April 30, 2019

Jennifer Borski
Wisconsin Department of Natural Resources
625 E. County Rd Y, Suite 700
Oshkosh, WI 54901

Re: Revised Remediation Injection Request
BRRTS# 02-45-000015
FIN# 61613

Dear Ms. Borski:

EnviroForensics is proposing a subsurface injection utilizing products that create and support reducing geochemical conditions as a method of groundwater treatment at the former Appleton Wire facility in Appleton, Wisconsin (Site). On behalf of the responsible party, we are requesting review and approval of the attached request. Site information is provided below.

Site Details:	Appleton Wire (Former) 908 N. Lawe Street Appleton, WI 53122 BRRTS# 02-45-000015
Site Owner:	Luvata Appleton, LLC P.O. Box 1714 Appleton, WI 54912
Responsible Party:	Albany International Corp. Joseph Gaug, Associate General Counsel P.O.1907 Albany, NY 12201 (518) 445-2273 joseph.gaug@albint.com
Consultant:	EnviroForensics, LLC Wayne Fassbender, Senior Project Manager N16 W23390 Stone Ridge Drive, Suite G, Waukesha, WI 53188 262-290-4001 wfassbender@enviroforensics.com

An injection request is attached. Coverage under WPDES Permit No. WI-0046566-07-0 was previously granted and remains valid through 2023. The site was assigned FIN# 61613. A Technical Assistance review fee of $700 was sent to Ms. Danelski with the original injection request on April 10, 2019.

Sincerely,
EnviroForensics, LLC

Wayne Fassbender, PG, PMP
Senior Project Manager

Brian Kappen, PG
Project Manager

cc:

enclosure

INJECTION REQUEST
APPLETON WIRE (FORMER)
908 N. LAWE STREET, APPLETON, WI

EnviroForensics is requesting approval to perform injections for groundwater remediation at the former Appleton Wire facility in Appleton, Wisconsin (Site). The objective of the remedial injections is to reduce concentrations of hexavalent chromium in groundwater.

Soil beneath the Site consists of a relatively homogenous blanket of reddish-brown lean clay, having trace amounts of sand to the maximum sampling depth of 60 feet. Discontinuous seams of clayey, medium to coarse sand and fine to medium gravel were observed in a few soil borings at depths below our target injection zone of 6-20 feet. Sand and gravel fill is present within a few feet of the warehouse foundation and behind the east and south concrete basement walls which are inset from the exterior of the building.

The shallow water table is encountered at the Site within the glacial clay overburden at between approximately 3-6 feet below ground surface (bgs). Recharge of groundwater to Site monitoring wells is extremely slow due to the very low hydraulic conductivity of the clay soil. Recharge of the wells is not consistent across the Site, takes days to weeks for full recharge upon evacuating the water, and is reliant on precipitation. The vertical separation of water levels between water table wells and deeper piezometers varies between each well cluster, but ranges between from approximately 7 to 16 feet.

It is expected that the direction of shallow groundwater flow is to the east towards a drainage channel following the slope of topography, or to the southeast towards the Fox River, which is the primary discharge point in this area for groundwater within the shallow unconsolidated soil. The Fox River at its closest point to the Site is located approximately 2,800 feet to the southeast.

The target compound for treatment is hexavalent chromium [Cr(VI)], identified in Site groundwater at concentrations up to 170 milligrams per liter (mg/L). The remedial technology selected for groundwater treatment is reduction of Cr(VI) to the less toxic and less mobile trivalent form [Cr(III)] and subsequent formation of insoluble chromium hydroxide and iron-chromium hydroxide co-precipitates by chemical and microbial processes. The proposed amendment to be injected is a combination of the following products:

- Anaerobic BioChem (ABC®), a mixture of lactates, fatty acids, alcohols and a phosphate buffer; and
- Zero-valent iron (ZVI).

The product brochure for ABC® prepared by the manufacturer is provided in **Attachment 1**. These products are non-hazardous and safe to handle with level D personal protective equipment; however, respiratory protection will be used if significant ZVI dust is generated during preparation of the solution.

INJECTION REQUEST
APPLETON WIRE (FORMER)
908 N. LAWE STREET, APPLETON, WI

Implementation Plan

Six (6) separate groundwater remediation areas have been defined based on the magnitude and distribution of hexavalent chromium impacts identified during the site investigation. The areas that will be treated by injection are highlighted and designated A through F on **Figure 1**. The target injection interval is 6 to 20 feet bgs in all areas which the exception of the basement, under which injections will occur from just beneath the floor slab to 10 feet bgs.

The total treatment application will consist of 29,000 pounds of ABC+ZVI (50% of each by weight) along with a minimal amount of guar to keep the ZVI in suspension. The products will be mixed with potable water to produce a total of 9,900 gallons of a slurry at the desired concentration. This is equivalent to approximately 5 percent of the treatment volume pore space assuming a porosity of 30 percent.

The ABC+ ZVI slurry will be similar in viscosity to the Provect-IRM slurry that was injected for pilot testing. Therefore, the injection pressure and flow rate are anticipated to be similar to those observed during the pilot test injections. The pilot test injection pressure ranged from 31 to 62 psi, and the flow rate ranged from 2.0 to 4.9 gallons per minute.

The products will be delivered directly to the site in 2,000 pound super sacks and stored inside the site building prior to use. Mixing will be performed in large, trailer-mounted tanks with continuous agitation. The solution will then be pumped from the tanks, through a manifold to the injection points via flexible hosing. Injection will occur at up to four (4) points simultaneously. The solution will be injected directly through the bottom of direct-push rods in 1 to 2 foot intervals in a bottom-up approach. Pressure and flow rate will be monitored separately at each injection point and recorded to confirm that injection design parameters are met.

The proposed direct-push injection points are arranged in a grid pattern within each area as shown on **Figure 1**. However, the final locations may be adjusted slightly to avoid subsurface utilities. The injection plan for each area A through F is summarized below:

- Area A: Advance 28 injection points at locations surrounding the southern pilot test area.
- Area B: Advance nine (9) injection points through the basement floor, and seven (7) injection points around the perimeter of the south and east basement walls. The target injection interval in the basement will be from just beneath the floor slab to 10 feet bgs.
- Area C: Advance 19 injection points to the south and east of the northern pilot test area. Injection Area C overlaps the northern pilot test area around the MW-20 well nest to address elevated hexavalent chromium concentrations detected during pilot test

performance monitoring. A higher percentage of ZVI may be applied to the mixture in this location depending on subsurface response to injection and daylighting issues.

- Area D: Advance 12 injection points west of the northern pilot test area.

- Area E: Advance 16 injection points outside south of the warehouse building, surrounding the MW-5 well nest.

- Area F: Advance 27 injection points in three (3) lines outside the north building wall to treat contaminated soil below and around the footing(s), and to treat soil and groundwater below the depth of soil blending operations in this area.

The direct-push tooling will be removed from each location after the prescribed volume of solution is injected, and the boreholes will be abandoned in accordance with Chapter NR 141.25.

Monitoring Plan

Groundwater elevation measurements will be collected from Site monitoring wells before, during, and after injections to evaluate the temporary effect of injection on potentiometric surfaces and flow direction. The depth to water in each well will be measured to the nearest 0.01 foot using an electronic water level indicator.

The post-injection groundwater monitoring program is detailed on **Table 1** (attached). The objectives of monitoring are to verify that subsurface conditions are conducive to reductive processes and to document decreasing Cr(VI) concentration trends. It is anticipated that monitoring will be conducted for two (2) years following injections.

The monitoring well locations are depicted on **Figure 2**. Existing wells (MW-2, -5, -5A, and MW-25), post-remediation replacement wells (MW-19R, -19AR, -20R, -20AR, -26R, -28R, and MW-30R), and new well clusters (MW-31/31A and MW-32/32A) will be used for remediation performance monitoring purposes. These wells are positioned both within and immediately surrounding the target remediation areas. Groundwater samples will be collected by bailer due to slow recharge, and analyzed for dissolved chromium, iron, and manganese according to EPA test method 6010. Water quality data including electrical conductivity, temperature, dissolved oxygen, total dissolved solids, pH and oxidation-reduction potential (ORP) will be measured in the field with a portable meter during each sampling event.

Investigation-derived media (IDM), including purge water and decontamination fluids, will be containerized in 55-gallon drums. A licensed contractor will be retained to remove drums following each monitoring event. The IDM will be managed under existing non-hazardous waste profiles.

Vapor Screening

Although the risk of generating high concentrations of flammable gas is low considering the nature and distribution of contaminants at the site, methane and hydrogen sulfide can be produced via in-situ chemical reduction processes. The production of vapors at each injection area will be evaluated by collecting headspace field measurements at monitoring wellheads using a portable gas analyzer. Vapor screening measurements will be collected prior to injections and during the groundwater monitoring events. The wellheads will be fitted with expandable plugs with ports designed for vapor monitoring. If the vapor concentration exceeds 10% of the LEL (i.e., 0.5% by volume methane or 0.4% by volume hydrogen sulfide), vapors will be evacuated using appropriate, intrinsically-safe equipment. Additional mitigation methods will be evaluated if necessary.

Timeframe

The remedial injections are tentatively scheduled to begin in July 2019. EnviroForensics anticipates the injection activities can be completed in ten (10) days. Post-injection monitoring will be performed as prescribed on **Table 1**, with the first monitoring event to occur approximately six (6) months after the injection activities are completed to allow time for the subsurface environment to equilibrate and the sequestering of Cr(VI) to be complete. EnviroForensics is requesting injection approval through the end of 2020 in case remediation activities are delayed.

INJECTION REQUEST
APPLETON WIRE (FORMER)
908 N. LAWE STREET, APPLETON, WI

Certifications

I, Andrew Horwath, hereby certify that I am a registered professional engineer in the State of Wisconsin, registered in accordance with the requirements of ch. A-E 4, Wis. Adm. Code; that this document has been prepared in accordance with the Rules of Professional Conduct in ch. A-E 8, Wis. Adm. Code; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code.

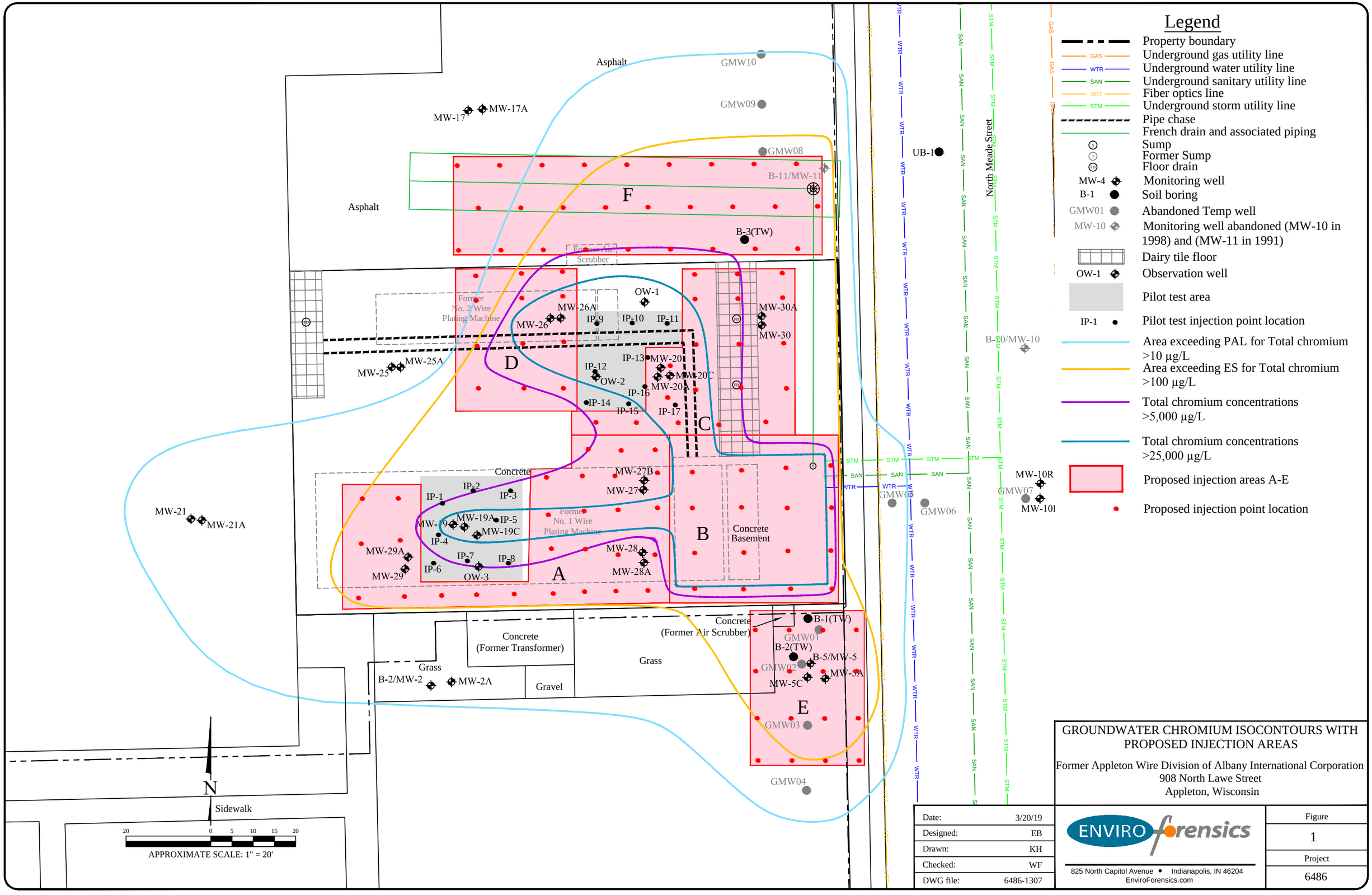
Senior Engineer, PE Lic. No. E-43831-6
Signature, title and P.E. number

P.E. stamp

I, Brian Kappen, hereby certify that I am a hydrogeologist as that term is defined in s. NR 712.03 (1), Wis. Adm. Code, am registered in accordance with the requirements of ch. GHSS 2, Wis. Adm. Code, or licensed in accordance with the requirements of ch. GHSS 3, Wis. Adm. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code.

Project Manager
Signature and title

4/30/19
Date



GROUNDWATER CHROMIUM ISOCONTOURS WITH PROPOSED INJECTION AREAS

Former Appleton Wire Division of Albany International Corporation
908 North Lawe Street
Appleton, Wisconsin

Date:	3/20/19
Designed:	EB
Drawn:	KH
Checked:	WF
DWG file:	6486-1307

ENVIRO forensics
825 North Capitol Avenue • Indianapolis, IN 46204
EnviroForensics.com

Figure 1

Project 6486

REDOX TECH, LLC

"Providing Innovative In Situ Soil and Groundwater Treatment"

ABC+ PRODUCT ANNOUNCEMENT

Redox Tech, Inc is pleased to offer an enhanced version of our industry proven Anaerobic Biochem (ABC®) formula, promoting both anaerobic biodegradation and reductive dechlorination of halogenated solvents in groundwater. This product, Anaerobic Biochem Plus (ABC+), is a mixture of our ABC® formula and Zero Valent Iron (ZVI). Formulated and mixed on a site-by-site basis, up to fifty percent (50%) by weight of ZVI can be added. ZVI has been proven and widely accepted as an effective in situ remediation technology of chlorinated solvents such as TCA, PCE, TCE, and daughter products. The degradation process using ZVI is an abiotic reductive dechlorination process occurring on the surface of the granular iron, with the iron acting as an electron donor.

The addition of ZVI to the ABC® mixture provides a number of advantages for enhanced reductive dechlorination (ERD). The ZVI will provide an immediate reduction. The ABC® will provide short-term and long-term nutrients to anaerobic growth, which also assists to create a reducing environment. ABC® contains soluble lactic acid and a phosphate buffer that provides phosphates, which are a micronutrient for bioremediation, and maintains the pH in a range that is best suited for microbial growth. In addition, the corrosion of iron metal yields ferrous iron and hydrogen, both of which are possible reducing agents. The hydrogen gas produced is also an excellent energy source for a wide variety of anaerobic bacteria.

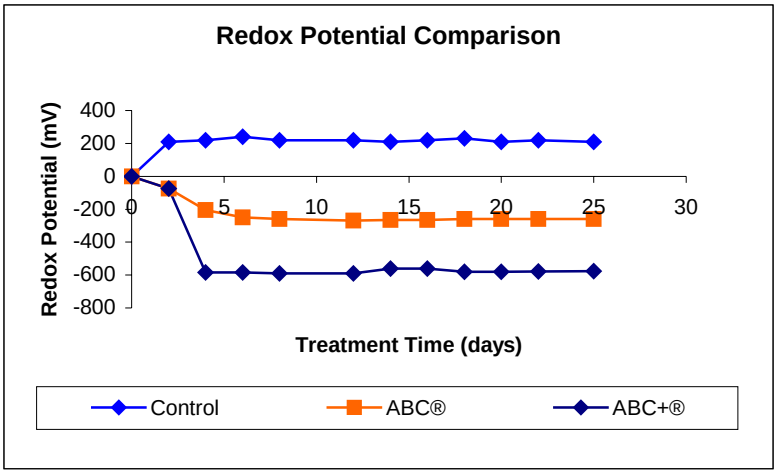
The ABC® and ZVI are mixed with potable water and emplaced in the subsurface simultaneously. The dilution factor (i.e. water content) can be adjusted to achieve optimal dispersion and distribution based on site-specific parameters such as well spacing, permeability of the formation, and contaminant concentrations. The solution can be emplaced by a variety of techniques, including injection through wells or drill rods (for permeable geologic environments such as sands and fractured rock), hydraulic fracturing (for lower permeable environments such as silt and clay), and through soil blending (for all unconsolidated shallow depth applications less than 20 ft bgs). All of these techniques are part of Redox Tech's service offerings.

Benefits of ABC+ include:

- The presence of ZVI allows for the rapid and complete dechlorination of target compounds. Degradation rates using ZVI are several orders of magnitude greater than under natural conditions. As a consequence, the process does not result in the formation of daughter products other than ethane, ethane, and methane.
- ABC® will last up to 12 months in the subsurface environment due to slow releasing compounds, allowing for long-term anaerobic biodegradation
- By creating a reducing environment, ABC+ has the ability to provide long term immobilization of heavy metals (e.g. Ni, Zn, Hg, As)
- Does not require direct contact to act on target constituents.
-

[1]ABC® is protected by US Patents 6,001,252 and 6,472,198. Trademark pending

- Does not divert groundwater flow. ABC is typically mixed at a 15% by weight solution with water. The viscosity of the solution is similar to sugar water and therefore does not measurably influence groundwater flow paths. Due to the relatively low volume of ZVI used, it does not measurably lower the bulk permeability of the formation.
- Ease of handling. The ABC$^+$ product is comprised of food grade compounds and therefore does not require high-levels of personal protective equipment (PPE) or special training to handle. The ZVI is a stable compound that also requires low-level PPE protection.
- Patent protection: Redox Tech is licensed under Enviromental Technologies, Inc. (an Adventus Company) who is the current holder of patents pertaining to remediation using ZVI. Therefore, Redox Tech is able to market, sell, and emplace our ABC$^+$ product. There is no patent infringement risk to the client in selecting the ABC$^+$ approach.
- Price advantage. The cost of the ABC$^+$ formula is an extremely competitive approach in relation to other ERD products on the market.
- ABC$^+$ produces a significantly lower redox potential of approximately –600 mV



Let Redox Tech help formulate a remedial program for your site today. For more information visit our web page at www.redox-tech.com or contact:

John Haselow
Redox Tech, LLC
200 Quade Drive
Cary, NC 27513
Phone: 919-678-0140
FAX: 919-678-0150
jhaselow@redox-tech.com

TABLE 1
POST-REMEDIATION GROUNDWATER MONITORING PLAN
Former Appleton Wire Facility
908 N. Lawe Street, Appleton, Wisconsin

	Frequency of Monitoring		
Monitoring Well ID	**Quarterly for 2 Years** (Remediation Performance)	**Annually for 2 Years** (Plume Distribution)	**Final Pre-Closure Event**
MW-1			C
MW-1B			C
MW-2		C, I, M	
MW-2A			C
MW-5	C, I, M		
MW-5A		C, I, M	
MW-10R			C
MW-10B			C
MW-17			C
MW-17A			C
MW-18			C
MW-18A			C
MW-19R	C, I, M		
MW-19AR		C, I, M	
MW-20R	C, I, M		
MW-20AR		C, I, M	
MW-21			C
MW-21A			C
MW-22			C
MW-22A			C
MW-23			C
MW-23A			C
MW-24			C
MW-24A			C
MW-25		C, I, M	
MW-25A			C
MW-26R	C, I, M		
MW-28R	C, I, M		
MW-30R	C, I, M		
MW-31		C, I, M	
MW-31A		C, I, M	
MW-32		C, I, M	
MW-32A		C, I, M	

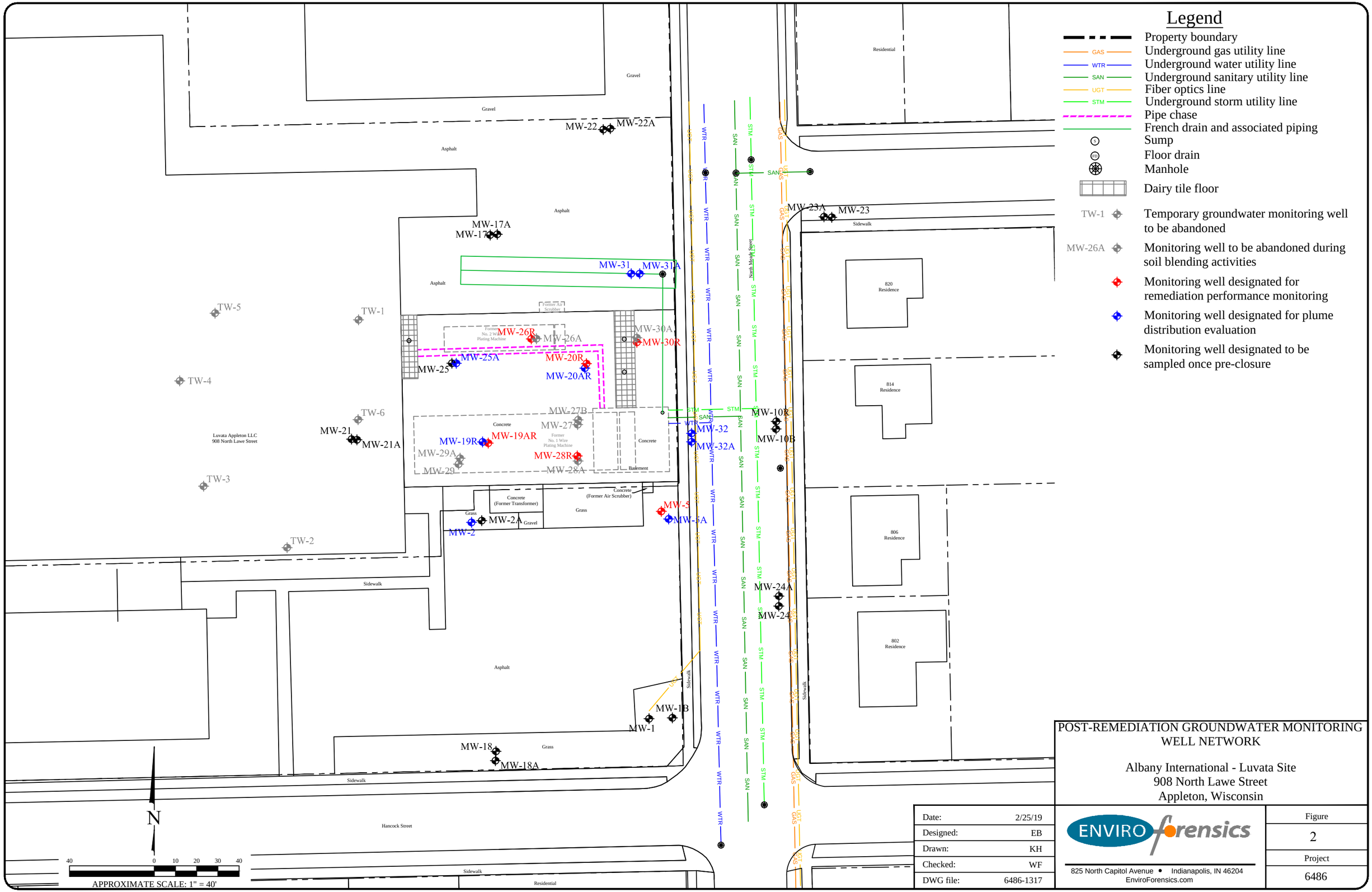
Notes:

Groundwater monitoring will begin approximately six (6) months after completion of the remedial actions

C = total chromium analysis

I = iron analysis

M = manganese analysis


Legend
Property boundary
Underground gas utility line
Underground water utility line
Underground sanitary utility line
Fiber optics line
Underground storm utility line
Pipe chase
French drain and associated piping
Sump
Floor drain
Manhole
Dairy tile floor
TW-1 Temporary groundwater monitoring well to be abandoned
MW-26A Monitoring well to be abandoned during soil blending activities
Monitoring well designated for remediation performance monitoring
Monitoring well designated for plume distribution evaluation
Monitoring well designated to be sampled once pre-closure
MW-22
MW-22A
MW-17A
MW-17
MW-31
MW-31A
MW-23A
MW-23
MW-26R
MW-26A
MW-30A
MW-30R
MW-25A
MW-25
MW-20R
MW-20AR
MW-27B
MW-27
MW-19R
MW-19AR
MW-29A
MW-29
MW-28R
MW-28A
MW-32
MW-32A
MW-10R
MW-10B
MW-5
MW-5A
MW-2A
MW-2
MW-24A
MW-24
MW-1B
MW-1
MW-18
MW-18A
MW-21
MW-21A
TW-1
TW-2
TW-3
TW-4
TW-5
TW-6
Gravel
Asphalt
Residential
Sidewalk
Grass
Concrete
Concrete (Former Transformer)
Concrete (Former Air Scrubber)
Former No. 2 Wire Plating Machine
Former No. 1 Wire Plating Machine
Former Air Scrubber
Basement
820 Residence
814 Residence
806 Residence
802 Residence
Luvata Appleton LLC
908 North Lawe Street
Hancock Street
N
40 0 10 20 30 40
APPROXIMATE SCALE: 1" = 40'
POST-REMEDIATION GROUNDWATER MONITORING WELL NETWORK
Albany International - Luvata Site
908 North Lawe Street
Appleton, Wisconsin
Date: 2/25/19
Designed: EB
Drawn: KH
Checked: WF
DWG file: 6486-1317
ENVIROforensics
825 North Capitol Avenue • Indianapolis, IN 46204
EnviroForensics.com
Figure
2
Project
6486