Sterling Environmental Engineering, P.C.

ADDENDUM NO. 1

REMEDIAL ACTION WORK PLAN

FOR

53 PUTNAM STREET
SARATOGA SPRINGS, NEW YORK
BCP #C546057

Prepared for:

Putnam Resources, LLC
15 W Main Street, #1C
Cambridge, New York 12816

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Latham, New York 12110

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(Revised)

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Attachments

1.0 INTRODUCTION

This Addendum No. 1 was prepared to revise Section 5.6.1 of the New York State Department of Environmental Conservation (NYSDEC)-approved Remedial Action Work Plan for the Brownfield Cleanup Program (BCP) Site #C546057 located at 53 Putnam Street, City of Saratoga Springs, Saratoga County, New York (hereinafter the "Site"). The revision was deemed necessary following further review of the methods in Section 5.6.1 of the approved RAWP. Specifically, the methods may not achieve the goals for evaluating the effectiveness of the remedy, based on discussions with Eurofins/TestAmerica Laboratory, ReSolution Partners, LLC Treatability Study Laboratory, the in-situ injection contractor (Innovative Environmental Technologies, Inc.), and NYSDEC personnel. The following portions of Section 5.6.1 are revised as indicated in the following sections.

1.1 Area A Effectiveness Monitoring

The approved RAWP includes the following regarding sampling and analysis of soil in Area A (In-Situ Geochemical Stabilization (ISGS) injection).

- Collect a sufficient volume of soil from the target injection zone from three (3) soil borings approximately two (2) weeks after treatment for laboratory analysis. These three soil borings will be located within a few feet of pre-injection soil borings.

- Submit each soil sample for analysis of VOCs and SVOCs using Leaching Environmental Assessment Framework (LEAF), USEPA Method 1315.

1.1.1 Proposed Revision for Area A Effectiveness Monitoring

- Collect a sufficient volume of soil from areas immediately adjacent to and beyond the injection zone from three (3) soil borings (MW-18, MW-19, and MW-20) approximately two (2) weeks after treatment for laboratory analysis. The locations of the post-treatment effectiveness soil borings are shown on revised Engineering Drawing Sheet 2 (Attachment A). Note: This work was performed November 30, 2021 to comply with the schedule in the approved RAWP to collect and analyze post-injection soil samples two (2) weeks following injection.

- Submit each soil sample for analysis of VOCs and SVOCs using USEPA Method 8260C and 8270D, respectively. Note: This work has been completed to comply with the schedule in the approved RAWP to collect and analyze post-injection soil samples two (2) weeks following injection.

- Drill four (4) borings within the ISGS treatment area (EB-8, 9, 10, and 11) at the locations shown on revised Engineering Drawing Sheet 2 (Attachment A) to collect samples of treated soil for microscopy analysis. Three (3) of the four (4) borings are located near an injection point and one (1) is located at the center of the treated area. The microscopy analysis will confirm the presence of the manganese dioxide (MnO_2) formed by the ISGS process in the subsurface.

- Drill one (1) boring at a location outside the ISGS treatment area (EB-12) at the approximate location shown on revised Engineering Drawing Sheet 2 (Attachment A) on the east end of the site. This location will provide baseline or background untreated soil samples for comparison to soil samples from the ISGS treatment area.

1.1.2 Rationale and Discussion

The ISGS process uses modified permanganate solutions that migrate through the treatment area, destroying targeted compounds in the dissolved phase and causing a hardening and encapsulation of the free phase petroleum (NAPL). Both the insoluble MnO_2 precipitate that results from permanganate oxidation and other mineral species included in the ISGS formulation accumulate along the NAPL interface, physically encapsulating the NAPL.

Quality Control and performance evaluation methods often employed for In-Situ Solidification and Stabilization (ISS) remedial technologies include coring using drilling methods or trenching to allow collection of samples of the physically stabilized material for analysis and visual examination. Unlike ISS however, ISGS is a geochemical stabilization method yielding a material that could release NAPL if disturbed by coring or trenching.

There is a high likelihood that drilling into the treated mass for purposes of colleting soil samples or installing monitoring wells would disturb the MnO_2 coating thereby releasing the NAPL. Soil samples collected from the treated area likely would exhibit NAPL and not be representative of the treated mass due to the disruption caused by the sampling process and destruction of the MnO_2 encapsulation. Similarly, NAPL accumulation in new wells installed in the treated mass would be likely due to the disruption of the drilling and well installation process. All borings advanced areas part of this Addendum will be abandoned with a cement/bentonite grout or bentonite pellets consistent with CP-43 policy for decommissioning monitoring wells.

The presence of NAPL in the borings to be drilled into treatment Area A or in samples collected from those borings, if any, will not be considered an indication that the ISGS was ineffective because of the disturbance the drilling and sample collection will cause, as described above. Rather, microscopic analysis will be performed to provide evidence that the ISGS treatment was successful and effective.

The microscopic analysis will be performed by Resolution Partners of Madison, WI. Resolution Partners is a treatability laboratory specializing in the evaluation and selection of remediation technologies, bench-scale pilot testing design and implementation, and treatment evaluations to meet site-specific remediation goals. Generally, the analysis to be performed by Resolution Partners will consist of microscopic inspection of treated and untreated soil from the site to positively identify the formation and presence of MnO2 precipitate and identify evidence of residual permanganate, if any. Greater details regarding the analysis are provided in Resolution Partners proposal presented in Attachment B.

1.2 Area B Effectiveness Monitoring

The approved RAWP includes the following regarding sampling and analysis of soil in Area B (cVOC dechlorination area).

- Submit each soil sample for analysis of VOCs (USEPA Method 8260C) using Leaching Environmental Assessment Framework (LEAF), USEPA Method 1315.

1.2.1 Proposed Revision for Area B Effectiveness Monitoring

- Submit each pre-treatment and post-treatment soil sample for analysis of VOCs using USEPA Method 8260C. Note: This work was performed November 30, 2021 to comply with the schedule in the approved RAWP to collect and analyze post-injection soil samples two (2) weeks following injection.

1.2.2 Rationale and Discussion

No change is proposed for the location of the pre-treatment or post-treatment soil sampling locations.

The reductive dichlorination treatment chemically degrades the cVOCs and does not encapsulate contaminants in the manner that ISGS does for NAPL; therefore, standard total VOC analysis can be performed directly on the soil to assess effectiveness.

1.3 Groundwater Monitoring

Sampling and analysis of groundwater in Area A provides data that ultimately determines whether there is an impact on groundwater quality and whether free product persists in the subsurface.

The first round of post-remediation groundwater monitoring was performed on December 14, 2021 to comply with the schedule in the approved RAWP to collect and analyze the first round of post-injection groundwater samples approximately four (4) weeks following in-situ remediation. The sampling was performed as described in Section 5.6.2 of the approved RAWP with the minor exception that the new monitoring wells (MW-18, MW-19, and MW-20) were installed immediately adjacent to and beyond the injection zone to avoid releasing or remobilizing NAPL from the treatment area, as explained above in Section 1.1.2. The approximate locations of the new monitoring wells are shown on revised Engineering Drawing Sheet 2 (attached). The groundwater sampling results will be used to determine whether free product is present immediately adjacent to the treatment area and whether there is an adverse impact to groundwater quality from dissolved phase contaminants.

2.0 REMEDIAL ACTION OBJECTIVES

The revised effectiveness monitoring proposed herein is expected to provide data that allows evaluation of whether the Remedial Action Objectives presented in the approved RAWP have been met. The RAOs for soil and groundwater presented in the approved RAWP are as follows:

Groundwater

RAOs for Public Health Protection

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.
- Prevent contact with, or inhalation of volatiles, from contaminated groundwater.

RAOs for Environmental Protection

- Restore groundwater aquifer to pre-disposal/pre-release conditions, to the extent practicable.
- Remove the source of groundwater contamination.

Soil

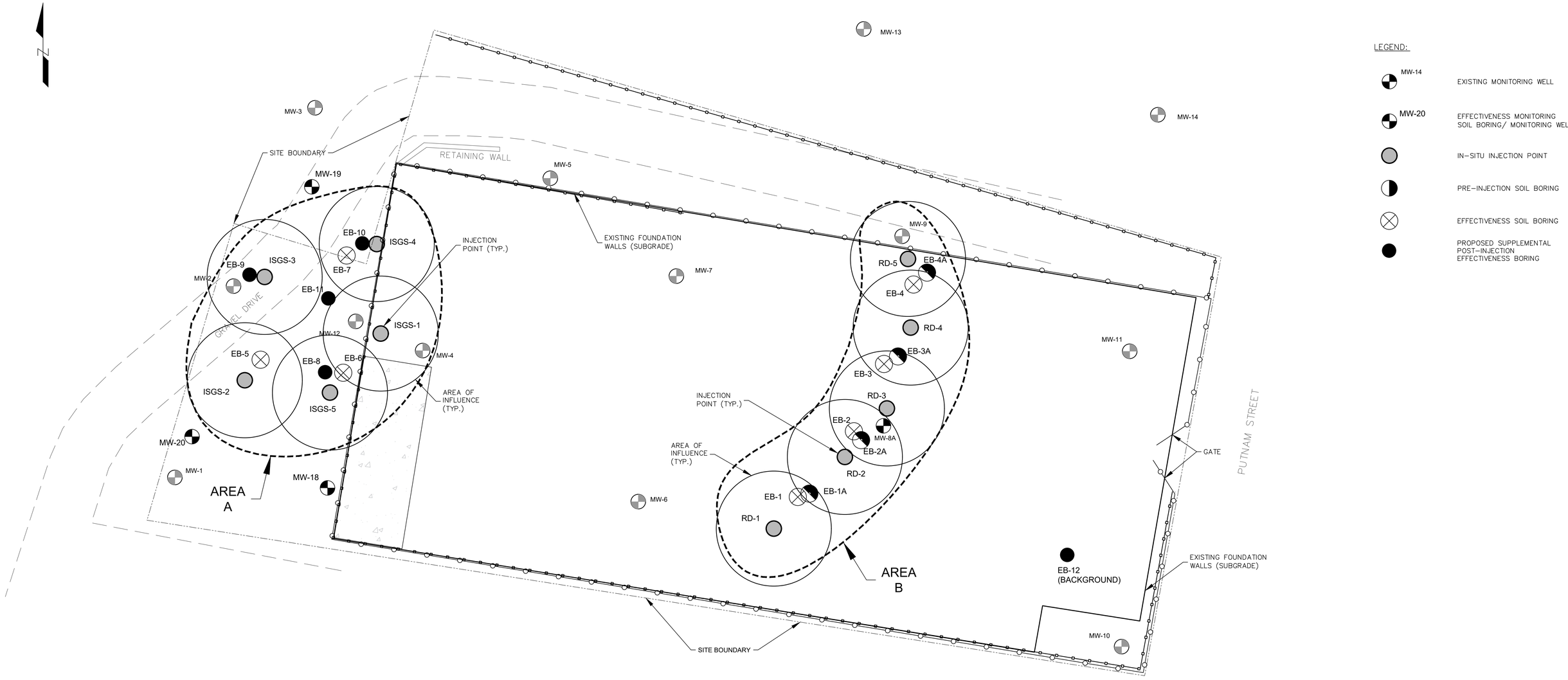
RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.
- Prevent inhalation exposure to contaminants volatilizing from soil.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater contamination.
- Prevent impacts to biota from ingestion/direct contact with soil causing toxicity or impacts from bioaccumulation through the terrestrial food chain.

ATTACHMENT A:
Revised Engineering Design Drawing
(Sheet 2 of 2)



LEGEND:

- MW-14 — EXISTING MONITORING WELL
- MW-20 — EFFECTIVENESS MONITORING SOIL BORING/ MONITORING WELL
- IN–SITU INJECTION POINT
- PRE–INJECTION SOIL BORING
- EFFECTIVENESS SOIL BORING
- PROPOSED SUPPLEMENTAL POST–INJECTION EFFECTIVENESS BORING

IN–SITU INJECTION QUANTITIES

AREA A	
ISGS MIXTURE	3,510 GALLONS
AREA B	
VITAMIN B–2	4,766 GRAMS
VITAMIN B–12	686 GRAMS
RED YEAST RICE EXTRACT	116 GRAMS
PROVECT IR	2,500 POUNDS
ZERO VALENT IRON	810 POUNDS
SODIUM SULFITE	100 POUNDS
NUTRIENT	100 POUNDS
CALCIUM PROPIONATE	1,000 POUNDS
WATER	2,000 GALLONS

IN–SITU INJECTION NOTES

1. INJECTION LOCATIONS TO BE DETERMINED BY CONTRACTOR AND CONFIRMED BY PROJECT ENGINEER.
2. ISGS SOLUTION WILL BE THE APPROXIMATE QUANTITY LISTED ABOVE AND WILL TREAT BETWEEN 12 AND 29 FEET BELOW GROUND SURFACE (BGS) WITH FOUR EVENLY SPACED INJECTION INTERVALS.
3. A 10% ISGS SOLUTION WILL BE USED IN AREA A (3,600 GALLONS OF ISGS INJECTED AT RATES FROM 1–20 GPM AND PRESSURES RANGING FROM 10 TO 100 PSI).
4. THE REDUCTIVE DECHLORINATION SLURRY FOR AREA B WILL TREAT BETWEEN 12 AND 29 FEET BELOW GROUND SURFACE (BGS) WITH FOUR EVENLY SPACED INJECTION INTERVALS.
5. A SLURRY FOR AREA B WILL BE THE APPROXIMATE QUANTITIES LISTED ABOVE EVENLY DISTRIBUTED THROUGH INJECTION LOCATIONS AT RATES OF 1–20 GPM AND PRESSURES RANGING FROM 10 TO 100PSI.
6. THE ABOVE VOLUMES, FLOWRATES AND CONCENTRATIONS ARE ESTIMATES BASED ON CALCULATIONS AND KNOWN SITE CONDITIONS. ACTUAL QUANTITIES WILL BE DETERMINED BY CONTRACTOR, ADJUSTED AS NECESSARY BASED ON FIELD CONDITIONS, AND MONITORED DURING THE INJECTION PROCESS.

STATE OF NEW YORK — ANDREW M. MILLSPAUGH — 094708 — LICENSED PROFESSIONAL ENGINEER

UNAUTHORIZED ALTERATION OR ADDITION TO THIS DRAWING IS A VIOLATION OF SECTION 7209, SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW.

NO.	DATE	RECORD OF WORK	DRN	CKD	APPR
1	12/03/20	ADDED EFFECTIVENESS SOIL BORING LOCATIONS	TAS	TMJ	AMM
2	04/01/21	MOVE EFFECTIVENESS SOIL BORING LOCATIONS	TAS	TMJ	AMM
3	11/22/21	REVISED EFFECTIVENESS BORINGS FOR 11/23/21 RAWP ADDENDUM 1	TAS	TMJ	AMM
4	01/14/22	REVISED EFFECTIVENESS BORINGS FOR 1/14/22 RAWP ADDENDUM 1	TAS	AMM	TMJ

PROJECT	
PROJ. ENGR.:	AMM
PROJ. NO.:	2015–30
PREPARED BY:	TAS
DRAFTED BY:	TAS
CHECKED BY:	
APPROVED BY:	
DATUM:	N/A
CONTOUR INTERVAL =	N/A FEET

0 2' 4' 8' 16'
1" = 8'

REMEDIAL DESIGN DOCUMENT
IN–SITU INJECTION REMEDY
53 PUTNAM STREET
PUTNAM RESOURCES, LLC
CITY OF SARATOGA SPRINGS SARATOGA CO., NEW YORK

STERLING
Sterling Environmental Engineering, P.C.
24 Wade Road • Latham, New York 12110

DATE: 10/13/2020 | SCALE: 1" = 8' | DWG. NO. 2015–30072 | SHEET 2 OF 2

S:\Sterling\Projects\2015 Projects\Putnam Resources - 2015-30\Drawings and Figures\ACAD\2015-30072_SH-2_RDD-IN1 Plan_Rev - Addendum 1.dwg 1/14/2022 11:30 AM TYLER.SWEET

ATTACHMENT B:
Microscopy Analysis Proposal by Resolution Partners

ReSolution Partners, LLC

Final

Proposal for the Evaluation of IET ISGS Application
Confidential Site, New York

Prepared for

Mr. Frank Zarro, Putnam Resources, LLC.
15 W Main Street, #1, Cambridge, NY 12816

10 January 2022 Revision 1

Introduction.

IET, Inc. applied *In Situ* Geochemical Stabilization **(ISGS)** to stabilize No. 6 fuel oil present as a non-aqueous phase liquid (NAPL) in the subsurface below the water table. ISGS uses a proprietary solution that destroys some organic compounds (mass reduction) and in the process forms an insoluble MnO_2 precipitate (birnessite) that encapsulates the NAPL and reduces the dissolution of the NAPL to the groundwater water (flux reduction) (*i.e.*, NAPL stabilization).

Sterling Environmental's (SE) e-mail of 30 December 2021 requested that ReSolution Partners (RP) prepare a study to document NAPL encapsulation by ISGS in response to the 16 December 2021 conference call with the NYDEC and the 30 December 2021 response to the SE draft Remedial Action Work Plan Addendum 1 of 23 November 2021.

SE's e-mail of 6 January 2022 noted that the injection zone was 12 to 29 feet below ground surface (bgs) with four injection intervals from 12 to 14 feet, 17 to 19 feet, 22 to 24 feet and 27 to 29 feet bgs. Soil mostly consisted of medium to coarse sand and fine gravel, which is likely the result of the area having been excavated and backfilled when the former UST was removed, with a 0.3 ft. layer of peat identified in only one of the six (6) borings. NAPL was observed in both peat and sand matrices. Recovery in recent soil borings in the area ranged from approximately 1 to 5 feet for a 5-ft push interval, averaging about 2.5 to 3 feet.

RP is proposing to use microscopic and chemical evaluation of site post-remediation soil samples to document the formation of the birnessite encapsulation of the NAPL.

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Sample Collection and Preparation.

Soil samples will be collected from four locations within the area of ISGS treatment, as noted on Figure 3 provided in the SE e-mail of 30 December 2021. The sample collection will be completed from the 12 to 29 feet bgs over which the ISGS had been injected. Soil samples will be collected from a fifth location where ISGS was not injected to provide a baseline for subsequent microscopic examinations.

Collection of soil samples needs to minimize disturbance of the birnessite crusts that encapsulate the NAPL. RP suggested that direct push tools with acetate core liners be used to collect the samples. To the extent practical, the core samplers should be pushed rather than pounded. The acetate sleeves should be cut to minimize "headspace" and capped. The intent is to minimize physical disturbance of the samples during shipment. If necessary, the cores can be cut to lengths that facilitate shipment. Core labels should include boring identification and sample depth.

Soil samples collected by SE will be shipped to RP by next-day delivery service to:

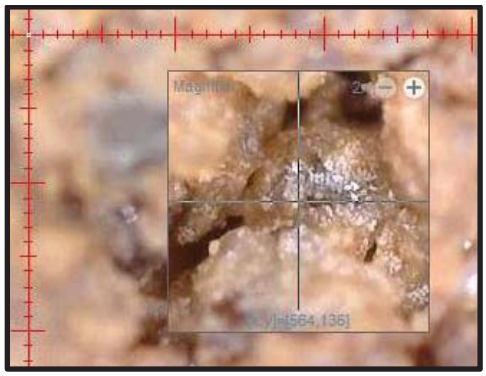
ReSolution Partners, LLC
967 Jonathon Drive
Madison, WI 53713
608-669-6949

Kevin Baker (kbaker@resolutionpartnersllc.net) should be provided the tracking number when the samples are shipped.

Sample Examination

Based on the average historical core recovery, approximately 35 to 45 feet of samples will be recovered (approximately 7 to 9 feet for core per boring). The acetate sample sleeves will be split upon receipt and visually logged. Evidence of ISGS presence resulting from purple coloration due to residual permanganate will be noted. Four discrete samples from each of the five borings will be selected for additional examination (total of 20 samples).

Three ~50 g aliquots from each of the treated samples will be placed on parchment paper under a digital electronic microscope (Dino-Lite Edge, Torrance CA) equipped with a 10x to 220x polarized lens. Visual examination of the samples from the untreated location will provide a baseline against which samples from the treated area can be compared. The reddish-brown to black birnessite crusts on NAPL are visually apparent in sandy soils (100x magnification) on the following photograph.



Example photographs from aliquots of ISGS-treated site samples will support visual observations regarding the presence and extent of the crusts.

When a solution of 3% H_2O_2 is applied to soil treated with ISGS using a syringe to carefully place the peroxide solution, there will be effervescence as the peroxide reacts with permanganate present with excess ISGS; even if there is no visual indication of ISGS. The effervescence is visually apparent under the microscope as illustrated below:

Example photographs from aliquots of ISGS-treated samples will support visual observations regarding the presence of effervescence.

Schedule and Reporting.

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Examination and photo-documentation of the soil samples will require approximately 2 to 3 weeks following receipt of the samples.

A draft report describing the procedure and photo-documentation appendices will be provided to SE for review and comment followed by a final report that addresses SE comments.

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