

## **May 3, 2023 Update**

### **2023 Schedule and Outline of Proposed Work**

#### **Region 18, Lyme-Old Lyme Middle School**

Turner Environmental has performed additional testing and soil remediation at the Region 18 campus to address the oil spill which occurred in August 2022. Since our last update on April 24, 2023 the following tasks have been completed or are proposed.

#### **Outdoor Investigation/Remediation**

DEEP personnel have indicated that the water table at the time of the spill was lower than the current water table. At the time of the spill the water table on the southern side of the Middle School was 7.6 to 8.97 fbg and have questioned whether there may be additional petroleum impacted soil that remains deeper than the depth of the post-excavation soil samples collected by Turner in March. During the additional soil excavation substantial groundwater was encountered and we excavated to approximately seven feet deep, approximately 1.5 to 2 feet below the current water table.

Additional investigation is proposed for this area with drilling scheduled for May 7, 2023. Samples will be obtained from multiple depths from several borings focusing on depths of 7 to 10 ft below grade to determine if any contaminants remaining in the saturated zone below the depth of the previous excavation that may be outside of the building and therefore accessible and further addressed through additional excavation.

If additional deeper contaminated soils are identified, our plan would be to perform additional excavation and disposal.

Two additional shallow monitoring wells will also be installed on the western portion of the property between MW-9 and MW-10R. We also plan to attempt two additional interior borings in the boiler room to evaluate our ability to deliver the injectable products in that area.

#### **Work Plan for Remediation**

Turner has begun preparation of a Work Plan/Remedial Action Plan for Region 18. We previously indicated our intent to use Oxygen Release Compounds (ORC) to provide an oxygen source for bioremediation of the petroleum compounds present in groundwater. Our initial plan is to start with an application in the outdoor area, inject additional ORC in numerous locations in the boiler room to initiate bioremediation. The injected compounds are expected to follow the flow path of the plume beneath the building.

We also plan to use another Regenesys product – “PetroFix” as a “Barrier Wall” on the western side of the building. This would include injections in an overlapping pattern in the area where the plume exits from beneath the building, intercepting it and reducing and eliminating the contaminants before they move off-site.

The Petrofix product contains activated carbon and electron acceptors to decrease petroleum concentrations in groundwater. The product we are recommending removes hydrocarbons from the dissolved phase by adsorbing them on to activated carbon particles and then stimulates hydrocarbon biodegradation by adding electron acceptors which are contained in the product. The electron acceptors are sulfate and nitrates with very low toxicity.

It is our understanding that DEEP/SATSU have been authorized to review and approve our plan. The overall plan outlined here will be further refined and specific details will be provided including the number and location of injection points, monitoring parameters and schedule.

We anticipate submitting a preliminary plan next week.

Conceptually our plan for additional ORC injections/applications through the boiler room floor would include eight to ten injection locations with product applied through a range of depths at each location. Additional actions on west side of the school would also include injection at 43 locations on the western side of the building from just north of MW-7 south to MW-6 (approximately 125 feet) to mitigate/remediate petroleum if it exits from beneath the building and intercept contaminants that would otherwise move off-site.

Our preliminary plan is to inject apply ORC in the exterior excavation area, beneath the floor in the boiler room and in the outdoor remedial area. We proposed using another injectable product manufactured by Regenisis, Petrofix, as a barrier wall on the western portion of the property. Petrofix contains activated carbon (1-2 microns) and associated electron acceptors (sulfates and nitrates) that will stimulate biodegradation in place. The activated carbon absorbs the petroleum compounds where they can be broken down by stimulated bioremediation.

We may need to reevaluate additional excavation in the outdoor remedial area based on results of the additional soil sampling performed in this area. Additional wells and groundwater data will help us refine the locations and quantities of products used. Manufacturers provided information on these products is provided in Attachment A.

### **Interior Investigation**

Previous investigation included borings placed through several cracks and seams in the boiler room floor. Four additional borings were placed inside the boiler room on March 14, 2023. These borings were placed on seams and cracks in the boiler room floor. After removal of the concrete, a plastic vapor barrier was encountered beneath the floor. We completed borings beneath the floor in these locations and screened the soil with a PID. While elevated PID readings were observed in these soil borings, they did not indicate a top down release through the floor.

Recovery wells in the boiler room previously had free product present. Observations made in January, through May 1, 2023 did not find any free product or sheen in any of these wells.

### **Additional monitoring wells**

Two off-site monitoring wells were installed on the [REDACTED] March 14, 2023. Those wells were sampled on March 30, 2023.

The results of these samples indicate that MW-12 had Bis(2-ethylhexyl)phthalate detected at 6.61 ug/L. That contaminant has not been detected in any other well. No VOCs, ETPH or other PAHs were detected in that well. This compound is not considered a petroleum contaminant.

MW-13 was resampled on April which is located east of [REDACTED] had several VOCs detected including 1, 2, 4 trimethyl-benzene at 23.5 ug/L, **benzene at 1.18 ug/L**, ethylbenzene at 5.91 ug/L, isopropyl benzene at 2.08 ug/L, and total xylenes at 15.52 ug/L, naphthalene 2.24 ug/l. In addition, several additional VOCs were detected in this samples that were not previously detected. and ETPH was detected in this sample a 0.165 mg/l in that sample. Benzene was the only contaminant that exceeded its RSR criteria.

In our last call DEEP requested resampling of that well. MW-13 was re-sampled on April 26, 2023. The preliminary results of retesting that well show several VOCs detected including 1, 2, 4 trimethyl-benzene at 3.85 ug/L, 1,3,5 trimethylbenzene at 1.79 ug/L, **benzene at 6.11 ug/L**, ethylbenzene at 5.91 ug/L, isopropyl benzene at 2.08 ug/L and total xylenes at 15.52 ug/L. Naphthalene was detected at 0.22 ug/l, n-butylbenzene was detected at 1.72 ug/L, n-propyl benzene at 1.65, and sec-butylbenzene was detected at 0.55 ug/L.

**ETPH was detected in this sample a 0.49 mg/l** in that sample. Benzene and ETPH exceed their respective RSR criteria. criteria in MW-13 on the retest.

A site plan with groundwater elevations and groundwater flow directions is also provided (See Figure 3).

### **Off-site Drinking Water Wells**

Due to the detection of contaminants in one off-site well the drinking water well at [REDACTED] was retested again on April 26, 2023. No ETPH, VOCs or PAHs were detected in that Drinking Water sample. This well was inspected on May 3, 2023. It is a shallow dug well with a fieldstone lining and a flat concrete cover. The depth to water is approximately seven (7) feet below grade and its total depth is ten and one-half (10.5) feet. After measurements were obtained the well was sanitized with chlorine and recovered.

[REDACTED]  
We also collected and analyzed a drinking water sample from [REDACTED]  
[REDACTED] This is also a shallow well. No contaminants were detected in that well.

[REDACTED]  
[REDACTED] The limited information found on the well construction was provided in our previous update letter. [REDACTED]  
[REDACTED]

### **Soil Vapor Sampling**

Sub slab soil vapor sampling was performed on April 26, 2023. Samples were collected from four locations, the boiler room, the basement beneath the kitchen, the auditorium adjacent to the boiler room and from the hallway between the auditorium and the cafeteria. All locations are closer in proximity to the source of the spill than the previous soil vapor sample. Samples were submitted for analyses by TO-15 VOCs. Results are expected in approximately one week. We are preparing a figure that shows all soil vapor sampling locations.

### **Future Work**

A substantial amount of the necessary site characterization work is complete. We are currently proposing two additional monitoring wells between MW-9 and MW-10 to try to further evaluate the plume leaving the site. Locations of proposed wells are shown on Figures 2 and 3. We have also proposed additional soil sampling at deeper intervals in the outdoor remedial area located south of the building. This work is now scheduled for May 7, 2023. Proposed boring locations in that area are shown in Figure 4. We are performing weekend work to expedite results and complete the site characterization. No soil sampling is proposed for the monitoring wells. Soil sampling from the remedial area will be analyzed for ETPH and VOCs only. We are proposing obtaining two soil samples from each boring at different depths.

Additional borings and wells will be installed on May 7, 2023. Sample results will be available the week of May 15, 2023. If any substantial petroleum is found at depth in the former holding tank remedial area, we would plan a subsequent dewatering and excavation event to remove impacted soil.

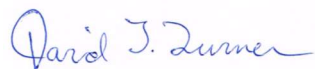
Additional groundwater monitoring will be performed with samples collected in the second week of May for selected wells. These will include the new monitoring wells between MW-9 and MW-10 (to be designated MW-15 and MW-16), MW-7R, MW-7D, MW-10R, MW-12 and MW-13. These samples will be analyzed for ETPH and VOCs only as they will be the parameters primarily driving the remediation.

The drinking water well most at risk is [REDACTED]. We are proposing sampling this drinking water source once a month going forward for VOCs only.

Our remedial action work plan will be submitted in the second week of May and we believe initial steps could be implemented in late May if approved.

Respectfully submitted,

**TURNER ENVIRONMENTAL, LLC**

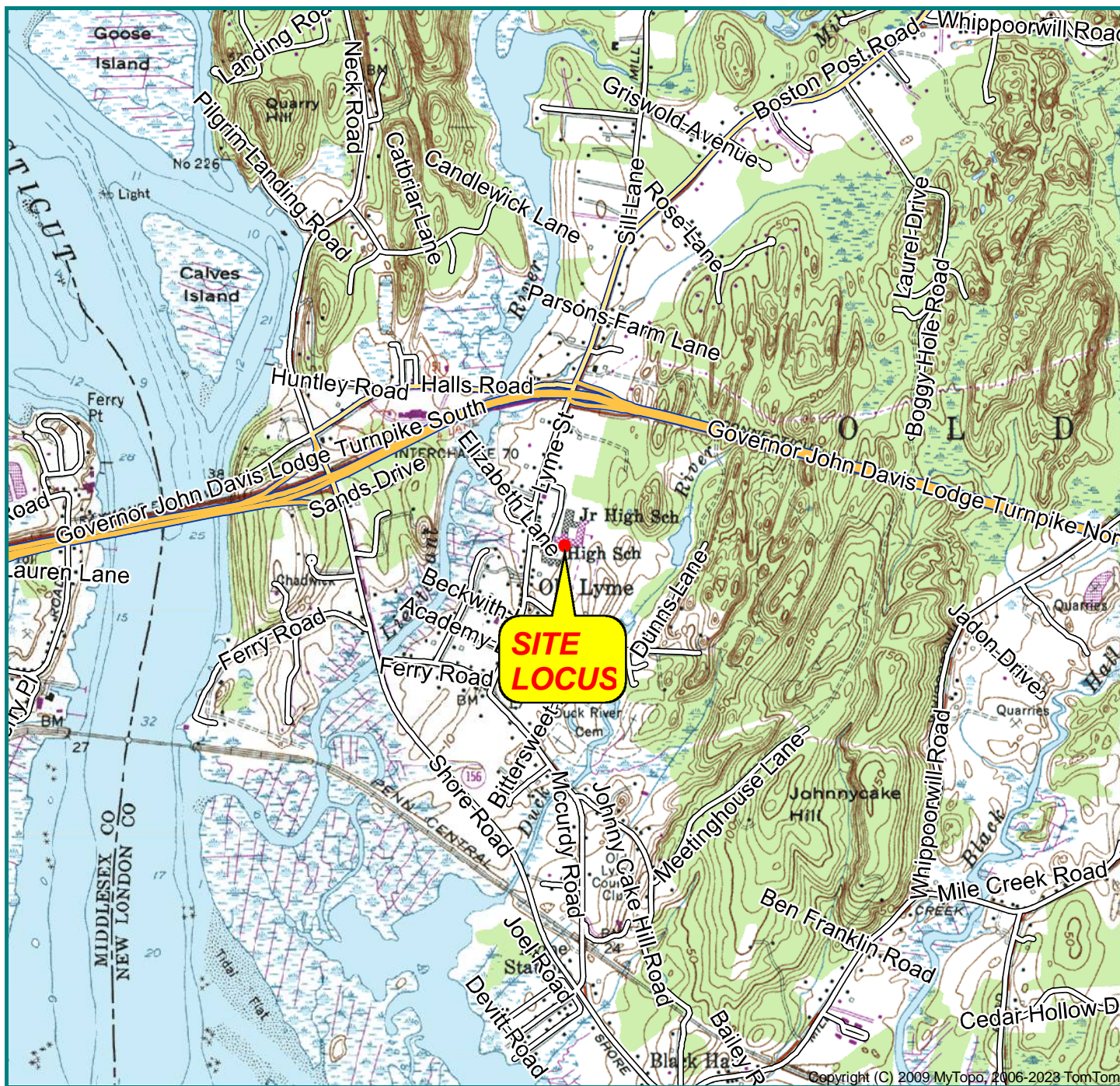


David T. Turner, LEP

Attachments

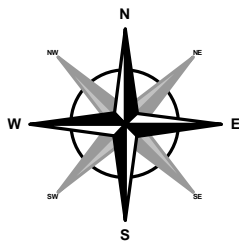
Figures





OLD LYME Topographic 1958 41072-C3-TF-024 National Geodetic Vertical Datum 1929

SCALE 1:24000



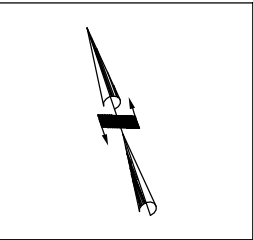
Site Coordinates:  
041° 19' 04.35" N, 072° 19' 42.04" W

**Turner Environmental LLC**  
P.O. Box 581, East Lyme, CT 06333  
(860) 705-8704 [turnerenviro@att.net](mailto:turnerenviro@att.net)

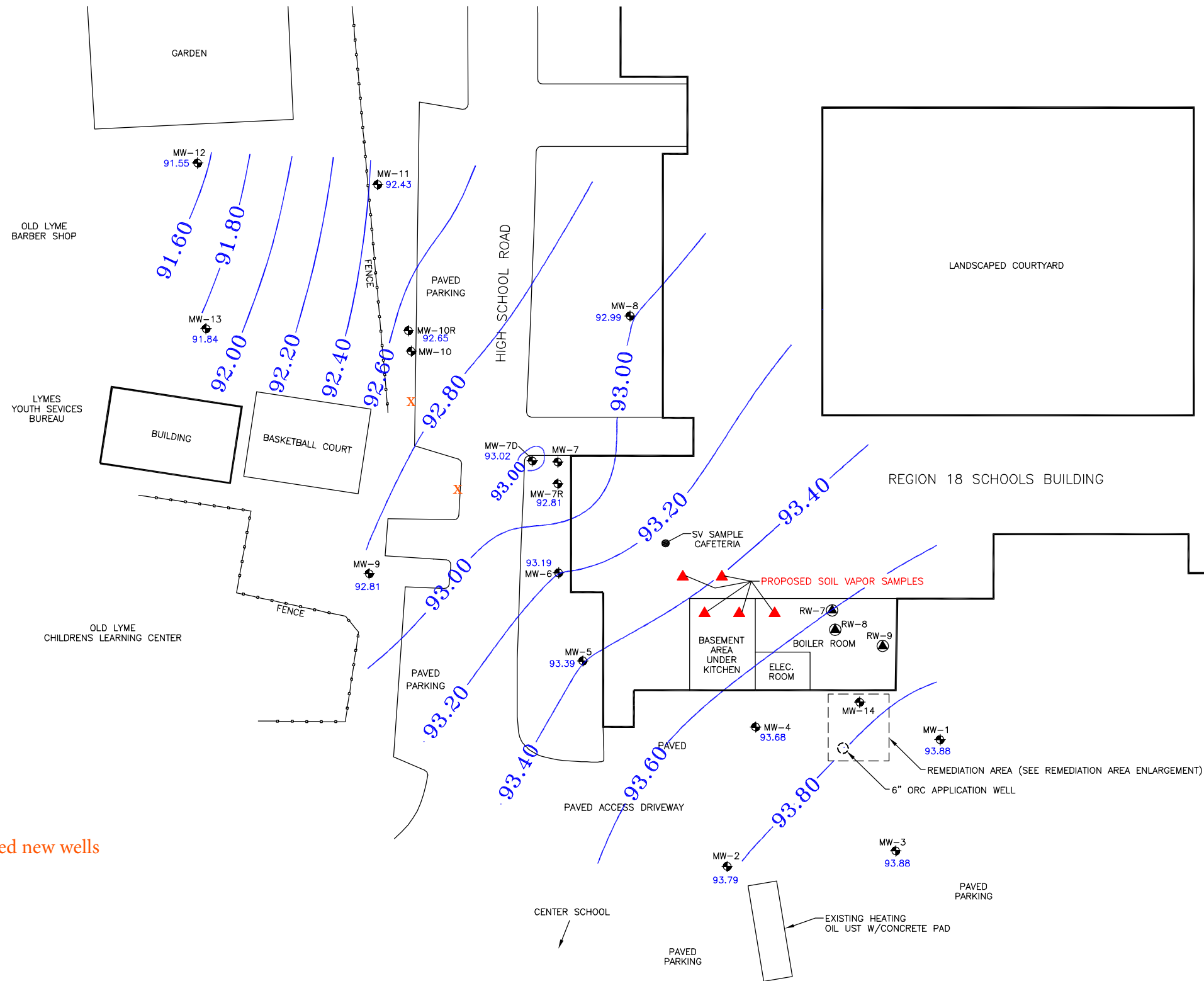
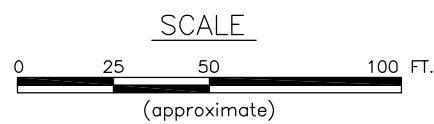
**Site Location:**  
47 Lyme Street  
New London County,  
Old Lyme, CT

Project: TE 23-007 Date: 3/9/23

**Figure-1**  
**Site Locus Map**



x = Proposed new wells



- LEGEND
- MW-14 - EXISTING MONITORING WELL
  - RW-9 - EXISTING RECOVERY WELL
  - ▲ - PROPOSED SOIL VAPOR SAMPLES

Turner Environmental LLC

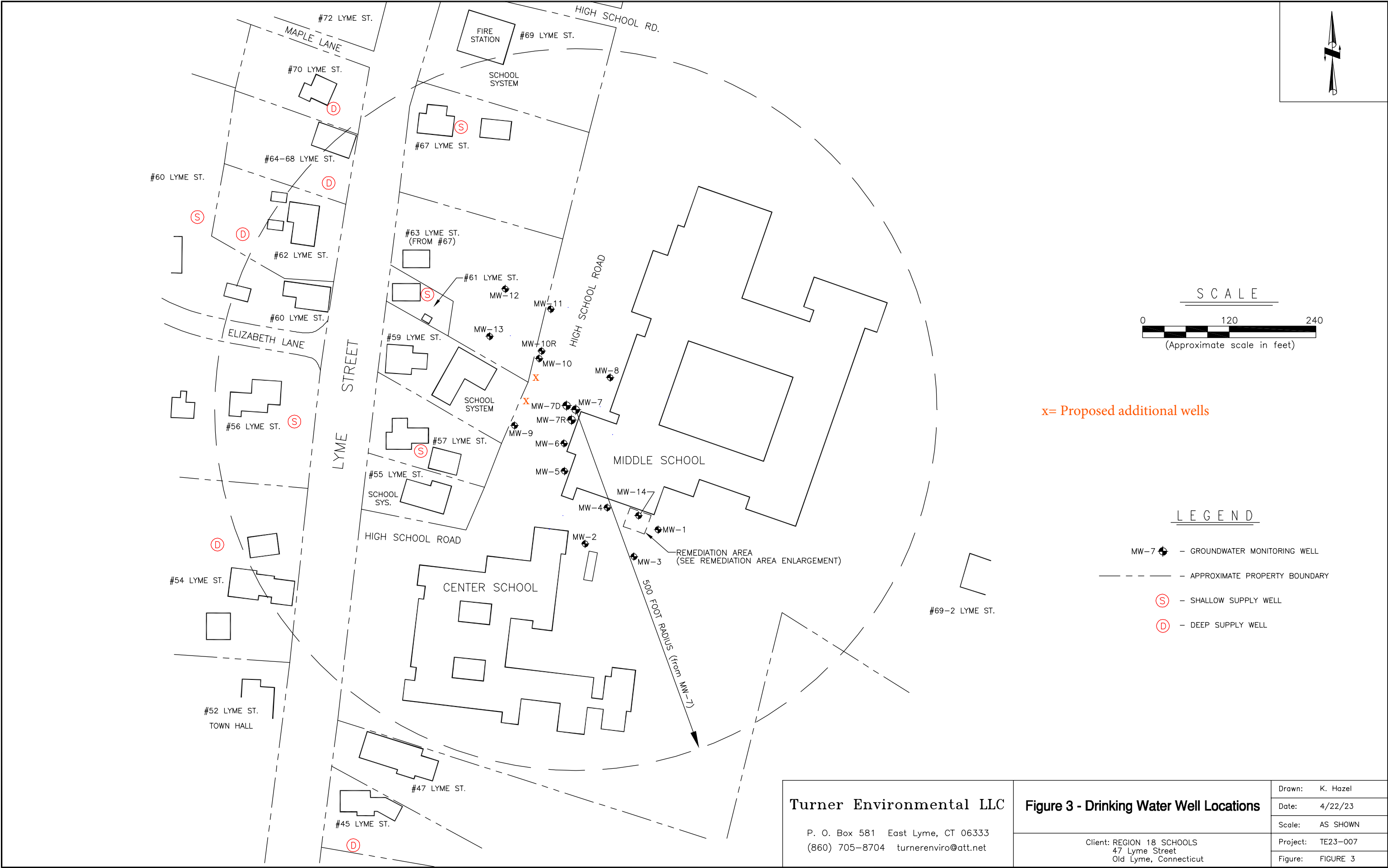
P. O. Box 581 East Lyme, CT 06333  
(860) 705-8704 turnerenviro@att.net

Figure 2 - Site Plan

Client: REGION 18 SCHOOLS  
47 Lyme Street  
Old Lyme, Connecticut

Drawn:	K. Hazel
Date:	4/22/23
Scale:	AS SHOWN
Project:	TE23-007
Figure:	FIGURE 2





x= Proposed additional wells

LEGEND

- MW-7 - GROUNDWATER MONITORING WELL
- - - - - APPROXIMATE PROPERTY BOUNDARY
- (S) - SHALLOW SUPPLY WELL
- (D) - DEEP SUPPLY WELL

Turner Environmental LLC

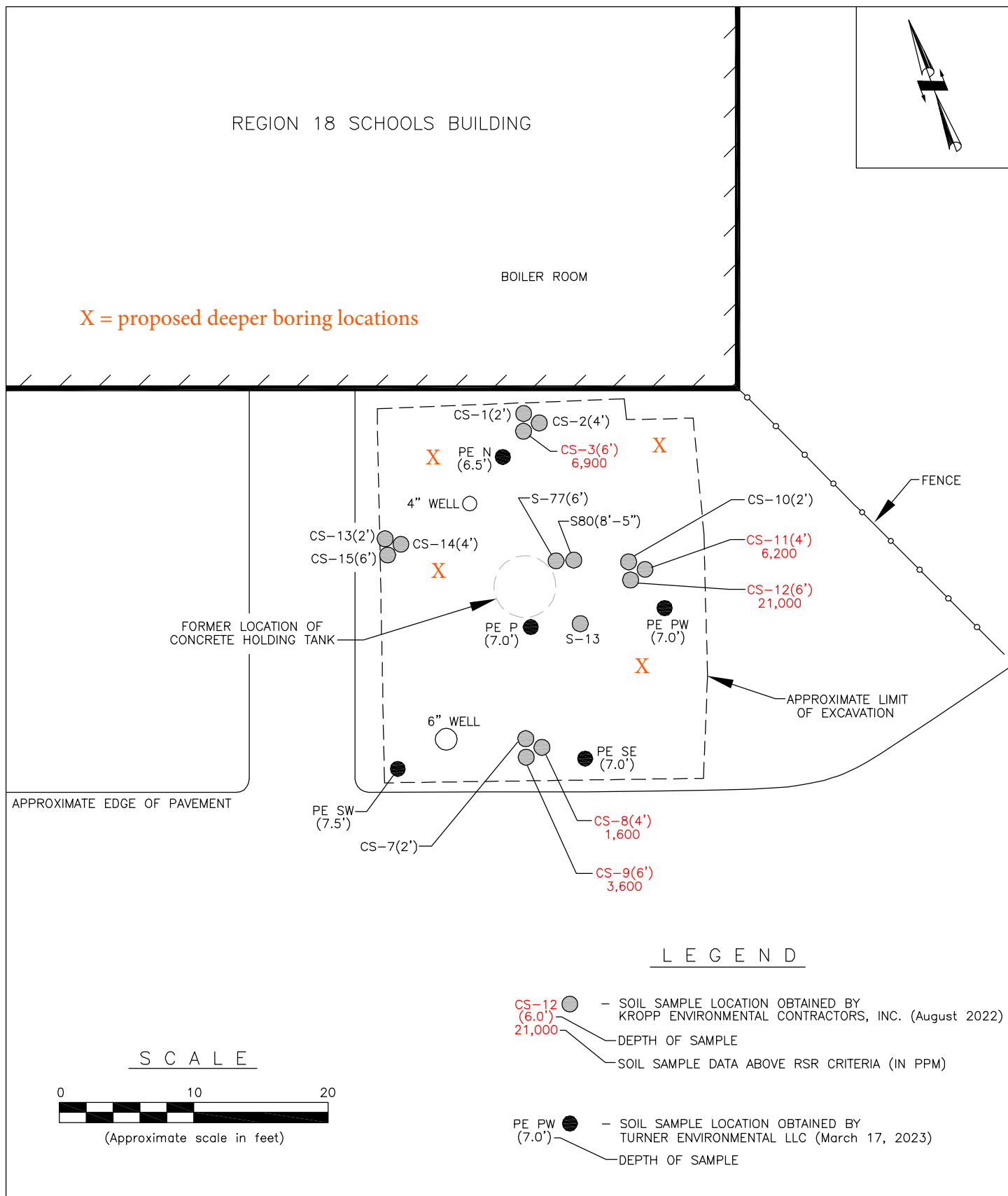
P. O. Box 581 East Lyme, CT 06333  
(860) 705-8704 turnerenviro@att.net

Figure 3 - Drinking Water Well Locations

Client: REGION 18 SCHOOLS  
47 Lyme Street  
Old Lyme, Connecticut

Drawn:	K. Hazel
Date:	4/22/23
Scale:	AS SHOWN
Project:	TE23-007
Figure:	FIGURE 3





**Turner Environmental LLC**  
P.O. Box 581 East Lyme, CT 06333  
(860) 705-8704 turnerenviro@att.net

**Figure 4**  
**Remediation Area Enlargement**

Address: 49 Lyme Street  
Town of Old Lyme, New London County, Connecticut

Drawn: K. HAZEL

Date: 4/22/23

Scale: As Shown

Project: TE 23-007

Figure: FIGURE-4

**Attachment A**  
Manufacturers Literature, ORC and Petrofix



**OXYGEN  
RELEASE  
COMPOUND**

## ORC Advanced® Technical Description

ORC Advanced® is an engineered, oxygen release compound designed specifically for enhanced, *in situ* aerobic bioremediation of petroleum hydrocarbons in groundwater and saturated soils. Upon contact with groundwater, this calcium oxyhydroxide-based material becomes hydrated producing a controlled release of molecular oxygen (17% by weight) for periods of up to 12 months on a single application.

ORC Advanced decreases time to site closure and accelerates degradation rates up to 100 times faster than natural degradation rates. A single ORC Advanced application can support aerobic biodegradation for up to 12 months with minimal site disturbance, no permanent or emplaced above ground equipment, piping, tanks, power sources, etc are needed. There is no operation or maintenance required. ORC Advanced provides lower costs, greater efficiency and reliability compared to engineered mechanical systems, oxygen emitters and bubblers.



Example of ORC Advanced

ORC Advanced provides remediation practitioners with a significantly faster and highly effective means of treating petroleum contaminated sites. Petroleum hydrocarbon contamination is often associated with retail petroleum service stations resulting from leaking underground storage tanks, piping and dispensers. As a result, ORC Advanced technology and applications have been tailored around the remediation needs of the retail petroleum industry and include: tank pit excavations, amending and mixing with backfill, direct-injection, bore-hole backfill, ORC Advanced Pellets for waterless and dustless application, combined ISCO and bioremediation applications, etc.

For a list of treatable contaminants with the use of ORC Advanced, view the [Range of Treatable Contaminants Guide](#)

### Chemical Composition

- Calcium hydroxide oxide
- Calcium hydroxide

### Properties

- Physical state: Solid
- Form: Powder
- Odor: Odorless
- Color: White to pale yellow
- pH: 12.5 (3% suspension/water)



**OXYGEN  
RELEASE  
COMPOUND**

# ORC Advanced® Technical Description

## Storage and Handling Guidelines

### Storage

- Store in a cool, dry place out of direct sunlight
- Store in original tightly closed container
- Store in a well-ventilated place
- Do not store near combustible materials
- Store away from incompatible materials
- Provide appropriate exhaust ventilation in places where dust is formed

### Handling

- Minimize dust generation and accumulation
- Keep away from heat
- Routine housekeeping should be instituted to ensure that dust does not accumulate on surfaces
- Observe good industrial hygiene practices
- Take precaution to avoid mixing with combustibles
- Keep away from clothing and other combustible materials
- Avoid contact with water and moisture
- Avoid contact with eyes, skin, and clothing
- Avoid prolonged exposure
- Wear appropriate personal protective equipment

## Applications

- Slurry mixture direct-push injection through hollow rods or direct-placement into boreholes
- *In situ* or *ex situ* slurry mixture into contaminated backfill or contaminated soils in general
- Slurry mixture injections in conjunction with chemical oxidants like RegenOx or PersulfOx
- Filter sock applications in groundwater for highly localized treatment
- *Ex situ* biopiles

## Health and Safety

Wash thoroughly after handling. Wear protective gloves, eye protection, and face protection. Please review the [ORC Advanced Safety Data Sheet](#) for additional storage, usage, and handling requirements.



www.regenesis.com  
1011 Calle Sombra, San Clemente CA 92673  
949.366.8000

©2016 All rights reserved. REGENESIS and ORC Advanced® are registered trademarks of REGENESIS Bioremediation Products. All other trademarks are the property of their respective owners.

# PetroFix™ Specification Sheet

## PetroFix Technical Description

PetroFix is a new remedial technology designed to treat petroleum fuel spills in soil and groundwater. A simple-to-use fluid that can be applied under low pressure into the subsurface or simply poured into open excavations, PetroFix offers a cost-effective solution for environmental practitioners and responsible parties to address petroleum hydrocarbon contaminants quickly and effectively.

PetroFix has a dual function; quickly removing hydrocarbons from the dissolved phase, by absorbing them onto the activated carbon particles, while added electron acceptors stimulate hydrocarbon biodegradation in-place. PetroFix does not require high pressure “fracking” for application and can be applied with ease using readily available equipment associated with direct push technology.

The remedial fluid is a highly concentrated water-based suspension consisting of micron-scale activated carbon and biostimulating electron acceptors. PetroFix has a viscosity higher than water and is black in appearance. Its environmentally-compatible formulation of micron-scale activated carbon (1-2 microns) is combined with both slow and quick-release inorganic electron acceptors. A blend of additional electron acceptors is included along with the PetroFix fluid. Practitioners can select between a sulfate and nitrate combination blend (recommended), or sulfate only for the additional electron acceptors required.



## PetroFix Design Assistant



REGENESIS has developed a proprietary web-based design assistant called PetroFix Design Assistant™ that provides environmental professionals the ability to input their site parameters, determine the required product amount, and order the product through REGENESIS' customer service. The PetroFix Design Assistant includes defaults and warnings throughout the process to guide users toward effective designs that will offer best results.

To access the PetroFix Design Assistant, create an account and login at [www.PetroFix.com](http://www.PetroFix.com)

PetroFix Fluid Chemical Composition	Properties
Activated Carbon - CAS 7440-44-0 > 30% Calcium Sulfate Dihydrate - CAS 10101-41-4 < 10%	<b>Appearance:</b> Black Fluid <b>Viscosity:</b> 1500-3500 cP (corn syrup-like) <b>pH:</b> 8-10

PetroFix Electron Acceptor Powder Chemical Composition	Properties
OPTION 1 - EA Blend (preferred) Sodium Nitrate - CAS 7631-99-4, 50% Ammonium Sulfate - CAS 7783-20-2, 50%  OPTION 2 - EA Blend NF Potassium Sulfate - CAS 7778-80-5, 50% Ammonium Sulfate - CAS 7783-20-2, 50%	<b>Appearance:</b> White Powder

Storage and Handling Guidelines	
<b>Storage:</b> <ul style="list-style-type: none"> <li>• Store away from incompatible materials</li> <li>• Store in original closed container</li> <li>• Store at temperatures between 40°F and 95°F</li> <li>• Do not allow material to freeze or store in direct sunlight.</li> <li>• Freezing and hot weather technical memo can be accessed at <a href="http://www.petrofix.com/resources">www.petrofix.com/resources</a> or at this <a href="#">link</a> here.</li> <li>• Dispose of waste and residues in accordance with local authority requirements</li> </ul>	<b>Handling:</b> <ul style="list-style-type: none"> <li>• Never add additives to solution prior to mixing with water</li> <li>• Wear appropriate personal protective equipment</li> <li>• Do not taste or ingest</li> <li>• Observe good industrial hygiene practices</li> <li>• Wash hands after handling</li> </ul>

## Applications

PetroFix is mixed with water on-site and easily applied onto the sub-surface using low pressure injections, or mixed in excavations. PetroFix is compatible with and can be used with ORC Advanced® to expedite rates of biodegradation. For more information about co-application with ORC Advanced, contact REGENESIS.