SPECIAL ORDER BY CONSENT EMC SOC WQ 219-010 SAMPLING/MONITORING PLAN
CITY OF GREENSBORO T. Z. OSBORNE POTW (TZO) NPDES PERMIT #NC0047384 EFFECTIVE DECEMBER 1, 2021

SUBMITTAL DATE: 11-23-2021 Reflecting Amended SOC/Settlement Agreement (NCDEQ WSRO Approval 12-2-2021)

TABLE OF CONTENTS – CITY OF GREENSBORO 1,4-DIOXANE SOC SAMPLING/MONITORING PLAN

I. BACKGROUND AND PURPOSE

Background

- The City's proactive, voluntary efforts to identify/address the source of 1,4-dioxane to TZO began in early 2015
- The City developed and implemented a comprehensive 1,4-dioxane source identification sampling plan that included both POTWs and collection system trunkline monitoring.
- Initial study sampling started in March 2015 and Shamrock Environmental was identified as a major source in October 2015.
- From March 2015-October 2015 the TZO effluent averaged 126.4 ug/l.
- Once notified, Shamrock immediately developed and implemented a source control program that resulted in a significant financial impact to them from identifying and turning away clients with potential to add 1,4-dioxane to their system.
- From February 2016 through January 2020 the TZO effluent averaged 59.6 ug/l, a 52% reduction.
- Shamrock continued their reduction efforts through engineering investigations that included bench and pilot scale testing of various treatment and removal technologies. The final multi-million dollar proprietary pretreatment system was installed in 2020 with final optimization in 2021. *All source reduction efforts were conducted voluntarily by Shamrock.*

Purpose

- The 2-Year SOC between the City and NCDEQ re: 1,4-dioxane, effective 5-1-2021, is a commitment outlining the continuation of Greensboro's previous identification and reductions efforts.
- Previous POTW 1,4-dioxane study sites will be revisited with an expanded focus during the SOC:
  - Identification of smaller contributors to TZO (industrial, commercial, domestic, drinking water), recognizing that not all of those identified may be in the purview of the Pretreatment Program.
  - Comparison of Year One SOC data with 2015 study data at various sampling sites (40 CFR Part 136 method used in 2021)
  - Determine background or uncontrollable/uncontrolled concentrations of 1,4-dioxane from various sectors
  - Use of sector results to target public education outreach plan information and activities
  - Use of sector results to determine 1,4-dioxane mass-balance and building block calculations
- In response to 2 objections/petitioners the SOC was amended by the NC EMC on 11-18-2021. Changes include:
  - Now a 3-Year SOC with more stringent Compliance Values: Year One = 35 ug/l; Year Two = 31.5 ug/l; Year Three = 23 ug/l
  - Added direct monitoring of 29 Significant Industrial Users (SIU)/32 monitoring sites (see Addendum)
  - Two surface water sites added: Pittsboro Haw River drinking water intake and Haw River Arm of Jordan Lake
  - Added one TZO daily influent composite sample per week

II. T. Z. OSBORNE POTW INFORMATION

The following criteria characterize the TZO Wastewater Treatment Facility:

NPDES Permit Number and Issue Date:	NC0047384 Issued July 1, 2014
NPDES Permit Expiration Date:	June 30, 2019 (Administratively Extended by NCDEQ)
Design Capacity:	56 Million Gallons Per Day (as of 8-1-2021) [Permit Tier 2-Part I, pg 5]
Service Area:	Entire City of Greensboro; parts of Guilford County NC
Total Number of Significant Industrial Users:	28
Number of Categorical SIUs:	20
Number of SIUs due to flow only:	8
Average Flow CY 2019 and CY 2020:	2019 = 35.5 MGD 2020 = 36.2 MGD
Receiving Waters:	South Buffalo Creek WS-V/NSW Cape Fear River Basin
% Effluent Contribution at 7Q10 Flow:	97% [calculated by DEQ]

The following process descriptions characterize the T. Z. Osborne Water Reclamation Facility treatment train:

influent wastewater receiving station
mechanical bar screens
influent wet well pumps
optional 8.0 MG flow equalization tanks (Tank #1 = 3.5 MG, Tank #2 = 4.5 MG)
aerated grit tanks
air scrubbing system for odor control
phosphorus removal by chemical addition and precipitation
primary clarifiers
5-stage biological nutrient removal (BNR) activated sludge tanks
secondary clarifiers
tertiary filters (cloth media filters)
disinfection with sodium hypochlorite
dechlorination with sodium bisulfite
reaeration cascade and flow measurement

The following process descriptions characterize the TZO solids treatment and disposal train:

sludge receiving/blending tanks
gravity sludge thickeners
thickened sludge holding tanks
Centrifuges
(2) fluidized bed incinerators
ash clarifier
ash press
incinerator ash disposal at dedicated municipal landfill site (City of Greensboro)

North Buffalo (NB) Flow Transfer Pump Station

The North Buffalo POTW [NC0024325] was decommissioned in October 2017 and all wastewater is currently being treated at the T. Z. Osborne POTW. The North Buffalo site is now a flow transfer pump station.

- Flow from the NB transfer station does not go through the TZO influent sampling point.
- The old North Buffalo Influent sampler is still operated on a daily basis. In order to calculate the true influent pollutant loadings to the TZO facility, a flow-weighted loading calculation is conducted daily (Mon-Fri) using NB influent data, TZO influent data and corresponding daily flow readings.
- The previous 1,4-dioxane study that started in March 2015 was conducted when North Buffalo was in operation. The data indicated no significant concentrations of 1,4-dioxane in the NB Influent or the NB Sand Filter Effluent. Data from 2021 was consistent with the 2015 concentrations. One daily 24-hour NB Influent composite was analyzed each week for 13 consecutive weeks from 5-5-2021 through 7-28-2021. All 13 results were <1 ug/l.

III. GENERAL INFORMATION

1. Pollutant of Concern (POC): 1,4-dioxane

a. POC Laboratory Analytical Methods

- EPA Method 624.1 will be used for most 1,4-dioxane samples. This method was added to 40 CFR Part 136 in September 2017 as an approved wastewater analytical method for 1,4-dioxane.
- EPA Method 8270 SIM (Solid Waste Method) will be used for 1) dewatered sludge cake samples 2) sludge dewatering/incinerator samples, and 3) domestic septage samples.
- EPA Method 522 (Drinking Water Method) may be used for the Drinking Water samples

b. Sample Preservation and Holding Time for 624.1 eDMR samples

- Preservation: None required
- Holding Time: 7 days
- Samples containing measurable amounts of chlorine must be pretreated

c. Commercial Laboratories Certified by NCDEQ

The City will use the following laboratories certified by NCDEQ to conduct 1,4-dioxane analyses: Meritech Inc. and Pace Laboratories. Both labs are currently being used by the City for 1,4-dioxane eDMR split analyses and were both used in the initial 2015 study.

d. Practical Quantitation Limit (PQL) or Reporting Level (RL)

- The PQL/RL values from the 2 certified laboratories used are as follows: Meritech <1 ug/l and Pace <2 ug/l.

- PQLs indicated are based on assumption that no dilution of the sample was needed due to elevated concentrations, matrix interference, or to prevent damage to lab equipment. If a sample requires dilution, the PQL would be adjusted accordingly.

[The PQL is the lowest concentration that can be confidently quantified in wastewater samples and is a function of instrument sensitivity, reproducibility, and precision. The PQL typically represents the lowest concentration point on the calibration curve, and it is always higher (often much higher) than the method detection limit (MDL).]

2. **Sample Types**
   a. *Grab samples are required for all weekly TZO effluent eDMR monitoring events required by the SOC.*
   b. Although the EPA Method 624.1 for volatile organics calls for a grab sample collected in VOA vials, 1,4-dioxane is not volatile. Composite samples collected during the City's initial 1,4-dioxane study were invaluable in source identification and will be used for the SOC study as well.
   c. Composite samples (24 hours up to 72 hours) collected with ISCO samplers will be used in the study for trunkline monitoring (commercial, industrial and domestic) and SIU monitoring
   d. Weekly volumetric composites (TZO effluent Monday-Friday) prepared by TZO Lab staff will be available to NCDEQ and for periodic use by the City of Greensboro.

3. **Sampling Frequency**
   a. TZO Effluent eDMR compliance samples are required weekly (1 grab sample per week) for the duration of the 2-year SOC
   b. Weekly TZO effluent volumetric composites (Mon-Fri) will continue to be collected and retained for NCDEQ. These samples will be retained in the Lab Walk-In Cooler for 2 weeks after the TZO effluent eDMR sample for the week has been reported to NCDEQ. NCDEQ may acquire an aliquot of the sample at any time during that period. See separate SOP.
   c. Sampling frequencies for other sampling points vary and are outlined in Section V, Section VI, and Addendum.
   d. Sampling frequencies and schedules may be impacted by circumstances beyond the control of the City of Greensboro (e.g. inclement weather, boat ramp closure, sample site inaccessible, samples collected by Pittsboro and Meritech).
   e. If the T.Z. Osborne effluent value exceeds 35 µg/L, the City shall send the most recent daily and weekly composite samples to a DEQ-approved laboratory for rush analysis.

4. **Quality Assurance/Quality Control**
   a. Split sample analyses using 2 different certified commercial laboratories will be conducted on at least 10% of the SOC samples. <u>All weekly TZO effluent eDMR samples will be split.</u> Other split samples will be selected by Lab/IWS staff.
   b. Periodic automatic sampler blanks will be conducted
   c. Field blanks and trip blanks will be provided by commercial lab

IV. SAMPLING POINTS (SP) AND DESCRIPTIONS

1. TZO Water Reclamation Facility Locations	SP #
▪ T. Z. Osborne POTW Influent (TZO NPDES Influent Sampler)	1
▪ North Buffalo Influent (North Buffalo NPDES Influent Sampler)	2
▪ T. Z. Osborne POTW Effluent (after chlorination/dechlorination) eDMR GRAB (52 samples/year)	3 GRAB
▪ T. Z. Osborne POTW Effluent Weekly Volumetric Composite (from NPDES Effluent sampler)	3 COMP
▪ T. Z. Osborne Aeration Tank	4
▪ Dewatered Sludge Cake	5
▪ Sludge Dewatering and Incinerator Scrubber discharge (to influent wet well)	6
SP#s 1, 2, 3 used to correlate trunkline results and loading/discharge/compliance values at TZO. SP #3COMP is also the weekly composite the City agreed to retain for potential use by NCDEQ. SP#s 4, 5, 6 used to confirm results of initial study that indicated 1,4-dioxane does not partition to solids/sludge.	

2. TZO Collection System Industrial (Sites 7-12A)		SP #
▪ Industrial Trunkline Site 1 Patton: Includes 7 SIU wastestreams	(SIUs: O, T, W, AA, AE, AG, AH)	7
▪ Industrial Trunkline Site 2 Arlington: Includes 6 SIU wastestreams	(SIUs: I, L, P, Q, Y, AF)	8
▪ Industrial Trunkline Site 3 Reedy Fork: Includes 4 SIU wastestreams	(SIUs: E, F, G, H)	9
▪ Industrial Trunkline Site 4 Airport: Includes 5 SIU wastestreams	(SIUs: N, R, V, AC, AD)	10
▪ Industrial Trunkline Site 5 Whitsett: Includes 4 SIU wastestreams	(SIUs: X, AB, J, AI)	11
▪ Industrial Trunkline Site 6 North Buffalo: Includes 3 SIU wastestreams	(SIUs: A, B, D)	12
▪ Industrial Trunkline Site 7 Radar Road: Includes 2 SIU wastestreams	(SIUs: S, U)	12A
SP#s 7-12A used to conduct source identification and generate mass-balance data for the industrial sector, includes smaller industrial users as well as SIUs as defined by EPA. SIUs include those that discharge >25,000 gpd of process wastewater as well as SIUs subject to Categorical standards (who may or may not meet the EPA flow criteria). SIU Total Permitted flow = 3.67 MGD.		
If trunkline or SIU results are >100 ug/l in SOC Year One, City will immediately begin source investigation/ tracking/identification via additional sampling, evaluation and source notification. In SOC Year Two the trigger is 31.5 ug/l and in SOC Year 3 the trigger is 23 ug/l.		
See Sampling Plan Addendum for specific SIU Sampling Plan details.		

3. TZO Collection System Domestic/Commercial (Sites 13-17) [Uncontrollable/Uncontrolled Sources]	SP #
▪ Domestic/Commercial Trunkline Site 1 Wesley Long (Hospital)	13
▪ Domestic/Commercial Trunkline Site 2 A&T University	14
▪ Domestic/Commercial Trunkline Site 3 Huffine at Wendover (Bessemer)	15
▪ Domestic Trunkline Site 4 Willoughby Boulevard	16
▪ Domestic Trunkline Site 5 Shelby Drive	17
SPs #13-17 are considered uncontrollable/uncontrolled sources and used to determine typical concentrations of 1,4-dioxane in various commercial and domestic/residential areas. Loadings will be used in mass-balance and HWA uncontrollable/uncontrolled calculations. SPs #13-15 are commercial while SPs #16-17 are considered domestic wastewater. The majority of the flow (90%) to TZO is considered uncontrollable/uncontrolled	

4. Drinking Water Sources to Greensboro POTW (Sites 18-22)	SP #
▪ Drinking Water Site 1 Townsend Plant	18
▪ Drinking Water Site 2 Mitchell Plant	19
▪ Drinking Water Site 3 PTRWA: Holden & Bishop Rd	20
▪ Drinking Water Site 4 Burlington: Burlington Rd.	21
▪ Drinking Water Site 5 Reidsville: Chickasha & Summit Ave	22
SPs #18-22 include all drinking water sources to TZO. UCMR3 data: SPs #18, #19, #21, #22 did not have UCMR3 detections while SP #20 did have UCMR3 detections. Loading calculations from this sector will be used in mass-balance and HWA calculations.	

5. Other Sampling Sites (Sites 23-26)	SP #
▪ City Landfill Leachate Discharge	23
▪ Domestic Septage Hauler Discharge	24
▪ Haw River Arm of Jordan Lake (CPF055C) – Below Pittsboro (Note: Includes all Upper Cape Fear NPDES dischargers)	25
▪ Pittsboro Haw River Raw Water Intake (Note: Includes all Upper Cape Fear NPDES dischargers)	26
SP#23 had detectable values in previous 2015 study. SP#24 will be used to calculate loading from ~4 MG per year of domestic septage received at TZO. SPs#25/26 will be used to provide data for downstream utilities and monitor goal of SOC.	

V. SAMPLING FREQUENCIES

SAMPLING POINTS	MINIMUM SAMPLING FREQUENCY for SOC
TZO INFLUENT COMPOSITE	24-Hour TZO Influent daily composites available M-F One daily composite analyzed per week (starting 12-1-2021) Frequency of analyses determined by Lab/IWS staff BPJ
NB INFLUENT COMPOSITE (NB Transfer Line)	24-Hour NB Influent daily composites available M-F Frequency of analyses determined by Lab/IWS staff BPJ
TZO EFFLUENT COMPOSITE (for NCDEQ)	Weekly volumetric composite (Mon-Fri) (for NCDEQ retains and for use by City per BPJ)
TZO AERATION TANK	Quarterly on a weekday (Mon-Fri)
DEWATERED SLUDGE CAKE **INCINERATOR SCRUBBER DISCHARGE** (to influent wet well)	Quarterly Grab sample on a weekday (Mon-Fri)
INDUSTRIAL TRUNKLINE SAMPLES (7 Sites)	Quarterly + Tracking + Surveillance
SIU EFFLUENTS	See SIU Sampling Plan Addendum
COMMERCIAL TRUNKLINE SAMPLES (3 Sites)	Quarterly + Tracking
DOMESTIC TRUNKLINE SAMPLES (2 Sites)	Quarterly + Tracking
DRINKING WATER SAMPLES (5 sites) **(2 GSO Water Plants, 3 GSO Interconnects)**	Quarterly: Townsend, Mitchell, Reidsville, Burlington Monthly: PTRWA
OTHER SAMPLING POINTS	As indicated
SAMPLING POINT	**SAMPLING FREQUENCY for SOC/eDMR**
TZ OSBORNE EFFLUENT GRAB for eDMR	Weekly grab Compliance Sample on a weekday (Tues-Fri) (day selected by Lab/IWS)

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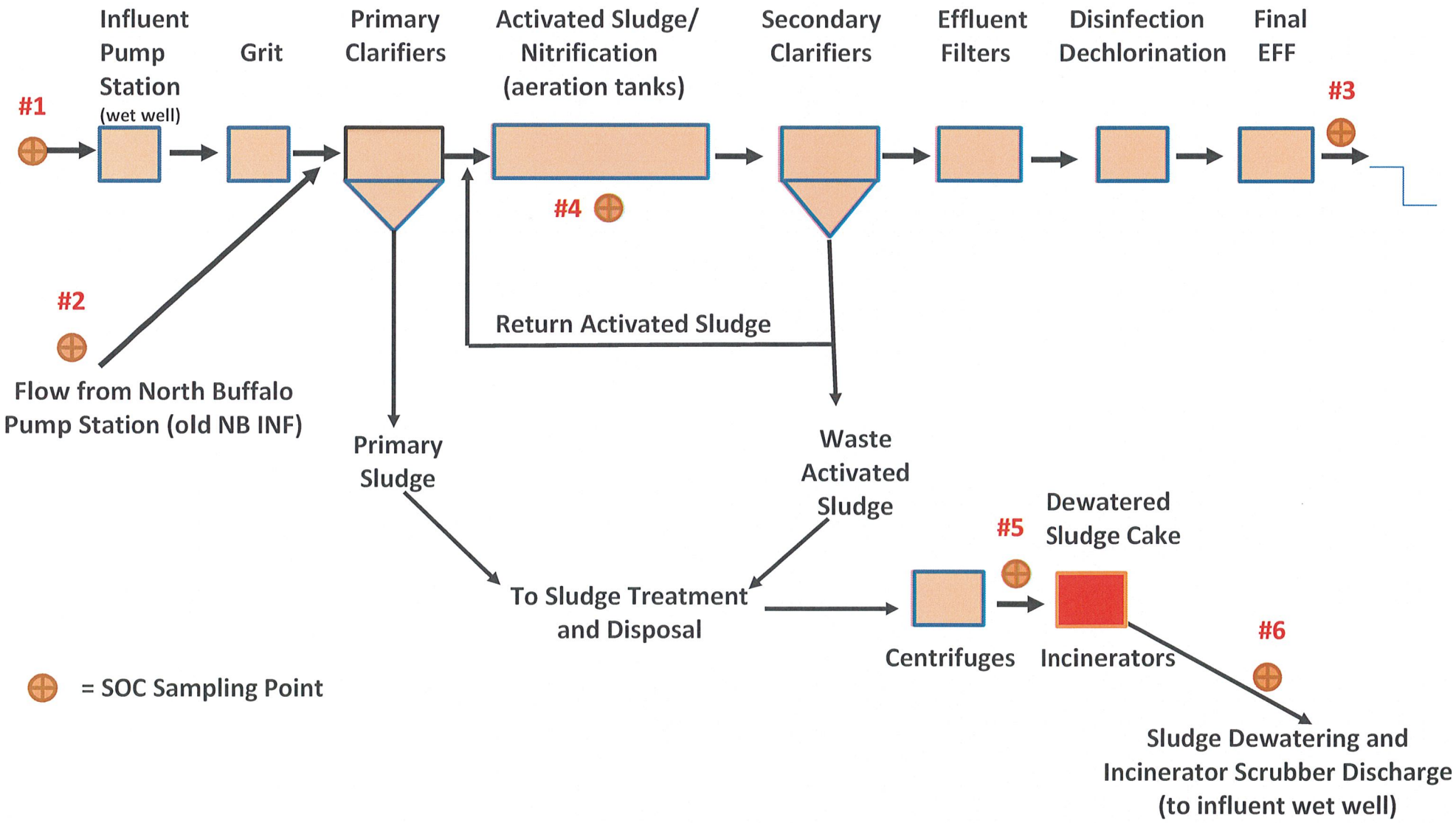
VI. SAMPLING PLAN

SP #	Sampling Location	Grab (G) Composite (C)	Split Samples?	Minimum Sampling Frequency/ Specific Times	Comments
1	TZO INF	COMP	No	1 daily composite every week	
2	NB INF (Transfer Line)	COMP	No	Monthly	
3G	TZO EFF Grab	G	YES	Weekly	For eDMR reporting
3C	TZO EFF Composite	Weekly Comp	No	Weekly Volumetric	Retain samples for NCDEQ
4	TZO Aeration Tank	G	No	Quarterly	Samples taken on same day Use Solid Waste Lab Method
5	Sludge Cake	COMP	No	Quarterly	
6	Solids Handling Bldg	G	No	Quarterly	
7	IND 1 Patton	COMP	No	Quarterly + Tracking	
8	IND 2 Arlington	COMP	No	Quarterly + Tracking	
9	IND 3 Reedy Fork	COMP	No	Quarterly + Tracking + Surveillance	
10	IND 4 Airport	COMP	No	Quarterly + Tracking	
11	IND 5 Whitsett	COMP	No	Quarterly + Tracking	
12	IND 6 NB Trunkline	COMP	No	Quarterly + Tracking	
12A	IND 7 Radar	COMP	No	Quarterly + Tracking	
13	COM 1 Wesley Long	COMP	No	Quarterly + Tracking	
14	COM 2 A&T Univ	COMP	No	Quarterly + Tracking	
15	COM 3 Bessemer	COMP	No	Quarterly + Tracking	
16	DOM 4 Willoughby	COMP	No	Quarterly + Tracking	
17	DOM 5 Shelby	COMP	No	Quarterly + Tracking	
18	DW 1 Townsend	G	No	Quarterly: Jun/Aug/Nov/Feb	
19	DW 2 Mitchell	G	No	Quarterly: Jun/Aug/Nov/Feb	
20	DW 3 PTRWA	G	No/YES*	Monthly	*Duplicate at least 2 samples
21	DW 4 Burlington	G	No	Quarterly: Jun/Aug/Nov/Feb	Sampling with Water Division
22	DW 5 Reidsville	G	No	Quarterly: Jun/Aug/Nov/Feb	Sampling with Water Division
23	GSO Landfill	COMP	No/YES*	6/year	*Duplicate at least 2 samples
24	Domestic Septage	Truck Grab	No	Jun/Aug/Nov/Feb	4 Different companies
25	HR Arm Jordan Lake	Grab	No	Twice/Month (by Meritech)	If accessible (weather, COVID)
26	Pittsboro DW Intake	COMP (by Town)	No	1 daily composite every week	Includes all Haw River dischargers

VII. FACILITY DIAGRAM - T. Z. Osborne POTW Sampling Points



VIII. DATA REVIEW, VALIDATION and REPORTING/SUBMITTAL

Regarding all data generated and submitted in response to the SOC requirements:

1. All laboratory results shall indicate the units of concentration measured.
2. "Below Detection Limit" [BDL] data - All data will be reported as having been measured to a specific numerical limit and the designation of < (less than).
3. BDL data will be considered "zero" when averaging data (as per NCDEQ eDMR policy)
4. All data generated will be reviewed by Lab/IWS staff for inclusion in light of quality control and quality assurance data generated at the time of analysis.
    a. Reporting of data qualified by the commercial lab will be reviewed for use on a case-by-case basis.
    b. Reporting of data associated with positive field and/or trip blank will be reviewed for use on a case-by-case basis.
5. Any TZO effluent data generated and analyzed using required 40 CFR Part 136 holding times, methodologies, and sample types (NPDES effluent site, grab sample, EPA approved 40 CFR Part 136 method) will be:
    a. Reported to NCDEQ on effluent eDMRs within 30 days of the last day of the monitoring month
    b. Sent to NCDEQ via email prior to eDMR submittal
    c. Data emailed to NCDEQ will also be posted on the City of Greensboro SOC webpage
6. Periodic reports based on notes from quarterly meetings with NCDEQ shall be posted on the City of Greensboro SOC webpage.
7. SOC data will be available after being submitted to NCDEQ.
8. Any deviations from EPA 40 CFR Part 136 sampling/methodology will be noted along with the reasons for the deviations.

	SOC 1,4-DIOXANE SIU SAMPLING PLAN (and TZO Loading Estimates @100 ug/l)			
	1 ug/l at TZO effluent = 0.2919 pounds (using 35 MGD)			
SP#	MAP	Significant Industrial User (SIU) Listed by Flow	CY 2021 Jan-Jun average FLOW in MGD	Potential Pounds/day at 100 ug/l
42	E	P&G Brown Summit 01	0.3542	0.295
30	O	Elastic Fabrics	0.1676	0.140
39	B	ITG (Lorillard)	0.1310	0.109
52	H	Shamrock BS 02	0.1290	0.108
47	AA	Precision Fabrics	0.1196	0.100
27	I	Aramark	0.1167	0.097
49	AD	QORVO	0.1140	0.095
51	G	Shamrock BS 01	0.0890	0.074
57	AH	Vertellus	0.0874	0.073
44	AC	P&G Swing	0.0664	0.055
29	N	Ecolab	0.0609	0.051
40	W	Lanxess	0.0586	0.049
32	P	Evonik 02	0.0547	0.046
58	AI	ZINK	0.0546	0.046
50	J	Qualicaps	0.0407	0.034
43	F	P&G Brown Summit 02	0.0405	0.034
54	AF	Solenis	0.0398	0.033
53	AE	Shamrock Patton	0.0343	0.029
28	L	Chemol	0.0328	0.027
46	Z	Piedmont Plating	0.0216	0.018
33	R	Express Container	0.0170	0.014
31	Q	Evonik 01	0.0166	0.014
34	S	GILBARCO	0.0112	0.009
48	AB	PRECOR	0.0078	0.007
45	Y	Parker Metal Finishing	0.0076	0.006
41	X	Machine Specialities	0.0055	0.005
36	T	Greensboro Industrial 02	0.0050	0.004
56	AG	United Metal	0.0046	0.004
35	A	Greensboro Industrial 01	0.0032	0.003
38	V	IQE	0.0014	0.001
55	D	Triad Anodizing 02	0.0014	0.001
37	U	HAECO	0.0008	0.001

August 2021 - GSO commits to sampling/analysis of all 29 SIUs once for at least 2 quarters in Year One. *(32 sampling locations since 3 SIUs have more than one discharge pipe.)* ***GSO proposes to have all Aug-Oct quarter samples to commercial lab by November 15 (completed). Data from 2 quarters will be reviewed to prioritize next steps for any SIU >100 ug/l.***
Year Two – GSO commits to sampling/analysis once for at least 2 quarters for all SIUs that do not already have a Source Reduction Plan and had detectable concentrations in Year One. Source Reduction Evaluation Trigger = >31.5 ug/l
Year Three - GSO commits to sampling/analysis once for at least 2 quarters for all SIUs that do not already have a Source Reduction Plan and had detectable concentrations in Year Two. Source Reduction Evaluation Trigger = >23 ug/l