

# NEW YORK BROWNFIELD SITE ACHIEVES CLOSURE

## CASE STUDY:

*In Situ* Remedy Replaces Pump  
and Treat and Achieves TCE/PCE  
Cleanup Targets at Former Metals  
Manufacturing Site





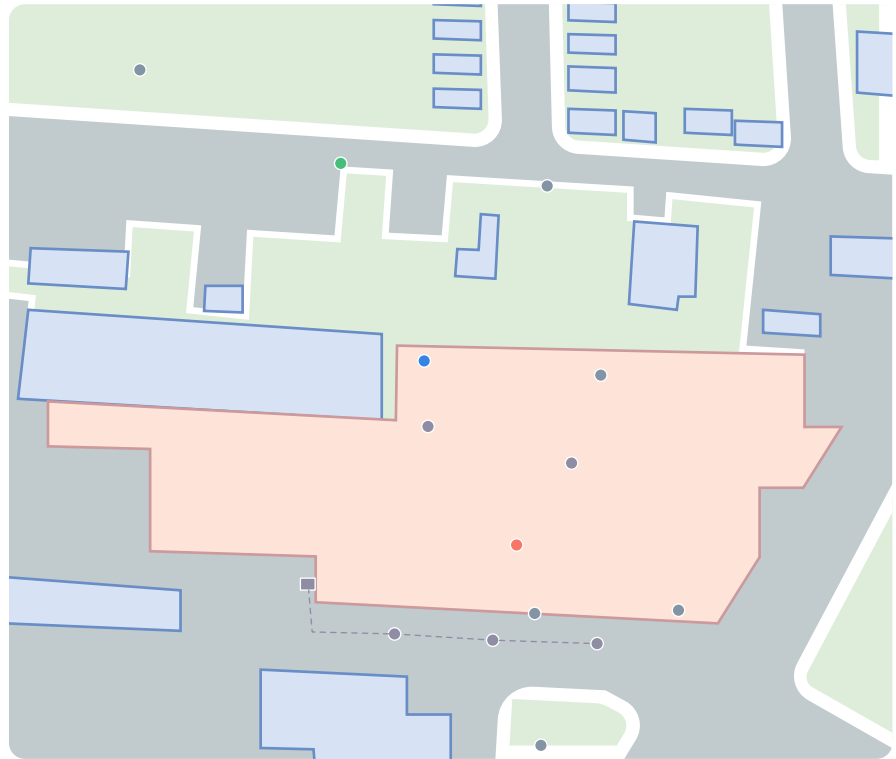
## Background

### ***Ex Situ* Pump-and-Treat System Reduced Chlorinated Solvent Impacts, But Did Not Achieve Cleanup Targets, Leading to a Change in Remedial Strategy**

The site is a former metals manufacturing facility in upstate New York that produced hardware and decorative metal products. Industrial metal processing, including stamping, cutting, degreasing, and electroplating operations, occurred at the site for nearly a century. Chlorinated volatile organic compounds (CVOCs) from the plating operations, predominantly comprised of tetrachloroethene (PCE) and trichloroethene (TCE), impacted the shallow groundwater, forming a narrow contaminant plume migrating offsite.

In 2002, the site owner entered into a Voluntary Cleanup Agreement (VCA) with the New York State Department of Environmental Conservation (NYSDEC) to address these impacts and forge a path to site closure through NYSDEC's Voluntary Cleanup Program.

Interim remedial measures (IRM) were undertaken beginning in 2004. The IRM entailed installing building sub-slab-depressurization controls and a groundwater recovery and pre-treatment system, utilizing a low-profile air stripper. This pump-and-treat system recovered over 30 million gallons of CVOC-impacted groundwater near-continuously until 2018. The system was expanded and modified in 2012 to incorporate hydrogen gas infusion treatment and reinjection.



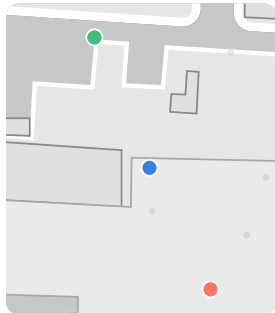
*Reinjection wells shown identify where well replacement would have been necessary*

The groundwater pump-and-treat system significantly reduced CVOC concentrations in groundwater. However, after a few years, the reinjection wells became clogged and no longer accepted water. Per the requirements of the site Management Plan, “if any component of the remedy is found to have failed, a Corrective Measures Plan will be submitted to the NYSDEC for approval.”

The *ex situ*, pump-and-treat remedy had maintained plume control. However, to continue this approach would have required well replacement. Additionally, these systems are well known to reach an asymptotic boundary condition above the low, part-per-billion cleanup targets for CVOCs and are prone to rebound once shut down. Such was the case at the site.

In response to these conditions, Benchmark Civil/Environmental Engineering & Geology, PLLC (Benchmark), a leading engineering and redevelopment consulting company headquartered in Buffalo, New York, quickly adapted the remedial strategy, favoring an *in situ* approach to achieve the project objectives and facilitate site closure.

### Total CVOCs in Wells MW-5, MW-6, MW-9



- MW-5
- MW-6
- MW-9

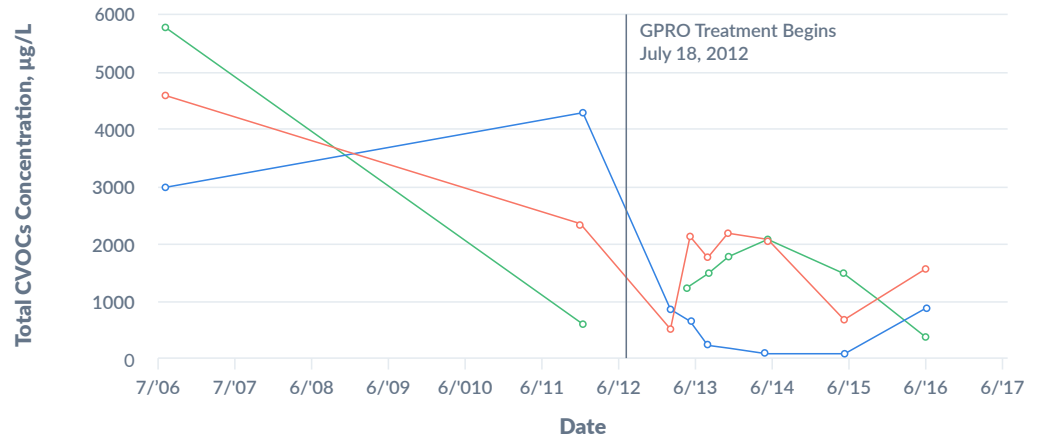


Chart Showing CVOC Response to Groundwater Pump-and-Treat Over 10-Year Period from 2006 to 2016. Hydrogen Diffusion Treatment Begins July 2012 and Stops in 2016 due to Well Fouling.



## PlumeStop *In Situ* Remediation

# By Adapting the Treatment Approach to Improve Performance, Substantial Cost and Energy Savings are Realized



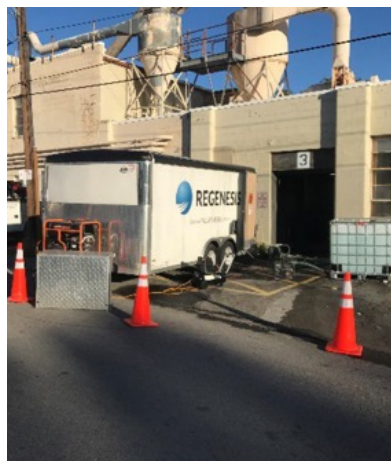
**HYDROGEN  
RELEASE  
COMPOUND**



**BIO-DECHLOR  
INOCULUM**

After evaluating remedial alternatives, Benchmark proposed a new Corrective Action Plan (CAP), specifying the *in situ* application of PlumeStop® colloidal activated carbon, Hydrogen Release Compound® (HRC), a controlled-release electron donor, and Bio-Dechlor INOCULUM Plus® (BDI Plus), a bioaugmentation culture containing *Dehalococcoides sp.* and other beneficial microbes.

PlumeStop remediation treatments rely on natural groundwater advection to move the CVOCs through a treatment zone. The CVOCs are immediately sorbed onto an immense surface of activated carbon which coats the aquifer materials. They are subsequently biologically transformed to non-toxic end products via reductive dechlorination from the co-applied HRC and BDI Plus. Together this passive treatment process is referred to as sorption-enhanced reductive dechlorination.



*PlumeStop Injection Trailer and Mixing Setup*



*PlumeStop Injected at Multiple Points Simultaneously*

## Timeline

### C. 1900 - 1998

Industrial manufacturing of metals, hardware, and decorative metals

### 2000-2002

Phase I and Phase II investigations identify CVOCs in groundwater

### 2002

Site owner enters into voluntary cleanup agreement with NYSDEC

### 2004

Interim remedial measures installed - building sub slab depressurization and groundwater pump-and-treat

### 2012

Remediation expanded to include additional pumping well and hydrogen gas diffusion treatment system

### 2016

Reinjection wells become clogged, Benchmark develops new corrective action plan specifying PlumeStop *in situ* remedy

### 2017

PlumeStop, HRC, and BDI Plus injected, performance monitoring begins

### 2018

Groundwater pump-and-treat system shut off

### 2019

Limited supplemental application of PlumeStop at source area

### 2020

Groundwater pump-and-treat system decommissioned

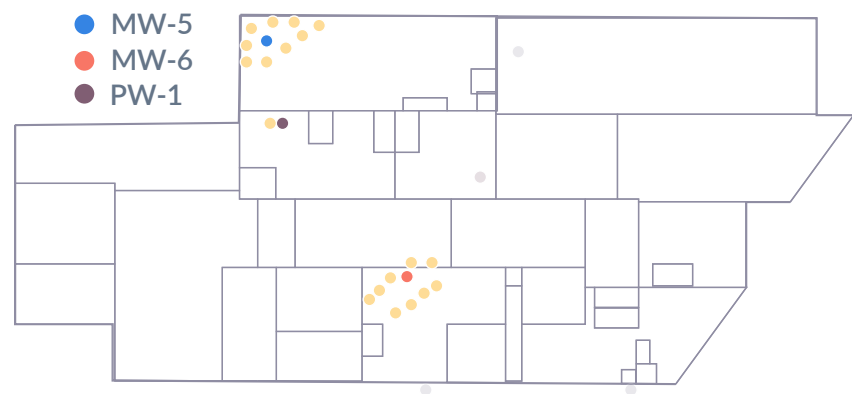
### 2021

Site closure: NYSDEC approves discontinuing further monitoring following 6 consecutive clean sampling events below or near detection levels

Compared to *ex situ* pump-and-treat approaches, *in situ* PlumeStop treatments produce no greenhouse gas emissions or disposal waste, do not consume energy, generate no noise pollution, require minimal infrastructure (i.e., only the performance monitoring wells) and no post-installation operation. Due to these factors, the PlumeStop approach results in substantial project cost savings over the lifetime of the project.

In addition to its proven performance in fully remediating CVOCs at over 500 sites worldwide, these green and sustainability remediation (GSR) benefits were a factor in selecting the PlumeStop *in situ* remedy for the CAP, completed in 2016.

Following CAP approval, the PlumeStop, HRC, and BDI Plus injection was completed in 2017, with a limited supplemental injection completed in 2019. The pump-and-treat system was discontinued in 2018.

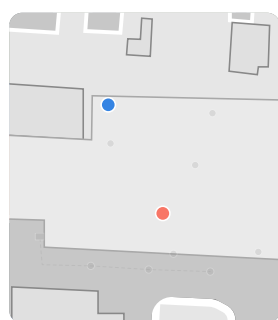


Site Plan Depicting PlumeStop Treatment Areas. PlumeStop was injected in two treatment zones with 9 points surrounding MW-5 and MW-6, as well as directly into PW-1.

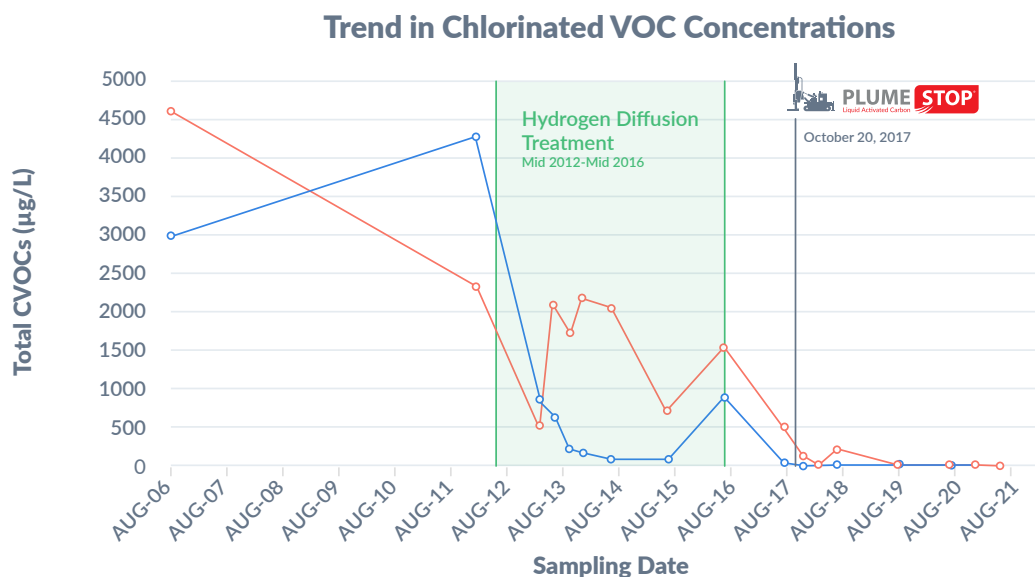
## Results

# Six Consecutive Monitoring Events With CVOCs at or Near Detection Levels Leads to Site Closure

Performance monitoring was initiated soon after the PlumeStop injection and continued through June 2021. Following the application, CVOC concentrations were reduced from as high as 500 micrograms per liter ( $\mu\text{g/L}$ ) at baseline to below one  $\mu\text{g/L}$  in the source area and downgradient performance monitoring wells for six consecutive sampling events. Based on these results, the pump-and-treat system was decommissioned in 2020, and the NYSDEC granted the site closure in August 2021.



- MW-5
- MW-6



Switching to a PlumeStop *in situ* approach in 2017, combined with the system shutdown in 2018, saved an additional six million gallons of groundwater recovery (approximate) through August 2021, when the site closure was obtained. By not having to operate and maintain the pump-and-treat system, substantial energy and cost savings were realized in this period. However, the real cost savings were certainly much greater as the PlumeStop treatment reduced the CVOC concentrations below drinking water maximum contaminant levels much more efficiently than is possible with pump-and-treat. Benchmark's agile site management, making the switch from an *ex situ* to a PlumeStop *in situ* approach, saved time and money for their client.



## About The Consultant

### Benchmark Civil/Environmental Engineering & Geology, PLLC

A recognized environmental remediation/engineering leader in New York State, Benchmark has investigated and remediated nearly every environmental contaminant in soil, sediment, air, biota, structures, surface water and groundwater on hundreds of abandoned, underutilized, and environmentally-impaired sites encompassing over 2,000 acres, representing more than \$150,000,000 in remedial costs and over \$1.3 Billion in redevelopment construction costs. Benchmark staff have investigated, planned, designed, constructed and operated remediation, restoration and/or redevelopment projects, including a wide range of Federal National Priority List (NPL) sites, State Superfund sites, New York Voluntary Cleanup Program (VCP) sites, New York Brownfield Clean Program (BCP) sites and Resource Conservation and Recovery Act (RCRA) corrective action sites. These include high-profile assignments such as the Love Canal Site Creeks and Sewers Remediation, Former Bethlehem Steel RCRA/BCP projects, the liability transfer and cleanup of the former Republic Steel and Donner-Hanna Coke Plant (Steelfields, aka Riverbend) site, the liability transfer, and many other remediation/redevelopment projects in western New York.



### Lori Riker, P.E.

Lori Riker offers decades of experience in environmental and civil engineering focused on industrial regulatory compliance assistance; Phase I environmental site assessments; hazardous waste site investigations and remedial evaluations; detailed design; and construction administration. Ms. Riker's regulatory compliance experience includes: petroleum bulk storage (PBS) and chemical bulk storage (CBS) auditing and the associated spill prevention reporting; Emergency Planning and Community Right-to-Know Act (EPCRA) Tier II and Toxic Release Inventory (Form R) reporting; Title V air permitting (Title V, State facility, minor facility registrations), compliance reporting, and emission statement preparation; Resource Conservation and Recovery Act (RCRA) hazardous waste reporting; storm water permitting and preparing discharge monitoring reports (DMRs), storm water pollution prevention plans (SWPPPs), and Best Management Practices (BMP) Plans; and hazardous waste annual reporting and reduction plans. Ms. Riker's role also include site investigation and remediation under various New York State Department of Environmental Conservation (NYSDEC) remedial programs including the: Brownfield Cleanup Program (BCP); RCRA Corrective Action Program; and Voluntary Cleanup Program (VCP). Ms. Riker holds a Bachelor of Science Civil Engineering degree from the University of Waterloo and a Master of Science in Environmental Engineering degree from the University of Guelph.



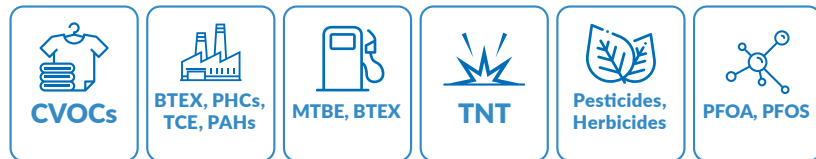
## Technologies Used

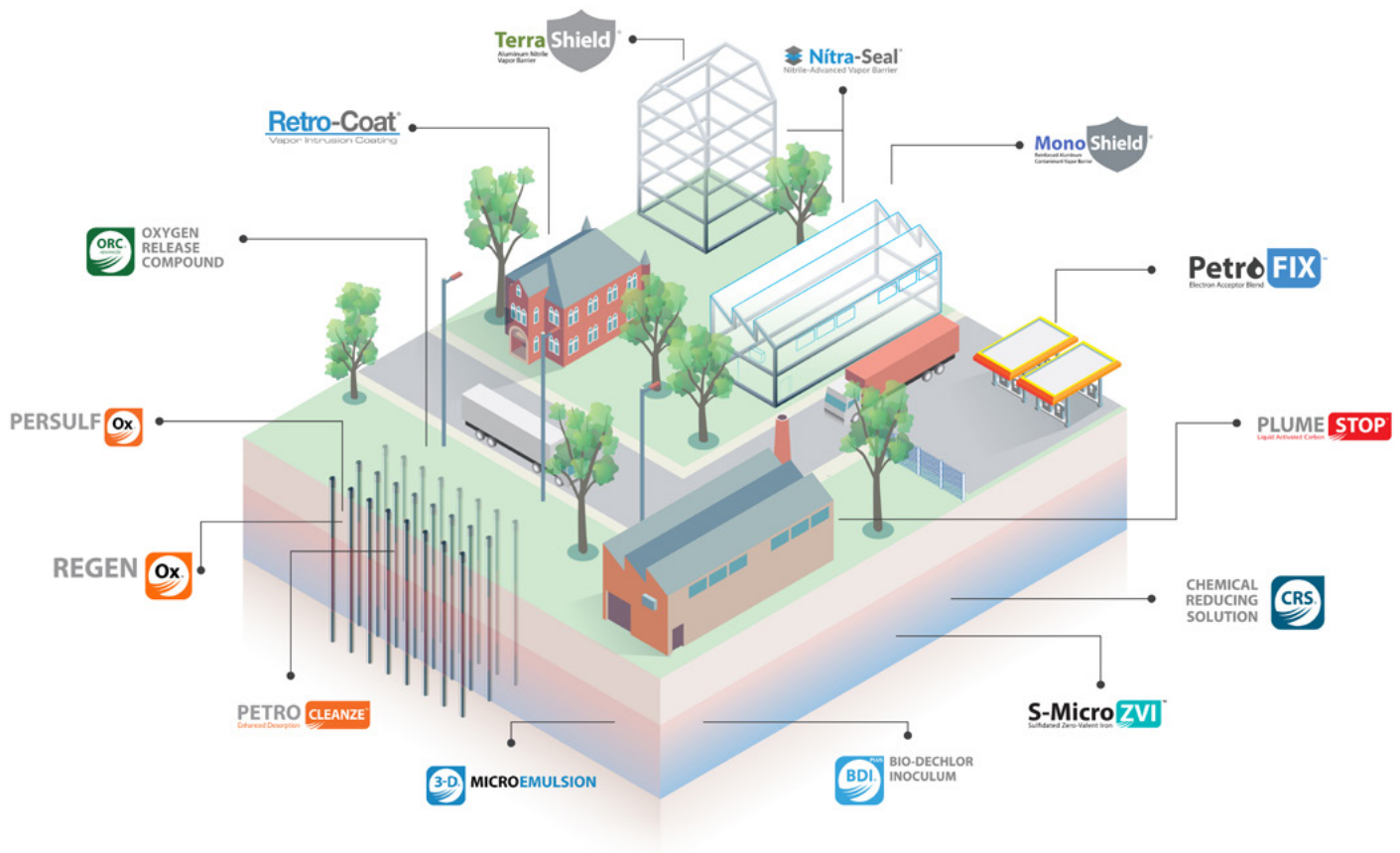
# PlumeStop, A Colloidal Activated Carbon Remedy with Seven Years of Proven Performance



PlumeStop® Colloidal Activated Carbon is a fast-acting groundwater remediation reagent which captures and biodegrades a range of contaminants, thus accelerating the successful treatment of impacted sites and leading to their permanent closure. As a science-based, *in situ* treatment technology, REGENESIS' PlumeStop rapidly removes contaminants from groundwater and stimulates their permanent degradation.

### Proven Effective on a Wide Range of Contaminants





## About REGENESIS

At REGENESIS we value innovation, technology, expertise and people which together form the unique framework we operate in as an organization. We see innovation and technology as inseparably linked with one being born out of the other.

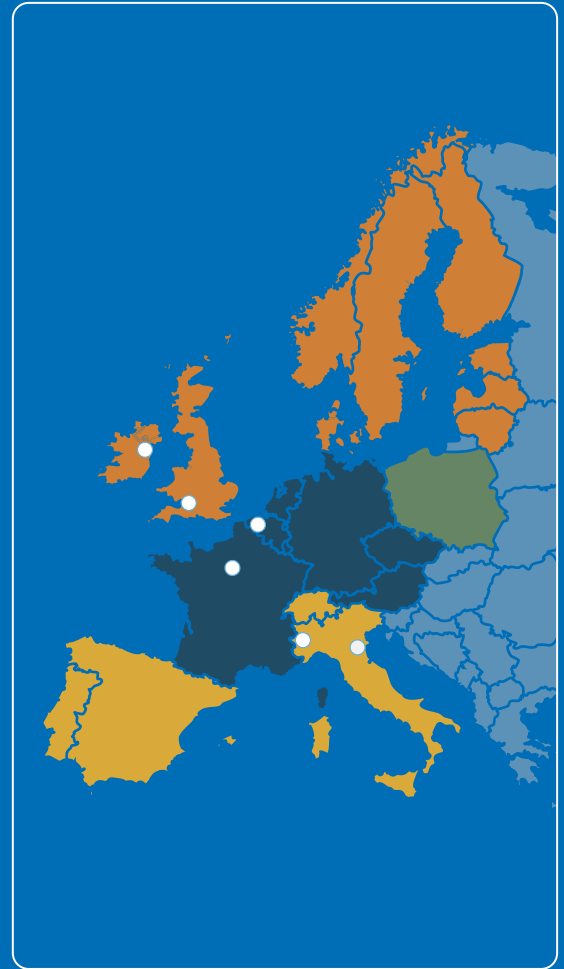
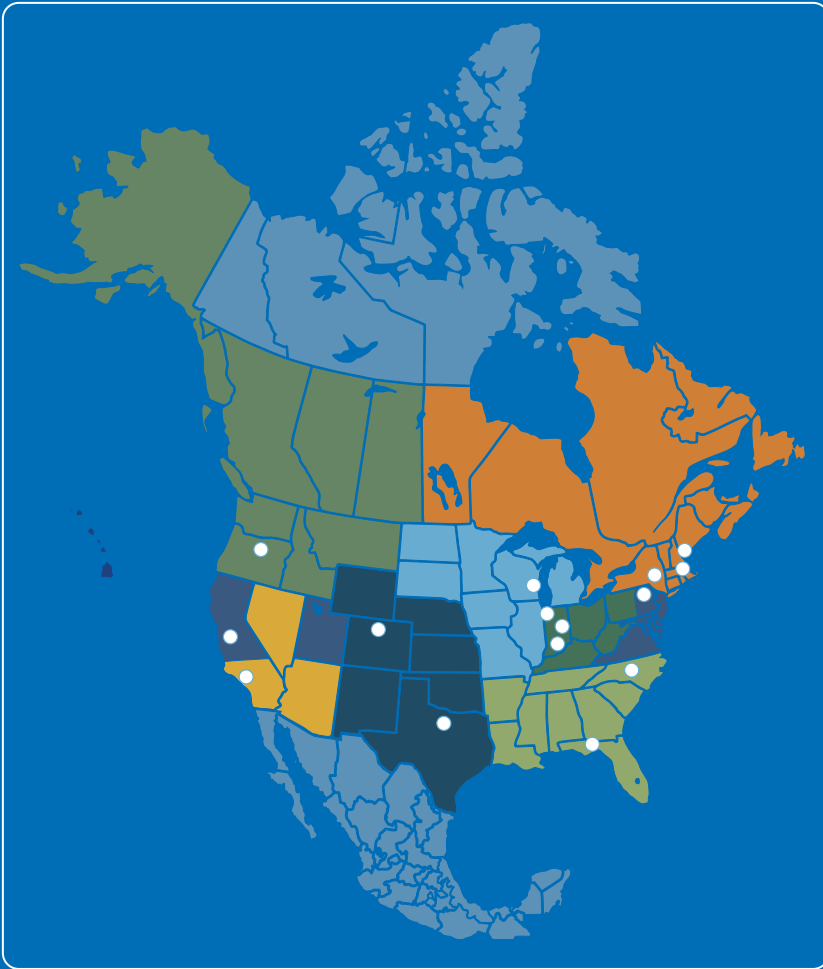
Inherently, innovation imparts new and better ways of thinking and doing. For us this means delivering expert environmental solutions in the form of the most advanced and effective technologies and services available today.

We value expertise, both our customers' and our own. We find that when our experienced staff collaborates directly with customers on complex problems there is a high potential for success including savings in time, resources and cost.

At REGENESIS we are driven by a strong sense of responsibility to the people charged with managing the complex environmental problems we encounter and to the people involved in developing and implementing our technology-based solutions. We are committed to investing in lasting relationships by taking time to understand the people we work with and their circumstances. We believe this is a key factor in achieving successful project outcomes.

We believe that by acting under this set of values, we can work with our customers to achieve a cleaner, healthier, and more prosperous world.

# We're Ready to Help You Find the Right Solution For Your Site



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