Prepared for

Mr. William P. Scott
Mallery & Zimmerman, S.C.
731 North Jackson Street, Suite 900
Milwaukee, Wisconsin 53202-4697

Date

August 30, 2016

Proposal No.

P21-15124

FORMER EXPRESS CLEANERS SITE
RACINE, WISCONSIN

BRRTS #02-52-547631
FID #252010000

PROPOSAL FOR REMEDIAL ACTION SERVICES

RAMBOLL ENVIRON

CONTENTS

Ramboll Environ
175 North Corporate Drive
Suite 160
Brookfield, WI 53045
USA

T +1 262 901 0099
F +1 262 901 0079
www.ramboll-environ.com

TABLES

FIGURES

APPENDICES

EXECUTIVE SUMMARY

In response to the Request for Proposal (RFP) dated May 5, 2015, Ramboll Environ US Corporation (Ramboll Environ) appreciates the opportunity to submit this revised proposal to provide environmental remediation consulting services for the Former Express Cleaners Property located at 3921-41 N. Main Street in Racine, Wisconsin (the "Site"). Our initial proposal was submitted on May 29, 2015. It has been updated and presented herein based on further discussions and a meeting with the Wisconsin Department of Natural Resources (WDNR). As requested, the proposed scope of services includes presentation of a remedial strategy to address soil, groundwater, and soil vapor contamination at the Site and adjacent property. The objective of the project is to implement a technically sound and cost-effective approach that leverages the Dry Cleaner Environmental Repair Fund Program (DERP) eligibility of project costs while maintaining compliance with applicable rules, regulations and guidance.

As required by DERP, this proposal includes a Remedial Action Options Report (RAOR)/Remedial Action Plan (RAP) as part of this proposal consistent with Wisconsin Administrative Code (WAC) Chapters NR 169 and NR 700. The RAOR identifies a number of potentially applicable remedial action technologies including the following:

- no action;
- institutional controls;
- monitored natural attenuation (MNA);
- excavation and landfill disposal;
- soil vapor extraction;
- air sparging;
- groundwater extraction and treatment;
- *in-situ* electro-thermal remediation;
- *in-situ* chemical oxidation; and
- *in-situ* enhanced reductive dechlorination.

These technologies were screened based on technical and economic feasibility. Considering the technical and economic feasibility criteria evaluated herein, it is critical to optimize the application of valuable financial resources in order to maximize the reduction in risk to public health, safety and welfare as well as the environment over time. Complete soil and groundwater remediation to meet all WAC NR 140 and NR 700 soil and groundwater clean-up standards is not practical based on the concentrations detected across the Site. As such, Ramboll Environ evaluated the spatial distribution of chlorinated volatile organic compound (CVOC) concentrations in soil and groundwater to identify a target treatment volume that, upon remediation, would represent such an optimization of financial resources while maximizing reduction in risk. Based on the results of this evaluation, the target treatment volume covers an area of approximately 5,700 square feet, and extends down to an approximate depth of 9 feet below ground surface (bgs). Based on these dimensions, the target treatment volume totals approximately 1,900 cubic yards (approximately 2,850 tons). To reduce the potential for off-site migration of impacted groundwater, the recommended target treatment volume includes the east-west trending utility corridor located between the site building and the western property boundary.

Key considerations in identifying and evaluating remedial options were the following pertinent site characteristics obtained from the Site Investigation.

- The site owner desires that the Site be available for re-development after remediation is complete. The redevelopment could include construction of a new site building within the area of impact. Therefore, remedial methods that include significant short term mass removal are preferred, to reduce the vapor intrusion potential for any new site building.
- Deeper subsurface soils (generally below 6 to 8 feet) are generally clayey in nature with relatively low hydraulic conductivity when compared with coarse-grained surficial soils. The depth to the water table is approximately 3 feet bgs.
- The most heavily impacted soil and groundwater is present within the northern third of the property, and extends from the ground surface to approximate depths of 9 feet bgs. Although the presence of dense non-aqueous phase liquid (DNAPL) has not been observed, historical groundwater data suggest that concentrations of tetrachloroethene (PCE) are sufficiently high that DNAPL could be present as DNAPL droplets or ganglia within the porous media near former temporary wells TW-1 and TW-2.
- Soil affected with PCE from former dry cleaner operations is subject to Universal Treatment Standards, under 40 CFR §268.49. Soils with PCE concentrations that exceed 60 milligrams per kilogram (mg/kg) will require treatment prior to disposal at a RCRA Subtitle C facility at a cost of $700 per ton. In addition, soil with PCE concentrations that exceed approximately 1,000 mg/kg would be required to be treated through incineration with transportation and disposal costs that exceed approximately $1,200 per ton. Based on the foregoing, Ramboll Environ concludes that the soil excavation and off-site disposal alternative would be cost-prohibitive and impracticable.
- Removal of all contamination in soil and groundwater to below generic soil cleanup standards and groundwater standards, respectively, is not practicable given the magnitude and extent of impacted soil and groundwater. Therefore, a performance based standard for soil and groundwater that focuses on contaminant mass removal is recommended.
- The proposed remedy needs to be consistent with the intended site demolition and redevelopment schedule.

Based on review of the key site characteristics and applicable remedial action options, Ramboll Environ recommends implementation of *in-situ* enhanced reductive dechlorination through on-site soil blending of zero valent iron (ZVI) and carbon amendment at the subject property. This remedial approach eliminates potential future liability associated with disposal of hazardous waste soil in a landfill or other off-site location. After contaminant mass removal, Ramboll Environ recommends groundwater monitoring of residual CVOCs to demonstrate continued natural attenuation. The detected presence of PCE degradation products trichloroethene (TCE), cis-1,2-dichlorethene (cDCE) and vinyl chloride (VC) in groundwater samples obtained from the Site indicate that reductive dechlorination is already occurring, and can be stimulated. The recommended remedial action based on reductive dechlorination technologies is therefore consistent with native groundwater conditions at the Site.

This remedial strategy was selected based on the following technical factors:

- Only 1% of the total contaminated mass is estimated to be in the groundwater. By using enhanced reductive dechlorination, blending of the soil mass (both saturated and unsaturated) in the source area as proposed herein, over 90% of the total contaminant mass will be treated. This amount of mass reduction coupled with stable or decreasing CVOC groundwater concentration will meet the goals and objectives for site closure.

- The existing groundwater environment is already demonstrated to be favorable for generation of PCE degradation products, based on the groundwater data collected to date. Addition of ZVI and carbon amendment will enhance the existing environment, rather than attempting to modify it.
- The estimated cost for remediation of the target treatment volume using *in-situ* chemical reduction (i.e., ZVI) is substantially less than that associated with other technically feasible options.
- The duration of chemical oxidation of the CVOCs of interest would range between several days and several weeks; in contrast, the application of *in-situ* enhanced reductive dechlorination could provide a hydrogen source to support and maintain reductive dechlorination over a several-year timeframe.

A 2-year natural attenuation groundwater monitoring program will be necessary following implementation of *in-situ* enhanced reductive dechlorination to demonstrate continuing natural attenuation of groundwater following treatment of the target area. After CVOC concentrations in groundwater are demonstrated to decline or remain stable, a request for case closure will be submitted to the WDNR in accordance with WAC
NR 726. Our proposed RAP includes costs through closure including post-treatment monitoring, closure package preparation, Geographic Information System (GIS) registries, and well abandonment following WDNR approval of the closure.

A meeting was held on August 2, 2016, with representatives of the WDNR (Ms. Nancy Ryan and Ms. Pam Mylotta), Ramboll Environ, and Mallery & Zimmerman (legal representative for the Ehrlich Family Limited Partnership) to discuss the proposed remediation scope of work presented in the original May 29, 2015 proposal, receive clarification on DERF reimbursement for removing and disposal of contaminated versus non-contaminated concrete foundation debris, and present a recommended pre-remedial soil sampling scope of work to delineate the extent of PCE impacts to soil to further refine treatment volumes and costs in advance of performing remedial activities.

At the request of the WDNR, additional information associated with the project cost estimate was also prepared following the August 2, 2016 meeting and is presented in the supporting detailed cost estimate and summary table contained in Appendix C of this proposal. Ramboll Environ has revised the estimate to include the actual proposed dollar amount (vs. rounding up or down) shown on the cost summary sheets, a detailed break down of consulting/sub-contractor costs (including descriptions for the miscellaneous/field equipment costs), and clarification of the costs that are included under the consultant cost category. In addition, updated 2016 subcontractor cost estimates were requested and are included in this proposal. Ramboll Environ's hourly rates are consistent with the 2015 proposal rates.

This revised proposal is being provided to incorporate these modifications, summarize/document the updated work scope items, and present the updated cost estimate for the project.

1. INTRODUCTION

Ramboll Environ appreciates the opportunity to submit this RAOR/RAP and estimated costs for the Former Express Cleaners Property located at 3921-41 N. Main Street in Racine, Wisconsin (Figure 1). This proposal offers a strategy and approach for implementing soil and groundwater remedial actions; groundwater monitoring is also recommended to be conducted to evaluate the progress of groundwater remediation. We have summarized key project team member's experience, including their relevant experience with remediation of sites with CVOC impacted soil and groundwater. We have also included a Statement of Qualifications that highlights additional unique capabilities that will allow us to successfully execute this project. Key strengths that demonstrate the Ramboll Environ team's ability to successfully complete this project include the following.

Experienced Project Team: The project team will be led by Jeanne Tarvin, PG, CPG, and Scott Tarmann, PE, and managed by Stanley Popelar, PG, with Mark Mejac, PG, serving as a technical expert and hydrogeologist. Our team has demonstrated site investigation, remediation and monitoring experience with numerous projects involving chlorinated solvents, in particular dry cleaning solvents. Ms. Tarvin, Mr. Tarmann, and Mr. Mejac also have substantial experience with DERP, and are currently working with the WDNR on five other DERP remediation projects in southern Wisconsin. Ms. Tarvin is also a member of the DERF Advisory Committee.

Qualified Subcontractors: Ramboll Environ has selected experienced subcontractors to implement the recommended remedial actions. Our proposed remedial subcontractors, Redox Tech, LLC and North Shore Environmental Construction, have extensive chlorinated solvent remediation experience in Wisconsin. Ramboll Environ has successfully completed similar projects using Redox Tech and North Shore Environmental Construction under our direct supervision.

Focused Remedial Approach: Ramboll Environ has evaluated data available from past site investigations and reviewed investigative studies in the surrounding area to better understand regional hydrogeologic conditions and site characteristics. The information we gathered and reviewed, as well as our past experience with respect to similar projects, has allowed us to develop a recommended scope of work to complete the remedial action of soil and groundwater to achieve timely site closure in an efficient and cost-effective manner.

Local Presence: Proximity to the site is an important component of cost control. Field work will be completed by staff from our Milwaukee area office, which is located in close proximity to the site. As demonstrated in this proposal, Ramboll Environ and our subcontractors are familiar with local conditions and regulatory environment.

Sustainable Solutions: Our proposed strategy remediates the soil and groundwater in place, thereby reducing truck traffic and limiting the transfer of waste to off-site disposal areas.

2. RAMBOLL ENVIRON QUALIFICATIONS

2.1 About Ramboll Environ

A premier global consultancy, Ramboll Environ is trusted by clients to manage their most challenging environmental, health and social issues. We have earned a reputation for technical and scientific excellence, innovation and client service. Our independent science-first approach ensures that our strategic advice is objective and defensible. We apply integrated multidisciplinary services and tailor each solution to our client's specific needs and challenges.

At the end of 2014, ENVIRON International Corporation joined forces with Ramboll, Northern Europe's leading engineering, design and management consultancy, to create a global practice called Ramboll Environ. Together we provide an even higher level of service to our clients and address some of the most important issues facing our global community, including the environmental and health implications of urbanization, climate change and resource scarcity.

Ramboll Environ's network of experts includes more than 12,000 employees across 300 offices in 26 countries around the world. Clients will continue to benefit from our unique ability to bring clarity to issues at the intersection of science, business and policy.

Our vibrant and collaborative work environment will continue to attract—and retain—many of the world's top consultants. This expanded worldwide network of professionals will provide clients strategic and technical support.

2.2 Environmental Service Offerings

Ramboll Environ has completed extensive site investigation and remediation projects (i.e., feasibility studies, pilot tests, and design) for a variety of sites with media (e.g., soil, groundwater, sediments, surface water, etc.) contaminated with a wide variety of constituents (e.g., CVOCs, perchlorate, PCBs, inorganics, etc.).

Ramboll Environ has no preference for a specific technology but utilizes our vast technical experience to identify and evaluate a full spectrum of remedial technologies depending on site conditions and contaminants of concern. We have experience in physical, biological, chemical and thermal techniques for both soil and groundwater. Solidification and stabilization are also common remediation technologies to impart chemical or physical stability. Traditional source control technologies include soil excavation or dredging. Technologies identified and screened based on technical feasibility and cost generally include surfactant enhanced aquifer remediation, pump and treat of groundwater, ISCO, soil vapor extraction, electrical resistance or 6-phase heating, reactive barriers, soil mixing, bioremediation using whey, molasses or other proprietary products, and natural attenuation of groundwater.

Ramboll Environ's approach to evaluating sites and to selecting remediation alternatives often differs from the approach of many traditional engineering consultants in that our work is founded on and guided by a strong scientific basis in health and environmental science. Our preeminent skills and experience in chemical exposure and risk assessment, along with a complementary capability in fate and transport analysis and engineering, enable us to address the complex remediation issues effectively.

Ramboll Environ's relevant experience includes several current sites in DERP. Project profiles of some of the more recent and notable sites are included in Appendix A. This relevant experience has enabled us to develop a streamlined-phased remediation approach by identifying and evaluating known source areas, while understanding overall groundwater quality and its effect on receptors.

2.3 Project Team

Ramboll Environ has assembled a project team to lead the Site to regulatory case closure. The following is a brief description of each project team member:

- Ms. Jeanne Tarvin, PG, CPG, will serve as the Project Principal for the project. Ms. Tarvin has over 30 years of experience in managing environmental investigation and remediation projects. As a Principal, she is responsible for various hydrogeologic studies, environmental assessments, landfill studies, feasibility studies, remedial designs and remedial actions. Ms. Tarvin is a

Gubernatorial Appointment to the Technical Advisory Committee for the Dry Cleaners Environmental Reimbursement Fund.

- Mr. Scott Tarmann, PE, will serve as Project Director and Engineer. Mr. Tarmann has over 25 years of experience with environmental and civil design projects, with particular emphasis on the application of remedial investigation, feasibility studies, remedial system performance evaluation, groundwater modeling, and remedial action design. His work has included technical design of *in-situ* and *ex-situ* remediation technologies to address organic and inorganic contaminants in soil and groundwater. His main focus has been primarily with technological applications involving enhanced *in-situ* bioremediation, *in-situ* solidification/ stabilization, soil vapor extraction, vapor intrusion mitigation, *in-situ* thermal remediation processes, *in-situ* chemical oxidation, hydraulic containment/control technologies, and permeable reactive barriers. His work has also included developing technical strategies for remediation, providing technical support for regulatory negotiations, conducting sophisticated remediation system performance evaluations and feasibility studies, and preparing technical design plans and specifications documents in support of construction bidding and implementation. Mr. Tarmann is a registered professional engineer in the State of Wisconsin.
- Mr. Stanley Popelar, PG, will serve as the Project Manager. Mr. Popelar has over 30 years of consulting experience in the fields of environmental consulting, geology, hydrogeology, hazardous waste management and applied science, with particular emphasis on site investigation, risk-based corrective action and management of remediation projects. The sites investigated involve numerous industries including dry cleaning, the steel industry, chemical manufacturing and recycling, retail petroleum, machine tool manufacturing, construction equipment maintenance facilities, coal storage and transfer yards, railroad warehouse and bulk oil facilities, property development, military installations and landfills.
- Mr. Mark Mejac, PG, CGWP, will serve as a technical resource for the site remediation activities. Mr. Mejac has over 31 years of environmental consulting experience. He has extensive experience in a variety of hydrogeologic investigations, environmental risk assessments, and remedial alternatives evaluations. He specializes in the evaluation and implementation of innovative and cost effective remedial alternatives at contaminated groundwater and soil sites. Mr. Mejac routinely applies his expertise in groundwater flow and contaminant transport modeling, and migration analysis of DNAPLs contaminants in porous and fractured media.

Professional resumes for key personnel dedicated to the success of this project are provided in Appendix B. These staff members will be available to complete all tasks associated with this project on a prompt and timely basis.

In addition to the Ramboll Environ team, the subcontractors we propose to use for the selected remedial option is Redox Tech, LLC (Redox Tech), North Shore Environmental Construction, Inc. (North Shore) and the analytical laboratory PACE Analytical Services, Inc. (PACE). Redox Tech is a specialty environmental remediation company that provides expert, turn-key *in-situ* soil and groundwater remediation services. The company was founded in 1995 by Dr. John Haselow. Redox Tech can design an *in-situ* remedial approach from bench- to pilot- to full-scale implementation. Redox Tech has experience with chemical oxidation (Fenton's chemistry, permanganate, persulfate and ozone), bioremediation (biosparging, cometabolic, anaerobic bioremediation (ABC+®) and bioaugmentation), reductive chlorination (ZVI) and metals treatment via Eh-pH manipulation.

Redox Tech has worked for numerous Fortune 500 companies through contracts with large consulting firms. In addition, Redox Tech has $5 million of general liability, workmen's compensation and auto insurance coverage. Redox Tech has $2 million in pollution and professional liability coverage.

Redox Tech currently employs more than 30 individuals ranging from PhD engineers to field level technicians. This diversity allows both design and implementation of our remediation strategies. In addition, Redox Tech owns and operates a wide range of environmental equipment, such that no other subcontractors are typically required to implement the remedial design.

Equipment owned and operated by Redox Tech includes Geoprobe® direct push drilling equipment, injection trailers for a variety of chemicals and fluids, hydraulic fracturing capabilities, blowers for sparging, steamers for thermal enhancement, and *in-situ* soil blending.

North Shore, a Milwaukee area environmental management company, provides emergency hazardous material response, site remediation, AST/UST removal, and other industrial services. North Shore will provide abandoned utility removal services, install temporary soil erosion and sediment controls, soil and materials management, perform ambient air monitoring and control during remediation, and backfilling/earthwork services.

PACE is one of the largest analytical laboratories in the United States. PACE provides the scientific expertise and instrumentation to support variant analytical testing requirements--regardless of scope or complexity. Throughout their 34-year history, clients have benefited from their commitment to data quality, timely sample turnaround times and excellent service. PACE offers comprehensive testing services for consulting, engineering, energy/utility companies, industry, municipalities and government agencies--as well as for the pharmaceutical and medical device industries. Their full service environmental testing laboratories offer inorganic, organic and radiochemistry capabilities--specializing in the analysis of trace level contaminants in air, water, wastewater, soil, biota and waste. PACE is a Wisconsin certified laboratory.

3. SITE BACKGROUND INFORMATION

This Site Background Information section was summarized from the May 5, 2015, Request for Remedial Action Bid Proposal for Former Express Cleaners Site, and from the reports listed below in Section 3.2. Parties currently involved with this project include the following:

Responsible Party/Site Owner:	Ehrlich Family Limited Partnership c/o James Small P.O. Box 081007 Racine, Wisconsin 53408-1007
Owner's Representative:	Mr. William P. Scott Mallery & Zimmerman, S.C. 731 North Jackson Street, Suite 900 Milwaukee, Wisconsin 53202-4697
Regulatory Agency/Project Manager:	Ms. Nancy Ryan Wisconsin Department of Natural Resources 2300 North Dr. Martin Luther King, Jr. Drive Milwaukee, Wisconsin 53212-3128

3.1 Site Setting

The Site is located at 3921-41 N. Main Street in the northeast 1/4 of the northeast 1/4 of Section 33, Township 4 North, Range 23 East, City of Racine, Racine County, Wisconsin (Figure 1). The geographic position of the Site in WTM 91 (x, y) coordinates obtained from the WDNR Remediation and Redevelopment (RR) interactive Site Map (http://dnrmaps.wi.gov) is 701507, 257580.

The Site consists of a one-story, 6,804 square foot strip mall (without a basement) on a 0.77-acre lot located at 3921-3941 North Main Street and the adjacent 0.45-acre lot located at 3936 North Bay Drive, Racine, Wisconsin 53402-3611 (Figure 2). The northern unit of the strip mall (3941 N. Main Street) was formerly the location of a dry cleaning operation from 1971 until approximately 2006. The Site has been contaminated by dry cleaning solvents; concentrations of PCE, TCE, cis-1,2 DCE and vinyl chloride in groundwater have all historically exceeded the enforcement standards. Impacted soils are present in some locations beneath the paved surfaces and building slab, and extend beneath the water table to a depth of up to approximately 11 feet. Impacted soils within 4 feet of the ground surface exceed the direct contact industrial RCLs for some contaminants. PCE and/or TCE have been detected in soil vapor beneath the foundation of the strip mall building. An off-site monitoring well west of Main Street tested on April 7, 2011, did not contain dry-cleaning related contaminants above laboratory analytical detection limits.

The ground surface slopes radially from the site building. Surface-water runoff on the Site flows to the east on the eastern half of the Site and to the west on the western half. The Site and vicinity commercial properties are served by the Racine municipal water supply that obtains potable water from Lake Michigan. The nearest surface water body is Lake Michigan, which is located approximately 0.4 mile to the east of the Site.

The Site and adjacent area to the east (3936 North Bay Drive) have been the subject of several subsurface investigations since 2006. The WDNR has assigned BRRTS #02-52-547631 to the case file. Based on the RFP, Ramboll Environ understands that the Site will be redeveloped upon completion of active remedial site work including the construction of a new site building.

3.2 Previous Subsurface Investigations

Several investigation reports have been submitted to the WDNR by previous consultants that contain additional background information regarding this Site. The following key documents were utilized to evaluate site conditions and the investigative history for the subject property:

1. Site Investigation Dry Cleaner Solvent Release, Express Cleaners, Inc., 3941 N. Main Street, Racine, Wisconsin, BRRTS #02-52-547631, prepared by Northern Environmental Technologies, Incorporated, May 14, 2008.
2. Additional Information, Express Cleaners, 3941 N. Main Street, Racine, Wisconsin, BRRTS #02-52-547631, prepared by Northern Environmental Technologies, Incorporated, January 14, 2009.
3. Additional Investigation Activities, Express Cleaners, 3941 N. Main Street, Racine, Wisconsin, BRRTS #02-52-547631, prepared by Bonestroo/Northern Environmental, June 9, 2009.
4. Additional Investigation Activities, Express Cleaners, 3941 N. Main Street, Racine, Wisconsin, BRRTS #02-52-547631, prepared by Bonestroo, May 2, 2011.
5. STS, January 14, 2000, Results of the Environmental Assessment at 1214-1222 West Wells Street, Milwaukee, Wisconsin.

Based on this information, from April 2006 through April 2011, a total of 43 Geoprobe® borings were sampled on the Site and at adjacent properties (B1 through B34 and BA1 through BA9), two of which were converted to temporary groundwater monitoring wells (B5/TW1 and B7/TW2). Fifteen monitoring wells (MW1 through MW15) and one piezometer (PZ1) were also installed; with *in-situ* hydraulic conductivity testing conducted at monitoring well MW3 and piezometer PZ1. Additionally, three sub-slab vapor probes were installed and sampled (VP4 through VP6). The most recent groundwater sampling was conducted during April 2011.

3.3 Geologic and Hydrogeologic Setting

Up to 4 feet of gravelly sand to sand fill underlie the site building and other portions of the Site. Native sediments consisting of silty sand underlie the fill or are present at the surface in areas where no fill is present, and extend to depths of approximately 6 to 8 feet bgs. The silty sand is underlain by silty clay that extends to the maximum depth investigated of approximately 16 feet bgs. The silty clay was identified by the previous consultants as part of the Oak Creek Formation. Reportedly Silurian-age dolomite bedrock is present in the vicinity of the Site at depths ranging from 50 to 150 feet bgs (Trotta and Cotter, 1973).

Slug testing of site wells indicates the silty sand has a hydraulic conductivity measured at 2.1×10^{-4} centimeters per sec (cm/sec). The water table is reported to be present at approximately 2.75 to 4.75 feet bgs with a shallow groundwater divide present beneath the existing building in which groundwater flows to the east at locations east of the building and to the west/southwest west of the building.

3.4 CVOC Mass Estimates

Based on the available site information, Ramboll Environ estimated the CVOC contaminant mass present in site soil and groundwater in the areas shown on Figure 2 that included analytical data for 1,2-cis-dichloroethene (cis-1,2-DCE), trans-1,2-dichloroethene (trans-1,2-DCE), tetrachloroethene (PCE), and trichloroethene (TCE)[1]. As part of this evaluation the area of impacted soil and groundwater was divided into the 12 areas shown on Figure 2 in which average soil and groundwater concentrations and vertical layer thickness were assigned. Vertical layers[2] evaluated included:

1. Soil (vadose) – ranging 2.75 to 4.25 feet thick[3] in the areas evaluated;
2. Soil (coarse, saturated) – ranging 4.5 to 5 feet thick at the source area (Source Areas 1 and 2);
3. Soil (clay, saturated) – 1.5 feet thick at the source area (Area 1);
4. Groundwater (coarse saturated) – ranging 1 to 4.5 feet thick in the areas evaluated; and
5. Groundwater (clay saturated) – ranging 0 to 9 feet thick in the areas evaluated.

The contaminant mass estimate indicates that approximately 287 pounds of CVOC is present in the areas evaluated, and the primary CVOC site contaminant in soil and groundwater is PCE (97.3% of total CVOC mass present), with smaller amounts of breakdown products (TCE, cis-1,2-DCE, and trans-1,2-DCE). A summary tabulation of the results of this evaluation is presented on Table 1. As discussed below, this evaluation indicates that 99.0% of the CVOC is present in soil; with 1.0% present in groundwater.

3.4.1 Soil

The largest amount of CVOCs present in site soil are within Areas 1 and 2 (Source Areas 1 and 2; 2,179 ft^2), containing approximately 94.7% of the total CVOC contaminant mass present at the Site (approximately 0 to 8 feet bgs). Approximately one-half (50.6%) of the total mass is contained in the vadose zone (0 to 3 feet bgs), with another 37.5% estimated to be present in coarse-grained

---

[1] Based on the data available, vinyl chloride was only historically detected in groundwater one time at one location (MW3) and was not observed to be present in follow-up groundwater sampling events. Therefore, vinyl chloride was not included in this evaluation.

[2] Note that Ramboll Environ has interpreted the data to indicate that CVOCs are adhered to soil in the upper saturated zone in source Area 1 and 2, and as such may be a continuing source of CVOCs to groundwater. This interpretation differs somewhat from the assumption presented in the RFP that assumes all soil analytical data from soil samples collected below the water table are representative of groundwater impacts.

[3] Average thickness values used for each area evaluated.

saturated soil (3 to 8 feet bgs) in Areas 1 and 2, and the remaining 6.6 % present in the upper portion of the saturated clay (8 to 9.5 feet bgs) in Area 1.

The CVOC impacts at Area 5 are apparently due to a separate surface release at that location, and that CVOCs have migrated downgradient from Source Areas 1 and 2 through the subsurface utility corridor in Area 4. Even though elevated maximum CVOC concentrations were detected in these areas, the calculated contaminant mass in vadose soil is low, only 0.4% of the total mass present at the Site.

The remainder of the CVOC mass present in vadose zone soil at the Site is distributed at lower concentrations throughout the remainder of the Site (9,029 ft^2) and accounts for approximately 3.8% of the total CVOC mass present.

Toxicity characteristic leaching procedure (TCLP) soil testing results are not available for site soil. The concentration of PCE in vadose soil in Source Areas 1 and 2 (maximum detected concentration of 270 mg/kg at 2 to 4 feet at boring B4) suggests that the soils, if excavated, would likely be above both the 35 mg/kg contained-out concentration and above the 0.7 mg/L TCLP limit for PCE, and would need to be treated/disposed as a RCRA characteristically hazardous waste.

3.4.2 Groundwater Quality

Only 1.0% of the total contaminant mass is estimated to be present in site groundwater (Table 1). The highest CVOC concentrations in groundwater have been identified at monitoring well MW-3 and temporary wells TW-1 and TW-2 (Source Areas 1 and 2) beneath the northern portion of the former dry cleaning building where PCE was historically released to the subsurface. Detected concentrations of PCE in groundwater at Source Areas 1 and 2 have ranged from 770 to 6,000 µg/L.

Based on the concentrations of PCE, TCE, and cis-1,2-DCE detected in the groundwater, impacted groundwater with CVOC concentrations greater than ES values extends east from the source area near wells MW3, TW1, and TW2 (and just north of the source area at PZ1, MW1, and MW2) to monitoring well MW6 located at the eastern boundary of the 3936 North Bay Drive property, and to the west/southwest to Well MW8 on the western site boundary. Historically, CVOCs have not been detected in groundwater, or were detected at low concentrations below the ES, at monitoring wells located north of the plume (MW-7 MW-9, MW-10), south of the plume (MW4, MW5, MW11, and MW13), and west/southwest of the plume (MW14 and MW15).

3.5 Potential Receptors

3.5.1 Soil

Previous subsurface investigations have indicated the presence of CVOCs in soil at the Site. Potential scenarios by which CVOCs may come in contact with receptors include direct dermal contact during drilling, soil excavation, or soil injection activities. Such activities at the Site will be monitored to reduce potential risk due to inhalation of vapors or particulate matter and dermal protection will be utilized as necessary to protect field personnel from direct contact.

3.5.2 Groundwater

Potential ingestion of CVOC-impacted groundwater could hypothetically occur if affected groundwater were to migrate off-site to a private or municipal well used for potable water supply. However, no such groundwater receptors are currently present within the site vicinity, as it is served by the Milwaukee municipal water supply that obtains potable water from Lake Michigan. As such, the groundwater exposure pathway is not complete.

3.5.3 Surface Water

Local surface waters consist of Lake Michigan, which is located 0.4 mile to the east of the Site. As such, the surface water pathway is not complete on site.

3.5.4 Utility Corridors

Potential concerns for sites with chlorinated-solvent contamination include migration of contaminants along utility corridors. The depth to the water table at the Site ranges between approximately 2.75 to 4.25 feet bgs. Based on their invert elevations relative to the water table, the sanitary sewer and water service utility corridor to the former strip mall may receive impacted groundwater from the Site (see Figure 2).

3.5.5 Vapor Intrusion

Potential concerns for sites with CVOC contamination include vapor migration into buildings. WDNR vapor intrusion guidance for CVOCs indicates that the vapor intrusion pathway should be investigated if any of the following conditions are met:

- the building of interest is located over a CVOC source;
- the building is located within 100 feet of a CVOC source;
- the building overlies a groundwater plume that exceeds WAC NR 140 Enforcement Standard (ES) concentrations;
- groundwater with CVOC concentrations that exceed WAC NR 140 Preventive Action Limit (PAL) values is entering the building or is in contact with the building foundation or sump; and
- vapors have the potential to enter preferential pathways that connect to the building.

Based on these criteria, the occupied building located on the former Pugh Oil property approximately 40 feet directly north of the Site is close enough to the soil and groundwater CVOC plume to warrant investigation of the vapor intrusion pathway. No information was available concerning the building on the former Pugh Oil property north of the Site, so it is not known if it has a basement or sump that could contact groundwater. In any event, the vapor intrusion pathway at this building will be evaluated as part of the remedial action activities proposed for the Site. Additionally, as part of the scope of work discussed herein, Ramboll Environ has provided the scope and estimated cost to conduct a soil vapor assessment at the building located on the former Pugh Oil property.

3.6 Summary of Design Considerations

Based on the above site conditions and pathways of concern, a summary of site conditions relative to remedial evaluation and selection is as follows:

- The Site is located in a populated urban area, with high visibility. A remediation strategy should be selected that minimizes short-term exposure and impacts to receptors during construction and long-term exposure based on the final remedy.
- The site owner desires that the Site be available for re-development after remediation is complete. Ramboll Environ assumes the redevelopment will include construction of a new site building and other site improvements. Therefore, remedial methods that can accomplish significant soil and groundwater mass removal in the short term are preferred.
- The most heavily impacted soil and groundwater is present within the northern third of the property, and extends from the ground surface to approximate depths of 9 feet bgs.
- Pre-remedial soil sampling is included herein to delineate the extent of PCE impacts to soil to further refine treatment volumes and costs in advance of performing remedial activities. A

baseline groundwater sampling round will also be conducted to determine the current extent of groundwater contamination.

- Although the presence of DNAPL has not been observed in groundwater samples obtained from the Site, historical data suggests that concentrations of PCE are sufficiently high that DNAPL could be present as DNAPL droplets or ganglia within the porous media near former temporary wells TW-1 and TW-2.
- Removal of all contamination in soil and groundwater to below generic soil and groundwater cleanup standards is not practicable given the magnitude and extent of impacted soil and groundwater at the Site. Therefore, utilization of WAC NR 720 performance standards for soil and groundwater that rely on contaminant mass removal and groundwater CVOC plume stability as the primary remediation objective is proposed.
- Removal of the majority of the residual soil and groundwater CVOC mass in the former source area is essential to reduce the probability for indoor air vapor action level exceedances to occur within any new site building.
- While the mass of soil and groundwater impacts that extend onto the adjacent properties to the north and east of the former Express Cleaners site are relatively small compared to the mass on the former Express Cleaners property, the likelihood for these off-site impacts to cause an indoor air vapor action level exceedance within a building on the former Express Cleaners property may be relatively low. However, any new building that may be constructed at the Site should incorporate a vapor migration barrier.
- After contaminant mass removal, groundwater remediation via natural attenuation will be essential. Enhancing degradation via reductive dechlorination technologies consistent with the existing natural processes at the Site will likely be more successful for long-term groundwater natural attenuation.
- Ramboll Environ does not recommend active soil and groundwater remediation within the eastern portion of the site near monitoring wells MW-6 and MW-13. Groundwater samples collected to date from monitoring well MW-13 have not contained detectable concentrations of VOCs, and only one groundwater sample obtained from MW-6 revealed a slight exceedance (6.5 ug/L) of the WAC NR 140 ES for PCE (5 ug/L). Monitoring well MW-6 will, however, be included as part of the recommended quarterly groundwater monitoring program for evaluation of MNA.

4. REMEDIAL GOALS AND OBJECTIVES

This section presents the proposed remedial action goals and objectives for the impacted soil and groundwater at the Site. The overall goal of the remedial action is to remediate soil impacts that threaten human health and the environment, reduce source soil concentrations and mass to minimize leaching of VOCs through the vadose zone to groundwater, and decrease the persistent groundwater contaminant concentrations at the source and down gradient of the source area consistent with WAC NR 700. This goal can be realized by effectively remediating source soil and groundwater concentrations on site to levels that will ultimately result in stable and/or receding groundwater contaminant concentrations down gradient of the source area as well as reducing the potential for vapor intrusion or need to implement vapor mitigation actions in nearby buildings. The remedial actions proposed for achieving this goal will also result in increased value to, and redevelopment potential of the Site. The following sections discuss the rationale and selected method for establishment of the soil clean-up goals for soil and the remedial objective for achieving a no-further action for residual groundwater impacts at the Site.

The case closure goal for the Site is to obtain a "no further action" status under WAC NR 726 following successful implementation of soil and groundwater remedial actions. The closure pathway is anticipated to rely upon WDNR's GIS registry for recording closed sites that have contamination exceeding residual contaminant levels (RCLs) in soil and ES in groundwater. For the Site, the closure pathway for obtaining a no further action status for soil is via the use of a soil performance standard as a component of active remediation while the closure pathway for obtaining a no further action status for groundwater is via a MNA remedy subsequent to active remediation.

4.1 Proposed Remedial Action Goals for Soil

As the generic WDNR soil to groundwater pathway RCLs for the chemicals of interest (PCE [4.5 ug/kg], TCE [3.6 ug/kg], cis-DCE [41.2 ug/kg], and VC [0.1 ug/kg]) using a dilution-attenuation factor of 2 are more stringent than the corresponding non-industrial direct contact RCLs (PCE [30,700 ug/kg], TCE [1,260 ug/kg], cis-DCE [156,000 ug/kg], and VC [67 ug/kg]), remediation of the site soil to meet groundwater pathway RCLs would require over a 99.99% reduction in the maximum soil concentration and a 99.97% reduction in contaminant mass to achieve the soil to groundwater RCL goals. Contaminant concentration and mass reduction of this magnitude is beyond the capabilities of ordinary soil remedial methods and technologies, and therefore, may not be technically or economically feasible. Furthermore, the soil clean-up concentrations for PCE, TCE, and VC at this level are well below the method detection limits that analytical laboratories can achieve using the most current SW846 methods. As such, a performance-based remedial action goal for the protection of groundwater is recommended instead of the WDNR groundwater pathway RCLs and for the following additional reasons:

- Remediation of the soil source area to the groundwater protection RCLs would likely create an area of clean subsurface soil that may become re-contaminated by potential off-site shallow groundwater impacts in the area;
- Rebound to higher concentration levels following remediation activities could exceed the soil to groundwater RCL concentrations for PCE, TCE, and VC. From this perspective, any added benefit to achieving a soil mass removal to meet the low level soil to groundwater RCL concentrations may prove to be ineffective in the long term; and
- Remediation of soil to these concentrations would be cost prohibitive.

As such, a performance based soil remedial action goal for the protection of groundwater is proposed for the Site. As described in the previous paragraphs, WAC NR 720 stipulates that site specific soil clean-up standards protective of public health, safety, and welfare and the environment are generally established to restore the environment to the lowest concentration practicable for specified soil contaminants. However, in the event that it is not practicable to achieve the established and/or most stringent soil RCL, a soil performance standard may instead be implemented. For the Express Cleaners Site, soil performance standards are applicable to address both the direct contact and groundwater pathways and must be implemented and maintained to ensure that contamination no longer poses a threat to human health or the environment.

Ramboll Environ proposes to establish a clean-up goal for impacted soil based on the direct contact exposure pathway. The default non-industrial direct contact RCL's for PCE, TCE, cis-DCE, and VC will be used as the soil clean-up goals for the Site and are summarized below:

- PCE – 30,700 ug/kg
- TCE – 1,260 ug/kg
- cis 1,2-DCE – 156,000 ug/kg
- VC – 67 ug/kg

In addition to achieving the direct contact RCLs, the remedial objective includes removal of sufficient CVOC mass to allow for stable and/or receding groundwater concentrations. To achieve this objective, we believe that this residual PCE concentration may result in non-stable groundwater conditions. Therefore, our recommended approach is to address the PCE concentration in soil to at least an order of magnitude less than the non-industrial direct contact RCL. Based on our experience on other similar sites in Wisconsin and because the sorbed phase CVOC mass represents an estimated 99% of the total CVOC mass at the Site, we propose an internal goal of 1,500 ug/kg for PCE.

These proposed remedial action goals will allow the impacted soil boundaries to be defined and to establish a performance level in which various remedial alternatives can be reasonably compared and evaluated. As direct contact with soil is a potential exposure pathway at the Site, two potential receptors of the residually impacted soil have been identified: 1) current and future on-site workers; and 2) future construction workers. The current and future on-site worker is assumed to not be exposed to soil deeper than 4 feet bgs. However, a future construction worker may be exposed to the chemical of interest (COI) in surface and subsurface soils (0 to 9 feet bgs) via incidental ingestion, dermal contact, and inhalation of volatiles and dust. Therefore, the default non-industrial direct contact RCLs are considered applicable for the subsurface soil throughout the 0 to 9 foot depth to address the construction worker receptor scenario.

The proposed soil remedial action goals for the Site will be performance based to ensure that any residual soil contamination remaining at the Site does not further degrade groundwater quality. The performance based soil remedial action goals will be evaluated by monitoring groundwater conditions to document a stable and/or receding contaminant plume.

Remediation of the site soil to the above RCLs will result in a greater than 93% reduction in the maximum documented soil concentration and a greater than 95% overall contaminant mass reduction in source soil. Remediation of soil to these soil performance standards also requires a demonstration that natural degradation processes are functioning to remediate any residual contaminants to levels that are protective of groundwater and which will result in stable and/or decreasing groundwater contaminant concentrations. This remedial strategy achieves the goal of the soil clean-up standard (reducing the threat to the environment) by containing and remediating environmental contaminants. Provided that the conditions required by the performance standard are maintained, no further action regarding the contaminated soil would be required once the soil performance standard has been successfully documented.

4.2 Proposed Remedial Action Goals for Groundwater

The closure pathway objective for groundwater at the Site is to obtain a “no further action” status under WAC NR 726 following successful documentation that remedial actions conducted at the source results in reduced mass loading of contaminants to groundwater so that the residual groundwater contaminant plume is stabilized and/or has receding COI concentrations. To document attainment of this goal, a groundwater monitoring program will be implemented to evaluate plume conditions and document that no adverse impact on human health, safety or welfare, and to the environment exists or develops in the future. This closure pathway for the residual groundwater impacts is anticipated to incorporate a closure approach that relies upon the WDNR’s GIS registry for recording closed sites that have residual contamination that exceeds the ES in groundwater.

The following sections provide an evaluation of remedial options for soil and groundwater followed by a recommended remedial action scope of work.

5. EVALUATION OF REMEDIAL ACTION OPTIONS

This section identifies several feasible remedial action options that have the greatest potential to achieve the goals and objectives for remediating the impacted soil, groundwater and vapor at the Site. The identified remedial action options are evaluated based on the requirements specified in WAC NR 722, which are summarized in the following sections. Alternatives that were determined to not be technically or economically feasible were not retained for further evaluation.

5.1 Technical Feasibility

The technical feasibility of appropriate remedial action options are evaluated using the following criteria:

1. Long-term Effectiveness: The long-term effectiveness of appropriate remedial action options, taking into account the following factors:
   - the degree to which the toxicity, mobility and volume of the contamination is expected to be reduced; and
   - the degree to which a remedial action option, if implemented, will protect public health, safety and welfare and the environment over time.
2. Short-term Effectiveness: The short-term effectiveness of appropriate remedial action options, taking into account any adverse impacts on public health, safety and welfare and the environment that may be posed during the construction and implementation period until case closure under WAC NR 726.
3. Implementability: The implementability of appropriate remedial action options, taking into account the technical and administrative feasibility of construction and implementation of the remedial action options. Disruption of the existing business and potential impacts to neighboring properties were also considered when evaluating the implementability of each alternative.
4. Restoration Timeframe: The expected timeframe needed to achieve the necessary restoration.

5.2 Economic Feasibility

The economic feasibility of each appropriate remedial action option was evaluated using the following criteria: capital costs, annual operation and maintenance costs, total present worth of the costs, costs associated with potential future liability, and disruption to businesses on or adjacent to the Site. The economic feasibility of a remedial action option is determined by comparing the costs to what is expected to be technically achieved by that option, taking into account long-term effectiveness, short-term effectiveness, implementability, and the time until restoration is achieved for each option.

5.3 Identified Remedial Action Options

The response actions identified for preliminary screening for the subject property include an appropriate range of potential remedial action options. The no action alternative is included as a general response action against which other actions can be evaluated.

Based on review of laboratory results of previously-collected soil and groundwater samples, the recommended soil and groundwater treatment area includes the location approximately bounded by monitoring wells MW-1, MW-2, MW-4 and MW-8, as shown on Figure 3. This recommended soil and groundwater treatment area covers approximately 5,700 square feet. The vertical extent of the impacted soil and groundwater extends to approximately 9 feet bgs. Based on these dimensions, the target treatment volume includes approximately 1,900 cubic yards, which is equivalent to approximately 2,850 tons. To reduce the potential for off-site migration of impacted groundwater,

the recommended target treatment volume includes the east-west trending utility corridor located between the site building and the western property boundary.

Based on the remedial objectives for soil and groundwater identified in Section 4.1 and 4.2, and the available groundwater quality data, Ramboll Environ does not recommend active soil and groundwater remediation within the eastern portion of the site near monitoring wells MW-6 and MW-13. Groundwater samples collected to date from monitoring well MW-13 have not contained detectable concentrations of VOCs, and only one groundwater sample obtained from MW-6 revealed a slight exceedance (6.5 ug/L) of the WAC NR 140 ES for PCE (5 ug/L). Monitoring well MW-6 will, however, be included as part of the recommended quarterly groundwater monitoring program for evaluation of MNA.

Approximately one-half of the estimated CVOC mass is present in the vadose zone, and one-half is present in the saturated zone at the Site. As such, CVOC mass above the water table can act as a long-term source of groundwater impact, such that the intended site remediation will include reducing contaminant mass flux to the water table from the vadose zone.

Remedial action options considered for the impacted soil and groundwater at the subject property are as follows:

- no action;
- institutional/engineering controls;
- monitored natural attenuation;
- excavation and landfill disposal;
- soil vapor extraction;
- air sparging;
- groundwater extraction and treatment;
- *in-situ* electro-thermal remediation;
- *in-situ* chemical oxidation; and
- *in-situ* enhanced reductive dechlorination.

5.3.1 No Action

The No Action response involves no treatment of contaminated soil, groundwater and vapor at the subject property. This response typically serves as a baseline against which the other remedial options and technologies can be compared. The No Action response may be used as the sole remedial action only in the event the prevailing site conditions lead to the determination that the Site poses no significant risk to human health or the environment. In that event, implementation of other types of action becomes unnecessary.

In terms of technical feasibility, the No Action alternative would eventually reduce the magnitude of the existing risk by natural attenuation processes. Because No Action is proposed under this alternative, the implementability is very high. From an administrative feasibility point of view, this alternative would likely not be accepted by the WDNR as the remedy for the Site because short-term remedial objectives would not be met.

This alternative was considered the lowest in terms of present worth cost and disruption to the subject property. It has no associated capital costs or operation and maintenance costs. As

indicated above, this alternative would likely not be accepted by the WDNR and is not retained for further evaluation.

5.3.2 Institutional Controls

In Wisconsin, the GIS Registry of Closed Remediation Sites provides a means of public notice regarding properties with residual contamination. Sites closed with residual soil contamination exceeding WAC NR 720 RCL values for soil and/or WAC NR 140 ES values for groundwater are required to be listed in the GIS Registry. Sites closed with deed restrictions prior to June 2006 are also included in the GIS Registry. As of June 2006, the GIS Registry also became the database for listing sites closed with land use controls, which replaced deed restrictions.

If a land use control is required for a particular site, a maintenance plan may also be required. Maintenance plans may include requirements for cover inspections, fencing inspections, and/or routine groundwater monitoring. General information provided in the GIS Registry related to soil and/or impacts includes the site analytical data, site maps, as well as any special precautions that may be required for future potential redevelopment of a site.

With regard to technical feasibility, no additional treatment technology would be included with this option; therefore, this alternative can only offer gradual reduction in the toxicity, mobility or volume of the contaminants. As with the No Action alternative, this option would likely not be accepted by the WDNR as the sole remedy for the Site as short-term remedial objectives would not be met. This alternative is therefore not retained for further evaluation as a sole remedy; it is, however, retained for further evaluation in conjunction with closure activities using active remediation.

5.3.3 Monitored Natural Attenuation

Natural attenuation processes can account for improvements in groundwater quality. This process is therefore considered a passive remedial alternative. Natural attenuation in the subsurface occurs due to a combination of processes including the following: biodegradation, adsorption, dilution, and dispersion. Depending on the initial concentrations and properties of the chemicals in the groundwater, and physical or biological processes controlling attenuation, the contaminant plume may eventually decrease or narrow over time, as the edges of the plume will degrade to insignificant concentrations. Intrinsic bioremediation is the use of a scientific approach to demonstrate the occurrence of microbial degradation of contaminants by monitoring the geochemical and biological properties of the groundwater, including pH, temperature, conductivity, oxidation/reduction potential, electron acceptors (e.g., dissolved oxygen, nitrate, nitrite, sulfate, etc.), carbonate, bicarbonate, carbon dioxide, methane, alkalinity, cations, TDS, chloride, sulfide, etc.

Biodegradation of PCE has been well documented under reducing conditions, and the biochemical pathway and microorganisms responsible identified. In addition to these general considerations, cDCE and other daughter products of TCE and PCE are commonly detected in groundwater at the Site. The presence of daughter products such as cDCE is generally understood to result from the biodegradation of TCE, consistent with the well-known biodegradation pathway:

PCE→TCE→cDCE/tDCE→vinyl chloride→ethene

Therefore, the detected presence of cDCE and other daughter compounds at the Site is consistent with biodegradation of TCE and PCE.

MNA has limited effectiveness for contaminant plumes that have migrated to receptors or are present in an area where future groundwater use is likely. The ideal goal of MNA is to demonstrate that active remediation is unnecessary because groundwater plumes will not reach potential receptors or

other points of compliance before being remediated by organisms that occur naturally in groundwater.

Groundwater monitoring is used as a tool to provide information regarding changes in subsurface conditions over time. This action is a component of remedial action options for groundwater. In the case of MNA, time-series data are collected from monitoring wells to evaluate plume stability and determine if natural attenuation is occurring. If MNA is selected as the preferred remedy at a site, time-series monitoring is used to confirm the effectiveness of natural processes in the degradation of contaminants. The WDNR endorses use of the Mann-Whitney U Test, which is equivalent to the Wilcoxon Rank Sum Test, for evaluating natural attenuation processes. Per current WDNR guidance, the Mann-Whitney U Test is conducted by assembling well data for the most recent eight consecutive quarterly or semi-annual sampling events for each contaminant that has exceeded the WAC NR 140 ES at one or more monitoring wells.

No active groundwater treatment process is proposed under this alternative; instead it would rely on the effectiveness of natural processes to reduce the toxicity, mobility and volume of the contaminants after vadose zone soil remediation. Because no major remedial action is proposed as part of this alternative, it would have minimal impact to the community, and on-site workers. No short-term environmental impacts are therefore expected from this alternative. Remedial objectives may be met by implementing this alternative; however, the time to achieve the remedial objectives would be longer than most of the other alternatives considered and would not occur within a reasonable timeframe.

From an administrative feasibility point of view, this option will require a demonstration of effectiveness (*i.e.,* stable or declining concentration trends) before the administrative agency can accept this alternative as the final remedy for the Site. Soluble hydrocarbon plumes containing CVOCs are amenable to natural attenuation processes. However, the presence of CVOCs as DNAPL has been detected in site groundwater. As such, it is not currently possible to estimate a timeframe for completion of MNA and attainment of regulatory case closure in the absence of active groundwater remediation. Moreover, as indicated in WAC NR 722.07, for CVOCs “that do not readily degrade in soil and groundwater, an active remedial action that will reduce the contaminant mass and concentration will typically be necessary.” Based on the foregoing, the MNA alternative alone is not retained for further evaluation, except in conjunction with active remediation.

5.3.4 Excavation and Landfill Disposal

Soil excavation and off-site treatment/disposal is a commonly-used approach to achieve remedial objectives for sites with contaminated soils within a short time-frame. Under this option, impacted soils would be excavated and transported off-site for appropriate landfill disposal.

In terms of the identified remedial alternatives to address the CVOC-impacted soil, soil disposal costs associated with the excavation and off-site landfill disposal alternative would be high, as a substantial portion of the impacted soils would likely represent RCRA characteristic hazardous waste based on detected PCE concentrations. Soil that contains greater than 60 mg/kg PCE represents a characteristic RCRA hazardous waste that exceeds land disposal restriction threshold concentrations as provided in 40 CFR 268.40, such that a substantial portion of the excavated soil might require chemical oxidation pre-treatment or incineration with a transportation and disposal cost alone of approximately $700 per ton. Moreover, the depth to the water table is approximately 3 feet bgs, such that substantial additional costs would likely be incurred for infiltrated groundwater disposal and possible excavation shoring during the course of excavation activities. Based on the target treatment identified in Section 5.3 (1,900 cubic yards or 2,850 tons), the cost to implement the soil excavation and off-site treatment/disposal alternative is estimated to total approximately

$2,900,000. Based on this evaluation of economic feasibility, the soil excavation and off-site treatment/disposal alternative is not retained for further evaluation.

5.3.5 Soil Vapor Extraction

Soil vapor extraction (SVE), also known as "soil venting" or "vacuum extraction," is an *in-situ* remedial technology that reduces concentrations of VOCs adsorbed to soils in the unsaturated (vadose) zone. In this technology, a vacuum is applied through extraction wells near the source of contamination in the soil. Volatile constituents of the contaminant mass enter the vapor phase and the vapors are drawn toward the extraction wells. Extracted vapor is then treated as necessary (commonly with carbon adsorption) before being released to the atmosphere. SVE may be enhanced by the addition of air inlet wells (sometimes pressurized) within the vacuum radius of influence (ROI), pulsing the air flow in the soil, or switching flow by reversing inlet and extraction wells.

SVE is most effective in removing VOCs at sites with homogeneous, relatively coarse grained soils where the water table is sufficiently deep such that upwelling of groundwater into SVE wells does not occur. SVE typically has limited effectiveness in low permeability and/or wet silts and clays. Based on the shallow depth to the water table at the Site (approximately 3 feet), the SVE remedial alternative is not retained for further evaluation based on technical implementability.

5.3.6 Air Sparging

Air sparging is an *in-situ* remedial technology that reduces concentrations of VOCs in petroleum products that are adsorbed to coarse-grained soils and dissolved in groundwater. This technology, which is also known as "*in-situ* air stripping" and "*in-situ* volatilization," involves the injection of contaminant-free air into the subsurface saturated zone, enabling a phase transfer of hydrocarbons from a dissolved state to a vapor phase. The air is then vented through the unsaturated zone. Air sparging is often used together with SVE, but it can also be used with other remedial technologies. When air sparging is combined with SVE, the SVE system creates a negative pressure in the unsaturated zone through a series of extraction wells to control the vapor plume migration.

When used appropriately, air sparging has been found to be effective in reducing concentrations of VOCs found in petroleum products. However, air sparging is generally more applicable to the lighter gasoline constituents (*i.e.*, benzene, ethylbenzene, toluene, and xylene [BTEX]), because they readily transfer from the dissolved to the gaseous phase. Oxygen added to contaminated groundwater as part of air sparging can also enhance biodegradation of BTEX and other VOCs that are amenable to aerobic bioremediation. PCE is not amenable to aerobic bioremediation. Air sparging processes can also mobilize DNAPLs. Based on comparison of detected PCE concentrations in groundwater with the aqueous solubility of PCE, PCE as DNAPL may be present in the subsurface at the Site. As such, the air sparging remedial alternative is not retained for further evaluation based on technical implementability.

5.3.7 Groundwater Extraction

This alternative consists of groundwater collection coupled with vadose zone source remediation as the selected remedial action option to treat affected groundwater at the subject property. Collection of groundwater is conducted as part of pump-and-treat systems. Groundwater is extracted from the subsurface for the purpose of aboveground treatment prior to re-injection, reuse, or discharge. Collection techniques include use of vertical or horizontal extraction wells or interceptor trenches.

It is widely established that contaminated aquifers typically cannot be restored through simple groundwater extraction and treatment (Keely, 1990; Travis and Doty, 1990; and McKay and Cherry, 1989). As such, groundwater extraction is often used as a hydraulic containment technology, as

opposed to an aquifer restoration technology. The limitations associated with pump-and-treat methodology include the following:

- Organic contaminants generally have low solubility in groundwater. Therefore, only a small fraction of the total contaminant mass is accessible to the pump-and-treat process.
- Contaminants sorb onto sediments, further restricting their removal by the pump-and-treat process.
- Many pumping systems create stagnation zones or lead to contamination of previously uncontaminated areas.

The limitations associated with pump-and-treat methodology listed above are exacerbated by the possible presence of DNAPL at the Site, which would result in extended remedial timeframes. Based on the foregoing, the groundwater collection alternative is not retained for further evaluation associated with the Site.

5.3.8 *In-Situ* Electro-Thermal Remediation

Using an *in-situ* electrical resistance thermal remediation technology, the impacted soil and groundwater in the target area is heated by resistance from an electric current applied between subsurface electrodes. The heating creates an *in-situ* source of steam to strip VOCs from the soil and groundwater as the dissolved constituents partition to the vapor phase. Udell (1996) determined that steam stripping was the mechanism by which subsurface heating removed a wide range of hydrocarbons from pore spaces, including high boiling point compounds. Specific processes include evaporation into the subsurface air stream, and steam distillation (as the treatment zone is heated, each milliliter of soil moisture produces over a liter of steam). Organic vapors tend to partition into the produced steam, and are swept along with the steam toward extraction wells.

The continuous heating also lowers the viscosity of water, and causes pressure-driven micro-fracturing in low permeability soils to increase the effective permeability of the soil; these two processes increase the mobility of the identified CVOCs. The increased contaminant mobility allows for the removal of the CVOCs using soil vapor extraction to a degree that would not be possible in the current condition of the soil. Under some *in-situ* electrical resistance thermal remediation approaches, tap water is injected into the electrodes and drawn to soil vapor extraction wells during the operation, to sustain the presence of beneficial steam.

ERH is an aggressive and relatively costly remediation technology that is best suited for treatment of low permeability sites, as opposed to the moderately-high permeability media associated with the impacted silty sand soil at the Site. Moreover, based on the high infrastructure costs alone associated with this technology (often in excess of $1,000,000), this remedial action option is not retained for further evaluation for the Site.

5.3.9 *In-Situ* Chemical Oxidation

Remediation of soil and groundwater impacted with contaminants of interest using *in-situ* chemical oxidation (ISCO) involves injecting or mixing oxidants and potentially co-amendments directly into the impacted media. With chemical oxidation, the substrate loses electrons and is oxidized, while the oxidant gains electrons and is reduced:

$$Cl2C{=}CHCl + H_2O + 3O_3 \rightarrow 2CO_2 + 3Cl^- + 3H^+ + 3O_2$$

Oxidation of Substrate: $Cl2C{=}CHCl + 4H_2O \rightarrow 2CO_2 + 3Cl^- + 9H^+ + 6e^-$

Reduction of oxidant: $O_3 + 2H^+ + 2e^- \rightarrow O_2 + H_2O$

The oxidant chemicals react with the contaminants, producing innocuous substances such as carbon dioxide, water, and, in the case of chlorinated compounds, inorganic chloride. Chlorinated solvents (ethene and ethanes) are amenable to treatment by ISCO.

Four commonly-used oxidants for soil and groundwater remediation are permanganate, persulfate, peroxide, and ozone. Permanganate oxidants are typically selected for their longer persistence in the subsurface to address relatively low permeability soils, fractures, and sometimes to achieve longer transport periods.

For treatment of contaminated soil and groundwater, oxidants in concentrated solution or solid form can be delivered using hydraulic injection, *in-situ* soil blending, or hydraulic fracturing techniques. The chemical oxidant can be injected as a liquid or slurry into the capillary fringe and water bearing zone.

The two most critical success factors in all ISCO projects are the effective distribution of the reagents in the treatment zone and the reactivity of a particular oxidant with the contamination present. Failure to account for subsurface heterogeneities or preferential flow paths can cause an uneven distribution of the oxidant, resulting in pockets of untreated contaminants. The applied reagents also consume natural organic matter in the soil, some of which has sorbed contamination. As the natural organic matter is consumed, the sorbed contamination will be released. Therefore, when applying liquid oxidants in the both the saturated and vadose zone, there is a potential to release contamination to the groundwater. This phenomenon is highly dependent on the transport properties of the soil. The more permeable the soil, the greater chance for release to groundwater because the oxidant has less time for reacting with the contaminants. Desorption of contamination can be considered a benefit for remediation purposes because reactions typically occur in the aqueous phase and more contamination is available for reaction. The remedial design must account for both the sorbed and dissolved-phase contamination for effective site cleanup. An important advantage of ISCO is its relatively high rate of reaction. However, because of the reactivity of the oxidants, there is potential to cause a significant change in both the concentration and distribution of contamination, potentially resulting in large changes in a site's established equilibrium of contaminants between the vapor, liquid, and sorbed phases.

The overall effectiveness of ISCO is primarily dependent on contact with the contaminants. Factors that affect the efficiency, implementability, and costs include injection spacing, hydraulic conductivity, and the ability to inject by direct-push rather than by conventional well drilling techniques. Advantages of using ISCO include *in-situ* treatment (i.e., no treatment equipment to operate and maintain), relatively fast treatment, and potential enhancements to the post-oxidation aerobic microbial environment. Some disadvantages of ISCO are that the natural oxidant demand may be high in some areas and multiple applications may be required. Proper design of a field-scale implementation of ISCO involves evaluation of contaminant concentrations as well as quantitative estimates of other oxidant sinks. In addition to the target contaminants, other possible oxidant sinks include reduced minerals and naturally occurring organic matter. Not all naturally occurring organic matter will be amenable to oxidation, and the level of oxidation of naturally occurring organic matter depends upon the oxidant selected. If all of the oxidant sinks are not properly taken into account, the amount of oxidant that needs to be applied will be underestimated, and it is likely that the ISCO effort will fail.

DNAPL pools, in themselves, cannot be oxidized by chemical oxidants. Chemical oxidation (as well as biodegradation) must occur in the aqueous phase with the process working solely on the "halo" of dissolved constituents surrounding the immiscible-phase contaminants.

Experimental data have shown that if the oxidant can contact the dissolved VOC in the aqueous phase, the VOC will be rapidly destroyed. Similar experiments have shown that small DNAPL droplets in the aqueous phase can also be effectively remediated as the soluble phase is oxidized, driving the equilibrium conditions to solubilize more of the VOC from the DNAPL droplet which is subsequently quickly oxidized (Fam and Kidd, 2005).

Other experimental data indicate that generation of manganese dioxide and carbon dioxide (reaction by-products) presents plugging issues for ISCO application in DNAPL source areas, which can limit treatment efficiencies in terms of total mass destroyed. Localized plugging over time may be sufficient to prevent the efficient delivery of oxidant to the source areas that the oxidant was intended to treat. This entombment of contaminants is due to the generation of manganese dioxide encrustation at the location of reaction. Because source areas contain the most contaminant, these plugging by-products tend to be co-located at the VOC source areas. In such instances, the resultant oxidant flow regime will no longer contact the most contaminated areas and may lead to flow regimes following paths of least resistance.

As indicated above, oxidants can be delivered using hydraulic injection or *in-situ* soil blending. Injection of oxidants in liquid form through vertical hydraulic probes into shallow heterogeneous vadose zone soils can readily result in preferential transport of oxidant through relatively high permeability zones and short-circuiting of injected oxidant to the ground surface. Both of these outcomes would result in poor oxidant delivery and ineffective soil remediation. Oxidants are often delivered into contaminated soil using *in-situ* soil blending, which serves to increase contact between the oxidant and impacted soil. This approach is most applicable to shallow contamination within the vadose zone (ITRC, 2005).

Hydraulic injection approaches are not effective in delivering oxidant to locations just below ground surface as indicated above. Based on the high detected CVOC concentrations in surficial soil samples previously obtained at the Site, and the high costs associated with soil disposal as discussed in Section 5.3.4, ISCO application using *in-situ* soil blending is retained for further evaluation.

Potassium permanganate would represent an appropriate oxidant for the Site based on its demonstrated effectiveness in treating soil and groundwater impacted with CVOCs. Based on the possible presence of DNAPL at the Site, the total average soil oxidant demand is assumed to range on the order of 10 grams of oxidant per kilogram of soil (g/kg). The actual soil oxidant demand to be applied at the Site would be based on the results of permanganate natural oxidant demand (PNOD) testing.

To achieve a 10 g/kg loading rate, the target treatment zone would need to be dosed with approximately 55,000 pounds of oxidant. Using this quantity of oxidant, costs associated with implementation of the ISCO alternative using *in-situ* soil blending are estimated to total approximately $495,000.

5.3.10 *In-Situ* Enhanced Reductive Dechlorination

A variety of *in-situ* reductive chemical and biological reactions can be induced in a contaminated aquifer to remove CVOCs through enhanced solubilization and desorption. Chemical reduction by amendments such as zero valent iron (ZVI) have the advantage of being able to treat high concentrations of CVOCs while producing limited amounts of intermediates, such as VC. Biological reduction by amendments such as emulsified vegetable oil (EVO) or lactates have the advantage of being able to treat low concentrations of CVOCs. The state of the soil and groundwater remediation practice is evolving, in recognition that combining chemical and biological reduction can function synergistically by creating a reducing environment that thermodynamically promotes biological

reductive dechlorination. This combined approach is intended to promote rapid abiotic degradation within the zone of influence, and to also enhance long-term biological dechlorination. Summaries of *in-situ* chemical and biological reduction processes are provided below.

In-Situ Chemical Reduction

In-situ chemical reduction (ISCR) is essentially a mirrored technology of ISCO. Both processes involve the transfer of electrons. With chemical reduction, electrons are transferred from the reductant to the substrate. The substrate gains electrons and is reduced, while the reductant loses electrons and is oxidized (Brown, 2008):

$Cl_2C{=}CHCl + Fe^0 \rightarrow HC{\equiv}CCl + 2Cl^- + Fe^{+2}$

Reduction of Substrate: $Cl_2C{=}CHCl + 2e^- \rightarrow HC{\equiv}CCl + 2Cl^-$

Oxidation of reductant: $Fe0 \rightarrow Fe^{+2} + 2e^-$

How susceptible a chlorinated solvent is to oxidation or reduction is determined by its chemical structure. In general, solvents with carbon atoms that are electron rich are more susceptible to oxidation; carbon atoms that are electron deficient are more susceptible to reduction. The more chlorines added to a solvent molecule the more oxidized it is and the more resistant it is to further oxidation but the more susceptible to reduction.

ZVI has been employed successfully in low pH environments as a stand-alone remedy to support abiotic VOC degradation. Chemical reduction of the VOCs can occur on the ZVI particle surface, and hydrogen produced during iron corrosion can serve as an electron donor for biological dechlorination. In addition, hydroxyl ions produced from corrosion of ZVI increase pH within the treatment area to levels favorable for dechlorination. This abiotic process is suited to aquifers that have relatively high accumulation of daughter products. β-*elimination* mechanisms promoted by ZVI would typically not accumulate daughter products, as the degradation pathways bypass the production of cDCE and VC.

In-Situ Biological Reduction

CVOCs can be degraded by anaerobic microbes known as reductive dechlorinators to non-toxic daughter products. Such biodegradation requires reducing conditions to stimulate anaerobic bacteria to dechlorinate the CVOC. The approach is designed to provide a carbon or electron donor source to create reducing conditions necessary to enhance anaerobic biodegradation. Examples of effective electron donors that degrade the chlorinated VOCs when delivered to the subsurface include molasses/water mixture, whey, high fructose corn syrup, or sodium lactate. Such anaerobic bioremediation processes have been successful and well documented at a wide variety of sites, and guidance documents are available that describe the process in detail (AFCEE, 2004).

The anaerobic microbes use CVOCs during dehalorespiration via reductive dechlorination. There are a variety of bacteria that dehalorespire only on PCE or TCE, producing toxic cDCE in the process. In contrast, the dechlorinating microorganisms *Dehalococcoides* (*Dhc*) are the only known microorganisms capable of further dechlorination to non-toxic ethene. Although *Dhc* microorganisms are widely distributed in the environment, research indicates that they are not ubiquitous. If *Dhc* is absent from a site, incomplete dechlorination and accumulation of cDCE is anticipated to occur, or extended acclimation periods will be required to allow low concentrations or poorly distributed *Dhc* populations to achieve functional cell densities. If the results of groundwater monitoring during the course of anaerobic bioremediation indicate insufficient *Dhc* bacterial populations, then the biostimulation is often combined with bioaugmentation using commercially-available microbes.

Under this remedial approach, the microbes sequentially dechlorinate the CVOCs and gain energy in each step, while utilizing the substrate as a carbon source and the CVOC as an electron acceptor. The adapted microbes respire using the CVOCs in place of other electron acceptors such as oxygen. The areas in which substrate is delivered become anaerobic due to the uptake of available electron acceptors to support respiration of the microbes, which provides the environment required for the bioremediation process to take place. This process has been shown to be more effective and less costly than other treatment processes, such as physical removal.

In order to effectively anaerobically bioremediate a particular area, it is critical to:

- Select the optimal chemical additives.
- Properly distribute the chemical and biological additives to stimulate the dechlorination process within the contaminated area.
- Bioaugment (if necessary) the site with dechlorinating microbes.
- Maintain the enhanced subsurface conditions for sufficient time to fully dechlorinate the dissolved and adsorbed CVOCs.

Combined *In-Situ* Chemical and Biological Reduction

Biologically mediated ZVI technology has focused on systems that combine abiotic and biotic reduction. For example, NASA developed emulsified zero valent iron (EZVI) to address DNAPL TCE found at the Cape Canaveral Launch Complex 34, Florida facility (Reinhart et al., 2003). The emulsion of oil, surfactants, water, and either microscale (1 to 10 microns) or nanoscale (<1.0 micron) ZVI is injected into the subsurface in the vicinity of the DNAPL. The DNAPL constituents partition into the oil phase and react with the ZVI, yielding less chlorinated VOCs and the innocuous end-products acetylene, ethene and ethane. The oil coating is designed to protect the ZVI from oxidation, which extends the timeframe that the ZVI remains active. The oil and surfactants are fermented to hydrogen, and the corrosion of the iron with the water also leads to hydrogen formation that can then support biological reductive dechlorination of CVOCs. Several reports have demonstrated the effectiveness of EZVI to destroy DNAPL (Lee, M.D., 2008).

Commercially-available products other than EZVI that cost-effectively combine slow-release carbon amendment with ZVI would be applicable to the Site. Such products would represent appropriate reductants based on their demonstrated effectiveness in treating soil and groundwater impacted with high concentrations of CVOCs.

As with ISCO as discussed in Section 5.3.9, reductants can be delivered using hydraulic injection or *in-situ* soil blending. Hydraulic injection approaches are not effective in delivering reagent to locations just below ground surface as indicated above. Based on the high detected CVOC concentrations in surficial soil samples previously obtained at the Site, and the high costs associated with soil disposal as discussed in Section 5.3.4, application of enhanced reductive dechlorination using *in-situ* soil blending is retained for further evaluation.

The application of approximately 38,000 pounds of ZVI and carbon amendment would be recommended to treat the target CVOC-impacted soil and groundwater. The ZVI content would be equivalent to approximately 0.5% of the weight of the target treatment volume. Using this quantity of reductant, costs associated with implementation of the enhanced reductive dechlorination alternative using *in-situ* soil blending are estimated to total approximately $358,300.

6. SELECTED REMEDIAL ACTION OPTIONS/RAP

Based on the identification and evaluation of the remedial options presented above, Ramboll Environ recommends implementation of the following remedial action options for the Site.

- Enhanced reductive dechlorination of unsaturated and saturated soil using a combined *in-situ* chemical and biological reduction approach (ZVI and carbon amendment or similar reductant such as ABC+) that is applied with *in-situ* soil blending methods;
- Monitored natural attenuation of near-source and down-gradient groundwater impacts; and,
- Institutional controls (WDNR GIS registry) for residual soil and groundwater impacts that remain in excess of WAC NR 720 non-industrial soil remediation goals and WAC NR 140 ES, respectively.

Treatment of CVOCs by ZVI has been proven and widely-accepted as an effective in situ remediation technology. ZVI destroys CVOCs in groundwater, including PCE and daughter products detected in soil and groundwater at the Site. The degradation process is an abiotic reductive dehalogenation process occurring on the surface of the granular iron, with the iron acting as an electron source. Because the site is already anaerobically degrading the PCE, this remedial process will enhance the natural degradation process.

A natural attenuation groundwater monitoring program will be instituted following implementation of chemical reduction using a soil blending technology. A request for case closure will be submitted to the WDNR in accordance with WAC NR 726 after demonstrating CVOC concentrations are stable or declining after the source soil remediation activities have been completed. Eight rounds of groundwater monitoring are proposed as required by WDNR guidance to demonstrate natural attenuation has sufficiently reduced or stabilized the groundwater concentrations after source treatment.

As residual soil and/or groundwater concentrations are likely to remain above WAC NR 720 non-industrial soil remediation goals and WAC NR 140 ESs, respectively, institutional controls will be employed to satisfy the requirement of conditional closure as a part of the active remedy. The intuitional control will consist of listing the former Express Cleaners property, possibly the former Pugh Oil property to the north, and the adjacent property to the east on the WDNR GIS Registry.

Based on the expected contaminant mass reduction and the attendant reduction in soil and groundwater concentration from the aggressive proposed remedy, it is Ramboll Environ's opinion that the potential for on-and off-site vapor intrusion risk will be greatly reduced. Therefore, our proposal does not include extensive vapor intrusion monitoring; however, we have included a contingent scope and cost to perform a vapor intrusion assessment of the former Pugh Oil property. It is recommended that any new building that may be constructed at the Site should incorporate a vapor migration barrier.

The following sections provide a proposed RAP to complete the remedial actions described herein, as summarized below:

1. Preparation of remedial action work plan documents and permit requests.
2. Pre-remedial soil and groundwater sampling.
3. Remove and dispose of concrete foundation, concrete slab, asphalt and abandoned utilities.
4. Implementation of *in situ* enhanced reductive dechlorination.
5. Installation of additional and replacement monitoring wells.

6. Post-remediation soil confirmation sampling.
7. Preparation of remedial action completion report.
8. Conduct vapor intrusion assessment at former Pugh Oil building.
9. Completion of groundwater monitoring and reporting.

6.1 Preparation of Remedial Action Work Plan and Permit Requests

6.1.1 Design Report and Design Plans/Specifications

Pursuant to WAC NR 724.09 and 724.11, a Design Report and Design Plans/Specifications will be submitted to the WDNR that will include the following information:

- a complete and detailed description of the remedial action being designed; criteria, concepts, assumptions and calculations used in preparing the design, including adequate justification for their use; and test results used to develop the design;
- a description of the public health and environmental laws and standards applicable to the contamination and the remedial action being implemented, including the physical location where the environmental standards will be complied with;
- a preliminary discussion of the types, frequency and schedule for monitoring of the remedial action; and
- a proposed schedule for implementation of the remedial action, which identifies timing for initiation and completion of the tasks.

The proposed dates for completion of the remedial action and major milestones will be specified in the Design Report. The schedule will include deadlines for all reports, plans and submittals required by the WDNR, and a discussion of any other relevant technical factors. The Design Plans/ Specifications will include detailed drawings of the proposed design, including general process flow information, and sampling locations; visual aids, including maps, plan sheets, drawings, and cross-sections as appropriate for the remedial technology.

Pursuant to WAC NR 724.17, a long-term groundwater monitoring plan will also be incorporated into the Design Report that will include the following information: the parameters to be monitored; the sampling and analytical methods to be used, consistent with the sampling and analysis requirements in WAC NR 716.13; the interval at which monitoring is to be performed; and the public health and environmental laws, including standards, to be complied with.

6.1.2 Underground Injection Control (UIC) Permit

As required by the WDNR guidance document entitled “Underground Injection Control Approval Request, Technical Assistance for Submittals,” two permits will be required as part of the recommended remedial actions: 1) an Underground Injection Permit, and 2) a General Permit for Groundwater Remediation Projects. These permits need to be approved by the WDNR prior to remedial action implementation. Ramboll Environ will prepare these permit requests as part of our proposed scope of services.

6.1.3 Removal of Existing Building Foundations and Abandoned Utilities

The Former Express Cleaners Site currently contains the concrete footings and a 6-inch concrete slab on-grade for the former one-story building that once consisted of a 6,804 square foot strip mall (without a basement) situated on a 0.77-acre lot. The building was demolished in 2015 and the immediate area surrounding the strip mall consists of paved parking lots and access drives. In addition, abandoned subsurface utilities that once serviced the strip mall (water, sanitary sewer,

natural gas and electric) currently remain in-place in the area designated for remediation and must be removed. The abandoned utilities are presently capped at the property boundary.

In order to implement the selected remedial option, it is recommended that the existing strip mall building foundation, concrete slab and abandoned utilities be removed prior to conducting the proposed soil remediation activities. Previous investigations conducted at the site indicate that the concrete slab where the dry cleaning processes occurred is contaminated and must be properly managed and disposed. However, the extent of the concrete foundations impacted by CVOC has not been delineated. Therefore, Ramboll Environ has included a scope of work and cost to test the additional concrete footings at the time of their removal and to manage the additional impacted concrete materials for disposal at a pre-approved solid waste disposal facility. Based on the concrete slab testing data collected during previous site investigations, the concrete foundation materials are expected to be non-hazardous and disposal can be arranged at a local solid waste disposal facility. Removal of the abandoned utilities, the building slab and foundations, and the asphalt parking area within the proposed area of remediation will be completed before the implementation of the selected remedy.

6.2 Pre-Remedial Soil and Groundwater Sampling

Ramboll Environ will perform pre-remedial soil sampling to further delineate the extent of PCE impacted soil that is above the proposed soil remediation goal of 1,500 ug/kg. The results from the pre-remedial soil samples will be used to define the boundaries/volume of soil targeted for remediation and to determine if the volume estimates provided in this proposal will meet the remedial objectives based on current data. Ramboll Environ will collect the pre-remedial soil samples using a Geoprobe™ at 16 soil boring locations (twelve on the Former Express Cleaners property and four on the adjacent Former Community Gardens site). The locations of the proposed Geoprobe soil borings are illustrated on the attached Figure 4 (shown as B35 through B50). The Geoprobe™ borings will be advanced to an average depth of 10 feet bgs at each location. Soil samples for laboratory analysis will be collected from pre-determined locations and depth intervals based on the previous soil sampling results and from field screening using a photoionization detector (PID) to obtain the data needed to refine the extent of impacts. Two soil samples from each Geoprobe™ boring will be submitted for laboratory analysis for VOCs using United States Environmental Protection Agency (USEPA) method SW-846 8260B. Prior to advancing any borings, Ramboll Environ will have all utilities at the Site marked by a private utility locator and will survey the locations of the Geoprobe™ borings. The survey of the boring locations will be tied in with the existing soil sample location basemap. The analytical data, the extent of the soil PCE impacts and volume of soil to be remediated will be documented in the Design Report.

Ramboll Environ will verify that the volume of soil targeted for remediation is consistent with the volume and cost estimates provided in this proposal. If the volume of soil targeted for remediation deviates significantly from the estimate provided, a revised cost estimate to remediate impacted soil in excess of the soil remediation goal will be prepared and submitted for approval. Any changes to the cost estimate provided in this proposal will be addressed through the change order process as described in WAC NR 169.23(3)(d).

The initial groundwater monitoring task to be completed is baseline groundwater monitoring, prior to completion of the Remedial Action Work Plan. It is critical to conduct a baseline groundwater monitoring event since the wells have not been sampled since 2011. As part of this task, all 14 monitoring wells will be sampled for VOCs (Method 8260). In addition, field instruments will be used to measure geochemical parameters, including pH, dissolved oxygen, and oxidation-reduction potential. In accordance with the WDNR April 2003 guidance document “Understanding Chlorinated Hydrocarbon Behavior in Groundwater” (WDNR Publication RR-669), monitoring wells MW-3 and

MW-8 (near the treatment area) also will be sampled for the following natural attenuation parameters: ethene/ethane/methane (Method 8015), dissolved iron (Method 8146), total organic carbon (Method 5310), nitrate+nitrite (Method 353.2), and sulfate (Method 300). One quality assurance/quality control (QA/QC) duplicate groundwater sample and one QA/QC laboratory trip blank sample will be submitted for laboratory analysis of VOCs as part of the baseline groundwater monitoring event.

6.3 Implementation of *In-Situ* Enhanced Reductive Dechlorination

Chapter NR 169.23(6)(d) requires that this proposal includes "a description and cost estimate for the implementation, analysis and interpretation of a pilot test for all active remediation systems, unless the consultant can justify to the department's satisfaction that a pilot test is not necessary." It is Ramboll Environ's opinion that a pilot test is not necessary, based on the following factors:

1. The contaminants of concern, PCE and its degradation products, are relatively common and well understood in terms of documented reductive dechlorination as an effective soil and groundwater remedial technology. Ramboll Environ has directed the successful remediation of a similar CVOC site in Wisconsin using the reductive amendments that are proposed herein.
2. *In-situ* soil blending facilitates effective contact between amendment and contaminant, and allows for greater amendment dosing than hydraulic injection delivery approaches. Therefore, completion of a costly and time-consuming pilot test would not represent efficient use of limited DERF funds.

Based on the foregoing, Ramboll Environ does not include a pilot test as part of the proposed remedial actions for the Site.

Ramboll Environ will develop a Health and Safety Plan for personnel conducting field activities on site. This Plan is a separate document and will be available for WDNR review upon request. Project field personnel will be familiar with the Plan prior to commencement of fieldwork. Subcontractors will be provided with a copy of the project Health and Safety Plan and Ramboll Environ will conduct a briefing on-site prior to commencement of field work. Subcontractors, however, will be responsible for developing their own Site Safety Plans regarding their activities. Prior to soil blending activities, Ramboll Environ will contact Digger's Hotline for the location of public utilities within the VOC-impacted area and will also review maps and other available information regarding the locations of private utilities. Ramboll Environ will request notification of the type and location of all private utilities on the property.

In-situ soil blending involves using an *in-situ* blender to effectively distribute chemical amendments throughout the soil medium to treat contaminants of concern. The chemical amendments can range from oxidants, reductants, biostimulants, or soil stabilizers. The *in-situ* blender is mounted on a large excavator with a modified diesel engine and hydraulic power system. Utilizing hydraulic pressures of 5,000 pounds per square inch (psi), a 28-inch diameter mixing drum with specially designed "teeth" is rotated at speeds up to 100 rounds per minute (rpm) with a torque of 20,300 pounds per foot.

Because many chemical remediation alternatives require direct contact with the target contaminants, the effectiveness of the remediation strategy is often limited by the ability to distribute the chemical amendments throughout the soil medium. Application of an *in-situ* blender is among the most effective and efficient methods to achieve mixing at shallow depths (less than 20 feet).

The *in-situ* blending process will be performed systematically by subdividing the treatment area into smaller cells. The cell dimensions typically do not exceed 20 feet by 20 feet, depending on location,

chemical loading rates, etc. A detailed implementation plan would be developed prior to mobilization to properly coordinate the mixing process.

The application of approximately 38,000 pounds of ZVI and carbon amendment is recommended to treat the target CVOC-impacted soil and groundwater. The ZVI content will be equivalent to approximately 0.5% of the weight of the target treatment volume. The blending and addition of amendments and water will increase the volume of soils. Generally, we anticipate that the degree of soil swell that will result from the soil blending technology will not exceed approximately 2 feet within the treatment area. After soil blending has been completed, any mounded or excess soil will be segregated into roll off boxes, or appropriately managed within the treatment area on-site pending laboratory analysis of the soil for TCLP-VOCs for Subtitle D landfill acceptance. We have accounted for additional soil management/removal and disposal in our proposal to allow for the swell and to restore the ground surface to match the existing grade using No. 6 crushed stone aggregate. We estimate that the *in-situ* soil blending activities can be completed within a 2-week timeframe.

During implementation of the in situ soil blending activities, air quality around the Site must be monitored to ensure that safe conditions are maintained and on-Site workers and the surrounding community is protected. Therefore, an ambient air monitoring program will be conducted during soil blending and the air quality will be measured and documented within the work zone (soil handling/ mixing areas) and Site perimeter (property boundaries).

Work zone air monitoring is used to set the necessary level of worker respiratory protection. It also provides the first indication that emissions are elevated and provides an early warning (before air quality at the perimeter zone is affected) that elevated emissions are present. In the work zone, an air monitoring technician will operate a calibrated portable Gasmet DX4040 gas analyzer instrument that utilizes Fourier Transformed Infrared Spectroscopy [FTIR] to measure the concentration of total VOCs in ambient air. This instrument provides instantaneous readings on a continuous basis. During routine operations, an air monitoring technician will monitor the work zone air quality throughout the soil blending operations. Ramboll Environ will document established an air action level for the chemicals of concern (PCE, TCE, VC) and include these levels in the Design Report.

The purpose of monitoring at the perimeter of the Site is to confirm that the air quality off site is acceptable and to provide a record of air quality during the cleanup of the source area. Air monitoring locations will be designated on the perimeter of the Site based on receptor location and the most probable wind direction at the time of conducting the remediation. The proposed locations of perimeter air monitoring will be documented in the Design Report. During routine operations, an air monitoring technician will monitor each perimeter location using the calibrated FTIR instrument described above.

If the action level at a perimeter location is exceeded or if operations in the work zone require an increase in respiratory protection, actions will be immediately implemented to reduce air emissions and continuous monitoring at a downwind perimeter location will continue until monitoring levels are below the action level. The primary response for reducing air emissions is likely to be the use of vapor suppressant foam that can be applied immediately to the soil blending area by the remediation contractor.

Vapor controls will be provided during soil blending activities to suppress volatile vapors that may be driven off during soil blending. If necessary, a vapor control system consisting of Rusmar® Foam will be used to produce a thick, long-lasting, viscous foam barrier within the blending area for immediate control of VOCs. The foam, if required based on the ambient air-monitoring readings, will be applied during active soil blending activities or for overnight coverage of exposed contaminated

soils within the blending area. The foam can supply up to 17 hours of continuous and effective emission control and is non-hazardous, non-combustible, biodegradable, and safe for Site personnel and the environment.

The foam will be obtained from the manufacturer in 450-pound drums of liquid concentrate and requires dilution with water prior to application (6.5 parts water to 1 part chemical). Each drum of chemical will cover approximately 4,500 square feet. A Rusmar® pneumatic foam unit will be used to apply the foam to the soil blending area. This unit is a completely self-contained and portable foam-generating system and can be mobilized around the Site with a pickup truck. The unit includes an air compressor, pump, hoses, nozzles, a 400-gallon solution storage tank, and freeze protection for use during cold weather. A protective barrier of foam will be applied to the extent of the soil blending area as often as necessary, depending on the real-time ambient air quality data supplied by the ambient air monitoring personnel. This scope of work and the associated cost has been included in the proposal for the Implementation of *In-Situ* Enhanced Reductive Dechlorination task.

6.4 Soil Remediation Verification Sampling

Verification of soil remediation will be conducted through confirmation soil sampling and analysis. To evaluate post-remediation soil conditions, eight hydraulic probes will be installed after completion of the *in-situ* enhanced reductive dechlorination remedial action. The hydraulic probes will be installed to depths of 9 feet bgs.

Two soil samples will be collected from each of the probes, one between 0 to 4 feet bgs and one between 4 and 9 feet bgs, for a total of 16 post-remediation soil samples to be submitted for laboratory analysis of VOCs using USEPA Method 8260. Following soil sample collection, each sample container will be labeled with the sample location identification, date of sample collection and intended analysis. The sample containers will then be packed in an iced, insulated container. A chain-of-custody form will be filled out upon completion and will accompany the container of soil samples to the laboratory. The samples will be transported from the Site to the laboratory via same-day or overnight courier.

Based on toxicity, concentration, and frequency of detection, the identified chemicals of interest in soil at the site are PCE, TCE, cDCE, and VC. Laboratory results of soil samples collected prior to commencement of *in-situ* chemical reduction that revealed detectable concentrations of these CVOCs will be compared to the results of soil samples collected after completion of *in-situ* chemical reduction. Based on the anticipated several order-of-magnitude variations in VOC concentrations in the soil samples, geometric mean values may be used to quantify average residual soil contamination concentrations to evaluate the amount of contaminant mass reduced by the remedial action.

6.5 Installation of Additional Monitoring Wells

After completion of the soil blending activities and before implementation of the MNA groundwater monitoring program, the installation of two monitoring wells will be conducted. One well will be generally located at the eastern margin of the groundwater plume affecting the North Bay Drive portion of the Site at a location satisfactory to WDNR (MW-16). Another well will be located in the general location of MW-3 in the blending area and will serve as a replacement well (MW-3R). These wells will be installed using hollow stem auger drilling methods. The wells will be developed in accordance with WAC NR 141 requirements.

6.6 Vapor Assessment at Former Pugh Oil Building

A vapor assessment of the former Pugh Oil building located adjacent to the northern property boundary of the Main Street portion of the Site will be conducted. The vapor assessment will consist

of installing two soil vapor pins in the building floor followed by the collection of two sub-slab soil vapor samples. The soil vapor samples will be collected using 6-liter Summa canisters that will be submitted for laboratory analysis using EPA Method TO-15.

6.7 Preparation of Remedial Action Completion Report

Pursuant to WAC NR 724.15, a Remedial Action Completion Report will be prepared after completion of the remedial actions, which will include the following information: a summary of the remedial action and documentation that the design was carried out in accordance with the specifications; an explanation of any minor changes to the technical approach and the rationale for those changes; the results from the soil remediation verification sampling; and a description of the public health and environmental laws applicable to the contamination and the remedial action selected.

6.8 Implementation of Groundwater Monitoring Program

After completion of *in-situ* soil blending, eight quarterly groundwater monitoring events will be conducted. As part of this task, seven existing monitoring wells (MW-1, MW-2, MW-6, MW-8, MW-9, MW-12, and MW-15) will be sampled for VOCs (Method 8260). In addition, the two new monitoring wells (MW-3R and MW-16) will also be sampled. Monitoring wells MW-4, MW-5, MW-10, MW-11, MW-13, MW-14, and PZ-1 have historically not revealed notable VOC concentrations, and based on the assumption (for cost estimating purposes) those seven monitoring wells will not be included as part of the subsequent quarterly monitoring program. However, all 16 wells will be sampled as part of the eighth (and assumed final) quarterly groundwater monitoring event prior to preparation of a Case Closure Request.

For the quarterly groundwater monitoring, the selected monitoring wells will be sampled for VOCs (Method 8260). In addition, field instruments will be used to measure geochemical parameters, including pH, dissolved oxygen and oxidation-reduction potential. In addition, monitoring wells MW-3R and MW-8 (near the treatment area) also will be sampled at least once for the following natural attenuation parameters: ethene/ethane/methane (Method 8015), dissolved iron (Method 8146), total organic carbon (Method 5310), nitrate+nitrite (Method 353.2), and sulfate (Method 300). One QA/QC duplicate groundwater sample and one QA/QC laboratory trip blank sample will be submitted for laboratory analysis of VOCs as part of each groundwater monitoring event.

Groundwater monitoring will continue until it is demonstrated that concentrations of the CVOCs of interest are stable or decreasing to the extent that a conditional regulatory case closure under WAC NR 726 is secured. The WDNR endorses use of the Mann-Whitney U Test for evaluating natural attenuation processes. Per current WDNR guidance, the Mann-Whitney U Test or other similar approved trend analysis methods will be conducted by assembling well data for the eight quarterly sampling events for each contaminant that has exceeded the WAC NR 140 ES at one or more monitoring wells.

Following MNA termination and case closure, the site monitoring wells will be abandoned in accordance with WAC NR 141. For cost estimating purposes, Ramboll Environ assumes that nine (one baseline and eight quarterly) groundwater monitoring events will be conducted. Additional rounds of groundwater monitoring may be necessary to demonstrate the presence of enhanced natural attenuation processes to achieve site closure.

6.9 Case Closure Report

After completion of the soil and groundwater remedial activities and groundwater monitoring results document that the groundwater plume remains stable and/or is receding, a site closure package will be prepared and submitted for WDNR approval in accordance with WAC NR 726. Institutional controls will be implemented, as necessary, as part of case closure. Institution controls will consist

of recording the Site and any adjacent properties affected by the residual CVOC impacts to be recorded on the WDNR GIS database for closed remediation sites.

The groundwater monitoring data will be continuously evaluated to determine when the plume has become stable. If constituent concentrations remain stable or decrease after eight quarters of monitoring, a request for closure will be submitted in accordance with WAC NR 726. The necessity for these institutional controls will be based on the effectiveness of the recommended remediation measures. The closure package will include the applicable GIS Registry information required for a conditional site closure, as appropriate. After final closure is granted by the WDNR, the groundwater monitoring wells will be abandoned.

7. COST ESTIMATE

A summary of the project costs are provided on WDNR Form 4400-212 and 4400-214d and are contained in Appendix C. In addition, itemized costs for each of the work elements as outlined in the Request for Remedial Action Bid proposal is included in Appendix C.

Additional proposal-specific conditions and assumptions used for developing our cost estimate are summarized below:

1. Pilot testing is not recommended as part of the remedial action activities.
2. The volume of soil to be treated is approximately 1,900 cubic yards.
3. The maximum depth of treatment will not exceed 9 feet bgs.
4. Meetings with the WDNR outside the context of interaction in the field as part of scheduled activities are not included in the attached project budget. Any such meetings would be invoiced on a time-and-expense basis in accordance with our Fee Schedule.
5. Subcontractor markups are not reimbursable under DERP. As such, Ramboll Environ assumes that the Client will contract directly with the major remedial subcontractors (Redox Tech and North Shore Environmental Construction) to avoid the subcontractor markup (as assumed in the estimated costs provided in Appendix C). Alternatively, the project-specific subcontractor markup rate is 8 percent.
6. Post blending soil stabilization of the treated soils is not included in the cost estimate. Alternatives for providing soil stabilization can be further evaluated based on specific site redevelopment plans.
7. Groundwater monitoring results will be submitted to the WDNR on a quarterly basis, and groundwater monitoring reports will be submitted to the WDNR on a semi-annual basis.
8. A nearby municipal water source will be available for use during the remedial activities.
9. WDNR review and GIS Registry fees have not been included.

Ramboll Environ has selected the recommended remedial alternative based on literature review, communications with specialized remediation contractors, successful application of the recommended remedial technology at other similar sites, and professional experience, in conformance with the care and skill ordinarily exercised by reputable members of the professional engineering community practicing under similar conditions at the same time in the same or similar locality. No other warranty of any kind, expressed or implied, is provided herein.

8. SCHEDULE

A schedule that includes the major remedial activities, milestones, and phases for the project is presented in Appendix D.

9. INSURANCE

Ramboll Environ has provided a certificate of insurance in Appendix E that demonstrates that Ramboll Environ meets the errors and omissions of $1,000,000/claim and a minimum of $1,000,000/year aggregate. The policy is an occurrence-based policy. Although our maximum deductible is greater than $25,000 per claim, we hereby declare that Ramboll Environ meets the proof of financial responsibility for the amount of deductible under WAC NR 169.23 (9)(b)2. Because we are a privately held corporation, we will provide the required proof upon request.

10. TERMS AND CONDITIONS

10.1 General

We propose to provide the services outlined in this proposal on a time-and-expense basis in accordance with the DERP Interim and Remedial Action Bid Proposals Summary provided in Appendix C, and our Fee Schedule also provided in Appendix C. Ramboll Environ's Conditions of Service and Certificate of Insurance (Appendix E) are also expressly incorporated into, and are an integral part of our contract for professional services. Invoice amounts will be based on actual units utilized at the rates shown on the Fee Schedule. Estimated costs associated with the proposed remedial action services are provided in Appendix C. The work will be performed under Ramboll Environ's Terms and Conditions as provided in Appendix F.

10.2 Certifications

Consultant and contract services will be generally completed in accordance with §292.65, Wis. Stat., and WAC NR 169, NR 140, and NR 700 series. Ramboll Environ will obtain and evaluate bids for commodity services, including excavation and analytical testing services. In addition, Ramboll Environ will coordinate and supervise drilling, laboratory and such other subcontractors as required for completion of investigation activities. Ramboll Environ will make available to the WDNR upon request, for inspection and copying, the consultant's documents and records related to the contract services.

In accordance with WAC NR 169.21, Ramboll Environ will do the following:

1. Be fully informed about the project's scope and required services, and have the experience and ability to analyze alternatives and design the most suitable response action consistent with technical and economic feasibility, environmental statutes and rules, restoration timeframes, and the latest technical advances.
2. Provide necessary staff and facilities for all phases of planning, investigation, design, construction, and operation.
3. Retain and confer with specialists on unusual matters; provide qualified technical reviewers, who will keep the owner advised on technical and regulatory matters and work toward planned remediation goals.
4. Perform all services in an ethical, professional and timely manner.

In addition, Ramboll Environ certifies the following:

1. Consultant and contract services comply with applicable requirements under Chapters NR 169 and NR 700 series.
2. Ramboll Environ will make available to the department for inspection and copying all documents and records related to the contract services.
3. Ramboll Environ did not prepare this bid in collusion with any other consultant submitting a bid on the Site.

11. LIMITATIONS

This remediation protocol has been prepared exclusively for use by Owner and may not be relied upon by any other person or entity without Ramboll Environ's permission. The conclusions presented in this report represent Ramboll Environ's professional judgment based on the information available to us during the course of this assignment and on conditions that existed at the time of the assessment. Ramboll Environ made reasonable efforts to verify the information provided to us. Nonetheless, this proposal is accurate and complete only to the extent that information provided to Ramboll Environ was itself accurate and complete.

12. REFERENCES

Air Force Center for Environmental Excellence (AFCEE), 2004. "Principles and Practices of Enhanced Anaerobic Bioremediation of Chlorinated Solvents." Environmental Security Technology Certification Program, Arlington, Virginia.

Brown, Richard A., 2008. "Developments in In Situ Chemical Reduction (ISCR) Technology," Proceedings of the Sixth International Conference on Remediation of Chlorinated and Recalcitrant Compounds. Battelle ISBN 1-57477-163-9.

Fam, S. and D. Kidd, 2005. "Chemical Oxidation or Enhanced Anaerobic Dechlorination – A Science-Based Decision," Battelle Press.

ITRC (Interstate Technology & Regulatory Council), 2005. Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Soil and Groundwater, 2nd ed. ISCO-2. Washington, D.C.: Interstate Technology & Regulatory Council, In Situ Chemical Oxidation Team. Available on the Internet at http://www.itrcweb.org.

Keely, J.F., October 1990. "Performance Evaluation of Pump-and-Treat Remediations," EPA/540/4-89/005.

Mackay, D.M. and Cherry, J.A., 1989. "Groundwater Contamination: Pump-and-Treat Remediation," Environmental Science & Technology, Vol. 23, No. 6, pp. 630.

Lee, M.D., 2008. "Treatability Studies Using EZVI and Bioaugmentation for Dissolved Phase and DNAPL Chlorinated Solvents," Proceedings of the Sixth International Conference on Remediation of Chlorinated and Recalcitrant Compounds. Battelle ISBN 1-57477-163-9.

Reinhart, D.R., C. Clausen, C.L. Geiger, J. Quinn, and K. Brooks, 2003. U.S. Patent 6,664,298 B1. Zero-Valent Metal Emulsion for Reductive Dehalogenation of DNAPLs.

Travis, C.C. and Doty, C.B., 1990. “Can Contaminated Aquifers at Superfund Sites be Remediated?” Environmental Science & Technology, Vol. 24, No. 10, pp. 1465.

Trotta, L.C. and R.D. Cotter, 1973. “Depth to Bedrock in Wisconsin. ”Madison, WI: Geological and Natural History, University of Wisconsin. 1 map (1:1,000,000).”

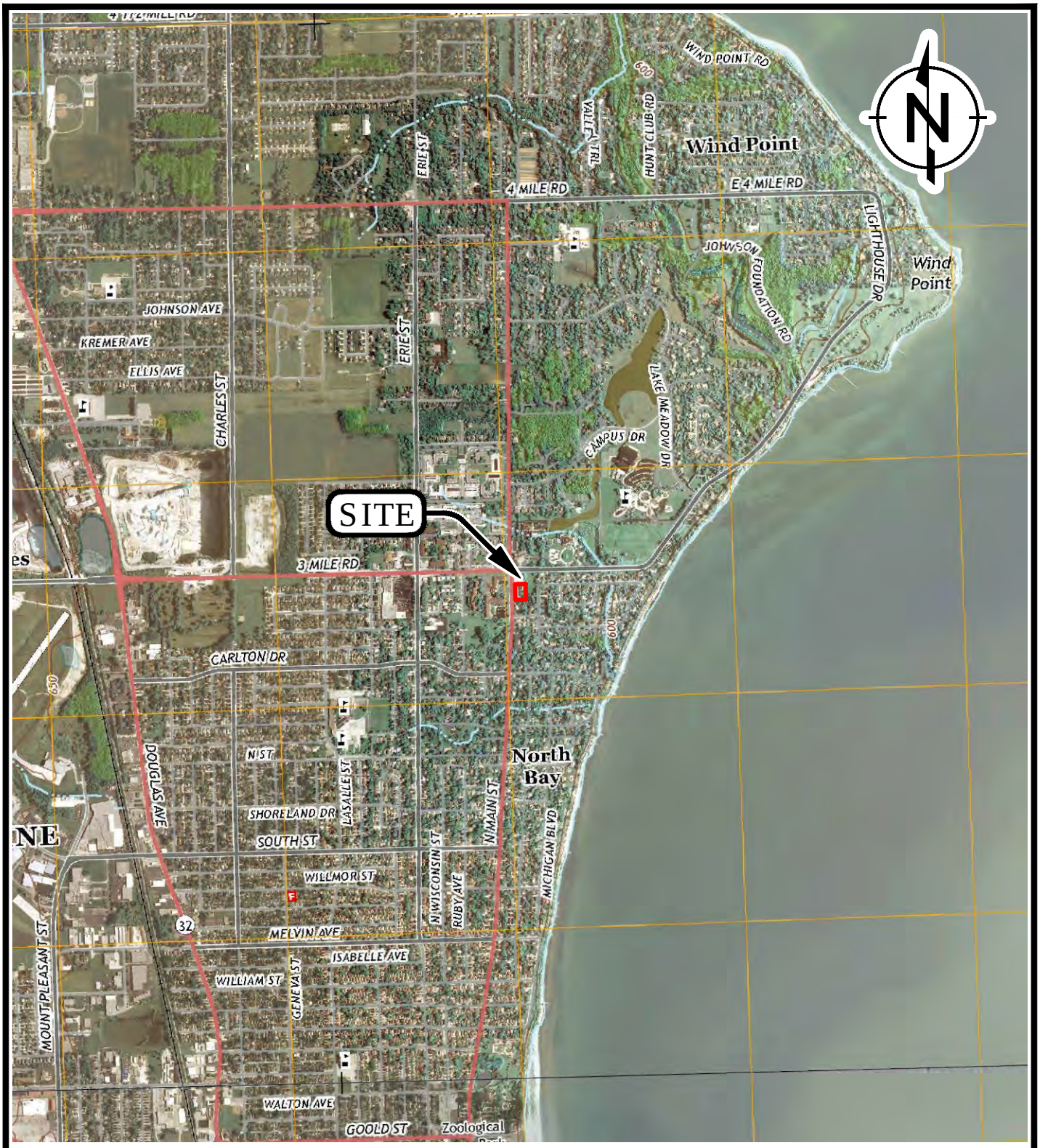
Udell, K.S., 1996. Heat and mass transfer in clean-up of underground toxic wastes. In Annual Reviews of Heat Transfer, vol. 7, ed. C.-L. Tien. 333–405. New York/Wallingford, UK: Begell House, Inc.

TABLES

Table 1. CVOC Mass Summary
Express Cleaners, Racine, Wisconsin

Zone	Area Designations	Area (sq ft)	Vertical Zone	cis 1,2 DCE (lbs)	trans 1,2 DCE (lbs)	PCE (lbs)	TCE (lbs)	Subtotal (lbs)	Percent of Total CVOC
Primary Source	1, 2	2,179	Soil - Vadose Zone	2.735	0.745	139.789	2.012	145.28	50.6%
			Soil (Coarse, Saturated)	0.174	0.003	107.035	0.496	107.71	37.5%
			Soil (Clay, Saturated)	0.001	0.001	18.783	0.082	18.87	6.6%
			Groundwater (Coarse saturated)	0.118	0.004	0.151	0.016	0.29	0.1%
			Groundwater (Clay saturated)	0.240	0.008	0.307	0.033	0.59	0.2%
Downgradient of Source	4, 5	4,801	Soil - Vadose Zone	0.027	0.027	1.089	0.027	1.17	0.4%
			Groundwater (Coarse saturated)	0.024	0.006	0.185	0.003	0.22	0.1%
			Groundwater (Clay saturated)	0.041	0.008	0.332	0.005	0.39	0.1%
Plume Adjacent to Source	3	802	Soil - Vadose Zone	0.033	0.004	3.140	0.027	3.20	1.1%
			Groundwater (Coarse saturated)	0.084	0.002	0.398	0.011	0.49	0.2%
			Groundwater (Clay saturated)	0.135	0.003	0.637	0.017	0.79	0.3%
Migrated Plume	6, 7, 8, 9, 10, 11, 12	8,227	Soil - Vadose Zone	0.159	0.158	7.327	0.172	7.82	2.7%
			Groundwater (Coarse saturated)	0.013	0.001	0.023	0.002	0.04	0.01%
			Groundwater (Clay saturated)	0.014	0.000	0.027	0.002	0.04	0.02%
Proposed Treatment Area	Portions of 1, 2, 3, 4, 6, 7, 8, 9	5,708	Soil - Vadose Zone	2.870	0.847	138.333	2.085	144.13	50.2%
			Soil (Coarse, Saturated)	0.174	0.003	100.719	0.467	101.36	35.3%
			Soil (Clay, Saturated)	0.001	0.001	17.672	0.077	17.75	6.2%
			Groundwater (Coarse saturated)	0.202	0.010	0.782	0.032	1.03	0.4%
			Groundwater (Clay saturated)	0.371	0.018	1.340	0.057	1.79	0.6%
Total Site	All Areas	16,009	Soil - Vadose Zone	2.955	0.933	151.345	2.237	157.47	54.9%
			Soil (Coarse, Saturated)	0.174	0.003	107.035	0.496	107.71	37.5%
			Soil (Clay, Saturated)	0.001	0.001	18.783	0.082	18.87	6.6%
			Groundwater (Coarse saturated)	0.239	0.012	0.757	0.032	1.04	0.4%
			Groundwater (Clay saturated)	0.429	0.019	1.303	0.057	1.81	0.6%
			Summary Total	**3.80**	**0.97**	**279.22**	**2.90**	**286.9**	

FIGURES



CONTOUR INTERVAL 10 FEET

LEGEND:

PROPERTY BOUNDARY (APPROXIMATE)

0 1/2 1

SCALE IN MILES

2000 0 2000 4000

SCALE IN FEET

QUADRANGLE LOCATION

Source: USGS 7.5 minute series (topographic)
Quadrangle: Racine North, Wisconsin (2013), Racine South, Wisconsin (2013).

RAMBOLL ENVIRON

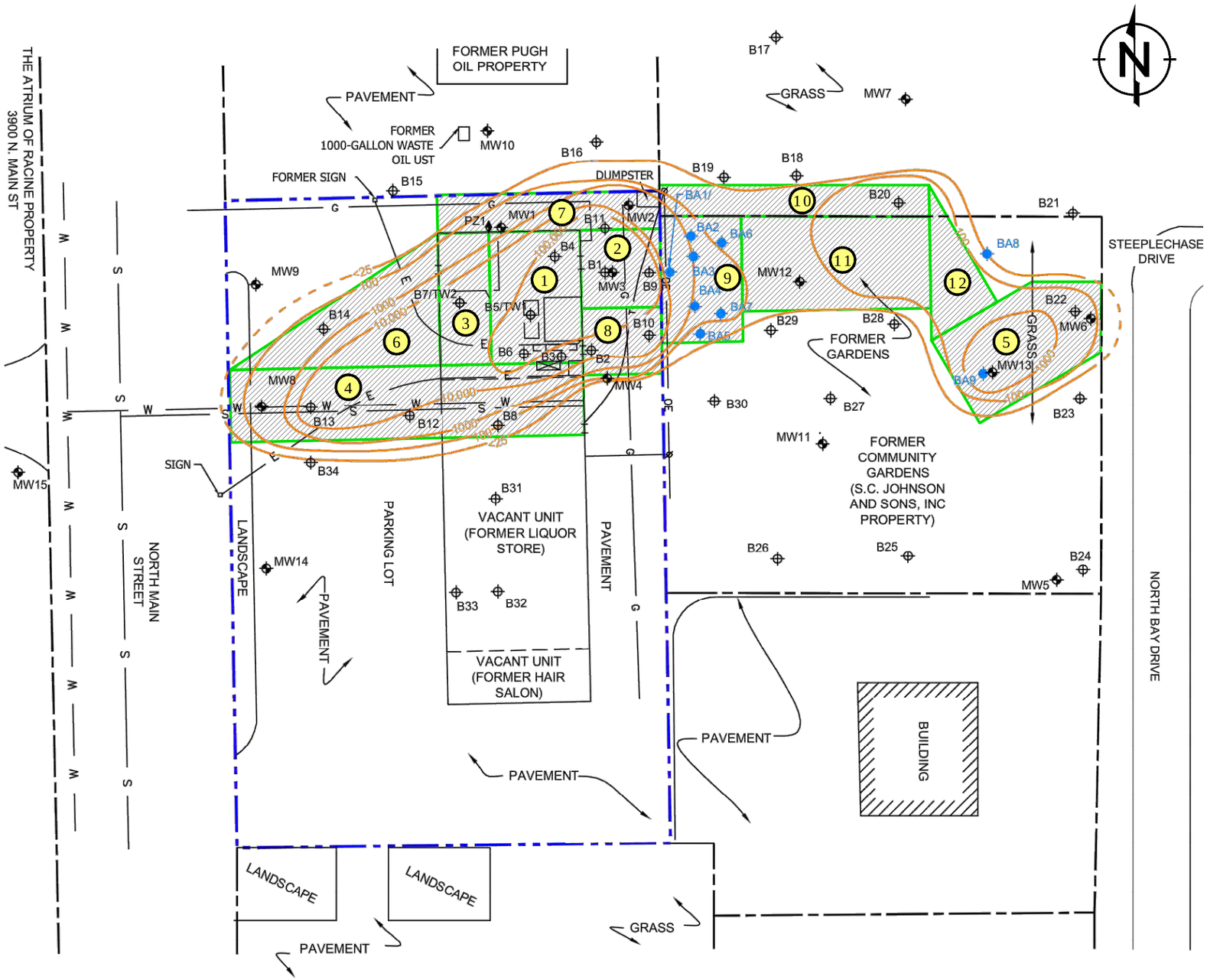
SITE LOCATION MAP
EXPRESS CLEANERS, INC.
3941 NORTH MAIN STREET
RACINE, WISCONSIN

FIGURE
1

DRAFTED BY: CKL

DATE: 5/21/15

L:\Loop Project Files\00_CAD FILES\NO#\3941 North Main Street Racine Wisconsin\01_Site Location Map.dwg



LEGEND

- SUBJECT PROPERTY BOUNDARY
- ADJACENT PROPERTY BOUNDARIES
- OE — OVERHEAD ELECTRIC LINE
- G — UNDERGROUND GAS LINE
- W — WATERMAIN
- E — BURIED ELECTRIC LINE
- S — BURIED SANITARY SEWER
- T — BURIED TELEPHONE LINE
- UTILITY POLE
- FORMER DRY CLEANING MACHINE LOCATION
- EXISTING DRY CLEANING MACHINE
- MW1 — 2" MONITORING WELL LOCATION AND IDENTIFICATION
- B34 — BOREHOLE LOCATION AND IDENTIFICATION
- BA5 — HAND AUGER NEAR SURFACE SAMPLE LOCATION AND IDENTIFCATION
- PZ1 — PIEZOMETER LOCATION AND IDENTIFICATION
- TW2 — 1" TEMPORARY MONITORING WELL LOCATION AND IDENTIFICATION
- 100 — UNSATURATED SOIL PCE ISOCONCENTRATION LINE IN MICROGRAMS PER KILOGRAM (DASHED WHERE INFERRED)
- # — AREA DESIGNATIONS

SOURCE: BASE FIGURE FROM REPORT BY BONESTROO, "ADDITIONAL INVESTIGATION ACTIVITIES, EXPRESS CLEANERS", MAY 22,2011

RAMBOLL ENVIRON

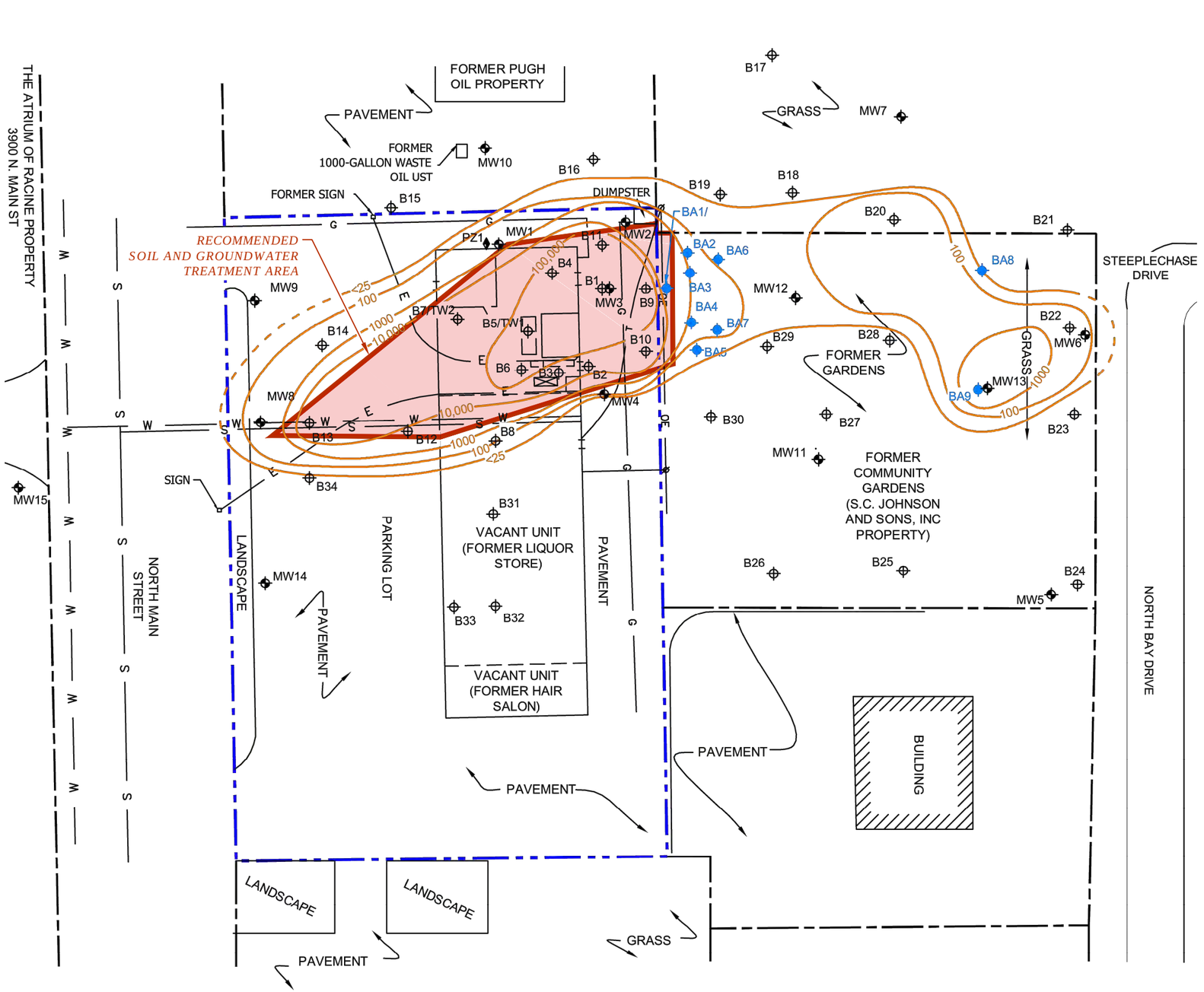
DRAFTED BY: CKL | DATE: 5/21/15

SITE LAYOUT WITH AREA DESIGNATIONS

EXPRESS CLEANERS, INC.
3941 NORTH MAIN STREET
RACINE, WISCONSIN

FIGURE
2

L:\Loop Project Files\00_CAD FILES\NO#\3941 North Main Street Racine Wisconsin\02_Site Layout with Area Designations.dwg



SOURCE: BASE FIGURE FROM REPORT BY BONESTROO, "ADDITIONAL INVESTIGATION ACTIVITIES, EXPRESS CLEANERS", MAY 22,2011

RAMBOLL ENVIRON

DRAFTED BY: CKL/APR | DATE: 5/28/15

RECOMMENDED SOIL AND GROUNDWATER TREATMENT AREA

EXPRESS CLEANERS, INC.
3941 NORTH MAIN STREET
RACINE, WISCONSIN

FIGURE 3

L:\Loop Project Files\00_CAD FILES\NO#\3941 North Main Street Racine Wisconsin\03_Recommended Soil & GW Treatment Area.dwg

N MAIN STREET

FORMER PUGH OIL BUILDING

STEEPLECHASE DRIVE

N BAY DRIVE

FORMER EXPRESS CLEANERS

FORMER COMMUNITY GARDENS (S.C. JOHNSON AND SONS, INC PROPERTY)

MW1 430 3.5-5.5 ft <25 13.5-15.5 ft

B4 270000 2-4 ft 138000 4-6 ft

B11 63000 2-4 ft 590000 6-8 ft

MW2 1740 1-3 ft <25 13.5-15.5 ft

B9 92000 0-2 ft 770000 8-10 ft

B19 <25 2-4 ft

BA2 650 0.5 ft 700 2 ft

B17 <25 2-4 ft

MW7

B20 104 2-4 ft

BA8 <25 0.5 ft <25 2 ft

MW10

B1 121000 4 ft <25 12 ft

B16 <25 2-4 ft

B15 <25 2-4 ft <25 4-6 ft

B18 <25 2-4 ft <25 6-8 ft

MW12 <18 1-3 ft

B28 <25 2-4 ft

BA9 33 0.5 ft 1200 J 2 ft

B21 <25 2-4 ft

PZ1 370 1-3 ft <25 21-23 ft

B43

B44

B7/TW2 10200 2-4 ft 77000 6-8 ft

B41

BA6 56 0.5 ft 74 2 ft

B22 670 2-4 ft

B40

B45

BA3 1200 0.5 ft 1300 2 ft

1,500 ug/kg

100,000 ug/kg

B48

MW9

B14 131 2-4 ft

B39

B36

B37

BA1 130000 2 ft

B49

MW6 48 J 2-4 ft

B46

10,000 ug/kg

B47

MW15 <24 2-4 ft <24 6-8 ft

B42

B50

B35

B38

MW13

B23 <25 2-4 ft

MW8 330 1-3 ft

B30 <25 2-4 ft

BA5 <25 0.5 ft 43 2 ft

B29 <25 2-4 ft

B13 112 2-4 ft 68000 6-8 ft

B31 <25 2-4 ft

BA7 84 0.5 ft 380 2 ft

B34 <24 3-5 ft <24 7-9 ft

B27 <25 2-4 ft

BA4 690 0.5 ft 1000 2 ft

B10 14000 2-4 ft 27.5 J 8-10 ft

MW14 <24 3-5 ft <24 6-8 ft

B8 67 2-4 ft <25 4-6 ft

MW5

B24 <25 2-4 ft <25 4-6 ft

B12 1370 2-4 ft <25 10-12 ft

MW3 8400 1-3 ft 41 J 13.5-15.5 ft

B25 <25 2-4 ft

B5/TW1 66000 2-4 ft 305 10-12 ft

B32 <25 2-4 ft

B33 <25 2-4 ft

MW11

B6 136000 2-4 ft 174 12-14 ft

B26 <25 2-4 ft

B2 9900 2 ft 465 12 ft

MW4 <25 1-3 ft <25 8.5-10.5 ft

B3 21100 4 ft

Note: All concentrations are in ug/kg

Legend

- Proposed Soil Sample Location
- Existing Soil Sample Location
- Existing Monitoring Well
- Existing Piezometer
- Soil PCE Isoconcentration Contour
- Proposed Soil Blending
- Approximate Property Boundary - Former Express Cleaners
- Approximate Property Boundary - Former Community Gardens

0 50 100

SCALE IN FEET

PROPOSED PRE-REMEDIATION SOIL SAMPLE LOCATIONS

EXPRESS CLEANERS, INC.
3941 NORTH MAIN STREET
RACINE, WISCONSIN

RAMBOLL ENVIRON

PREPARED BY: JCF	DATE: 8/29/2016
DRAFTED BY: JCF	SCALE: AS SHOWN
APPROVED BY: ST	PROJECT: P21-15124

FIGURE 4

M:\Proposals\YR 2015\P21-15124_ExpressCleaners\Database\GIS\MXD\Figure 1_Proposed Pre-Remediation Soil Sample Locations.mxd

APPENDIX A

Project Profiles

RAMBOLL ENVIRON PROJECT SUMMARY

- **Project Name:** McHenry, Illinois Facility
- **Project Charge Code:** 21-29660A
- **Project Location:** McHenry, Illinois
- **Date Completed:** On-Going
- **Client Name:** Confidential
- **Principal-in-Charge / Project Manager:** Jeanne Tarvin/Mark Mejac
- **Practice Area:** Site Solutions
- **Industry:** Manufacturing

Description:

Previous subsurface investigations of a manufacturing site in northeastern Illinois revealed the presence of groundwater impacted with trichloroethene (TCE). The TCE-impacted groundwater covered an approximate 3-acre area and extended to depths of approximately 35 feet below ground surface within a fine to medium sand aquifer media. Based on technical feasibility, cost, and implementability criteria, groundwater remediation using enhanced anaerobic dechlorination (EAD) technology was recommended in 2008 in order to address the TCE-impacted groundwater.

Use of molasses solution as an inexpensive electron donor was recommended for the subject site. Based on the scale of the impacted area (approximately 3 acres), the electron donor was injected using groundwater re-circulation as opposed to batch injection. This approach uses increased hydraulic gradients imposed by injection and extraction wells to expedite electron donor distribution within the impacted aquifer.

The EAD system design consists of a network of ten vertical injection wells and four groundwater extraction wells. Groundwater is recovered at the four extraction wells, amended with substrate, and injected into the injection wells. An existing horizontal sparge well was also used for supplemental addition of substrate-amended groundwater. The EAD system commenced operations in December 2010, and ongoing quarterly groundwater monitoring has continued since that time.

Injection of molasses-based electron donor resulted in biofouling of the injection well screens within 6 months of EAD system start-up. The wells were subsequently rehabilitated, which involved the injection of chlorine dioxide solution through the injection wells. Well biofouling was further reduced by changing the electron donor to ethyl lactate solution and implementing a more intermittent (pulsed) electron donor injection cycle. Based on evaluation of chlorinated ethene molar concentrations and molar fractions associated with the most heavily impacted monitoring well, which had previously contained 9,500 micrograms per liter of TCE, injection and re-circulation of electron donor alone (without bioaugmentation with microbial culture) has led to complete dechlorination of TCE and its intermediate degradation products to only ethene within 22 months. The results of future groundwater monitoring will be used to evaluate the need for additional EAD system operations or to determine if the site is eligible for regulatory case closure.

RAMBOLL ENVIRON PROJECT SUMMARY

- **Project Name:** Reedsburg, Wisconsin Facility
- **Project Charge Code:** 21-28166A
- **Project Location:** Reedsburg, Wisconsin
- **Date Completed:** On-Going
- **Client Name:** Confidential
- **Principal-in-Charge / Project Manager:** Jeanne Tarvin/Mark Mejac
- **Practice Area:** Site Solutions
- **Industry:** Dry Cleaning

Description:

Previous subsurface investigations at a dry cleaner site in western Wisconsin revealed the presence of groundwater impacted with tetrachloroethene (PCE). The PCE-impacted groundwater covered an approximate 1-acre area and extended to depths of approximately 30 feet below ground surface within a poorly-buffered bedrock aquifer media. Based on technical feasibility, cost, and implementability criteria, groundwater remediation using enhanced anaerobic dechlorination (EAD) technology was recommended in 2009 in order to address the PCE-impacted groundwater.

Chlorinated volatile organic compounds (CVOCs) can be degraded to non-toxic daughter products by certain anaerobic microbes, which require reducing and moderate pH conditions to dechlorinate the CVOCs. An electron donor source is used in this approach to create reducing conditions. Use of dairy whey as an inexpensive electron donor was recommended for the subject site. Whey is a water soluble byproduct of the food industry and contains lactose and several mineral nutrients.

Applications of whey through injection wells occurred in December 2009, July 2010, November 2010, and June 2011. Injection of sufficient whey to maintain anaerobic conditions supportive of EAD adversely impacted aquifer pH. The reduced aquifer pH suppressed development of *Dehalococcoides* population such that accumulation of cis-1,2-dichloroethene occurred. To address this challenge, several pH buffers were added with the whey and bioaugmentation with microbial culture was conducted in November 2010. EAD within a poorly-buffered bedrock aquifer media is inherently challenging. However, within a 2-1/2 year timeframe after the initial whey electron donor injection event, the areal extent of PCE-impacted groundwater has substantially receded and maximum PCE concentrations have decreased by 2-1/2 orders-of-magnitude at the site. The results of future groundwater monitoring will be used to evaluate whether additional remedial action may be necessary, or if the site may be eligible for regulatory case closure.

RAMBOLL ENVIRON PROJECT SUMMARY

- **Project Name:** Sao Paulo, Brazil Facility
- **Project Charge Code:** BR-1101101
- **Project Location:** Sao Paulo, Brazil
- **Date Completed:** On-Going
- **Client Name:** Confidential
- **Principal-in-Charge / Project Manager:** Jeanne Tarvin/Mark Mejac
- **Practice Area:** Site Solutions
- **Industry:** Manufacturing

Description:

Production of heat exchangers and radiators at an industrial facility near Sao Paulo, Brazil, commenced during 1996. A subsurface investigation of this industrial facility conducted in 2007 revealed two separate areas of groundwater impacted with chlorinated volatile organic compounds (CVOCs), which cover an approximate 12-acre area and extend to depths of approximately 60 feet below ground surface. ENVIRON[1] was retained in October 2011 to complete an evaluation of remedial alternatives to address the CVOC-impacted groundwater. Based on technical feasibility, cost, and implementability criteria, ENVIRON recommended active groundwater remediation using enhanced anaerobic dechlorination (EAD) technology. The proposed strategy consists of a two-phased approach. Implementation of Phase 1 expeditiously restricts migration of impacted groundwater onto hydraulically downgradient properties. Phase 2 is designed to meet the groundwater remedial objectives modeled in a 2011 Human Health Risk Assessment report.

The operation of an EAD system works to create biologically active mixing zones for distributing amendments and enhancing the degradation of the CVOCs. This distribution of amendments can be accomplished by recovering groundwater with extraction wells, amending the groundwater with dilute solutions of a degradable food source such as molasses, ethanol and/or sodium lactate, buffers and nutrients, as necessary, and subsequently recharging the amended groundwater to the subsurface through recirculation wells. The areas in which this substrate is delivered become anaerobic due to the uptake of available electron acceptors to support respiration of the microbes, which provides the environment required for the EAD process to take place. This process has been shown to be more effective than other treatment processes including physical and chemical removal, and can be completed within a relatively short (several year) timeframe, depending on aquifer characteristics and groundwater flow rates. Application of EAD is a particularly attractive alternative in the vicinity of Sao Paulo because the average groundwater temperature is greater than 70ºF, which is approximately 20 degrees higher than groundwater temperatures in North America and Europe. The higher temperature may provide desired reaction rates up to twice as high as those commonly observed in more temperate climates. Additional benefits of EAD over other remedial technologies include: no air emissions, no need for the treatment or discharge of extracted groundwater, no waste by-products, and no use of toxic chemical reagents. ENVIRON is currently preparing engineering plans and specifications for the Phase 2 EAD system, Phase 1 of which became operational in late 2012.

[1] Effective May 1, 2015, the legal name of ENVIRON International Corporation became Ramboll Environ US Corporation.

APPENDIX B

Key Staff Resumes

RAMBOLL ENVIRON

ENVIRONMENT & HEALTH

JEANNE M. TARVIN

Principal

Jeanne Tarvin is a certified professional geologist with more than 30 years of consulting experience. Her project experience includes directing and managing transaction due diligence work, hydrogeologic studies, remedial investigations, landfill studies, feasibility studies, remedial designs and remedial actions under CERCLA, RCRA, TSCA and state-led programs. Responsible for technical quality, project execution, strategic direction and resource management. Her practice focuses on remediation and redevelopment of environmentally impaired properties, solid and hazardous waste management, environmental, health and safety due diligence for mergers and acquisitions, and contaminated sediment issues. Jeanne is currently a Gubernatorial Appointee to the Technical Advisory Committee for the Wisconsin Drycleaners Environmental Reimbursement Fund (DERF).

EDUCATION

BS, Engineering Geophysics
Michigan Technological University

Post-Graduate Studies, Hydrogeology
University of Wisconsin-Milwaukee

COURSES/CERTIFICATIONS

Certified Professional Geologist
Certified Hydrogeologist - Wisconsin
Professional Geologist - Wisconsin
OSHA 40-hour Hazardous Waste Operations and Emergency Response Standard - HAZWOPER
FRA Railroad Workplace Safety

PROJECTS

- Served as Project Principal on RI/FS and remediation for four Manufactured Gas Plant Sites in Wisconsin. Former member of MGP Advisory Committee for major utility in Midwest.
- Presented technical data/interpretation at public meetings on behalf of responsible parties.
- Performed as Project Manager for a Superfund NPL site in Central Wisconsin. Negotiated a Record of Decision Amendment to delete an Alternative Water Supply as part of

CONTACT INFORMATION

Jeanne M. Tarvin, PG, CPG

jtarvin@environcorp.com
+1 (262) 901-0085

Ramboll Environ
175 North Corporate Drive
Suite 160
Brookfield, WI 53045
United States of America

the final remedy. This Amendment saved the client millions of dollars over projected remedial action costs.

- Managed compliance audits and environmental permitting at several industrial sites and power plants.
- Served as Project Principal for development of a Remedial Action Work Plan for dredging at the Great Lakes Naval Station in Illinois. Negotiated dredging strategy with USEPA Region 5 and IEPA.
- Functioned as Project Manager for a RFI at an industrial facility in Little Rock, Arkansas. Negotiated a scope of work with the ADEQ and USEPA Region 6. The work is being completed under the USEPA Region 6 Corrective Action Strategy (CAS) Pilot Program.
- Performed as Project Principal on a RCRA Part B Permit Modification for a hazardous waste kiln in Missouri. Project included USEPA Region 3 negotiations, design plans and specifications and preparation of the permit modification.
- Managed and performed numerous environmental site assessments for property transfer including preparation of work plans for soil and groundwater sampling, soil gas surveying, interpretation of chemical analysis, development of remedial action plans and final report preparation.
- Served as Project Principal on Remedial Action Dredging Project for the Fox River Operable Unit One cleanup in Little Lake Butte Des Morts for a pulp and paper client. Responsible for developing remedial action work plans and overseeing remedial action as oversight engineer.
- Functioned as Project Principal on a RCRA 3013 Order for investigation at a steel manufacturing facility in Indiana. Responsible for negotiations with USEPA Region 5 and IDEM for development of a scope of work for investigation. Performed further investigation in an attempt to avoid a Corrective Action on the majority of the site. Corrective Action is proposed on the former Coke Plant location within the site.
- Served as Project Environmental Principal for confidential railroad derailment site in Illinois. Provided operation and maintenance services and developed a closure strategy on a groundwater pump and treatment system/bentonite containment wall installed in response to a release of 30,000 gallons of tetrachloroethene. In addition, performed a hydrogeologic evaluation and risk assessment of the remedial system performance to develop a closure strategy for the site.
- Investigated and closed industrial and commercial sites with chlorinated VOC impacts using natural attenuation and risk based evaluation. Successfully closed site using natural attenuation that were slated for active remediation by the WDNR.
- Performed geophysical surveys including seismic refraction, thermography, electromagnetics, electrical resistivity, downhole bore logging and subsurface interface radar for contamination assessments; development of groundwater monitoring plans, hydrogeologic analysis and engineering design of drilling activities for major exploration programs.
- Prepared siting studies, feasibility studies, hydrogeologic studies and facility designs for industrial and municipal landfills, including permitting.
- Functioned as Project Manager for preparation and negotiation of a RCRA Facility Investigation Work Plan at a solvent recovery facility in Wisconsin which contains nine SWMUs.
- Functioned as Project Manager for a pre-design study, remedial design and remedial action for two multi-million dollar Superfund NPL projects in Central Wisconsin. Directly responsible for USEPA Region 5 and WDNR negotiations, project scheduling and budgeting, development of project work plans, technical direction of NCP level field and laboratory testing program, regulatory liaison and preparation and review of technical work plans and reports.
- Performed as Project Principal on M&A projects involving portfolios of sites ranging from two sites to upwards of 100 sites. Responsible for directing project teams on quick turn projects and providing technical review. Developed and implemented probabilistic cost modeling on numerous sites for estimating environmental liabilities for clients and their environmental counsel. Strategies used for reducing liability risks have included Voluntary Party Liability Exemption tools in Minnesota, Wisconsin, New Jersey, Illinois and Michigan.

- Provided expert and fact witness testimony on contested cases involving hydrogeologic characterization, sediment costs and landfill design and operation.
- Served as Lead Auditor for a comprehensive environmental compliance audit for a large manufacturing facility. The audit addressed handling and storage of hazardous materials, storage and disposal of hazardous and special waste, spill response and spill containment, storm water regulations, wastewater permits and air emissions. The final report included an air emissions inventory and recommendations for a spill response plan, as well as improvements in hazardous waste stream management.
- Functioned as Project Manager on a Superfund site in Wisconsin. Negotiated a Record of Decision Amendment to remove the requirement for an active groundwater pump and treat system. Performed a corrective action on a failed landfill cover in 2009. The original design by another consultant was flawed. The new innovative cover was the largest application of a geoweb cover system in the Midwest.
- Performed as Project Manager for a RCRA Part B closure of four cupola sludge lagoons at an iron works foundry. Duties included a RFI and preparation and implementation of the closure plan. As part of the closure plan, a confirmation of removal of hazardous soils was performed and a groundwater monitoring system was installed.
- Responsible for negotiating Administrative Orders on Consent and Consent Decrees with state and federal regulatory agencies on Superfund, RCRA and state-led remediation projects.

OTHER ACTIVITIES

- Recipient of Supply Chain Award of Excellence for 1996 and 1997 from Wisconsin Electric
- Gubernatorial Appointment to the Technical Advisory Committee for the Drycleaners Environmental Reimbursement Fund (DERF) - current
- BT1 Client Service A-team's roster in 1996 for delivering truly superior client services
- Cost Effectiveness of the Horizontal Biosparge Well Application for Aerobic Co-Metabolic Groundwater Remediation, NGWA Remediation Conference
- Application of Horizontal Biosparge Wells for Aerobic Co-metabolic Groundwater Remediation, Eighth International In-Situ and On-Site Bioremediation Symposium
- Avoiding RCRA and CERCLA Liabilities, Client Training Seminar
- Waste Management, Risks and Liabilities, Client Training Seminar
- Brownfields From a Technical Standpoint, Brownfields Development in Wisconsin Seminar
- Mergers and Acquisitions: Audits and Due Diligence Strategies, STS Client Seminar
- Drycleaner Cleanup Rules Legislative Update, Wisconsin Fabricare Institute
- Spill Response Awareness Training, Client Training Seminar
- Remediation: A Case Study, Client Training Seminar
- Strategic Regulatory Negotiations, Client Seminar
- Comparison of Sludge Lagoon Covers, TAPPI Conference Proceedings

MEMBERSHIPS

American Institute of Professional Geologists (AIPG)
Federation of Environmental Technologists (FET)
National Water Well Association
Women Environmental Professionals

SCOTT W. TARMANN

Senior Manager

Scott Tarmann has over 24 years of experience with environmental and civil design projects, with particular emphasis on the application of remedial investigation, feasibility studies, remedial system performance evaluation, groundwater modeling, and remedial action design under Superfund, Resource Conservation and Recovery Act (RCRA) and state cleanup programs. His work has included technical design of *in situ* and *ex situ* remediation technologies to address organic and inorganic contaminants in soil and groundwater. His main focus has been primarily with technological applications involving enhanced *in situ* bioremediation, *in situ* solidification/ stabilization, soil vapor extraction, vapor intrusion mitigation, *in situ* thermal remediation processes, *in situ* chemical oxidation, hydraulic containment/control technologies, and permeable reactive barriers. His work has also included developing technical strategies for remediation, providing technical support for regulatory negotiations, conducting sophisticated remediation system performance evaluations and feasibility studies, and preparing technical design plans and specifications documents in support of construction bidding and implementation.

CONTACT INFORMATION
Scott W. Tarmann, PE

starmann@environcorp.com
+1 (262) 901-0093

Ramboll Environ
175 North Corporate Drive
Suite 160
Brookfield, WI 53045
United States of America

EDUCATION

BS, Civil and Environmental Engineering
University of Wisconsin - Madison

CERTIFICATIONS

Registered Professional Engineer: Wisconsin, Michigan, Indiana, Illinois, Minnesota, and Ohio

RELEVANT PROJECT EXPERIENCE

- Senior Project Manager responsible for investigating releases of chlorinated and petroleum volatile organic compounds to soil and groundwater at a former paint manufacturing facility in Milwaukee, WI. Performed extensive soil and groundwater sampling to characterize the sources of chemicals and describe risk-based impacts to groundwater. Utilized EPA's contained-in rule to manage contaminated soil as non-hazardous to implement a cost-effective remediation. Project objectives were also to determine the financial risks associated with the use of various short and long-term remedial approaches and to provide potential purchasers guidance on selecting the best alternative that met their goals and objectives for property redevelopment. Implemented

successful and cost-effective corrective action approaches to address impacted soils and groundwater to facilitate the transfer of the property and return it back into productive use. Responsibilities also included negotiating clean-up levels with WDNR during the development of remedial alternatives, identifying source remediation options that would lead to cost-effective risk reduction measures, coordinated site remediation activities with adjacent landowners and local government agencies, prepared detailed design plans and technical specifications, and prepared subcontractor bid documents, which included, site clearing/ demolition, applying storm water best management practices to conform with state requirements, removal/ excavation of source area soil, backfilling operations, utility relocation, shoring system installation, soil treatment and disposal, site capping, and site restoration activities.

- Remediation design engineer and project manager for an *in situ* chemical oxidation soil treatment remedy utilizing an innovative application methodology (rotating dual axis blending) to remediate 14,000 yd3 of trichloroethylene (TCE) impacted soil at a former electrical components manufacturing facility in southeast Wisconsin. Responsibilities included:
  - Developing attainable soil clean-up goals and objectives.
  - Evaluating chemical oxidation bench scale and pilot test results for chemical reagent selection and designing application dose rates.
  - Preparing remedial action plans, technical design plans and specifications.
- Remediation design engineer for the construction, operation, and monitoring of a thermal remediation system (electrical resistance heating [ERH]) to reduce source concentrations of CVOC in soil and groundwater at a former electronics manufacturing facility in central Indiana. Responsibilities included:
  - Conducted cost evaluations for various treatment configuration scenarios.
  - Assisted ERH subcontractor with the system construction and operation.
  - Designed vapor recovery systems for contaminant recovery and vapor intrusion mitigation.
  - Assisted with construction permitting and developed system monitoring plans for performance verification.
- Lead engineer for designing a soil vapor extraction (SVE) system to remediate CVOC impacted soil and to address soil vapor beneath a large manufacturing facility to reduce the risk of CVOC vapor intrusion. Technical responsibilities for the project included designing and coordinating SVE pilot studies, performing subsurface air-flow modeling to determine air-flow velocity and radius of influence for the design basis; air permitting and treatment system design; and, assessment of SVE system performance.
- Remedial design engineer responsible for the design and implementation of an enhanced bioremediation system involving reductive dechlorination of CVOC's in groundwater at a former electronics manufacturing facility. Responsibilities including designing an injection system to deliver substrate to a stratified groundwater aquifer to stimulate natural microorganisms to enhance the biodegradation of CVOC's. Assisted in the design of the bioremediation process evaluation to determine the optimal substrate for bioremediation and the required volumes needed to achieve remedial clean-up goals and objectives.
- Principal remedial design engineer responsible for the design and construction of a groundwater and DNAPL recovery system to remediate CVOC's in unconsolidated sediments and fractured bedrock at a former paper manufacturing facility in Neenah, WI. Responsibilities also included assisting in the design and implementation of source soil removal actions to remediate source area impacts to soil. Removal action design required evaluation of several shoring and soil stabilization techniques to protect building foundations and maintain structural integrity of the facility.
- Lead engineer responsible for designing a sub-slab vapor intrusion mitigation system to reduce indoor air CVOC concentrations and worker exposure at a former electronics manufacturing facility in Indiana. Challenges associated with the project included designing the vapor extraction and

piping distribution system within an extensive facility with numerous utilities and foundation obstacles and installing the system with minimal disruption to the existing tenant work spaces.

- Lead engineer in charge of designing, planning and implementing vapor intrusion mitigation systems to address petroleum hydrocarbon vapors from entering indoor air in approximately 100 homes downgradient of a petroleum refinery in southwest Illinois. Responsibilities included:
  - Preparing interim measure work plans, effectiveness monitoring plans, and directing vapor intrusion abatement measures for a large residential neighborhood affected by the release.
  - Interfacing with private homeowners, the potentially responsible party (PRP) Group, and the USEPA to present various alternatives for vapor intrusion mitigation.
  - Designing non-intrusive and aesthetic sub-slab depressurization systems to effectively reduce human health impacts.
  - Developing operation, maintenance and monitoring plans to document effectiveness.

PUBLICATIONS & PRESENTATIONS

Tarmann, Scott W. 2012. In Situ Chemical Oxidation Using Rotating Dual Axis Blending Technology. Proceeding of Fourth International Symposium and Exhibition on the Redevelopment of Manufactured Gas Plant Sites, Chicago, Illinois.

Hellerich, L., Tarmann, S.W., Curran, R., and Stevens, G. Mitigation Techniques for Existing Structures. Massachusetts LSPA – Vapor Intrusion Course. January 2009.

Tarmann, S.W., Gregg, W.M., and Lingle, J.W., 2004. Cost Allocation at a Former MGP and LUST Site, Neenah, WI. Proceeding of Gas Technology Institute Conference, Phoenix, Arizona.

Adams, T.V., Tarmann, S.W., and Sopcich, D.J., 2004. PRB Installation for TCE Remediation in a Bedrock Aquifer. Proceeding of Battelle Memorial Institute's 4th International Conference on Remediation of Chlorinated & Recalcitrant Compounds, Monterey, California.

STANLEY J. POPELAR

Senior Manager

Stanley Popelar has more than 30 years of experience in environmental consulting, geology, hydrogeology, hazardous waste management and applied science, with particular emphasis in site investigation, risk-based corrective action and remediation projects. He has extensive experience with clients in the Midwest and California performing environmental assessment and/or remediation of CERCLA, RCRA, LUST and voluntary brownfield sites, providing successful solutions for their environmental contaminant problems and regulatory compliance. He has provided litigation support and acted as an expert witness on matters related to environmental sampling and data analysis. The sites investigated and/or remediated involve numerous industries, including dry cleaning, steel and chemical manufacturing and recycling, retail petroleum, machine tool manufacturing, construction equipment maintenance facilities, coal storage and transfer yards, railroad warehouse and bulk oil facilities, property development, military installations and landfills. Stan has also conducted geological and hydrogeological evaluations of proposed low-level radioactive disposal facilities, bedrock tunnel routes beneath Lake Michigan, offshore marine platform sites, and existing and proposed aggregate and silica quarries.

CONTACT INFORMATION
Stanley J. Popelar, PG

spopelar@environcorp.com
+1 (312) 288-3858

Ramboll Environ
333 West Wacker Drive
Suite 2700
Chicago, IL 60606
United States of America

EDUCATION

MS, Geology
California State University

BS, Geology
California State University

COURSES/CERTIFICATIONS

Professional Geologist – Illinois and California
OSHA and USEPA 40-hour Health and Safety Training Course
OSHA and USEPA 8-hour Health and Safety Refresher Course, Annual
OSHA 8-hour Health and Safety Supervisor Training
American Red Cross-Certified CPR/First Aid Training
Project Manager Training, Smith Culp Consulting
Hydrogeology Short Course, Harding Lawson Associates
Organic Chemistry of Hazardous Materials and Their By-Products, University of California, Irvine
Biotransformation of Chlorinated Solvents, University of California, Irvine
Introduction to Groundwater Geochemistry, Association of Groundwater Scientists

Principles of Hazardous Materials Management, University of California, Irvine
Instrumental Analysis of Hazardous Materials, University of California, Irvine
Hazardous Materials, Wastes and Dangerous Goods Shipping Paper Preparation, Government Service Institute

PROJECTS

Litigation Support

- Provided litigation support and expert testimony in the field of environmental sampling and remediation. Specific expertise includes evaluation of environmental sampling plans and data analysis.

Voluntary Cleanup

- Performed environmental site assessment, risk assessment, and an evaluation of areas of potential concerns and developed a risk-based closure strategy for a 45-acre former manufacturing site. The site had a 100-year history of heavy manufacturing, chlorinated volatile organic chemical and petroleum solvent use, and was located along a lakefront that the local city government had targeted for redevelopment. The client decided to decommission site facilities, deal with any environmental concerns and sell the property. As a result of these activities the city acquired portions of the site under eminent domain, for construction of roads and bike paths. The challenge was to evaluate appropriate cleanup criteria for the proposed land uses, and to develop cost effective remedial solutions that would protect the health and safety of potential future users of the site. Project required dealing with eminent domain concerns, evaluation of changing regulatory criteria and requirements, coordinating activities with the client's site decommissioning contractors, and responding under short time frames to evaluate discovered site conditions. Prepared a site remedial action plan that presented a risk-based evaluation of soil and groundwater impacts to prevent unnecessary remediation at the site.
- Served as project manager and technical lead for a project that involved an active manufacturing facility that historically utilized an on-site water supply well until the county sampled the well and determined that the water contained chlorinated volatile organic compounds. The Michigan Department of Environmental Quality (MDEQ) requested that the facility owner conduct a remedial investigation to evaluate the nature and extent of impact in accordance with the Michigan Environmental Response Act. Site investigations were conducted in several phases to define impacts to soil and groundwater, aquifer pump tests were conducted to define aquifer characteristics, and risk assessment was conducted to evaluate potential health and safety concerns. A feasibility study was prepared, and an off-site investigation was conducted to evaluate potential off-site impacts.
- Served as the project manager and environmental consultant for Liquidating Trustee responsible for assessing and addressing environmental response actions at 56 former railroad-related properties. Duties have included coordination of a due diligence and remediation program of Trust owned properties located in Minnesota, Wisconsin, Iowa, Indiana and Missouri under the oversight of the USEPA. Related follow-up work included the closure of two Iowa sites through the Iowa Department of Natural Resources, ten Minnesota sites through the Minnesota Pollution Control Agency Petroleum Remediation Program, and the Minnesota Department of Agriculture for agricultural chemical releases, and four Wisconsin sites through the Wisconsin Department of Natural Resources. Additional duties included monitoring USEPA actions at a Trust related southeast Minneapolis national priorities list (NPL) site.
- Served as project and technical manager for the redevelopment of a 66-acre, former steel mill brownfield site, allowing the property to be put back into productive use as a heavy equipment maintenance and storage facility for a large construction company. The site is located in an area of heavy industrial use, is surrounded on two sides by a river, and has about five acres of natural wetland along another site boundary. Received no further remediation (NFR) status for the site using a combination of hot-spot soil remediation (6,800 tons of impacted soil), partial wetland replacement, the use of a site-wide engineered barrier and risked-based closure.
- Worked with a Chicago-area developer to remediate six acres of industrial property to allow redevelopment and residential use through the Illinois Site Remediation Program (SRP). The

property was formerly used for the production of electrical relays and circuit boards, and was located in the middle of a residential neighborhood. The facility was idle and had become an eyesore and a source of anxiety for the local residents. Cleanup of the site by the previous owner had been begun, but was halted due to local resident concerns. Initial work involved the detailed review of pre-existing environmental data and reports, and the evaluation of the feasibility and cost of remedial alternatives to clean the site. Additional follow-up work included an asbestos survey, soil sampling to verify site conditions, and a Phase I environmental assessment of an adjoining parcel. Pilot testing of an in situ remedial oxidation method was also conducted. Upon completion of this work, assisted in addressing community concerns by presenting planned remediation work to focused neighborhood committees and to the general public at community meetings, and then began remediation under the Illinois SRP. Soil excavation and off-site disposal was the selected remedial alternative, and involved the use of structural shoring to excavate to depths of 28 feet, and coordination with a gas company and other property owners to prevent damage to a natural gas substation and other nearby structures. A clean soil engineered barrier was utilized in one area to prevent costly excavation and replacement of a storm sewer. Approximately 7,100 cubic yards of hazardous and non-hazardous soil were excavated and transported off-site for disposal during two phases of remediation work; site completion reports were prepared, and two NFR letters were issued by the Illinois Environmental Protection Agency (IEPA). The site was featured as a “success story” by the IEPA in their 2002 SRP Annual Report (www.epa.state.il.us/land/site-remediation/annual-reports/index.html).

- Served as project and technical manager for work related to a self-implemented polychlorinated biphenyl (PCB) cleanup of an out-of-service above ground storage tank (AST) and the related concrete secondary containment structure. Prepared a remediation work plan for submittal and approval of USEPA Region 5. Supervised the confined-entry cleanup contractor and performed post-remediation sampling of both porous and non-porous surfaces located in a low occupancy area. Documented remediation work and post-remediation sampling in a written report.
- Participated in the redevelopment of a brownfield located in Sterling, Illinois, formerly an electric arc furnace steel mill (mini-mill). Conducted bedrock groundwater investigations that successfully led to less restrictive remediation objectives. Investigation efforts were coordinated with local government officials allowing access to brownfield grant monies made available by the city of Sterling. At the 2004 Brownfield Association Conference, the Deputy Director of the Illinois SRP considered the steel company to be one of the four top brownfield redevelopment success stories in Illinois.
- Participated in a voluntary cleanup project of an auto part manufacturer. The industrial facility had a light nonaqueous phase liquid (LNAPL), which existed beneath the building slab that contained PCBs. The project included the design, construction and operations and maintenance of a product recovery system. The PCB-containing oil that was collected was held in a containment area and was shipped off-site for incineration. Over 6,000 gallons of LNAPL was removed from the site over a five-year period.
- Performed site assessment and evaluated the extent of impact related to former site operations at an Illinois site. Conducted site remediation that consisted on excavating approximately 200 yards of metal and cyanide impacted soil from beneath a building; restored site facilities.
- Conducted site assessments at seven locations at a California military base. Field duties included supervision of a five member field crew in a high security area, geologic logging of 80 soil borings and installation and sampling of three groundwater monitoring wells. Compiled and evaluated data, prepared reports and conducted a follow-up investigation at one locality.
- Conducted preliminary site assessment prior to new construction at a California military base. Field activities included directing use of a backhoe to collect shallow soil samples from glacial till deposits. Coordinated a three-member field crew with base personnel to conduct investigation.

Resource Conservation and Recovery Act

- Served as project and technical manager for environmental work at a California RCRA site. Work included soil and groundwater site investigation, and developing and implementing a monitoring program to evaluate the migration of chlorinated volatile organic compounds through groundwater. Designed soil gas monitoring network, and performed and evaluated a soil vapor extraction (SVE) pilot test.

- Served as project and technical manager for work related to a RCRA feasibility investigation (RFI) at a 23-acre sulfuric acid recycling facility in Hammond, Indiana. The purpose of the RFI was to evaluate the nature and extent of on-site releases of hazardous waste or hazardous waste constituents and to gather all necessary data to support a corrective measures study. The RFI was organized and implemented using four related documents, including a RFI work plan, a community relations plan, a quality assurance project plan, and a site safety and health plan. Field work associated with the RFI involved the installation of three piezometers, seven groundwater monitoring wells, and drilling and sampling 70 soil borings. By negotiating with the Indiana Department of Environmental Management (IDEM) to install groundwater wells along the site perimeter, avoided having to install wells at each solid waste management unit (SMWU) and areas of concern (AOC), resulting in substantial savings to the client. The collected data was used to develop a remedial strategy and utilize Indiana Risk Integrated System of Closure (RISC) to develop site-specific cleanup objectives for soil that resulted in no further action at 11 SWMUs and AOCs, and eliminated further investigation at seven other SWMUs and AOCs.
- Served as project and technical manager for characterization and remediation of chromium-impacted soil and groundwater at an Illinois RCRA site. Evaluated site geology and hydrogeology, conducted aquifer tests and analysis, designed and installed a groundwater extraction and containment system. Conducted a risk-based analysis to achieve closure of site soil issues. Established a groundwater management zone for the site with the IEPA; negotiated elimination of select compounds present at background concentrations from inclusion into the Groundwater Management Zone. Oversaw operation of groundwater extraction system, remediated groundwater to below clean up objects and moved site into post-remediation monitoring prior to site closure.

Leaking Underground Storage Tank

- Supervised installation of 40 steam injection and 40 dual phase extraction wells for the remediation of soil impacted by 140,000 gallons of diesel fuel. Work included continuously coring numerous borings to a depth of 60 feet to verify site stratigraphy and preparing isopach maps of the lower confining bed. Installed well cluster network to monitor shallow and deep aquifers. Installed temperature probes to monitor migration of steam front during remediation. Abandoned numerous site wells using mud rotary drilling techniques. Performed monthly groundwater monitoring and periodic sampling at 30 site wells.
- Conducted the removal of a 10,000-gallon fuel oil underground storage tank (UST) and remediation and closure of the resulting LUST incidents. Received an NFR letter from the IEPA approximately two months after tank removal.
- Served as project manager and technical lead of a project that involved the removal of five USTs and closure of the resulting two LUST incidents. The USTs were discovered during remediation of impacted soil related to a historical release incident at the site. Work included oversight of the removal of the USTs and the over-excavation and disposal of petroleum impacted soil. Required reports, including 20-day, 45-day/corrective action completion reports were prepared in accordance with Illinois LUST regulations. Met clients demanding site re-development construction deadlines and received as NFR letter from the IEPA to close the incidents.
- Managed project to conduct site classification for two LUST incidents at a municipal service center in Illinois. Provided technical support for field personnel, evaluated collected data, prepared site classification completion Reports and received two NFR letters to close the LUST incidents.
- Served as the project and technical manager for the remediation and closure of two LUST incidents with the receipt of an NFR from the IEPA. The USTs were discovered during demolition of a former school, demolished to make way for the construction of a new residential subdivision. Remediation work was conducted that involved oversight of the removal of the USTs and the over-excavation and disposal of petroleum impacted soil. Required reports, including 20-day, 45-day/corrective action completion reports were prepared in accordance with Illinois LUST regulations. Although the majority of the former school property had been purchased by the developer, during remediation work, it was discovered that the USTs were located on portion of the property that would become a future road, and would remain in the possession of the city. Therefore, the project also involved dealing with city representatives to obtain an NFR for the two LUST incidents.

- Served as project and technical manager for the remediation and closure of two LUST incidents related to three USTs that were discovered during demolition of several structures, demolished to make way for the construction of a new high-density residential housing. Remediation work was conducted that involved oversight of the removal of the USTs and the over-excavation and disposal of petroleum impacted soil. . Required reports, including 20-day, 45-day and free product removal reports were prepared and submitted to the IEPA LUST Division. Transferred the LUST incidents to the SRP by submitting an election to proceed under the SRP and a remedial action completion report to the IEPA SRP Group, so that closure of the LUST incidents could become part of a draft NFR letter that had already been issued for the site. A revised draft NFR letter has been issued by the IEPA, and the final NFR will be issued upon the construction an engineered barrier (concrete floor slab) at several locations on the site.
- Served as a project manager for work related to a Voluntary Remediation Program (VRP)/LUST site with a subsurface dielectric oil release from underground piping associated with an AST farm. Initial work involved evaluation of tank removal sampling data, and performance of site investigations to fully delineate that extent of impacted soil and groundwater in the vicinity of the former UST and in the vicinity of the underground piping release. Entered site into Indiana VRP. Prepared assessment reports and a remediation work plan to recover free product dielectric oil from the subsurface.
- Evaluated effectiveness of dual vapor extraction/groundwater extraction remediation system. Provided technical review of corrective action completion report; received NFR closure of LUST incident. Provided assistance with LUST reimbursement paperwork.
- Served as a project manager for environmental work at an Illinois photo-processing facility. Negotiated cleanup objectives and removed a waste photo processing chemical UST under the Illinois Pre-Notice program. Obtained clean closure letter ("4Y letter") from IEPA.
- Served as project manager and technical lead for environmental work at a Chicago-area adhesive manufacturing site. Negotiated site-specific soil and groundwater cleanup objectives for waste and raw material UST farm. Obtained no further action letter and closure of the LUST incident from the IEPA.
- Served as project manager and technical lead for environmental work at a California retail petroleum site. Conducted aquifer evaluation, and preliminary design of an SVE and groundwater pump-and-treat systems to remediate aromatic hydrocarbons in soil and groundwater resulting from a LUST incident.
- Served as project manager for a process tank removal project in California. Arranged for the removal of below-ground process tank, coordinated work with subcontractors, assisted in permitting, conducted soil sampling and arranged for hydrocarbon fingerprint analysis to identify hydrocarbons in soil.
- Served as the project manager and technical lead for environmental work at a California retail petroleum site. Conducted soil and groundwater assessment work; supervised natural gamma, neutron and induction logging at eight site wells; used collected data to assess the extent of free phase and dissolved phased contaminant plumes; assessed the presence of unconfined and semi-confined groundwater; and evaluated geologic constraints on the migration of contaminants in the subsurface.
- Served as project manager for a California UST removal project. Coordinated efforts with subcontractors, obtained permits, assigned field personnel to conduct South Coast Air Quality Management District monitoring and soil sampling, arranged soil disposal and prepared report documenting activities.
- Served as the project manager for a remedial investigation and vapor extraction pilot test in California. Prepared remedial action plan and a feasibility study. Managed interim remedial action and site monitoring. Supervised preparation of bid documents for construction of a vapor extraction system.

Geologic / Hydrogeologic / Geotechnical Evaluation

- Served as technical and field manager for a geological/hydrogeological/geotechnical evaluation of a two-mile-long bedrock tunnel route to be located approximately 150 feet below Lake Michigan. Project involved 24-hour-day field operations on a “jack-up” barge for a three- to four-week period.

Investigation work involved the logging of lake bed sediments and bedrock core down to depths of approximately 150 feet, and the collection and packaging of bedrock and sediment samples for laboratory geotechnical testing. Performed constant head injection packer testing at 20-foot intervals within the bedrock portions of the core holes. The core holes underwent downhole geophysical logging, and a marine seismic survey and bottom profiling were also conducted. Interpreted packer test data and assembled the collected data into an investigation report.

- Performed geologic/hydrogeologic evaluation of a proposed underground aggregate mine. Work involved researching publicly-available geological information, conducting on-site mapping of bedrock joint sets, reviewing available packer test data and preparing a report of findings. Presented information concerning site geology and hydrogeology at a meeting with representatives from a near-by electrical generating plant, and at a public meeting held to approve re-zoning of the site for use as an underground mine. The new zoning status was granted, thereby clearing the way for use of the site as an underground mine.
- Conducted mapping of chemical quality indicators for a proposed expansion of an existing Portland cement quarry. Utilized client-supplied chemical analysis and boring logs to contour C3S quality indicators, target limestone thickness, and overburden thickness in an area proposed for quarry expansion. Evaluated contoured data and made recommendations for additional data collection to help select areas for future mining.
- Conducted a hydrogeologic assessment to evaluate potential groundwater drawdown around a proposed open-pit silica sand quarry. The evaluation included the review of available local and regional stratigraphic, structural geologic and hydrogeologic information. Utilized available data to estimate future groundwater flow into the quarry and potential drawdown of the local groundwater table. Presented information at public meetings to address concerns about the potential for future mining activities to affect groundwater quality, and the potential for mine dewatering to drawdown groundwater levels in nearby water supply wells.
- Performed groundwater level drawdown evaluation for a proposed open-pit, aggregate quarry. Proposed site was located in the vicinity of the client's existing open-pit quarry, so water level drawdown data around the existing quarry was collected and used to evaluate potential drawdown around the proposed location.
- Performed hydrogeologic evaluation for a proposed open-pit, aggregate quarry. Evaluation work included the installation of a bedrock well and performing chemical sampling and hydraulic aquifer testing of the well. Collected data was used to evaluate potential future drawdown and to estimate the potential for offsite groundwater impacts to migrate on site during mining operations. Attended public meetings to present the results of the study.
- Served as project manager and technical lead for a hydrogeologic evaluation of groundwater flow conditions at an Illinois aggregate quarry. The evaluation included the review of available local and regional stratigraphic, structural geologic and hydrogeologic information. Additionally, surface geophysical data, collected by another consultant, was reviewed and utilized along with the information described above to identify structural or stratigraphic discontinuities, and to determine optimal drilling locations for the evaluation of groundwater flow. For the purpose of characterizing groundwater movement and production from bedrock, 2,300 feet of drilling was conducted and 11 bedrock groundwater monitoring wells were installed to depths ranging from to 87 to 300 feet below the base of the quarry floor. The bedrock wells were develop and monitored for water elevation. Groundwater contour maps were prepared and this data was evaluated. Planning and permitting work was conducted to install wells and evaluate glacial overburden geology, hydrogeology, and slope stability and bearing capacity of the soils.
- Served as field activities manager of a multi-million dollar geologic and hydrogeologic assessment to support the licensing effort for a proposed low-level radioactive waste disposal site. Developed and implemented technical procedures to conduct drilling, coring to a depth of 700 feet, and high technology geologic and hydrogeolgic logging work. Field logging and evaluation techniques included borehole geophysics, hydrophysical logging, vertical seismic profiling, packer tests and geochemical sampling. Conducted hydrogeologic analysis of site's fracture flow environment.

- Prepared geologic and hydrogeologic portions of an environmental impact report for a marine oil terminal. Researched historical seismic activity, geologic and hydrogeologic setting, and groundwater quality and improvement plans.
- Participated in geological/marine investigation for siting of an offshore oil platform. Prepared structural cross sections, bathymetry, isopach and geologic hazard maps using high resolution seismic data; X-rayed and described shallow marine cores.
- Participated in the geotechnical investigation of the quantity and geotechnical properties of potential fill material located in select borrow sites at a military base. Performed aerial photography interpretation and mapping, geotechnical data evaluation and report preparation.

Health and Safety/Environmental Compliance Audit

- Associated with acquisition of real property, along with merger and acquisitions. Sites investigated include chemical and manufacturing plants, commercial properties, military bases, landfills, retail petroleum, petroleum storage and refining facilities, steel plants, aggregate quarries, silica quarries and marine harbor facilities.
- Conducted due diligence compliance audits of numerous manufacturing facilities. Audits included reviewing site manufacturing processes and evaluation of all facility air permits, wastewater and surface water discharge permits, handling of all hazardous and nonhazardous waste streams, and compliance with worker right-to-know, community right-to-know and other agency reporting requirements.
- Performed audit of clean construction debris acceptance program. Reviewed procedures and program documentation, provided a compliance evaluation and recommendations to assist the client with maintaining conformity with state law and the written program procedures.
- Performed annual environmental and health and safety audits of facility. Participated in pilot waste minimization projects. Developed and implemented SARA Title III worker right-to-know and community right-to-know reporting programs. Responsible for air pollutant emissions and wastewater discharge permitting, hazardous waste management, environmental compliance, and the facility's health and safety program. Supervised removal of the facility's USTs.
- Conducted training of consultants and contractors. Discussed appropriate health and safety procedures to be used during environmental site assessments.

PUBLICATIONS & PRESENTATIONS

Popelar, S. J. and F.W. Boelter, 2012. Redeveloping Abandoned Industrial Property Resolving a Stalemate with Local Government and a Neighboring Community. AIChE Conference, Indianapolis, Indiana.

Yaldezian, J.G., Popelar, S.J., and Fritsche, A.E., 1983. Movement of the Nacimiento fault in northern Santa Barbara County, in Andersen, D.W., and Rymer, M.J., eds., Tectonics and sedimentation along faults of the San Andreas Systems: Society of Economic Paleontologists and Mineralogists, Pacific Section, pp.11-15.

RAMBOLL ENVIRON

ENVIRONMENT & HEALTH

MARK M. MEJAC

Senior Manager

Mark Mejac has over 30 years of environmental consulting experience, which includes subsurface investigation, evaluation and implementation of innovative and cost-effective soil and groundwater remediation technologies, groundwater flow and contaminant transport modeling, and technical support for regulatory negotiations under CERCLA, RCRA and state led programs. His particular area of experience includes in-situ bioremediation, in-situ chemical reduction, and in-situ thermal remediation of groundwater impacted with chlorinated volatile organic compounds. He is a registered professional geologist in Wisconsin and Illinois.

EDUCATION

BS, Geological Sciences
University of Wisconsin-Milwaukee

MS, Geology
Northern Illinois University

COURSES/CERTIFICATIONS

Professional Geologist: Wisconsin, Illinois
NR 712 Wisconsin Certified Hydrogeologist
HAZWOPER 40-Hour and 8-Hour Supervisor Safety Training
Federal Railroad Association (FRA) Railroad Workplace Safety

PROJECTS

- Directed the remedial alternative selection and completed the conceptual design of an electron donor injection and groundwater recirculation system for remediation of a large-scale tetrachloroethene-impacted industrial facility located in Sao Paulo, Brazil. This cost-effective strategy includes a phased remedial approach using enhanced anaerobic dechlorination (EAD) technology that features groundwater recirculation to enhance electron donor distribution within the aquifer.
- Directed the technology selection and implementation of an enhanced reductive dechlorination system using groundwater recirculation, and prepared a Tier 2 remedial objective risk assessment for a northern Illinois industrial site affected with chlorinated volatile organic compounds (VOCs).
- Directed the technology selection and implementation of emulsified vegetable oil and/or whey electron donor injection and bioaugmentation technology at four chlorinated VOC impacted dry cleaner sites in Wisconsin.

CONTACT INFORMATION

Mark M. Mejac, PG

mmejac@environcorp.com
+1 (262) 901-0127

Ramboll Environ
175 North Corporate Drive
Suite 160
Brookfield, WI 53045
United States of America

- Directed the technology selection and implementation of an electro-thermal remediation system at a chlorinated VOC impacted industrial site in southeastern Wisconsin, which resulted in timely regulatory case closure.
- Directed the technology selection and implementation of a co-metabolic aerobic horizontal biosparge well groundwater remediation system at a southeastern Wisconsin industrial facility impacted with chlorinated VOCs. Received American Council of Engineering Companies (ACEC) 2006 Engineering Excellence State Finalist Award.
- Directed the technology selection and implementation of in-situ chemical reduction at an eastern Wisconsin industrial facility impacted with chlorinated VOCs.
- Managed a RCRA 3013 Order for investigations at a steel manufacturing facility in Indiana.
- Managed a site investigation and water supply alternatives evaluation for a former landfill in central Wisconsin that was previously a proposed National Priorities List (NPL) site.
- Managed a Superfund remedial investigation and risk assessment of a paper sludge lagoon facility located in northern Wisconsin.
- Managed a remedial investigation of a US Department of Energy facility in northern Illinois affected with radionucleides, VOCs and metals.
- Managed a feasibility study of remedial alternatives for a spent sulfite liquor contaminated paper mill site in northern Wisconsin.
- Managed the implementation of a Superfund remedial design Investigation of a trichloroethene-contaminated aquifer in central Nebraska, which involved analysis of a large-scale aquifer pumping test, followed by groundwater capture zone analysis to design a high-capacity groundwater extraction well field.
- Managed a soil and groundwater investigation of an industrial site in central Illinois affected with CVOCs as dense non-aqueous phase liquids, as well as metals and cyanide.
- Directed the technology selection and implementation of aerobic bioremediation of a petroleum hydrocarbon impacted agricultural property in southeastern Wisconsin, which resulted in rapid regulatory case closure.
- Directed the technology selection and implementation of aerobic bioremediation of a manufacturing facility located in northeastern Illinois, which was impacted by aromatic VOCs, resulting in regulatory case closure.
- Managed a site assessment and remedial action plan of a northeastern Illinois industrial facility affected with VOCs, which involved presentation of investigation results to the city's mayor and local organizations.
- Assisted in preparation of a RCRA Part B Permit Modification for a hazardous waste kiln in Missouri.
- Provided expert and fact witness testimony involving evaluations of source contributions and contaminant travel times.
- Provided environmental consulting services as part of a two-month professional exchange program in Arnhem, The Netherlands.

PUBLICATIONS & PRESENTATIONS

"A Geochemical Study of Surface Water-Groundwater Interaction in Lake Ellyn, Glen Ellyn, Illinois," unpublished Master's thesis, Northern Illinois University, 1984.

"Application of Analytical Contaminant Transport Modeling to Evaluate Public Health Risks," McGill University, Montreal, Canada, Guest Lecturer, February 1989.

"Application of Horizontal Biosparge Wells for Aerobic Co-Metabolic Groundwater Remediation," Proceedings of the Eighth International In-Situ and On-Site Bioremediation Symposium, June 2005, Baltimore, Maryland, Battelle Press, Columbus, Ohio.

"Cost Effectiveness of Horizontal Biosparge Well Application for Aerobic Co-metabolic Groundwater Remediation," Proceedings of the National Groundwater Association (NGWA) Conference on Remediation: Site Closure and the Total Cost of Cleanup, November 2005, Houston, Texas, NGWA Press, Westerville, Ohio.

"Horizontal Biosparge Wells: A Cost Effective and Rapid Groundwater Remediation Technology," Federation of Environmental Technologists (FET) Annual Conference and Exhibition, March 2006, Milwaukee, Wisconsin.

"Cost Effectiveness of Horizontal Biosparge Well Application for Aerobic Co-metabolic Groundwater Remediation," Railroad Environmental Conference, October 2006, Urbana, Illinois.

"In-Situ Electro-Thermal Remediation of Chlorinated VOCs: Full-Scale Evaluation," Proceedings of the Battelle Sixth International Conference on Remediation of Chlorinated and Recalcitrant Compounds, May 2008, Monterey, California, Battelle Press, Columbus, Ohio.

"Enhanced Anaerobic Dechlorination Case Studies: Challenges and Solutions," Proceedings of the Battelle Second International Symposium on Bioremediation and Sustainable Environmental Technologies, June 2013, Jacksonville, Florida, Battelle Press, Columbus, Ohio.

"Challenges Associated with Large-Scale Enhanced Anaerobic Dechlorination Near Sao Paulo, Brazil," Battelle Ninth International Conference on Remediation of Chlorinated and Recalcitrant Compounds, May 2014, Monterey, California.

HONORS AND AWARDS

ASFE "Fundamentals of Professional Practice," magna cum laude, 2008

APPENDIX C

Summary of Project Costs

State of Wisconsin
Department of Natural Resources
Box 7921, Madison, WI 53707-7921

Dry Cleaner Environmental Response Program
Interim and Remedial Action Bid Proposals Summary

Form 4400-212 (R 4/04)

Notice: This form is authorized under s. 292.65, Wis. Stats., and ch. NR 169, Wis. Adm. Code. The following information about the selection of consultants for interim actions, site investigations, and remedial action activities is required under ch. NR 169, Wis. Adm. Code. There are no penalties for failing to complete this form, but persons who do not complete and submit this form will not be eligible for reimbursement under this program. Personal information is not intended to be used for any other purpose other than that for which it is originally being collected. Information will be made available to requesters under Wisconsin's Open Records laws (s. 19.32-19.39, Wis. Stats.) and requirements.

Instructions: Complete this form and attach a copy of the accepted signed bid. See reverse side for detailed instructions. ***Copy this form as necessary.***

Applicant Information

Applicant Name	Business Name
James Small	Erlich Family Limited Partnership
Dry Cleaning Facility Name	**Location**
Former Express Cleaners	3921-41 Street, Racine, Wisconsin

Consultant Information

Consultant Name	Bid Proposal Amount	Consultant Selected (select one)
Ramboll Environ US Corporation	$386,842	☐
		☐
		☐
		☐
		☐

If this summary is being provided as part of a reimbursement application, did your actual costs exceed the proposal costs by more than $3,000 or 5% of the original estimate (whichever is larger).

☐ Yes ☐ No

If yes, send a copy of the accepted amendment, signed by the DNR project manager.

Certification

I certify that the information co

Applicant Signature	Date Signed

ntained above is true and correct to the best of my knowledge.

Department Use Only		
Project Manager Signature	Date	Telephone Number

Consultant Selection	Reason For Rejection/Notes
☐ Accepted ☐ Rejected	

Instructions

You are required to submit this form with a copy of the signed accepted bid. The accepted bid must be signed by both the applicant and the Project Manager.

You are required to provide the bid proposals summary information on this form for interim and remedial actions.

a. Fill in applicant name, applicant business name, dry cleaning facility name and location.

b. Submit this form with the Dry Cleaner Environmental Response Program Application, Form 4400-211 to your DNR region Remediation and Redevelopment project manager.

c. **Attach a copy of the accepted proposal for services,** including copies of any records of contract negotiations. Remember to code the detailed costs on the accepted bid proposal to the program's standard cost categories. Also submit a copy of all signed amendments.

See the application instructions for information on coding bid proposals for reimbursement..

Definition of Form Sections

Applicant Information: Enter your name and check the appropriate box indicating why you are submitting this form.

Applicant Additional Information: If you are submitting this form to obtain DNR approval to select a consultant other than the lowest bidder, enter your mailing address and telephone number. Enter your fax number and e-mail address if you have them.

Consultant Information: Check the appropriate box to indicate the type of response action services you solicited bid proposals for. For each consultant that you received a bid proposal from (the program requires a minimum of three), list their name, the total amount of their bid proposal, and then in the "Consultant Selected" column check one box to indicate the consultant that you selected or would like to select. If you are submitting this form with a reimbursement application, check the box to indicate whether your actual costs exceeded the original proposal costs by more than $3,000. **Certification:** Sign and date the application, certifying that the information you are submitting is true and correct.

FOR ADDITIONAL INFORMATION: see ch. NR 169.23, Wis. Adm. Code, Consulting and Contract Services, and publications RR #631, The Dry Cleaner Environmental Response Program and RR #635, Hiring a Consultant - What You Should Know. Contact your DNR regional Remediation and Redevelopment project manager, if you have any questions.

Site Name: *Former Express Cleaners*
BRRTS #: *02-52-547631*
Type of Action: *In Situ Soil Blending, VI Sampling and Groundwater Natural Attenuation Monitoring*

Dry Cleaner Environmental Response Program
Reimbursement Cost Detail Linking Spreadsheet **Form 4400-214D (R 08/12)**

TASKS	BUDGET				INVOICES						DERF COST BREAKOUT (this claim)									
Bid / Budgeted Description	Bid / Budgeted Amount	INSERT	Total Approved Budget	Previous Claims (If applicable)	*Provider Name, Invoice #, Billing Date*	*Provider Name, Invoice #, Billing Date*	*Provider Name, Invoice #, Billing Date*	*Provider Name, Invoice #, Billing Date*	INSERT	Total Invoiced Costs	A Soil Investigation	B Soil Remediation	C Groundwater Investigation	D Groundwater Remediation	E Air/Vapor Investigation	F Air/Vapor Remediation	G Lab & Other Analysis	H Miscellaneous Costs	Budget Remaining Use (-) to indicate cost over-run	% Task Complete, Remarks
Consultant Costs																				
1 Project Management and Setup, Contracts, HASP Preparation	$6,229		$ 6,229							$ -									$ 6,229	
2 Pre-Remediation Soil, GW Sampling & Abandonment MW3	$11,624		$ 11,624							$ -									$ 11,624	
3 Remedial Action Plan	$14,285		$ 14,285							$ -									$ 14,285	
4 Building Slab Removal	$4,065		$ 4,065							$ -									$ 4,065	
5 In-Situ Enhanced Reductive Dechlorination	$22,380		$ 22,380							$ -									$ 22,380	
6 Post-Remediation Confirmation Sampling	$2,427		$ 2,427							$ -									$ 2,427	
7 Well Replacement (MW3)	$1,801		$ 1,801							$ -									$ 1,801	
8 Well Installation (Optional - 1 Well)	$472		$ 472							$ -									$ 472	
9 Remedial Action Completion Report	$9,184		$ 9,184							$ -									$ 9,184	
10 MNA Groundwater Sampling (8 qtrs) & Reporting	$41,392		$ 41,392							$ -									$ 41,392	
11 Sub-Slab VI Sampling	$3,513		$ 3,513							$ -									$ 3,513	
12 Case Closure Reporting/GIS Registry	$8,685		$ 8,685							$ -									$ 8,685	
13 Final Well Abandonment	$3,783		$ 3,783							$ -									$ 3,783	
Consultant Cost Total	$ 129,840	$ -	$ 129,840	$ -						$ -									$ 129,840	
Sub-Contractor Costs																				
1 Project Management and Setup, Contracts, HASP Preparation	$0		$ -							$ -									$ -	
2 Pre-Remediation Soil, GW Sampling & Abandonment MW3	$11,691		$ 11,691							$ -									$ 11,691	
3 Remedial Action Plan	$0		$ -							$ -									$ -	
4 Building Slab Removal	$33,792		$ 33,792							$ -									$ 33,792	
5 In-Situ Enhanced Reductive Dechlorination	$186,919		$ 186,919							$ -									$ 186,919	
6 Post-Remediation Confirmation Sampling	$3,120		$ 3,120							$ -									$ 3,120	
7 Well Replacement (MW3)	$2,900		$ 2,900							$ -									$ 2,900	
8 Well Installation (Optional - 1 Well)	$1,640		$ 1,640							$ -									$ 1,640	
9 Remedial Action Completion Report	$0		$ -							$ -									$ -	
10 MNA Groundwater Sampling (8 qtrs) & Reporting	$12,000		$ 12,000							$ -									$ 12,000	
11 Sub-Slab VI Sampling	$1,540		$ 1,540							$ -									$ 1,540	
12 Case Closure Reporting/GIS Registry	$0		$ -							$ -									$ -	
13 Final Well Abandonment	$3,400		$ 3,400							$ -									$ 3,400	
Sub-Contractor Cost Total	$ 257,002	$ -	$ 257,002	$ -						$ -									$ 257,002	
DERF ELIGIBLE SUB-TOTALS	**$ 386,842**	**$ -**	**$ 386,842**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$-**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 386,842**	

Non-Eligible Expenses	Estimated Amount		Actual Amount							
1 Project Management and Setup, Contracts, HASP Preparation	$ -									
2 Pre-Remediation Soil, GW Sampling & Abandonment MW3	$ 795									
3 Remedial Action Plan	$ -									
4 Building Slab Removal	$ 29,121									
5 In-Situ Reductive Dechlorination	$ 2,121									
6 Post Remediation Confirmation Sampling	$ 150									
7 Well Replacement (MW3)	$ 150									
8 Well Installation (Optional - 1 Well)	$ -									
9 Remedial Action Completion Report	$ -									
10 MNA Groundwater Sampling & Reporting (8 qtrs)	$ 3,000									
11 Sub-Slab VI Sampling	$ 200									
12 Case Closure Reporting/GIS Registry	$ -									
13 Final Well Abandonment	$ 288								$ -	
Non-Eligible Cost Total	**$ 35,825**		$ -	$ -	$ -	$ -	$ -	$ -	$ -	
INVOICE GRAND TOTAL				**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	##	**$ -**
Check Numbers										

Total DERF Eligible Costs This Claim **$ -**

Table C-1. Remediation Cost Estimate Summary (Revision 3)
Express Cleaners, Racine Wisconsin

Task No.	Task Description	Ramboll Environ Labor and Expenses	Subcontractors	Subtotal	Ineligible Expenses	DERF Subtotal
1	Project Management and Setup, Contracts, HASP Preparation	$6,229	$0	$6,229	$0	$6,229
2	Pre-Remediation Soil & Groundwater Sampling & MW3 Abandonment	$12,419	$11,691	$24,110	$795	$23,315
3	Remedial Action Plan	$14,285	$0	$14,285	$0	$14,285
4	Building Slab and Foundation Removal*	$4,535	$62,443	$66,978	$29,121	$37,857
5	In-Situ Enhanced Reductive Dechlorination	$24,501	$186,919	$211,421	$2,121	$209,299
6	Post-Remediation Confirmation Sampling	$2,577	$3,120	$5,697	$150	$5,547
7	Well Replacement (MW3)	$1,951	$2,900	$4,851	$150	$4,701
8	Additional Well Installation (Optional - 1 Well)	$472	$1,640	$2,112	$0	$2,112
9	Remedial Action Completion Report	$9,184	$0	$9,184	$0	$9,184
10	MNA Groundwater Sampling & Reporting (8 qtrs)	$44,392	$12,000	$56,392	$3,000	$53,392
11	Pugh Oil Building Sub-Slab Sampling	$3,713	$1,540	$5,253	$200	$5,053
12	Case Closure Reporting/GIS Registry	$8,685	$0	$8,685	$0	$8,685
13	Final Well Abandonment	$4,071	$3,400	$7,471	$288	$7,183
	Total Estimate	**$137,014**	**$285,653**	**$422,667**	**$35,825**	**$386,842**

Notes:
* - For Task 4 Building Slab and Foundation Removal, DERF Eligible costs include $15,000 for building slab and foundation removal in area of soil treatment, supplemental laboratory analytical testing for disposal facility acceptance, hauling and disposal of contaminated concrete (est 125 tons) to disposal facility, removal of abandoned utilities in soil treatment area, and consultant oversight costs for testing and management of contaminated concrete removal/disposal. Ineligible expenses include subcontractor cost for removal and disposal of remaining concrete slab/foundation and asphalt parking lot.

COST SUMMARY FOR:	*Project Management & HASP*
	Express Cleaners - Task 1
PROJECT NUMBER:	P21-15124
PREPARED BY:	ST
DATE:	8/15/2016

COST SUMMARY	
Labor	$6,229
Expenses	$0
Subcontractors	$0
Total	$6,229

COST SUMMARY	
Task 1	$3,325
Task 2	$1,120
Task 3	$1,164
Task 4	$620
Totals	$6,229

TASK NO.	TASK DESCRIPTION	STAFF: RATE:	Principal $185	Manager 10 $155	Manager 9 $155	Manager 8 $134	Sr. Assoc 6 $118	Assoc 4 $88	Drafting $77	Support $65	DOLLARS	HOURS
1	Project management	*HOURS*	4	7	8					4		23
		DOLLARS	$740	$1,085	$1,240	$0	$0	$0	$0	$260	$3,325	
2	Contracts	*HOURS*	2		4					2		8
		DOLLARS	$370	$0	$620	$0	$0	$0	$0	$130	$1,120	
3	HASP	*HOURS*			1		8			1		10
		DOLLARS	$0	$0	$155	$0	$944	$0	$0	$65	$1,164	
4	Scheduling	*HOURS*		2	2							4
		DOLLARS	$0	$310	$310	$0	$0	$0	$0	$0	$620	
TOTAL HOURS BY CATEGORY			**6**	**9**	**15**	**0**	**8**	**0**	**0**	**7**		**45**
TOTAL DOLLARS BY CATEGORY			**$1,110**	**$1,395**	**$2,325**	**$0**	**$944**	**$0**	**$0**	**$455**	**$6,229**	

	1.00
	1.00

EXPENSE CATEGORY	COST FACTOR	PROJECT TASK NO. 1	2	3	4	5	6	7	8	9	DOLLARS
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
TASK TOTALS		**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

COST SUMMARY FOR:	*Pre-Remediation Sampling & Abandonment* *Express Cleaners - Task 2*
PROJECT NUMBER:	P21-15124
PREPARED BY:	ST
DATE:	8/15/2016

COST SUMMARY	
Labor	$10,232
Consultant Expenses	$2,187
Subcontractors	$11,691
Total	$24,110

COST SUMMARY	
Task 1	$9,537
Task 2	$1,670
Task 3	$0
Task 4	$12,903
	$24,110

TASK NO.	TASK DESCRIPTION	STAFF: RATE:	Principal $185	Manager 10 $155	Manager 9 $155	Manager 8 $134	Sr. Assoc 6 $118	Assoc 4 $88	Drafting $77	Support $65	DOLLARS	HOURS
1	gw sampling (15 wells)	*HOURS*		1	3		50			2		56
	Low flow	*DOLLARS*	$0	$155	$465	$0	$5,900	$0	$0	$130	$6,650	
2	Abandon MW3	*HOURS*	0	1	1		5			2		9
		DOLLARS	$0	$155	$155	$0	$590	$0	$0	$130	$1,030	
3	No report, data put into RAP	*HOURS*										0
		DOLLARS	$0	$0	$0	$0	$0	$0	$0	$0	$0	
4	Pre-remedial soil sampling	*HOURS*		2				24		2		28
	16 SB's	*DOLLARS*	$0	$310	$0	$0	$0	$2,112	$0	$130	$2,552	
TOTAL HOURS BY CATEGORY			**0**	**4**	**4**	**0**	**55**	**24**	**0**	**6**		**93**
TOTAL DOLLARS BY CATEGORY			**$0**	**$620**	**$620**	**$0**	**$6,490**	**$2,112**	**$0**	**$390**	**$10,232**	

	1.00
	1.00

CONSULTANT EXPENSES	COST FACTOR	PROJECT TASK NO. 1	2	3	4	5	6	7	8	9	DOLLARS
Rental Car	1.00	$500			$250						
		$500	$0	$0	$250	$0	$0	$0	$0	$0	**$750**
Car Mileage	0.565				80						
(Enter number of miles)		$0	$0	$0	$45	$0	$0	$0	$0	$0	**$45**
Field Supplies	1.00	$50			$15						
ice, DI water, etc.		$50	$0	$0	$15	$0	$0	$0	$0	$0	**$65**
Field Equipment	1.00	$1,077			$250						
3-day rental of Low flow GW sampling pump, YSI field parameter equip, flow cell, tubing, decon, water Level Indicator; PID (for soil)		$1,077	$0	$0	$250	$0	$0	$0	$0	$0	**$1,327**
CONSULTANT EXPENSE TOTALS		**$1,627**	**$0**	**$0**	**$560**	**$0**	**$0**	**$0**	**$0**	**$0**	**$2,187**
SUBCONTRACTOR COSTS											
Utility Clearance/Private Locator	1.00				$695						
		$0	$0	$0	$695	$0	$0	$0	$0	$0	**$695**
Surveyor	1.00				$3,500						
		$0	$0	$0	$3,500	$0	$0	$0	$0	$0	**$3,500**
Drilling Subcontractor	1.00		$640		$3,356						
		$0	$640	$0	$3,356	$0	$0	$0	$0	$0	**$3,996**
Analytical Laboratory Subcontractor	1.00	$1,260			$2,240						
Task 1 GW: 15 samples (VOC), 1 dup, 1 TB, 1 EB. Task 4 SOIL: 32 samples (VOC)		$1,260	$0	$0	$2,240	$0	$0	$0	$0	$0	**$3,500**
SUBCONTRACTOR TOTALS		**$1,260**	**$640**	**$0**	**$9,791**	**$0**	**$0**	**$0**	**$0**	**$0**	**$11,691**

COST SUMMARY FOR:	*RAP* *Express Cleaners - Task 3*
PROJECT NUMBER:	P21-15124
PREPARED BY:	ST
DATE:	8/15/2016

COST SUMMARY	
Labor	$14,285
Consultant Expenses	$0
Subcontractors	$0
Total	$14,285

COST SUMMARY	
Task 1	$8,938
Task 2	$2,850
Task 3	$2,497
	$14,285

TASK NO.	TASK DESCRIPTION	STAFF: RATE:	Principal $185	Manager 10 $155	Manager 9 $155	Manager 8 $134	Sr. Assoc 6 $118	Assoc 4 $88	Drafting $77	Support $65	DOLLARS	HOURS
1	RAP Preparation/permitting	*HOURS*		12	10		32		16	8		78
		DOLLARS	$0	$1,860	$1,550	$0	$3,776	$0	$1,232	$520	$8,938	
2	RAP QC Review	*HOURS*	2	8	8							18
		DOLLARS	$370	$1,240	$1,240	$0	$0	$0	$0	$0	$2,850	
3	Revisions to RAP and Submittal	*HOURS*	1	2	4		8		4	2		21
		DOLLARS	$185	$310	$620	$0	$944	$0	$308	$130	$2,497	
TOTAL HOURS BY CATEGORY			**3**	**22**	**22**	**0**	**40**	**0**	**20**	**10**		**117**
TOTAL DOLLARS BY CATEGORY			**$555**	**$3,410**	**$3,410**	**$0**	**$4,720**	**$0**	**$1,540**	**$650**	**$14,285**	

	1.00
	1.00

EXPENSE CATEGORY	COST FACTOR	PROJECT TASK NO. 1	2	3	4	5	6	7	8	9	DOLLARS
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
EXPENSE TOTALS		**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

COST SUMMARY FOR:	*Concrete Slab Removal* *Express Cleaners - Task 4*
PROJECT NUMBER:	P21-15124
PREPARED BY:	ST
DATE:	8/17/2016

COST SUMMARY	
Labor	$4,065
Consultant Expenses	$470
Subcontractors	$62,443
Total	$66,978

COST SUMMARY	
Task 1	$66,978
Task 2	$0
Task 3	$0
Task 4	$0
Task 5	$0
Task 6	$0
	$66,978

TASK NO.	TASK DESCRIPTION	STAFF: RATE:	Principal $185	Manager 10 $155	Manager 9 $155	Manager 8 $134	Sr. Assoc 6 $118	Assoc 4 $88	Drafting $77	Support $65	DOLLARS	HOURS
1	Contractor Coordination & Field Oversight	*HOURS*	1	2	6			30				39
		DOLLARS	$185	$310	$930	$0	$0	$2,640	$0	$0	$4,065	
TOTAL HOURS BY CATEGORY			**1**	**2**	**6**	**0**	**0**	**30**	**0**	**0**		**39**
TOTAL DOLLARS BY CATEGORY			**$185**	**$310**	**$930**	**$0**	**$0**	**$2,640**	**$0**	**$0**	**$4,065**	

	1.00
	1.00

CONSULTANT EXPENSES	COST FACTOR	PROJECT TASK NO. 1	2	3	4	5	6	7	8	9	DOLLARS
Rental Car	1.00	425									
		$425	$0	$0	$0	$0	$0	$0	$0	$0	**$425**
Car Mileage (Enter number of miles)	0.565	80									
		$45	$0	$0	$0	$0	$0	$0	$0	$0	**$45**
CONSULTANT EXPENSE TOTALS		**$470**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$470**
SUBCONTRACTOR COSTS											
DEMO: Concrete slab, conc footing, asphalt removal, Load & Disposal (**non-contaminated** - Est 125 tons + 72 tons)	1.00	$23,603									
		$23,603	$0	$0	$0	$0	$0	$0	$0	$0	**$23,603**
DEMO: Concrete footing & slab Removal (~125 tons. Conc footings 140' x 5' x 1' ; slab 50' x 45' x 6") (**Contaminated**)	1.00	$19,048									
		$19,048	$0	$0	$0	$0	$0	$0	$0	$0	**$19,048**
Laboratory Analytical (Concrete Testing for Disposal (concrete footings); VOC and TCLP VOC - 6 samples)	1.00	$1,290									
		$1,290	$0	$0	$0	$0	$0	$0	$0	$0	**$1,290**
DEMO: Load 125 tons of **contaminated** concrete for disposal to Waste Management Metro landfill	1.00	$1,000									
		$1,000	$0	$0	$0	$0	$0	$0	$0	$0	**$1,000**
Transportation of **contaminated** concrete to Metro Landfill ($270.00/load x 20 loads)	1.00	$5,670									
		$5,670	$0	$0	$0	$0	$0	$0	$0	$0	**$5,670**
Abandoned Utility Removal (in area of soil treatment only)	1.00	$6,832									
		$6,832	$0	$0	$0	$0	$0	$0	$0	$0	**$6,832**
Disposal of estimated 250 tons of **contaminated** stockpiled concrete (@$40/ton)	1.00	$5,000									
		$5,000	$0	$0	$0	$0	$0	$0	$0	$0	**$5,000**
SUBCONTRACTOR TOTALS		**$62,443**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$62,443**

COST SUMMARY FOR:	*In-Situ Reductive Dechlorination* *Express Cleaners - Task 5*
PROJECT NUMBER:	P21-15124
PREPARED BY:	ST
DATE:	8/15/2016

COST SUMMARY	
Labor	$22,380
Consultant Expenses	$2,121
Subcontractors	$186,919
Total	$211,421

COST SUMMARY	
Task 1	$211,421
Task 2	$0
Task 3	$0
Task 4	$0
Task 5	$0
Task 6	$0
	$211,421

TASK NO.	TASK DESCRIPTION	STAFF: RATE:	Principal $185	Manager 10 $155	Manager 9 $155	Manager 8 $134	Sr. Assoc 6 $118	Assoc 4 $88	Drafting $77	Support $65	DOLLARS	HOURS
1		*HOURS*	16	24	24		80	20		12		176
	Field Implementation of ZVI Soil Blending	*DOLLARS*	$2,960	$3,720	$3,720	$0	$9,440	$1,760	$0	$780	$22,380	
TOTAL HOURS BY CATEGORY			**16**	**24**	**24**	**0**	**80**	**20**	**0**	**12**		**176**
TOTAL DOLLARS BY CATEGORY			**$2,960**	**$3,720**	**$3,720**	**$0**	**$9,440**	**$1,760**	**$0**	**$780**	**$22,380**	

	1.00
	1.00

CONSULTANT EXPENSES	COST FACTOR	PROJECT TASK NO. 1	2	3	4	5	6	7	8	9	DOLLARS
Field vehicle	1.00	$1,850									
		$1,850	$0	$0	$0	$0	$0	$0	$0	$0	**$1,850**
Car Mileage (Enter number of miles)	0.565	480									
		$271	$0	$0	$0	$0	$0	$0	$0	$0	**$271**
ELEGIBLE CONSULTANT EXPENSE TOTALS		**$2,121**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$2,121**
SUBCONTRACTOR COSTS											
Contractor Mobilization & HASP	1.00	$2,530									
		$2,530	$0	$0	$0	$0	$0	$0	$0	$0	**$2,530**
Install 600 L.F. of silt fence around perimeter of work zone; Install Filter Fabric at storm sewer catch basins	1.00	$2,600									
		$2,600	$0	$0	$0	$0	$0	$0	$0	$0	**$2,600**
Install temporary chain link fence (panels) for site security (3-4 week rental)	1.00	$3,460									
		$3,460	$0	$0	$0	$0	$0	$0	$0	$0	**$3,460**
Excavate and load estimated 600 tons of excess c-soil for disposal	1.00	$4,800									
		$4,800	$0	$0	$0	$0	$0	$0	$0	$0	**$4,800**
Laboratory Analyses for excess c-soil waste disposal profile. 4 samples: VOC, TCLP Metals and TCLP VOC.	1.00	$1,440									
		$1,440	$0	$0	$0	$0	$0	$0	$0	$0	**$1,440**
Transport Excess Soil (Estimated 600 tons) to Waste Management Metro landfill ($270/load x 21 loads)	1.00	$5,670									
		$5,670	$0	$0	$0	$0	$0	$0	$0	$0	**$5,670**
Excess Soil Disposal (Estimated 600 tons) (Waste Management Metro landfill)	1.00	$31,667									
		$31,667	$0	$0	$0	$0	$0	$0	$0	$0	**$31,667**
Soil Blending Contractor (Redox Tech; Incl tax on materials purchased)	1.00	$111,399									
		$111,399	$0	$0	$0	$0	$0	$0	$0	$0	**$111,399**
0.5 ft of #6 crushed stone aggregate (105 CY)	1.00	$4,644									
		$4,644	$0	$0	$0	$0	$0	$0	$0	$0	**$4,644**
Potable Water	1.00	$770									
		$770	$0	$0	$0	$0	$0	$0	$0	$0	**$770**
Vapor monitoring & Control - RT Vapor analyzer (FTIR), Rusmar NTC-8 foam machine for 10-day period; incl 2-55 gallon drums of Rusmar foam	1.00	$17,230									
		$17,230	$0	$0	$0	$0	$0	$0	$0	$0	**$17,230**
Site restoration, removal of silt fence and temporary fencing & Demobilization	1.00	$2,150									
		$2,150	$0	$0	$0	$0	$0	$0	$0	$0	**$2,150**
SUBCONTRACTOR TOTALS		**$186,919**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$186,919**

COST SUMMARY FOR:	*Post Remediation Confirmation Sampling* *Express Cleaners - Task 6*
PROJECT NUMBER:	P21-15124
PREPARED BY:	ST
DATE:	8/15/2016

COST SUMMARY	
Labor	$2,027
Consultant Expenses	$550
Subcontractors	$3,120
Total	$5,697

COST SUMMARY	
Task 1	$5,697
Task 2	$0
Task 3	$0
Task 4	$0
Task 5	$0
Task 6	$0
	$5,697

TASK NO.	TASK DESCRIPTION	STAFF: RATE:	Principal $185	Manager 10 $155	Manager 9 $155	Manager 8 $134	Sr. Assoc 6 $118	Assoc 4 $88	Drafting $77	Support $65	DOLLARS	HOURS
1	Post-remediation Conf Soil Sampling	*HOURS*		1	1		14			1		17
		DOLLARS	$0	$155	$155	$0	$1,652	$0	$0	$65	$2,027	
TOTAL HOURS BY CATEGORY			**0**	**1**	**1**	**0**	**14**	**0**	**0**	**1**		**17**
TOTAL DOLLARS BY CATEGORY			**$0**	**$155**	**$155**	**$0**	**$1,652**	**$0**	**$0**	**$65**	**$2,027**	

	1.00
	1.00

CONSULTANT EXPENSES	COST FACTOR	PROJECT TASK NO. 1	2	3	4	5	6	7	8	9	DOLLARS
Field vehicle	1.00	$150									
		$150	$0	$0	$0	$0	$0	$0	$0	$0	**$150**
Field Equipment (Ice, PPE, PID rental)	1.00	$400									
		$400	$0	$0	$0	$0	$0	$0	$0	$0	**$400**
CONSULTANT EXPENSE TOTALS		**$550**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$550**
SUBCONTRACTOR COSTS											
Geoprobe Contractor (8 soil probes to 9 ft)	1.00	2,000									
		$2,000	$0	$0	$0	$0	$0	$0	$0	$0	**$2,000**
Laboratory (16 soil samples for VOC analysis)	1.00	1,120									
		$1,120	$0	$0	$0	$0	$0	$0	$0	$0	**$1,120**
SUBCONTRACTOR TOTALS		**$3,120**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$3,120**

COST SUMMARY FOR:	*Well Replacement (mw3)* *Express Cleaners*
PROJECT NUMBER:	P21-15124
PREPARED BY:	ST
DATE:	8/16/2016

COST SUMMARY	
Labor	$1,551
Consultant Expenses	$400
Subcontractors	$2,900
Total	$4,851

COST SUMMARY	
Task 1	$4,851
Task 2	$0
Task 3	$0
Task 4	$0
Task 5	$0
Task 6	$0
	$4,851

TASK NO.	TASK DESCRIPTION	STAFF: RATE:	Principal $185	Manager 10 $155	Manager 9 $155	Manager 8 $134	Sr. Assoc 6 $118	Assoc 4 $88	Drafting $77	Support $65	DOLLARS	HOURS
1	Well installation - Replacement of MW-3	*HOURS*		1	2		8		1	1		13
		DOLLARS	$0	$155	$310	$0	$944	$0	$77	$65	$1,551	
2	No Report - Included in Constr. Comp. Rpt	*HOURS*										0
		DOLLARS	$0	$0	$0	$0	$0	$0	$0	$0	$0	
TOTAL HOURS BY CATEGORY			**0**	**1**	**2**	**0**	**8**	**0**	**1**	**1**		**13**
TOTAL DOLLARS BY CATEGORY			**$0**	**$155**	**$310**	**$0**	**$944**	**$0**	**$77**	**$65**	**$1,551**	

	1.00
	1.00

CONSULTANT EXPENSES	COST FACTOR	PROJECT TASK NO. 1	2	3	4	5	6	7	8	9	DOLLARS
Field Vehicle	1.00	$150									
		$150	$0	$0	$0	$0	$0	$0	$0	$0	**$150**
Field Equipment and Supplies PID, water level meter, Bailer	1.00	$250									
		$250	$0	$0	$0	$0	$0	$0	$0	$0	**$250**
CONSULTANT EXPENSE TOTALS		**$400**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$400**
SUBCONTRACTOR COSTS											
Surveyor	1.00	$800									
		$800	$0	$0	$0	$0	$0	$0	$0	$0	**$800**
Drilling Subcontractor	1.00	$1,700									
		$1,700	$0	$0	$0	$0	$0	$0	$0	$0	**$1,700**
Drill Cutting Waste Disposal (1 drum)	1.00	$400									
		$400	$0	$0	$0	$0	$0	$0	$0	$0	**$400**
SUBCONTRACTOR TOTALS		**$2,900**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$2,900**

COST SUMMARY FOR:	*Well Installation (Optional)* *Express Cleaners - Task 8*
PROJECT NUMBER:	P21-15124
PREPARED BY:	ST
DATE:	8/16/2016

COST SUMMARY	
Labor	$472
Consultant Expenses	$0
Subcontractors	$1,640
Total	$2,112

COST SUMMARY	
Task 1	$2,112
Task 2	$0
Task 3	$0
Task 4	$0
Task 5	$0
Task 6	$0
	$2,112

TASK NO.	TASK DESCRIPTION	STAFF: RATE:	Principal $185	Manager 10 $155	Manager 9 $155	Manager 8 $134	Sr. Assoc 6 $118	Assoc 4 $88	Drafting $77	Support $65	DOLLARS	HOURS
1	Well installation (1 new well, cost assumes well will be installed at same time as the replacmt' well)	*HOURS*					4					4
		DOLLARS	$0	$0	$0	$0	$472	$0	$0	$0	$472	
2	No Report - Included in Constr. Comp. Rpt	*HOURS*										0
		DOLLARS	$0	$0	$0	$0	$0	$0	$0	$0	$0	
TOTAL HOURS BY CATEGORY			**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**		**4**
TOTAL DOLLARS BY CATEGORY			**$0**	**$0**	**$0**	**$0**	**$472**	**$0**	**$0**	**$0**	**$472**	

	1.00
	1.00

CONSULTANT EXPENSES	COST FACTOR	PROJECT TASK NO. 1	2	3	4	5	6	7	8	9	DOLLARS
Field Vehicle	1.00										
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
Car Mileage (Enter number of miles)	0.565										
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
Field Equipment and Supplies	1.00										
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
CONSULTANT EXPENSE TOTALS		**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
SUBCONTRACTOR COSTS											
Utility Clearance	1.00	$400									
		$400	$0	$0	$0	$0	$0	$0	$0	$0	**$400**
Drilling Subcontractor	1.00	$700									
		$700	$0	$0	$0	$0	$0	$0	$0	$0	**$700**
Drill Cutting Waste Disposal (1 drum)	1.00	$400									
		$400	$0	$0	$0	$0	$0	$0	$0	$0	**$400**
Laboratory Analytical (2 soil samples for VOC)	1.00	$140									
		$140	$0	$0	$0	$0	$0	$0	$0	$0	**$140**
SUBCONTRACTOR TOTALS		**$1,640**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$1,640**

COST SUMMARY FOR:	***Remedial Action Completion Report*** ***Express Cleaners - Task 9***
PROJECT NUMBER:	P21-15124
PREPARED BY:	ST
DATE:	8/16/2016

COST SUMMARY	
Labor	$9,184
Consultant Expenses	$0
Subcontractors	$0
Total	$9,184

COST SUMMARY	
Task 1	$5,438
Task 2	$990
Task 3	$2,756
Task 4	$0
Task 5	$0
Task 6	$0
	$9,184

TASK NO.	TASK DESCRIPTION	STAFF: RATE:	Principal $185	Manager 10 $155	Manager 9 $155	Manager 8 $134	Sr. Assoc 6 $118	Assoc 4 $88	Drafting $77	Support $65	DOLLARS	HOURS
1	Report Preparation	*HOURS*		4	8		24		8	2		46
		DOLLARS	$0	$620	$1,240	$0	$2,832	$0	$616	$130	$5,438	
2	Report QC Review	*HOURS*	2	4								6
		DOLLARS	$370	$620	$0	$0	$0	$0	$0	$0	$990	
3	Revisions to Report and Submittal	*HOURS*	2	2	6		6		4	2		22
		DOLLARS	$370	$310	$930	$0	$708	$0	$308	$130	$2,756	
TOTAL HOURS BY CATEGORY			**4**	**10**	**14**	**0**	**30**	**0**	**12**	**4**		**74**
TOTAL DOLLARS BY CATEGORY			**$740**	**$1,550**	**$2,170**	**$0**	**$3,540**	**$0**	**$924**	**$260**	**$9,184**	

	1.00
	1.00

CONSULTANT EXPENSES	COST FACTOR	PROJECT TASK NO. 1	2	3	4	5	6	7	8	9	DOLLARS
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
CONSULTANT EXPENSE TOTALS		**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

COST SUMMARY FOR:	*MNA GW sampling (Per Event)* *Express Cleaners - Task 10*
PROJECT NUMBER:	P21-15124
PREPARED BY:	ST
DATE:	8/16/2016

COST SUMMARY	
Labor	$4,374
Consultant Expenses	$1,175
Subcontractors	$1,500
Total	$7,049

8 Qtrs $56,392

COST SUMMARY	
Task 1	$5,097
Task 2	$1,952
Task 3	$0
Task 4	$0
Task 5	$0
Task 6	$0
	$7,049

TASK NO.	TASK DESCRIPTION	STAFF: RATE:	Principal $185	Manager 10 $155	Manager 9 $155	Manager 8 $134	Sr. Assoc 6 $118	Assoc 4 $88	Drafting $77	Support $65	DOLLARS	HOURS
1	Quarterly Sampling (Per Event)	*HOURS*			2			24				26
	8 wells, 1 Dup, 1 TB	*DOLLARS*	$0	$0	$310	$0	$0	$2,112	$0	$0	$2,422	
2	Reporting (Annual), Qrtly Data Submittals	*HOURS*	1	1	4		6		2	2		16
		DOLLARS	$185	$155	$620	$0	$708	$0	$154	$130	$1,952	
TOTAL HOURS BY CATEGORY			**1**	**1**	**6**	**0**	**6**	**24**	**2**	**2**		**42**
TOTAL DOLLARS BY CATEGORY			**$185**	**$155**	**$930**	**$0**	**$708**	**$2,112**	**$154**	**$130**	**$4,374**	

	1.00
	1.00

CONSULTANT EXPENSES	COST FACTOR	PROJECT TASK NO. 1	2	3	4	5	6	7	8	9	DOLLARS
Rental Car	1.00	$375									
		$375	$0	$0	$0	$0	$0	$0	$0	$0	$375
Car Mileage	0.565										
(Enter number of miles)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Field Equipment and Supplies (2-day rental of Low flow GW sampling pump, YSI field parameter equip, flow cell, Water Level Indicator; supplies - sample tubing, decon)	1.00	$800									
		$800	$0	$0	$0	$0	$0	$0	$0	$0	$800
CONSULTANT EXPENSE TOTALS		**$1,175**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$1,175**
SUBCONTRACTOR COSTS											
Laboratory Subcontractor	1.00	$1,500									
(10 samples VOCs and MNA parameters/wet chem)		$1,500	$0	$0	$0	$0	$0	$0	$0	$0	$1,500
SUBCONTRACTOR TOTALS		**$1,500**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$1,500**

COST SUMMARY FOR:	*Subslab VI sampling, 2 subslab locations* *Express Cleaners - Task 11*
PROJECT NUMBER:	P21-15124
PREPARED BY:	ST
DATE:	8/16/2016

COST SUMMARY	
Labor	$2,963
Consultant Expenses	$750
Subcontractors	$1,540
Total	$5,253

COST SUMMARY	
Task 1	$4,016
Task 2	$1,237
Task 3	$0
Task 4	$0
Task 5	$0
Task 6	$0
	$5,253

TASK NO.	TASK DESCRIPTION	STAFF: RATE:	Principal $185	Manager 10 $155	Manager 9 $155	Manager 8 $134	Sr. Assoc 6 $118	Assoc 4 $88	Drafting $77	Support $65	DOLLARS	HOURS
1	VI Sampling (Pugh Oil Bldg)	*HOURS*		2			12					14
		DOLLARS	$0	$310	$0	$0	$1,416	$0	$0	$0	$1,726	
2	VI report -will be included in RAP	*HOURS*			2		6		2	1		11
	Addl time needed shown	*DOLLARS*	$0	$0	$310	$0	$708	$0	$154	$65	$1,237	
TOTAL HOURS BY CATEGORY			**0**	**2**	**2**	**0**	**18**	**0**	**2**	**1**		**25**
TOTAL DOLLARS BY CATEGORY			**$0**	**$310**	**$310**	**$0**	**$2,124**	**$0**	**$154**	**$65**	**$2,963**	

	1.00
	1.00

CONSULTANT EXPENSES	COST FACTOR	PROJECT TASK NO. 1	2	3	4	5	6	7	8	9	DOLLARS
Fedex	1.00	$50									
		$50	$0	$0	$0	$0	$0	$0	$0	$0	**$50**
Rental Car	1.00	$150									
		$150	$0	$0	$0	$0	$0	$0	$0	$0	**$150**
Car Mileage	0.565										
(Enter number of miles)		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
Field Equipment and Supplies	1.00	$550									
(2 vapor pins, drill, helium detector, helium gas)		$550	$0	$0	$0	$0	$0	$0	$0	$0	**$550**
CONSULTANT EXPENSE TOTALS		**$750**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$750**
SUBCONTRACTOR COSTS											
Utility Clearance/private locator	1.00	$1,100									
		$1,100	$0	$0	$0	$0	$0	$0	$0	$0	**$1,100**
Laboratory Subcontractor	1.00	$440									
(2 Summa Can Samples - VOC TO-15 Analysis)		$440	$0	$0	$0	$0	$0	$0	$0	$0	**$440**
SUBCONTRACTOR TOTALS		**$1,540**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$1,540**

COST SUMMARY FOR:	*Case closure report and GIS submittal* *Express Cleaners - Task 12*
PROJECT NUMBER:	P21-15124
PREPARED BY:	ST
DATE:	8/15/2016

COST SUMMARY	
Labor	$8,685
Consultant Expenses	$0
Subcontractors	$0
Total	$8,685

COST SUMMARY	
Task 1	$4,032
Task 2	$990
Task 3	$1,639
Task 4	$2,024
Task 5	$0
Task 6	$0
	$8,685

TASK NO.	TASK DESCRIPTION	STAFF: / RATE:	Principal $185	Manager 10 $155	Manager 9 $155	Manager 8 $134	Sr. Assoc 6 $118	Assoc 4 $88	Drafting $77	Support $65	DOLLARS	HOURS
1	Closure Report Preparation	*HOURS*		4	8		16		2	2		32
		DOLLARS	$0	$620	$1,240	$0	$1,888	$0	$154	$130	$4,032	
2	Closure Report QC Review	*HOURS*	2	4								6
		DOLLARS	$370	$620	$0	$0	$0	$0	$0	$0	$990	
3	Revisions to Closure Report and Submittal	*HOURS*	1	1	4		4		1	2		13
		DOLLARS	$185	$155	$620	$0	$472	$0	$77	$130	$1,639	
4	GIS Registry	*HOURS*	2	2	6				2	4		16
		DOLLARS	$370	$310	$930	$0	$0	$0	$154	$260	$2,024	
TOTAL HOURS BY CATEGORY			**5**	**11**	**18**	**0**	**20**	**0**	**5**	**8**		**67**
TOTAL DOLLARS BY CATEGORY			**$925**	**$1,705**	**$2,790**	**$0**	**$2,360**	**$0**	**$385**	**$520**	**$8,685**	

	1.00
	1.00

CONSULTANT EXPENSES	COST FACTOR	PROJECT TASK NO. 1	2	3	4	5	6	7	8	9	DOLLARS
	1.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
	1.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
	0.565	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
	1.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
	1.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
	1.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
	1.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
	1.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
CONSULTANT EXPENSE TOTALS		**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

COST SUMMARY FOR:	*Post closure well abandonment* *Express Cleaners - Task 13*
PROJECT NUMBER:	P21-15124
PREPARED BY:	ST
DATE:	8/16/2016

COST SUMMARY	
Labor	$3,733
Consultant Expenses	$338
Subcontractors	$3,400
Total	$7,471

COST SUMMARY	
Task 1	$7,471
Task 2	$0
Task 3	$0
Task 4	$0
Task 5	$0
Task 6	$0
	$7,471

TASK NO.	TASK DESCRIPTION	STAFF: RATE:	Principal $185	Manager 10 $155	Manager 9 $155	Manager 8 $134	Sr. Assoc 6 $118	Assoc 4 $88	Drafting $77	Support $65	DOLLARS	HOURS
1	Well Abandonment			2	4		22		1	2		31
	16 wells	*DOLLARS*	$0	$310	$620	$0	$2,596	$0	$77	$130	$3,733	
TOTAL HOURS BY CATEGORY			**0**	**2**	**4**	**0**	**22**	**0**	**1**	**2**		**31**
TOTAL DOLLARS BY CATEGORY			**$0**	**$310**	**$620**	**$0**	**$2,596**	**$0**	**$77**	**$130**	**$3,733**	

	1.00
	1.00

CONSULTANT EXPENSES	COST FACTOR	PROJECT TASK NO. 1	2	3	4	5	6	7	8	9	DOLLARS
Rental Car	1.00	250									
		$288	$0			$0	$0	$0	$0	$0	**$288**
Car Mileage (Enter number of miles)	0.565										
		$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
Field Supplies	1.00	$50									
		$50	$0	$0	$0	$0	$0	$0	$0	$0	**$50**
CONSULTANT EXPENSE TOTALS		**$338**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$338**
SUBCONTRACTOR COSTS											
Driller	1.00	$3,400									
		$3,400	$0	$0	$0	$0	$0	$0	$0	$0	**$3,400**
SUBCONTRACTOR TOTALS		**$3,400**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$3,400**

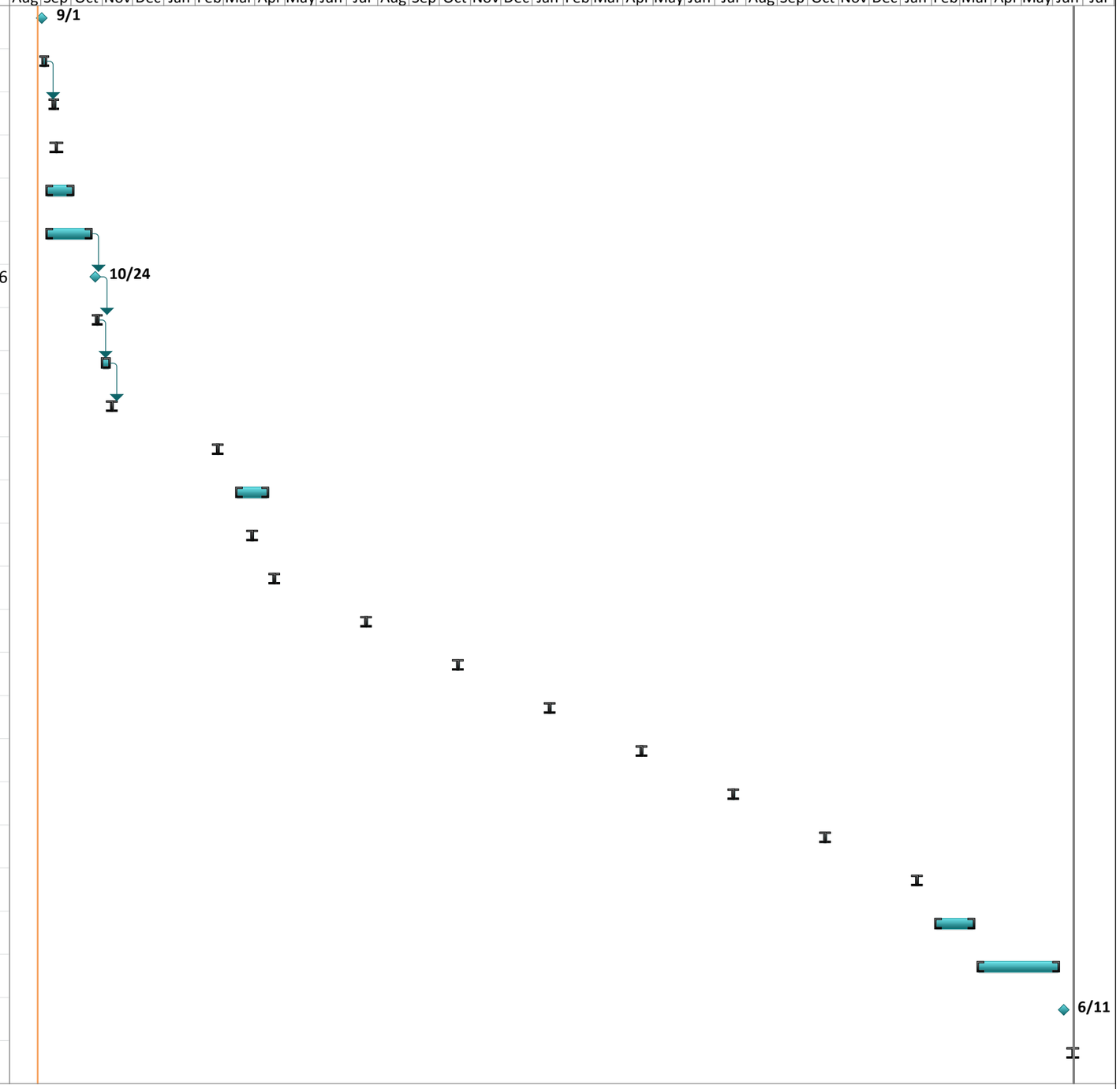
Ramboll Environ US Corporation 2016 Rate Schedule Former Express Cleaners Site Racine, Wisconsin US$	
Principal	185
Principal Consultant	185
Manager 10	155
Manager 9	155
Manager 8	134
Sr. Assoc. 7	129
Sr. Assoc. 6B	124
Assoc. 6	118
Assoc. 5	103
Assoc. 4	88
Assoc. 3	77
Drafting	77
Support	65

APPENDIX D

Project Schedule

Estimated Site Remediation Schedule
Former Express Cleaners Site
Racine, WI

ID	Task Name	Duration	Start	Finish
1	Estimated Date of Contract Award	1 day	Thu 9/1/16	Thu 9/1/16
2	Contract Execution and Project Set-up	3 days	Fri 9/2/16	Tue 9/6/16
3	Pre-Remedial Soil and Groundwater Sampling	4 days	Mon 9/12/16	Thu 9/15/16
4	Vapor Assessment at Former Pugh Oil Building	1 day	Fri 9/16/16	Fri 9/16/16
5	Prepare NR 724 Remedial Action Work Plans	20 days	Tue 9/6/16	Mon 10/3/16
6	Permitting	34 days	Tue 9/6/16	Fri 10/21/16
7	Mobilization and Setup of Soil Erosion Controls and Temp Fencing	1 day	Mon 10/24/16	Mon 10/24/16
8	Remove and Dispose of Concrete Slab and Abandoned Utilities	4 days	Tue 10/25/16	Fri 10/28/16
9	In Situ Soil Blending	7 days	Mon 10/31/16	Tue 11/8/16
10	Site Restoration and Demobilization	3 days	Wed 11/9/16	Fri 11/11/16
11	Post Remediation Soil Confirmation Sampling	3 days	Wed 2/22/17	Fri 2/24/17
12	Prepare NR 724 Soil Remedial Action Completion Report	25 days	Mon 3/13/17	Fri 4/14/17
13	Install Additional/Replacement Monitoring Wells	3 days	Tue 3/28/17	Thu 3/30/17
14	1st Post Remediation Quarterly Groundwater Monitoring Round	3 days	Wed 4/19/17	Fri 4/21/17
15	2nd Post Remediation Quarterly Groundwater Monitoring Round	3 days	Wed 7/19/17	Fri 7/21/17
16	3rd Post Remediation Quarterly Groundwater Monitoring Round	3 days	Wed 10/18/17	Fri 10/20/17
17	4th Post Remediation Quarterly Groundwater Monitoring Round	3 days	Wed 1/17/18	Fri 1/19/18
18	5th Post Remediation Quarterly Groundwater Monitoring Round	3 days	Wed 4/18/18	Fri 4/20/18
19	6th Post Remediation Quarterly Groundwater Monitoring Round	3 days	Wed 7/18/18	Fri 7/20/18
20	7th Post Remediation Quarterly Groundwater Monitoring Round	3 days	Wed 10/17/18	Fri 10/19/18
21	8th Post Remediation Quarterly Groundwater Monitoring Round	3 days	Wed 1/16/19	Fri 1/18/19
22	Prepare and Submit NR 726 Closure/GIS Documents	30 days	Mon 2/4/19	Fri 3/15/19
23	WDNR Case Closure Review	60 days	Mon 3/18/19	Fri 6/7/19
24	Estimated Case Closure by WDNR	1 day	Tue 6/11/19	Tue 6/11/19
25	Well Abandonment	2 days	Thu 6/20/19	Fri 6/21/19



APPENDIX E

Certificate of Insurance

CERTIFICATE OF LIABILITY INSURANCE

DATE(MM/DD/YYYY)
08/29/2016

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER
Aon Risk Insurance Services West, Inc.
San Francisco CA Office
425 Market Street
Suite 2800
San Francisco CA 94105 USA

CONTACT NAME:
PHONE (A/C. No. Ext): (949) 608-6300 **FAX (A/C. No.):** (949) 608-6451
E-MAIL ADDRESS:

INSURER(S) AFFORDING COVERAGE		NAIC #
INSURER A:	The Continental Insurance Company	35289
INSURER B:	National Fire Ins. Co. of Hartford	20478
INSURER C:	Allied World Assurance Company (US) Inc	19489
INSURER D:		
INSURER E:		
INSURER F:		

INSURED
Ramboll Environ, Inc.
Ramboll Environ US Corporation
4350 N. Fairfax Drive, Suite 300
Arlington, VA 22203 USA

COVERAGES **CERTIFICATE NUMBER:** 570063467433 **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

Limits shown are as requested

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
B	X **COMMERCIAL GENERAL LIABILITY** CLAIMS-MADE X OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: POLICY X PRO-JECT X LOC OTHER:			6023863690	12/31/2015	12/31/2016	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG	$1,000,000 $100,000 $15,000 $1,000,000 $2,000,000 $2,000,000
A	**AUTOMOBILE LIABILITY** X ANY AUTO OWNED AUTOS ONLY HIRED AUTOS ONLY SCHEDULED AUTOS NON-OWNED AUTOS ONLY			C 6023863706	12/31/2015	12/31/2016	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident)	$1,000,000
	UMBRELLA LIAB OCCUR **EXCESS LIAB** CLAIMS-MADE DED RETENTION						EACH OCCURRENCE AGGREGATE	
A	**WORKERS COMPENSATION AND EMPLOYERS' LIABILITY** ANY PROPRIETOR / PARTNER / EXECUTIVE OFFICER/MEMBER EXCLUDED? Y/N: N **(Mandatory in NH)** If yes, describe under DESCRIPTION OF OPERATIONS below	N / A		WC623863687	12/31/2015	12/31/2016	X PER STATUTE OTH-ER E.L. EACH ACCIDENT E.L. DISEASE-EA EMPLOYEE E.L. DISEASE-POLICY LIMIT	 $1,000,000 $1,000,000 $1,000,000
C	Env CPL/Prof			03099524 Prof Liab - Claims Made SIR applies per policy terms & conditions	12/31/2015	12/31/2016	Poll-Prof Occ/Agg	$2,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)
Ehrlich Family Limited Partnership is included as Additional Insured in accordance with the policy provisions of the General Liability, Automobile Liability and Pollution Liability policies. General Liability Excludes Claims Arising out of the Performance of Professional Services.

CERTIFICATE HOLDER

Express Cleaners, c/o Mallery & Zimmerman, S.C.
Attn: William P. Scott
731 North Jackson Street, Suite 900
Milwaukee WI 53202-4697 USA

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

Aon Risk Insurance Services West, Inc.

Holder Identifier : BOPR

Certificate No : 570063467433

Blanket Additional Insured - Owners, Lessees or Contractors - with Products-Completed Operations Coverage Endorsement

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

It is understood and agreed as follows:

I. The **WHO IS AN INSURED** section is amended to add as an **Insured** any person or organization whom the **Named Insured** is required by **written contract** to add as an additional insured on this **coverage part,** including any such person or organization, if any, specifically set forth on the Schedule attachment to this endorsement. However, such person or organization is an **Insured** only with respect to such person or organization's liability for:

A. unless paragraph **B.** below applies,

1. **bodily injury**, **property damage**, or **personal and advertising injury** caused in whole or in part by the acts or omissions by or on behalf of the **Named Insured** and in the performance of such **Named Insured's** ongoing operations as specified in such **written contract**; or

2. **bodily injury** or **property damage** caused in whole or in part by **your work** and included in the **products-completed operations** hazard, and only if

a. the **written contract** requires the **Named Insured** to provide the additional insured such coverage; and

b. this **coverage part** provides such coverage.

B. **bodily injury, property damage,** or **personal and advertising injury** arising out of **your work** described in such **written contract**, but only if:

1. this **coverage part** provides coverage for **bodily injury** or **property damage** included within the **products completed operations hazard**; and

2. the **written contract** specifically requires the **Named Insured** to provide additional insured coverage under the 11-85 or 10-01 edition of CG2010 or the 10-01 edition of CG2037.

II. Subject always to the terms and conditions of this policy, including the limits of insurance, the Insurer will not provide such additional insured with:

A. coverage broader than required by the **written contract**; or

B. a higher limit of insurance than required by the **written contract**.

III. The insurance granted by this endorsement to the additional insured does not apply to **bodily injury**, **property damage**, or **personal and advertising injury** arising out of:

A. the rendering of, or the failure to render, any professional architectural, engineering, or surveying services, including:

1. the preparing, approving, or failing to prepare or approve maps, shop drawings, opinions, reports, surveys, field orders, change orders or drawings and specifications; and

2. supervisory, inspection, architectural or engineering activities; or

B. any premises or work for which the additional insured is specifically listed as an additional insured on another endorsement attached to this **coverage part**.

IV. Notwithstanding anything to the contrary in the section entitled **COMMERCIAL GENERAL LIABILITY CONDITIONS,** the Condition entitled **Other Insurance**, this insurance is excess of all other insurance available to the additional insured whether on a primary, excess, contingent or any other basis. However, if this insurance

Blanket Additional Insured - Owners, Lessees or Contractors - with Products-Completed Operations Coverage Endorsement

is required by **written contract** to be primary and non-contributory, this insurance will be primary and non-contributory relative solely to insurance on which the additional insured is a named insured.

V. Solely with respect to the insurance granted by this endorsement, the section entitled **COMMERCIAL GENERAL LIABILITY CONDITIONS** is amended as follows:

The Condition entitled **Duties In The Event of Occurrence, Offense, Claim or Suit** is amended with the addition of the following:

Any additional insured pursuant to this endorsement will as soon as practicable:

1. give the Insurer written notice of any **claim**, or any **occurrence** or offense which may result in a **claim**;

2. except as provided in Paragraph IV. of this endorsement, agree to make available any other insurance the additional insured has for any loss covered under this **coverage part**;

3. send the Insurer copies of all legal papers received, and otherwise cooperate with the Insurer in the investigation, defense, or settlement of the **claim**; and

4. tender the defense and indemnity of any **claim** to any other insurer or self insurer whose policy or program applies to a loss that the Insurer covers under this **coverage part**. However, if the **written contract** requires this insurance to be primary and non-contributory, this paragraph **(4)** does not apply to insurance on which the additional insured is a named insured.

The Insurer has no duty to defend or indemnify an additional insured under this endorsement until the Insurer receives written notice of a **claim** from the additional insured.

VI. Solely with respect to the insurance granted by this endorsement, the section entitled **DEFINITIONS** is amended to add the following definition:

Written contract means a written contract or written agreement that requires the **Named Insured** to make a person or organization an additional insured on this **coverage part**, provided the contract or agreement:

A. is currently in effect or becomes effective during the term of this policy; and

B. was executed prior to:

1. the **bodily injury** or **property damage**; or

2. the offense that caused the **personal and advertising injury**

for which the additional insured seeks coverage.

Any coverage granted by this endorsement shall apply solely to the extent permissible by law.

All other terms and conditions of the Policy remain unchanged.

This endorsement, which forms a part of and is for attachment to the Policy issued by the designated Insurers, takes effect on the effective date of said Policy at the hour stated in said Policy, unless another effective date is shown below, and expires concurrently with said Policy.

NOTICE OF CANCELLATION OR MATERIAL CHANGE – DESIGNATED PERSON OR ORGANIZATION

It is understood and agreed that this endorsement amends the **BUSINESS AUTO COVERAGE FORM** as follows:

In the event of cancellation or material change that reduces or restricts the insurance provided by this Coverage Form, we agree to send prior notice of cancellation or material change to the person or organization scheduled below at the address scheduled below. This endorsement does not amend our obligation to notify the Named Insured of cancellation as described in the Common Policy Conditions or in another endorsement attached to this policy.

SCHEDULE

1. Number of days advance notice:

30 Days if we cancel for non-payment of premium.

30 Days if the policy is cancelled for any other reason, or if coverage is restricted or reduced by endorsement.

2. Person or Organization's Name and Address

Name:	AS PER SCHEDULE ON FILE WITH COMPANY
Attention:	AS PER SCHEDULE ON FILE WITH COMPANY
Street Address:	AS PER SCHEDULE ON FILE WITH COMPANY
City, State, ZIP:	AS PER SCHEDULE ON FILE WITH COMPANY
e-mail address**:**	AS PER SCHEDULE ON FILE WITH COMPANY

All other terms and conditions of the Policy remain unchanged.

COMMERCIAL GENERAL LIABILITY

Changes - Notice of Cancellation or Material Restriction Endorsement

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART
EMPLOYEE BENEFITS LIABILITY COVERAGE PART
LIQUOR LIABILITY COVERAGE PART
OWNERS AND CONTRACTORS PROTECTIVE LIABILITY COVERAGE PART
PRODUCTS/COMPLETED OPERATIONS LIABILITY COVERAGE PART
RAILROAD PROTECTIVE LIABILITY COVERAGE PART
STOP GAP LIABILITY COVERAGE PART
TECHNOLOGY ERRORS AND OMISSIONS LIABILITY COVERAGE PART
SPECIAL PROTECTIVE AND HIGHWAY LIABILITY POLICY – NEW YORK DEPARTMENT OF TRANSPORTATION

SCHEDULE	
Number of days notice (other than for nonpayment of premium):	**60**
Number of days notice for nonpayment of premium:	**10**
Name of person or organization to whom notice will be sent:	**AS PER SCHEDULE ON FILE WITH COMPANY**
Address:	**AS PER SCHEDULE ON FILE WITH COMPANY**

If no entry appears above, the number of days notice for nonpayment of premium will be 10 days.

It is understood and agreed that in the event of cancellation or any material restrictions in coverage during the **policy period**, the Insurer also agrees to mail prior written notice of cancellation or material restriction to the person or organization listed in the above Schedule. Such notice will be sent prior to such cancellation in the manner prescribed in the above Schedule.

All other terms and conditions of the Policy remain unchanged.

This endorsement, which forms a part of and is for attachment to the Policy issued by the designated Insurers, takes effect on the effective date of said Policy at the hour stated in said Policy, unless another effective date is shown below, and expires concurrently with said Policy.

Policy No: 6023863690

Effective Date: 12/31/2015

Insured Name: RAMBOLL ENVIRON, INC.

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

DESIGNATED INSURED FOR COVERED AUTOS LIABILITY COVERAGE

This endorsement modifies insurance provided under the following:

AUTO DEALERS COVERAGE FORM
BUSINESS AUTO COVERAGE FORM
MOTOR CARRIER COVERAGE FORM

With respect to coverage provided by this endorsement, the provisions of the Coverage Form apply unless modified by this endorsement.

This endorsement identifies person(s) or organization(s) who are "insureds" for Covered Autos Liability Coverage under the Who Is An Insured provision of the Coverage Form. This endorsement does not alter coverage provided in the Coverage Form.

This endorsement changes the policy effective on the inception date of the policy unless another date is indicated below.

Named Insured: RAMBOLL ENVIRON, INC.

Endorsement Effective Date: 12/31/2015

SCHEDULE

Name Of Person(s) Or Organization(s):
ANY PERSON OR ORGANIZATION TO WHOM OR WHICH YOU ARE REQUIRED TO PROVIDE ADDITIONAL INSURED STATUS OR ADDITIONAL INSURED STATUS ON A PRIMARY, NON-CONTRIBUTORY BASIS, IN A WRITTEN CONTRACT OR WRITTEN AGREEMENT EXECUTED PRIOR TO LOSS, EXCEPT WHERE SUCH CONTRACT OR AGREEMENT IS PROHIBITED BY LAW.
Information required to complete this Schedule, if not shown above, will be shown in the Declarations.

Each person or organization shown in the Schedule is an "insured" for Covered Autos Liability Coverage, but only to the extent that person or organization qualifies as an "insured" under the Who Is An Insured provision contained in Paragraph **A.1.** of Section **II** – Covered Autos Liability Coverage in the Business Auto and Motor Carrier Coverage Forms and Paragraph **D.2.** of Section **I** – Covered Autos Coverages of the Auto Dealers Coverage Form.

APPENDIX F

Contract Terms and Conditions

PROJECT AGREEMENT

Between:

Ramboll Environ US Corporation

175 North Corporate Drive, Suite 160

Brookfield, WI 53045

And:

For: Ehrlich Family Limited Partnership

By: Phydele G. Ehrlich Irrevocable Trust

Its: General Partner

This Project Agreement consists of:

Ramboll Environ Proposal No. P21-15124 for Remedial Action Services at the Former Express Cleaners Site in Racine, Wisconsin (BRRTS No. 02-52-547631), dated August 30, 2016 (attached).

Tasks	Ramboll Environ Labor and Expenses ($USD)
1. Project Management and Setup, Contracts, HASP Preparation	$6,229
2. Pre-Remediation Soil & Groundwater Sampling and MW3 Abandonment	$12,419
3. Remedial Action Plan	$14,285
4. Building Slab and Foundation Removal	$4,535
5. In-situ Enhanced Reductive Dechlorination	$24,501
6. Post-Remediation Confirmation Sampling	$2,577
7. Well Replacement (MW3)	$1,951
8. Additional Well Installation (Optional – One Well)	$472
9. Remedial Action Completion Report	$9,184
10. MNA Groundwater Sampling and Reporting (8 Quarters)	$44,392
11. Pugh Oil Building Sub-Slab Sampling	$3,713
12. Case Closure Reporting/GIS Registry	$8,685
13. Final Well Abandonment	$4,071
TOTAL BUDGET	**$137,014**

Actual charges will be billed on a time-and-materials basis in accordance with the hourly rates in the Rate Schedule (Appendix C). Ramboll Environ assumes that the Client will contract directly with the major remedial subcontractors.

Schedule

Estimated Project Start Date: September 1, 2016

Estimated Project Completion: June 30, 2019

Project Contact Information

Scott W. Tarmann, PE, Senior Manager
Project Manager/Title

262-901-0093 262-901-0079
Phone Fax

starmann@ramboll.com
Email

William P. Scott, Mallery & Zimmerman, S.C.
Project Manager/Title

414-727-6260 414-271-8678
Phone Fax

wscott@mzmilw.com
Email

Approved and accepted in accordance with the attached Terms and Conditions.

RAMBOLL ENVIRON US CORPORATION	**For: EHRLICH FAMILY LIMITED PARTNERSHIP** **By: PHYDELE G. EHRLICH IRREVOCABLE TRUST**
Signature	Signature
Jeanne M. Tarvin, PG, CPG	James C. Small
Printed Name	Printed Name
Principal	Trustee
Title	Title
August 30, 2016	
Date	Date

RAMBOLL ENVIRON

TERMS AND CONDITIONS

Ramboll Environ US Corporation, a Virginia corporation, ("Ramboll Environ") agrees to provide professional services under the following Terms and Conditions:

1. Fees: Ramboll Environ bills for its services on a time and materials basis using standard hourly rates. If requested, we will provide an estimate of the fees for a particular task, and we will not exceed that estimate without prior Client approval. For deposition and testimony we charge premium hourly rates. In certain circumstances we will undertake an assignment on a fixed fee basis if the requirements can be clearly defined.

2. Invoicing: Ramboll Environ bills its clients on a monthly basis using a standard invoice format. This format provides for a description of work performed and a summary of professional fees, expenses, and communication and reproduction charges. For more detailed invoicing requests, Ramboll Environ reserves the right to charge for invoice preparation time by staff members.

3. Payment: Ramboll Environ bills are payable UPON RECEIPT. We reserve the right to assess a late charge of 1.5 percent per month for any amounts not paid within 30 days of the billing date. We also reserve the right to stop work or withhold work product if invoices remain unpaid for more than 60 days past the billing date. If our work relates to a business transaction, we expect to be paid in a timely fashion, without regard to whether or when the transaction closes. If we are required to take legal action to have our invoices paid and we win in court, Client agrees to pay our costs, including reasonable legal fees.

4. Subcontractors: Ramboll Environ has a policy that its Clients should directly retain other contractors whose services are required in connection with field services for a project (e.g., drillers, analytical laboratories, transporters). As a service to you, we will advise you with respect to selecting other such contractors and will assist you in coordinating and monitoring their performance. In no event will we assume any liability or responsibility for the work performed by other contractors you may hire. When Ramboll Environ engages a subcontractor on behalf of the Client, the expenses incurred, including rental of special equipment necessary for the work, will be billed as they are incurred, at cost plus 15 percent. By engaging us to perform these services, you agree to indemnify, defend and hold Ramboll Environ, its directors, officers, employees, and other agents harmless from and against any claims, demands, judgment, obligations, liabilities and costs (including reasonable attorneys' and expert fees) relating in any way to the performance or non-performance of work by another contractor, except claims for personal injury or property damage to the extent caused by the negligence or willful misconduct of Ramboll Environs' employees.

5. Reimbursable Expenses: Project-related expenses including travel, priority mail, and overnight delivery, outside reproduction and courier services will be billed at cost plus 15 percent. The use of company-owned cars, trucks, and vans will be charged at $125 per day. The use of company-owned equipment and protective clothing will be billed in accordance with our standard fee schedule. The cost of project-related communications, to include in-house telephone, facsimile, postage, and reproduction, computers, data compilation, and CADD will be charged at a total of 6 percent of the total labor charges.

6. Access and Information: Client agrees to grant or obtain for Ramboll Environ reasonable access to any sites to be investigated as part of Ramboll Environ's scope of work. Client also agrees to indicate to Ramboll Environ the boundary lines of the site and the location of any underground structures, including tanks, piping, water, telephone, electric, gas, sewer, and other utility lines. Client agrees to notify Ramboll Environ of any hazardous site conditions or hazardous materials, about which Client has knowledge and to which Ramboll Environ's employees or contractors may be exposed while performing services on behalf of Client, including providing copies of relevant Material Safety Data Sheets. Client also shall make available to Ramboll Environ all information within its control necessary to allow Ramboll Environ to perform its services and agrees to comply with reasonable requests by Ramboll Environ for clarification or additional information. Client shall be responsible for the accuracy of this information. Ramboll Environ shall not be responsible for any damage to underground structures or utilities to the extent such damage was caused by incomplete or inaccurate information provided to us by the client or other party. Client agrees to make Ramboll Environ aware of any unsafe conditions at any project site about which Client has knowledge.

7. Reporting Requirements: Client may be required under federal, state or local statutes or regulations to report the results of Ramboll Environ's services to appropriate regulatory agencies. Ramboll Environ is not responsible for advising Client about its reporting obligations and Client agrees that it shall be responsible for all reporting, unless Ramboll Environ has an independent duty to report under applicable law. In those situations, Ramboll Environ will provide Client with advance notice that Ramboll Environ believes that it has an obligation to report as well as the substance of the report it intends to make.

8. RCRA Compliance: Client shall be responsible for complying with the Resource Conservation and Recovery Act, 42 U.S.C. Section 6901 et. seq. ("RCRA") and its implementing regulations in connection with Ramboll Environ's work under this Agreement. Client may request Ramboll Environ's assistance in meeting its RCRA and other similar waste management obligations, including analytical testing to assist Client in proper characterization of waste, identifying potential transporters and disposal facilities for waste (provided that Client shall make the final selection of both the transporter and disposal facility), entering into subcontracts or purchase order arrangements with the transporters and/or disposal facilities selected by Client, and preparing manifests for the Client's approval and execution. Client agrees that, by virtue of providing these services, Ramboll Environ shall not be deemed a "generator" or a party who "arranges" for the "transportation," "treatment" or "disposal" of any "hazardous waste" or "hazardous substance" (as those terms are defined in the Comprehensive Environmental Response Compensation and Liability Act or "CERCLA", 42 U.S.C. Section 9601). Client agrees to indemnify, defend and hold Ramboll Environ, its directors, officers, employees and agents, harmless from and against any and all claims, demands, judgments, obligations, liabilities, any costs (including reasonable attorneys' and expert fees) relating to: (1) Ramboll Environ's work in assisting Client with its RCRA obligations; and (2) the transportation, treatment, and disposal of hazardous substances or hazardous waste generated by the field activities conducted for Client.

9. Confidentiality: We treat all information obtained from Clients as confidential, unless such information is previously known to us, comes into the public domain through no fault of ours, or is furnished to us by a third party who is under no obligation to keep the information confidential. If we are subpoenaed to disclose confidential information obtained from you or about our work for you, we will give you reasonable notice and the opportunity to object before releasing any confidential information.

10. Independent Contractor: Client agrees that Ramboll Environ is acting as an independent contractor and shall retain responsibility for and control over the means for performing its services. Nothing in these Terms and Conditions shall be construed to make Ramboll Environ or any of its officers, employees or agents, an employee or agent of Client.

11. Standard of Care: In performing services, we agree to exercise professional judgment, made on the basis of the information available to us, and to use the same degree of care and skill ordinarily exercised in similar circumstances by reputable consultants performing comparable services in the same geographic area. This standard of care shall be judged as of the time the services are rendered, and not according to later standards. Ramboll Environ makes no other warranty or representation, either express or implied, with respect to its services. Estimates of cost, recommendations and opinions are made on the basis of our experience and professional judgment; they are not guarantees. Reasonable people may disagree on matters involving professional judgment and, accordingly, a difference of opinion on a question of professional judgment shall not excuse a Client from paying for services rendered.

Client recognizes that there may be hazardous conditions at sites to be investigated as part of Ramboll Environ's work. Client acknowledges that Ramboll Environ has neither created nor contributed to the existence of any hazardous, toxic or otherwise dangerous substance or condition at the site(s) which are covered by Ramboll Environ's work. Client also recognizes that some investigative procedures may carry the risk of release or dispersal of pre-existing contamination, even when exercising due care. Client releases Ramboll Environ from any claim (including claims under CERCLA or state law) that it is an "operator" of any site where it performs work for Client or a "generator" or a party who "arranges" for the "transportation," "treatment" or "disposal" of any "hazardous substance" (as those terms are defined in CERCLA), by virtue of its work for Client at any site.

12. Insurance: Ramboll Environ shall maintain the following insurance coverage while it performs the work described in Exhibit "A:" (1) statutory Workers Compensation and Employer's Liability Coverage; (2) General Liability for bodily injury and property damage of $1,000,000 aggregate; (3) Automobile Liability with $1,000,000 combined single limit; and (4) Professional Liability and Contractor's Pollution Liability with a combined single limit of $1,000,000 per claim and in the aggregate. If Client desires additional insurance or special endorsements, premiums associated with that coverage would be considered a reimbursable expense. Upon request, we will provide you with a certificate of insurance.

13. Third Parties: Ramboll Environ's services are solely for Client's benefit and may not be relied upon by any third party without Ramboll Environ's express written consent. Any use or dissemination of Ramboll Environ work products (including Ramboll Environ reports), without the written consent of Ramboll Environ, shall be at Client's risk and Client shall indemnify and defend Ramboll Environ from any and all claims, demands, judgments, liabilities and costs (including reasonable attorneys' and expert fees), related to the unauthorized use or dissemination of Ramboll Environ's work. Client also agrees to be solely responsible for and to defend, indemnify, and hold Ramboll Environ harmless from and against any and all claims, demands, judgments, liabilities and costs (including reasonable attorneys' and expert fees), asserted by third parties arising out of or in any way related to our performance or non-performance of services, except for claims of personal injury or property damage to the extent caused by the negligence or willful misconduct of Ramboll Environ's employees.

14. Limitation of Liability: Ramboll Environ shall be liable only for direct damages that result from Ramboll Environ's negligence or willful misconduct in the performance of its services. UNDER NO CIRCUMSTANCES SHALL RAMBOLL ENVIRON BE LIABLE FOR INDIRECT, CONSEQUENTIAL, SPECIAL, OR PUNITIVE DAMAGES, OR FOR DAMAGES CAUSED BY THE CLIENT'S FAILURE TO PERFORM ITS OBLIGATIONS UNDER LAW OR CONTRACT. Ramboll Environ shall not be liable for and Client shall indemnify Ramboll Environ from and against all claims, demands, liabilities and costs (including attorneys' and expert fees) arising out of or in any way related to our performance or non-performance of services, including all on-site activities except to the extent caused by Ramboll Environ's negligence or willful misconduct. In no event shall our liability exceed $1,000,000 and Client specifically releases Ramboll Environ for any damages, claims, liabilities and costs in excess of that amount.

15. Termination: This Agreement may be terminated by either party upon ten (10) days written notice to the other. If Client terminates the Agreement, Client agrees to pay Ramboll Environ for all services performed until the effective date of the termination. Client's obligations under Paragraphs 3, 4, 8, 9, 11, 13, 14, 16, 18 and 20 shall survive termination of this Agreement and/or completion of the services hereunder.

16. Disputes: All disputes under this Agreement shall be resolved by binding arbitration under the rules of the American Arbitration Association. If our personnel or documents are subpoenaed for depositions or court appearance in any dispute related to the project (except disputes between Ramboll Environ and Client related to our services), Client agrees to reimburse us at our then current billing rates for responding to those subpoenas, including out-of-pocket reimbursable expenses.

17. Scope of Agreement: Once Client has signed Ramboll Environ's proposal, that proposal and these Terms and Conditions shall constitute the complete and exclusive Agreement between the parties and will supersede all prior or contemporaneous agreements, whether written or oral. No provision of these Terms and Conditions may be waived, altered or modified except in writing and signed by Ramboll Environ. Client may use standard business forms, such as purchase orders, for convenience only; any provision on those forms that conflict with these Terms and Conditions shall not apply.

18. Nonsolicitation: Both Ramboll Environ and Client agree during the term of this Agreement and for 12 months following its termination for any reason, neither party will solicit for employment, or hire as an employee or contractor, any personnel of the other party involved in the performance of services hereunder.

19. Force Majeure: Ramboll Environ shall not be liable in any way because of any delay or failure in performance hereunder due to unforeseen circumstances or causes beyond its control, including without limitation strike, lockout, embargo, riot, war, act of terrorism, fire, act of God, accident, failure or breakdown of components necessary to order completion, subcontractor or supplier non-performance, inability to obtain labor, materials or manufacturing facilities, or compliance with any law, regulation or order.

20. Intellectual Property. If Ramboll Environ delivers a written product to the Client, Ramboll Environ hereby grants to Client a perpetual, nonexclusive, royalty-free license to copy, modify and otherwise utilize the product in connection with the Client project for which the Services were provided. Ramboll Environ retains all intellectual property rights.