The Chemours Company
Fayetteville Works
22828 NC Highway 87 W
Fayetteville, NC 28306

February 27, 2019

Dr. Joe Ghiold, Ph.D., Project Manager
Facility Management Branch
Hazardous Waste Section
Division of Waste Management
NC Department of Environmental Quality
1646 Mail Service Center
Raleigh, NC 27699-1646

Re: Creeks, Old Outfall 002 and Seeps Assessment Workplan
Chemours Fayetteville Works
Fayetteville, North Carolina
EPA ID No. NCD 047 368 642

Dear Dr. Ghiold:

Enclosed, please find a PDF copy of the *Creeks, Old Outfall 002 and Seeps Assessment Workplan* for the Chemours Fayetteville Works. This document presents a field investigation to assess the presence of groundwater seeps and to measure the volumetric flow rates and per- and polyfluoroalkyl substances (PFAS) concentrations of creeks and seeps at and near the Chemours Fayetteville Works, North Carolina site that reach the Cape Fear River. Components of this voluntary sampling activity have already been conducted while other elements are pending based access agreements and field conditions.

If you have any questions or need any additional information, please contact me at Brian.D.Long@Chemours.com.

Respectfully submitted,

Brian D. Long
Plant Manager

cc: Christel Compton – Chemours Fayetteville Works
File
Enclosures

Geosyntec Consultants of NC, PC
2501 Blue Ridge Road, Suite 430
Raleigh, NC 27607
PH 919.870.0576
FAX 919.870.0578
www.geosyntec.com

Creeks, Old Outfall 002 and Seeps Assessment Workplan

12 February 2019

INTRODUCTION AND OBJECTIVES

This workplan was prepared by Geosyntec Consultants of NC, P.C. (Geosyntec) for the Chemours Company, FC, LLC (Chemours). This workplan describes a scope of work to be performed at Willis Creek, Georgia Branch Creek, Old Outfall 002 and three channels with flowing water from seeps along the bluff face at the Chemours Fayetteville Works Site (the Site) (Figure 1). The objectives of this scope of work are as follows:

1. Assess the base volumetric flow rate of seeps and creeks entering the Cape Fear River at and near the Site;
2. Assess gain in stream flow of the creeks and seeping water flow towards the Cape Fear River;
3. Compare volumetric flow rate measurements from two independent flow measurement methods (flow velocity gauging and salt dilution gauging);
4. Assess the per and polyfluoroalkyl substances (PFAS) concentrations in waters to obtain more information on PFAS mass loading as it pertains to the Cape Fear River;
5. Assess water quality parameters in selected water samples to further inform the design of potential treatment options for PFAS; and
6. Assess water temperatures near the stream bed in Willis Creek, Georgia Branch Creek, Old Outfall 002, and the channels with flowing water from seeps for regions of groundwater upwelling.

SCOPE OF WORK

This scope of work involves three tasks: (i) collecting water samples for PFAS and other water quality parameters, (ii) gauging seep/creek volumetric flow and (iii) assessing temperature contrasts near the stream bed to aid in identification of areas of upwelling and observing stream channel to visually identify areas of groundwater seepage. Methods for each task are described later in the Methods section. Table 1 and shown in Figures 2 through 6 show the locations of the proposed work.

All work will be performed according to the project health and safety plan (HASP) prepared by Parsons (Parsons Health and Safety Plan Chemours Fayetteville Site, 2018). A POAD and Project Safety Analysis (PSA) will be held prior to commencing field activities. All work will be performed under Nationwide Permit 6 (USACE, 2017).

Sample locations indicated in this workplan are planned potential locations. The field team may collect from different or additional locations depending on field conditions, in-person observations, and accessibility considerations. Several of the planned sample locations will require access permits as these locations are not on Chemours property. Work may not be completed if access is not obtained.

At each location, the following tasks will be conducted in order: 1. Water quality parameter assessment; 2. Water sample collection for laboratory analyses if specified in Table 1; and 3. gauging and other physical flow measurements if specified in Table 1.

All salt dilution gauging work will maintain chloride concentrations below 230 milligrams per liter (mg/L); this is the United States Environmental Protection Agency (USEPA) acute freshwater aquatic life criteria and the North Carolina 15A NCAC 02B Water Quality Standards for Surface Waters (USEPA, 2019; NCDEQ, 2019).

The work will be performed at the following creek/seep/river locations in the order shown below, unless the field team changes the order of work in consultation with the Geosyntec project manager (Matt Vanderkooy) or for health and safety reasons the order of the work needs to be adjusted:

1. Old Outfall 002
2. Georgia Branch Creek
3. Willis Creek
4. North Seeps
5. Center Seeps
6. South Seeps
7. Cape Fear River Upstream and Downstream

The remainder of this section describes the order and sequence of tasks to be implemented at each of the creeks/seeps/river listed above.

<u>Old Outfall 002</u>

At Old Outfall 002, water samples for laboratory and field analysis will be collected, and volumetric flow rates will be assessed at the Old Outfall 002 locations shown in Figure 2. Work will start at location OLDOF-1 and progress sequentially upstream towards location OLDOF-5.

Some locations are individual locations, and some are grouped locations to assess flow and concentrations where two streams meet: the main stream and a tributary. Tributaries are indicated by the suffix “TR”. The groupings are as follows:

- OLDOF-1 – individual
- OLDOF-2 – individual
- OLDOF-3 – individual
- OLDOF-4, OLDOF-TR1-1 – grouped
- OLDOF-5 – individual

At all locations, water samples for field and laboratory analysis will be collected first and then the salt dilution gauging will be performed.

At grouped locations, laboratory and field parameter samples will first be collected from the downstream location and then the upstream location of Old Outfall 002 and then the tributary location.

At grouped locations, the salt dilution gauging stock solution will be placed upstream of the confluence of the stream and tributary. The solution will be metered at a sufficient distance upstream such that the salt solution is fully mixed into the stream before the tributary joins (i.e., such that electrical conductivity is stable ±10% across the stream cross section). This way both the upstream and downstream locations of the confluence (e.g. OLDOF-3 and OLDOF-4) can both be gauged using a single salt dilution gauging location.

Stream bottom temperatures will be recorded, and photographs taken using an infrared camera at regular intervals along the length of the stream.

At location OLDOF-2, both salt dilution gauging and flow velocity gauging measurements will be collected to assess and compare volumetric flow rates.

Georgia Branch Creek

At Georgia Branch Creek water samples for field and laboratory analysis will be collected, and volumetric flow rates will be assessed at the Georgia Branch Creek locations shown in Figure 3 provided sampling and gauging locations are accessible.

Work will start at location GBC-1 and progress sequentially upstream towards location GBC-7. If the field team accesses GBC-1 by foot, they should minimize any walking or disturbance in the creek in order to minimize disruption to water and subsequent sample collection. Some locations are individual locations, and some are grouped locations to assess flow and concentrations where two streams meet, the main stream and a tributary. Tributaries are indicated by the suffix “TR”. The groupings are as follows:

- GBC-1 – individual
- GBC-2, GBC-3, GBC-TR-1 – grouped
- GBC-4, GBC-5, GBC-TR-2 – grouped
- GBC-6 – individual
- GBC-7 – individual

At all locations water samples for laboratory and field analysis will be collected first and then the salt dilution gauging will be performed.

At grouped locations, laboratory and field samples will first be collected from the downstream location, then the upstream location of the Georgia Branch Creek, and finally the tributary location. At grouped locations, the salt dilution gauging stock solution will be setup upstream of the confluence of the stream and tributary. The solution will be metered at a sufficient distance upstream such that the salt solution is fully mixed into the stream before the tributary joins (i.e., such that electrical conductivity is stable ±10% across the stream cross section). This way both the upstream and downstream locations of the confluence (e.g. GBC-2 and GBC-3) can both be gauged using a single salt dilution gauging location.

Stream bottom temperatures will be recorded, and photographs taken using an infrared camera at regular intervals along the length of the stream.

Willis Creek

At Willis Creek water samples for field and laboratory analysis will be collected, and volumetric flow rates will be assessed at the Willis Creek locations shown in Figure 4.

Work will start at location WC-1 and progress sequentially upstream towards location WC-5. All locations are individual locations:

- WC-1 – individual
- WC-2 – individual
- WC-3 – individual
- WC-4 – individual
- WC-5 – individual

At each location, a water sample for field and laboratory analysis will be collected first and then the salt dilution gauging will be performed.

At Location WC-5, both salt dilution gauging and flow velocity gauging measurements will be collected to assess and compare volumetric flow rates.

The field team will inspect the Site side of Willis Creek (generally the south bank) for any seeps or streams entering Willis Creek. The field team will collect a water sample for PFAS analysis from any of these seeps or streams. The field team will also attempt to measure flow rates.

Stream bottom temperatures will be recorded, and photographs taken using an infrared camera at regular intervals along the length of the stream.

Seeps

Work will be performed first at the North (Seep A), then the Center (Seep B), and last the South seep areas (Seep C). The proposed locations for surface water sample collection and salt dilution gauging are shown in Figure 5. At the three sections of the bluff slope with visible seepage water the scope will be to collect water samples for field and laboratory analysis and volumetric flow rates will be assessed at the mouth of each seep entering the Cape Fear River.

Water samples for laboratory analysis will be collected first, followed by volumetric flow rate analysis. At the north and center, Seep A and Seep B, respectively, multiple sampling points will be required. The field team may use their judgement in selecting these locations. Locations identified in this plan are suggested locations. The objectives in selecting these locations should include:

- Locations before and after where two seeps meet;
- Locations where underlying geology has / is soon to change; and
- Locations where water is seeping into a stream.

For Seep C only one sampling point is required – closest to the river.

At all streams, work will start at where the seep/stream meets the Cape Fear River (Seep-C-1, Seep-B-1, and Seep-A-1) and then progress upland. Seep/stream bottom temperatures will be recorded, and photographs taken using an infrared camera at regular intervals along the length of the feature.

Cape Fear River

At the Cape Fear River, two sample locations have been identified, River Mile 76 upstream and River Mile 84 downstream (see Figure 6). The upstream sample will be collected first and then the downstream sample. The sampling location will be selected as follows: the thalweg (the deepest point in the river) will be identified, then field parameters will be collected, then a sample will be collected from middle depth. Sampling locations and depths will be recorded.

METHODS

This section describes the general field methods and specific procedures for collecting samples, gauging stream flow and assessing stream bed temperatures.

General Field Procedures

All equipment will be inspected by the field program on-Site supervisor and calibrated at least daily prior to use in the field according to the manufacturer's recommended guidelines. Calibration information will be recorded in a field logbook. Field parameters will be measured with a water quality meter prior to sample collection and include the following:

- pH;
- Temperature (degrees Celsius; °C);
- Specific conductance [SC] (micromhos, µmho);
- Dissolved oxygen [DO] (mg/L);
- Oxidation/Reduction Potential [ORP] (millivolts; mV);
- Turbidity (nephelometric turbidity units, NTU);
- Color; and
- Odor.

All sampling equipment will be decontaminated between sample locations in the following manner:

- De-ionized water rinse;
- Non-phosphate detergent wash (i.e., Alconox®);
- De-ionized water rinse; and
- Air dry.

Disposable equipment (e.g. gloves, tubing, etc.) will not be reused. New sample containers will be used for each sample. At each proposed sampling location at least 6 sample bottles for PFAS analysis will be collected with the intent that this will provide up to 3 sample bottles to archive for potential future analyses.

Creek and Seep Water Sampling

Creek and seep water samples will be collected as grab samples. Sample bottles will be lowered into the flowing water of the creek to collect the sample. The bottles will be lowered into the stream either using a properly decontaminated dip rod with bottle attached with a nylon zip tie, or in shallow streams, by hand. The bottle will be lowered into the stream with the cap removed, open and facing oncoming flow. Where possible, the sample will be collected from the middle of the stream. Care will be taken to avoid collecting suspended solids or other materials in the sample. Samples will be collected into new 250 milliliters (mL) laboratory-supplied HDPE bottles. Water quality parameters will be measured (pH, temperature, SC, DO, ORP) after sample collection using water from the same location in the stream.

Cape Fear River Water Sampling

Cape Fear River water samples will be collected using a peristaltic pump and new dedicated HDPE tubing and dedicated silicone tubing for the pump head at each location. The tubing will be lowered to the specified sampling depth below the water surface using an anchor weight and the tubing fastened to the anchor pointing upwards. Surface water will be pumped directly from the submerged tubing through the pump head to a flow-through cell. Field parameters will be monitored over a 5-minute interval, then the flow-through cell will be disconnected, the tubing cut to provide a new, clean end and grab samples will be collected from the discharge of the peristaltic pump in new 250 mL laboratory-supplied HDPE bottles.

Sample Packing and Shipping

Upon sample collection, each containerized sample will be labeled and placed as soon as possible into an insulated sample cooler. The cooler will serve as a shipping container and will be provided by the laboratory along with the appropriate sample containers. Wet ice will be placed around the sample containers within heavy-duty plastic bags within the sample cooler. Samples will be maintained at a cool temperature (optimum 4°Celsius ± 2°Celsius) from the time of collection until the coolers arrive at the laboratory (if required). Plastic “bubble wrap” and/or polystyrene foam may also be used to protect the samples during shipping.

Prior to shipment of the samples to the laboratory, a chain-of-custody form will be completed by the field sample custodian. Sample locations, sample identification numbers, description of samples, number of samples collected, and specific laboratory analyses to be run on each sample will be recorded on the chain-of-custody form.

Upwelling Assessment via Temperature Assessment

Areas of groundwater upwelling into surface water bodies can be assessed using temperature differentials of groundwater versus surface water. Groundwater temperatures usually reflect the mean annual temperature of a location. For example, at the Fayetteville Works Site groundwater temperatures are usually near 20°Celsius year-round while surface water temperatures are close to seasonal average temperature. Therefore, surface water temperatures will be closer to 10°C in winter and closer to 30°C in summer. Additionally the field team will inspect the channels the creeks follow for evidence of seeping groundwater which then enters the creek / seep channel.

Submersible Temperature Probe

Areas of upwelling can be identified by placing a submersible temperature probe in the bottom of the stream and recording the temperature. If the temperature is similar to surface water temperatures, then the stream is not in a zone of upwelling. But, if the stream bottom temperatures are different than surface water (warmer if work is conducted in winter, colder if conducted in summer) the stream is likely in a zone of upwelling. Stream bed temperatures will be measured by a combination of inserting the probe into the bottom of the creek bed and by having the probe present just above the creek bottom.

Infrared Camera

Infrared cameras can also be used to identify stream bottom locations where groundwater is upwelling. The cameras are used to take photographs of the stream. Areas with temperature differentials, namely where the stream bottom is warmer than the surface water may be indicative areas of upwelling. An infrared camera will be used to assess the suitability of this method for identifying areas of upwelling in the creeks. Photographs of the creeks will be taken with an infrared camera to identify areas of upwelling groundwater based on temperature differences.

Flow Velocity Gauging

Where streams pass through structures with regular geometries, i.e. through culverts, the flow rate of the stream can be measured using a submersible flow meter. The flow meter is placed beneath the flowing stream along the cross section of the stream at regular intervals (e.g. every six inches) and the height of the water is recorded along with the recorded water velocity. These measurements are then used to calculate the volumetric flow of water passing through the structure based on the regular geometry and measured flow rates.

Salt Dilution Streamflow Gauging

The flow of streams can be measured by dosing at a constant flow rate into the stream a solution with a known concentration of a tracer compound, in this case sodium chloride – salt (Moore, 2004). Using a Mariotte bottle or constant flow pump, the salt solution with a known concentration is dosed into the flowing stream at a known flow rate. The metered salt solution then mixes with the stream flow. The concentration of salt in the stock solution and in the stream can be measured using a conductivity probe reporting the result in units of microsiemens per centimeter (µS/cm). Using the known flow rate of the stock solution and the known concentrations of the stream and stock solution, the flow rate of the stream can be calculated. Salt is a suitable tracer since it can be easily and accurately measured in the field and it can be used at concentrations that do not impact aquatic life. Both the USEPA acute freshwater aquatic life criteria and the North Carolina 15A NCAC 02B Water Quality Standards for Surface Waters is 230 mg/L of chloride, or 373 mg/L of salt (USEPA, 2019; NCDEQ, 2019). Therefore, the flow rate metering of the stock solution should be set such that the mixed concentration in streams should not exceed this value.

Implementation Steps

- Select gauging location. Select a location along the stream suitable for the measurements. Ideally flow of the stream will be focused in a moving channel (moving water helps increase mixing of the stock solution), and there will be a suitable location to place the stock solution.
- Calibrate conductivity probe. Calibrate the conductivity probe using the provided calibration solutions and test against 4 previously prepared solutions of known salt concentration.
- Record background stream conductivity. Record background stream conductivity and collect a sample.
- Prepare stock solution. Stock solution can be prepared by mixing water from the stream with previously prepared sodium chloride brine solutions of known concentrations.
- Begin dosing stream with stock solution. Set the stock solution on a stable platform (potentially a board spanning the stream) and begin metering the stock solution into the stream. Record three measurements of flow rate into the stream using a stopwatch and a container with accurate gradations – i.e. a graduated cylinder.
- Measure stock solution and stream concentrations. Using the conductivity probe, measure the conductivity of the stock solution and then the stream. Progress the measurement locations far enough downstream such that measurements recorded across the stream all provide the same value indicating complete mixing. Collect a sample of the stock solution and the dosed, well-mixed stream (10-mL sample is enough).

- Record final stock solution flow rate. Assess the uniformity of stock solution addition during the gauging event by measuring the stock solution flow rate after sample collection.

LABORATORY ANALYSES

Collected samples will be analyzed by up to three laboratory methods to assess PFAS presence and concentrations as specified in Table 1. The methods to be applied are:

- EPA Method 537 Mod;
- EPA Method 8321 Mod; and
- Table 3 Lab SOP.

Analyte lists for each method are provided in Table 2. Samples will be shipped to either TestAmerica Sacramento, TestAmerica Denver or Lancaster Laboratories depending on laboratory availability at the time of sampling. Samples will be shipped on the same day as sample collection to meet the hold time for nitrate analysis (48 hours).

Samples will also be collected for the analyses listed below at the selected locations specified in Table 1:

- Total Dissolved Solids (TDS); Method SM 2540 C-1997
- Total Suspended Solids (TSS); Method SM 2540 D-1997
- Cation / Anion Balance; Methods EPA 200.7, EPA 300.0, and SM 2320 B-1997
- Total Organic Carbon (TOC); Method SM 5310 C-2000
- Iron (Field Analyses)
- Priority Pollutant List (PPL) Metals; Method SW-846 6010C/7470A
- PPL Volatile Organic Compounds (VOCs); Method SW-846 8260C
- PPL Semi-Volatile Organic Compounds (SVOCs); Method SW-846 8270D

Field QA/QC Samples

The following field QA/QC samples will be collected:

- A minimum of a daily blind duplicate sample, or at a frequency of 1 per 20 samples;
- A minimum of a daily matrix spike and replicate sample, or at a frequency of 1 per 20 samples;
- A daily field blank sample; and
- A daily rinsate sample when any HDPE tubing and peristaltic pump equipment are used to collect the sample.

FIELD NOTES AND DATA REPORTING

The project field team will keep a daily diary of field activities and note sample collection times, measured field parameters, and other recorded field data or observations. All field collected data will be furnished to the project team within 10 business days of the conclusion of the field event.

REFERENCES

Moore, R.D., 2004. Introduction to salt dilution gauging for streamflow measurement: Part 1. *Streamline Watershed Management Bulletin*, *7*(4), pp.20-23.

NCDEQ, 2019. NC_StdsTable_09222017; North Carolina 15A NCAC 02B Water Quality Standards for Surface Waters. https://deq.nc.gov/nc-stdstable-09222017. Accessed 27 January 2019.

Parsons, 2018. Health and Safety Plan Chemours Fayetteville Site.

United States Army Corps of Engineers. Nationwide Permit 6. 19 March 2017. http://saw-reg.usace.army.mil/NWP2017/2017NWP06.pdf. Accessed 30 January 2019.

USEPA, 2019. National Recommended Water Quality Criteria - Aquatic Life Criteria Table. https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table. Accessed 27 January 2019.

****

Enclosures:

Table 1: Sampling and Gauging Locations

Table 2: Analytical Methods and Analyte List

Figure 1: Site Map

Figure 2: Old Outfall Locations

Figure 3: Georgia Branch Locations

Figure 4: Willis Creek Locations

Figure 5: Small Streams Locations

Figure 6: Cape Fear River Locations

TABLES

TABLE 1
Sampling and Gauging Locations
Chemours Fayetteville Works, North Carolina

Location Name	Sample Name	Water Body	Suggested Sequence	PFAS Sample Bottles	Analytical Method: EPA 537	EPA 8321	Table 3	Iron (Field Analysis)	Other Analytical [1]	PPL Analytical [2]	Salt Dilution Gauging	Flow Velocity Gauging	Temperature Survey
GBC-1	FAY-SW-GBC-1-MMDDYY	Georgia Branch Creek	1	6	Y	Y	Y	Y	Y	--	Y	--	
GBC-2	FAY-SW-GBC-2-MMDDYY	Georgia Branch Creek	2	6	--	Y	Y	Y	Y	--	Y	--	
GBC-3	FAY-SW-GBC-3-MMDDYY	Georgia Branch Creek	3	6	--	Y	Y	Y	Y	--	Y	--	
GBC-TR1-1	FAY-SW-GBC-TR1-1-MMDDYY	GBC Tributary	4	6	--	Y	Y	Y	Y	--	Y	--	
GBC-4	FAY-SW-GBC-4-MMDDYY	Georgia Branch Creek	5	6	--	Y	Y	Y	Y	--	Y	--	Y
GBC-5	FAY-SW-GBC-5-MMDDYY	Georgia Branch Creek	6	6	--	Y	Y	Y	Y	--	Y	--	
GBC-TR2-1	FAY-SW-GBC-TR2-1-MMDDYY	GBC Tributary	7	6	--	Y	Y	Y	Y	--	Y	--	
GBC-6	FAY-SW-GBC-6-MMDDYY	Georgia Branch Creek	8	6	--	Y	Y	Y	Y	--	Y	--	
GBC-7	FAY-SW-GBC-7-MMDDYY	Georgia Branch Creek	9	6	--	Y	Y	Y	Y	--	Y	--	
WC-1	FAY-SW-WC-1-MMDDYY	Willis Creek	1	6	Y	Y	Y	Y	Y	--	Y	--	
WC-2	FAY-SW-WC-2-MMDDYY	Willis Creek	2	6	--	Y	Y	Y	Y	--	Y	--	
WC-3	FAY-SW-WC-3-MMDDYY	Willis Creek	3	6	--	Y	Y	Y	Y	--	Y	--	Y
WC-4	FAY-SW-WC-4-MMDDYY	Willis Creek	4	6	--	Y	Y	Y	Y	--	Y	--	
WC-5	FAY-SW-WC-5-MMDDYY	Willis Creek	5	6	--	Y	Y	Y	Y	--	Y	Y	
OLDOF-1	FAY-SW-OLDOF-1-MMDDYY	Old Outfall 002	1	6	Y	Y	Y	Y	Y	--	Y	--	
OLDOF-2	FAY-SW-OLDOF-2-MMDDYY	Old Outfall 002	2	6	--	Y	Y	Y	Y	--	Y	Y	
OLDOF-3	FAY-SW-OLDOF-3-MMDDYY	Old Outfall 002	3	6	--	Y	Y	Y	Y	--	Y	--	Y
OLDOF-4	FAY-SW-OLDOF-4-MMDDYY	Old Outfall 002	4	6	--	Y	Y	Y	Y	--	Y	--	
OLDOF-TR1-1	FAY-SW-OLDOF-TR1-1-MMDDYY	Old Outfall Tributary	5	6	--	Y	Y	Y	Y	--	Y	--	
OLDOF-5	FAY-SW-OLDOF-5-MMDDYY	Old Outfall 002	6	6	--	Y	Y	Y	Y	--	Y	--	
Seep-C-1	FAY-SW-Seep-C-1-MMDDYY	Seeps South	1	6	Y	Y	Y	Y	Y	Y	Y	--	Y
Seep-B-1	FAY-SW-Seep-B-1-MMDDYY	Seeps Center	1	6	Y	Y	Y	Y	Y	Y	Y	--	
Seep-B-2	FAY-SW-Seep-B-2-MMDDYY	Seeps Center	2	6	--	Y	Y	Y	Y	--	Y	--	Y
Seep-B-3	FAY-SW-Seep-B-3-MMDDYY	Seeps Center	3	6	--	Y	Y	Y	Y	--	Y	--	
Seep-B-4	FAY-SW-Seep-B-4-MMDDYY	Seeps Center	4	6	--	Y	Y	Y	Y	Y	Y	--	
Seep-A-1	FAY-SW-Seep-A-1-MMDDYY	Seeps North	1	6	Y	Y	Y	Y	Y	Y	Y	--	
Seep-A-2	FAY-SW-Seep-A-2-MMDDYY	Seeps North	2	6	--	Y	Y	Y	Y	--	Y	--	
Seep-A-3	FAY-SW-Seep-A-3-MMDDYY	Seeps North	2	6	--	Y	Y	Y	Y	--	Y	--	
Seep-A-4	FAY-SW-Seep-A-4-MMDDYY	Seeps North	2	6	--	Y	Y	Y	Y	--	Y	--	
Seep-A-5	FAY-SW-Seep-A-5-MMDDYY	Seeps North	2	6	--	Y	Y	Y	Y	--	Y	--	
Seep-A-6	FAY-SW-Seep-A-6-MMDDYY	Seeps North	2	6	--	Y	Y	Y	Y	--	Y	--	Y
Seep-A-7	FAY-SW-Seep-A-7-MMDDYY	Seeps North	2	6	--	Y	Y	Y	Y	--	Y	--	
Seep-A-8	FAY-SW-Seep-A-8-MMDDYY	Seeps North	2	6	--	Y	Y	Y	Y	--	Y	--	
Seep-A-9	FAY-SW-Seep-A-9-MMDDYY	Seeps North	2	6	--	Y	Y	Y	Y	--	Y	--	
Seep-A-10	FAY-SW-Seep-A-10-MMDDYY	Seeps North	2	6	--	Y	Y	Y	Y	--	Y	--	
Seep-A-11	FAY-SW-Seep-A-11-MMDDYY	Seeps North	2	6	--	Y	Y	Y	Y	Y	Y	--	
CFR-RM-76	FAY-SW-CFR-RM-76-MMDDYY	Cape Fear River	1	6	Y	Y	Y	Y	Y	--	--	--	Y
CFR-RM-84	FAY-SW-CFR-RM-84-MMDDYY	Cape Fear River	2	6	Y	Y	Y	Y	Y	--	--	--	
Field Duplicates	1 in 20												
MS/MS-Rep	1 in 20												
Rinsate	Daily as Appropriate (i.e. during Cape Fear River sampling)												
Field Blank	Daily												
Estimated Total				390	13	46	46	46	46	10			

TABLE 1
Sampling and Gauging Locations
Chemours Fayetteville Works, North Carolina

Notes
1 - Other analytical methods:
- TDS
- TSS
- Cations (Calcium, Magnesium, Sodium, Potassium, Iron, Ammonia, Manganese, Aluminum)
- Anions (Chloride, Sulfate, Alkalinity, Phosphate, Nitrate)
- TOC

2 - PPL analytical methods:
- PPL Metals
- PPL VOCs
- PPL SVOCs

Acronyms
CFR - Cape Fear River
EPA - Environmental Protection Agency
GBC - Georgia Branch Creek
MS - matrix spike
OLDOF - Old Outfall 002
PFAS - per and polyfluoroalkyl substances
PPL - Priority Pollutant List
SVOC - semi-volatile organic compounds
TDS - total dissolved solids
TOC - total organic carbon
TR - tributary
TSS - totals suspended solids
VOC - volatile organic compounds
WC - Willis Creek
Y - yes

TABLE 2
Analytical Methods and Analyte List
Chemours Fayetteville Works, North Carolina

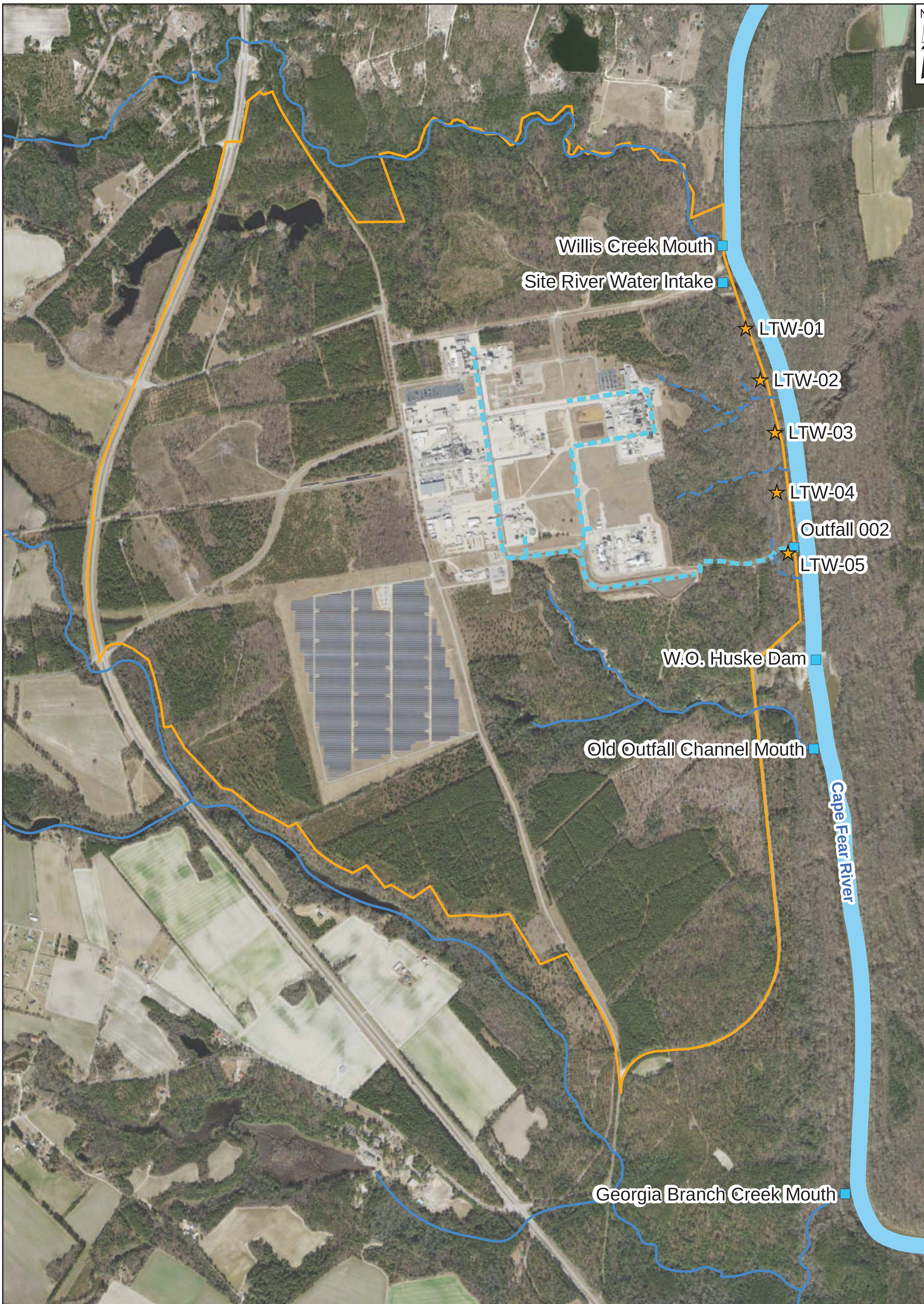
Compound Group	Name	Abbreviation	Carbon Atoms	CAS Number	Laboratory	Method
Perfluoroalkyl carboxylic acids (PFCAs)	Perfluorobutanoic acid	PFBA	4	375-22-4	TestAmerica Sacramento	EPA 537 PFAS Compounds
	Perfluoropentanoic acid	PFPeA	5	2706-90-3		
	Perfluorohexanoic acid	PFHxA	6	307-24-4		
	Perfluoroheptanoic acid	PFHpA	7	375-85-9		
	Perfluorooctanoic acid	PFOA	8	335-67-1		
	Perfluorononanoic acid	PFNA	9	375-95-1		
	Perfluorodecanoic acid	PFDA	10	335-76-2		
	Perfluoroundecanoic acid	PFUnA	11	2058-94-8		
	Perfluorododecanoic acid	PFDoA	12	307-55-1		
	Perfluorotridecanoic acid	PFTriA	13	72629-94-8		
	Perfluorotetradecanoic acid	PFTeA	14	376-06-7		
	Perfluorohexadecanoic acid	PFHxDA	15	67905-19-5		
	Perfluorooctadecanoic acid	PFODA	16	16517-11-6		
Perfluoroalkyl sulfonic acids (PFSAs)	Perfluorobutanesulfonic acid	PFBS	4	375-73-5		
	Perfluoropentanesulfonic acid	PFPeS	5	2706-91-4		
	Perfluorohexanesulfonic acid	PFHxS	6	355-46-4		
	Perfluoroheptanesulfonic acid	PFHpS	7	375-92-8		
	Perfluorooctanesulfonic acid	PFOS	8	1763-23-1		
	Perfluorononanesulfonic acid	PFNS	9	474511-07-4		
	Perfluorodecanesulfonic acid	PFDS	10	335-77-3		
	Perfluorododecanesulfonate	PFDoS	11	79780-39-5		
Other	4:2 fluorotelomersulfonate	4:2 FTS	6	757124-72-4		
	6:2 fluorotelomersulfonate	6:2 FTS	8	27619-97-2		
	8:2 fluorotelomersulfonate	8:2 FTS	10	39108-34-4		
	10:2-fluorotelomersulfonate	10:2 FTS	12	120226-60-0		
	N-ethyl perfluorooctane sulfonamidoacetic acid	NEtFOSAA	12	2991-50-6		
	N-ethyl heptadecafluoro octanesulfonamid	NEtPFOSA	10	4151-50-2		
	N-ethyl-N-(2-hydroxyethyl)perfluorooctylsulphonamide	NEtPFOSAE	12	1691-99-2		
	N-methyl perfluorooctane sulfonamidoacetic acid	NMeFOSAA	11	2355-31-9		
	heptadecafluoro-N-methyloctanesulphonamide	NMePFOSA	9	31506-32-8		
	N-methylperfluorooctanesulfonamidoethanol	NMePFOSAE	11	24448-09-7		
	Perfluorooctanesulfonamide	PFOSA	8	754-91-6		
	Ammonium 4,8-dioxa-3H-perfluorononanoate	ADONA	7	958445-44-8		
	chlorododecafluorohexyloxyl tetrafluoroethanesulfonic acid	F-53B Major	10	73606-19-6		
	chlorohexadecafluoroctyloxyl tetrafluoroethanesulfonic acid	F-53B Minor	8	83329-89-9		

TABLE 2
Analytical Methods and Analyte List
Chemours Fayetteville Works, North Carolina

Compound Group	Name	Abbreviation	Carbon Atoms	CAS Number	Laboratory	Method
Other	Hexafluoropropylene oxide dimer acid	HFPO-DA	6	13252-13-6	TestAmerica Denver	EPA 8321 Mod
Perfluoroalkyl ether carboxylic acids (PFECAs)	Perfluoro-1-methoxyacetic acid	PFMOAA	3	674-13-5	TestAmerica Sacramento	Table 3 Lab SOP
	Perfluoro(3,5-dioxahexanoic) acid	PFO2HxA	4	39492-88-1		
	Perfluoro(3,5,7-trioxaoctanoic) acid	PFO3OA	5	39492-89-2		
	Perfluoro(3,5,7,9-tetraoxadecanoic) acid	PFO4DA	6	39492-90-5		
	Perfluoro(3,5,7,9,11-pentaoxatridecanoic) acid	PFO5DA	7	39492-91-6		
	Perfluoro-3-methoxypropanoic acid	PMPA	4	13140-29-9		
	Perfluoro-4-methoxybutanoic acid	PEPA	5	863090-89-5		
	Perfluoroether alkyl carbonic acid – G	PFECA-G	7	801212-59-9		
Perfluoroalkyl ether sulfonic acids (PFESAs)	Nafion Byproduct #1, Perfluoro-3,6-dioxa-4-methyl-7-octene-1-sulfonic acid	PFESA BP 1	7	29311-67-8		
	Nafion Byproduct #2, 2-[1-[difluoro(1,2,2,2-tetra fluoroethoxy)methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-Ethanesulfanoic acid	PFESA BP 2	7	749836-20-2		

Acronyms
HDPE - high density polyethylene
PFAS - per- and polyfluoroalkly substances
SOP - standard operating procedure

FIGURES



Legend

- ★ LTW - Long Term Well
- Site Feature
- Cape Fear River
- Nearby Tributary
- Observed Seep
- Drainage Network
- Site Boundary

0.25 0.125 0 0.25 Miles

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

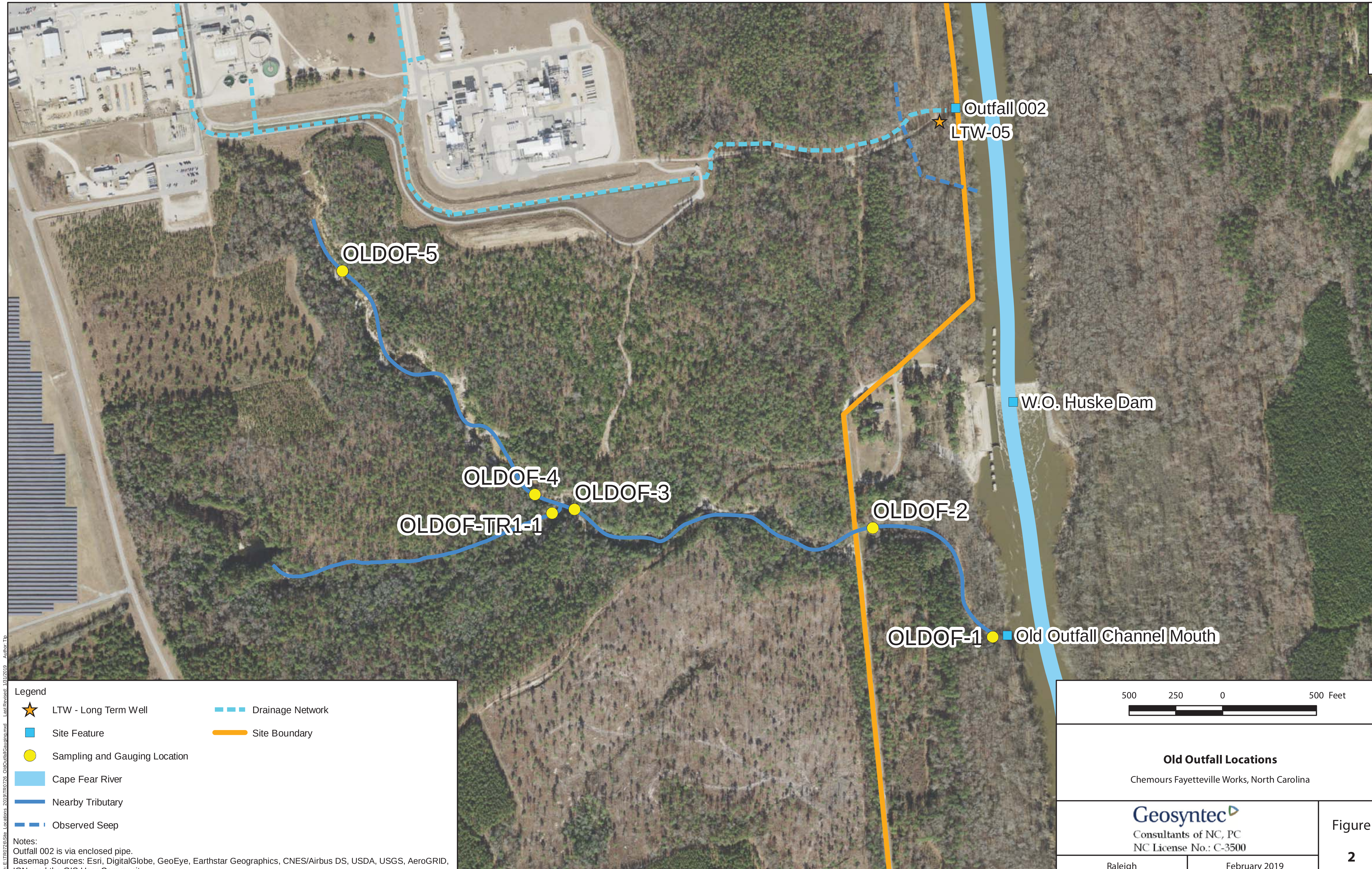
Site Map

Chemours Fayetteville Works, North Carolina

Geosyntec
Consultants of NC, PC
NC License No.: C-3500

Raleigh | February 2019

Figure 1



Notes:
Outfall 002 is via enclosed pipe.
Basemap Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Projection: NAD 1983 StatePlane North Carolina FIPS 3200 Feet; Units in Foot US

Path: E:\TR0726\Site Locations 2019\TR0726 OldOutfallGauging.mxd Last Revised: 1/31/2019 Author: Tlp

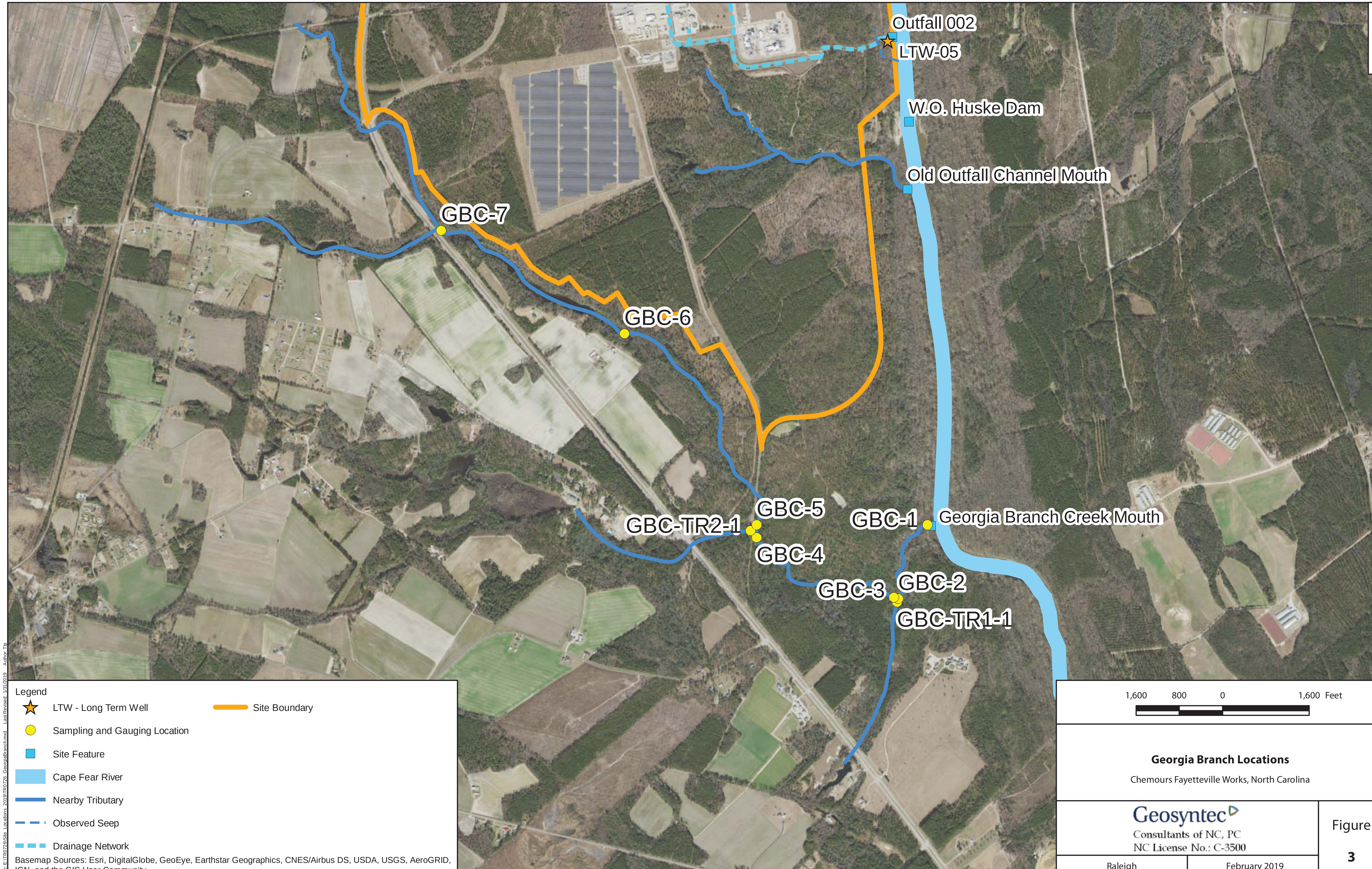
Old Outfall Locations

Chemours Fayetteville Works, North Carolina

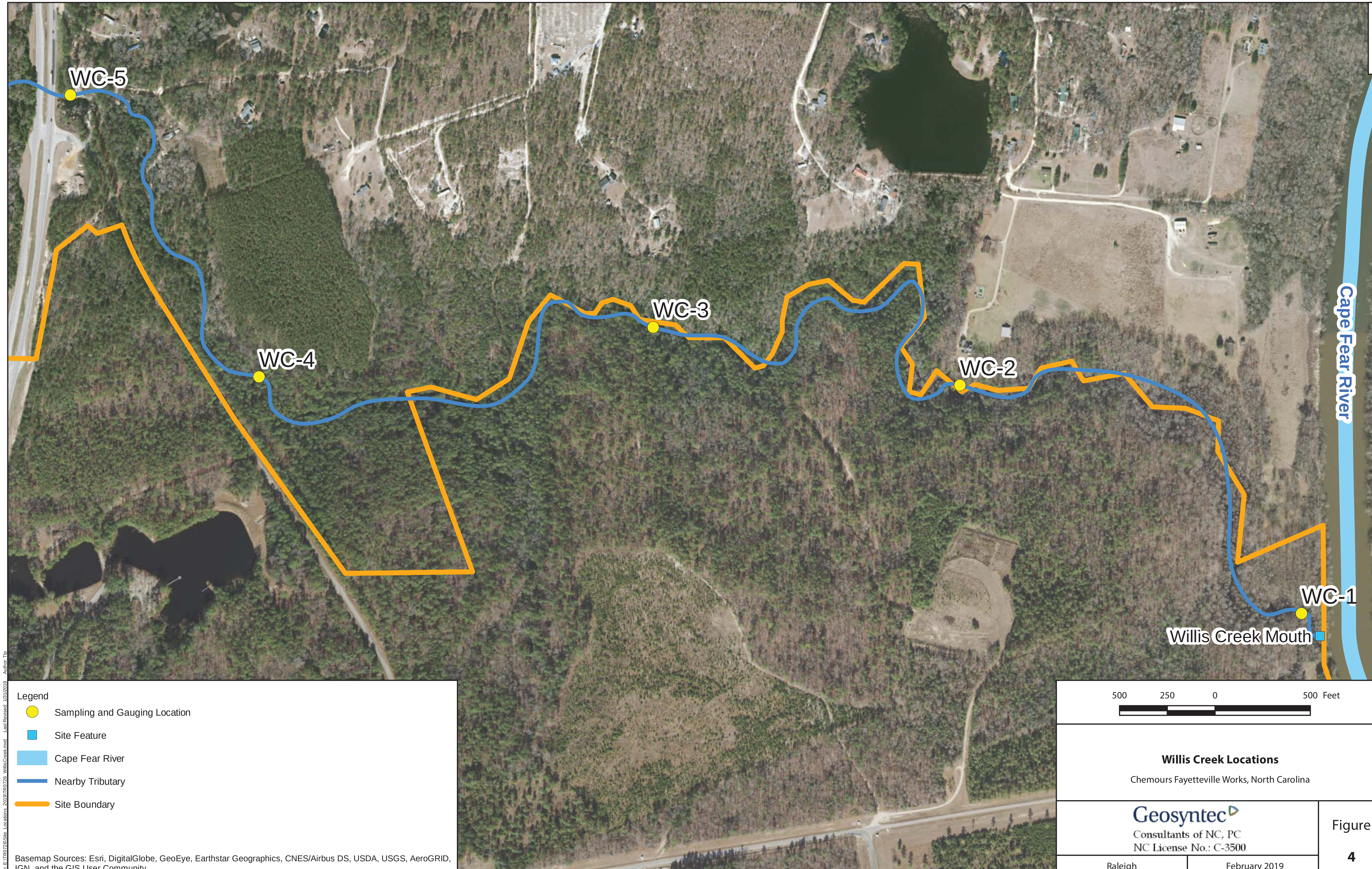
Geosyntec
Consultants of NC, PC
NC License No.: C-3500

Raleigh | February 2019

Figure 2



Projection: NAD 1983 StatePlane North Carolina FIPS 3200 Feet; Units in Foot US



Projection: NAD 1983 StatePlane North Carolina FIPS 3200 Feet; Units in Foot US

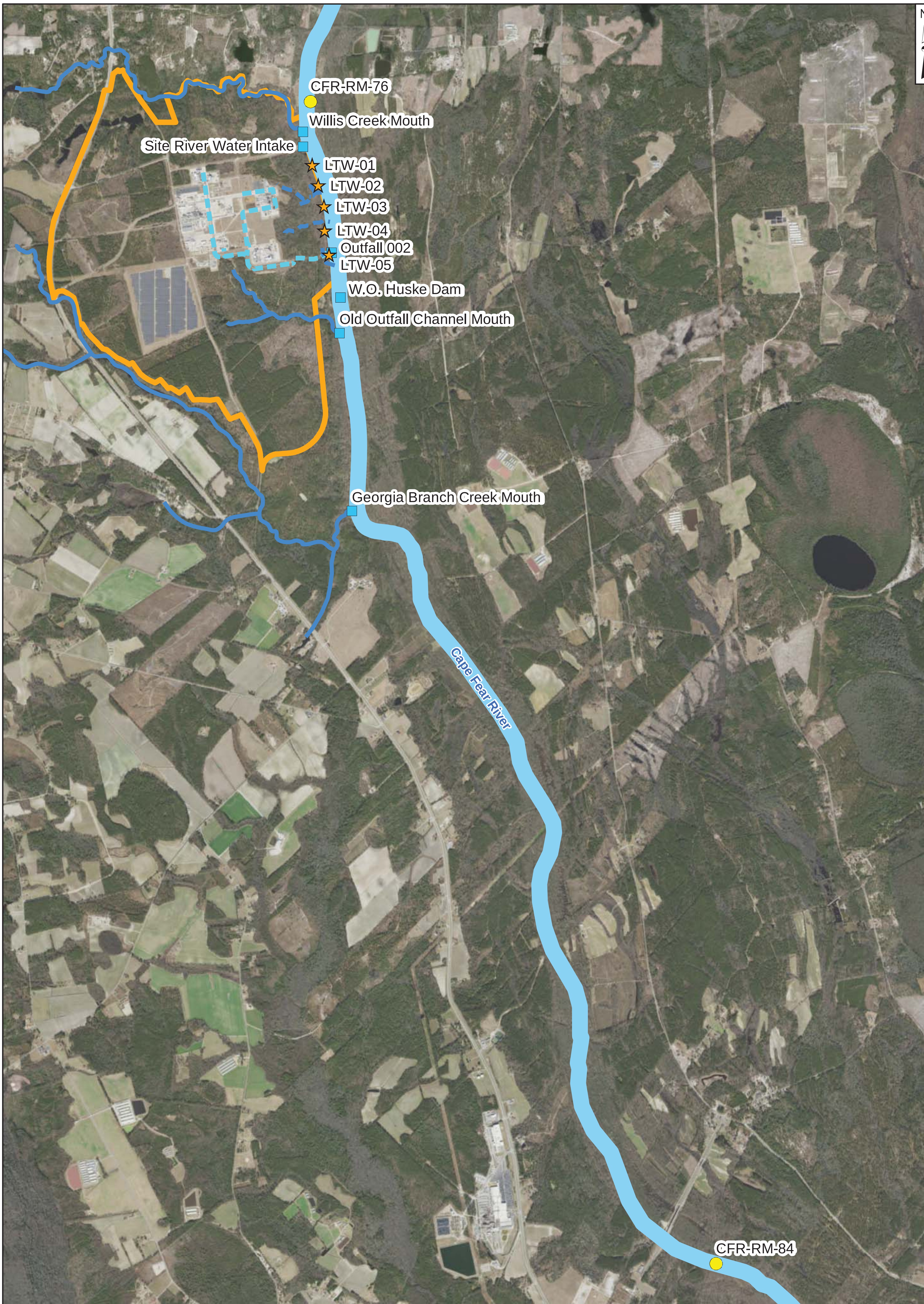
Small Streams Locations

Chemours Fayetteville Works, North Carolina

Geosyntec Consultants of NC, PC
NC License No.: C-3500

Raleigh | February 2019

Figure 5



Legend
- ★ LTW - Long Term Well
- Sampling Location
- Site Feature
- Cape Fear River
- Nearby Tributary
- Observed Seep
- Drainage Network
- Site Boundary

1 0.5 0 1 Miles

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

Path: E:\TR0726\Site_Locations_2019\TR0726_CapeFearRiver.mxd; JK; 01/31/2019

Cape Fear River Locations

Chemours Fayetteville Works, North Carolina

Geosyntec
Consultants of NC, PC
NC License No.: C-3500

Raleigh | February 2019

Figure 6