Enclosure 4 to
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Enclosure 4

Response to Request for Additional Information

Phase II Remedial Investigation Work Plan

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Phase II Remedial Investigation Work Plan

Columbia Fuel Fabrication Facility
Hopkins, Richland County, South Carolina

Westinghouse Electric Company, LLC

Project number: 60595649

September 2020

Westinghouse Electric Company, LLC
5801 Bluff Road
Hopkins, SC 29061

Quality information

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List of Acronyms

AECOM	AECOM Technical Services, Inc.
AOC	Area of Concern
Beacon	Beacon Environmental Services, Inc.
BLS	below land surface
CA	Consent Agreement
CFFF	Columbia Fuel Fabrication Facility
COPC	constituent(s) of potential concern
CSM	Conceptual Site Model
CVOCs	chlorinated volatile organic compounds
DCE	1,1-Dichloroethene
DHEC	South Carolina Department of Health and Environmental Control
DOE	United States Department of Energy
DPT	direct push technology
EML HASL	Environmental Measurements Laboratory Health and Safety Laboratory
EPA	United States Environmental Protection Agency
ICP-MS	inductively coupled plasma mass spectrometry
µg	microgram
MCL	maximum contaminant level
MSL	mean sea level
NPDES	National Pollution Discharge Elimination System
NPL	National Priority List
OU	Operational Unit
OVA PID	organic vapor analyzer photoionization device
pCi	picocuries
PCE	tetrachloroethylene
RAL	site-specific remediation action level
RI	remedial investigation
RUSL	residential use screening level
Rust	Rust Environment and Infrastructure
SC	South Carolina
SGS	soil gas survey
SVOCs	semi-volatile organic compounds
Tc-99	Technetium-99
TAL	Target Analyte List
TCE	trichloroethylene
U	uranium
Westinghouse	Westinghouse Electric Company, LLC
WWTP	wastewater treatment plant

1. Introduction and Executive Summary

Westinghouse Electric Company, LLC (Westinghouse) Columbia Fuel Fabrication Facility (CFFF) is located at 5801 Bluff Road (site or property) in Hopkins, approximately 15 miles southeast of Columbia, South Carolina (**Figure 1**). The site includes approximately 1,151 acres, with the developed area encompassing approximately 75 acres centrally located on the site, thereby creating substantial buffers from adjoining properties. The property is surrounded by rural forested and agricultural property. CFFF was opened in 1969 and manufactures fuel assemblies and components for the commercial nuclear power industry. Site features are shown on **Figure 2** and monitoring well locations are displayed on **Figure 3**.

On February 26, 2019, the South Carolina Department of Health and Environmental Control (DHEC) and CFFF entered into Consent Agreement (CA) 19-02-HW to comprehensively assess potential environmental impacts from current and historical operations, including additional assessment of known impacts. The CA requires further assessment and potential remediation of known constituents of potential concern (COPC) and assessment of additional areas where releases may have occurred. CFFF submitted a *Final Remedial Investigation Work Plan* to DHEC in June 2019 (AECOM, 2019), which DHEC approved on June 19, 2019.

Assessment activities outlined in the June 2019 Final RI Work Plan (also referred to as Phase I) represented the first step in an iterative process to fulfill the requirements of the CA to assess the source, nature and extent of impacts from historical operations. The RI Phase I work was performed from June to December 2019.

As agreed with DHEC, an *Interim Remedial Investigation Data Summary Report* was prepared (AECOM, 2020a) to document the findings of the Phase I assessment activities. Based on comments from DHEC, CFFF submitted the *Final Interim Remedial Investigation Data Summary Report* on July 15, 2020 (AECOM, 2020b). On July 30, 2020, DHEC approved the report and requested a Phase II RI Work Plan be submitted by September 15, 2020.

In summary, the Phase I assessment data document the following:

- Groundwater, surface water and sediment data indicate that there are no COPCs migrating off the site, and the documented impacts pose no potentially significant threat to plant workers, the general public or the environment.
- A survey of water supply wells in the area identified the closest water supply well to be over 1 mile downgradient of the known areas impacted by COPCs. Analysis of groundwater samples from four private water supply wells, including the closest downgradient well, identified no COPCs related to CFFF manufacturing operations. These findings reinforce that there is no potential for COPCs from CFFF to impact private water supply wells.
- There is no active source of Technetium-99 (Tc-99) impacts from current operations.
- In general, the vertical and horizontal extent of COPCs has been further defined and shows that the groundwater plume sizes and locations are similar to those previously identified.
- Conditions within the floodplain are conducive to natural degradation and attenuation of the CVOC plume which will limit the plume's size.
- Sediment impacted by COPCs is limited and well defined horizontally.
- An improved understanding of site geology and hydrogeology has been developed, particularly with respect to the floodplain and how shallow groundwater interacts with surface water and sediment. The Conceptual Site Model (CSM) has been enhanced by the newly acquired data, making it a more effective decision-making tool.

To address high priority, targeted issues more quickly, CFFF also has conducted other focused data collection under the RI including:

- Addendum I to remove materials and intermodal ("sealand") containers, investigate soil underneath and assure residential screening levels are met.
- Addendum II to assess East Lagoon sludge characteristics and facilitate preparation of the *East Lagoon Closure Plan* which is currently under DHEC review.
- An overall Tc-99 source investigation concluding that the impacts are historic and not the result of current operations.

In the past 2 years, Westinghouse has also undertaken numerous risk reduction improvements including:

- eliminated a nickel plating operation,
- eliminated the use of tetrachloroethylene (PCE),
- re-designed the HF Spiking Station,
- installed a sentinel groundwater monitoring well network in the Chemical Area OU, and
- significantly reduced stored waste via offsite disposal.

In addition to the assessment activities performed by CFFF, DHEC conducted an assessment of potential CFFF impacts to fish in the Congaree River. DHEC's *Uranium and Fluoride in Fish from the Congaree River Technical Report No. 007-2020* dated May 2020 concluded:

> "Overall, within the context of the point in time of sample collection, target species and analytical "methods, no signal for uranium from the Westinghouse Nuclear Fuels (WNF) facility was discerned. A slight, apparent signal for fluoride was observed from the WNF facility but it was not overall statistically significant from the other locations. The target species, as indicated by the noted limitations, were indicated to be healthy from an ecological viewpoint and safe for human consumption from a public health protection viewpoint."

This RI Phase II Work Plan has been developed to collect additional focused data. The additional data will further define the source, location and extent of specific COPCs.

1.1 Site Location and Physical Setting

Figures 1 through 3 illustrate the site features discussed below. The primary plant building is located approximately 2,700 feet southwest of Bluff Road on the northern portion of the property. The wastewater treatment plant (WWTP) is located near the southwest corner of the plant building. Treated wastewater is piped to the Congaree River where it is discharged under National Pollution Discharge Elimination System (NPDES) permit SC0001848 from a diffuser located along the bottom of the river at a location approximately 3 miles south of the developed portion of the property.

The SCRDI Bluff Road site (formerly known as South Carolina Recycling and Disposal, Inc.) is located across Bluff Road from the northern property boundary. According to information on the internet (Justia US Law – law.justia.com), hazardous waste storage began on this property in late-1973 or early-1974, and operations ceased in 1982. This property was placed on the United States Environmental Protection Agency's (EPA) Superfund program's National Priority List (NPL) in 1983. Releases at SCRDI are not known to have impacted CFFF.

A site wide topographic map using elevation contour data from the Richland County GIS website (https://www.richlandmaps.com/apps/dataviewer/) is included in **Appendix A**. The developed area of the property is approximately 130-140 feet above mean sea level (MSL). Elevations drop to approximately 110 feet above MSL immediately south of the plant/WWTP area, on the Congaree River floodplain and Mill Creek, a tributary of the

Congaree River. The change in elevation occurs abruptly along a bluff that defines the southern edge of the developed portion of the property.

The Gator Pond is a manmade pond constructed prior to CFFF's development of the site. It is located approximately 500 feet southwest of the WWTP within a step-down area of the bluff (**Figures 2 and 3**). The pond is fed by groundwater and does not have a constructed spillway. Water discharges from the pond through groundwater seepage or overland flow during periods of high precipitation.

Upper and Lower Sunset Lakes are located west and south of the pond and approximately 900 feet southwest of the WWTP (**Figures 2 and 3**). Sunset Lakes are located within a natural oxbow of Mill Creek. A manmade dam approximately 1,700 feet south of the WWTP backs up water in Mill Creek, creating Lower Sunset Lake. A second manmade dam cuts across Mill Creek approximately 1,000 feet southwest of the WWTP, creating Upper Sunset Lake.

The southern portion of the property, including the Gator Pond, Mill Creek, and Sunset Lakes are located within the floodplain of the Congaree River. Surface drainage at the site flows into several drainage ditches across the property and surrounding areas. These ditches merge and flow into Upper Sunset Lake.

1.2 Site Operational Background

The main manufacturing activity is the fabrication of low-enriched uranium (U) fuel assemblies and components for the nuclear power industry. The manufacturing process generates multiple wastewater streams which are treated by various physical/chemical/biological processes including in WWTP lagoons prior to discharge to the Congaree River under a NPDES permit issued by DHEC.

Releases of COPCs have occurred from the wastewater treatment system and manufacturing operations. CFFF has assessed known releases and installed an extensive groundwater monitoring network beginning in the early 1980s. Assessment activities have determined that releases have impacted soil and groundwater in locations largely confined to the immediate plant area. Various remediation efforts have been undertaken in response to the identified releases. No offsite impacts are known to have occurred.

1.3 Facility Operational Units

The facility has been divided into eight operational units (OU) illustrated on **Figure 4** in recognition of the different types of site activities and potential sources of impact. The OUs are identified as the Northern Storage Area, Mechanical Area of the plant building, Chemical Area of the plant building, West Lagoons Area, Wastewater Treatment Area, Sanitary Lagoon Area, Southern Storage Area and Western Storage Area. One area of concern (AOC), the "Western Groundwater AOC," has also been identified. These OUs and the AOC are described in detail in the *Final Remedial Investigation Work Plan* dated June 2019 (AECOM, 2019).

1.4 Geology and Hydrogeology

The CFFF is located in the Upper Coastal Plain physiographic province. The CFFF is underlain by three hydrogeologic units: the surficial aquifer, Black Mingo aquifer, and Middendorf aquifer.

Groundwater in the surficial aquifer occurs under unconfined (water table) conditions and generally flows from areas of higher topography in the vicinity of the plant building towards areas of lower topography in the floodplain of the Congaree River along Mill Creek. Previously, the water table aquifer above the bluff and the water table aquifer below the bluff were described as the two separate aquifers: the surficial aquifer and the floodplain aquifer. Although the river terrace sediment above and below the bluff were deposited during different time periods, the deposits are of similar lithology and have been found to be connected based on data collected during Phase I of the RI. Since groundwater flows continuously from above the bluff into the floodplain in a single surficial aquifer, groundwater above the Black Mingo confining clay will be referred to as the surficial aquifer henceforth.

Surficial aquifer sediments generally occur to a depth of 30 to 40 feet below land surface (BLS), both above and below the bluff, and consist of clay, silt or silty sand at the surface coarsening downward to coarse sand and gravel on top of the Black Mingo confining clay. Silt and clay lenses occur at varying depths with the coarsening downward sands of the surficial aquifer. One notable surficial aquifer total thickness anomaly was discovered during Phase I of

the RI near the location of monitoring well W-95 (**Figure 3**) where there is over 80 feet of sediment above the Black Mingo confining clay.

Groundwater monitoring wells were installed at differing depths to assess COPC migration within the surficial aquifer. Monitoring wells installed near the top of the surficial aquifer are designated as surficial aquifer upper zone monitoring wells, whereas wells installed on top of or within 5 feet of the Black Mingo confining clay are designated as surficial aquifer lower zone monitoring wells. One exception of the criteria above is well W-95. Monitoring well W-95 is designated as a surficial aquifer lower zone monitoring well because chlorinated volatile organic compounds (CVOCs) migrating within the lower zone of the surficial aquifer are found in it and the Black Mingo Formation is anomalously deep at this location. W-95 and its relationship to other wells and aquifers is illustrated by cross section J-J' included in **Appendix B**.

There is a dynamic relationship between surface water in the ditches that transect the site above the bluff and groundwater in the upper zone of the surficial aquifer. The ditches continually or intermittently receive discharge of groundwater from the upper surficial aquifer depending on the elevation of the water table. The northern portions of the ditches are above the elevation of the seasonal high water table and thus the ditches at these locations are often dry. Runoff from precipitation that enters the dry portions of the ditches may infiltrate the water table, temporarily recharging the surficial aquifer. The southern portions of the ditches where the ditches are deeply incised may intermittently be above or below the water table, depending upon the extent of incisement and seasonal variations in the elevation of the water table. Middle portions of the ditches may recharge the shallow aquifer during low water table conditions and may receive groundwater discharge during high water table conditions.

The predominant direction of groundwater flow in the surficial aquifer is to the southwest with components of flow to the south and southeast. Discharge of groundwater to the deeply incised portions of the ditches appears to influence groundwater flow and COPC migration within the upper zone of the surficial aquifer. The Gator Pond also appears to influence COPC migration as evidenced by COPC impacts in surficial aquifer groundwater migrating in a more easterly or westerly direction in the vicinity of the Gator Pond. A topographic map of the deeply incised area of the ditches using elevation contour data from the Richland County GIS website is included in **Appendix A**.

The surficial aquifer is underlain by a confining unit composed of dry silt/clay and brittle shale of the upper Black Mingo Formation. Previous geologic cross sections (AECOM, 2013) and Phase I of the RI indicate that the Black Mingo confining clay ranges in thickness from 39 to 83 feet. Beneath the clay confining unit is an artesian sand aquifer within the lower Black Mingo Formation known as the Black Mingo aquifer. Groundwater flow in the Black Mingo aquifer is inferred to the southwest based upon groundwater elevations from the four monitoring wells that are screened within this aquifer.

The Middendorf Formation occurs below the Black Mingo Formation. Sediments of the Middendorf Formation generally consist of multi-colored clay interbedded with fine to coarse grained sand. Subsurface investigations at CFFF have not extended into the Middendorf aquifer since there is no potential that it has been impacted. The Middendorf aquifer is unconformably underlain by bedrock.

Previous hydraulic characterization by AECOM Technical Services, Inc. (AECOM) and Rust Environment and Infrastructure (Rust), estimated the average linear flow velocity in the surficial aquifer to be 0.42 feet per day or 153 feet per year. The potential for flow between the surficial aquifer and the Black Mingo aquifer was previously assessed to be downward at vertical hydraulic gradients ranging between 0.04 and 0.1 feet per foot (Rust, 1995 and AECOM, 2013). However, low moisture content and vertical hydraulic conductivities of less than 10^{-7} centimeters per second (S&ME, 1982) throughout the 39 to 83 foot thickness of the Black Mingo confining clay preclude migration of groundwater between the surficial aquifer and the Black Mingo aquifer which in turn precludes potential migration to the Middendorf Aquifer.

1.5 Remedial Investigation Objective

Evaluation of the Phase I RI data identified limited areas requiring additional assessment to further develop the conceptual site model (CSM). The objective of this Phase II Work Plan is to complete this comprehensive assessment to the extent practical. Field conditions and investigation results will be shared with DHEC in real-time to enable evaluation of the next steps to be taken in response to the data, e.g., development of additional work scopes, identification of contingencies or alternative actions due to changes in field conditions, etc.

1.6 Work Plan Organization

This Phase II RI Work Plan is organized in the following sections:

- Section 2 – Conceptual Site Model
- Section 3 – Phase II Assessment Activities
- Section 4 – Data Management
- Section 5 – Reporting
- Section 6 – Assessment Stages and Project Schedule
- Section 7 – References

2. Conceptual Site Model

A CSM has been developed for the CFFF that depicts the current understanding of site hydrogeology, known COPC sources, and potential pathways of COPC releases. The CSM uses existing environmental data as well as other readily available information such as topographic data, underground utility locations and depths, and information regarding leaks and spills. The purpose of the CSM is to graphically illustrate site surface and subsurface conditions to facilitate understanding of COPC origin (source[s]), fate, and transport. The CSM also facilitates identification of data needs. The CSM is updated as additional data are gathered, thereby serving as a living document.

Geologic and COPC data collected during Phase I of the RI were incorporated into the current CSM. A copy of the CSM output, known as Rev 1a, is included in **Appendix B**.

3. Phase II Assessment Activities

The following sections discuss the scope of work for Phase II of the RI. **Table 1** summarizes the scope of work by sample media type, proposed analytes, and rationale for the proposed activity. Unless otherwise specified, procedures for these activities are documented in the *Final Remedial Investigation Work Plan* (AECOM, 2019). Based upon multi-media analytical results from previous assessments, CFFF proposes the following revisions to the analytes for Phase II of the RI:

- Removal of semi-volatile organic compounds (SVOCs) analysis – SVOCs are not a COPC at CFFF and groundwater from the monitoring well network did not exceed MCLs for any SVOC during Phase I of the RI or previous groundwater sampling campaigns.
- Removal of Target Analyte List (TAL) metals – TAL metals are not a COPC at CFFF and, except for antimony, groundwater from the monitoring well network did not exceed MCLs for TAL metals during Phase I of the RI or previous groundwater sampling campaigns. Antimony, a naturally occurring metal, has a low MCL compared to other metals and the occurrence of antimony above its MCL in groundwater at CFFF does not appear to be associated with plant operations.
- Revision of U analyses – Currently isotopic U is speciated by two methods: isotopic U by United States Department of Energy (DOE) Environmental Measurements Laboratory Health and Safety Laboratory (EML HASL)-300 (U-02-RC Modified) via alpha spectroscopy and by EPA Method 200.8/200.2 via inductively coupled plasma mass spectrometry (ICP-MS). Alpha spectroscopy results are reported in picocuries (pCi) per unit (e.g., pCi/gram) whereas ICP-MS results are reported in micrograms per unit (e.g., µg/liter). CFFF proposes to analyze soil and sediment samples by alpha spectroscopy for comparison to CFFF's site-specific remediation action level (RAL) and groundwater by ICP-MS for comparison to U's MCL.

Note that with DHEC's approval additional assessment activities may be performed in response to field conditions and real-time investigation results. DHEC approval will be obtained on a case-by-case basis prior to performing any additional assessment, and the activity or activities will be documented as determined necessary by DHEC, e.g., separate work plan, addendum, monthly report, etc.

As with any subsurface investigation, there is a possibility that previously unrecorded cultural resources or human remains may be discovered. CFFF developed a procedure to manage the discovery of previously unrecorded cultural resources or human remains. This procedure is included in **Appendix C**. The only presently known cultural resource on the site is Denley Cemetery. The location of Denley Cemetery is shown on **Figures 2-12**.

3.1 Soil Gas Survey

Primary Area

Historical activities on the CFFF property have resulted in the release of CVOCs. The distribution of CVOCs in groundwater suggests a general area where a release(s) may have occurred. However, the data do not indicate what residual impact, if any, remains within unsaturated subsurface soils and if the residual impact may continue to be a potential source of CVOCs to groundwater. Based upon groundwater analytical results from the monitoring well network at the CFFF site, a passive soil gas survey (SGS) will be performed in the primary area shown on **Figure 5**.

SGS uses absorbent sampling devices that are placed into the subsurface in areas where vapors from residual impact may exist. Field personnel will advance approximately 1-inch diameter boreholes using a rotary hammer drill or similar boring device to a depth of approximately 3 feet BLS at the approximate locations identified on **Figure 5**. Soil gas samples will be collected from approximately 25 locations within the primary soil gas survey area using SGS devices spaced on a 75-foot offset grid.

Field personnel will follow USEPA Region 4 Soil Vapor Sampling Procedure (SESDPROC-307-R3) when collecting soil vapor samples (USEPA, 2014). An SGS device provided by Beacon Environmental Services, Inc. (Beacon) will be placed in each borehole with a cork or other device implanted at land surface to seal each borehole. The SGS devices will be left in place for approximately 2 weeks. Field personnel will then retrieve the SGS devices and submit them to Beacon for analysis.

The result of the SGS will be shown in the form of a "heat map" which indicates areas where vapor concentrations are higher or lower as well as the relative CVOC concentration at each location. If the initial SGS results identify a potential source(s), more closely spaced SGS sampling devices will be deployed in the potential source area(s) to focus on the area where soil samples will be collected for laboratory analysis to assess the residual impact.

Secondary Area

Groundwater screening described in **Section 3.3.1** will be conducted east of the Western Groundwater AOC to assess if there is an undocumented preferential groundwater flow pathway from the developed area of the facility to this AOC. If the groundwater screening indicates that CVOCs in groundwater within the AOC do not originate from the main plant area, this finding would indicate there is a separate source of CVOCs in the AOC. To further assess this source (if indicated to be necessary), a secondary SGS area is shown on **Figure 5** in the Western Groundwater AOC. This area would be assessed using the same techniques described above.

3.2 Soil Sampling

CVOC Source Assessment

After receipt of the initial and any subsequent SGS results, CFFF will meet with DHEC to discuss appropriate soil sampling locations, if determined to be necessary. The soil borings will be advanced using direct push technology (DPT) or hand auger if underground utilities do not allow safe use of mechanical equipment. At each DPT location, continuous soil cores will be collected in approximately 4-foot intervals using either a dual-tube, discrete interval soil sampler, or other closed sampling system to the approximate depth of the seasonal high water table in each area, 8 feet in the primary SGS area and 17 feet in the secondary SGS area, respectively. The soil cores will be collected in acetate sleeves placed within the core barrels. Soil lithology will be described and logged by a geologist.

Soil will be composited from each 1-foot interval and placed into a ziploc bag for field screening. Organic vapors will be measured by inserting the probe tip of the organic vapor analyzer photoionization device (OVA PID) into the bag and measuring the vapor concentration in the headspace. The OVA PID results will be recorded on the geologist logs. Soil samples will be collected for laboratory analysis for CVOCs using EPA Method 8260B from the interval containing the highest OVA PID reading and from the deepest interval. Should OVA PID readings remain similar throughout the boring, only the sample from the deepest interval will be analyzed. Each borehole will be abandoned by filling with bentonite chips or grouting with Portland cement.

Technetium-99 Source Assessment

Although there are no historical records of the East Lagoon or the Sanitary Lagoon having overtopped, two soil borings will be installed to assess these areas. One soil boring will be installed along the southern edge of the East Lagoon and one soil boring will be installed along the southern edge of the Sanitary Lagoon using a hand auger or DPT. Composite soil samples will be collected from these borings at depths of 0-0.5 feet BLS, 0.5-1 foot BLS, and 1-2 feet BLS. Soil samples from these borings will be analyzed for Tc-99 using analytical method DOE EML HASL-300 (Tc-02-RC Modified).

Surface Soil Properties

The Nuclear Regulatory Commission has recently requested soil property data on the surface and shallow subsurface (up to 5 feet BLS) soils in the developed site area, undeveloped area above the bluff, and the floodplain. Soil samples will be collected at a total of six to eight locations within these areas. The samples will be submitted to a laboratory for grain size analyses with hydrometer to assess the percentage of sand, silt, and clay within each sample.

3.3 Groundwater Screening

Additional data is needed in some areas to further delineate the CVOC, nitrate, fluoride and Tc-99 plumes. No additional assessment is needed for the well-defined U impacts close to the manufacturing building. CFFF proposes to obtain groundwater screening samples using a DPT and/or sonic drill rig in order to optimize specific locations for monitoring wells to be installed. Subsurface utilities will be located prior to conducting groundwater screening or monitoring well installation as described in the *Final Remedial Investigation Work Plan* dated June 2019 (AECOM, 2019).

COPCs in groundwater preferentially migrate within the sand unit(s) in the surficial aquifer. Prior to collection of groundwater samples, a continuous core will be drilled from the surface to the top of the Black Mingo confining clay to assess the thickness of the sand layer(s) at each boring location. For borings intended to assess CVOCs, subsurface soils will be screened with an OVA PID approximately every 2-3 feet for the presence of organic vapors that may be indicative of CVOCs.

Based upon the thickness of the sand(s) and OVA PID readings, field personnel will determine the number of groundwater samples to collect from each location. DPT groundwater sample tooling will consist of a 2-inch outside diameter stainless steel drive rod with a 4-foot long, 1¼ inch diameter inner retractable screen. Once the sampling device is driven to its desired depth, the outer drive casing will be retracted, exposing the inner screen. In instances where a rotosonic drill rig must be used for sampling (instead of DPT), a boring will be advanced to a specific target depth, after which a 2-inch diameter, 5-foot long, stainless steel well point sampler with an inflatable packer assembly will be lowered through the outer casing and advanced into the undisturbed subsurface to the desired screen interval.

Groundwater screening samples will be collected after parameters stabilize per the criteria specified in the *Final Remedial Investigation Work Plan* dated June 2019 (AECOM, 2019) to ensure that the samples are representative of groundwater quality. In many cases, multiple COPCs will be analyzed from each groundwater screening interval.

3.3.1 CVOCs

Surficial Aquifer – Upper Zone Downgradient of Monitoring Well W-41R

Groundwater discharge into the deeply incised portion of the eastern ditch directly affects CVOC migration in the upper zone of the surficial aquifer. To further understand the effect of groundwater discharge to the ditch on COPC

migration, CFFF proposes to install one permanent surficial aquifer – upper zone monitoring well (W-98) near but outside of the southern edge of Denley Cemetery (**Figure 6**). Denley Cemetery abuts the bluff, and this well will be the furthest downgradient monitoring well location outside of the floodplain. Westinghouse completed restoration of Denley Cemetery in 2007, and no investigation will be conducted within the fenced area.

Surficial Aquifer – Upper Zone East of Monitoring Well W-67

The existing data indicates a preference for COPCs in groundwater to flow around the Gator Pond in a nearly easterly-westerly direction. Surface water head within the Gator Pond, the thickness of low permeability layers along the southern side of the Gator Pond, or a combination of these factors may explain the preferential flow directions. Currently, the extent of CVOC impact east of monitoring well W-67 has not been fully defined. Monitoring well W-67 is screened in the upper zone of the surficial aquifer. Previous assessment in this area indicates that CVOC impact is limited to the upper zone. One boring (L-20, **Figure 6**) screening the upper zone of the surficial aquifer is proposed to be installed east of W-67 on a gently sloping portion of the bluff. Should groundwater from this boring contain COPCs above their respective maximum contaminant level (MCL), an additional, step out boring will be installed east of boring L-20.

Western Groundwater AOC

No records have been identified of historical activities in the Western Groundwater AOC involving CVOCs. Therefore, CFFF proposes to install four groundwater screening borings (L-25 through L-28, **Figures 6 and 7**) running generally north-south between the plant and the Western Groundwater AOC to assess if there could be a preferential groundwater flow path from the plant area to the Western Groundwater AOC. If no preferential path is identified, an SGS as described in **Section 3.1** will be conducted in an effort to identify the source of CVOCs.

Surficial Aquifer – Upgradient of Monitoring Wells W-65, W-66 and W-87

The upgradient extent of the CVOCs next to the plant building is not fully defined because groundwater in monitoring well pair W-65/W-66 and monitoring well W-87 contain concentrations of CVOCs above their MCLs. CFFF proposes to install four groundwater screening borings (L-21 though L-24, **Figures 6 and 7**) upgradient of these monitoring well locations to assess the upgradient extent of CVOCs.

Surficial Aquifer – Lower Zone Sidegradient of Monitoring Wells W-6 and W-93

Groundwater in surficial aquifer - lower zone monitoring wells W-6 and W-93 contained CVOCs above their MCLs. There are no surficial aquifer – lower zone monitoring wells east (sidegradient) of these two wells. CFFF proposes to install three groundwater screening borings (L-39 though L-41, **Figure 7**) to assess the extent of CVOC in the lower zone of the surficial aquifer east of monitoring wells W-6 and W-93. Boring L-39 will be installed adjacent to monitoring well W-13R, boring L-41 will be installed adjacent to monitoring well W-83, and boring L-40 will be installed roughly equidistant between borings L-39 and L-41.

Surficial Aquifer – Lower Zone Downgradient of Monitoring Well W-48

Surficial aquifer – lower zone monitoring well W-48 is located approximately 150 feet north of a steep portion of the bluff and contains CVOC above MCL(s). Better understanding the migration of COPCs from the developed portion of the site into the floodplain is one of the goals of this phase of work. Therefore, CFFF proposes to install three groundwater screening borings (L-36 through L-38, **Figures 6 and 7**), and to a lesser extent groundwater screening boring L-35, to assess the downgradient extent of the primary CVOC plume.

Tetrachloroethylene (PCE) can naturally breakdown to trichloroethylene (TCE), then to 1,1-Dichloroethene (DCE) or one of DCE's isomers (trans-1,2-DCE or cis-1,2-DCE), and then to vinyl chloride. After vinyl chloride, it further degrades to harmless daughter products beginning with ethene followed by ethane, and finally to carbon dioxide. This process is known as reductive dechlorination. Data gathered during Phase I of the RI indicate that CVOCs are naturally reductively dechlorinating during their migration within the surficial aquifer in the floodplain.

The Upper Sunset Dike provides a unique opportunity to safely assess groundwater quality and the rate of reductive dechlorination as groundwater migrates beneath these lakes. Lithologic borings L-3 and L-4 were drilled on the Upper Sunset Dike during Phase I of the RI. Based upon geologic data collected from borings L-3 and L-4, the surficial aquifer sand layer beneath the dike extends from approximately 17 feet to 30 feet BLS. Two borings (L-37 and L-38,

Figures 6 and 7) are proposed for Phase II to collect groundwater samples beneath the Upper Sunset Lake Dike. Based upon the lithologic data collected during Phase I, CFFF proposes to collect groundwater samples from borings L-37 and L-38 at the 17-21 feet and the 26-30 feet intervals.

Surficial Aquifer – Downgradient of Monitoring Well W-68

Surficial aquifer – lower zone monitoring well W-68 is located within the floodplain north of Upper Sunset Lake. CVOCs associated with the Western Groundwater AOC have impacted groundwater in monitoring well W-68. As described above, groundwater on the southern side of Upper Sunset Lake contained daughter products of the natural breakdown of PCE in monitoring wells W-94 and W-95. Monitoring well W-95 is also the location of a geologically anomalous incisement into the Black Mingo confining clay. To further understand the natural breakdown of CVOCs and the extent of the geologic anomaly, CFFF proposes to install seven groundwater screening borings (L-29 through L-35, **Figures 6 and 7**).

Surficial Aquifer – Lower Zone Upgradient of Monitoring Well W-93

Groundwater in surficial aquifer - lower zone monitoring well W-93 contained CVOCs above their MCLs. There are no surficial aquifer – lower zone monitoring wells directly upgradient of well W-93 because of this well's proximity to nearby structures, above-ground and below-ground utilities, and the plant building. The closest available upgradient location is along the west side of the plant building. Therefore, CFFF proposes to install one groundwater screening boring (L-44, **Figure 7**) to assess the extent of CVOC in the lower zone of the surficial aquifer upgradient of monitoring well W-93. Boring L-44 will be installed adjacent to monitoring well W-53 or W-54, depending on the presence of underground utilities. This location is roughly equidistant between existing wells W-RW1 and W-74.

Sanitary Lagoon

CFFF proposes to install a surficial well pair consisting of an upper zone well (W-99, **Figure 6**) and a lower zone well (W-100, **Figure 7**) west of the Sanitary Lagoon to obtain additional groundwater quality data downgradient of the sanitary lagoon.

3.3.2 Nitrate

Surficial Aquifer – Upper Zone Downgradient of Monitoring Well W-41R

As discussed previously, groundwater flow in the upper zone of the surficial aquifer appears to be influenced by discharge to the deeply incised portions of the stormwater ditches. Groundwater in monitoring well W-41R contains nitrate above its MCL. Monitoring well W-98 (**Figure 8**) is proposed to be installed downgradient of monitoring well W-41R in a location that is adjacent to the top of the bluff near but outside the southern edge of Denley Cemetery.

Surficial Aquifer – Upper Zone East of Monitoring Well W-67

Groundwater in monitoring well W-67 contained nitrate above its MCL. As outlined in **Section 3.3.1**, groundwater will be collected from the upper zone of the surficial aquifer in screening boring L-20 (**Figure 8**). This boring is proposed to be installed east of monitoring well W-67 with the possibility of an additional, step out boring east of L-20 should groundwater from boring L-20 contain COPCs above their MCL(s). CFFF proposes to also analyze the groundwater from this screening boring(s) for nitrate.

Surficial Aquifer – Downgradient of Monitoring Wells W-47 and W-64

Groundwater in monitoring well pair W-47/W-64 contains nitrate in excess of its MCL. This well pair is located adjacent to the northern edge of the bluff. CFFF proposes to install four groundwater screening borings (L-35 though L-38, **Figure 8**) in the floodplain to assess nitrate migration downgradient of this well pair.

3.3.3 Fluoride

Surficial Aquifer – Downgradient of Monitoring Well W-47

Groundwater in monitoring well pair W-47 contained fluoride in excess of its MCL. This well is located adjacent to the northern edge of the bluff. CFFF proposes four groundwater screening borings (L-35 though L-38, **Figure 9**) to assess fluoride migration downgradient into the floodplain.

Surficial Aquifer – Downgradient of RI Phase I Boring L-19

Groundwater screening during Phase I of the RI identified fluoride above its MCL in boring L-19. The groundwater screening boring was in the floodplain near the bend of the dewatering ditch where this ditch makes an abrupt turn to the southwest towards Lower Sunset Lake. CFFF proposes to install one groundwater screening boring (L-42, **Figure 9**) downgradient of the location of boring L-19, approximately 100 feet upgradient of Lower Sunset Lake, to assess COPCs migration towards the lake in this area.

3.3.4 Technetium-99

Because groundwater screening samples are collected from temporary wells that are unable to be properly developed, turbidity levels may be higher than typically acceptable in groundwater samples. Metals such as Tc-99 can adsorb to clay particles in soil and then desorb into groundwater samples that are preserved with acid per EPA protocols. Therefore, CFFF proposes to collect unfiltered groundwater samples (Total Tc-99) and field-filtered groundwater samples (Dissolved Tc-99) during the groundwater screening of Tc-99 described below.

Surficial Aquifer – Lower Zone Adjacent to Monitoring Well W-11

After submittal of the *Interim Remedial Investigation Data Summary Report* in February 2020 (AECOM, 2020), an analysis of both the depth to the top of the Black Mingo confining clay and the total well depths determined that monitoring well W-11 is a surficial aquifer - upper zone well, not a lower zone well as previously indicated. However, this well is still screened deeper than its paired well, W-32. Generally, Tc-99 concentrations increase with depth within the surficial aquifer. The top of the Black Mingo Clay is approximately 9 feet below the bottom of the screen of monitoring well W-11. CFFF proposes installing monitoring well W-101 (**Figure 10**) on top of the Black Mingo confining clay adjacent to W-11 to further define the vertical distribution of Tc-99.

Surficial Aquifer – Lower Zone Sidegradient of Monitoring Wells W-6 and W-11

Currently, there are no surficial aquifer – lower zone monitoring wells installed east of monitoring wells W-6 and W-11. Concentrations of Tc-99 in groundwater in monitoring wells W-6 and W-11 exceed its MCL. CFFF proposes to install three groundwater screening borings (L-39 though L-41, **Figure 10**) to assess the extent of Tc-99 in the lower zone of the surficial aquifer east of monitoring wells W-6 and W-11. Boring L-39 will be installed adjacent to monitoring well W-13R, boring L-41 will be installed adjacent to monitoring well W-83, and boring L-40 will be installed roughly equidistant between borings L-39 and L-41.

Surficial Aquifer – Lower Zone Near Monitoring Well W-30

The extent of Tc-99 in the upgradient direction is currently defined by monitoring well W-93, located approximately 300 feet upgradient of monitoring well W-11. Groundwater data suggests that the historic source of Tc-99 may be located within the Wastewater Treatment OU (**Figure 4**). To further define the upgradient extent of Tc-99, CFFF proposes to install one groundwater screening boring (L-43, **Figure 10**) in the vicinity of monitoring well W-30 to screen the lower zone of the surficial aquifer.

Surficial Aquifer – Downgradient of Monitoring Wells W-47 and W-64

Groundwater in monitoring well pair W-47 and W-64 contained concentrations of Tc-99 below its MCL. This well pair is located adjacent to the northern edge of the bluff. Although the concentrations of Tc-99 in monitoring wells W-47 and W-64 did not exceed its MCL, CFFF desires to better understand the migration of COPCs in groundwater as the COPCs migrate into the floodplain. Therefore, CFFF proposes four groundwater screening borings (L-35 though L-38, **Figure 10**) to assess Tc-99 migration downgradient into the floodplain.

Surficial Aquifer – Downgradient of Monitoring Well W-4

Groundwater in monitoring well W-4 contained a concentration of Tc-99 below its MCL. This well is located adjacent to the Gator Pond and near the northern edge of the secondary bluff. Although the concentration of Tc-99 in monitoring well W-4 did not exceed its MCL, CFFF desires to better understand the migration of COPCs in groundwater at the site, particularly as they migrate into the floodplain. Therefore, CFFF proposes one groundwater screening boring (L-42, **Figure 10**) to assess Tc-99 migration downgradient into the floodplain.

Surficial Aquifer – Upper Zone East of Monitoring Well W-67

Groundwater in monitoring well W-67 contained a concentration of Tc-99 below its MCL. CFFF proposes to collect groundwater from the upper zone of the surficial aquifer in screening boring L-20 (**Figure 10**). This boring is proposed to be installed east of monitoring well W-67 with the possibility of an additional, step out boring east of L-20 should groundwater from boring L-20 contain COPCs above their MCL(s).

3.4 Monitoring Well Installation and Development

After receipt of the groundwater screening data, CFFF will meet with DHEC to propose permanent well locations. Permanent monitoring wells will be installed and developed as described in the *Final Remedial Investigation Work Plan* dated June 2019 (AECOM, 2019).

Monitoring well W-4 has been dry or had anomalous groundwater elevations during recent groundwater sampling campaigns. Due to the proximity of this monitoring well to the Gator Pond, this well should not be dry if the groundwater in this well is hydraulically connected to the Gator Pond. Therefore, CFFF proposes to redevelop this well during the development of the newly installed wells. Furthermore, the screened interval of this well will be evaluated since the boring log has not been located.

3.5 Sediment Sampling

CFFF proposes to use a multistage sediment sampler or similar device to obtain vertical sediment samples from multiple intervals. A multistage sediment sampler is similar to a direct push Macro-Core® sampler and consists of a 2-foot long stainless-steel tube with an acetate liner. Use of the multistage sampler will ensure that the sediment samples are collected from the desired depth in areas of standing water where visibility of the borehole is obstructed or unable to be seen.

The multistage sediment sampler is typically attached to a slide hammer that is used to drive it into the sediment. Sediment samples from the core will be collected at 6-inch intervals (i.e. 0-6 inch, 6-12 inch) with a minimum of 1 foot of sediment core being collected. Should more than 1 foot of sediment be recovered at a particular location, the sediment from the deeper interval(s) will also be analyzed.

Sediment – Middle Ditch, Gator Pond, Upper Sunset Lake and Lower Sunset Lake

During Phase I of the RI, 59 sediment samples were collected. COPCs were documented in sediment in the Middle Ditch, Gator Pond, Upper Sunset Lake and Lower Sunset Lake and sludge from the Sanitary Lagoon and the East Lagoon.

The sediment samples from Phase I of the RI in the locations listed above were collected from the top 6 inches. Sediment samples in Phase II of the RI will either laterally expand on the area of sediment assessment of Phase I or will further assess the vertical distribution of COPCs at previous sediment sample locations. Proposed sediment sample locations are shown on **Figure 11**.

Middle Ditch

Surficial sediment from sample location SED-16 in the Middle Ditch contained U above the residential use screening level (RUSL). This location is near the intersection with the Eastern Ditch. Sediment samples upstream and downstream of the confluence of the ditches did not contain U above the RUSL. To understand the extent of U above the RUSL in this portion of the Middle Ditch, sediment from one location upstream (SED-60, **Figure 11**) and one location downstream (SED-61, **Figure 11**) within the Middle Ditch and at the original SED-16 (**Figure 11)** location will be collected to assess the vertical and horizontal U impact.

Gator Pond

Surficial sediment within the Gator Pond contained Tc-99 at concentrations above the RUSL as well as detections of other COPCs in the two sediment samples collected from this surface water body during Phase I of the RI. To assess the vertical and horizontal extent of impact of COPCs on sediment quality in this surface water body, CFFF proposes to collect sediment samples from six locations: the two original sediment sample locations (SED-23 and SED-24, **Figure 11**) and four additional locations (SED-62 through SED-65, **Figure 11**).

Upper Sunset Lake and Lower Sunset Lake

Surficial sediment from four of the 17 sediment samples within Upper and Lower Sunset Lakes contained U concentrations above the RUSL during Phase I of the RI. To further assess the vertical and horizontal extent of impact of COPCs on sediment quality in this surface water body, CFFF proposes to collect sediment samples from the 17 original sediment sample locations (SED-19 through SED-22 and SED-38 through SED-50, **Figure 11**) including at greater depths.

Sediment – Background U Upstream of the Entrance Dike in Mill Creek

Further assessment of background U in sediment upstream of the Entrance Dike in Mill Creek will be collected to supplement the Phase I data. Due to the low permeability of surficial soils, some or most of the precipitation that falls on the property, along Bluff Road, and north of Bluff Road flows via overland flow into the stormwater ditch system which empties into Upper Sunset Lake. Much of the flow of Mill Creek is diverted away from Sunset Lakes via the man-made canal along the southern property boundary. Given these factors, surface water and suspended sediment in Upper Sunset Lake could flow “upstream” during heavy precipitation events when there is little flow through the Entrance Dike into Upper Sunset Lake.

To address this potential scenario, CFFF proposes to collect sediment from one transect located approximately 500 feet upstream of the diversion canal. This portion of Mill Creek is within the CFFF property boundary where water in Mill Creek has not been diverted and would not be subject to possible backflow. Sediment samples at three locations (SED-57 through SED-59, **Figure 11**) will be collected along this transect.

3.6 Sludge Characterization

Sludge samples from the Sanitary Lagoon and the East Lagoon were collected during Phase I of the RI. Additional assessment of sludge from the East Lagoon was completed to support lagoon closure in 2021.

Sludge – Sanitary Lagoon

Assessment of the Sanitary Lagoon sludge will be conducted under a separate work plan. CFFF intends to remove the sludge from this lagoon and either line the lagoon or remove this lagoon from service. A comprehensive sampling plan similar to the sludge characterization plan for the East Lagoon will be developed by CFFF for the Sanitary Lagoon and will be submitted to DHEC’s Bureau of Land and Waste Management and Bureau of Water for approval. The plan will outline a process for collecting samples to accurately characterize the sludge accumulated in the lagoon. A Sludge Characterization Report will be submitted to DHEC under separate cover following completion of the characterization.

3.7 Using Staff Gauges and Pressure Transducers to Better Understand Surface Water and Groundwater Interaction

Gator Pond

As described in **Section 3.3.1**, the Gator Pond appears to influence COPC migration in groundwater in the vicinity of the pond. To better understand whether this influence is the result of surface water head, the thickness of low permeability layers along the southern side of the Gator Pond, or a combination of these factors, CFFF proposes to install pressure transducers in monitoring wells W-4, W-15, W-16, W-27 and W-92 to assess the horizontal and vertical effect of this surface water body on the surficial aquifer. Pressure transducers will allow CFFF to collect water level data in real-time, which will allow the effects of precipitation events on the Gator Pond to be evaluated, including any subsequent influences on nearby water levels in the surficial aquifer.

Upper Sunset Lake and Mill Creek

As described in **Section 3.5**, there is a potential that surface water and suspended sediment could flow “upstream” from Upper Sunset Lake via Mill Creek to the canal. To assess surface water elevations in these areas of Mill Creek, three additional staff gauges are proposed for installation. One staff gauge (Upper 2, **Figure 11**) is proposed to be installed in Upper Sunset Lake near the eastern side of the Entrance Dike; a second staff gauge (Entrance **Figure**

11) is proposed to be installed in Mill Creek near the western side of the Entrance Dike; and a third staff gauge (Canal, **Figure 11**) is proposed to be installed near the western end of the canal.

CFFF also proposes that pressure transducers be attached to the Lower, Upper, Upper 2, Entrance and Canal staff gauges to be able to collect real-time surface water elevation data from this portion of Mill Creek. This will allow CFFF to understand if "upstream" flow occurs from Upper Sunset Lake to the canal.

3.8 Aquifer Hydraulic Characteristics

To further assess the hydrogeologic characteristics of the surficial aquifer and the rate of groundwater flow at the site, CFFF proposes that slug tests be conducted in the following monitoring wells: W-6, W-11 (or W-101 if groundwater from this well contains a higher Tc-99 concentration), W-19B, W-67, W-68, W-98, one of the surficial aquifer - lower zone wells installed to assess the eastern extent of the PCE/Tc-99 impact, 2-3 of the newly installed wells in the floodplain, and a surficial aquifer - lower zone well in the Western Groundwater AOC if additional assessment indicates a previously unknown migration pathway between the plant and the Western Groundwater AOC.

3.9 Surveying

The following locations and elevations will be surveyed by a South Carolina Registered Land Surveyor:

1. the three proposed staff gauges;
2. the groundwater screening borings;
3. the top of casing of the new monitoring wells and associated ground surface; and
4. the deeply incised portions of the ditches.

To further understand the groundwater to surface water interaction within the deeply incised portions of the ditches, CFFF proposes that the Middle Ditch and the Eastern Ditch be surveyed in the areas shown on **Figure 12**.

4. Data Management

Data will be collected and recorded in a variety of ways as documented in the *Final Remedial Investigation Work Plan* dated June 2019 (AECOM, 2019). Since Phase I of the RI, CFFF has developed an EQuIS database for its electronic environmental data management needs. This database will be used to manage most of the data input and output for the RI.

One revision to data collection as a result of the EQuIS database is the sample nomenclature for some samples. Because some sediment samples are proposed to be collected from the same locations in the Gator Pond and Sunset Lakes, the sediment samples must have a distinct name to not overwrite existing sediment data. CFFF proposes adding P2-top depth in inches-bottom depth in inches (e.g., SED-19P2-6-12) to the sediment sample name. Also, groundwater screening sample naming protocol was not discussed in the June 2019 Work Plan. CFFF proposes naming the groundwater screening samples by the boring number and the screening interval (e.g., L-37-17-21) and to add the year and quarter sampled to the groundwater sample designation (e.g., W-70-2021-Q2).

Forms not stored in EQuIS or data collected electronically (e.g. pressure transducer data, slug test data, survey data) but not transmitted to EQuIS will be included in appendices of the Phase II report.

5. Reporting

Field conditions and Phase II RI results will be shared with DHEC in real-time to enable assessment of the next steps to be taken in response to the data, e.g., development of additional work scopes, identification of contingencies or alternative actions due to changes in field conditions, etc. CFFF anticipates discussion of the results during routine weekly phone calls and webinars to be scheduled as needed. CFFF will continue submittal of monthly progress

reports to DHEC in accordance with the CA. Upon completion of the assessment activities to the extent practical, a *Remedial Investigation Report* will be submitted to DHEC as described in the *Final Remedial Investigation Work Plan* dated June 2019 (AECOM, 2019).

6. Assessment Stages and Project Schedule

Phase II of the RI can be divided into five general stages of work. Tasks within stages may be conducted concurrently with tasks in a subsequent stage. The stages are as follows:

Stage 1 – Groundwater screening, sediment sample collection, and staff gauge and pressure transducer installation.
Stage 2 – Soil gas survey, soil sampling, and soil property sample collection.
Stage 3 – Monitoring well installation, development and surveying.
Stage 4 – Groundwater sample collection and aquifer characterization.
Stage 5 – Report preparation.

The following schedule assumes that approval of this plan (or approval to begin Stage 1) occurs within 45 days after submittal. This schedule also assumes that there are no delays due to acts of nature (e.g., severe inclement weather, Covid-19, etc.) or subcontractor/vendor services. Due to the dynamic nature of the work activities, the schedule is subject to change based on field conditions and additional investigation resulting from real-time sample analysis. Detailed progress on the investigation will be discussed in weekly phone calls with DHEC and in written monthly reports.

- September 15, 2020 – Submittal of the Phase II RI Work Plan
- November 2020 – Begin fieldwork, i.e., groundwater screening, sediment sampling, soil gas survey (SGS), and staff gauge and pressure transducer installations.
- December 2020 – Meet with DHEC to discuss results to date and proposed well locations.
- January 2021 – Monitoring well installation begins. Fieldwork continues.
- February 2021 – Groundwater sampling of the newly installed wells.
- April 2021 – Groundwater sampling of the previously existing wells.
- June 2021 – Meet with DHEC to discuss Phase II results and next steps.

7. References

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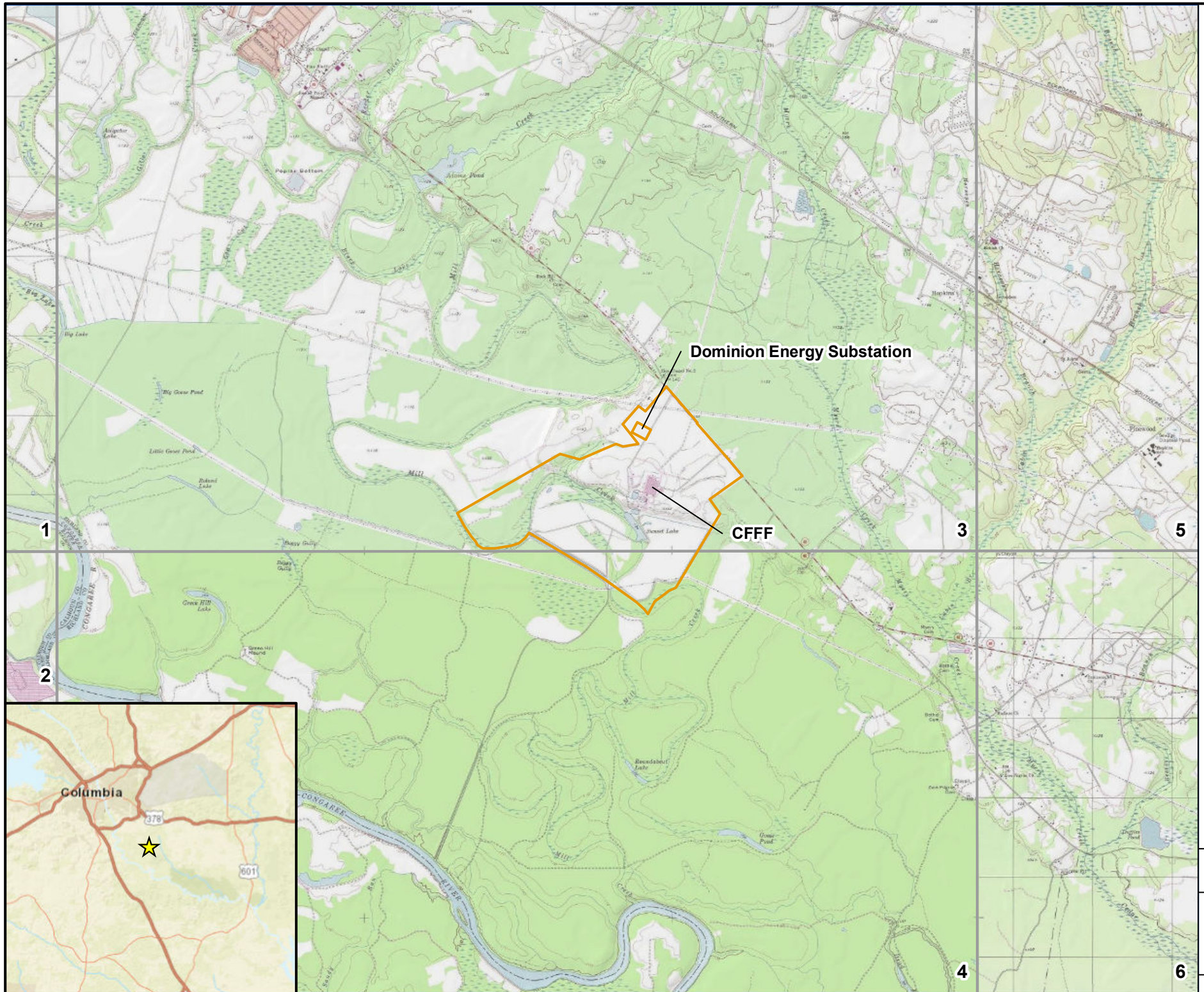
Figures



Legend

Locations

- Property Line
- Topographic Quadrangle Boundary

ID	Topographic Quadrangle Name
1	Southwest Columbia
2	Gaston
3	Fort Jackson South
4	Saylors Lake
5	Congaree
6	Gadsden

0 2,000 4,000 Feet

1:48,000

Map Projection: NAD 1983, South Carolina State Plane, FIPS 3900, Feet

Datum: North American 1983

Data Source: Esri/USGS

N

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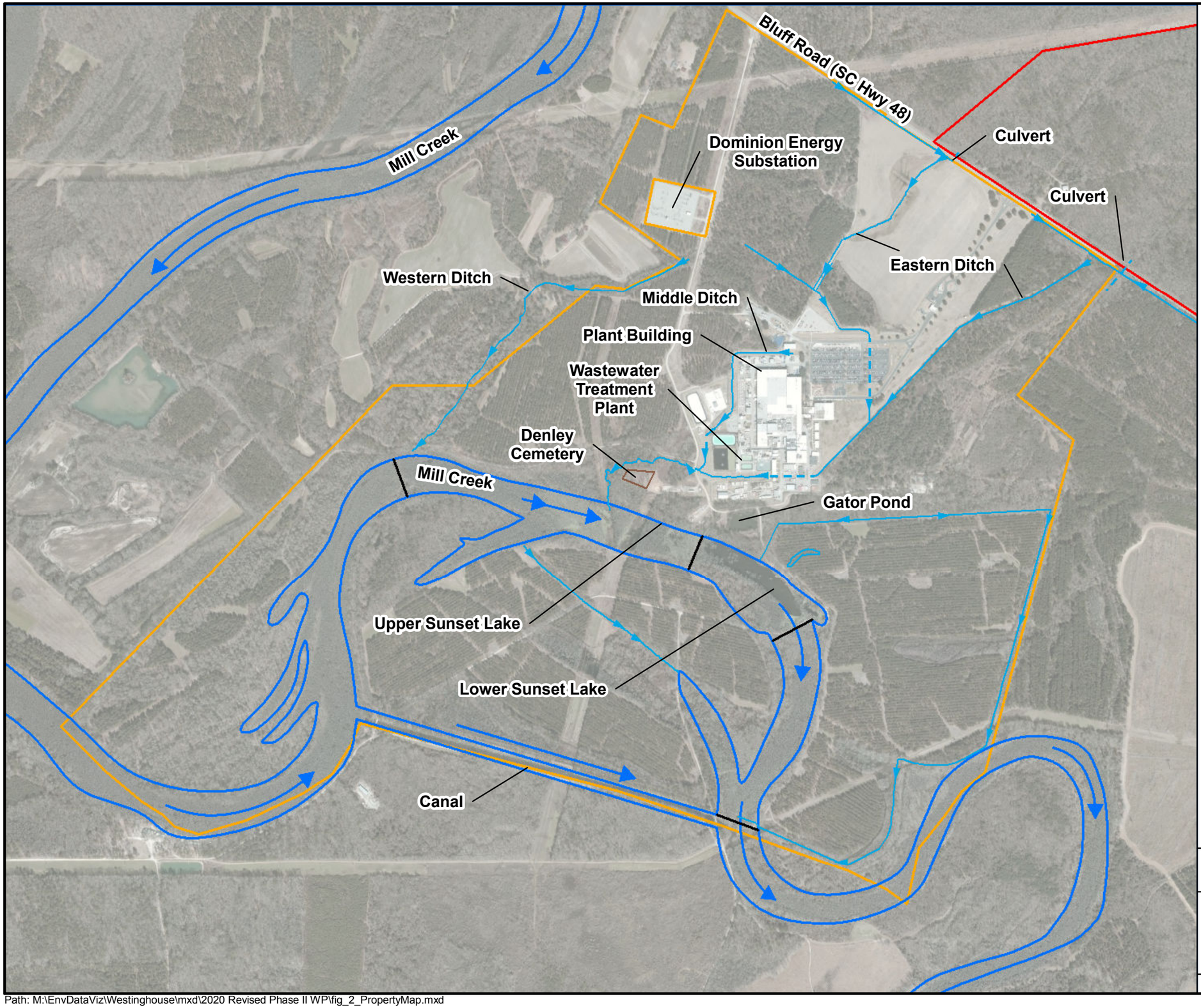
Site Location Map

WESTINGHOUSE COLUMBIA FUEL FABRICATION FACILITY
HOPKINS, SOUTH CAROLINA

PROJECT NO.	PREPARED BY:	DATE:	
60595649	CCS	August 2020	**FIGURE 1**

Path: M:\EnvDataViz\Westinghouse\mxd\2020 Revised Phase II WP\fig_1_sitelocationmap.mxd



Legend

- Mill Creek Flow Direction
- Ditch
- Culvert
- Property Line
- SCRDI Bluff Road (Superfund Site)
- Mill Creek
- Dike Location

0 500 1,000 Feet

1:12,000

Map Projection: NAD 1983, South Carolina State Plane, FIPS 3900, Feet

Datum: North American 1983

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Property Map

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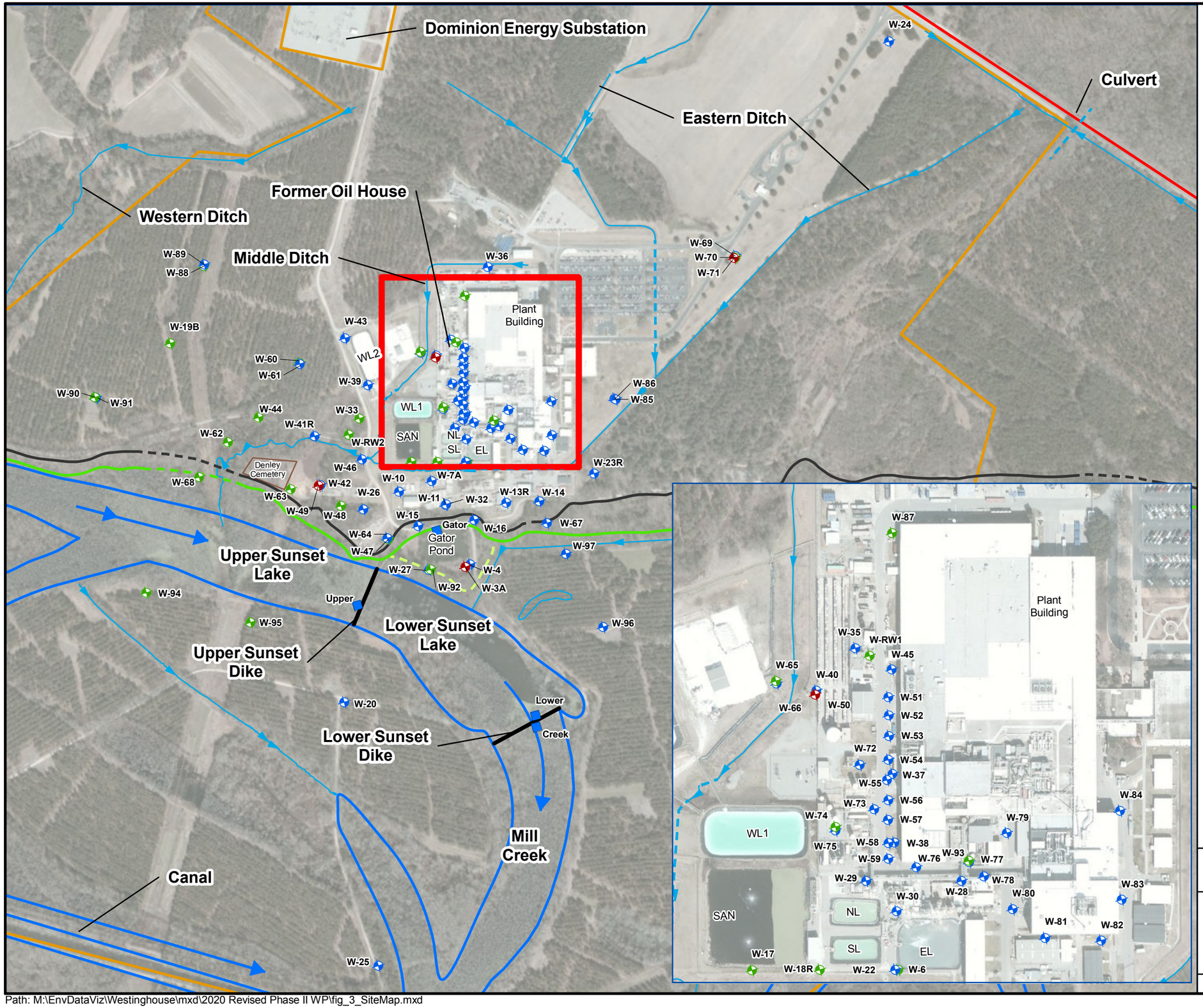
PROJECT NO.	PREPARED BY:	DATE:	
60595649	CCS	August 2020	**FIGURE 2**

Path: M:\EnvDataViz\Westinghouse\mxd\2020 Revised Phase II WP\fig_2_PropertyMap.mxd



Legend

- Upper Surficial Aquifer Monitoring Well Location
- Lower Surficial Monitoring Well Location
- Black Mingo Monitoring Well
- Staff Gauge Location
- Ditch
- Culvert
- Dike Location
- Mill Creek Flow Direction
- Mill Creek
- Property Line
- SCRDI Bluff Road (Superfund Site)
- Top of Bluff
- Inferred Top of Bluff
- Bottom of Bluff
- Inferred Bottom of Bluff
- Secondary Bluff Area

EL	East Lagoon
NL	North Lagoon
SL	South Lagoon
SAN	Sanitary Lagoon
WL1	West Lagoon I
WL2	West Lagoon II

0 300 600 Feet

1:7,200

Map Projection: NAD 1983, South Carolina State Plane, FIPS 3900, Feet

Datum: North American 1983

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Site Map

WESTINGHOUSE COLUMBIA FUEL FABRICATION FACILITY
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PROJECT NO.	PREPARED BY:	DATE:	
60595649	CCS	August 2020	**FIGURE 3**

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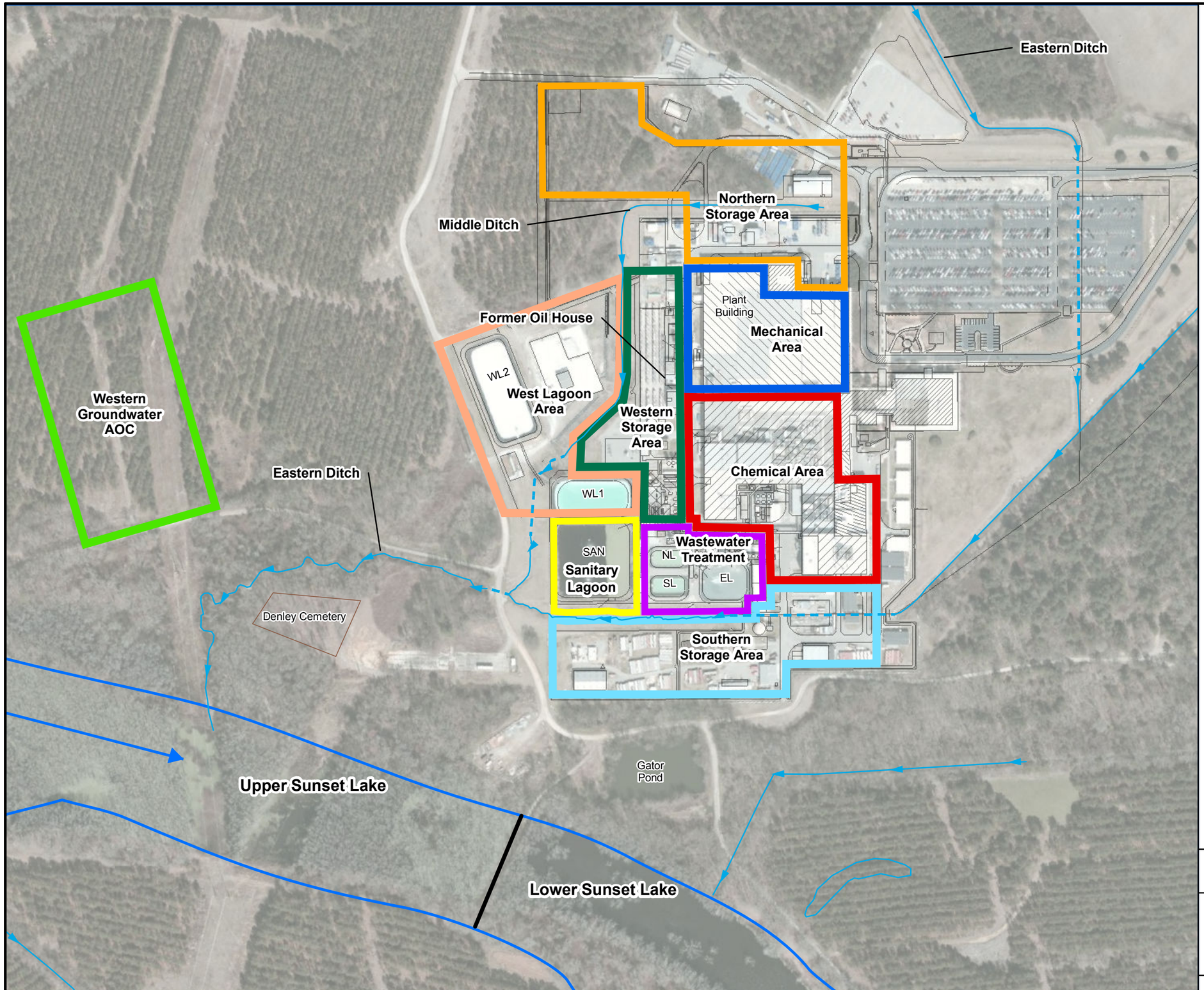

Legend

- Ditch
- Culvert
- Mill Creek Flow Direction
- EL East Lagoon
- NL North Lagoon
- SL South Lagoon
- SAN Sanitary Lagoon
- WL1 West Lagoon I
- WL2 West Lagoon II
- Mill Creek
- Dike Location

Operable Units

- Chemical Area
- Mechanical Area
- Northern Storage Area
- Sanitary Lagoon Area
- Southern Storage Area
- Wastewater Treatment Area
- West Lagoons Area
- Western Storage Area
- Western Groundwater AOC

0 150 300 Feet

1:3,600

Map Projection: NAD 1983, South Carolina State Plane, FIPS 3900, Feet

Datum: North American 1983

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Operational Units Map

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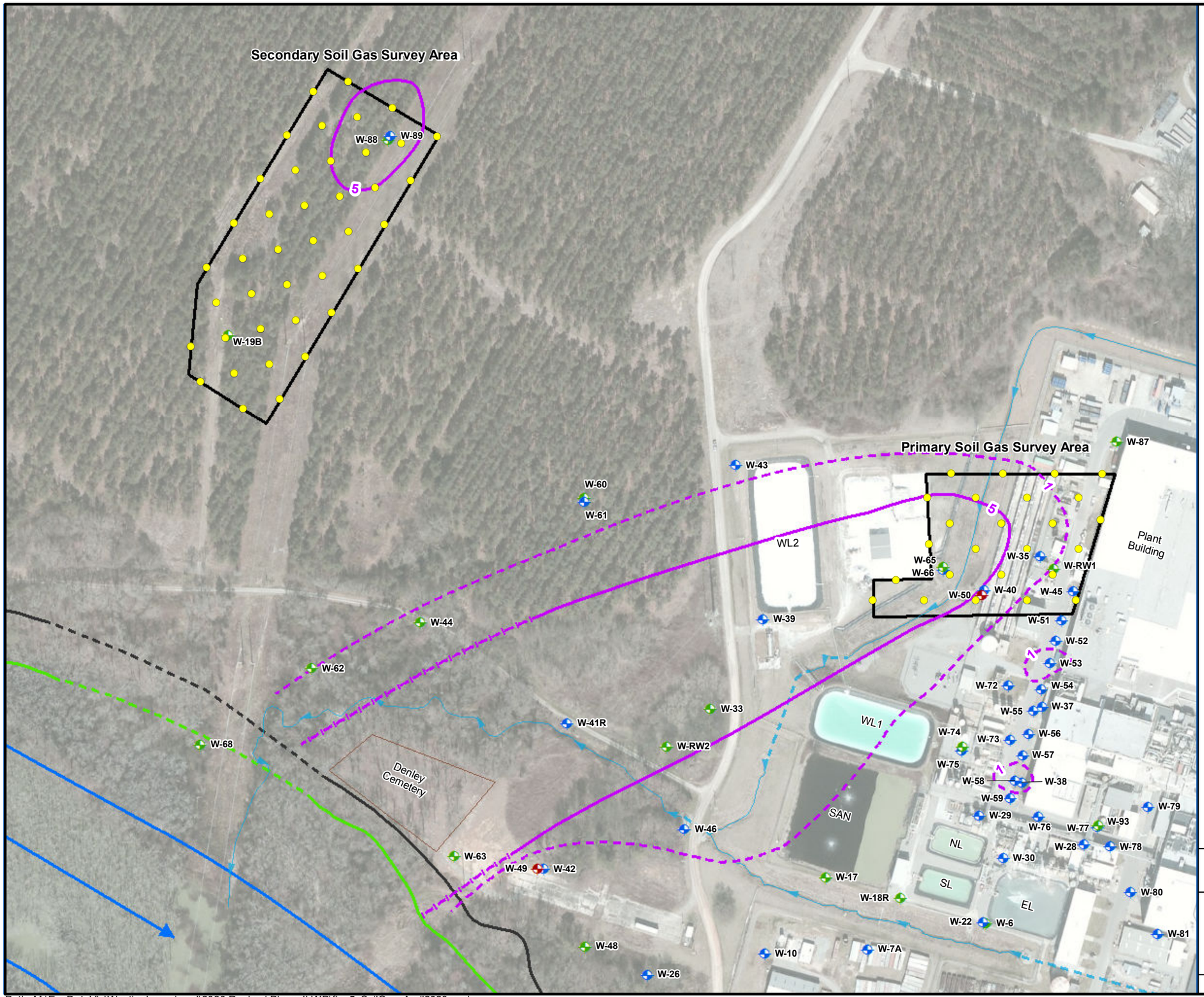
HOPKINS, SOUTH CAROLINA

PROJECT NO.	PREPARED BY:	DATE:	
60595649	CCS	August 2020	**FIGURE 4**

Path: M:\EnvDataViz\Westinghouse\mxd\2020 Revised Phase II WP\fig_4_OperationUnitsMap.mxd



Legend

- Surficial Aquifer Monitoring Well - Upper Zone
- Surficial Aquifer Monitoring Well - Lower Zone
- Black Mingo Aquifer Monitoring Well
- Proposed Soil Gas Sample Location
- Ditch
- Culvert
- Mill Creek Flow Direction
- Mill Creek
- Top of Bluff
- Inferred Top of Bluff
- Bottom of Bluff
- Inferred Bottom of Bluff
- PCE Isoconcentration Contour (µg/L)
- PCE Inferred Isoconcentration Contour (µg/L)
- PCE Isoconcentration Contour at a concentration less than the maximum contaminant level (µg/L)
- EL East Lagoon
- NL North Lagoon
- SL South Lagoon
- SAN Sanitary Lagoon
- WL1 West Lagoon 1
- WL2 West Lagoon 2

Note:

Based upon data collected in April 2020

0 100 200 Feet

1:2,400

Map Projection: NAD 1983, South Carolina State Plane, FIPS 3900, Feet

Datum: North American 1983

N

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Soil Gas Assessment Map

WESTINGHOUSE COLUMBIA FUEL FABRICATION FACILITY
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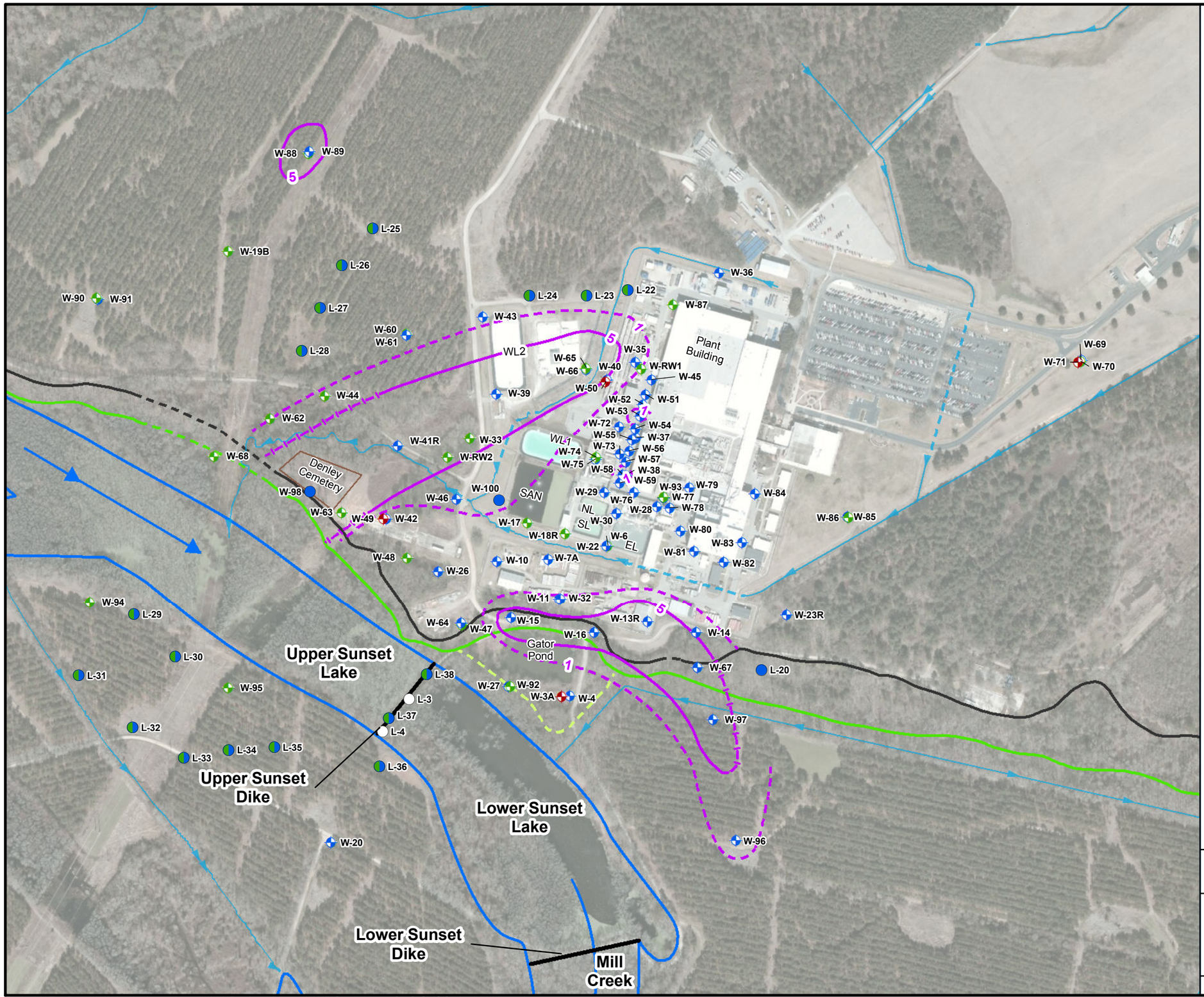
PROJECT NO.	PREPARED BY:	DATE:	
60595649	CCS	August 2020	**FIGURE 5**

Path: M:\EnvDataViz\Westinghouse\mxd\2020 Revised Phase II WP\fig_5_SoilGas_April2020.mxd



Legend

- Surficial Aquifer - Upper Zone Monitoring Well
- Surficial Aquifer - Lower Zone Monitoring Well
- Black Mingo Aquifer Monitoring Well
- Proposed Surficial Aquifer Groundwater Screening/Well Location - Upper Zone
- Proposed Surficial Aquifer Groundwater Screening Location - Upper and Lower Zones
- RI Phase I Boring Location
- Ditch
- Culvert
- Dike Location
- Mill Creek Flow Direction
- Mill Creek
- Top of Bluff
- Inferred Top of Bluff
- Bottom of Bluff
- Inferred Bottom of Bluff
- Secondary Bluff Area
- PCE Isoconcentration Contour (µg/L)
- PCE Inferred Isoconcentration Contour (µg/L)
- PCE Isoconcentration Contour at a concentration less than the Maximum Contaminant Level (µg/L)

EL	East Lagoon
NL	North Lagoon
SL	South Lagoon
SAN	Sanitary Lagoon
WL1	West Lagoon 1
WL2	West Lagoon 2

Note:

Based upon data collected in April 2020

0 200 400 Feet

1:4,800

Map Projection: NAD 1983, South Carolina State Plane, FIPS 3900, Feet

Datum: North American 1983

N

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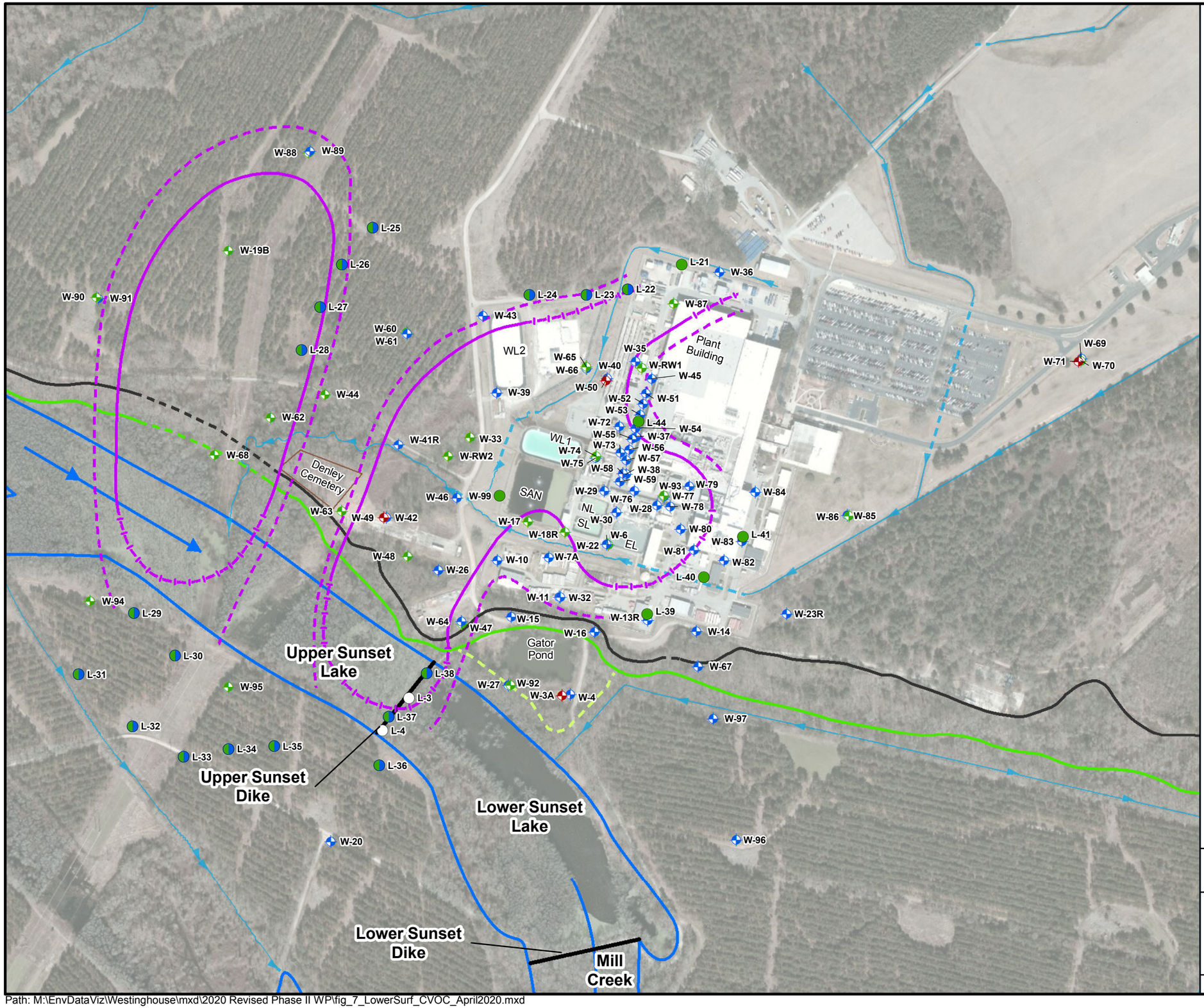
Surficial Aquifer - Upper Zone CVOC Assessment Map

WESTINGHOUSE COLUMBIA FUEL FABRICATION FACILITY
HOPKINS, SOUTH CAROLINA

PROJECT NO.	PREPARED BY:	DATE:	
60595649	CCS	August 2020	**FIGURE 6**

Path: M:\EnvDataViz\Westinghouse\mxd\2020 Revised Phase II WP\fig_6_UpperSurf_CVOC_April2020.mxd



Legend

- Surficial Aquifer - Upper Zone Monitoring Well
- Surficial Aquifer - Lower Zone Monitoring Well
- Black Mingo Aquifer Monitoring Well
- Proposed Surficial Aquifer Groundwater Screening Location - Upper and Lower Zones
- Proposed Surficial Aquifer Groundwater Screening/Well Location - Lower Zone
- RI Phase I Boring Location
- Ditch
- Culvert
- Dike Location
- Mill Creek Flow Direction
- Mill Creek
- Top of Bluff
- Inferred Top of Bluff
- Bottom of Bluff
- Inferred Bottom of Bluff
- Secondary Bluff Area
- PCE Isoconcentration Contour (µg/L)
- PCE Inferred Isoconcentration Contour (µg/L)
- PCE Isoconcentration Contour at a concentration less than the Maximum Contaminant Level (µg/L)

EL	East Lagoon
NL	North Lagoon
SL	South Lagoon
SAN	Sanitary Lagoon
WL1	West Lagoon 1
WL2	West Lagoon 2

Note:

Based upon data collected in April 2020

N

0 200 400 Feet

1:4,800

Map Projection: NAD 1983, South Carolina State Plane, FIPS 3900, Feet

Datum: North American 1983

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Surficial Aquifer - Lower Zone CVOC Assessment Map

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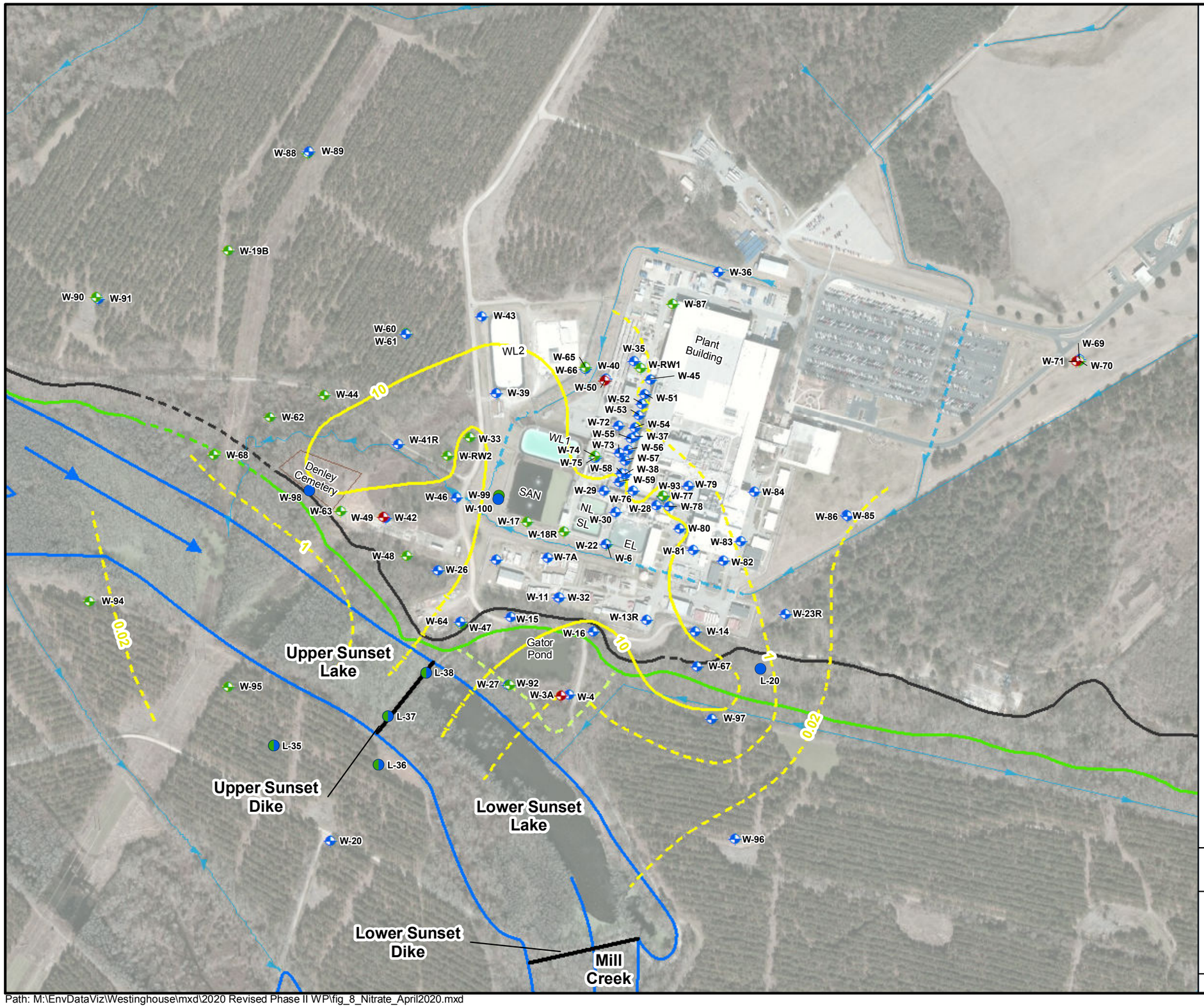
HOPKINS, SOUTH CAROLINA

PROJECT NO.	PREPARED BY:	DATE:	
60595649	CCS	August 2020	**FIGURE 7**

Path: M:\EnvDataViz\Westinghouse\mxd\2020 Revised Phase II WP\fig_7_LowerSurf_CVOC_April2020.mxd



Legend

- Upper Surficial Aquifer Monitoring Well
- Lower Surficial Monitoring Well Location
- Black Mingo Monitoring Well
- Proposed Surficial Aquifer Groundwater Screening/Well Location - Upper Zone
- Proposed Surficial Aquifer Groundwater Screening Location - Upper and Lower Zones
- Proposed Surficial Aquifer Groundwater Screening/Well Location - Lower Zone
- Ditch
- Culvert
- Dike Location
- Mill Creek Flow Direction
- Mill Creek
- Top of Bluff
- Inferred Top of Bluff
- Bottom of Bluff
- Inferred Bottom of Bluff
- Secondary Bluff Area
- Nitrate Isoconcentration Contour (mg/L)
- Nitrate Inferred Isoconcentration Contour (mg/L)
- Nitrate Isoconcentration Contour at a concentration less than the Maximum Contaminant Level (mg/L)

EL	East Lagoon
NL	North Lagoon
SL	South Lagoon
SAN	Sanitary Lagoon
WL1	West Lagoon 1
WL2	West Lagoon 2

Note:

Based upon data collected in April 2020

N

0 200 400 Feet

1:4,800

Map Projection: NAD 1983, South Carolina State Plane, FIPS 3900, Feet

Datum: North American 1983

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Nitrate Assessment Map

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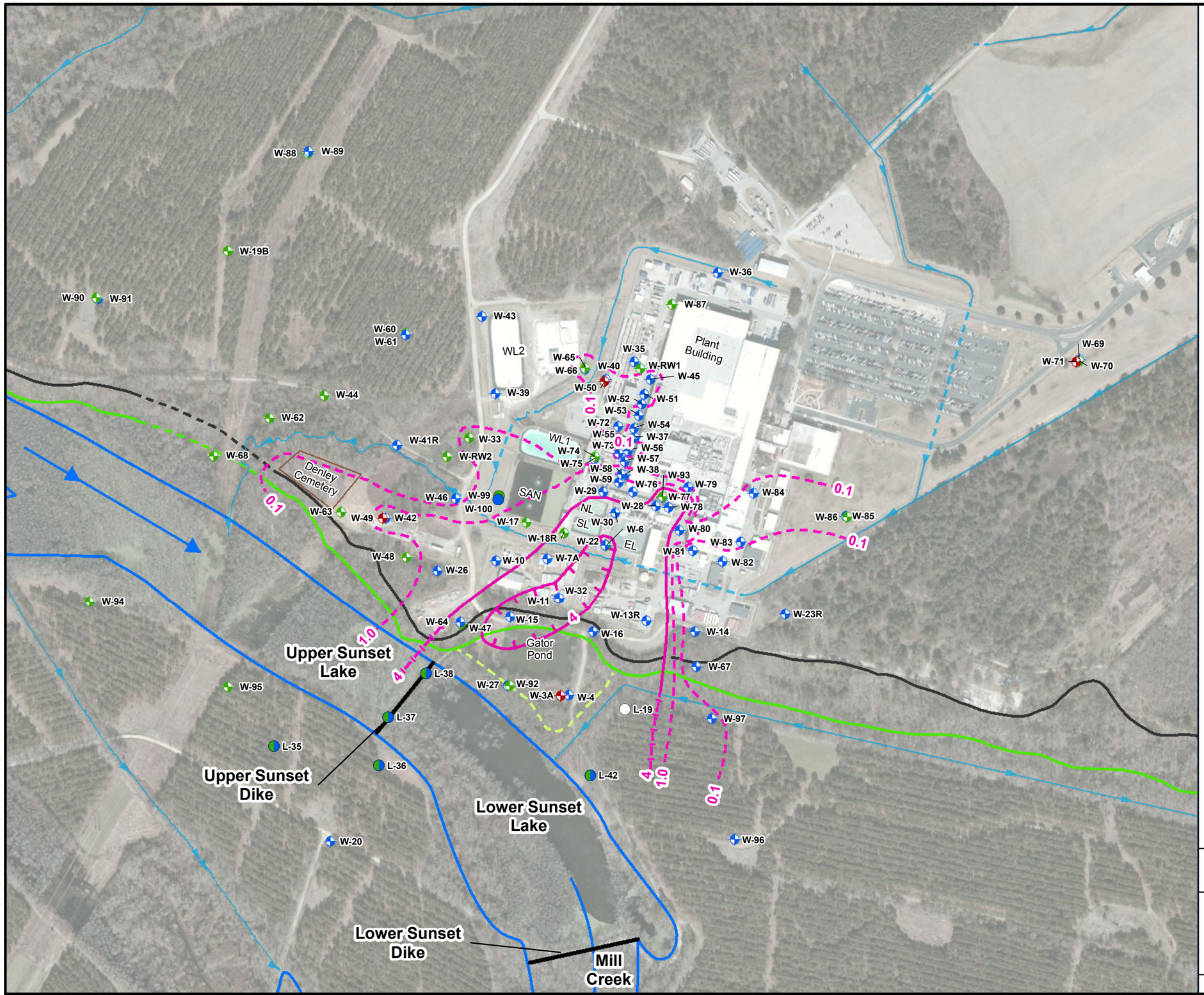
PROJECT NO.	PREPARED BY:	DATE:	
60595649	CCS	August 2020	**FIGURE 8**

Path: M:\EnvDataViz\Westinghouse\mxd\2020 Revised Phase II WP\fig_8_Nitrate_April2020.mxd



Legend

- Surficial Aquifer - Upper Zone Monitoring Well
- Surficial Aquifer - Lower Zone Monitoring Well
- Black Mingo Aquifer Monitoring Well
- Proposed Surficial Aquifer Well Location - Upper
- Proposed Surficial Aquifer Groundwater Screening Location - Upper and Lower Zones
- Proposed Surficial Aquifer Well Location - Lower
- RI Phase I Boring Location
- Ditch
- Culvert
- Dike Location
- Mill Creek Flow Direction
- Mill Creek
- Top of Bluff
- Inferred Top of Bluff
- Bottom of Bluff
- Inferred Bottom of Bluff
- Secondary Bluff Area
- Fluoride Isoconcentration Contour (mg/L)
- Fluoride Inferred Isoconcentration Contour (mg/L)
- Fluoride Isoconcentration Contour at a concentration less than the Maximum Contaminant Level (mg/L)
- Fluoride Isoconcentration Contour Depression (mg/L)

EL	East Lagoon
NL	North Lagoon
SL	South Lagoon
SAN	Sanitary Lagoon
WL1	West Lagoon 1
WL2	West Lagoon 2

Note:

Based upon data collected in April 2020

0 200 400 Feet

1:4,800

Map Projection: NAD 1983, South Carolina State Plane, FIPS 3900, Feet

Datum: North American 1983

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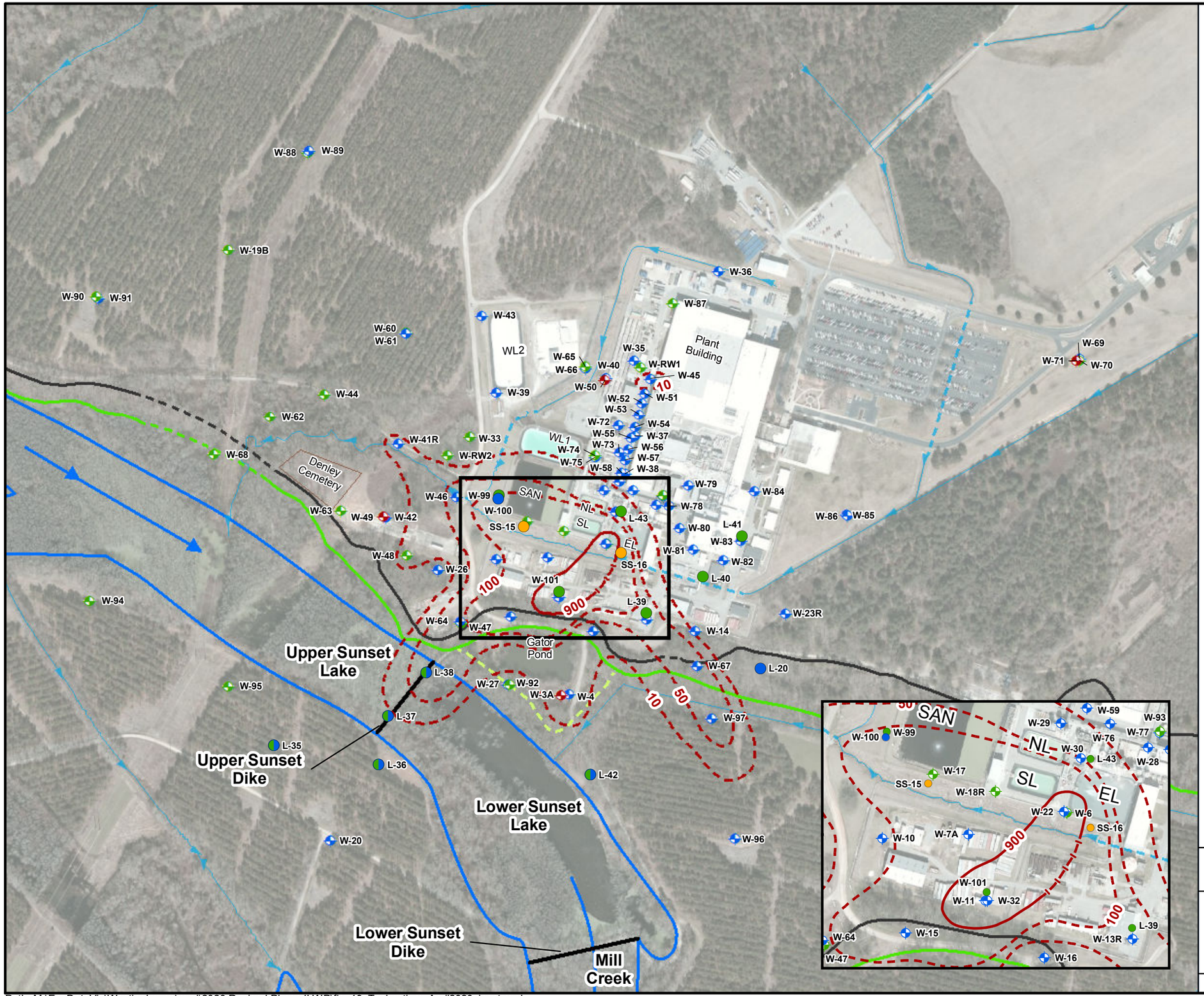
Fluoride Assessment Map

WESTINGHOUSE COLUMBIA FUEL FABRICATION FACILITY
HOPKINS, SOUTH CAROLINA

PROJECT NO.	PREPARED BY:	DATE:	
60595649	CCS	August 2020	**FIGURE 9**

Path: M:\EnvDataViz\Westinghouse\mxd\2020 Revised Phase II WP\fig_9_Fluoride_April2020.mxd



Legend

- Upper Surficial Aquifer Monitoring Well Location
- Lower Surficial Monitoring Well Location
- Black Mingo Monitoring Well
- Proposed Soil Sample
- Proposed Surficial Aquifer Groundwater Screening/Well Location - Upper Zone
- Proposed Surficial Aquifer Groundwater Screening Location - Upper and Lower Zones
- Proposed Surficial Aquifer Groundwater Screening/Well Location - Lower Zone
- Ditch
- Culvert
- Dike Location
- Mill Creek Flow Direction
- Mill Creek
- Top of Bluff
- Inferred Top of Bluff
- Bottom of Bluff
- Inferred Bottom of Bluff
- Secondary Bluff Area
- Tc-99 Isoconcentration Contour (pCi/L)
- Tc-99 Inferred Isoconcentration Contour (pCi/L)
- Tc-99 Inferred Isoconcentration Contour at a Concentration Less Than the Maximum Contamminant Level (pCi/L)

EL	East Lagoon
NL	North Lagoon
SL	South Lagoon
SAN	Sanitary Lagoon
WL1	West Lagoon 1
WL2	West Lagoon 2

Note:

Based upon data collected in April 2020

0 200 400 Feet

1:4,800

Map Projection: NAD 1983, South Carolina State Plane, FIPS 3900, Feet

Datum: North American 1983

N

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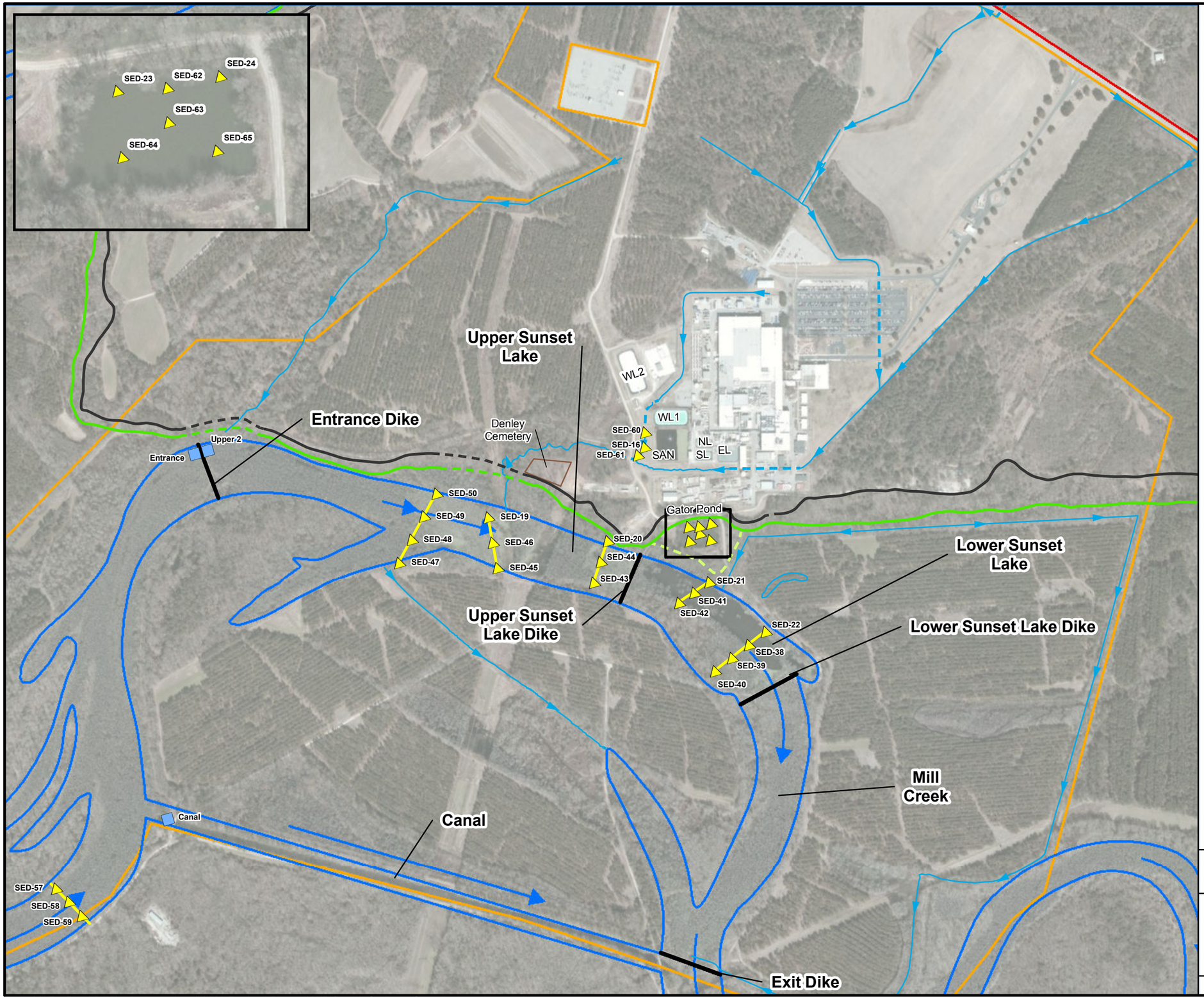
Technetium-99 Assessment Map

WESTINGHOUSE COLUMBIA FUEL FABRICATION FACILITY
HOPKINS, SOUTH CAROLINA

PROJECT NO.	PREPARED BY:	DATE:	
60595649	CCS	August 2020	**FIGURE 10**

Path: M:\EnvDataViz\Westinghouse\mxd\2020 Revised Phase II WP\fig_10_Technetium_April2020_inset.mxd



Legend

- Proposed Sediment Sample Location
- Proposed Staff Gauge Location
- Sediment Sample Transect
- Ditch
- Culvert
- Mill Creek Flow Direction
- Dike Location
- Mill Creek
- Property Line
- Top of Bluff
- Inferred Top of Bluff
- Bottom of Bluff
- Inferred Bottom of Bluff
- Secondary Bluff Area
- EL East Lagoon
- NL North Lagoon
- SL South Lagoon
- SAN Sanitary Lagoon
- WL1 West Lagoon 1
- WL2 West Lagoon 2

0 350 700 Feet

1:8,400

Map Projection: NAD 1983, South Carolina State Plane, FIPS 3900, Feet

Datum: North American 1983

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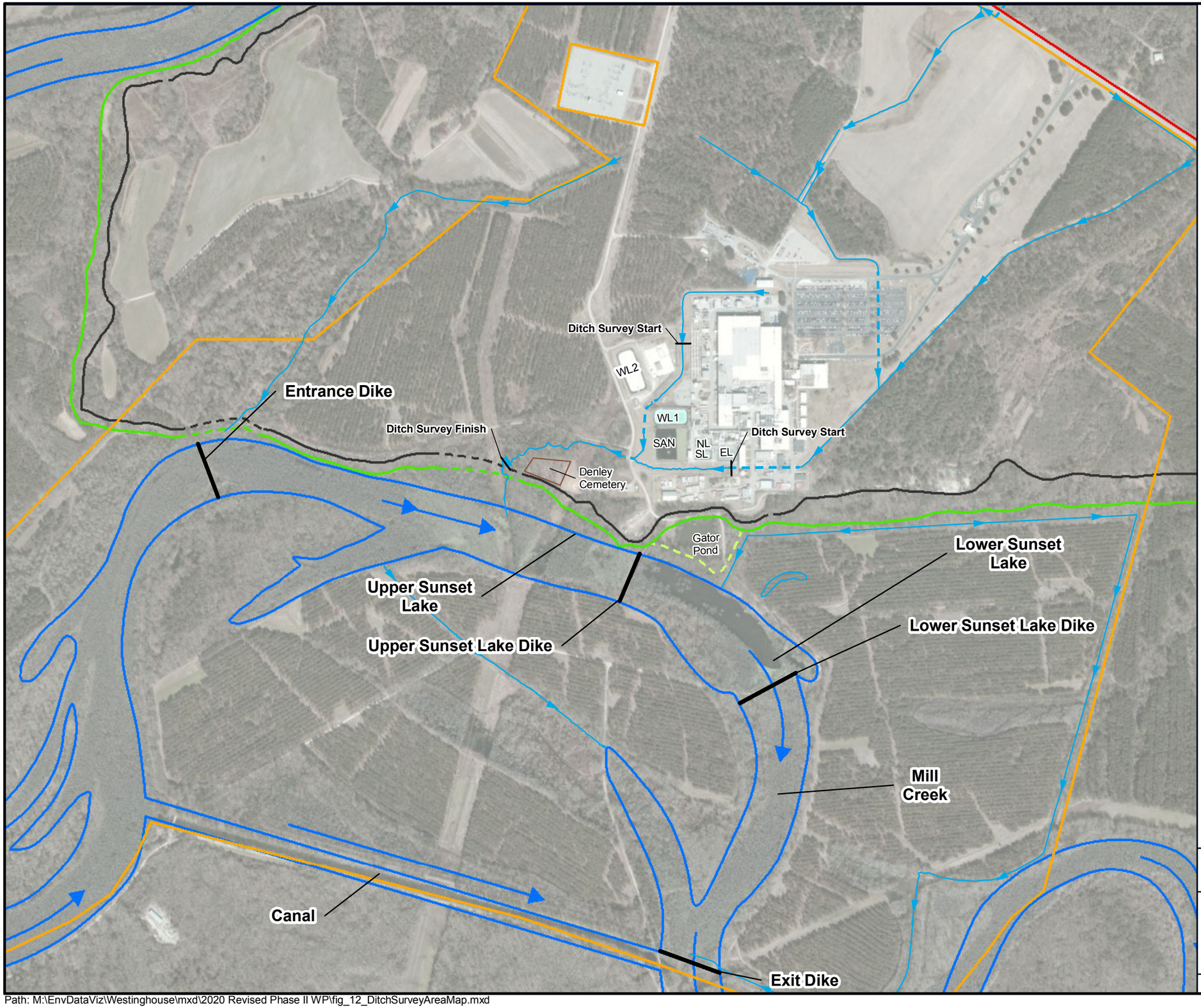
Sediment Assesment Map

WESTINGHOUSE COLUMBIA FUEL FABRICATION FACILITY
HOPKINS, SOUTH CAROLINA

PROJECT NO.	PREPARED BY:	DATE:	
60595649	CCS	August 2020	**FIGURE 11**

Path: M:\EnvDataViz\Westinghouse\mxd\2020 Revised Phase II WP\fig_11_SedimentSamplingLocations.mxd



Legend

- Ditch
- Culvert
- Mill Creek Flow Direction
- Dike Location
- Mill Creek
- Property Line
- Top of Bluff
- Inferred Top of Bluff
- Bottom of Bluff
- Inferred Bottom of Bluff
- Secondary Bluff Area
- EL East Lagoon
- NL North Lagoon
- SL South Lagoon
- SAN Sanitary Lagoon
- WL1 West Lagoon 1
- WL2 West Lagoon 2

0 350 700 Feet

1:8,400

Map Projection: NAD 1983, South Carolina State Plane, FIPS 3900, Feet

Datum: North American 1983

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Ditch Survey Area Map

WESTINGHOUSE COLUMBIA FUEL FABRICATION FACILITY
HOPKINS, SOUTH CAROLINA

PROJECT NO.	PREPARED BY:	DATE:	
60595649	RGM	June 2020	**FIGURE 12**

Path: M:\EnvDataViz\Westinghouse\mxd\2020 Revised Phase II WP\fig_12_DitchSurveyAreaMap.mxd

Tables

Table 1
Summary of Proposed Phase II RI Scope of Work
Westinghouse Columbia Fuel Fabrication Facility
Hopkins, South Carolina

COPC or Area of Interest	Data Need	Environmental Media	Assessment Activities	Analytes	Boring or Monitoring Well Reference	Figure Reference	Purpose and Rationale
CVOCs	Source area - former Oil House, Middle Ditch, W-65/66 area	Soil gas	-- Primary soil gas survey area -- Multiple soil gas sampling points -- 25 initial soil gas samples. If initial soil gas samples indicate a potential source, additional closely spaced soil gas samples to narrow area prior to confirmatory soil sampling.	Target CVOCs	N/A	5	Assess potential CVOC source area(s)
	Source area - former Oil House, Middle Ditch, W-65/66 area	Soil	-- Targeted DPT soil sampling if the soil gas survey indicates a potential CVOC source(s). -- Multiple interval soil sampling above the water table -- Number and location of borings to be determined	Target CVOCs	N/A	5	Assess potential CVOC source area(s)
	Surficial aquifer - upper zone downgradient of monitoring well W-41R	Groundwater	-- 1 permanent montioring well -- Adjacent to the graveyard at the top of bluff -- Upper zone of the surficial aquifer	Full COPCs	W-98	6	Further delineate CVOCs in the upper zone of the surficial aquifer as it migrates towards the floodplain
	Surficial aquifer - upper zone east of monitoring well W-67	Groundwater	-- 1 or 2 DPT borings with multiple interval groundwater screening -- If CVOCs above MCL in first boring, install 1 additional soil boring east of the first boring -- Install 1 permanent monitoring well adjacent to the DPT boring with COPCs below MCL	Target CVOCs for DPT groundwater. Full COPCs for well.	L-20	6	Groundwater CVOC delineation east of well W-67
	Western Groundwater AOC	Groundwater	-- 4 DPT groundwater screening borings between the plant and the Western Groundwater AOC -- Multiple interval groundwater screening -- Evaluate groundwater screening data -- Permanent well(s) based upon screening data	Target CVOCs for DPT groundwater. Full COPCs for well.	L-25 thorugh L-28	6 and 7	Assess whether CVOCs have migrated in groundwater from the plant area to the Western Groundwater AOC along a currently unknown preferential pathway
	Western Groundwater AOC	Soil gas	-- Secondary soil gas survey area if groundwater results do not indicate a preferential groundwater pathway from developed area of site to the Western Groundwater AOC -- Multiple soil gas sampling points -- 40 initial soil gas samples. If initial soil gas samples indicate a potential soruce, additional closely spaced soil gas samples to narrow area prior to confirmatory soil sampling .	Target CVOCs	N/A	5	Assess potential CVOC source area(s)
	Western Groundwater AOC	Soil	-- Targeted DPT soil sampling if the soil gas survey indicates a potential CVOC source(s). -- Multiple intervall soil sampling above the water table -- Number and location of borings to be determined	Target CVOCs	N/A	5	Assess potential CVOC source area(s)
	Surficial aquifer - upgradient of wells W-65, W-66 and W-87	Groundwater	-- 4 DPT groundwater screening borings upgradient of wells W-65, W-66 and W-87 -- Multiple interval groundwater screening -- Evaluate groundwater screening data -- Permanent well(s) based upon screening data	Target CVOCs for DPT groundwater. Full COPCs for well.	L-21 through L-24	6 and 7	Assess the upgradient extent of CVOC impact
	Surficial aquifer - lower zone sidegradient of monitoring wells W-93 and W-6	Groundwater	-- 3 DPT groundwater screening borings sidegradient of wells W-93 and W-6 -- Lower zone groundwater screening -- Evaluate groundwater screening data -- Permanent well(s) based upon screening data	Target CVOCs for DPT groundwater. Full COPCs for well.	L-39 through L-41	7	Delineate the eastern extent of CVOC impact.
	Surficial aquifer - lower zone downgradient of monitoring well W-48	Groundwater	-- 3 total DPT groundwater screening borings -- 2 DPT borings on USL Dike and 1 DPT boring south of LSL -- Multiple interval groundwater screening -- Evaluate groundwater screening data -- Permanent well(s) based upon screening data	Target CVOCs for DPT groundwater. Full COPCs for well.	L-36 thorugh L-38	6 and 7	Delineate CVOCs in the floodplain downgradient of well W-48 and LSL
	Surficial aquifer downgradient of well W-68	Groundwater	-- 7 DPT or sonic groundwater screening borings in floodplain south of USL and well W-68 -- Multiple interval groundwater screening -- Evaluate groundwater screening data -- Permanent well(s) based upon screening data	Target CVOCs for DPT groundwater. Full COPCs for well.	L-29 through L35	6 and 7	Delineate CVOCs in the floodplain downgradient of well W-68 and USL. Assessment of the incisement into the Black Mingo confining clay observed in boring L-1 (W-95).
	Surficial aquifer - lower zone upgradient of monitoring well W-93	Groundwater	-- 1 DPT groundwater screening boring near monitoring well W-53 or W-54 -- Lower zone groundwater screening -- Evaluate groundwater screening data -- Permanent well(s) based upon screening data	Target CVOCs for DPT groundwater. Full COPCs for well.	L-44	7	Delineate CVOCs upgradient of monitoring well W-93.

Table 1
Summary of Proposed Phase II RI Scope of Work
Westinghouse Columbia Fuel Fabrication Facility
Hopkins, South Carolina

COPC or Area of Interest	Data Need	Environmental Media	Assessment Activities	Analytes	Boring or Monitoring Well Reference	Figure Reference	Purpose and Rationale
Nitrate	Surficial aquifer - upper zone downgradient of monitoring well W-41R	Groundwater	-- 1 permanent montioring well -- Adjacent to the graveyard at the top of bluff -- Upper zone of the surficial aquifer	Full COPCs	W-98	8	Further delineate CVOCs in the upper zone of the surficial aquifer as it migrates towards the floodplain
	Surficial aquifer - upper zone east of monitoring well W-67	Groundwater	-- 1 or 2 DPT borings with multiple interval groundwater sampling -- If nitrate is above MCL in the first boring, perform 1 additional soil boring east of the first boring -- Install 1 permanent monitoring well adjacent to the DPT boring with nitrate below MCL	Nitrate for DPT groundwater. Full COPCs for well.	L-20	8	Groundwater nitrate delineation east of well W-67
	Surficial aquifer downgradient of monitoring wells W-47 and W-64	Groundwater	-- 2 DPT borings on USL Dike and 1 DPT boring south of LSL -- Multiple interval groundwater screening -- Evaluate groundwater screening data -- Permanent well(s) based upon screening data	Nitrate for DPT groundwater. Full COPCs for well	L-36 thorugh L-38	8	Delineate nitrate in the floodplain downgradient of well W-47/64 pair and LSL.
	Surficial aquifer downgradient of monitoring wells W-47 and W-64	Groundwater	-- 1 DPT or sonic groundwater screening boring in floodplain south of USL and wells W-47/64 -- Eastern-most boring from CVOC 8 -- Multiple interval groundwater screening -- Evaluate groundwater screening data -- Permanent well(s) based upon screening data	Nitrate for DPT groundwater. Full COPCs for well	L-35	8	Delineate nitrate in the floodplain downgradient of well W-68 and USL
Fluoride	Surficial aquifer downgradient of monitorings well W-47 and W-64	Groundwater	-- 3 DPT groundwater screening borings -- 2 DPT borings on USL Dike and 1 DPT boring south of LSL -- 1 DPT or sonic groundwater screening boring west of the USL Dike -- Eastern-most boring from CVOC 8 -- Multiple interval groundwater screening -- Evaluate groundwater screening data -- Permanent well(s) based upon screening data	Fluoride for DPT groundwater. Full COPCs for well	L-35 thorugh L-38	9	Delineate fluoride in the floodplain downgradient of well W-47/64 pair and LSL.
	Surficial aquifer downgradient of RI Phase I boring L-19	Groundwater	-- 1 DPT groundwater screening boring downgradient of RI Phase I boring L-19 -- Multiple interval groundwater screening -- Evaluate groundwater screening data -- Permanent well(s) based upon screening data	Fluoride for DPT groundwater. Full COPCs for well	L-42	9	Delineate fluoride in the floodplain downgradient of former boring L-19 and upgradient of LSL

Table 1
Summary of Proposed Phase II RI Scope of Work
Westinghouse Columbia Fuel Fabrication Facility
Hopkins, South Carolina

COPC or Area of Interest	Data Need	Environmental Media	Assessment Activities	Analytes	Boring or Monitoring Well Reference	Figure Reference	Purpose and Rationale
Tc-99	Tc-99 potential source assessment	Soil	-- 2 soil boring locations, 1 south of the Sanitary Lagoon and 1 south of the East Lagoon -- Surface soil sampling from the 0-0.5 ft depth -- Subsurface soil sampling from 0.5-1.0 and 1.0-2.0 ft depth	Tc-99	SS-15 and SS-16	10	Evaluate if there is Tc-99 impact to surface and subsurface soil resulting from potential overtopping of the watsewater lagoons during historic precipitation events
	Surficial groundwater - lower zone adjacent to monitoring well W-11	Groundwater	-- 1 permanent surficial aquifer lower zone monitoring well -- Adjacent to well W-11 -- Five foot screen on top of the Black Mingo confining clay	Full COPCs	W-101	10	Delineate Tc-99 in the surficial aquifer - lower zone
	Surficial aquifer - lower zone sidegradient of monitoring wells W-11 and W-6	Groundwater	-- 3 DPT groundwater screening borings sidegradient of wells W-11 and W-6 -- Lower zone groundwater screening -- Evaluate groundwater screening data -- Permanent well(s) based upon screening data	Total Tc-99 and dissolved Tc-99 for DPT groundwater. Full COPCs for well	L-39 through L-41	10	Delineate the eastern extent of Tc-99 impact.
	Surficial aquifer - lower zone near monitoring well W-30	Groundwater	-- 1 DPT groundwater screening borings near wells W-30 -- Lower zone groundwater screening -- Evaluate groundwater screening data -- Permanent well(s) based upon screening data	Total Tc-99 and dissolved Tc-99 for DPT groundwater. Full COPCs for well	L-43	10	Delineate the eastern extent of Tc-99 impact.
	Surficial aquifer - downgradient of monitoring wells W-47 and W-64	Groundwater	-- 3 DPT groundwater screening borings -- 2 DPT borings on USL Dike and 1 DPT boring south of LSL -- 1 DPT or sonic groundwater screening boring west of the USL Dike -- Eastern-most boring from CVOC 8 -- Multiple interval groundwater screening -- Evaluate groundwater screening data -- Permanent well(s) based upon screening data	Tc-99 for DPT groundwater. Full COPCs for well.	L-35 through L-38	10	Delineate Tc-99 in the floodplain downgradient of well W-48 and LSL
	Surficial aquifer - downgradient of monitoring well W-4	Groundwater	-- 1 DPT groundwater screening boring downgradient of well W-4 -- Multiple interval groundwater screening -- Evaluate groundwater screening data -- Permanent well(s) based upon screening data	Tc-99 for DPT groundwater. Full COPCs for well	L-42	10	Delineate Tc-99 in the floodplain downgradient of well W-4 and upgradient of LSL
	Surficial aquifer - upper zone east of monitoring well W-67	Groundwater	-- 1 or 2 DPT borings with multiple interval groundwater sampling -- If other COPCs are above the MCL in the first boring, install 1 additional groundwater screenning boring east of the first boring -- Install 1 permanent monitoring well adjacent to the DPT boring with COPCs below MCL	Tc-99 for DPT groundwater. Full COPCs for well.	L-20	10	Groundwater Tc-99 delineation east of well W-67
Uranium	Upper Sunset Lake and Lower Sunset Lake	Sediment	-- 5 sediment transects -- 17 sediment sample locations -- Same sediment transects and sample locations as Phase I -- Collect sediment samples from the 0-0.5 ft, 0.5-1.0 ft depths -- Collect sediment samples from deeper 0.5 ft intervals if recovered in sampling equipment	Full COPCs	SED-19 trough SED-22, SED-38 through SED-50	11	Vertical delineation of uranium in sediment in USL and LSL
	Mill Creek background area	Sediment	-- 1 additional background sediment transect -- 3 sediment sample locations -- Collect sediment samples from the 0-0.5 ft, 0.5-1.0 ft depths -- Collect sediment samples from deeper 0.5 ft intervals if recovered in sampling equipment	U	SED-57 through SED-59	11	Further assessment of background sediment U concentrations in Mill Creek upstream of the canal
	Middle Ditch sediment quality	Sediment	-- 3 sediment sample locations in Middle Ditch -- Samples upstream, downstream, and at the location of sediment sample SED-16 -- Collect sediment samples from the 0-0.5 ft, 0.5-1.0 ft depths -- Collect sediment samples from deeper 0.5 ft intervals if recovered in sampling equipment	Full COPCs	SED-16, SED-60 and SED-61	11	Further assessment of sediment quality in the Middle Ditch near sediment sample SED-16
	Surface water elevations in upstream areas of Mill Creek and the canal	Surface water	-- 1 staff gauge in Mill Creek immediately downstream of Entrance Dike -- 1 staff gauge in Mill Creek immediately upstream of Entrance Dike -- 1 staff gauge in the upstream end of the canal	Surface water elevations	N/A	11	Assess surface water elevations and gradients in the areas of the Entrance Dike and canal to compare to the surface water elevations in USL and LSL to understand the potential for backflow from USL

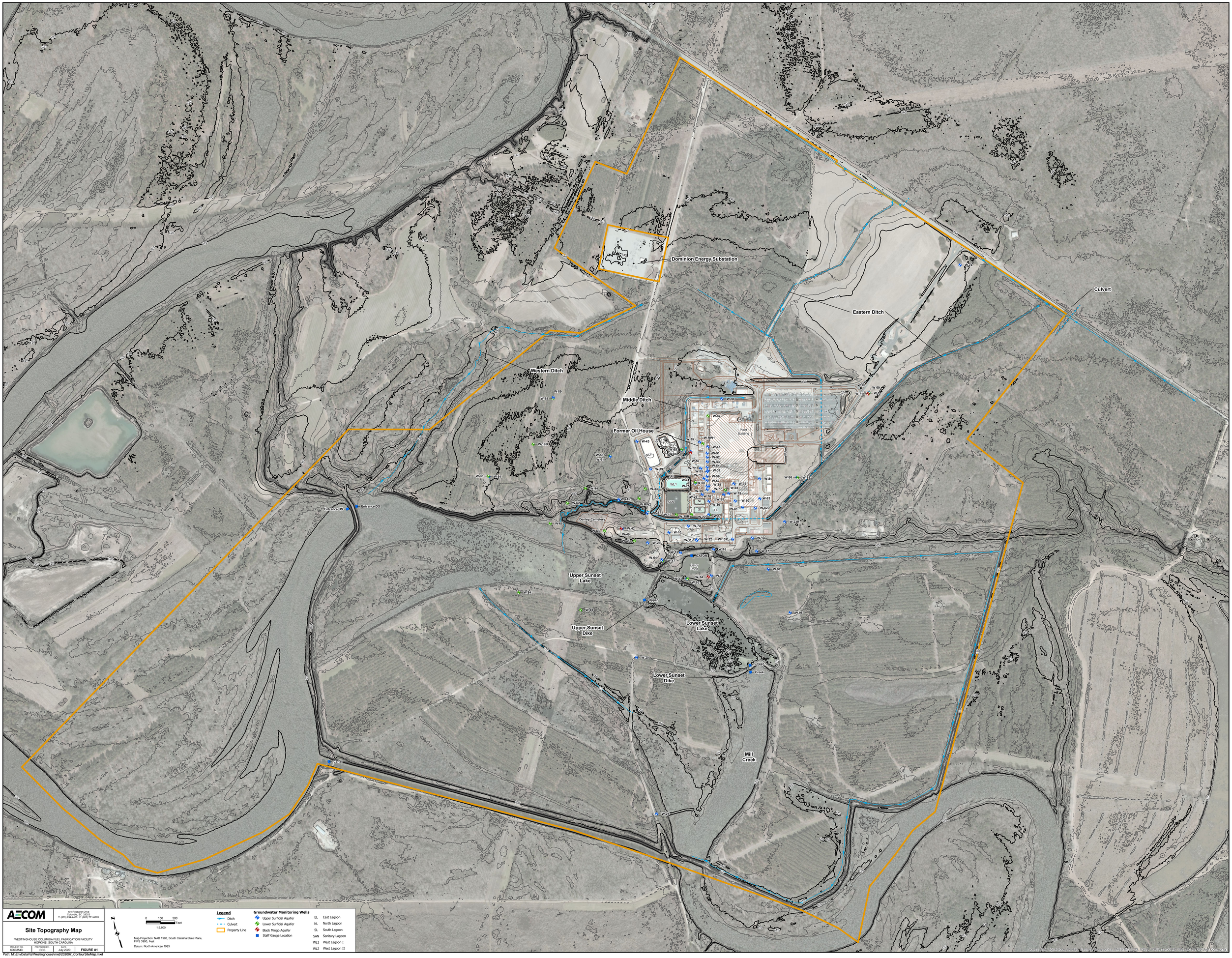
Table 1
Summary of Proposed Phase II RI Scope of Work
Westinghouse Columbia Fuel Fabrication Facility
Hopkins, South Carolina

COPC or Area of Interest	Data Need	Environmental Media	Assessment Activities	Analytes	Boring or Monitoring Well Reference	Figure Reference	Purpose and Rationale
Sanitary Lagoon	Groundwater quality west of the Sanitary Lagoon	Groundwater	-- Well pair adjacent to the western side of the Sanitary Lagoon -- 1 surficial aquifer - upper zone monitoring well -- 1 surficial aquifer - lower zone monitoring well	Full COPCs	W-99 and W-100	6-10	Assess whether COPCs have migrated from Sanitary Lagoon sludge into the upper and lower zones of the surficial aquifer
	Sludge characterization	Sludge	-- Sludge characterization plan to be submitted under separate cover.	Full COPCs	N/A	N/A	Further assessment of COPCs within the sludge
Gator Pond	Sediment quality	Sediment	-- 6 sediment sample locations -- Collect sediment samples from the 0-0.5 ft, 0.5-1.0 ft depths -- Collect sediment samples from deeper 0.5 ft intervals if recovered in sampling tools	Full COPCs	SED-23 and SED-24, SED-62 through SED-65	11	Assess whether COPCs are present in sediment in the Gator Pond
	Effect of surface water elevation on nearby groundwater flow	Surface water and groundwater	-- 1 pressure transducer on the Gator Pond staff gauge -- 5 pressure transducers in monitoring wells W-04, W-15, W-16, W-27, and W-92 -- Evaluate data collected from transducers	Surface water and groundwater Levels	N/A	N/A	Evaluate the effect of the surface water head in the Gator Pond on groundwater flow in the surficial aquifer
Middle Ditch	Groundwater/surface water interaction	Surface water and groundwater	-- Survey portions of Middle Ditch and Eastern Ditch for elevations of the bottom of the ditches -- Middle Ditch from near the calcium fluoride pad to the confluence with Eastern Ditch -- Eastern Ditch from the pipe south of the East Lagoon to power line right of way near well W-62	N/A	N/A	11	Further understand the groundwater/surface water interaction within the deeply incised portions of the ditches
Multiple areas	Surface soil properties	Soil	-- Surface/shallow subsurface soils in multiple areas above the bluff and within the floodplain -- DPT coring to 4-5 feet -- Grain size analyses	Grain size	N/A	N/A	Assess properties of low permeability surface soil and shallow subsurface soil
Multiple monitoring wells	Hydraulic conductivity and average groundwater velocity	Groundwater	-- 11 slug tests on permanent monitoring wells -- Existing monitoring wells W-6, W-11, W-19B, W-67, W-68 -- 3 new wells above the bluff -- 3 new wells in the floodplain	N/A	N/A	N/A	Assess hydraulic characteristics and groundwater velocity of the surficial aquifer

Notes:

CVOC - Chlorinated volatile organic compound
SCDHEC - South Carolina Department of Health and Environmental Control
PCE - Tetrachloroethene
DPT - Direct push technology
COPC - Contaminant of potential concern
MCL - Maximum contaminant level
AOC - Area of concern
USL - Upper Sunset Lake
LSL - Lower Sunset Lake
Tc-99 - Technetium 99
NRC - Nuclear Regulatory Commission
N/A - Not applicable

Appendix A
Site Topographic Maps



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Site Topography Map

WESTINGHOUSE COLUMBIA FUEL FABRICATION FACILITY
HOPKINS, SOUTH CAROLINA

PROJECT NO	PREPARED BY	DATE	
60633043	CCB	July 2020	**FIGURE A1**

0 150 300 Feet
1:3,600

Map Projection: NAD 1983, South Carolina State Plane, FIPS 3900, Feet
Datum: North American 1983

Legend
- Ditch
- Culvert
- Property Line

Groundwater Monitoring Wells
- Upper Surficial Aquifer
- Lower Surficial Aquifer
- Black Mingo Aquifer
- Staff Gauge Location

EL East Lagoon
NL North Lagoon
SL South Lagoon
SAN Sanitary Lagoon
WL1 West Lagoon I
WL2 West Lagoon II

Path: M:\Env\Data\Viz\Westinghouse\mxd\202007_ContourSiteMap.mxd

AECOM
101 Research Drive
Columbia, SC 29203
T: (803) 254-4400 F: (803) 771-6676

Ditch Topography Map

WESTINGHOUSE COLUMBIA FUEL FABRICATION FACILITY
HOPKINS, SOUTH CAROLINA

PROJECT NO.	PREPARED BY	DATE	
60633543	CCB	July 2020	**FIGURE A2**

0 25 50 Feet
1:600

Map Projection: NAD 1983, South Carolina State Plane, FIPS 3900, Feet
Datum: North American 1983

Legend
- Ditch
- Culvert
- Property Line

Groundwater Monitoring Wells
- Upper Surficial Aquifer
- Lower Surficial Aquifer
- Black Mingo Aquifer
- Staff Gauge Location

EL	East Lagoon
NL	North Lagoon
SL	South Lagoon
SAN	Sanitary Lagoon
WL1	West Lagoon I
WL2	West Lagoon II

Path: M:\Env\Data\Viz\Westinghouse\mxd\20200707_ContourSiteMap-50ft.mxd

Appendix B
Conceptual Site Model

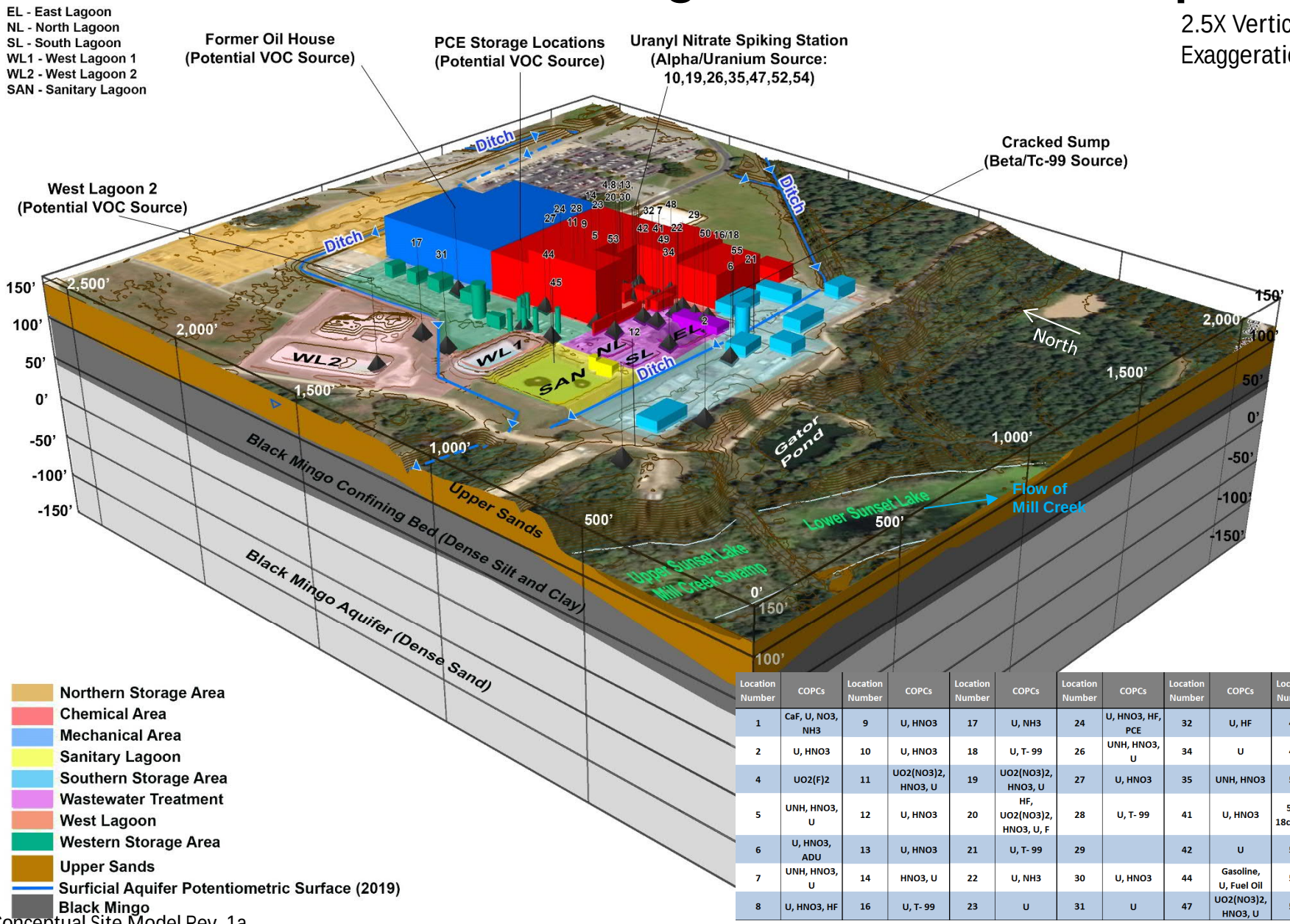
Conceptual Site Model
Rev. 1a

Westinghouse Columbia

Site CSM Block Diagram – Known Spills

EL - East Lagoon
NL - North Lagoon
SL - South Lagoon
WL1 - West Lagoon 1
WL2 - West Lagoon 2
SAN - Sanitary Lagoon

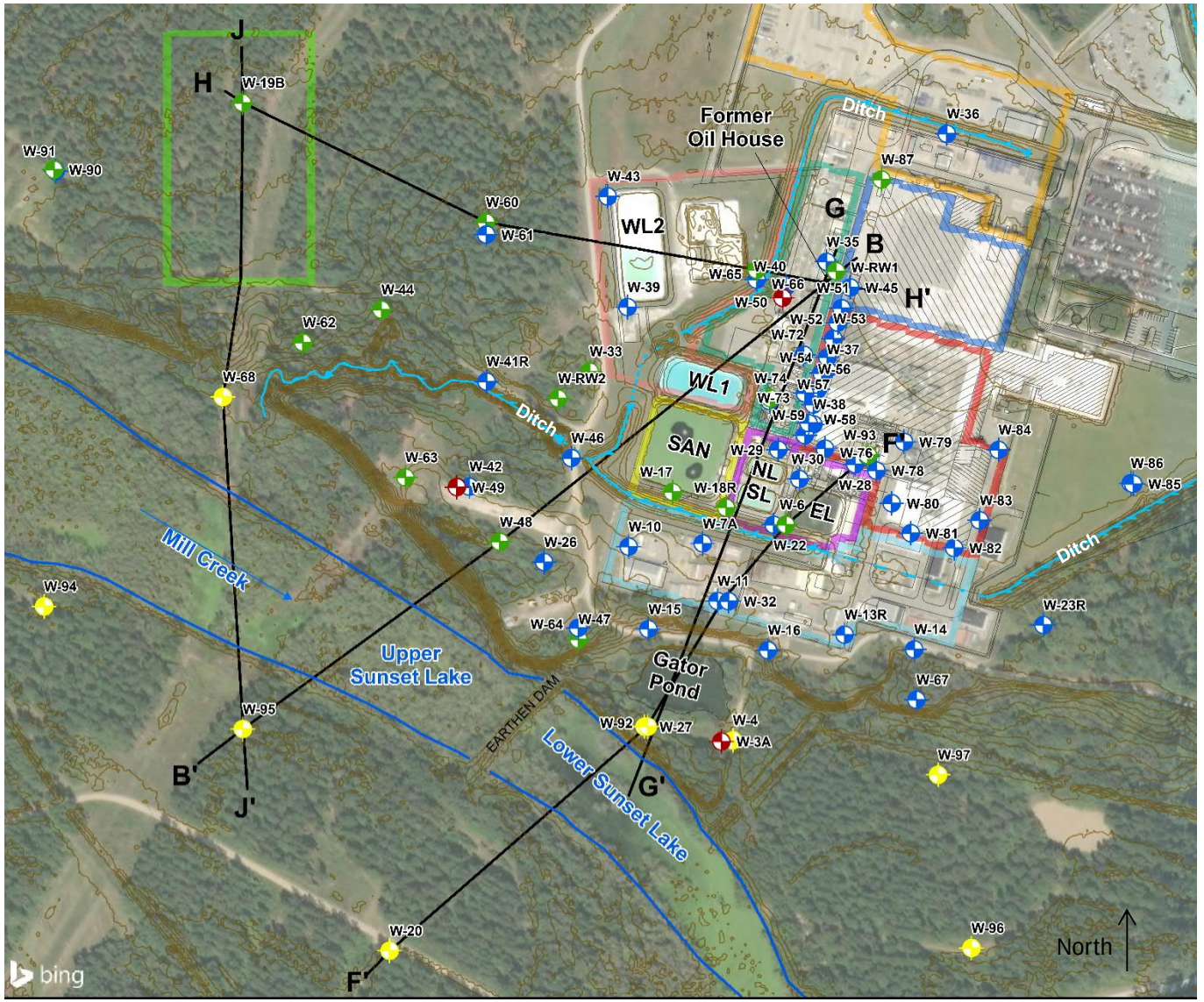
2.5X Vertical Exaggeration



Northern Storage Area
Chemical Area
Mechanical Area
Sanitary Lagoon
Southern Storage Area
Wastewater Treatment
West Lagoon
Western Storage Area
Upper Sands
Surficial Aquifer Potentiometric Surface (2019)
Black Mingo

Location Number	COPCs	Location Number	COPCs	Location Number	COPCs	Location Number	COPCs	Location Number	COPCs	Location Number	COPCs
1	CaF, U, NO3, NH3	9	U, HNO3	17	U, NH3	24	U, HNO3, HF, PCE	32	U, HF	48	HF, U,
2	U, HNO3	10	U, HNO3	18	U, T- 99	26	UNH, HNO3, U	34	U	49	U
4	UO2(F)2	11	UO2(NO3)2, HNO3, U	19	UO2(NO3)2, HNO3, U	27	U, HNO3	35	UNH, HNO3	50	U
5	UNH, HNO3, U	12	U, HNO3	20	HF, UO2(NO3)2, HNO3, U, F	28	U, T- 99	41	U, HNO3	52c 18c&46c	UNH, HNO3, U
6	U, HNO3, ADU	13	U, HNO3	21	U, T- 99	29		42	U	53	U
7	UNH, HNO3, U	14	HNO3, U	22	U, NH3	30	U, HNO3	44	Gasoline, U, Fuel Oil	54	UNH, HNO3, U
8	U, HNO3, HF	16	U, T- 99	23	U	31	U	47	UO2(NO3)2, HNO3, U	55	U, Tc-99

Site CSM Block Diagram – Transect Reference

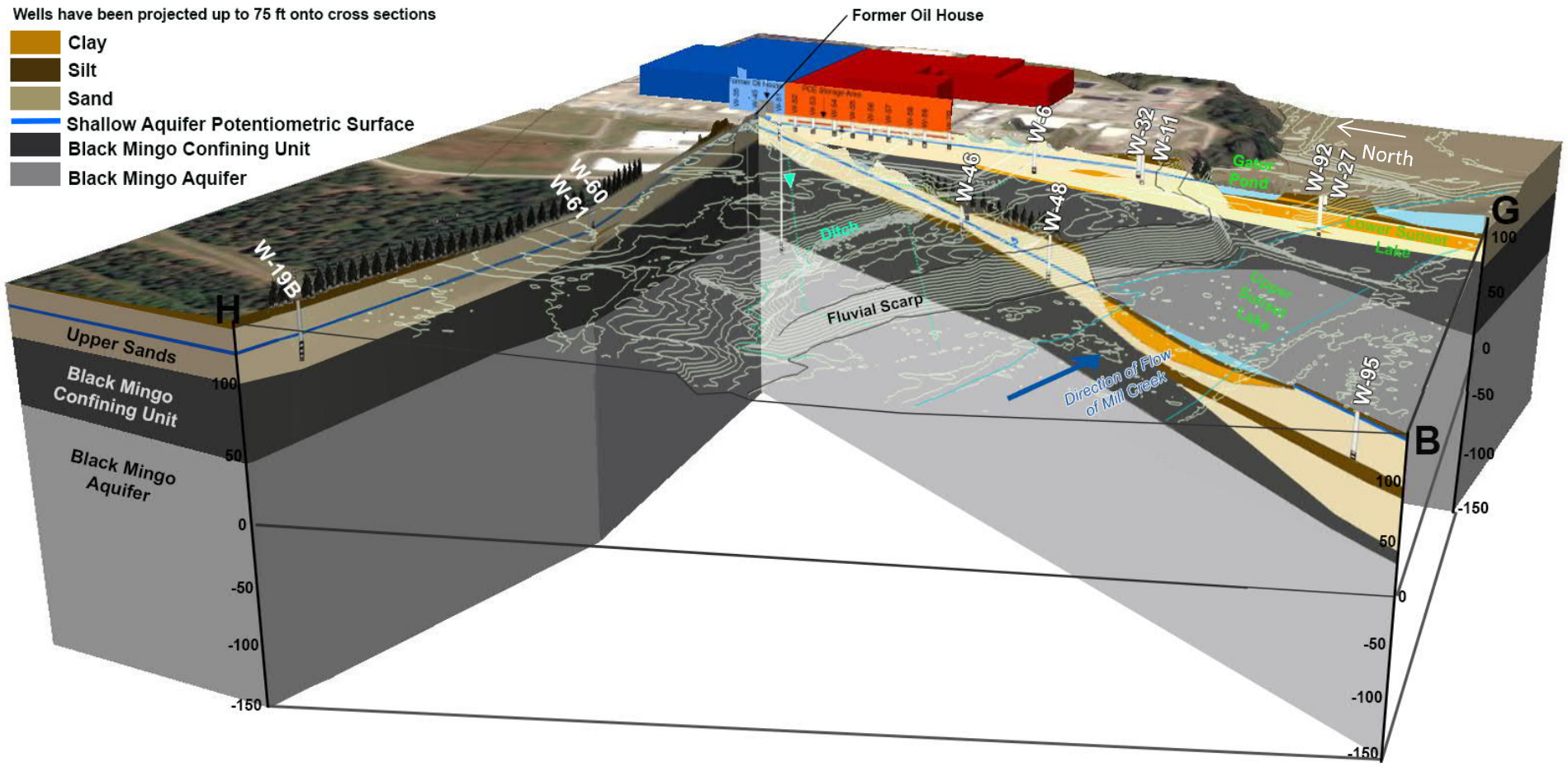


EL - East Lagoon
NL - North Lagoon
SL - South Lagoon
WL1 - West Lagoon 1
WL2 - West Lagoon 2
SAN - Sanitary Lagoon

- Northern Storage Area
- Chemical Area
- Mechanical Area
- Sanitary Lagoon
- Southern Storage Area
- Wastewater Treatment
- West Lagoon
- Western Storage Area

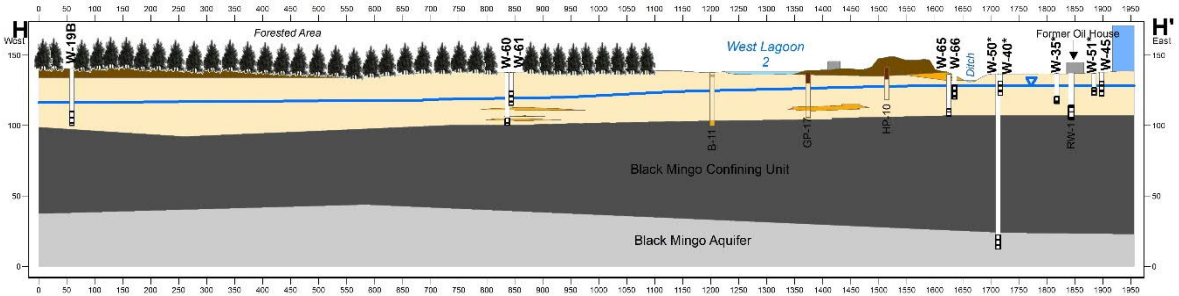
Conceptual Site Model Rev. 1a

Site CSM Block Diagram – Geology

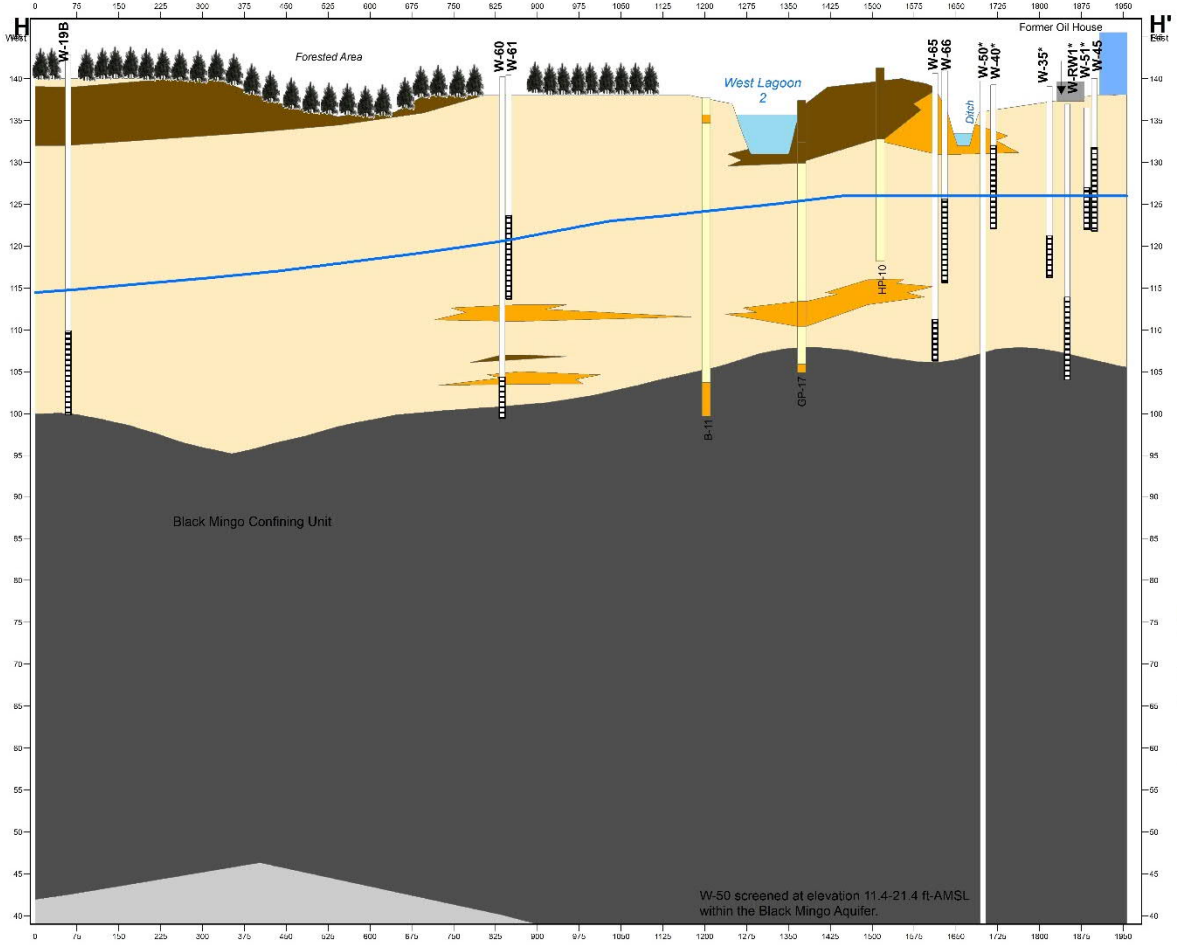


2.5X Vertical Exaggeration

Site CSM Cross Sections



2.5X Vertical Exaggeration



15X Vertical Exaggeration

Wells up to 75' away from the transect are projected onto the cross sections. Wells that are >20 ft and less than 75 ft are indicated with an asterisk (*).

Legend

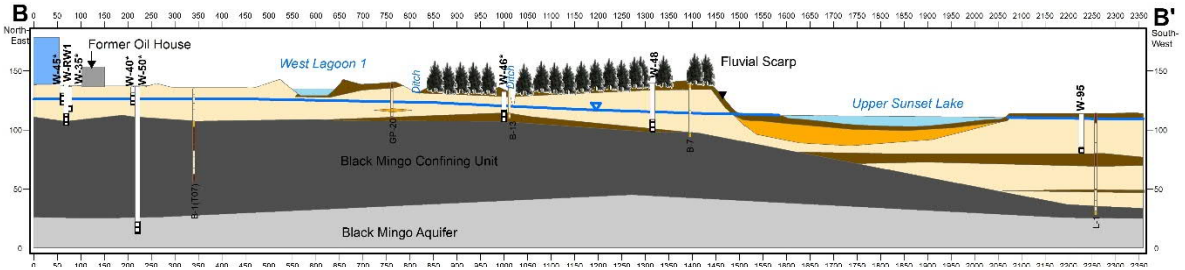
- Well Riser
- Well Screen
- Potentiometric Surface (2019)
- Mechanical Area OU
- Surface Water

Lithology

- Clay
- Silt
- Sand
- Black Mingo
- Black Mingo Aquifer

Conceptual Site Model Rev. 1a

Site CSM Cross Sections



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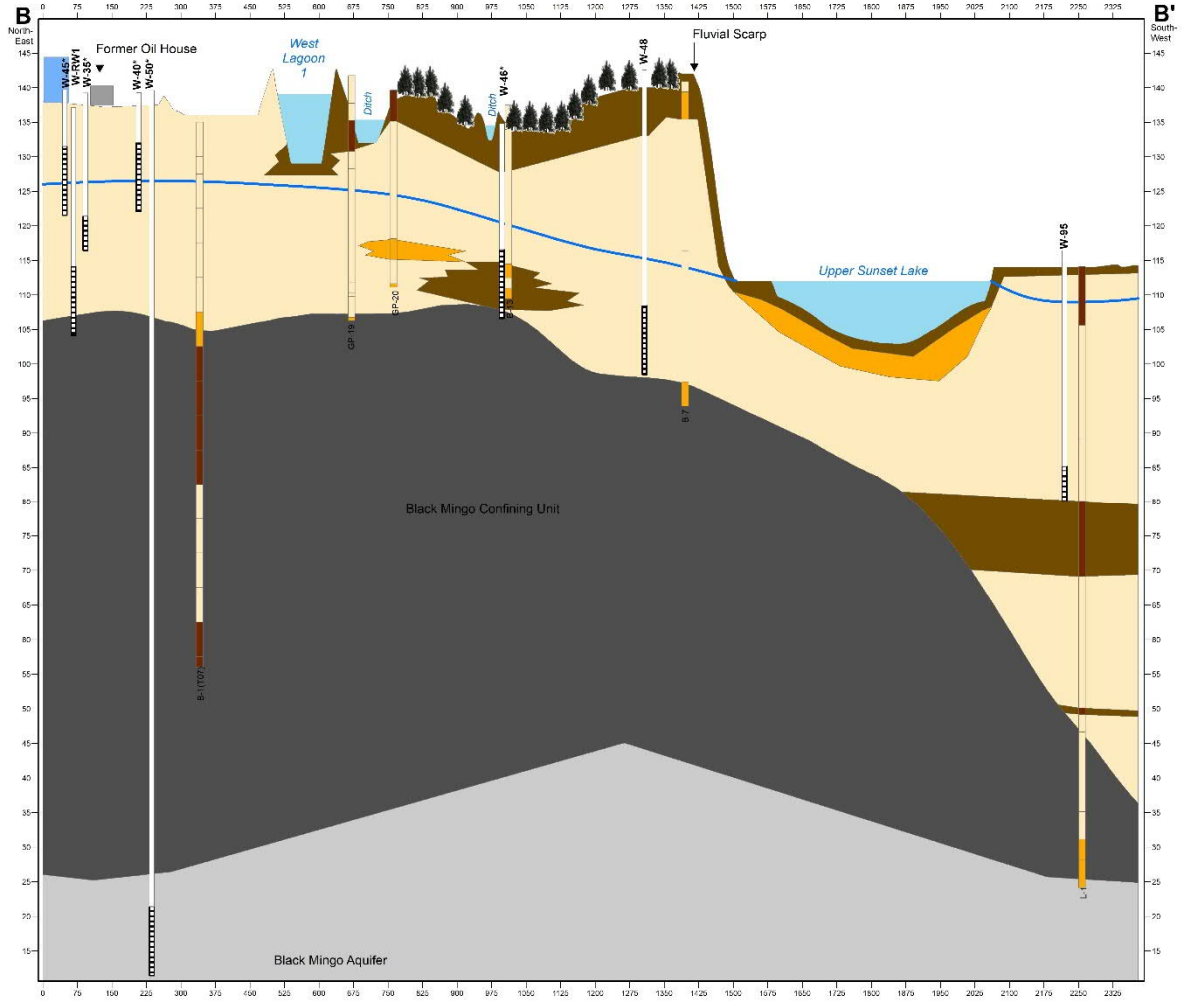


15X Vertical Exaggeration

Wells up to 75' away from the transect are projected onto the cross sections. Wells that are >20 ft and less than 75 ft are indicated with an asterisk (*).

Legend

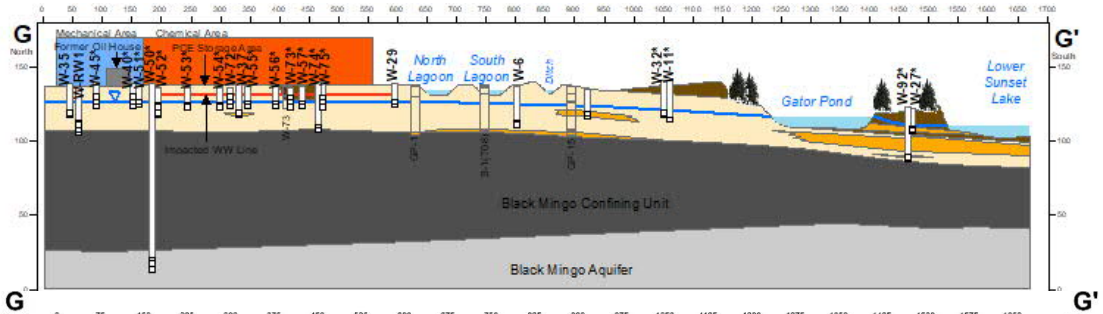
- Well Riser
- Well Screen
- Potentiometric Surface (2019)
- Mechanical Area OU
- Surface Water

Lithology

- Clay
- Silt
- Sand
- Black Mingo
- Black Mingo Aquifer

Conceptual Site Model Rev. 1a

Site CSM Cross Sections



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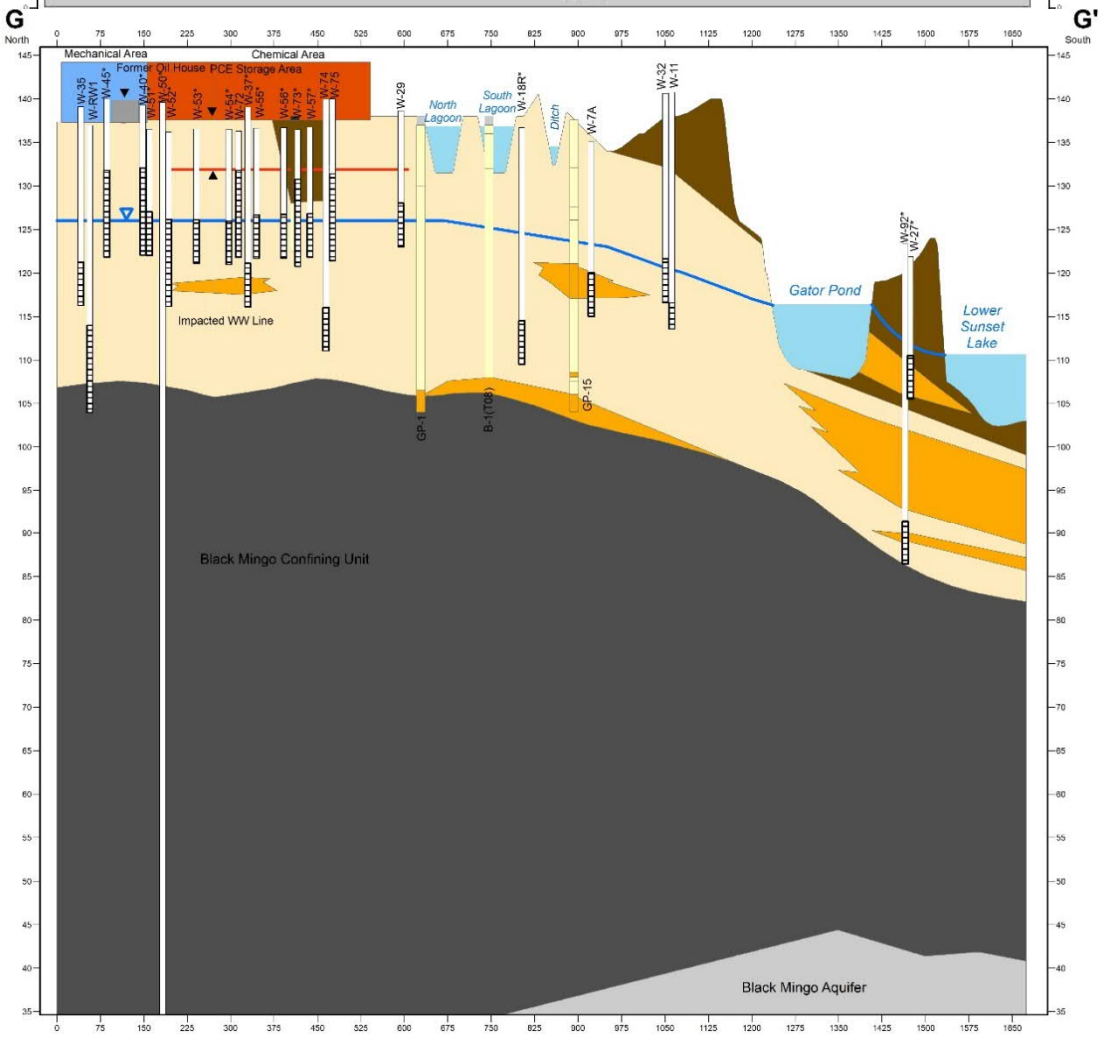


15X Vertical Exaggeration

Wells up to 75' away from the transect are projected onto the cross sections. Wells that are >20 ft and less than 75 ft are indicated with an asterisk (*).

Legend

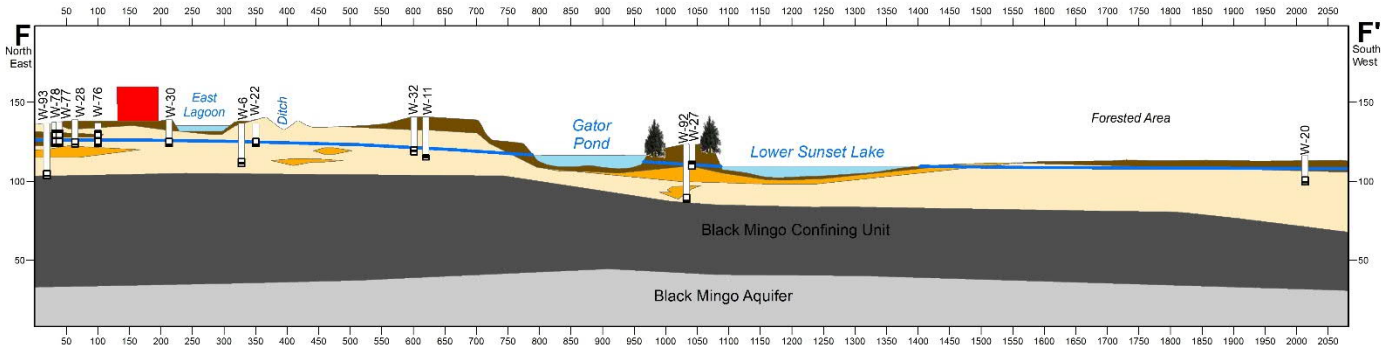
- Well Riser
- Well Screen
- Potentiometric Surface (2019)
- Mechanical Area OU
- Chemical Area OU
- Surface Water

Lithology

- Clay
- Silt
- Sand
- Black Mingo
- Black Mingo Aquifer

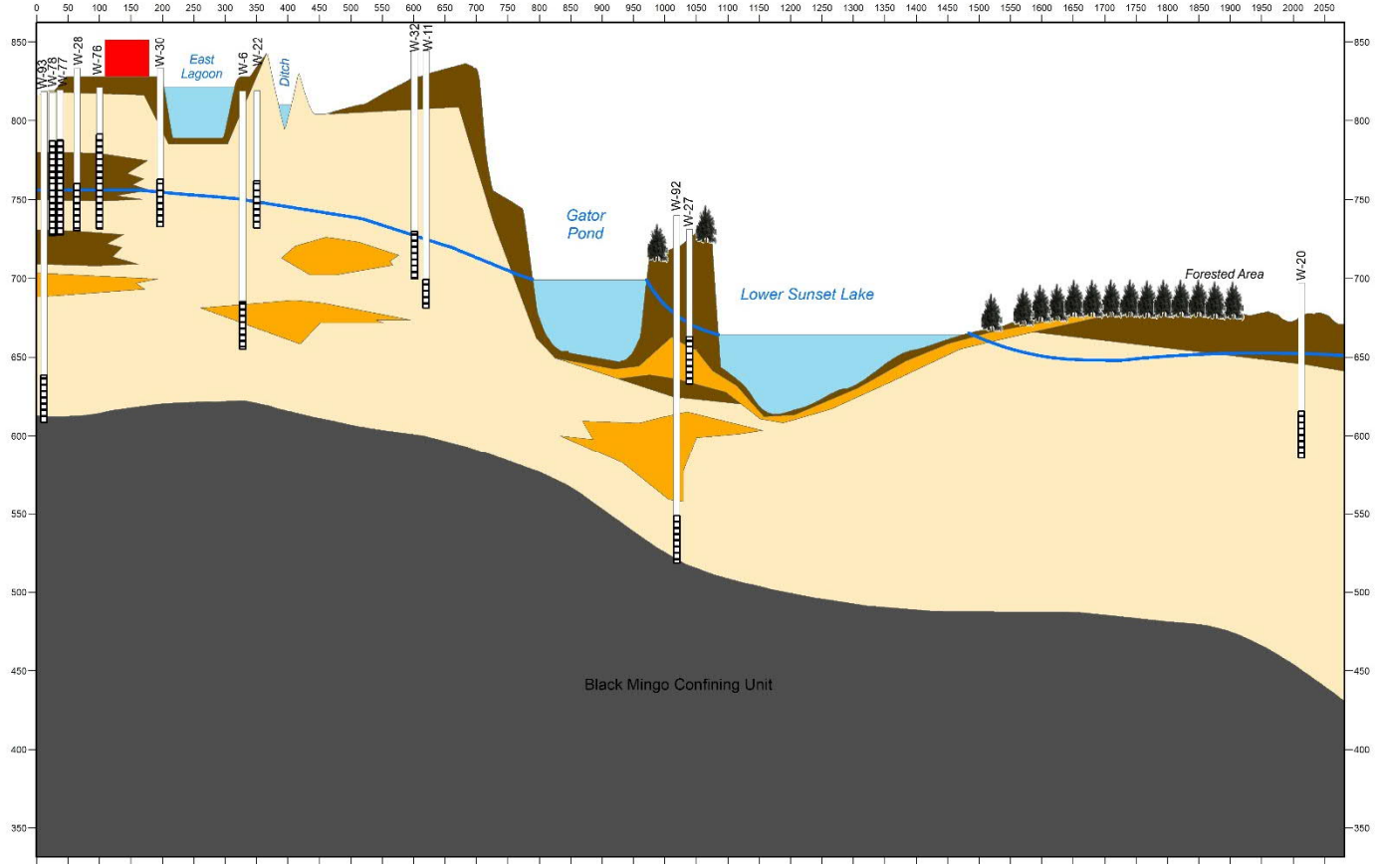
Conceptual Site Model Rev. 1a

Site CSM Cross Sections



2.5X Vertical Exaggeration

15X Vertical Exaggeration



Wells up to 75' away from the transect are projected onto the cross sections. Wells that are >20 ft and less than 75 ft are indicated with an asterisk (*).

Legend

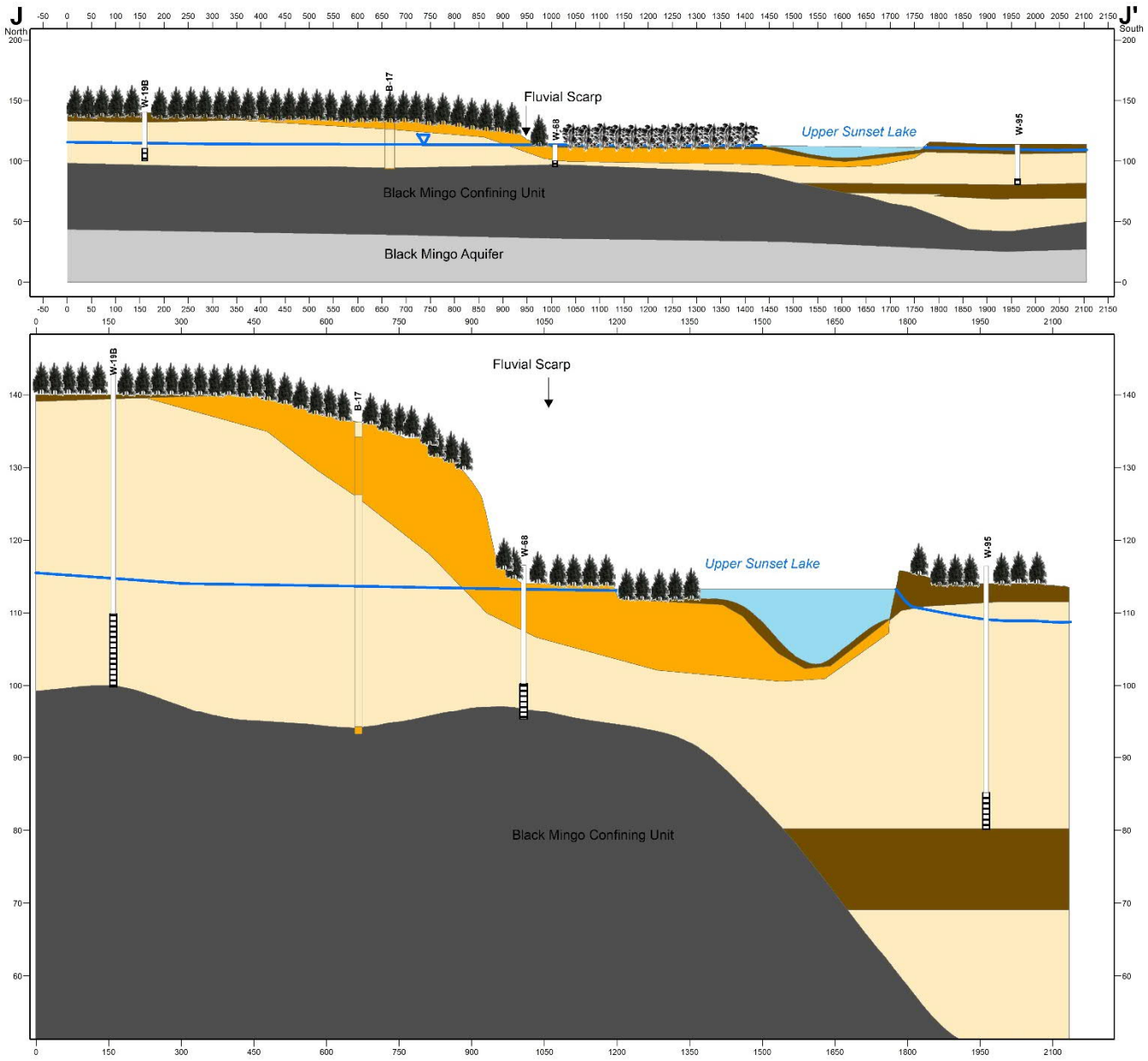
- Well Riser
- Well Screen
- Potentiometric Surface (2019)
- Chemical Area OU
- Surface Water

Lithology

- Clay
- Silt
- Sand
- Black Mingo
- Black Mingo Aquifer

Conceptual Site Model Rev. 1a

Site CSM Cross Sections



2.5X Vertical Exaggeration

15X Vertical Exaggeration

Wells up to 75' away from the transect are projected onto the cross sections. Wells that are >20 ft and less than 75 ft are indicated with an asterisk (*).

Legend

Well Riser

Well Screen

Potentiometric Surface (2019)

Surface Water

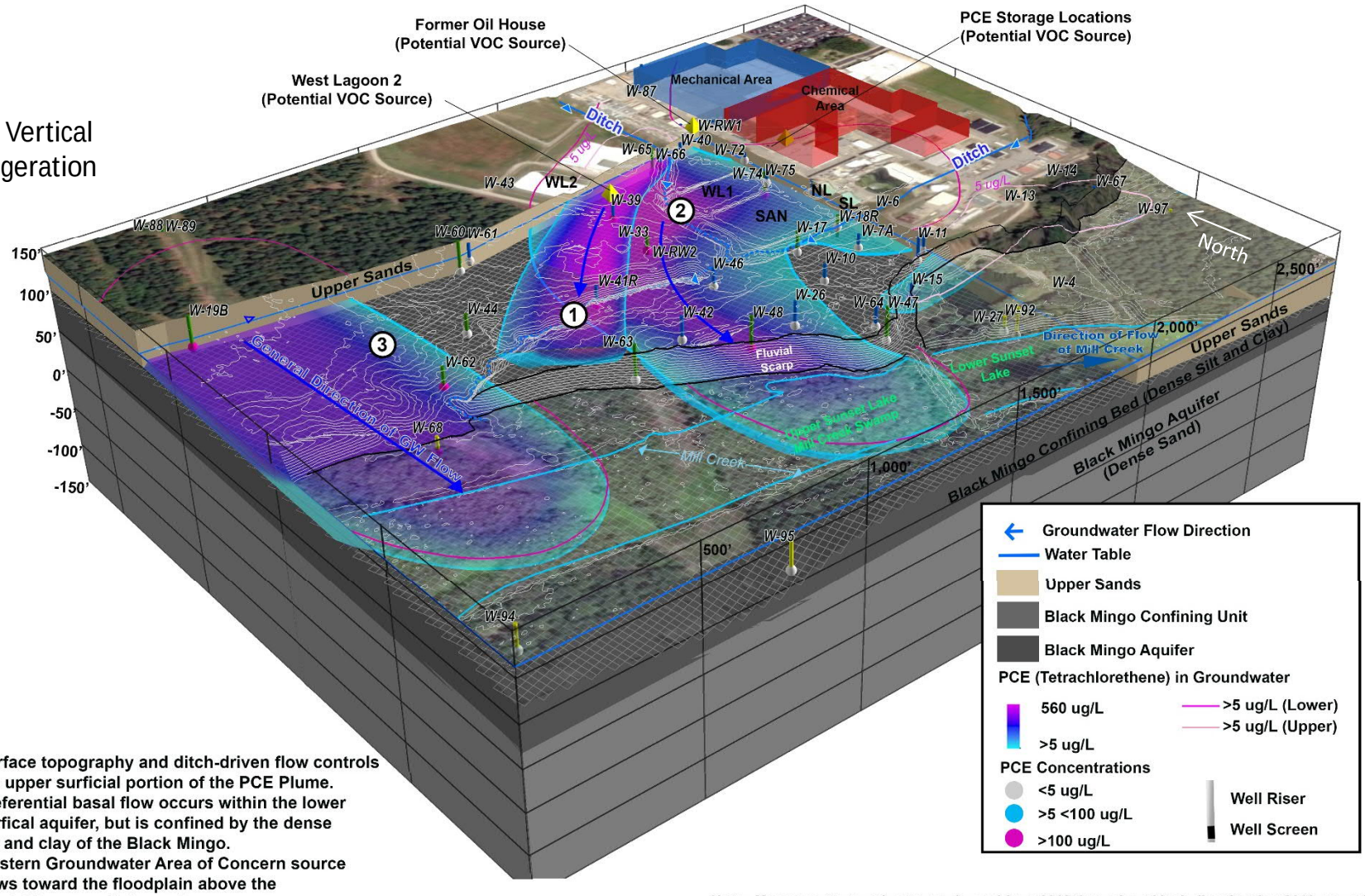
Lithology

- Clay
- Silt
- Sand
- Black Mingo
- Black Mingo Aquifer

Conceptual Site Model Rev. 1a

Site CSM Block – PCE

2.5X Vertical Exaggeration

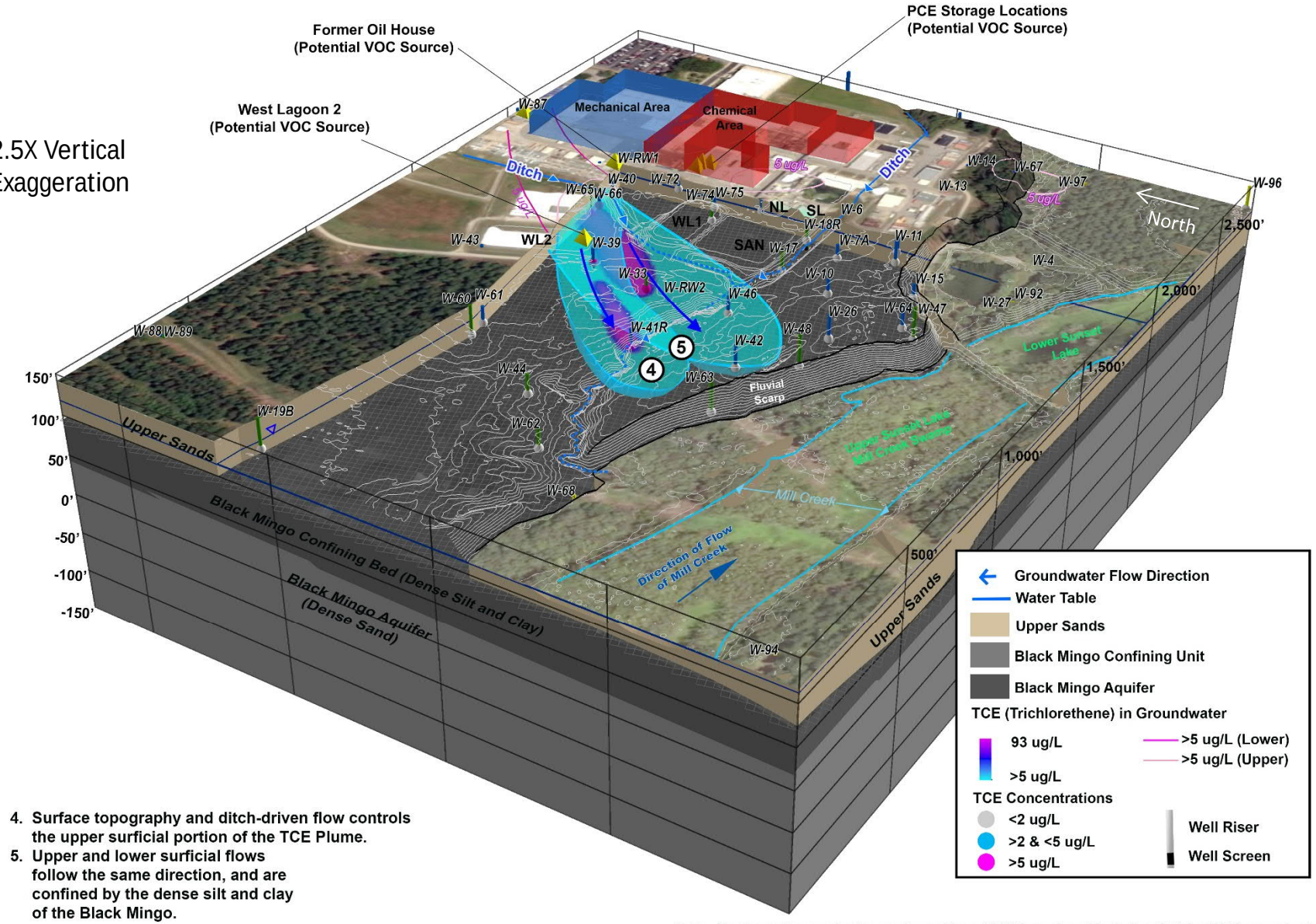


1. Surface topography and ditch-driven flow controls the upper surficial portion of the PCE Plume.
2. Preferential basal flow occurs within the lower surfical aquifer, but is confined by the dense silt and clay of the Black Mingo.
3. Western Groundwater Area of Concern source flows toward the floodplain above the Black Mingo confining unit.

Note: Most recent groundwater result used from 2018 through and including October 2019 groundwater results.

Site CSM Block – TCE

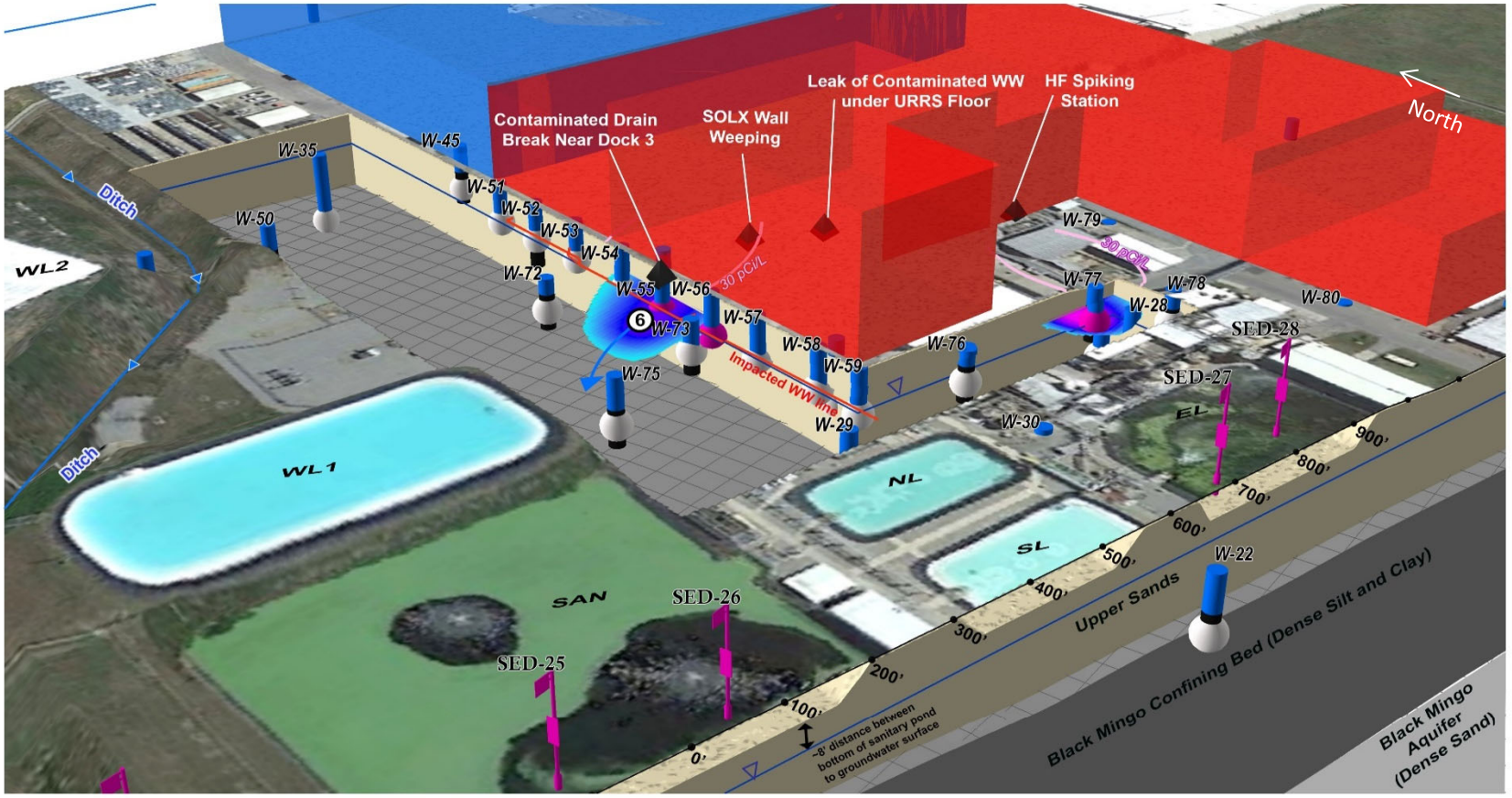
2.5X Vertical Exaggeration



4. Surface topography and ditch-driven flow controls the upper surficial portion of the TCE Plume.
5. Upper and lower surficial flows follow the same direction, and are confined by the dense silt and clay of the Black Mingo.

Note: Most recent groundwater result used from 2018 through and including October 2019 groundwater results.

Site CSM Block –Uranium Sources



Uranium Concentrations
>200 ug/L in Groundwater
>30 ug/L in Groundwater
Potential Radioactive Release Sources
Uranium in Groundwater Above MCL
Uranium in Groundwater Above MCL

Upper Surficial Groundwater Well

Upper Sands
Black Mingo Confining Unit
Black Mingo Aquifer
Groundwater Flow Direction
Water Table
>30 pCi/L (Upper)

6. Flow from source areas into uppermost surficial aquifer only and low rate of advection and dispersion

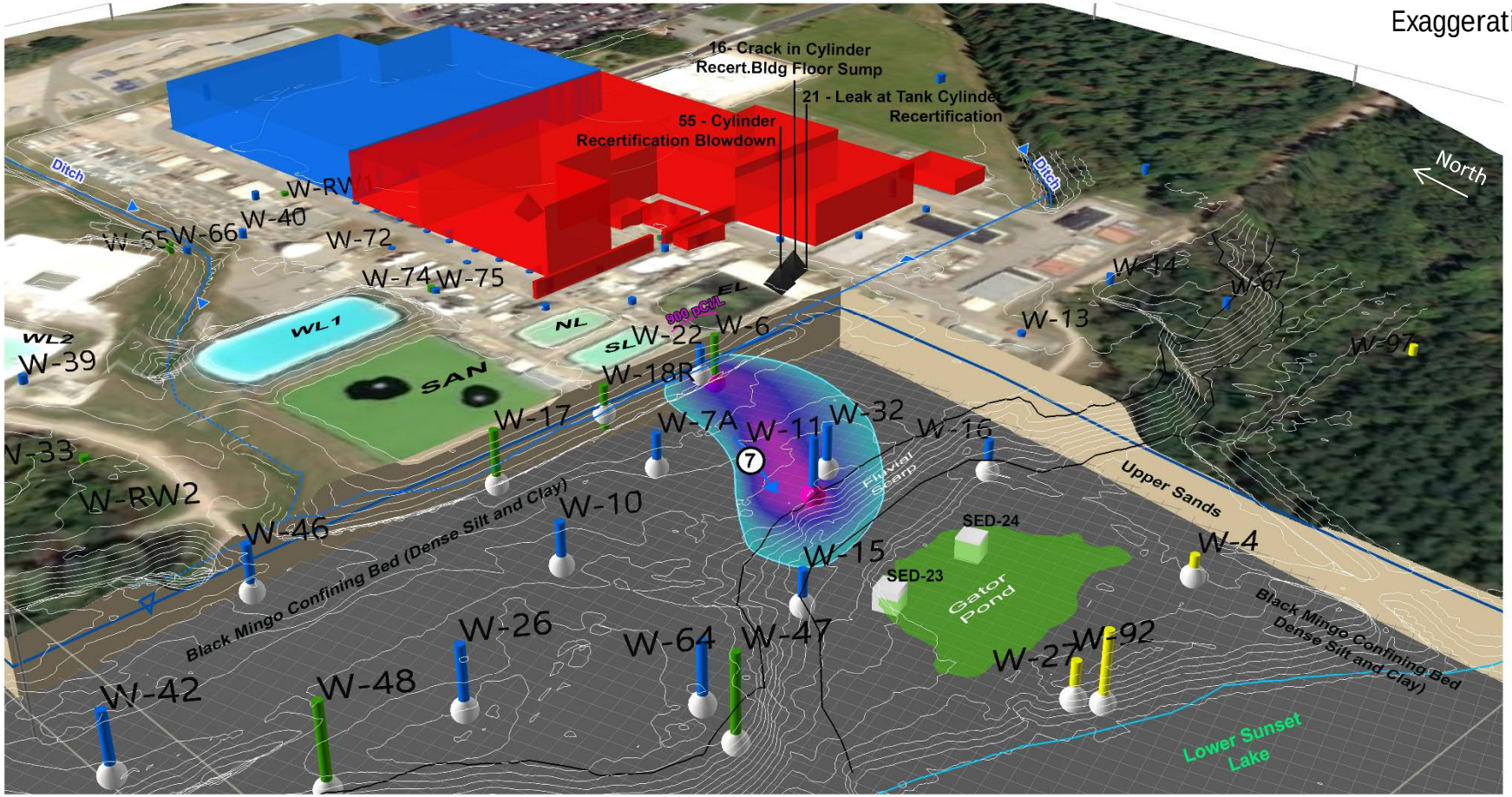
EL - East Lagoon
NL - North Lagoon
SL - South Lagoon
WL1 - West Lagoon 1
WL2 - West Lagoon 2
SAN - Sanitary Lagoon

Note: Most recent groundwater result used from 2018 through and including October 2019 groundwater results.

2.5X Vertical Exaggeration

Site CSM Block –Tc-99 Sources

2.5X Vertical Exaggeration



Technetium-99 Concentrations
>3000 pCi/L in Groundwater
>900 pCi/L in Groundwater
Potential Tc-99 Release Sources
>900 pCi/L (Lower)

Upper Sands
Black Mingo Confining Bed

Groundwater Flow Direction
Water Table

Upper Surficial Monitoring Well
Lower Surficial Monitoring Well
Floodplain Surficial Monitoring Well

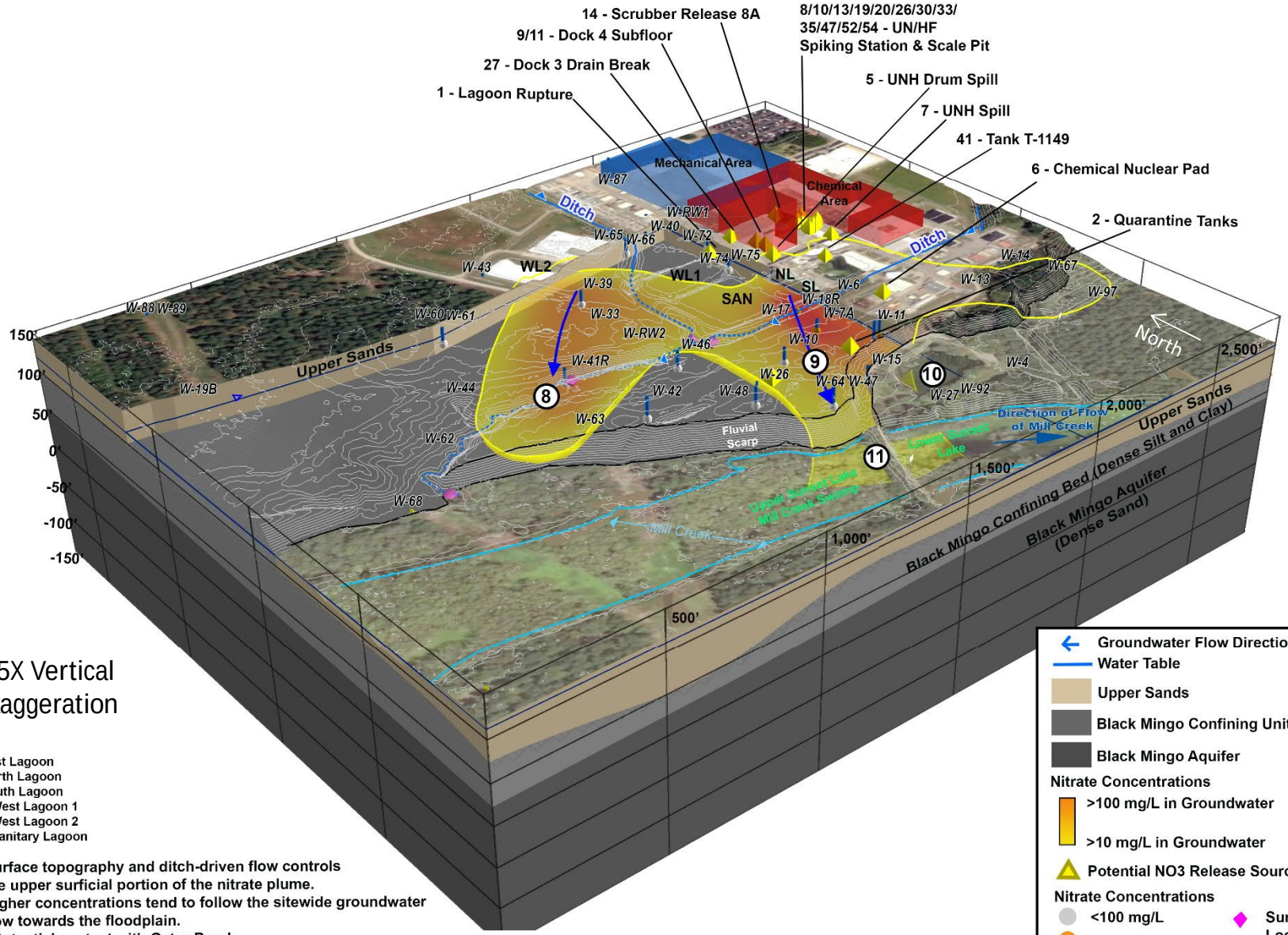
7. Higher concentrations tend to follow the sitewide groundwater flow toward the floodplain.

Tc-99 > 900 pCi/L
Tc-99 < 900 pCi/L

EL - East Lagoon
NL - North Lagoon
SL - South Lagoon
WL1 - West Lagoon 1
WL2 - West Lagoon 2
SAN - Sanitary Lagoon

Note: Most recent groundwater result used from 2018 through and including October 2019 groundwater results.

Site CSM Block –NO3 Sources



2.5X Vertical Exaggeration

EL - East Lagoon
NL - North Lagoon
SL - South Lagoon
WL1 - West Lagoon 1
WL2 - West Lagoon 2
SAN - Sanitary Lagoon

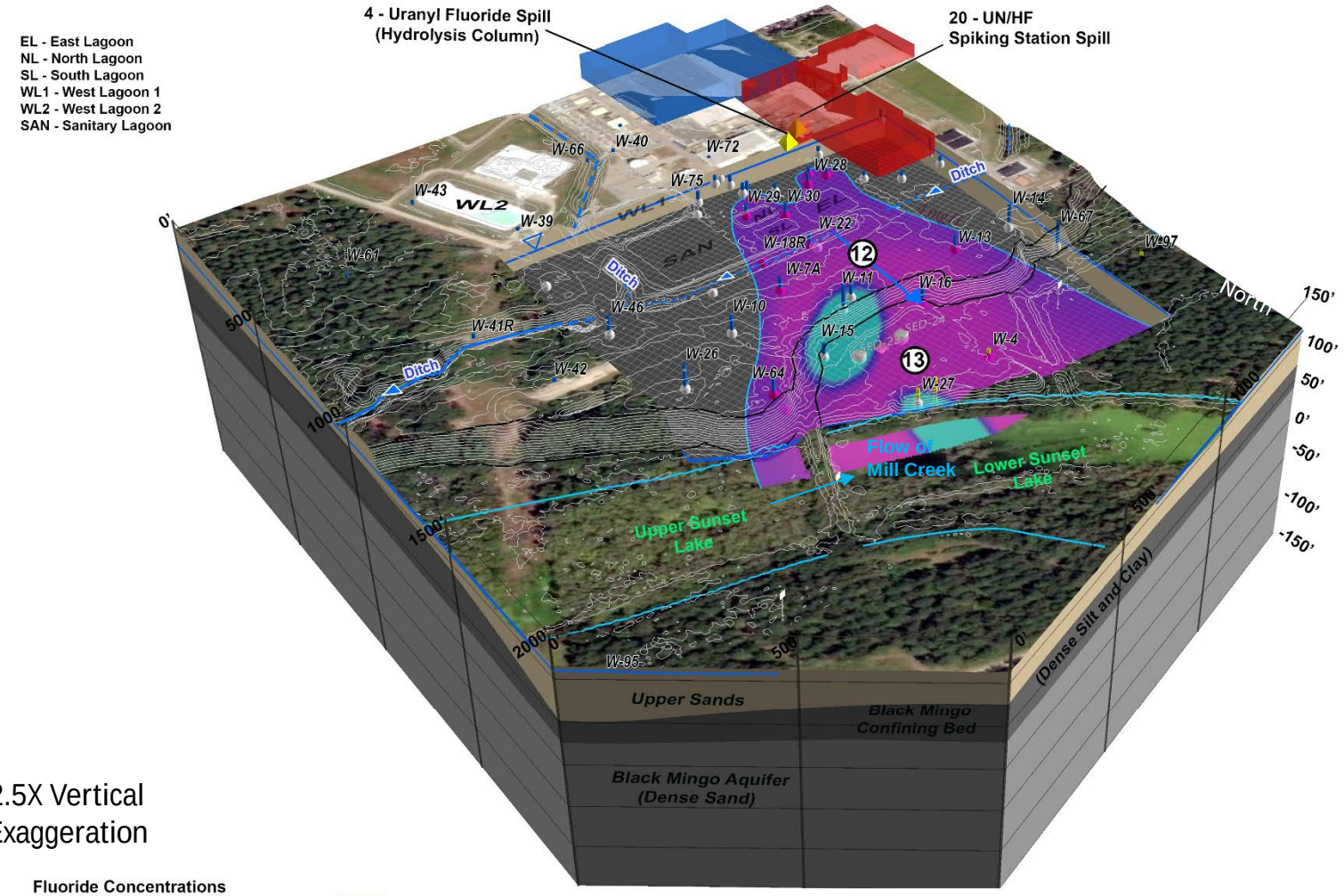
8. Surface topography and ditch-driven flow controls the upper surficial portion of the nitrate plume.
9. Higher concentrations tend to follow the sitewide groundwater flow towards the floodplain.
10. Potential contact with Gator Pond
11. Potential flow beneath Lower Sunset Lake

Groundwater Flow Direction
Water Table
Upper Sands
Black Mingo Confining Unit
Black Mingo Aquifer
Nitrate Concentrations
>100 mg/L in Groundwater
>10 mg/L in Groundwater
Potential NO3 Release Sources
Nitrate Concentrations
<100 mg/L
>100 mg/L
Surface Water Locations

Conceptual Site Model Rev. 1a

Note: Most recent groundwater result used from 2018 through and including October 2019 groundwater results.

Site CSM Block –Fluoride Sources



2.5X Vertical Exaggeration

Fluoride Concentrations
>9 mg/L in Groundwater
>4mg/L in Groundwater
Potential Fluoride Release Sources

Upper Sands
Black Mingo Confining Bed
Black Mingo Aquifer

Groundwater Flow Direction
Water Table
Upper Surficial Groundwater Well

Fluoride > 4 mg/L
Fluoride < 4 mg/L

12. Fluoride plume tends to follow the sitewide groundwater flow toward the Gator Pond and the floodplain.
13. Contact with the Gator Pond.

Conceptual Site Model Rev. 1a

Note: Most recent groundwater result used from 2018 through and including October 2019 groundwater results.

Appendix C
Unanticipated Discovery Procedure

Procedures Guiding the Discovery of Unanticipated Cultural Resources and Human Remains

Unanticipated Discovery Plan for the WCFFF, Rev0

Previously unrecorded cultural resources are sometimes discovered during the course of subsurface investigation projects, even after the project area has been surveyed for cultural resources. Because there is a potential to encounter undiscovered cultural resources within the limits of the project's Area of Potential Effects, WCFFF has developed the following Unanticipated Discovery Plan to be implemented should new or additional cultural resources be found after subsurface investigation has begun on the project.

This plan has been developed in order to assure protection of cultural resources. A cultural resource discovery could be prehistoric or historic. Examples include:

- An accumulation of shell, burned rocks, or other food-related materials;
- Bones or fragments of bones;
- An area of charcoal or dark stained soil;
- Stone tools or stone waste flakes;
- Clusters of glass bottles, cans, jars, bricks, etc.;
- Stone foundations; or
- Buried railroad ties or tracks, machinery, or other industrial equipment.

An unusual object or soil deposit should be assumed to be a cultural resource until determined otherwise by qualified personnel as described in the evaluation and consultation steps below.

The following steps will be implemented should an unanticipated discovery be made by a WCFFF inspector, contractor, or subcontractor during environmental investigations:

1) STOP WORK. Construction activities within the immediate area of an unanticipated discovery will be halted ("immediate area" is a context-specific measure, however roughly 30 to 50 feet is generally adequate, although special attention should be given to the possible extension of a new find beyond this buffer zone), and the discovery will be marked off and protected from further disturbance by equipment, vehicles, or personnel. No work will resume until identification and treatment of the find has been resolved via the procedure outlined in the consultation step.

2) NOTIFICATION. The WCFFF Project Manager and Environmental Manager in the attached Contact List will be immediately notified by telephone. The Environmental Manager will notify the South Carolina State Historic Preservation Office (SHPO) and law enforcement agencies as needed (the latter parties will be notified only in the case of a finding of human remains). These notifications will take place within 24 hours of an unanticipated discovery.

3) EVALUATION. The Environmental Manager will ensure that a qualified professional archaeologist examines the find to determine if it is of potential archaeological

significance. The archaeologist will consult with the SHPO in making the evaluation of potential significance. If it is not, construction will be allowed to continue. If it is determined to be of potential significance, additional notifications and consultation will be made.

4) CONSULTATION. WCFFF will consult with the SHPO to determine further course of action. This may involve further archaeological study or consultation with Native American groups or other parties with established cultural affiliation. Construction activities will remain halted until the South Carolina Department of Health and Environmental Control (DHEC) and the SHPO indicates to WCFFF that it may proceed in the area of a specific unanticipated discovery.

In the case of an unanticipated discovery of human remains, WCFFF will follow all relevant state and federal laws regarding treatment of human remains. In South Carolina, state laws protect cemeteries, graveyards, and burial grounds, including S.C. Code Ann. Section 16-17-600 et. seq., which makes it a felony to destroy, damage, remove, or desecrate human remains, as well as to vandalize, destroy, deface, or otherwise damage graveyards, tombs, mausoleums, gravestones, memorial monuments, and markers. WCFFF recognizes the importance of providing careful and respectful treatment for human remains recovered as an unanticipated discovery or as part of an archaeological investigation. In the event of an unanticipated discovery of human remains, WCFFF will use the following *Human Remains Discovery Protocol:*

1) Should human remains be encountered, work in the general area of the discovery will stop immediately and the location will be immediately secured and protected from damage and disturbance.

2) Human remains or associated artifacts will be left in place and not disturbed. No skeletal remains or materials associated with the remains will be collected or removed until appropriate consultation has taken place and a plan of action has been developed.

3) The county coroner/medical examiner, local law enforcement, and the SHPO will be notified immediately. The coroner and local law enforcement will make the official ruling on the nature of the remains, being either forensic or archaeological.

4) If human remains are determined to be Native American, the remains will be left in place and protected from further disturbance until a plan for their avoidance or removal can be generated. Avoidance is usually the preferred choice of the SHPO and the Indian Nations. The involved agency will consult SHPO and appropriate Indian Nations to develop a plan of action that is consistent with the Native American Graves Protection and Repatriation Act (NAGPRA) guidance.

5) If human remains are determined to be non-Native American, the remains will be left in place and protected from further disturbance until a plan for their avoidance or removal can be generated. Avoidance is usually the preferred choice of the SHPO. Consultation with the SHPO and other appropriate parties will be required to determine a plan of action.

Contact List:

Unanticipated Discovery Plan

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Office: (803) 647-3338
parrnb@westinghouse.com

AECOM Cultural Resource Contact
Daniel Cassedy
Cell: (919) 522-5885
Office: (919) 461-1442
daniel.cassedy@aecom.com

aecom.com