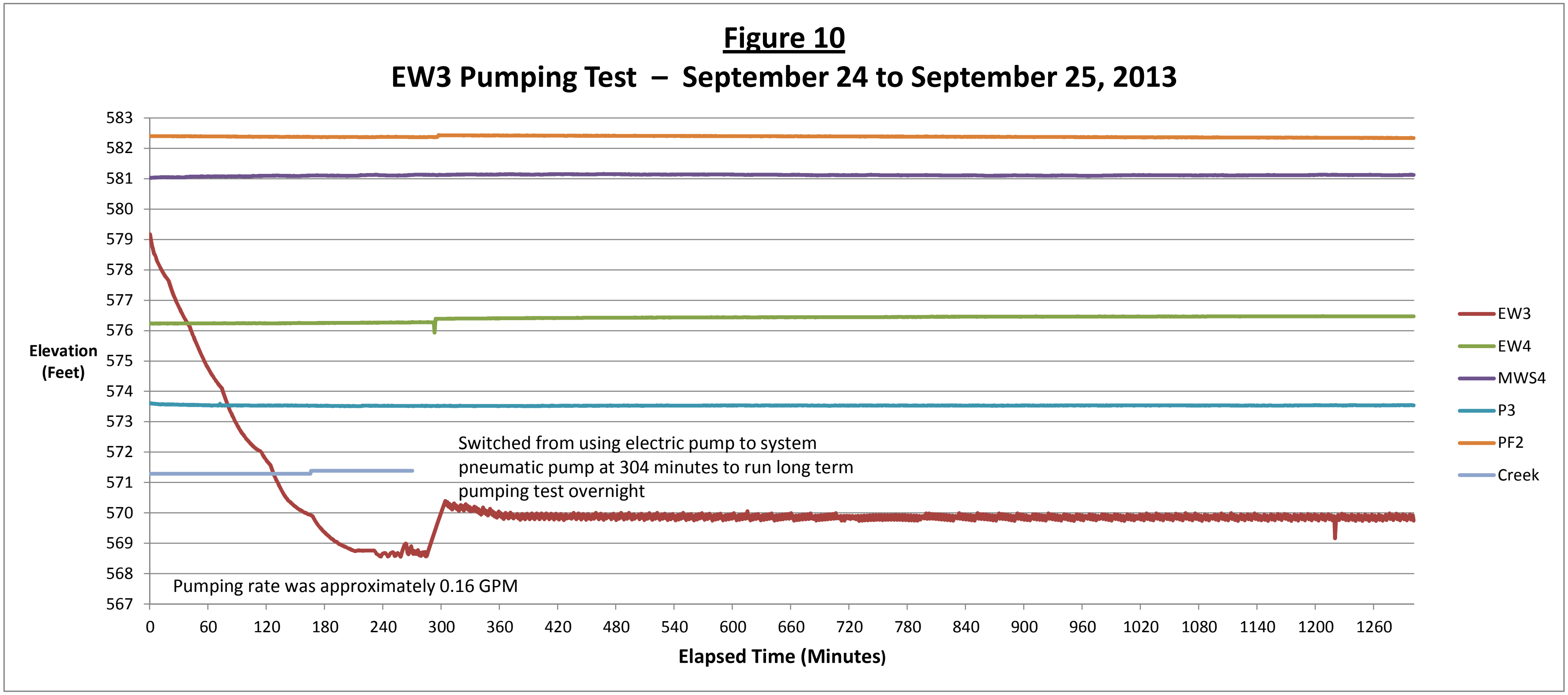
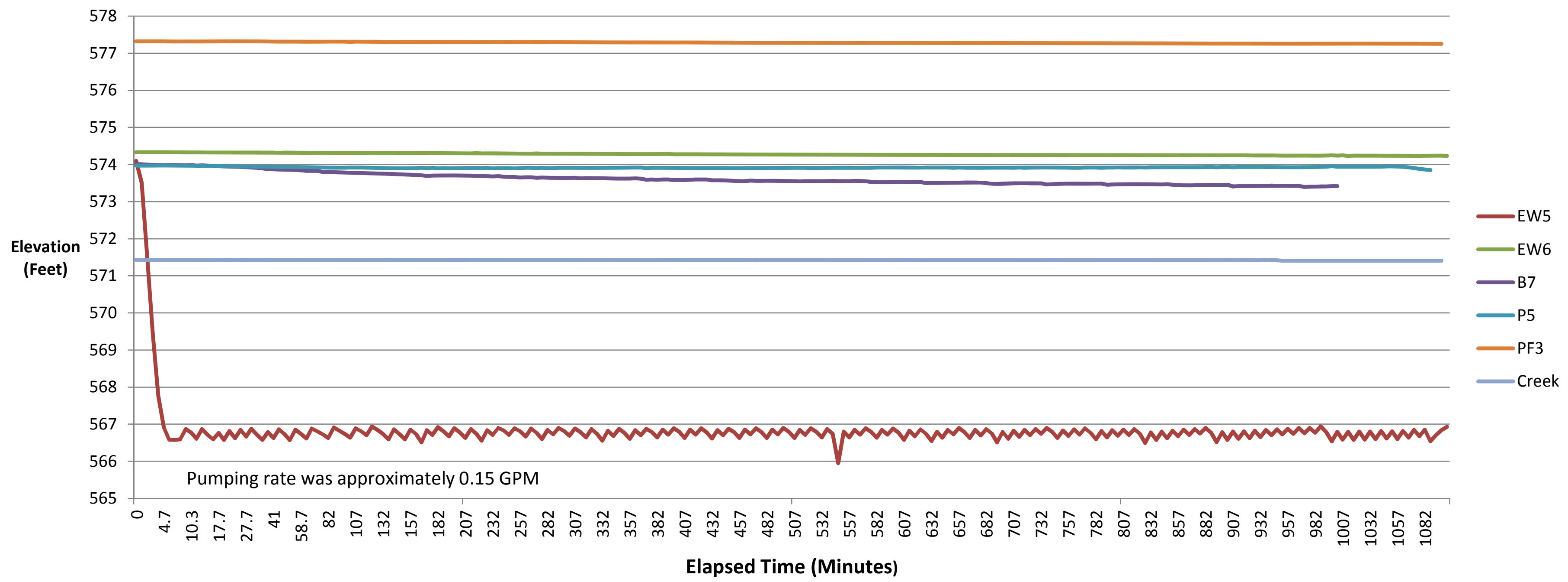


Figure 10
EW3 Pumping Test – September 24 to September 25, 2013
Elevation (Feet)
583
582
581
580
579
578
577
576
575
574
573
572
571
570
569
568
567
0
60
120
180
240
300
360
420
480
540
600
660
720
780
840
900
960
1020
1080
1140
1200
1260
Elapsed Time (Minutes)
Switched from using electric pump to system pneumatic pump at 304 minutes to run long term pumping test overnight
Pumping rate was approximately 0.16 GPM
EW3
EW4
MWS4
P3
PF2
Creek

Figure 11

EW5 Pumping Test – September 25 to September 26, 2013



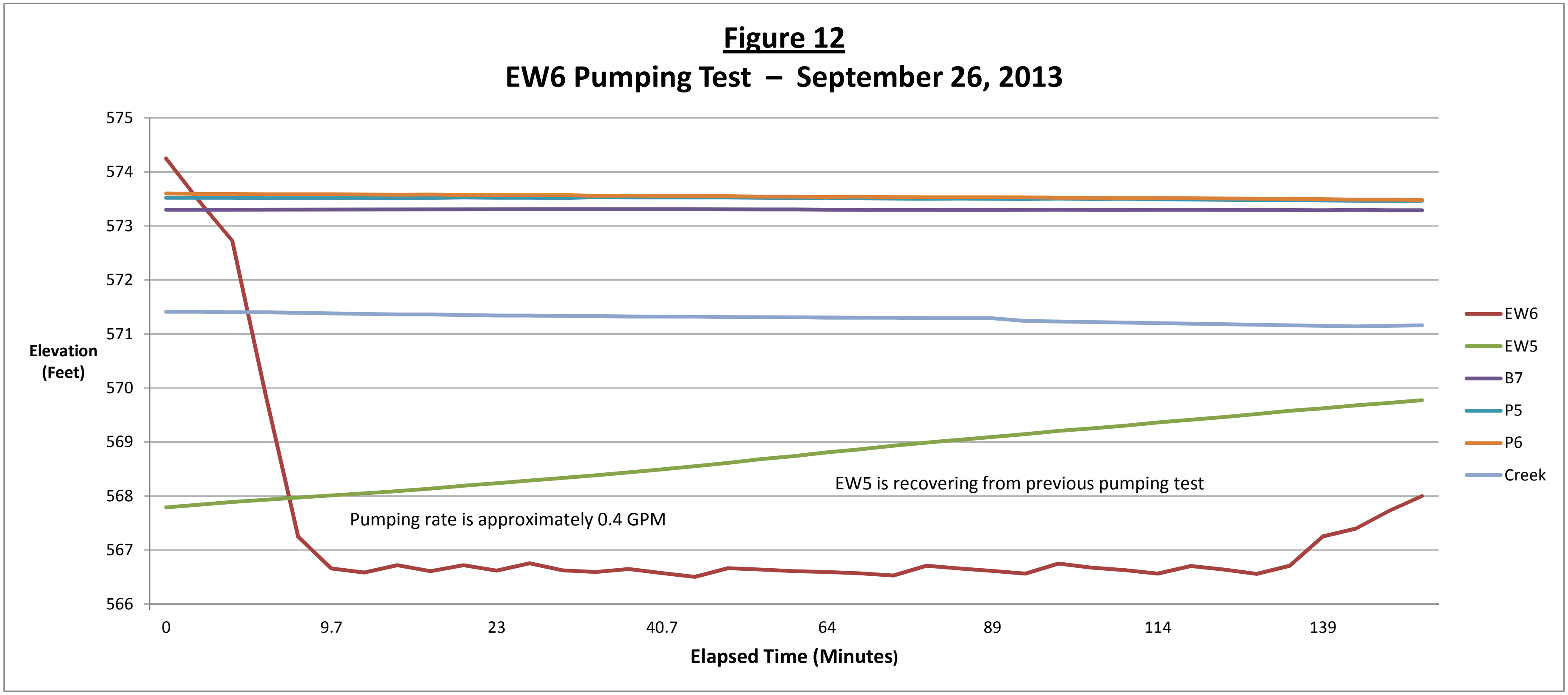


Figure 12
EW6 Pumping Test – September 26, 2013
575
574
573
572
571
570
569
568
567
566
Elevation (Feet)
0
9.7
23
40.7
64
89
114
139
Elapsed Time (Minutes)
EW5 is recovering from previous pumping test
Pumping rate is approximately 0.4 GPM
EW6
EW5
B7
P5
P6
Creek

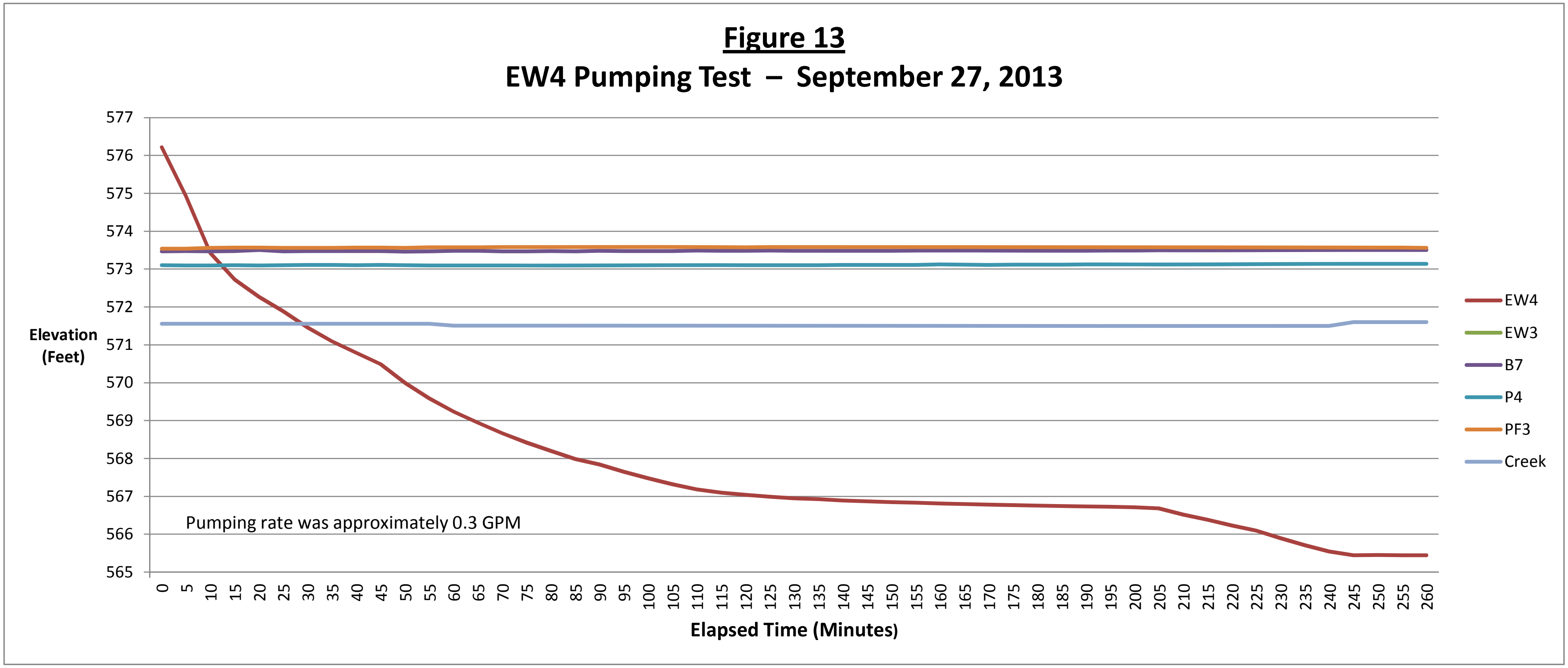


Figure 13
EW4 Pumping Test – September 27, 2013
Elevation (Feet)
577
576
575
574
573
572
571
570
569
568
567
566
565
Pumping rate was approximately 0.3 GPM
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150 155 160 165 170 175 180 185 190 195 200 205 210 215 220 225 230 235 240 245 250 255 260
Elapsed Time (Minutes)
EW4
EW3
B7
P4
PF3
Creek

Figure 14

EW8 Pumping Test – September 30, 2013

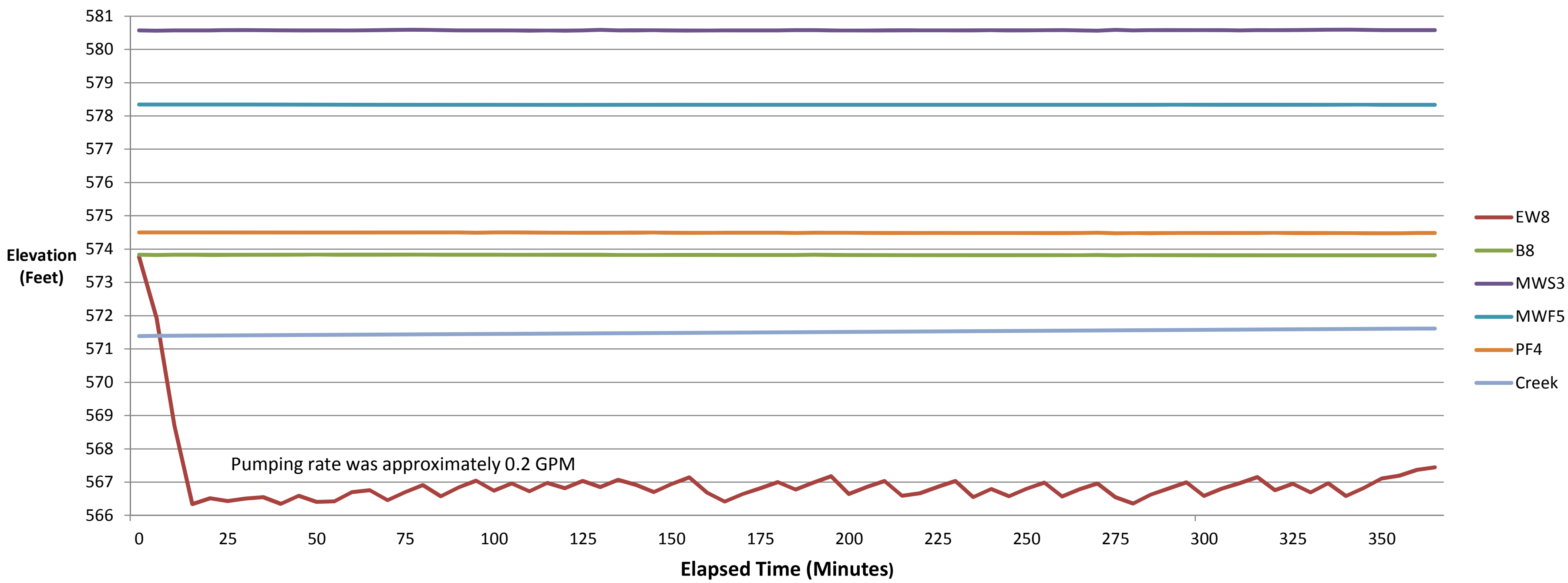
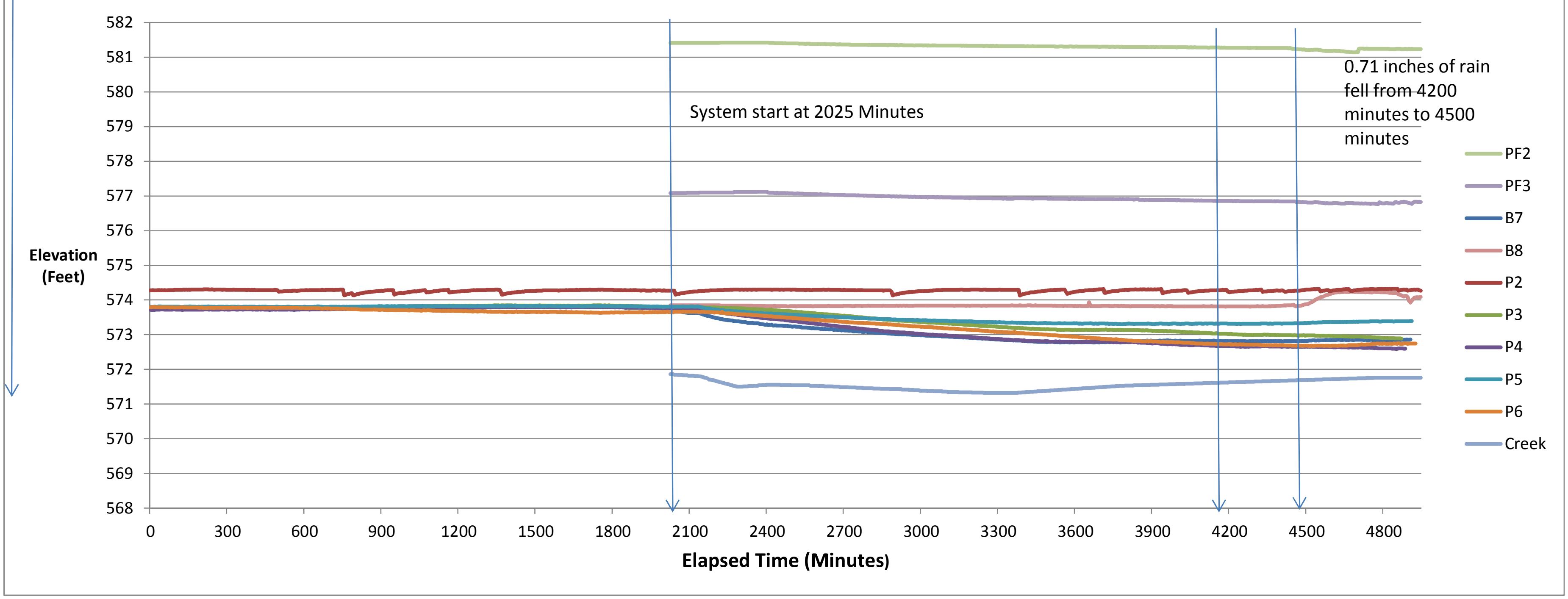
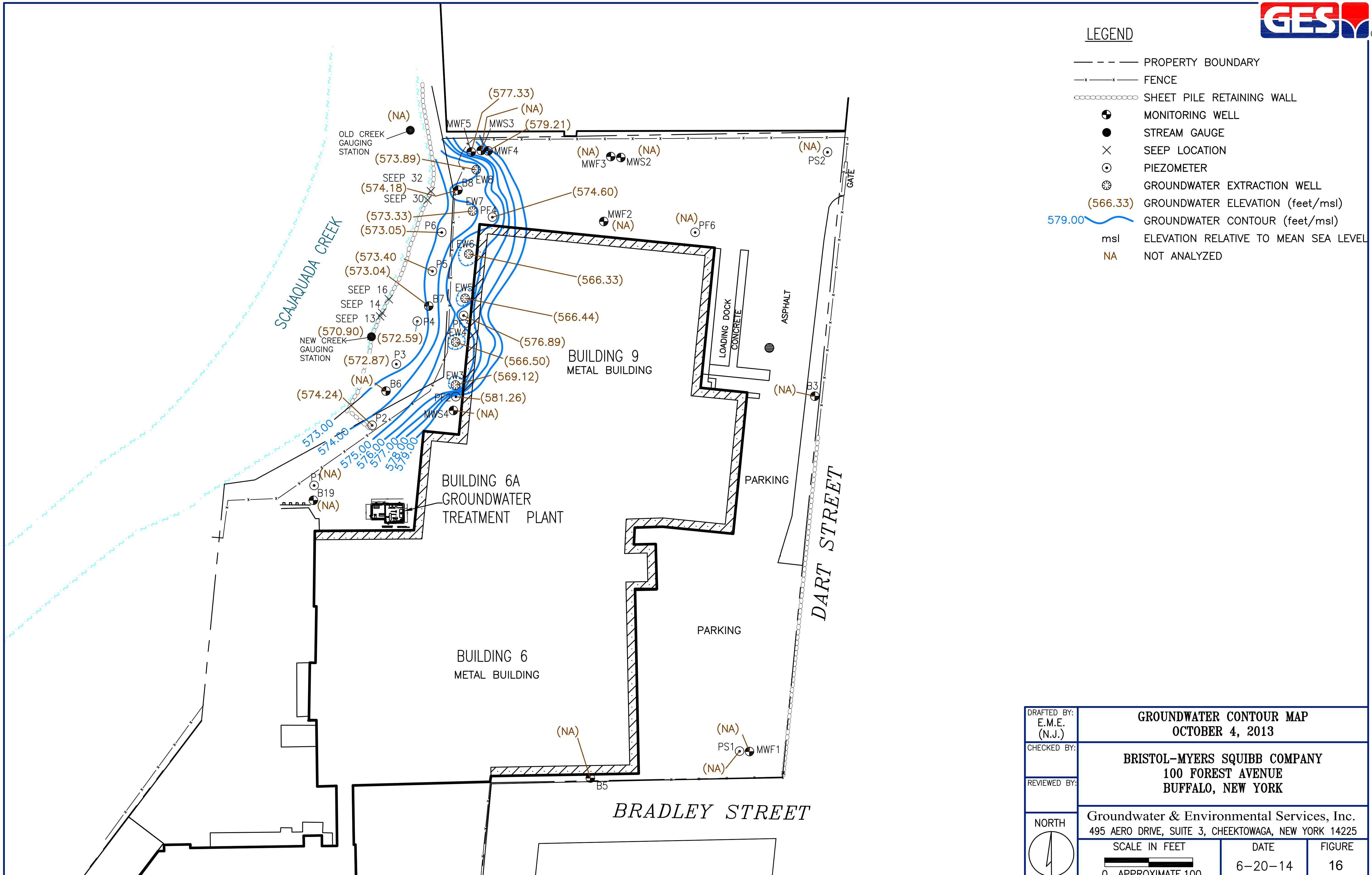


Figure 15

Monitored System Re-Start – October 2 to October 4, 2013





DRAFTED BY: E.M.E. (N.J.)	GROUNDWATER CONTOUR MAP OCTOBER 4, 2013
CHECKED BY:	BRISTOL-MYERS SQUIBB COMPANY 100 FOREST AVENUE BUFFALO, NEW YORK
REVIEWED BY:	
NORTH	Groundwater & Environmental Services, Inc. 495 AERO DRIVE, SUITE 3, CHEEKTOWAGA, NEW YORK 14225

SCALE IN FEET	DATE	FIGURE
0 APPROXIMATE 100	6-20-14	16

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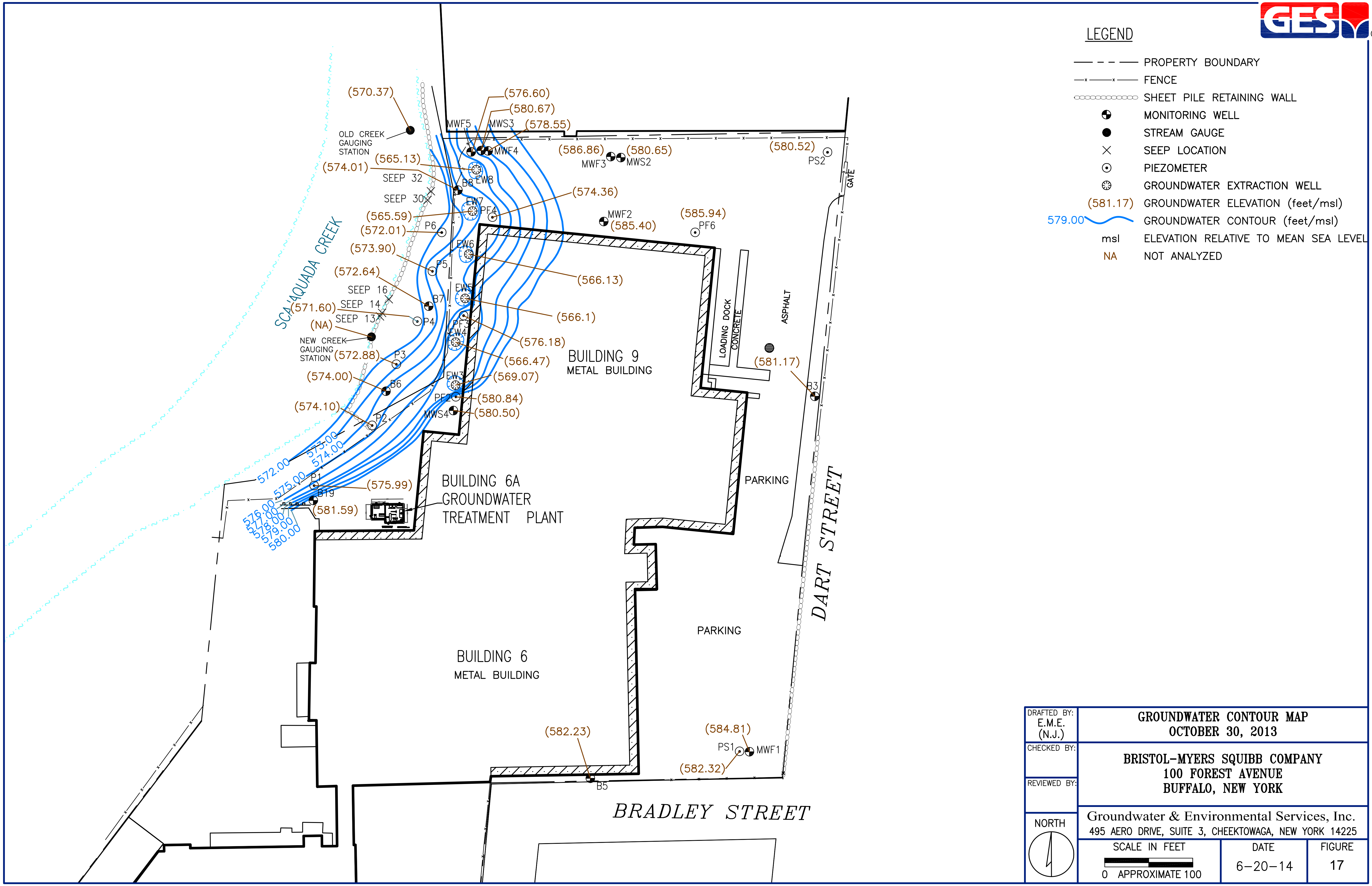


DRAFTED BY: E.M.E. (N.J.)
CHECKED BY:
REVIEWED BY:

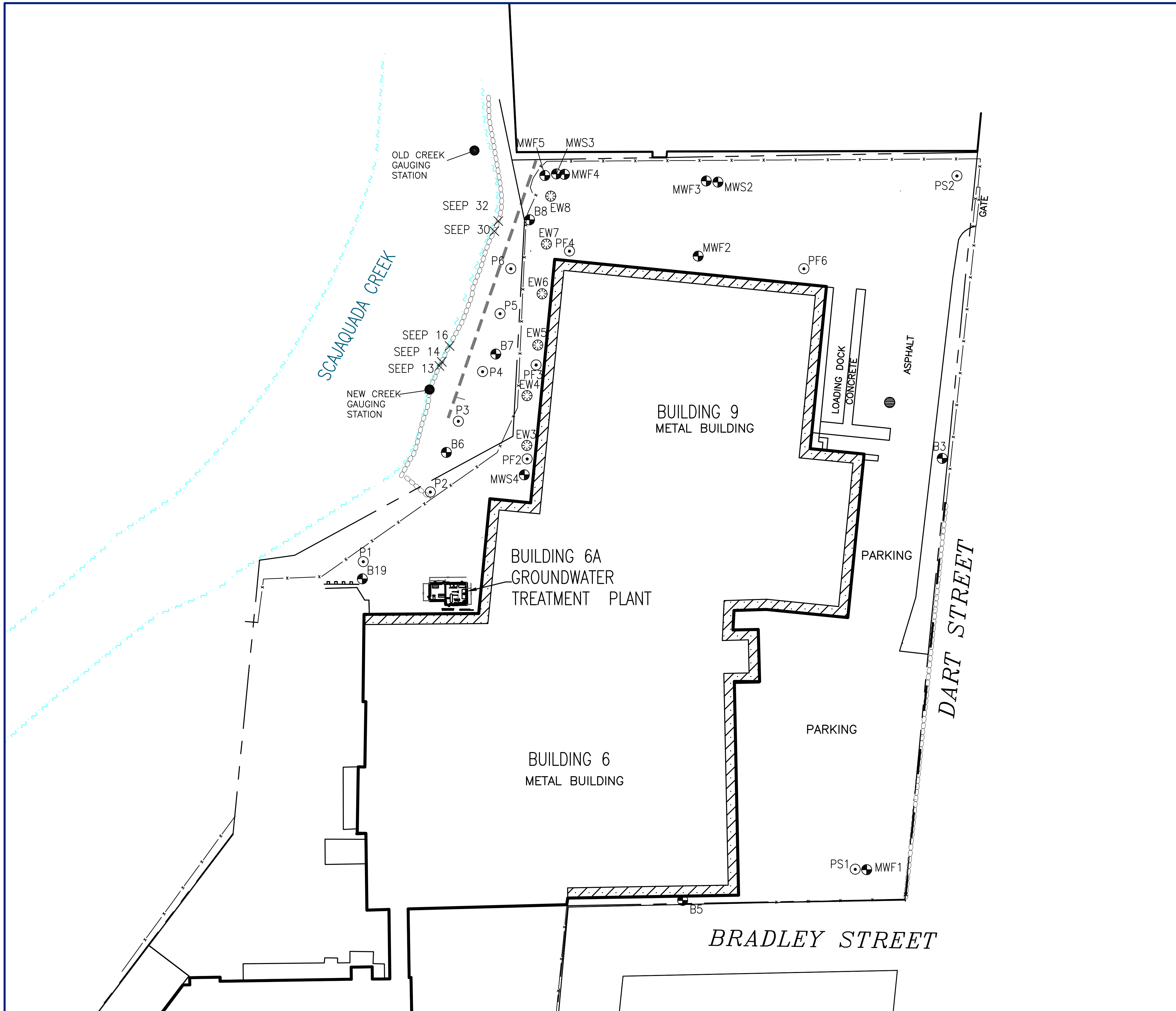
GROUNDWATER CONTOUR MAP
OCTOBER 30, 2013

BRISTOL-MYERS SQUIBB COMPANY
100 FOREST AVENUE
BUFFALO, NEW YORK

Groundwater & Environmental Services, Inc.
495 AERO DRIVE, SUITE 3, CHEEKTOWAGA, NEW YORK 14225

DATE	FIGURE
6-20-14	17

M:\Graphics\0900-Buffalo\Misc\Bristol Myers Squibb\Bristol Myers Squibb SM.dwg, B-100 SM, 6/20/2014 10:55:41 AM, EEdwards



LEGEND

- PROPERTY BOUNDARY
- FENCE
- SHEET PILE RETAINING WALL
- MONITORING WELL
- STREAM GAUGE
- SEEP LOCATION
- PIEZOMETER
- GROUNDWATER EXTRACTION WELL
- PROPOSED INTERCEPTOR TRENCH

NOTES:

THE CROSS SECTION DIAGRAM MAY BE REFERENCED ON THE CONCEPTUAL INTERCEPTOR TRENCH DESIGN SCHEMATIC.

DRAFTED BY: E.M.E. (N.J.)	CONCEPTUAL INTERCEPTOR TRENCH LOCATION MAP
CHECKED BY:	BRISTOL-MYERS SQUIBB COMPANY 100 FOREST AVENUE BUFFALO, NEW YORK
REVIEWED BY:	
NORTH	Groundwater & Environmental Services, Inc. 495 AERO DRIVE, SUITE 3, CHEEKTOWAGA, NEW YORK 14225
	SCALE IN FEET: 0 APPROXIMATE 100 / DATE: 6-20-14 / FIGURE: 18

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TABLES

Iroquois Gas/Westwood Pharmaceuticals Site
100 Forest Avenue
Buffalo, New York

Table 1

Summary of Detected VOCs in Seeps

	TOGS 1.1.1 Groundwater Standards (µg/L)	NYSDEC Seep 13 (µg/L) 4/17/2013	GES Seep 13 (µg/L) 4/17/2013	GES Seep 13 (µg/L) 6/4/2013	GES Seep 13 (µg/L) 6/26/2013	GES Seep 13 (µg/L) 7/15/2013	NYSDEC Seep 32 (µg/L) 4/17/2013	GES Seep 32 (µg/L) 4/17/2013	GES Seep 32 (µg/L) 6/4/2013	GES Seep 30 (µg/L) 6/26/2013	GES Seep 30 (µg/L) 7/15/2013
Benzene	1	0.60 J	0.45 J	0.68 J	0.43 J	0.47 J	**840**	**700**	**630**	**630**	**670**
Chloroform	7	4.9	5	5.6	**7.7**	**7.4**	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0
Cyclohexane	NA	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	0.84 J	ND<1.0	0.80 J	0.66 J	0.74 J
Ethylbenzene	5	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	**560**	**520**	**470**	**64**	**46**
Isopropylbenzene	5	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	**40**	**37**	**28**	**24**	**24**
Methylcyclohexane	NA	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	1.3	0.87 J	1.3	1.1	1.4
Toluene	5	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	**6.2**	**5.6**	4.8	1.8	1.7
Total Xylenes	5	ND<2.0	ND<2.0	ND<2.0	ND<2.0	ND<2.0	**220**	**190**	**140**	**30**	**24**

Notes:
VOCs= Volatile Organic Compounds
All data presented in micrograms per Liter (ug/L)
ND< = None detected above laboratory limit indicated
J = Concentration is less than the reporting limit but is greater than or equal to the laboratory method detection limit and the concentration is an approximate value
TOGS 1.1.1 = New York State Department of Environmental Conservation (NYSDEC) Technical & Operational Guidance Series Groundwater Standards
Bold values indicate exceedence of TOGS 1.1.1 Groundwater Standards
NA = Not available

Iroquois Gas/Westwood Pharmaceuticals Site
100 Forest Avenue
Buffalo, New York

Table 2

Summary of Creek Inspection Results

Date	Recorded Rainfall (inches)	Seep 13	Seep 14	Seep 16	Seep 17	Seep 30	Seep 32
7/15/2013	NA	0.5 GPM	NF	NF	NF	0.25 GPH	NF
8/19/2013	NA	0.15 GPM	NF	NF	NF	< 1 GPD	NF
System shut down on 9/13/13							
9/17/2013	0.00	0.25 GPM	NM	NF	NF	0.1 GPH	NF
9/18/2013	0.00	< 0.25 GPM	Wet	NF	NF	<0.1 GPH	NF
9/19/2013	0.00	< 0.1 GPM	NM	NF	NF	~ 2 GPD	< 1 GPD
9/20/2013	0.00	< 0.1 GPM	NM	NF	NF	< 1 GPD	< 1 GPD
9/23/2013	3.52	1 GPM	0.5 GPM	NM	NM	0.1 GPM	0.1 GPM
9/24/2013	0.00	0.75 GPM	0.25 GPM	Wet	Wet	0.1 GPM	NM
9/25/2013	0.00	0.5 GPM	0.25 GPM	Wet	Wet	0.1 GPM	Wet
9/26/2013	0.00	0.25 GPM	0.1 GPM	Wet	Wet	NM	Wet
9/27/2013	0.00	< 0.1 GPM	NM	Wet	Wet	Wet	Wet
10/2/2013	0.00	0.05 GPM	NF	0.01 GPM	Wet	Wet	Wet
10/3/2013	0.08	0.5 GPM	0.1 GPM	Wet	Wet	NM	Wet
10/4/2013	0.73	1 GPM	0.5 GPM	0.25 GPM	0.1 GPM	NM	0.5 GPM

Notes:

Recorded rainfall indicates cumulative rainfall that occurred since the most recent inspection was conducted
GPM = Gallons per minute
GPH = Gallons per hour
GPD = Gallons per day
NM = Slight flow observed but not sufficient for measurement
NF = No observable flow and sheet pile was dry
Wet = No observable flow but sheet pile was wet
NA = Rainfall information is not available

Iroquois Gas/Westwood Pharmaceuticals Site
100 Forest Avenue
Buffalo, New York

Table 3

Groundwater Elevation Data – September 16, 2013

Well Location	DTW (ft)	Reference Elevation Measurement Location	Reference Elevation (ft msl)	Groundwater Elevation (ft msl)
P1	15.05	Top of casing	590.77	575.72
P2	17.20	Top of casing	591.30	574.10
P3	19.23	Top of casing	591.09	571.86
P4	19.70	Top of casing	591.51	571.81
P5	18.31	Top of casing	591.42	573.11
P6	18.89	Top of casing	590.83	571.94
PS1	11.59	Top of casing	592.89	581.30
B3	9.97	Top of casing	590.74	580.77
B5	10.00	Top of casing	592.50	582.50
B6	18.67	Top of casing	592.30	573.63
B7	19.11	Top of casing	591.86	572.75
B8	18.65	Top of casing	592.16	573.51
B19	10.54	Top of casing	592.14	581.60
MWS2	11.75	Road Box	591.89	580.14
MWS3	11.29	Road Box	591.57	580.28
MWS4	13.22	Top of casing	593.05	579.83
PF2	12.45	Road Box	591.84	579.39
PF3	15.07	Road Box	591.48	576.41
PF4	21.27	Top of casing	594.11	572.84
PF6	7.38	Top of casing	592.86	585.48
EW3	13.95	Top of grate	590.52	576.57
EW4	15.10	Top of grate	590.78	575.68
EW5	18.57	Top of grate	590.69	572.12
EW6	16.91	Top of grate	590.33	573.42
EW7	16.77	Top of grate	590.31	573.54
EW8	17.50	Top of grate	591.07	573.57
MWF1	8.27	Top of casing	592.28	584.01
MWF2	10.09	Top of casing	594.66	584.57
MWF3	5.15	Top of casing	591.66	586.51
MWF4	15.78	Top of casing	594.47	578.69
MWF5	15.38	Top of casing	590.95	575.57
Old Creek Gauging Station	12.90	NA	583.54	570.64
New Creek Gauging Station	5.11	NA	576.01	570.90

Notes:
DTW = Measured depth to groundwater
ft = Feet
msl = Elevation relative to mean sea level

Iroquois Gas/Westwood Pharmeuticals Site
100 Forest Avenue
Buffalo, New York

Table 4

Groundwater Analytical Data – September 16 to September 18, 2013

Well Location	Date	Acetone (µg/L)	Benzene (µg/L)	Chloroform (µg/L)	cis-1,2-Dichloroethene (µg/L)	Ethylbenzene (µg/L)	Isopropyl Benzene (µg/L)	Methylcyclohexane (µg/L)	Tetrachloroethene (µg/L)	Toluene (µg/L)	Trichloroethene (µg/L)	Vinyl chloride (µg/L)	Total Xylenes (µg/L)	Total VOCs (µg/L)
TOGS 1.1.1 Groundwater Standards (ug/L)		**50**	**1**	**7**	**5**	**5**	**5**	**NA**	**5**	**5**	**5**	**2**	**5**	**NA**
P1	9/16/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
P2	9/16/2013	ND	1.2	ND	ND	ND	ND	ND	ND	0.78 J	ND	ND	1.8	4
P3	9/16/2013	ND	**59**	ND	ND	5	ND	ND	ND	ND	ND	ND	**15**	79
P4	9/16/2013	3.6 J	**61**	ND	ND	**110**	**5.1**	ND	ND	**47**	ND	ND	**110**	337
P5	9/16/2013	ND	**280**	ND	ND	**2,300**	**68**	2.2 J	ND	**12**	ND	ND	**530**	3,192
P6	9/16/2013	33	**7,000**	ND	ND	**4,400**	**70**	ND	ND	**32**	ND	ND	**1,200**	12,735
PS1	9/18/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
B3	9/18/2013	3.7 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.7
B5	9/18/2013	4.2 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.2
B6	9/16/2013	ND	ND	3.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.1
B7	9/16/2013	ND	1.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.4
B8	9/17/2013	ND	**130**	ND	ND	**28**	2.7	ND	ND	ND	ND	ND	**18**	179
B19	9/16/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MWS2	9/18/2013	3.3 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.3
MWS3	9/17/2013	34	ND	ND	ND	0.78 J	ND	ND	ND	ND	ND	ND	ND	35
MWS4	9/16/2013	4.1 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.1
PF2	9/16/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PF3	9/16/2013	ND	**780**	ND	ND	**180**	**110**	4.4 J	**8.5 J**	ND	ND	ND	**310**	1,393
PF4	9/17/2013	ND	**2,300**	ND	ND	**2,100**	**75**	ND	ND	ND	ND	ND	**960**	5,435
PF6	9/18/2013	ND	**15,000**	ND	ND	**2,300**	ND	ND	ND	ND	ND	ND	**2,200**	19,500

Iroquois Gas/Westwood Pharmeuticals Site
100 Forest Avenue
Buffalo, New York

Table 4

Groundwater Analytical Data – September 16 to September 18, 2013

Well Location	Date	Acetone (µg/L)	Benzene (µg/L)	Chloroform (µg/L)	cis-1,2-Dichloroethene (µg/L)	Ethylbenzene (µg/L)	Isopropyl Benzene (µg/L)	Methylcyclohexane (µg/L)	Tetrachloroethene (µg/L)	Toluene (µg/L)	Trichloroethene (µg/L)	Vinyl chloride (µg/L)	Total Xylenes (µg/L)	Total VOCs (µg/L)
TOGS 1.1.1 Groundwater Standards (ug/L)		**50**	**1**	**7**	**5**	**5**	**5**	**NA**	**5**	**5**	**5**	**2**	**5**	**NA**
EW3	9/16/2013	22	ND	ND	**7.6**	ND	ND	ND	ND	ND	**6**	1.1	ND	37
EW4	9/16/2013	**53**	**35**	ND	ND	**14**	ND	ND	ND	ND	ND	ND	**11**	113
EW5	9/16/2013	**310**	**100**	ND	ND	**84**	**7**	ND	**6.6**	ND	ND	ND	**61**	569
EW6	9/16/2013	ND	**400**	ND	ND	**390**	**14**	ND	5	ND	ND	ND	**110**	919
EW7	9/16/2013	**64**	**50**	ND	ND	**74**	ND	ND	ND	ND	ND	ND	**480**	668
EW8	9/17/2013	ND	**2.1**	ND	ND	**10**	ND	ND	ND	ND	ND	ND	**8.2**	20.3
MWF1	9/18/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MWF2	9/18/2013	ND	**34**	ND	ND	**450**	**33**	ND	ND	**5.3**	ND	ND	**720**	1,242
MWF3	9/18/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MWF4	9/17/2013	24	**82**	ND	ND	**110**	**17**	ND	ND	2.1	ND	ND	**87**	322
MWF5	9/17/2013	ND	**46**	ND	ND	**43**	**6.4**	0.74 J	ND	4	ND	ND	**43**	143

Notes:

EPA = United States Environmental Protection Agency

VOCs = Volatile Organic Compounds

All samples analyzed for target compound list (TCL) VOCs by EPA Method 8260B

TOGS 1.1.1 = New York State Department of Environmental Conservation (NYSDEC) Technical & Operational Guidance Series Groundwater Standards

Only detected compounds are shown

All data presented in micrograms per Liter (µg/L)

J = Concentration is less than the reporting limit but greater than or equal to the laboratory method detection limit and the concentration is an approximate value

Bold values indicate exceedence of TOGS 1.1.1 Groundwater Standards

ND = None detected above laboratory limit indicated

NA = Not Applicable

Iroquois Gas/Westwood Pharmaceuticals Site
100 Forest Avenue
Buffalo, New York

Table 5

Pre-Test Pumping Field Measurements

Well Location	Date	Time	DTW (ft)	Rate (gpm)
P5	9/17/2013	1100	18.32	0.5
		1105	20.10	0.5
		1110	20.50	0.5
		1115	21.90	0.25
		1120	24.50	0.25
		1130	26.10	0.25
		1135	27.80	0.25
		1138	27.90	0.125
		1145	28.00	0.125
		1152	28.60	0.125
		1200	29.50	0.125
		1210	28.50	0.06
		1215	27.50	0.06
		1220	27.00	0.06
		1230	26.80	0.06
		1235	27.20	0.06
P6	9/17/2013	1245	18.14	0.125
		1300	18.54	0.125
		1305	19.82	0.06
		1310	22.96	0.06
		1313	24.05	0.01
		1320	25.00	0.06
	Problems with the pump at 1320, restarted at 1325			
		1325	18.24	0.03
		1330	19.95	0.03
		1335	20.05	0.03
		1340	20.05	0.03

Iroquois Gas/Westwood Pharmaceuticals Site
100 Forest Avenue
Buffalo, New York

Table 5

Pre-Test Pumping Field Measurements

Well Location	Date	Time	DTW (ft)	Rate (gpm)
EW3	9/19/2013	1200	13.05	0.3
		1202	13.31	0.3
		1205	13.36	0.3
		1215	13.32	NR
		1230	13.52	0.3
		1242	14.20	NR
		1255	14.52	0.25
		1303	14.70	0.25
		1315	14.85	0.25
		1325	14.91	0.25
		1335	15.14	0.25
		1343	15.24	0.25
		1348	15.31	0.175
	Problems with the pump at 1348, restarted at 1415			
		1415	17.30	0.15
		1430	17.40	0.15
		1440	17.48	0.125
		1446	17.50	0.125
		1700	17.48	0.125
		1710	17.40	0.125
EW4	9/18/2013	1430	14.69	NA
		1445	NR	NA
		1450	15.12	0.15
		1458	15.17	0.15
		1515	17.48	0.15
		1540	14.42	0.125
		1545	17.60	0.125
		1600	17.32	0.125
		1620	17.95	0.15
		1625	18.15	0.15
		1638	18.75	0.15
		1645	19.23	0.15
		1650	19.70	0.15
		1653	20.19	0.15
		1657	20.36	0.125
		1705	20.62	0.125

Iroquois Gas/Westwood Pharmaceuticals Site
100 Forest Avenue
Buffalo, New York

Table 5

Pre-Test Pumping Field Measurements

Well Location	Date	Time	DTW (ft)	Rate (gpm)
EW5	9/18/2013	1105	17.70	NA
		1110	17.78	0.25
		1130	19.90	0.125
		1140	19.87	0.1
		1200	18.40	0.1
		1215	18.48	0.1
		1220	19.10	0.15
		1235	20.26	0.15
		1240	22.01	0.15
		1255	22.69	0.15
		1300	22.87	0.15
		1305	23.10	0.15
EW6	9/17/2013	1718	16.85	0.25
		1720	16.98	0.25
		1725	17.25	0.25
		1730	18.07	0.25
		1735	19.93	0.15
		1740	20.55	0.15
		1745	21.01	0.15
		1748	21.67	0.15
		1753	22.18	0.15
		1800	22.71	0.15
		1803	23.16	0.125
		1808	23.38	0.125
		1812	23.56	0.125
		1815	23.58	0.125

Iroquois Gas/Westwood Pharmaceuticals Site
100 Forest Avenue
Buffalo, New York

Table 5

Pre-Test Pumping Field Measurements

Well Location	Date	Time	DTW (ft)	Rate (gpm)
EW7	9/17/2013	1635	16.74	0.25
		1638	18.80	0.25
		1640	19.90	0.15
		1645	19.99	0.15
		1650	20.05	0.15
		1658	20.65	0.15
		1703	20.01	0.15
		1710	20.91	0.15
		1715	20.85	0.15
EW8	9/17/2013	1445	17.46	0.15
		1448	17.60	0.15
		1452	18.40	0.15
		1555	20.18	0.125
		1600	21.65	0.125
		1605	22.45	0.1
		1608	22.98	0.1
		1614	23.42	0.1
		1620	23.47	0.06
		1625	23.50	0.06
		1630	23.57	0.06

Notes:
DTW = Depth to Water
ft = Feet
gpm = Gallons per minute

Iroquois Gas/Westwood Pharmaceuticals Site
100 Forest Avenue
Buffalo, New York

Table 6

Groundwater Analytical Data – September 18 to September 30, 2013

Well Location	Date	Acetone (µg/L)	Benzene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Cyclohexane (µg/L)	Ethylbenzene (µg/L)	Isopropyl Benzene (µg/L)	Methylcyclohexane (µg/L)	Methylene chloride (µg/L)	Toluene (µg/L)	Trans-1,2-dichloroethene (µg/L)	Trichloroethene (µg/L)	Vinyl chloride (µg/L)	Total Xylenes (µg/L)	Total VOCs (µg/L)
TOGS 1.1.1 Groundwater Standards (ug/L)		**50**	**1**	**5**	**7**	**5**	**5**	**NA**	**5**	**5**	**5**	**5**	**2**	**5**	**NA**
P5	9/19/2013	**120**	**330**	ND	1.9	**1,700**	**55**	3.3	ND	**12**	ND	ND	ND	**330**	2,552
P6	9/18/2013	ND	**1,800**	ND	ND	**2,800**	**60**	ND	ND	**11**	ND	ND	ND	**970**	5,641
EW3	9/24/2013	6.0 J	**1.3**	**12**	ND	0.99 J	ND	ND	ND	ND	0.94 J	**9.1**	1.1	ND	31.4
EW4	9/27/2013	**22 J**	**48**	ND	ND	**120**	**10**	ND	ND	3.5 J	ND	ND	ND	**66**	270
EW5	9/26/2013	42 J	**250**	ND	ND	**110**	**12**	ND	ND	**11**	ND	ND	ND	**80**	505
EW6	9/26/2013	25 J	**180**	ND	ND	**160**	**6.9**	ND	ND	3.1 J	ND	ND	ND	**77**	452
EW7	9/23/2013	3.0 J	**950**	ND	3	**2,300**	**77**	3.7	ND	**15**	ND	ND	ND	**640**	3,991
EW8	9/20/2013	ND	**9.2**	ND	ND	**81**	4.8	ND	ND	ND	ND	ND	ND	**71**	166
	9/30/2013	20 J	**40**	ND	ND	**140**	8.6	ND	1.9 J	3.9 J	ND	ND	ND	**150**	364

Notes:

EPA = United States Environmental Protection Agency

VOCs = Volatile Organic Compounds

All samples analyzed for target compound list (TCL) VOCs by EPA Method 8260B

TOGS 1.1.1 = New York State Department of Environmental Conservation (NYSDEC) Technical & Operational Guidance Series Groundwater Standards

Only detected compounds are shown

All data presented in micrograms per Liter (µg/L)

J = Concentration is less than the reporting limit but greater than or equal to the laboratory method detection limit and the concentration is an approximate value

Bold values indicate exceedence of TOGS 1.1.1 Groundwater Standards

ND = None detected above laboratory limit indicated

NA = Not Applicable

Iroquois Gas/Westwood Pharmaceuticals Site
100 Forest Avenue
Buffalo, New York

Table 7

Post System Re-Start Groundwater Elevation Data – October 4, 2013

Well Location	DTW (ft)	Reference Elevation Measurement Location	Reference Elevation (ft msl)	Groundwater Elevation (ft msl)
P1	NM	Top of casing	590.77	NA
P2	17.06	Top of casing	591.30	574.24
P3	18.22	Top of casing	591.09	572.87
P4	18.92	Top of casing	591.51	572.59
P5	18.02	Top of casing	591.42	573.40
P6	17.78	Top of casing	590.83	573.05
PS1	NM	Top of casing	592.89	NA
PS2	NM	Top of casing	593.40	NA
B3	NM	Top of casing	590.74	NA
B5	NM	Top of casing	592.50	NA
B6	NM	Top of casing	592.30	NA
B7	18.82	Top of casing	591.86	573.04
B8	17.98	Top of casing	592.16	574.18
B19	NM	Top of casing	592.14	NA
MWS2	NM	Road Box	591.89	NA
MWS3	NM	Road Box	591.57	NA
MWS4	NM	Top of casing	593.05	NA
PF2	10.58	Road Box	591.84	581.26
PF3	14.59	Road Box	591.48	576.89
PF4	19.51	Top of casing	594.11	574.60
PF6	NM	Top of casing	592.86	NA
EW3	21.40	Top of grate	590.52	569.12
EW4	24.28	Top of grate	590.78	566.50
EW5	24.25	Top of grate	590.69	566.44
EW6	24.00	Top of grate	590.33	566.33
EW7	16.98	Top of grate	590.31	573.33
EW8	17.18	Top of grate	591.07	573.89
MWF1	NM	Top of casing	592.28	NA
MWF2	NM	Top of casing	594.66	NA
MWF3	NM	Top of casing	591.66	NA
MWF4	15.26	Top of casing	594.47	579.21
MWF5	13.62	Top of casing	590.95	577.33
Old Creek Gauging Station	NM	NA	583.54	NA
New Creek Gauging Station	4.30	NA	576.01	571.71

Notes:
DTW = Measured depth to groundwater
ft = Feet
msl = Elevation relative to mean sea level

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Table 8

Groundwater Elevation Data – October 30, 2013

Well Location	DTW (ft)	Reference Elevation Measurement Location	Reference Elevation (ft msl)	Groundwater Elevation (ft msl)
P1	14.78	Top of casing	590.77	575.99
P2	17.03	Top of casing	591.30	574.27
P3	18.21	Top of casing	591.09	572.88
P4	19.91	Top of casing	591.51	571.60
P5	17.52	Top of casing	591.42	573.90
P6	18.82	Top of casing	590.83	572.01
PS1	10.57	Top of casing	592.89	582.32
PS2	12.88	Top of casing	593.40	580.52
B3	9.57	Top of casing	590.74	581.17
B5	10.27	Top of casing	592.50	582.23
B6	18.30	Top of casing	592.30	574.00
B7	19.22	Top of casing	591.86	572.64
B8	18.15	Top of casing	592.16	574.01
B19	10.55	Top of casing	592.14	581.59
MWS2	11.24	Road Box	591.89	580.65
MWS3	10.90	Road Box	591.57	580.67
MWS4	12.55	Top of casing	593.05	580.50
PF2	11.00	Road Box	591.84	580.84
PF3	15.30	Road Box	591.48	576.18
PF4	19.75	Top of casing	594.11	574.36
PF6	6.92	Top of casing	592.86	585.94
EW3	21.45	Top of grate	590.52	569.07
EW4	24.31	Top of grate	590.78	566.47
EW5	24.59	Top of grate	590.69	566.10
EW6	24.20	Top of grate	590.33	566.13
EW7	24.72	Top of grate	590.31	565.59
EW8	25.94	Top of grate	591.07	565.13
MWF1	7.47	Top of casing	592.28	584.81
MWF2	9.26	Top of casing	594.66	585.40
MWF3	4.80	Top of casing	591.66	586.86
MWF4	15.92	Top of casing	594.47	578.55
MWF5	14.35	Top of casing	590.95	576.60
Old Creek Gauging Station	13.17	NA	583.54	570.37
New Creek Gauging Station	NM	NA	576.01	NM

Notes:
DTW = Measured depth to groundwater
ft = Feet
msl = Elevation relative to mean sea level

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Table 9

Detailed Evaluation of Remedial Alternatives

EVALUATION CRITERIA	No Additional Action (Continue Existing Remedy)	Institutional Controls (Continue Existing Remedy)	Air Sparge & Soil Vapor Extraction	In-Situ Chemical Oxidation	Vacuum Enhanced Groundwater Recovery	Interceptor Trench with Treatment
Overall Protection of the Public Health and the Environment Alternative eliminates, reduces or controls threats to public health and the environment.	• Volume and concentration of contaminants will be reduced in source area • Subsurface heterogeneities will continue to limit effectiveness of existing remedy and result in contaminant migration • Does not address hydraulic control of impacted groundwater plume	• Volume and concentration of contaminants will be reduced in source area • Subsurface heterogeneities will continue to limit effectiveness of existing remedy and result in contaminant migration • Does not address hydraulic control of impacted groundwater plume	• Volume and concentration of contaminants will be reduced in source area • Subsurface heterogeneities may limit effectiveness and may result in contaminant migration • Does not address hydraulic control of impacted groundwater plume	• Volume and concentration of contaminants will be reduced in source area • Subsurface heterogeneities may limit effectiveness and may result in contaminant migration • Does not address hydraulic control of impacted groundwater plume • Mobilization of injected chemicals or contaminants may impact the creek	• Volume and concentration of contaminants will be reduced in source area • Subsurface heterogeneities may limit effectiveness and may result in contaminant migration • Similarity to existing remedy may result in incomplete hydraulic control of impacted groundwater plume due to system complexity	• Volume and concentration of contaminants will be reduced in source area over an extended time frame • Trench will intercept preferential contaminant flow paths, capturing contaminants • Alternative will achieve hydraulic control of impacted groundwater plume
EVALUATION RATING[a] =	2	3	2	1	3	5
Compliance with Relevant Standards, Criteria and Guidance (SCGs) Alternative meets site-specific RAOs and applicable SCGs as defined by the NYSDEC (ROD, 1994).	• RAOs for Public Health Protection (contact and inhalation) may not be met • RAOs for Environmental Protection (discharge) may not be met • SCGs for groundwater and surface water may not be met	• RAOs for Public Health Protection (contact and inhalation) may not be met • RAOs for Environmental Protection (discharge) may not be met • SCGs for groundwater and surface water may not be met	• RAOs for Public Health Protection (contact and inhalation) may not be met • RAOs for Environmental Protection (discharge) may not be met • SCGs for groundwater and surface water may not be met	• RAOs for Public Health Protection (contact and inhalation) may not be met • RAOs for Environmental Protection (discharge) may not be met • SCGs for groundwater and surface water may not be met	• RAOs for Public Health Protection (contact and inhalation) and RAOs for Environmental Protection (discharge) can be met if hydraulic control is consistently maintained • SCGs for groundwater and surface water can be met if hydraulic control is consistently maintained	• All RAOs for Public Health Protection will be achieved by achieving full hydraulic control of groundwater • RAOs for Environmental Protection will be achieved to the extent practicable by preventing contaminant discharge • SCG for surface water will be met • SCG for groundwater will be met to the extent practicable
EVALUATION RATING[a] =	3	3	3	1	3	5
Reduction in Toxicity, Mobility and Volume of Hazardous Waste Alternative reduces the harmful effects of principal contaminants, contaminant mobility and the amount of contamination present.	• Volume and concentration of contaminants will be reduced in source area • Incomplete hydraulic control may limit effectiveness and may result in contaminant migration	• Volume and concentration of contaminants will be reduced in source area • Incomplete hydraulic control may limit effectiveness and may result in contaminant migration	• Volume and concentration of contaminants will be reduced in source area • Subsurface heterogeneities may limit effectiveness and may result in contaminant migration • Sparging may mobilize contaminants	• Volume and concentration of contaminants will be reduced in source area • Subsurface heterogeneities may limit effectiveness and may result in oxidant or contaminant migration • Adjacent surface water body is a potential receptor of oxidants	• Volume and concentration of contaminants will be reduced in source area • Subsurface heterogeneities and incomplete hydraulic control resulting from complex O&M issues may limit effectiveness and may result in contaminant migration	• Volume and concentration of contaminants will be reduced in source area over time • Mobile contaminants will be intercepted and treated • Hydraulic control of groundwater will prevent off-site migration
EVALUATION RATING[a] =	2	2	3	3	3	4
Long-Term Effectiveness Alternative can maintain protection of human health and the environment over time under the conditions and limitations present at the Site (includes treatment residuals and /or untreated or treated waste).	• Volume and concentration of contaminants will be reduced in source area • Captured contaminants will be treated or disposed of on-site • Incomplete hydraulic control may limit effectiveness and may result in contaminant migration • RAOs may not be achieved	• Volume and concentration of contaminants will be reduced in source area • Captured contaminants will be treated or disposed of on-site • Incomplete hydraulic control may limit effectiveness and may result in contaminant migration • RAOs may not be achieved	• Volume and concentration of contaminants will be reduced in source area • Captured contaminants will be treated or disposed of in situ and/or on-site • Subsurface heterogeneities and lack of hydraulic control may limit effectiveness and may result in contaminant migration • RAOs may not be achieved	• Volume and concentration of contaminants will be reduced in source area • Captured contaminants will be treated or disposed of in situ • Subsurface heterogeneities and lack of hydraulic control may limit effectiveness and may result in contaminant migration • RAOs may not be achieved	• Volume and concentration of contaminants will be reduced in source area • Captured contaminants will be treated or disposed of on-site • Subsurface heterogeneities and incomplete hydraulic control may limit effectiveness and may result in contaminant migration • RAOs may not be achieved	• Volume and concentration of contaminants will be reduced in source area • Captured contaminants will be treated or disposed of on-site • Mobile contaminants will be intercepted and treated • Hydraulic control of groundwater will ensure contaminants cannot migrate • RAOs will be achieved to the extent practicable
EVALUATION RATING[a] =	2	2	2	2	2	5

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Table 9

Detailed Evaluation of Remedial Alternatives

EVALUATION CRITERIA	No Additional Action (Continue Existing Remedy)	Institutional Controls (Continue Existing Remedy)	Air Sparge & Soil Vapor Extraction	In-Situ Chemical Oxidation	Vacuum Enhanced Groundwater Recovery	Interceptor Trench with Treatment
Short-Term Effectiveness Implementation of the alternative does not pose risks to environmental workers, the local community or the environment.	• Continued operation of existing remedial system will not negatively impact the local community • Continued monitoring of existing remedial system will not pose exposure risks to workers • Continued operation of existing remedial system could pose exposure risks to the environment	• Continued operation of existing remedial system will not negatively impact the local community • Implementation of a Site Management Plan and Deed Restrictions will not negatively impact the local community • Continued monitoring of existing remedial system will not pose exposure risks to workers • Continued operation of existing remedial system could pose exposure risks to the environment	• Construction and implementation activities are not likely to negatively impact the local community • Heterogeneous subsurface characteristics could pose exposure risks to workers and/or the environment	• Construction and implementation activities are not likely to negatively impact the local community • Heterogeneous subsurface characteristics could pose exposure risks to workers and/or the environment	• Construction and implementation activities are not likely to negatively impact the local community • Heterogeneous subsurface characteristics could pose exposure risks to workers and/or the environment	• Construction and implementation activities are not likely to negatively impact the local community • Heterogeneous subsurface characteristics could pose exposure risks to workers and/or the environment
EVALUATION RATING[a] =	3	3	3	2	3	3
Implementation and Technical Reliability Alternative is technically and administratively feasible considering the relative degree of difficulty anticipated in implementing the technology option under the regulatory and technical constraints posed at the Site.	• Existing remedial system has been safely implemented and is operational • Lack of hydraulic control may pose environmental exposure risks and minimize technical reliability • Continued monitoring of existing remedial system can be performed using standard practices and technologies	• Existing remedial system has been safely implemented and is operational • Site Management Plans and Deed Restrictions are established and proven methods of minimizing exposure risks • Lack of hydraulic control may pose environmental exposure risks and minimize technical reliability • Continued monitoring of existing remedial system can be performed using standard practices and technologies	• Subsurface heterogeneities pose environmental exposure risks and minimize technical reliability • Required equipment and resources are commercially available • Monitoring can be performed using standard practices and technologies • Existing utilities and Site logistics may make installation problematic • Additional and/or renewed permitting (NYSDEC, DOH) and coordination with adjacent property owners will be needed • Pilot testing will be required to determine remedial design and overall technical feasibility	• Subsurface heterogeneities pose environmental exposure risks and minimize technical reliability • Required equipment and resources are commercially available • Monitoring can be performed using standard practices and technologies • Existing utilities and Site logistics may make installation problematic • Additional and/or renewed permitting (NYSDEC, DOH) and coordination with adjacent property owners will be needed • Pilot testing will be required to determine remedial design and overall technical feasibility	• Subsurface heterogeneities pose environmental exposure risks and minimize technical reliability • Required equipment and resources are commercially available • Monitoring can be performed using standard practices and technologies • Existing utilities and Site logistics may make installation problematic • Additional and/or renewed permitting (NYSDEC, DOH) and coordination with adjacent property owners will be needed • Pilot testing will be required to determine remedial design and overall technical feasibility	• Alternative is an established and proven technology • Required equipment and resources are commercially available • Monitoring can be performed using standard practices and technologies • Existing utilities and Site logistics will make installation problematic • Additional and/or renewed permitting (NYSDEC, DOH) and coordination with adjacent property owners will be needed • Additional study of Site characteristics will be required to determine remedial design and overall technical feasibility
EVALUATION RATING[a] =	3	4	3	3	3	4
Cost[c] Criterion includes direct capital costs (equipment, labor and materials), indirect capital costs (engineering and overhead) and operations and maintenance (O&M) costs.	• No additional costs beyond operation and maintenance of the existing remediation system	• No additional costs would be incurred beyond those due to continued operation of the existing remediation system • Minimal costs would be incurred by implementation of a Site Management Plan and Deed Restrictions • 10-year estimated addtional costs = $70,000	• Moderate indirect capital costs (engineering, pilot testing) • High direct capital costs • Low O&M costs • 10-year estimated additional costs (including construction and O&M) = $(260,000) to $(100,000)	• Moderate indirect capital costs (engineering, pilot testing) • High direct capital costs • Low O&M costs • 10-year estimated additional costs (including construction and O&M) = $(200,000) to $1,250,000	• High indirect capital costs (engineering, pilot testing) • Moderate direct capital costs • High O&M costs • 10-year estimated additional costs (including construction and O&M) = $440,000 to $1,070,000	• Low indirect capital costs (design) • High direct capital costs (construction) • Low to Moderate O&M costs • 10-year estimated additional costs (including construction and O&M) = $250,000 to $790,000
EVALUATION RATING[a] =	5	5	4	1	2	3
Land Use Alternative coincides with current and/or anticipated future land use and all applicable deeds and restrictions.	• Existing alternative is consistent with the anticipated future land use and existing land use restrictions[b]	• Existing alternative is consistent with the anticipated future land use and existing land use restrictions[b]	• Alternative is consistent with the anticipated future land use and existing land use restrictions[b]	• Alternative is consistent with the anticipated future land use and existing land use restrictions[b]	• Alternative is consistent with the anticipated future land use and existing land use restrictions[b]	• Alternative is consistent with the anticipated future land use and existing land use restrictions[b]
EVALUATION RATING[a] =	5	5	5	5	5	5
Community Acceptance Alternative is perceived positively and/or meets with the approval of the local community.	• No risks to the surrounding community would be incurred due to continued operation of the existing remedial system	• No risks to the surrounding community would be incurred due to continued operation of the existing remedial system • No risks to the surrounding community would result from the implementation of Site Management Plan or additional Deed Restrictions	• No risks to the surrounding community would be incurred due to application of the technology	• No risks to the surrounding community would be incurred due to application of the technology	• No risks to the surrounding community would be incurred due to application of the technology	• No risks to the surrounding community would be incurred due to application of the technology
EVALUATION RATING[a] =	5	5	5	5	5	5
TOTAL SCORE =	30	32	30	23	29	39

Notes:

[a] Evaluation Ratings of Criteria: 0 = Not Valid, does not satisfy any element required to meet criterion, 1 = Very Low, minimally satisfies few elements required to meet criteric
2 = Low, satisfies few elements required to meet criterion, 3 = Moderate, satisfies some elements required to meet criterion, 4 = Good, satisfies most elements required to meet criterion, 5 = Excellent, satisfies all elements required to meet criterion

[b] It is anticipated that the Site will remain an industrial facility and transfer of property ownership will be subject the Declaration of Covenants and Restrictions implemented for the location by the State of New York on August 8, 1995.

[c] Includes incurred costs over and above the current groundwater pump and treat system operation costs ($450,000 to $750,000)

RAO = Remedial Action Objectives

NYSDEC = New York State Department of Environmental Conservation

ROD = Record of Decision, NYSDEC, March 28, 1994