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Technical Memorandum

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To: Wendi Zheng, Cris-Sandra Maycock, Jane H. O'Connell (NYSDEC)

From: Jason Hayes, PE, LEED AP and Gerald Nicholls, PE, CHMM

Info: James Strobel, Aaron Lipman, Eric Saretsky, Sam Bernstein, Queens Development Group (QDG); Langan Team

Date: November 4, 2022

Re: Remedial Design for In-Situ Groundwater Treatment
Willets Point Development - Operable Unit 1 (OU-1)
Queens, NY
NYSDEC BCP Site No. C241146
Langan Project No.: 170197601

On behalf of the Volunteers (Queens Development Group, LLC [QDG]; QDG Hotel Partners, LLC; QDG 126th Street Partners, LLC; QDG Parking Partners, LLC; and QDG Retail Partners, LLC), Langan prepared this technical memorandum to present the Remedial Design (RD) for in-situ groundwater treatment as anticipated in the New York State Department of Environmental Conservation (NYSDEC)-approved May 11, 2022 Operable Unit 1 (OU-1) Remedial Action Work Plan (RAWP). The RAWP contemplated in-situ groundwater treatment as a contingency in the northern part of OU-1 where construction of a school is planned.

OU-1 is a 7.803-acre property located at Seaver Way (formerly 126th Street) and Willets Point Boulevard in Queens, New York. The overall Willets Point Development Brownfield Cleanup Program (BCP) Site is located in a former industrial zone in the Borough of Queens and has a total area of 22.887 acres (7.803 acres for OU-1 and 15.084 acres for OU-2, also known as Phase 2). A Site Layout Map is provided as Figure 1.

The remedial elements described herein include post-excavation in-situ groundwater treatment and continuation of post-remediation groundwater monitoring. The in-situ groundwater treatment contingency is being completed in accordance with the Decision Document to address the presence of target compounds that are present both in remaining soil below the water table and in groundwater.

1.0 REMEDIAL ACTIONS AND FUTURE REDEVELOPMENT

From June 7, 2021 through March 18, 2022, remedial excavation of soil exceeding restricted-residential (RR) soil cleanup objectives was completed. OU-1 redevelopment will begin in January 2023 consisting of an affordable housing development (including a Senior Affordable Rental Apartment [SARA] building), associated infrastructure improvements, and a school to be constructed by the New York City School Construction Authority (NYC SCA). This will be the first phase of redevelopment of the Willets Point Development BCP Site.

1.1 OU-1 Remediation Summary

Remediation of OU-1 to date has included installing a support of excavation (SOE) system, excavating site-wide soil/fill to between elevation (el) -10.10 to el 25.59 feet North American Vertical Datum of 1988 (NAVD88), and dewatering to accommodate SOE and foundation installation. OU-1 was remediated in accordance with the remedy selected by the September 18, 2019 Interim Remedial Measures Work Plan (IRMWP), May 11, 2021 RAWP, May 21, 2021 Decision Document, and the September 16, 2021 RAWP Modification letter.

IRMWP and RAWP implementation included bulk removal of petroleum source via excavation and offsite disposal throughout OU-1. To document the remedial activities performed in 2021 and 2022, Langan prepared a draft Construction Completion Report (CCR) that describes the remedy and nature and extent of remaining contamination following RAWP implementation within OU-1. The results of endpoint soil samples in the northeastern part of OU-1 indicated petroleum-related contamination exceeding the Part 375 Protection of Groundwater (PGW) Soil Cleanup Objectives (SCO). Langan submitted the draft CCR to NYSDEC for review on June 24, 2022. The draft CCR will be revised following demonstration of in-situ groundwater treatment efficacy as described in this RD. In addition to the draft CCR, Langan prepared a draft Interim Site Management Plan (SMP), which was submitted to NYSDEC for review on August 30, 2022. The draft Interim SMP provides environmental procedures and controls that will be complied with during redevelopment activities (infrastructure improvements and building construction) until the site-wide SMP is prepared for the overall BCP Site. At this time, the draft Interim SMP is not approved; therefore, OU-1 in-situ groundwater treatment will be performed under the approved OU-1 RAWP.

1.2 OU-1 Post-Remedial Performance Monitoring

The post-remedial quarterly groundwater monitoring plan is summarized in the draft Interim SMP and the RAWP. Quarterly groundwater sampling results are compared to the pre-remedial groundwater sample results collected during the remedial investigation (RI) and will continue quarterly to assess the performance of the remedy until residual groundwater concentrations are found to be below NYSDEC standards or have become asymptotic over an extended period. The first post-remedial quarterly groundwater sampling was performed on August 3 through 5, 2022 in accordance with the RAWP to document conditions following remedial excavation and groundwater containment wall installation. The results of the first post-remedial quarterly groundwater sampling will be documented in the forthcoming quarterly groundwater monitoring report. A total of 9 groundwater monitoring well locations distributed across OU-1 were sampled.

The results of the first post-remedial sampling event indicated significant reduction in contaminants of concern; however, petroleum impacts remain in soil and groundwater in the northeastern part of the corner of OU-1 (the SCA parcel). LNAPL was not observed in any groundwater monitoring wells during the first post-remedial sampling event. Both groundwater samples collected during the first post-remedial quarterly groundwater sampling in the SCA parcel had at least one detection above the Title 6 New York Codes, Rules, and Regulations

(NYCRR) Part 703.5 and NYSDEC Technical and Operational Guidance Series 1.1.1 Ambient Water Quality Standards and Guidance Values for Class GA (drinking water) (TOGS SGVs). At C-MW201, total volatile organic compounds (VOC), and semivolatile organic compounds (SVOC) decreased by an order of magnitude compared to the concentrations documented during the 2019 pre-remediation RI. While not directly comparable because the well locations are different, C-PZ206 sampled during the 2019 RI and C-RMW01 sampled in 2022 post-remedy were both collected within the SCA parcel. Total VOC concentrations in C-RMW01 are an order of magnitude lower than C-PZ206, and total SVOCs decreased by two orders of magnitude. Groundwater results are presented in Table 1 and on Figure 2.

Seven VOCs (1,2,4-trimethylbenzene, acetone, benzene, ethylbenzene, tert-butyl methyl ether [MTBE], toluene, and total xylenes) and one SVOC (naphthalene) were detected at concentrations exceeding both the NYSDEC TOGS SGVs in groundwater and PGW SCOs in documentation soil samples collected in the SCA parcel. Three of these VOCs, 1,2,4-trimethylbenzene, ethylbenzene, and total xylenes also exceeded RR SCOs in documentation soil samples collected in the SCA parcel during RAWP implementation.

To address the presence of the above-described compounds, the RAWP includes a contingency for in-situ groundwater treatment after source material excavation to achieve groundwater Remedial Action Objectives. As such, the proposed in-situ treatment is necessary within the SCA parcel. The petroleum-impacted area of about 15,000-square-feet within the SCA parcel shown on Figure 3 is proposed for in-situ treatment ("in-situ treatment area"), based on documentation soil sample and post-remedial groundwater sample results.

2.0 POST-EXCAVATION IN-SITU GROUNDWATER TREATMENT

The on-site groundwater treatment objective is to treat remaining impacts to soil, further reduce concentrations of target compounds in groundwater, and maintain plume containment/stabilization to prevent, to the extent feasible, the migration of the petroleum-impacted groundwater plume, consistent with the NYSDEC Program Policy DER-10: Technical Guidance for Site Investigation and Remediation (DER-10).

Based on review of the August 2022 groundwater monitoring data and the documentation sample results within the in-situ treatment area, the following contaminants of concern were detected in school parcel soil above PGW SCOs and in groundwater above NYSDEC TOGS SGVs:

- 1,2,4-Trimethylbenzene
- Acetone
- Benzene
- Ethylbenzene
- MTBE
- Toluene
- Total xylenes
- Naphthalene

2.1 In-Situ Treatment Area Groundwater Conditions

The current surface elevation in the in-situ treatment area ranges from el 6.2 to 12.3 feet. The area was previously excavated to below the groundwater table and backfilled with imported clean soil and virgin 0.75-inch stone. Based on the RI in 2019, monitoring well gauging during remedial actions in 2021, and OU-1 post-remedial performance monitoring in 2022, the groundwater table elevation ranges from el 7.36 to 10.9 feet.

Groundwater has an overall flow direction from east to west. Because of the lack of drainage systems, groundwater elevations are presumed to heavily depend on precipitation and infiltration

Groundwater quality parameters from instrument screening data collected during the August 2022 sampling event are summarized below for all monitoring wells at OU-1 and within the in-situ treatment area:

- Oxidation-reduction potential (ORP) ranged from -36 to -296 mV on OU-1
    - Within in-situ treatment area (C-RMW01): -181 millivolt (mV)
- Dissolved oxygen (DO) ranged from 0.0 to 7.29 milligram per liter (mg/L) on OU-1
    - Within in-situ treatment area: 0.01 mg/L
- pH ranged from 7.75 to 12.25 on OU-1
    - Within in-situ treatment area: 8.60
- Conductivity ranged from 1.19 to 11.9 mV on OU-1
    - Within in-situ treatment area: 10.1 microsiemens per centimeter (mS/cm)
- Temperature ranged from 19.22 to 25.41 °C on OU-1
    - Within in-situ treatment area: 24.20 °C

The groundwater quality parameter data along with analytical data was reviewed as part of the scoping process with Langan and REGENESIS. Based on the August 2022 data, the in-situ treatment area is under anaerobic conditions (less than 0.5 mg/L DO). Oxygen is the energetically-favored electron acceptor for natural anaerobic petroleum degradation and is likely being consumed in the current conditions, resulting in anaerobic biodegradation of petroleum hydrocarbons under current conditions when dissolved oxygen is exhausted. As documented in the Interstate Technology & Regulatory Council (IRTC) Technology Overview Evaluating Natural Source Zone Depletion at Sites with LNAPL (April 2009), petroleum hydrocarbon-degrading bacteria are ubiquitous in nature.

2.2 Remedial Technology Selection

As part of the design process, Langan coordinated with the remediation product vendor, REGENESIS, to select the appropriate reagent mix, dosage, and application method to address the above-listed contaminants of concern. In-situ remedial technologies were evaluated,

including in-situ chemical oxidization (ISCO), aerobic biodegradation and anaerobic biodegradation. Stimulation of biodegradation was the chosen approach for the following reasons:

- ISCO, while effective in degrading petroleum hydrocarbons, can oxidize organic material containing metals, which could temporarily mobilize currently insoluble/immobile metals bound in the nonnative fill. Metals, including cadmium, copper, lead, and mercury, were identified in soil endpoint samples within the treatment area above PGW and/or RR SCOs. In addition to the potential mobilization of metals, the treatment area overlies a former marsh deposit with a higher natural oxidant demand that could compete with or potentially consume remedial oxidants.
- Petroleum hydrocarbon-degrading bacteria are ubiquitous in nature and can utilize the OU-1 petroleum compounds as sources of carbon and energy.
- Biodegradation was evaluated and tested for feasibility as part of the approved OU-2 remedial approach. Given the consistent contaminant profile between OU-1 and OU-2, the design effort for OU-2 helped expedite the OU-1 additional groundwater treatment.

Once stimulation of biodegradation was confirmed to be the most effective remedial approach for OU-1 groundwater treatment, further treatment design analysis was performed to assess whether anaerobic, aerobic, or both anaerobic and aerobic biodegradation would be enhanced. Groundwater monitoring data in OU-1 confirmed oxygen-depleted groundwater conditions, consistent with the established naturally-occurring biodegradation. While anaerobic conditions are known and effective in degrading petroleum hydrocarbons, aerobic condition provide improved degradation kinetics (aerobic biodegradation is up to 100 times faster per REGENESIS). As such, to further increase the degradation rate, stimulation of both anaerobic and aerobic biodegradation pathways is planned, which is why both PetroFix™ and Oxygen Release Compound (ORC) Advanced® will be applied directly to groundwater and mixed with saturated soil/fill evenly across the treatment area.

PetroFix™ is an activated carbon remedial fluid paired with soluble, anaerobic electron acceptors designed to remediate dissolved hydrocarbons. PetroFix™ alone is designed to remediate a majority of the contaminants of concern, but according to REGENESIS, may treat MTBE to a lesser extent. ORC Advanced® is specially designed to treat petroleum impacts and has demonstrated capability to treat MTBE; therefore, a combined reagent mix of both products is proposed. Petroleum hydrocarbon plumes are typically depleted in oxygen, which limits the ability of naturally occurring microorganisms to degrade petroleum hydrocarbons. ORC Advanced® supplies a controlled release of oxygen for 9 to 12 months in the target treatment zone to create and support aerobic biodegradation of contaminants, as oxygen is the preferred natural electron acceptor for hydrocarbon bioremediation based on the standard free energy available for oxidation. The physical mixing of PetroFix™, the electron acceptor blend, and ORC Advanced® will also introduce additional oxygen to the treatment zone and promote aerobic degradation. Additionally, the nitrate and sulfate electron acceptor blend that is part of the PetroFix™

application promotes anaerobic degradation once oxygen is depleted in the subsurface. Therefore, with the combination of reagents, aerobic degradation will occur for the first 9 to 12 months while oxygen is present from the ORC Advanced® placement and direct mixing. Enhanced biodegradation will then continue under anaerobic conditions with the electron acceptor blend for an additional 3 to 6 months and will then be followed by natural anaerobic degradation, if needed.

2.2.1 Reagent 1: PetroFix with Powdered Electron Acceptor Blend

The remediation contractor will apply PetroFix™, a water-based suspension fluid of micron-scale activated carbon and biostimulating electron acceptors, to the treatment area. PetroFix™, developed by REGENESIS, of San Clemente, California, remediates hydrocarbons from the dissolved phase by absorbing them to activated carbon particles and stimulating anaerobic hydrocarbon biodegradation with added electron acceptors, which will be provided by the addition of a powdered electron acceptor blend. The powdered electron acceptor blend provides a 50:50 blend of sodium nitrate and ammonium sulfate to deliver the nitrate and sulfate anions, which act as electronic acceptors in anaerobic degradation of petroleum hydrocarbons. PetroFix™ and the powdered electron acceptor blend will be mechanically mixed directly into groundwater and remaining impacted saturated soil using an excavator attachment (i.e., bucket, auger, or rotary tool).

Based on a treatment area of about 15,000 square feet area and a treatment depth of about 4 feet into saturated soil, the total treatment volume is about 2,250 cubic yards of saturated soil/fill. The remediation contractor will procure PetroFix™ in 2,000-pound (lb) (275-gallon) totes and 400 lb (55-gallon) poly drums. The electron acceptor blend is a powder that will be provided in 20-lb pails. Based on a technical proposal prepared by REGENESIS, 9,200 lbs of PetroFix™ (4 totes and 3 drums) and 460 lbs of electron acceptor blend (23 pails) will be applied to the treatment area. The planned dosage is a minimum of 4.1 pounds per cubic yard (lbs/yd^3) of PetroFix™ and a minimum of 0.2 lbs/yd^3 of electron acceptor blend. Based on a 4-foot-thick mixing interval, the reagent mix amount needed for each 1,000 square feet of treatment area is about 63 gallons of PetroFix™ (about 0.3 totes or 1.5 drums[1]) and 31 pounds of electron acceptor blend (about 1.5 pails).

2.2.2 Reagent 2: Oxygen Release Compound (ORC) Advanced®

After PetroFix™ and the electron acceptor blend are mechanically mixed into the treatment area, ORC Advanced® will be applied and mechanically mixed into the treatment area. ORC Advanced® is a white, odorless powder and an engineered, oxygen-release compound designed specifically for enhanced, in-situ aerobic bioremediation of petroleum hydrocarbons in groundwater and saturated soils. ORC Advanced® is specifically designed to treat petroleum impacts and also has demonstrated capability to treat MTBE. ORC Advanced® supplies a controlled release of oxygen

[1] Dosage calculations assume that each 275-gallon tote contains 205 gallons of PetroFix™ and each 55-gallon drum contains 41 gallons of PetroFix™.

for 9 to 12 months in the target treatment zone to create and support aerobic biodegradation of contaminants. The physical mixing of PetroFix™, the electron acceptor blend, and ORC Advanced® will also introduce additional oxygen to the treatment zone.

The remediation contractor will procure ORC Advanced® in 40-lb bags. Based on a technical proposal prepared by REGENESIS, 5,920 lbs of ORC Advanced® (148 bags) will be applied. Based on a 4-foot-thick mixing interval, the reagent mix amount needed for each 1,000 square feet of treatment area is about 395 pounds of ORC Advanced® (about 9.9 bags).

2.1 In-Situ Treatment Area and Depths

The remediation products described above will be applied by direct in-situ mixing into the saturated soil and groundwater. Direct mixing was chosen instead of groundwater injection via wells primarily because direct mixing delivers remediation products more effectively. In addition, injection is not the preferred method in this case as groundwater is shallow, which can result in "daylighting" of injected material.

The in-situ groundwater treatment area represents the approximate area of remaining impacts within the SCA parcel following source material excavation performed in 2021/2022 and is based on documentation soil sample and post-remedial groundwater sample results. The proposed in-situ treatment area is an about 15,000-square-foot area within the SCA parcel shown on Figure 3.

Direct mixing will be performed to a minimum depth of 4 feet below the water table (about el 7.3), which corresponds to elevations ranging from about el 2 to el 3. Ground surface elevation varies from about el 6 to el 12 across the treatment area, consisting of a 2-foot thick composite cover system underlain with non-native fill.

The top of the composite cover system in western part of the treatment area is below the water table at about el 6.2. Direct mixing in this western area will be performed to a minimum depth of about el 2.2; direct mixing will occur within the 2 feet of the composite cover system and extend an additional 2 feet into non-native fill. The 2 feet of composite cover system material will be sacrificed and mixed during this process, and a new demarcation layer and composite cover system will be installed after treatment. The top of the composite cover system in eastern part of the treatment area is above the water table at about el 12.3. The 2-foot composite cover system in the western part of the treatment area and additional unsaturated non-native fill beneath the demarcation layer will be temporarily relocated adjacent to the excavation to expose saturated soil. Direct mixing will then be performed to a minimum depth of about el 3.3; direct mixing will occur within saturated fill about 4 feet into groundwater.

2.3 Field Implementation

Field implementation will be performed in accordance with the following sequence:

1. Cordon off treatment area and establish community air monitoring program (CAMP)
2. Temporarily relocate site cap and segregate clean cap material into a separate stockpile

3. Remove demarcation layer
4. Direct mix
5. Replace demarcation layer
6. Backfill / restore 2-foot composite cover

The field implementation activities are further detailed below.

All intrusive work will be completed within the OU-1 construction fence. The CAMP will include real-time monitoring for VOCs and particulates at the downwind perimeter of each designated work area when ground-intrusive work is in progress. Community air monitoring will be conducted in accordance with the CAMP presented in the RAWP Construction Health and Safety Plan (CHASP), which is in accordance with the NYSDOH Generic CAMP included as Appendix 1A in DER-10 and Appendix I in the RAWP. We anticipate maintaining two CAMP stations surrounding the work zone.

A minimum two-foot clean composite cover system was installed above a high-visibility demarcation barrier during RAWP implementation. A physical demarcation layer, consisting of orange snow material was placed under the composite cover system to provide a visual reference. This demarcation layer constitutes the top of the 'Residuals Management Zone', the zone that requires adherence to special conditions for disturbance of contaminated residual soils defined in the draft Interim SMP. To expose saturated soil/fill in the treatment zone, the composite cover system above the demarcation layer will be temporarily relocated into a separate stockpile and the demarcation layer will be removed in areas of the treatment zone that do not currently have exposed groundwater at grade surface. The underlying unsaturated non-native fill will also be temporarily removed and stockpiled separately to expose groundwater in the treatment area.

PetroFix™ will be either pumped into or sprayed across the treatment area and mechanically mixed with sitting groundwater in accordance with the manufacturer specifications (included as Attachment 1). Current site elevation in part of the treatment area is below groundwater, which will result in direct mixing of PetroFix™ within the exposed groundwater. The remaining parts of the treatment area at higher elevation will require temporary relocation of the site cap, removal of the demarcation barrier, and if required, temporary relocation of underlying unsaturated non-native fill to reach groundwater. Dilution is not required for application directly on standing groundwater, but a water source (potable water or un-impacted surface water from within OU-1) will be used to rinse the shipping containers so that all of the PetroFix™ liquid has been applied to the in-situ treatment area. The electron acceptor blend will then be applied separately to the treatment area; the electron acceptor powder should not be directly mixed into the PetroFix™ liquid prior to mixing with groundwater to avoid clumping and improper distribution of the powder. Application of the powdered electron acceptor represents an inhalation risk; as such, special precautions during application will be taken in compliance with RAWP CHASP and appropriate PPE will be donned by personnel within the mixing area to avoid inhalation.

Once PetroFix™ and the powdered electron accepter have been applied, an excavator will be used to mechanically mix the products with standing groundwater and saturated soil to about 4-feet below groundwater (between about el 2.2 and el 3.3), using standard excavator attachments such as a bucket, auger, or rotary tool. Standing water must be present in the base of the treatment area for this application method, or dilution of the PetroFix™ will be required as specified in the manufacturer technical proposal and specifications (provided in Attachment 1).

Following PetroFix™ and electron acceptor application, ORC Advanced® will be applied to the treatment area and an excavator will be used to mechanically mix ORC Advanced® evenly across the treatment area both horizontally and vertically within the 4-foot treatment area in accordance with manufacturer specifications (included as Attachment 1). If feasible, ORC Advanced® will be applied one day after PetroFix™ and electron acceptor application is complete; however, it can be applied the same day (after PetroFix™ and the electron acceptor are fully mixed) if work flow requires.

Following ORC Advanced® application, all disturbed areas will be restored with the temporarily relocated unsaturated non-native fill, composite cover system, and/or imported material subject to NYSDEC approval, and the final composite cover system will be restored in accordance with the RAWP. A physical demarcation layer, consisting of orange snow fencing or equivalent material will be placed to provide a visual reference before placement of the composite cover system. The composite cover system will consist of a minimum of 2 feet of clean fill or gravel imported from an approved facility/source. If a soil cover is constructed, the top 4 inches may consist of virgin ¾-inch crushed stone to serve as dust and vegetation suppression and mitigate erosion. Imported soil (i.e., clean fill), if needed, will meet NYSDEC NYCRR Part 375 Unrestricted Use (UU) SCOs.

The REGENESIS dosing calculations and excavation application guidance are provided in Attachment 1. Safety Data Sheets (SDS) for PetroFix™, the electron acceptor blend, and ORC Advanced® are provided in Attachment 2 and 3, respectively. The remediation contractor will provide product submittals prior to purchase and on-site implementation.

3.0 REMEDIAL PERFORMANCE MONITORING

Groundwater monitoring will be performed 60-days after the groundwater treatment is complete. To document in-situ groundwater treatment performance, groundwater samples will be collected from six groundwater monitoring wells (C-MW112, C-MW201, C-MW205, C-RMW01, B-MW206, and C-MW206). Four of the performance monitoring wells are down or crossgradient of the treatment area: C-MW112, C-MW201, C-MW205, B-MW206. Analytical data obtained from these wells will be used to confirm plume stabilization is maintained, consistent with the August 2022 quarterly groundwater monitoring results. Two of the performance monitoring wells are located within the treatment area: C-RMW01 and C-MW206[2]. Data collected from these two

[2] C-MW206 was found to be damaged during the August 2022 groundwater monitoring event and will be reinstalled after direct mixing; C RMW01 will either be protected during direct mixing or reinstalled in accordance with the RAWP and Interim SMP.

wells will be used to confirm contaminant reduction within the treatment area and demonstrate treatment efficacy.

Groundwater monitoring will be performed in accordance with this Remedial Design and the OU-1 RAWP until the draft Interim SMP is approved. Monitoring well locations are provided on Figure 3.

3.1 Post-Treatment Groundwater Monitoring Program

Prior to post-treatment sampling, the head space of each well will be monitored with a PID, an interface probe will be used to measure depth to water and confirm absence of LNAPL. Post-treatment groundwater samples will be analyzed for Part 375 and Target Compound List (TCL)-listed VOCs and SVOCs. A duplicate, field blank, and trip blank sample will also be analyzed.

PetroFix™ may take a few weeks to a few months to fully attach to soils, and it is not recommended to begin post-treatment sampling until PetroFix™ concentrations in groundwater have dropped below 100 mg/L in monitoring wells. If PetroFix™ concentrations have not subsided below this concentration, as determined by a colorimetric field test provided by REGENESIS, filtered and unfiltered groundwater samples will be collected.

4.0 SCHEDULE

The in-situ groundwater treatment is estimated to take approximately 10± days to complete, and is anticipated to begin the first week of November 2022, assuming NYSDEC approval. Following a 60-day waiting period to allow for remediation products to dissolve, stimulate biodegradation and treat target compounds, it is anticipated that the first post-treatment groundwater monitoring samples will be collected in mid-January.

After the first post-treatment groundwater results are validated, the results will be provided to NYSDEC for review. If the first round results demonstrate plume stabilization is achieved and groundwater concentrations continue to reduce relative to the baseline (2019 Remedial Investigation) and August 2022 groundwater sampling events, the draft CCR will be revised to reflect the in-situ groundwater treatment and performance monitoring results and re-submitted to NYSDEC for review and approval. If the first round of in-situ treatment results do not confirm treatment efficacy, additional treatment time and sampling will occur or supplemental treatment will be considered to achieve the Remedial Action Objectives.

Langan anticipates acceptance of the revised CCR by mid-March 2023. Subsequent to CCR submission, the draft Interim SMP will be revised and resubmitted and quarterly groundwater monitoring will resume. The draft Interim SMP will govern ground-intrusive and monitoring activities within OU-1 until the site-wide SMP is prepared and approved (anticipated to be December 2023 per the planned certificate of completion for the Willets Point BCP Site).

While the in-situ groundwater treatment is occurring in the SCA parcel, infrastructure and building development work will begin in 2023. We do not anticipate any conflict between the in-situ groundwater treatment and the construction activities associated with infrastructure and building

development, which will occur in accordance with their applicable agency approvals, the OU-1 RAWP, and/or the draft Interim SMP.

A breakdown of the anticipated schedule is included as Attachment 4.

5.0 CERTIFICATION

I, Jason J. Hayes, PE, certify that I am currently a NYS registered professional engineer as defined in 6 NYCRR Part 375 and that this Technical Memorandum was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10) and that all activities were performed in full accordance with the DER-approved work plan and any DER-approved modifications.

Jason Hayes
NYS Professional Engineer 089491

11/4/2022
Date

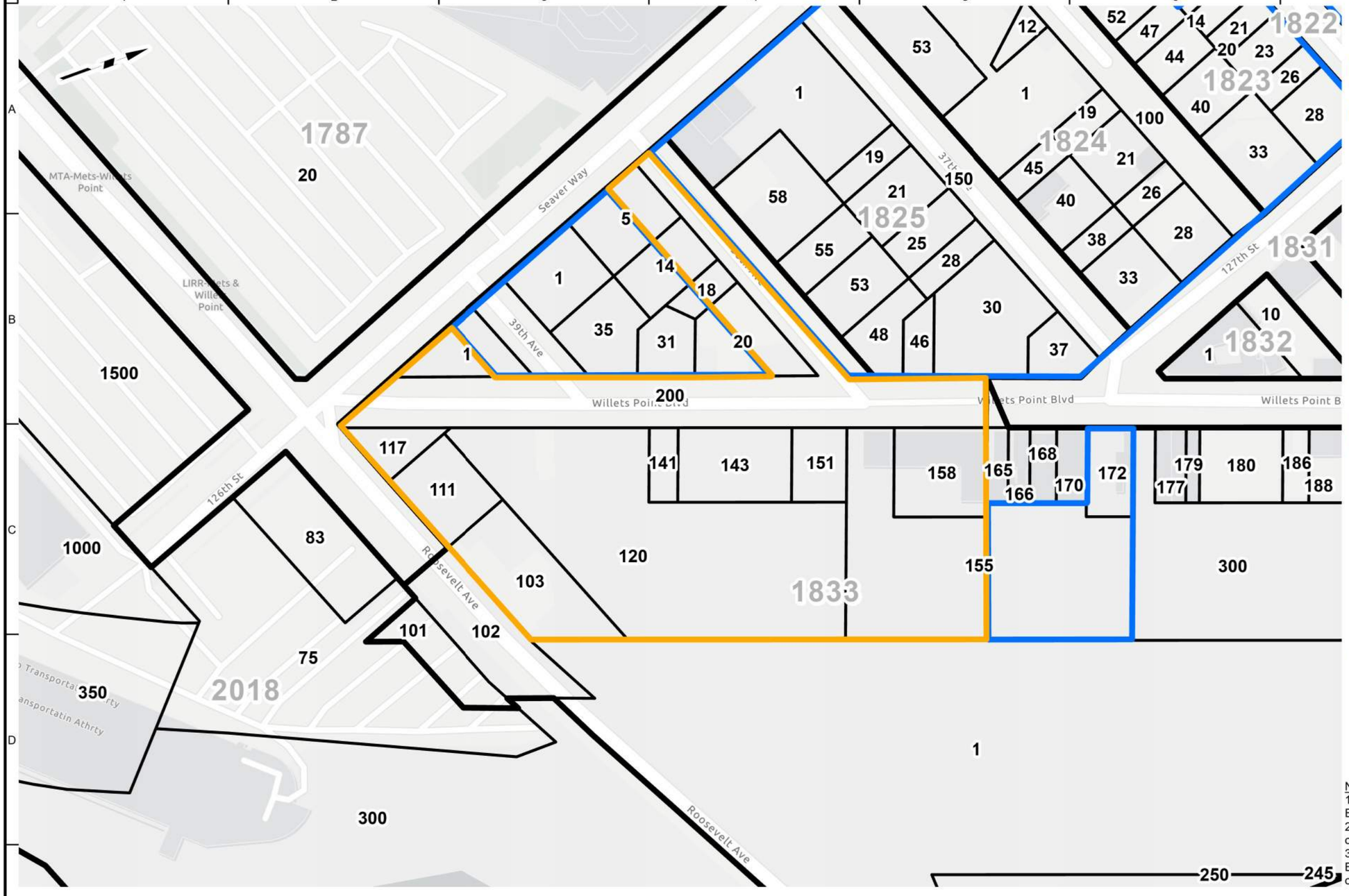
Signature

Figures
Figure 1: OU-1 Location and Layout Plan
Figure 2: Groundwater Analytical Results Map
Figure 3: Proposed In-Situ Treatment and Monitoring Well Location Map

Tables
Table 1: Groundwater Sample Analytical Results

Attachments
Attachment 1: REGENESIS Quote, Application Guidance, and Specifications
Attachment 2: PetroFix™ and Electron Acceptor Blend SDS
Attachment 3: ORC Advanced® SDS
Attachment 4: Schedule

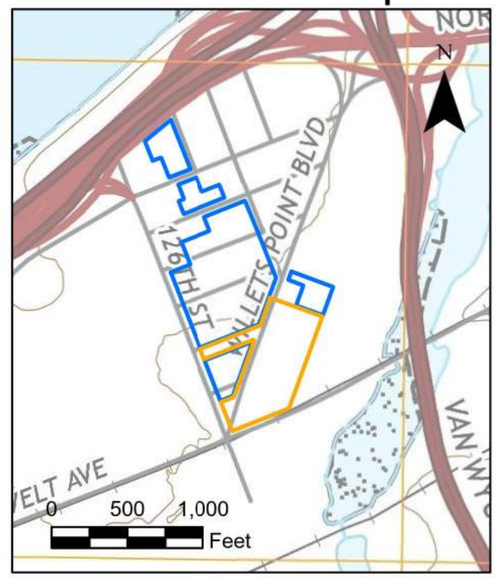
FIGURES



Legend

- Approximate Operable Unit (OU-1) Boundary
- Approximate Willets Point BCP Site Boundary
- Tax Block
- Tax Lot

Reference Map



Notes:
1. Light Gray Canvas basemap provided through Langan's Esri and ArcGIS software licensing and ArcGIS Online.
2. Tax parcel data provided by the New York City Department of City Planning, 2022.
3. Lots 103, 111, 120, 135, 140, 141, 143, 151, 155,158 and Block 1833 extracted from the NYC "Application for Apportionments or Mergers" form, dated February 2022.

150 0 150
SCALE IN FEET

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Project
WILLETS POINT DEVELOPMENT OU-1
QUEENS NEW YORK

Figure Title
OU-1 LOCATION AND LAYOUT PLAN

Project No. 170197601	Figure No. 1
Date 10/19/2022	
Scale 1"=150'	
Drawn By PDT	Figure 1 of 3

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Path: \\Langan.com\data\NY\data6\170197601\ArcGIS\APRX\170197601\170197601_CCR.aprx Date: 6/17/2022 User: pditillio Time: 1:22 PM

Location	E-MW01	E-MW01
Sample Name	E-MW01_110519	E-MW01_080522
Sample Date	11/5/2019	8/5/2022
VOCs		
1,2,4,5-Tetramethylbenzene	**12**	**9.9**
1,2,4-Trimethylbenzene	0.79 J	**6.6 J**
1,3,5-Trimethylbenzene (Mesitylene)	<2.5 U	<10 U
1,4-Dioxane (P-Dioxane)	<250 U	<1,000 U
Acetone	<5 U	**67 J**
Benzene	**8.8**	**11**
Cymene	<2.5 U	<10 U
Ethylbenzene	<2.5 U	3.8 J
Isopropylbenzene (Cumene)	**8.9**	3.6 J
M,P-Xylene	1.5 J	**72 J**
Methyl Ethyl Ketone (2-Butanone)	<5 U	<20 U
Naphthalene	<2.5 U	**440**
n-Propylbenzene	**13**	**74 J**
o-Xylene (1,2-Dimethylbenzene)	0.76 J	<10 U
Tert-Butyl Methyl Ether	3.8	**70**
Tetrachloroethene (PCE)	<0.5 U	<2 U
Toluene	0.97 J	<10 U
Total Xylenes	2.3 J	**72 J**
Trichloroethene (TCE)	<0.5 UJ	<2 U
Total VOCs	56.2	640.1
SVOCs		
2,4-Dimethylphenol	<5 U	**11 J**
Benzo(a)anthracene	<0.1 U	<0.1 U
Benzo(a)pyrene	<0.1 U	<0.1 U
Benzo(b)fluoranthene	<0.1 U	<0.1 U
Benzo(k)fluoranthene	<0.1 U	<0.1 U
Chrysene	<0.1 U	**0.01 J**
Indeno(1,2,3-cd)pyrene	<0.1 U	<0.1 U
Naphthalene	0.07 J	**240**
Phenol	<5 U	**23**
Total SVOCs	2.83	343.02

Location	A-MW204	A-MW204
Sample Name	A-MW204_052819	A-MW204_080522
Sample Date	5/28/2019	8/5/2022
VOCs		
1,2,4,5-Tetramethylbenzene	<2 U	<2 U
1,2,4-Trimethylbenzene	<2.5 U	<2.5 U
1,3,5-Trimethylbenzene (Mesitylene)	<2.5 U	<2.5 U
1,4-Dioxane (P-Dioxane)	<250 UJ	<250 U
Acetone	4.9 J	14 J
Benzene	<0.5 U	<0.5 U
Cymene	<2.5 U	<2.5 U
Ethylbenzene	<2.5 U	<2.5 U
Isopropylbenzene (Cumene)	<2.5 U	<2.5 U
M,P-Xylene	<2.5 U	<2.5 U
Methyl Ethyl Ketone (2-Butanone)	<5 U	3.1 J
Naphthalene	<2.5 UJ	0.72 J
n-Propylbenzene	<2.5 U	<2.5 U
o-Xylene (1,2-Dimethylbenzene)	<2.5 U	<2.5 U
Tert-Butyl Methyl Ether	75	4.7
Tetrachloroethene (PCE)	<0.5 U	<0.5 U
Toluene	<2.5 U	<2.5 U
Total Xylenes	<2.5 U	<2.5 U
Trichloroethene (TCE)	<0.5 U	<0.5 U
Total VOCs	12.4	24.42
SVOCs		
1,4-Dioxane (P-Dioxane)	3.44	NA
2,4-Dimethylphenol	<5 U	<5 UJ
Benzo(a)anthracene	<0.1 U	<0.1 U
Benzo(a)pyrene	<0.1 U	**0.06 J**
Benzo(b)fluoranthene	<0.1 U	<0.1 U
Benzo(k)fluoranthene	<0.1 U	**0.03 J**
Chrysene	<0.1 U	**0.07 J**
Indeno(1,2,3-cd)pyrene	<0.1 U	**0.05 J**
Naphthalene	<0.1 U	0.32
Phenol	<5 U	<5 U
Total SVOCs	8.97	0.91

Location	A-PZ112	A-PZ112
Sample Name	A-PZ112_052819	GWDUP01_052819
Sample Date	5/28/2019	5/28/2019
VOCs		
1,2,4,5-Tetramethylbenzene	1.9 J	1.7 J
1,2,4-Trimethylbenzene	**17**	**15**
1,3,5-Trimethylbenzene (Mesitylene)	1.7 J	1.5 J
1,4-Dioxane (P-Dioxane)	<250 UJ	<250 UJ
Acetone	3.7 J	9.3 J
Benzene	**1.7**	**1.4**
Cymene	<2.5 U	<2.5 U
Ethylbenzene	4.8	3.6
Isopropylbenzene (Cumene)	<2.5 U	<2.5 U
M,P-Xylene	**9.5**	**8.6**
Methyl Ethyl Ketone (2-Butanone)	<5 U	<5 U
Naphthalene	2.5 J	2.7 J
n-Propylbenzene	0.8 J	<2.5 U
o-Xylene (1,2-Dimethylbenzene)	<2.5 U	<2.5 U
Tert-Butyl Methyl Ether	**26**	**25**
Tetrachloroethene (PCE)	<0.5 U	<0.5 U
Toluene	<2.5 U	<2.5 U
Total Xylenes	**9.5**	**8.6**
Trichloroethene (TCE)	<0.5 U	<0.5 U
Total VOCs	85.1	82.9
SVOCs		
1,4-Dioxane (P-Dioxane)	3.87	3.87
2,4-Dimethylphenol	<5 U	<5 U
Benzo(a)anthracene	<0.1 U	<0.1 U
Benzo(a)pyrene	<0.1 U	<0.1 U
Benzo(b)fluoranthene	<0.1 U	<0.1 U
Benzo(k)fluoranthene	<0.1 U	<0.1 U
Chrysene	<0.1 U	<0.1 U
Indeno(1,2,3-cd)pyrene	<0.1 U	<0.1 U
Naphthalene	2.1	2.2 J
Phenol	<5 U	<5 U
Total SVOCs	7.17	707

Location	D-MW201	D-MW201
Sample Name	D-MW201_052819	D-MW201_080522
Sample Date	5/28/2019	8/5/2022
VOCs		
1,2,4,5-Tetramethylbenzene	<2 U	<2 U
1,2,4-Trimethylbenzene	<2.5 U	<2.5 U
1,3,5-Trimethylbenzene (Mesitylene)	<2.5 U	<2.5 U
1,4-Dioxane (P-Dioxane)	<250 UJ	<250 U
Acetone	1.8 J	1.5 J
Benzene	<0.5 U	<0.5 U
Cymene	<2.5 U	<2.5 U
Ethylbenzene	<2.5 U	<2.5 U
Isopropylbenzene (Cumene)	<2.5 U	<2.5 U
M,P-Xylene	<2.5 U	<2.5 U
Methyl Ethyl Ketone (2-Butanone)	<5 U	<5 U
Naphthalene	<2.5 UJ	1.4 J
n-Propylbenzene	<2.5 U	<2.5 U
o-Xylene (1,2-Dimethylbenzene)	<2.5 U	<2.5 U
Tert-Butyl Methyl Ether	1.9 J	2.3 J
Tetrachloroethene (PCE)	<0.5 U	<0.5 U
Toluene	<2.5 U	<2.5 U
Total Xylenes	<2.5 U	<2.5 U
Trichloroethene (TCE)	<0.5 U	<0.5 U
Total VOCs	3.7	5.2
SVOCs		
1,4-Dioxane (P-Dioxane)	0.719	NA
2,4-Dimethylphenol	<5 U	<5 UJ
Benzo(a)anthracene	<0.1 U	<0.1 U
Benzo(a)pyrene	<0.1 U	**0.02 J**
Benzo(b)fluoranthene	<0.1 U	<0.1 U
Benzo(k)fluoranthene	<0.1 U	**0.01 J**
Chrysene	<0.1 U	**0.01 J**
Indeno(1,2,3-cd)pyrene	<0.1 U	**0.04 J**
Naphthalene	<0.18 U	0.4
Phenol	<5 U	<5 U
Total SVOCs	0.91	0.54

Location	B-MW201
Sample Name	B-MW201_052919
Sample Date	5/29/2019
VOCs	
1,2,4,5-Tetramethylbenzene	<2 U
1,2,4-Trimethylbenzene	<2.5 U
1,3,5-Trimethylbenzene (Mesitylene)	<2.5 U
1,4-Dioxane (P-Dioxane)	<250 U
Acetone	5.2
Benzene	<0.5 U
Cymene	<2.5 U
Ethylbenzene	<2.5 U
Isopropylbenzene (Cumene)	<2.5 UJ
M,P-Xylene	<2.5 U
Methyl Ethyl Ketone (2-Butanone)	<5 U
Naphthalene	<2.5 UJ
n-Propylbenzene	<2.5 U
o-Xylene (1,2-Dimethylbenzene)	<2.5 U
Tert-Butyl Methyl Ether	3.7
Tetrachloroethene (PCE)	<0.5 U
Toluene	<2.5 U
Total Xylenes	<2.5 U
Trichloroethene (TCE)	<0.5 U
Total VOCs	12.7
SVOCs	
1,4-Dioxane (P-Dioxane)	0.756
2,4-Dimethylphenol	<5 U
Benzo(a)anthracene	<0.1 U
Benzo(a)pyrene	<0.1 U
Benzo(b)fluoranthene	<0.1 U
Benzo(k)fluoranthene	<0.1 U
Chrysene	<0.1 U
Indeno(1,2,3-cd)pyrene	<0.1 U
Naphthalene	<0.99 U
Phenol	0.59 J
Total SVOCs	3729

Location	C-PZ112	C-MW112
Sample Name	C-PZ112_052919	C-MW112_080422
Sample Date	5/29/2019	8/4/2022
VOCs		
1,2,4,5-Tetramethylbenzene	**8.8**	<2 U
1,2,4-Trimethylbenzene	1.2 J	<2.5 U
1,3,5-Trimethylbenzene (Mesitylene)	<2.5 UJ	<2.5 U
1,4-Dioxane (P-Dioxane)	<250 UJ	<250 U
Acetone	<5 U	11 J
Benzene	**30**	0.38 J
Cymene	0.74 J	<2.5 U
Ethylbenzene	0.71 J	<2.5 U
Isopropylbenzene (Cumene)	**6.2 J**	<2.5 U
M,P-Xylene	2.2 J	<2.5 U
Methyl Ethyl Ketone (2-Butanone)	<5 UJ	<5 U
Naphthalene	2.4 J	<2.5 U
n-Propylbenzene	**6.9 J**	<2.5 U
o-Xylene (1,2-Dimethylbenzene)	0.83 J	<2.5 U
Tert-Butyl Methyl Ether	6.4	2.8
Tetrachloroethene (PCE)	<0.5 U	<0.5 U
Toluene	0.7 J	<2.5 U
Total Xylenes	3 J	<2.5 U
Trichloroethene (TCE)	<0.5 U	<0.5 U
Total VOCs	7798	14.18
SVOCs		
1,4-Dioxane (P-Dioxane)	0.551	NA
2,4-Dimethylphenol	<5 U	<5 U
Benzo(a)anthracene	**0.03** J	<0.1 U
Benzo(a)pyrene	<0.1 U	**0.02 J**
Benzo(b)fluoranthene	<0.1 U	**0.02 J**
Benzo(k)fluoranthene	<0.1 U	**0.02 J**
Chrysene	<0.1 U	**0.04 J**
Indeno(1,2,3-cd)pyrene	<0.1 U	**0.03 J**
Naphthalene	<0.22 U	**16**
Phenol	0.59 J	**16**
Total SVOCs	3729	30.57

Location	C-MW201	C-MW201
Sample Name	C-MW201_052919	C-MW201_080422
Sample Date	5/29/2019	8/4/2022
VOCs		
1,2,4,5-Tetramethylbenzene	17 J	<2 U
1,2,4-Trimethylbenzene	4.4	<2.5 U
1,3,5-Trimethylbenzene (Mesitylene)	**5.6**	<2.5 U
1,4-Dioxane (P-Dioxane)	<250 UJ	<250 U
Acetone	30 J	<5 U
Benzene	**3.5**	0.3 J
Cymene	**6**	<2.5 U
Ethylbenzene	1 J	<2.5 U
Isopropylbenzene (Cumene)	<2.5 U	<2.5 U
M,P-Xylene	**5.1**	<2.5 U
Methyl Ethyl Ketone (2-Butanone)	2.9 J	<5 U
Naphthalene	0.78 J	4.8
n-Propylbenzene	<2.5 U	<2.5 U
o-Xylene (1,2-Dimethylbenzene)	**13**	<2.5 U
Tert-Butyl Methyl Ether	12 J	**15**
Tetrachloroethene (PCE)	**160**	<0.5 U
Toluene	**9.2**	<2.5 U
Total Xylenes	**18**	<2.5 U
Trichloroethene (TCE)	**110**	<0.5 U
Total VOCs	38788	21.5
SVOCs		
1,4-Dioxane (P-Dioxane)	0.221	NA
2,4-Dimethylphenol	<5 U	<5 U
Benzo(a)anthracene	<0.1 U	<0.1 U
Benzo(a)pyrene	<0.1 U	**0.06 J**
Benzo(b)fluoranthene	<0.1 U	<0.1 U
Benzo(k)fluoranthene	<0.1 U	**0.03 J**
Chrysene	<0.1 U	**0.07 J**
Indeno(1,2,3-cd)pyrene	<0.1 U	**0.05 J**
Naphthalene	<0.68 U	2.7
Phenol	**1.6 J**	<5 U
Total SVOCs	30.84	4.97

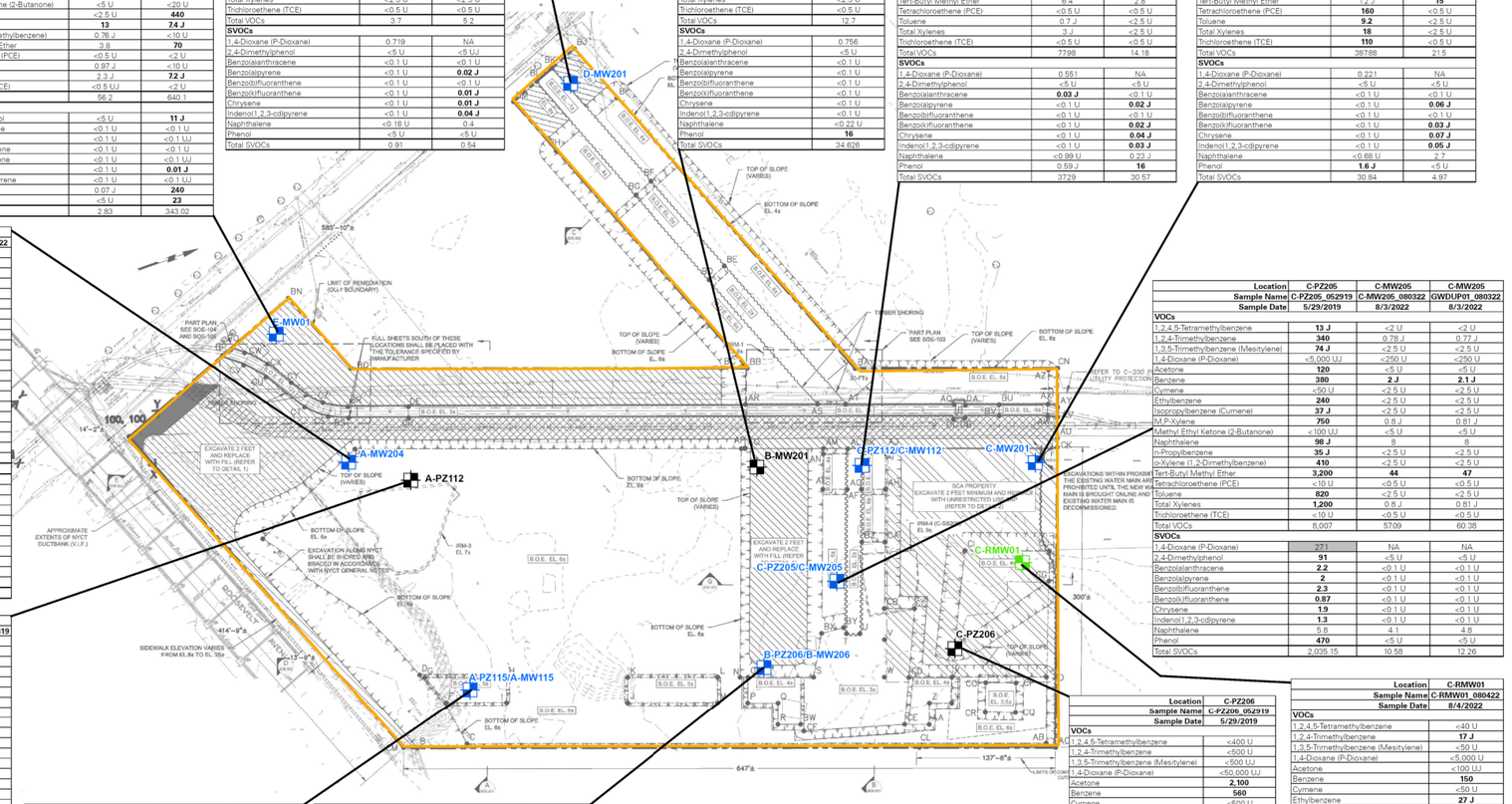
Location	C-PZ205	C-MW205	C-MW205
Sample Name	C-PZ205_052919	C-MW205_080322	GWDUP01_080322
Sample Date	5/29/2019	8/3/2022	8/3/2022
VOCs			
1,2,4,5-Tetramethylbenzene	**13 J**	<2 U	<2 U
1,2,4-Trimethylbenzene	**340**	0.78 J	0.77 J
1,3,5-Trimethylbenzene (Mesitylene)	**74 J**	<2.5 U	<2.5 U
1,4-Dioxane (P-Dioxane)	<5,000 UJ	<250 U	<250 U
Acetone	**120**	<5 U	<5 U
Benzene	**380**	**2 J**	**2.1 J**
Cymene	<50 U	<2.5 U	<2.5 U
Ethylbenzene	**240**	<2.5 U	<2.5 U
Isopropylbenzene (Cumene)	**37 J**	<2.5 U	<2.5 U
M,P-Xylene	**750**	0.8 J	0.81 J
Methyl Ethyl Ketone (2-Butanone)	<100 UJ	<5 U	<5 U
Naphthalene	**98 J**	8	8
n-Propylbenzene	**35 J**	<2.5 U	<2.5 U
o-Xylene (1,2-Dimethylbenzene)	**410**	<2.5 U	<2.5 U
Tert-Butyl Methyl Ether	**3,200**	**44**	**47**
Tetrachloroethene (PCE)	<10 U	<0.5 U	<0.5 U
Toluene	**820**	<2.5 U	<2.5 U
Total Xylenes	**1,200**	0.8 J	0.81 J
Trichloroethene (TCE)	<10 U	<0.5 U	<0.5 U
Total VOCs	8,007	5709	60.38
SVOCs			
1,4-Dioxane (P-Dioxane)	271	NA	NA
2,4-Dimethylphenol	**91**	<5 U	<5 U
Benzo(a)anthracene	**2.2**	<0.1 U	<0.1 U
Benzo(a)pyrene	**2**	<0.1 U	<0.1 U
Benzo(b)fluoranthene	**2.3**	<0.1 U	<0.1 U
Benzo(k)fluoranthene	**0.87**	<0.1 U	<0.1 U
Chrysene	**1.9**	<0.1 U	<0.1 U
Indeno(1,2,3-cd)pyrene	**1.3**	<0.1 U	<0.1 U
Naphthalene	5.8	4.1	4.8
Phenol	**470**	<5 U	<5 U
Total SVOCs	2,035.15	10.58	12.26

Location	A-PZ115	A-MW115
Sample Name	A-PZ115_052919	A-MW115_080322
Sample Date	5/29/2019	8/3/2022
VOCs		
1,2,4,5-Tetramethylbenzene	<2 U	<2 U
1,2,4-Trimethylbenzene	<2 5 U	<2.5 U
1,3,5-Trimethylbenzene (Mesitylene)	<2 5 UJ	<2.5 U
1,4-Dioxane (P-Dioxane)	<250 UJ	<250 U
Acetone	2.4 J	45 J
Benzene	<0.5 U	<0.5 U
Cymene	<2 5 U	<2.5 U
Ethylbenzene	<2 5 U	<2.5 U
Isopropylbenzene (Cumene)	<2.5 UJ	<2.5 U
M,P-Xylene	<2 5 U	<2.5 U
Methyl Ethyl Ketone (2-Butanone)	<5 UJ	6.2
Naphthalene	<2 5 UJ	<2.5 U
n-Propylbenzene	<2.5 UJ	<2.5 U
o-Xylene (1,2-Dimethylbenzene)	<2 5 U	<2.5 U
Tert-Butyl Methyl Ether	6.4	<2.5 U
Tetrachloroethene (PCE)	<0.5 U	<0.5 U
Toluene	<2 5 U	<2.5 U
Total Xylenes	<2 5 U	<2.5 U
Trichloroethene (TCE)	<0.5 U	<0.5 U
Total VOCs	8.8	51.2
SVOCs		
1,4-Dioxane (P-Dioxane)	0.608	NA
2,4-Dimethylphenol	<5 U	<5 U
Benzo(a)anthracene	<0.1 U	<0.1 U
Benzo(a)pyrene	<0.1 UJ	<0.1 U
Benzo(b)fluoranthene	<0.1 U	<0.1 U
Benzo(k)fluoranthene	<0.1 U	<0.1 U
Chrysene	<0.1 U	<0.1 U
Indeno(1,2,3-cd)pyrene	<0.1 UJ	<0.1 U
Naphthalene	<0.1 U	0.12
Phenol	<5 U	**3.6 J**
Total SVOCs	0.608	19.8

Location	B-PZ206	B-MW206
Sample Name	B-PZ206_052919	B-MW206_080322
Sample Date	5/29/2019	8/3/2022
VOCs		
1,2,4,5-Tetramethylbenzene	<2 U	<2 U
1,2,4-Trimethylbenzene	<2.5 U	<2.5 U
1,3,5-Trimethylbenzene (Mesitylene)	<2.5 UJ	<2.5 U
1,4-Dioxane (P-Dioxane)	<250 UJ	<250 U
Acetone	4.9 J	26 J
Benzene	<0.5 U	**75**
Cymene	<2.5 U	<2.5 U
Ethylbenzene	<2.5 U	<2.5 U
Isopropylbenzene (Cumene)	<2.5 UJ	<2.5 U
M,P-Xylene	<2.5 U	<2.5 U
Methyl Ethyl Ketone (2-Butanone)	<5 UJ	4.2 J
Naphthalene	<2.5 UJ	2.7
n-Propylbenzene	<2.5 UJ	<2.5 U
o-Xylene (1,2-Dimethylbenzene)	<2.5 U	<2.5 U
Tert-Butyl Methyl Ether	**88**	2.1 J
Tetrachloroethene (PCE)	<0.5 U	<0.5 U
Toluene	<2.5 U	<2.5 U
Total Xylenes	<2.5 U	<2.5 U
Trichloroethene (TCE)	<0.5 U	<0.5 U
Total VOCs	92.9	44.2
SVOCs		
1,4-Dioxane (P-Dioxane)	2.04	NA
2,4-Dimethylphenol	<5 U	<5 U
Benzo(a)anthracene	**0.13**	**0.12 J**
Benzo(a)pyrene	**0.07 J**	**0.08 J**
Benzo(b)fluoranthene	**0.15**	**0.1 J**
Benzo(k)fluoranthene	**0.06 J**	<0.1 U
Chrysene	**0.11**	**0.11 J**
Indeno(1,2,3-cd)pyrene	**0.09 J**	<0.1 U
Naphthalene	<0.1 U	17
Phenol	**4.2 J**	**15**
Total SVOCs	19.13	25.77

Location	C-PZ206
Sample Name	C-PZ206_052919
Sample Date	5/29/2019
VOCs	
1,2,4,5-Tetramethylbenzene	<400 U
1,2,4-Trimethylbenzene	<500 U
1,3,5-Trimethylbenzene (Mesitylene)	<500 UJ
1,4-Dioxane (P-Dioxane)	<50,000 UJ
Acetone	**2,100**
Benzene	**560**
Cymene	<500 U
Ethylbenzene	<500 U
Isopropylbenzene (Cumene)	<500 UJ
M,P-Xylene	**410 J**
Methyl Ethyl Ketone (2-Butanone)	**640 J**
Naphthalene	<500 UJ
n-Propylbenzene	<500 UJ
o-Xylene (1,2-Dimethylbenzene)	**190 J**
Tert-Butyl Methyl Ether	**29,000**
Tetrachloroethene (PCE)	<100 U
Toluene	**1,200**
Total Xylenes	**600 J**
Trichloroethene (TCE)	<100 U
Total VOCs	34,700
SVOCs	
1,4-Dioxane (P-Dioxane)	86
2,4-Dimethylphenol	**83 J**
Benzo(a)anthracene	<10 U
Benzo(a)pyrene	<10 U
Benzo(b)fluoranthene	<10 U
Benzo(k)fluoranthene	<10 U
Chrysene	<10 U
Indeno(1,2,3-cd)pyrene	<10 U
Naphthalene	**55**
Phenol	**1,400**
Total SVOCs	8,870.1

Location	C-RMW01
Sample Name	C-RMW01_080422
Sample Date	8/4/2022
VOCs	
1,2,4,5-Tetramethylbenzene	<40 U
1,2,4-Trimethylbenzene	**17 J**
1,3,5-Trimethylbenzene (Mesitylene)	<50 U
1,4-Dioxane (P-Dioxane)	<5,000 U
Acetone	<100 UJ
Benzene	**150**
Cymene	<50 U
Ethylbenzene	**27 J**
Isopropylbenzene (Cumene)	<50 U
M,P-Xylene	**35 J**
Methyl Ethyl Ketone (2-Butanone)	<100 U
Naphthalene	<50 U
n-Propylbenzene	<50 U
o-Xylene (1,2-Dimethylbenzene)	<50 U
Tert-Butyl Methyl Ether	**2,800**
Tetrachloroethene (PCE)	<10 U
Toluene	<50 U
Total Xylenes	**35 J**
Trichloroethene (TCE)	<10 U
Total VOCs	3,064
SVOCs	
2,4-Dimethylphenol	**1.8 J**
Benzo(a)anthracene	<0.2 U
Benzo(a)pyrene	<0.2 U
Benzo(b)fluoranthene	<0.2 U
Benzo(k)fluoranthene	<0.2 U
Chrysene	<0.2 U
Indeno(1,2,3-cd)pyrene	<0.2 U
Naphthalene	7.1
Phenol	<5 U
Total SVOCs	19.5



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SCALE IN FEET

Legend

- OU-1 Boundary
- Approximate Location of Monitoring Well Sampled During the August 2022 Quarterly Sampling Event
- Approximate Location of Monitoring Well Sampling During the Remedial Investigation
- Approximate Location of Monitoring Well Sampled During the Remedial Investigation and August 2022 Quarterly Sampling Event

Analyte	NYSDEC SGVs	NYSDEC Guidance Values
VOCs		
1,2,4,5-Tetramethylbenzene	5	NS
1,2,4-Trimethylbenzene	5	NS
1,3,5-Trimethylbenzene (Mesitylene)	5	NS
1,4-Dioxane (P-Dioxane)	NS	1
Acetone	50	NS
Benzene	1	NS
Cymene	5	NS
Ethylbenzene	5	NS
Isopropylbenzene (Cumene)	5	NS
M,P-Xylene	5	NS
Methyl Ethyl Ketone (2-Butanone)	50	NS
Naphthalene	10	NS
n-Propylbenzene	5	NS
o-Xylene (1,2-Dimethylbenzene)	5	NS
Tert-Butyl Methyl Ether	10	NS
Tetrachloroethene (PCE)	5	NS
Toluene	5	NS
Total Xylenes	5	NS
Trichloroethene (TCE)	5	NS
SVOCs		
1,4-Dioxane (P-Dioxane)	NS	1
2,4-Dimethylphenol	1	NS
Benzo(a)anthracene	0.002	NS
Benzo(a)pyrene	0	NS
Benzo(b)fluoranthene	0.002	NS
Benzo(k)fluoranthene	0.002	NS
Chrysene	0.002	NS
Indeno(1,2,3-cd)pyrene	0.002	NS
Naphthalene	10	NS
Phenol	1	NS

Exceedance Summary:

10 - Result exceeds NYSDEC SGVs

10 - Result exceeds NYSDEC Guidance Values

Notes:

1. Basemap extracted from Willets Point Development Site Remediation Bulletin #2 drawing SOE-101.01 "Excavation Plan"drawing, dated October 8, 2021.
2. OU = Operable Unit
3. Sample concentrations are in micrograms per liter (µg/l)

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Project

WILLETS POINT DEVELOPMENT OU-1

QUEENS NEW YORK

Figure Title

GROUNDWATER ANALYTICAL RESULTS MAP

Project No. 170197601	Figure No. 2
Date 9/14/2022	
Scale 1"=150'	
Drawn By MG\PDT	Figure 2 of 3

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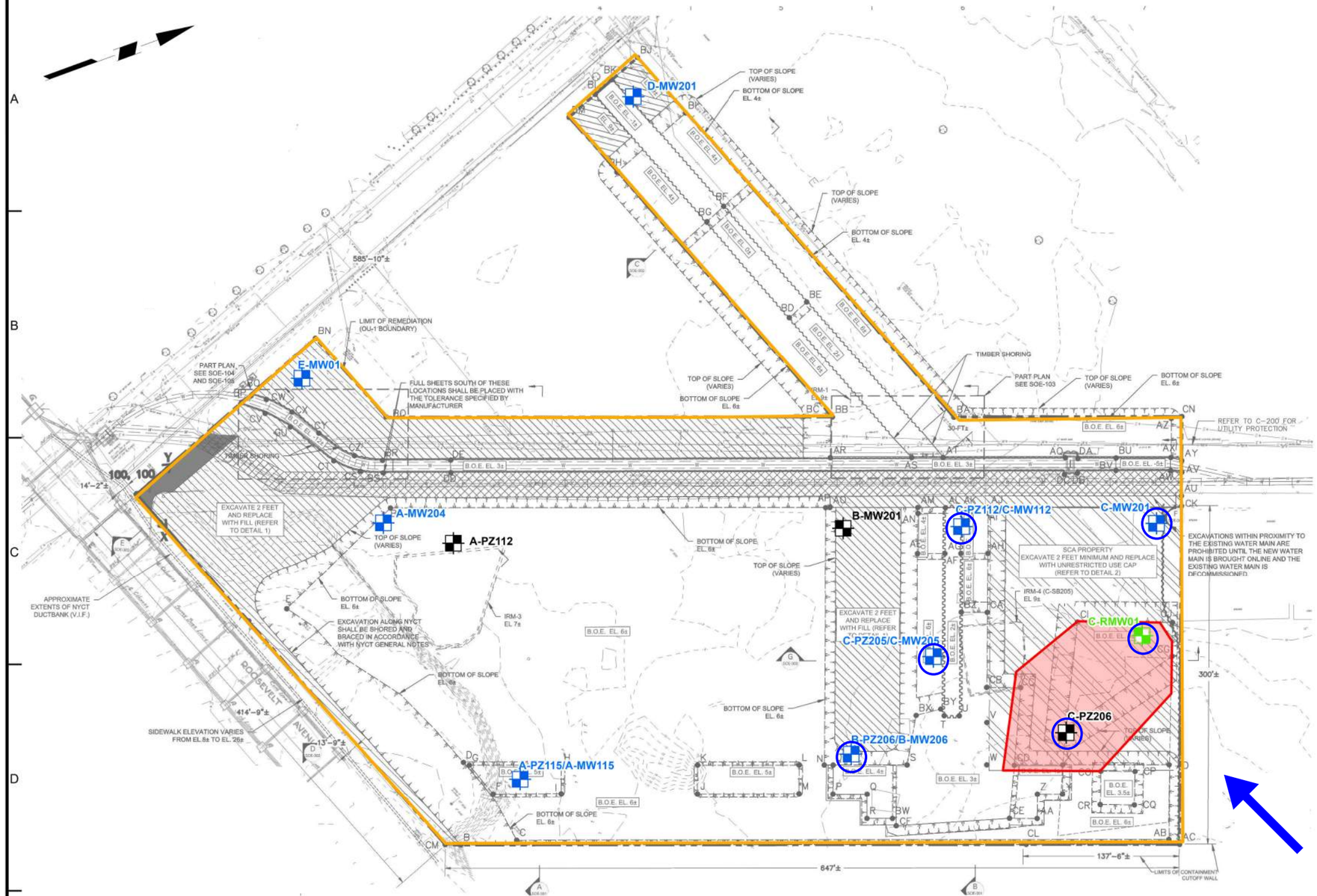

Legend

- OU-1 Boundary
- Approximate Location of Monitoring Well Sampled During the August 2022 Quarterly Sampling Event
- Approximate Location of Monitoring Well Sampling During the Remedial Investigation
- Approximate Location of Monitoring Well Sampled During the Remedial Investigation and August 2022 Quarterly Sampling Event
- Proposed In-Situ Groundwater Treatment Area
- Monitoring Well to be Sampled for In-Situ Groundwater Treatment Performance
- Groundwater Flow Direction

Notes:
1. Basemap extracted from Willets Point Development Site Remediation Bulletin #2 drawing SOE-101.01 "Excavation Plan"drawing, dated October 8, 2021.
2. OU = Operable Unit

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Project
WILLETS POINT DEVELOPMENT OU-1
QUEENS NEW YORK

Figure Title
PROPOSED IN-SITU TREATMENT AND GROUNDWATER MONITORING LOCATION MAP

Project No. 170197601
Date 9/30/2022
Scale 1"=100'
Drawn By TZ
Figure No. 3
Figure 3 of 3

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TABLE

Table 1
Remedial Design Memo
Groundwater Sample Analytical Results

Willets Point OU-1
Corona, Queens, New York
NYSDEC BCP Site No.: C241146
Langan Project No.: 170197601

Analyte	CAS Number	NYSDEC SGVs	NYSDEC Guidance Values	Location	A-MW204	A-MW204	A-PZ112	A-PZ112	A-PZ115	A-MW115	B-MW201	B-PZ206	B-MW206	C-MW201	C-MW201	C-PZ112	C-MW112	C-PZ205	C-MW205	C-MW205	C-PZ206	C-RMW01	D-MW201	D-MW201	E-MW01	E-MW01
				Sample Name	A-MW204_052819	A-MW204_080522	A-PZ112_052819	GWDUP01_052819	A-PZ115_052919	A-MW115_080322	B-MW201_052919	B-PZ206_052919	B-MW206_080322	C-MW201_052919	C-MW201_080422	C-PZ112_052919	C-MW112_080422	C-PZ205_052919	C-MW205_080322	GWDUP01_080322	C-PZ206_052919	C-RMW01_080422	D-MW201_052819	D-MW201_080522	E-MW01_110519	E-MW01_080522
				Sample Date	05/28/2019	08/05/2022	05/28/2019	05/28/2019	05/29/2019	08/03/2022	05/30/2019	05/29/2019	08/03/2022	05/29/2019	08/04/2022	05/29/2019	08/04/2022	05/29/2019	08/03/2022	08/03/2022	05/29/2019	08/04/2022	05/28/2019	08/05/2022	11/05/2019	08/05/2022
				Unit	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Volatile Organic Compounds																										
1,1,1,2-Tetrachloroethane	630-20-6	5	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 U	<10 U
1,1,1-Trichloroethane	71-55-6	5	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 U	<10 U
1,1,2,2-Tetrachloroethane	79-34-5	5	NS	ug/l	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<10 U	<0.5 U	<0.5 U	<100 U	<10 U	<0.5 U	<0.5 U	<0.5 U	<2 U
1,1,2-Trichloroethane	79-00-5	1	NS	ug/l	<1.5 U	<1.5 U	<1.5 U	<1.5 U	<1.5 U	<1.5 U	<1.5 U	<1.5 U	<1.5 U	<1.5 U	<1.5 U	<1.5 U	<1.5 U	<30 U	<1.5 U	<1.5 U	<300 U	<30 U	<1.5 U	<1.5 U	<1.5 UJ	<6 U
1,1-Dichloroethane	75-34-3	5	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 UJ	<10 U
1,1-Dichloroethene	75-35-4	5	NS	ug/l	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<10 U	<0.5 U	<0.5 U	<100 U	<10 U	<0.5 U	<0.5 U	<0.5 UJ	<2 U
1,1-Dichloropropene	563-58-6	5	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 UJ	<10 U
1,2,3-Trichlorobenzene	87-61-6	5	NS	ug/l	<2.5 UJ	<2.5 U	<2.5 UJ	<2.5 UJ	<2.5 UJ	<2.5 U	<2.5 UJ	<2.5 UJ	<2.5 U	<2.5 UJ	<2.5 U	<2.5 UJ	<2.5 U	<50 UJ	<2.5 U	<2.5 U	<500 UJ	<50 U	<2.5 UJ	<2.5 U	<2.5 UJ	<10 U
1,2,3-Trichloropropane	96-18-4	0.04	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 U	<10 U
1,2,4,5-Tetramethylbenzene	95-93-2	**5**	NS	ug/l	<2 U	<2 U	1.8 J	1.7 J	<2 U	<2 U	<2 U	<2 U	<2 U	1.7 J	<2 U	**8.8**	<2 U	**13 J**	<2 U	<2 U	<400 U	<40 U	<2 U	<2 U	**12**	**9.9**
1,2,4-Trichlorobenzene	120-82-1	5	NS	ug/l	<2.5 UJ	<2.5 U	<2.5 U	<2.5 UJ	<2.5 UJ	<2.5 U	<2.5 UJ	<2.5 UJ	<2.5 U	<2.5 UJ	<2.5 U	<2.5 UJ	<2.5 U	<50 UJ	<2.5 U	<2.5 UJ	<500 UJ	<50 U	<2.5 UJ	<2.5 U	<2.5 UJ	<10 U
1,2,4-Trimethylbenzene	95-63-6	**5**	NS	ug/l	<2.5 U	<2.5 U	**17**	**15**	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	4.4	<2.5 U	1.2 J	<2.5 U	**340**	0.78 J	0.77 J	<500 U	**17 J**	<2.5 U	<2.5 U	0.79 J	**6.6 J**
1,2-Dibromo-3-Chloropropane	96-12-8	0.04	NS	ug/l	<2.5 UJ	<2.5 U	<2.5 UJ	<2.5 UJ	<2.5 UJ	<2.5 U	<2.5 UJ	<2.5 UJ	<2.5 U	<2.5 UJ	<2.5 U	<2.5 UJ	<2.5 U	<50 UJ	<2.5 U	<2.5 U	<500 UJ	<50 U	<2.5 UJ	<2.5 U	<2.5 UJ	<10 U
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	0.0006	NS	ug/l	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<40 U	<2 U	<2 U	<400 U	<40 U	<2 U	<2 U	<2 U	<8 U
1,2-Dichlorobenzene	95-50-1	3	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 U	<10 U
1,2-Dichloroethane	107-06-2	0.6	NS	ug/l	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<10 U	<0.5 U	<0.5 U	<100 U	<10 U	<0.5 U	<0.5 U	<0.5 UJ	<2 U
1,2-Dichloropropane	78-87-5	1	NS	ug/l	<1 U	<1 U	<1 U	<1 U	<1 U	<1 U	<1 U	<1 U	<1 U	<1 U	<1 U	<1 U	<1 U	<20 U	<1 U	<1 U	<200 U	<20 U	<1 U	<1 U	<1 U	<4 U
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	**5**	NS	ug/l	<2.5 U	<2.5 U	1.7 J	1.5 J	<2.5 UJ	<2.5 U	<2.5 UJ	<2.5 UJ	<2.5 U	**5.6**	<2.5 U	<2.5 U	<2.5 U	**74 J**	<2.5 U	<2.5 U	<500 UJ	<50 U	<2.5 U	<2.5 U	<2.5 U	<10 U
1,3-Dichlorobenzene	541-73-1	3	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 U	<10 U
1,3-Dichloropropane	142-28-9	5	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 U	<10 U
1,4-Dichlorobenzene	106-46-7	3	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 U	<10 U
1,4-Diethyl Benzene	105-05-5	NS	NS	ug/l	<2 U	<2 U	1.3 J	1.2 J	<2 U	<2 U	<2 U	<2 U	<2 U	3.6	<2 U	1.7 J	<2 U	33 J	<2 U	<2 U	<400 U	<40 U	<2 U	<2 U	0.78 J	<8 U
1,4-Dioxane (P-Dioxane)	123-91-1	NS	1	ug/l	<250 UJ	<250 U	<250 UJ	<250 UJ	<250 UJ	<250 U	<250 UJ	<250 UJ	<250 U	<250 UJ	<250 U	<250 UJ	<250 U	<5,000 UJ	<250 U	<250 U	<50,000 UJ	<5,000 U	<250 UJ	<250 U	<250 U	<400 U
2,2-Dichloropropane	594-20-7	5	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 UJ	<10 U
2-Chlorotoluene	95-49-8	5	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 U	<10 U
2-Hexanone (MBK)	591-78-6	50	NS	ug/l	<5 U	<5 U	<5 U	<5 U	<5 UJ	<5 U	<5 UJ	<5 UJ	<5 U	<5 U	<5 U	<5 U	<5 U	<100 UJ	<5 U	<5 U	<1,000 UJ	<100 U	<5 U	<5 U	<5 U	<20 U
4-Chlorotoluene	106-43-4	5	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 U	<10 U
4-Ethyltoluene	622-96-8	NS	NS	ug/l	<2 U	<2 U	4.8	4.3	<2 UJ	<2 U	<2 UJ	<2 UJ	<2 U	4.8	<2 U	<2 UJ	<2 U	230 J	<2 U	<2 U	<400 UJ	<40 U	<2 U	<2 U	<2 U	3.4 J
Acetone	67-64-1	**50**	NS	ug/l	4.9 J	14 J	3.7 J	9.3 J	2.4 J	45 J	5.2	4.9 J	26 J	30 J	<5 UJ	<5 U	11 J	**120**	<5 U	<5 U	**2,100**	<100 UJ	1.8 J	1.5 J	<5 U	**67 J**
Acrylonitrile	107-13-1	5	NS	ug/l	<5 U	<5 U	<5 U	<5 U	<5 UJ	<5 U	<5 UJ	<5 UJ	<5 U	<5 U	<5 U	<5 UJ	<5 U	<100 UJ	<5 U	<5 U	<1,000 UJ	<100 U	<5 U	<5 U	<5 U	<20 U
Benzene	71-43-2	**1**	NS	ug/l	<0.5 U	<0.5 U	**1.7**	**1.4**	<0.5 U	<0.5 U	<0.5 U	<0.5 U	**7.5**	**3.5**	0.3 J	**30**	0.38 J	**380**	**2 J**	**2.1 J**	**560**	**150**	<0.5 U	<0.5 U	**8.8**	**11**
Bromobenzene	108-86-1	5	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 U	<10 U
Bromochloromethane	74-97-5	5	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 U	<10 U
Bromodichloromethane	75-27-4	50	NS	ug/l	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<10 U	<0.5 U	<0.5 U	<100 U	<10 U	<0.5 U	<0.5 U	<0.5 UJ	<2 U
Bromoform	75-25-2	50	NS	ug/l	<2 U	<2 U	<2 U	<2 U	<2 UJ	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<40 U	<2 U	<2 U	<400 U	<40 U	<2 U	<2 U	<2 U	<8 U
Bromomethane	74-83-9	5	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 UJ	<2.5 U	<2.5 UJ	<2.5 UJ	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 UJ	0.71 J	0.89 J	<500 UJ	<50 U	<2.5 U	<2.5 U	<2.5 UJ	**3 J**
Carbon Disulfide	75-15-0	60	NS	ug/l	<5 U	1.9 J	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	1.7 J	<5 U	<5 U	<5 U	**27 J**	<5 U	<5 U	<1,000 U	<100 U	<5 U	<5 U	<5 U	<20 U
Carbon Tetrachloride	56-23-5	5	NS	ug/l	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<10 U	<0.5 U	<0.5 U	<100 U	<10 U	<0.5 U	<0.5 U	<0.5 UJ	<2 U
Chlorobenzene	108-90-7	5	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 U	<10 U
Chloroethane	75-00-3	5	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 U	<10 U
Chloroform	67-66-3	7	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	3.8	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 U	<10 U
Chloromethane	74-87-3	5	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 U	<10 U
Cis-1,2-Dichloroethene	156-59-2	5	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	**1.4 J**	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 UJ	<10 U
Cis-1,3-Dichloropropene	10061-01-5	0.4	NS	ug/l	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<10 U	<0.5 U	<0.5 U	<100 U	<10 U	<0.5 U	<0.5 U	<0.5 U	<2 U
Cymene	99-87-6	**5**	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	**6**	<2.5 U	0.74 J	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 U	<10 U
Dibromochloromethane	124-48-1	50	NS	ug/l	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<10 U	<0.5 U	<0.5 U	<100 U	<10 U	<0.5 U	<0.5 U	<0.5 UJ	<2 U
Dibromomethane	74-95-3	5	NS	ug/l	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<100 U	<5 U	<5 U	<1,000 U	<100 U	<5 U	<5 U	<5 UJ	<20 U
Dichlorodifluoromethane	75-71-8	5	NS	ug/l	<5 UJ	<5 U	<5 UJ	<5 UJ	<5 UJ	<5 U	<5 UJ	<5 UJ	<5 U	<5 UJ	<5 U	<5 UJ	<5 U	<100 UJ	<5 U	<5 U	<1,000 UJ	<100 U	<5 UJ	<5 U	<5 UJ	<20 U
Diethyl Ether (Ethyl Ether)	60-29-7	NS	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 U	<10 U
Ethylbenzene	100-41-4	**5**	NS	ug/l	<2.5 U	<2.5 U	4.8	3.6	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	1 J	<2.5 U	0.71 J	<2.5 U	**240**	<2.5 U	<2.5 U	<500 U	**27 J**	<2.5 U	<2.5 U	<2.5 U	3.8 J
Hexachlorobutadiene	87-68-3	0.5	NS	ug/l	<2.5 UJ	<2.5 U	<2.5 UJ	<2.5 UJ	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 UJ	<2.5 U	<2.5 UJ	<2.5 U	<50 UJ	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 UJ	<2.5 U	<2.5 UJ	<10 U
Isopropylbenzene (Cumene)	98-82-8	**5**	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	**6.2 J**	<2.5 U	**37 J**	<2.5 U	<2.5 U	<500 UJ	<50 U	<2.5 U	<2.5 U	**8.9**	**3.6 J**
M,P-Xylene	179601-23-1	**5**	NS	ug/l	<2.5 U	<2.5 U	**9.5**	**8.6**	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	**5.1**	<2.5 U	2.2 J	<2.5 U	**750**	0.8 J	0.81 J	**410 J**	**35 J**	<2.5 U	<2.5 U	1.5 J	**7.2 J**
Methyl Ethyl Ketone (2-Butanone)	78-93-3	**50**	NS	ug/l	<5 U	3.1 J	<5 U	<5 U	<5 UJ	6.2	<5 UJ	<5 UJ	4.2 J	2.9 J	<5 U	<5 UJ	<5 U	<100 UJ	<5 U	<5 U	**640 J**	<100 U	<5 U	<5 U	<5 U	<20 U
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	108-10-1	NS	NS	ug/l	<5 UJ	<5 U	<5 UJ	<5 UJ	<5 UJ	<5 U	<5 UJ	<5 UJ	<5 U	4.3 J	<5 U	<5 UJ	<5 U	<100 UJ	<5 U	<5 U	<1,000 UJ	<100 U	<5 UJ	<5 U	<5 U	<20 U
Methylene Chloride	75-09-2	5	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 UJ	<10 U
Naphthalene	91-20-3	**10**	NS	ug/l	<2.5 UJ	0.72 J	2.5 J	2.7 J	<2.5 UJ	<2.5 U	<2.5 UJ	<2.5 UJ	2.7	0.78 J	4.8	2.4 J	<2.5 U	**98 J**	8	8	<500 UJ	<50 U	<2.5 UJ	1.4 J	<2.5 U	**440**
n-Butylbenzene	104-51-8	5	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 UJ	<2.5 U	<2.5 UJ	<2.5 UJ	<2.5 U	<2.5 U	<2.5 U	1.7 J	<2.5 U	<50 UJ	<2.5 U	<2.5 U	<500 UJ	<50 U	<2.5 U	<2.5 U	1.3 J	<10 U
n-Propylbenzene	103-65-1	**5**	NS	ug/l	<2.5 U	<2.5 U	0.8 J	<2.5 U	<2.5 UJ	<2.5 U	<2.5 UJ	<2.5 UJ	<2.5 U	<2.5 U	<2.5 U	**6.9 J**	<2.5 U	**35 J**	<2.5 U	<2.5 U	<500 UJ	<50 U	<2.5 U	<2.5 U	**13**	**7.4 J**
o-Xylene (1,2-Dimethylbenzene)	95-47-6	**5**	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	**13**	<2.5 U	0.83 J	<2.5 U	**410**	<2.5 U	<2.5 U	**190 J**	<50 U	<2.5 U	<2.5 U	0.76 J	<10 U
Sec-Butylbenzene	135-98-8	5	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 UJ	<2.5 U	<2.5 UJ	<2.5 UJ	<2.5 U	<2.5 U	<2.5 U	**2.4 J**	<2.5 U	<50 UJ	<2.5 U	<2.5 U	<500 UJ	<50 U	<2.5 U	<2.5 U	**1.3 J**	<10 U
Styrene	100-42-5	5	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 U	<10 U
T-Butylbenzene	98-06-6	5	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 U	<10 U
Tert-Butyl Methyl Ether	1634-04-4	**10**	NS	ug/l	7.5	4.7	**26**	**25**	6.4	<2.5 U	3.7	**88**	2.1 J	1.2 J	**15**	6.4	2.8	**3,200**	**44**	**47**	**29,000**	**2,800**	1.9 J	2.3 J	3.8	**70**
Tetrachloroethene (PCE)	127-18-4	**5**	NS	ug/l	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	**160**	<0.5 U	<0.5 U	<0.5 U	<10 U	<0.5 U	<0.5 U	<100 U	<10 U	<0.5 U	<0.5 U	<0.5 U	<2 U
Toluene	108-88-3	**5**	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	**9.2**	<2.5 U	0.7 J	<2.5 U	**820**	<2.5 U	<2.5 U	**1,200**	<50 U	<2.5 U	<2.5 U	0.97 J	<10 U
Total 1,2-Dichloroethene (Cis and Trans)	540-59-0	NS	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	1.4 J	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 U	<10 U
Total Xylenes	1330-20-7	**5**	NS	ug/l	<2.5 U	<2.5 U	**9.5**	**8.6**	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	**18**	<2.5 U	3 J	<2.5 U	**1,200**	0.8 J	0.81 J	**600 J**	**35 J**	<2.5 U	<2.5 U	2.3 J	**7.2 J**
Total, 1,3-Dichloropropene (Cis And Trans)	542-75-6	0.4	NS	ug/l	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<10 U	<0.5 U	<0.5 U	<100 U	<10 U	<0.5 U	<0.5 U	<0.5 U	<2 U
Trans-1,2-Dichloroethene	156-60-5	5	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 U	<10 U
Trans-1,3-Dichloropropene	10061-02-6	0.4	NS	ug/l	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<10 U	<0.5 U	<0.5 U	<100 U	<10 U	<0.5 U	<0.5 U	<0.5 U	<2 U
Trans-1,4-Dichloro-2-Butene	110-57-6	5	NS	ug/l	<2.5 UJ	<2.5 U	<2.5 UJ	<2.5 UJ	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 UJ	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 UJ	<2.5 U	<2.5 U	<10 U
Trichloroethene (TCE)	79-01-6	**5**	NS	ug/l	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	**110**	<0.5 U	<0.5 U	<0.5 U	<10 U	<0.5 U	<0.5 U	<100 U	<10 U	<0.5 U	<0.5 U	<0.5 U	<2 U
Trichlorofluoromethane	75-69-4	5	NS	ug/l	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<2.5 U	<50 U	<2.5 U	<2.5 U	<500 U	<50 U	<2.5 U	<2.5 U	<2.5 U	<10 U
Vinyl Acetate	108-05-4	NS	NS	ug/l	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<100 U	<5 U	<5 U	<1,000 U	<100 U	<5 U	<5 U	<5 U	<20 U
Vinyl Chloride	75-01-4	2	NS	ug/l	<1 U	<1 U	<1 U	<1 U	<1 U	<1 U	<1 U	<1 U	<1 U	<1 U	1.4	0.9 J	<1 U	<20 U	<1 U	<1 U	<200 U	<20 U	<1 U	<1 U	<1 U	<4 U
Total VOCs	VOCs	NS	NS	ug/l	12.4	24.42	85.1	82.9	8.8	51.2	12.7	92.9	44.2	387.88	21.5	77.98	14.18	8,007	57.09	60.38	34,700	3,064	3.7	5.2	56.2	640.1

Table 1
Remedial Design Memo
Groundwater Sample Analytical Results

Willets Point OU-1
Corona, Queens, New York
NYSDEC BCP Site No.: C241146
Langan Project No.: 170197601

Analyte	CAS Number	NYSDEC SGVs	NYSDEC Guidance Values	Location	A-MW204	A-MW204	A-PZ112	A-PZ112	A-PZ115	A-MW115	B-MW201	B-PZ206	B-MW206	C-MW201	C-MW201	C-PZ112	C-MW112	C-PZ205	C-MW205	C-MW205	C-PZ206	C-RMW01	D-MW201	D-MW201	E-MW01	E-MW01
				Sample Name	A-MW204_052819	A-MW204_080522	A-PZ112_052819	GWDUP01_052819	A-PZ115_052919	A-MW115_080322	B-MW201_052919	B-PZ206_052919	B-MW206_080322	C-MW201_052919	C-MW201_080422	C-PZ112_052919	C-MW112_080422	C-PZ205_052919	C-MW205_080322	GWDUP01_080322	C-PZ206_052919	C-RMW01_080422	D-MW201_052819	D-MW201_080522	E-MW01_110519	E-MW01_080522
				Sample Date	05/28/2019	08/05/2022	05/28/2019	05/28/2019	05/29/2019	08/03/2022	05/29/2019	05/29/2019	08/03/2022	05/29/2019	08/04/2022	05/29/2019	08/04/2022	05/29/2019	08/03/2022	08/03/2022	05/29/2019	08/04/2022	05/28/2019	08/05/2022	11/05/2019	08/05/2022
				Unit	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Semi-Volatile Organic Compounds																										
1,2,4,5-Tetrachlorobenzene	95-94-3	5	NS	ug/l	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<50 U	<10 U	<10 U	<200 U	<10 U	<10 U	<10 U	<10 U	<10 U
1,2,4-Trichlorobenzene	120-82-1	5	NS	ug/l	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<25 U	<5 U	<5 U	<100 U	<5 U	<5 U	<5 U	<5 U	<5 U
1,2-Dichlorobenzene	95-50-1	3	NS	ug/l	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<10 U	<2 U	<2 U	<40 U	<2 U	<2 U	<2 U	<2 U	<2 U
1,3-Dichlorobenzene	541-73-1	3	NS	ug/l	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<10 U	<2 U	<2 U	<40 U	<2 U	<2 U	<2 U	<2 U	<2 U
1,4-Dichlorobenzene	106-46-7	3	NS	ug/l	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<10 U	<2 U	<2 U	<40 U	<2 U	<2 U	<2 U	<2 U	<2 U
1,4-Dioxane (P-Dioxane)	123-91-1	NS	1	ug/l	3.44	NA	3.87	3.87	0.608	NA	0.756	2.04	NA	0.221	NA	0.551	NA	27.1	NA	NA	86	NA	0.719	NA	NA	NA
2,4,5-Trichlorophenol	95-95-4	NS	NS	ug/l	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<25 U	<5 U	<5 U	<100 U	<5 U	<5 U	<5 U	<5 U	<5 U
2,4,6-Trichlorophenol	88-06-2	NS	NS	ug/l	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<25 U	<5 U	<5 U	<100 U	<5 U	<5 U	<5 U	<5 U	<5 U
2,4-Dichlorophenol	120-83-2	1	NS	ug/l	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<25 U	<5 U	<5 U	<100 U	<5 U	<5 U	<5 U	<5 U	<5 U
2,4-Dimethylphenol	105-67-9	**1**	NS	ug/l	<5 U	<5 UJ	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	**91**	<5 U	<5 U	**83 J**	**1.8 J**	<5 U	<5 UJ	<5 U	**11 J**
2,4-Dinitrophenol	51-28-5	1	NS	ug/l	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 UJ	<20 U	<20 UJ	<100 U	<20 U	<20 U	<400 U	<20 UJ	<20 U	<20 U	<20 U	<20 U
2,4-Dinitrotoluene	121-14-2	5	NS	ug/l	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<25 UJ	<5 U	<5 U	<100 UJ	<5 U	<5 U	<5 U	<5 U	<5 U
2,6-Dinitrotoluene	606-20-2	5	NS	ug/l	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<25 U	<5 U	<5 U	<100 U	<5 U	<5 U	<5 U	<5 U	<5 U
2-Chloronaphthalene	91-58-7	10	NS	ug/l	<0.2 U	<0.2 U	<0.2 U	<0.2 U	<0.2 U	<0.2 U	<0.2 U	<0.2 U	<0.2 U	<0.2 U	0.07 J	<0.2 U	<0.2 U	<0.2 U	<0.2 U	<0.2 U	<20 U	<0.4 U	<0.2 U	<0.2 U	<0.2 U	<0.2 U
2-Chlorophenol	95-57-8	NS	NS	ug/l	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<10 U	<2 U	<2 U	<40 U	<2 U	<2 U	<2 U	<2 U	<2 U
2-Methylnaphthalene	91-57-6	NS	NS	ug/l	<0.1 U	0.03 J	1.2	1 J	<0.1 U	<0.1 U	<0.1 U	<0.1 U	0.25	0.46	0.32 J	2.2	0.11 J	3.4	1.2	1.4	23	1.2	<0.1 U	<0.1 U	<0.1 U	16
2-Methylphenol (o-Cresol)	95-48-7	NS	NS	ug/l	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	62	<5 U	<5 U	210	7.9	<5 U	<5 U	<5 U	2.1 J
2-Nitroaniline	88-74-4	5	NS	ug/l	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<25 U	<5 U	<5 U	<100 U	<5 U	<5 U	<5 U	<5 U	<5 U
2-Nitrophenol	88-75-5	NS	NS	ug/l	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<50 U	<10 U	<10 U	<200 U	<10 U	<10 U	<10 U	<10 U	<10 U
3 & 4 Methylphenol (m&p Cresol)	65794-96-9	NS	NS	ug/l	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	0.98 J	<5 U	2.4 J	0.58 J	<5 U	<5 U	1.8 J	520	1.2 J	1.4 J	1,200	<5 U	<5 U	<5 U	<5 U	6
3,3'-Dichlorobenzidine	91-94-1	5	NS	ug/l	<5 U	<5 U	<5 U	<5 U	<5 U	<5 UJ	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<25 U	<5 UJ	<5 UJ	<100 U	<5 U	<5 U	<5 U	<5 U	<5 U
3-Nitroaniline	99-09-2	5	NS	ug/l	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<25 UJ	<5 U	<5 U	<100 UJ	<5 U	<5 U	<5 U	<5 U	<5 U
4,6-Dinitro-2-Methylphenol	534-52-1	NS	NS	ug/l	<10 UJ	<10 UJ	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 UJ	<50 U	<10 U	<10 U	<200 U	<10 UJ	<10 U	<10 U	<10 U	<10 U
4-Bromophenyl Phenyl Ether	101-55-3	NS	NS	ug/l	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<10 U	<2 U	<2 U	<40 U	<2 U	<2 U	<2 U	<2 U	<2 U
4-Chloro-3-Methylphenol	59-50-7	NS	NS	ug/l	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<10 U	<2 U	<2 U	<40 U	<2 U	<2 U	<2 U	<2 U	<2 U
4-Chloroaniline	106-47-8	5	NS	ug/l	<5 U	<5 UJ	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<25 U	<5 U	<5 U	<100 U	<5 U	<5 U	<5 UJ	<5 U	<5 UJ
4-Chlorophenyl Phenyl Ether	7005-72-3	NS	NS	ug/l	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<10 U	<2 U	<2 U	<40 U	<2 U	<2 U	<2 U	<2 U	<2 U
4-Nitroaniline	100-01-6	5	NS	ug/l	<5 U	<5 U	<5 U	<5 U	<5 U	<5 UJ	<5 U	<5 U	<5 UJ	<5 U	<5 U	<5 U	<5 U	<25 UJ	<5 UJ	<5 UJ	<100 UJ	<5 U	<5 U	<5 U	<5 U	<5 U
4-Nitrophenol	100-02-7	NS	NS	ug/l	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<50 UJ	<10 U	<10 U	<200 UJ	<10 U	<10 U	<10 U	<10 U	<10 U
Acenaphthene	83-32-9	20	NS	ug/l	<0.1 U	0.04 J	<0.1 U	<0.1 U	<0.1 U	<0.1 U	0.35	0.13	1.1	<0.1 U	0.98	1.7	0.21	0.62	0.88	1	4.1 J	0.46	0.1 J	<0.1 U	1.1	17
Acenaphthylene	208-96-8	NS	NS	ug/l	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	0.04 J	0.05 J	<0.1 U	0.04 J	0.31	0.02 J	0.23	0.06 J	0.08 J	<10 U	<0.2 U	<0.1 U	<0.1 U	0.02 J	0.17
Acetophenone	98-86-2	NS	NS	ug/l	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<25 U	<5 U	<5 U	<100 U	<5 U	<5 U	<5 U	<5 U	<5 U
Anthracene	120-12-7	50	NS	ug/l	<0.1 U	0.02 J	<0.1 U	<0.1 U	<0.1 U	0.02 J	<0.13 U	<0.17 U	0.18	<0.1 U	0.06 J	<0.18 U	0.09 J	1.4	0.27	0.34	3.1 J	0.47	<0.1 U	<0.1 UJ	0.12	<0.1 UJ
Benzo(a)anthracene	56-55-3	**0.002**	NS	ug/l	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	**0.13**	**0.12 J**	<0.1 U	<0.1 U	<0.1 U	**0.03 J**	<0.1 U	**2.2**	<0.1 U	<0.1 U	<10 U	<0.2 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U
Benzo(a)pyrene	50-32-8	**0**	NS	ug/l	<0.1 U	**0.06 J**	<0.1 U	<0.1 U	<0.1 UJ	<0.1 U	<0.1 U	**0.07 J**	**0.08 J**	<0.1 U	**0.06 J**	<0.1 U	**0.02 J**	**2**	<0.1 U	<0.1 U	<10 U	<0.2 U	<0.1 U	**0.02 J**	<0.1 U	<0.1 UJ
Benzo(b)fluoranthene	205-99-2	**0.002**	NS	ug/l	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	**0.15**	**0.1 J**	<0.1 U	<0.1 U	<0.1 U	<0.1 U	**2.3**	<0.1 U	<0.1 U	<10 U	<0.2 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U
Benzo(g,h,i)Perylene	191-24-2	NS	NS	ug/l	<0.1 U	0.05 J	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	0.08 J	<0.1 U	<0.1 U	0.05 J	<0.1 U	0.02 J	1.2	<0.1 U	<0.1 U	<10 U	<0.2 U	<0.1 U	0.04 J	<0.1 U	<0.1 UJ
Benzo(k)fluoranthene	207-08-9	**0.002**	NS	ug/l	<0.1 U	**0.03 J**	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	**0.06 J**	<0.1 U	<0.1 U	**0.03 J**	<0.1 U	**0.02 J**	**0.87**	<0.1 U	<0.1 U	<10 U	<0.2 U	<0.1 U	**0.01 J**	<0.1 U	<0.1 UJ
Benzoic Acid	65-85-0	NS	NS	ug/l	<50 U	<50 UJ	<50 U	<50 U	<50 U	16 J	16 J	12 J	<50 U	**27 J**	<50 UJ	**28 J**	**11 J**	750	<50 U	<50 U	5,700	<50 UJ	<50 U	<50 U	<50 R	<50 UJ
Benzyl Alcohol	100-51-6	NS	NS	ug/l	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	0.98 J	<2 U	<2 U	<2 U	61	<2 U	<2 U	99	<2 U	<2 U	<2 U	<2 U	<2 U
Benzyl Butyl Phthalate	85-68-7	50	NS	ug/l	<5 UJ	<5 U	<5 UJ	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<25 UJ	<5 U	<5 U	<100 UJ	<5 U	<5 U	<5 U	<5 U	<5 U
Biphenyl (Diphenyl)	92-52-4	5	NS	ug/l	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<10 U	<2 U	<2 U	<40 U	<2 U	<2 U	<2 U	<2 U	2.7
Bis(2-chloroethoxy) methane	111-91-1	5	NS	ug/l	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<25 UJ	<5 U	<5 U	<100 UJ	<5 U	<5 U	<5 U	<5 U	<5 U
Bis(2-chloroethyl) ether (2-chloroethyl ether)	111-44-4	1	NS	ug/l	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<10 U	<2 U	<2 U	<40 U	<2 U	<2 U	<2 U	<2 U	<2 U
Bis(2-chloroisopropyl) ether	108-60-1	5	NS	ug/l	<2 U	<2 U	<2 U	<2 U	<2 U	<2 UJ	<2 U	<2 U	<2 UJ	<2 U	<2 U	<2 U	<2 U	<10 U	<2 UJ	<2 UJ	<40 U	<2 U	<2 U	<2 U	<2 U	<2 U
Bis(2-ethylhexyl) phthalate	117-81-7	5	NS	ug/l	2.7 J	<3 U	<3 UJ	<3 UJ	<3 UJ	<3 UJ	<3 U	<3 U	1.6 J	<3 U	<3 U	<3 U	<3 U	<15 U	<3 UJ	<3 UJ	<60 U	<3 U	<3 U	<3 U	<3 U	<3 U
Carbazole	86-74-8	NS	NS	ug/l	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	0.87 J	<2 U	<2 U	<2 U	<2 U	16	0.6 J	0.66 J	<40 U	<2 U	<2 U	<2 U	<2 U	**5**
Chrysene	218-01-9	**0.002**	NS	ug/l	<0.1 U	**0.07 J**	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	**0.11**	**0.11 J**	<0.1 U	**0.07 J**	<0.1 U	**0.04 J**	**1.9**	<0.1 U	<0.1 U	<10 U	<0.2 U	<0.1 U	**0.01 J**	<0.1 U	**0.01 J**
Dibenz(a,h)anthracene	53-70-3	NS	NS	ug/l	<0.1 U	<0.1 UJ	<0.1 U	<0.1 UJ	<0.1 UJ	0.06 J	<0.1 U	0.03 J	0.02 J	<0.1 U	0.01 J	<0.1 U	<0.1 U	0.33	<0.1 U	<0.1 U	<10 U	<0.2 U	<0.1 U	<0.1 UJ	<0.1 U	<0.1 UJ
Dibenzofuran	132-64-9	NS	NS	ug/l	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	0.61 J	<2 U	<10 U	0.53 J	0.54 J	<40 U	<2 U	<2 U	<2 U	<2 U	7.2
Dibutyl phthalate	84-74-2	50	NS	ug/l	2.8 J	<5 U	<5 U	<5 U	<5 U	<5 UJ	<5 U	<5 U	<5 UJ	<5 U	<5 U	<5 U	<5 U	<25 U	<5 UJ	<5 UJ	<100 U	<5 U	<5 U	<5 U	<5 U	<5 U
Diethyl phthalate	84-66-2	50	NS	ug/l	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<25 U	<5 U	<5 U	<100 U	<5 U	<5 U	<5 U	<5 U	<5 U
Dimethyl phthalate	131-11-3	50	NS	ug/l	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<25 U	<5 U	<5 U	<100 U	<5 U	<5 U	<5 U	<5 U	<5 U
Dioctyl phthalate	117-84-0	50	NS	ug/l	<5 UJ	<5 U	<5 UJ	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<25 UJ	<5 U	<5 U	<100 UJ	<5 U	<5 U	<5 U	<5 U	<5 U
Fluoranthene	206-44-0	50	NS	ug/l	<0.1 U	0.11 J	<0.1 U	<0.1 U	<0.1 U	<0.1 U	0.29	<0.19 U	0.3 J	<0.1 U	0.13	<0.1 U	0.14	4.6	0.11 J	0.15 J	<10 U	<0.2 U	<0.1 U	0.02 J	0.1	0.3 J
Fluorene	86-73-7	50	NS	ug/l	0.03 J	0.02 J	<0.1 U	<0.1 U	<0.1 U	<0.1 U	0.25	<0.1 U	0.62	0.05 J	1.6	0.12	0.84	0.84	0.59	0.69	2.6 J	0.23	0.09 J	<0.1 U	0.85	8
Hexachlorobenzene	118-74-1	0.04	NS	ug/l	<0.8 U	<0.8 UJ	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<80 U	<1.6 U	<0.8 U	<0.8 UJ	<0.8 U	<0.8 UJ
Hexachlorobutadiene	87-68-3	0.5	NS	ug/l	<0.5 U	<0.5 U	<0.5 U	<0.5 UJ	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<50 U	<1 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
Hexachlorocyclopentadiene	77-47-4	5	NS	ug/l	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<20 U	<100 UJ	<20 U	<20 U	<400 UJ	<20 U	<20 U	<20 U	<20 U	<20 U
Hexachloroethane	67-72-1	5	NS	ug/l	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<80 U	<1.6 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U
Indeno(1,2,3-cd)pyrene	193-39-5	**0.002**	NS	ug/l	<0.1 U	**0.05 J**	<0.1 U	<0.1 UJ	<0.1 UJ	<0.1 U	<0.1 U	**0.09 J**	<0.1 U	<0.1 U	**0.05 J**	<0.1 U	**0.03 J**	**1.3**	<0.1 U	<0.1 U	<10 U	<0.2 U	<0.1 U	**0.04 J**	<0.1 U	<0.1 UJ
Isophorone	78-59-1	50	NS	ug/l	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<25 UJ	<5 U	<5 U	<100 UJ	<5 U	<5 U	<5 U	<5 U	<5 U
Naphthalene	91-20-3	**10**	NS	ug/l	<0.1 U	0.32	2.1	2.2 J	<0.1 U	0.12	<0.22 U	<0.1 U	1.7	<0.68 U	2.7	<0.99 U	0.23 J	5.8	4.1	4.8	**55**	7.1	<0.18 U	0.4	0.07 J	**240**
Nitrobenzene	98-95-3	0.4	NS	ug/l	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<10 UJ	<2 U	<2 U	<40 UJ	<2 U	<2 U	<2 U	<2 U	<2 U
n-Nitrosodi-N-Propylamine	621-64-7	NS	NS	ug/l	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<5 U	<25 UJ	<5 U	<5 U	<100 UJ	<5 U	<5 U	<5 U	<5 U	<5 U
n-Nitrosodiphenylamine	86-30-6	50	NS	ug/l	<2 UJ	<2 U	<2 UJ	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<2 U	<10 UJ	<2 U	<2 U	<40 UJ	<2 U	<2 U	<2 U	<2 U	<2 U
Pentachlorophenol	87-86-5	1	NS	ug/l	<0.8 UJ	<0.8 UJ	<0.8 UJ	<0.8 U	<0.8 U	<0.8 UJ	<0.8 U	<0.8 UJ	0.26 J	<0.8 U	<0.8 UJ	<0.8 U	0.3 J	0.26 J	0.26 J	0.29 J	<80 UJ	<1.6 UJ	<0.8 U	<0.8 UJ	<0.8 UJ	0.25 J
Phenanthrene	85-01-8	50	NS	ug/l	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.27 U	<0.19 U	0.74	<0.1 U	0.16	1.7	0.3	4.6	0.68	0.78	4.3 J	0.25	<0.22 U	<0.1 U	0.5	4.1
Phenol	108-95-2	**1**	NS	ug/l	<5 U	<5 U	<5 U	<5 U	<5 U	**3.6 J**	**16**	**4.2 J**	**15**	**1.6 J**	<5 U	0.59 J	**16**	**470**	<5 U	<5 U	**1,400**	<5 U	<5 U	<5 U	<5 U	**23**
Pyrene	129-00-0	50	NS	ug/l	<0.1 U	0.11 J	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.24 U	<0.17 U	0.27 J	<0.1 U	0.19	<0.15 U	0.12	4.2	0.1 J	0.13 J	<10 U	0.09 J	<0.1 U	<0.1 UJ	0.07 J	0.19 J
Total SVOCs	SVOCs	NS	NS	ug/l	8.97	0.91	7.17	7.07	0.608	19.8	34.626	19.13	25.77	30.841	4.97	37.291	30.57	2,035.15	10.58	12.26	8,870.10	19.5	0.909	0.54	2.83	343.02

Table 1
Remedial Design Memo
Groundwater Sample Analytical Results

Willets Point OU-1
Corona, Queens, New York
NYSDEC BCP Site No.: C241146
Langan Project No.: 170197601

Notes:

CAS - Chemical Abstract Service
NS - No standard
ug/l - microgram per liter
NA - Not analyzed
RL - Reporting limit
<RL - Not detected

Groundwater sample analytical results are compared to the New York State Department of Environmental Conservation (NYSDEC) Title 6 of the Official Compilation of New York Codes, Rules, and Regulations (NYCRR) Part 703.5 and the NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values for Class GA Water (herein collectively referenced as "NYSDEC SGVs").

Qualifiers:

R - The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.
J - The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
UJ - The analyte was not detected at a level greater than or equal to the RL; however, the reported RL is approximate and may be inaccurate or imprecise.
U - The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the RL or the sample concentration for results impacted by blank contamination.

Exceedance Summary:

10 - Result exceeds NYSDEC SGVs
10 - Result exceeds NYSDEC Guidance Values

ATTACHMENT 1

REGENESIS Quote, Application Guidance, and Specifications

REGENESIS

Technology-Based Solutions for the Environment

PROJECT NAME

Confidential Queens BCP OU-1

PREPARED FOR

Langan Engineering & Environmental
Elizabeth Burgess
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PREPARED BY

Regenesis
Tyler Harris
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September 30, 2022

Project Summary

REGENESIS appreciates the opportunity to provide Langan Engineering & Environmental this remedial design and cost estimate for this project. Included within is a brief summary of our proposed solution, our understanding of your project goals, the technologies proposed, and a table summarizing the design.

Proposed Solution

We are proposing the use of PetroFix Remedial Fluid and ORC Advanced® to remediate dissolved phase hydrocarbons at your project site.

Project Goals

The goal of this proposal is to quickly the soils and groundwater on site to Restricted - Residential SCOs.

Design Assumptions

- This proposal assumes that at least two feet of soils have already been removed off site and all data predating 2022 reflects prior to this excavation.
- The planned excavation of this proposal will dig to roughly 4 ft below the water table and mix remedial reagents into the standing groundwater and backfill.

Technologies Proposed

- PetroFix
- ORC Advanced®

Click above to access product specification sheets

Excavation		
Design Parameters	**Unit**	**Value**
Treatment Surface Area (Base)	ft^2	15,200
Thickness Dosage Will Treat	ft	4
Treatment Volume	cy	2,252
Native Soil Type		Mix of Coarse and Fine
Product Dosage		
PetroFix Remedial Fluid	lb	9,200
Electron Acceptor Blend	lb	460
Volume of PetroFix	gallons	942
Estimated Dilution		2:1
Estimated Mix Water	gallons	942
Estimated Application Volume*	gallons	1,883
**Can reduce or increase in field as needed*		

ORC Advanced® Pellets Application Design Summary		
Application Method	--	**Excavation Application**
Excavation Width	ft	0
Excavation Length	ft	0
Areal Extent (square ft)	sq. ft.	15,200
Top Application Depth (ft bgs)	ft	10
Bottom Application Depth (ft bgs)	ft	14
Estimated Saturated Treatment Thickness	ft	4
ORC Advanced to be Applied (lbs)	**lbs**	5920.00
ORC Advanced per 1 ft lift	lb/ft	1,480

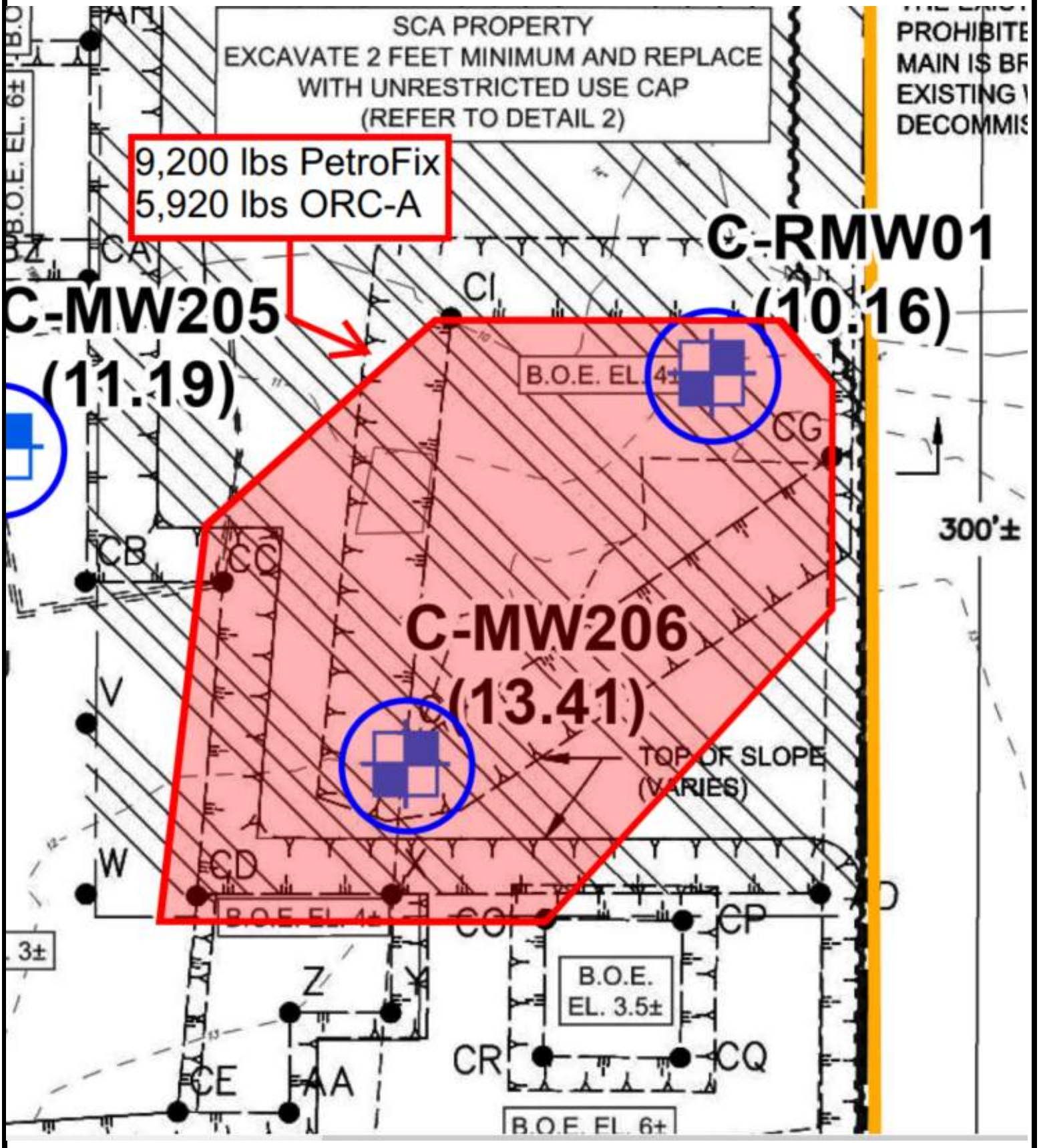

Figure 1-Injection Location Map

Confidential Queens BCP OU-1

Langan Engineering & Environmental

September 30, 2022

REGENESIS

Technology-Based Solutions for the Environment

Technical Approach

Both PetroFix and ORC Advanced should be applied directly to the groundwater and mixed with fill material to evenly coat.

Petroleum hydrocarbon plumes are typically depleted in oxygen, which limits the ability of naturally occurring microorganisms to degrade petroleum hydrocarbons. Oxygen Release Compound (ORC) Advanced supplies a controlled release of oxygen for 9-12 months in the target treatment zone to create and support the geochemical environment necessary for aerobic biodegradation of contaminants.

ORC Advanced are specifically engineered for use in excavations. They may be spread with mechanical equipment or by hand. Regardless of the methods used to emplace the ORC Advanced, the product should be spread evenly across the excavation area both horizontally and vertically within the saturated zone targeted for treatment. Regenesis can assist with further site-specific application design information, as needed, upon notification that our proposed remedy is chosen for implementation.

PetroFix is a unique activated carbon remedial fluid (carbon milled to a diameter of 1 to 2 micrometers) paired with soluble, anaerobic electron acceptors designed to remediate dissolved hydrocarbons. This allows the product to be injected as a fluid using low pressure. PetroFix is commonly used for source and plume treatment, excavation polishing, and barrier applications. PetroFix features:

- Provides rapid and sustained results allowing for faster and more certain site closure
- Dual-technology approach relies on both carbon sorption and anaerobic biodegradation
- Low-pressure "flooding" vs high pressure "fracturing" improves distribution and reduces surfacing
- Safe to handle because is non-hazardous and shipped as a liquid (no fugitive carbon dust)
- Mitigates hydrocarbon back diffusion which is a cause of concentration rebound

PetroFix is typically self-applied and is supported by a large library of application instruction, technical bulletin, and videos (www.petrofix.com/resources). Based on our experience at hundreds of sites we have developed recommendations listed in a hyperlinked planning document included in the following sections. Below are links for additional technologies information:

PetroFix® - An Animated Overview

PetroFix Application Guidance - Excavations

PetroFix Monitoring Parameters

Pricing

Below is the cost estimate to provide the remediation technologies and execute the application design provided in this proposal. Please also see the assumptions and qualifications section.

Description	Price	Qty	Subtotal
PetroFix Totes (2000 lb)	$4.90	8000	$39,200
PetroFix Drums (400 lb)	$4.90	1200	$5,880
PetroFix EA Blend Pail (20 lb)	$0	460	$0
ORC Advanced® Bags (40 lb)	$9.87	5920	$58,430.40
Subtotal			$103,510.40
Shipping and Tax (18%)			+$18,631.87
Total			**$122,142.27**

Electron Acceptor Blend (a mix of ammonium sulfate and sodium nitrate) is included in the price of PetroFix.

COST ESTIMATE DISCLAIMER: The cost listed assumes conditions set forth within the proposed scope of work and assumptions and qualifications. Changes to either could impact the final cost of the project. This may include final shipping arrangements, sales tax or application-related tasks such as product storage and handling, access to water, etc. If items listed need to be modified, please contact Regenesis for further evaluation.

REGENESIS developed this Scope of Work in reliance upon the data and professional judgments provided by those who completed the earlier environmental site assessment(s), and in reliance upon REGENESIS' prior experience on similar project sites. The fees and charges associated with the Scope of Work were generated through REGENESIS' proprietary formulas and thus may not conform to billing guidelines, constraints or other limits on fees. REGENESIS does not seek reimbursement directly from any government agency or any governmental reimbursement fund (the "Government"). In any circumstance where REGENESIS may serve as a supplier or subcontractor to an entity that seeks reimbursement from the Government for all or part of the services performed or products provided by REGENESIS, it is the sole responsibility of the entity seeking reimbursement to ensure the Scope of Work and associated charges are in compliance with and acceptable to the Government prior to submission. When serving as a supplier or subcontractor to an entity that seeks reimbursement from Government, REGENESIS does not knowingly present or cause to be presented any claim for payment to the government.

PROFESSIONAL JUDGEMENT: In generating this estimate, REGENESIS relied upon professional judgment and site-specific information provided by others. Using this information as input, we performed calculations based upon the known chemical and geologic relationships to generate an estimate of the mass of product and subsurface placement required to effect remediation of the site.

Excavation Project Planning Document

PLEASE REVIEW THE 3 CRITICAL PHASES TO COMPLETING A SUCCESSFUL PETROFIX EXCAVATION APPLICATION

PHASE 1: PRE-APPLICATION PLANNING AND BID RESOURCES

Please follow the specific handling, injection tips, and field distribution verification steps recommended. Examples include having long, multi-port injection tips and budgeting a few hours for Day 1 field distribution observation and adjustments. Please review: There are specific handling, injection tip, and field distribution verification steps we recommend you plan for. Examples include having long, multi-port injection tips and budgeting a few hours for Day 1 field distribution observation and adjustments. Please review:

Storage requirements for freezing or hot weather

Safety Data Sheets (SDS)

PHASE 2: IMPLEMENTING YOUR PROJECT

In most cases, PetroFix is spray applied to the base of an excavation following soil removal. Prior to spray-applying the material, PetroFix should be diluted with water. Determine the amount of dilution based on the ability to safely spray and fully coat the base and sidewalls of the excavation. Larger excavations tend to require more dilution water (2:1 dilution or higher) for the spray "reach" into the excavation. A suggested dilution is provided on your output page but modified as needed.

Excavation Application Guidance Document

PHASE 3: POST APPLICATION GROUNDWATER SAMPLING

PetroFix takes a few weeks to a few months to fully attach to soils and we recommend that groundwater not be sampled if PetroFix is >100 mg/L in concentration (difficult to see through a 40 ml VOA). Each PetroFix shipment comes with one (1) simple, colorimetric field test kit taped to the top of a tote or drum to help assess field concentrations. Please review the "Groundwater Sampling Technical Bulletin".

Recommended Performance monitoring Parameters

Groundwater Sampling Guidance Document

Acknowledgement

This scope and associated costs are budgetary and should not be considered final. Listed below are the next steps to secure a final design and cost estimate from REGENESIS.

Steps to Final Design and Scope of Work

1. Signature notifying REGENESIS to proceed with final design.
2. REGENESIS technical team contacts Langan Engineering & Environmental to review final scope of work and provide a detailed design and cost estimate
3. Provide Detailed Remediation Services Scope of Work, if applicable.
4. Confirm Implementation Schedule
5. Submit Detailed Design and Cost Estimate to Langan Engineering & Environmental for review and final approval

Signature below confirms signee accepts this preliminary scope of work and would like REGENESIS to proceed with a detailed design and cost estimate.

SIGNATURE
Elizabeth Burgess

Not yet accepted

Langan Engineering & Environmental | Elizabeth Burgess, Senior Engineer

Terms & Conditions

1. **PAYMENT TERMS.** Net 30 Days. Accounts outstanding after 30 days will be assessed 1.5% monthly interest. Volume discount pricing will be rescinded on all accounts outstanding over 90 days. An early payment discount of 1.5% Net 10 is available for cash or check payments only. We accept Master Card, Visa and American Express.
2. **RETURN POLICY.** A 15% re-stocking fee will be charged for all returned goods. All requests to return product must be pre-approved by seller. Returned product must be in original condition and no product will be accepted for return after a period of 90 days.
3. **FORCE MAJEURE.** Seller shall not be liable for delays in delivery or services or failure to manufacture or deliver due to causes beyond its reasonable control, including but not limited to acts of God, acts of buyer, acts of military or civil authorities, fires, strikes, flood, epidemic, war, riot, delays in transportation or car shortages, or inability to obtain necessary labor, materials, components or services through seller's usual and regular sources at usual and regular prices. In any such event Seller may, without notice to buyer, at any time and from time to time, postpone the delivery or service dates under this contract or make partial delivery or performance or cancel all or any portion of this and any other contract with buyer without further liability to buyer. Cancellation of any part of this order shall not affect Seller's right to payment for any product delivered or service performed hereunder.
4. **LIMITED WARRANTY.** Seller warrants the product(s) sold and services provided as specified on face of invoice, solely to buyer. Seller makes no other warranty of any kind respecting the product and services, and expressly DISCLAIMS ALL OTHER WARRANTIES OF WHATEVER KIND RESPECTING THE PRODUCT AND SERVICES, INCLUDING ALL WARRANTIES OF MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE AND NON-INFRINGEMENT.
5. **DISCLAIMER.** Where warranties to a person other than buyer may not be disclaimed under law, seller extends to such a person the same warranty seller makes to buyer as set forth herein, subject to all disclaimers, exclusions and limitations of warranties, all limitations of liability and all other provisions set forth in the Terms and Conditions herein. Buyer agrees to transmit a copy of the Terms and Conditions set forth herein to any and all persons to whom buyer sells, or otherwise furnishes the products and/or services provided buyer by seller and buyer agrees to indemnify seller for any liability, loss, costs and attorneys' fees which seller may incur by reason, in whole or in part, of failure by buyer to transmit the Terms and Conditions as provided herein.
6. **LIMITATION OF SELLER'S LIABILITY AND LIMITATION OF BUYER'S REMEDY.** Seller's liability on any claim of any kind, including negligence, for any loss or damage arising out of, connected with, or resulting from the manufacture, sale, delivery, resale, repair or use of any goods or performance of any services covered by or furnished hereunder, shall in no case exceed the lesser of (1) the cost of repairing or replacing goods and repeating the services failing to conform to the foregoing warranty or the price of the goods and/or services or part thereof which gives rise to the claim. IN NO EVENT SHALL SELLER BE LIABLE FOR SPECIAL INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING LOST PROFITS, OR FOR DAMAGES IN THE NATURE OF PENALTIES.
7. **INDEMNIFICATION.** Buyer agrees to defend and indemnify seller of and from any and all claims or liabilities asserted against seller in connection with the manufacture, sale, delivery, resale or repair or use of any goods, and performance of any services, covered by or furnished hereunder arising in whole or in part out of or by reason of the failure of buyer, its agents, servants, employees or customers to follow instructions, warnings or recommendations furnished by seller in connection with such goods and services, by reason of the failure of buyer, its agents, servants, employees or customers to comply with all federal, state and local laws applicable to such goods and services, or the use thereof, including the Occupational Safety and Health Act of 1970, or by reason of the negligence or misconduct of buyer, its agents, servants, employees or customers.

8. **EXPENSES OF ENFORCEMENT.** In the event seller undertakes any action to collect amounts due from buyer, or otherwise enforce its rights hereunder, Buyer agrees to pay and reimburse Seller for all such expenses, including, without limitation, all attorneys and collection fees.
9. **TAXES.** Liability for all taxes and import or export duties, imposed by any city, state, federal or other governmental authority, shall be assumed and paid by buyer. Buyer further agrees to defend and indemnify seller against any and all liabilities for such taxes or duties and legal fees or costs incurred by seller in connection therewith.
10. **ASSISTANCE AND ADVICE.** Upon request, seller in its discretion will furnish as an accommodation to buyer such technical advice or assistance as is available in reference to the goods and services. Seller assumes no obligation or liability for the advice or assistance given or results obtained, all such advice or assistance being given and accepted at buyer's risk.
11. **SITE SAFETY.** Buyer shall provide a safe working environment at the site of services and shall comply with all applicable provisions of federal, state, provincial and municipal safety laws, building codes, and safety regulations to prevent accidents or injuries to persons on, about or adjacent to the site.
12. **INDEPENDENT CONTRACTOR.** Seller and Buyer are independent contractors and nothing shall be construed to place them in the relationship of partners, principal and agent, employer/employee or joint ventures. Neither party will have the power or right to bind or obligate the other party except as may be expressly agreed and delegated by other party, nor will it hold itself out as having such authority.
13. **REIMBURSEMENT.** Seller shall provide the products and services in reliance upon the data and professional judgments provided by or on behalf of buyer. The fees and charges associated with the products and services thus may not conform to billing guidelines, constraints or other limits on fees. Seller does not seek reimbursement directly from any government agency or any governmental reimbursement fund (the “Government”). In any circumstance where seller may serve as a supplier or subcontractor to an entity that seeks reimbursement from the Government for all or part of the services performed or products provided by seller, it is the sole responsibility of the buyer or other entity seeking reimbursement to ensure the products and services and associated charges are in compliance with and acceptable to the Government prior to submission. When serving as a supplier or subcontractor to an entity that seeks reimbursement from the Government, seller does not knowingly present or cause to be presented any claim for payment to the Government.
14. **APPLICABLE LAW/JURISDICTION AND VENUE.** The rights and duties of the parties shall be governed by, construed, and enforced in accordance with the laws of the State of California (excluding its conflict of laws rules which would refer to and apply the substantive laws of another jurisdiction). Any suit or proceeding hereunder shall be brought exclusively in state or federal courts located in Orange County, California. Each party consents to the personal jurisdiction of said state and federal courts and waives any objection that such courts are an inconvenient forum.
15. **ENTIRE AGREEMENT.** This agreement constitutes the entire contract between buyer and seller relating to the goods or services identified herein. No modifications hereof shall be binding upon the seller unless in writing and signed by seller's duly authorized representative, and no modification shall be effected by seller's acknowledgment or acceptance of buyer's purchase order forms containing different provisions. Trade usage shall neither be applicable nor relevant to this agreement, nor be used in any manner whatsoever to explain, qualify or supplement any of the provisions hereof. No waiver by either party of default shall be deemed a waiver of any subsequent default.

Detailed Design Tables

Project Info		
Confidential Queens BCP OU-1		
Corona, NY, 11368		
Entire Excavation		
Prepared For:		
Elizabeth Burgess (Langan)		
Target Treatment Zone (TTZ) Info	**Unit**	**Value**
Treatment Area	ft^2	15,200
Top Treat Depth	ft	10.0
Bot Treat Depth	ft	14.0
Vertical Treatment Interval	ft	4.0
Treatment Zone Volume	ft^3	60,800
Treatment Zone Volume	cy	2,252
Soil Type	---	sand
Porosity	cm^3/cm^3	0.33
Effective Porosity	cm^3/cm^3	0.20
Treatment Zone Pore Volume	gals	150,089
Treatment Zone Effective Pore Volume	gals	90,963
Fraction Organic Carbon (foc)	g/g	0.002
Soil Density	g/cm^3	1.7
Soil Density	lb/ft^3	108
Soil Weight	lbs	6.6E+06
Recommended Weight of ORC Advanced/Wt.	%	0.0
ORC Advanced Pellets Required	lbs	5920.000
Estimated Degradation Capacity as TPH	lbs	296.00
ORC Advanced® Pellets Application Design Summary		
Application Method	--	**Excavation Application**
Excavation Width	ft	0
Excavation Length	ft	0
Areal Extent (square ft)	sq. ft.	15,200
Top Application Depth (ft bgs)	ft	10
Bottom Application Depth (ft bgs)	ft	14
Estimated Saturated Treatment Thickness	ft	4
ORC Advanced to be Applied (lbs)	**lbs**	**5920.00**
ORC Advanced per 1 ft lift	**lb/ft**	**1,480**
Prepared By:		
Tyler Harris - PetroFix Design Specialist		

PetroFix™ Application Summary
Excavation Estimate
Enter Site Name
Excavation

PetroFix Amount	9,200 lb
Treatment Surface Area	15,200 ft^2
Assumed Placement Interval At Base	4 ft
Treatment Volume	2,252 yd^3
PetroFix Dose	4.1 lb/yd^3
Shipped PetroFix Volume	942 gal
Shipped Electron Acceptor (EA)	460 lb

Total Volume For Spraying	1,883 gal
Mix Tank Volume*	500 gal
Dilution Factor*	2 x
Total Volume of Water For Dilution	942 gal
PetroFix Per Mix Tank	250 gal
Water Per Mix Tank	250 gal
Electron Acceptor Per Mix Tank	122.1 lb
Number of Mix Tanks Required	3.8
Applied Fluid Thickness Across Excavation	0.2 inch

Specific Area Notes:
Native soil type: Mix of Coarse and Fine

Direct Spray Volumes for Excavation Subsections

Area (ft^2)	Spray Volume (gallons)
15,200	1,883
500	62
100	12

For use as reference for large excavations where the application may occur in subsections.

General Application Approach: PetroFix should be distributed horizontally and vertically as best possible throughout the placement interval starting at the base of the excavation. See excavation application instructions (link below) to learn more about direct spray and soil mixing application approaches. PetroFix application rates can be adjusted to apply higher or lower amounts across the excavation based on field observations or sampling of contaminant presence.

***Mix Tank Volume And Dilution Factor:** Both can be manually adjusted to accommodate different spray application approaches through the on-line design software (modify by going to "view area results" and then "view/customize application") or by Regenesis for any designs provided by Regenesis. A dilution factor of 1 indicates no use of additional water to distribute PetroFix. A dilution factor of 1 to 2 is appropriate for low-volume applications where PetroFix needs little water to spray or to apply. Consider larger dilution factors of roughly 4 or 5 when spraying into large excavations and reach is needed.

Reported Groundwater Concentrations (mg/L)

Benzene	0.150	Naphthalenes	0.000
Toluene	0.000	MTBE	0.000
Ethylbenzene	0.027	TPH-GRO	0.530
Xylenes	0.035	TPH-DRO	0.000
Trimethylbenzenes	0.017	TPH-ORO	0.000

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

PetroFIX™ Remediation Fluid

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

Storage and Handling Guidelines

Storage:

- Store away from incompatible materials
- Store in original closed container
- Store at temperatures between 40°F and 95°F
- Do not allow material to freeze or store in direct sunlight.
- Freezing and hot weather technical memo can be accessed at www.petrofix.com/resources or at this ***link*** here.
- Dispose of waste and residues in accordance with local authority requirements

Handling:

- Never add additives to solution prior to mixing with water
- Wear appropriate personal protective equipment
- Do not taste or ingest
- Observe good industrial hygiene practices
- Wash hands after handling

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.

REGENESIS®

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www.regenesis.com

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PetroFIX™
Remediation Fluid

Excavation Application Guidance For PetroFix™

PetroFIX™
Remediation Fluid

Table of Contents

Excavation Application Guidance for PetroFix

Questions?
Get in touch with us.

Phone: 949-366-8000
Email: info@petrofix.com

Or visit https://petrofix.com/apply today to learn more.

Introduction

Excavation Application Guidance for PetroFix

PetroFix™ Remediation Fluid (PetroFix) is an environmentally-compatible formulation of micron-scale activated carbon (1-2 microns) that is combined with both slow and quick-release inorganic electron acceptors (Electron Acceptor Blend or EA Blend). PetroFix can be applied to the floor and sidewalls of an excavation through *in situ* soil mixing or direct spraying. PetroFix should generally be applied to the vertical interval of the excavation that is naturally saturated with groundwater or expected to become naturally saturated.

REGENESIS has prepared this guidance document for remediation practitioners who are planning to use PetroFix as an amendment for remedial excavations. Two methods of application are described: Direct and *in situ* soil mixing.

For guidance on application methods that are not described in either document, please contact REGENESIS directly at 949-366-8000 or send an inquiry to info@petrofix.com.

H&S Note: Prior to use all personnel should review the specific SDSs to assure compliance and preparedness for any type of emergency that arises. OSHA (29 CFR 1910.1200)

PetroFix Health & Safety Information

Storage and Handling Guidelines

- Store away from incompatible materials and in original closed container
- Store at temperatures between 40°F and 95°F
- Do not allow material to freeze or store in direct sunlight
- Freezing and hot weather technical memo can be accessed here
- Dispose of waste and residues in accordance with local authority requirements

LEVEL D

Level D Protection is primarily a work uniform and is used for nuisance contamination only. It requires only coveralls and safety shoes/boots. Other PPE is based upon the situation (types of gloves, etc.). It should not be worn on any site where respiratory or skin hazards exist.

Source: https://chemm.nlm.nih.gov/ppe.htm

Note: *This recommendation is only for PetroFix and does not supersede additional precautions due to site conditions and potential exposures.*

Personal Protective Equipment (PPE) Requirements for Safe Installation

PetroFix is considered nonhazardous although it is recommended that personnel working with or in areas where there is a potential for contact with PetroFix should be required at a minimum to be fitted with Level D personal protective equipment. However, this recommendation is only for PetroFix and does not supersede additional precautions due to site conditions and potential exposures.

PPE should be upgraded from modified Level D based on site-specific hazards and requirements.

Typical Requirements

Features, Installation Equipment and Supplies Needed for PetroFix Application

- Secure storage area for PetroFix
- PetroFix SDS
- Appropriate Personal Protective Equipment (PPE)
- Qualified heavy equipment operators if mechanically mixing PetroFix
- Water source for mixing and spraying
- Access to electricity if spray pumps are used
- Mixing tanks – size based on the desired amounts of water to use and site logistics
- Drum mixer for homogenizing PetroFix in its 55-gallon drums (examples given later in this document)
- Hosing between mixing tank/drum and spray pump
- Spray pump if doing a direct spray application

More specifics are provided in the following sections.

Application Process

Pre-Mixing of PetroFix

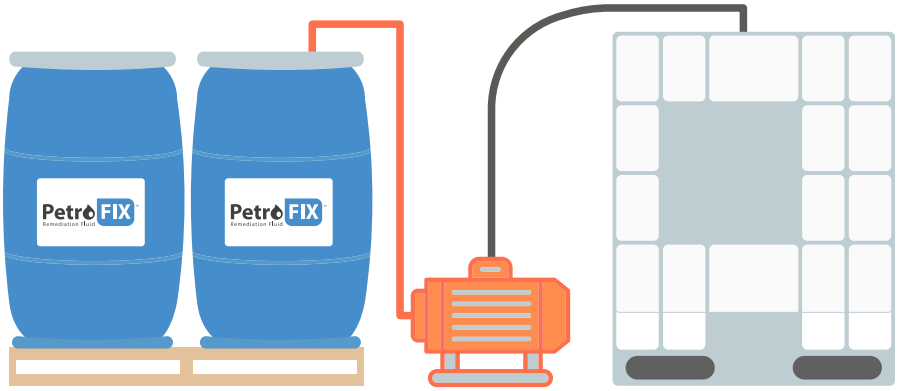
Shipping Information: PetroFix fluid is shipped in 55-gal. polyethylene drums and the EA version is shipped in 20-lb plastic pails.

PetroFix fluid is shipped in 55-gallon polyethylene drums and the EA Blend is shipped in 20-lb plastic pails. There are 41 gallons of fluid in each drum. PetroFix fills to roughly 12 to 14 inches below the top of the drum. PetroFix fluid can be transferred from its drum into a mix tank using either a diaphragm pump, trash pump, or a drum pump.

Note: *Always add water to mixing tank prior to adding PetroFix Remediation Fluid*

In most instances PetroFix will need to be diluted in a larger mixing tank and then pumped from that mixing tank to spray or pour into the excavation. Both PetroFix and the supplied electron acceptor should be diluted in the mixing tank and not in the drum the material was shipped in. **Mix tank volumes of 200 to 500 gallons should be enough for most sites and one should expect repeated re-fills of the tank until PetroFix is distributed.** Always add water to mixing tank prior to adding PetroFix Remediation Fluid.

- Assemble product transfer system to move the PetroFix from the drums to the mix tank. A diaphragm pump such as a Yamada diaphragm pump can be used to pump PetroFix form a drum to a mix tank.



The image shows an example PetroFix transfer and mixing setup where a tote was chosen as the mix tank

The image shows the homogenization of PetroFix using a high torque/high rpm mixer with appropriate mixing paddle.

- Always pre-mix PetroFix in its container prior to pumping material out of the container

- PetroFix is easy to mix with a proper power drill/mixer and a mixing blade combination. In cold weather or prolonged storage times PetroFix may settle a few inches at the bottom of the 55-gallon poly drum. Any such settling can be resuspended in the field with little time and the right equipment. A recommended mixing combination for all circumstances would be a high torque, double handle mixer such as a QEP or Rigid thinset grout and mortar power mixer with QEP 30" pro spiral mixing paddle, or equivalent (available at Home Depot). Other high torque mixers and paddle combinations can be used if they can create a vortex in the drum.

- If the PetroFix is difficult to pump after mixing with our recommended mixer you may need to thin the material. We recommend you add 3 to 5 gallons of water to the drum and blend that into the material. This will reduce the viscosity to allow for proper homogenization and transfer to dilution tanks.

- Transfer appropriate volume of PetroFix remediation fluid to the water in the mix tank.

- Thoroughly mix PetroFix solution in the mixing tank using an impeller type drum mixer or by recirculating the product inside the tank.

- Add recommended ratio of PetroFix Electron Acceptor Blend to the mixed solution in the tank. One tip is to use a scale to measure mass of electron acceptor blend needed for partial mix batches. Standard dosing is one bucket of electron acceptor blend per one drum of PetroFix.

  CAUTION: DO NOT mix PetroFix Electron Acceptor (EA) blend from the 20 lb buckets into undiluted PetroFix Remediation Fluid in the drums or totes. Only add the PetroFix EA blend into the diluted PetroFix solution in the mix tank. Adding the EA blend directly into the PetroFix Remediation Fluid will prevent the EA blend from properly dissolving in the mix water.

- As the drum is emptied into the mixing tank, flush out the drum with water to fully use all material. Flush water can be used as mix water.

Excavation Applications

The following text provides general guidance for how to apply PetroFix by direct application through spraying or in-excavation soil mixing. This document should not be considered an exhaustive review of all potential PetroFix application techniques and only provides a brief discussion on procedures recommended by REGENESIS.

PetroFix should never be applied by personnel within the excavation, unless proper shoring or sidewall cutback is in place.

Aerial view of PetroFix application an excavation site via direct-spraying

Direct Application

PetroFix can be sprayed onto the floor and sidewalls of an excavation by mixing PetroFix with water in above-ground mixing tanks and spraying using a high-volume water pump to fully cover the treatment area. PetroFix application should be focused in areas where complete excavation was not possible or where there is a concern for potential contaminant rebound. To facilitate focused application for sidewalls or areas of concern, application of the PetroFix solution can be sequenced to coincide with the incremental lifts during the soil backfilling.

PetroFix should be applied on a mass basis per treatment area using the design recommendations provided by REGENESIS. The minimum recommended mixing ratio for PetroFix for spraying is 1:1 by volume with water (i.e. 41 gallons of PetroFix fluid + 20 lb of supplied EA Blend to 41

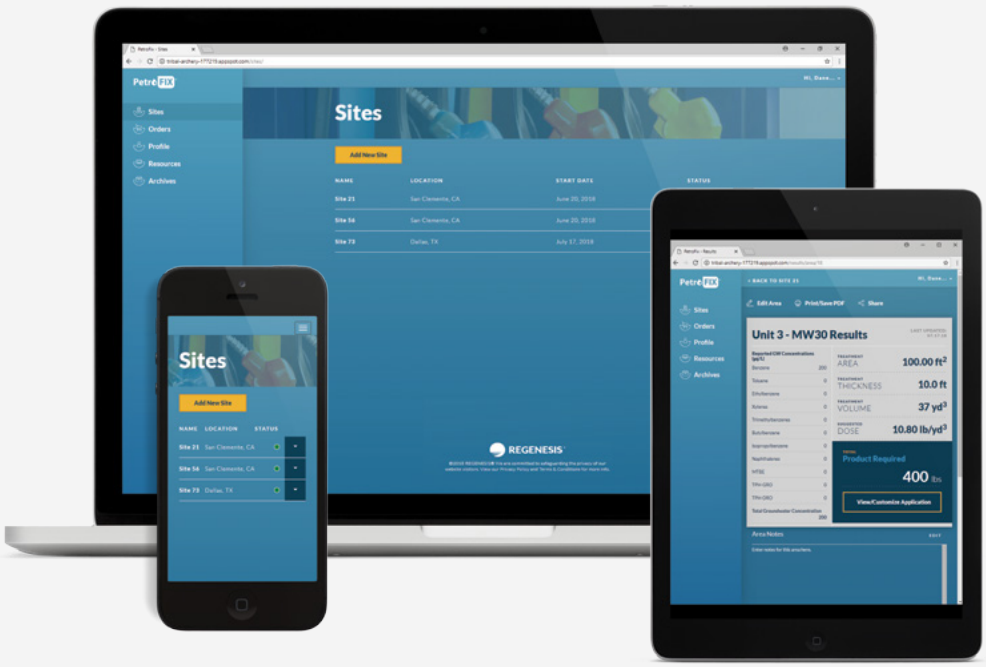
H&S Note: All excavations should be assessed by an "excavation competent person" as defined in OSHA (29 CFR 1926.50) to assure that personnel and equipment applying the product are a safe distance away from sheer walls to prevent engulfment and injury.

gallons of mix water) and this is usually used for relatively small excavations where a large area of distribution is not needed. Higher dilution volumes would be recommended where PetroFix is sprayed into the middle of a large excavation that is harder to reach. The volume of mix water can be increased or decreased as needed to fully cover the treatment area and is usually determined in field. As a rule-of-thumb, plan on using at least 5x as much volume of mix water as PetroFix remedial fluid used and vary as needed so that you feel you have enough water to achieve the coverage that you need. Enough water should be used to spread PetroFix through the entire excavation treatment area. If the excavation is not saturated, enough water should be used to attain coverage and saturate the first few inches of the excavation and cause some downward percolation.

PetroFix can be applied directly to the soil using a towable water trailer (such as Wastecorp 500 to 1,600 gallon water trailers) equipped with an onboard centrifugal water pump and sprayed using a 1.5" lay flat hose fitted with a 1.5" fire nozzle. This equipment can be rented at most construction rental supply stores. PetroFix and the associated Electron Acceptor Blend can be mixed by recirculating the solution within the water tank using either the onboard water pump or an external pump. PetroFix and the EA Blend should be mixed with water for approximately five minutes before it is ready to be sprayed into the excavation. It is recommended to flush the pump, hose, and nozzle with clean water after spraying each PetroFix drum and at the end of the day to prevent potential clogging. Follow OSHA-required health and safety practices while spraying and follow regulations on appropriate distances to stand away from the edges of the excavation. Use caution when spraying PetroFix upwind and it is advised to wear a face shield to prevent liquid splashing on the face.

In Situ Soil Mixing

In situ soil mixing can be performed to improve PetroFix distribution within the soil targeted for remediation. PetroFix can be added undiluted into the excavated area and mixed *in situ* with standing groundwater. If the excavated area is dry, it is recommended to add water to the floor of the excavation to aid in soil mixing and saturate at a minimum the first few inches of soil. Add water as needed to aid in mixing and plan for enough water based on the volume of excavation to be treated. Another option is that PetroFix can be diluted (per instructions in the prior section) with higher volumes of water and then sprayed into the excavation at the mixing head. Mechanical mixing can be performed using a variety of excavator attachments, including bucket, auger, or rotary tool.



Simple
Easy to Use

Flexible
Designs Tailored to Your Site

Fast
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Phone: (949) 366-8000

www.PetroFix.com

www.REGENESIS.com

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REGENESIS®

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.

Example of ORC Advanced

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.

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.

REGENESIS®

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

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Oxygen Release Compound (ORC®) Installation Instructions: Excavation Applications

Safety

Pure ORC® is shipped to you as a fine powder, which is rated at -325 mesh (passes through a 44 micron screen). It is considered to be a mild oxidizer and as such should be handled with care while in the field. Field personnel should take precautions while applying the pure ORC.

Typically, the operator should work up wind of the product as well as use appropriate safety equipment. These would include eye, respiratory protection and gloves as deemed appropriate by exposure duration and field conditions.

Although two options are discussed, application of ORC should never be applied by personnel within the tank excavation, unless proper shoring or sidewall cutback is in place.

General Guidelines

ORC can be applied in a dry powder form or as a slurry. Field conditions dictate which form of ORC can be used most effectively.

Installation of ORC should be within the tank excavation floor and/or in an adequate backfill section thickness to account for the anticipated groundwater "smear zone".

Maximum treatment effect is obtained when ORC is mixed as thoroughly as possible within the backfill material. The more dispersed the ORC slurry/powder within the excavation backfill, the more effective the treatment.

The quantity of ORC to be used is generally calculated prior to moving into the field for installation. Generally it is applied at a rate of between 0.1% and 1.0% by weight of the soil matrix.

The Following Illustrates a Dilute Application Rate Calculation

Use a weight/weight percent of ORC/backfill material to ensure distribution of the ORC into the desired aquifer section. For example: a 0.15% weight of ORC to weight of backfill for the standard ORC weight (30 pounds) per container calculates as follows: 30 lb. ORC/0.15% = 20,000 lbs. of soil matrix.

Thus, to achieve a 0.15% mixture of ORC in the backfill material, 30 lb. of pure ORC should be mixed into 10 tons (20,000 lbs. ÷2,000 lbs./ton) of backfill, or approximately 7 - 10 cubic yards of soil depending on field conditions. Professional judgment should be used to select the appropriate soil mass per cubic yard for designing each site treatment.

Choosing the Form of Installation

Pure ORC is shipped to you in a powder form. Weather conditions (especially wind) may have a direct effect on the application of ORC as a tank backfill amendment.

Application of the dry powder may be difficult in windy conditions. To counter the effects of wind (and the subsequent potential loss of ORC), REGENESIS® recommends that a water source or a spray tank be on-site to wet down the ORC and the backfill material as ORC is applied.

Application of ORC in a slurry format is a very effective method and eliminates the wind issue.
Four somewhat different installation conditions can be encountered in the field:

- ORC in a pea gravel back-fill. ("Type 1")
- ORC in a soil back-fill. ("Type 2")
- ORC mixed in native soil in the bottom of a tank pit. ("Type 3")
- ORC installed in soil under standing water in the bottom of a tank pit. ("Type 4")

A single tank pit excavation can include more than one of these conditions, depending on the site and extent of treatment. Instructions for each condition are discussed separately in the following sections. After the installation instructions are detailed instructions for mixing the slurry, if that is the option chosen.

Installation Instructions

"Type 1," ORC in a Pea Gravel Back-fill

The easiest method for installing ORC in pea gravel back-fill is to mix the ORC in the material in a backhoe or skiploader bucket before placing it in the excavation.

Dry Powder Method

Into each scoop of back-fill material add the appropriate portion of ORC being installed. Generally, it is advisable to moisten the material in the bucket to reduce wind blown ORC loss. Excessive winds make this method not feasible. After mixing the dry powder in the bucket, it is dumped into the bottom of the excavation. The backhoe bucket can be used for further mixing in the excavation.

Slurry Method

Mix a 63% solids slurry of ORC and water (see "Steps to make ORC slurry"). This relatively thick slurry is used to help keep the ORC dispersed through the pea gravel, even when it contacts water in the bottom of the excavation during installation. It is generally desirable to avoid having the ORC run down through the pea gravel and collect in the bottom of the excavation. The thick slurry addresses this issue.

In each scoop of back-fill material, add the appropriate amount of ORC slurry. Pre-mix the materials in the backhoe bucket After mixing, dump the slurry and back-fill into the bottom of the excavation. The backhoe bucket can be used for further mixing in the excavation.

If the slurry method is being used, observe the physical behavior of the ORC in the fill material. If the ORC collects at the bottom of the back-fill material, increase the percent solids content by reducing the amount of water being used to make the slurry.

"Type 2," ORC in a Soil Back-fill

Follow the instructions for the pea gravel back-fill method, except: If the slurry method is being used, the solids content should be reduced. Typically a 50% solids is appropriate, although soil conditions sometimes dictate lower solids contents (see "Steps to make ORC slurry").

" Type 3," ORC Mixed in Native Soil in the Bottom of the Tank Pit

When ORC is added to the bottom of a tank pit it may be done by backhoe or injection.
CAUTION: Personnel should never work within the tank excavation, unless proper shoring or sidewall cutback is in place.

Backhoe Method

A skilled backhoe operator can distribute the ORC around the bottom of the tank excavation and, using the bucket, mix it thoroughly. If there are no winds, it may be possible to:

1. Put the dry ORC powder in the backhoe bucket,
2. Lower it to the bottom of the pit,
3. Gently deposit the ORC evenly on the remaining soil,
4. Use the bucket to mix the powder into the soil,
5. To mitigate dusting, if necessary, spray water into the excavation during the process.

An alternative backhoe method is to use a 50% (or less) solids ORC slurry (see "Steps to make ORC slurry) in place of the dry powder. This eliminates the dusting problem, and in some cases enhances the even distribution of ORC into the soil. Observe the slurry mixing behavior in the bottom of the excavation, and adjust the water content of the slurry to optimize mixing, if necessary.

Injection Method

If available, a pump and root feeder may be used to inject an ORC slurry into the excavation floor. This may require a more dilute slurry mix, and care should be taken to assure that the solids do not settle out of the slurry prior to injection.

" Type 4," ORC installed in standing water in the bottom of a tank pit

Application of ORC into tank excavations with standing water requires the operator apply ORC in a slurry form. ORC powder application in this scenario is not advised because a portion of the ORC particle fraction is not likely to pass through the surface tension of the standing water.

CAUTION: Personnel should never work within the tank excavation, unless proper shoring or sidewall cutback is in place.

Backhoe Method

A skilled backhoe operator can distribute the ORC slurry within the excavation, and mix it into the soil underlying the standing water with the bucket. Steps for installation:

1. Mix a high solids content ORC slurry (63% solids). See ("Steps to make ORC slurry").
2. Pour slurry into the backhoe bucket.
3. Lower the bucket to the standing water level in the excavation, and deposit the slurry as evenly as possible across the excavation floor. The dense slurry (63%solids is 1.6 grams per ml) will tend to make the majority of the slurry sink quickly to the bottom of the water layer.
4. Use the bucket to mix the slurry into the soil.
5. Water in the vicinity of the ORC slurry will often turn white and milky, since some of the ORC is dispersed within the standing water. This provides additional dispersion within the standing water and back-fill material as it is added to the excavation.

Injection Method

If available, a pump and root feeder may be used to inject an ORC slurry into the soil in an excavation. This may require a more dilute slurry mix, and care should be taken to assure that the solids do not settle out of the slurry prior to injection.

Mixing ORC Slurry

ORC powder is shipped to you in pre-measured batches. Each batch is contained in a plastic bag which is shipped in a 5-gallon bucket. Remove the pre-measured ORC bag from the 5-gallon bucket and open. Measure and pour the appropriate amount of water from the following table into the 5 gallon bucket

Slurry Solids Content (%)	Pounds of ORC	Gallons of Water
63%	30 lbs.	2.1 gal. (2 gal. + 2 cups)
50%	30 lbs.	3.6 gal. (3 gal + 2 1/2 qts.)

Add the entire ORC pre-measured bag to the water (30 pounds). If the slurry solids contents of less than 50% are desired, the quantity of ORC per batch mixed in the bucket must be reduced. For example, a bucket containing four gallons of water would require 22.4 pounds of ORC to make a 40% solids slurry, and 16.6 pounds of ORC to make a 33% slurry.

Use an appropriate mixing device to thoroughly mix ORC and water. REGENESIS recommends use of a 0.5 Horsepower (minimum) hand held drill with a "jiffy mixer" or stucco mixer. A common paint paddle can be used to scrape the bottom and sides of the container to ensure thorough mixing. Standard environmental slurry mixers may also be used. After mixing, small amounts of water can be added to adjust the consistency of the slurry. When slurries are used, the early batches should be observed in the process of mixing with the soil. Each site can vary, due to soil type and moisture content. Based on professional judgment, additional water can be added to subsequent slurry batches.

ORC slurry should be used ASAP; if the ORC slurry has been standing more than 15 minutes, it should be remixed immediately before using. Do not let stand more than 30 minutes without stirring. Otherwise, the slurry will begin to harden into a weak cement.

For direct assistance or answers to any questions you may have regarding these instructions, contact REGENESIS Technical Services at 949.366.8000.

ATTACHMENT 2

PetroFix™ and Electron Acceptor Blend SDS

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

PetroFIX™ Remediation Fluid

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

Storage and Handling Guidelines

Storage:

- Store away from incompatible materials
- Store in original closed container
- Store at temperatures between 40°F and 95°F
- Do not allow material to freeze or store in direct sunlight.
- Freezing and hot weather technical memo can be accessed at www.petrofix.com/resources or at this ***link*** here.
- Dispose of waste and residues in accordance with local authority requirements

Handling:

- Never add additives to solution prior to mixing with water
- Wear appropriate personal protective equipment
- Do not taste or ingest
- Observe good industrial hygiene practices
- Wash hands after handling

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.

REGENESIS®

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SAFETY DATA SHEET

1. Identification

Product identifier **PetroFix**

Other means of identification None.

Recommended use Remediation of contaminants in soil and groundwater.

Recommended restrictions None known.

Manufacturer/Importer/Supplier/Distributor information

Company Name Regenesis

Address 1011 Calle Sombra
San Clemente, CA 92673 USA

General information 949-366-8000

E-mail CustomerService@regenesis.com

Emergency phone number For Hazardous Materials Incidents ONLY (spill, leak, fire, exposure or accident), call CHEMTREC 24/7 at:

USA, Canada, Mexico 1-800-424-9300

International 1-703-527-3887

2. Hazard(s) identification

Physical hazards Not classified.

Health hazards Not classified.

OSHA defined hazards Not classified.

Label elements

Hazard symbol None.

Signal word None.

Hazard statement The mixture does not meet the criteria for classification.

Precautionary statement

Prevention Observe good industrial hygiene practices.

Response Wash hands after handling.

Storage Store away from incompatible materials.

Disposal Dispose of waste and residues in accordance with local authority requirements.

Hazard(s) not otherwise classified (HNOC) None known.

Supplemental information None.

3. Composition/information on ingredients

Mixtures

Chemical name	CAS number	%
Activated carbon <10 µm	7440-44-0	>25
Calcium sulfate dihydrate	10101-41-4	<10
Additive	-	<2

Composition comments All concentrations are in percent by weight unless otherwise indicated.
Components not listed are either non-hazardous or are below reportable limits.
Chemical ingredient identity and/or concentration information withheld for some or all components present is confidential business information (trade secret), and is being withheld as permitted by 29 CFR 1910.1200(i).

4. First-aid measures

Inhalation	Move to fresh air. Call a physician if symptoms develop or persist.
Skin contact	Wash off with soap and water. Get medical attention if irritation develops and persists.
Eye contact	Rinse with water. Get medical attention if irritation develops and persists.
Ingestion	Rinse mouth. Get medical attention if symptoms occur.
Most important symptoms/effects, acute and delayed	Direct contact with eyes may cause temporary irritation.
Indication of immediate medical attention and special treatment needed	Treat symptomatically.
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media	Water fog. Foam. Dry chemical powder. Carbon dioxide (CO2).
Unsuitable extinguishing media	None known.
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed. Combustion products may include: carbon oxides, nitrogen oxides, sulfur oxides, calcium oxide.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire fighting equipment/instructions	Move containers from fire area if you can do so without risk.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	This material will not burn until the water has evaporated. Residue can burn. When dry may form combustible dust concentrations in air.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Absorb in vermiculite, dry sand or earth and place into containers. Following product recovery, flush area with water. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Avoid prolonged exposure. Observe good industrial hygiene practices.
Conditions for safe storage, including any incompatibilities	Store in original tightly closed container. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-3 (29 CFR 1910.1000)

Components	Type	Value	Form
Activated carbon <10 µm (CAS 7440-44-0)	TWA	5 mg/m3	Respirable fraction.
		15 mg/m3	Total dust.

US. ACGIH Threshold Limit Values

Components	Type	Value	Form
Activated carbon <10 µm (CAS 7440-44-0)	TWA	2 mg/m3	Respirable fraction.

US. ACGIH Threshold Limit Values

Components	Type	Value	Form
Calcium sulfate dihydrate (CAS 10101-41-4)	TWA	10 mg/m3	Inhalable fraction.

Biological limit values No biological exposure limits noted for the ingredient(s).

Appropriate engineering controls Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin protection

Hand protection Wear appropriate chemical resistant gloves. Suitable gloves can be recommended by the glove supplier.

Skin protection

Other Wear suitable protective clothing.

Respiratory protection In case of insufficient ventilation, wear suitable respiratory equipment.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

Physical state Liquid.

Form Aqueous suspension.

Color Not available.

Odor Not available.

Odor threshold Not available.

pH 8 - 10

Melting point/freezing point Not available.

Initial boiling point and boiling range 212 °F (100 °C)

Flash point Not available.

Evaporation rate Not available.

Flammability (solid, gas) Not applicable.

Upper/lower flammability or explosive limits

Flammability limit - lower (%) Not available.

Flammability limit - upper (%) Not available.

Vapor pressure Not available.

Vapor density Not available.

Relative density Not available.

Solubility(ies)

Solubility (water) Not available.

Partition coefficient (n-octanol/water) Not available.

Auto-ignition temperature Not available.

Decomposition temperature Not available.

Viscosity Not available.

Other information

Explosive properties Not explosive.

Oxidizing properties Not oxidizing.

10. Stability and reactivity

Reactivity The product is stable and non-reactive under normal conditions of use, storage and transport.

Chemical stability Material is stable under normal conditions.

Possibility of hazardous reactions No dangerous reaction known under conditions of normal use.

Conditions to avoid Contact with incompatible materials. Avoid drying out product. May generate combustible dust if material dries.

Incompatible materials Strong oxidizing agents. Acids.

Hazardous decomposition products No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Inhalation Spray mist may irritate the respiratory system. For dry material: Dust may irritate respiratory system.

Skin contact Prolonged or repeated exposure may cause minor irritation.

Eye contact Direct contact with eyes may cause temporary irritation.

Ingestion May cause discomfort if swallowed.

Symptoms related to the physical, chemical and toxicological characteristics Direct contact with eyes may cause temporary irritation.

Information on toxicological effects

Acute toxicity Not expected to be acutely toxic.

Components	Species	Test Results
Activated carbon <10 µm (CAS 7440-44-0)		
Acute		
Oral		
LD50	Rat	> 10000 mg/kg

Skin corrosion/irritation Prolonged skin contact may cause temporary irritation.

Serious eye damage/eye irritation Direct contact with eyes may cause temporary irritation.

Respiratory or skin sensitization

Respiratory sensitization Not a respiratory sensitizer.

Skin sensitization This product is not expected to cause skin sensitization.

Germ cell mutagenicity No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Carcinogenicity Not classifiable as to carcinogenicity to humans.

IARC Monographs. Overall Evaluation of Carcinogenicity

Not listed.

NTP Report on Carcinogens

Not listed.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)

Not regulated.

Reproductive toxicity This product is not expected to cause reproductive or developmental effects.

Specific target organ toxicity - single exposure Not classified.

Specific target organ toxicity - repeated exposure Not classified.

Aspiration hazard Not an aspiration hazard.

12. Ecological information

Ecotoxicity The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Persistence and degradability	No data is available on the degradability of this product.
Bioaccumulative potential	No data available.
Mobility in soil	No data available.
Other adverse effects	None known.

13. Disposal considerations

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not established.

15. Regulatory information

US federal regulations	This product is not known to be a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)

Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical	No

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA)	Not regulated.

US state regulations

US. Massachusetts RTK - Substance List

Calcium sulfate dihydrate (CAS 10101-41-4)

US. New Jersey Worker and Community Right-to-Know Act

Not listed.

US. Pennsylvania Worker and Community Right-to-Know Law

Not listed.

US. Rhode Island RTK

Activated carbon <10 µm (CAS 7440-44-0)
Calcium sulfate dihydrate (CAS 10101-41-4)

California Proposition 65

California Safe Drinking Water and Toxic Enforcement Act of 2016 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins. For more information go to www.P65Warnings.ca.gov.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
Taiwan	Taiwan Chemical Substance Inventory (TCSI)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s).
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date 15-February-2018

Revision date -

Version # 01

HMIS® ratings Health: 1
Flammability: 1
Physical hazard: 0

NFPA ratings

Disclaimer Regenesis cannot anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used. It is the user's responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use. The information in the sheet was written based on the best knowledge and experience currently available.

SAFETY DATA SHEET

1. Identification

Product identifier **PetroFix Electron Acceptor Blend**

Other means of identification None.

Recommended use Remediation of soils and groundwater.

Recommended restrictions None known.

Manufacturer/Importer/Supplier/Distributor information

Company Name Regenesis

Address 1011 Calle Sombra
San Clemente, CA 92673 USA

General information 949-366-8000

E-mail CustomerService@regenesis.com

Emergency phone number For Hazardous Materials Incidents ONLY (spill, leak, fire, exposure or accident), call CHEMTREC 24/7 at:

USA, Canada, Mexico 1-800-424-9300

International 1-703-527-3887

2. Hazard(s) identification

Physical hazards Not classified.

Health hazards Serious eye damage/eye irritation Category 2B

OSHA defined hazards Not classified.

Label elements

Hazard symbol None.

Signal word Warning

Hazard statement Causes eye irritation.

Precautionary statement

Prevention Wash thoroughly after handling.

Response If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

Storage Store away from incompatible materials.

Disposal Dispose of waste and residues in accordance with local authority requirements.

Hazard(s) not otherwise classified (HNOC) None known.

Supplemental information None.

3. Composition/information on ingredients

Mixtures

Chemical name	CAS number	%
Ammonium sulfate	7783-20-2	40 - 60
Sodium nitrate	7631-99-4	40 - 60

Composition comments All concentrations are in percent by weight unless otherwise indicated.

4. First-aid measures

Inhalation Move to fresh air. Call a physician if symptoms develop or persist.

Skin contact Wash off with soap and water. Get medical attention if irritation develops and persists.

Eye contact	Do not rub eyes. Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention if irritation develops and persists.
Ingestion	Rinse mouth. Get medical attention if symptoms occur.
Most important symptoms/effects, acute and delayed	Irritation of eyes. Exposed individuals may experience eye tearing, redness, and discomfort. Dusts may irritate the respiratory tract, skin and eyes.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. Keep victim under observation. Symptoms may be delayed.
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media	Use extinguishing agent suitable for type of surrounding fire.
Unsuitable extinguishing media	None known.
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed. Combustion products may include: nitrogen oxides, sulfur oxides, ammonia.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire fighting equipment/instructions	Use water spray to cool unopened containers.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	Material will not burn.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Wear appropriate protective equipment and clothing during clean-up. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	Avoid the generation of dusts during clean-up. Collect dust using a vacuum cleaner equipped with HEPA filter. Stop the flow of material, if this is without risk. Large Spills: Wet down with water and dike for later disposal. Absorb in vermiculite, dry sand or earth and place into containers. Shovel the material into waste container. Following product recovery, flush area with water. Small Spills: Sweep up or vacuum up spillage and collect in suitable container for disposal. Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Minimize dust generation and accumulation. Provide appropriate exhaust ventilation at places where dust is formed. Avoid contact with eyes. Wear appropriate personal protective equipment. Observe good industrial hygiene practices.
Conditions for safe storage, including any incompatibilities	Store in tightly closed container. Store in a well-ventilated place. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits	No exposure limits noted for ingredient(s).
Biological limit values	No biological exposure limits noted for the ingredient(s).

Appropriate engineering controls	Good general ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. If engineering measures are not sufficient to maintain concentrations of dust particulates below the Occupational Exposure Limit (OEL), suitable respiratory protection must be worn. If material is ground, cut, or used in any operation which may generate dusts, use appropriate local exhaust ventilation to keep exposures below the recommended exposure limits. Provide eyewash station.

Individual protection measures, such as personal protective equipment

Eye/face protection	Unvented, tight fitting goggles should be worn in dusty areas.
Skin protection	
Hand protection	Wear appropriate chemical resistant gloves. Suitable gloves can be recommended by the glove supplier.
Skin protection	
Other	Wear suitable protective clothing.
Respiratory protection	In case of insufficient ventilation, wear suitable respiratory equipment. Wear NIOSH approved respirator appropriate for airborne exposure at the point of use. Appropriate respirator selection should be made by a qualified professional. Recommended use: Wear respirator with dust filter.
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.
General hygiene considerations	Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance	
Physical state	Solid.
Form	Powder.
Color	White.
Odor	Not available.
Odor threshold	Not available.
pH	Not available.
Melting point/freezing point	Not available.
Initial boiling point and boiling range	Not available.
Flash point	Not available.
Evaporation rate	Not available.
Flammability (solid, gas)	This material will not burn.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Vapor pressure	Not available.
Vapor density	Not available.
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Not available.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Explosive properties	Not explosive.
Oxidizing properties	Not oxidizing.

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Contact with incompatible materials. Heat.
Incompatible materials	Strong reducing agents. Strong acids.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Inhalation	Dust may irritate respiratory system.
Skin contact	Dust or powder may irritate the skin.
Eye contact	Causes eye irritation.
Ingestion	May cause discomfort if swallowed.

Symptoms related to the physical, chemical and toxicological characteristics	Irritation of eyes. Exposed individuals may experience eye tearing, redness, and discomfort. Dusts may irritate the respiratory tract, skin and eyes.

Information on toxicological effects

Acute toxicity	Not expected to be acutely toxic.
Skin corrosion/irritation	Prolonged skin contact may cause temporary irritation.
Serious eye damage/eye irritation	Causes eye irritation.

Respiratory or skin sensitization

Respiratory sensitization	Not a respiratory sensitizer.
Skin sensitization	This product is not expected to cause skin sensitization.

Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	Not classifiable as to carcinogenicity to humans.

IARC Monographs. Overall Evaluation of Carcinogenicity

Not listed.

NTP Report on Carcinogens

Not listed.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)

Not regulated.

Reproductive toxicity	This product is not expected to cause reproductive or developmental effects.
Specific target organ toxicity - single exposure	Not classified.
Specific target organ toxicity - repeated exposure	Not classified.
Aspiration hazard	Not an aspiration hazard.
Further information	Nitrate poisoning resulting in methemoglobinemia manifested as cyanosis is rare, but possible for people with specific susceptibility traits.

12. Ecological information

Ecotoxicity	The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.
Persistence and degradability	The product solely consists of inorganic compounds which are not biodegradable.
Bioaccumulative potential	No data available.
Mobility in soil	No data available.
Other adverse effects	None known.

13. Disposal considerations

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Dispose of contents/container in accordance with local/regional/national/international regulations.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not applicable.

15. Regulatory information

US federal regulations	This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)

Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical	Yes
Classified hazard categories	Serious eye damage or eye irritation

SARA 313 (TRI reporting)

Chemical name	CAS number	% by wt.
Ammonium sulfate	7783-20-2	40 - 60
Sodium nitrate	7631-99-4	40 - 60

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA)	Not regulated.

US state regulations

US. Massachusetts RTK - Substance List

Ammonium sulfate (CAS 7783-20-2)
Sodium nitrate (CAS 7631-99-4)

US. New Jersey Worker and Community Right-to-Know Act

Sodium nitrate (CAS 7631-99-4)

US. Pennsylvania Worker and Community Right-to-Know Law

Ammonium sulfate (CAS 7783-20-2)
Sodium nitrate (CAS 7631-99-4)

US. Rhode Island RTK

Ammonium sulfate (CAS 7783-20-2)
Sodium nitrate (CAS 7631-99-4)

California Proposition 65

California Safe Drinking Water and Toxic Enforcement Act of 2016 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins. For more information go to www.P65Warnings.ca.gov.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
Taiwan	Taiwan Chemical Substance Inventory (TCSI)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s).
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date 15-August-2018

Revision date -

Version # 01

HMIS® ratings

Health: 1
Flammability: 0
Physical hazard: 0

NFPA ratings

Disclaimer

Regenesis cannot anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used. It is the user's responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use. The information in the sheet was written based on the best knowledge and experience currently available.

ATTACHMENT 3

ORC Advanced® SDS

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.

Example of ORC Advanced

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.

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.

REGENESIS®

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

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SAFETY DATA SHEET

1. Identification

Product identifier	**Oxygen Release Compound Advanced (ORC Advanced®)**
Other means of identification	None.
Recommended use	Soil and Groundwater Remediation.
Recommended restrictions	None known.

Manufacturer/Importer/Supplier/Distributor information

Company name	Regenesis
Address	1011 Calle Sombra San Clemente, CA 92673 USA
General information	949-366-8000
E-mail	CustomerService@regenesis.com

Emergency phone number	For Hazardous Materials Incidents ONLY (spill, leak, fire, exposure or accident), call CHEMTREC 24/7 at:
USA, Canada, Mexico	(+)1-800-424-9300
International	(+)1-703-527-3887

2. Hazard identification

Physical hazards	Oxidising solids	Category 2
Health hazards	Skin corrosion/irritation	Category 2
	Serious eye damage/eye irritation	Category 1
	Specific target organ toxicity following single exposure	Category 3 respiratory tract irritation

Label elements

Signal word	Danger
Hazard statement	May intensify fire; oxidiser. Causes skin irritation. Causes serious eye damage. May cause respiratory irritation.

Precautionary statement

Prevention	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Keep away from clothing and other combustible materials. Avoid breathing dust. Wash thoroughly after handling. Use only outdoors or in a well-ventilated area. Wear protective gloves/protective clothing/eye protection/face protection.
Response	IF ON SKIN: Wash with plenty of water. IF INHALED: Remove person to fresh air and keep comfortable for breathing. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTRE/doctor. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash it before reuse. In case of fire: Use appropriate media to extinguish.
Storage	Store in a well-ventilated place. Keep container tightly closed. Store locked up.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Other hazards	None known.
Supplemental information	None.

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
Calcium peroxide		1305-79-9	≥75
Calcium hydroxide		1305-62-0	≤25
Dipotassium Phosphate		7758-11-4	<5
Monopotassium Phosphate		7778-77-0	<5

Composition comments All concentrations are in percent by weight unless otherwise indicated.

4. First-aid measures

Inhalation Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTRE or doctor/physician if you feel unwell.

Skin contact IF ON CLOTHING: rinse immediately contaminated clothing and skin with plenty of water before removing clothes. Rinse skin with water/shower. If skin irritation occurs: Get medical advice/attention. Wash contaminated clothing before reuse.

Eye contact Do not rub eyes. Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention immediately.

Ingestion Never give anything by mouth to a victim who is unconscious or is having convulsions. Rinse mouth. Do not induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed Severe eye irritation. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result. Dusts may irritate the respiratory tract, skin and eyes. Skin irritation. May cause redness and pain.

Indication of immediate medical attention and special treatment needed Provide general supportive measures and treat symptomatically. Keep victim under observation. Symptoms may be delayed.

General information Take off all contaminated clothing immediately. Contact with combustible material may cause fire. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Wash contaminated clothing before reuse.

5. Fire-fighting measures

Suitable extinguishing media Water spray, fog (flooding amounts). Foam. Dry chemical powder. Carbon dioxide (CO2).

Unsuitable extinguishing media None known.

Specific hazards arising from the chemical Greatly increases the burning rate of combustible materials. Containers may explode when heated. During fire, gases hazardous to health may be formed. Combustion products may include: metal oxides.

Special protective equipment and precautions for firefighters Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

Fire fighting equipment/instructions In case of fire and/or explosion do not breathe fumes. Move containers from fire area if you can do so without risk. Use water spray to cool unopened containers.

Specific methods Cool containers exposed to flames with water until well after the fire is out.

General fire hazards May intensify fire; oxidiser. Contact with combustible material may cause fire.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Keep away from clothing and other combustible materials. Wear appropriate protective equipment and clothing during clean-up. Use a NIOSH/MSHA approved respirator if there is a risk of exposure to dust/fume at levels exceeding the exposure limits. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.

Methods and materials for containment and cleaning up

Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Collect dust using a vacuum cleaner equipped with HEPA filter. Keep combustibles (wood, paper, oil etc) away from spilled material. Ventilate the contaminated area. Stop the flow of material, if this is without risk. Absorb in vermiculite, dry sand or earth and place into containers.

Large Spills: Sweep up or vacuum up spillage and collect in suitable container for disposal. Shovel the material into waste container. Minimise dust generation and accumulation. Avoid the generation of dusts during clean-up. Following product recovery, flush area with water.

Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination.

Never return spills to original containers for re-use. Place all material into loosely covered plastic containers for later disposal. For waste disposal, see section 13 of the SDS. Wear appropriate protective equipment and clothing during clean-up.

Environmental precautions

Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling

Minimise dust generation and accumulation. Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces. Keep away from heat. Provide appropriate exhaust ventilation at places where dust is formed. Keep away from clothing and other combustible materials. Take any precaution to avoid mixing with combustibles. Avoid contact with water and moisture. Do not get this material in contact with eyes. Avoid contact with eyes, skin, and clothing. Avoid prolonged exposure. Wear appropriate personal protective equipment. Observe good industrial hygiene practices.

Conditions for safe storage, including any incompatibilities

Keep away from heat. Store in a cool, dry place out of direct sunlight. Store in original tightly closed container. Keep container tightly closed. Store in a well-ventilated place. Do not store near combustible materials. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

US. ACGIH Threshold Limit Values

Components	Type	Value
Calcium hydroxide (CAS 1305-62-0)	TWA	5 mg/m3

Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2)

Components	Type	Value
Calcium hydroxide (CAS 1305-62-0)	TWA	5 mg/m3

Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended)

Components	Type	Value
Calcium hydroxide (CAS 1305-62-0)	TWA	5 mg/m3

Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act)

Components	Type	Value
Calcium hydroxide (CAS 1305-62-0)	TWA	5 mg/m3

Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents)

Components	Type	Value
Calcium hydroxide (CAS 1305-62-0)	TWA	5 mg/m3

Canada. Quebec OELs. (Ministry of Labor - Regulation respecting occupational health and safety)

Components	Type	Value
Calcium hydroxide (CAS 1305-62-0)	TWA	5 mg/m3

Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21)

Components	Type	Value
Calcium hydroxide (CAS 1305-62-0)	15 minute	10 mg/m3
	8 hour	5 mg/m3

Biological limit values No biological exposure limits noted for the ingredient(s).

Appropriate engineering controls Good general ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. If engineering measures are not sufficient to maintain concentrations of dust particulates below the OEL (occupational exposure limit), suitable respiratory protection must be worn. If material is ground, cut, or used in any operation which may generate dusts, use appropriate local exhaust ventilation to keep exposures below the recommended exposure limits. Eye wash facilities and emergency shower must be available when handling this product.

Individual protection measures, such as personal protective equipment

Eye/face protection Use dust-tight, unvented chemical safety goggles when there is potential for eye contact.

Skin protection

Hand protection Wear appropriate chemical resistant gloves. Frequent change is advisable. Recommended gloves include rubber, neoprene, nitrile or viton.

Other Wear appropriate chemical resistant clothing.

Respiratory protection If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn. Recommended use: Wear respirator with dust filter.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations Keep from contact with clothing and other combustible materials. Remove and wash contaminated clothing promptly. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

Physical state Solid.

Form Powder.

Colour White to pale yellow.

Odour Odourless.

Odour threshold Not available.

pH 12.5 (3% suspension/water)

Melting point/freezing point Not available.

Initial boiling point and boiling range Not available.

Flash point Not available.

Evaporation rate Not available.

Flammability (solid, gas) Oxidizer.

Upper/lower flammability or explosive limits

Flammability limit - lower (%) Not available.

Flammability limit - upper (%) Not available.

Explosive limit - lower (%) Not available.

Explosive limit – upper (%) Not available.

Vapour pressure Not available.

Vapour density Not available.

Relative density Not available.

Solubility(ies)

Solubility (water)	Slightly soluble
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	275 °C (527 °F)
Viscosity	Not available.

Other information

Bulk density	0.5 - 0.9 g/ml
Explosive limit	Non-explosive.

10. Stability and reactivity

Reactivity	Greatly increases the burning rate of combustible materials.
Chemical stability	Decomposes on heating. Product may be unstable at temperatures above: 275°C/527°F.
Possibility of hazardous reactions	Reacts slowly with water.
Conditions to avoid	Heat. Moisture. Avoid temperatures exceeding the decomposition temperature. Contact with incompatible materials.
Incompatible materials	Acids. Bases. Salts of heavy metals. Reducing Agents. Combustible material.
Hazardous decomposition products	Oxygen. Hydrogen peroxide (H_2O_2). Steam. Heat.

11. Toxicological information

Information on likely routes of exposure

Inhalation	Dust may irritate respiratory system. Prolonged inhalation may be harmful.
Skin contact	Causes skin irritation.
Eye contact	Causes serious eye damage.
Ingestion	Ingestion may cause irritation and malaise.
Symptoms related to the physical, chemical and toxicological characteristics	Severe eye irritation. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result. Dusts may irritate the respiratory tract, skin and eyes. Skin irritation. May cause redness and pain.

Information on toxicological effects

Acute toxicity

Components	Species	Test Results
Calcium hydroxide (CAS 1305-62-0)		
Acute		
Oral		
LD50	Rat	7340 mg/kg
Dipotassium Phosphate (CAS 7758-11-4)		
Acute		
Oral		
LD50	Rat	> 2000 mg/kg

Skin corrosion/irritation	Causes skin irritation.
Serious eye damage/eye irritation	Causes serious eye damage.

Respiratory or skin sensitisation

Canada - Alberta OELs: Irritant

Calcium hydroxide (CAS 1305-62-0)	Irritant

Respiratory sensitisation	Not a respiratory sensitiser.
Skin sensitisation	This product is not expected to cause skin sensitisation.
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

Reproductive toxicity	This product is not expected to cause reproductive or developmental effects.
Specific target organ toxicity - single exposure	May cause respiratory irritation.
Specific target organ toxicity - repeated exposure	Not classified.
Aspiration hazard	Due to the physical form of the product it is not expected to be an aspiration hazard.
Chronic effects	Prolonged inhalation may be harmful.

12. Ecological information

Ecotoxicity The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Components		Species	Test Results
Dipotassium Phosphate (CAS 7758-11-4)			
Aquatic			
Acute			
Algae	EC50	Pseudokirchneriella subcapitata	> 100 mg/l, 72 Hours
Crustacea	EC50	Daphnia magna	118.9 mg/l, 48 Hours
Fish	LC50	Oryzias latipes	> 100 mg/l, 96 Hours

Persistence and degradability	Decomposes in the presence of water. The product contains inorganic compounds which are not biodegradable.
Bioaccumulative potential	The product does not contain any substances expected to be bioaccumulating.
Mobility in soil	This substance has very low solubility in water and low mobility in the environment.
Other adverse effects	None known.

13. Disposal considerations

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Dispose of contents/container in accordance with local/regional/national/international regulations.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport information

TDG

UN number	UN1457
UN proper shipping name	CALCIUM PEROXIDE
Transport hazard class(es)	
Class	5.1
Subsidiary risk	-
Packing group	II
Environmental hazards	No
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

IATA

UN number	UN1457
UN proper shipping name	Calcium peroxide
Transport hazard class(es)	
Class	5.1
Subsidiary risk	-
Packing group	II
Environmental hazards	No
ERG Code	5L
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

IMDG

UN number	UN1457
UN proper shipping name	CALCIUM PEROXIDE
Transport hazard class(es)	
Class	5.1
Subsidiary risk	-
Packing group	II
Environmental hazards	
Marine pollutant	No
EmS	F-G, S-Q
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not applicable.

15. Regulatory information

Canadian regulations

Controlled Drugs and Substances Act

Not regulated.

Export Control List (CEPA 1999, Schedule 3)

Not listed.

Greenhouse Gases

Not listed.

Precursor Control Regulations

Not regulated.

International regulations

Stockholm Convention

Not applicable.

Rotterdam Convention

Not applicable.

Kyoto Protocol

Not applicable.

Montreal Protocol

Not applicable.

Basel Convention

Calcium peroxide (CAS 1305-79-9)

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
Taiwan	Taiwan Chemical Substance Inventory (TCSI)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s).
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information

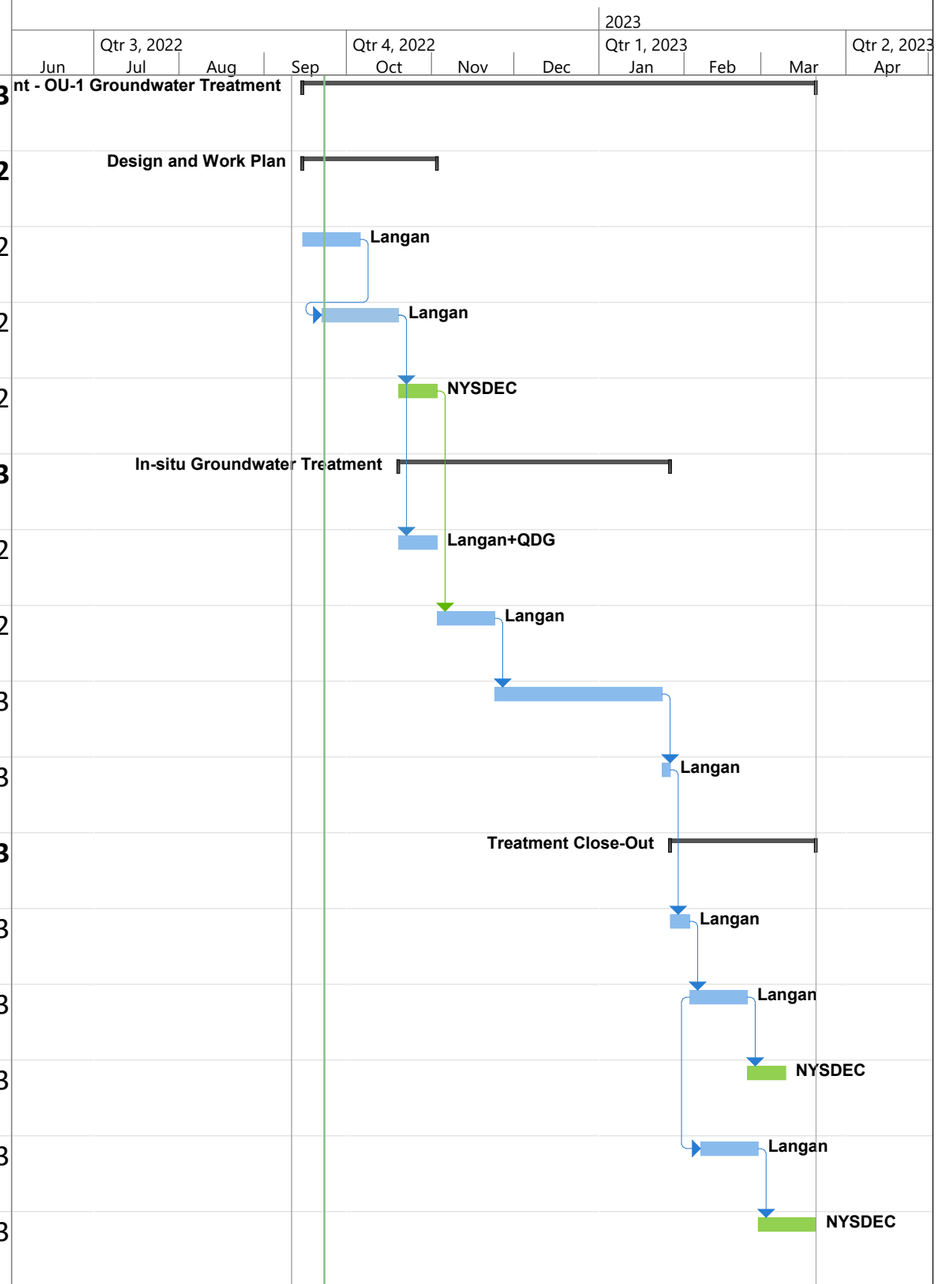
Issue date	12-October-2015
Revision date	19-February-2022
Version No.	03
Disclaimer	Regenesis cannot anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used. It is the user's responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use. The information in the sheet was written based on the best knowledge and experience currently available.

ATTACHMENT D

Schedule

In-Situ Groundwater Treatment Schedule
Willets Point Development - OU-1
Brownfield Cleanup Program Site No.: C241146
Langan Project No. 170197605

ID	Task Name	Duration	Start	Finish
1	**Willets Point - OU-1 Groundwater Treatment**	**133 days**	**Thu 9/15/22**	**Mon 3/20/23**
2	**Design and Work Plan**	**35 days**	**Thu 9/15/22**	**Wed 11/2/22**
3	Design (Langan and Regenesis)	15 days	Thu 9/15/22	Wed 10/5/22
4	Preparation and Submittal of Work Plan (Langan)	20 days	Thu 9/22/22	Wed 10/19/22
5	Work Plan Review, Comment and Approval (NYSDEC)	10 days	Thu 10/20/22	Wed 11/2/22
6	**In-situ Groundwater Treatment**	**71 days**	**Thu 10/20/22**	**Thu 1/26/23**
7	Treatment Subcontractor Bidding and Procurement (Langan+QDG)	10 days	Thu 10/20/22	Wed 11/2/22
8	In-Situ Treatment Application (Langan)	15 days	Thu 11/3/22	Wed 11/23/22
9	60-day Treatment Period	43 days	Thu 11/24/22	Mon 1/23/23
10	Post-Remedial Groundwater Sampling (Langan)	3 days	Tue 1/24/23	Thu 1/26/23
11	**Treatment Close-Out**	**37 days**	**Fri 1/27/23**	**Mon 3/20/23**
12	Receive Post-Remedial Groundwater Results (Langan)	5 days	Fri 1/27/23	Thu 2/2/23
13	Preparation and Submittal of Groundwater Report (Langan)	15 days	Fri 2/3/23	Thu 2/23/23
14	Groundwater Report Review and Approval (NYSDEC)	10 days	Fri 2/24/23	Thu 3/9/23
15	CCR Revisions and Resubmission (Langan)	15 days	Tue 2/7/23	Mon 2/27/23
16	Issue CCR Approval (NYSDEC)	15 days	Tue 2/28/23	Mon 3/20/23



Date: Fri 9/23/22

Task	Project Summary	Manual Task	Start-only	Deadline	
Split	Inactive Task	Duration-only	Finish-only	Progress	
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress	
Summary	Inactive Summary	Manual Summary	External Milestone		

"day(s)" in the Duration Column are working (business) days

LANGAN