Superior Refining Company LLC
2407 Stinson Avenue
Superior, WI 54880

2018 Superior Refinery Fire
Summary of Water Sampling Results for Ongoing Monitoring
5/30/2018

The purpose of this memorandum is to provide a summary of the ongoing surface water sampling activities and water quality sampling results initiated on April 26th, 2018 in response to the 2018 Superior Refinery Fire. Ongoing sampling is being completed in accordance with the approved 2018 Superior Refinery Fire Surface Water Sampling and Analysis Plan (SWSAP), developed in conjunction with the Wisconsin Department of Natural Resources (WDNR) and United States Environmental Protection Agency (USEPA).

The facility maintains a WPDES effluent discharge permit for the Refinery's Waste Water Treatment Plant (WWTP, Outfall 001) which treats surface water from the refinery process unit areas. Surface water from the facility outside of the refinery process areas is conveyed off site via the northern Stinson Avenue storm water ditch or managed through authorized storm water Outfalls 002 and 003. Both the WWTP and other site surface water discharge to the head of Newton Creek, a small stream approximately 1.5 miles long that connects to Superior Bay via Hog Island Inlet.

During the incident, both water and firefighting foam were used to extinguish the fire. The majority of these firefighting materials were contained onsite in the facility's fire water and storm water retention ponds. However, a small percentage of the firefighting materials from the early stages of the response are known to have migrated to the northern Stinson Avenue storm water ditch and into Newton Creek prior to implementation of onsite containment measures during the evening of the initial response. Following the implementation of containment measures, a treatment plan for PFAS mitigation was developed through close consultation with WDNR. The water collected on-site will be run through the on-site wastewater treatment plant and the recently installed onsite PFAS mitigation system consisting of granular activated carbon and/or polishing resin. Optimization of this system, using best available control technology, will mitigate and potentially eliminate the PFAS compounds before discharging the water from site.

Surface water sample locations were selected post incident based on known sensitivity or risk as well as field observations including safety of sampling personnel, site accessibility and visual impact assessments. All samples collected are being analyzed by accredited third party laboratories. Ongoing surface water sample locations are presented on Figure 1.

A summary of water sampling results for ongoing monitoring are contained in Table 1. For ease of reference, the following units of measure and identifiers have been defined as follows:

mg/L = milligrams per liter which is the equivalent of parts per million (ppm)

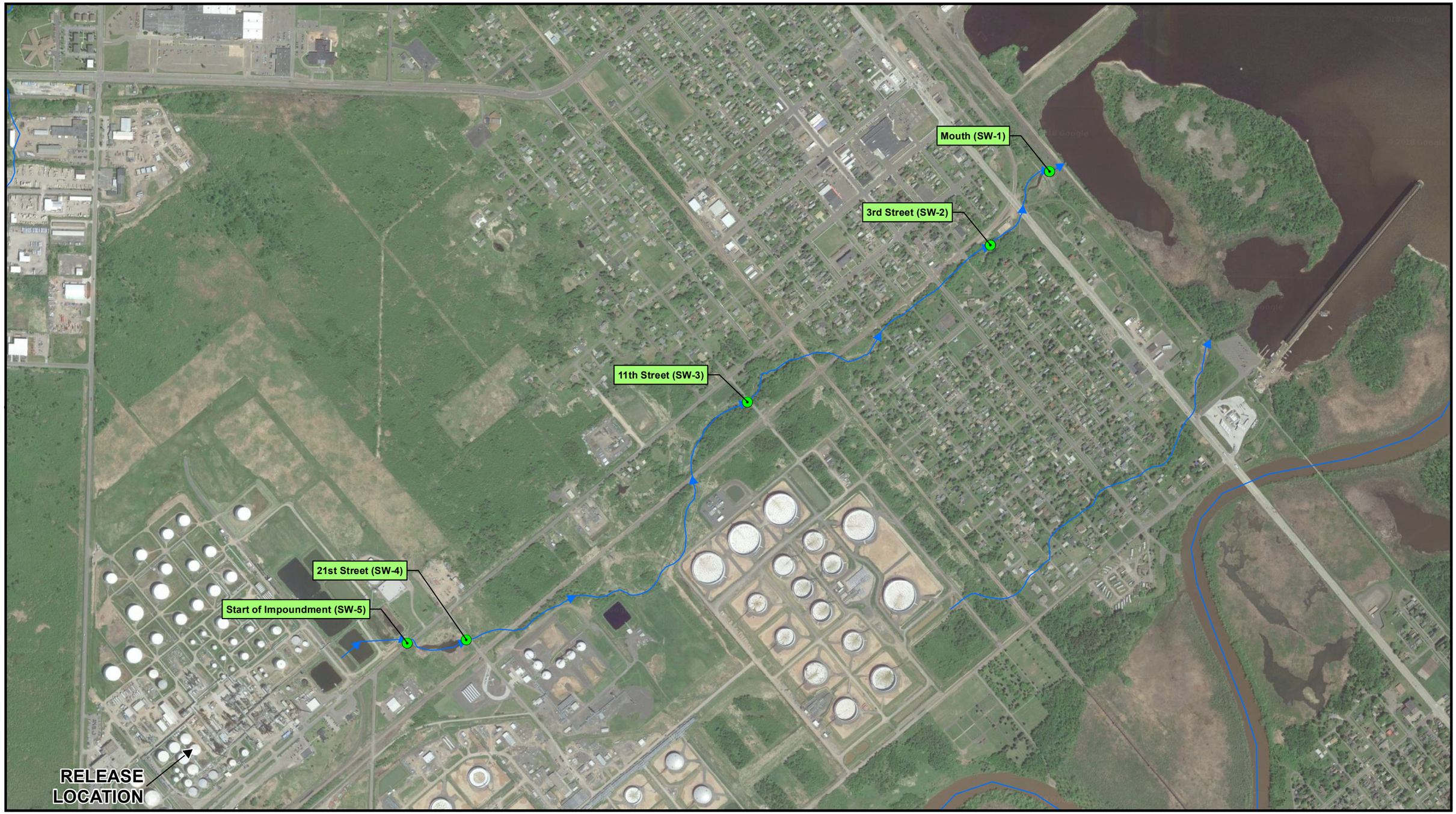
ug/L = micrograms per liter which is the equivalent of parts per billion (ppb)

ng/L = nanograms per liter which is the equivalent of parts per trillion (ppt)

ND = Indicates the analyte was not detected in the analysis and the number represented inside the () indicates the detection limit.

J = Indicates the analyte estimated value was less than reporting limit but greater than the method detection limit

\- = Indicates analyte was not analyzed



Sources: 2015 TIGER/Line Shapefiles, prepared by the U.S. Census Bureau, 2015; U.S. Geological Survey, National Geospatial Technical Operations Center - National Elevation Dataset, 2015; USGS High Resolution National Hydrology Dataset. Imagery © Google.

0 250 500 750
Feet

Coordinate System:
NAD 1983 HARN StatePlane
Wisconsin North FIPS 4801 Feet

N

Legend

- Surface Water Sample Location
- Surficial Drainage Direction (USGS NHD)

GHD

HUSKY ENERGY – SUPERIOR REFINERY FIRE
SUPERIOR, WISCONSIN

11156937-00
May 22, 2018

SURFACE WATER SAMPLING LOCATIONS

FIGURE 1

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TABLE 1
2018 SUPERIOR REFINERY FIRE
SUMMARY OF WATER SAMPLING RESULTS FOR ONGOING MONITORING
(Results obtained through 5/30/2018)

Sample Location	Date	Benzene	Ethylbenzene	Toluene	Total Xylenes (m, o, p)	Methyl Tert Butyl Ether (MTBE)	1,2,4-Trimethyl benzene	1,3,5-Trimethyl benzene	Naphthalene	PAHs (All)	GRO	DRO	ORO	Oil & Grease	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	Combined Total "PFAS"
		(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(mg/L)	(mg/L)	(mg/L)	(ng/L)	(ng/L)	(ng/L)
Human Health Screening Level →		610	2920	15359	8300	None	330	4200	1200	0.00013 to 1200	None	None	None	None	None^	None^	None^
Aquatic Life Protection Screening Level →		None	None	None	None	None	None	None	None	None	None	None	None	30	None^	None^	None^
Start of Impoundment (SW-5)																	
	4/29/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND*	ND (8.9)	5.7	5.0	1.9 J	410	40	450
	4/30/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	ND (8.9)	ND (0.14)	0.15	ND (1.4)	ND (10)	ND (10)	0
	5/2/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	ND (8.9)	ND (0.081)	0.080	ND (1.4)	20	ND (10)	20
	5/2/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	ND (8.9)	ND (0.076)	0.073	ND (1.4)	40	20	60
	5/4/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	ND (8.9)	ND (0.075)	0.072	ND (1.4)	20	ND (10)	20
	5/6/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	ND (8.9)	0.098	0.13	ND (1.5)	90	20	110
	5/8/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	11.7 J	ND (0.11)	0.10	ND (1.4)	740	90	830
	5/10/2018	0.40 J	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	ND (8.9)	ND (0.095)	ND (0.11)	ND (1.4)	140	70	210
*= All ND except Phenanthrene at 1.2 J ppb																	
21st Street (SW-4)																	
Impoundment Weir	4/29/2018	5.8	0.81 J	7.3	5.7	ND (0.40)	3.2	1.1	1.8 J	ND*	141	2.7	0.55	ND (1.4)	120	560	680
	4/30/2018	2.5	0.20 J	3.3	1.3 J	ND (0.40)	0.99 J	0.84 J	1.1 J	ND	111	2.7	0.95	2.8 J	190	870	1060
	5/2/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	31.7 J	0.30	0.16	ND (1.4)	100	150	250
	5/2/2018	ND (0.34)	ND (0.14)	0.20 J	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	21.8 J	0.29	0.17	ND (1.6)	80	110	190
	5/4/2018	ND (0.34)	ND (0.14)	0.43 J	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	0.67 J	ND	37.3 J	0.30	0.18	ND (1.5)	70	100	170
	5/6/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	ND (52.0)	0.25	0.18	ND (1.5)	80	70	150
	5/8/2018	ND (0.34)	ND (0.14)	ND (0.56)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	54.4 J	0.28	0.15	ND (1.4)	120	60	180
Duplicate Sample	5/8/2018	ND (0.34)	ND (0.14)	ND (0.54)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	49.7 J	0.27	0.15	ND (1.4)	120	60	180
	5/10/2018	0.39 J	ND (0.14)	0.68 J	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	17.2 J	0.22	0.18	ND (1.5)	160	110	270
Duplicate Sample	5/10/2018	0.38 J	ND (0.14)	0.70 J	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	16.9 J	0.21	0.18	ND (1.5)	150	100	250
*= All ND except 1-Methylnaphthalene (3.8 J), 2-Methylnaphthalene (3.6 J), Phenanthrene (1.2 J)																	
21st Street (SW-4)																	
21st Street Plunge Pool	4/26/2018	55.9	7.0	73.9	42.6	ND (0.40)	17.2	4.0	12.0	ND*	474	5.6	6.3	11.1	None Collected	None Collected	N/A
	4/27/2018	33.7	4.7	40.2	29.0	ND (0.40)	15.2	3.7	8.2	ND	510	-	13.1	5.3	None Collected	None Collected	N/A
	4/28/2018	18.4	2.5	22.2	16.5	ND (0.40)	9.0	2.3	4.9	ND	330	-	10.3	2.4 J	None Collected	None Collected	N/A
	5/15/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	ND (59.1)	0.24	0.16	Not Analyzed	210	100	310
Duplicate Sample	5/15/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	ND (49.1)	0.27	0.17	Not Analyzed	220	110	330
	5/21/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	Pending	ND (32.2)	0.27	0.16	Not Analyzed	180	100	280
*= All ND except 1-Methylnaphthalene (12.0), 2-Methylnaphthalene (17.2), 2-Methylphenol (5.7 J), 3&4-Methylphenol (10.9), Fluorene (3.1 J), Naphthalene (9.7), Phenanthrene (4.0), Phenol (32.2)																	
11th Street (SW-3)																	
	4/27/2018	11.2	1.8	14.0	11.0	ND (0.40)	5.8	1.6	3.5 J	ND	227	-	-	ND (1.4)	-	-	-
	4/28/2018	4.4	0.73 J	5.5	4.6	ND (0.40)	2.5	0.82 J	1.6 J	ND*	150	-	-	1.4 J	-	-	-
	4/29/2018	ND (0.34)	ND (0.14)	0.29 J	ND (0.24)	ND (0.40)	0.21 J	0.35 J	ND (0.42)	ND	45.2 J	0.70	0.32	ND (1.5)	80	740	820
	4/30/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	9.0 J	0.56	0.22	ND (1.4)	100	210	310
	5/2/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	24.1 J	0.21	0.11	ND (1.4)	50	90	140
	5/4/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	19.2 J	0.21	0.11	ND (1.4)	80	80	160
	5/6/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	ND (32.0)	0.20	0.14	ND (1.5)	60	60	120
	5/8/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND**	25.5 J	0.21	0.11	ND (1.4)	60	70	130
	5/10/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	ND (8.9)	ND (0.19)	ND (0.16)	ND (1.4)	90	70	160
	5/15/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	ND (40.5)	0.20	ND (0.13)	Not Analyzed	100	80	180
	5/21/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	Pending	ND (32.1)	0.22	0.13	Not Analyzed	90	80	170
*= All ND except 1-Methylnaphthalene (2.4 J), Phenanthrene (1.2 J)																	
**= All ND except bis(2-Ethylhexyl)phthalate (DEHP) (8.7 J)																	
3rd Street (SW-2)																	
	4/26/2018	41.9	4.3	54.3	25.7	ND (0.40)	8.8	2.1	7.5	ND*	297	1.3	-	6.4	-	-	-
	4/27/2018	6.8	1.1	8.7	7.0	ND (0.40)	4.0	1.0	2.6 J	ND	148	-	-	ND (1.4)	-	-	-
	4/28/2018	2.0	0.33 J	2.5	ND (0.24)	ND (0.40)	ND (1.1)	0.40 J	0.92 J	-	328	-	-	ND (1.5)	-	-	-
	4/29/2018	ND (0.34)	ND (0.14)	0.22 J	ND (0.24)	ND (0.40)	0.14 J	ND (0.18)	ND (0.42)	ND	11.1 J	0.56	0.22	ND (1.5)	60	300	360
	4/30/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	ND (8.9)	0.60	0.26	ND (1.4)	50	200	250
	5/2/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	ND (8.9)	0.14	0.089	ND (1.4)	30	60	90
	5/4/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	11.7 J	ND (0.11)	0.069	ND (1.4)	20	40	60
	5/6/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	ND (22.7)	0.13	ND (0.11)	ND (1.5)	20	40	60
	5/8/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	22.2 J	0.16	0.089	ND (1.4)	30	40	70
	5/10/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	13.8 J	ND (0.15)	ND (0.14)	ND (1.4)	60	40	100
	5/15/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND**	ND (22.0)	ND (0.16)	ND (0.11)	Not Analyzed	60	60	120
	5/21/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	Pending	ND (28.3)	0.18	ND (0.12)	Not Analyzed	50	60	110
*= All ND except 1-Methylnaphthalene (5.2 J), 2-Methylnaphthalene (6.0 J), 2-Methylphenol (3.6 J), 3&4-Methylphenol (2.7 J), Naphthalene (4.6 J), Phenol (5.2)																	
**= All ND except bis(2-Ethylhexyl)phthalate (DEHP) (6.2 J)																	
Mouth (SW-1)																	
Newton Creek Mouth	4/27/2018	7.5	1.3	9.9	8.1	ND (0.40)	4.6	1.2	2.9 J	ND	182	-	-	1.6 J	-	-	-
	4/28/2018	2.1	0.37 J	2.5	ND (0.24)	ND (0.40)	ND (1.2)	0.40 J	0.95 J	ND	66.7 J	-	-	ND (1.4)	-	-	-
	4/29/2018	ND (0.34)	ND (0.14)	0.32 J	ND (0.24)	ND (0.40)	0.22 J	ND (0.18)	ND (0.42)	ND	15.6 J	0.74	0.25	ND (1.5)	220	230	450
	4/30/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	ND (8.9)	0.73	0.53	ND (1.4)	50	160	210
	5/2/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	ND (8.9)	0.15	0.096	ND (1.4)	30	60	90
	5/4/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	ND (8.9)	ND (0.11)	0.079	ND (1.5)	ND (10)	20	20
	5/6/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	ND (15.6)	0.098	ND (0.11)	ND (1.4)	10	20	30
Duplicate Sample	5/6/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	ND (8.9)	0.11	ND (0.12)	ND (1.5)	10	10	20
	5/8/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	23.6 J	0.15	0.11	ND (1.4)	10	20	30
	5/10/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	ND (8.9)	ND (0.14)	ND (0.13)	ND (1.5)	50	30	80
	5/15/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	ND (26.2)	ND (0.14)	ND (0.12)	Not Analyzed	40	40	80
	5/21/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	Pending	ND (9.2)	ND (0.073)	ND (0.082)	Not Analyzed	ND (10)	ND (10)	0
Duplicate Sample	5/21/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	Pending	ND (11.0)	ND (0.075)	ND (0.085)	Not Analyzed	ND (10)	ND (10)	0
FAXON CREEK (REFERENCE SITE)																	
Faxon Creek Reference Site	4/29/2018	ND (0.34)	ND (0.14)	ND (0.17)	ND (0.24)	ND (0.40)	ND (0.14)	ND (0.18)	ND (0.42)	ND	ND (8.9)	ND (0.069)	0.12	ND (1.5)	ND (10)	ND (10)	0

None^ = No State of Wisconsin PFOS and/or PFOA human health or aquatic life protection screening levels currently established