ELECTROKINETICS ENHANCED IN SITU CHEMICAL OXIDATION (EK-ISCO) PILOT TEST REPORT

REVISION 0

Cristex Drum Superfund Site

Oxford, Granville County, North Carolina

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Acronyms and Abbreviations

%	percent
°C	degrees celsius
°F	degrees fahrenheit
µg	micrograms
µg/kg	microgram per kilogram
1,1-DCE	1,1-dichloroethene
AC	alternating current
bgs	below ground surface
Black & Veatch	Black & Veatch Special Projects Corp.
cDCE	cis-1,2-dichlorethene
CHP	catalyzed hydrogen peroxide
cm	centimeter
CMZs	contaminated media zones
CSM	conceptual site model
CVOCs	chlorinated volatile organic compounds
DC	direct current
DCB	dichlorobenzenes
DNAPL	dense non-aqueous phase liquid
DOT	Department of Transportation
DP	dilute plume
DQOs	data quality objectives
E°	redox potential
EISB	enhanced in situ bioremediation
EK-ISCO	electrokinetics-in situ chemical oxidation
EKMW	electrokinetic monitoring well
ERH	electrical resistance heating
EW	electrode well
FS	Feasibility Study
FSP	Field Sampling Plan

ft	feet/foot
Geosyntec	Geosyntec Consultants of NC, P.C.
gpm	gallon per minute
HDPE	high density polyethylene
IDW	investigation derived waste
K	hydraulic conductivity
K_{eo}	coefficient of electroosmotic permeability
kg	kilograms
Low-K	low-permeability
m^2	square meter
MIP	membrane interface probe
MMO	mixed metal oxide
NOD	natural oxidant demand
O&M	operation and maintenance
ORP	oxidation reduction potential
PAH	polycyclic aromatic hydrocarbons
PCE	tetrachloroethene
PLC	programmable logic controller
PPE	personal protective equipment
PSI	pounds per square inch
PSV	pressure safety valve
PTA	pilot test area
PVC	polyvinyl chloride
RA	Remedial Action
RD	Remedial Design
RDI	remedial design investigation
RI	Remedial Investigation
ROD	Record of Decision
s	second
Site	Cristex Drum Superfund Site
SSHP	Site Safety and Health Plan

SSZ	saturated source zone
SVOCs	semi-volatile organic compounds
SW	supply well
TCE	trichloroethene
USEPA	United States Environmental Protection Agency
UZ	unsaturated zone
V	volt
VC	vinyl chloride
VOCs	volatile organic compounds
Work Plan	EK-ISCO Pilot Test Work Plan

1.0 INTRODUCTION

1.1 PURPOSE

The United States Environmental Protection Agency (USEPA) has contracted Black & Veatch to prepare a remedial design (RD) of the selected remedy as defined in the record of decision (ROD) issued on September 29, 2017 for the Cristex Drum Superfund Site in Oxford, North Carolina (Site). Black & Veatch previously completed the Remedial Investigation (RI) for the Site in 2015-2016 to investigate and characterize the nature and extent of the contamination identified during previous investigations, and to develop a conceptual site model (CSM) for evaluation of potential remedial approaches (Black & Veatch, 2016). Black & Veatch subsequently completed a Feasibility Study (FS) in 2017 to further evaluate remedial alternatives and to develop a recommended remedy (Black & Veatch, 2017). The USEPA finalized the selected remedy and issued the ROD for the Site in September 2017.

The ROD for the Site includes soil excavation, electrokinetics-in situ chemical oxidation (EK-ISCO) and enhanced in situ bioremediation (EISB) via biobarriers to address various contaminated media zones (CMZs). Geosyntec Consultants of NC, P.C. (Geosyntec), jointly with Black & Veatch, prepared an EK-ISCO pilot test work plan (Black and Veatch & Geosyntec, 2020) for the EK-ISCO pilot test designed to evaluate the feasibility of an EK-ISCO remedy at the Site and to support the design of full-scale implementation. The work plan was approved by the USEPA in January 2020, and the EK-ISCO pilot test was completed in April 2020. This report describes the EK-ISCO pilot test conducted at the Site under the approved work plan and an Access Authorization from the County of Granville, North Carolina (**Appendix A**).

1.2 GENERAL OVERVIEW OF SITE CONDITIONS

The Site information presented in this section, as well as the Site geology, hydrogeology, and nature of contamination presented in the following sections, are based on the information reported in the RI (Black & Veatch, 2016), the FS (Black & Veatch, 2017), and the ROD issued by the USEPA. Black & Veatch collected additional Site characterization data since 2018 as part of the RD investigation (RDI) to further refine the CSM (Black & Veatch, 2020).

The Site is located in a predominantly industrial area, off Industrial Drive about ¼ mile west of the Rt. 15/Industry Drive intersection in Oxford, Granville County, North Carolina (**Figure 1-1**). The former Cristex facility was operated as a textile plant from 1968 until 1986. The estimated building size is 150,000 square feet, and there are concrete trenches and floor grates throughout the building. When the facility was in operation, boilers were fueled by natural gas and fuel oil and chemicals were stored mostly on the east side of the building. Dyes, dyeing assistants, and cellulosic and synthetic yarns were used in the manufacturing process. Chlorinated solvents were used to clean equipment, dry clean fabric, and as part of the dyeing process. A former drum storage pad lies adjacent to the southeast side and a concrete pad is at the northeast corner. A partially drained ½-acre lagoon lies to the northeast of the building. There were two #6 fuel oil above-ground storage tanks, with a total capacity of 50,000 gallons, at the facility between the building and the lagoon (**Figure 1-2**).

1.3 SITE GEOLOGY

The geological stratigraphy underlying the Site is composed of surficial fill material and natural deposits to depths ranging from approximately 1 to 20 feet below ground surface (ft bgs). The fill material generally consists of clayey sand in hues of reddish brown, orange, yellow, and brown. The fill material is underlain by the saprolite extending to a depth of approximately 70 ft bgs. The saprolite consists primarily of fine sand and silt containing variable amounts of clay. The saprolite material does not contain significant organic matter. The saprolite is underlain by a hydrogeologic transition zone from approximately 60 to 95 ft bgs. The transition zone generally consists of coarser sand and weathered rock fragments representing incomplete chemical weathering of the bedrock. The transition zone is underlain by competent bedrock at a depth of approximately 95 ft bgs. Bedrock lithologies include metadiorite, granodiorite, and metabasalt. In addition to regional metamorphism of the parent intrusive rocks, bedrock underlying the Site is variably altered by chemical weathering and groundwater movement.

1.4 SITE HYDROGEOLOGY

Groundwater at the Site generally exists in a two-part aquifer system. The surficial aquifer (regolith aquifer) includes saprolite overlying a basal transition zone. The underlying bedrock aquifer includes fractured metamorphic bedrock. These two aquifers are interconnected but have different characteristics that influence the speed at which groundwater flows and the transport mechanisms for the contaminants within them. The transport through the surficial aquifer is intergranular, while flow through the bedrock aquifer occurs predominantly by transport along fractures. As reported in RI and updated by RD investigations (RDI), hydraulic conductivity for the saprolite estimated from hydraulic testing ranged from 2.7 to 5.2 ft per day (ft/day) (Black & Veatch, 2020). Measurements at other sites in the same groundwater system (i.e., Piedmont) suggested significantly lower values (0.002 ft/day; Black & Veatch, 2016). Hydraulic conductivity of the fractured bedrock estimated from hydraulic testing was generally 0.009 to 1.02 ft/day (Black & Veatch, 2020). The transition zone between the regolith and bedrock aquifers serves as the primary transmitter of contaminated groundwater. The predominant vertical groundwater flow is downward from the surficial aquifer to the bedrock aquifer. Laterally, the groundwater flow is predominantly toward the north-northeast in the aquifers. **Figure 1-3** presents the December 2019 groundwater potentiometric surface of the saprolite zone, which is the aquifer unit considered in this pilot test.

1.5 NATURE OF CONTAMINATION

The discussions presented in this section are mainly based on the RI/FS with updates from 2018-2020 RDI (Black & Veatch, 2020). The RI identified chlorinated volatile organic compounds (CVOCs), mainly chlorinated ethenes, as the primary contaminants, with limited local exceedances of criteria for benzene, dichlorobenzenes (DCB), polycyclic aromatic hydrocarbons (PAHs), and metals. The primary contaminant source is believed to be the soil initially impacted by spills and leaks near the Cristex building in the area of the former drum storage pad, former oil-water separator, drainage ditch and former above-ground fuel oil storage tanks (**Figure 1-2**).

Residual CVOCs and Semi-volatile Organic Compounds (SVOCs) in Soil

Organic contaminants detected above screening values in soils collected during the RI include CVOCs (tetrachloroethene [PCE], trichloroethene [TCE], cis-1,2-dichloroethene [cDCE]) and SVOCs (1,1-biphenyl, 2-methylnaphthalene, benzo(a)anthracene, benzo(a)pyrene, naphthalene, and 1-methylnaphthalene). PCE, the most prevalent soil contaminant at the Site, was measured above detection limits in subsurface soils down to 24-25 ft bgs, with a maximum concentration of 180,000 microgram per kilogram (µg/kg) near the former drum storage pad. Soil sampling during the RDI revealed soil contamination along the drainage ditch and identified a previously unknown location of higher PCE concentrations along the ditch approximately 125 feet northeast of the former drum storage pad (Black & Veatch, 2020). The primary contaminant source is believed to be a result of spills and leaks near the Cristex building in the area of the drum storage pad, former oil-water separator, drainage ditch, and above ground fuel oil storage tanks, which contaminated the soils beneath these areas. It is believed the contaminated soils continue to act as an ongoing source of contamination to the groundwater below.

The highest concentrations of CVOCs in soil occur at the eastern edge of the asphalt drum storage pad. Nearby membrane interface probe (MIP) measurements and soil borings installed during the RI and RDI did not encounter similarly high values, suggesting that residual dense non-aqueous phase liquid (DNAPL) present in the subsurface, if any exists, likely has a comparatively small volume and limited areal extent.

Residual VOCs and SVOCs in Groundwater

Contaminants identified above water quality standards in one or more wells screened in the regolith aquifer include 1,2-DCB, 1,3-DCB, benzene, PCE, TCE, 1,1-dichloroethene (1,1-DCE), cDCE, and vinyl chloride (VC). During the RI, PCE was the most widespread and exceeded its water quality standard in 26 of 33 samples with a maximum detected concentration of 13,000 micrograms per liter (µg/L). During the RDI, PCE was again the most widespread and exceeded its water quality standard in 20 of 22 samples with a maximum detected concentration of 13,000 µg/L. A few PAH compounds were measured in concentrations slightly exceeding water quality standards in 1 of 22 samples collected from the regolith aquifer, including benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. Contaminants identified above water quality standards in one or more wells screened in the bedrock aquifer include PCE, TCE, and cDCE; during the RI, the maximum measured concentration of PCE was 250 µg/L. During the RDI, PCE was again the most widespread and exceeded its water quality standard in three of four bedrock aquifer samples with a maximum detected concentration of 190 µg/L.

Groundwater analytical results, coupled with observations from MIP results, suggest that a PCE source area is present along the eastern side of the Cristex building. A dissolved plume of CVOC contamination is present east and northeast of the Cristex building. It extends vertically from the saprolite into the underlying transition zone and fractured bedrock. The maximum depth of contamination in the bedrock aquifer is unknown, but PCE (250 µg/L), TCE (28 µg/L), and cDCE (76 µg/L) were detected during the RI at MW-16D, which is screened from 116 to 136 ft bgs and located near a former drum burial area approximately 200 ft northeast of the former drum storage pad. When sampled during the RDI, PCE in MW-16D had declined to 2.7 µg/L, but new

bedrock wells in the former drum burial area, MW-17D and MW-18D, detected PCE at 190 µg/L and 180 µg/L, respectively. **Figure 1-4** presents the groundwater PCE concentrations in the saprolite zone, which is the unit considered in this pilot test, updated with the recent data collected during the RDI (Black & Veatch, 2020).

1.6 SELECTED REMEDY

The Site soil and groundwater requiring remediation were classified into three CMZs: unsaturated zone (UZ), saturated source zone (SSZ), and dilute plume (DP). The remedial strategy for the Site, which utilizes an adaptive management approach, includes: (1) aggressive remediation of source contamination (e.g., soil and groundwater with high concentrations of contaminants or DNAPL); and (2) phased active remediation of groundwater in the greater dilute plume. The major components of the selected remedy for the CMZs are:

- UZ: Soil Excavation
- SSZ: EK-ISCO with EISB Biobarriers
- DP: EISB Biobarriers

The proposed soil excavation remedy for the UZ is to remove contaminated soil and transport the excavated soil to an offsite, EPA approved, disposal facility. The excavation will focus on CVOC-contaminated unsaturated soil that exceeds the ROD cleanup criteria of 2.3 µg/kg, primarily in the source areas. High density polyethylene (HDPE) laterals will be placed at the bottom of the excavation as a contingency for future application of treatment amendments below the excavated area. The excavated area will be backfilled with clean compacted soil.

The SSZ represents an approximately 70 ft thick zone (generally between 20 and 90 ft bgs) of saturated soil and groundwater within the saprolite and transition zone above the bedrock. The remediation of SSZ will focus on the adsorbed CVOCs, dissolved CVOCs, and possible residual DNAPL. The selected remedial alternative for the SSZ includes EK-ISCO and EISB biobarriers. The EK-ISCO remedy involves the application of direct current (DC) to electrodes installed in a network of electrode wells located within the SSZ, thereby creating an electric field in the subsurface between electrodes. The electric field will transport the ionic amendment, i.e., the selected chemical oxidant, through the aquifer materials within the target treatment zone. Organic contaminants in contact with the transported chemical oxidant will be oxidized, thereby eliminating contaminant mass in the treatment zone.

EISB biobarriers will be implemented in both the SSZ (in saprolite and transition zone) and the DP (in bedrock), and the remedy is to target the dissolved CVOCs in these CMZs. EISB is a remedy involving the addition of amendments, and potentially microorganisms, to the subsurface to enhance in situ biodegradation of target contaminants. The target CVOCs at the Site, primarily chlorinated ethenes, are amenable to biodegradation via anaerobic reductive dechlorination. EISB biobarriers will be established by injecting selected amendments, e.g., fermentable organic substrates, into a network of injection wells, thereby creating a biologically active zone in the subsurface where dissolved CVOCs in the groundwater passing through are biodegraded. Depending on the presence and makeup of indigenous microbial populations, an addition of particular dechlorination bacteria (e.g., *Dehalococcoides* [*Dhc*] with VC reductase functional

genes) that are capable of completing dechlorination from cDCE to end product, ethene, may be required. The addition of particular microbial culture to facilitate EISB is a remediation technology termed bioaugmentation.

1.7 REPORT ORGANIZATION

The remainder of this Report is organized as the following:

Section 2 Basis of EK-ISCO Pilot Test

Section 3 EK-ISCO Pilot Test Objectives and Approach

Section 4 Pilot Test System

Section 5 Pilot Test Implementation

Section 6 Pilot Test Results and Analyses

Section 7 Conclusions and Recommendations

Section 8 References

2.0 BASIS OF EK-ISCO PILOT TEST

This section provides a brief overview of the EK-ISCO technology and a summary of the EK-ISCO treatability study conducted to support the design of EK-ISCO pilot test.

2.1 EK-ISCO TECHNOLOGY OVERVIEW

2.1.1 Oxidants for EK-ISCO Remediation

Various oxidants have been used in laboratory and field applications to aggressively destroy organic chemicals, including Fenton's reagent (or more generally known as catalyzed hydrogen peroxide [CHP]), permanganate, persulfate, ozone, and ozone combined with peroxide. These oxidants react to varying degrees with organic contaminants, converting them into innocuous end products such as carbon dioxide, water, and inorganic chloride (in the case of CVOCs). The treatment effectiveness of chemical oxidants currently in use varies based on several factors, including the redox potential (E^o) of the oxidant, and the reactive specificity of the oxidant toward a given type of contaminant.

Permanganate-based ISCO is a relatively mature remediation technology that has been implemented in the field at numerous sites. Permanganate is an effective oxidant (E_h of 1.7 volts [V]) that can oxidize a wide range of contaminants, including chlorinated ethenes which are the target contaminants at the Site to be addressed by EK-ISCO. Oxidation of chlorinated ethenes by permanganate occurs via electron transfer leading to production of manganese dioxide (MnO_2) as a solid precipitate in the pH range of 3.5 to 12 (EPA, 2006). The reaction rate of permanganate is relatively slow compared with that of CHP and ozone, and permanganate can potentially persist in the subsurface for weeks to months depending on site-specific conditions.

Persulfate has been demonstrated to be a very effective (E_h of 2.1V) oxidant for many recalcitrant contaminants such as chlorinated solvents. While persulfate can oxidize contaminants via direct electron transfer, the most common persulfate-based ISCO application involves activating persulfate to produce a sulfate radical, which is a very powerful oxidant (E_h of 2.6V). Activation of persulfate is typically achieved using heat, base activation (pH ~12), addition of peroxide, or addition of a suitable reductant, such as ferrous iron. Persulfate has been demonstrated to treat a broad array of organic contaminants in groundwater and is relatively more persistent (longer half-life) in the subsurface in comparison to some other strong oxidants such as CHP and ozone. Oxidation of contaminants by persulfate produces sulfate as a reaction product.

A common challenge for implementing ISCO remedies at many sites with low-permeability (low-K) soils is the ability to effectively deliver an oxidant to achieve successful treatment of the target contaminants. Oxidants such as CHP and ozone are typically short-lived in the subsurface, and in low-K materials, it is difficult to effectively distribute these short-lived oxidants before they react. In comparison, permanganate and unactivated persulfate are slower to react, thereby allowing these oxidants to be distributed farther through the subsurface, and through low-K materials.

2.1.2 EK-Enhanced Amendment Delivery

The EK-enhanced amendment delivery technology entails the use of electrodes and DC electrical power to establish an electric field in the subsurface. The voltage gradient established across the

DC electric field is the driving force for transporting remediation reagents, including chemical oxidants for ISCO or electron donors and/or microorganisms for EISB, through low-K soils or uniformly through heterogeneous formations. A major mechanism for the EK transport process with the application of an electric field is electromigration (or ion migration). Electromigration is the movement of charged dissolved ions through an aqueous medium in response to the applied electric field. The direction of ion migration is toward the electrode with a polarity opposite of the ion's charge.

One reason EK represents a fundamentally more effective delivery technique in low-K materials compared to an advective hydraulic approach is the relatively uniform electrical property of various soil materials. For example, while the hydraulic conductivity (K) of fine sand and kaolin materials can vary by several orders of magnitude, the coefficient of electroosmotic permeability (K_{eo}) of fine sand ($4x10^{-9}$ square meters per second-volt [m^2/s-V]) is comparable to that of kaolin ($5.7x10^{-9}$ m^2/s-V) and clayey till ($5.0x10^{-9}$ m^2/s-V). Therefore, the EK-enhanced amendment delivery technology can achieve relatively effective amendment distribution at sites where heterogeneous subsurface materials often limit the applications of hydraulic-based methods.

To implement the EK-enhanced amendment delivery technology in the field, remediation amendments are added to electrode wells and/or supply wells. Electrodes of selected inert materials are installed in electrode wells and connected to a DC power source. The power supply unit supplies electrical energy to the electrodes at a constant current. The electrical field will transport the amendments from the electrode wells and supply wells into and through the formation materials to achieve a relatively uniform transport and distribution. Circulation flow and pH-balancing can be employed at the electrode wells to overcome the effects of water electrolysis (electrochemical redox of water) and retain the natural pH of the system as needed.

Results from many studies completed at both bench-scale and field-pilot scale have shown the potential of EK-enhanced amendment transport (Mao et al., 2012; Gent, 2001; Reynolds et al., 2008; Hodges et al., 2011). Common oxidants such as permanganate and persulfate are charged compounds and will migrate under the driving force of the imposed electrical gradient. Migration rates of monovalent and divalent oxidants have been measured in the laboratory at levels more than 500-times higher than that achievable through diffusion alone. Bench-scale studies completed by US Army Corps of Engineers effectively delivered charged remediation reagents (e.g., acetate, lactate) through loess soil ($K=10^{-7}$ centimeters per second [cm/s]) and clay ($K=10^{-9}$ cm/s) at rates of 2.1 and 2.5 centimeters per day (cm/day), respectively.

2.2 SUMMARY OF EK-ISCO TREATABILITY STUDY

An EK-ISCO treatability study using Site-specific aquifer materials was completed to evaluate the feasibility of applying this technology at the Site. The treatability testing activities, data, and findings were presented in a treatability study report (Black & Veatch and Geosyntec, 2019). Based on the treatability testing data, the following recommendations related to three key aspects of designing an EK-ISCO pilot test and the subsequent full-scale remedy were developed.

Selection of chemical oxidant and estimate of Site-specific oxidant demands

- The Site-specific natural oxidant demand (NOD) for persulfate (un-activated) and permanganate were comparable and relatively low (7-Day NOD of 0.81 to 2.25 g oxidant per kg soil). This supports the selection of an ISCO-based remediation approach for the Site.
- Some literature states that when permanganate encounters appreciable DNAPL mass, the reaction product (MnO_2) can potentially form a film or crust at the DNAPL-water interface (ESTCP, 2010). The formation of such film/crust can reduce subsequent contact between the additional oxidant supplied and the remaining DNAPL, thus, limiting the overall effectiveness of DNAPL mass removal. The potential reduction of aquifer formation permeability due to MnO_2 precipitation is another factor warranting considerations given the low-permeability Site geology.
- The treatability test results showed that un-activated (i.e., matrix activated) persulfate would still affect the treatment of target CVOCs. This suggests that the field implementation of EK-ISCO using persulfate may be designed with the flexibility so the decision for whether to include heat-activation as a second-stage remedy component can be made based on the field monitoring data collected following a Stage-1 persulfate transport operation.
- The 28-Day NOD showed that the NOD for un-activated persulfate (ranged between 1.15 – 1.67 g persulfate / kg of soil) was lower than that for permanganate (2.36 – 3.73 g permanganate / kg of soil). Pending supplier, shipping, and quantity purchased, the unit price for sodium permanganate is approximately $2.54 per pound compared to $1.48 per pound for sodium persulfate. However, there are other factors (e.g., ease of handling and storage in the field) that can affect the final total cost of oxidant for field implementation.

Transport of the selected oxidant under EK conditions

- The treatability test results showed that persulfate was transported by EK through Site aquifer solids under the conditions tested. The EK-transported persulfate detected in the soil column in this test represents persulfate that was available to react with other oxidizable compounds beyond Site-specific NOD. This test confirmed the feasibility of an EK-ISCO remediation approach for the Site.
- The observations from the EK-persulfate transport test and the subsequent EK-ISCO treatability tests suggest that maintaining adequate levels of electrical conductance in both anode and cathode solutions is an important design consideration for EK transport.
- The net EK persulfate transport rates estimated from this treatability study range from 1 to 1.3 cm/day (15.6 ft/year), which may be an underestimate, to 2.2 to 3.3 cm/day (30 to 40 ft/year) that is comparable to the observations in past EK bench-scale tests and field pilot tests in similar geological materials.

Assess the treatment of CVOCs under applied EK-ISCO conditions

- The EK-ISCO test demonstrated EK transport of persulfate through Site aquifer solids under the conditions tested. In addition, effective treatment of CVOCs by EK-transported persulfate, both with and without heat-activation, was observed.

2.3 SELECTION OF EK-ISCO PILOT TEST APPROACH

Based on the treatability test results, the following initial recommendations were made for the design of EK-ISCO pilot test:

- The results of the treatability study collectively demonstrated that EK-ISCO using persulfate can be an effective in-situ remediation approach for treating target CVOCs at the Site.
- Given the intrinsic limitations of laboratory tests, a field pilot test is needed to further evaluate certain engineering parameters needed for completing the remedial design of a full-scale remedy. The treatability test results provided a basis for the design of a field pilot test of EK-ISCO.
- The EK transport rate for persulfate (an anion) in undisturbed Site aquifer solids will need to be further evaluated in the pilot test under the field-scale EK operational conditions (i.e., electrical current and voltage applied). The pilot test monitoring plan will be designed based on the net persulfate transport rate estimated from the treatability study.
- The oxidant dosage required to achieve effective distribution within a treatment zone will also need to be confirmed in the pilot test. The NOD test and EK column test conducted in the treatability study estimated the minimum requirement of persulfate that would be necessary to satisfy the oxidant demands of Site aquifer materials. It is expected that additional persulfate will be needed during the persulfate transport stage in areas containing elevated CVOCs above the level tested in the treatability study (i.e., PCE at 14.5 mg/kg). As an example, the stoichiometric demand of persulfate (as sodium persulfate) for treating PCE (the primary CVOC at the Site) can be calculated based on the reaction below:

  $$C_2Cl_4 + 2S_2O_8^{2-} + 4H_2O \rightarrow 2CO_2 + 4HSO_4^{1-} + 4HCl$$

  which results in a demand of 2.88 pounds of sodium persulfate for treating 1 pound of PCE. Similarly, the stoichiometric demand of permanganate (as sodium permanganate) for treating PCE can be calculated based on the reaction below:

  $$3C_2Cl_4 + 4\mathrm{Mn}O_4^{1-} + 4H_2O \rightarrow 6CO_2 + 4MnO_2 \ + 8H^+ + 12Cl^-$$

  which results in a demand of 1.14 pounds of sodium permanganate for treating 1 pound of PCE.

The project team and the USEPA further discussed the treatability study results and additional considerations regarding the field implementation of overall Site remedy. The USEPA selected permanganate as the oxidant for the EK-ISCO pilot test based on the following considerations:

- Both permanganate and persulfate are effective oxidants for treating the target contaminants at the Site. EK transport of permanganate, under the same EK transport mechanism for persulfate, has been demonstrated at bench-scale and documented in technical literature (Chowdhury et al., 2017; Reynolds et al., 2008).

- Permanganate-based ISCO can be implemented as a single-step remedy, whereas persulfate-based ISCO generally requires a separate phase of operation to activate persulfate;
- The production of sulfate as the reaction product of persulfate-based ISCO may require additional measures as part of the overall Site remedial actions.
- The potential reduction of aquifer formation permeability, due to MnO_2 precipitation, and its impact on EK transport effectiveness, while noted as a possibility, may be at a lesser extent that can be overcome by EK transport mechanisms.

3.0 EK-ISCO PILOT TEST OBJECTIVES AND APPROACH

This section presents the EK-ISCO pilot test objectives and a general description of the pilot test approach.

3.1 PILOT TEST OBJECTIVES

The objectives of EK-ISCO pilot test included:

- an evaluation of technology deployment (e.g., equipment requirements) for distributing the selected oxidant within the target pilot test zone, but not the full extent of CVOC treatment because the contaminant mass within the test area may be at a level that requires a significantly extended pilot test duration;
- an evaluation of potential changes in geochemistry (e.g., pH and ORP) within the pilot test area under EK conditions; and
- an evaluation of engineering parameters, including oxidant transport/supply rate, injection well spacing, and electrical current and voltage needed, to support the design and full-scale implementation of an EK-ISCO remedy at the Site.

Given that the treatment effectiveness of the selected oxidant (permanganate) for target chlorinated ethenes is well understood and has been documented in many field projects, the EK-ISCO pilot test was designed to operate for a duration (approximately 60 days) for evaluating oxidant transport rather than targeting a particular level of reduction in CVOC concentrations.

3.1.1 Data Quality Objectives

Data quality objectives (DQOs) were identified to guide the design of the pilot test so the type and accuracy of data collected during the pilot test can support the RD for the full-scale remedy. The specific data that were collected during the pilot test are further discussed in Section 6.

As presented in **Table 3-1**, there are two categories of data that were collected during the pilot test: system operational data and performance monitoring of the pilot test via chemical analyses of environmental samples (groundwater). The EK pilot test system operational data included the data collected by system instruments (e.g., voltage, current) and by the operator during regular system maintenance visits (e.g., amendment solution volume, chemical usage). Collectively, the system operational data were obtained to: (1) document and confirm the system operational conditions; (2) identify potential conditions that may impact the system operation (e.g., elevated pressure, extreme current or voltage); and (3) derive design parameters (e.g., current and voltage, amendment usage) for the RD of the full-scale remedy.

In addition to the system operational data, the pilot test performance monitoring program included collecting groundwater samples from the pilot test monitoring wells for analyses of field parameters (e.g., pH, ORP) and select groundwater constituents. Specific groundwater sample analyses, containers, preservatives, and holding times are provided in **Table 3-2** and further discussed in Section 5.2 Pilot Test Monitoring. The laboratory analyses were performed using laboratory analytical methods that generate definitive and accurate data of appropriate quality to support the intended data use decisions which include: (1) distribution of selected oxidant

(permanganate in this case) within the target area, and (2) potential changes in groundwater constituents (e.g., iron, manganese, CVOCs) that may be affected by the addition of permanganate. The analytical laboratories provided Level II data packages inclusive of analytical results, methods used, laboratory detection limits, and a summary of laboratory quality control samples.

3.2 PILOT TEST APPROACH

This section provides general descriptions of the pilot test program, including the pilot test area and the overall pilot test approach. Additional detailed information related to the pilot test system and the pilot test implementation is provided in Sections 4 and 5, respectively.

3.2.1 Pilot Test Target Area

The EK-ISCO pilot test targeted the vicinity of the existing monitoring well cluster MW-3/MW-3I located near the former drum storage pad (**Figure 3-1**). This target pilot test area was selected based on: (1) the treatability study was conducted using the aquifer materials collected from this area; (2) the groundwater quality data of the MW-3 cluster indicated the presence of PCE (730 to 2,400 µg/L) within the general target depth interval for EK-ISCO remedy (i.e., from the water table to 50 ft bgs); (3) the area has been considered in the FS and the ROD as within the overall SSZ remediation area; and (4) the area was generally accessible so that no significant earth work was required to prepare for the pilot test.

The target depth interval for the pilot test was from the water table (approximately 20 ft bgs) to approximately 50 ft bgs. As discussed in Section 1.3, the saprolite material at the Site is estimated to generally extend to 70 ft bgs and underlain by a hydrogeologic transition zone. The information from prior investigations in the vicinity of MW-3 cluster suggests that the transition zone in the pilot test area may begin at approximately 60 ft bgs. Given that the transition zone is expected to have a permeability that should allow, to an extent, hydraulic distribution of remediation amendment, this EK-ISCO pilot test targeted only the saprolite materials from water table (approximately 20 ft bgs) to approximately 50 ft bgs, the depth interval where hydraulic distribution mechanisms are likely ineffective.

3.2.2 Overall Pilot Test Approach

As presented in **Figure 3-1**, the overall EK-ISCO pilot test system included two electrode wells (EW-1 and EW-2), one supply well (SW-1), and two new monitoring wells (EKMW-1 and EKMW-2). The general spacing between pilot test wells and the well screen intervals are also presented in **Figure 3-1**. In addition to EKMW-1 and EKMW-2, the existing monitoring well MW-3I (screened from 47 to 52 ft bgs) was also included in the pilot test monitoring program as described in Section 5.2.

The pilot test layout and the well spacing presented in **Figure 3-1** were designed based on: (1) an anion (e.g., permanganate) migration rate of 1 to 2 ft/month estimated based on the treatability study; (2) 60 days of pilot test operation; and (3) experience derived from other prior EK field projects. As presented in **Figure 3-1**, while the electrode wells and supply wells were designed to deliver permanganate within the overall target depth interval of 20 to 50 ft bgs, individual monitoring wells were designed with varying screen intervals to allow for an assessment of

separate depth intervals in order to assess potential variations across the overall target interval within the pilot test area.

Following the installation of pilot test wells, a baseline groundwater sampling event was conducted to assess the conditions prior to the addition of remediation amendments. An EK pilot test system, assembled off-Site, was mobilized to the Site and connected to the pilot test wells. The EK pilot test system operated for 57 days, during which time permanganate, provided to the subsurface via the supply well (SW-1), migrated towards the anode well (EW-2) under electromigration mechanism. Two groundwater sampling events were conducted during the 57-day system operation. Following the completion of the 57-day EK operation for permanganate transport, a post-test sampling event was performed to complete the pilot test monitoring program as described in Section 5.2.

4.0 PILOT TEST SYSTEM

This section describes the major components of the pilot test system that was constructed and installed to facilitate the implementation of the EK-ISCO pilot test. The pilot test system process flow diagram is presented in **Figure 4-1**. The well construction records for pilot test wells are provided as **Appendix B**.

4.1 PILOT TEST WELLS

4.1.1 Electrode Wells

Two electrode wells (EW-1 and EW-2) were installed in the pilot test area. In this pilot test, EW-1 was used as the cathode well and EW-2 as the anode well. With this arrangement, permanganate, as an anion, was expected to migrate in the direction from EW-1 toward EW-2 (**Figure 3-1**). Each electrode well was constructed with a 4-inch diameter polyvinyl chloride (PVC) riser casing and a 30-ft long, 0.01-inch slotted screen. The screened interval is between approximately 20 and 50 ft bgs within the saprolite unit. A medium sand (20/40) filter pack was placed around the screen from the bottom of the borehole up to 2 ft above the screen interval. A 2-ft thick bentonite seal was installed above the sand. Grout, consisting of cement and bentonite powder, was then added to fill the remaining annulus up to the ground surface.

Figure 4-2 presents the typical construction of the electrode well surface completion. The top of the riser casing was fitted with a threaded coupling to accommodate a PVC riser extension that extends approximately 2 ft above ground surface during the testing program. The top of the riser extension was completed with a PVC flange, which facilitated installation of the down-well components. Access ports were installed in the PVC flange for installation of the electrodes, tubing for extraction and injection, and level switches for process controls (**Figure 4-2**).

4.1.2 Supply Well

One supply well (SW-1) was installed in the pilot test area. The supply well was constructed with 4-inch diameter PVC casing and the 0.01-inch slotted screen. The screened interval is between approximately 20 and 50 ft bgs (i.e., same screened interval as the electrode wells). A medium sand (20/40) filter pack was placed around the screen from the bottom of the borehole up to 2 ft above the screened interval. A 2-foot thick bentonite seal was installed above the sand pack by placing bentonite pellets and hydrating for at least one hour. Grout, consisting of cement and bentonite powder, was then added to fill the remaining annulus up to the ground surface.

Figure 4-3 presents the typical supply well surface completion. The top of the riser casing was fitted with a threaded coupling to accommodate a PVC riser extension that extended approximately 2 ft above ground surface. The top of the riser extension was completed with a PVC flange, which facilitated installation of the down-well components. Access ports were installed in the PVC flange for installation of tubing for permanganate addition, and level switches for process controls (**Figure 4-3**).

4.1.3 Monitoring Wells

Two new monitoring wells (EKMW-1 and EKMW-2) were installed for the pilot test. The existing monitoring well MW-3I was also included in the pilot test monitoring program. Each new monitoring well was constructed with a 2-inch diameter PVC casing and 0.01-inch slotted screen. The screen interval of each monitoring well is presented in **Figure 3-1**. A medium sand (20/40) filter pack was placed around the screen from the bottom of the borehole up to 2 ft above the screened interval. A 2-ft thick bentonite seal was installed above the filter pack by placing bentonite pellets and hydrating for at least one hour. Grout, consisting of cement and bentonite powder, was then added to fill the remaining annulus up to the ground surface. The monitoring well was completed at the top with the installation of a compression cap. Well construction records are provided as **Appendix B**.

4.2 POWER SUPPLY AND ELECTRODES

The DC power required for the EK pilot test was provided by a DC power supply unit (Magna Power SL 160-9/UI rated for 160 VDC, 9 A, 120 VAC). The power unit, installed in the EK system control trailer, received AC power input and delivered DC power to the electrodes installed in the electrode wells. Each electrode (TELPRO tubular anode by Titanium Electrode Products Inc.) was a 2-ft long, ¾-inch diameter titanium rod with mixed metal oxide (MMO) coating that consists of IrO_2/Ta_2O_5. Two electrodes (each 2-ft long) were suspended in each electrode well, one at approximately 25 ft bgs and the other at 40 ft bgs. Each electrode was pre-fabricated by the vendor with a center-connected cathodic protection electrical cable to be connected to the DC power unit.

4.3 AMENDMENT SUPPLY SYSTEM

An EK control and amendment supply pilot system, installed in a trailer, was used for (a) delivery of permanganate to the supply well (SW-1), (b) delivery of pH buffer (sodium bicarbonate) to the electrode wells (EW-1 and EW-2), and (c) exchange of well water between the cathode well and the anode well. Sodium permanganate solution was prepared by mixing the 40% (wt.) liquid chemical reagent (RemOx®-L provided by Carus Corporation) with potable water at a volume ratio of approximately 1 to 5 in a chemical solution tank (approximately 80.1 g $NaMnO_4$/L). The permanganate solution was delivered from the chemical solution tank to the supply well in pulsed cycles using a peristaltic pump controlled by the system programmable logic controller (PLC). The system components in contact with permanganate solution used materials that are compatible with permanganate.

The pilot test system supplied pH buffer solution (sodium bicarbonate) from a chemical solution tank to the cathode and anode wells. The buffer solution was prepared by mixing sodium bicarbonate (provided by Univar Solutions) powder in potable water in the solution tank. The concentration of bicarbonate solution prepared in the buffer solution tank was approximately 36.4 g $NaHCO_3$/L. Additions of the bicarbonate buffer solution were performed in pulsed cycles using a peristaltic pump controlled by the system PLC.

5.0 PILOT TEST IMPLEMENTATION

This section describes the tasks performed during the implementation of the EK-ISCO pilot test. The key milestones of the pilot test include:

- Pilot test well installation – December 2 through 5, 2019
- Baseline sampling – December 12, 2019
- Pilot test system installation and startup – January 20 through 24, 2020
- Pilot test system operation – February 5* through April 6, 2020
- Pilot test performance monitoring events during the operation - February 24 and March 16, 2020
- Post-test sampling – April 7 through 9, 2020.

(* There was a four-day period between February 5 and February 9 for system startup, shakedown and adjustment.)

5.1 PILOT TEST CONSTRUCTION AND BASELINE SAMPLING

The installation of pilot test wells followed the procedures described in the Sampling and Analysis Plan, Volume 2 – Field Sampling Plan (FSP) prepared by Black & Veatch (2018) for the field activities conducted at the Site as part of the RDI. The well installation and development were performed in general accordance with EPA Design and Installation of Monitoring Well Guidance document SESDGUID-101-R1. Well construction records are provided as **Appendix B**.

Following the installation of pilot test wells, a baseline groundwater sampling event was conducted at the pilot test monitoring wells (EKMW-1, EKMW-2, and MW-3I) to establish baseline groundwater conditions within the pilot test area. The analytical plan for the pilot test is presented in **Table 3-2**. The groundwater sampling was conducted following the procedures described in the FSP (Black & Veatch, 2018). The field sampling forms are provided as **Appendix C**.

5.2 PILOT TEST SYSTEM OPERATION AND MONITORING

The existing Site Safety and Health Plan (SSHP; Black & Veatch, 2018a) was updated to include the job hazard analyses and safety data sheets related to pilot test system operations, including activities associated with electrical system components as well as permanganate and bicarbonate handling.

Following the system startup and with operational parameters finalized and stabilized, the pilot test system was operated for a period of 57 days. The pilot test system was demobilized off the site on April 6, 2020. No health and safety incident occurred throughout the course of pilot test construction, operation, and monitoring.

The EK control system was equipped with telemetry capability allowing remote monitoring of certain system operational conditions (e.g., pumping actions, alarms, shutdown). In addition, the project staff performed regular system operation and maintenance (O&M) visits approximately

three times a week to confirm system operations and perform necessary maintenance activities, primarily amendment solution replenishment. Each O&M visit was performed by one person and required approximately two to three hours of onsite time.

The volume of permanganate solution and pH buffer solution used was recorded during each O&M visit. The supply of electrical current to the electrodes was also confirmed during the visit by measuring the DC current at the electrode wellheads with a current clamp multimeter. The O&M data are presented and discussed in Section 6.1.

Three performance monitoring events were conducted during and following the pilot test operation: Day 15 and Day 36 after the commencement of system operation plus a post-test sampling event (Day 58) after the end of system operation. The pilot test sampling locations are presented in **Figure 5-1**. For each performance monitoring event, groundwater samples were collected from the three pilot test monitoring wells (EKMW-1, EKMW-2, and MW-3I). The field-measured parameters, including field measurements of permanganate concentrations using the field test kit suggested in an EPA 2012 guidance (**Appendix D**), and the laboratory analytical program for the pilot test monitoring are presented in **Table 3-2**.

Following a discussion with EPA during an onsite meeting on February 27, the team decided that the post-test sampling event would also include collecting soil and groundwater samples using a Geoprobe from eight discrete locations and depths (P-1 through P-8 shown in **Figure 5-1**). Individual grab groundwater samples collected using direct push technology (DPT) were analyzed for permanganate using the same field method as that for performance groundwater sampling described above. In addition, grab soil and groundwater samples were provided to a laboratory for analysis of total manganese.

5.3 INVESTIGATION DERIVED WASTE MANAGEMENT

Management of the various types of investigation derived waste (IDW) followed the minimum specified criteria as outlined in the SESD Operating Procedure and presented in the FSP (Black & Veatch, 2018). Types of IDW generated included: 1) personal protective equipment (PPE), 2) soil cuttings, 3) purge water, and 4) decontamination fluids. The procedures and safeguards for processing the IDW included the following:

Personal Protective Equipment (PPE). This category includes the disposable work clothing such as booties, gloves, and coveralls worn by field personnel during the field investigation. The procedure for handling disposable personal protective clothing included:

- ✓ Placed such articles in DOT-approved 55-gallon UN 1A-1 or 1A-2 drums or DOT-approved roll-off container.
- ✓ Labeled to indicate contents.
- ✓ Staged the drums on-Site.
- ✓ Household trash, packaging, and other uncontaminated solid waste materials were not placed in drums and instead were taken offsite for disposal.

Drilling Fluids. These fluids included water used during drilling as well as water purged from newly installed monitoring wells during development. The fluids were containerized in DOT-approved

55-gallon UN 1A-1 or 1A-2 drums, labeled to indicate contents, and staged at an accumulation area on-site.

Purge and Decontamination Fluids. These fluids included purge water from sampling onsite wells, wash waters used to decontaminate the sampling equipment as well as the PPE decontamination fluids. The wash waters were containerized in DOT-approved 55-gallon UN 1A-1 or 1A-2 drums, labeled to indicate contents, and staged at an accumulation area on-site.

Waste manifests were signed by professional with the appropriate training to do so according to the DOT Hazardous Materials Regulations (49 CFR 171–181). All IDW drums were transported off site in April 2020 for disposal at an approved waste disposal facility.

6.0 PILOT TEST RESULTS AND ANALYSIS

There are two categories of data that were collected during the pilot test: system operational data and performance monitoring of the pilot test via chemical analyses of environmental samples. Section 6.1 presents and discusses the system operational monitoring data and Section 6.2 presents and discusses the performance monitoring results.

6.1 PILOT TEST SYSTEM OPERATION MONITORING

Table 6-1 summarizes the system operational conditions throughout the pilot test duration. The system operation data are discussed in two sections: one related to the electrical power supply and the other the chemical amendment supply.

6.1.1 Electrical Power

The voltage and current output of the DC power supply are presented in **Table 6-1**. The pilot test was designed to supply a constant current to the electrodes, while the power supply unit would operate at levels of voltage that were needed to supply the target current across the subsurface between cathode and anode. Therefore, the voltage required of the power supply unit reflected the overall electrical conductance of the subsurface materials which is a site-specific characteristic. **Figure 6-1A** presents the operational conditions of the power supply unit and the calculated electrical power usage over the pilot test duration. The target current was set at 0.69 A at the start of the test. The voltage readings at the power supply unit decreased from the initial level of approximately 160 V to 110 V on Day 12 suggesting the subsurface had become more conductive for the movement of ions across the formation between cathode (EW-1) and anode (EW-2). The target current was increased to 0.87 A on Day 12 and the required voltage increased initially to 144 V and gradually decreased to 123 V at the end of 57-day pilot test operation.

The voltage requirement observed in this pilot test was higher than those observed in past EK field projects, which were generally below 100V for a similar or slightly higher target current. The required voltage observed in this 57-day pilot test likely would continue to decrease as normally observed in past projects with longer operation duration (e.g., 3 to 5 months). The design of a full-scale EK-ISCO system for the Site planning to operate multiple pairs of electrodes simultaneously should consider selecting a power supply unit rated for providing sufficient power capacity.

The voltage and current output by the DC power unit were used to calculate the electrical power usage over the pilot test duration (**Figure 6-1A**). The total power usage over the 57-day pilot test operation was calculated to be approximately 152 Kilowatts-Hour (kW-hr). This power usage was relatively low compared to a typical household power usage that can be in the range of 300 kW-hr per month or even higher. The electrical operational conditions and power usage incurred during this pilot test provide scalable parameters for the design of a full-scale EK-ISCO remedy for the Site.

In addition to the readings recorded at the DC power supply unit, the electrical current was measured at each wellhead for EW-1 and EW-2 (**Figure 6-1B**). Overall, the electrical current supplied to each of the electrode wells was relatively stable, and no apparent loss of current from

the power supply unit to the electrodes in the electrode wells was observed confirming the overall stability of the system operation throughout the pilot test duration.

6.1.2 Amendment Supply

As presented in **Table 6-1**, over the 57-day pilot test, a total of 535 gallons of $NaMnO_4$ solution (at approximately 80.1 g $NaMnO_4$/L), prepared from 88 gallons of 40% sodium permanganate reagent (RemOx®-L by Carus Corporation), were supplied to SW-1. Through this amendment supply operation, the overall quantity (mass) of MnO_4 supplied to SW-1 was approximately 136.5 kg or 300 pounds (as MnO_4).

Table 6-1 shows a total of 1,530 gallons of sodium bicarbonate buffer solution at approximately 36.4 g $NaHCO_3$/L were supplied to the two electrode wells over the 57-day pilot test. EW-1 and EW-2 each received approximately half of the total buffer solution supplied, i.e., 765 gallons each. The quantity of sodium bicarbonate supplied to EW-1/EW-2 via amendment solutions was 467 pounds (212 kg) of sodium bicarbonate (106 kg each to EW-1 and EW-2).

The NOD estimated from the treatability test, as discussed in Section 2.2, was up to 3.73 g MnO_4 per kg of soil before considering the demand by potential CVOC mass. As a preliminary evaluation, assuming a depth interval of 30 ft (i.e., from 20 to 50 ft bgs targeted by the pilot test) and a soil unit weight of 1,200 to 1,700 kg/m^3, the amount of MnO_4 supplied during the pilot test (136.5 kg) could theoretically overcome the soil NOD within an area of 36 to 25.4 ft^2. Additional discussions regarding MnO_4 supply and soil NOD are provided in Section 6.2 together with the discussion of groundwater monitoring data.

The total volume of $NaMnO_4$ solution supplied to SW-1 (535 gallons) was equivalent to the pore volume within an area of approximately 1.47 ft radius surrounding SW-1, assuming a 30-ft depth interval and 35% total porosity. It is noted that the distances between SW-1 and monitoring wells are 2 to 2.8 ft (**Figure 3-1)**, and the general direction of groundwater flow in saprolite within the pilot test area is northeast while the monitoring wells are located to the west (upgradient) of SW-1. The rate of supplying 535 gallons of NaMnO4 solution to SW-1 over the 57-day operation was equivalent of 0.0065 gallon per minute (gpm). At such a low volumetric amendment supply rate and with the considerations of soil pore volume and groundwater flow direction in the pilot test area, it is expected that EK transport should be the primary mechanism for the appearance of permanganate at performance monitoring wells as discussed in Section 6.2.

The objective of supplying the buffer solution was to help control the pH within electrode wells where water electrolysis would cause a pH imbalance. While no specific monitoring of pH in the electrode wells was undertaken, the overall system operation was sustained with no downtime through the duration of pilot test, including no malfunction of electrodes which were the only instruments installed in electrode wells. The full-scale remedy design can factor in the buffer usage applied in this pilot test and include pH monitoring of electrode wells for long-term operation consideration.

6.2 PERFORMANCE MONITORING RESULTS

A baseline sampling event was conducted to establish pre-pilot test groundwater conditions within the pilot test area. The baseline soil sampling results are presented in **Table 6-2**, while the

baseline groundwater sampling results are presented in **Table 6-3** together with the results of subsequent groundwater sampling events conducted for performance monitoring.

As presented in **Table 6-2**, PCE was the only chlorinated ethene detected in all the samples collected and also the chlorinated ethene with the highest detected concentration. Other chlorinated ethenes (TCE and cDCE) were detected at relatively low concentrations (between 1.5 and 6.4 µg/kg). As a comparison, these baseline soil PCE concentrations (12 to 72.8 µg/kg) at 30 to 45 ft bgs, which were below the water table, were higher than the soil PCE concentration previously detected at a nearby boring location CDSB26 at 4.78 µg/kg at 19-20 ft bgs above the water table (Black & Veatch, 2020).

The performance monitoring data collected at the three monitoring wells, including the baseline groundwater quality data, are discussed in Section 6.2.1, and the post-test Geoprobe sampling results are discussed in Section 6.2.2.

6.2.1 Groundwater Monitoring Wells

The groundwater monitoring data collected from the three monitoring wells, EKMW-1, EKMW-2, and MW-3I, from baseline through post-test monitoring event are presented in **Table 6-3**.

Groundwater Geochemistry

Groundwater pH at the monitoring wells did not show apparent changes over the course of the pilot test, generally ranged between 6.5 and 6.9 in the baseline event and between 6.3 and 6.7 in the post-test sampling event.

Changes in groundwater redox condition, reflected in the ORP monitoring, provided an indication of the effects of chemical oxidant (MnO_4) introduced to the target treatment zone. As illustrated in **Figures 6-2A through 6-2C**, groundwater ORP at the three monitoring wells showed apparent increases from baseline levels between -145.1 mV and 97.8 mV to between 634 mV and 727 mV in the post-test event, indicating the groundwater within the pilot test area had become significantly more oxidizing through the pilot test duration. Except MW-3I, the increases of ORP at EKMW-1 and EKMW-2 continued to progress through each sampling event likely reflecting the continuing increase of oxidant in the vicinity.

Groundwater CVOCs

Also presented in **Figures 6-2A through 6-2C** are the decreases of CVOCs (PCE, TCE, and cDCE) from the baseline event through the post-test event, which corresponded to the observed increases of ORP over the same duration. The combination of these two observed changes provides strong evidence of the effects of MnO_4 being transported from SW-1 toward monitoring wells and the treatment of CVOCs affected by the transported MnO_4.

It is noted that baseline CVOCs (mainly PCE) were highest in EKMW-1 (PCE 2,020 µg/L; screened at 25 – 40 ft bgs), followed by EKMW-2 (PCE 1,070 µg/L; screened at 35 – 50 ft bgs), and lowest in MW-3I (266 µg/L; screened at 47 – 52 ft bgs). This observed CVOC vertical distribution is consistent with the previous characterization of MW-3 (PCE at 2,400 µg/L; screened at 9 – 24 ft bgs) and MW-3I (730 µg/L; screened at 47 – 52 ft bgs).

The objective of this pilot test was to evaluate the EK transport of the selected oxidant since the oxidation of target CVOCs by MnO_4 is well understood and already assessed in the treatability test. As presented in **Table 6-3**, post-test PCE/TCE/cDCE/VC were all below detection in MW-3I which had the lowest baseline concentrations, whereas approximately a 74% to 90% decrease of PCE/TCE/cDCE concentrations from baseline to post-test were observed at EKMW-1 and EKMW-2, respectively. While this pilot test demonstrated the feasibility of applying EK-ISCO to achieve CVOC treatment within the target area, given the vertical distribution of CVOCs observed in the baseline event and previous characterization results in this area, the full-scale EK-ISCO remedy may be designed to deliver more treatment in the upper saprolite unit to potentially achieve better remediation cost-efficiency.

Permanganate in Groundwater

The detection of permanganate in groundwater at a monitoring well is a direct confirmation of the presence of permanganate that has not been consumed by oxidizable substances in the subsurface and, thus, is still available to react with contaminants if present. As presented in **Table 6-3**, permanganate was first detected at MW-3I in the first performance monitoring event (Day 15 event), while at EKMW-2 the first detection was in the Day 36 event and EKMW-1 in the Day 58 event. There is some uncertainty as how permanganate could arrive MW-3I within such a short duration. There could be potential hydraulic connection between SW-1 and MW-3I given that the bottom depth of these two wells at 50 ft bgs could approach the top of transition zone in this area, which was thought to be near 60 ft bgs, or potential connection via relic weathering features within the saprolite. The arrival time of permanganate at EKMW-1 and EKMW-2 appear to be relatively consistent to the anticipated EK transport rate. Based on the approximate distance (2.8 ft) between SW-1 and each of EKMW-1 and EKMW-2 (**Figure 5-1**) and the arrival time of Day 58 and Day 36 based on permanganate detections, the estimated net EK transport rates for permanganate under the pilot test conditions are 1.5 cm/day (1.5 ft/month) and 2.3 cm/day (2.3 ft/month). As a comparison, the estimated EK transport rate for persulfate (an anion as permanganate) derived from the treatability test using Site aquifer material was 1 to 1.3 cm/day (Section 2.2).

As discussed above, the observed changes in groundwater ORP and CVOC concentrations suggest that oxidation treatment of CVOCs likely already occurred in the vicinity of EKMW-1 and EKMW-2 as early as Day 15 or Day 36. Another consideration is the volume of permanganate solution supplied to SW-1 through Day 15 and through Day 36 (approximately 126 gallons and 295 gallons respectively) could potentially affect a theoretical cylindrical volume with a 0.72 ft to 1.09 ft radius surrounding SW-1, assuming a 30-ft vertical interval and total porosity of 35%. While it is recognized that the actual amendment distribution zone in the subsurface is likely non-isotropic and not uniformly radial, the volumetric estimate discussed above is a reasonable approach with the data collected. When factoring these two additional considerations (i.e., the observed changes in groundwater ORP and CVOC concentrations and the volumetric estimate), the net EK transport rate for permanganate is estimated to be at 1.4 cm/day to 4.2 cm/day, which is consistent with the treatability test results as well as those reported in literature for EK transport of anion as discussed in Section 2.1.2 (2.1 – 2.5 cm/day; Gent, 2002).

Another consideration related to the estimated net EK transport rate is that the general groundwater flow direction in saprolite within the pilot test area is toward northeast (**Figure 5-1**) against the general EK permanganate transport direction from EW-1 (cathode) westward toward EW-2 (anode). Therefore, the observed effects at monitoring wells and the estimated permanganate transport rate reflect the net effect of EK transport under the field conditions in the pilot test area and provide a sound and realistic basis for designing the full-scale remedy.

As discussed earlier, the total MnO_4 supplied (136.5 kg) could theoretically satisfy the soil NOD within an area of 25.4 to 36 ft^2 for the 30-foot injection interval and 35% porosity. Given the distance from SW-1 to each of EKMW-1 and EKMW-2 at approximately 2.8 ft, a radial area centered at SW-1 and encompasses EKMW-1 and EKMW-2 will be approximately 24.6 ft^2. While the actual permanganate distribution zone is likely not a uniformly circular area, the detection of available permanganate at these monitoring wells was consistent with a potential treatment zone anticipated based on stoichiometric oxidant demand. It is noted that, as documented in many ISCO projects, permanganate can last in the subsurface for durations ranging up to months providing a continuing treatment capacity. Therefore, the detections of permanganate at the performance monitoring wells in the final performance sampling event suggest there was likely additional CVOC treatment (beyond the 74% to 90% concentration decreases observed) within the pilot test area after the pilot test was terminated. The findings of this pilot test indicate that the oxidant demand estimated from the treatability test and the oxidant dosage used in this pilot test provide an adequate design basis for the full-scale remedy.

6.2.2 Post-Test Soil and Groundwater Sampling By Direct Push Technology

Tables 6-4 and 6-5 summarize the results and observations of the post-test groundwater and soil sampling conducted using DPT. **Figures 6-3A and 6-3B** present the DPT groundwater sampling results. As presented in the figures, permanganate was detected at 6 of the 7 locations (P-1, P-2, P-3, P-4, P-6, and P-7) where groundwater samples were collected. No groundwater sample was collected at P-8 because the borehole collapsed before sampling. The groundwater sample from location P-5 did not contain detectable levels of permanganate using the field method.

Location P-2 was closest to SW-1 (approximately 2 ft) and had the highest detected permanganate concentration. While P-2 was hydraulically downgradient of SW-1, all other locations with permanganate detections were in areas that were hydraulically cross-gradient or upgradient of SW-1. Among the locations with permanganate detections, location P-3 was the location furthest away from SW-1 (approximately 7.3 ft). Also as presented in **Table 6-4**, total manganese concentrations in groundwater samples appeared to correspond to permanganate detections. The highest total manganese was detected in P-2 sample, followed by those in P-1, P-3, and P-7 samples, which generally matched the observed pattern of permanganate detections. Collectively, these data support the conclusion that permanganate was distributed to the vicinity of the DPT sampling locations with detected permanganate. It is also noted that permanganate was detected at locations spaced somewhat symmetrically on both sides (north and south) of the center alignment connecting EW-1 (cathode) and EW-2 (anode), as shown in **Figures 6-3A and 6-3B**, reflecting the anticipated pattern of EK transport between electrodes (**Figure 5-1**).

The sampling depths with permanganate detections ranged between 26 and 37 ft bgs. No particular pattern regarding the depths of permanganate detection was discerned, which was not unexpected given the limited number of samples spaced within a relatively small depth interval. It is noted that baseline CVOC concentrations detected at the monitoring wells (**Table 6-3**) suggest more CVOC mass may be present in the upper portion of the saprolite in this area, given that PCE concentration at EKMW-1 (screened at 25-40 ft bgs) was twice of that at EKMW-2 (screened at 35-50 ft bgs) and more than 7 times of that at MW-3I (screened at 47–52 ft bgs). The range of permanganate detection depths in this post-test sampling event suggest that a cost-efficient treatment of this portion of the saprolite, among the overall SSZ, by EK-ISCO is feasible.

The distance between P-3 (the furthest permanganate detection away from SW-1) and SW-1 is approximately 7.3 ft. Assuming permanganate just arrived at P-3 prior to the post-test sampling event (Day 58) and factoring in the total volume of permanganate solution supplied to SW-1, the estimated net EK transport rate for permanganate is 3 cm/day (3 ft/month). Among the cross-gradient and upgradient locations with permanganate detections, location P-1 had the highest detected concentration. Location P-1 is approximately 5.6 ft from SW-1. The estimated net EK transport rate based on the detection at P-1 is 2.1 cm/day. These estimated transport rates are consistent with the rates (1.4 cm/day to 4.2 cm/day) estimated based on performance monitoring data collected at the monitoring wells as discussed in Section 6.2.1, providing additional support for deriving this engineering design parameter from the overall pilot test results.

A potential area of permanganate distribution achieved by EK transport is approximated by connecting the cross-gradient and upgradient locations with permanganate detections as presented in the inset of **Figures 6-3A and 6-3B**. Location P-2 is not included because it is located downgradient of SW-1 and the permanganate solution could potentially migrate to that location via a hydraulic mechanism. The potential area of EK-facilitated permanganate distribution as shown in **Figures 6-3A and 6-3B** encompasses approximately 38.4 ft^2. If location P-2 is included in the estimate of permanganate distribution area, the estimated area would be approximately 41.3 ft^2. As discussed in Section 6.1.2, the amount of permanganate supplied through the course of pilot test (136.5 kg) can theoretically satisfy the NOD within an area of 25.4 to 36 ft^2 with the assumed depth interval and porosity. Therefore, the approximated area of EK permanganate transport derived from the post-test sampling results is a reasonable estimate and consistent with the estimates derived from the treatability tests as well as the observations of performance monitoring program. Collectively, the pilot test monitoring results provide Site-specific, realistic, and an adequate design basis for the full-scale EK-ISCO remedy to be developed and implemented at the Site.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are developed based on the overall pilot test results and data analysis discussed in Section 6.

The pilot test met the objectives identified in Section 3.1:

- The pilot test provided an evaluation of technology deployment (equipment requirements, operational conditions) for distributing the selected oxidant (permanganate) within the target pilot test zone. The electrical, mechanical, chemical, and system control components of the overall pilot test system allowed a steady operation through the pilot test duration without significant downtime nor health and safety incident.
- No apparent changes of groundwater pH within the pilot test area were observed over the course of pilot test operation. Increases of groundwater ORP were indications of oxidant distribution and as expected. The pilot test duration was only 57 days and, therefore, geochemistry monitoring should still be included in the full-scale remedy implementation.
- The pilot test results supported an evaluation of important engineering parameters, including oxidant transport/supply rate and electrical current and voltage needed, to support the design and full-scale implementation of EK-ISCO remedy at the Site.

Additional specific conclusions and recommendations are discussed below.

I. The EK transport of permanganate in the pilot test area:

- Permanganate was distributed within the pilot test area based on groundwater ORP, CVOC concentrations, and permanganate detections at the performance monitoring wells, as well as permanganate detections and total manganese concentrations at post-test DPT sampling locations.
- The distribution of permanganate to locations that are hydraulically cross-gradient and upgradient of supply well SW-1 indicated EK transport of the oxidant was achieved under the field conditions.
- The net EK transport rates for permanganate (i.e., accounting for the potential counter effects of hydraulic mechanisms) estimated from this pilot test range between 1.4 cm/day and 4.2 cm/day (or 1.3 and 4.1 ft/month). These estimated rates are comparable to other references from literature and prior projects and, therefore, provide a realistic design basis for the full-scale remedy.

II. The treatment of CVOCs by EK-transported permanganate:

- Treatment of CVOCs observed at performance monitoring wells over the course of pilot test corresponded with the changes in oxidizing condition and the detection of permanganate reflecting the effects achieved by the EK-transported oxidant.

- The area of permanganate distribution (approximately 38 to 41 ft^2) estimated based on the collective pilot test observations was consistent with the estimate based on the total quantity of MnO_4 supplied (136.5 kg) and the soil NOD estimated from the treatability test.
- The pilot test results provided a reasonable estimate of the chemical oxidant dosage for designing the full-scale implementation.

III. The electrical energy demand and EK system operational conditions:

- The overall electrical energy used to power the electrodes over the 57-day pilot test duration (152 kW-hr) was relatively low. This energy demand is a scalable parameter for the design of full-scale remedy implementation.
- While the voltage requirement observed was higher than past project observations, it is expected that this requirement would decrease over a longer operation. Still, this observation provided a basis for equipment selection for a full-scale system.
- Overall, the EK system operation was steady and no extreme operational conditions were encountered. The pilot test system and operational conditions employed can support the design of a full-scale system.

IV. Additional recommendations:

- The baseline sampling results and prior characterization suggest that in the pilot test area more CVOCs existed in the upper saprolite unit than the lower portion. While additional source area characterization and CSM updates can further refine the design of full-scale EK-ISCO, the pilot test results suggest that it is feasible to achieve cost-efficient remediation in this area of the Site and the assumptions upon which the remediation cost estimate was based during the FS appear to be reasonable.
- The overall pilot test duration was 57 days, as intended, to evaluate oxidant transport. While the O&M tasks were performed generally by one field staff with three visits per week and with relative ease, a more automated system operation with less field staff efforts may be considered for the full-scale remedy that may require a more extended operation period.
- The full-scale design should evaluate a means to factor in and potentially take advantages of the variability of the saprolite permeability as well as the groundwater flow direction in this area of the Site, e.g., alternating orientations of the electric field in a phased implementation approach.

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TABLES

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Table 3-1. Data Quality Objectives
EK-ISCO Pilot Test
Cristex Drum Site, Oxford, North Carolina

Objective		Data Type	Data Collection Method	Data Quality
Pilot Test System Operation Monitoring	Power supply to electrodes	Electrical current and voltage	Direct reading at DC power supply unit; Current measurements at electrode wellheads	Recorded by system operator in field forms
	Amendment supply operation	Amendment supply scheme (pump on/off, pump cycle run-time; pressure; flow rate)	Recorded by system PLC; Confirmed observations by system operator	Auto-data acquisition and archived by system PLC; Recorded by system operator in field forms
	Quantity of amendment supplied to pilot test area	Oxidant and pH buffer quantity (solution volume, chemicals added)	Solution volume and chemical usage measured by system operator	Recorded by system operator in field forms
Pilot Test Performance Monitoring	Delivery of oxidant within pilot test area	Groundwater concentrations of oxidant and oxidant breakdown products, as well as target CVOCs (1)	Groundwater samples from pilot test monitoring wells analyzed by laboratory (except permanganate concentration measured by a field method (4))	Standard laboratory analytical methods (4); EPA guidance document for permanganate field analysis (4); Field QC samples (4)
	Potential changes in geochemistry in pilot test area	Groundwater field parameters (2); Groundwater concentrations of select metals (3)	Field parameters measured during groundwater sampling; Groundwater samples from pilot test monitoring wells analyzed by laboratory	Standard procedures (5) for field parameter measurement; Standard laboratory analytical methods (4); Field QC samples (4)

Notes: (1) Oxidant : permanganate; Oxidant Breakdown Products : sulfate and total sulfur; Target CVOCs : PCE, TCE, cDCE
(2) Field Parameters : pH, dissolved oxygen (DO), oxidation-reduction potential (ORP), conductivity, temperature
(3) Metals : dissolved iron, dissolved manganese
(4) See Table 3-2
(5) Provided in Sampling and Analysis Plan, Volume 2 – Field Sampling Plan (Black & Veatch, 2018)

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Table 3-2. Pilot Test Monitoring Program
EK-SICO Pilot Test
Cristex Drum Site, Oxford, North Carolina

Analyte Group or Compound	Analytical Method	Container	Preservatives	Holding Time	MDL	QC Sample
CVOCs (1)	EPA SW-846 8260D	40 mL VOA	Ascorbic acid (6); 4±2°C	7 days	1 µg/L	One per event – TB; FD; RB; MS/MSD
Dissolved Metals (2)	EPA SW-846 6010B	250 mL polyethylene	HNO_3; 4±2°C	6 months	0.1 mg/L	One per event – FD; RB
Permanganate	Field Method (4)	NA	NA	NA	0.5 mg/L	NA
Field Parameters (3)	Field Method (5)	NA	NA	NA	NA	NA

Notes :
(1) Only for Baseline and Post-Test sampling events; CVOCs – PCE, TCE, cDCE
(2) Only for Baseline and Post-Test sampling events; Dissolved metals – iron, manganese
(3) Field parameters – pH, DO, ORP, specific conductance, temperature
(4) Method for permanganate analysis using field test kits (SenSafe® by Industrial Test Systems, Inc., Rock Hill, SC) suggested in USEPA 2012 guidance (provided as Appendix D).
(5) Sampling and Analysis Plan, Volume 2 – Field Sampling Plan (Black & Veatch, 2018)
(6) Samples for CVOC analysis were quenched using ascorbic acid (1.5 M; 40 µL in 40 mL vial) as suggested in USEPA guidance (2012); see Appendix D.

CVOCs: chlorinated volatile organic compounds
QC: quality control
mL: milliliter
TB: Trip Blank
RB: Rinsate Blank
MDL: method detection limit
mg/L: milligram per liter
NA : Not Applicable
FD: Field Duplicate
MS/MSD: Matrix Spike/Matrix Spike Duplicate

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Table 6-1. Pilot Test System Operation Monitoring
EK-ISCO Pilot Test
Cristex Drum Site, Oxford, North Carolina

# of Days in Operation	Cumulative $NaMnO_4$ Solution Injected (Gal)	Volume of $NaMnO_4$ Reagent Product Used (Gal)	Cumulative Buffer Solution Injected (Gal)	Weight of $NaHCO_3$ Chemical Used (lbs)	Power Supply Unit Readings		Cumulative Power Usage (kW-hr)	Current Measurement at Wellheads	
					Voltage (V)	Current (A)		Total to EW-1 (A)	Total from EW-2 (A)
5	60	20	20	3	159	0.69	12.9	0.62	0.19
8	85	14	30	3	168	0.69	21.0	0.72	0.66
10	95	0*	125	28	125	0.68	25.9	0.72	0.77
12	120	0*	190	20	110	0.69	29.7	0.69	0.62
19	160	11	290	29	144	0.87	46.4	1.01	0.88
22	195	0*	400	34	138	0.87	55.2	0.92	0.84
24	220	14	470	20.5	140	0.87	61.0	0.84	0.85
26	220	0*	550	23.5	140	0.87	66.8	0.89	0.86
29	260	0*	660	30	141	0.87	75.6	0.90	0.78
31	280	10	740	23.5	144	0.87	81.6	0.87	0.87
33	290	0*	810	23.5	136	0.87	87.4	0.86	0.84
36	295	0*	845	0*	147	0.87	96.3	1.01	1.18
38	330	7	925	30	135	0.87	102.2	0.69	0.91
40	345	0*	995	22.5	129	0.87	107.7	0.84	0.95
43	370	12	1095	18	128	0.87	115.8	1.06	0.94
45	395	0*	1160	35	128	0.87	121.1	0.87	0.88
47	440	0*	1255	25	125	0.87	126.4	0.97	0.92
50	440	0*	1380	25	123	0.87	134.2	0.98	0.96
52	475	0*	1460	23.5	122	0.87	139.3	0.78	0.82
54	505	0*	1530	0*	121	0.87	144.3	1.11	1.05
57	535	0*	1530	0*	123	0.87	152.0	1.06	0.85
Total	**535**	**88**	**1,530**	**467**					

Notes:

***** $NaMnO_4$ solution and buffer solution were made in large batches for multi-day uses. "0" denotes the day when no fresh batch of solution was prepared.

Gal: gallon lbs: pounds

V: volt A: amp

kW-hr: kilowatts-hour

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Table 6-2. Baseline VOC Concentrations in Soil
EK-ISCO Pilot Test
Cristex Drum Site, Oxford, North Carolina

Boring Location	Sampling Depth (ft bgs)	VOCs						
		Acetone	2-Butanone (MEK)	cDCE	PCE	TCE	1,2,4-TMB	m,p-Xylene
EK-MW1	33–35	**78.5(J)**	**6.9(J)**	< 0.72	**12**	< 0.52	**1.1(J)**	**0.79(J)**
EK-MW2	43–45	< 38	< 2.8	**5.1**	**72.8**	**2.5**	**0.55(J)**	**0.53(J)**
SW-1	30–32	< 82	< 6.0	**6.4**	**45.8**	**2.1(J)**	< 0.82	< 0.91
SW-1	40–42	< 69	< 5.0	**4.7**	**34**	**1.5(J)**	< 0.69	< 0.76

Notes:
All results are reported in micrograms per kilogram (µg/kg).
Bold: detection
VOCs: volatile organic compounds
J: estimated value
ft bgs: feet below ground surface
cDCE: cis-1,2-dichloroethene
PCE: tetrachloroethene
TCE: trichloroethene
1,2,4-TMB: 1,2,4-trimethylbenzene

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Table 6-3. Performance Monitoring – Groundwater Monitoring Results
EK-ISCO Pilot Test
Cristex Drum Site, Oxford, North Carolina

Monitoring Well	Sampling Date	pH (Std. Unit)	ORP (mV)	Permanganate Field Test (ppm)	CVOC					Dissolved Metals	
					1,1-DCA	cDCE	PCE	TCE	VC	Iron	Manganese
EKMW-1	12/12/2019 (Baseline)	6.5	24.8	0	< 8.5	**152**	**2,020**	**78.4**	**35.9**	< 300	**261**
EKMW-2		6.8	-145.1	0	< 6.8	**89.8**	**1,070**	**42.4**	< 8.2	< 300	**396**
MW-3I		6.9	97.8	0	< 1.7	**32.4**	**266**	**14.4**	< 2	< 300	**259**
EKMW-1	02/24/2020 (Day 15)	6.3	125.7	0	< 6.8	**69.3**	**1,030**	**41.8**	< 8.2	< 300	**117**
EKMW-1 (DUP)		--	--	--	< 6.8	**70.9**	**1,110**	**41.9**	< 8.2	< 300	**106**
EKMW-2		6.6	348.1	0	< 1.7	**49.3**	**477**	**29.1**	< 2	< 300	**339**
MW-3I		6.8	689.4	**> 3**	< 1.7	< 1.4	< 1.1	< 1.7	< 2	< 75000	**1,600,000**
EKMW-1	03/16/2020 (Day 36)	6.2	507.7	0	< 3.4	**66.1**	**833**	**38.6**	**4.1**	NA	**94.4**
EKMW-2		6.6	585.7	**~ 0.05**	< 1.7	**22.2**	**355**	**15.3**	< 2	< 300	**435**
EKMW-2 (DUP)		--	--	--	< 3.4	**34**	**488**	**25.1**	< 4.1	< 300	**411**
MW-3I		11.8*	405.5	**> 3**	**0.61(J)**	< 0.28	**5.6**	< 0.35	< 0.41	< 300	**21,600**
EKMW-1	04/07/2020 (Day 58)	6.3	634.9	**~ 0.15**	< 3.4	**50.9**	**516**	**29.3**	< 4.1	< 300	**53.9**
EKMW-2		6.7	656.4	**> 2**	< 0.68	**4.1**	**118**	**2.7**	< 0.82	< 3000	**13,100**
EKMW-2 (DUP)		--	--	--	< 0.68	**4.8**	**100**	**3.1**	< 0.82	< 3000	**13,200**
MW-3I		6.5	726.9	**> 3**	**0.45(J)**	< 0.28	< 0.22	< 0.35	< 0.41	< 3000	**1,340,000**

Notes:
All results for VOCs and metals are reported in micrograms per liter (µg/L).
Bold: detection
*: anomaly field reading
J: estimated value
CVOC: chlorinated volatile organic compounds
1,1-DCA: 1,1-dichloroethane
cDCE: cis-1,2-dichloroethene
PCE: tetrachloroethene
TCE: trichloroethene
VC: vinyl chloride
ORP: oxidation-reduction potential
NA: Not Analyzed
mV: millivolt
ppm: part per million

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Table 6-4. Post-Test Geoprobe Groundwater Sampling Results
EK-ISCO Pilot Test
Cristex Drum Site, Oxford, North Carolina

Borehole ID	Total Borehole Depth (ft)	Screen Interval (ft bgs)	Sample Depth (ft)	Permanganate Field Test (ppm)	Total Manganese (1) (mg/L)
P1	35	30–34	32	0.05	5.49
P2	35	30–34	32	1 – 2	16
P3	30	25–29	28	0.05	3
P4	35	30–35	32	0 – 0.05	1.46
P5	40	34–39	35	ND	1.76
P6	40	35–39	37	0 – 0.05	1.08
P7	30	24–29	26	0 – 0.05	5.58
P8	30	24–29	N/A	N/A	N/A

Notes:
(1) Total manganese analyzed for unfiltered groundwater samples.
N/A: borehole collapsed during purging prevented sample collection.
bgs: below ground surface
ft: feet
mg/L: milligram per liter
ppm: part per million

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Table 6-5. Post-Test Geoprobe Soil Sampling Results
EK-ISCO Pilot Test
Cristex Drum Site, Oxford, North Carolina

Borehole ID	Total Borehole Depth (ft)	Total Manganese (mg/kg)	Lithologic Description of Sampling Depth
P1	35	360	Tan to orangish brown silty sand with fine and medium gravel, dry, loose, friable
P2	35	276	Orangish brown to tan silt with some gravel, dry, loose
P3	30	473	Orangish brown to tan silty sand with some gravel, loose, moist; dark stains visible at approximately 28–30 ft bgs
P4	35	289	Light brown to orangish-tan silty sand with some fine gravel, dry, hard
P5	35	862	Light brown silty sand with gravel, loose, dry
P6	40	322	Orangish-tan to light brown silty sand with fine gravel, loose, dry
P7	30	297	Light brown to tan silty sand with some fine gravel, loose, dry
P8	30	410	Tan to orangish brown silty sand and some gravel, loose, moist; dark stains visible at approximately 24 ft bgs

Notes:
ft: feet
mg/kg: milligram per kilogram
bgs: below ground surface

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Figures

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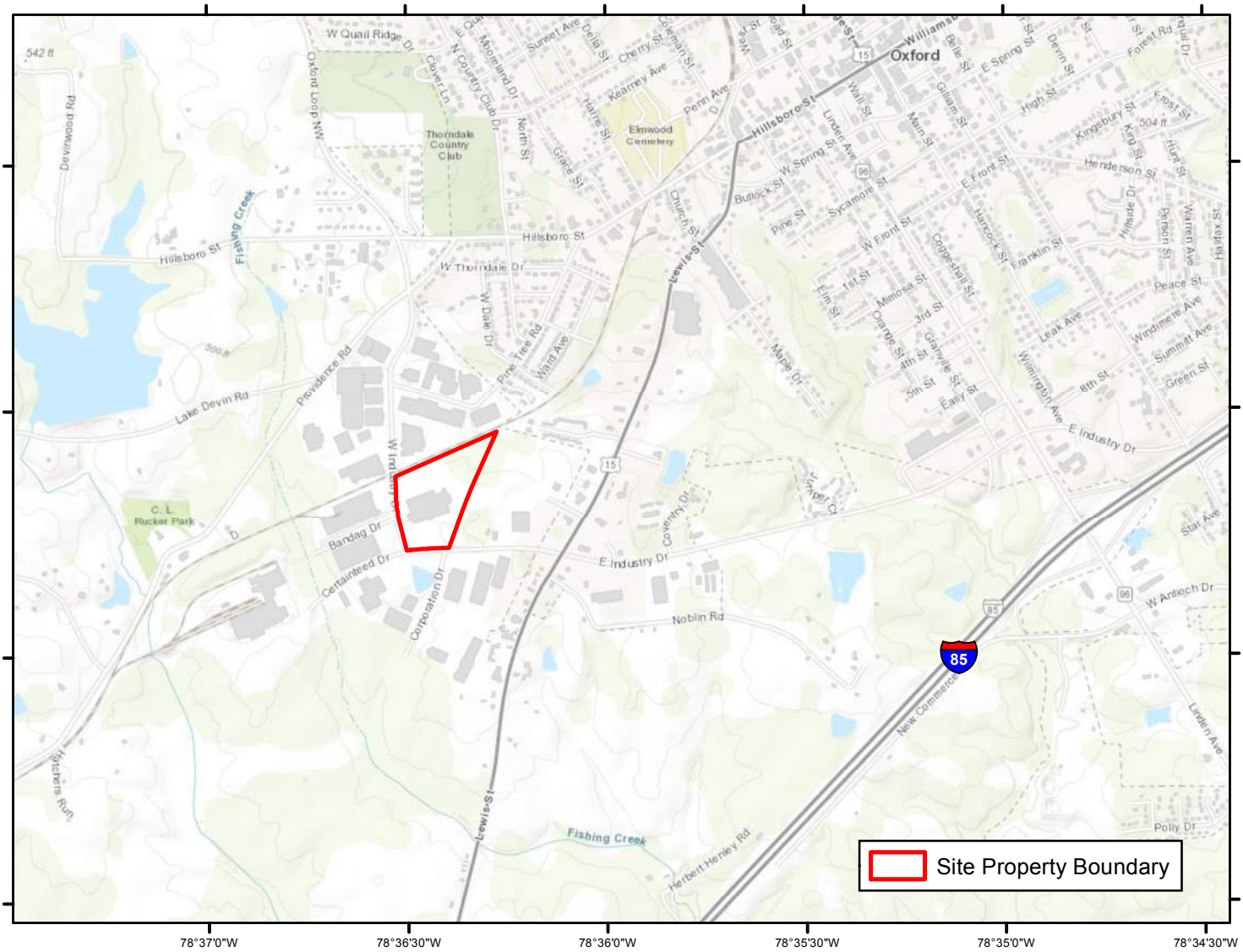

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0 0.25 0.5

Miles

USGS Quadrangle: Oxford
10' Topographic Contours
NAD 83 State Plane North Carolina, Feet

Site Location Map
Cristex Drum Site
Oxford, Granville County, North Carolina

Figure
1-1

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Feet

NAD83 Stateplane North Carolina, Feet

Site Plan
Cristex Drum Site
Oxford, Granville County, North Carolina

Figure 1-2

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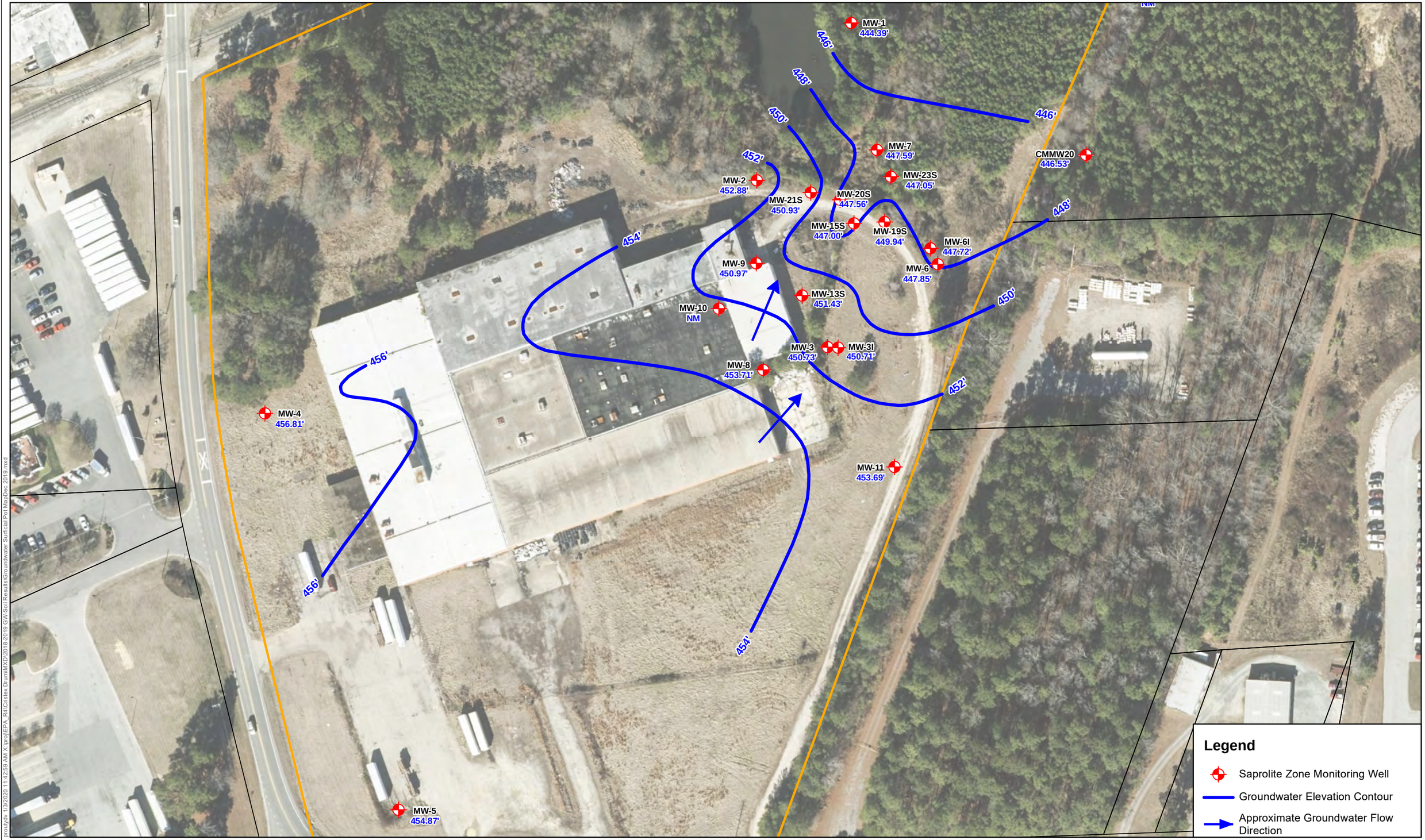

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Feet
NAD83 Stateplane North Carolina, Feet

Groundwater Potentiometric Surface Map - Saprolite Zone - December 2019
Cristex Drum Site
Oxford, Granville County, North Carolina

Figure 1-3

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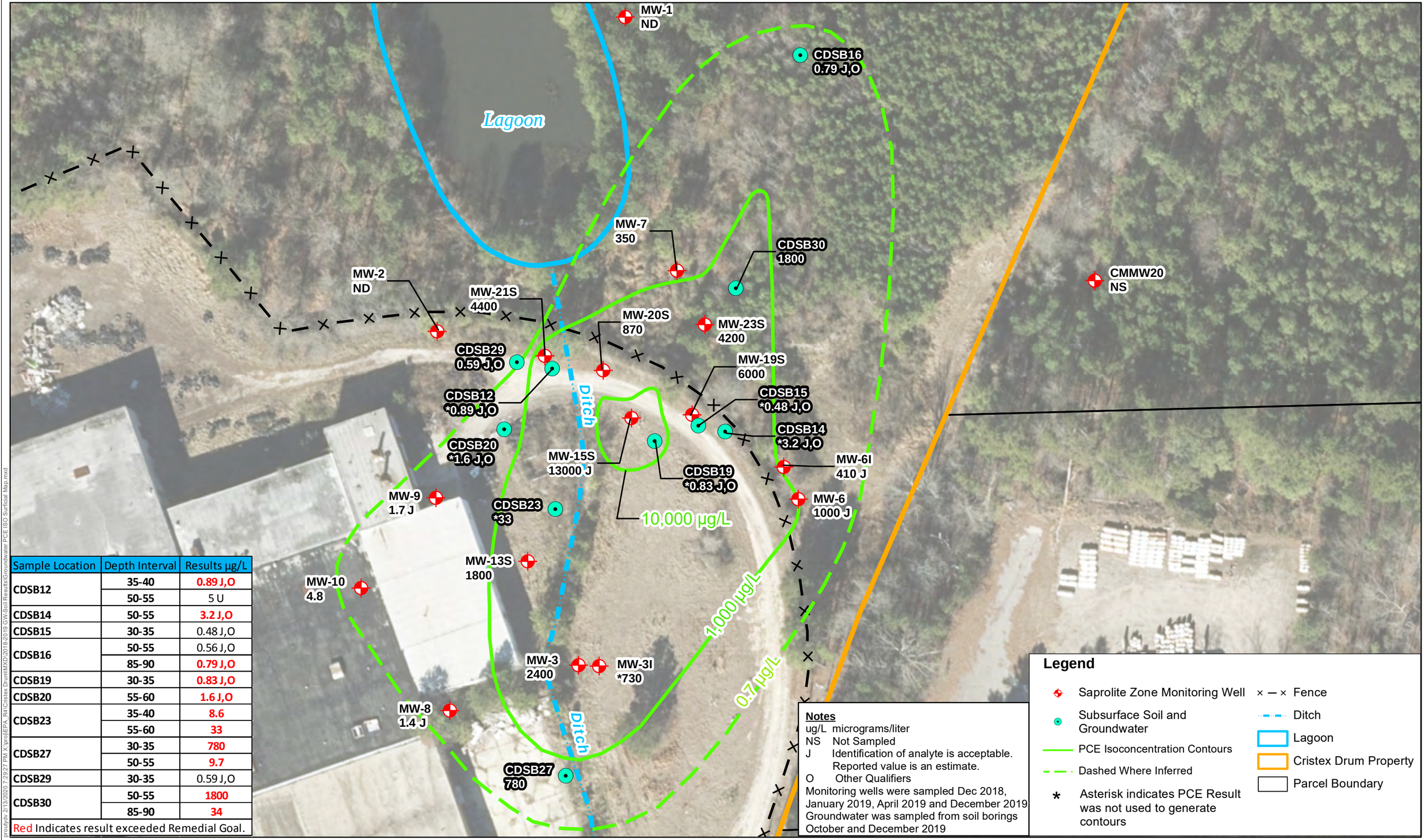

Sample Location	Depth Interval	Results µg/L
CDSB12	35-40	0.89 J,O
	50-55	5 U
CDSB14	50-55	3.2 J,O
CDSB15	30-35	0.48 J,O
CDSB16	50-55	0.56 J,O
	85-90	0.79 J,O
CDSB19	30-35	0.83 J,O
CDSB20	55-60	1.6 J,O
CDSB23	35-40	8.6
	55-60	33
CDSB27	30-35	780
	50-55	9.7
CDSB29	30-35	0.59 J,O
CDSB30	50-55	1800
	85-90	34

Red Indicates result exceeded Remedial Goal.

N 0 25 50 100 Feet
NAD83 Stateplane North Carolina, Feet

Tetrachloroethene (PCE) Isoconcentration Map - Saprolite Zone
Cristex Drum Site
Oxford, Granville County, North Carolina

Figure 1-4

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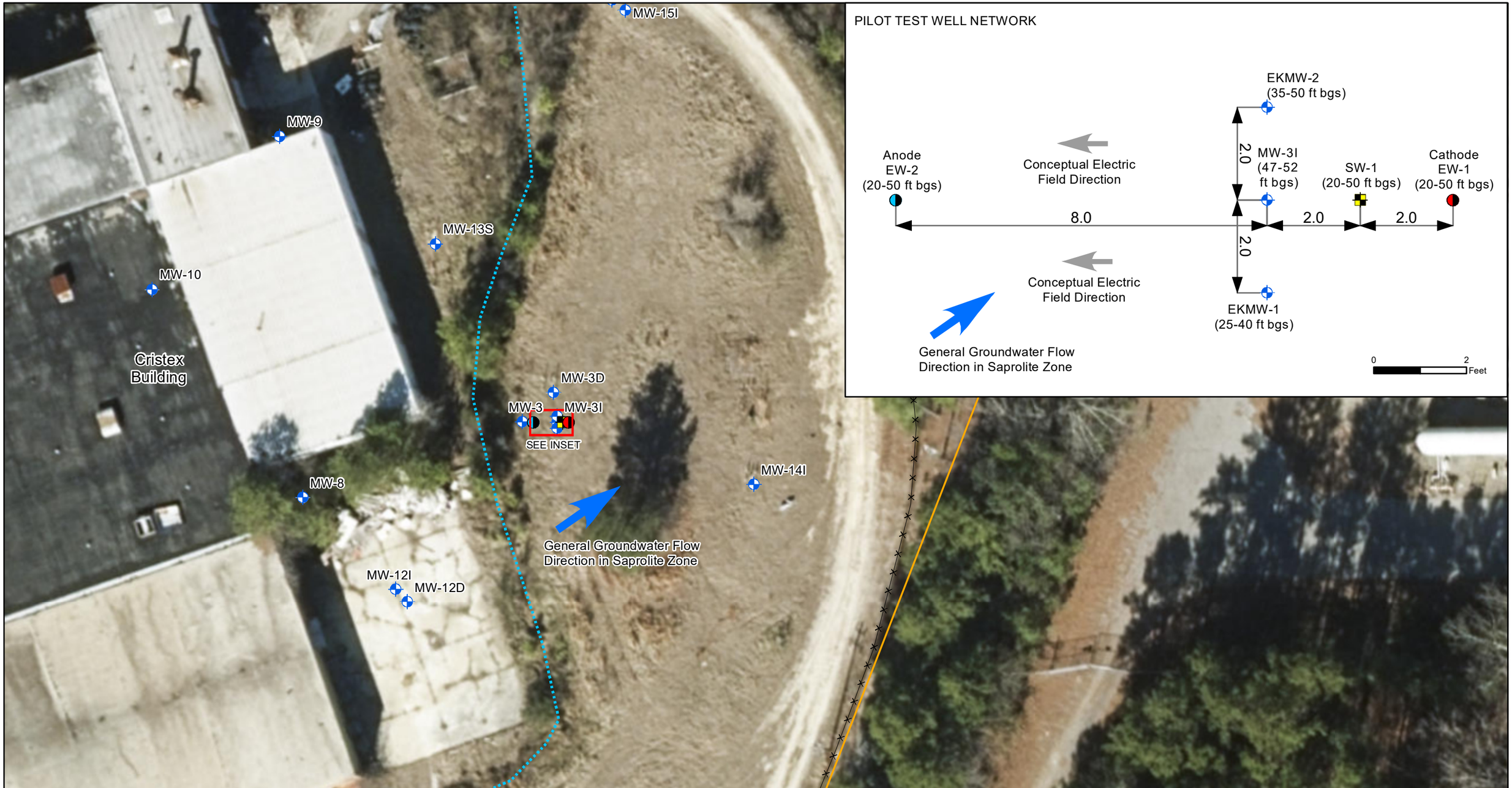

Legend

- Electrode Well - Anode
- Electrode Well - Cathode
- Monitoring Well
- Supply Well
- Cristex Drum Property
- Ditch
- Fence

N

0 30 60 Feet

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Pilot Test Well Network

EK-ISCO Pilot Test
Cristex Drum Site
Oxford, Granville County, North Carolina

Geosyntec consultants

Columbia, Maryland | May 2020

Figure 3-1

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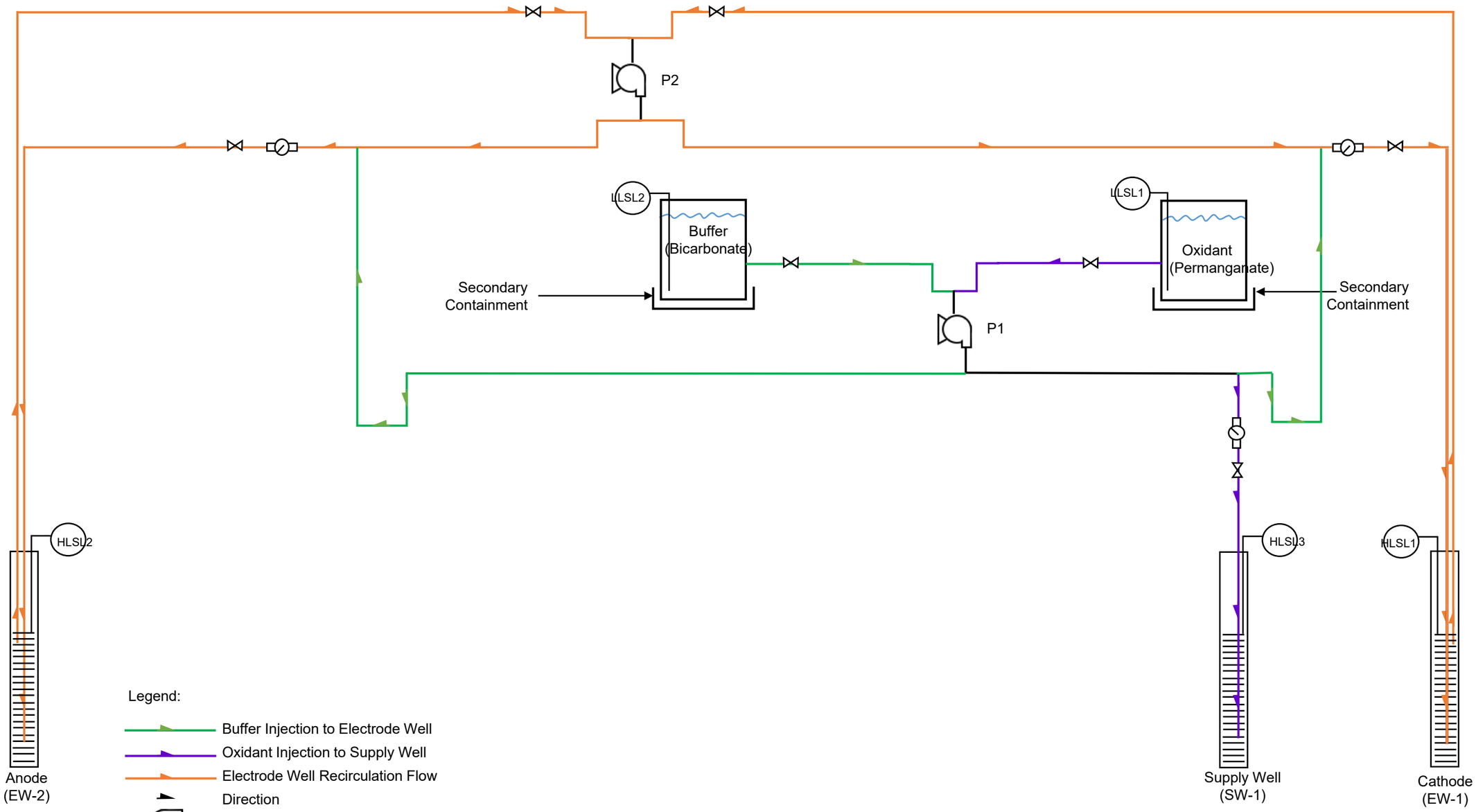

EK-ISCO Pilot Test
Process Flow Diagram

Cristex Drum Site, Oxford, North Carolina

Geosyntec consultants

Geosyntec Consultants of NC, PC

Columbia, Maryland | December 2019

Figure 4-1

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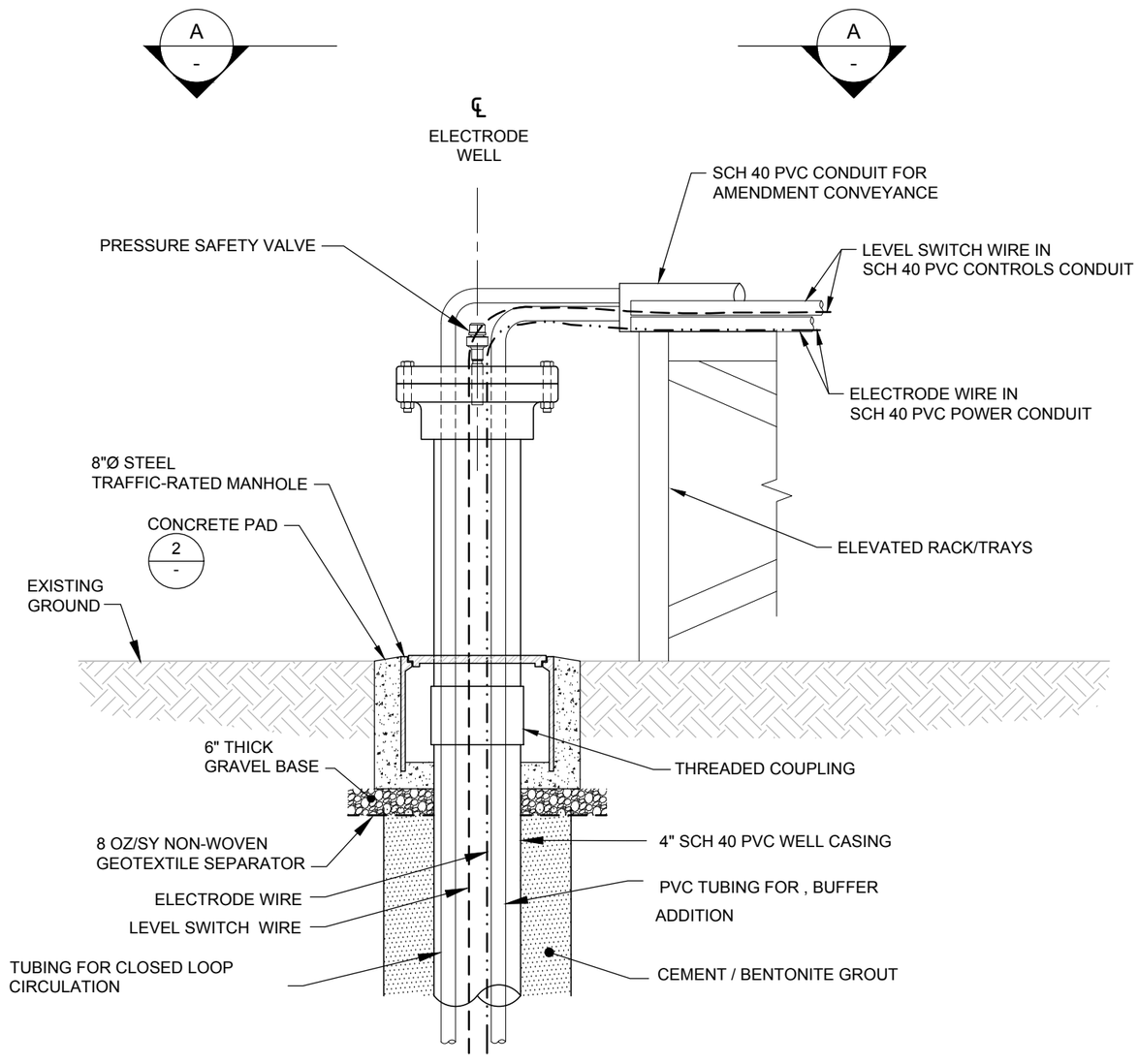
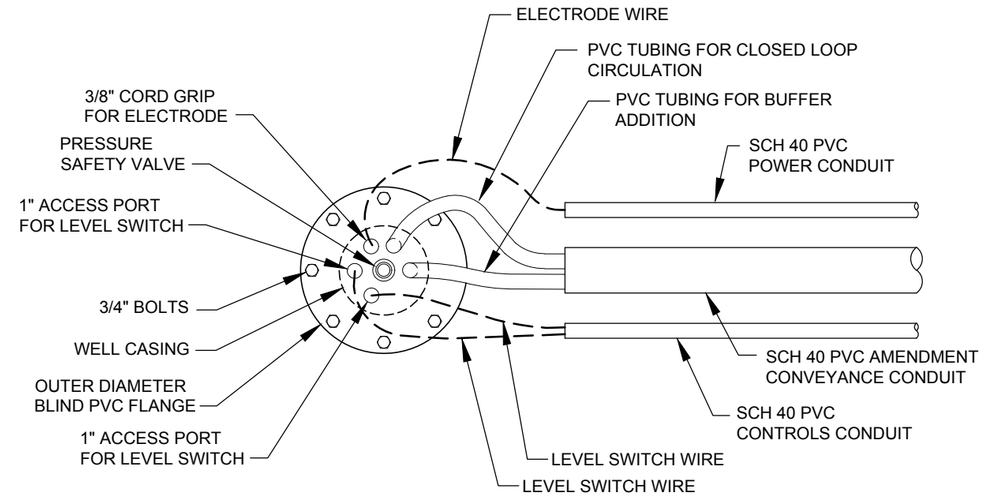


1 DETAIL

ELECTRODE WELL SURFACE COMPLETION (PROFILE)

NOT TO SCALE



A
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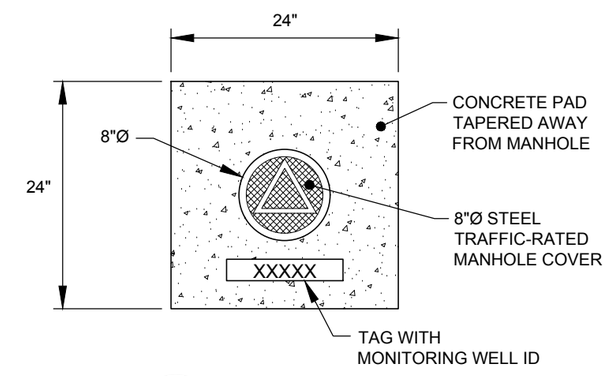
DETAIL

ELECTRODE WELL (PLAN VIEW)

NOT TO SCALE
(NOTE 1)



2
-
DETAIL

CONCRETE PAD

NOT TO SCALE

PRELIMINARY - NOT FOR CONSTRUCTION

ELECTRODE WELL
SURFACE COMPLETION
CRISTEX DRUM SITE
OXFORD, NORTH CAROLINA

Geosyntec consultants
COLUMBIA, MARYLAND

DATE:	OCTOBER 2019
PROJECT NO.	GR6764
DOCUMENT NO.	
FILE NO.	0673-101
FIGURE NO.	4-2

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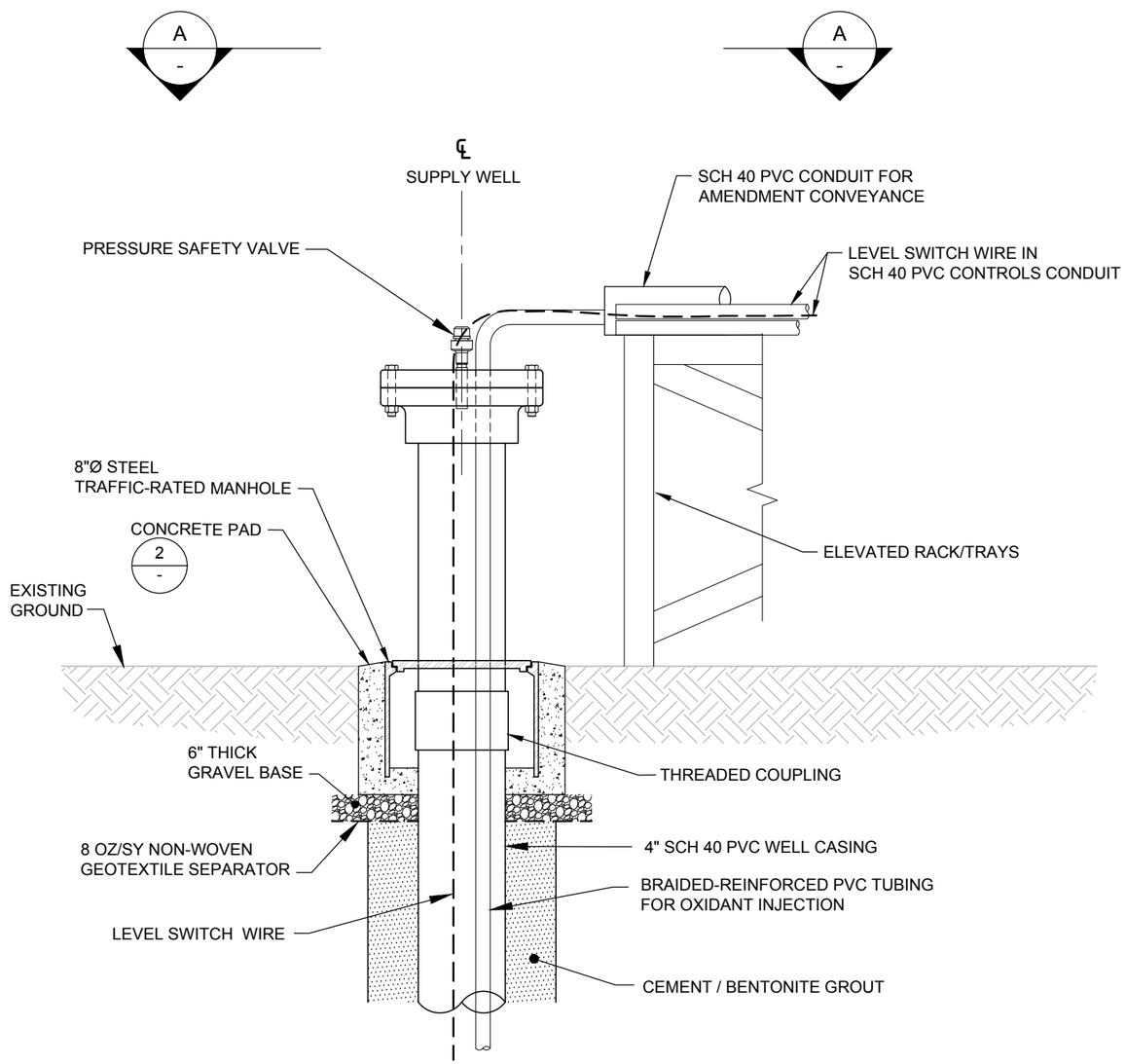
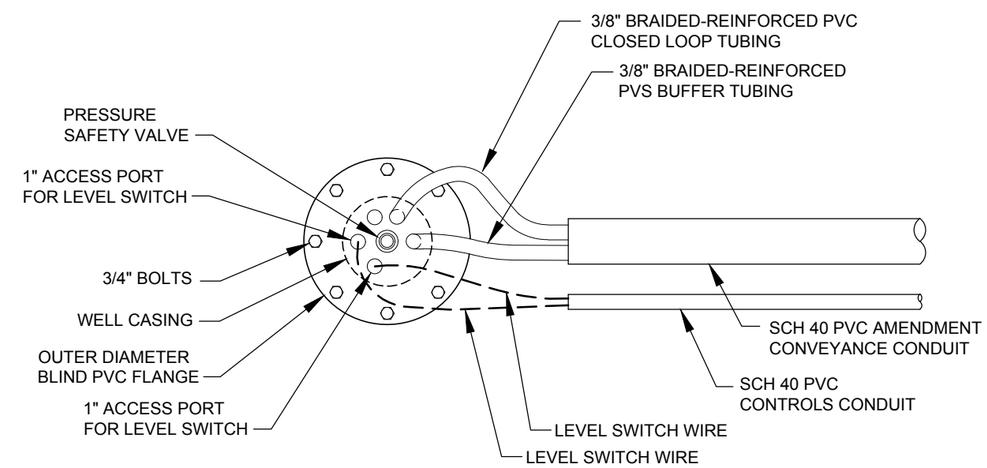


1 DETAIL

SUPPLY WELL SURFACE COMPLETION (PROFILE)

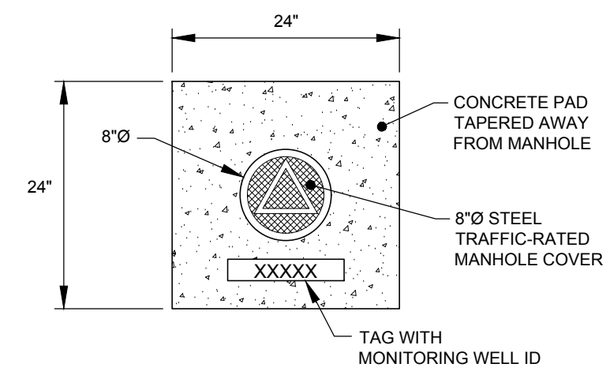
NOT TO SCALE



A - DETAIL

SUPPLY WELL (PLAN VIEW)

NOT TO SCALE



2 - DETAIL

CONCRETE PAD

NOT TO SCALE

PRELIMINARY - NOT FOR CONSTRUCTION

SUPPLY WELL
SURFACE COMPLETION
CRISTEX DRUM SITE
OXFORD, NORTH CAROLINA

Geosyntec consultants
COLUMBIA, MARYLAND

DATE:	OCTOBER 2019
PROJECT NO.	GR6764
DOCUMENT NO.	
FILE NO.	0673-101
FIGURE NO.	4-3

L:\G\GUELPH\STENNIS CENTER TR0673\2019.03 WATLING\0673-101.dwg

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Location ID	Distance From SW-1 (ft)	Sampling Depth (ft bgs)
SW-1	-	-
P-1	5.6	32
P-2	2.1	32
P-3	7.3	28
P-4	5.3	32
P-5	5.8	35
P-6	3.4	37
P-7	3.5	26
P-8	4.5	N/A
EW-1	2.0	N/A
EW-2	10.0	N/A
MW-3I	2.0	47-52
EKMW-2	2.8	35-50
EKMW-1	2.8	25-40

Legend

- Electrode Well - Anode
- Conceptual Electric Field
- Electrode Well - Cathode
- Monitoring Well
- Supply Well
- DPT Sampling Location

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Notes:
N/A - Not Applicable

N

0 2 Feet

Pilot Test Sampling Locations

EK-ISCO Pilot Test
Cristex Drum Site
Oxford, Granville County, North Carolina

Geosyntec consultants

Columbia, Maryland | May 2020

Figure 5-1

\\columbia-01\Data\GIS\Cristex_Drum\Fig5_1_PostTest_Sampling_Locations.mxd 5/19/2020 10:54:41 AM

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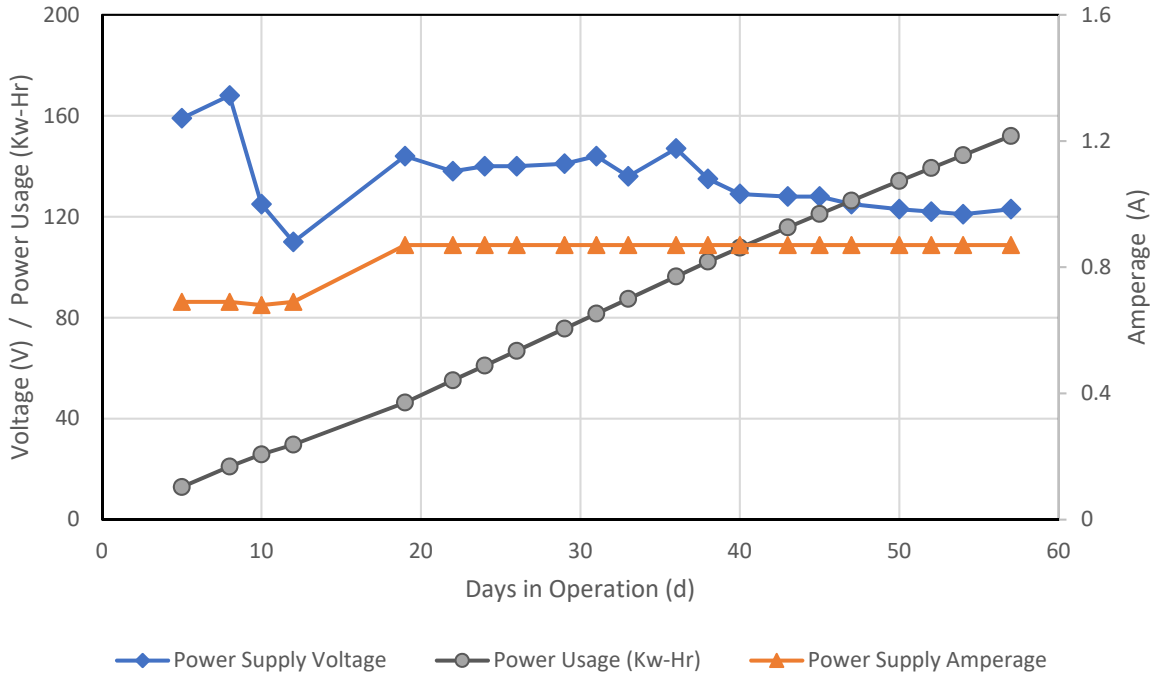

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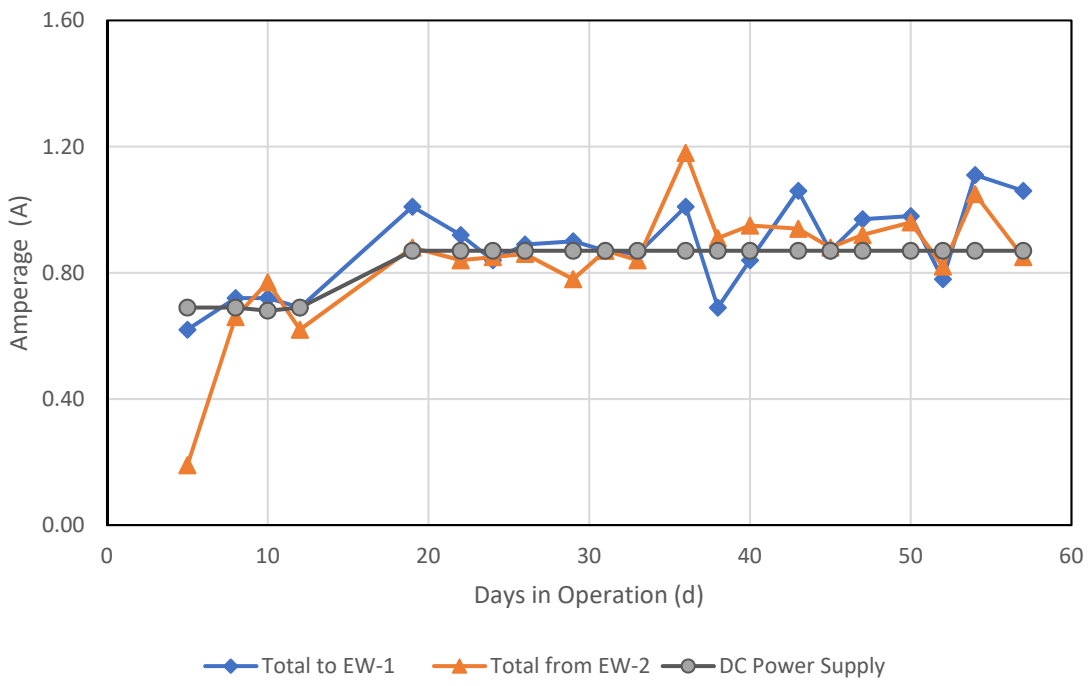

Pilot Test System Operation

EK-ISCO Pilot Test
Cristex Drum Site, Oxford, North Carolina

Geosyntec consultants
Geosyntec Consultants of NC, PC

Columbia, Maryland | May 2020

Figure 6-1

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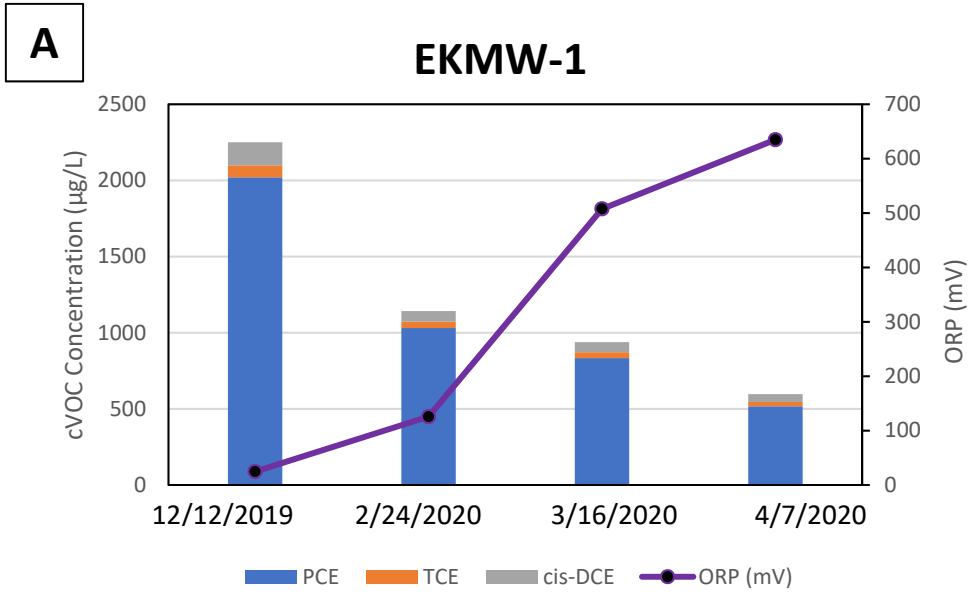

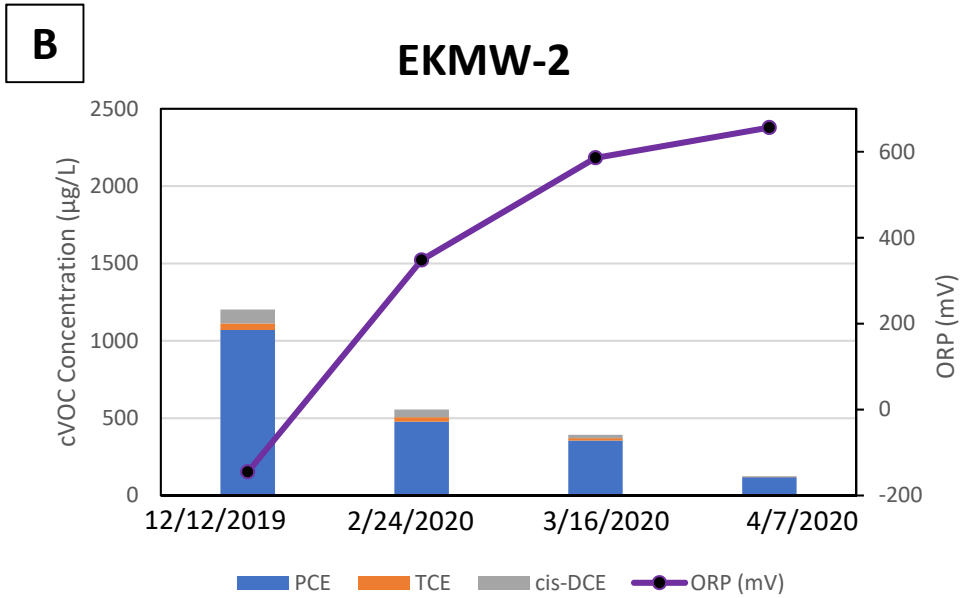

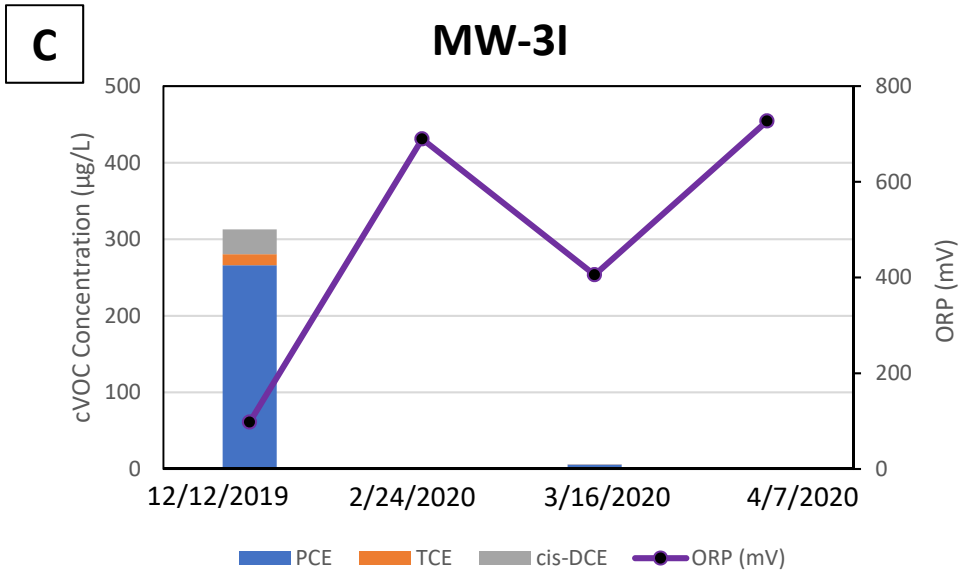

Performance Monitoring Results

EK-ISCO Pilot Test
Cristex Drum Site, Oxford, North Carolina

Geosyntec consultants
Geosyntec Consultants of NC, PC

Columbia, Maryland | May 2020

Figure 6-2

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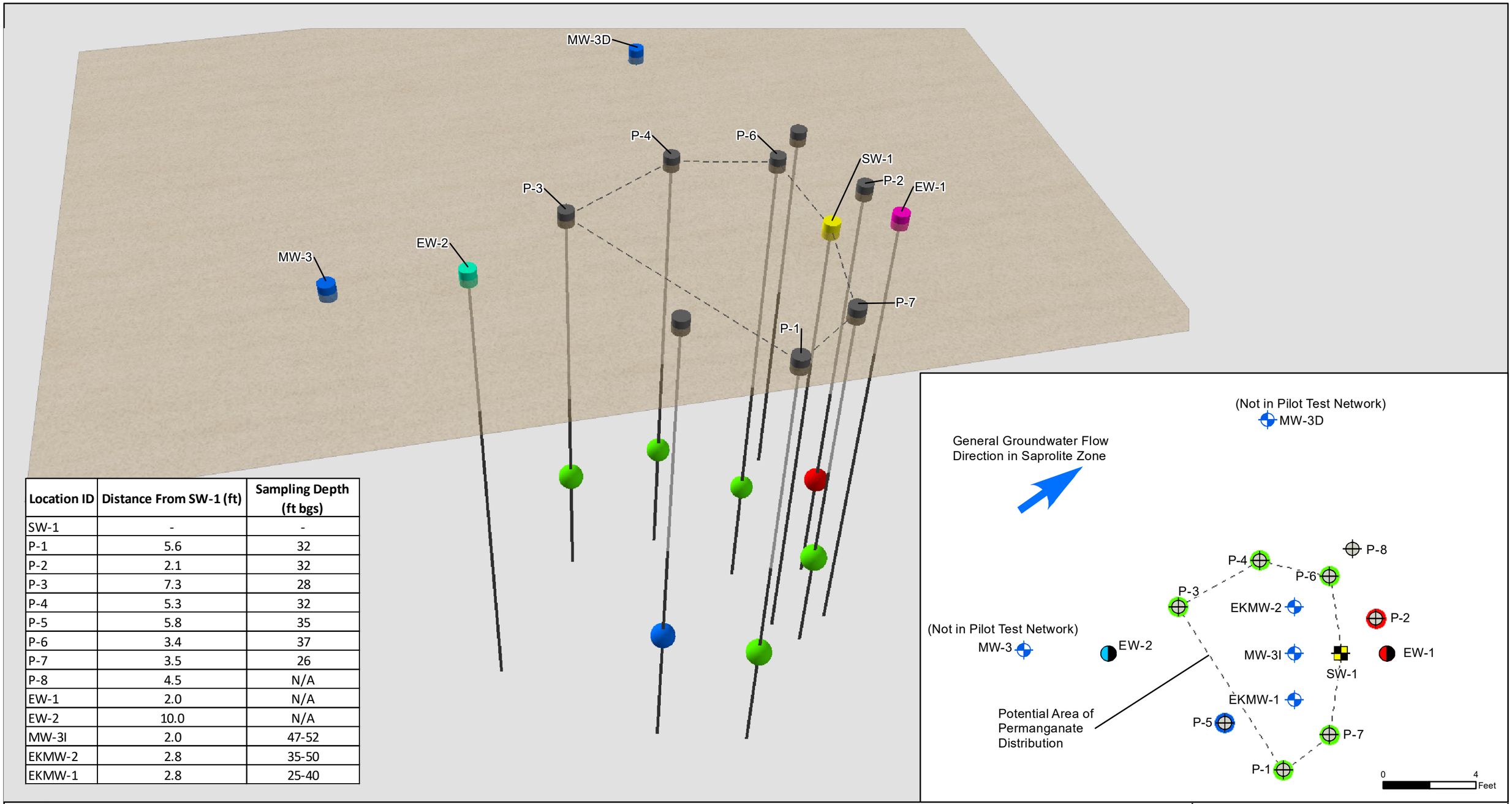

Location ID	Distance From SW-1 (ft)	Sampling Depth (ft bgs)
SW-1	-	-
P-1	5.6	32
P-2	2.1	32
P-3	7.3	28
P-4	5.3	32
P-5	5.8	35
P-6	3.4	37
P-7	3.5	26
P-8	4.5	N/A
EW-1	2.0	N/A
EW-2	10.0	N/A
MW-3I	2.0	47-52
EKMW-2	2.8	35-50
EKMW-1	2.8	25-40

Legend

- Electrode Well - Anode
- Electrode Well - Cathode
- Monitoring Well
- Supply Well
- DPT Sampling Location

Permanganate Field Sampling Results (Avg. PPM)

- 0.0
- 0.0 - 0.05
- 0.05 - 1.5

Notes:
N/A - Not Applicable
PPM - Parts Per Million

N

Post-Test Groundwater Permanganate Sampling

EK-ISCO Pilot Test
Cristex Drum Site
Oxford, Granville County, North Carolina

Geosyntec consultants

Columbia, Maryland | May 2020

Figure 6-3A

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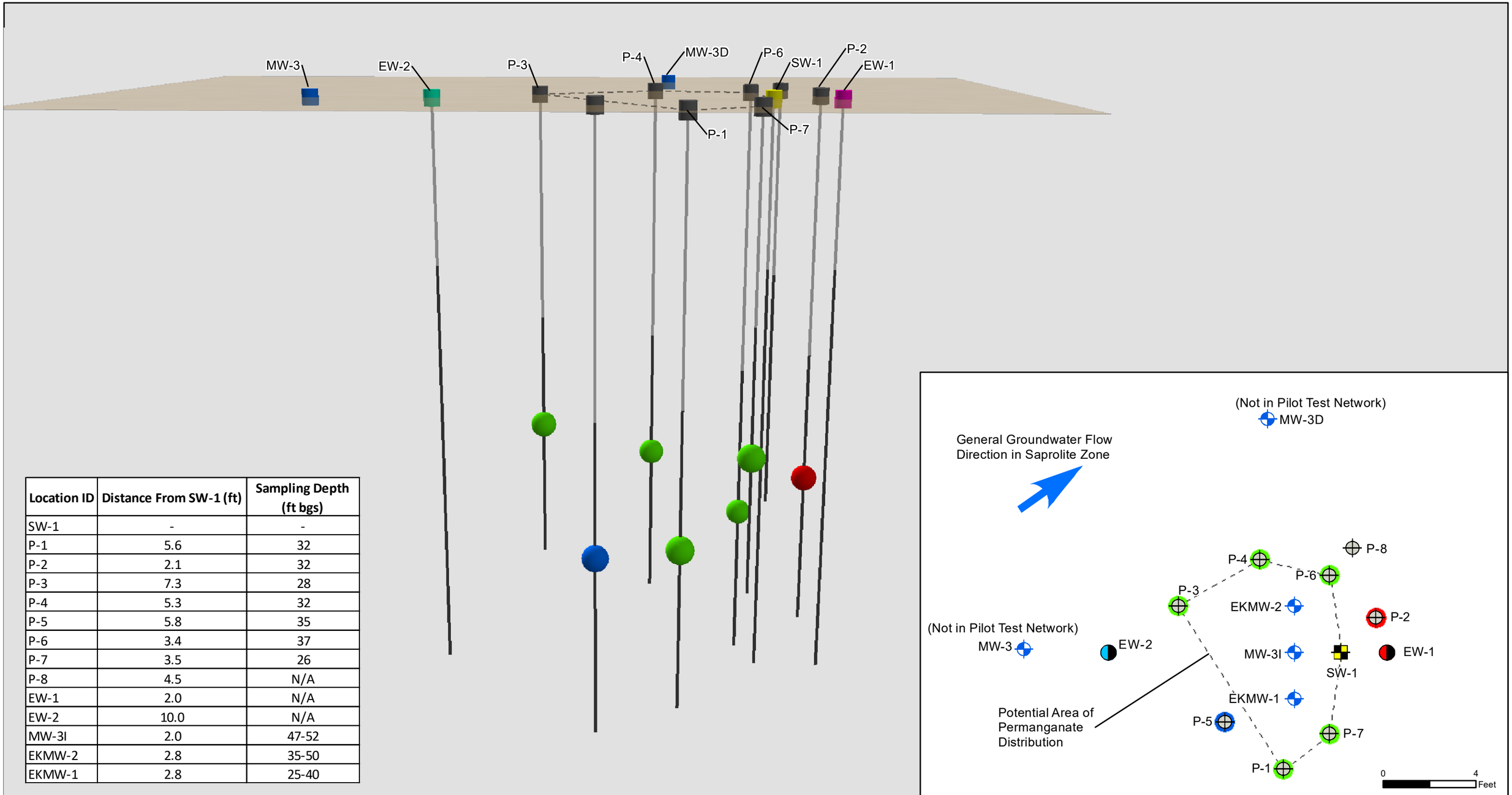

Location ID	Distance From SW-1 (ft)	Sampling Depth (ft bgs)
SW-1	-	-
P-1	5.6	32
P-2	2.1	32
P-3	7.3	28
P-4	5.3	32
P-5	5.8	35
P-6	3.4	37
P-7	3.5	26
P-8	4.5	N/A
EW-1	2.0	N/A
EW-2	10.0	N/A
MW-3I	2.0	47-52
EKMW-2	2.8	35-50
EKMW-1	2.8	25-40

Legend

- Electrode Well - Anode
- Electrode Well - Cathode
- Monitoring Well
- Supply Well
- DPT Sampling Location

Permanganate Field Sampling Results (Avg. PPM)

- 0.0
- 0.0 - 0.05
- 0.05 - 1.5

Notes:
N/A - Not Applicable
PPM - Parts Per Million

N

Post-Test Groundwater Permanganate Sampling

EK-ISCO Pilot Test
Cristex Drum Site
Oxford, Granville County, North Carolina

Geosyntec consultants

Columbia, Maryland | May 2020

Figure 6-3B

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Appendices

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Appendix A
Access Authorization

ACCESS AUTHORIZATION

1. I, Michael S. Felts as manager for the County of Granville have the authority to sign this Access Authorization to allow access to the properties designated as **Parcel ID 191211577430 and Parcel ID 191211567918** ("Properties").

2. I grant authorization to the United States Environmental Protection Agency, its officers, employees, contractors, and other authorized representatives to enter the Properties. This authorization allows the EPA, its officers, employees, contractors, and other authorized personnel to have access to the Properties to conduct environmental remediation activities in connection with the Cristex Drums Superfund Site in Oxford, Granville County, North Carolina ("Site") is deemed necessary by the EPA. The EPA's activities at the Properties will include, but are not limited to the following:

   a. Removal of buildings, structures, slabs, metal debris, trash, and other materials to facilitate remedial activities and associated construction activities;

   b. Collection of surface, subsurface soil, sediment, groundwater, air, and waste samples;

   c. Documenting remediation activities at the Properties by inspecting, sketching, photographing, and/or videotaping the premises;

   d. Excavation and removal of contaminated soil and sediment to designated areas;

   e. Restoration activities, including backfilling, replacement of grass, bushes, shrubbery, trees, and planting, and replacement of existing fencing;

   f. Transportation of equipment, supplies, and/or temporary structures onto and about the Properties as necessary to accomplish the above activities;

   g. Temporary storage of equipment, as necessary, to accomplish the above activities;

   h. Demolition of the existing Cristex building and Construction activities associated with the following: Soil Excavation, Electrokinetics-In Situ Chemical Oxidation, and Enhanced In Situ Bioremediation on the Properties; and,

   i. Other activities as needed to complete the remedial activities at the Site.

3. All tools, equipment, and other property taken upon and placed upon the Properties by the EPA, its officers, employees, contractors, and other authorized representatives, shall remain their Properties. The EPA, its officers, employees, contractors, and other

authorized representatives may remove such tools, equipment, and other property at any time within a reasonable period, including within a reasonable time after the expiration of this Access Agreement.

4. The consent for access granted herein will commence on upon the date of execution below and will continue until the EPA completes remedial activities at the Site.

5. I have been notified that these actions by the EPA are undertaken pursuant to its response authority under Section 104(a) of the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), 42 U.S.C. § 9604(a).

Date: 1/16/, 2020

Printed Name of Responsible Official: Michael S. Felts, County Manager

Signature of Responsible Official: [signature]

Mailing Address: P.O. Box 906 (mail); 141 Gilliam Street (delivery); Oxford, North Carolina 27565

Phone number: (919) 693-5240

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Appendix B
Well Construction Records

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WELL CONSTRUCTION RECORD

This form can be used for single or multiple wells

1. Well Contractor Information:

NICHOLAS HAYES

Well Contractor Name

A - 4121

NC Well Contractor Certification Number

GEOLOGIC EXPLORATION, INC

Company Name

2. Well Construction Permit #: _____

List all applicable well construction permits (i.e. County, State, Variance, etc.)

3. Well Use (check well use):

Water Supply Well:

☐Agricultural ☐Municipal/Public
☐Geothermal (Heating/Cooling Supply) ☐Residential Water Supply (single)
☐Industrial/Commercial ☐Residential Water Supply (shared)
☐Irrigation

Non-Water Supply Well:

☐Monitoring ☐Recovery

Injection Well:

☐Aquifer Recharge ☑Groundwater Remediation
☐Aquifer Storage and Recovery ☐Salinity Barrier
☐Aquifer Test ☐Stormwater Drainage
☐Experimental Technology ☐Subsidence Control
☐Geothermal (Closed Loop) ☐Tracer
☐Geothermal (Heating/Cooling Return) ☐Other (explain under #21 Remarks)

4. Date Well(s) Completed: 12/03/19 **Well ID#** EW-1

5a. Well Location:

CRISTEX DRUM

Facility/Owner Name

Facility ID# (if applicable)

699 INDUSTRY DRIVE OXFORD 27565

Physical Address, City, and Zip

GRANVILLE

County

Parcel Identification No. (PIN)

5b. Latitude and Longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)

36° 17' 48.83" **N** 78° 30' 22.96" **W**

6. Is (are) the well(s): ☑**Permanent** **or** ☐**Temporary**

7. Is this a repair to an existing well: ☐**Yes** **or** ☑**No**

If this is a repair, fill out known well construction information and explain the nature of the repair under #21 remarks section or on the back of this form.

8. Number of wells constructed: 1

*For multiple injection or non-water supply wells **ONLY** with the **same construction**, you can submit one form.*

9. Total well depth below land surface: 50.0 **(ft.)**

For multiple wells list all depths if different (example- 3@200' and 2@100')

10. Static water level below top of casing: 20.0 **(ft.)**

If water level is above casing, use "+"

11. Borehole diameter: 10.0 **(in.)**

12. Well construction method: AUGER

(i.e. auger, rotary, cable, direct push, etc.)

FOR WATER SUPPLY WELLS ONLY:

13a. Yield (gpm) _____ **Method of test:** _____

13b. Disinfection type: _____ **Amount:** _____

For Internal Use ONLY:

14. WATER ZONES

FROM	TO	DESCRIPTION
ft.	ft.	
ft.	ft.	

15. OUTER CASING (for multi-cased wells) OR LINER (if applicable)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
ft.	ft.	in.		

16. INNER CASING OR TUBING (geothermal closed-loop)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
0.0 ft.	20.0 ft.	4.0 in.	SCH 40	PVC
ft.	ft.	in.		

17. SCREEN

FROM	TO	DIAMETER	SLOT SIZE	THICKNESS	MATERIAL
20.0 ft.	50.0 ft.	4.0 in.	.010	SCH 40	PVC
ft.	ft.	in.			

18. GROUT

FROM	TO	MATERIAL	EMPLACEMENT METHOD & AMOUNT
0.0 ft.	16.0 ft.	PORTLAND BENTONITE	SLURRY
ft.	ft.		
ft.	ft.		

19. SAND/GRAVEL PACK (if applicable)

FROM	TO	MATERIAL	EMPLACEMENT METHOD
18.0 ft.	50.0 ft.	20-40	FINE SILICA SAND
ft.	ft.		

20. DRILLING LOG (attach additional sheets if necessary)

FROM	TO	DESCRIPTION (color, hardness, soil/rock type, grain size, etc.)
0.0 ft.	48.0 ft.	BROWN SANDY SILT
48.0 ft.	50.0 ft.	PWR
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	

21. REMARKS

BENTONITE SEAL FROM 16.0 TO 18.0 FEET

22. Certification:

Signature of Certified Well Contractor

12/18/19

Date

By signing this form, I hereby certify that the well(s) was (were) constructed in accordance with 15A NCAC 02C .0100 or 15A NCAC 02C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

23. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well construction details. You may also attach additional pages if necessary.

SUBMITTAL INSTUCTIONS

24a. For All Wells: Submit this form within 30 days of completion of well construction to the following:

Division of Water Quality, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

24b. For Injection Wells: In addition to sending the form to the address in 24a above, also submit a copy of this form within 30 days of completion of well construction to the following:

Division of Water Quality, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

24c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well construction to the county health department of the county where constructed.

WELL CONSTRUCTION RECORD

This form can be used for single or multiple wells

1. Well Contractor Information:

NICHOLAS HAYES

Well Contractor Name

A - 4121

NC Well Contractor Certification Number

GEOLOGIC EXPLORATION, INC

Company Name

2. Well Construction Permit #: _____

List all applicable well construction permits (i.e. County, State, Variance, etc.)

3. Well Use (check well use):

Water Supply Well:

☐Agricultural ☐Municipal/Public
☐Geothermal (Heating/Cooling Supply) ☐Residential Water Supply (single)
☐Industrial/Commercial ☐Residential Water Supply (shared)
☐Irrigation

Non-Water Supply Well:

☐Monitoring ☐Recovery

Injection Well:

☐Aquifer Recharge ☑Groundwater Remediation
☐Aquifer Storage and Recovery ☐Salinity Barrier
☐Aquifer Test ☐Stormwater Drainage
☐Experimental Technology ☐Subsidence Control
☐Geothermal (Closed Loop) ☐Tracer
☐Geothermal (Heating/Cooling Return) ☐Other (explain under #21 Remarks)

4. Date Well(s) Completed: 12/02/19 **Well ID#** EW-2

5a. Well Location:

CRISTEX DRUM

Facility/Owner Name

Facility ID# (if applicable)

699 INDUSTRY DRIVE OXFORD 27565

Physical Address, City, and Zip

GRANVILLE

County

Parcel Identification No. (PIN)

5b. Latitude and Longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)

36° 17' 48.74" **N** 78° 30' 23.34" **W**

6. Is (are) the well(s): ☑**Permanent** **or** ☐**Temporary**

7. Is this a repair to an existing well: ☐**Yes** **or** ☑**No**

If this is a repair, fill out known well construction information and explain the nature of the repair under #21 remarks section or on the back of this form.

8. Number of wells constructed: 1

*For multiple injection or non-water supply wells **ONLY** with the **same construction**, you can submit one form.*

9. Total well depth below land surface: 50.0 **(ft.)**

For multiple wells list all depths if different (example- 3@200' and 2@100')

10. Static water level below top of casing: 20.0 **(ft.)**

If water level is above casing, use "+"

11. Borehole diameter: 10.0 **(in.)**

12. Well construction method: AUGER

(i.e. auger, rotary, cable, direct push, etc.)

FOR WATER SUPPLY WELLS ONLY:

13a. Yield (gpm) _____ **Method of test:** _____

13b. Disinfection type: _____ **Amount:** _____

For Internal Use ONLY:

14. WATER ZONES

FROM	TO	DESCRIPTION
ft.	ft.	
ft.	ft.	

15. OUTER CASING (for multi-cased wells) OR LINER (if applicable)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
ft.	ft.	in.		

16. INNER CASING OR TUBING (geothermal closed-loop)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
0.0 ft.	20.0 ft.	4.0 in.	SCH 40	PVC
ft.	ft.	in.		

17. SCREEN

FROM	TO	DIAMETER	SLOT SIZE	THICKNESS	MATERIAL
20.0 ft.	50.0 ft.	4.0 in.	.010	SCH 40	PVC
ft.	ft.	in.			

18. GROUT

FROM	TO	MATERIAL	EMPLACEMENT METHOD & AMOUNT
0.0 ft.	16.0 ft.	PORTLAND BENTONITE	SLURRY
ft.	ft.		
ft.	ft.		

19. SAND/GRAVEL PACK (if applicable)

FROM	TO	MATERIAL	EMPLACEMENT METHOD
18.0 ft.	50.0 ft.	20-40	FINE SILICA SAND
ft.	ft.		

20. DRILLING LOG (attach additional sheets if necessary)

FROM	TO	DESCRIPTION (color, hardness, soil/rock type, grain size, etc.)
0.0 ft.	48.0 ft.	BROWN SANDY SILT
48.0 ft.	50.0 ft.	PWR
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	

21. REMARKS

BENTONITE SEAL FROM 16.0 TO 18.0 FEET

22. Certification:

Signature of Certified Well Contractor

12/18/19

Date

By signing this form, I hereby certify that the well(s) was (were) constructed in accordance with 15A NCAC 02C .0100 or 15A NCAC 02C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

23. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well construction details. You may also attach additional pages if necessary.

SUBMITTAL INSTUCTIONS

24a. For All Wells: Submit this form within 30 days of completion of well construction to the following:

Division of Water Quality, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

24b. For Injection Wells: In addition to sending the form to the address in 24a above, also submit a copy of this form within 30 days of completion of well construction to the following:

Division of Water Quality, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

24c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well construction to the county health department of the county where constructed.

WELL CONSTRUCTION RECORD

This form can be used for single or multiple wells

1. Well Contractor Information:

NICHOLAS HAYES

Well Contractor Name

A - 4121

NC Well Contractor Certification Number

GEOLOGIC EXPLORATION, INC

Company Name

2. Well Construction Permit #: _____

List all applicable well construction permits (i.e. County, State, Variance, etc.)

3. Well Use (check well use):

Water Supply Well:

☐Agricultural ☐Municipal/Public
☐Geothermal (Heating/Cooling Supply) ☐Residential Water Supply (single)
☐Industrial/Commercial ☐Residential Water Supply (shared)
☐Irrigation

Non-Water Supply Well:

☐Monitoring ☐Recovery

Injection Well:

☐Aquifer Recharge ☑Groundwater Remediation
☐Aquifer Storage and Recovery ☐Salinity Barrier
☐Aquifer Test ☐Stormwater Drainage
☐Experimental Technology ☐Subsidence Control
☐Geothermal (Closed Loop) ☐Tracer
☐Geothermal (Heating/Cooling Return) ☐Other (explain under #21 Remarks)

4. Date Well(s) Completed: 12/04/19 **Well ID#** SW-1

5a. Well Location:

CRISTEX DRUM

Facility/Owner Name

Facility ID# (if applicable)

699 INDUSTRY DRIVE OXFORD 27565

Physical Address, City, and Zip

GRANVILLE

County

Parcel Identification No. (PIN)

5b. Latitude and Longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)

36° 17' 48.83" **N** 78° 30' 22.90" **W**

6. Is (are) the well(s): ☑**Permanent** **or** ☐**Temporary**

7. Is this a repair to an existing well: ☐**Yes** **or** ☑**No**

If this is a repair, fill out known well construction information and explain the nature of the repair under #21 remarks section or on the back of this form.

8. Number of wells constructed: 1

*For multiple injection or non-water supply wells **ONLY** with the **same construction**, you can submit one form.*

9. Total well depth below land surface: 50.0 **(ft.)**

For multiple wells list all depths if different (example- 3@200' and 2@100')

10. Static water level below top of casing: 20.0 **(ft.)**

If water level is above casing, use "+"

11. Borehole diameter: 10.0 **(in.)**

12. Well construction method: AUGER

(i.e. auger, rotary, cable, direct push, etc.)

FOR WATER SUPPLY WELLS ONLY:

13a. Yield (gpm) _____ **Method of test:** _____

13b. Disinfection type: _____ **Amount:** _____

For Internal Use ONLY:

14. WATER ZONES

FROM	TO	DESCRIPTION
ft.	ft.	
ft.	ft.	

15. OUTER CASING (for multi-cased wells) OR LINER (if applicable)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
ft.	ft.	in.		

16. INNER CASING OR TUBING (geothermal closed-loop)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
0.0 ft.	20.0 ft.	4.0 in.	SCH 40	PVC
ft.	ft.	in.		

17. SCREEN

FROM	TO	DIAMETER	SLOT SIZE	THICKNESS	MATERIAL
20.0 ft.	50.0 ft.	4.0 in.	.010	SCH 40	PVC
ft.	ft.	in.			

18. GROUT

FROM	TO	MATERIAL	EMPLACEMENT METHOD & AMOUNT
0.0 ft.	16.0 ft.	PORTLAND BENTONITE	SLURRY
ft.	ft.		
ft.	ft.		

19. SAND/GRAVEL PACK (if applicable)

FROM	TO	MATERIAL	EMPLACEMENT METHOD
18.0 ft.	50.0 ft.	20-40	FINE SILICA SAND
ft.	ft.		

20. DRILLING LOG (attach additional sheets if necessary)

FROM	TO	DESCRIPTION (color, hardness, soil/rock type, grain size, etc.)
0.0 ft.	48.0 ft.	BROWN SANDY SILT
48.0 ft.	50.0 ft.	PWR
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	

21. REMARKS

BENTONITE SEAL FROM 16.0 TO 18.0 FEET

22. Certification:

Signature of Certified Well Contractor

12/18/19

Date

By signing this form, I hereby certify that the well(s) was (were) constructed in accordance with 15A NCAC 02C .0100 or 15A NCAC 02C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

23. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well construction details. You may also attach additional pages if necessary.

SUBMITTAL INSTUCTIONS

24a. For All Wells: Submit this form within 30 days of completion of well construction to the following:

Division of Water Quality, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

24b. For Injection Wells: In addition to sending the form to the address in 24a above, also submit a copy of this form within 30 days of completion of well construction to the following:

Division of Water Quality, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

24c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well construction to the county health department of the county where constructed.

WELL CONSTRUCTION RECORD

This form can be used for single or multiple wells

1. Well Contractor Information:

NICHOLAS HAYES

Well Contractor Name

A - 4121

NC Well Contractor Certification Number

GEOLOGIC EXPLORATION, INC

Company Name

2. Well Construction Permit #: _____

List all applicable well construction permits (i.e. County, State, Variance, etc.)

3. Well Use (check well use):

Water Supply Well:

☐Agricultural ☐Municipal/Public
☐Geothermal (Heating/Cooling Supply) ☐Residential Water Supply (single)
☐Industrial/Commercial ☐Residential Water Supply (shared)
☐Irrigation

Non-Water Supply Well:

☑Monitoring ☐Recovery

Injection Well:

☐Aquifer Recharge ☐Groundwater Remediation
☐Aquifer Storage and Recovery ☐Salinity Barrier
☐Aquifer Test ☐Stormwater Drainage
☐Experimental Technology ☐Subsidence Control
☐Geothermal (Closed Loop) ☐Tracer
☐Geothermal (Heating/Cooling Return) ☐Other (explain under #21 Remarks)

4. Date Well(s) Completed: 12/03/19 **Well ID#** MW-1

5a. Well Location:

CRISTEX DRUM

Facility/Owner Name

Facility ID# (if applicable)

699 INDUSTRY DRIVE OXFORD 27565

Physical Address, City, and Zip

GRANVILLE

County

Parcel Identification No. (PIN)

5b. Latitude and Longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)

36° 17' 48.78" **N** 78° 30' 23.02" **W**

6. Is (are) the well(s): ☑**Permanent** **or** ☐**Temporary**

7. Is this a repair to an existing well: ☐**Yes** **or** ☑**No**

If this is a repair, fill out known well construction information and explain the nature of the repair under #21 remarks section or on the back of this form.

8. Number of wells constructed: 1

*For multiple injection or non-water supply wells **ONLY** with the **same construction**, you can submit one form.*

9. Total well depth below land surface: 40.0 **(ft.)**

For multiple wells list all depths if different (example- 3@200' and 2@100')

10. Static water level below top of casing: 20.0 **(ft.)**

If water level is above casing, use "+"

11. Borehole diameter: 8.0 **(in.)**

12. Well construction method: AUGER

(i.e. auger, rotary, cable, direct push, etc.)

FOR WATER SUPPLY WELLS ONLY:

13a. Yield (gpm) _____ **Method of test:** _____

13b. Disinfection type: _____ **Amount:** _____

For Internal Use ONLY:

14. WATER ZONES

FROM	TO	DESCRIPTION
ft.	ft.	
ft.	ft.	

15. OUTER CASING (for multi-cased wells) OR LINER (if applicable)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
ft.	ft.	in.		

16. INNER CASING OR TUBING (geothermal closed-loop)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
0.0 ft.	25.0 ft.	2.0 in.	SCH 40	PVC
ft.	ft.	in.		

17. SCREEN

FROM	TO	DIAMETER	SLOT SIZE	THICKNESS	MATERIAL
25.0 ft.	40.0 ft.	2.0 in.	.010	SCH 40	PVC
ft.	ft.	in.			

18. GROUT

FROM	TO	MATERIAL	EMPLACEMENT METHOD & AMOUNT
0.0 ft.	21.0 ft.	PORTLAND BENTONITE	SLURRY
ft.	ft.		
ft.	ft.		

19. SAND/GRAVEL PACK (if applicable)

FROM	TO	MATERIAL	EMPLACEMENT METHOD
23.0 ft.	40.0 ft.	20-40	FINE SILICA SAND
ft.	ft.		

20. DRILLING LOG (attach additional sheets if necessary)

FROM	TO	DESCRIPTION (color, hardness, soil/rock type, grain size, etc.)
0.0 ft.	40.0 ft.	BROWN SANDY SILT
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	

21. REMARKS

BENTONITE SEAL FROM 21.0 TO 23.0 FEET

22. Certification:

Signature of Certified Well Contractor

12/18/19

Date

By signing this form, I hereby certify that the well(s) was (were) constructed in accordance with 15A NCAC 02C .0100 or 15A NCAC 02C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

23. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well construction details. You may also attach additional pages if necessary.

SUBMITTAL INSTUCTIONS

24a. For All Wells: Submit this form within 30 days of completion of well construction to the following:

Division of Water Quality, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

24b. For Injection Wells: In addition to sending the form to the address in 24a above, also submit a copy of this form within 30 days of completion of well construction to the following:

Division of Water Quality, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

24c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well construction to the county health department of the county where constructed.

WELL CONSTRUCTION RECORD

This form can be used for single or multiple wells

1. Well Contractor Information:

NICHOLAS HAYES

Well Contractor Name

A - 4121

NC Well Contractor Certification Number

GEOLOGIC EXPLORATION, INC

Company Name

2. Well Construction Permit #: _____

List all applicable well construction permits (i.e. County, State, Variance, etc.)

3. Well Use (check well use):

Water Supply Well:

☐Agricultural ☐Municipal/Public
☐Geothermal (Heating/Cooling Supply) ☐Residential Water Supply (single)
☐Industrial/Commercial ☐Residential Water Supply (shared)
☐Irrigation

Non-Water Supply Well:

☑Monitoring ☐Recovery

Injection Well:

☐Aquifer Recharge ☐Groundwater Remediation
☐Aquifer Storage and Recovery ☐Salinity Barrier
☐Aquifer Test ☐Stormwater Drainage
☐Experimental Technology ☐Subsidence Control
☐Geothermal (Closed Loop) ☐Tracer
☐Geothermal (Heating/Cooling Return) ☐Other (explain under #21 Remarks)

4. Date Well(s) Completed: 12/03/19 **Well ID#** MW-2

5a. Well Location:

CRISTEX DRUM

Facility/Owner Name

Facility ID# (if applicable)

699 INDUSTRY DRIVE OXFORD 27565

Physical Address, City, and Zip

GRANVILLE

County

Parcel Identification No. (PIN)

5b. Latitude and Longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)

36° 17' 48.85" **N** 78° 30' 22.98" **W**

6. Is (are) the well(s): ☑**Permanent** **or** ☐**Temporary**

7. Is this a repair to an existing well: ☐**Yes** **or** ☑**No**

If this is a repair, fill out known well construction information and explain the nature of the repair under #21 remarks section or on the back of this form.

8. Number of wells constructed: 1

*For multiple injection or non-water supply wells **ONLY** with the **same construction**, you can submit one form.*

9. Total well depth below land surface: 50.0 **(ft.)**

For multiple wells list all depths if different (example- 3@200' and 2@100')

10. Static water level below top of casing: 20.0 **(ft.)**

If water level is above casing, use "+"

11. Borehole diameter: 8.0 **(in.)**

12. Well construction method: AUGER

(i.e. auger, rotary, cable, direct push, etc.)

FOR WATER SUPPLY WELLS ONLY:

13a. Yield (gpm) _____ **Method of test:** _____

13b. Disinfection type: _____ **Amount:** _____

For Internal Use ONLY:

14. WATER ZONES

FROM	TO	DESCRIPTION
ft.	ft.	
ft.	ft.	

15. OUTER CASING (for multi-cased wells) OR LINER (if applicable)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
ft.	ft.	in.		

16. INNER CASING OR TUBING (geothermal closed-loop)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
0.0 ft.	35.0 ft.	2.0 in.	SCH 40	PVC
ft.	ft.	in.		

17. SCREEN

FROM	TO	DIAMETER	SLOT SIZE	THICKNESS	MATERIAL
35.0 ft.	50.0 ft.	2.0 in.	.010	SCH 40	PVC
ft.	ft.	in.			

18. GROUT

FROM	TO	MATERIAL	EMPLACEMENT METHOD & AMOUNT
0.0 ft.	31.0 ft.	PORTLAND BENTONITE	SLURRY
ft.	ft.		
ft.	ft.		

19. SAND/GRAVEL PACK (if applicable)

FROM	TO	MATERIAL	EMPLACEMENT METHOD
33.0 ft.	50.0 ft.	20-40	FINE SILICA SAND
ft.	ft.		

20. DRILLING LOG (attach additional sheets if necessary)

FROM	TO	DESCRIPTION (color, hardness, soil/rock type, grain size, etc.)
0.0 ft.	48.0 ft.	BROWN SANDY SILT
48.0 ft.	50.0 ft.	PWR
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	

21. REMARKS

BENTONITE SEAL FROM 31.0 TO 33.0 FEET

22. Certification:

Signature of Certified Well Contractor

12/18/19

Date

By signing this form, I hereby certify that the well(s) was (were) constructed in accordance with 15A NCAC 02C .0100 or 15A NCAC 02C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

23. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well construction details. You may also attach additional pages if necessary.

SUBMITTAL INSTUCTIONS

24a. For All Wells: Submit this form within 30 days of completion of well construction to the following:

Division of Water Quality, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

24b. For Injection Wells: In addition to sending the form to the address in 24a above, also submit a copy of this form within 30 days of completion of well construction to the following:

Division of Water Quality, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

24c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well construction to the county health department of the county where constructed.

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Appendix C
Field Sampling Forms

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Geosyntec consultants

10211 Wincopin Circle, 4th Floor
Columbia Maryland 21044

GROUNDWATER SAMPLING LOG

Project Name: Cristex Drum Site
Project Number: GR6764 Phase: 07
Location: Oxford NC
Date: 12 / 12 / 19
Task:
Personnel: Alli W

Sample Type: GW
Location ID: EK MW-1
Duplicate ID: —
Location Type:
Depth Measurement Location:
Screen Interval (ft): -40
Well Diameter (inches): 2"
DTW (feet): 24.94'
DTB (feet) from prior data: 40.0'
Pump Setting (feet): 26'

Purge Method

Time	DTW (ft)	pH (S.U.)	Conductivity (µS/cm)	Temp. (°C)	Turbidity (NTU)	ORP (mV)	DO (mg/L)	Flow rate (mL/min)
1000	24.94							250
1015	24.95	6.49	239	11.75	139	61.0	0.89	150
1020	24.95	6.49	238	12.48	138	62.8	1.07	150
1025	24.95	6.50	238	13.50	134	64.7	1.18	150
1030	24.95	6.48	240	12.37	135	59.4	1.18	150
1035	24.98	6.49	239	12.75	116	50.6	1.08	150
1040	24.98	6.48	236	13.95	107	44.5	0.70	150
1050	24.98	6.51	241	13.75	96.7	31.3	1.22	150
1055	24.98	6.51	234	14.70	87.4	42.0	1.31	150
1100	24.98	6.49	234	14.76	92.6	32.9	1.19	150
1110	24.99	6.48	235	15.24	92.1	29.2	1.16	150
1115	24.98	6.50	234	15.44	84.7	22.3	1.19	150

Sample Method: Peri-pump Rate (mL/min): 150 Date: 12/12/19 Time: 1125

Final/Sample Field Parameters		Stabilization Guidance	
pH	6.50	± 0.1	met? Y / N
Conductivity (uS)	234	± 3%	met? Y / N
Temp. (°C)	14.90	none	
Turbidity (NTU)	90.1	±10% or <10	met? Y / N
ORP (mV)	24.8	± 10	met? Y / N
DO (mg/L)	1.23	±10% if > 0.5 or 3 read < 0.5	met? Y / N

NOTES:

SAMPLE COLOR: Clear / slight cloudy

Constituent	Method	Container	Preservative	Filtered?
VOC		3 vials	ascorbic	N
VOC (no/a)		3 vials	NA	N
Dissolved metals		1 500 mL	NA	N
DM Dup		1 500 mL	NA	N
DM Rinsate		1 500 mL	NA	N
permanganate strip	- 0.0 Reading 2X		NA	N
VOC Rinsate		3 vials	ascorbic	

COMMENTS:

Geosyntec consultants

10211 Wincopin Circle, 4th Floor
Columbia Maryland 21044

GROUNDWATER SAMPLING LOG

Project Name: Cristey Drum Site
Date: 12 / 12 / 19
Project Number: C-R6764
Phase: 07
Task:
Location: Oxford NC
Personnel: Alli VB

Sample Type: GW
Location Type:
Depth Measurement Location:
DTW (feet): 22.51'
DTB (feet) from prior data: 50
Location ID: MW-31
Screen Interval (ft):
Pump Setting (feet): 24'
Duplicate ID: —
Well Diameter (inches): 2"

Purge Method

Time	DTW (ft)	pH (S.U.)	Conductivity (µS/cm)	Temp. (°C)	Turbidity (NTU)	ORP (mV)	DO (mg/L)	Flow rate (mL/min)
1155	22.51	—	—	—	—	—	—	150
1205	22.52	7.02	270	15.97	44.0	107.5	3.22	150
1210	22.54	7.21	272	17.28	41.7	97.9	1.02	150
1215	22.55	7.23	278	16.21	35.2	98.5	1.19	150
1220	22.56	7.23	270	15.91	32.1	98.4	0.80	150
1225	22.58	7.15	260	16.41	28.5	94.8	1.05	150
1230	22.58	7.13	253	16.06	24.0	95.0	0.96	150
1245	22.58	7.01	245	16.89	24.6	94.8	0.90	150
1250	22.58	6.97	236	16.23	22.6	95.1	1.36	150
1255	22.57	6.91	232	16.04	22.3	95.6	1.17	150
1300	22.57	6.94	230	15.44	22.3	97.0	1.21	150
1305	22.57	6.90	232	15.92	22.3	96.1	1.15	150

Sample Method: Peri-pump Rate (mL/min): 150 Date: 12/12/19 Time: 1315

Final/Sample Field Parameters		Stabilization Guidance		
pH	~~19.94~~	± 0.1	6.89	met? Y / N
Conductivity (uS)	229	± 3%		met? Y / N
Temp. (°C)	15.73	none		
Turbidity (NTU)	21.9	±10% or <10		met? Y / N
ORP (mV)	97.8	± 10		met? Y / N
DO (mg/L)	1.16	±10% if > 0.5 or 3 read < 0.5		met? Y / N

NOTES:

SAMPLE COLOR: clear

Constituent	Method	Container	Preservative	Filtered?
VOC		3 vials	ascorbic	N
VOC duplicate		"	ascorbic	N
VOC w/o Acid		"	NA	N
metal dissolved		1 500 mL	NA	N
permanganate kit	Reading = 0.0 (2x)			

COMMENTS:

Geosyntec consultants

10211 Wincopin Circle, 4th Floor
Columbia Maryland 21044

GROUNDWATER SAMPLING LOG

Project Name: Cristex Drum Site
Date: 12 / 12 / 19
Project Number: GR6764
Phase: 07
Task: 04
Location: Oxford NC
Personnel: Alli VD

Sample Type: GW
Location Type: —
Depth Measurement Location: —
DTW (feet): 24.89'
DTB (feet) from prior data: 50.0'
Location ID: EKIMW-2
Screen Interval (ft): 20-50
Pump Setting (feet): 26'
Duplicate ID: —
Well Diameter (inches): 2"

Purge Method

Time	DTW (ft)	pH (S.U.)	Conductivity (µS/cm)	Temp. (°C)	Turbidity (NTU)	ORP (mV)	DO (mg/L)	Flow rate (mL/min)
1330								150
1340	24.91	6.78	241	13.81	12.9	61.2	2.31	150
1350	24.92	6.86	244	14.07	13.9	-80.5	1.40	150
1400	24.92	6.86	231	12.45	19.8	-140.6	1.22	150
1405	24.92	6.88	229	13.61	16.6	-133.2	1.54	150
1410	24.91	6.89	220	13.40	18.6	-136.9	1.40	150
1415	24.92	6.86	200	13.67	18.8	-137.8	1.31	150
1420	24.90	6.84	190	AVI 13.96	13.5	-142.9	1.32	150
1425	24.90	6.85	199	14.48	14.6	-145.8	1.01	150
1430	24.90	6.83	203	13.66	13.9	-140.0	0.98	150
1435	24.90	6.85	206	14.22	13.8	-143.1	1.00	150
1440	24.90	6.86	205	13.49	12.9	-144.0	1.02	150

Sample Method: peri pump Rate (mL/min): Date: 12/12/19 Time: 1445

Final/Sample Field Parameters		Stabilization Guidance	
pH	~~12.4~~ 6.85 AV	± 0.1	met? Y / N
Conductivity (uS)	208	± 3%	met? Y / N
Temp. (°C)	13.48	none	
Turbidity (NTU)	12.4	±10% or <10	met? Y / N
ORP (mV)	-145.1	± 10	met? Y / N
DO (mg/L)	1.01	±10% if > 0.5 or 3 read < 0.5	met? Y / N

NOTES:

SAMPLE COLOR:

Constituent	Method	Container	Preservative	Filtered?
VOC	V8260SL	3 vials	ascorbic	N
Dissolved Metals		1 500ml	NA	N
MS		3 vials	ascorbic	N
MSD		3 vials	ascorbic	N

COMMENTS:

Geosyntec Consultants
Groundwater Sampling Log

Geosyntec consultants

Project Name: Cristex Location: Oxford, NC Date: 2/24/2020

Project Number: GR6764 Phase/Task: 07/04 Personnel: R. Grabelman

Well ID: EK-MW1 Screen Interval (ft) 30-40 DTW (ft) 23.31

Pump/Tubing Setting (ft) 34 DTB (ft) 40

Well Diameter (in) 2 Depth To Product (ft) NA

Tubing Diameter (in) 1/4

Water Quality Meter Model #: YSI w/flow through Measurement Location: TOC

Time	Purge Rate (mL/min)	DTW (ft)	pH (S.U.)	Specific Conductance (µS/cm)	Temp (°C)	Turbidity (NTU)	ORP (mV)	DO (mg/L)	Comments
1030	BEGIN PURGE								
1040	150	23.36	6.34	161	15.54	clear	172.7	1.54	
1050		23.38	6.33	163	15.62		187.1	1.63	
1055		23.38	6.33	162	15.67		193.9	1.43	
1100		23.38	6.32	160	15.68		200.1	1.86	
1105		23.38	6.31	159	15.72		203.1	1.94	
1110		23.38	6.31	158	15.70		203.7	2.34	
1115		23.38	6.31	158	15.76		201.9	2.42	
1120		23.38	6.31	159	15.83		144.9	2.43	
1125		23.38	6.31	158	15.84		133.0	2.51	
1130		23.38	6.30	158	15.89		129.1	2.42	
1135		23.38	6.30	158	15.80		125.7	2.53	
1135	SAMPLE								

Stabilization Criteria	*EPA Region 4*	*ASTM D 6771-02*
pH	0.1	0.2
Sp. Cond.	5%	3%
Turbitiy	10% or <10 NTU	none
DO	10% or 0.2 mg/L	10% or 0.2 mg/L
ORP	none	20 mV

Sample ID with Time and Analysis

SAMPLE:

EK-MW1 @ 1135

DUP-1 @ 1200

Permanganate: 0.0 mg/L

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY

= (feet - feet) x gallons/foot = gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME

= (gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2**

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Geosyntec Consultants
Groundwater Sampling Log

Geosyntec consultants

Project Name: Cristex Location: Oxford, NC Date: 2/24/2020

Project Number: GR6764 Phase/Task: 07/04 Personnel: R. Gabelman

Well ID: MW-31 Screen Interval (ft) ~~45~~ 47-52 DTW (ft) 20.9

Pump/Tubing Setting (ft) 48 DTB (ft) 50

Well Diameter (in) 2 Depth To Product (ft) NA

Tubing Diameter (in) 1/4

Water Quality Meter Model #: YSI w/flow throug Measurement Location:

Time	Purge Rate (mL/min)	DTW (ft)	pH (S.U.)	Specific Conductance (µS/cm)	Temp (°C)	Turbidity (NTU)	ORP (mV)	DO (mg/L)	Comments
1215	BEGIN		PURGE						
1225	150	21.08	10.53	547	15.54	Clear	80.9	5.68	
1235		21.1	10.53	551	15.54	Clear	267.9	5.21	
1240		21.1	10.48	558	15.45	Pink	340.1	5.0	
1245		21.1	6.80	5246	15.50	Pink	608.7	5.21	
1250		21.1	6.73	5826	15.48	D. Pink	647	3.20	
1300		21.1	6.73	5683	15.51	D. Pink	665.3	3.25	
1305		21.1	6.71	5476	15.47	D. Pink	672.7	3.26	
1310		21.1	6.70	5297	15.45	D. Pink	676.9	3.58	
1315		21.1	6.68	5096	15.52	D. Pink	684.7	3.67	
1320		21.1	6.69	5109	15.53	D. Pink	686.1	3.89	
1330		21.1	6.68	5235	15.60	D. Pink	686.9	3.96	
1335		21.1	6.72	5507	15.48	D. Pink	688.9	4.1	
1340		21.1	6.76	5737	15.51	D. Pink	689.5	4.30	
1345		21.1	6.80	5886	15.38	D. Pink	689.4	4.42	

Stabilization Criteria	*EPA Region 4*	*ASTM D 6771-02*
pH	0.1	0.2
Sp. Cond.	5%	3%
Turbitiy	10% or <10 NTU	none
DO	10% or 0.2 mg/L	10% or 0.2 mg/L
ORP	none	20 mV

Sample ID with Time and Analysis

SAMPLE:
MW-31 @ 1350
MW-31MS @ 1400
MW-31MSD @ 1410

Permanganate > 3.0 mg/L

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY
= (feet - feet) x gallons/foot = gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
= (gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2**

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Geosyntec Consultants
Groundwater Sampling Log

Geosyntec consultants

Project Name: Cristex Location: Oxford, NC Date: 2/24/2020

Project Number: GR6764 Phase/Task: 07/04 Personnel: R. Grabelman

Well ID: EK-MW2 Screen Interval (ft) 20-50 DTW (ft) 23.19

Pump/Tubing Setting (ft) 42 DTB (ft) 50

Well Diameter (in) 2 Depth To Product (ft) NA

Tubing Diameter (in) 1/4

Water Quality Meter Model #: YSI w/flow through Measurement Location: TOC

Time	Purge Rate (mL/min)	DTW (ft)	pH (S.U.)	Specific Conductance (µS/cm)	Temp (°C)	Turbidity (NTU)	ORP (mV)	DO (mg/L)	Comments
1430	BEGIN		PURGE						
1435	150	23.32	5.79	177	14.6	clear	317.6	1.86	
1445		23.32	6.40	173	14.95		308.5	2.01	
1455		23.35	6.53	174	15.14		299.8	2.18	
1505		23.35	6.56	174	15.11		305.9	2.33	
1510		23.35	6.57	172	15.03		312.1	2.32	
1515		23.35	6.58	173	15.09		342.3	2.28	
1520		23.35	6.58	173	14.97		338.9	2.29	
1525		23.35	6.59	172	15.07		353.2	2.23	
1535		23.35	6.59	172	15.11		355.9	2.30	
1540		23.35	6.60	172	15.04		348.1	2.34	
1540	SAMPLE								

Stabilization Criteria	*EPA Region 4*	*ASTM D 6771-02*
pH	*0.1*	*0.2*
Sp. Cond.	*5%*	*3%*
Turbitiy	*10% or <10 NTU*	*none*
DO	*10% or 0.2 mg/L*	*10% or 0.2 mg/L*
ORP	*none*	*20 mV*

Sample ID with Time and Analysis

Sample: EK-MW2@1540

permanganate: 0 mg/L

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY

= (feet - feet) x gallons/foot = gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME

= (gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2**

Scanned with CamScanner

Geosyntec Consultants
Groundwater Sampling Log

Geosyntec consultants

Project Name: Cristex Drum Site Location: Oxford NC Date: 3/16/2020

Project Number: GR6764 Phase/Task: 07/08 Personnel: ALL VD

Well ID: EKMW-2 Screen Interval (ft) 30-50' DTW (ft) 22.91'

Pump/Tubing Setting (ft) 30' DTB (ft) 50'

Well Diameter (in) 2" Depth To Product (ft) —

Tubing Diameter (in) 1/4"

Water Quality Meter Model #: Geotech # 5419 + (YSI w/flow cell) Measurement Location: 30' TOC

Time	Purge Rate (mL/min)	DTW (ft)	pH (S.U.)	Specific Conductance (µS/cm)	Temp (°C)	Turbidity (NTU)	ORP (mV)	DO (mg/L) (%)	Comments
1120	150	22.91	PURGE	—	—	—	—	—	—
1125	150	23.04	7.60	163	15.08	5.68	34.6	106.4	—
1130	150	23.05	7.11	160	15.47	10.18	42.5	65.9	—
1135	130	23.05	7.06	157	15.53	7.55	45.5	62.4	—
1145	130	23.06	6.93	154	15.53	7.36	51.0	54.4	—
1150	130	23.06	10.87	154	15.62	7.15	52.5	52.0	—
1200	130	23.06	6.85	154	15.77	10.5	53.6	46.0	—
1205	130	23.06	6.84	154	15.85	10.0	53.9	47.2	—
1210	130	23.06	10.83	153	15.69	11.1	59.9	46.5	—
1220	130	23.06	6.80	153	15.75	11.2	200.4	43.9	—
1225	130	23.06	6.72	154	15.85	11.3	432.9	44.7	pinkish
1230	130	23.06	6.66	155	15.90	9.79	470.7	43.6	"
1235	130	23.07	6.62	156	16.12	9.80	527.5	44.5	"
1240	130	23.07	6.63	157	16.17	9.74	549.0	41.4	"
1245	130	23.07	6.59	156	16.04	9.98	570.2	42.3	"
1250	130	23.07	6.58	154	15.88	9.94	580.1	43.7	"
1255	130	23.07	6.56	154	16.09	9.61	585.7	41.9	"
1300	SAMPLE								

Stabilization Criteria		EPA Region 4	ASTM D 6771-02
pH	✓	0.1	0.2
Sp. Cond.	✓	5%	3%
Turbitiy	✓	10% or <10 NTU	none
DO	✓	10% or 0.2 mg/L	10% or 0.2 mg/L
ORP	✗	none	20 mV

Sample ID with Time and Analysis

EKMW-2 - 20200316 @ 1300

DUP-1 @ 1315

Permanganate = 0.05 mg/L

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY

= (50 feet - 23 feet) x 0.16 gallons/foot = gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME

= (gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.

Geosyntec Consultants
Groundwater Sampling Log

Geosyntec consultants

Project Name: Cristex Drum Site Location: Oxford NC Date: 3/16/2020

Project Number: GR6764 Phase/Task: 07/08 Personnel: ALL VO

Well ID: EK-MW1 Screen Interval (ft) 30-40 DTW (ft) 22.94'

Pump/Tubing Setting (ft) 34 DTB (ft) 40

Well Diameter (in) 2 Depth To Product (ft) NA

Tubing Diameter (in) 1/4"

Water Quality Meter Model #: YSI w/flow cell Measurement Location: TOC

geotech pump w/flow cell

Time	Purge Rate (mL/min)	DTW (ft)	pH (S.U.)	Specific Conductance (µS/cm)	Temp (°C)	Turbidity (NTU)	ORP (mV)	DO (mg/L) (%)	Comments
1330	130	22.94	PURGE	—	—	—	—	—	—
1340	130	22.95	6.28	135	16.51	3.11	552.3	40.6	—
1345	130	22.95	6.27	135	16.77	3.29	527.2	27.7	—
1350	130	22.96	6.22	134	16.55	3.97	519.4	27.2	—
1355	130	22.96	6.19	133	16.51	4.23	515.1	28.0	—
1400	130	22.97	6.19	132	16.40	6.81	509.9	27.4	—
1410	130	22.99	6.19	132	16.49	1.81	505.5	27.3	—
1415	130	22.99	6.19	132	16.38	1.92	507.7	28.1	—
1415	SAMPLE								

Stabilization Criteria		EPA Region 4	ASTM D 6771-02
pH	✓	0.1	0.2
Sp. Cond.	✓	5%	3%
Turbitiy	✓	10% or <10 NTU	none
DO	✓	10% or 0.2 mg/L	10% or 0.2 mg/L
ORP	✓	none	20 mV

Sample ID with Time and Analysis

EKMW-1 @ 1415
EKMW-1-MS @ 1425
EKMW-1-MSD @ 1440

Permanganate = 0.0 mg/L

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY
= (feet - feet) x gallons/foot = gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
= (gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.

Geosyntec Consultants
Groundwater Sampling Log

Geosyntec consultants

Project Name: Cristex Drum Site Location: Oxford NC Date: 3/16/20

Project Number: GR6764 Phase/Task: 07/08 Personnel: ALI VO

Well ID: MW-3I

Screen Interval (ft) 47-52
Pump/Tubing Setting (ft) 48
Well Diameter (in) 2
Tubing Diameter (in) 1/4"

DTW (ft) 20.09
DTB (ft) 50
Depth To Product (ft) NA

Water Quality Meter Model #: YSI w/flow cell
Geotech WLM #5419

Measurement Location: TOC

Time	Purge Rate (mL/min)	DTW (ft)	pH (S.U.)	Specific Conductance (µS/cm)	Temp (°C)	Turbidity (NTU)	ORP (mV)	DO (mg/L) (%)	Comments
1455	130	20.09	PURGE						PINK
1500	130	20.71	11.71	1227	17.30	18.7	289.7	38.8	very pink
1505	130	20.84	11.79	1253	16.91	19.2	390.2	36.9	"
1510	130	20.89	11.82	1276	16.65	20.1	396.5	36.3	"
1515	130	20.89	11.83	1282	16.52	23.4	398.2	36.0	"
1520	130	20.90	11.86	1281	16.52	23.2	398.4	35.3	"
1530	130	20.90	11.89	1301	17.20	11.0	391.3	35.1	"
1540	130	20.90	11.80	1300	16.85	10.51	403.2	35.8	"
1545	130	20.90	11.87	1298	16.80	10.62	401.4	34.9	"
1550	130	20.90	11.87	1298	16.79	10.68	405.3	35.0	"
1555	130	20.90	11.88	1304	17.02	10.73	405.5	35.6	
1600	SAMPLE								

Stabilization Criteria	EPA Region 4	ASTM D 6771-02
pH ✓	0.1	0.2
Sp. Cond.	5%	3%
Turbitiy	10% or <10 NTU	none
DO	10% or 0.2 mg/L	10% or 0.2 mg/L
ORP ✓	none	20 mV

Sample ID with Time and Analysis

MW-3I @ 1600
metals (end of sampling very purple after injection)

Permanganate >3.0 mg/L

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY
= (feet - feet) x gallons/foot = gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
= (gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.

Geosyntec Consultants
Groundwater Sampling Log

Geosyntec consultants

Project Name: CRISTEX DRUM Location: Oxford NC Date: 4/7/20
Project Number: GR6764 Phase/Task: 07/08 Personnel: ALLI VO

Well ID: EK-MW-Z1 Screen Interval (ft) 30-40' DTW (ft) 22.78 TOC
Pump/Tubing Setting (ft) 32' bgs DTB (ft) 40'
Well Diameter (in) 2" Depth To Product (ft) —
Tubing Diameter (in) 1/4"
Water Quality Meter Model #: YSI 556 MSP/HANNA Measurement Location: TOC

Time	Purge Rate (mL/min)	DTW (ft)	pH (S.U.)	Specific Conductance (µS/cm)	Temp (°C)	Turbidity (NTU)	ORP (mV)	DO (mg/L)	Comments
1240 1040	150	22.78							
1050	150	22.79	6.43	246	19.28	NA	717.0	2.37	clear
1100	150	22.75	6.26	145	19.64	24.6	704.1	2.04	clear
1105	150	22.73	6.28	125	19.36	25.1	689.0	1.97	clear
1110	150	22.73	6.26	121	19.36	25.9	674.8	1.86	light
1115	150	22.73	6.22	121	19.68	24.7	676.2	1.82	pink
1125	150	22.73	6.29	127	21.86	23.8	658.5	1.65	"
1130	150	22.72	6.29	128	22.11	20.0	636.2	1.66	"
1135	150	22.72	6.30	128	22.30	19.8	634.9	1.65	"
1340 1040	SAMPLE								

AW

Stabilization Criteria	EPA Region 4	ASTM D 6771-02
pH	0.1	0.2
Sp. Cond.	5%	3%
Turbitiy	10% or <10 NTU	none
DO	10% or 0.2 mg/L	10% or 0.2 mg/L
ORP	none	20 mV

Sample ID with Time and Analysis

EKMW-1 @ 1040 1340
EKMW-1-MS @ 1045 1345
EKMW-1-MSD @ 1050 1350

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY
= (feet - feet) x gallons/foot = gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
= (gal/ft x ft) + gallons = gallons

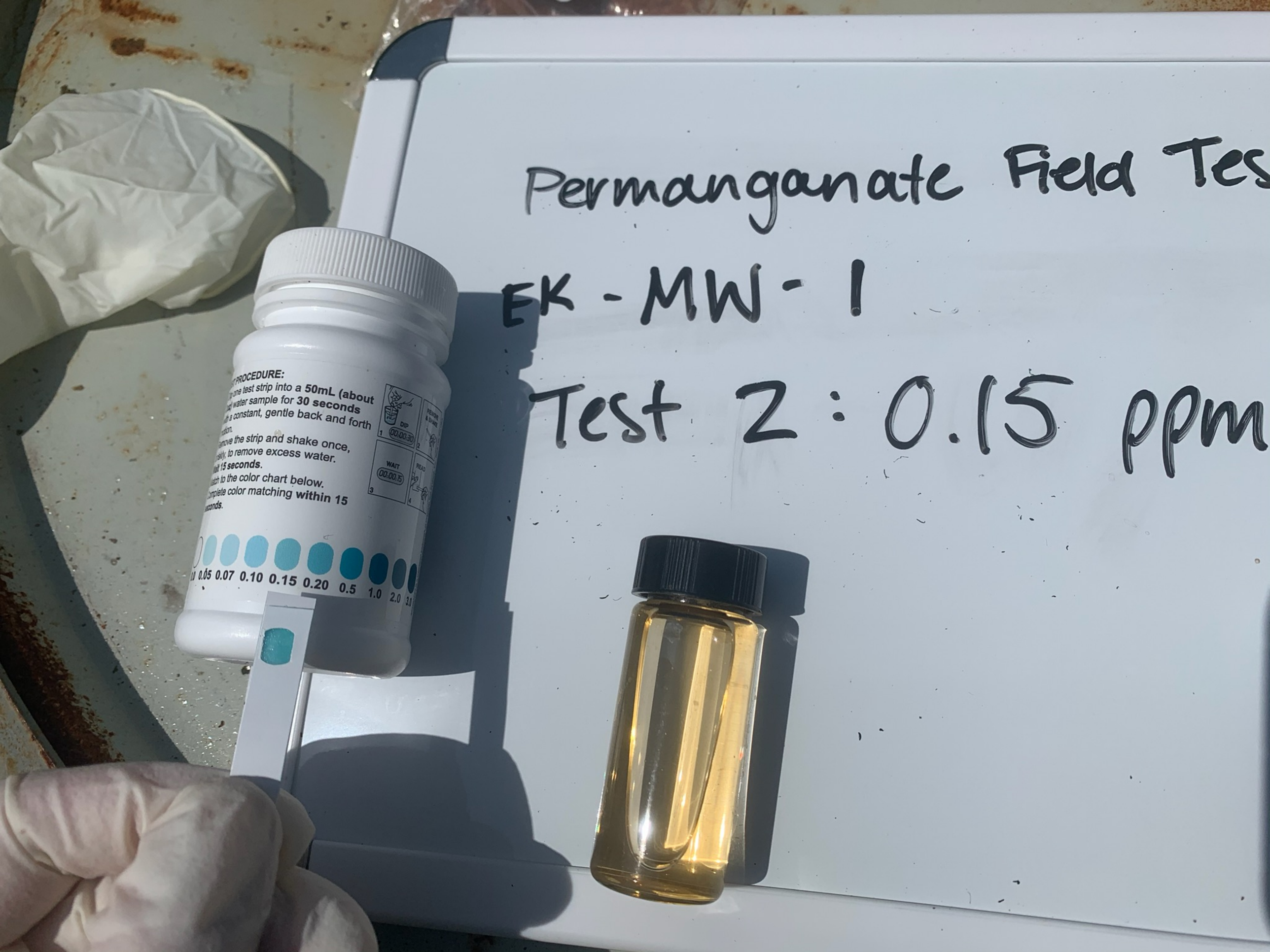
Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.

Permanganate Test 1 = 0.15 ppm see photos
2 = 0.15 ppm

Permanganate Field Tes

EK - MW - 1

Test 2 : 0.15 ppm



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Geosyntec Consultants
Groundwater Sampling Log

Geosyntec consultants

Project Name: CRISTEX DRUM Location: OXFORD NC Date: 4/7/2020
Project Number: GR6764 Phase/Task: 07/08 Personnel: ACL/VO

Well ID: MW-2
Screen Interval (ft) 35-50'
Pump/Tubing Setting (ft) 43' TOC (40' bgs)
Well Diameter (in) 2"
Tubing Diameter (in) 1/4"
DTW (ft) 22.68' TOC
DTB (ft) 50'
Depth To Product (ft) —
Water Quality Meter Model #: YSI 556 MSP HANNA
Measurement Location: TOC

Time	Purge Rate (mL/min)	DTW (ft) (TOC)	pH (S.U.)	Specific Conductance (µS/cm)	Temp (°C)	Turbidity (NTU)	ORP (mV)	DO (mg/L)	Comments
0945	150	22.67	PURGE						hot pink
0955	150	22.76	3.17	199	17.26	25.3	624.8	3.11	pH = 6.77
1005	150	22.74	6.69	186	17.47	17.9	644.0	2.66	pH = 6.64
1010	150	22.74	6.74	176	17.45	17.3	646.7	2.41	not pink
1015	150	22.74	6.73	172	17.59	17.5	649.4	2.19	not pink
1020	150	22.73	6.72	170	17.67	14.6	652.0	2.03	not pink
1025	150	22.73	6.71	169	17.74	10.3	653.8	2.14	
1030	150	22.72	6.71	165	17.74	10.2	655.3	1.93	
1035	150	22.72	6.70	164	17.81	9.6	656.0	1.92	
1040	150	22.72	6.70	163	18.02	7.9	656.4	1.92	
1045	—	SAMPLE							

Stabilization Criteria	EPA Region 4	ASTM D 6771-02
pH	0.1	0.2
Sp. Cond.	5%	3%
Turbitiy	10% or <10 NTU	none
DO	10% or 0.2 mg/L	10% or 0.2 mg/L
ORP	none	20 mV

Sample ID with Time and Analysis

EK-MW-2-20200407 @ 1045

DUP-1- @ 1055 20200407

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY
= (feet - feet) x gallons/foot = gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
= (gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = (

Permanganate Strip: ~~3.0~~ 2.0 ppm (mg/L) see photo
(2 tests) 2.0 ppm (mg/L) see photo

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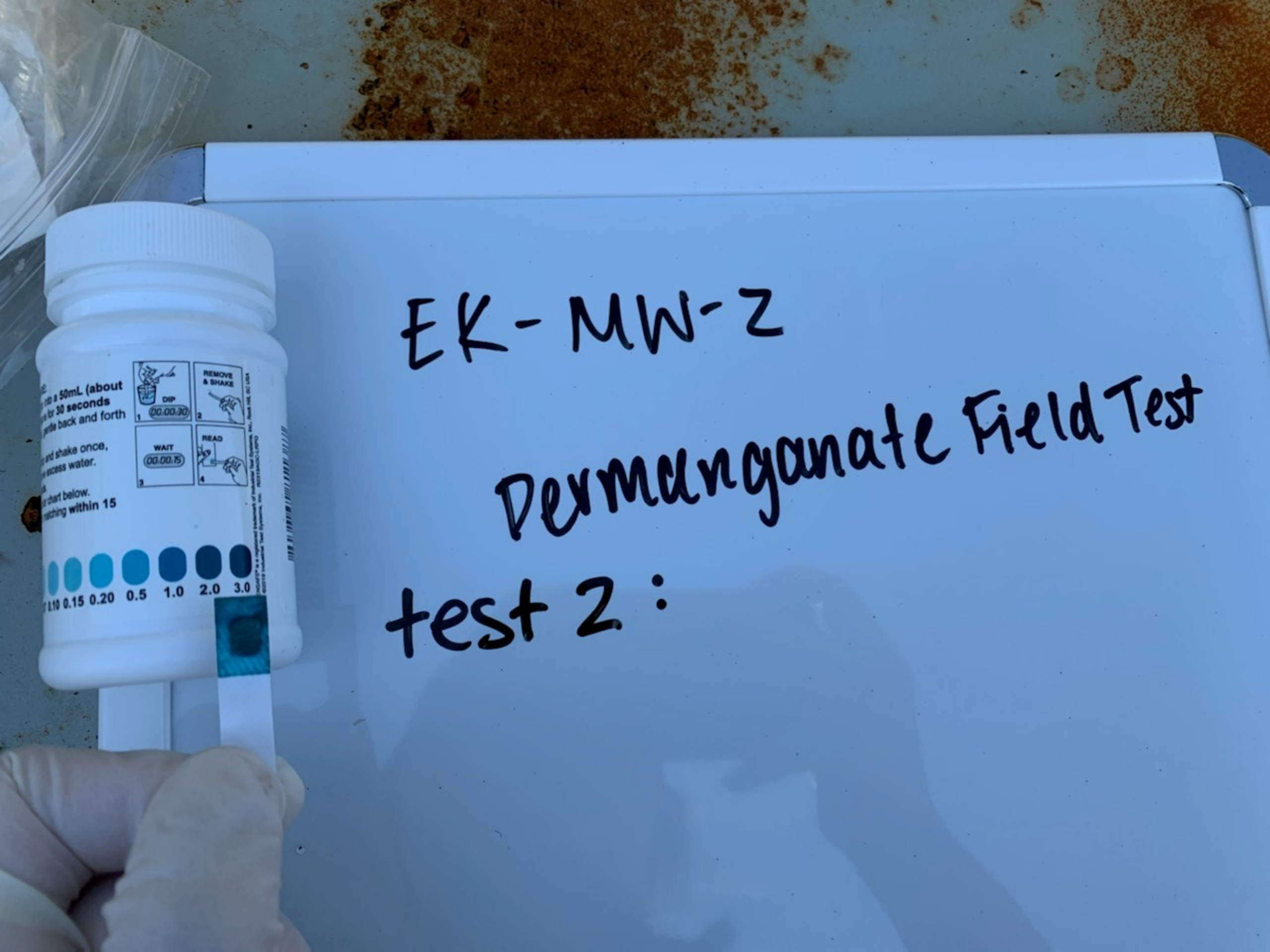
EK-MW-2

Permanganate Field Test

test 2:



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Geosyntec Consultants
Groundwater Sampling Log

Geosyntec consultants

Project Name: CRISTEX DRUMSITE Location: OXFORD Date: 4/7/2020

Project Number: GR6764 Phase/Task: 04/08 Personnel: ALLI VO

Well ID: MW-3I Screen Interval (ft) 47-52 DTW (ft) 20.38'

Pump/Tubing Setting (ft) 50' TOC DTB (ft) 52'

Well Diameter (in) 2" Depth To Product (ft) —

Tubing Diameter (in) 1/4"

Water Quality Meter Model #: YSI 556 MSP Measurement Location: TOC

Time	Purge Rate (mL/min)	DTW (ft)	pH (S.U.)	Specific Conductance (µS/cm)	Temp (°C)	Turbidity (NTU)	ORP (mV)	DO (mg/L)	Comments
1115	150	PURGE							dark purple
1120	150	20.48	6.56	2855	18.03	69.7	726.5	2.55	"
1135	150	20.49	6.60	2886	18.16	63.4	723.0	2.45	"
1140	150	20.47	6.60	2907	18.59	59.1	721.8	2.38	"
1145	150	20.46	6.60	2950	19.46	55.0	720.0	2.29	"
1150	150	20.46	6.59	2954	19.57	58.2	719.7	2.28	"
1155	150	20.46	6.55	2936	19.43	47.6	725.4	2.33	"
1200	150	20.42	6.56	2944	19.68	46.3	725.8	2.32	"
1205	150	20.41	6.54	2950	19.72	44.7	726.5	2.30	"
1210	150	20.41	6.55	2950	19.72	42.1	726.9	2.32	"
1215	SAMPLE								

Stabilization Criteria	EPA Region 4	ASTM D 6771-02
pH	0.1	0.2
Sp. Cond.	5%	3%
Turbitiy	10% or <10 NTU	none
DO	10% or 0.2 mg/L	10% or 0.2 mg/L
ORP	none	20 mV

Sample ID with Time and Analysis

MW-3I-20200407
@ 1215

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY
= (feet - feet) x gallons/foot = gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
= (gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = (

Permanganate Test: 1 = >3.0 ppm see photos
2 = >3.0 ppm

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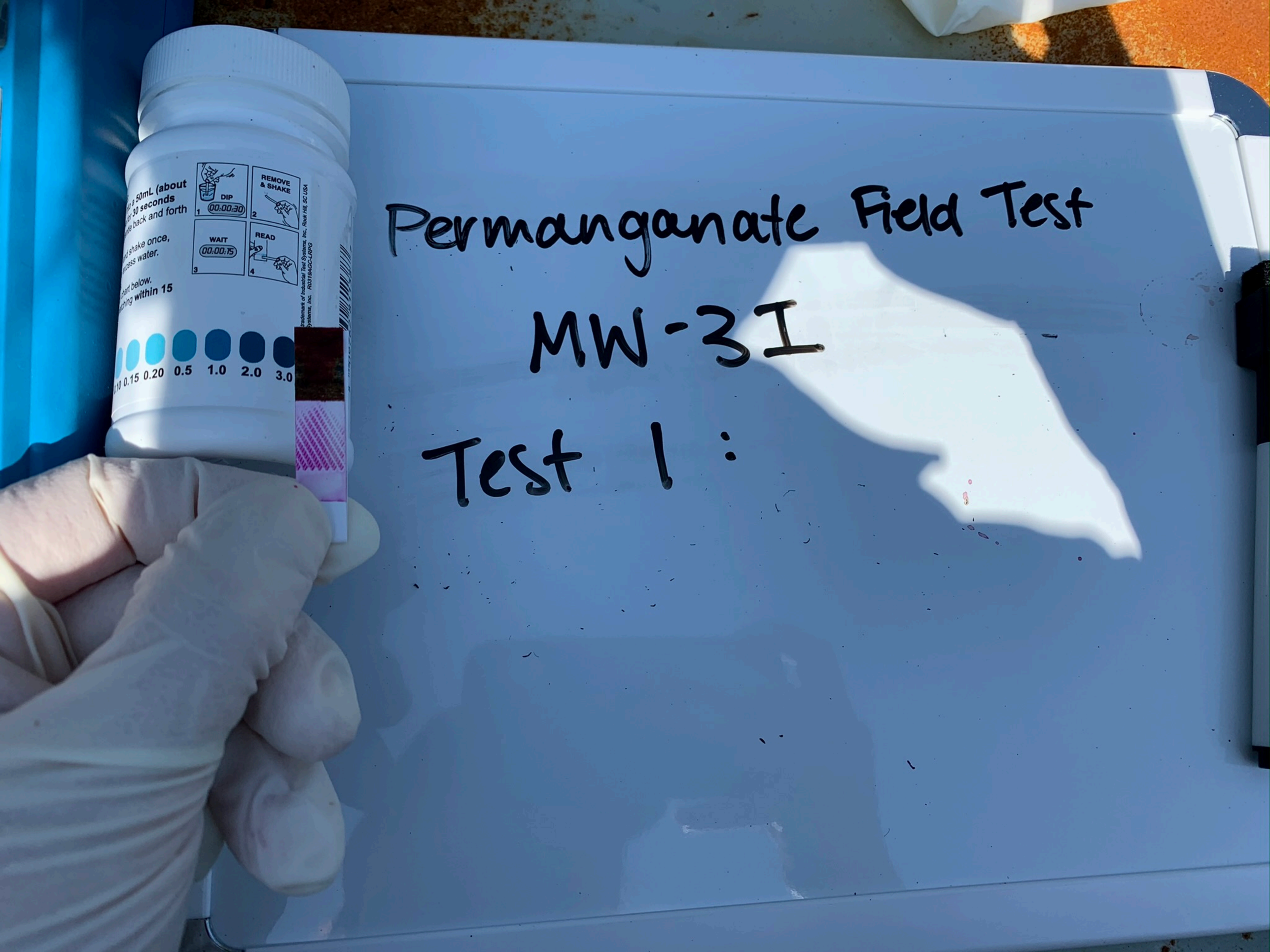

Permanganate Field Test

MW-3I

Test 1:

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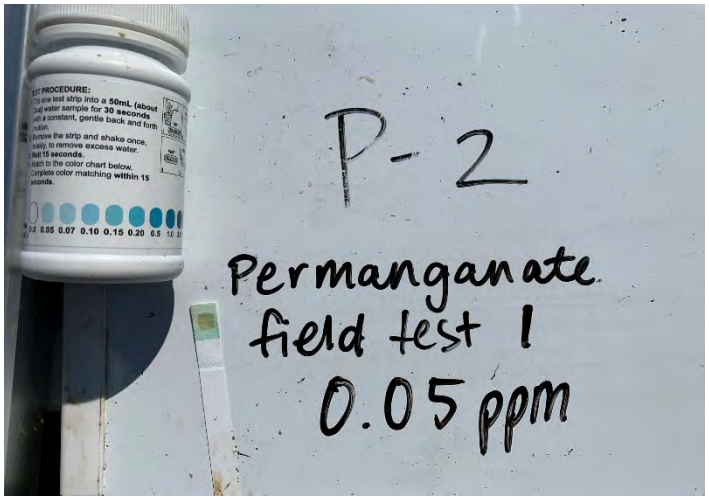
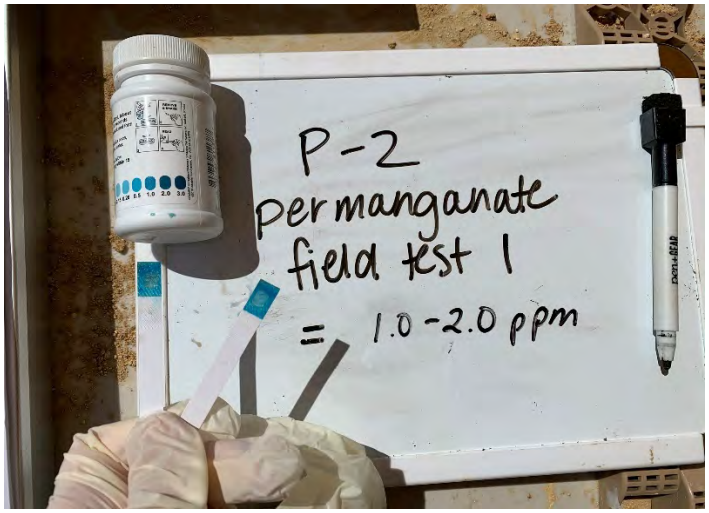
GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

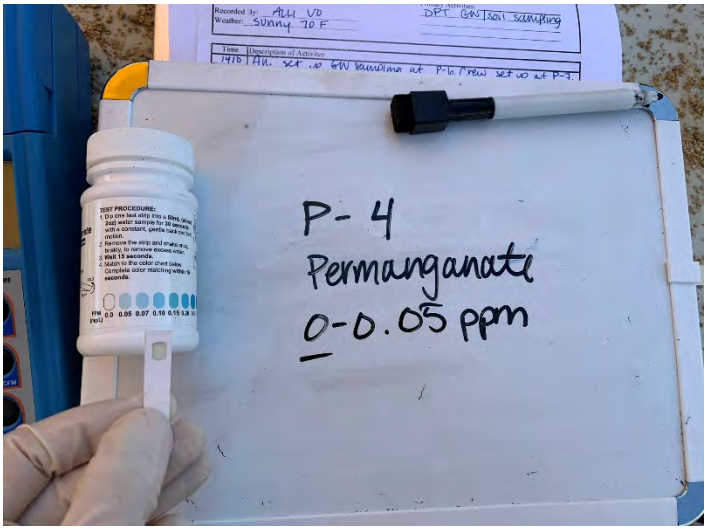
Photograph 1	
Date: 4/9/2020 10:40 AM	
Direction:	
Comments: Mislabeled on white board. The test strip shown was P-1 sample.	

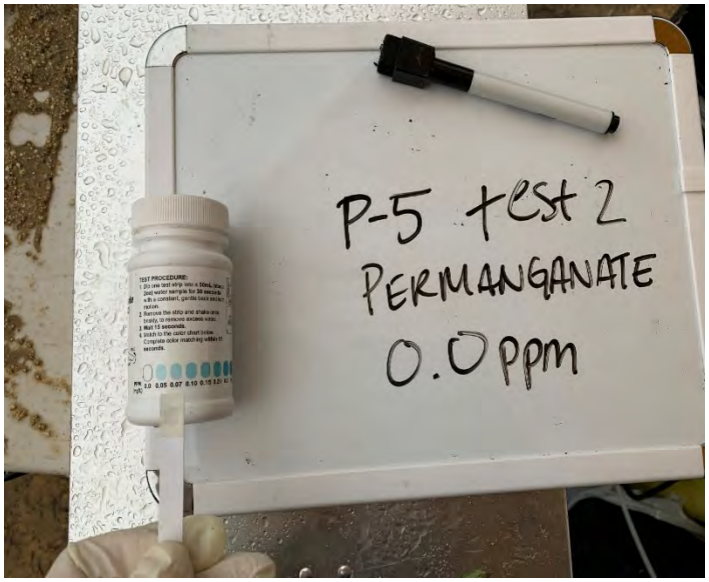
Photograph 2	
Date: 4/9/2020 11:53 AM	
Direction:	
Comments:	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

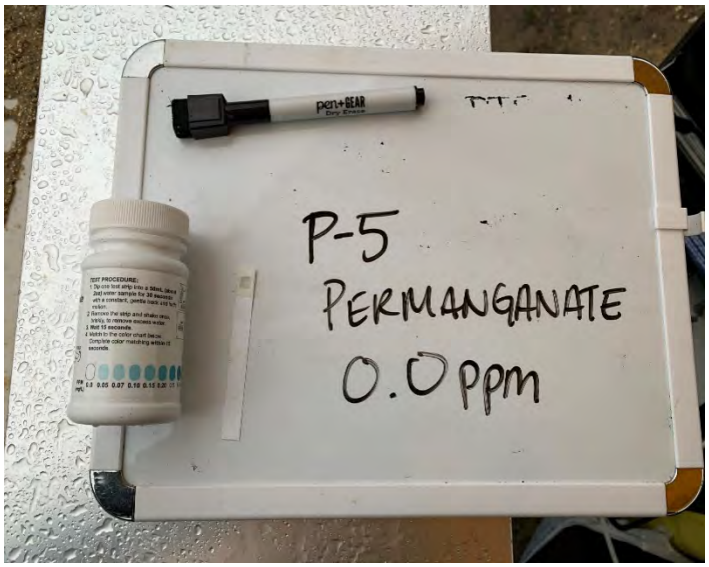
Photograph 3	
Date: 4/8/2020 3:23 PM	
Direction:	
Comments:	

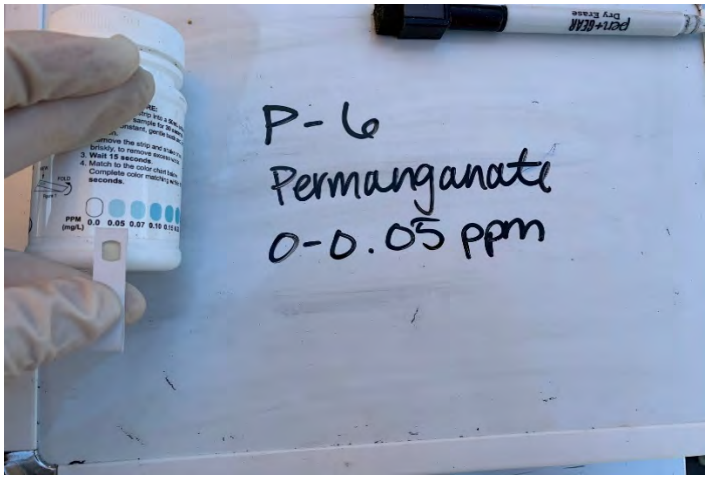
Photograph 4	
Date: 4/9/2020 7:23 AM	
Direction:	
Comments:	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

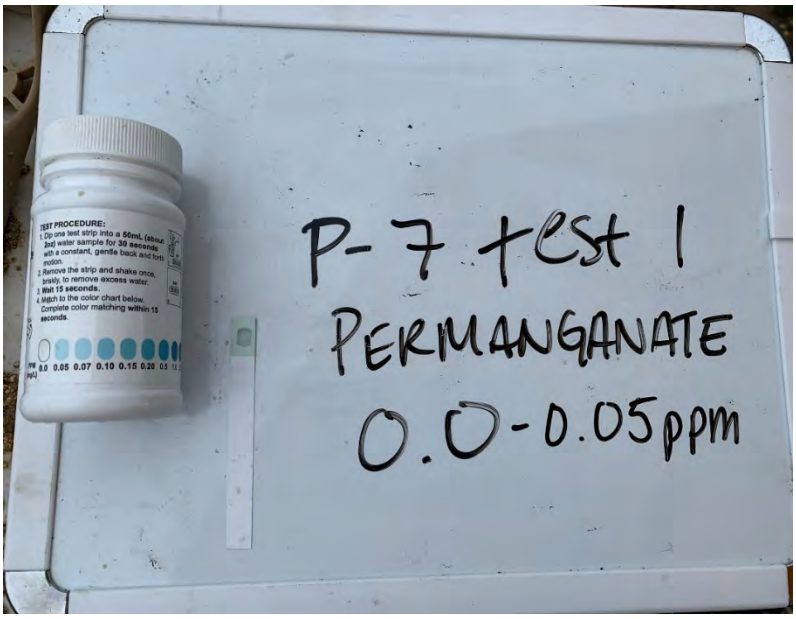
Photograph 5	
Date: 4/9/2020 7:22 AM	
Direction:	
Comments:	

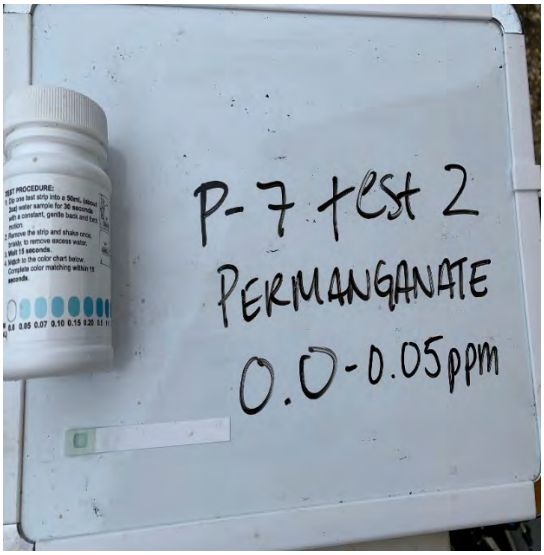
Photograph 6	
Date: 4/8/2020 3:23 PM	
Direction:	
Comments:	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

Photograph 7	
Date: 4/9/2020 8:09 AM	
Direction:	
Comments:	

Photograph 8	
Date: 4/9/2020 8:10 AM	
Direction:	
Comments:	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

Photograph 9	
Date: 4/9/2020 2:25 PM	
Direction:	
Comments:	

Photograph 10	
Date: 4/8/2020 9:38 AM	
Direction:	
Comments:	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

Photograph 11

Date: 4/8/2020 10:06 AM

Direction:

Comments:

Photograph 12

Date: 4/8/2020 10:27 AM

Direction:

Comments:

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

Photograph 13	
Date: 4/8/2020 10:27 AM	
Direction:	
Comments:	

Photograph 14	
Date: 4/8/2020 10:34 AM	
Direction:	
Comments:	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

Photograph 15

Date: 4/8/2020 10:40 AM

Direction:

Comments:

Photograph 16

Date: 4/8/2020 10:40 AM

Direction:

Comments:

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

Photograph 17

Date: 4/8/2020 10:44 AM

Direction:

Comments:

Photograph 18

Date: 4/8/2020 11:56 AM

Direction:

Comments:

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

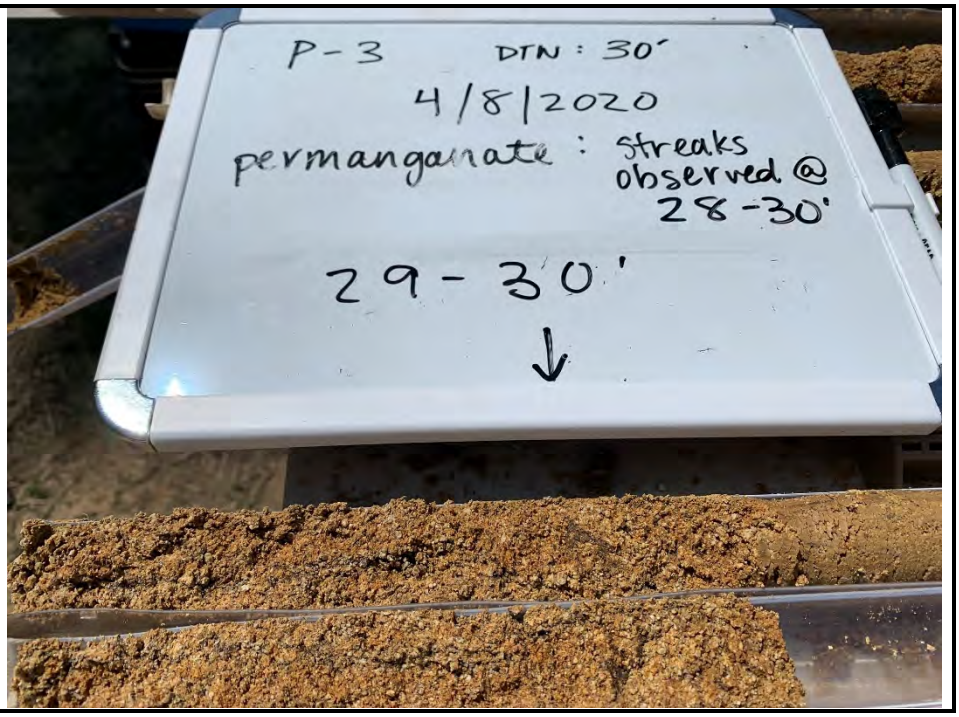
Photograph 19	
Date: 4/8/2020 11:57 AM	
Direction:	
Comments:	

Photograph 20	
Date: 4/8/2020 12:00 PM	
Direction:	
Comments:	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

Photograph 21	
Date: 4/8/2020 12:01 PM	
Direction:	
Comments:	

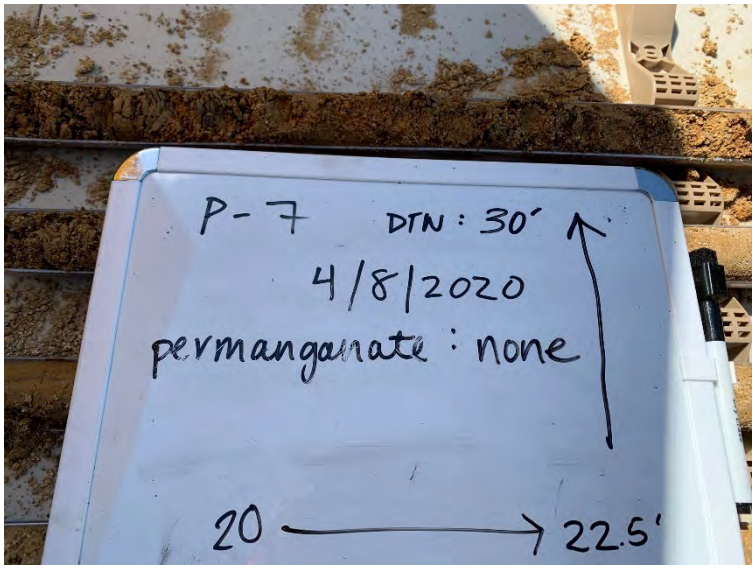
Photograph 22	
Date: 4/8/2020 12:01 PM	
Direction: NA	
Comments: Purple staining in soil at approximately 29' bgs.	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

Photograph 23	
Date: 4/8/2020 2:29 PM	
Direction:	
Comments:	

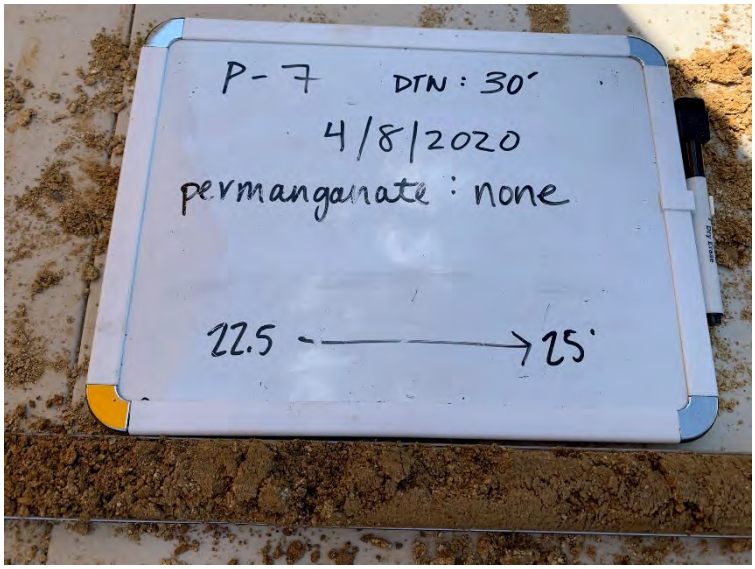
Photograph 24	
Date: 4/8/2020 2:29 PM	
Direction:	
Comments:	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

Photograph 25	
Date: 4/8/2020 2:37 PM	
Direction:	
Comments:	

Photograph 26	
Date: 4/8/2020 2:37 PM	
Direction:	
Comments:	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

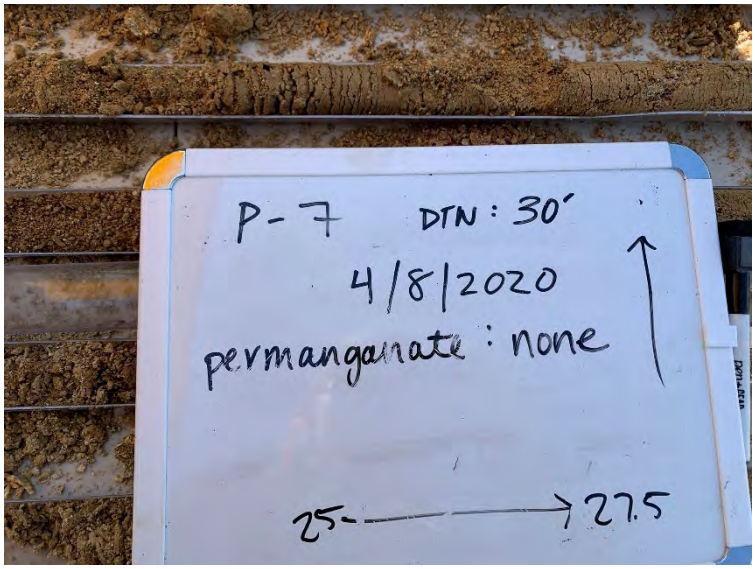
Photograph 27	
Date: 4/8/2020 2:45 PM	
Direction:	
Comments:	

Photograph 28	
Date: 4/8/2020 2:45 PM	
Direction:	
Comments:	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

Photograph 29	
Date: 4/8/2020 2:45 PM	
Direction:	
Comments:	

Photograph 30	
Date: 4/8/2020 4:03 PM	
Direction:	
Comments:	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

Photograph 31	
Date: 4/8/2020 4:06 PM	
Direction:	
Comments:	

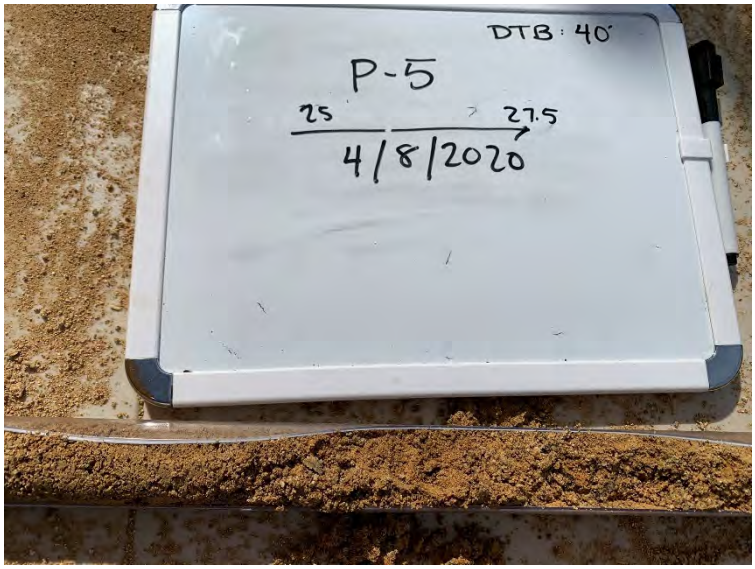
Photograph 32	
Date: 4/8/2020 4:06 PM	
Direction:	
Comments:	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

Photograph 33	
Date: 4/8/2020 4:11 PM	
Direction:	
Comments:	

Photograph 34	
Date: 4/8/2020 4:11 PM	
Direction:	
Comments:	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

Photograph 35

Date: 4/8/2020 4:13 PM

Direction:

Comments:

Photograph 36

Date: 4/8/2020 4:13 PM

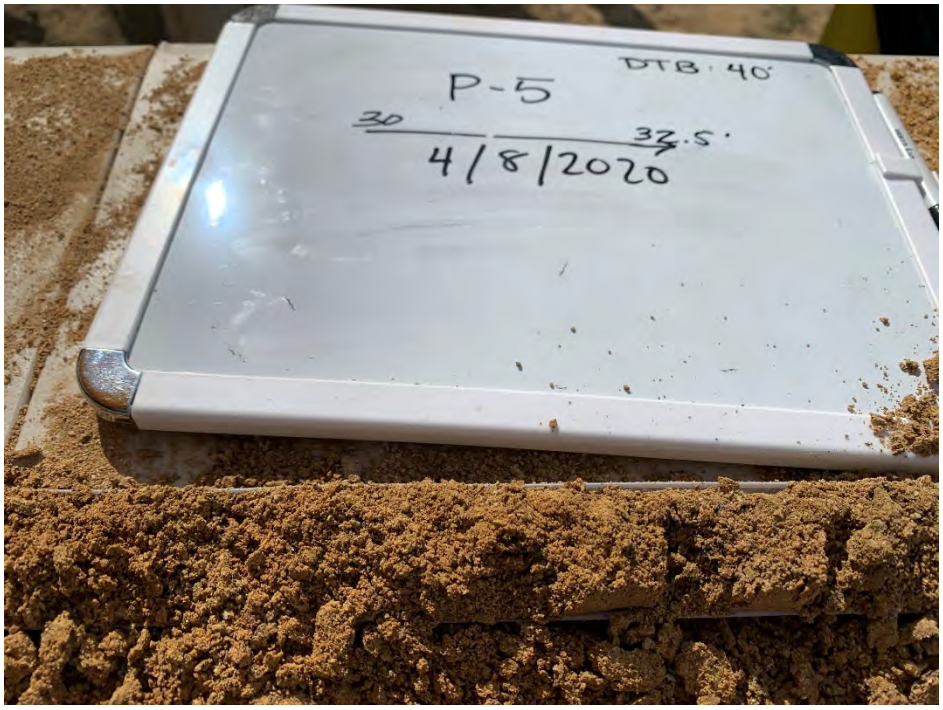
Direction:

Comments:

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

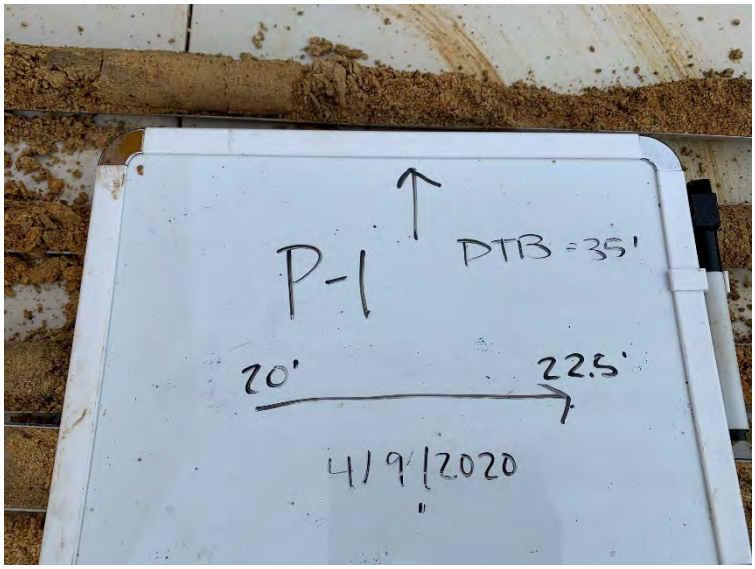
Photograph 37 **Date: 4/8/2020 4:15 PM** **Direction:** **Comments:**	
Photograph 38 **Date: 4/8/2020 4:15 PM** **Direction:** **Comments:**	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

Photograph 39	
Date: 4/8/2020 4:30 PM	
Direction:	
Comments:	

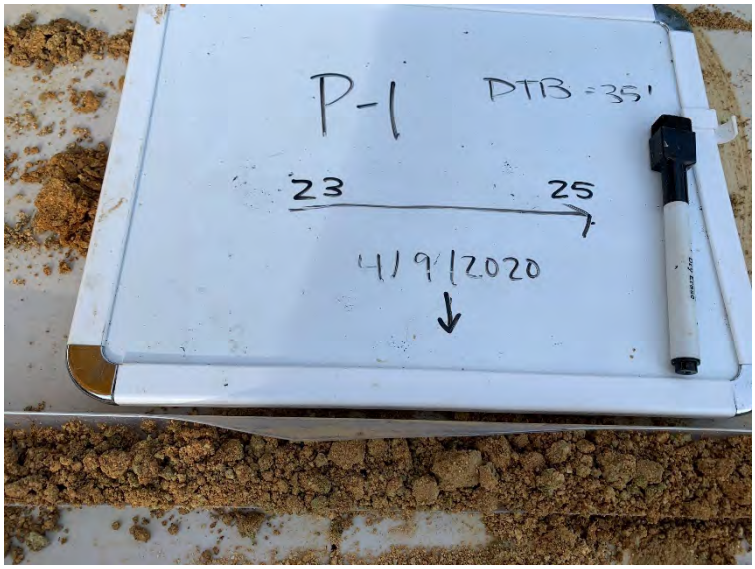
Photograph 40	
Date: 4/9/2020 8:47 AM	
Direction:	
Comments:	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

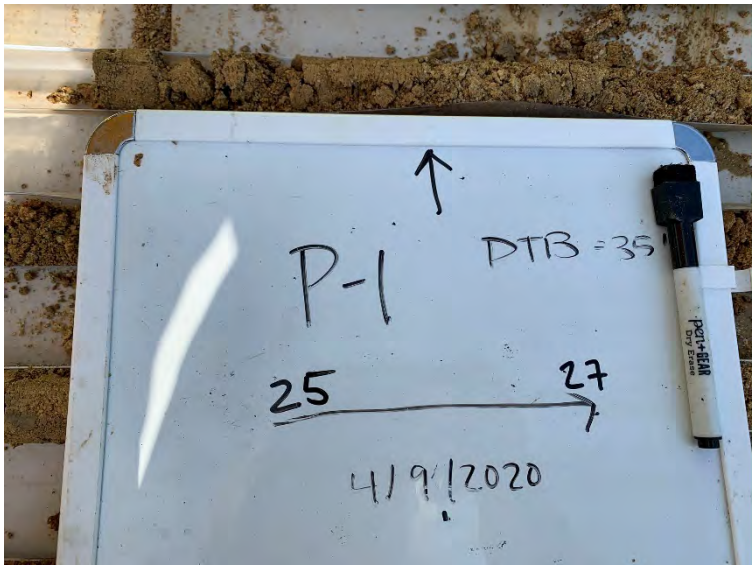
Photograph 41	
Date: 4/9/2020 9:01 AM	
Direction:	
Comments:	

Photograph 42	
Date: 4/9/2020 9:01 AM	
Direction:	
Comments:	

GEOSYNTEC CONSULTANTS
Photographic Record

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

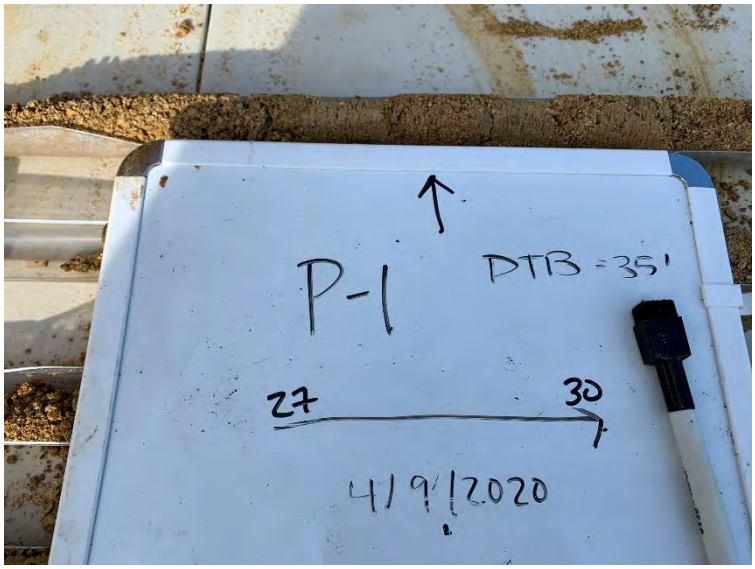
Photograph 43	
Date: 4/9/2020 9:08 AM	
Direction:	
Comments:	

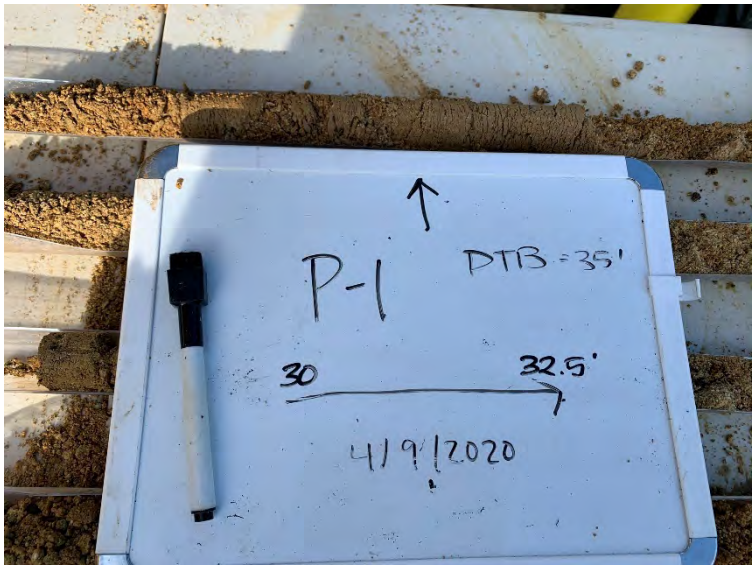
Photograph 44	
Date: 4/9/2020 9:08 AM	
Direction:	
Comments:	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

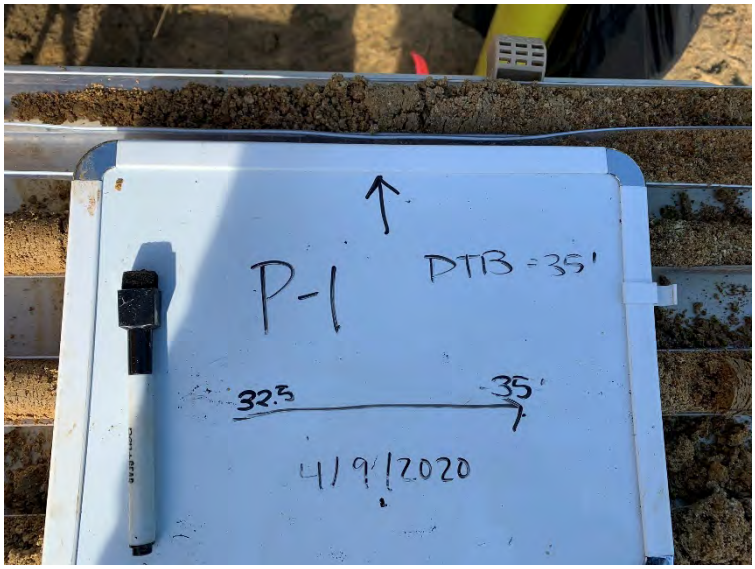
Photograph 45	
Date: 4/9/2020 9:12 AM	
Direction:	
Comments:	

Photograph 46	
Date: 4/9/2020 9:13 AM	
Direction:	
Comments:	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

Photograph 47	
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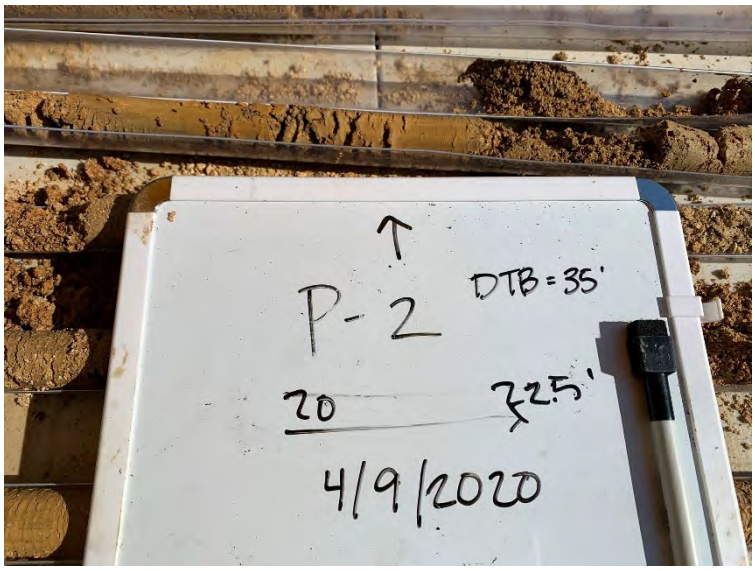
Comments:	

Photograph 48	
Date: 4/9/2020 10:10 AM	
Direction:	
Comments:	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

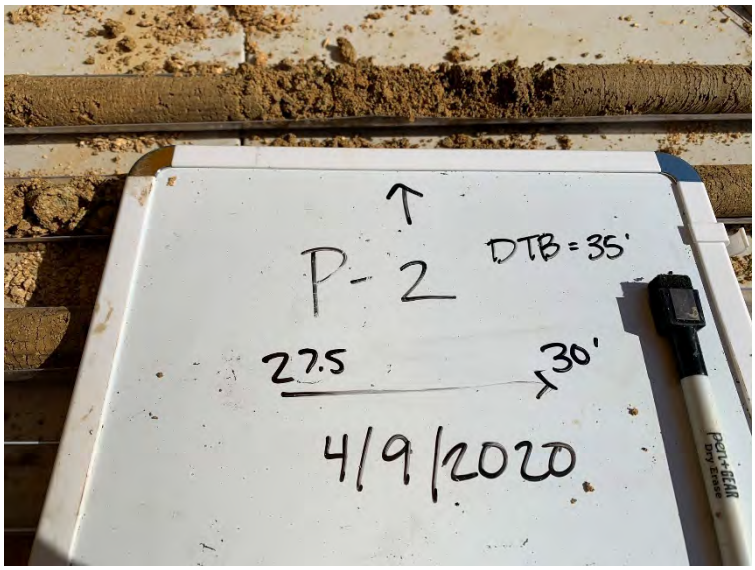
Photograph 49	
Date: 4/9/2020 10:11 AM	
Direction:	
Comments:	

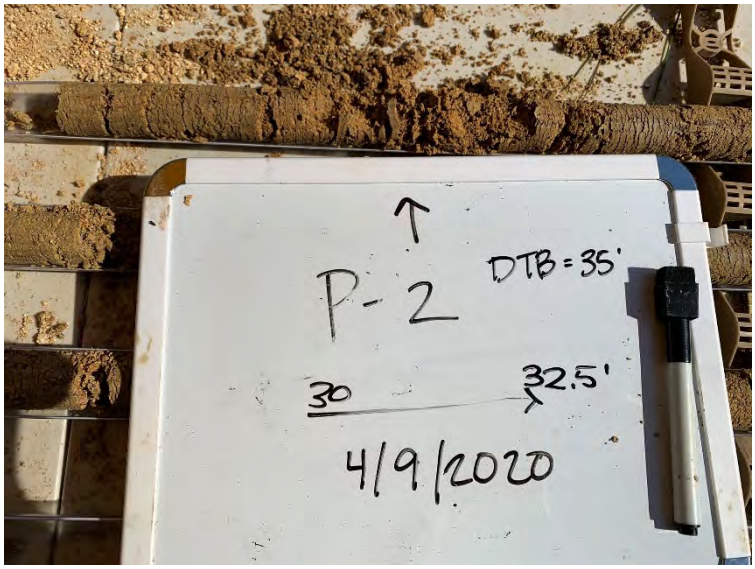
Photograph 50	
Date: 4/9/2020 10:13 AM	
Direction:	
Comments:	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

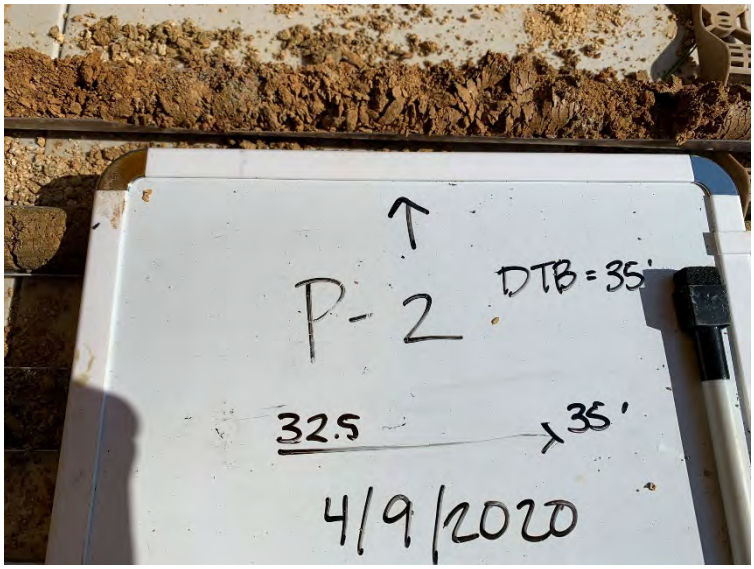
Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

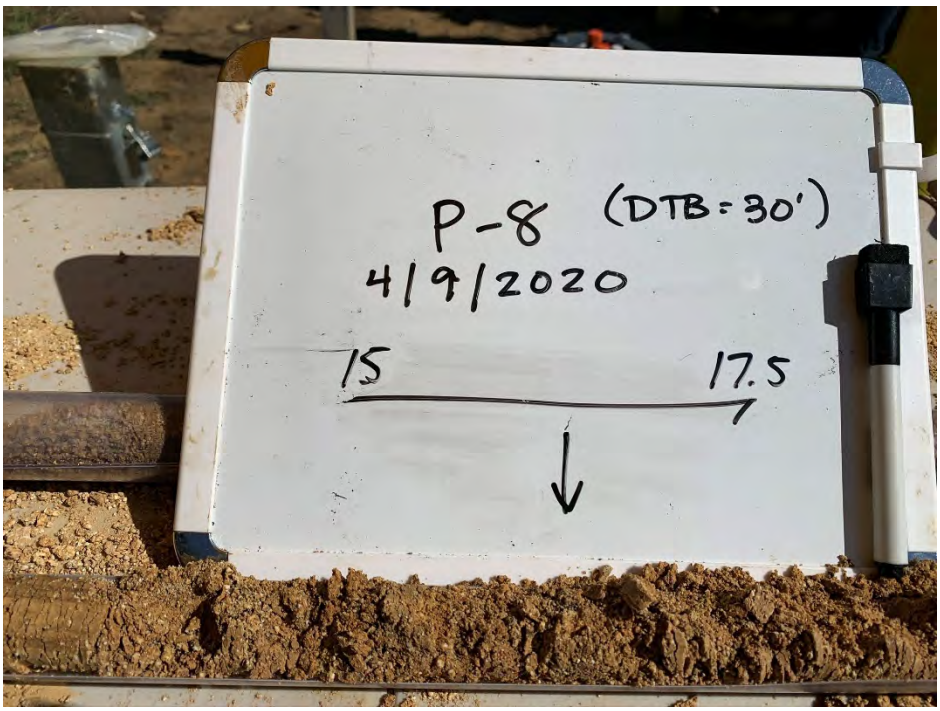
Photograph 51	
Date: 4/9/2020 10:14 AM	
Direction:	
Comments:	

Photograph 52	
Date: 4/9/2020 10:18 AM	
Direction:	
Comments:	

GEOSYNTEC CONSULTANTS
Photographic Record

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

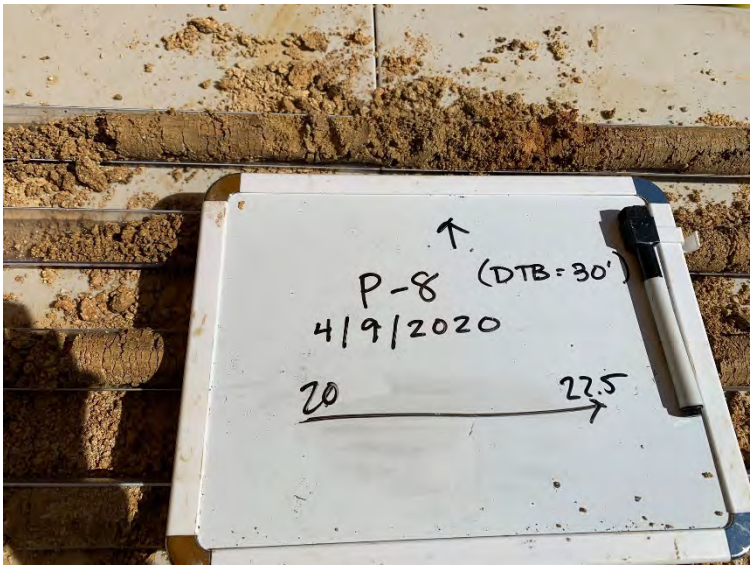
Photograph 53	
Date: 4/9/2020 10:19 AM	
Direction:	
Comments:	

Photograph 54	
Date: 4/9/2020 10:45 AM	
Direction:	
Comments:	

GEOSYNTEC CONSULTANTS
Photographic Record

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

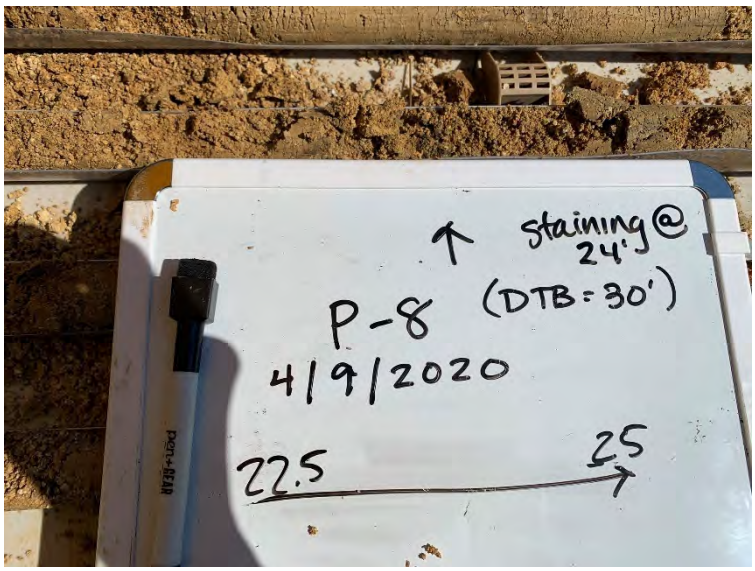
Photograph 55	
Date: 4/9/2020 10:46 AM	
Direction:	
Comments:	

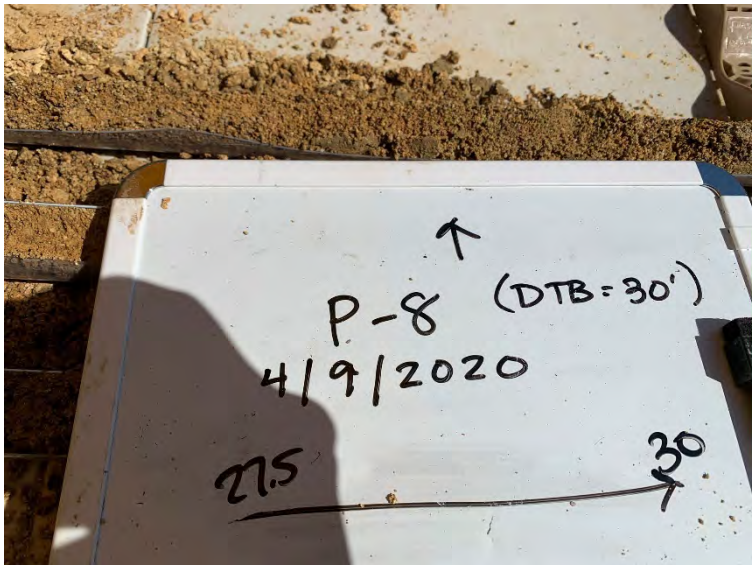
Photograph 56	
Date: 4/9/2020 10:48 AM	
Direction:	
Comments:	

GEOSYNTEC CONSULTANTS
Photographic Record

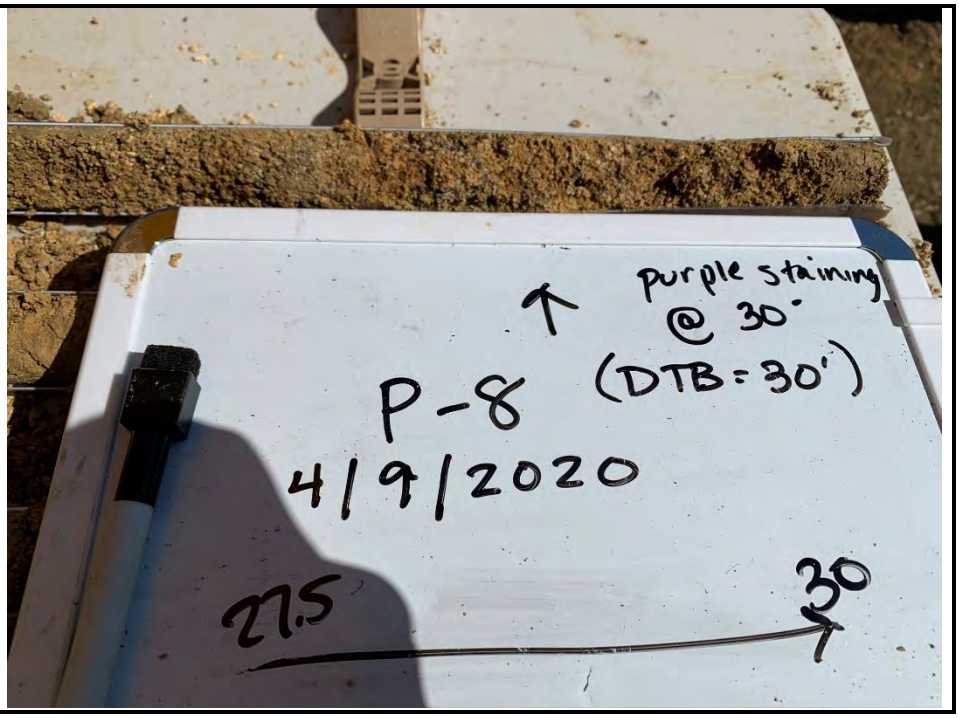
Geosyntec consultants

Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

Photograph 57	
Date: 4/9/2020 10:50 AM	
Direction:	
Comments:	

Photograph 58	
Date: 4/9/2020 10:54 AM	
Direction:	
Comments:	

GEOSYNTEC CONSULTANTS Photographic Record	
Client: Black and Veatch	**Project Number: GR6764**
Site Name: Cristex Drum Site	**Site Location: Oxford NC**

Photograph 59	
Date: 4/9/2020 10:55 AM	
Direction:	
Comments:	

Appendix D
USEPA 2012 GROUND WATER ISSUE
Ground Water Sample Preservation at In-Situ Chemical Oxidation Sites – Recommended Guidelines

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United States Environmental Protection Agency

Ground Water Issue

Ground Water Sample Preservation at In-Situ Chemical Oxidation Sites – Recommended Guidelines

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1. INTRODUCTION

In-situ chemical oxidation (ISCO) involves the introduction of a chemical oxidant into the subsurface for the purpose of transforming ground water and/or soil contaminants into less harmful chemical by-products (Huling and Pivetz, 2006; Rivas, 2006; Ferrarese *et al.,* 2008; Kao *et al.,* 2008). Often, ground water samples collected specifically to analyze organic contaminants may contain the oxidant and the organic contaminants in a "binary mixture" (Huling *et al.,* 2011a; Johnson *et al.,* 2012). When organic contaminants and oxidants are commingled in the ground water sample, there is significant potential for oxidative transformation of contaminants to occur after the sample is collected and the results of the sample analysis to become non-representative of in-situ conditions at the time of sampling. Consequently, the quality of the ground water sample may be compromised and a false negative result may occur.

An integral component of ISCO is the collection and analysis of ground water samples to assess ISCO treatment performance. A technical issue faced by Remedial Project Managers is the collection and analysis of representative, high quality ground water samples that can be used to support a site assessment and remedial performance monitoring at sites where ISCO is being deployed. The purpose of this *Issue Paper* is to provide background information and general guidelines involving methods and procedures that can be used to detect whether an oxidant (i.e., permanganate or persulfate) is present in ground water, to approximate the oxidant concentration, and to estimate and deliver the volume or mass of preservative, specifically ascorbic acid, required to preserve the binary mixture ground water sample. The focus of this *Issue Paper* is on permanganate and persulfate, two oxidants that can persist for long periods of time in the subsurface and therefore represent the greatest potential for binary mixture ground water samples. An Appendix to this *Issue Paper* (Recommended Operating Procedures - Preservation of Ground Water Samples at ISCO Sites Using Ascorbic Acid) provides specific details regarding the preservation procedures for use by EPA Regional personnel, contractors, and other environmental professionals engaged in ground water sample collection and analysis.

The guidelines are also applicable to bench-scale studies where oxidants are used to investigate the feasibility of ISCO treatment. For

example, aqueous samples collected from bench-scale soil reactors are analyzed for organic contaminants, but may also contain the oxidant amended to the reactor to destroy the contaminant. Consequently, the guidelines described below also extend to bench-scale studies where the potential for binary mixture aqueous samples may occur, and are analyzed for organic contaminants.

1.1. Reasons to Sample and Analyze Binary Mixtures

It is often desirable for oxidants in ground water to fully react prior to collecting and analyzing ground water samples for organic contaminants. However, there are circumstances where the collection and analysis of binary mixture ground water samples may not be avoided. These reasons vary widely and some examples include the need to:

(1) conduct an immediate preliminary assessment of ISCO to validate in-progress treatment performance,
(2) establish design parameters from interim ISCO pilot-scale studies needed to design full-scale ISCO deployment,
(3) assess the potential redistribution of the ground water contaminant plume as affected by ISCO activities, and
(4) evaluate reaction kinetics during oxidative treatment.

Rapid turnaround of field data and information may be needed to meet specified milestones and deadlines for full-scale remedy selection, design, construction, and implementation. In addition, regulatory-driven goals and associated timelines may require rapid completion of pilot-scale testing and full-scale deployment of ISCO. Therefore, a significant emphasis may be placed on the collection of ground water samples at ISCO sites prior to complete reaction of the oxidant (Huling *et al.,* 2011a).

1.2. Binary Mixtures of Oxidant and Organic Contaminants in Ground Water Samples

Heterogeneous distribution of oxidant and contaminants, and hydraulic conductivity variations in heterogeneous aquifers are two main causes of binary mixtures (Figure 1) (Huling *et al.,* 2011a). For example, oxidants and contaminants can enter a monitoring well screen from different lithologic zones. These solutes may be captured as separate solutes from different lithologic zones, or as separate or commingled solutes from the same lithologic zone. Insufficient contact time (i.e., reaction time) between the oxidant and contaminants prior to, or after, entering the well leads to binary mixtures in the ground water sample.

Commingling of organic contaminants and oxidants in the ground water sample impacts the quality of the ground water sample, but may also impact the analytical instruments used to measure the concentration of analyte(s) in the ground water sample (Johnson *et al.,* 2012). Although rarely reported and documented, the impact of oxidants on analytical instruments is exclusively reported for permanganate and predominantly involves instrument malfunction resulting from MnO_2(s)-clogged lines and ports. No information was found that documented the impact of hydrogen peroxide or persulfate on analytical instruments despite numerous studies where binary mixtures were analyzed.

1.3. Impact of Binary Mixtures – Previous Studies

A detailed study involving the impact of residual persulfate on the quality of ground water samples was performed (Huling *et al.,* 2011a). A significant decline (49 to 100 percent (%)) in volatile organic compound (VOC) concentrations was measured in unpreserved binary mixture samples using gas chromatography (GC) purge and trap, and GC mass spectroscopy (MS) headspace analytical methods. In that study, preservation of the binary mixture samples was achieved through the addition of ascorbic acid and resulted in 99 to 100% VOC average recovery relative to oxidant-free control samples. Adding high concentrations of ascorbic acid (42 to 420 millimolar (mM)) to the samples did not interfere in the measurement of the VOCs and did not negatively impact the analytical instruments. These results indicated that if persulfate is present in the sample, and the binary sample is not appropriately preserved, the quality of the sample will be compromised. A companion study involving the impact of permanganate on the quality of ground water samples and analytical instruments, and the use of ascorbic acid yielded similar results (Johnson *et al.,* 2012). The results of these studies (Huling *et al.,* 2011a; Johnson *et al.,* 2012) serve as the basis for the guidelines provided in this *Issue Paper*.

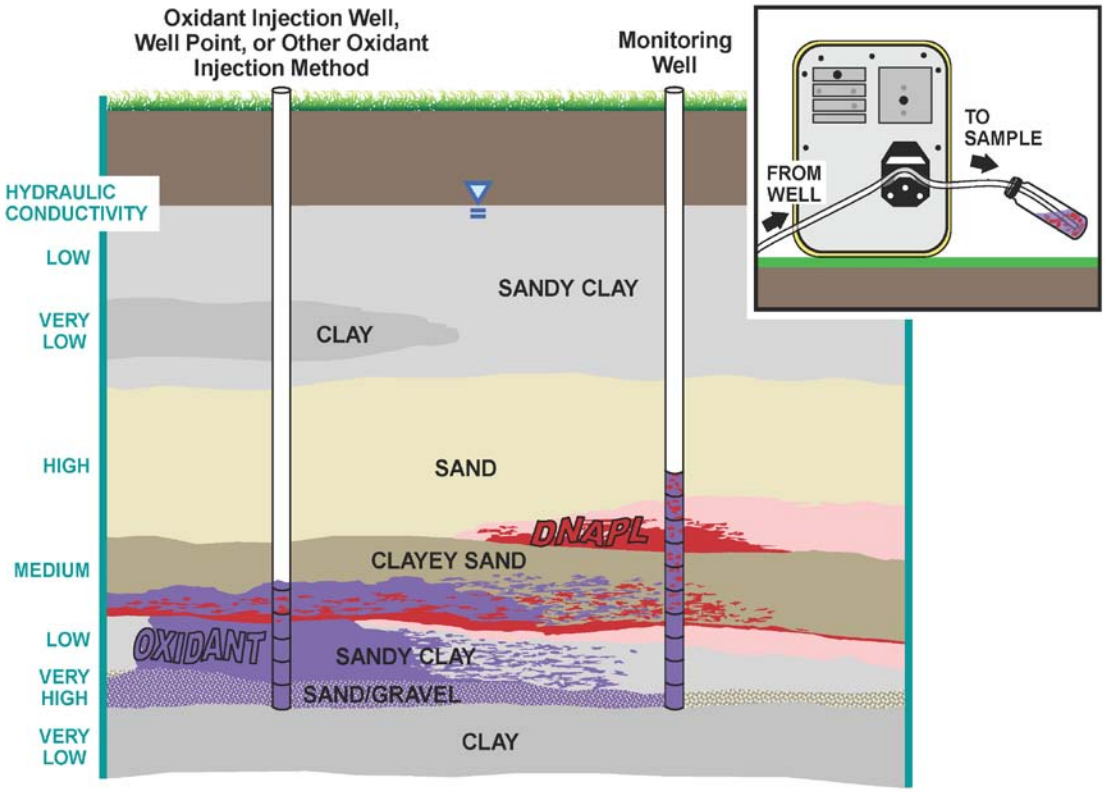


Figure 1. Conceptual model of hydrogeologic, and oxidant and contaminant fate and transport conditions that contribute to binary mixture ground water samples. The oxidant illustrated in purple, conceptually represents any oxidant (permanganate, persulfate) used for in-situ chemical oxidation (Huling *et al.,* 2011a).

The analytical methods used in these studies are commonly used in commercial analytical laboratories. The analytes, including benzene, toluene, xylene (BTX), perchloroethylene (PCE), and trichloroethylene (TCE), are representative of contaminants commonly found at hazardous waste sites. Similarly, empirical results were obtained in the analysis of binary mixtures comprised of persulfate and pentachlorophenol (PCP) by high performance liquid chromatography (HPLC) where significant loss of PCP was measured in unpreserved samples relative to persulfate-free control samples and ascorbic acid-preserved samples (data not included). Currently, we do not have a firm explanation for a viable mechanism responsible for persulfate activation and PCP oxidation in these samples.

Overall, results are applicable to a broad set of analytical methods, analytes, and site conditions. It is unclear to what extent these results extend to analytical methods and contaminants that were not tested in these studies, however. Additional specific studies are needed in cases where different analytical methods and ground water contaminants are involved.

Specifically, analysis involved the measurement of (1) BTX, PCE, and TCE using the GC/MS headspace method, and (2) BTX using the GC purge and trap method (Huling *et al.,* 2011a). The GC/MS headspace method is involved in EPA Method Nos. 8260C and 5021A. The automated headspace GC/MS method is used to confirm the identity and quantity of purgeable VOCs in water samples in 40 mL volatile organic analysis (VOA) vials. This method is used to quantify over sixty VOCs in drinking water, including aromatics, haloalkenes, haloalkanes, haloaromatics, and fuel oxygenates. This automated method involves the transfer of an aqueous sub-sample (10 mL) to a sealed headspace vial which is heated from room temperature to 80 degrees Celsius (°C) in 30 minutes. A sample of the headspace gas is then transferred to the capillary column in the GC. After separation on the GC column and introduction into the MS, the VOCs are identified and

quantified using the MS. We propose that contaminant loss occurs during the heating step of the sub-sample where residual persulfate is thermally activated resulting in VOC oxidation.

The automated purge and trap GC (Agilent, Model 6890, Wilmington, DE) method was used to quantify BTX in water samples (40 mL VOA vials). This method is most similar to EPA Methods 602 and 8020, but shares similarities with several other EPA methods that involve purge and trap, including: EPA 501, 502.2, 503.1, 524.2, 601, 602, 624, 8010, 8020, 8021, 8240, and 8260. In this method, a sub-sample (10 mL) is transferred to a sparge chamber and purged with helium (6 minutes). The VOCs are transferred to a K VOCARB 3000 Encon trap and dry purged with helium to remove water vapor. The VOCs are thermally desorbed and transferred to the GC column for separation and measurement. Sample transfer is through a heated 1.9 mm×1.0 m Silcosteel (Restek, Bellefonte, PA) transfer line coupled directly to the analytical column. Following separation on the column, the presence of VOCs is determined and quantified with photoionization and flame ionization detectors. It was proposed that the contaminant loss was due to the helium sparging step where aerosols are formed containing persulfate and are transfered to the VOC granular activated carbon trap (Huling *et al.,* 2011a). Subsequently, during the VOC thermal desorption step where the trap is heated from room temperature to 260 °C (25 min), the persulfate residing in the trap is thermally activated resulting in the oxidation of the VOCs immobilized and concentrated on the trap. Similarly, highly efficient oxidation of organics immobilized in solid media (i.e., granular activated carbon) by thermally activated persulfate has been demonstrated (Huling *et al.,* 2011b).

The impact of residual permanganate was evaluated in water samples prepared in the lab using a multi-component standard, and in ground water samples collected at ISCO sites (Johnson *et al.,* 2012). Binary mixture aqueous samples were prepared that contained a 52-component standard of organic compounds and permanganate. Ascorbic acid was added to the binary mixture which reacted rapidly with the MnO_4^-, preserved the sample, and limited the reaction between MnO_4^- and the organic compounds. Consequently, the concentrations of the majority of the compounds in the multi-component standard were within the control limits established for quality assurance. However, despite timely efforts to preserve the laboratory-prepared binary mixture samples, the quality of the sample was impacted; concentrations were generally lower than oxidant-free controls, and the concentration of several compounds (*cis*-1,3-dichloropropene, styrene, *trans*-1,2-dichloroethene, *trans*-1,3-dichloropropene, vinyl chloride) fell below the applicable lower control limit.

Concentrations of VOCs measured in field-preserved binary mixture ground water samples were greater than in replicate samples refrigerated in the field and preserved with ascorbic acid upon arrival at the lab (Johnson *et al.,* 2012). These results indicate that the VOCs reacted in transit despite refrigeration. Excess ascorbic acid did not negatively impact the quality of the simulated ground water samples containing a 52-component stock standard, or actual ground water samples collected from two field sites, and did not negatively impact the GC/MS instruments used in the analysis.

2. GROUND WATER SAMPLE COLLECTION, OXIDANT MEASUREMENT, AND OXIDANT NEUTRALIZATION/SAMPLE PRESERVATION

Specific details regarding the procedures used in amending ground water samples with ascorbic acid are provided in the Appendix entitled, "Recommended Operating Procedures - Preservation of Ground Water Samples at ISCO Sites Using Ascorbic Acid".

It is recommended that a representative ground water sample be collected at the well head in a test vial for the specific purpose of measuring the oxidant concentration. Ground water sample collection for this purpose should follow the normal ground water sampling protocol established at the site. This initial screening ground water sample is not collected for the purpose of measuring organic contaminant concentrations. If contaminant analysis of the ground water sample is desired, additional samples must be subsequently collected and preserved, if necessary. Normal sampling procedures appropriate for site conditions and regulatory acceptance are recommended. Sample preservation and handling requirements are based on the type of analyses being performed and should be specified in project-specific documents such as the quality assurance project plan, field sampling

plan, or in general EPA documents such as the Resource Conservation and Recovery Act (RCRA) guidance document (U.S. EPA, 1992) or EPA SW-846 (U.S. EPA, 1982). Additional direction on ground water sampling techniques can be found in Yeskis and Zavala (2002).

2.1. Permanganate (MnO_4^-)

Data and information presented below are reported in terms of the permanganate anion (MnO_4^-; 118.9 grams per mole (g/mol)). Permanganate is purchased either as sodium permanganate ($NaMnO_4$; 141.9 g/mol) or potassium permanganate ($KMnO_4$; 158.0 g/mol) and as a result conversion to the permanganate anion concentration is needed to determine sample preservation needs as per the *Issue Paper*. Specifically, the ratios 118.9/141.9 (g-mole/g-mole) and 118.9/158.0 (g-mole/g-mole) are used to convert $NaMnO_4$ and $KMnO_4$, respectively to MnO_4^-.

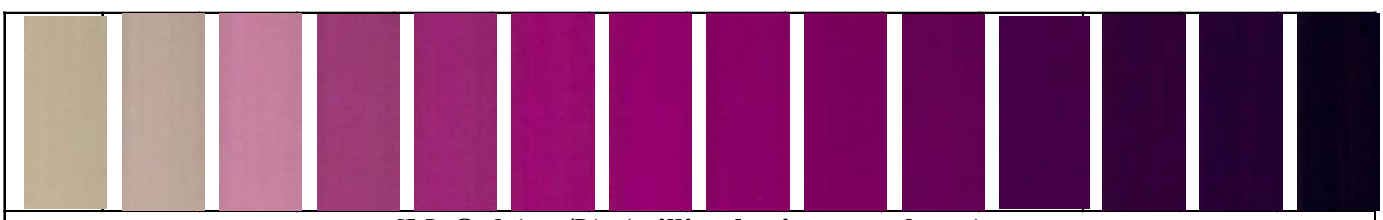
2.1.1. Analysis by Visual Observation

The characteristic pink or purple color of MnO_4^- in a 40 mL VOA vial can be used as a general guideline to estimate the concentration by using the MnO_4^- colorimetric scale (Table 1). This method should be used with caution because ground water turbidity and colloidal manganese dioxide solids ($MnO_2(s)$) can affect sample color and result in deviations from the tabulated color scale. Field filtration can help minimize these interferences, but may not fully remove all color if sub-micron colloidal and/or dissolved constituents are present.

2.1.2. Spectrophotometric Analysis

The permanganate concentration can be determined using commercially available field test kits (SenSafe™, 2011; CHEMetrics, 2011). Additionally, an accurate measurement of the permanganate concentrations can be determined using a field spectrophotometer (maximum absorbance wavelength (λ) = 525 nanometers (nm) (A_{525})) and a calibration curve involving a linear correlation between MnO_4^- concentration and A_{525} (Figure 2, Table 1). Filtered samples (0.2-0.45 micron) may be required to eliminate background colloidal or suspended solid materials that can absorb light at 525 nm and interfere with permanganate measurement. Volatilization of

Table 1. Permanganate concentration, spectrophotometric absorbance at 525 nm, and required amount of ascorbic acid required to neutralize the oxidant in a 40 mL vial. The color scale represents actual photos of MnO_4^- vials and is included for conceptual guidance. Actual colors vary based on background lighting, and color printers. Additionally, photographs of low concentrations (i.e., clear solutions) do not accurately capture transparency.



$[MnO_4^-]$ (mg/L) (millimolar in parentheses)													
0 (0)	0.75 (0.01)	3.8 (0.03)	7.5 (0.06)	11.3 (0.09)	18.8 (0.16)	30.1 (0.25)	37.6 (0.32)	56.4 (0.47)	75.3 (0.63)	113 (0.95)	151 (1.27)	188 (1.58)	376 (3.16)
Absorbance(1), wavelength (λ) = 525 nm													
0	0.011	0.059	0.134	0.197	0.329	0.516	0.627	NL	NL	NL	NL	NL	NL
Ascorbic Acid Stock Solution (M) (2)													
-	0.015	0.015	0.15	0.15	0.15	0.15	0.15	1.5	1.5	1.5	1.5	1.5	1.5
Volume of Ascorbic Acid solution (µL)													
0	30	150	30	46	76	121	152	23	30	46	61	76	152
Mass of Ascorbic Acid (mg)													
0	0.08	0.4	0.79	1.21	2.1	3.32	4.17	6.1	7.9	12.2	16.1	20.1	40.2

(1) $[MnO_4^-]$ (mg/L) = 58.8 × A_{525}; A_{525} is the absorbance at 525 nm; non-linear above 38 mg/L MnO_4^-.
(2) To minimize sample dilution, the ascorbic acid stock solution used was 0.015, 0.15, and 1.5 M.

contaminants is not a concern since the initial screening ground water sample is used specifically to determine the concentration of permanganate.

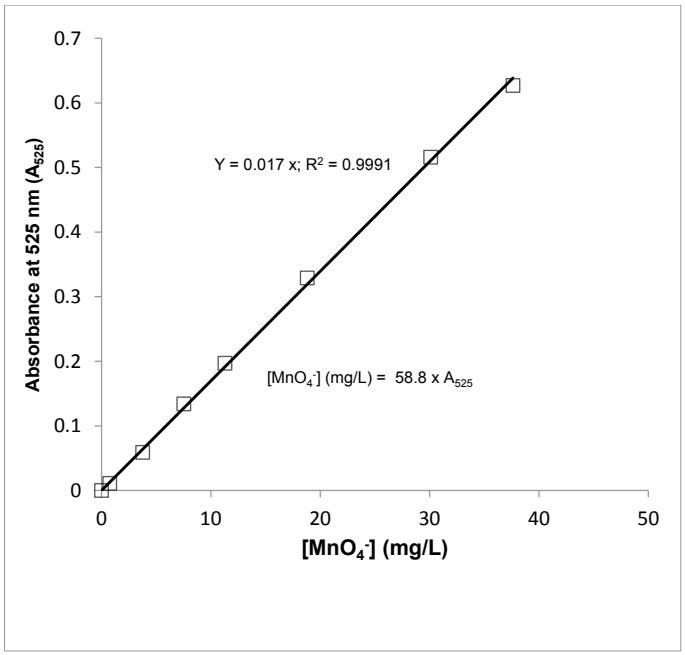


Figure 2. Calibration curve of MnO_4^- concentration versus absorbance at wavelength (λ) of 525 nm.

2.1.3. Results

If MnO_4^- is not detected in the ground water sample, it is recommended that normal ground water sampling and analysis procedures be used. If MnO_4^- is detected, there are two general options to consider. The first option is to delay the collection and analysis of the ground water sample for a sufficient time allowing the MnO_4^- concentration to fully diminish in the subsurface, if desired. In some cases, MnO_4^- persistence is lengthy and this option is not possible (as discussed above in Section 1.1). Due to the site-specific time-dependency of contaminant mass transfer and transport, the time required to approach chemical equilibrium in ground water will likely require additional time after the oxidant is fully consumed. Subsequently, ground water sampling would follow routine guidelines and requirements. The second option is to collect and preserve the ground water sample (i.e., neutralize the oxidant) prior to analysis to minimize the impact of the commingled oxidant. The second option may be desirable for a number of reasons described in Section 1.1.

2.1.4. Oxidant Neutralization and Sample Preservation

Given the MnO_4^- concentration, the volume of ascorbic acid stock solution (0.015, 0.15, or 1.5 mol/L), or weight of crystalline ascorbic acid (176.12 g/mol) required to preserve the binary mixture is determined (Table 1). Sample preservation involves the addition of the appropriate amount of ascorbic acid to preserve a binary mixture in a 40 mL VOA vial. In a lab study (Johnson *et al.,* 2012), the mass of ascorbic acid required to neutralize MnO_4^- ranging in concentration from 1-750 milligrams per liter (mg/L) was determined empirically. The average molar ratio (n=14) was 1.64 mol ascorbic acid/mol MnO_4^- and values ranged from 1.45 to 1.75 mol/mol. Therefore, the weight of ascorbic acid that corresponded with the MnO_4^- colorimetric scale was conservatively based on a stoichiometric ratio of 1.8 mol ascorbic acid/mol MnO_4^-, since, as noted below, no negative side-effects were noted with over-dosing. Detailed recommended operating procedures are provided in the Appendix to estimate the volume of crystalline ascorbic acid or ascorbic acid stock solution required to neutralize the MnO_4^-. Once the oxidant is neutralized, it is recommended that normal ground water sample handling and procedures be followed.

The recommended volume and mass of ascorbic acid included in Table 1 is a guideline. The addition of ascorbic acid will rapidly reduce the MnO_4^- concentration and eliminate the pink/purple color. The formation of colloidal or particulate MnO_2(s) (i.e., Mn^{+4}) may occur causing a brown tinge appearance of the solution. Incremental amendment of ascorbic acid is required to further reduce the Mn^{+4} to Mn^{+2}, and eliminate the brownish tinge color. Mn^{+2} is highly soluble and the most desirable form of Mn to minimize the impact of colloidal or particulate matter on the laboratory analytical instruments. Overall, Table 1 is used as a guideline but the actual amount of ascorbic acid to be added should be based on the amount required to fully eliminate the MnO_4^- and MnO_2(s), and to achieve a clear solution.

Excess ascorbic acid did not have a negative impact on the quality of the ground water sample involving GC and GC/MS analysis of a broad range of organic chemicals (Johnson *et al.,* 2012). The volume of ascorbic acid solution added to the sample vial should be recorded so

appropriate dilution calculations can be performed to obtain an accurate estimate of the contaminant concentrations. Pre-amending sample vials with ascorbic acid is also an option and is discussed further in Section 7.F of the Appendix. Other sample preservation requirements are based on the analyses being performed and are specified in the quality assurance project plan, field sampling plan, RCRA guidance document (U.S. EPA, 1992) or EPA SW-846 (U.S. EPA, 1982). Additional direction on ground water sampling techniques can be found in Yeskis and Zavala (2002)

2.2. Persulfate ($S_2O_8^{2-}$)

The data and information below are presented in terms of the persulfate anion ($S_2O_8^{2-}$; 192.0 g/mol). However, persulfate is predominantly purchased as sodium persulfate ($Na_2S_2O_8$; 238.1 g/mol). As a result, conversion of sodium persulfate to persulfate anion concentrations is necessary to determine sample preservation needs as per the *Issue Paper*. Specifically, the ratio of 192.0/238.1 (g-mol/g-mol) is used to convert $Na_2S_2O_8$ to $S_2O_8^{2-}$. Persulfate is colorless and requires field measurement at the well head to determine its presence and concentration in the ground water sample.

2.2.1. Analysis by Field Test Kit Colorimetry

Field test kits are commercially available to measure persulfate concentration in aqueous samples (CHEMetrics, 2011; FMC, 2012). CHEMetrics persulfate test kits are available for two sodium persulfate concentration ranges (0-7, 7-70 mg/L). Given the high concentrations of persulfate injected into the subsurface at ISCO sites, significant dilution may be required in the use of these test kits. FMC commercial test kits are dependent on whether the persulfate activator is base or thermal (test kit "K"), or whether persulfate is activated by iron chelates or H_2O_2 (test kit "C") (FMC, 2012). The lower detection limit of persulfate using the current FMC test kits is 500 mg/L, a sufficient quantity of oxidant to significantly impact the concentrations of VOCs and the quality of the sample. Based on the current detection limit using the FMC test kit, it is recommended that the minimum amount of ascorbic acid added to the sample vessel should conservatively account for 500 mg/L persulfate.

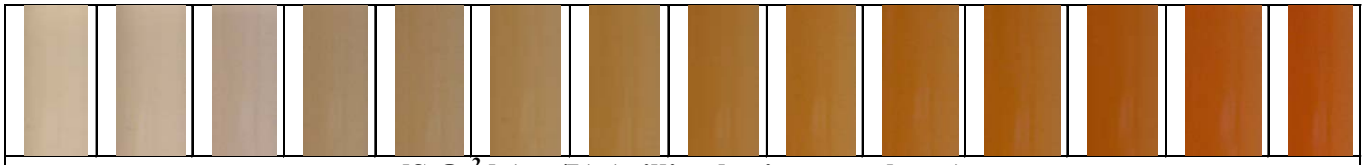
2.2.2. Analysis by Spectrophotometric Analysis (Ferrous Ammonium Sulfate (FAS) Method)

A spectrophotometric method can be used to analyze the persulfate concentration in aqueous samples. The ground water sample should be filtered (0.2-0.45 micron) to eliminate background material (i.e., turbidity) that may interfere with $S_2O_8^{2-}$ analysis. A small volume of de-ionized (DI) water (0.9 mL) and sulfuric acid (H_2SO_4) (10 mL, 2.5 normal (N)) (or, add 10.9 mL of 2.3 N H_2SO_4) is placed in a 20 mL glass or plastic test vessel. These can be prepared prior to transport to the field. A blank is prepared by mixing 1 mL DI water with H_2SO_4 (10 mL, 2.5 N). The filtered sample (0.1 mL) is placed in the test vessel, followed by the addition of ferrous ammonium sulfate (FAS) ($Fe(SO_4)_2(NH_4)_2 \cdot 6H_2O$) (0.1 mL, 0.4 N) (prepared immediately before use). Adding a couple drops of H_2SO_4 (conc.) to the FAS reagent increases the stability of the ferrous iron for several more hours (5 to 10 hours). The mixture is swirled/mixed and allowed to react for 30 to 40 minutes. Subsequently, the mixture is amended with ammonium thiocyanate (NH_4SCN) (0.2 mL, 0.6 N) and the absorbance of the solution is analyzed immediately with a spectrophotometer at a wavelength of λ = 450 nm (A_{450}) (Huang *et al.,* 2002; Huling *et al.,* 2011a; b). The general colorimetric scale provided below can be used to estimate the persulfate concentration in a ground water sample (Table 2) analyzed by the FAS method. Alternatively, a calibration curve involving a linear correlation between $S_2O_8^{2-}$ concentration and A_{450} can be used to determine a more precise estimate of the persulfate concentration (Figure 3).

2.2.3. Results

If $S_2O_8^{2-}$ is not detected in the ground water sample, it is recommended to proceed using normal ground water sampling and analysis procedures. If $S_2O_8^{2-}$ is detected, there are two general options to consider. The first is to delay collection and analysis of the ground water sample for sufficient time which allows the persulfate concentration to fully diminish in the subsurface, if desired. Due to the site-specific time-dependency of contaminant mass transfer and transport, the time required to approach chemical equilibrium in ground water will likely require additional time after the oxidant is fully consumed. Subsequently, ground water sampling would follow routine guidelines. The second option is to collect and

Table 2. Persulfate concentrations resulting from the ferrous ammonium sulfate analytical method involving the spectrophotometric measurement (λ = 450 nm) of the solution, and the required amount of ascorbic acid required to neutralize the oxidant in a 40 mL vial. The color scale represents actual photos of $S_2O_8^{2-}$ vials and is included for conceptual guidance. Actual colors vary based on background lighting, and color printers. Additionally, photographs of low concentrations (i.e., clear solutions) do not accurately capture transparency.



$[S_2O_8^{2-}]$ (mg/L) (millimolar in parentheses)													
0 0	80 (0.42	200 (1.1)	400 (2.1)	610 (3.2)	810 (4.2)	1210 (6.3)	1610 (8.4)	2020 (10.5)	2420 (12.6)	2820 (14.7)	3230 (16.8)	3630 (18.9)	4030 (21.0)
Absorbance[(1)], wavelength (λ) = 450 nm													
0	0.011	0.019	0.04	0.062	0.076	0.121	0.164	0.204	0.245	0.275	0.313	0.349	0.397
Volume of Ascorbic Acid solution (mL)													
0	0.04	0.11	0.22	0.34	0.45	0.67	0.89	1.12	1.34	1.57	1.79	2.02	2.24
Mass of Ascorbic Acid (176.12 g/mol) (g)													
0	0.01	0.03	0.06	0.09	0.12	0.18	0.24	0.3	0.35	0.41	0.47	0.53	0.59

(1) Solubility of ascorbic acid in water = 330 g/L (1.87 mol/L); 80% solubility (1.5 mol/L) used as stock solution; $[S_2O_8^{2-}]$ (mg/L) = 10,000 × A_{450}; where A_{450} is the absorbance at 450 nm.

preserve the ground water sample prior to analysis to minimize the impact of persulfate on the ground water sample. The second option may be desirable for a number of reasons described in Section 1.1.

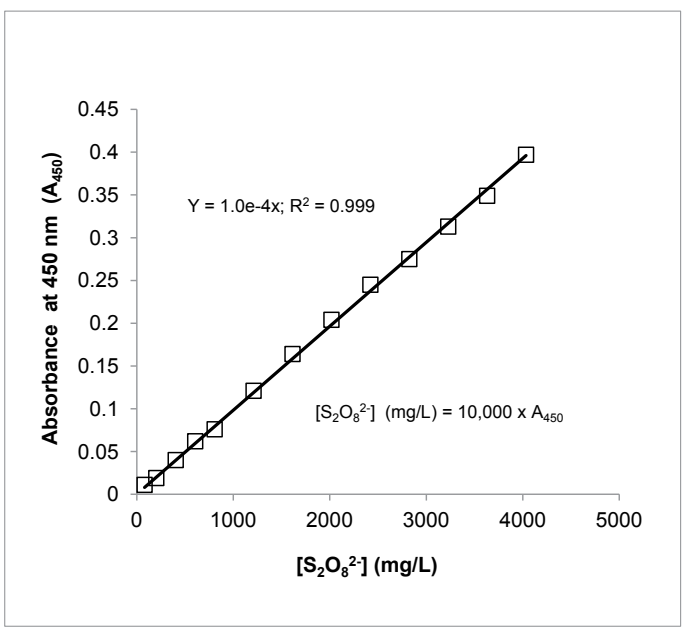


Figure 3. Calibration curve for $S_2O_8^{2-}$ concentration versus absorbance at wavelength 450 nm using the ferrous ammonium sulfate method.

2.2.4. Oxidant Neutralization and Sample Preservation

Guidelines for the volume of ascorbic acid stock solution (1.5 mol/L) or the weight of crystalline ascorbic acid (176.1 g/mol) required to preserve the binary mixture in a 40 mL sample vial are provided (Table 2). The mass of ascorbic acid that corresponds with the persulfate colorimetric scale is based on a stoichiometric ratio of 4 mol ascorbic acid/mol persulfate and was determined empirically in a laboratory study (Huling *et al.,* 2011a). Detailed recommended operating procedures are provided in the Appendix to estimate the volume of crystalline ascorbic acid or ascorbic acid stock solution required to neutralize the $S_2O_8^{2-}$. This stoichiometric ratio is in excess of the ideal stoichiometry for mineralization of persulfate by ascorbic acid. Excess ascorbic acid (4 – 40 mol ascorbic acid/mol persulfate) did not have a negative impact on the quality of the ground water sample involving GC and GC/MS analysis of BTX, TCE, and PCE (Huling *et al.,* 2011a). The basis for this quantity of ascorbic acid is to achieve favorable reaction kinetics between $\cdot SO_4^-$ and ascorbic acid, relative to the reaction between the sulfate radical ($\cdot SO_4^-$) and the VOCs. Following oxidant neutralization, it is recommended that other approved sample preservation and handling methods

in ground water sample handling be performed. For example, acidification of the sample is normally carried out to minimize biochemical and reduction reactions. Other sample preservation requirements are based on the analyses being performed and are specified in the quality assurance project plan, field sampling plan, RCRA guidance document (U.S. EPA, 1992) or EPA SW-846 (U.S. EPA, 1982). Additional direction on ground water sampling techniques can be found in Yeskis and Zavala (2002).

3. ADDITIONAL INFORMATION

It is recommended that the analytical laboratory be notified that the aqueous samples contain residual persulfate or permanganate and were preserved with ascorbic acid. The volume of ascorbic acid solution added to the sample should be recorded so the appropriate calculations can be used to correct for dilutions. If MnO_2(s) has settled on the bottom of the VOA vial, it is important that the sample not be disturbed prior to analysis. This precaution in sample handling prevents the suspension of the MnO_2(s) particles and the potential for accidental injection into the analytical instruments.

Other preservatives have been used to successfully neutralize these oxidants, but may negatively impact the quality of the sample (Huling *et al.,* 2011a). Despite efforts used to neutralize the oxidant and to preserve the quality of the ground water sample, the presence of oxidant in ground water samples introduces uncertainty in the precise measurement of contaminant concentrations in the subsurface. This is attributed to the potential impact of the oxidant on contaminant concentrations in the ground water sample prior to neutralization, the transient nature of contaminant fate and transport in the subsurface where ISCO activities were deployed, and the site-specific oxidant injection and hydrogeologic conditions contributing to binary mixtures. Consequently, additional ground water sample collection and analysis will likely be required to achieve an accurate evaluation of post-ISCO performance, and regulatory adherence with US EPA ground water compliance monitoring requirements.

Numerous examples exist where elevated permanganate and VOC concentrations have been measured in ground water samples collected over extended periods of time at hazardous waste sites. It can be concluded from a simple kinetic analysis that long term VOC persistence can primarily be explained by spatial separation between the ground water containing the oxidant and contaminant (Figure 1) (Johnson *et al.,* 2012). Ground water samples derived from wells screened over spatially separate vertical intervals indicate an in-well mixture of ground water containing either oxidants or contaminants. Limited contact between the oxidant and contaminant within the same lithologic unit can be due to specific mass transfer or mass transport conditions including the dissolution of non-aqueous phase liquids (NAPLs) or slow diffusion of contaminants from low permeability materials. These fate and transport conditions indicate the oxidant has not been uniformly delivered to the contaminated zone(s). A critical analysis of screened intervals, injection intervals, contaminated intervals, oxidant and contaminant transport characteristics, and ground water sample results from analyzing preserved binary mixtures, could provide valuable insight for the development of a more accurate site conceptual model that could be used to design and deploy a more effective oxidant delivery system.

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5. ACKNOWLEDGEMENTS

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Appendix Recommended Operating Procedures - Preservation of Ground Water Samples at ISCO Sites Using Ascorbic Acid

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1. PURPOSE (SCOPE AND APPLICATION)

The commingling of organic contaminants and oxidants in ground water or aqueous samples represents a condition in which there is significant potential for oxidative transformation of the contaminants after the sample is collected. Consequently, the quality of the ground water or aqueous sample may be compromised and a false negative result may occur. These recommended operating procedures describe the steps used to preserve ground water samples containing the oxidants permanganate (MnO_4^-), or persulfate ($S_2O_8^{2-}$) and organic contaminants of concern (COCs) prior to analysis. It is applicable for ground water samples containing volatile and non-volatile organic contaminants to be analyzed by gas chromatography (GC), or gas chromatography-mass spectroscopy (GC-MS), using either the purge and trap or headspace sample introduction methods, and high performance liquid chromatography (HPLC).

These procedures are also applicable to bench-scale studies where oxidants are used to investigate the feasibility of ISCO treatment. For example, aqueous samples collected from bench-scale soil reactors are analyzed for organic contaminants, but may also contain the oxidant amended to the reactor to destroy the contaminant. Consequently, the guidelines and general procedures described below also extend to bench-scale studies where the potential for binary mixture aqueous samples may occur, and are analyzed for organic contaminants.

2. METHOD SUMMARY

Based on the measured or estimated oxidant concentration in a ground water or aqueous sample, a specific quantity of the preservative, ascorbic acid, is added to the ground water or aqueous sample to either neutralize or to limit the impact of the residual oxidant on the quality of the sample. Tables 1 and 2 in the *Issue Paper* are used as guidelines to estimate the amount of ascorbic acid to add to a 40 mL VOA vial to preserve binary mixture ground water and/or aqueous samples.

3. REAGENTS

Ascorbic Acid ($C_6H_8O_6$; 176.1 g mol^{-1})

De-ionized (DI) water

Ferrous amonium sulfate (FAS) reagents – sulfuric acid (H_2SO_4), ferrous ammonium sulfate ($Fe(SO_4)_2(NH_4)_2 \cdot 6H_2O$), ammonium thiocyanate (NH_4SCN).

4. EQUIPMENT/APPARATUS

Pipette, volumetric flasks, spectrophotometer (or field test kits)

SenSafe™ or CHEMetrics field test kits for permanganate measurement (if used), or direct measurement.

CHEMetrics or FMC field test kits for persulfate measurement (if used), or measurement using FAS method.

5. HEALTH AND SAFETY PRECAUTIONS

The Materials Safety Data Sheet for ascorbic acid indicates potentially acute health effects: slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. In case of skin contact: wash

with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops. Cold water may be used. Other guidelines are available based on exposure (*http://www.sciencelab.com/*msds.php?msdsId=9922972). It is recommended to wear gloves and safety glasses during all of the procedures described herein due to the potential for exposure to oxidants, impacted ground water sample, and other chemicals involved in these procedures. Always consult site-specific health and safety plans prior to sampling.

6. INTERFERENCES

Colloidal and/or suspended solids in ground water samples may adsorb light and interfere with the measurement of oxidant concentration. For this reason, the ground water sample may require filtration (0.2-0.45 µm) to eliminate background material (i.e., turbidity).

7. PROCEDURES

A. Ascorbic Acid

Prepare ascorbic acid stock solution either in the lab prior to ground water sampling, or in the field. The appropriate use of these stock solutions is dependent on concentrations of the oxidant measured in the ground water samples. The stock solution should be stored in a refrigerator or cooler until used, and discarded after 150 days.

High Concentration Stock Solution: 1.5 M ascorbic acid (e.g., add 264 g of ascorbic acid (MW=176.1 g/mol) to 1L volumetric flask and fill with DI water). This stock solution can be diluted in the preparation of 0.015 and 0.15 M ascorbic acid stock solutions.

Medium Concentration Stock Solution: 0.15 M ascorbic acid: Dilute 1.5 M ascorbic acid stock solution 1:10 (e.g., dilute 100 mL of 1.5 M stock solution to 1L with DI water).

Low Concentration Stock Solution: 0.015 M ascorbic acid: Dilute 1.5 M ascorbic acid stock solution 1:100 (e.g., dilute 10 mL of 1.5 M stock solution to 1L with DI water).

B. Sample Filtration

Filter the ground water or aqueous sample using 0.2–0.45 µm filter (as needed in accordance with the site QAPP or Sampling and Analysis Plan) to eliminate background material (i.e., turbidity) that may interfere with oxidant analysis.

C. Concentration Measurement

Determine the oxidant concentrations (permanganate or persulfate) through one of three methods below.

1) Commercially available test kits
   a. Permanganate: SenSafe™ or CHEMetrics
   b. Persulfate: CHEMetrics or FMC
2) UV-VIS absorbance
   a. Permanganate (direct measurement): wavelength = 525 nm
   b. Persulfate (Ferrous Ammonium Sulfate method): wavelength = 450 nm (Huang *et al.,* 2002; Huling *et al.,* 2011)
3) Colorimetric scales presented in Tables 1 and 2.

Based on the oxidant concentration determined, ascorbic acid stock solution is added to an empty sample vial according to Tables 1 and 2.

D. Quality Assurance and Quality Control (QA/QC)

Quality control includes regularly scheduled analysis of method blanks and sample replicates, and the verification of stock solutions of known concentration via the analysis for concentrations of secondary solutions prepared from the stocks. Results of the analyses of method blanks, replicate analyses, and the verification of stock solution concentrations are logged and maintained in record books specific to the research being conducted. The frequency, control limits, and corrective actions should be appropriately developed for specific applications.

E. Calculations

1) Concentration conversion

a. Permanganate.

The concentrations of permanganate (MnO_4^-) have been presented in terms of the permanganate anion (118.9 g/mol) (Table 1). However, permanganate is purchased either as sodium permanganate ($NaMnO_4$; 141.9 g/mol) or potassium permanganate ($KMnO_4$; 158.0 g/mol) and as a result conversion to permanganate anion concentrations may be desired to determine

adequate sample preservation needs. Specifically, the ratios 118.9/141.9 (0.84) and 118.9/158.0 (0.75) are used to convert $NaMnO_4$ and $KMnO_4$ respectively, to MnO_4^- (Table A1).

Because 1 mmole of either sodium or potassium permanganate produces 1 mmole of permanganate (Eqs 1 and 2), the molar concentrations of sodium and potassium permanganate are the same as permanganate (Table 3).

$$NaMnO_4 \rightarrow Na^+ + MnO_4^- \quad (1)$$

$$KMnO_4 \rightarrow K^+ + MnO_4^- \quad (2)$$

Converting sodium and potassium permanganate concentrations from mg/L to millimolar, and calculating their permanganate equivalence,

X mg/L $NaMnO_4$ =
(X mg/L) × (1 mmol/141.9 mg) =
X/141.9 mM $NaMnO_4$ =
X/141.9 mM MnO_4^- X/141.9 mM MnO_4^- =
((X/141.9) mmol/L) × (118.9 mg/mmol) =
0.84X mg/L MnO_4^-

NOTE: 1 mmol = 0.001 mol; mM= mmol/L

Y mg/L $KMnO_4$ =
(Y mg/L) × (1 mmol/158.0 mg) =
Y/158.0 mM $KMnO_4$ =
Y/158.0 mM MnO_4^-

Y/158.0 mM MnO_4^- =
((Y/158.0) mmol/L) × (118.9 mg/mmol) =
0.75Y mg/L MnO_4^-

NOTE: 1 mmol = 0.001 mol; mM= mmol/L

b. Persulfate.

The concentration of persulfate is presented in terms of the persulfate anion ($S_2O_8^{2-}$; 192.0 g/mol) (Table A2). However, persulfate is purchased as sodium persulfate ($Na_2S_2O_8$; 238.1 g/mol) and as a result a conversion may be desired to correct for the anionic form of the oxidant and to determine adequate sample preservation needs. Specifically, the ratio of 192.0/238.1 (0.81) is used to convert $Na_2S_2O_8$ to $S_2O_8^{2-}$. Persulfate is colorless and requires field measurement at the well head to determine its presence and concentration in the ground water sample.

Converting sodium persulfate concentrations from mg/L to millimolar, and calculating the persulfate equivalence,

$$Na_2S_2O_8 \rightarrow 2Na^+ + S_2O_8^{2-} \quad (3)$$

Z mg/L $Na_2S_2O_8$ =
(Z mg/L) × (1 mmole/238.1 mg) =
Z/238.1 mM $Na_2S_2O_8$ =
Z/238.1 mM $S_2O_8^{2-}$

Z/238.1 mM $S_2O_8^{2-}$ =
(Z/238.1) mmole/L) × (192 mg/mmole) =
0.81Z mg/L $S_2O_8^{2-}$

2) Required volume and mass of ascorbic acid to neutralize oxidants.

a. Permanganate.

1.8 mole ascorbic acid per mole of permanganate was empirically determined to effectively neutralize permanganate in an aqueous sample containing VOCs (Johnson *et al.*, 2012). Therefore, the mass balance equation (Eq 4) can be set up as follows,

$$1.8C_{MnO4-}V_{MnO4-} = C_{H2A}V_{H2A} \quad (4)$$

Where,

C_{MnO4-} = permanganate concentration determined in step 7.C,

Table A1. Corresponding concentration of sodium permanganate and potassium permanganate to permanganate.

$NaMnO_4$	mg/L	0.90	4.5	9.0	13.5	22.4	35.9	44.9	67.3	89.9	135	180	224	449
	mM	0.006	0.032	0.063	0.095	0.16	0.25	0.32	0.47	0.63	0.95	1.27	1.58	3.16
$KMnO_4$	mg/L	1.00	5.0	10.0	15.0	25.0	40.0	50.0	74.9	100	150	201	250	500
	mM	0.006	0.032	0.063	0.095	0.16	0.25	0.32	0.47	0.63	0.95	1.27	1.58	3.16
MnO_4^-	mg/L	0.75	3.8	7.5	11.3	18.8	30.1	37.9	56.4	75.3	113	151	188	376
	mM	0.006	0.032	0.063	0.095	0.16	0.25	0.32	0.47	0.63	0.95	1.27	1.58	3.16

Table A2. Corresponding concentration of sodium persulfate to persulfate ($S_2O_8^{2-}$).

$Na_2S_2O_8$	mg/L	99	248	496	756	1004	1500	1996	2504	3000	3496	4004	4500	4996
	mM	0.42	1.0	2.1	3.2	4.2	6.3	8.4	10.5	12.6	14.7	16.8	18.9	21.0
$S_2O_8^{2-}$	mg/L	80	200	400	610	810	1210	1610	2020	2420	2820	3230	3630	4030
	mM	0.42	1.0	2.1	3.2	4.2	6.3	8.4	10.5	12.6	14.7	16.8	18.9	21.0

V_{MnO4-} = volume of permanganate solution in the VOA vial (0.04 L),

C_{H2A} = ascorbic acid concentration (0.015, 0.15 or 1.5 M), and

V_{H2A} = volume of ascorbic acid required to neutralize permanganate.

V_{H2A} can be calculated (Eq 5) through rearranging Eq. (4)

$$\mathbf{V_{H2A} = (1.8 \times C_{MnO4-} \times V_{MnO4-})/C_{H2A}} \quad (5)$$

For example, a 40 mL permanganate concentration of 1.27mM (151 mg/L) is neutralized using 1.5 M ascorbic acid. The volume of stock solution and mass of ascorbic acid can be calculated as follows.

$$V_{H2A} = (1.8 \times 1.27 \text{ mmol/L} \times 0.04\text{L}/1.5 \text{ mol/L}) \times (1 \text{ mol}/1000 \text{ mmol}) \times (10^6 \ \mu\text{L}/1\text{L}) = 61 \ \mu\text{L}$$

$$M_{H2A} = 1.5 \text{ mol/L} \times 61 \ \mu\text{L} \times (1\text{L}/10^6 \ \mu\text{L}) \times (176.12 \text{ g/mol}) \times (1000 \text{ mg/g}) = 16.1 \text{ mg}$$

Where,

M_{H2A} = mass of ascorbic acid

The formation of colloidal or particulate $MnO_2(s)$ (i.e., Mn^{+4}) may occur causing a brown tinge appearance of the solution. Incremental amendment of ascorbic acid may be required to further reduce the Mn^{+4} to Mn^{+2}, and eliminate the brownish tinge color. Mn^{+2} is highly soluble and the most desirable form of Mn to minimize the impact of colloidal or particulate matter on the laboratory analytical instruments. Overall, Table 1 is used as a guideline but the actual amount should be based on the amount required to fully eliminate the MnO_4^- and $MnO_2(s)$, and to achieve a clear solution. The volume of ascorbic acid solution added to the sample vial should be recorded so appropriate dilution calculations can be performed to obtain an accurate estimate of the contaminant concentrations.

b. Persulfate.

4 mole of ascorbic acid per mole of persulfate was empirically determined to effectively limit the impact of the oxidant on VOCs in aqueous samples (Huling *et al.,* 2011). Therefore, the mass balance equation (Eq 6) can be set up as follows,

$$4C_{S2O82-}V_{S2O82-} = C_{H2A}V_{H2A} \quad (6)$$

Where,

C_{S2O82-} = persulfate concentration determined in step 7.C,

V_{S2O82-} = volume of persulfate solution in the VOA vial 0.04 L,

C_{H2A} = ascorbic acid concentration (1.5 M),

V_{H2A} = volume of ascorbic acid required to neutralize persulfate

V_{H2A} can be calculated (Eq 7) through rearranging Eq. (6)

$$\mathbf{V_{H2A} = (4 \times C_{S2O82-} \times V_{S2O82-})/C_{H2A}} \quad (7)$$

For example, persulfate concentration is 10.5 mM (2020 mg/L) and neutralized using 1.5 M ascorbic acid. The volume of stock solution and mass of ascorbic acid can be calculated as follows.

$$V_{H2A} = (4 \times 10.5 \text{ mmol/L} \times 0.04\text{L} / 1.5 \text{ mol/L}) \times (1 \text{ mol}/1000 \text{ mmol}) \times (1000 \text{ mL}/1\text{L}) = 1.12 \text{ mL}$$

$$M_{H2A} = 1.5 \text{ mol/L} \times 1.12 \text{ mL} \times (1 \text{ L}/1000 \text{ mL}) \times (176.12 \text{ g/mol}) = 0.3 \text{ g}$$

Where,

M_{H2A} = mass of ascorbic acid

The volume of ascorbic acid solution added to the sample vial should be recorded so appropriate dilution calculations can be performed to obtain an accurate estimate of the contaminant concentrations.

F. Pre-amending Sample Vials With Preservative

Pre-amending the 40 mL sample vials prior to performing ground water sample collection in the field is one step that may help simplify sample preservation procedures. The advantage is that all sample vials are

amended with the preservative in a uniform manner, and this reduces the number of steps and time required during ground water sampling activities in the field. Specifically, this would involve amending the sample vial with an appropriate quantity of ascorbic acid using the procedures recommended above. Successful sample preservation would be immediately obvious in the case with permanganate binary mixtures as the pink/purple color would disappear and the sample would become clear. A persistent pink/purple or brown tinge color would indicate the need for additional preservative. The immediate visual feedback would not occur in the preservation of persulfate binary mixtures due to the absence of oxidant coloration. Success of the preservation method will most likely require prior knowledge of oxidant concentrations in ground water samples to support the selection of an appropriate quantity of preservative. A quality assurance step could include the collection of duplicate samples, and subsequent analysis for persulfate, when time permits, to confirm that a sufficient quantity of preservative was amended. Other appropriate quality assurance steps could be developed.

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Johnson, K.T., Wickham-St. Germain, M., Ko, S. and Huling, S.G. 2012. Binary Mixtures of Permanganate and Chlorinated Volatile Organic Compounds in Groundwater Samples: Sample Preservation and Analysis. *Ground Water Monit. Remed.,* 32(3), Summer 84–92.

9. DISCLAIMER

This recommended operating procedure has been prepared for general use. This is not an official approved U.S. Environmental Protection Agency method and has not undergone the Agency's peer review process.

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Appendix E
Laboratory Analytical Reports

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SGS North America Inc.

Sample Summary

Geosyntec Consultants

Job No: FA70512

Cristex Drum Site; 500 W Industry Dr, Oxford, NC
Project No: GR6764

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
FA70512-1	12/03/19	08:35	AV	12/05/19	SO	Soil	EKMW-1-33-35
FA70512-2	12/03/19	11:30	AV	12/05/19	SO	Soil	EKMW-2-43-45
FA70512-3	12/03/19	09:30	AV	12/05/19	SO	Soil	SW-1-30-32
FA70512-4	12/03/19	09:40	AV	12/05/19	SO	Soil	SW-1-40-42
FA70512-5	12/03/19	11:40	AV	12/05/19	SO	Soil	DUP-1-20191203
FA70512-6	12/03/19	00:00	AV	12/05/19	SO	Trip Blank Soil	TRIP BLANK

This report contains results reported as ND = Not detected. The following applies:
Organics ND = Not detected above the MDL

Soil samples reported on a dry weight basis unless otherwise indicated on result page.

SAMPLE DELIVERY GROUP CASE NARRATIVE

Client: Geosyntec Consultants **Job No:** FA70512

Site: Cristex Drum Site; 500 W Industry Dr, Oxford, NC **Report Date** 12/18/2019 6:32:23

5 Samples, 1 Trip Blank were collected on 12/03/2019 and were received at SGS North America Inc - Orlando on 12/05/2019 properly preserved, at 1.8 Deg. C and intact. These Samples received an SGS Orlando job number of FA70512. A listing of the Laboratory Sample ID, Client Sample ID and dates of collection are presented in the Results Summary Section. Except as noted below, all method specified calibrations and quality control performance criteria were met for this job. For more information, please refer to QC summary pages.

MS Volatiles By Method SW846 8260D

Matrix: SO **Batch ID:** V2B533

All samples were analyzed within the recommended method holding time.

Sample(s) FA70512-1MS, FA70512-1MSD were used as the QC samples indicated.

All method blanks for this batch meet method specific criteria.

Blank Spike Recovery(s) for 2,2-Dichloropropane, Chloroethane, Chloroform are outside control limits.

Matrix Spike Recovery(s) for 1,1-Dichloroethane, 1,2,3-Trichlorobenzene, 1,2,4-Trichlorobenzene, 1,2-Dichlorobenzene, 1,3-Dichlorobenzene, 1,4-Dichlorobenzene, 2,2-Dichloropropane, 2-Butanone (MEK), Acetone, Chloroethane, Chloroform, Hexachlorobutadiene, Methylene Chloride, Naphthalene, Styrene, Tetrachloroethylene, Trichlorofluoromethane are outside control limits. Probable cause is due to matrix interference.

Matrix Spike Duplicate Recovery(s) for 1,1-Dichloroethane, 1,2,3-Trichlorobenzene, 1,2,4-Trichlorobenzene, 1,2-Dichlorobenzene, 1,3-Dichlorobenzene, 1,4-Dichlorobenzene, 2,2-Dichloropropane, Acetone, Chloroethane, Chloroform, Hexachlorobutadiene, Methylene Chloride, n-Butylbenzene, Naphthalene, p-Isopropyltoluene, Styrene, Tetrachloroethylene, Trichlorofluoromethane are outside control limits. Probable cause is due to matrix interference.

FA70512-1: Results reported from bisulfate preserved sample. Internal standard response outside control limits. Confirmation run for internal standard areas.

FA70512-3: Results reported from bisulfate preserved sample.

FA70512-4 for 1,2,3-Trichlorobenzene: Associated CCV outside of control limits low.

FA70512-4: Results reported from bisulfate preserved sample.

FA70512-5 for 1,2,3-Trichlorobenzene: Associated CCV outside of control limits low.

FA70512-5: Results reported from bisulfate preserved sample.

FA70512-6 for 1,2,3-Trichlorobenzene: Associated CCV outside of control limits low.

FA70512-6: Results reported from bisulfate preserved sample.

FA70512-6 for 2,2-Dichloropropane: Associated BS recovery outside control limits high; however sample is ND. Associated CCV outside of control limits high, sample was ND.

FA70512-6 for Chloroform: Associated BS recovery outside control limits high; however sample is ND.

FA70512-5 for Chloroethane: Associated ICV and BS outside control limits high, however sample ND. Associated CCV outside of control limits high, sample was ND.

FA70512-5 for 2,2-Dichloropropane: Associated BS recovery outside control limits high; however sample is ND. Associated CCV outside of control limits high, sample was ND.

FA70512-5 for Chloroform: Associated BS recovery outside control limits high; however sample is ND.

FA70512-4 for Chloroethane: Associated ICV and BS outside control limits high, however sample ND. Associated CCV outside of control limits high, sample was ND.

FA70512-6 for Chloroethane: Associated ICV and BS outside control limits high, however sample ND. Associated CCV outside of control limits high, sample was ND.

FA70512-3 for Chloroform: Associated BS recovery outside control limits high; however sample is ND.

FA70512-4 for 2,2-Dichloropropane: Associated BS recovery outside control limits high; however sample is ND. Associated CCV outside of control limits high, sample was ND.

FA70512-4 for Chloroform: Associated BS recovery outside control limits high; however sample is ND.

FA70512-3 for Chloroethane: Associated ICV and BS outside control limits high, however sample ND. Associated CCV outside of control limits high, sample was ND.

FA70512-3 for 1,2,3-Trichlorobenzene: Associated CCV outside of control limits low.

FA70512-5 for 2-Butanone (MEK): Associated CCV outside of control limits high.

FA70512-3 for 2,2-Dichloropropane: Associated BS recovery outside control limits high; however sample is ND. Associated CCV outside of control limits high, sample was ND.

Matrix: SO **Batch ID:** V3C337

All samples were analyzed within the recommended method holding time.

All method blanks for this batch meet method specific criteria.

Sample(s) FA70711-1MS, FA70711-1MSD were used as the QC samples indicated.

Matrix Spike Recovery(s) for 1,1,1,2-Tetrachloroethane, 1,1,2,2-Tetrachloroethane, 1,1,2-Trichloroethane, 1,1-Dichloroethane, 1,1-Dichloroethylene, 1,1-Dichloropropene, 1,2,3-Trichlorobenzene, 1,2,3-Trichloropropane, 1,2,4-Trichlorobenzene, 1,2,4-Trimethylbenzene, 1,2-Dibromo-3-chloropropane, 1,2-Dibromoethane, 1,2-Dichlorobenzene, 1,2-Dichloroethane, 1,2-Dichloropropane, 1,3,5-Trimethylbenzene, 1,3-Dichlorobenzene, 1,3-Dichloropropane, 1,4-Dichlorobenzene, 2-Butanone (MEK), 2-Hexanone, 4-Methyl-2-pentanone (MIBK), Acetone, Benzene, Bromobenzene, Bromochloromethane, Bromodichloromethane, Bromoform, Carbon Disulfide, Carbon Tetrachloride, Chlorobenzene, Chloroform, cis-1,2-Dichloroethylene, cis-1,3-Dichloropropene, Dibromochloromethane, Ethylbenzene, Hexachlorobutadiene, Isopropylbenzene, m,p-Xylene, Methyl Bromide, Methyl Tert Butyl Ether, Methylene Bromide, Methylene Chloride, n-Butylbenzene, n-Propylbenzene, Naphthalene, o-Chlorotoluene, o-Xylene, p-Chlorotoluene, p-Isopropyltoluene, sec-Butylbenzene, Styrene, tert-Butylbenzene, Tetrachloroethylene, Toluene, trans-1,2-Dichloroethylene, trans-1,3-Dichloropropene, Trichloroethylene, Vinyl Acetate, Vinyl Chloride are outside control limits. Probable cause is due to matrix interference.

Matrix Spike Duplicate Recovery(s) for 1,1,1,2-Tetrachloroethane, 1,1,2,2-Tetrachloroethane, 1,1,2-Trichloroethane, 1,1-Dichloroethane, 1,1-Dichloroethylene, 1,1-Dichloropropene, 1,2,3-Trichlorobenzene, 1,2,3-Trichloropropane, 1,2,4-Trichlorobenzene, 1,2,4-Trimethylbenzene, 1,2-Dibromo-3-chloropropane, 1,2-Dibromoethane, 1,2-Dichlorobenzene, 1,2-Dichloroethane, 1,2-Dichloropropane, 1,3,5-Trimethylbenzene, 1,3-Dichlorobenzene, 1,3-Dichloropropane, 1,4-Dichlorobenzene, 2-Butanone (MEK), 2-Hexanone, 4-Methyl-2-pentanone (MIBK), Acetone, Benzene, Bromobenzene, Bromochloromethane, Bromodichloromethane, Bromoform, Carbon Disulfide, Carbon Tetrachloride, Chlorobenzene, Chloroform, cis-1,2-Dichloroethylene, cis-1,3-Dichloropropene, Dibromochloromethane, Ethylbenzene, Hexachlorobutadiene, Isopropylbenzene, m,p-Xylene, Methyl Bromide, Methyl Tert Butyl Ether, Methylene Bromide, Methylene Chloride, n-Butylbenzene, n-Propylbenzene, Naphthalene, o-Chlorotoluene, o-Xylene, p-Chlorotoluene, p-Isopropyltoluene, sec-Butylbenzene, Styrene, tert-Butylbenzene, Tetrachloroethylene, Toluene, trans-1,2-Dichloroethylene, trans-1,3-Dichloropropene, Trichloroethylene, Trichlorofluoromethane, Vinyl Acetate, Vinyl Chloride are outside control limits. Probable cause is due to matrix interference.

RPD(s) for MSD for 1,1-Dichloroethylene, 1,1-Dichloropropene, 1,2,4-Trimethylbenzene, 1,2-Dichloroethane, 1,2-Dichloropropane, 1,3-Dichloropropane, 2-Butanone (MEK), 2-Hexanone, Benzene, Bromochloromethane, Bromodichloromethane, Bromoform, Carbon Disulfide, Chlorobenzene, Chloroform, cis-1,2-Dichloroethylene, Dibromochloromethane, Ethylbenzene, Isopropylbenzene, m,p-Xylene, Methylene Chloride, n-Propylbenzene, o-Chlorotoluene, o-Xylene, p-Chlorotoluene, Tetrachloroethylene, trans-1,2-Dichloroethylene, Trichloroethylene, Vinyl Chloride are outside control limits for sample FA70711-1MSD. Probable cause is due to sample non-homogeneity.

FA70512-1: Soil vials were not received within 48 hours of sampling; results are considered minimum values.

FA70512-1 for Vinyl Acetate: Associated CCV outside of control limits low.

Matrix: SO **Batch ID:** VF3265

All samples were analyzed within the recommended method holding time.

Sample(s) FA70512-2MS, FA70512-2MSD were used as the QC samples indicated.

All method blanks for this batch meet method specific criteria.

Blank Spike Recovery(s) for 2-Butanone (MEK), 2-Hexanone, Acetone are outside control limits.

Matrix Spike Recovery(s) for 1,2,3-Trichlorobenzene, 1,2,4-Trichlorobenzene, Hexachlorobutadiene, Methylene Chloride, Tetrachloroethylene are outside control limits. Probable cause is due to matrix interference.

MS Volatiles By Method SW846 8260D

Matrix: SO **Batch ID:** VF3265

Matrix Spike Duplicate Recovery(s) for 1,2,3-Trichlorobenzene, Hexachlorobutadiene, Tetrachloroethylene are outside control limits. Probable cause is due to matrix interference.

FA70512-2: Soil vials were not received within 48 hours of sampling; results are considered minimum values.

FA70512-2 for 2-Butanone (MEK): Associated BS recovery outside control limits high; however sample is ND.

FA70512-2 for 2-Hexanone: Associated BS recovery outside control limits high; however sample is ND. Associated CCV outside of control limits high, sample was ND.

General Chemistry By Method SM19 2540G

Matrix: SO **Batch ID:** GN83842

Sample(s) FA70512-3DUP were used as the QC samples for Solids, Percent.

SGS Orlando certifies that this report meets the project requirements for analytical data produced for the samples as received at SGS Orlando and as stated on the COC. SGS Orlando certifies that the data meets the Data Quality Objectives for precision, accuracy and completeness as specified in the SGS Orlando Quality Manual except as noted above. This report is to be used in its entirety.
SGS Orlando is not responsible for any assumptions of data quality if partial data packages are used.

Narrative prepared by:

_____
Ariel Hartney, Client Services (signature on file)

Summary of Hits

Job Number: FA70512
Account: Geosyntec Consultants
Project: Cristex Drum Site; 500 W Industry Dr, Oxford, NC
Collected: 12/03/19

Lab Sample ID Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
FA70512-1	**EKMW-1-33-35**					
Acetone [a]		78.5 J	100	52	ug/kg	SW846 8260D
2-Butanone (MEK) [a]		6.9 J	13	3.8	ug/kg	SW846 8260D
Tetrachloroethylene [a]		12.0	2.6	0.66	ug/kg	SW846 8260D
1,2,4-Trimethylbenzene [a]		1.1 J	2.6	0.52	ug/kg	SW846 8260D
m,p-Xylene [a]		0.79 J	5.2	0.57	ug/kg	SW846 8260D
FA70512-2	**EKMW-2-43-45**					
cis-1,2-Dichloroethylene [a]		5.1	1.9	0.52	ug/kg	SW846 8260D
Tetrachloroethylene [a]		72.8	1.9	0.48	ug/kg	SW846 8260D
Trichloroethylene [a]		2.5	1.9	0.38	ug/kg	SW846 8260D
1,2,4-Trimethylbenzene [a]		0.55 J	1.9	0.38	ug/kg	SW846 8260D
m,p-Xylene [a]		0.53 J	3.8	0.42	ug/kg	SW846 8260D
FA70512-3	**SW-1-30-32**					
cis-1,2-Dichloroethylene [b]		6.4	4.1	1.1	ug/kg	SW846 8260D
Tetrachloroethylene [b]		45.8	4.1	1.1	ug/kg	SW846 8260D
Trichloroethylene [b]		2.1 J	4.1	0.82	ug/kg	SW846 8260D
FA70512-4	**SW-1-40-42**					
cis-1,2-Dichloroethylene [b]		4.7	3.4	0.95	ug/kg	SW846 8260D
Tetrachloroethylene [b]		34.0	3.4	0.88	ug/kg	SW846 8260D
Trichloroethylene [b]		1.5 J	3.4	0.69	ug/kg	SW846 8260D
FA70512-5	**DUP-1-20191203**					
2-Butanone (MEK) [c]		5.3 J	12	3.6	ug/kg	SW846 8260D
cis-1,2-Dichloroethylene [b]		2.5	2.4	0.68	ug/kg	SW846 8260D
Tetrachloroethylene [b]		32.8	2.4	0.63	ug/kg	SW846 8260D
Trichloroethylene [b]		1.0 J	2.4	0.49	ug/kg	SW846 8260D
FA70512-6	**TRIP BLANK**					

No hits reported in this sample.

(a) Soil vials were not received within 48 hours of sampling; results are considered minimum values.
(b) Results reported from bisulfate preserved sample.
(c) Results reported from bisulfate preserved sample. Associated CCV outside of control limits high.

Sample Results

Report of Analysis

SGS North America Inc.

Report of Analysis

Client Sample ID:	EKMW-1-33-35		
Lab Sample ID:	FA70512-1	**Date Sampled:**	12/03/19
Matrix:	SO - Soil	**Date Received:**	12/05/19
Method:	SW846 8260D	**Percent Solids:**	84.8
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	3C8150.D	1	12/11/19 16:07	SP	n/a	n/a	V3C337
Run #2 [b]	2B13875.D	1	12/09/19 14:31	SP	n/a	n/a	V2B533

	Initial Weight	Final Volume
Run #1	11.4 g	5.0 ml
Run #2	12.9 g	5.0 ml

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	78.5	100	52	ug/kg	J
71-43-2	Benzene	ND	2.6	0.63	ug/kg	
108-86-1	Bromobenzene	ND	2.6	0.52	ug/kg	
74-97-5	Bromochloromethane	ND	2.6	0.77	ug/kg	
75-27-4	Bromodichloromethane	ND	2.6	0.52	ug/kg	
75-25-2	Bromoform	ND	2.6	0.52	ug/kg	
78-93-3	2-Butanone (MEK)	6.9	13	3.8	ug/kg	J
104-51-8	n-Butylbenzene	ND	2.6	0.52	ug/kg	
135-98-8	sec-Butylbenzene	ND	2.6	0.52	ug/kg	
98-06-6	tert-Butylbenzene	ND	2.6	0.52	ug/kg	
75-15-0	Carbon Disulfide	ND	2.6	0.52	ug/kg	
56-23-5	Carbon Tetrachloride	ND	2.6	0.53	ug/kg	
108-90-7	Chlorobenzene	ND	2.6	0.52	ug/kg	
75-00-3	Chloroethane	ND	2.6	1.0	ug/kg	
67-66-3	Chloroform	ND	2.6	0.69	ug/kg	
95-49-8	o-Chlorotoluene	ND	2.6	0.52	ug/kg	
106-43-4	p-Chlorotoluene	ND	2.6	0.52	ug/kg	
124-48-1	Dibromochloromethane	ND	2.6	0.52	ug/kg	
96-12-8	1,2-Dibromo-3-chloropropane	ND	2.6	1.0	ug/kg	
106-93-4	1,2-Dibromoethane	ND	2.6	0.52	ug/kg	
75-71-8	Dichlorodifluoromethane	ND	2.6	1.0	ug/kg	
95-50-1	1,2-Dichlorobenzene	ND	2.6	0.52	ug/kg	
541-73-1	1,3-Dichlorobenzene	ND	2.6	0.52	ug/kg	
106-46-7	1,4-Dichlorobenzene	ND	2.6	0.60	ug/kg	
75-34-3	1,1-Dichloroethane	ND	2.6	0.92	ug/kg	
107-06-2	1,2-Dichloroethane	ND	2.6	0.52	ug/kg	
75-35-4	1,1-Dichloroethylene	ND	2.6	0.52	ug/kg	
156-59-2	cis-1,2-Dichloroethylene	ND	2.6	0.72	ug/kg	
156-60-5	trans-1,2-Dichloroethylene	ND	2.6	0.52	ug/kg	
78-87-5	1,2-Dichloropropane	ND	2.6	0.52	ug/kg	
142-28-9	1,3-Dichloropropane	ND	2.6	0.52	ug/kg	
594-20-7	2,2-Dichloropropane	ND	2.6	0.52	ug/kg	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EKMW-1-33-35		
Lab Sample ID:	FA70512-1	**Date Sampled:**	12/03/19
Matrix:	SO - Soil	**Date Received:**	12/05/19
Method:	SW846 8260D	**Percent Solids:**	84.8
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	2.6	0.53	ug/kg	
10061-01-5	cis-1,3-Dichloropropene	ND	2.6	0.52	ug/kg	
10061-02-6	trans-1,3-Dichloropropene	ND	2.6	0.52	ug/kg	
100-41-4	Ethylbenzene	ND	2.6	0.52	ug/kg	
87-68-3	Hexachlorobutadiene	ND	2.6	0.67	ug/kg	
591-78-6	2-Hexanone	ND	13	3.9	ug/kg	
98-82-8	Isopropylbenzene	ND	2.6	0.52	ug/kg	
99-87-6	p-Isopropyltoluene	ND	2.6	0.52	ug/kg	
74-83-9	Methyl Bromide	ND	2.6	1.0	ug/kg	
74-87-3	Methyl Chloride	ND	2.6	1.0	ug/kg	
74-95-3	Methylene Bromide	ND	2.6	0.52	ug/kg	
75-09-2	Methylene Chloride	ND	10	5.7	ug/kg	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	13	3.9	ug/kg	
1634-04-4	Methyl Tert Butyl Ether	ND	2.6	0.52	ug/kg	
91-20-3	Naphthalene	ND	2.6	1.0	ug/kg	
103-65-1	n-Propylbenzene	ND	2.6	0.52	ug/kg	
100-42-5	Styrene	ND	2.6	0.52	ug/kg	
630-20-6	1,1,1,2-Tetrachloroethane	ND	2.6	0.53	ug/kg	
79-34-5	1,1,2,2-Tetrachloroethane	ND	2.6	0.52	ug/kg	
127-18-4	Tetrachloroethylene	12.0	2.6	0.66	ug/kg	
108-88-3	Toluene	ND	10	5.2	ug/kg	
87-61-6	1,2,3-Trichlorobenzene	ND	2.6	0.73	ug/kg	
120-82-1	1,2,4-Trichlorobenzene	ND	2.6	0.52	ug/kg	
71-55-6	1,1,1-Trichloroethane	ND	2.6	0.52	ug/kg	
79-00-5	1,1,2-Trichloroethane	ND	2.6	0.52	ug/kg	
79-01-6	Trichloroethylene	ND	2.6	0.52	ug/kg	
75-69-4	Trichlorofluoromethane	ND	2.6	1.0	ug/kg	
96-18-4	1,2,3-Trichloropropane	ND	2.6	0.65	ug/kg	
95-63-6	1,2,4-Trimethylbenzene	1.1	2.6	0.52	ug/kg	J
108-67-8	1,3,5-Trimethylbenzene	ND	2.6	0.52	ug/kg	
108-05-4	Vinyl Acetate [c]	ND	13	8.5	ug/kg	
75-01-4	Vinyl Chloride	ND	2.6	0.52	ug/kg	
	m,p-Xylene	0.79	5.2	0.57	ug/kg	J
95-47-6	o-Xylene	ND	2.6	0.52	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	108%	105%	75-124%
17060-07-0	1,2-Dichloroethane-D4	115%	119%	72-135%
2037-26-5	Toluene-D8	95%	103%	75-126%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EKMW-1-33-35		
Lab Sample ID:	FA70512-1	**Date Sampled:**	12/03/19
Matrix:	SO - Soil	**Date Received:**	12/05/19
Method:	SW846 8260D	**Percent Solids:**	84.8
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	101%	118%	71-133%

(a) Soil vials were not received within 48 hours of sampling; results are considered minimum values.
(b) Results reported from bisulfate preserved sample. Internal standard response outside control limits. Confirmation run for internal standard areas.
(c) Associated CCV outside of control limits low.

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	EKMW-2-43-45		
Lab Sample ID:	FA70512-2	**Date Sampled:**	12/03/19
Matrix:	SO - Soil	**Date Received:**	12/05/19
Method:	SW846 8260D	**Percent Solids:**	88.7
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	F0093126.D	1	12/06/19 15:18	SP	n/a	n/a	VF3265
Run #2							

	Initial Weight	Final Volume
Run #1	14.9 g	5.0 ml
Run #2		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone [b]	ND	76	38	ug/kg	
71-43-2	Benzene	ND	1.9	0.46	ug/kg	
108-86-1	Bromobenzene	ND	1.9	0.38	ug/kg	
74-97-5	Bromochloromethane	ND	1.9	0.56	ug/kg	
75-27-4	Bromodichloromethane [c]	ND	1.9	0.38	ug/kg	
75-25-2	Bromoform	ND	1.9	0.38	ug/kg	
78-93-3	2-Butanone (MEK) [d]	ND	9.5	2.8	ug/kg	
104-51-8	n-Butylbenzene	ND	1.9	0.38	ug/kg	
135-98-8	sec-Butylbenzene	ND	1.9	0.38	ug/kg	
98-06-6	tert-Butylbenzene	ND	1.9	0.38	ug/kg	
75-15-0	Carbon Disulfide	ND	1.9	0.38	ug/kg	
56-23-5	Carbon Tetrachloride [c]	ND	1.9	0.39	ug/kg	
108-90-7	Chlorobenzene	ND	1.9	0.38	ug/kg	
75-00-3	Chloroethane	ND	1.9	0.76	ug/kg	
67-66-3	Chloroform	ND	1.9	0.50	ug/kg	
95-49-8	o-Chlorotoluene	ND	1.9	0.38	ug/kg	
106-43-4	p-Chlorotoluene	ND	1.9	0.38	ug/kg	
124-48-1	Dibromochloromethane	ND	1.9	0.38	ug/kg	
96-12-8	1,2-Dibromo-3-chloropropane	ND	1.9	0.73	ug/kg	
106-93-4	1,2-Dibromoethane	ND	1.9	0.38	ug/kg	
75-71-8	Dichlorodifluoromethane	ND	1.9	0.76	ug/kg	
95-50-1	1,2-Dichlorobenzene	ND	1.9	0.38	ug/kg	
541-73-1	1,3-Dichlorobenzene	ND	1.9	0.38	ug/kg	
106-46-7	1,4-Dichlorobenzene	ND	1.9	0.44	ug/kg	
75-34-3	1,1-Dichloroethane [c]	ND	1.9	0.67	ug/kg	
107-06-2	1,2-Dichloroethane	ND	1.9	0.38	ug/kg	
75-35-4	1,1-Dichloroethylene	ND	1.9	0.38	ug/kg	
156-59-2	cis-1,2-Dichloroethylene	5.1	1.9	0.52	ug/kg	
156-60-5	trans-1,2-Dichloroethylene	ND	1.9	0.38	ug/kg	
78-87-5	1,2-Dichloropropane	ND	1.9	0.38	ug/kg	
142-28-9	1,3-Dichloropropane	ND	1.9	0.38	ug/kg	
594-20-7	2,2-Dichloropropane [c]	ND	1.9	0.38	ug/kg	

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EKMW-2-43-45		
Lab Sample ID:	FA70512-2	**Date Sampled:**	12/03/19
Matrix:	SO - Soil	**Date Received:**	12/05/19
Method:	SW846 8260D	**Percent Solids:**	88.7
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	1.9	0.39	ug/kg	
10061-01-5	cis-1,3-Dichloropropene	ND	1.9	0.38	ug/kg	
10061-02-6	trans-1,3-Dichloropropene	ND	1.9	0.38	ug/kg	
100-41-4	Ethylbenzene	ND	1.9	0.38	ug/kg	
87-68-3	Hexachlorobutadiene	ND	1.9	0.49	ug/kg	
591-78-6	2-Hexanone [b]	ND	9.5	2.8	ug/kg	
98-82-8	Isopropylbenzene	ND	1.9	0.38	ug/kg	
99-87-6	p-Isopropyltoluene	ND	1.9	0.38	ug/kg	
74-83-9	Methyl Bromide	ND	1.9	0.76	ug/kg	
74-87-3	Methyl Chloride	ND	1.9	0.76	ug/kg	
74-95-3	Methylene Bromide	ND	1.9	0.38	ug/kg	
75-09-2	Methylene Chloride [c]	ND	7.6	4.2	ug/kg	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	9.5	2.8	ug/kg	
1634-04-4	Methyl Tert Butyl Ether	ND	1.9	0.38	ug/kg	
91-20-3	Naphthalene	ND	1.9	0.76	ug/kg	
103-65-1	n-Propylbenzene	ND	1.9	0.38	ug/kg	
100-42-5	Styrene	ND	1.9	0.38	ug/kg	
630-20-6	1,1,1,2-Tetrachloroethane	ND	1.9	0.39	ug/kg	
79-34-5	1,1,2,2-Tetrachloroethane	ND	1.9	0.38	ug/kg	
127-18-4	Tetrachloroethylene	72.8	1.9	0.48	ug/kg	
108-88-3	Toluene	ND	7.6	3.8	ug/kg	
87-61-6	1,2,3-Trichlorobenzene	ND	1.9	0.53	ug/kg	
120-82-1	1,2,4-Trichlorobenzene	ND	1.9	0.38	ug/kg	
71-55-6	1,1,1-Trichloroethane [c]	ND	1.9	0.38	ug/kg	
79-00-5	1,1,2-Trichloroethane	ND	1.9	0.38	ug/kg	
79-01-6	Trichloroethylene	2.5	1.9	0.38	ug/kg	
75-69-4	Trichlorofluoromethane [c]	ND	1.9	0.76	ug/kg	
96-18-4	1,2,3-Trichloropropane	ND	1.9	0.47	ug/kg	
95-63-6	1,2,4-Trimethylbenzene	0.55	1.9	0.38	ug/kg	J
108-67-8	1,3,5-Trimethylbenzene	ND	1.9	0.38	ug/kg	
108-05-4	Vinyl Acetate [c]	ND	9.5	6.2	ug/kg	
75-01-4	Vinyl Chloride	ND	1.9	0.38	ug/kg	
	m,p-Xylene	0.53	3.8	0.42	ug/kg	J
95-47-6	o-Xylene	ND	1.9	0.38	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	106%		75-124%
17060-07-0	1,2-Dichloroethane-D4	110%		72-135%
2037-26-5	Toluene-D8	94%		75-126%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EKMW-2-43-45		
Lab Sample ID:	FA70512-2	**Date Sampled:**	12/03/19
Matrix:	SO - Soil	**Date Received:**	12/05/19
Method:	SW846 8260D	**Percent Solids:**	88.7
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	104%		71-133%

(a) Soil vials were not received within 48 hours of sampling; results are considered minimum values.
(b) Associated BS recovery outside control limits high; however sample is ND. Associated CCV outside of control limits high, sample was ND.
(c) Associated CCV outside of control limits high, sample was ND.
(d) Associated BS recovery outside control limits high; however sample is ND.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	SW-1-30-32		
Lab Sample ID:	FA70512-3	**Date Sampled:**	12/03/19
Matrix:	SO - Soil	**Date Received:**	12/05/19
Method:	SW846 8260D	**Percent Solids:**	90.9
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	2B13876.D	1	12/09/19 14:56	SP	n/a	n/a	V2B533
Run #2							

	Initial Weight	Final Volume
Run #1	6.68 g	5.0 ml
Run #2		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone [b]	ND	160	82	ug/kg	
71-43-2	Benzene	ND	4.1	1.0	ug/kg	
108-86-1	Bromobenzene	ND	4.1	0.82	ug/kg	
74-97-5	Bromochloromethane	ND	4.1	1.2	ug/kg	
75-27-4	Bromodichloromethane	ND	4.1	0.82	ug/kg	
75-25-2	Bromoform	ND	4.1	0.82	ug/kg	
78-93-3	2-Butanone (MEK) [b]	ND	21	6.0	ug/kg	
104-51-8	n-Butylbenzene	ND	4.1	0.82	ug/kg	
135-98-8	sec-Butylbenzene	ND	4.1	0.82	ug/kg	
98-06-6	tert-Butylbenzene	ND	4.1	0.82	ug/kg	
75-15-0	Carbon Disulfide	ND	4.1	0.82	ug/kg	
56-23-5	Carbon Tetrachloride	ND	4.1	0.84	ug/kg	
108-90-7	Chlorobenzene	ND	4.1	0.82	ug/kg	
75-00-3	Chloroethane [c]	ND	4.1	1.6	ug/kg	
67-66-3	Chloroform [d]	ND	4.1	1.1	ug/kg	
95-49-8	o-Chlorotoluene	ND	4.1	0.82	ug/kg	
106-43-4	p-Chlorotoluene	ND	4.1	0.82	ug/kg	
124-48-1	Dibromochloromethane	ND	4.1	0.82	ug/kg	
96-12-8	1,2-Dibromo-3-chloropropane	ND	4.1	1.6	ug/kg	
106-93-4	1,2-Dibromoethane	ND	4.1	0.82	ug/kg	
75-71-8	Dichlorodifluoromethane	ND	4.1	1.6	ug/kg	
95-50-1	1,2-Dichlorobenzene	ND	4.1	0.82	ug/kg	
541-73-1	1,3-Dichlorobenzene	ND	4.1	0.82	ug/kg	
106-46-7	1,4-Dichlorobenzene	ND	4.1	0.95	ug/kg	
75-34-3	1,1-Dichloroethane	ND	4.1	1.5	ug/kg	
107-06-2	1,2-Dichloroethane	ND	4.1	0.82	ug/kg	
75-35-4	1,1-Dichloroethylene	ND	4.1	0.82	ug/kg	
156-59-2	cis-1,2-Dichloroethylene	6.4	4.1	1.1	ug/kg	
156-60-5	trans-1,2-Dichloroethylene	ND	4.1	0.82	ug/kg	
78-87-5	1,2-Dichloropropane	ND	4.1	0.82	ug/kg	
142-28-9	1,3-Dichloropropane	ND	4.1	0.82	ug/kg	
594-20-7	2,2-Dichloropropane [e]	ND	4.1	0.82	ug/kg	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	SW-1-30-32		
Lab Sample ID:	FA70512-3	**Date Sampled:**	12/03/19
Matrix:	SO - Soil	**Date Received:**	12/05/19
Method:	SW846 8260D	**Percent Solids:**	90.9
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	4.1	0.84	ug/kg	
10061-01-5	cis-1,3-Dichloropropene	ND	4.1	0.82	ug/kg	
10061-02-6	trans-1,3-Dichloropropene	ND	4.1	0.82	ug/kg	
100-41-4	Ethylbenzene	ND	4.1	0.82	ug/kg	
87-68-3	Hexachlorobutadiene	ND	4.1	1.1	ug/kg	
591-78-6	2-Hexanone	ND	21	6.2	ug/kg	
98-82-8	Isopropylbenzene	ND	4.1	0.82	ug/kg	
99-87-6	p-Isopropyltoluene	ND	4.1	0.82	ug/kg	
74-83-9	Methyl Bromide	ND	4.1	1.6	ug/kg	
74-87-3	Methyl Chloride	ND	4.1	1.6	ug/kg	
74-95-3	Methylene Bromide	ND	4.1	0.82	ug/kg	
75-09-2	Methylene Chloride [b]	ND	16	9.1	ug/kg	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	21	6.2	ug/kg	
1634-04-4	Methyl Tert Butyl Ether	ND	4.1	0.82	ug/kg	
91-20-3	Naphthalene	ND	4.1	1.6	ug/kg	
103-65-1	n-Propylbenzene	ND	4.1	0.82	ug/kg	
100-42-5	Styrene	ND	4.1	0.82	ug/kg	
630-20-6	1,1,1,2-Tetrachloroethane	ND	4.1	0.85	ug/kg	
79-34-5	1,1,2,2-Tetrachloroethane	ND	4.1	0.82	ug/kg	
127-18-4	Tetrachloroethylene	45.8	4.1	1.1	ug/kg	
108-88-3	Toluene	ND	16	8.2	ug/kg	
87-61-6	1,2,3-Trichlorobenzene [f]	ND	4.1	1.2	ug/kg	
120-82-1	1,2,4-Trichlorobenzene [f]	ND	4.1	0.82	ug/kg	
71-55-6	1,1,1-Trichloroethane	ND	4.1	0.82	ug/kg	
79-00-5	1,1,2-Trichloroethane	ND	4.1	0.82	ug/kg	
79-01-6	Trichloroethylene	2.1	4.1	0.82	ug/kg	J
75-69-4	Trichlorofluoromethane [b]	ND	4.1	1.6	ug/kg	
96-18-4	1,2,3-Trichloropropane	ND	4.1	1.0	ug/kg	
95-63-6	1,2,4-Trimethylbenzene	ND	4.1	0.82	ug/kg	
108-67-8	1,3,5-Trimethylbenzene	ND	4.1	0.82	ug/kg	
108-05-4	Vinyl Acetate	ND	21	14	ug/kg	
75-01-4	Vinyl Chloride	ND	4.1	0.82	ug/kg	
	m,p-Xylene	ND	8.2	0.91	ug/kg	
95-47-6	o-Xylene	ND	4.1	0.82	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	103%		75-124%
17060-07-0	1,2-Dichloroethane-D4	120%		72-135%
2037-26-5	Toluene-D8	94%		75-126%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	SW-1-30-32		
Lab Sample ID:	FA70512-3	**Date Sampled:**	12/03/19
Matrix:	SO - Soil	**Date Received:**	12/05/19
Method:	SW846 8260D	**Percent Solids:**	90.9
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	87%		71-133%

(a) Results reported from bisulfate preserved sample.
(b) Associated CCV outside of control limits high, sample was ND.
(c) Associated ICV and BS outside control limits high, however sample ND. Associated CCV outside of control limits high, sample was ND.
(d) Associated BS recovery outside control limits high; however sample is ND.
(e) Associated BS recovery outside control limits high; however sample is ND. Associated CCV outside of control limits high, sample was ND.
(f) Associated CCV outside of control limits low.

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	SW-1-40-42		
Lab Sample ID:	FA70512-4	**Date Sampled:**	12/03/19
Matrix:	SO - Soil	**Date Received:**	12/05/19
Method:	SW846 8260D	**Percent Solids:**	88.5
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	2B13877.D	1	12/09/19 15:22	SP	n/a	n/a	V2B533
Run #2							

	Initial Weight	Final Volume
Run #1	8.19 g	5.0 ml
Run #2		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone [b]	ND	140	69	ug/kg	
71-43-2	Benzene	ND	3.4	0.84	ug/kg	
108-86-1	Bromobenzene	ND	3.4	0.69	ug/kg	
74-97-5	Bromochloromethane	ND	3.4	1.0	ug/kg	
75-27-4	Bromodichloromethane	ND	3.4	0.69	ug/kg	
75-25-2	Bromoform	ND	3.4	0.69	ug/kg	
78-93-3	2-Butanone (MEK) [b]	ND	17	5.0	ug/kg	
104-51-8	n-Butylbenzene	ND	3.4	0.69	ug/kg	
135-98-8	sec-Butylbenzene	ND	3.4	0.69	ug/kg	
98-06-6	tert-Butylbenzene	ND	3.4	0.69	ug/kg	
75-15-0	Carbon Disulfide	ND	3.4	0.69	ug/kg	
56-23-5	Carbon Tetrachloride	ND	3.4	0.70	ug/kg	
108-90-7	Chlorobenzene	ND	3.4	0.69	ug/kg	
75-00-3	Chloroethane [c]	ND	3.4	1.4	ug/kg	
67-66-3	Chloroform [d]	ND	3.4	0.92	ug/kg	
95-49-8	o-Chlorotoluene	ND	3.4	0.69	ug/kg	
106-43-4	p-Chlorotoluene	ND	3.4	0.69	ug/kg	
124-48-1	Dibromochloromethane	ND	3.4	0.69	ug/kg	
96-12-8	1,2-Dibromo-3-chloropropane	ND	3.4	1.3	ug/kg	
106-93-4	1,2-Dibromoethane	ND	3.4	0.69	ug/kg	
75-71-8	Dichlorodifluoromethane	ND	3.4	1.4	ug/kg	
95-50-1	1,2-Dichlorobenzene	ND	3.4	0.69	ug/kg	
541-73-1	1,3-Dichlorobenzene	ND	3.4	0.69	ug/kg	
106-46-7	1,4-Dichlorobenzene	ND	3.4	0.79	ug/kg	
75-34-3	1,1-Dichloroethane	ND	3.4	1.2	ug/kg	
107-06-2	1,2-Dichloroethane	ND	3.4	0.69	ug/kg	
75-35-4	1,1-Dichloroethylene	ND	3.4	0.69	ug/kg	
156-59-2	cis-1,2-Dichloroethylene	4.7	3.4	0.95	ug/kg	
156-60-5	trans-1,2-Dichloroethylene	ND	3.4	0.69	ug/kg	
78-87-5	1,2-Dichloropropane	ND	3.4	0.69	ug/kg	
142-28-9	1,3-Dichloropropane	ND	3.4	0.69	ug/kg	
594-20-7	2,2-Dichloropropane [e]	ND	3.4	0.69	ug/kg	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	SW-1-40-42		
Lab Sample ID:	FA70512-4	**Date Sampled:**	12/03/19
Matrix:	SO - Soil	**Date Received:**	12/05/19
Method:	SW846 8260D	**Percent Solids:**	88.5
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	3.4	0.70	ug/kg	
10061-01-5	cis-1,3-Dichloropropene	ND	3.4	0.69	ug/kg	
10061-02-6	trans-1,3-Dichloropropene	ND	3.4	0.69	ug/kg	
100-41-4	Ethylbenzene	ND	3.4	0.69	ug/kg	
87-68-3	Hexachlorobutadiene	ND	3.4	0.89	ug/kg	
591-78-6	2-Hexanone	ND	17	5.2	ug/kg	
98-82-8	Isopropylbenzene	ND	3.4	0.69	ug/kg	
99-87-6	p-Isopropyltoluene	ND	3.4	0.69	ug/kg	
74-83-9	Methyl Bromide	ND	3.4	1.4	ug/kg	
74-87-3	Methyl Chloride	ND	3.4	1.4	ug/kg	
74-95-3	Methylene Bromide	ND	3.4	0.69	ug/kg	
75-09-2	Methylene Chloride [b]	ND	14	7.6	ug/kg	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	17	5.2	ug/kg	
1634-04-4	Methyl Tert Butyl Ether	ND	3.4	0.69	ug/kg	
91-20-3	Naphthalene	ND	3.4	1.4	ug/kg	
103-65-1	n-Propylbenzene	ND	3.4	0.69	ug/kg	
100-42-5	Styrene	ND	3.4	0.69	ug/kg	
630-20-6	1,1,1,2-Tetrachloroethane	ND	3.4	0.71	ug/kg	
79-34-5	1,1,2,2-Tetrachloroethane	ND	3.4	0.69	ug/kg	
127-18-4	Tetrachloroethylene	34.0	3.4	0.88	ug/kg	
108-88-3	Toluene	ND	14	6.9	ug/kg	
87-61-6	1,2,3-Trichlorobenzene [f]	ND	3.4	0.97	ug/kg	
120-82-1	1,2,4-Trichlorobenzene [f]	ND	3.4	0.69	ug/kg	
71-55-6	1,1,1-Trichloroethane	ND	3.4	0.69	ug/kg	
79-00-5	1,1,2-Trichloroethane	ND	3.4	0.69	ug/kg	
79-01-6	Trichloroethylene	1.5	3.4	0.69	ug/kg	J
75-69-4	Trichlorofluoromethane [b]	ND	3.4	1.4	ug/kg	
96-18-4	1,2,3-Trichloropropane	ND	3.4	0.86	ug/kg	
95-63-6	1,2,4-Trimethylbenzene	ND	3.4	0.69	ug/kg	
108-67-8	1,3,5-Trimethylbenzene	ND	3.4	0.69	ug/kg	
108-05-4	Vinyl Acetate	ND	17	11	ug/kg	
75-01-4	Vinyl Chloride	ND	3.4	0.69	ug/kg	
	m,p-Xylene	ND	6.9	0.76	ug/kg	
95-47-6	o-Xylene	ND	3.4	0.69	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	105%		75-124%
17060-07-0	1,2-Dichloroethane-D4	122%		72-135%
2037-26-5	Toluene-D8	95%		75-126%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	SW-1-40-42		
Lab Sample ID:	FA70512-4	**Date Sampled:**	12/03/19
Matrix:	SO - Soil	**Date Received:**	12/05/19
Method:	SW846 8260D	**Percent Solids:**	88.5
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	87%		71-133%

(a) Results reported from bisulfate preserved sample.
(b) Associated CCV outside of control limits high, sample was ND.
(c) Associated ICV and BS outside control limits high, however sample ND. Associated CCV outside of control limits high, sample was ND.
(d) Associated BS recovery outside control limits high; however sample is ND.
(e) Associated BS recovery outside control limits high; however sample is ND. Associated CCV outside of control limits high, sample was ND.
(f) Associated CCV outside of control limits low.

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	DUP-1-20191203		
Lab Sample ID:	FA70512-5	**Date Sampled:**	12/03/19
Matrix:	SO - Soil	**Date Received:**	12/05/19
Method:	SW846 8260D	**Percent Solids:**	88.5
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	2B13878.D	1	12/09/19 15:48	SP	n/a	n/a	V2B533
Run #2							

	Initial Weight	Final Volume
Run #1	11.5 g	5.0 ml
Run #2		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone [b]	ND	98	49	ug/kg	
71-43-2	Benzene	ND	2.4	0.60	ug/kg	
108-86-1	Bromobenzene	ND	2.4	0.49	ug/kg	
74-97-5	Bromochloromethane	ND	2.4	0.72	ug/kg	
75-27-4	Bromodichloromethane	ND	2.4	0.49	ug/kg	
75-25-2	Bromoform	ND	2.4	0.49	ug/kg	
78-93-3	2-Butanone (MEK) [c]	5.3	12	3.6	ug/kg	J
104-51-8	n-Butylbenzene	ND	2.4	0.49	ug/kg	
135-98-8	sec-Butylbenzene	ND	2.4	0.49	ug/kg	
98-06-6	tert-Butylbenzene	ND	2.4	0.49	ug/kg	
75-15-0	Carbon Disulfide	ND	2.4	0.49	ug/kg	
56-23-5	Carbon Tetrachloride	ND	2.4	0.50	ug/kg	
108-90-7	Chlorobenzene	ND	2.4	0.49	ug/kg	
75-00-3	Chloroethane [d]	ND	2.4	0.98	ug/kg	
67-66-3	Chloroform [e]	ND	2.4	0.65	ug/kg	
95-49-8	o-Chlorotoluene	ND	2.4	0.49	ug/kg	
106-43-4	p-Chlorotoluene	ND	2.4	0.49	ug/kg	
124-48-1	Dibromochloromethane	ND	2.4	0.49	ug/kg	
96-12-8	1,2-Dibromo-3-chloropropane	ND	2.4	0.94	ug/kg	
106-93-4	1,2-Dibromoethane	ND	2.4	0.49	ug/kg	
75-71-8	Dichlorodifluoromethane	ND	2.4	0.98	ug/kg	
95-50-1	1,2-Dichlorobenzene	ND	2.4	0.49	ug/kg	
541-73-1	1,3-Dichlorobenzene	ND	2.4	0.49	ug/kg	
106-46-7	1,4-Dichlorobenzene	ND	2.4	0.56	ug/kg	
75-34-3	1,1-Dichloroethane	ND	2.4	0.87	ug/kg	
107-06-2	1,2-Dichloroethane	ND	2.4	0.49	ug/kg	
75-35-4	1,1-Dichloroethylene	ND	2.4	0.49	ug/kg	
156-59-2	cis-1,2-Dichloroethylene	2.5	2.4	0.68	ug/kg	
156-60-5	trans-1,2-Dichloroethylene	ND	2.4	0.49	ug/kg	
78-87-5	1,2-Dichloropropane	ND	2.4	0.49	ug/kg	
142-28-9	1,3-Dichloropropane	ND	2.4	0.49	ug/kg	
594-20-7	2,2-Dichloropropane [f]	ND	2.4	0.49	ug/kg	

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	DUP-1-20191203		
Lab Sample ID:	FA70512-5	**Date Sampled:**	12/03/19
Matrix:	SO - Soil	**Date Received:**	12/05/19
Method:	SW846 8260D	**Percent Solids:**	88.5
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	2.4	0.50	ug/kg	
10061-01-5	cis-1,3-Dichloropropene	ND	2.4	0.49	ug/kg	
10061-02-6	trans-1,3-Dichloropropene	ND	2.4	0.49	ug/kg	
100-41-4	Ethylbenzene	ND	2.4	0.49	ug/kg	
87-68-3	Hexachlorobutadiene	ND	2.4	0.63	ug/kg	
591-78-6	2-Hexanone	ND	12	3.7	ug/kg	
98-82-8	Isopropylbenzene	ND	2.4	0.49	ug/kg	
99-87-6	p-Isopropyltoluene	ND	2.4	0.49	ug/kg	
74-83-9	Methyl Bromide	ND	2.4	0.98	ug/kg	
74-87-3	Methyl Chloride	ND	2.4	0.98	ug/kg	
74-95-3	Methylene Bromide	ND	2.4	0.49	ug/kg	
75-09-2	Methylene Chloride [b]	ND	9.8	5.4	ug/kg	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	12	3.7	ug/kg	
1634-04-4	Methyl Tert Butyl Ether	ND	2.4	0.49	ug/kg	
91-20-3	Naphthalene	ND	2.4	0.98	ug/kg	
103-65-1	n-Propylbenzene	ND	2.4	0.49	ug/kg	
100-42-5	Styrene	ND	2.4	0.49	ug/kg	
630-20-6	1,1,1,2-Tetrachloroethane	ND	2.4	0.50	ug/kg	
79-34-5	1,1,2,2-Tetrachloroethane	ND	2.4	0.49	ug/kg	
127-18-4	Tetrachloroethylene	32.8	2.4	0.63	ug/kg	
108-88-3	Toluene	ND	9.8	4.9	ug/kg	
87-61-6	1,2,3-Trichlorobenzene [g]	ND	2.4	0.69	ug/kg	
120-82-1	1,2,4-Trichlorobenzene [g]	ND	2.4	0.49	ug/kg	
71-55-6	1,1,1-Trichloroethane	ND	2.4	0.49	ug/kg	
79-00-5	1,1,2-Trichloroethane	ND	2.4	0.49	ug/kg	
79-01-6	Trichloroethylene	1.0	2.4	0.49	ug/kg	J
75-69-4	Trichlorofluoromethane [b]	ND	2.4	0.98	ug/kg	
96-18-4	1,2,3-Trichloropropane	ND	2.4	0.61	ug/kg	
95-63-6	1,2,4-Trimethylbenzene	ND	2.4	0.49	ug/kg	
108-67-8	1,3,5-Trimethylbenzene	ND	2.4	0.49	ug/kg	
108-05-4	Vinyl Acetate	ND	12	8.0	ug/kg	
75-01-4	Vinyl Chloride	ND	2.4	0.49	ug/kg	
	m,p-Xylene	ND	4.9	0.54	ug/kg	
95-47-6	o-Xylene	ND	2.4	0.49	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	105%		75-124%
17060-07-0	1,2-Dichloroethane-D4	124%		72-135%
2037-26-5	Toluene-D8	93%		75-126%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	DUP-1-20191203		
Lab Sample ID:	FA70512-5	**Date Sampled:**	12/03/19
Matrix:	SO - Soil	**Date Received:**	12/05/19
Method:	SW846 8260D	**Percent Solids:**	88.5
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	86%		71-133%

(a) Results reported from bisulfate preserved sample.
(b) Associated CCV outside of control limits high, sample was ND.
(c) Associated CCV outside of control limits high.
(d) Associated ICV and BS outside control limits high, however sample ND. Associated CCV outside of control limits high, sample was ND.
(e) Associated BS recovery outside control limits high; however sample is ND.
(f) Associated BS recovery outside control limits high; however sample is ND. Associated CCV outside of control limits high, sample was ND.
(g) Associated CCV outside of control limits low.

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	TRIP BLANK		
Lab Sample ID:	FA70512-6	**Date Sampled:**	12/03/19
Matrix:	SO - Trip Blank Soil	**Date Received:**	12/05/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	2B13879.D	1	12/09/19 16:14	SP	n/a	n/a	V2B533
Run #2							

	Initial Weight	Final Volume
Run #1	5.00 g	5.0 ml
Run #2		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone [b]	ND	200	100	ug/kg	
71-43-2	Benzene	ND	5.0	1.2	ug/kg	
108-86-1	Bromobenzene	ND	5.0	1.0	ug/kg	
74-97-5	Bromochloromethane	ND	5.0	1.5	ug/kg	
75-27-4	Bromodichloromethane	ND	5.0	1.0	ug/kg	
75-25-2	Bromoform	ND	5.0	1.0	ug/kg	
78-93-3	2-Butanone (MEK) [b]	ND	25	7.3	ug/kg	
104-51-8	n-Butylbenzene	ND	5.0	1.0	ug/kg	
135-98-8	sec-Butylbenzene	ND	5.0	1.0	ug/kg	
98-06-6	tert-Butylbenzene	ND	5.0	1.0	ug/kg	
75-15-0	Carbon Disulfide	ND	5.0	1.0	ug/kg	
56-23-5	Carbon Tetrachloride	ND	5.0	1.0	ug/kg	
108-90-7	Chlorobenzene	ND	5.0	1.0	ug/kg	
75-00-3	Chloroethane [c]	ND	5.0	2.0	ug/kg	
67-66-3	Chloroform [d]	ND	5.0	1.3	ug/kg	
95-49-8	o-Chlorotoluene	ND	5.0	1.0	ug/kg	
106-43-4	p-Chlorotoluene	ND	5.0	1.0	ug/kg	
124-48-1	Dibromochloromethane	ND	5.0	1.0	ug/kg	
96-12-8	1,2-Dibromo-3-chloropropane	ND	5.0	1.9	ug/kg	
106-93-4	1,2-Dibromoethane	ND	5.0	1.0	ug/kg	
75-71-8	Dichlorodifluoromethane	ND	5.0	2.0	ug/kg	
95-50-1	1,2-Dichlorobenzene	ND	5.0	1.0	ug/kg	
541-73-1	1,3-Dichlorobenzene	ND	5.0	1.0	ug/kg	
106-46-7	1,4-Dichlorobenzene	ND	5.0	1.2	ug/kg	
75-34-3	1,1-Dichloroethane	ND	5.0	1.8	ug/kg	
107-06-2	1,2-Dichloroethane	ND	5.0	1.0	ug/kg	
75-35-4	1,1-Dichloroethylene	ND	5.0	1.0	ug/kg	
156-59-2	cis-1,2-Dichloroethylene	ND	5.0	1.4	ug/kg	
156-60-5	trans-1,2-Dichloroethylene	ND	5.0	1.0	ug/kg	
78-87-5	1,2-Dichloropropane	ND	5.0	1.0	ug/kg	
142-28-9	1,3-Dichloropropane	ND	5.0	1.0	ug/kg	
594-20-7	2,2-Dichloropropane [e]	ND	5.0	1.0	ug/kg	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	TRIP BLANK		
Lab Sample ID:	FA70512-6	**Date Sampled:**	12/03/19
Matrix:	SO - Trip Blank Soil	**Date Received:**	12/05/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	5.0	1.0	ug/kg	
10061-01-5	cis-1,3-Dichloropropene	ND	5.0	1.0	ug/kg	
10061-02-6	trans-1,3-Dichloropropene	ND	5.0	1.0	ug/kg	
100-41-4	Ethylbenzene	ND	5.0	1.0	ug/kg	
87-68-3	Hexachlorobutadiene	ND	5.0	1.3	ug/kg	
591-78-6	2-Hexanone	ND	25	7.5	ug/kg	
98-82-8	Isopropylbenzene	ND	5.0	1.0	ug/kg	
99-87-6	p-Isopropyltoluene	ND	5.0	1.0	ug/kg	
74-83-9	Methyl Bromide	ND	5.0	2.0	ug/kg	
74-87-3	Methyl Chloride	ND	5.0	2.0	ug/kg	
74-95-3	Methylene Bromide	ND	5.0	1.0	ug/kg	
75-09-2	Methylene Chloride [b]	ND	20	11	ug/kg	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	25	7.5	ug/kg	
1634-04-4	Methyl Tert Butyl Ether	ND	5.0	1.0	ug/kg	
91-20-3	Naphthalene	ND	5.0	2.0	ug/kg	
103-65-1	n-Propylbenzene	ND	5.0	1.0	ug/kg	
100-42-5	Styrene	ND	5.0	1.0	ug/kg	
630-20-6	1,1,1,2-Tetrachloroethane	ND	5.0	1.0	ug/kg	
79-34-5	1,1,2,2-Tetrachloroethane	ND	5.0	1.0	ug/kg	
127-18-4	Tetrachloroethylene	ND	5.0	1.3	ug/kg	
108-88-3	Toluene	ND	20	10	ug/kg	
87-61-6	1,2,3-Trichlorobenzene [f]	ND	5.0	1.4	ug/kg	
120-82-1	1,2,4-Trichlorobenzene [f]	ND	5.0	1.0	ug/kg	
71-55-6	1,1,1-Trichloroethane	ND	5.0	1.0	ug/kg	
79-00-5	1,1,2-Trichloroethane	ND	5.0	1.0	ug/kg	
79-01-6	Trichloroethylene	ND	5.0	1.0	ug/kg	
75-69-4	Trichlorofluoromethane [b]	ND	5.0	2.0	ug/kg	
96-18-4	1,2,3-Trichloropropane	ND	5.0	1.3	ug/kg	
95-63-6	1,2,4-Trimethylbenzene	ND	5.0	1.0	ug/kg	
108-67-8	1,3,5-Trimethylbenzene	ND	5.0	1.0	ug/kg	
108-05-4	Vinyl Acetate	ND	25	16	ug/kg	
75-01-4	Vinyl Chloride	ND	5.0	1.0	ug/kg	
	m,p-Xylene	ND	10	1.1	ug/kg	
95-47-6	o-Xylene	ND	5.0	1.0	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	104%		75-124%
17060-07-0	1,2-Dichloroethane-D4	121%		72-135%
2037-26-5	Toluene-D8	93%		75-126%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	TRIP BLANK		
Lab Sample ID:	FA70512-6	**Date Sampled:**	12/03/19
Matrix:	SO - Trip Blank Soil	**Date Received:**	12/05/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	86%		71-133%

(a) Results reported from bisulfate preserved sample.
(b) Associated CCV outside of control limits high, sample was ND.
(c) Associated ICV and BS outside control limits high, however sample ND. Associated CCV outside of control limits high, sample was ND.
(d) Associated BS recovery outside control limits high; however sample is ND.
(e) Associated BS recovery outside control limits high; however sample is ND. Associated CCV outside of control limits high, sample was ND.
(f) Associated CCV outside of control limits low.

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

FA70512

SGS North America Inc - Orlando
Chain of Custody

4405 Vineland Road, Suite C-15 Orlando, Fl 32811
TEL 407-425-6700 FAX: 407-425-0707
www.sgs.com

SGS - ORLANDO JOB # : PAGE 1 OF 1

SGS - ORLANDO Quote # | SKIFF #

Client / Reporting Information

Company Name: Geosyntec Consultants
Address: 2501 Blue Ridge Rd Ste. 403
City: Raleigh State: NC Zip: 27607
Project Contact: James Wang Email: jwang@geosyntec.com
Phone #: 410-910-7622
Sampler(s) Name(s) (Printed)
Sampler 1: Allison Vo Sampler 2:

Project Information

Project Name: Cristex Drum Site
Street: 500 W Industry Dr.
City: Oxford State: NC
Project #: GR6764
Fax #:
Client Purchase Order #:

Analytical Information: V8260STD

Matrix Codes: DW - Drinking Water; GW - Ground Water; WW - Water; SW - Surface Water; SO - Soil; SL- Sludge; OI - Oil; LIQ - Other Liquid; AIR - Air; SOL - Other Solid

SGS Orlando Sample #	Field ID / Point of Collection	COLLECTION DATE	TIME	SAMPLED BY:	MATRIX	TOTAL # OF BOTTLES	OTHER	NONE	HCl	NaOH	HNO3	H2SO4	NAOH+ZNAC	DI WATER	MEOH	V8260STD	LAB USE ONLY
1	EKMW-1-33-35	12/3/19	0835	AV	SO	6	1	~~5~~						2	2	6	
2	EKMW-2-43-45	12/3/19	1130	AV	SO	6	1	~~5~~						2	2	6	
3	SW-1-30-32	12/4/19	0930	AV	SO	4	2	1							1	4	
4	SW-1-40-42	12/4/19	0940	AV	SO	4	2	1							1	4	
5	DUP-1-20191203	12/3/19	1140	AV	SO	6	1	1						2	2	6	
6	Trip Blank	12/4/19	—	AV	SO	3										3	

Turnaround Time (Business days)

10 Day (Business) Approved By: / Date:
7 Day
5 Day
3 Day *RUSH*
2 Day *RUSH*
1 Day *RUSH*
Other
Rush T/A Data Available VIA Email or Lablink

Data Deliverable Information

- [ ] COMMERCIAL "A" (RESULTS ONLY)
- [ ] COMMERCIAL "B" (RESULTS PLUS QC)
- [ ] REDT1 (EPA LEVEL 3)
- [x] FULLT1 (EPA LEVEL 4)
- [x] EDD'S

Comments / Remarks

Samples collected 12/3 using PACE lab VOC kits.

Raleigh, NC Service Center

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Sampler/Affiliation	Date Time:	Received By/Affiliation	Relinquished By/Affiliation	Date Time:	Received By/Affiliation
1	12/4/19 1700	2 EX	3 EX		4 12/5/19 930
Relinquished by/Affiliation	Date Time:	Received By/Affiliation	Relinquished By/Affiliation	Date Time:	Received By/Affiliation
5		6	7		8

Lab Use Only : Cooler Temperature (s) Celsius (corrected): 1.8

http://www.sgs.com/en/terms-and-conditions

ORLD-SMT-0001-03-FORM-COC (1) Rev 031318

SGS Sample Receipt Summary

Job Number: FA70512 **Client:** GEOSYNTEC CONSULTANTS **Project:** CRISTEX DRUM SITE

Date / Time Received: 12/5/2019 9:30:00 AM **Delivery Method:** FX **Airbill #'s:** 4913 8691 0071

Therm ID: IR 1; **Therm CF:** -0.8; **# of Coolers:** 1

Cooler Temps (Raw Measured) °C: Cooler 1: (2.6);

Cooler Temps (Corrected) °C: Cooler 1: (1.8);

Cooler Information	Y	or	N
1. Custody Seals Present	☑		☐
2. Custody Seals Intact	☑		☐
3. Temp criteria achieved	☑		☐
4. Cooler temp verification	IR Gun		
5. Cooler media	Ice (Bag)		

Trip Blank Information	Y	or	N	N/A
1. Trip Blank present / cooler	☐		☐	☑
2. Trip Blank listed on COC	☐		☐	☑
	W	**or**	**S**	**N/A**
3. Type Of TB Received	☐		☐	☑

Sample Information	Y	or	N	N/A
1. Sample labels present on bottles	☑		☐	
2. Samples preserved properly	☑		☐	
3. Sufficient volume/containers recvd for analysis:	☑		☐	
4. Condition of sample	Intact			
5. Sample recvd within HT	☑		☐	
6. Dates/Times/IDs on COC match Sample Label	☑		☐	
7. VOCs have headspace	☐		☐	☑
8. Bottles received for unspecified tests	☐		☑	
9. Compositing instructions clear	☐		☐	☑
10. Voa Soil Kits/Jars received past 48hrs?	☐		☐	☑
11. % Solids Jar received?	☐		☐	☑
12. Residual Chlorine Present?	☐		☐	☑

Misc. Information

Number of Encores: 25-Gram _____ 5-Gram _____ Number of 5035 Field Kits: 6 Number of Lab Filtered Metals: _____

Test Strip Lot #s: pH 0-3 230315 pH 10-12 219813A Other: (Specify) _____ _____

Residual Chlorine Test Strip Lot #: _____

Comments

SM001
Rev. Date 05/24/17

Technician: RYANO Date: 12/5/2019 9:30:00 AM Reviewer: _____ Date: _____

FA70512: Chain of Custody
Page 2 of 2

The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

Geosyntec Consultants

Cristex Drum Site; 500 W Industry Dr, Oxford, NC

GR6764

SGS Job Number: FA70862

Sampling Date: 12/12/19

Report to:

Geosyntec Consultants
2501 Blue Ridge Rd Suite 430
Raleigh, NC 27607
jwang@geosyntec.com; mschott@geosyntec.com; mjenny@geosyntec.com
ATTN: James Wang

Total number of pages in report: **310**

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

Caitlin Brice, M.S.
General Manager

Client Service contact: Jean Dent-Smith 407-425-6700

Certifications: FL(E83510), LA(03051), KS(E-10327), IL(200063), NC(573), NJ(FL002), NY(12022), SC(96038001) DoD ELAP(ANAB L2229), AZ(AZ0806), CA(2937), TX(T104704404), PA(68-03573), VA(460177), AK, AR, IA, KY, MA, MS, ND, NH, NV, OK, OR, UT, WA, WV

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SGS North America Inc.

Sample Summary

Geosyntec Consultants

Job No: FA70862

Cristex Drum Site; 500 W Industry Dr, Oxford, NC
Project No: GR6764

This report contains results reported as ND = Not detected. The following applies:
Organics ND = Not detected above the MDL

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
FA70862-1	12/12/19	12:15	AV	12/13/19	AQ	Equipment Blank	RINSATE BLANK-20191212
FA70862-1F	12/12/19	12:15	AV	12/13/19	AQ	Equip Blank Filtered	RINSATE BLANK-20191212
FA70862-2	12/12/19	11:25	AV	12/13/19	AQ	Water	EKMW-1-20191212
FA70862-2F	12/12/19	11:25	AV	12/13/19	AQ	Water Filtered	EKMW-1-20191212
FA70862-3	12/12/19	11:25	AV	12/13/19	AQ	Water	DUP-1-20191212
FA70862-3F	12/12/19	11:25	AV	12/13/19	AQ	Water Filtered	DUP-1-20191212
FA70862-4	12/12/19	11:25	AV	12/13/19	AQ	Water	EKMW-1-20191212-NA
FA70862-5	12/12/19	14:45	AV	12/13/19	AQ	Water	EKMW-2-20191212
FA70862-5D	12/12/19	14:45	AV	12/13/19	AQ	Water Dup/MSD	EKMW-2-20191212
FA70862-5F	12/12/19	14:45	AV	12/13/19	AQ	Water Filtered	EKMW-2-20191212
FA70862-5S	12/12/19	14:45	AV	12/13/19	AQ	Water Matrix Spike	EKMW-2-20191212
FA70862-6	12/12/19	13:15	AV	12/13/19	AQ	Water	MW-3I-20191212

SGS North America Inc.

Sample Summary
(continued)

Geosyntec Consultants

Job No: FA70862

Cristex Drum Site; 500 W Industry Dr, Oxford, NC
Project No: GR6764

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
FA70862-6F	12/12/19	13:15	AV	12/13/19	AQ	Water Filtered	MW-3I-20191212
FA70862-7	12/12/19	13:15	AV	12/13/19	AQ	Water	MW-3I-20191212-NA
FA70862-8	12/12/19	13:15	AV	12/13/19	AQ	Water	DUP-2-20191212

SAMPLE DELIVERY GROUP CASE NARRATIVE

Client: Geosyntec Consultants **Job No:** FA70862

Site: Cristex Drum Site; 500 W Industry Dr, Oxford, NC **Report Date** 12/24/2019 1:16:07

9 Samples were collected on 12/12/2019 and were received at SGS North America Inc - Orlando on 12/13/2019 properly preserved, at 1.7 Deg. C and intact. These Samples received an SGS Orlando job number of FA70862. A listing of the Laboratory Sample ID, Client Sample ID and dates of collection are presented in the Results Summary Section. Except as noted below, all method specified calibrations and quality control performance criteria were met for this job. For more information, please refer to QC summary pages.

MS Volatiles By Method SW846 8260D

Matrix: AQ **Batch ID:** V1A967

All samples were analyzed within the recommended method holding time.

Sample(s) FA70862-5MS, FA70862-5MSD were used as the QC samples indicated.

All method blanks for this batch meet method specific criteria.

FA70862-1 for 1,2,3-Trichlorobenzene: Associated CCV outside of control limits low.

FA70862-1: Sample was not preserved to a pH < 2.

FA70862-5 for 1,2,3-Trichlorobenzene: Associated CCV outside of control limits low.

FA70862-5: Sample was not preserved to a pH < 2.

FA70862-6 for 1,2,3-Trichlorobenzene: Associated CCV outside of control limits low.

FA70862-6: Sample was not preserved to a pH < 2.

FA70862-7 for 1,2,3-Trichlorobenzene: Associated CCV outside of control limits low.

FA70862-7: Sample was not preserved to a pH < 2.

FA70862-8 for 1,2,3-Trichlorobenzene: Associated CCV outside of control limits low.

FA70862-8: Sample was not preserved to a pH < 2.

Matrix: AQ **Batch ID:** V1A969

All samples were analyzed within the recommended method holding time.

All method blanks for this batch meet method specific criteria.

Sample(s) FA70862-2MS, FA70862-2MSD were used as the QC samples indicated.

Matrix Spike Duplicate Recovery(s) for Tetrachloroethylene are outside control limits. Probable cause is due to matrix interference.

FA70862-1: Sample was not preserved to a pH < 2.

FA70862-2 for 1,2,3-Trichlorobenzene: Associated CCV outside of control limits low.

FA70862-2 for Chloroethane: Associated Initial Calibration outside control limits.

FA70862-2: Sample was not preserved to a pH < 2.

FA70862-4 for 1,2,3-Trichlorobenzene: Associated CCV outside of control limits low.

FA70862-4 for Chloroethane: Associated Initial Calibration outside control limits.

FA70862-4: Sample was not preserved to a pH < 2.

Metals Analysis By Method SW846 6010D

Matrix: AQ **Batch ID:** MP36555

All samples were digested within the recommended method holding time.

All samples were analyzed within the recommended method holding time.

All method blanks for this batch meet method specific criteria.

Sample(s) FA70862-1FDUP, FA70862-1FMS, FA70862-1FMSD, FA70862-1FPS, FA70862-1FSDL were used as the QC samples for metals.

RPD(s) for Serial Dilution for Manganese are outside control limits for sample MP36555-SD1. Percent difference acceptable due to low initial sample concentration (< 50 times IDL).

SGS Orlando certifies that this report meets the project requirements for analytical data produced for the samples as received at SGS Orlando and as stated on the COC. SGS Orlando certifies that the data meets the Data Quality Objectives for precision, accuracy and completeness as specified in the SGS Orlando Quality Manual except as noted above. This report is to be used in its entirety. SGS Orlando is not responsible for any assumptions of data quality if partial data packages are used.

Narrative prepared by:

_____

Ariel Hartney, Client Services *(Signature on File)*

Summary of Hits

Job Number: FA70862
Account: Geosyntec Consultants
Project: Cristex Drum Site; 500 W Industry Dr, Oxford, NC
Collected: 12/12/19

3

Lab Sample ID Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
FA70862-1	**RINSATE BLANK-20191212**					
Acetone [a]		18.4 J	25	10	ug/l	SW846 8260D
Toluene [a]		140	2.0	0.60	ug/l	SW846 8260D
FA70862-1F	**RINSATE BLANK-20191212**					
No hits reported in this sample.						
FA70862-2	**EKMW-1-20191212**					
cis-1,2-Dichloroethylene [a]		152	25	6.9	ug/l	SW846 8260D
Tetrachloroethylene [a]		2020	25	5.4	ug/l	SW846 8260D
Trichloroethylene [a]		78.4	25	8.6	ug/l	SW846 8260D
Vinyl Chloride [a]		35.9	25	10	ug/l	SW846 8260D
FA70862-2F	**EKMW-1-20191212**					
Manganese		261	15		ug/l	SW846 6010D
FA70862-3F	**DUP-1-20191212**					
Manganese		269	15		ug/l	SW846 6010D
FA70862-4	**EKMW-1-20191212-NA**					
cis-1,2-Dichloroethylene [a]		156	25	6.9	ug/l	SW846 8260D
Tetrachloroethylene [a]		2060	25	5.4	ug/l	SW846 8260D
Trichloroethylene [a]		80.7	25	8.6	ug/l	SW846 8260D
FA70862-5	**EKMW-2-20191212**					
cis-1,2-Dichloroethylene [a]		89.8	20	5.5	ug/l	SW846 8260D
Tetrachloroethylene [a]		1070	20	4.3	ug/l	SW846 8260D
Trichloroethylene [a]		42.4	20	6.9	ug/l	SW846 8260D
FA70862-5F	**EKMW-2-20191212**					
Manganese		396	15		ug/l	SW846 6010D
FA70862-6	**MW-3I-20191212**					
cis-1,2-Dichloroethylene [a]		32.4	5.0	1.4	ug/l	SW846 8260D
Tetrachloroethylene [a]		266	5.0	1.1	ug/l	SW846 8260D
Trichloroethylene [a]		14.4	5.0	1.7	ug/l	SW846 8260D

Summary of Hits

Job Number: FA70862
Account: Geosyntec Consultants
Project: Cristex Drum Site; 500 W Industry Dr, Oxford, NC
Collected: 12/12/19

Lab Sample ID Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
FA70862-6F	**MW-3I-20191212**					
Manganese		259	15		ug/l	SW846 6010D
FA70862-7	**MW-3I-20191212-NA**					
cis-1,2-Dichloroethylene [a]		34.5	5.0	1.4	ug/l	SW846 8260D
Tetrachloroethylene [a]		276	5.0	1.1	ug/l	SW846 8260D
Toluene [a]		3.5 J	5.0	1.5	ug/l	SW846 8260D
Trichloroethylene [a]		14.8	5.0	1.7	ug/l	SW846 8260D
FA70862-8	**DUP-2-20191212**					
cis-1,2-Dichloroethylene [a]		32.2	5.0	1.4	ug/l	SW846 8260D
Tetrachloroethylene [a]		271	5.0	1.1	ug/l	SW846 8260D
Trichloroethylene [a]		14.1	5.0	1.7	ug/l	SW846 8260D

(a) Sample was not preserved to a pH < 2.

Sample Results

Report of Analysis

SGS North America Inc.

Report of Analysis

Client Sample ID:	RINSATE BLANK-20191212		
Lab Sample ID:	FA70862-1	**Date Sampled:**	12/12/19
Matrix:	AQ - Equipment Blank	**Date Received:**	12/13/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	1A23850.D	1	12/19/19 01:05	CV	n/a	n/a	V1A967
Run #2 [a]	1A23875.D	2	12/19/19 13:35	CV	n/a	n/a	V1A969

	Purge Volume
Run #1	5.0 ml
Run #2	5.0 ml

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	18.4	25	10	ug/l	J
71-43-2	Benzene	ND	1.0	0.31	ug/l	
108-86-1	Bromobenzene	ND	1.0	0.37	ug/l	
74-97-5	Bromochloromethane	ND	1.0	0.45	ug/l	
75-27-4	Bromodichloromethane	ND	1.0	0.24	ug/l	
75-25-2	Bromoform	ND	1.0	0.41	ug/l	
78-93-3	2-Butanone (MEK)	ND	5.0	2.0	ug/l	
104-51-8	n-Butylbenzene	ND	1.0	0.23	ug/l	
135-98-8	sec-Butylbenzene	ND	1.0	0.24	ug/l	
98-06-6	tert-Butylbenzene	ND	1.0	0.31	ug/l	
75-15-0	Carbon Disulfide	ND	2.0	0.53	ug/l	
56-23-5	Carbon Tetrachloride	ND	1.0	0.36	ug/l	
108-90-7	Chlorobenzene	ND	1.0	0.20	ug/l	
75-00-3	Chloroethane [b]	ND	2.0	0.67	ug/l	
67-66-3	Chloroform	ND	1.0	0.30	ug/l	
95-49-8	o-Chlorotoluene	ND	1.0	0.22	ug/l	
106-43-4	p-Chlorotoluene	ND	1.0	0.31	ug/l	
124-48-1	Dibromochloromethane	ND	1.0	0.28	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	5.0	1.0	ug/l	
106-93-4	1,2-Dibromoethane	ND	2.0	0.28	ug/l	
75-71-8	Dichlorodifluoromethane	ND	2.0	0.50	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	1.0	0.32	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	1.0	0.22	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	1.0	0.26	ug/l	
75-34-3	1,1-Dichloroethane	ND	1.0	0.34	ug/l	
107-06-2	1,2-Dichloroethane	ND	1.0	0.31	ug/l	
75-35-4	1,1-Dichloroethylene	ND	1.0	0.32	ug/l	
156-59-2	cis-1,2-Dichloroethylene	ND	1.0	0.28	ug/l	
156-60-5	trans-1,2-Dichloroethylene	ND	1.0	0.22	ug/l	
78-87-5	1,2-Dichloropropane	ND	1.0	0.43	ug/l	
142-28-9	1,3-Dichloropropane	ND	1.0	0.31	ug/l	
594-20-7	2,2-Dichloropropane	ND	1.0	0.24	ug/l	

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	RINSATE BLANK-20191212		
Lab Sample ID:	FA70862-1	**Date Sampled:**	12/12/19
Matrix:	AQ - Equipment Blank	**Date Received:**	12/13/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	1.0	0.34	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	1.0	0.29	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	1.0	0.21	ug/l	
100-41-4	Ethylbenzene	ND	1.0	0.36	ug/l	
87-68-3	Hexachlorobutadiene [b]	ND	2.0	0.30	ug/l	
591-78-6	2-Hexanone	ND	10	2.0	ug/l	
98-82-8	Isopropylbenzene	ND	1.0	0.22	ug/l	
99-87-6	p-Isopropyltoluene	ND	1.0	0.21	ug/l	
74-83-9	Methyl Bromide [b]	ND	2.0	0.59	ug/l	
74-87-3	Methyl Chloride	ND	2.0	0.50	ug/l	
74-95-3	Methylene Bromide	ND	2.0	0.37	ug/l	
75-09-2	Methylene Chloride	ND	5.0	2.0	ug/l	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	5.0	1.0	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	1.0	0.23	ug/l	
91-20-3	Naphthalene	ND	5.0	1.0	ug/l	
103-65-1	n-Propylbenzene	ND	1.0	0.29	ug/l	
100-42-5	Styrene	ND	1.0	0.22	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	1.0	0.28	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	1.0	0.30	ug/l	
127-18-4	Tetrachloroethylene	ND	1.0	0.22	ug/l	
108-88-3	Toluene	140 [c]	2.0	0.60	ug/l	
87-61-6	1,2,3-Trichlorobenzene [b]	ND	2.0	0.61	ug/l	
120-82-1	1,2,4-Trichlorobenzene	ND	2.0	0.50	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	1.0	0.25	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	1.0	0.47	ug/l	
79-01-6	Trichloroethylene	ND	1.0	0.35	ug/l	
75-69-4	Trichlorofluoromethane	ND	2.0	0.50	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	2.0	0.63	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	1.0	0.32	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	1.0	0.27	ug/l	
108-05-4	Vinyl Acetate	ND	10	2.0	ug/l	
75-01-4	Vinyl Chloride	ND	1.0	0.41	ug/l	
	m,p-Xylene	ND	2.0	0.47	ug/l	
95-47-6	o-Xylene	ND	1.0	0.26	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	97%	98%	83-118%
17060-07-0	1,2-Dichloroethane-D4	96%	97%	79-125%
2037-26-5	Toluene-D8	104%	105%	85-112%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	RINSATE BLANK-20191212		
Lab Sample ID:	FA70862-1	**Date Sampled:**	12/12/19
Matrix:	AQ - Equipment Blank	**Date Received:**	12/13/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	107%	107%	83-118%

(a) Sample was not preserved to a pH < 2.
(b) Associated CCV outside of control limits low.
(c) Result is from Run# 2

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	RINSATE BLANK-20191212		
Lab Sample ID:	FA70862-1F	**Date Sampled:**	12/12/19
Matrix:	AQ - Equip Blank Filtered	**Date Received:**	12/13/19
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Iron	< 300	300	ug/l	1	12/16/19	12/16/19	LM	SW846 6010D [1]	SW846 3010A [2]
Manganese	< 15	15	ug/l	1	12/16/19	12/16/19	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16406
(2) Prep QC Batch: MP36555

RL = Reporting Limit

SGS North America Inc.

Report of Analysis

Client Sample ID:	EKMW-1-20191212		
Lab Sample ID:	FA70862-2	**Date Sampled:**	12/12/19
Matrix:	AQ - Water	**Date Received:**	12/13/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	1A23889.D	25	12/19/19 19:41	CV	n/a	n/a	V1A969
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	630	250	ug/l	
71-43-2	Benzene	ND	25	7.8	ug/l	
108-86-1	Bromobenzene	ND	25	9.2	ug/l	
74-97-5	Bromochloromethane	ND	25	11	ug/l	
75-27-4	Bromodichloromethane	ND	25	6.1	ug/l	
75-25-2	Bromoform	ND	25	10	ug/l	
78-93-3	2-Butanone (MEK)	ND	130	50	ug/l	
104-51-8	n-Butylbenzene	ND	25	5.8	ug/l	
135-98-8	sec-Butylbenzene	ND	25	6.1	ug/l	
98-06-6	tert-Butylbenzene	ND	25	7.9	ug/l	
75-15-0	Carbon Disulfide	ND	50	13	ug/l	
56-23-5	Carbon Tetrachloride	ND	25	8.9	ug/l	
108-90-7	Chlorobenzene	ND	25	5.0	ug/l	
75-00-3	Chloroethane [b]	ND	50	17	ug/l	
67-66-3	Chloroform	ND	25	7.5	ug/l	
95-49-8	o-Chlorotoluene	ND	25	5.6	ug/l	
106-43-4	p-Chlorotoluene	ND	25	7.7	ug/l	
124-48-1	Dibromochloromethane	ND	25	6.9	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	130	26	ug/l	
106-93-4	1,2-Dibromoethane	ND	50	6.9	ug/l	
75-71-8	Dichlorodifluoromethane	ND	50	13	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	25	8.1	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	25	5.4	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	25	6.4	ug/l	
75-34-3	1,1-Dichloroethane	ND	25	8.5	ug/l	
107-06-2	1,2-Dichloroethane	ND	25	7.8	ug/l	
75-35-4	1,1-Dichloroethylene	ND	25	8.1	ug/l	
156-59-2	cis-1,2-Dichloroethylene	152	25	6.9	ug/l	
156-60-5	trans-1,2-Dichloroethylene	ND	25	5.5	ug/l	
78-87-5	1,2-Dichloropropane	ND	25	11	ug/l	
142-28-9	1,3-Dichloropropane	ND	25	7.7	ug/l	
594-20-7	2,2-Dichloropropane	ND	25	6.0	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EKMW-1-20191212		
Lab Sample ID:	FA70862-2	**Date Sampled:**	12/12/19
Matrix:	AQ - Water	**Date Received:**	12/13/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	25	8.4	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	25	7.3	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	25	5.4	ug/l	
100-41-4	Ethylbenzene	ND	25	8.9	ug/l	
87-68-3	Hexachlorobutadiene [c]	ND	50	7.4	ug/l	
591-78-6	2-Hexanone	ND	250	50	ug/l	
98-82-8	Isopropylbenzene	ND	25	5.5	ug/l	
99-87-6	p-Isopropyltoluene	ND	25	5.3	ug/l	
74-83-9	Methyl Bromide	ND	50	15	ug/l	
74-87-3	Methyl Chloride	ND	50	13	ug/l	
74-95-3	Methylene Bromide	ND	50	9.2	ug/l	
75-09-2	Methylene Chloride	ND	130	50	ug/l	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	130	25	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	25	5.7	ug/l	
91-20-3	Naphthalene [c]	ND	130	25	ug/l	
103-65-1	n-Propylbenzene	ND	25	7.2	ug/l	
100-42-5	Styrene	ND	25	5.6	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	25	6.9	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	25	7.5	ug/l	
127-18-4	Tetrachloroethylene	2020	25	5.4	ug/l	
108-88-3	Toluene	ND	25	7.5	ug/l	
87-61-6	1,2,3-Trichlorobenzene [c]	ND	50	15	ug/l	
120-82-1	1,2,4-Trichlorobenzene	ND	50	13	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	25	6.2	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	25	12	ug/l	
79-01-6	Trichloroethylene	78.4	25	8.6	ug/l	
75-69-4	Trichlorofluoromethane	ND	50	13	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	50	16	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	25	8.1	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	25	6.9	ug/l	
108-05-4	Vinyl Acetate	ND	250	50	ug/l	
75-01-4	Vinyl Chloride	35.9	25	10	ug/l	
	m,p-Xylene	ND	50	12	ug/l	
95-47-6	o-Xylene	ND	25	6.4	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	98%		83-118%
17060-07-0	1,2-Dichloroethane-D4	97%		79-125%
2037-26-5	Toluene-D8	104%		85-112%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EKMW-1-20191212		
Lab Sample ID:	FA70862-2	**Date Sampled:**	12/12/19
Matrix:	AQ - Water	**Date Received:**	12/13/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	106%		83-118%

(a) Sample was not preserved to a pH < 2.
(b) Associated Initial Calibration outside control limits.
(c) Associated CCV outside of control limits low.

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EKMW-1-20191212		
Lab Sample ID:	FA70862-2F	**Date Sampled:**	12/12/19
Matrix:	AQ - Water Filtered	**Date Received:**	12/13/19
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Iron	< 300	300	ug/l	1	12/16/19	12/16/19	LM	SW846 6010D [1]	SW846 3010A [2]
Manganese	261	15	ug/l	1	12/16/19	12/16/19	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16406
(2) Prep QC Batch: MP36555

RL = Reporting Limit

Report of Analysis

Client Sample ID:	DUP-1-20191212		
Lab Sample ID:	FA70862-3F	**Date Sampled:**	12/12/19
Matrix:	AQ - Water Filtered	**Date Received:**	12/13/19
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Iron	< 300	300	ug/l	1	12/16/19	12/16/19	LM	SW846 6010D [1]	SW846 3010A [2]
Manganese	269	15	ug/l	1	12/16/19	12/16/19	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16406
(2) Prep QC Batch: MP36555

RL = Reporting Limit

SGS North America Inc.

Report of Analysis

Client Sample ID:	EKMW-1-20191212-NA		
Lab Sample ID:	FA70862-4	**Date Sampled:**	12/12/19
Matrix:	AQ - Water	**Date Received:**	12/13/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	1A23890.D	25	12/19/19 20:07	CV	n/a	n/a	V1A969
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	630	250	ug/l	
71-43-2	Benzene	ND	25	7.8	ug/l	
108-86-1	Bromobenzene	ND	25	9.2	ug/l	
74-97-5	Bromochloromethane	ND	25	11	ug/l	
75-27-4	Bromodichloromethane	ND	25	6.1	ug/l	
75-25-2	Bromoform	ND	25	10	ug/l	
78-93-3	2-Butanone (MEK)	ND	130	50	ug/l	
104-51-8	n-Butylbenzene	ND	25	5.8	ug/l	
135-98-8	sec-Butylbenzene	ND	25	6.1	ug/l	
98-06-6	tert-Butylbenzene	ND	25	7.9	ug/l	
75-15-0	Carbon Disulfide	ND	50	13	ug/l	
56-23-5	Carbon Tetrachloride	ND	25	8.9	ug/l	
108-90-7	Chlorobenzene	ND	25	5.0	ug/l	
75-00-3	Chloroethane [b]	ND	50	17	ug/l	
67-66-3	Chloroform	ND	25	7.5	ug/l	
95-49-8	o-Chlorotoluene	ND	25	5.6	ug/l	
106-43-4	p-Chlorotoluene	ND	25	7.7	ug/l	
124-48-1	Dibromochloromethane	ND	25	6.9	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	130	26	ug/l	
106-93-4	1,2-Dibromoethane	ND	50	6.9	ug/l	
75-71-8	Dichlorodifluoromethane	ND	50	13	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	25	8.1	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	25	5.4	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	25	6.4	ug/l	
75-34-3	1,1-Dichloroethane	ND	25	8.5	ug/l	
107-06-2	1,2-Dichloroethane	ND	25	7.8	ug/l	
75-35-4	1,1-Dichloroethylene	ND	25	8.1	ug/l	
156-59-2	cis-1,2-Dichloroethylene	156	25	6.9	ug/l	
156-60-5	trans-1,2-Dichloroethylene	ND	25	5.5	ug/l	
78-87-5	1,2-Dichloropropane	ND	25	11	ug/l	
142-28-9	1,3-Dichloropropane	ND	25	7.7	ug/l	
594-20-7	2,2-Dichloropropane	ND	25	6.0	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EKMW-1-20191212-NA		
Lab Sample ID:	FA70862-4	**Date Sampled:**	12/12/19
Matrix:	AQ - Water	**Date Received:**	12/13/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	25	8.4	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	25	7.3	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	25	5.4	ug/l	
100-41-4	Ethylbenzene	ND	25	8.9	ug/l	
87-68-3	Hexachlorobutadiene [c]	ND	50	7.4	ug/l	
591-78-6	2-Hexanone	ND	250	50	ug/l	
98-82-8	Isopropylbenzene	ND	25	5.5	ug/l	
99-87-6	p-Isopropyltoluene	ND	25	5.3	ug/l	
74-83-9	Methyl Bromide	ND	50	15	ug/l	
74-87-3	Methyl Chloride	ND	50	13	ug/l	
74-95-3	Methylene Bromide	ND	50	9.2	ug/l	
75-09-2	Methylene Chloride	ND	130	50	ug/l	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	130	25	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	25	5.7	ug/l	
91-20-3	Naphthalene [c]	ND	130	25	ug/l	
103-65-1	n-Propylbenzene	ND	25	7.2	ug/l	
100-42-5	Styrene	ND	25	5.6	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	25	6.9	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	25	7.5	ug/l	
127-18-4	Tetrachloroethylene	2060	25	5.4	ug/l	
108-88-3	Toluene	ND	25	7.5	ug/l	
87-61-6	1,2,3-Trichlorobenzene [c]	ND	50	15	ug/l	
120-82-1	1,2,4-Trichlorobenzene	ND	50	13	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	25	6.2	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	25	12	ug/l	
79-01-6	Trichloroethylene	80.7	25	8.6	ug/l	
75-69-4	Trichlorofluoromethane	ND	50	13	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	50	16	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	25	8.1	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	25	6.9	ug/l	
108-05-4	Vinyl Acetate	ND	250	50	ug/l	
75-01-4	Vinyl Chloride	ND	25	10	ug/l	
	m,p-Xylene	ND	50	12	ug/l	
95-47-6	o-Xylene	ND	25	6.4	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	98%		83-118%
17060-07-0	1,2-Dichloroethane-D4	99%		79-125%
2037-26-5	Toluene-D8	103%		85-112%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EKMW-1-20191212-NA		
Lab Sample ID:	FA70862-4	**Date Sampled:**	12/12/19
Matrix:	AQ - Water	**Date Received:**	12/13/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	104%		83-118%

(a) Sample was not preserved to a pH < 2.
(b) Associated Initial Calibration outside control limits.
(c) Associated CCV outside of control limits low.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	EKMW-2-20191212		
Lab Sample ID:	FA70862-5	**Date Sampled:**	12/12/19
Matrix:	AQ - Water	**Date Received:**	12/13/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	1A23851.D	20	12/19/19 01:32	CV	n/a	n/a	V1A967
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	500	200	ug/l	
71-43-2	Benzene	ND	20	6.2	ug/l	
108-86-1	Bromobenzene	ND	20	7.3	ug/l	
74-97-5	Bromochloromethane	ND	20	9.0	ug/l	
75-27-4	Bromodichloromethane	ND	20	4.8	ug/l	
75-25-2	Bromoform	ND	20	8.1	ug/l	
78-93-3	2-Butanone (MEK)	ND	100	40	ug/l	
104-51-8	n-Butylbenzene	ND	20	4.6	ug/l	
135-98-8	sec-Butylbenzene	ND	20	4.9	ug/l	
98-06-6	tert-Butylbenzene	ND	20	6.3	ug/l	
75-15-0	Carbon Disulfide	ND	40	11	ug/l	
56-23-5	Carbon Tetrachloride	ND	20	7.1	ug/l	
108-90-7	Chlorobenzene	ND	20	4.0	ug/l	
75-00-3	Chloroethane [b]	ND	40	13	ug/l	
67-66-3	Chloroform	ND	20	6.0	ug/l	
95-49-8	o-Chlorotoluene	ND	20	4.4	ug/l	
106-43-4	p-Chlorotoluene	ND	20	6.1	ug/l	
124-48-1	Dibromochloromethane	ND	20	5.5	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	100	21	ug/l	
106-93-4	1,2-Dibromoethane	ND	40	5.5	ug/l	
75-71-8	Dichlorodifluoromethane	ND	40	10	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	20	6.5	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	20	4.3	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	20	5.1	ug/l	
75-34-3	1,1-Dichloroethane	ND	20	6.8	ug/l	
107-06-2	1,2-Dichloroethane	ND	20	6.2	ug/l	
75-35-4	1,1-Dichloroethylene	ND	20	6.4	ug/l	
156-59-2	cis-1,2-Dichloroethylene	89.8	20	5.5	ug/l	
156-60-5	trans-1,2-Dichloroethylene	ND	20	4.4	ug/l	
78-87-5	1,2-Dichloropropane	ND	20	8.5	ug/l	
142-28-9	1,3-Dichloropropane	ND	20	6.2	ug/l	
594-20-7	2,2-Dichloropropane	ND	20	4.8	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EKMW-2-20191212		
Lab Sample ID:	FA70862-5	**Date Sampled:**	12/12/19
Matrix:	AQ - Water	**Date Received:**	12/13/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	20	6.7	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	20	5.8	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	20	4.3	ug/l	
100-41-4	Ethylbenzene	ND	20	7.1	ug/l	
87-68-3	Hexachlorobutadiene [b]	ND	40	5.9	ug/l	
591-78-6	2-Hexanone	ND	200	40	ug/l	
98-82-8	Isopropylbenzene	ND	20	4.4	ug/l	
99-87-6	p-Isopropyltoluene	ND	20	4.3	ug/l	
74-83-9	Methyl Bromide [b]	ND	40	12	ug/l	
74-87-3	Methyl Chloride	ND	40	10	ug/l	
74-95-3	Methylene Bromide	ND	40	7.4	ug/l	
75-09-2	Methylene Chloride	ND	100	40	ug/l	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	100	20	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	20	4.6	ug/l	
91-20-3	Naphthalene	ND	100	20	ug/l	
103-65-1	n-Propylbenzene	ND	20	5.7	ug/l	
100-42-5	Styrene	ND	20	4.4	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	20	5.5	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	20	6.0	ug/l	
127-18-4	Tetrachloroethylene	1070	20	4.3	ug/l	
108-88-3	Toluene	ND	20	6.0	ug/l	
87-61-6	1,2,3-Trichlorobenzene [b]	ND	40	12	ug/l	
120-82-1	1,2,4-Trichlorobenzene	ND	40	10	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	20	5.0	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	20	9.3	ug/l	
79-01-6	Trichloroethylene	42.4	20	6.9	ug/l	
75-69-4	Trichlorofluoromethane	ND	40	10	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	40	13	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	20	6.5	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	20	5.5	ug/l	
108-05-4	Vinyl Acetate	ND	200	40	ug/l	
75-01-4	Vinyl Chloride	ND	20	8.2	ug/l	
	m,p-Xylene	ND	40	9.3	ug/l	
95-47-6	o-Xylene	ND	20	5.1	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	98%		83-118%
17060-07-0	1,2-Dichloroethane-D4	94%		79-125%
2037-26-5	Toluene-D8	103%		85-112%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EKMW-2-20191212		
Lab Sample ID:	FA70862-5	**Date Sampled:**	12/12/19
Matrix:	AQ - Water	**Date Received:**	12/13/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	108%		83-118%

(a) Sample was not preserved to a pH < 2.
(b) Associated CCV outside of control limits low.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EKMW-2-20191212		
Lab Sample ID:	FA70862-5F	**Date Sampled:**	12/12/19
Matrix:	AQ - Water Filtered	**Date Received:**	12/13/19
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Iron	< 300	300	ug/l	1	12/16/19	12/16/19	LM	SW846 6010D [1]	SW846 3010A [2]
Manganese	396	15	ug/l	1	12/16/19	12/16/19	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16406
(2) Prep QC Batch: MP36555

RL = Reporting Limit

SGS North America Inc.

Report of Analysis

Client Sample ID:	MW-3I-20191212		
Lab Sample ID:	FA70862-6	**Date Sampled:**	12/12/19
Matrix:	AQ - Water	**Date Received:**	12/13/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	1A23864.D	5	12/19/19 07:16	CV	n/a	n/a	V1A967
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	130	50	ug/l	
71-43-2	Benzene	ND	5.0	1.6	ug/l	
108-86-1	Bromobenzene	ND	5.0	1.8	ug/l	
74-97-5	Bromochloromethane	ND	5.0	2.3	ug/l	
75-27-4	Bromodichloromethane	ND	5.0	1.2	ug/l	
75-25-2	Bromoform	ND	5.0	2.0	ug/l	
78-93-3	2-Butanone (MEK)	ND	25	10	ug/l	
104-51-8	n-Butylbenzene	ND	5.0	1.2	ug/l	
135-98-8	sec-Butylbenzene	ND	5.0	1.2	ug/l	
98-06-6	tert-Butylbenzene	ND	5.0	1.6	ug/l	
75-15-0	Carbon Disulfide	ND	10	2.7	ug/l	
56-23-5	Carbon Tetrachloride	ND	5.0	1.8	ug/l	
108-90-7	Chlorobenzene	ND	5.0	1.0	ug/l	
75-00-3	Chloroethane [b]	ND	10	3.3	ug/l	
67-66-3	Chloroform	ND	5.0	1.5	ug/l	
95-49-8	o-Chlorotoluene	ND	5.0	1.1	ug/l	
106-43-4	p-Chlorotoluene	ND	5.0	1.5	ug/l	
124-48-1	Dibromochloromethane	ND	5.0	1.4	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	25	5.2	ug/l	
106-93-4	1,2-Dibromoethane	ND	10	1.4	ug/l	
75-71-8	Dichlorodifluoromethane	ND	10	2.5	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	5.0	1.6	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	5.0	1.1	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	5.0	1.3	ug/l	
75-34-3	1,1-Dichloroethane	ND	5.0	1.7	ug/l	
107-06-2	1,2-Dichloroethane	ND	5.0	1.6	ug/l	
75-35-4	1,1-Dichloroethylene	ND	5.0	1.6	ug/l	
156-59-2	cis-1,2-Dichloroethylene	32.4	5.0	1.4	ug/l	
156-60-5	trans-1,2-Dichloroethylene	ND	5.0	1.1	ug/l	
78-87-5	1,2-Dichloropropane	ND	5.0	2.1	ug/l	
142-28-9	1,3-Dichloropropane	ND	5.0	1.5	ug/l	
594-20-7	2,2-Dichloropropane	ND	5.0	1.2	ug/l	

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MW-3I-20191212		
Lab Sample ID:	FA70862-6	**Date Sampled:**	12/12/19
Matrix:	AQ - Water	**Date Received:**	12/13/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	5.0	1.7	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	5.0	1.5	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	5.0	1.1	ug/l	
100-41-4	Ethylbenzene	ND	5.0	1.8	ug/l	
87-68-3	Hexachlorobutadiene [b]	ND	10	1.5	ug/l	
591-78-6	2-Hexanone	ND	50	10	ug/l	
98-82-8	Isopropylbenzene	ND	5.0	1.1	ug/l	
99-87-6	p-Isopropyltoluene	ND	5.0	1.1	ug/l	
74-83-9	Methyl Bromide [b]	ND	10	2.9	ug/l	
74-87-3	Methyl Chloride	ND	10	2.5	ug/l	
74-95-3	Methylene Bromide	ND	10	1.8	ug/l	
75-09-2	Methylene Chloride	ND	25	10	ug/l	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	25	5.0	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	5.0	1.1	ug/l	
91-20-3	Naphthalene	ND	25	5.0	ug/l	
103-65-1	n-Propylbenzene	ND	5.0	1.4	ug/l	
100-42-5	Styrene	ND	5.0	1.1	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	5.0	1.4	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	5.0	1.5	ug/l	
127-18-4	Tetrachloroethylene	266	5.0	1.1	ug/l	
108-88-3	Toluene	ND	5.0	1.5	ug/l	
87-61-6	1,2,3-Trichlorobenzene [b]	ND	10	3.1	ug/l	
120-82-1	1,2,4-Trichlorobenzene	ND	10	2.5	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	5.0	1.2	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	5.0	2.3	ug/l	
79-01-6	Trichloroethylene	14.4	5.0	1.7	ug/l	
75-69-4	Trichlorofluoromethane	ND	10	2.5	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	10	3.2	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	5.0	1.6	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	5.0	1.4	ug/l	
108-05-4	Vinyl Acetate	ND	50	10	ug/l	
75-01-4	Vinyl Chloride	ND	5.0	2.0	ug/l	
	m,p-Xylene	ND	10	2.3	ug/l	
95-47-6	o-Xylene	ND	5.0	1.3	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	97%		83-118%
17060-07-0	1,2-Dichloroethane-D4	94%		79-125%
2037-26-5	Toluene-D8	104%		85-112%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MW-3I-20191212		
Lab Sample ID:	FA70862-6	**Date Sampled:**	12/12/19
Matrix:	AQ - Water	**Date Received:**	12/13/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	108%		83-118%

(a) Sample was not preserved to a pH < 2.
(b) Associated CCV outside of control limits low.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MW-3I-20191212		
Lab Sample ID:	FA70862-6F	**Date Sampled:**	12/12/19
Matrix:	AQ - Water Filtered	**Date Received:**	12/13/19
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Iron	< 300	300	ug/l	1	12/16/19	12/16/19	LM	SW846 6010D [1]	SW846 3010A [2]
Manganese	259	15	ug/l	1	12/16/19	12/16/19	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16406
(2) Prep QC Batch: MP36555

RL = Reporting Limit

SGS North America Inc.

Report of Analysis

Client Sample ID:	MW-3I-20191212-NA		
Lab Sample ID:	FA70862-7	**Date Sampled:**	12/12/19
Matrix:	AQ - Water	**Date Received:**	12/13/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	1A23865.D	5	12/19/19 07:42	CV	n/a	n/a	V1A967
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	130	50	ug/l	
71-43-2	Benzene	ND	5.0	1.6	ug/l	
108-86-1	Bromobenzene	ND	5.0	1.8	ug/l	
74-97-5	Bromochloromethane	ND	5.0	2.3	ug/l	
75-27-4	Bromodichloromethane	ND	5.0	1.2	ug/l	
75-25-2	Bromoform	ND	5.0	2.0	ug/l	
78-93-3	2-Butanone (MEK)	ND	25	10	ug/l	
104-51-8	n-Butylbenzene	ND	5.0	1.2	ug/l	
135-98-8	sec-Butylbenzene	ND	5.0	1.2	ug/l	
98-06-6	tert-Butylbenzene	ND	5.0	1.6	ug/l	
75-15-0	Carbon Disulfide	ND	10	2.7	ug/l	
56-23-5	Carbon Tetrachloride	ND	5.0	1.8	ug/l	
108-90-7	Chlorobenzene	ND	5.0	1.0	ug/l	
75-00-3	Chloroethane [b]	ND	10	3.3	ug/l	
67-66-3	Chloroform	ND	5.0	1.5	ug/l	
95-49-8	o-Chlorotoluene	ND	5.0	1.1	ug/l	
106-43-4	p-Chlorotoluene	ND	5.0	1.5	ug/l	
124-48-1	Dibromochloromethane	ND	5.0	1.4	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	25	5.2	ug/l	
106-93-4	1,2-Dibromoethane	ND	10	1.4	ug/l	
75-71-8	Dichlorodifluoromethane	ND	10	2.5	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	5.0	1.6	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	5.0	1.1	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	5.0	1.3	ug/l	
75-34-3	1,1-Dichloroethane	ND	5.0	1.7	ug/l	
107-06-2	1,2-Dichloroethane	ND	5.0	1.6	ug/l	
75-35-4	1,1-Dichloroethylene	ND	5.0	1.6	ug/l	
156-59-2	cis-1,2-Dichloroethylene	34.5	5.0	1.4	ug/l	
156-60-5	trans-1,2-Dichloroethylene	ND	5.0	1.1	ug/l	
78-87-5	1,2-Dichloropropane	ND	5.0	2.1	ug/l	
142-28-9	1,3-Dichloropropane	ND	5.0	1.5	ug/l	
594-20-7	2,2-Dichloropropane	ND	5.0	1.2	ug/l	

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MW-3I-20191212-NA		
Lab Sample ID:	FA70862-7	**Date Sampled:**	12/12/19
Matrix:	AQ - Water	**Date Received:**	12/13/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	5.0	1.7	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	5.0	1.5	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	5.0	1.1	ug/l	
100-41-4	Ethylbenzene	ND	5.0	1.8	ug/l	
87-68-3	Hexachlorobutadiene [b]	ND	10	1.5	ug/l	
591-78-6	2-Hexanone	ND	50	10	ug/l	
98-82-8	Isopropylbenzene	ND	5.0	1.1	ug/l	
99-87-6	p-Isopropyltoluene	ND	5.0	1.1	ug/l	
74-83-9	Methyl Bromide [b]	ND	10	2.9	ug/l	
74-87-3	Methyl Chloride	ND	10	2.5	ug/l	
74-95-3	Methylene Bromide	ND	10	1.8	ug/l	
75-09-2	Methylene Chloride	ND	25	10	ug/l	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	25	5.0	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	5.0	1.1	ug/l	
91-20-3	Naphthalene	ND	25	5.0	ug/l	
103-65-1	n-Propylbenzene	ND	5.0	1.4	ug/l	
100-42-5	Styrene	ND	5.0	1.1	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	5.0	1.4	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	5.0	1.5	ug/l	
127-18-4	Tetrachloroethylene	276	5.0	1.1	ug/l	
108-88-3	Toluene	3.5	5.0	1.5	ug/l	J
87-61-6	1,2,3-Trichlorobenzene [b]	ND	10	3.1	ug/l	
120-82-1	1,2,4-Trichlorobenzene	ND	10	2.5	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	5.0	1.2	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	5.0	2.3	ug/l	
79-01-6	Trichloroethylene	14.8	5.0	1.7	ug/l	
75-69-4	Trichlorofluoromethane	ND	10	2.5	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	10	3.2	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	5.0	1.6	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	5.0	1.4	ug/l	
108-05-4	Vinyl Acetate	ND	50	10	ug/l	
75-01-4	Vinyl Chloride	ND	5.0	2.0	ug/l	
	m,p-Xylene	ND	10	2.3	ug/l	
95-47-6	o-Xylene	ND	5.0	1.3	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	98%		83-118%
17060-07-0	1,2-Dichloroethane-D4	95%		79-125%
2037-26-5	Toluene-D8	104%		85-112%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MW-3I-20191212-NA		
Lab Sample ID:	FA70862-7	**Date Sampled:**	12/12/19
Matrix:	AQ - Water	**Date Received:**	12/13/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	107%		83-118%

(a) Sample was not preserved to a pH < 2.
(b) Associated CCV outside of control limits low.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

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Report of Analysis

Client Sample ID:	DUP-2-20191212		
Lab Sample ID:	FA70862-8	**Date Sampled:**	12/12/19
Matrix:	AQ - Water	**Date Received:**	12/13/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	1A23866.D	5	12/19/19 08:09	CV	n/a	n/a	V1A967
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	130	50	ug/l	
71-43-2	Benzene	ND	5.0	1.6	ug/l	
108-86-1	Bromobenzene	ND	5.0	1.8	ug/l	
74-97-5	Bromochloromethane	ND	5.0	2.3	ug/l	
75-27-4	Bromodichloromethane	ND	5.0	1.2	ug/l	
75-25-2	Bromoform	ND	5.0	2.0	ug/l	
78-93-3	2-Butanone (MEK)	ND	25	10	ug/l	
104-51-8	n-Butylbenzene	ND	5.0	1.2	ug/l	
135-98-8	sec-Butylbenzene	ND	5.0	1.2	ug/l	
98-06-6	tert-Butylbenzene	ND	5.0	1.6	ug/l	
75-15-0	Carbon Disulfide	ND	10	2.7	ug/l	
56-23-5	Carbon Tetrachloride	ND	5.0	1.8	ug/l	
108-90-7	Chlorobenzene	ND	5.0	1.0	ug/l	
75-00-3	Chloroethane [b]	ND	10	3.3	ug/l	
67-66-3	Chloroform	ND	5.0	1.5	ug/l	
95-49-8	o-Chlorotoluene	ND	5.0	1.1	ug/l	
106-43-4	p-Chlorotoluene	ND	5.0	1.5	ug/l	
124-48-1	Dibromochloromethane	ND	5.0	1.4	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	25	5.2	ug/l	
106-93-4	1,2-Dibromoethane	ND	10	1.4	ug/l	
75-71-8	Dichlorodifluoromethane	ND	10	2.5	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	5.0	1.6	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	5.0	1.1	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	5.0	1.3	ug/l	
75-34-3	1,1-Dichloroethane	ND	5.0	1.7	ug/l	
107-06-2	1,2-Dichloroethane	ND	5.0	1.6	ug/l	
75-35-4	1,1-Dichloroethylene	ND	5.0	1.6	ug/l	
156-59-2	cis-1,2-Dichloroethylene	32.2	5.0	1.4	ug/l	
156-60-5	trans-1,2-Dichloroethylene	ND	5.0	1.1	ug/l	
78-87-5	1,2-Dichloropropane	ND	5.0	2.1	ug/l	
142-28-9	1,3-Dichloropropane	ND	5.0	1.5	ug/l	
594-20-7	2,2-Dichloropropane	ND	5.0	1.2	ug/l	

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	DUP-2-20191212		
Lab Sample ID:	FA70862-8	**Date Sampled:**	12/12/19
Matrix:	AQ - Water	**Date Received:**	12/13/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	5.0	1.7	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	5.0	1.5	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	5.0	1.1	ug/l	
100-41-4	Ethylbenzene	ND	5.0	1.8	ug/l	
87-68-3	Hexachlorobutadiene [b]	ND	10	1.5	ug/l	
591-78-6	2-Hexanone	ND	50	10	ug/l	
98-82-8	Isopropylbenzene	ND	5.0	1.1	ug/l	
99-87-6	p-Isopropyltoluene	ND	5.0	1.1	ug/l	
74-83-9	Methyl Bromide [b]	ND	10	2.9	ug/l	
74-87-3	Methyl Chloride	ND	10	2.5	ug/l	
74-95-3	Methylene Bromide	ND	10	1.8	ug/l	
75-09-2	Methylene Chloride	ND	25	10	ug/l	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	25	5.0	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	5.0	1.1	ug/l	
91-20-3	Naphthalene	ND	25	5.0	ug/l	
103-65-1	n-Propylbenzene	ND	5.0	1.4	ug/l	
100-42-5	Styrene	ND	5.0	1.1	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	5.0	1.4	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	5.0	1.5	ug/l	
127-18-4	Tetrachloroethylene	271	5.0	1.1	ug/l	
108-88-3	Toluene	ND	5.0	1.5	ug/l	
87-61-6	1,2,3-Trichlorobenzene [b]	ND	10	3.1	ug/l	
120-82-1	1,2,4-Trichlorobenzene	ND	10	2.5	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	5.0	1.2	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	5.0	2.3	ug/l	
79-01-6	Trichloroethylene	14.1	5.0	1.7	ug/l	
75-69-4	Trichlorofluoromethane	ND	10	2.5	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	10	3.2	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	5.0	1.6	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	5.0	1.4	ug/l	
108-05-4	Vinyl Acetate	ND	50	10	ug/l	
75-01-4	Vinyl Chloride	ND	5.0	2.0	ug/l	
	m,p-Xylene	ND	10	2.3	ug/l	
95-47-6	o-Xylene	ND	5.0	1.3	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	98%		83-118%
17060-07-0	1,2-Dichloroethane-D4	94%		79-125%
2037-26-5	Toluene-D8	104%		85-112%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	DUP-2-20191212		
Lab Sample ID:	FA70862-8	**Date Sampled:**	12/12/19
Matrix:	AQ - Water	**Date Received:**	12/13/19
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	108%		83-118%

(a) Sample was not preserved to a pH < 2.
(b) Associated CCV outside of control limits low.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

FA70862

SGS North America Inc - Orlando
Chain of Custody

4405 Vineland Road, Suite C-15 Orlando, Fl 32811
TEL. 407-425-6700 FAX: 407-425-0707
www.sgs.com

SGS - ORLANDO JOB # : PAGE 1 OF 1

SGS - ORLANDO Quote # | SKIFF #

Client / Reporting Information

Company Name: Geosyntec Consultants
Address: 2501 Blue Ridge Rd Ste 430
City: Raleigh State: NC Zip: 27607
Project Contact: Chris Shores Email: cshores@geosyntec.com
Phone #: 919 424 1836
Sampler(s) Name(s) (Printed) Sampler 1: Alli Vo Sampler 2:

Project Information

Project Name: Cristex Drum Site
Street: 500 W Industry Dr
City: Oxford State: NC
Project #: GR6764
Fax #:
Client Purchase Order #:

Analytical Information

Matrix Codes: DW - Drinking Water; GW - Ground Water; WW - Water; SW - Surface Water; SO - Soil; SL- Sludge; OI - Oil; LIQ - Other Liquid; AIR - Air; SOL - Other Solid

SGS Orlando Sample #	Field ID / Point of Collection	DATE	TIME	SAMPLED BY:	MATRIX	TOTAL # OF BOTTLES	OTHER	NONE	HCl	NaOH	HNO3	H2SO4	NAOH+ZNAC	DI WATER	MEOH	Dissolved Metals	V8260 SL	LAB USE ONLY
1	RinsateBlank-20191212	12/12/19	1215	AV	WW	4	3	1								1	3	
2	TripBlank	"	—	—	WW	3	3										3	
3	EKMW-1-20191212 (2)	"	1125	AV	WW	4	3	1								1	3	
4	DVP-1-20191212 (3)	"	1125	AV	WW	1		1								1		
5	EKMW-1-20191212-NA (4)	"	1125	AV	WW	3		3									3	
6	EKMW-2-20191212 (5)	"	1445	AV	WW	4	3	1								1	3	
6	MSD-20191212 (5)	"	1445	AV	WW	3	3										3	
6	MS-20191212 (5)	"	1445	AV	WW	3	3										3	
7	MW-3I-20191212 (6)	"	1315	AV	WW	4	3	1								1	3	
8	MW-3I-20191212-NA (7)	"	1315	AV	WW	3		3									3	
9	DVP-2-20191212 (8)	"	1315	AV	WW	3	3										3	

Turnaround Time (Business days)

10 Day (Business) Approved By: / Date:
7 Day
5 Day
3 Day *RUSH*
2 Day *RUSH*
1 Day *RUSH*
Other
Rush T/A Data Available VIA Email or Lablink

Data Deliverable Information

- [ ] COMMERCIAL "A" (RESULTS ONLY)
- [ ] COMMERCIAL "B" (RESULTS PLUS QC)
- [ ] REDT1 (EPA LEVEL 3)
- [x] FULLT1 (EPA LEVEL 4)
- [x] EDD'S

Comments / Remarks

Raleigh, NC
Service Center

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Sampler/Affiliation	Date Time:	Received By/Affiliation	Relinquished By/Affiliation	Date Time:	Received By/Affiliation
1 Allison Vo / Geosyntec	12/12/19 1726	2 FX	3 FX		4 [signature] 12/13/19 845
Relinquished by/Affiliation	Date Time:	Received By/Affiliation	Relinquished By/Affiliation	Date Time:	Received By/Affiliation
5		6	7		8

Lab Use Only : Cooler Temperature (s) Celsius (corrected): http://www.sgs.com/en/terms-and-conditions

ORLD-SMT-0001-03-FORM-COC (1) Rev 031318

1.7

5.1

5

FA70862: Chain of Custody
Page 1 of 2

The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

Geosyntec Consultants

Cristex Drum Site; 500 W Industry Dr, Oxford, NC

GR6764

SGS Job Number: FA72869

Sampling Date: 02/24/20

Report to:

Geosyntec Consultants
2501 Blue Ridge Rd Suite 430
Raleigh, NC 27607
jwang@geosyntec.com; AVo@Geosyntec.com;
RGabelman@Geosyntec.com
ATTN: Allison Vo

Total number of pages in report: **508**

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

Caitlin Brice, M.S.
General Manager

Client Service contact: Jean Dent-Smith 407-425-6700

Certifications: FL(E83510), LA(03051), KS(E-10327), IL(200063), NC(573), NJ(FL002), NY(12022), SC(96038001) DoD ELAP(ANAB L2229), AZ(AZ0806), CA(2937), TX(T104704404), PA(68-03573), VA(460177), AK, AR, IA, KY, MA, MS, ND, NH, NV, OK, OR, UT, WA, WV

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Test results relate only to samples analyzed.

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Please share your ideas about
how we can serve you better at:
EHS.US.CustomerCare@sgs.com

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SGS North America Inc.

Sample Summary

Geosyntec Consultants

Job No: FA72869

Cristex Drum Site; 500 W Industry Dr, Oxford, NC
Project No: GR6764

This report contains results reported as ND = Not detected. The following applies:
Organics ND = Not detected above the MDL

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
FA72869-1	02/24/20	11:35	RG	02/26/20	AQ	Ground Water	EK-MW-1
FA72869-1F	02/24/20	11:35	RG	02/26/20	AQ	Groundwater Filtered	EK-MW-1
FA72869-2	02/24/20	12:00	RG	02/26/20	AQ	Ground Water	DUP-1
FA72869-2F	02/24/20	12:00	RG	02/26/20	AQ	Groundwater Filtered	DUP-1
FA72869-3	02/24/20	13:50	RG	02/26/20	AQ	Ground Water	MW-31
FA72869-3D	02/24/20	13:50	RG	02/26/20	AQ	Water Dup/MSD	MW-31
FA72869-3DF	02/24/20	13:50	RG	02/26/20	AQ	Water Dup/MSD	MW-31
FA72869-3F	02/24/20	13:50	RG	02/26/20	AQ	Groundwater Filtered	MW-31
FA72869-3S	02/24/20	13:50	RG	02/26/20	AQ	Water Matrix Spike	MW-31
FA72869-3SF	02/24/20	13:50	RG	02/26/20	AQ	Water Matrix Spike	MW-31
FA72869-4	02/24/20	15:40	RG	02/26/20	AQ	Ground Water	EK-MW-2
FA72869-4F	02/24/20	15:40	RG	02/26/20	AQ	Groundwater Filtered	EK-MW-2

SGS North America Inc.

Sample Summary
(continued)

Geosyntec Consultants

Job No: FA72869

Cristex Drum Site; 500 W Industry Dr, Oxford, NC
Project No: GR6764

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
FA72869-5	02/24/20	16:20	RG	02/26/20	AQ	Ground Water	RB-2
FA72869-5F	02/24/20	16:20	RG	02/26/20	AQ	Groundwater Filtered	RB-2
FA72869-6	02/24/20	00:00	RG	02/26/20	AQ	Trip Blank Water	TRIP BLANK

SAMPLE DELIVERY GROUP CASE NARRATIVE

Client: Geosyntec Consultants **Job No:** FA72869

Site: Cristex Drum Site; 500 W Industry Dr, Oxford, NC **Report Date:** 3/10/2020 3:54:40 PM

5 Samples and 1 Trip Blank were collected on 02/24/2020 and were received at SGS North America Inc - Orlando on 02/26/2020 properly preserved, at 1.9 Deg. C and intact. These Samples received an SGS Orlando job number of FA72869. A listing of the Laboratory Sample ID, Client Sample ID and dates of collection are presented in the Results Summary Section. Except as noted below, all method specified calibrations and quality control performance criteria were met for this job. For more information, please refer to QC summary pages.

MS Volatiles By Method SW846 8260D

Matrix: AQ **Batch ID:** V5E949

All samples were analyzed within the recommended method holding time.

All method blanks for this batch meet method specific criteria.

Sample(s) FA72869-3MS, FA72869-3MSD were used as the QC samples indicated.

FA72869-1: Sample was not preserved to a pH < 2.

FA72869-2: Sample was not preserved to a pH < 2.

FA72869-3: Sample was not preserved to a pH < 2. Dilution required due to matrix interference.

FA72869-4: Sample was not preserved to a pH < 2.

FA72869-5: Sample was not preserved to a pH < 2.

FA72869-6: Sample was not preserved to a pH < 2.

Matrix: AQ **Batch ID:** V5E950

All samples were analyzed within the recommended method holding time.

All method blanks for this batch meet method specific criteria.

Sample(s) FA72785-1MS, FA72785-1MSD were used as the QC samples indicated.

Matrix Spike Recovery(s) for 1,1,1-Trichloroethane, 1,1-Dichloroethane, 1,2-Dichloropropane, Methyl Tert Butyl Ether, Methylene Bromide, Trichloroethylene, cis-1,2-Dichloroethylene are outside control limits. Outside control limits due to high level in sample relative to spike amount.

Matrix Spike Duplicate Recovery(s) for 1,1,1-Trichloroethane, 1,1-Dichloroethane, 1,2-Dichloroethane, 1,2-Dichloropropane, Benzene, Chloroform, cis-1,2-Dichloroethylene, Methyl Tert Butyl Ether, Methylene Bromide, Trichloroethylene are outside control limits. Probable cause is due to matrix interference.

FA72869-4: Sample was not preserved to a pH < 2.

FA72869-4 for Acetone: Associated CCV outside of control limits low.

Metals Analysis By Method SW846 6010D

Matrix: AQ **Batch ID:** MP36867

All samples were digested within the recommended method holding time.

All samples were analyzed within the recommended method holding time.

All method blanks for this batch meet method specific criteria.

Sample(s) FA72869-3DUP, FA72869-3FDUP, FA72869-3FSDL, FA72869-3SDL, FA72869-3FMSD, FA72869-3MSD, FA72869-3FPS, FA72869-3PS were used as the QC samples for metals.

Matrix Spike Recovery(s) for Manganese, Iron are outside control limits. Spike amount low relative to the sample amount. Refer to lab control or spike blank for recovery information.

Matrix Spike Duplicate Recovery(s) for Iron, Manganese are outside control limits. Probable cause is due to matrix interference.

RPD(s) for MSD for Iron, Manganese, Iron are outside control limits for sample MP36867-S2, MP36867-S4. High RPD due to possible sample non-homogeneity.

RPD(s) for Serial Dilution for Manganese are outside control limits for sample MP36867-SD2. Probable cause is due to sample non-homogeneity.

MP36867-MB1 for Manganese: All sample results >10x method blank concentration or <DL.

MP36867-PS1 for Manganese: Spike recovery indicates matrix interference and/or outside control limits due to high level in sample relative to spike amount.

MP36867-PS1 for Iron: Spike recovery indicates matrix interference and/or outside control limits due to high level in sample relative to spike amount.

MP36867-S3 for Iron: Spike recovery indicates matrix interference and/or outside control limits due to high level in sample relative to spike amount.

MP36867-PS2 for Manganese: Spike recovery indicates matrix interference and/or outside control limits due to high level in sample relative to spike amount.

MP36867-PS2 for Iron: Spike recovery indicates matrix interference and/or outside control limits due to high level in sample relative to spike amount.

MP36867-S1 for Iron: Spike recovery indicates matrix interference and/or outside control limits due to high level in sample relative to spike amount.

MP36867-SD2 for Manganese: Serial dilution indicates possible matrix interference.

Matrix: AQ **Batch ID:** MP36879

All samples were digested within the recommended method holding time.

All samples were analyzed within the recommended method holding time.

All method blanks for this batch meet method specific criteria.

Sample(s) FA72869-1DUP, FA72869-1MS, FA72869-1MSD, FA72869-1PS, FA72869-1SDL were used as the QC samples for metals.

RPD(s) for Serial Dilution for Iron are outside control limits for sample MP36879-SD1. Percent difference acceptable due to low initial sample concentration (< 50 times IDL).

SGS Orlando certifies that this report meets the project requirements for analytical data produced for the samples as received at SGS Orlando and as stated on the COC. SGS Orlando certifies that the data meets the Data Quality Objectives for precision, accuracy and completeness as specified in the SGS Orlando Quality Manual except as noted above. This report is to be used in its entirety. SGS Orlando is not responsible for any assumptions of data quality if partial data packages are used.

Narrative prepared by:

_____

Jenna Kravitz, Client Services *(Signature on File)*

Summary of Hits

Job Number: FA72869
Account: Geosyntec Consultants
Project: Cristex Drum Site; 500 W Industry Dr, Oxford, NC
Collected: 02/24/20

Lab Sample ID Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
FA72869-1	**EK-MW-1**					
cis-1,2-Dichloroethylene [a]		69.3	20	5.5	ug/l	SW846 8260D
Tetrachloroethylene [a]		1030	20	4.3	ug/l	SW846 8260D
Trichloroethylene [a]		41.8	20	6.9	ug/l	SW846 8260D
Manganese		117	15		ug/l	SW846 6010D
FA72869-1F	**EK-MW-1**					
Manganese		103	15		ug/l	SW846 6010D
FA72869-2	**DUP-1**					
cis-1,2-Dichloroethylene [a]		70.9	20	5.5	ug/l	SW846 8260D
Tetrachloroethylene [a]		1110	20	4.3	ug/l	SW846 8260D
Trichloroethylene [a]		41.9	20	6.9	ug/l	SW846 8260D
Manganese		141	15		ug/l	SW846 6010D
FA72869-2F	**DUP-1**					
Manganese		106	15		ug/l	SW846 6010D
FA72869-3	**MW-31**					
Acetone [b]		93.9 J	130	50	ug/l	SW846 8260D
2-Butanone (MEK) [b]		11.7 J	25	10	ug/l	SW846 8260D
Chloroform [b]		2.4 J	5.0	1.5	ug/l	SW846 8260D
Manganese		1270000	3800		ug/l	SW846 6010D
FA72869-3F	**MW-31**					
Manganese		1600000	3800		ug/l	SW846 6010D
FA72869-4	**EK-MW-2**					
cis-1,2-Dichloroethylene [a]		49.3	5.0	1.4	ug/l	SW846 8260D
Tetrachloroethylene [a]		477	10	2.2	ug/l	SW846 8260D
Trichloroethylene [a]		29.1	5.0	1.7	ug/l	SW846 8260D
Manganese		557	15		ug/l	SW846 6010D
FA72869-4F	**EK-MW-2**					
Manganese		339	15		ug/l	SW846 6010D

Summary of Hits

Job Number: FA72869
Account: Geosyntec Consultants
Project: Cristex Drum Site; 500 W Industry Dr, Oxford, NC
Collected: 02/24/20

Lab Sample ID Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
FA72869-5	**RB-2**					
Toluene [a]		0.45 J	1.0	0.30	ug/l	SW846 8260D
FA72869-5F	**RB-2**					
No hits reported in this sample.						
FA72869-6	**TRIP BLANK**					
No hits reported in this sample.						

(a) Sample was not preserved to a pH < 2.
(b) Sample was not preserved to a pH < 2. Dilution required due to matrix interference.

Sample Results

Report of Analysis

SGS North America Inc.

Report of Analysis

Client Sample ID:	EK-MW-1		
Lab Sample ID:	FA72869-1	**Date Sampled:**	02/24/20
Matrix:	AQ - Ground Water	**Date Received:**	02/26/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	5E20833.D	20	02/28/20 14:10	SO	n/a	n/a	V5E949
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	500	200	ug/l	
71-43-2	Benzene	ND	20	6.2	ug/l	
108-86-1	Bromobenzene	ND	20	7.3	ug/l	
74-97-5	Bromochloromethane	ND	20	9.0	ug/l	
75-27-4	Bromodichloromethane	ND	20	4.8	ug/l	
75-25-2	Bromoform	ND	20	8.1	ug/l	
78-93-3	2-Butanone (MEK)	ND	100	40	ug/l	
104-51-8	n-Butylbenzene	ND	20	4.6	ug/l	
135-98-8	sec-Butylbenzene	ND	20	4.9	ug/l	
98-06-6	tert-Butylbenzene	ND	20	6.3	ug/l	
75-15-0	Carbon Disulfide	ND	40	11	ug/l	
56-23-5	Carbon Tetrachloride	ND	20	7.1	ug/l	
108-90-7	Chlorobenzene	ND	20	4.0	ug/l	
75-00-3	Chloroethane	ND	40	13	ug/l	
67-66-3	Chloroform	ND	20	6.0	ug/l	
95-49-8	o-Chlorotoluene	ND	20	4.4	ug/l	
106-43-4	p-Chlorotoluene	ND	20	6.1	ug/l	
124-48-1	Dibromochloromethane	ND	20	5.5	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	100	21	ug/l	
106-93-4	1,2-Dibromoethane	ND	40	5.5	ug/l	
75-71-8	Dichlorodifluoromethane	ND	40	10	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	20	6.5	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	20	4.3	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	20	5.1	ug/l	
75-34-3	1,1-Dichloroethane	ND	20	6.8	ug/l	
107-06-2	1,2-Dichloroethane	ND	20	6.2	ug/l	
75-35-4	1,1-Dichloroethylene	ND	20	6.4	ug/l	
156-59-2	cis-1,2-Dichloroethylene	69.3	20	5.5	ug/l	
156-60-5	trans-1,2-Dichloroethylene	ND	20	4.4	ug/l	
78-87-5	1,2-Dichloropropane	ND	20	8.5	ug/l	
142-28-9	1,3-Dichloropropane	ND	20	6.2	ug/l	
594-20-7	2,2-Dichloropropane	ND	20	4.8	ug/l	

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EK-MW-1		
Lab Sample ID:	FA72869-1	**Date Sampled:**	02/24/20
Matrix:	AQ - Ground Water	**Date Received:**	02/26/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	20	6.7	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	20	5.8	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	20	4.3	ug/l	
100-41-4	Ethylbenzene	ND	20	7.1	ug/l	
87-68-3	Hexachlorobutadiene	ND	40	5.9	ug/l	
591-78-6	2-Hexanone	ND	200	40	ug/l	
98-82-8	Isopropylbenzene	ND	20	4.4	ug/l	
99-87-6	p-Isopropyltoluene	ND	20	4.3	ug/l	
74-83-9	Methyl Bromide	ND	40	12	ug/l	
74-87-3	Methyl Chloride	ND	40	10	ug/l	
74-95-3	Methylene Bromide	ND	40	7.4	ug/l	
75-09-2	Methylene Chloride	ND	100	40	ug/l	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	100	20	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	20	4.6	ug/l	
91-20-3	Naphthalene	ND	100	20	ug/l	
103-65-1	n-Propylbenzene	ND	20	5.7	ug/l	
100-42-5	Styrene	ND	20	4.4	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	20	5.5	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	20	6.0	ug/l	
127-18-4	Tetrachloroethylene	1030	20	4.3	ug/l	
108-88-3	Toluene	ND	20	6.0	ug/l	
87-61-6	1,2,3-Trichlorobenzene	ND	40	12	ug/l	
120-82-1	1,2,4-Trichlorobenzene	ND	40	10	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	20	5.0	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	20	9.3	ug/l	
79-01-6	Trichloroethylene	41.8	20	6.9	ug/l	
75-69-4	Trichlorofluoromethane	ND	40	10	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	40	13	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	20	6.5	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	20	5.5	ug/l	
108-05-4	Vinyl Acetate	ND	200	40	ug/l	
75-01-4	Vinyl Chloride	ND	20	8.2	ug/l	
	m,p-Xylene	ND	40	9.3	ug/l	
95-47-6	o-Xylene	ND	20	5.1	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	103%		83-118%
17060-07-0	1,2-Dichloroethane-D4	109%		79-125%
2037-26-5	Toluene-D8	102%		85-112%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EK-MW-1		
Lab Sample ID:	FA72869-1	**Date Sampled:**	02/24/20
Matrix:	AQ - Ground Water	**Date Received:**	02/26/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	100%		83-118%

(a) Sample was not preserved to a pH < 2.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EK-MW-1		
Lab Sample ID:	FA72869-1	**Date Sampled:**	02/24/20
Matrix:	AQ - Ground Water	**Date Received:**	02/26/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Total Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Manganese	117	15	ug/l	1	03/02/20	03/03/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16577
(2) Prep QC Batch: MP36879

RL = Reporting Limit

Report of Analysis

Client Sample ID:	EK-MW-1		
Lab Sample ID:	FA72869-1F	**Date Sampled:**	02/24/20
Matrix:	AQ - Groundwater Filtered	**Date Received:**	02/26/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Iron	< 300	300	ug/l	1	03/02/20	03/03/20	LM	SW846 6010D [1]	SW846 3010A [2]
Manganese	103	15	ug/l	1	03/02/20	03/03/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16577
(2) Prep QC Batch: MP36879

RL = Reporting Limit

SGS North America Inc.

Report of Analysis

Client Sample ID:	DUP-1		
Lab Sample ID:	FA72869-2	**Date Sampled:**	02/24/20
Matrix:	AQ - Ground Water	**Date Received:**	02/26/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	5E20834.D	20	02/28/20 14:32	SO	n/a	n/a	V5E949
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	500	200	ug/l	
71-43-2	Benzene	ND	20	6.2	ug/l	
108-86-1	Bromobenzene	ND	20	7.3	ug/l	
74-97-5	Bromochloromethane	ND	20	9.0	ug/l	
75-27-4	Bromodichloromethane	ND	20	4.8	ug/l	
75-25-2	Bromoform	ND	20	8.1	ug/l	
78-93-3	2-Butanone (MEK)	ND	100	40	ug/l	
104-51-8	n-Butylbenzene	ND	20	4.6	ug/l	
135-98-8	sec-Butylbenzene	ND	20	4.9	ug/l	
98-06-6	tert-Butylbenzene	ND	20	6.3	ug/l	
75-15-0	Carbon Disulfide	ND	40	11	ug/l	
56-23-5	Carbon Tetrachloride	ND	20	7.1	ug/l	
108-90-7	Chlorobenzene	ND	20	4.0	ug/l	
75-00-3	Chloroethane	ND	40	13	ug/l	
67-66-3	Chloroform	ND	20	6.0	ug/l	
95-49-8	o-Chlorotoluene	ND	20	4.4	ug/l	
106-43-4	p-Chlorotoluene	ND	20	6.1	ug/l	
124-48-1	Dibromochloromethane	ND	20	5.5	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	100	21	ug/l	
106-93-4	1,2-Dibromoethane	ND	40	5.5	ug/l	
75-71-8	Dichlorodifluoromethane	ND	40	10	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	20	6.5	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	20	4.3	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	20	5.1	ug/l	
75-34-3	1,1-Dichloroethane	ND	20	6.8	ug/l	
107-06-2	1,2-Dichloroethane	ND	20	6.2	ug/l	
75-35-4	1,1-Dichloroethylene	ND	20	6.4	ug/l	
156-59-2	cis-1,2-Dichloroethylene	70.9	20	5.5	ug/l	
156-60-5	trans-1,2-Dichloroethylene	ND	20	4.4	ug/l	
78-87-5	1,2-Dichloropropane	ND	20	8.5	ug/l	
142-28-9	1,3-Dichloropropane	ND	20	6.2	ug/l	
594-20-7	2,2-Dichloropropane	ND	20	4.8	ug/l	

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	DUP-1		
Lab Sample ID:	FA72869-2	**Date Sampled:**	02/24/20
Matrix:	AQ - Ground Water	**Date Received:**	02/26/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	20	6.7	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	20	5.8	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	20	4.3	ug/l	
100-41-4	Ethylbenzene	ND	20	7.1	ug/l	
87-68-3	Hexachlorobutadiene	ND	40	5.9	ug/l	
591-78-6	2-Hexanone	ND	200	40	ug/l	
98-82-8	Isopropylbenzene	ND	20	4.4	ug/l	
99-87-6	p-Isopropyltoluene	ND	20	4.3	ug/l	
74-83-9	Methyl Bromide	ND	40	12	ug/l	
74-87-3	Methyl Chloride	ND	40	10	ug/l	
74-95-3	Methylene Bromide	ND	40	7.4	ug/l	
75-09-2	Methylene Chloride	ND	100	40	ug/l	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	100	20	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	20	4.6	ug/l	
91-20-3	Naphthalene	ND	100	20	ug/l	
103-65-1	n-Propylbenzene	ND	20	5.7	ug/l	
100-42-5	Styrene	ND	20	4.4	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	20	5.5	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	20	6.0	ug/l	
127-18-4	Tetrachloroethylene	1110	20	4.3	ug/l	
108-88-3	Toluene	ND	20	6.0	ug/l	
87-61-6	1,2,3-Trichlorobenzene	ND	40	12	ug/l	
120-82-1	1,2,4-Trichlorobenzene	ND	40	10	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	20	5.0	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	20	9.3	ug/l	
79-01-6	Trichloroethylene	41.9	20	6.9	ug/l	
75-69-4	Trichlorofluoromethane	ND	40	10	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	40	13	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	20	6.5	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	20	5.5	ug/l	
108-05-4	Vinyl Acetate	ND	200	40	ug/l	
75-01-4	Vinyl Chloride	ND	20	8.2	ug/l	
	m,p-Xylene	ND	40	9.3	ug/l	
95-47-6	o-Xylene	ND	20	5.1	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	103%		83-118%
17060-07-0	1,2-Dichloroethane-D4	109%		79-125%
2037-26-5	Toluene-D8	101%		85-112%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	DUP-1		
Lab Sample ID:	FA72869-2	**Date Sampled:**	02/24/20
Matrix:	AQ - Ground Water	**Date Received:**	02/26/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	99%		83-118%

(a) Sample was not preserved to a pH < 2.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	DUP-1		
Lab Sample ID:	FA72869-2	**Date Sampled:**	02/24/20
Matrix:	AQ - Ground Water	**Date Received:**	02/26/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Total Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Manganese	141	15	ug/l	1	03/02/20	03/03/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16577
(2) Prep QC Batch: MP36879

RL = Reporting Limit

Report of Analysis

Client Sample ID:	DUP-1		
Lab Sample ID:	FA72869-2F	**Date Sampled:**	02/24/20
Matrix:	AQ - Groundwater Filtered	**Date Received:**	02/26/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Iron	< 300	300	ug/l	1	03/02/20	03/03/20	LM	SW846 6010D [1]	SW846 3010A [2]
Manganese	106	15	ug/l	1	03/02/20	03/03/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16577
(2) Prep QC Batch: MP36879

RL = Reporting Limit

SGS North America Inc.

Report of Analysis

Client Sample ID:	MW-31		
Lab Sample ID:	FA72869-3	**Date Sampled:**	02/24/20
Matrix:	AQ - Ground Water	**Date Received:**	02/26/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	5E20835.D	5	02/28/20 14:55	SO	n/a	n/a	V5E949
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	93.9	130	50	ug/l	J
71-43-2	Benzene	ND	5.0	1.6	ug/l	
108-86-1	Bromobenzene	ND	5.0	1.8	ug/l	
74-97-5	Bromochloromethane	ND	5.0	2.3	ug/l	
75-27-4	Bromodichloromethane	ND	5.0	1.2	ug/l	
75-25-2	Bromoform	ND	5.0	2.0	ug/l	
78-93-3	2-Butanone (MEK)	11.7	25	10	ug/l	J
104-51-8	n-Butylbenzene	ND	5.0	1.2	ug/l	
135-98-8	sec-Butylbenzene	ND	5.0	1.2	ug/l	
98-06-6	tert-Butylbenzene	ND	5.0	1.6	ug/l	
75-15-0	Carbon Disulfide	ND	10	2.7	ug/l	
56-23-5	Carbon Tetrachloride	ND	5.0	1.8	ug/l	
108-90-7	Chlorobenzene	ND	5.0	1.0	ug/l	
75-00-3	Chloroethane	ND	10	3.3	ug/l	
67-66-3	Chloroform	2.4	5.0	1.5	ug/l	J
95-49-8	o-Chlorotoluene	ND	5.0	1.1	ug/l	
106-43-4	p-Chlorotoluene	ND	5.0	1.5	ug/l	
124-48-1	Dibromochloromethane	ND	5.0	1.4	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	25	5.2	ug/l	
106-93-4	1,2-Dibromoethane	ND	10	1.4	ug/l	
75-71-8	Dichlorodifluoromethane	ND	10	2.5	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	5.0	1.6	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	5.0	1.1	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	5.0	1.3	ug/l	
75-34-3	1,1-Dichloroethane	ND	5.0	1.7	ug/l	
107-06-2	1,2-Dichloroethane	ND	5.0	1.6	ug/l	
75-35-4	1,1-Dichloroethylene	ND	5.0	1.6	ug/l	
156-59-2	cis-1,2-Dichloroethylene	ND	5.0	1.4	ug/l	
156-60-5	trans-1,2-Dichloroethylene	ND	5.0	1.1	ug/l	
78-87-5	1,2-Dichloropropane	ND	5.0	2.1	ug/l	
142-28-9	1,3-Dichloropropane	ND	5.0	1.5	ug/l	
594-20-7	2,2-Dichloropropane	ND	5.0	1.2	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MW-31		
Lab Sample ID:	FA72869-3	**Date Sampled:**	02/24/20
Matrix:	AQ - Ground Water	**Date Received:**	02/26/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	5.0	1.7	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	5.0	1.5	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	5.0	1.1	ug/l	
100-41-4	Ethylbenzene	ND	5.0	1.8	ug/l	
87-68-3	Hexachlorobutadiene	ND	10	1.5	ug/l	
591-78-6	2-Hexanone	ND	50	10	ug/l	
98-82-8	Isopropylbenzene	ND	5.0	1.1	ug/l	
99-87-6	p-Isopropyltoluene	ND	5.0	1.1	ug/l	
74-83-9	Methyl Bromide	ND	10	2.9	ug/l	
74-87-3	Methyl Chloride	ND	10	2.5	ug/l	
74-95-3	Methylene Bromide	ND	10	1.8	ug/l	
75-09-2	Methylene Chloride	ND	25	10	ug/l	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	25	5.0	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	5.0	1.1	ug/l	
91-20-3	Naphthalene	ND	25	5.0	ug/l	
103-65-1	n-Propylbenzene	ND	5.0	1.4	ug/l	
100-42-5	Styrene	ND	5.0	1.1	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	5.0	1.4	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	5.0	1.5	ug/l	
127-18-4	Tetrachloroethylene	ND	5.0	1.1	ug/l	
108-88-3	Toluene	ND	5.0	1.5	ug/l	
87-61-6	1,2,3-Trichlorobenzene	ND	10	3.1	ug/l	
120-82-1	1,2,4-Trichlorobenzene	ND	10	2.5	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	5.0	1.2	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	5.0	2.3	ug/l	
79-01-6	Trichloroethylene	ND	5.0	1.7	ug/l	
75-69-4	Trichlorofluoromethane	ND	10	2.5	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	10	3.2	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	5.0	1.6	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	5.0	1.4	ug/l	
108-05-4	Vinyl Acetate	ND	50	10	ug/l	
75-01-4	Vinyl Chloride	ND	5.0	2.0	ug/l	
	m,p-Xylene	ND	10	2.3	ug/l	
95-47-6	o-Xylene	ND	5.0	1.3	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	103%		83-118%
17060-07-0	1,2-Dichloroethane-D4	111%		79-125%
2037-26-5	Toluene-D8	102%		85-112%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MW-31		
Lab Sample ID:	FA72869-3	**Date Sampled:**	02/24/20
Matrix:	AQ - Ground Water	**Date Received:**	02/26/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	100%		83-118%

(a) Sample was not preserved to a pH < 2. Dilution required due to matrix interference.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MW-31		
Lab Sample ID:	FA72869-3	**Date Sampled:**	02/24/20
Matrix:	AQ - Ground Water	**Date Received:**	02/26/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Total Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Manganese	1270000	3800	ug/l	250	02/27/20	02/28/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16570
(2) Prep QC Batch: MP36867

RL = Reporting Limit

Report of Analysis

Client Sample ID:	MW-31		
Lab Sample ID:	FA72869-3F	**Date Sampled:**	02/24/20
Matrix:	AQ - Groundwater Filtered	**Date Received:**	02/26/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Iron	< 75000	75000	ug/l	250	02/27/20	02/28/20	LM	SW846 6010D [1]	SW846 3010A [2]
Manganese	1600000	3800	ug/l	250	02/27/20	02/28/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16570
(2) Prep QC Batch: MP36867

RL = Reporting Limit

SGS North America Inc.

Report of Analysis

Client Sample ID:	EK-MW-2		
Lab Sample ID:	FA72869-4	**Date Sampled:**	02/24/20
Matrix:	AQ - Ground Water	**Date Received:**	02/26/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	5E20857.D	5	03/02/20 12:10	SO	n/a	n/a	V5E950
Run #2 [a]	5E20836.D	10	02/28/20 15:18	SO	n/a	n/a	V5E949

	Purge Volume
Run #1	5.0 ml
Run #2	5.0 ml

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone [b]	ND	130	50	ug/l	
71-43-2	Benzene	ND	5.0	1.6	ug/l	
108-86-1	Bromobenzene	ND	5.0	1.8	ug/l	
74-97-5	Bromochloromethane	ND	5.0	2.3	ug/l	
75-27-4	Bromodichloromethane	ND	5.0	1.2	ug/l	
75-25-2	Bromoform	ND	5.0	2.0	ug/l	
78-93-3	2-Butanone (MEK)	ND	25	10	ug/l	
104-51-8	n-Butylbenzene	ND	5.0	1.2	ug/l	
135-98-8	sec-Butylbenzene	ND	5.0	1.2	ug/l	
98-06-6	tert-Butylbenzene	ND	5.0	1.6	ug/l	
75-15-0	Carbon Disulfide	ND	10	2.7	ug/l	
56-23-5	Carbon Tetrachloride	ND	5.0	1.8	ug/l	
108-90-7	Chlorobenzene	ND	5.0	1.0	ug/l	
75-00-3	Chloroethane	ND	10	3.3	ug/l	
67-66-3	Chloroform	ND	5.0	1.5	ug/l	
95-49-8	o-Chlorotoluene	ND	5.0	1.1	ug/l	
106-43-4	p-Chlorotoluene	ND	5.0	1.5	ug/l	
124-48-1	Dibromochloromethane	ND	5.0	1.4	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	25	5.2	ug/l	
106-93-4	1,2-Dibromoethane	ND	10	1.4	ug/l	
75-71-8	Dichlorodifluoromethane	ND	10	2.5	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	5.0	1.6	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	5.0	1.1	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	5.0	1.3	ug/l	
75-34-3	1,1-Dichloroethane	ND	5.0	1.7	ug/l	
107-06-2	1,2-Dichloroethane	ND	5.0	1.6	ug/l	
75-35-4	1,1-Dichloroethylene	ND	5.0	1.6	ug/l	
156-59-2	cis-1,2-Dichloroethylene	49.3	5.0	1.4	ug/l	
156-60-5	trans-1,2-Dichloroethylene	ND	5.0	1.1	ug/l	
78-87-5	1,2-Dichloropropane	ND	5.0	2.1	ug/l	
142-28-9	1,3-Dichloropropane	ND	5.0	1.5	ug/l	
594-20-7	2,2-Dichloropropane	ND	5.0	1.2	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EK-MW-2		
Lab Sample ID:	FA72869-4	**Date Sampled:**	02/24/20
Matrix:	AQ - Ground Water	**Date Received:**	02/26/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	5.0	1.7	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	5.0	1.5	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	5.0	1.1	ug/l	
100-41-4	Ethylbenzene	ND	5.0	1.8	ug/l	
87-68-3	Hexachlorobutadiene	ND	10	1.5	ug/l	
591-78-6	2-Hexanone	ND	50	10	ug/l	
98-82-8	Isopropylbenzene	ND	5.0	1.1	ug/l	
99-87-6	p-Isopropyltoluene	ND	5.0	1.1	ug/l	
74-83-9	Methyl Bromide	ND	10	2.9	ug/l	
74-87-3	Methyl Chloride	ND	10	2.5	ug/l	
74-95-3	Methylene Bromide	ND	10	1.8	ug/l	
75-09-2	Methylene Chloride	ND	25	10	ug/l	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	25	5.0	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	5.0	1.1	ug/l	
91-20-3	Naphthalene	ND	25	5.0	ug/l	
103-65-1	n-Propylbenzene	ND	5.0	1.4	ug/l	
100-42-5	Styrene	ND	5.0	1.1	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	5.0	1.4	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	5.0	1.5	ug/l	
127-18-4	Tetrachloroethylene	477 [c]	10	2.2	ug/l	
108-88-3	Toluene	ND	5.0	1.5	ug/l	
87-61-6	1,2,3-Trichlorobenzene	ND	10	3.1	ug/l	
120-82-1	1,2,4-Trichlorobenzene	ND	10	2.5	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	5.0	1.2	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	5.0	2.3	ug/l	
79-01-6	Trichloroethylene	29.1	5.0	1.7	ug/l	
75-69-4	Trichlorofluoromethane	ND	10	2.5	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	10	3.2	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	5.0	1.6	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	5.0	1.4	ug/l	
108-05-4	Vinyl Acetate	ND	50	10	ug/l	
75-01-4	Vinyl Chloride	ND	5.0	2.0	ug/l	
	m,p-Xylene	ND	10	2.3	ug/l	
95-47-6	o-Xylene	ND	5.0	1.3	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	102%	102%	83-118%
17060-07-0	1,2-Dichloroethane-D4	109%	110%	79-125%
2037-26-5	Toluene-D8	100%	102%	85-112%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EK-MW-2		
Lab Sample ID:	FA72869-4	**Date Sampled:**	02/24/20
Matrix:	AQ - Ground Water	**Date Received:**	02/26/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	99%	100%	83-118%

(a) Sample was not preserved to a pH < 2.
(b) Associated CCV outside of control limits low.
(c) Result is from Run# 2

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	EK-MW-2		
Lab Sample ID:	FA72869-4	**Date Sampled:**	02/24/20
Matrix:	AQ - Ground Water	**Date Received:**	02/26/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Total Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Manganese	557	15	ug/l	1	03/02/20	03/03/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16577
(2) Prep QC Batch: MP36879

RL = Reporting Limit

Report of Analysis

Client Sample ID:	EK-MW-2		
Lab Sample ID:	FA72869-4F	**Date Sampled:**	02/24/20
Matrix:	AQ - Groundwater Filtered	**Date Received:**	02/26/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Iron	< 300	300	ug/l	1	03/02/20	03/03/20	LM	SW846 6010D [1]	SW846 3010A [2]
Manganese	339	15	ug/l	1	03/02/20	03/03/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16577
(2) Prep QC Batch: MP36879

RL = Reporting Limit

SGS North America Inc.

Report of Analysis

Client Sample ID:	RB-2		
Lab Sample ID:	FA72869-5	**Date Sampled:**	02/24/20
Matrix:	AQ - Ground Water	**Date Received:**	02/26/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	5E20837.D	1	02/28/20 15:41	SO	n/a	n/a	V5E949
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	25	10	ug/l	
71-43-2	Benzene	ND	1.0	0.31	ug/l	
108-86-1	Bromobenzene	ND	1.0	0.37	ug/l	
74-97-5	Bromochloromethane	ND	1.0	0.45	ug/l	
75-27-4	Bromodichloromethane	ND	1.0	0.24	ug/l	
75-25-2	Bromoform	ND	1.0	0.41	ug/l	
78-93-3	2-Butanone (MEK)	ND	5.0	2.0	ug/l	
104-51-8	n-Butylbenzene	ND	1.0	0.23	ug/l	
135-98-8	sec-Butylbenzene	ND	1.0	0.24	ug/l	
98-06-6	tert-Butylbenzene	ND	1.0	0.31	ug/l	
75-15-0	Carbon Disulfide	ND	2.0	0.53	ug/l	
56-23-5	Carbon Tetrachloride	ND	1.0	0.36	ug/l	
108-90-7	Chlorobenzene	ND	1.0	0.20	ug/l	
75-00-3	Chloroethane	ND	2.0	0.67	ug/l	
67-66-3	Chloroform	ND	1.0	0.30	ug/l	
95-49-8	o-Chlorotoluene	ND	1.0	0.22	ug/l	
106-43-4	p-Chlorotoluene	ND	1.0	0.31	ug/l	
124-48-1	Dibromochloromethane	ND	1.0	0.28	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	5.0	1.0	ug/l	
106-93-4	1,2-Dibromoethane	ND	2.0	0.28	ug/l	
75-71-8	Dichlorodifluoromethane	ND	2.0	0.50	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	1.0	0.32	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	1.0	0.22	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	1.0	0.26	ug/l	
75-34-3	1,1-Dichloroethane	ND	1.0	0.34	ug/l	
107-06-2	1,2-Dichloroethane	ND	1.0	0.31	ug/l	
75-35-4	1,1-Dichloroethylene	ND	1.0	0.32	ug/l	
156-59-2	cis-1,2-Dichloroethylene	ND	1.0	0.28	ug/l	
156-60-5	trans-1,2-Dichloroethylene	ND	1.0	0.22	ug/l	
78-87-5	1,2-Dichloropropane	ND	1.0	0.43	ug/l	
142-28-9	1,3-Dichloropropane	ND	1.0	0.31	ug/l	
594-20-7	2,2-Dichloropropane	ND	1.0	0.24	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	RB-2		
Lab Sample ID:	FA72869-5	**Date Sampled:**	02/24/20
Matrix:	AQ - Ground Water	**Date Received:**	02/26/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	1.0	0.34	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	1.0	0.29	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	1.0	0.21	ug/l	
100-41-4	Ethylbenzene	ND	1.0	0.36	ug/l	
87-68-3	Hexachlorobutadiene	ND	2.0	0.30	ug/l	
591-78-6	2-Hexanone	ND	10	2.0	ug/l	
98-82-8	Isopropylbenzene	ND	1.0	0.22	ug/l	
99-87-6	p-Isopropyltoluene	ND	1.0	0.21	ug/l	
74-83-9	Methyl Bromide	ND	2.0	0.59	ug/l	
74-87-3	Methyl Chloride	ND	2.0	0.50	ug/l	
74-95-3	Methylene Bromide	ND	2.0	0.37	ug/l	
75-09-2	Methylene Chloride	ND	5.0	2.0	ug/l	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	5.0	1.0	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	1.0	0.23	ug/l	
91-20-3	Naphthalene	ND	5.0	1.0	ug/l	
103-65-1	n-Propylbenzene	ND	1.0	0.29	ug/l	
100-42-5	Styrene	ND	1.0	0.22	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	1.0	0.28	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	1.0	0.30	ug/l	
127-18-4	Tetrachloroethylene	ND	1.0	0.22	ug/l	
108-88-3	Toluene	0.45	1.0	0.30	ug/l	J
87-61-6	1,2,3-Trichlorobenzene	ND	2.0	0.61	ug/l	
120-82-1	1,2,4-Trichlorobenzene	ND	2.0	0.50	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	1.0	0.25	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	1.0	0.47	ug/l	
79-01-6	Trichloroethylene	ND	1.0	0.35	ug/l	
75-69-4	Trichlorofluoromethane	ND	2.0	0.50	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	2.0	0.63	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	1.0	0.32	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	1.0	0.27	ug/l	
108-05-4	Vinyl Acetate	ND	10	2.0	ug/l	
75-01-4	Vinyl Chloride	ND	1.0	0.41	ug/l	
	m,p-Xylene	ND	2.0	0.47	ug/l	
95-47-6	o-Xylene	ND	1.0	0.26	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	102%		83-118%
17060-07-0	1,2-Dichloroethane-D4	110%		79-125%
2037-26-5	Toluene-D8	101%		85-112%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	RB-2		
Lab Sample ID:	FA72869-5	**Date Sampled:**	02/24/20
Matrix:	AQ - Ground Water	**Date Received:**	02/26/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	99%		83-118%

(a) Sample was not preserved to a pH < 2.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	RB-2		
Lab Sample ID:	FA72869-5	**Date Sampled:**	02/24/20
Matrix:	AQ - Ground Water	**Date Received:**	02/26/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Total Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Manganese	< 15	15	ug/l	1	03/02/20	03/03/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16577
(2) Prep QC Batch: MP36879

RL = Reporting Limit

Report of Analysis

Client Sample ID:	RB-2		
Lab Sample ID:	FA72869-5F	**Date Sampled:**	02/24/20
Matrix:	AQ - Groundwater Filtered	**Date Received:**	02/26/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Iron	< 300	300	ug/l	1	02/27/20	02/28/20	LM	SW846 6010D [1]	SW846 3010A [2]
Manganese	< 15	15	ug/l	1	02/27/20	02/28/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16570
(2) Prep QC Batch: MP36867

RL = Reporting Limit

SGS North America Inc.

Report of Analysis

Client Sample ID:	TRIP BLANK		
Lab Sample ID:	FA72869-6	**Date Sampled:**	02/24/20
Matrix:	AQ - Trip Blank Water	**Date Received:**	02/26/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	5E20838.D	1	02/28/20 16:04	SO	n/a	n/a	V5E949
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	25	10	ug/l	
71-43-2	Benzene	ND	1.0	0.31	ug/l	
108-86-1	Bromobenzene	ND	1.0	0.37	ug/l	
74-97-5	Bromochloromethane	ND	1.0	0.45	ug/l	
75-27-4	Bromodichloromethane	ND	1.0	0.24	ug/l	
75-25-2	Bromoform	ND	1.0	0.41	ug/l	
78-93-3	2-Butanone (MEK)	ND	5.0	2.0	ug/l	
104-51-8	n-Butylbenzene	ND	1.0	0.23	ug/l	
135-98-8	sec-Butylbenzene	ND	1.0	0.24	ug/l	
98-06-6	tert-Butylbenzene	ND	1.0	0.31	ug/l	
75-15-0	Carbon Disulfide	ND	2.0	0.53	ug/l	
56-23-5	Carbon Tetrachloride	ND	1.0	0.36	ug/l	
108-90-7	Chlorobenzene	ND	1.0	0.20	ug/l	
75-00-3	Chloroethane	ND	2.0	0.67	ug/l	
67-66-3	Chloroform	ND	1.0	0.30	ug/l	
95-49-8	o-Chlorotoluene	ND	1.0	0.22	ug/l	
106-43-4	p-Chlorotoluene	ND	1.0	0.31	ug/l	
124-48-1	Dibromochloromethane	ND	1.0	0.28	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	5.0	1.0	ug/l	
106-93-4	1,2-Dibromoethane	ND	2.0	0.28	ug/l	
75-71-8	Dichlorodifluoromethane	ND	2.0	0.50	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	1.0	0.32	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	1.0	0.22	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	1.0	0.26	ug/l	
75-34-3	1,1-Dichloroethane	ND	1.0	0.34	ug/l	
107-06-2	1,2-Dichloroethane	ND	1.0	0.31	ug/l	
75-35-4	1,1-Dichloroethylene	ND	1.0	0.32	ug/l	
156-59-2	cis-1,2-Dichloroethylene	ND	1.0	0.28	ug/l	
156-60-5	trans-1,2-Dichloroethylene	ND	1.0	0.22	ug/l	
78-87-5	1,2-Dichloropropane	ND	1.0	0.43	ug/l	
142-28-9	1,3-Dichloropropane	ND	1.0	0.31	ug/l	
594-20-7	2,2-Dichloropropane	ND	1.0	0.24	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	TRIP BLANK		
Lab Sample ID:	FA72869-6	**Date Sampled:**	02/24/20
Matrix:	AQ - Trip Blank Water	**Date Received:**	02/26/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	1.0	0.34	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	1.0	0.29	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	1.0	0.21	ug/l	
100-41-4	Ethylbenzene	ND	1.0	0.36	ug/l	
87-68-3	Hexachlorobutadiene	ND	2.0	0.30	ug/l	
591-78-6	2-Hexanone	ND	10	2.0	ug/l	
98-82-8	Isopropylbenzene	ND	1.0	0.22	ug/l	
99-87-6	p-Isopropyltoluene	ND	1.0	0.21	ug/l	
74-83-9	Methyl Bromide	ND	2.0	0.59	ug/l	
74-87-3	Methyl Chloride	ND	2.0	0.50	ug/l	
74-95-3	Methylene Bromide	ND	2.0	0.37	ug/l	
75-09-2	Methylene Chloride	ND	5.0	2.0	ug/l	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	5.0	1.0	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	1.0	0.23	ug/l	
91-20-3	Naphthalene	ND	5.0	1.0	ug/l	
103-65-1	n-Propylbenzene	ND	1.0	0.29	ug/l	
100-42-5	Styrene	ND	1.0	0.22	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	1.0	0.28	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	1.0	0.30	ug/l	
127-18-4	Tetrachloroethylene	ND	1.0	0.22	ug/l	
108-88-3	Toluene	ND	1.0	0.30	ug/l	
87-61-6	1,2,3-Trichlorobenzene	ND	2.0	0.61	ug/l	
120-82-1	1,2,4-Trichlorobenzene	ND	2.0	0.50	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	1.0	0.25	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	1.0	0.47	ug/l	
79-01-6	Trichloroethylene	ND	1.0	0.35	ug/l	
75-69-4	Trichlorofluoromethane	ND	2.0	0.50	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	2.0	0.63	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	1.0	0.32	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	1.0	0.27	ug/l	
108-05-4	Vinyl Acetate	ND	10	2.0	ug/l	
75-01-4	Vinyl Chloride	ND	1.0	0.41	ug/l	
	m,p-Xylene	ND	2.0	0.47	ug/l	
95-47-6	o-Xylene	ND	1.0	0.26	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	103%		83-118%
17060-07-0	1,2-Dichloroethane-D4	110%		79-125%
2037-26-5	Toluene-D8	102%		85-112%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	TRIP BLANK		
Lab Sample ID:	FA72869-6	**Date Sampled:**	02/24/20
Matrix:	AQ - Trip Blank Water	**Date Received:**	02/26/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	99%		83-118%

(a) Sample was not preserved to a pH < 2.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

SGS North America Inc - Orlando
Chain of Custody

4405 Vineland Road, Suite C-15 Orlando, Fl 32811
TEL. 407-425-6700 FAX: 407-425-0707
www.sgs.com

FA72869

SGS - ORLANDO JOB # : PAGE 1 OF 1

SGS - ORLANDO Quote # | SKIFF #

Client / Reporting Information

Company Name: Geosyntec Consultants
Address: 2501 Blue Ridge Rd, Ste 430
City: Raleigh State: NC Zip: 27607
Project Contact: James Wang Email: Jwang@geosyntec.com
Phone #:

Project Information

Project Name: Cristex
Street
City Oxford State NC
Project # GR6764
Fax #
Client Purchase Order #

Sampler(s) Name(s) (Printed)
Sampler 1: R. Gubelman Sampler 2:

Analytical Information

SGS Orlando Sample #	Field ID / Point of Collection	Collection DATE	Collection TIME	SAMPLED BY:	MATRIX	TOTAL # OF BOTTLES	OTHER	NONE	HCl	NaOH	HNO3	H2SO4	NaOH+ZnAc	DI WATER	MEOH	8260D	6010B Total Metals	6010B Dissolved metals - Fe, Mn								LAB USE ONLY
1	EK-MW-1	2/24/20	1135	RG	GW	5	X				X					X	X	X								
2	DUP-1		1200				X				X					X	X	X								
3	MW-31		1350				X				X					X	X	X								
3A	MW-31MS		1400				X				X					X	X	X								
3B	MW-31MSD		1410				X				X					X	X	X								
4	EK-MW-2		1540				X				X					X	X	X								
5	RB-2		1620				X				X					X	X	X								
6	TRIP BLANK																									

Matrix Codes
DW - Drinking Water
GW - Ground Water
WW - Water
SW - Surface Water
SO - Soil
SL- Sludge
OI - Oil
LIQ - Other Liquid
AIR - Air
SOL - Other Solid

Turnaround Time (Business days)

10 Day (Business)
7 Day
5 Day
3 Day *RUSH*
2 Day *RUSH*
1 Day *RUSH*
Other

Approved By: / Date:

Rush T/A Data Available VIA Email or Lablink

Data Deliverable Information

- [ ] COMMERCIAL "A" (RESULTS ONLY)
- [ ] COMMERCIAL "B" (RESULTS PLUS QC)
- [ ] REDT1 (EPA LEVEL 3)
- [x] FULLT1 (EPA LEVEL 4)
- [ ] EDD'S

INITIAL ASSESSMENT PH
LABEL VERIFICATION JK

Comments / Remarks

Raleigh, NC Service Center

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Sampler/Affiliation	Date Time:	Received By/Affiliation	Relinquished By/Affiliation	Date Time:	Received By/Affiliation
1	2/25/2020	2 FX	3 FX		4 2/26/20 910
Relinquished by/Affiliation 5	Date Time:	Received By/Affiliation 6	Relinquished By/Affiliation 7	Date Time:	Received By/Affiliation 8

Lab Use Only : Cooler Temperature (s) Celsius (corrected): 1.9

http://www.sgs.com/en/terms-and-conditions

ORLD-SMT-0001-03-FORM-COC (4).xls Rev 031318

5.1 5

FA72869: Chain of Custody
Page 1 of 2

The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

Geosyntec Consultants

Cristex Drum Site; 500 W Industry Dr, Oxford, NC

GR6764

SGS Job Number: FA73504

Sampling Date: 03/16/20

Report to:

Geosyntec Consultants
2501 Blue Ridge Rd Suite 430
Raleigh, NC 27607
jwang@geosyntec.com; AVo@Geosyntec.com;
RGabelman@Geosyntec.com
ATTN: Allison Vo

Total number of pages in report: **361**

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

Caitlin Brice, M.S.
General Manager

Client Service contact: Jean Dent-Smith 407-425-6700

Certifications: FL(E83510), LA(03051), KS(E-10327), IL(200063), NC(573), NJ(FL002), NY(12022), SC(96038001) DoD ELAP(ANAB L2229), AZ(AZ0806), CA(2937), TX(T104704404), PA(68-03573), VA(460177), AK, AR, IA, KY, MA, MS, ND, NH, NV, OK, OR, UT, WA, WV

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Test results relate only to samples analyzed.

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Please share your ideas about
how we can serve you better at:
EHS.US.CustomerCare@sgs.com

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SGS North America Inc.

Sample Summary

Geosyntec Consultants

Job No: FA73504

Cristex Drum Site; 500 W Industry Dr, Oxford, NC
Project No: GR6764

This report contains results reported as ND = Not detected. The following applies:
Organics ND = Not detected above the MDL

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
FA73504-1	03/16/20	13:00	AV	03/17/20	AQ	Ground Water	EK-MW-2-20200314
FA73504-1F	03/16/20	13:00	AV	03/17/20	AQ	Groundwater Filtered	EK-MW-2-20200314
FA73504-2	03/16/20	13:15	AV	03/17/20	AQ	Ground Water	DUP-1-20200314
FA73504-2F	03/16/20	13:15	AV	03/17/20	AQ	Groundwater Filtered	DUP-1-20200314
FA73504-3	03/16/20	14:15	AV	03/17/20	AQ	Ground Water	EK-MW-1
FA73504-3D	03/16/20	14:15	AV	03/17/20	AQ	Water Dup/MSD	EK-MW-1
FA73504-3F	03/16/20	14:15	AV	03/17/20	AQ	Groundwater Filtered	EK-MW-1
FA73504-3FD	03/16/20	14:15	AV	03/17/20	AQ	Water Dup/MSD	EK-MW-1
FA73504-3FS	03/16/20	14:15	AV	03/17/20	AQ	Water Matrix Spike	EK-MW-1
FA73504-3S	03/16/20	14:15	AV	03/17/20	AQ	Water Matrix Spike	EK-MW-1
FA73504-4	03/16/20	00:00	AV	03/17/20	AQ	Ground Water	MW-3I
FA73504-4F	03/16/20	00:00	AV	03/17/20	AQ	Groundwater Filtered	MW-3I

SGS North America Inc.

Sample Summary
(continued)

Geosyntec Consultants

Job No: FA73504

Cristex Drum Site; 500 W Industry Dr, Oxford, NC
Project No: GR6764

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
FA73504-5	03/16/20	00:00	AV	03/17/20	AQ	Trip Blank Water	TRIP BLANK

SAMPLE DELIVERY GROUP CASE NARRATIVE

Client: Geosyntec Consultants **Job No:** FA73504

Site: Cristex Drum Site; 500 W Industry Dr, Oxford, NC **Report Date** 3/25/2020 9:46:46 AM

4 Sample(s), 1 Trip Blank were collected on 03/16/2020 and were received at SGS North America Inc - Orlando on 03/17/2020 properly preserved, at 3.1 Deg. C and intact. These Samples received an SGS Orlando job number of FA73504. A listing of the Laboratory Sample ID, Client Sample ID and dates of collection are presented in the Results Summary Section. Except as noted below, all method specified calibrations and quality control performance criteria were met for this job. For more information, please refer to QC summary pages.

MS Volatiles By Method SW846 8260D

Matrix: AQ **Batch ID:** VC5571

All samples were analyzed within the recommended method holding time.

Sample(s) FA73504-3MS, FA73504-3MSD were used as the QC samples indicated.

All method blanks for this batch meet method specific criteria.

FA73504-2 for 1,2-Dibromo-3-chloropropane: Associated CCV outside of control limits low.

FA73504-2 for Methyl Bromide: Associated ICV outside control limits high, however sample ND.

FA73504-2: Sample was not preserved to a pH < 2.

FA73504-3 for 1,2-Dibromo-3-chloropropane: Associated CCV outside of control limits low.

FA73504-3 for Methyl Bromide: Associated ICV outside control limits high, however sample ND.

FA73504-3: Confirmation run.

FA73504-3: Sample was not preserved to a pH < 2.

FA73504-4 for 1,2-Dibromo-3-chloropropane: Associated CCV outside of control limits low.

FA73504-4 for Methyl Bromide: Associated ICV outside control limits high, however sample ND.

FA73504-4: Sample was not preserved to a pH < 2.

FA73504-5 for 1,2-Dibromo-3-chloropropane: Associated CCV outside of control limits low.

FA73504-5 for Methyl Bromide: Associated ICV outside control limits high, however sample ND.

FA73504-5: Sample was preserved to a pH < 2.

Matrix: AQ **Batch ID:** VC5577

All samples were analyzed within the recommended method holding time.

Sample(s) FA73504-1MS, FA73504-1MSD were used as the QC samples indicated.

All method blanks for this batch meet method specific criteria.

Matrix Spike Recovery(s) for 1,1-Dichloroethylene, Bromodichloromethane, Bromoform, Carbon Disulfide, Dibromochloromethane are outside control limits. Probable cause is due to matrix interference.

Matrix Spike Duplicate Recovery(s) for 1,1-Dichloroethylene, Bromodichloromethane, Bromoform, Carbon Disulfide, Dibromochloromethane are outside control limits. Probable cause is due to matrix interference.

FA73504-1: Sample was not preserved to a pH < 2.

FA73504-1 for Dichlorodifluoromethane: Associated CCV outside of control limits high, sample was ND.

FA73504-1 for Methyl Bromide: Associated ICV outside control limits high, however sample ND.

Metals Analysis By Method SW846 6010D

Matrix: AQ **Batch ID:** MP36970

All samples were digested within the recommended method holding time.

All samples were analyzed within the recommended method holding time.

All method blanks for this batch meet method specific criteria.

Sample(s) FA73504-3DUP, FA73504-3FDUP, FA73504-3FMS, FA73504-3FPS, FA73504-3FSDL, FA73504-3MS, FA73504-3MSD, FA73504-3PS, FA73504-3SDL were used as the QC samples for metals.

RPD(s) for Serial Dilution for Manganese are outside control limits for sample MP36970-SD2. Probable cause is due to sample non-homogeneity.

SGS Orlando certifies that this report meets the project requirements for analytical data produced for the samples as received at SGS Orlando and as stated on the COC. SGS Orlando certifies that the data meets the Data Quality Objectives for precision, accuracy and completeness as specified in the SGS Orlando Quality Manual except as noted above. This report is to be used in its entirety.
SGS Orlando is not responsible for any assumptions of data quality if partial data packages are used.

Narrative prepared by:

_____
Ariel Hartney, Client Services (signature on file)

Summary of Hits

Job Number: FA73504
Account: Geosyntec Consultants
Project: Cristex Drum Site; 500 W Industry Dr, Oxford, NC
Collected: 03/16/20

Lab Sample ID / Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
FA73504-1	**EK-MW-2-20200314**					
cis-1,2-Dichloroethylene [a]		22.2	5.0	1.4	ug/l	SW846 8260D
Tetrachloroethylene [a]		355	5.0	1.1	ug/l	SW846 8260D
Trichloroethylene [a]		15.3	5.0	1.7	ug/l	SW846 8260D
Manganese		445	15		ug/l	SW846 6010D
FA73504-1F	**EK-MW-2-20200314**					
Manganese		435	15		ug/l	SW846 6010D
FA73504-2	**DUP-1-20200314**					
cis-1,2-Dichloroethylene [a]		34.0	10	2.8	ug/l	SW846 8260D
Tetrachloroethylene [a]		488	10	2.2	ug/l	SW846 8260D
Trichloroethylene [a]		25.1	10	3.5	ug/l	SW846 8260D
Manganese		437	15		ug/l	SW846 6010D
FA73504-2F	**DUP-1-20200314**					
Manganese		411	15		ug/l	SW846 6010D
FA73504-3	**EK-MW-1**					
cis-1,2-Dichloroethylene [a]		66.1	10	2.8	ug/l	SW846 8260D
Naphthalene [a]		13.3 J	50	10	ug/l	SW846 8260D
Tetrachloroethylene [a]		833	10	2.2	ug/l	SW846 8260D
Trichloroethylene [a]		38.6	10	3.5	ug/l	SW846 8260D
Manganese		96.0	15		ug/l	SW846 6010D
FA73504-3F	**EK-MW-1**					
Manganese		94.4	15		ug/l	SW846 6010D
FA73504-4	**MW-3I**					
1,1-Dichloroethane [a]		0.61 J	1.0	0.34	ug/l	SW846 8260D
Tetrachloroethylene [a]		5.6	1.0	0.22	ug/l	SW846 8260D
Toluene [a]		0.72 J	1.0	0.30	ug/l	SW846 8260D
Manganese		130000	750		ug/l	SW846 6010D
FA73504-4F	**MW-3I**					
Manganese		21600	150		ug/l	SW846 6010D

Summary of Hits

Job Number: FA73504
Account: Geosyntec Consultants
Project: Cristex Drum Site; 500 W Industry Dr, Oxford, NC
Collected: 03/16/20

Lab Sample ID Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
FA73504-5	**TRIP BLANK**					
Methyl Chloride [b]		0.57 J	2.0	0.50	ug/l	SW846 8260D

(a) Sample was not preserved to a pH < 2.
(b) Sample was preserved to a pH < 2.

Sample Results

Report of Analysis

SGS North America Inc.

Report of Analysis

Client Sample ID:	EK-MW-2-20200314		
Lab Sample ID:	FA73504-1	**Date Sampled:**	03/16/20
Matrix:	AQ - Ground Water	**Date Received:**	03/17/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	C0139526.D	5	03/23/20 15:01	KB	n/a	n/a	VC5577
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	130	50	ug/l	
71-43-2	Benzene	ND	5.0	1.6	ug/l	
108-86-1	Bromobenzene	ND	5.0	1.8	ug/l	
74-97-5	Bromochloromethane	ND	5.0	2.3	ug/l	
75-27-4	Bromodichloromethane	ND	5.0	1.2	ug/l	
75-25-2	Bromoform	ND	5.0	2.0	ug/l	
78-93-3	2-Butanone (MEK)	ND	25	10	ug/l	
104-51-8	n-Butylbenzene	ND	5.0	1.2	ug/l	
135-98-8	sec-Butylbenzene	ND	5.0	1.2	ug/l	
98-06-6	tert-Butylbenzene	ND	5.0	1.6	ug/l	
75-15-0	Carbon Disulfide	ND	10	2.7	ug/l	
56-23-5	Carbon Tetrachloride	ND	5.0	1.8	ug/l	
108-90-7	Chlorobenzene	ND	5.0	1.0	ug/l	
75-00-3	Chloroethane	ND	10	3.3	ug/l	
67-66-3	Chloroform	ND	5.0	1.5	ug/l	
95-49-8	o-Chlorotoluene	ND	5.0	1.1	ug/l	
106-43-4	p-Chlorotoluene	ND	5.0	1.5	ug/l	
124-48-1	Dibromochloromethane	ND	5.0	1.4	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	25	5.2	ug/l	
106-93-4	1,2-Dibromoethane	ND	10	1.4	ug/l	
75-71-8	Dichlorodifluoromethane [b]	ND	10	2.5	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	5.0	1.6	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	5.0	1.1	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	5.0	1.3	ug/l	
75-34-3	1,1-Dichloroethane	ND	5.0	1.7	ug/l	
107-06-2	1,2-Dichloroethane	ND	5.0	1.6	ug/l	
75-35-4	1,1-Dichloroethylene	ND	5.0	1.6	ug/l	
156-59-2	cis-1,2-Dichloroethylene	22.2	5.0	1.4	ug/l	
156-60-5	trans-1,2-Dichloroethylene	ND	5.0	1.1	ug/l	
78-87-5	1,2-Dichloropropane	ND	5.0	2.1	ug/l	
142-28-9	1,3-Dichloropropane	ND	5.0	1.5	ug/l	
594-20-7	2,2-Dichloropropane	ND	5.0	1.2	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EK-MW-2-20200314		
Lab Sample ID:	FA73504-1	**Date Sampled:**	03/16/20
Matrix:	AQ - Ground Water	**Date Received:**	03/17/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	5.0	1.7	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	5.0	1.5	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	5.0	1.1	ug/l	
100-41-4	Ethylbenzene	ND	5.0	1.8	ug/l	
87-68-3	Hexachlorobutadiene	ND	10	1.5	ug/l	
591-78-6	2-Hexanone	ND	50	10	ug/l	
98-82-8	Isopropylbenzene	ND	5.0	1.1	ug/l	
99-87-6	p-Isopropyltoluene	ND	5.0	1.1	ug/l	
74-83-9	Methyl Bromide [c]	ND	10	2.9	ug/l	
74-87-3	Methyl Chloride	ND	10	2.5	ug/l	
74-95-3	Methylene Bromide	ND	10	1.8	ug/l	
75-09-2	Methylene Chloride	ND	25	10	ug/l	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	25	5.0	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	5.0	1.1	ug/l	
91-20-3	Naphthalene	ND	25	5.0	ug/l	
103-65-1	n-Propylbenzene	ND	5.0	1.4	ug/l	
100-42-5	Styrene	ND	5.0	1.1	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	5.0	1.4	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	5.0	1.5	ug/l	
127-18-4	Tetrachloroethylene	355	5.0	1.1	ug/l	
108-88-3	Toluene	ND	5.0	1.5	ug/l	
87-61-6	1,2,3-Trichlorobenzene	ND	10	3.1	ug/l	
120-82-1	1,2,4-Trichlorobenzene	ND	10	2.5	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	5.0	1.2	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	5.0	2.3	ug/l	
79-01-6	Trichloroethylene	15.3	5.0	1.7	ug/l	
75-69-4	Trichlorofluoromethane	ND	10	2.5	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	10	3.2	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	5.0	1.6	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	5.0	1.4	ug/l	
108-05-4	Vinyl Acetate	ND	50	10	ug/l	
75-01-4	Vinyl Chloride	ND	5.0	2.0	ug/l	
	m,p-Xylene	ND	10	2.3	ug/l	
95-47-6	o-Xylene	ND	5.0	1.3	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	97%		83-118%
17060-07-0	1,2-Dichloroethane-D4	94%		79-125%
2037-26-5	Toluene-D8	102%		85-112%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EK-MW-2-20200314		
Lab Sample ID:	FA73504-1	**Date Sampled:**	03/16/20
Matrix:	AQ - Ground Water	**Date Received:**	03/17/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	100%		83-118%

(a) Sample was not preserved to a pH < 2.
(b) Associated CCV outside of control limits high, sample was ND.
(c) Associated ICV outside control limits high, however sample ND.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EK-MW-2-20200314		
Lab Sample ID:	FA73504-1	**Date Sampled:**	03/16/20
Matrix:	AQ - Ground Water	**Date Received:**	03/17/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Total Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Manganese	445	15	ug/l	1	03/19/20	03/19/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16618
(2) Prep QC Batch: MP36970

RL = Reporting Limit

Report of Analysis

Client Sample ID:	EK-MW-2-20200314		
Lab Sample ID:	FA73504-1F	**Date Sampled:**	03/16/20
Matrix:	AQ - Groundwater Filtered	**Date Received:**	03/17/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Iron	< 300	300	ug/l	1	03/19/20	03/19/20	LM	SW846 6010D [1]	SW846 3010A [2]
Manganese	435	15	ug/l	1	03/19/20	03/19/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16618
(2) Prep QC Batch: MP36970

RL = Reporting Limit

SGS North America Inc.

Report of Analysis

Client Sample ID:	DUP-1-20200314		
Lab Sample ID:	FA73504-2	**Date Sampled:**	03/16/20
Matrix:	AQ - Ground Water	**Date Received:**	03/17/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	C0139382.D	10	03/19/20 21:24	KB	n/a	n/a	VC5571
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	250	100	ug/l	
71-43-2	Benzene	ND	10	3.1	ug/l	
108-86-1	Bromobenzene	ND	10	3.7	ug/l	
74-97-5	Bromochloromethane	ND	10	4.5	ug/l	
75-27-4	Bromodichloromethane	ND	10	2.4	ug/l	
75-25-2	Bromoform	ND	10	4.1	ug/l	
78-93-3	2-Butanone (MEK)	ND	50	20	ug/l	
104-51-8	n-Butylbenzene	ND	10	2.3	ug/l	
135-98-8	sec-Butylbenzene	ND	10	2.4	ug/l	
98-06-6	tert-Butylbenzene	ND	10	3.1	ug/l	
75-15-0	Carbon Disulfide	ND	20	5.3	ug/l	
56-23-5	Carbon Tetrachloride	ND	10	3.6	ug/l	
108-90-7	Chlorobenzene	ND	10	2.0	ug/l	
75-00-3	Chloroethane	ND	20	6.7	ug/l	
67-66-3	Chloroform	ND	10	3.0	ug/l	
95-49-8	o-Chlorotoluene	ND	10	2.2	ug/l	
106-43-4	p-Chlorotoluene	ND	10	3.1	ug/l	
124-48-1	Dibromochloromethane	ND	10	2.8	ug/l	
96-12-8	1,2-Dibromo-3-chloropropan [b]	ND	50	10	ug/l	
106-93-4	1,2-Dibromoethane	ND	20	2.8	ug/l	
75-71-8	Dichlorodifluoromethane	ND	20	5.0	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	10	3.2	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	10	2.2	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	10	2.6	ug/l	
75-34-3	1,1-Dichloroethane	ND	10	3.4	ug/l	
107-06-2	1,2-Dichloroethane	ND	10	3.1	ug/l	
75-35-4	1,1-Dichloroethylene	ND	10	3.2	ug/l	
156-59-2	cis-1,2-Dichloroethylene	34.0	10	2.8	ug/l	
156-60-5	trans-1,2-Dichloroethylene	ND	10	2.2	ug/l	
78-87-5	1,2-Dichloropropane	ND	10	4.3	ug/l	
142-28-9	1,3-Dichloropropane	ND	10	3.1	ug/l	
594-20-7	2,2-Dichloropropane	ND	10	2.4	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	DUP-1-20200314		
Lab Sample ID:	FA73504-2	**Date Sampled:**	03/16/20
Matrix:	AQ - Ground Water	**Date Received:**	03/17/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	10	3.4	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	10	2.9	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	10	2.1	ug/l	
100-41-4	Ethylbenzene	ND	10	3.6	ug/l	
87-68-3	Hexachlorobutadiene	ND	20	3.0	ug/l	
591-78-6	2-Hexanone	ND	100	20	ug/l	
98-82-8	Isopropylbenzene	ND	10	2.2	ug/l	
99-87-6	p-Isopropyltoluene	ND	10	2.1	ug/l	
74-83-9	Methyl Bromide [c]	ND	20	5.9	ug/l	
74-87-3	Methyl Chloride	ND	20	5.0	ug/l	
74-95-3	Methylene Bromide	ND	20	3.7	ug/l	
75-09-2	Methylene Chloride	ND	50	20	ug/l	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	50	10	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	10	2.3	ug/l	
91-20-3	Naphthalene	ND	50	10	ug/l	
103-65-1	n-Propylbenzene	ND	10	2.9	ug/l	
100-42-5	Styrene	ND	10	2.2	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	10	2.8	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	10	3.0	ug/l	
127-18-4	Tetrachloroethylene	488	10	2.2	ug/l	
108-88-3	Toluene	ND	10	3.0	ug/l	
87-61-6	1,2,3-Trichlorobenzene	ND	20	6.1	ug/l	
120-82-1	1,2,4-Trichlorobenzene	ND	20	5.0	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	10	2.5	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	10	4.7	ug/l	
79-01-6	Trichloroethylene	25.1	10	3.5	ug/l	
75-69-4	Trichlorofluoromethane	ND	20	5.0	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	20	6.3	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	10	3.2	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	10	2.7	ug/l	
108-05-4	Vinyl Acetate	ND	100	20	ug/l	
75-01-4	Vinyl Chloride	ND	10	4.1	ug/l	
	m,p-Xylene	ND	20	4.7	ug/l	
95-47-6	o-Xylene	ND	10	2.6	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	99%		83-118%
17060-07-0	1,2-Dichloroethane-D4	99%		79-125%
2037-26-5	Toluene-D8	102%		85-112%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	DUP-1-20200314		
Lab Sample ID:	FA73504-2	**Date Sampled:**	03/16/20
Matrix:	AQ - Ground Water	**Date Received:**	03/17/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	100%		83-118%

(a) Sample was not preserved to a pH < 2.
(b) Associated CCV outside of control limits low.
(c) Associated ICV outside control limits high, however sample ND.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	DUP-1-20200314		
Lab Sample ID:	FA73504-2	**Date Sampled:**	03/16/20
Matrix:	AQ - Ground Water	**Date Received:**	03/17/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Total Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Manganese	437	15	ug/l	1	03/19/20	03/19/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16618
(2) Prep QC Batch: MP36970

RL = Reporting Limit

Report of Analysis

Client Sample ID:	DUP-1-20200314		
Lab Sample ID:	FA73504-2F	**Date Sampled:**	03/16/20
Matrix:	AQ - Groundwater Filtered	**Date Received:**	03/17/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Iron	< 300	300	ug/l	1	03/19/20	03/19/20	LM	SW846 6010D [1]	SW846 3010A [2]
Manganese	411	15	ug/l	1	03/19/20	03/19/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16618
(2) Prep QC Batch: MP36970

RL = Reporting Limit

SGS North America Inc.

Report of Analysis

Client Sample ID:	EK-MW-1		
Lab Sample ID:	FA73504-3	**Date Sampled:**	03/16/20
Matrix:	AQ - Ground Water	**Date Received:**	03/17/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	C0139384.D	10	03/19/20 22:20	KB	n/a	n/a	VC5571
Run #2 [b]	C0139367.D	20	03/19/20 14:19	KB	n/a	n/a	VC5571

	Purge Volume
Run #1	5.0 ml
Run #2	5.0 ml

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	250	100	ug/l	
71-43-2	Benzene	ND	10	3.1	ug/l	
108-86-1	Bromobenzene	ND	10	3.7	ug/l	
74-97-5	Bromochloromethane	ND	10	4.5	ug/l	
75-27-4	Bromodichloromethane	ND	10	2.4	ug/l	
75-25-2	Bromoform	ND	10	4.1	ug/l	
78-93-3	2-Butanone (MEK)	ND	50	20	ug/l	
104-51-8	n-Butylbenzene	ND	10	2.3	ug/l	
135-98-8	sec-Butylbenzene	ND	10	2.4	ug/l	
98-06-6	tert-Butylbenzene	ND	10	3.1	ug/l	
75-15-0	Carbon Disulfide	ND	20	5.3	ug/l	
56-23-5	Carbon Tetrachloride	ND	10	3.6	ug/l	
108-90-7	Chlorobenzene	ND	10	2.0	ug/l	
75-00-3	Chloroethane	ND	20	6.7	ug/l	
67-66-3	Chloroform	ND	10	3.0	ug/l	
95-49-8	o-Chlorotoluene	ND	10	2.2	ug/l	
106-43-4	p-Chlorotoluene	ND	10	3.1	ug/l	
124-48-1	Dibromochloromethane	ND	10	2.8	ug/l	
96-12-8	1,2-Dibromo-3-chloropropan [c]	ND	50	10	ug/l	
106-93-4	1,2-Dibromoethane	ND	20	2.8	ug/l	
75-71-8	Dichlorodifluoromethane	ND	20	5.0	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	10	3.2	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	10	2.2	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	10	2.6	ug/l	
75-34-3	1,1-Dichloroethane	ND	10	3.4	ug/l	
107-06-2	1,2-Dichloroethane	ND	10	3.1	ug/l	
75-35-4	1,1-Dichloroethylene	ND	10	3.2	ug/l	
156-59-2	cis-1,2-Dichloroethylene	66.1	10	2.8	ug/l	
156-60-5	trans-1,2-Dichloroethylene	ND	10	2.2	ug/l	
78-87-5	1,2-Dichloropropane	ND	10	4.3	ug/l	
142-28-9	1,3-Dichloropropane	ND	10	3.1	ug/l	
594-20-7	2,2-Dichloropropane	ND	10	2.4	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EK-MW-1		
Lab Sample ID:	FA73504-3	**Date Sampled:**	03/16/20
Matrix:	AQ - Ground Water	**Date Received:**	03/17/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	10	3.4	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	10	2.9	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	10	2.1	ug/l	
100-41-4	Ethylbenzene	ND	10	3.6	ug/l	
87-68-3	Hexachlorobutadiene	ND	20	3.0	ug/l	
591-78-6	2-Hexanone	ND	100	20	ug/l	
98-82-8	Isopropylbenzene	ND	10	2.2	ug/l	
99-87-6	p-Isopropyltoluene	ND	10	2.1	ug/l	
74-83-9	Methyl Bromide [d]	ND	20	5.9	ug/l	
74-87-3	Methyl Chloride	ND	20	5.0	ug/l	
74-95-3	Methylene Bromide	ND	20	3.7	ug/l	
75-09-2	Methylene Chloride	ND	50	20	ug/l	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	50	10	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	10	2.3	ug/l	
91-20-3	Naphthalene	13.3	50	10	ug/l	J
103-65-1	n-Propylbenzene	ND	10	2.9	ug/l	
100-42-5	Styrene	ND	10	2.2	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	10	2.8	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	10	3.0	ug/l	
127-18-4	Tetrachloroethylene	833	10	2.2	ug/l	
108-88-3	Toluene	ND	10	3.0	ug/l	
87-61-6	1,2,3-Trichlorobenzene	ND	20	6.1	ug/l	
120-82-1	1,2,4-Trichlorobenzene	ND	20	5.0	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	10	2.5	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	10	4.7	ug/l	
79-01-6	Trichloroethylene	38.6	10	3.5	ug/l	
75-69-4	Trichlorofluoromethane	ND	20	5.0	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	20	6.3	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	10	3.2	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	10	2.7	ug/l	
108-05-4	Vinyl Acetate	ND	100	20	ug/l	
75-01-4	Vinyl Chloride	ND	10	4.1	ug/l	
	m,p-Xylene	ND	20	4.7	ug/l	
95-47-6	o-Xylene	ND	10	2.6	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	98%	99%	83-118%
17060-07-0	1,2-Dichloroethane-D4	100%	99%	79-125%
2037-26-5	Toluene-D8	102%	99%	85-112%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EK-MW-1		
Lab Sample ID:	FA73504-3	**Date Sampled:**	03/16/20
Matrix:	AQ - Ground Water	**Date Received:**	03/17/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	100%	99%	83-118%

(a) Sample was not preserved to a pH < 2.
(b) Confirmation run.
(c) Associated CCV outside of control limits low.
(d) Associated ICV outside control limits high, however sample ND.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EK-MW-1		
Lab Sample ID:	FA73504-3	**Date Sampled:**	03/16/20
Matrix:	AQ - Ground Water	**Date Received:**	03/17/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Total Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Manganese	96.0	15	ug/l	1	03/19/20	03/19/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16618
(2) Prep QC Batch: MP36970

RL = Reporting Limit

Report of Analysis

Client Sample ID:	EK-MW-1		
Lab Sample ID:	FA73504-3F	**Date Sampled:**	03/16/20
Matrix:	AQ - Groundwater Filtered	**Date Received:**	03/17/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Iron	< 300	300	ug/l	1	03/19/20	03/19/20	LM	SW846 6010D [1]	SW846 3010A [2]
Manganese	94.4	15	ug/l	1	03/19/20	03/19/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16618
(2) Prep QC Batch: MP36970

RL = Reporting Limit

SGS North America Inc.

Report of Analysis

Client Sample ID:	MW-3I		
Lab Sample ID:	FA73504-4	**Date Sampled:**	03/16/20
Matrix:	AQ - Ground Water	**Date Received:**	03/17/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	C0139383.D	1	03/19/20 21:52	KB	n/a	n/a	VC5571
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	25	10	ug/l	
71-43-2	Benzene	ND	1.0	0.31	ug/l	
108-86-1	Bromobenzene	ND	1.0	0.37	ug/l	
74-97-5	Bromochloromethane	ND	1.0	0.45	ug/l	
75-27-4	Bromodichloromethane	ND	1.0	0.24	ug/l	
75-25-2	Bromoform	ND	1.0	0.41	ug/l	
78-93-3	2-Butanone (MEK)	ND	5.0	2.0	ug/l	
104-51-8	n-Butylbenzene	ND	1.0	0.23	ug/l	
135-98-8	sec-Butylbenzene	ND	1.0	0.24	ug/l	
98-06-6	tert-Butylbenzene	ND	1.0	0.31	ug/l	
75-15-0	Carbon Disulfide	ND	2.0	0.53	ug/l	
56-23-5	Carbon Tetrachloride	ND	1.0	0.36	ug/l	
108-90-7	Chlorobenzene	ND	1.0	0.20	ug/l	
75-00-3	Chloroethane	ND	2.0	0.67	ug/l	
67-66-3	Chloroform	ND	1.0	0.30	ug/l	
95-49-8	o-Chlorotoluene	ND	1.0	0.22	ug/l	
106-43-4	p-Chlorotoluene	ND	1.0	0.31	ug/l	
124-48-1	Dibromochloromethane	ND	1.0	0.28	ug/l	
96-12-8	1,2-Dibromo-3-chloropropan [b]	ND	5.0	1.0	ug/l	
106-93-4	1,2-Dibromoethane	ND	2.0	0.28	ug/l	
75-71-8	Dichlorodifluoromethane	ND	2.0	0.50	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	1.0	0.32	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	1.0	0.22	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	1.0	0.26	ug/l	
75-34-3	1,1-Dichloroethane	0.61	1.0	0.34	ug/l	J
107-06-2	1,2-Dichloroethane	ND	1.0	0.31	ug/l	
75-35-4	1,1-Dichloroethylene	ND	1.0	0.32	ug/l	
156-59-2	cis-1,2-Dichloroethylene	ND	1.0	0.28	ug/l	
156-60-5	trans-1,2-Dichloroethylene	ND	1.0	0.22	ug/l	
78-87-5	1,2-Dichloropropane	ND	1.0	0.43	ug/l	
142-28-9	1,3-Dichloropropane	ND	1.0	0.31	ug/l	
594-20-7	2,2-Dichloropropane	ND	1.0	0.24	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MW-3I		
Lab Sample ID:	FA73504-4	**Date Sampled:**	03/16/20
Matrix:	AQ - Ground Water	**Date Received:**	03/17/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	1.0	0.34	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	1.0	0.29	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	1.0	0.21	ug/l	
100-41-4	Ethylbenzene	ND	1.0	0.36	ug/l	
87-68-3	Hexachlorobutadiene	ND	2.0	0.30	ug/l	
591-78-6	2-Hexanone	ND	10	2.0	ug/l	
98-82-8	Isopropylbenzene	ND	1.0	0.22	ug/l	
99-87-6	p-Isopropyltoluene	ND	1.0	0.21	ug/l	
74-83-9	Methyl Bromide [c]	ND	2.0	0.59	ug/l	
74-87-3	Methyl Chloride	ND	2.0	0.50	ug/l	
74-95-3	Methylene Bromide	ND	2.0	0.37	ug/l	
75-09-2	Methylene Chloride	ND	5.0	2.0	ug/l	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	5.0	1.0	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	1.0	0.23	ug/l	
91-20-3	Naphthalene	ND	5.0	1.0	ug/l	
103-65-1	n-Propylbenzene	ND	1.0	0.29	ug/l	
100-42-5	Styrene	ND	1.0	0.22	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	1.0	0.28	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	1.0	0.30	ug/l	
127-18-4	Tetrachloroethylene	5.6	1.0	0.22	ug/l	
108-88-3	Toluene	0.72	1.0	0.30	ug/l	J
87-61-6	1,2,3-Trichlorobenzene	ND	2.0	0.61	ug/l	
120-82-1	1,2,4-Trichlorobenzene	ND	2.0	0.50	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	1.0	0.25	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	1.0	0.47	ug/l	
79-01-6	Trichloroethylene	ND	1.0	0.35	ug/l	
75-69-4	Trichlorofluoromethane	ND	2.0	0.50	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	2.0	0.63	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	1.0	0.32	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	1.0	0.27	ug/l	
108-05-4	Vinyl Acetate	ND	10	2.0	ug/l	
75-01-4	Vinyl Chloride	ND	1.0	0.41	ug/l	
	m,p-Xylene	ND	2.0	0.47	ug/l	
95-47-6	o-Xylene	ND	1.0	0.26	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	98%		83-118%
17060-07-0	1,2-Dichloroethane-D4	98%		79-125%
2037-26-5	Toluene-D8	101%		85-112%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MW-3I		
Lab Sample ID:	FA73504-4	**Date Sampled:**	03/16/20
Matrix:	AQ - Ground Water	**Date Received:**	03/17/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	100%		83-118%

(a) Sample was not preserved to a pH < 2.
(b) Associated CCV outside of control limits low.
(c) Associated ICV outside control limits high, however sample ND.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MW-3I		
Lab Sample ID:	FA73504-4	**Date Sampled:**	03/16/20
Matrix:	AQ - Ground Water	**Date Received:**	03/17/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Total Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Manganese	130000	750	ug/l	50	03/19/20	03/20/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16620
(2) Prep QC Batch: MP36970

RL = Reporting Limit

Report of Analysis

Client Sample ID:	MW-3I		
Lab Sample ID:	FA73504-4F	**Date Sampled:**	03/16/20
Matrix:	AQ - Groundwater Filtered	**Date Received:**	03/17/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Iron	< 300	300	ug/l	1	03/19/20	03/19/20	LM	SW846 6010D [1]	SW846 3010A [3]
Manganese	21600	150	ug/l	10	03/19/20	03/20/20	LM	SW846 6010D [2]	SW846 3010A [3]

(1) Instrument QC Batch: MA16618
(2) Instrument QC Batch: MA16620
(3) Prep QC Batch: MP36970

RL = Reporting Limit

SGS North America Inc.

Report of Analysis

Client Sample ID:	TRIP BLANK		
Lab Sample ID:	FA73504-5	**Date Sampled:**	03/16/20
Matrix:	AQ - Trip Blank Water	**Date Received:**	03/17/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	C0139366.D	1	03/19/20 13:51	KB	n/a	n/a	VC5571
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	25	10	ug/l	
71-43-2	Benzene	ND	1.0	0.31	ug/l	
108-86-1	Bromobenzene	ND	1.0	0.37	ug/l	
74-97-5	Bromochloromethane	ND	1.0	0.45	ug/l	
75-27-4	Bromodichloromethane	ND	1.0	0.24	ug/l	
75-25-2	Bromoform	ND	1.0	0.41	ug/l	
78-93-3	2-Butanone (MEK)	ND	5.0	2.0	ug/l	
104-51-8	n-Butylbenzene	ND	1.0	0.23	ug/l	
135-98-8	sec-Butylbenzene	ND	1.0	0.24	ug/l	
98-06-6	tert-Butylbenzene	ND	1.0	0.31	ug/l	
75-15-0	Carbon Disulfide	ND	2.0	0.53	ug/l	
56-23-5	Carbon Tetrachloride	ND	1.0	0.36	ug/l	
108-90-7	Chlorobenzene	ND	1.0	0.20	ug/l	
75-00-3	Chloroethane	ND	2.0	0.67	ug/l	
67-66-3	Chloroform	ND	1.0	0.30	ug/l	
95-49-8	o-Chlorotoluene	ND	1.0	0.22	ug/l	
106-43-4	p-Chlorotoluene	ND	1.0	0.31	ug/l	
124-48-1	Dibromochloromethane	ND	1.0	0.28	ug/l	
96-12-8	1,2-Dibromo-3-chloropropan [b]	ND	5.0	1.0	ug/l	
106-93-4	1,2-Dibromoethane	ND	2.0	0.28	ug/l	
75-71-8	Dichlorodifluoromethane	ND	2.0	0.50	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	1.0	0.32	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	1.0	0.22	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	1.0	0.26	ug/l	
75-34-3	1,1-Dichloroethane	ND	1.0	0.34	ug/l	
107-06-2	1,2-Dichloroethane	ND	1.0	0.31	ug/l	
75-35-4	1,1-Dichloroethylene	ND	1.0	0.32	ug/l	
156-59-2	cis-1,2-Dichloroethylene	ND	1.0	0.28	ug/l	
156-60-5	trans-1,2-Dichloroethylene	ND	1.0	0.22	ug/l	
78-87-5	1,2-Dichloropropane	ND	1.0	0.43	ug/l	
142-28-9	1,3-Dichloropropane	ND	1.0	0.31	ug/l	
594-20-7	2,2-Dichloropropane	ND	1.0	0.24	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	TRIP BLANK		
Lab Sample ID:	FA73504-5	**Date Sampled:**	03/16/20
Matrix:	AQ - Trip Blank Water	**Date Received:**	03/17/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	1.0	0.34	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	1.0	0.29	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	1.0	0.21	ug/l	
100-41-4	Ethylbenzene	ND	1.0	0.36	ug/l	
87-68-3	Hexachlorobutadiene	ND	2.0	0.30	ug/l	
591-78-6	2-Hexanone	ND	10	2.0	ug/l	
98-82-8	Isopropylbenzene	ND	1.0	0.22	ug/l	
99-87-6	p-Isopropyltoluene	ND	1.0	0.21	ug/l	
74-83-9	Methyl Bromide [c]	ND	2.0	0.59	ug/l	
74-87-3	Methyl Chloride	0.57	2.0	0.50	ug/l	J
74-95-3	Methylene Bromide	ND	2.0	0.37	ug/l	
75-09-2	Methylene Chloride	ND	5.0	2.0	ug/l	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	5.0	1.0	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	1.0	0.23	ug/l	
91-20-3	Naphthalene	ND	5.0	1.0	ug/l	
103-65-1	n-Propylbenzene	ND	1.0	0.29	ug/l	
100-42-5	Styrene	ND	1.0	0.22	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	1.0	0.28	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	1.0	0.30	ug/l	
127-18-4	Tetrachloroethylene	ND	1.0	0.22	ug/l	
108-88-3	Toluene	ND	1.0	0.30	ug/l	
87-61-6	1,2,3-Trichlorobenzene	ND	2.0	0.61	ug/l	
120-82-1	1,2,4-Trichlorobenzene	ND	2.0	0.50	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	1.0	0.25	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	1.0	0.47	ug/l	
79-01-6	Trichloroethylene	ND	1.0	0.35	ug/l	
75-69-4	Trichlorofluoromethane	ND	2.0	0.50	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	2.0	0.63	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	1.0	0.32	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	1.0	0.27	ug/l	
108-05-4	Vinyl Acetate	ND	10	2.0	ug/l	
75-01-4	Vinyl Chloride	ND	1.0	0.41	ug/l	
	m,p-Xylene	ND	2.0	0.47	ug/l	
95-47-6	o-Xylene	ND	1.0	0.26	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	100%		83-118%
17060-07-0	1,2-Dichloroethane-D4	100%		79-125%
2037-26-5	Toluene-D8	99%		85-112%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	TRIP BLANK		
Lab Sample ID:	FA73504-5	**Date Sampled:**	03/16/20
Matrix:	AQ - Trip Blank Water	**Date Received:**	03/17/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	100%		83-118%

(a) Sample was preserved to a pH < 2.
(b) Associated CCV outside of control limits low.
(c) Associated ICV outside control limits high, however sample ND.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

SGS North America Inc - Orlando
Chain of Custody

4405 Vineland Road, Suite C-15 Orlando, Fl 32811
TEL. 407-425-6700 FAX: 407-425-0707
www.sgs.com

SGS - ORLANDO JOB # : FA73504 PAGE 1 OF 1

SGS - ORLANDO Quote # | SKIFF #

Client / Reporting Information

Company Name: Geosyntec Consultants
Address: 2501 Blue Ridge Rd Ste. 430
City: Raleigh State: NC Zip: 27607
Project Contact: James Wang Email: jwang@geosyntec.com
Phone #: (443) 542-7501
Sampler(s) Name(s) (Printed)
Sampler 1: Allison Vo Sampler 2:

Project Information

Project Name: Cristex Drum Site
Street: 500 W Industry
City: Oxford State: NC
Project #: GR6764
Fax #: —
Client Purchase Order # 127000172

Analytical Information / **Matrix Codes**

Matrix Codes: DW - Drinking Water; GW - Ground Water; WW - Water; SW - Surface Water; SO - Soil; SL- Sludge; OI - Oil; LIQ - Other Liquid; AIR - Air; SOL - Other Solid

SGS Orlando Sample #	Field ID / Point of Collection	COLLECTION DATE	TIME	SAMPLED BY:	MATRIX	TOTAL # OF BOTTLES	OTHER	NONE	HCl	NaOH	HNO3	H2SO4	NaOH+ZnAc	DI WATER	MeOH	VOC 8260 STD (OSCAR VOC acid)	6010B (Tot. Metals)	6010B (Fe, Mn)	LAB USE ONLY
1	EK-MW-2-20200314	3/16/20	1300	AV	GW	5	3				2					3	1	1	
2	DUP-1-20200314	3/16/20	1315	AV	GW	5	3				2					3	1	1	
3	EK-MW-1	3/16/20	1415	AV	GW	5	3				2					3	1	1	
3	EK-MW-1-MS	↓	1425	↓	↓	↓	↓				↓					3	1	1	
3	EK-MW-1-MSD	↓	1440	↓	↓	↓	↓				↓					3	1	1	
4	MW-3I	↓		↓	↓	↓	↓				↓					3	1	1	
5	TRIP BLANK	↓																	

Turnaround Time (Business days)

10 Day (Business) — Approved By: / Date:
7 Day
5 Day
3 Day *RUSH*
2 Day *RUSH*
1 Day *RUSH*
Other
Rush T/A Data Available VIA Email or Lablink

Data Deliverable Information

- COMMERCIAL "A" (RESULTS ONLY)
- COMMERCIAL "B" (RESULTS PLUS QC)
- REDT1 (EPA LEVEL 3)
- FULLT1 (EPA LEVEL 4)
- EDD'S

Comments / Remarks

Raleigh, NC Service Center
INITIAL ASSESSMENT
LABEL VERIFICATION PA

Sample Custody must be documented below each time samples change possession, including courier delivery.

	Relinquished by Sampler/Affiliation	Date Time:	Received By/Affiliation	Relinquished By/Affiliation	Date Time:	Received By/Affiliation
1	Geosyntec	3/16/20 1600	2 Fed Ex	3 Fed Ex		4 03/17/2020 0800
5	Relinquished by/Affiliation	Date Time:	6 Received By/Affiliation	7 Relinquished By/Affiliation	Date Time:	8 Received By/Affiliation

Lab Use Only : Cooler Temperature (s) Celsius (corrected):

http://www.sgs.com/en/terms-and-conditions

ORLD-SMT-0001-03-FORM-COC (4).xls Rev 031318

3.1

5.1 5

FA73504: Chain of Custody
Page 1 of 2

SGS Sample Receipt Summary

Job Number: FA73504 **Client:** GEOSYNTEC CONSULTANTS **Project:** CRISTEX DRUM SITE

Date / Time Received: 3/17/2020 9:00:00 AM **Delivery Method:** FED EX **Airbill #'s:** 1002284362410003281100491386913107

Therm ID: IR 1; **Therm CF:** -0.8; **# of Coolers:** 1

Cooler Temps (Raw Measured) °C: Cooler 1: (3.9);

Cooler Temps (Corrected) °C: Cooler 1: (3.1);

Cooler Information	Y	or	N
1. Custody Seals Present	☑		☐
2. Custody Seals Intact	☑		☐
3. Temp criteria achieved	☑		☐
4. Cooler temp verification	IR Gun		
5. Cooler media	Ice (Bag)		

Trip Blank Information	Y	or	N	N/A
1. Trip Blank present / cooler	☑		☐	☐
2. Trip Blank listed on COC	☑		☐	☐
	W	or	S	N/A
3. Type Of TB Received	☑		☐	☐

Sample Information	Y	or	N	N/A
1. Sample labels present on bottles	☑		☐	
2. Samples preserved properly	☑		☐	
3. Sufficient volume/containers recvd for analysis:	☑		☐	
4. Condition of sample	Intact			
5. Sample recvd within HT	☑		☐	
6. Dates/Times/IDs on COC match Sample Label	☑		☐	
7. VOCs have headspace	☐		☑	☐
8. Bottles received for unspecified tests	☐		☑	
9. Compositing instructions clear	☐		☐	☑
10. Voa Soil Kits/Jars received past 48hrs?	☐		☐	☑
11. % Solids Jar received?	☐		☐	☑
12. Residual Chlorine Present?	☐		☐	☑

Misc. Information

Number of Encores: 25-Gram _____ 5-Gram _____ Number of 5035 Field Kits: _____ Number of Lab Filtered Metals: _____

Test Strip Lot #s: pH 0-3 230315 pH 10-12 219813A Other: (Specify) _____ _____

Residual Chlorine Test Strip Lot #: _____

Comments

SM001
Rev. Date 05/24/17

Technician: SHAYLAP Date: 3/17/2020 9:00:00 AM Reviewer: _____ Date: _____

FA73504: Chain of Custody
Page 2 of 2

The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

Geosyntec Consultants

Cristex Drum Site; 500 W Industry Dr, Oxford, NC

GR6764

SGS Job Number: FA74075

Sampling Date: 04/07/20

Report to:

Geosyntec Consultants
2501 Blue Ridge Rd Suite 430
Raleigh, NC 27607
jwang@geosyntec.com; AVo@Geosyntec.com;
RGabelman@Geosyntec.com
ATTN: Allison Vo

Total number of pages in report: **334**

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

Caitlin Brice, M.S.
General Manager

Client Service contact: Jean Dent-Smith 407-425-6700

Certifications: FL(E83510), LA(03051), KS(E-10327), IL(200063), NC(573), NJ(FL002), NY(12022), SC(96038001) DoD ELAP(ANAB L2229), AZ(AZ0806), CA(2937), TX(T104704404), PA(68-03573), VA(460177), AK, AR, IA, KY, MA, MS, ND, NH, NV, OK, OR, UT, WA, WV

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how we can serve you better at:
EHS.US.CustomerCare@sgs.com

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SGS North America Inc.

Sample Summary

Geosyntec Consultants

Job No: FA74075

Cristex Drum Site; 500 W Industry Dr, Oxford, NC
Project No: GR6764

This report contains results reported as ND = Not detected. The following applies:
Organics ND = Not detected above the MDL

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
FA74075-1	04/07/20	10:45	AV	04/08/20	AQ	Ground Water	EK-MW-2-20200407
FA74075-1F	04/07/20	10:45	AV	04/08/20	AQ	Groundwater Filtered	EK-MW-2-20200407
FA74075-2	04/07/20	10:55	AV	04/08/20	AQ	Ground Water	DUP-1-20200407
FA74075-2F	04/07/20	10:55	AV	04/08/20	AQ	Groundwater Filtered	DUP-1-20200407
FA74075-3	04/07/20	12:15	AV	04/08/20	AQ	Ground Water	MW-3I-20200407
FA74075-3F	04/07/20	12:15	AV	04/08/20	AQ	Groundwater Filtered	MW-3I-20200407
FA74075-4	04/07/20	13:40	AV	04/08/20	AQ	Ground Water	EK-MW-1
FA74075-4D	04/07/20	13:40	AV	04/08/20	AQ	Water Dup/MSD	EK-MW-1
FA74075-4F	04/07/20	13:40	AV	04/08/20	AQ	Groundwater Filtered	EK-MW-1
FA74075-4FD	04/07/20	13:40	AV	04/08/20	AQ	Water Dup/MSD	EK-MW-1
FA74075-4FS	04/07/20	13:40	AV	04/08/20	AQ	Water Matrix Spike	EK-MW-1
FA74075-4S	04/07/20	13:40	AV	04/08/20	AQ	Water Matrix Spike	EK-MW-1

SGS North America Inc.

Sample Summary
(continued)

Geosyntec Consultants

Job No: FA74075

Cristex Drum Site; 500 W Industry Dr, Oxford, NC
Project No: GR6764

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
FA74075-5	04/07/20	00:00	AV	04/08/20	AQ	Trip Blank Water	TRIP BLANK

SAMPLE DELIVERY GROUP CASE NARRATIVE

Client: Geosyntec Consultants **Job No:** FA74075

Site: Cristex Drum Site; 500 W Industry Dr, Oxford, NC **Report Date:** 4/15/2020 4:56:21 PM

4 Samples and 1 Trip Blank were collected on 04/07/2020 and were received at SGS North America Inc - Orlando on 04/08/2020 properly preserved, at 2.9 Deg. C and intact. These Samples received an SGS Orlando job number of FA74075. A listing of the Laboratory Sample ID, Client Sample ID and dates of collection are presented in the Results Summary Section. Except as noted below, all method specified calibrations and quality control performance criteria were met for this job. For more information, please refer to QC summary pages.

MS Volatiles By Method SW846 8260D

Matrix: AQ **Batch ID:** VC5597

All samples were analyzed within the recommended method holding time.

All method blanks for this batch meet method specific criteria.

Sample(s) FA74075-4MS, FA74075-4MSD were used as the QC samples indicated.

Matrix Spike Recovery(s) for Bromoform, Dibromochloromethane are outside control limits. Probable cause is due to matrix interference.

Matrix Spike Duplicate Recovery(s) for Bromoform, Dibromochloromethane are outside control limits. Probable cause is due to matrix interference.

FA74075-2: Sample was not preserved to a pH < 2.

FA74075-3: Sample was not preserved to a pH < 2.

FA74075-4: Sample was not preserved to a pH < 2.

VC5597-MB: Sample was treated with an anti-foaming agent.

Matrix: AQ **Batch ID:** VC5602

All samples were analyzed within the recommended method holding time.

All method blanks for this batch meet method specific criteria.

Sample(s) FA74081-4MS, FA74081-4MSD were used as the QC samples indicated.

FA74075-1: Sample was not preserved to a pH < 2.

FA74075-1 for Dichlorodifluoromethane: Associated CCV outside of control limits low.

Metals Analysis By Method SW846 6010D

Matrix: AQ **Batch ID:** MP37075

All samples were digested within the recommended method holding time.

All samples were analyzed within the recommended method holding time.

All method blanks for this batch meet method specific criteria.

Sample(s) FA74075-4DUP, FA74075-4FDUP, FA74075-4FMS, FA74075-4FMSD, FA74075-4FPS, FA74075-4FSDL, FA74075-4MS, FA74075-4MSD, FA74075-4PS, FA74075-4SDL were used as the QC samples for metals.

SGS Orlando certifies that this report meets the project requirements for analytical data produced for the samples as received at SGS Orlando and as stated on the COC. SGS Orlando certifies that the data meets the Data Quality Objectives for precision, accuracy and completeness as specified in the SGS Orlando Quality Manual except as noted above. This report is to be used in its entirety. SGS Orlando is not responsible for any assumptions of data quality if partial data packages are used.

Narrative prepared by:

_____

Jenna Kravitz, Client Services *(Signature on File)*

Summary of Hits

Job Number: FA74075
Account: Geosyntec Consultants
Project: Cristex Drum Site; 500 W Industry Dr, Oxford, NC
Collected: 04/07/20

Lab Sample ID Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
FA74075-1	**EK-MW-2-20200407**					
cis-1,2-Dichloroethylene [a]		4.1	2.0	0.55	ug/l	SW846 8260D
Tetrachloroethylene [a]		118	2.0	0.43	ug/l	SW846 8260D
Toluene [a]		0.96 J	2.0	0.60	ug/l	SW846 8260D
Trichloroethylene [a]		2.7	2.0	0.69	ug/l	SW846 8260D
Manganese		13200	150		ug/l	SW846 6010D
FA74075-1F	**EK-MW-2-20200407**					
Manganese		13100	150		ug/l	SW846 6010D
FA74075-2	**DUP-1-20200407**					
cis-1,2-Dichloroethylene [a]		4.8	2.0	0.55	ug/l	SW846 8260D
Tetrachloroethylene [a]		100	2.0	0.43	ug/l	SW846 8260D
Trichloroethylene [a]		3.1	2.0	0.69	ug/l	SW846 8260D
Manganese		13900	150		ug/l	SW846 6010D
FA74075-2F	**DUP-1-20200407**					
Manganese		13200	150		ug/l	SW846 6010D
FA74075-3	**MW-3I-20200407**					
Acetone [a]		45.8	25	10	ug/l	SW846 8260D
Bromodichloromethane [a]		0.68 J	1.0	0.24	ug/l	SW846 8260D
2-Butanone (MEK) [a]		2.6 J	5.0	2.0	ug/l	SW846 8260D
Chloroform [a]		2.3	1.0	0.30	ug/l	SW846 8260D
1,1-Dichloroethane [a]		0.45 J	1.0	0.34	ug/l	SW846 8260D
Toluene [a]		0.96 J	1.0	0.30	ug/l	SW846 8260D
Manganese		1300000	15000		ug/l	SW846 6010D
FA74075-3F	**MW-3I-20200407**					
Manganese		1340000	15000		ug/l	SW846 6010D
FA74075-4	**EK-MW-1**					
cis-1,2-Dichloroethylene [a]		50.9	10	2.8	ug/l	SW846 8260D
Tetrachloroethylene [a]		516	10	2.2	ug/l	SW846 8260D
Trichloroethylene [a]		29.3	10	3.5	ug/l	SW846 8260D
Manganese		69.6	15		ug/l	SW846 6010D

Summary of Hits

Job Number: FA74075
Account: Geosyntec Consultants
Project: Cristex Drum Site; 500 W Industry Dr, Oxford, NC
Collected: 04/07/20

Lab Sample ID Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
FA74075-4F	**EK-MW-1**					
Manganese		53.9	15		ug/l	SW846 6010D
FA74075-5	**TRIP BLANK**					

No hits reported in this sample.

(a) Sample was not preserved to a pH < 2.

Sample Results

Report of Analysis

SGS North America Inc.

Report of Analysis

Client Sample ID:	EK-MW-2-20200407		
Lab Sample ID:	FA74075-1	**Date Sampled:**	04/07/20
Matrix:	AQ - Ground Water	**Date Received:**	04/08/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	C0140074.D	2	04/12/20 12:17	KB	n/a	n/a	VC5602
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	50	20	ug/l	
71-43-2	Benzene	ND	2.0	0.62	ug/l	
108-86-1	Bromobenzene	ND	2.0	0.73	ug/l	
74-97-5	Bromochloromethane	ND	2.0	0.90	ug/l	
75-27-4	Bromodichloromethane	ND	2.0	0.48	ug/l	
75-25-2	Bromoform	ND	2.0	0.81	ug/l	
78-93-3	2-Butanone (MEK)	ND	10	4.0	ug/l	
104-51-8	n-Butylbenzene	ND	2.0	0.46	ug/l	
135-98-8	sec-Butylbenzene	ND	2.0	0.49	ug/l	
98-06-6	tert-Butylbenzene	ND	2.0	0.63	ug/l	
75-15-0	Carbon Disulfide	ND	4.0	1.1	ug/l	
56-23-5	Carbon Tetrachloride	ND	2.0	0.71	ug/l	
108-90-7	Chlorobenzene	ND	2.0	0.40	ug/l	
75-00-3	Chloroethane	ND	4.0	1.3	ug/l	
67-66-3	Chloroform	ND	2.0	0.60	ug/l	
95-49-8	o-Chlorotoluene	ND	2.0	0.44	ug/l	
106-43-4	p-Chlorotoluene	ND	2.0	0.61	ug/l	
124-48-1	Dibromochloromethane	ND	2.0	0.55	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	10	2.1	ug/l	
106-93-4	1,2-Dibromoethane	ND	4.0	0.55	ug/l	
75-71-8	Dichlorodifluoromethane [b]	ND	4.0	1.0	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	2.0	0.65	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	2.0	0.43	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	2.0	0.51	ug/l	
75-34-3	1,1-Dichloroethane	ND	2.0	0.68	ug/l	
107-06-2	1,2-Dichloroethane	ND	2.0	0.62	ug/l	
75-35-4	1,1-Dichloroethylene	ND	2.0	0.64	ug/l	
156-59-2	cis-1,2-Dichloroethylene	4.1	2.0	0.55	ug/l	
156-60-5	trans-1,2-Dichloroethylene	ND	2.0	0.44	ug/l	
78-87-5	1,2-Dichloropropane	ND	2.0	0.85	ug/l	
142-28-9	1,3-Dichloropropane	ND	2.0	0.62	ug/l	
594-20-7	2,2-Dichloropropane	ND	2.0	0.48	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EK-MW-2-20200407		
Lab Sample ID:	FA74075-1	**Date Sampled:**	04/07/20
Matrix:	AQ - Ground Water	**Date Received:**	04/08/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	2.0	0.67	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	2.0	0.58	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	2.0	0.43	ug/l	
100-41-4	Ethylbenzene	ND	2.0	0.71	ug/l	
87-68-3	Hexachlorobutadiene	ND	4.0	0.59	ug/l	
591-78-6	2-Hexanone	ND	20	4.0	ug/l	
98-82-8	Isopropylbenzene	ND	2.0	0.44	ug/l	
99-87-6	p-Isopropyltoluene	ND	2.0	0.43	ug/l	
74-83-9	Methyl Bromide	ND	4.0	1.2	ug/l	
74-87-3	Methyl Chloride	ND	4.0	1.0	ug/l	
74-95-3	Methylene Bromide	ND	4.0	0.74	ug/l	
75-09-2	Methylene Chloride	ND	10	4.0	ug/l	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	10	2.0	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	2.0	0.46	ug/l	
91-20-3	Naphthalene	ND	10	2.0	ug/l	
103-65-1	n-Propylbenzene	ND	2.0	0.57	ug/l	
100-42-5	Styrene	ND	2.0	0.44	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	2.0	0.55	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	2.0	0.60	ug/l	
127-18-4	Tetrachloroethylene	118	2.0	0.43	ug/l	
108-88-3	Toluene	0.96	2.0	0.60	ug/l	J
87-61-6	1,2,3-Trichlorobenzene	ND	4.0	1.2	ug/l	
120-82-1	1,2,4-Trichlorobenzene	ND	4.0	1.0	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	2.0	0.50	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	2.0	0.93	ug/l	
79-01-6	Trichloroethylene	2.7	2.0	0.69	ug/l	
75-69-4	Trichlorofluoromethane	ND	4.0	1.0	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	4.0	1.3	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	2.0	0.65	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	2.0	0.55	ug/l	
108-05-4	Vinyl Acetate	ND	20	4.0	ug/l	
75-01-4	Vinyl Chloride	ND	2.0	0.82	ug/l	
	m,p-Xylene	ND	4.0	0.93	ug/l	
95-47-6	o-Xylene	ND	2.0	0.51	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	95%		83-118%
17060-07-0	1,2-Dichloroethane-D4	102%		79-125%
2037-26-5	Toluene-D8	105%		85-112%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EK-MW-2-20200407		
Lab Sample ID:	FA74075-1	**Date Sampled:**	04/07/20
Matrix:	AQ - Ground Water	**Date Received:**	04/08/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	100%		83-118%

(a) Sample was not preserved to a pH < 2.
(b) Associated CCV outside of control limits low.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EK-MW-2-20200407		
Lab Sample ID:	FA74075-1	**Date Sampled:**	04/07/20
Matrix:	AQ - Ground Water	**Date Received:**	04/08/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Total Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Manganese	13200	150	ug/l	1	04/09/20	04/10/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16670
(2) Prep QC Batch: MP37075

RL = Reporting Limit

Report of Analysis

Client Sample ID:	EK-MW-2-20200407		
Lab Sample ID:	FA74075-1F	**Date Sampled:**	04/07/20
Matrix:	AQ - Groundwater Filtered	**Date Received:**	04/08/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Iron	< 3000	3000	ug/l	1	04/09/20	04/10/20	LM	SW846 6010D [1]	SW846 3010A [2]
Manganese	13100	150	ug/l	1	04/09/20	04/10/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16670
(2) Prep QC Batch: MP37075

RL = Reporting Limit

SGS North America Inc.

Report of Analysis

Client Sample ID:	DUP-1-20200407		
Lab Sample ID:	FA74075-2	**Date Sampled:**	04/07/20
Matrix:	AQ - Ground Water	**Date Received:**	04/08/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	C0139999.D	2	04/09/20 17:22	KB	n/a	n/a	VC5597
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	50	20	ug/l	
71-43-2	Benzene	ND	2.0	0.62	ug/l	
108-86-1	Bromobenzene	ND	2.0	0.73	ug/l	
74-97-5	Bromochloromethane	ND	2.0	0.90	ug/l	
75-27-4	Bromodichloromethane	ND	2.0	0.48	ug/l	
75-25-2	Bromoform	ND	2.0	0.81	ug/l	
78-93-3	2-Butanone (MEK)	ND	10	4.0	ug/l	
104-51-8	n-Butylbenzene	ND	2.0	0.46	ug/l	
135-98-8	sec-Butylbenzene	ND	2.0	0.49	ug/l	
98-06-6	tert-Butylbenzene	ND	2.0	0.63	ug/l	
75-15-0	Carbon Disulfide	ND	4.0	1.1	ug/l	
56-23-5	Carbon Tetrachloride	ND	2.0	0.71	ug/l	
108-90-7	Chlorobenzene	ND	2.0	0.40	ug/l	
75-00-3	Chloroethane	ND	4.0	1.3	ug/l	
67-66-3	Chloroform	ND	2.0	0.60	ug/l	
95-49-8	o-Chlorotoluene	ND	2.0	0.44	ug/l	
106-43-4	p-Chlorotoluene	ND	2.0	0.61	ug/l	
124-48-1	Dibromochloromethane	ND	2.0	0.55	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	10	2.1	ug/l	
106-93-4	1,2-Dibromoethane	ND	4.0	0.55	ug/l	
75-71-8	Dichlorodifluoromethane	ND	4.0	1.0	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	2.0	0.65	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	2.0	0.43	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	2.0	0.51	ug/l	
75-34-3	1,1-Dichloroethane	ND	2.0	0.68	ug/l	
107-06-2	1,2-Dichloroethane	ND	2.0	0.62	ug/l	
75-35-4	1,1-Dichloroethylene	ND	2.0	0.64	ug/l	
156-59-2	cis-1,2-Dichloroethylene	4.8	2.0	0.55	ug/l	
156-60-5	trans-1,2-Dichloroethylene	ND	2.0	0.44	ug/l	
78-87-5	1,2-Dichloropropane	ND	2.0	0.85	ug/l	
142-28-9	1,3-Dichloropropane	ND	2.0	0.62	ug/l	
594-20-7	2,2-Dichloropropane	ND	2.0	0.48	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	DUP-1-20200407		
Lab Sample ID:	FA74075-2	**Date Sampled:**	04/07/20
Matrix:	AQ - Ground Water	**Date Received:**	04/08/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	2.0	0.67	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	2.0	0.58	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	2.0	0.43	ug/l	
100-41-4	Ethylbenzene	ND	2.0	0.71	ug/l	
87-68-3	Hexachlorobutadiene	ND	4.0	0.59	ug/l	
591-78-6	2-Hexanone	ND	20	4.0	ug/l	
98-82-8	Isopropylbenzene	ND	2.0	0.44	ug/l	
99-87-6	p-Isopropyltoluene	ND	2.0	0.43	ug/l	
74-83-9	Methyl Bromide	ND	4.0	1.2	ug/l	
74-87-3	Methyl Chloride	ND	4.0	1.0	ug/l	
74-95-3	Methylene Bromide	ND	4.0	0.74	ug/l	
75-09-2	Methylene Chloride	ND	10	4.0	ug/l	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	10	2.0	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	2.0	0.46	ug/l	
91-20-3	Naphthalene	ND	10	2.0	ug/l	
103-65-1	n-Propylbenzene	ND	2.0	0.57	ug/l	
100-42-5	Styrene	ND	2.0	0.44	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	2.0	0.55	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	2.0	0.60	ug/l	
127-18-4	Tetrachloroethylene	100	2.0	0.43	ug/l	
108-88-3	Toluene	ND	2.0	0.60	ug/l	
87-61-6	1,2,3-Trichlorobenzene	ND	4.0	1.2	ug/l	
120-82-1	1,2,4-Trichlorobenzene	ND	4.0	1.0	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	2.0	0.50	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	2.0	0.93	ug/l	
79-01-6	Trichloroethylene	3.1	2.0	0.69	ug/l	
75-69-4	Trichlorofluoromethane	ND	4.0	1.0	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	4.0	1.3	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	2.0	0.65	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	2.0	0.55	ug/l	
108-05-4	Vinyl Acetate	ND	20	4.0	ug/l	
75-01-4	Vinyl Chloride	ND	2.0	0.82	ug/l	
	m,p-Xylene	ND	4.0	0.93	ug/l	
95-47-6	o-Xylene	ND	2.0	0.51	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	100%		83-118%
17060-07-0	1,2-Dichloroethane-D4	100%		79-125%
2037-26-5	Toluene-D8	99%		85-112%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	DUP-1-20200407		
Lab Sample ID:	FA74075-2	**Date Sampled:**	04/07/20
Matrix:	AQ - Ground Water	**Date Received:**	04/08/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	101%		83-118%

(a) Sample was not preserved to a pH < 2.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	DUP-1-20200407		
Lab Sample ID:	FA74075-2	**Date Sampled:**	04/07/20
Matrix:	AQ - Ground Water	**Date Received:**	04/08/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Total Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Manganese	13900	150	ug/l	1	04/09/20	04/10/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16670
(2) Prep QC Batch: MP37075

RL = Reporting Limit

Report of Analysis

Client Sample ID:	DUP-1-20200407		
Lab Sample ID:	FA74075-2F	**Date Sampled:**	04/07/20
Matrix:	AQ - Groundwater Filtered	**Date Received:**	04/08/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Iron	< 3000	3000	ug/l	1	04/09/20	04/10/20	LM	SW846 6010D [1]	SW846 3010A [2]
Manganese	13200	150	ug/l	1	04/09/20	04/10/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16670
(2) Prep QC Batch: MP37075

RL = Reporting Limit

SGS North America Inc.

Report of Analysis

Client Sample ID:	MW-3I-20200407		
Lab Sample ID:	FA74075-3	**Date Sampled:**	04/07/20
Matrix:	AQ - Ground Water	**Date Received:**	04/08/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	C0140005.D	1	04/09/20 20:10	KB	n/a	n/a	VC5597
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	45.8	25	10	ug/l	
71-43-2	Benzene	ND	1.0	0.31	ug/l	
108-86-1	Bromobenzene	ND	1.0	0.37	ug/l	
74-97-5	Bromochloromethane	ND	1.0	0.45	ug/l	
75-27-4	Bromodichloromethane	0.68	1.0	0.24	ug/l	J
75-25-2	Bromoform	ND	1.0	0.41	ug/l	
78-93-3	2-Butanone (MEK)	2.6	5.0	2.0	ug/l	J
104-51-8	n-Butylbenzene	ND	1.0	0.23	ug/l	
135-98-8	sec-Butylbenzene	ND	1.0	0.24	ug/l	
98-06-6	tert-Butylbenzene	ND	1.0	0.31	ug/l	
75-15-0	Carbon Disulfide	ND	2.0	0.53	ug/l	
56-23-5	Carbon Tetrachloride	ND	1.0	0.36	ug/l	
108-90-7	Chlorobenzene	ND	1.0	0.20	ug/l	
75-00-3	Chloroethane	ND	2.0	0.67	ug/l	
67-66-3	Chloroform	2.3	1.0	0.30	ug/l	
95-49-8	o-Chlorotoluene	ND	1.0	0.22	ug/l	
106-43-4	p-Chlorotoluene	ND	1.0	0.31	ug/l	
124-48-1	Dibromochloromethane	ND	1.0	0.28	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	5.0	1.0	ug/l	
106-93-4	1,2-Dibromoethane	ND	2.0	0.28	ug/l	
75-71-8	Dichlorodifluoromethane	ND	2.0	0.50	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	1.0	0.32	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	1.0	0.22	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	1.0	0.26	ug/l	
75-34-3	1,1-Dichloroethane	0.45	1.0	0.34	ug/l	J
107-06-2	1,2-Dichloroethane	ND	1.0	0.31	ug/l	
75-35-4	1,1-Dichloroethylene	ND	1.0	0.32	ug/l	
156-59-2	cis-1,2-Dichloroethylene	ND	1.0	0.28	ug/l	
156-60-5	trans-1,2-Dichloroethylene	ND	1.0	0.22	ug/l	
78-87-5	1,2-Dichloropropane	ND	1.0	0.43	ug/l	
142-28-9	1,3-Dichloropropane	ND	1.0	0.31	ug/l	
594-20-7	2,2-Dichloropropane	ND	1.0	0.24	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MW-3I-20200407		
Lab Sample ID:	FA74075-3	**Date Sampled:**	04/07/20
Matrix:	AQ - Ground Water	**Date Received:**	04/08/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	1.0	0.34	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	1.0	0.29	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	1.0	0.21	ug/l	
100-41-4	Ethylbenzene	ND	1.0	0.36	ug/l	
87-68-3	Hexachlorobutadiene	ND	2.0	0.30	ug/l	
591-78-6	2-Hexanone	ND	10	2.0	ug/l	
98-82-8	Isopropylbenzene	ND	1.0	0.22	ug/l	
99-87-6	p-Isopropyltoluene	ND	1.0	0.21	ug/l	
74-83-9	Methyl Bromide	ND	2.0	0.59	ug/l	
74-87-3	Methyl Chloride	ND	2.0	0.50	ug/l	
74-95-3	Methylene Bromide	ND	2.0	0.37	ug/l	
75-09-2	Methylene Chloride	ND	5.0	2.0	ug/l	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	5.0	1.0	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	1.0	0.23	ug/l	
91-20-3	Naphthalene	ND	5.0	1.0	ug/l	
103-65-1	n-Propylbenzene	ND	1.0	0.29	ug/l	
100-42-5	Styrene	ND	1.0	0.22	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	1.0	0.28	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	1.0	0.30	ug/l	
127-18-4	Tetrachloroethylene	ND	1.0	0.22	ug/l	
108-88-3	Toluene	0.96	1.0	0.30	ug/l	J
87-61-6	1,2,3-Trichlorobenzene	ND	2.0	0.61	ug/l	
120-82-1	1,2,4-Trichlorobenzene	ND	2.0	0.50	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	1.0	0.25	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	1.0	0.47	ug/l	
79-01-6	Trichloroethylene	ND	1.0	0.35	ug/l	
75-69-4	Trichlorofluoromethane	ND	2.0	0.50	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	2.0	0.63	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	1.0	0.32	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	1.0	0.27	ug/l	
108-05-4	Vinyl Acetate	ND	10	2.0	ug/l	
75-01-4	Vinyl Chloride	ND	1.0	0.41	ug/l	
	m,p-Xylene	ND	2.0	0.47	ug/l	
95-47-6	o-Xylene	ND	1.0	0.26	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	99%		83-118%
17060-07-0	1,2-Dichloroethane-D4	101%		79-125%
2037-26-5	Toluene-D8	98%		85-112%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MW-3I-20200407		
Lab Sample ID:	FA74075-3	**Date Sampled:**	04/07/20
Matrix:	AQ - Ground Water	**Date Received:**	04/08/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	98%		83-118%

(a) Sample was not preserved to a pH < 2.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MW-3I-20200407		
Lab Sample ID:	FA74075-3	**Date Sampled:**	04/07/20
Matrix:	AQ - Ground Water	**Date Received:**	04/08/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Total Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Manganese	1300000	15000	ug/l	100	04/09/20	04/10/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16670
(2) Prep QC Batch: MP37075

RL = Reporting Limit

SGS North America Inc.

Report of Analysis

Client Sample ID:	MW-3I-20200407		
Lab Sample ID:	FA74075-3F	**Date Sampled:**	04/07/20
Matrix:	AQ - Groundwater Filtered	**Date Received:**	04/08/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Iron	< 3000	3000	ug/l	1	04/09/20	04/10/20	LM	SW846 6010D [1]	SW846 3010A [2]
Manganese	1340000	15000	ug/l	100	04/09/20	04/10/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16670
(2) Prep QC Batch: MP37075

RL = Reporting Limit

SGS North America Inc.

Report of Analysis

Client Sample ID:	EK-MW-1		
Lab Sample ID:	FA74075-4	**Date Sampled:**	04/07/20
Matrix:	AQ - Ground Water	**Date Received:**	04/08/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	C0139993.D	10	04/09/20 14:34	KB	n/a	n/a	VC5597
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	250	100	ug/l	
71-43-2	Benzene	ND	10	3.1	ug/l	
108-86-1	Bromobenzene	ND	10	3.7	ug/l	
74-97-5	Bromochloromethane	ND	10	4.5	ug/l	
75-27-4	Bromodichloromethane	ND	10	2.4	ug/l	
75-25-2	Bromoform	ND	10	4.1	ug/l	
78-93-3	2-Butanone (MEK)	ND	50	20	ug/l	
104-51-8	n-Butylbenzene	ND	10	2.3	ug/l	
135-98-8	sec-Butylbenzene	ND	10	2.4	ug/l	
98-06-6	tert-Butylbenzene	ND	10	3.1	ug/l	
75-15-0	Carbon Disulfide	ND	20	5.3	ug/l	
56-23-5	Carbon Tetrachloride	ND	10	3.6	ug/l	
108-90-7	Chlorobenzene	ND	10	2.0	ug/l	
75-00-3	Chloroethane	ND	20	6.7	ug/l	
67-66-3	Chloroform	ND	10	3.0	ug/l	
95-49-8	o-Chlorotoluene	ND	10	2.2	ug/l	
106-43-4	p-Chlorotoluene	ND	10	3.1	ug/l	
124-48-1	Dibromochloromethane	ND	10	2.8	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	50	10	ug/l	
106-93-4	1,2-Dibromoethane	ND	20	2.8	ug/l	
75-71-8	Dichlorodifluoromethane	ND	20	5.0	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	10	3.2	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	10	2.2	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	10	2.6	ug/l	
75-34-3	1,1-Dichloroethane	ND	10	3.4	ug/l	
107-06-2	1,2-Dichloroethane	ND	10	3.1	ug/l	
75-35-4	1,1-Dichloroethylene	ND	10	3.2	ug/l	
156-59-2	cis-1,2-Dichloroethylene	50.9	10	2.8	ug/l	
156-60-5	trans-1,2-Dichloroethylene	ND	10	2.2	ug/l	
78-87-5	1,2-Dichloropropane	ND	10	4.3	ug/l	
142-28-9	1,3-Dichloropropane	ND	10	3.1	ug/l	
594-20-7	2,2-Dichloropropane	ND	10	2.4	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EK-MW-1		
Lab Sample ID:	FA74075-4	**Date Sampled:**	04/07/20
Matrix:	AQ - Ground Water	**Date Received:**	04/08/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	10	3.4	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	10	2.9	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	10	2.1	ug/l	
100-41-4	Ethylbenzene	ND	10	3.6	ug/l	
87-68-3	Hexachlorobutadiene	ND	20	3.0	ug/l	
591-78-6	2-Hexanone	ND	100	20	ug/l	
98-82-8	Isopropylbenzene	ND	10	2.2	ug/l	
99-87-6	p-Isopropyltoluene	ND	10	2.1	ug/l	
74-83-9	Methyl Bromide	ND	20	5.9	ug/l	
74-87-3	Methyl Chloride	ND	20	5.0	ug/l	
74-95-3	Methylene Bromide	ND	20	3.7	ug/l	
75-09-2	Methylene Chloride	ND	50	20	ug/l	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	50	10	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	10	2.3	ug/l	
91-20-3	Naphthalene	ND	50	10	ug/l	
103-65-1	n-Propylbenzene	ND	10	2.9	ug/l	
100-42-5	Styrene	ND	10	2.2	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	10	2.8	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	10	3.0	ug/l	
127-18-4	Tetrachloroethylene	516	10	2.2	ug/l	
108-88-3	Toluene	ND	10	3.0	ug/l	
87-61-6	1,2,3-Trichlorobenzene	ND	20	6.1	ug/l	
120-82-1	1,2,4-Trichlorobenzene	ND	20	5.0	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	10	2.5	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	10	4.7	ug/l	
79-01-6	Trichloroethylene	29.3	10	3.5	ug/l	
75-69-4	Trichlorofluoromethane	ND	20	5.0	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	20	6.3	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	10	3.2	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	10	2.7	ug/l	
108-05-4	Vinyl Acetate	ND	100	20	ug/l	
75-01-4	Vinyl Chloride	ND	10	4.1	ug/l	
	m,p-Xylene	ND	20	4.7	ug/l	
95-47-6	o-Xylene	ND	10	2.6	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	100%		83-118%
17060-07-0	1,2-Dichloroethane-D4	100%		79-125%
2037-26-5	Toluene-D8	99%		85-112%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EK-MW-1		
Lab Sample ID:	FA74075-4	**Date Sampled:**	04/07/20
Matrix:	AQ - Ground Water	**Date Received:**	04/08/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	99%		83-118%

(a) Sample was not preserved to a pH < 2.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EK-MW-1		
Lab Sample ID:	FA74075-4	**Date Sampled:**	04/07/20
Matrix:	AQ - Ground Water	**Date Received:**	04/08/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Total Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Manganese	69.6	15	ug/l	1	04/09/20	04/10/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16670
(2) Prep QC Batch: MP37075

RL = Reporting Limit

Report of Analysis

Client Sample ID:	EK-MW-1		
Lab Sample ID:	FA74075-4F	**Date Sampled:**	04/07/20
Matrix:	AQ - Groundwater Filtered	**Date Received:**	04/08/20
		Percent Solids:	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Iron	< 300	300	ug/l	1	04/09/20	04/10/20	LM	SW846 6010D [1]	SW846 3010A [2]
Manganese	53.9	15	ug/l	1	04/09/20	04/10/20	LM	SW846 6010D [1]	SW846 3010A [2]

(1) Instrument QC Batch: MA16670
(2) Prep QC Batch: MP37075

RL = Reporting Limit

SGS North America Inc.

Report of Analysis

Client Sample ID:	TRIP BLANK		
Lab Sample ID:	FA74075-5	**Date Sampled:**	04/07/20
Matrix:	AQ - Trip Blank Water	**Date Received:**	04/08/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	C0139989.D	1	04/09/20 12:41	KB	n/a	n/a	VC5597
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	25	10	ug/l	
71-43-2	Benzene	ND	1.0	0.31	ug/l	
108-86-1	Bromobenzene	ND	1.0	0.37	ug/l	
74-97-5	Bromochloromethane	ND	1.0	0.45	ug/l	
75-27-4	Bromodichloromethane	ND	1.0	0.24	ug/l	
75-25-2	Bromoform	ND	1.0	0.41	ug/l	
78-93-3	2-Butanone (MEK)	ND	5.0	2.0	ug/l	
104-51-8	n-Butylbenzene	ND	1.0	0.23	ug/l	
135-98-8	sec-Butylbenzene	ND	1.0	0.24	ug/l	
98-06-6	tert-Butylbenzene	ND	1.0	0.31	ug/l	
75-15-0	Carbon Disulfide	ND	2.0	0.53	ug/l	
56-23-5	Carbon Tetrachloride	ND	1.0	0.36	ug/l	
108-90-7	Chlorobenzene	ND	1.0	0.20	ug/l	
75-00-3	Chloroethane	ND	2.0	0.67	ug/l	
67-66-3	Chloroform	ND	1.0	0.30	ug/l	
95-49-8	o-Chlorotoluene	ND	1.0	0.22	ug/l	
106-43-4	p-Chlorotoluene	ND	1.0	0.31	ug/l	
124-48-1	Dibromochloromethane	ND	1.0	0.28	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	5.0	1.0	ug/l	
106-93-4	1,2-Dibromoethane	ND	2.0	0.28	ug/l	
75-71-8	Dichlorodifluoromethane	ND	2.0	0.50	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	1.0	0.32	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	1.0	0.22	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	1.0	0.26	ug/l	
75-34-3	1,1-Dichloroethane	ND	1.0	0.34	ug/l	
107-06-2	1,2-Dichloroethane	ND	1.0	0.31	ug/l	
75-35-4	1,1-Dichloroethylene	ND	1.0	0.32	ug/l	
156-59-2	cis-1,2-Dichloroethylene	ND	1.0	0.28	ug/l	
156-60-5	trans-1,2-Dichloroethylene	ND	1.0	0.22	ug/l	
78-87-5	1,2-Dichloropropane	ND	1.0	0.43	ug/l	
142-28-9	1,3-Dichloropropane	ND	1.0	0.31	ug/l	
594-20-7	2,2-Dichloropropane	ND	1.0	0.24	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	TRIP BLANK		
Lab Sample ID:	FA74075-5	**Date Sampled:**	04/07/20
Matrix:	AQ - Trip Blank Water	**Date Received:**	04/08/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Compound	Result	RL	MDL	Units	Q
563-58-6	1,1-Dichloropropene	ND	1.0	0.34	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	1.0	0.29	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	1.0	0.21	ug/l	
100-41-4	Ethylbenzene	ND	1.0	0.36	ug/l	
87-68-3	Hexachlorobutadiene	ND	2.0	0.30	ug/l	
591-78-6	2-Hexanone	ND	10	2.0	ug/l	
98-82-8	Isopropylbenzene	ND	1.0	0.22	ug/l	
99-87-6	p-Isopropyltoluene	ND	1.0	0.21	ug/l	
74-83-9	Methyl Bromide	ND	2.0	0.59	ug/l	
74-87-3	Methyl Chloride	ND	2.0	0.50	ug/l	
74-95-3	Methylene Bromide	ND	2.0	0.37	ug/l	
75-09-2	Methylene Chloride	ND	5.0	2.0	ug/l	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	5.0	1.0	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	1.0	0.23	ug/l	
91-20-3	Naphthalene	ND	5.0	1.0	ug/l	
103-65-1	n-Propylbenzene	ND	1.0	0.29	ug/l	
100-42-5	Styrene	ND	1.0	0.22	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	1.0	0.28	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	1.0	0.30	ug/l	
127-18-4	Tetrachloroethylene	ND	1.0	0.22	ug/l	
108-88-3	Toluene	ND	1.0	0.30	ug/l	
87-61-6	1,2,3-Trichlorobenzene	ND	2.0	0.61	ug/l	
120-82-1	1,2,4-Trichlorobenzene	ND	2.0	0.50	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	1.0	0.25	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	1.0	0.47	ug/l	
79-01-6	Trichloroethylene	ND	1.0	0.35	ug/l	
75-69-4	Trichlorofluoromethane	ND	2.0	0.50	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	2.0	0.63	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	1.0	0.32	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	1.0	0.27	ug/l	
108-05-4	Vinyl Acetate	ND	10	2.0	ug/l	
75-01-4	Vinyl Chloride	ND	1.0	0.41	ug/l	
	m,p-Xylene	ND	2.0	0.47	ug/l	
95-47-6	o-Xylene	ND	1.0	0.26	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	98%		83-118%
17060-07-0	1,2-Dichloroethane-D4	101%		79-125%
2037-26-5	Toluene-D8	99%		85-112%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	TRIP BLANK		
Lab Sample ID:	FA74075-5	**Date Sampled:**	04/07/20
Matrix:	AQ - Trip Blank Water	**Date Received:**	04/08/20
Method:	SW846 8260D	**Percent Solids:**	n/a
Project:	Cristex Drum Site; 500 W Industry Dr, Oxford, NC		

VOA 8260 List

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	98%		83-118%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

SGS North America Inc - Orlando
Chain of Custody

4405 Vineland Road, Suite C-15 Orlando, Fl 32811
TEL. 407-425-6700 FAX: 407-425-0707
www.sgs.com

SGS - ORLANDO JOB # : FA74075

PAGE 1 OF 1

SGS - ORLANDO Quote # | SKIFF #

Client / Reporting Information

Company Name: Geosyntec Consultants
Address: 2501 Blue Ridge Rd Ste 430
City: Raleigh State: NC Zip: 27607
Project Contact: James Wang Email: jwang@geosyntec.com
Phone #: 443-542-7501
Sampler(s) Name(s) (Printed) Sampler 1: ALLIVO Sampler 2:

Project Information

Project Name: Cristex Drum Site
Street: 500 W Industry
City: Oxford State: NC
Project # GR6764
Fax #
Client Purchase Order # 127000172

Analytical Information

Matrix Codes: DW - Drinking Water; GW - Ground Water; WW - Water; SW - Surface Water; SO - Soil; SL- Sludge; OI - Oil; LIQ - Other Liquid; AIR - Air; SOL - Other Solid

SGS Orlando Sample #	Field ID / Point of Collection	COLLECTION DATE	TIME	SAMPLED BY:	MATRIX	TOTAL # OF BOTTLES	OTHER	NONE	HCl	NaOH	HNO3	H2SO4	NaOH+ZnAc	DI WATER	MEOH	V8260 STD (ascorbic acid)	6010B (tot. metals)	6010B (dis. metals Fe, Mn)	LAB USE ONLY
1	EK-MW-2-20200407	4/7/20	1045	AV	GW	5	3				2					3	1	1	
2	DUP-1-20200407	↓	1055	↓	↓	5	3				2					3	1	1	
3	MW-3I-20200407	↓	1215	↓	↓	↓	↓				↓					↓	↓	↓	
4	EKMW-1	↓	1340	↓	↓	↓	↓				↓					↓	↓	↓	
4	EKMW-1-MS	↓	1345	↓	↓	↓	↓				↓					↓	↓	↓	
4	EKMW-1-MSD	↓	1350	↓	↓	↓	↓				↓					↓	↓	↓	
5	TRIP BLANKS					2													

Turnaround Time (Business days)

10 Day (Business)
7 Day
5 Day
3 Day *RUSH*
2 Day *RUSH*
1 Day *RUSH*
Other

Approved By: / Date:

Rush T/A Data Available VIA Email or Lablink

Data Deliverable Information

- [ ] COMMERCIAL "A" (RESULTS ONLY)
- [ ] COMMERCIAL "B" (RESULTS PLUS QC)
- [ ] REDT1 (EPA LEVEL 3)
- [ ] FULLT1 (EPA LEVEL 4)
- [ ] EDD'S

Comments / Remarks

INITIAL ASESSMENT JK
LABEL VERIFICATION SP
Raleigh, NC Service Center

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Sampler/Affiliation	Date Time:	Received By/Affiliation	Relinquished By/Affiliation	Date Time:	Received By/Affiliation
1	4/7/20 1550	2	3		4 4/8/20 900
5		6	7		8

Lab Use Only: Cooler Temperature (s) Celsius (corrected): 2.9

http://www.sgs.com/en/terms-and-conditions

ORLD-SMT-0001-03-FORM-COC (4).xls Rev 031318

SGS Sample Receipt Summary

Job Number: FA74075 **Client:** GEOSYNTEC CONSULTANT **Project:** CRISLEX DRUM SITE

Date / Time Received: 4/8/2020 9:00:00 AM **Delivery Method:** FX **Airbill #'s:** 4913 8691 3725

Therm ID: IR 1; **Therm CF:** -0.8; **# of Coolers:** N/A

Cooler Temps (Raw Measured) °C: Cooler 1: (3.7);

Cooler Temps (Corrected) °C: Cooler 1: (2.9);

Cooler Information	Y	N
1. Custody Seals Present	☑	☐
2. Custody Seals Intact	☑	☐
3. Temp criteria achieved	☐	☐
4. Cooler temp verification	N/A	
5. Cooler media	N/A	

Trip Blank Information	Y	N	N/A
1. Trip Blank present / cooler	☑	☐	☐
2. Trip Blank listed on COC	☑	☐	☐
	W	S	N/A
3. Type Of TB Received	☑	☐	☐

Sample Information	Y	N	N/A
1. Sample labels present on bottles	☑	☐	
2. Samples preserved properly	☑	☐	
3. Sufficient volume/containers recvd for analysis:	☑	☐	
4. Condition of sample	Intact		
5. Sample recvd within HT	☑	☐	
6. Dates/Times/IDs on COC match Sample Label	☑	☐	
7. VOCs have headspace	☐	☑	☐
8. Bottles received for unspecified tests	☐	☑	
9. Compositing instructions clear	☐	☐	☑
10. Voa Soil Kits/Jars received past 48hrs?	☐	☐	☑
11. % Solids Jar received?	☐	☐	☑
12. Residual Chlorine Present?	☐	☐	☑

Misc. Information

Number of Encores: 25-Gram _____ 5-Gram _____ Number of 5035 Field Kits: _____ Number of Lab Filtered Metals: _____

Test Strip Lot #s: pH 0-3 230315 pH 10-12 219813A Other: (Specify) _____ _____

Residual Chlorine Test Strip Lot #: _____

Comments

SM001
Rev. Date 05/24/17

Technician: PETERH Date: 4/8/2020 9:00:00 AM Reviewer: _____ Date: _____

FA74075: Chain of Custody
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