Superior Refining Company LLC
2407 Stinson Avenue
Superior, WI 54880

2018 Superior Refinery Fire
Summary of Water Sampling Results for Ongoing Monitoring
7/23/2018

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 and subsequent installation of a WDNR approved treatment system consisting of granular activated carbon and ion exchange resin, there has been no discharge from the retention ponds used to contain the firefighting materials or from the WWTP prior to the water undergoing treatment.

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. 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)

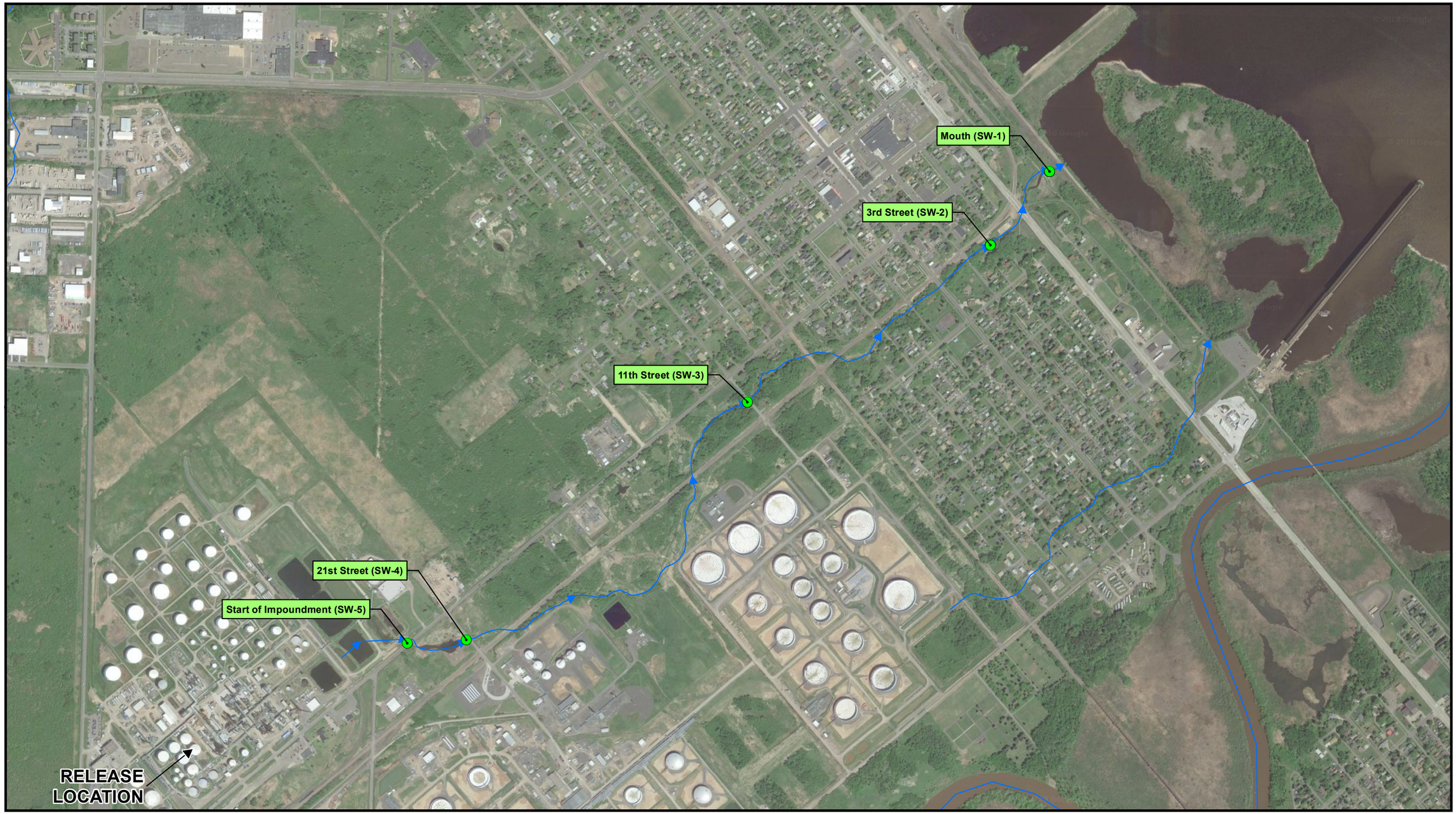
ug/L = micrograms per liter which is the equivalent of parts per billion (ppb)

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

GIS File: Q:\GIS\PROJECTS\11156000s\11156937\Layouts\PRES011\11156937-10(PRES011)GIS-WA007.mxd

TABLE 1
2018 SUPERIOR REFINERY FIRE
SUMMARY OF WATER SAMPLING RESULTS FOR ONGOING MONITORING
(Results recieved through 7/18/2018)

		Parameter	Benzene	Ethyl benzene	Toluene	Xylene, total	Methyl tertiary butyl ether (MTBE)	1,2,4-Trimethyl benzene	1,3,5-Trimethyl benzene	Naphthalene	Total PAHs	GRO	DRO	ORO	Oil and Grease	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)
		Units	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
Aquatic Life Protection Screening Level			None	None	None	None	None	None	None	None	None	None	None	None	30	None^	None^
Human Health Screening Level			610	2920	15359	8300	None	330	4200	1200	None	None	None	None	None	None^	None^
Location	Date	Sample Type															
21st St. Impoundment Start SW-5 Discontinued 5/10/18	4/26/2018		55.9	7.0	73.9	42.6	< 0.40	17.2	4.0	12.0	46 a[1]	474	5.6	6.3	11.1	--	--
	4/27/2018		33.7	4.7	40.2	29.0	< 0.40	15.2	3.7	8.2	ND	510	--	13.1	5.3	--	--
	4/28/2018		18.4	2.5	22.2	16.5	< 0.40	9.0	2.3	4.9	ND	330	--	10.3	2.4 j	--	--
	4/29/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	1.2 a[2]	< 8.9	5.7	5.0	1.9 j	410	40
	4/30/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	< 8.9	0.14	0.15	< 1.4	< 10	< 10
	5/02/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	< 8.9	0.081 b	0.080	< 1.4	20	< 10
	5/02/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	< 8.9 *	0.076 b	0.073	< 1.4	40	20
	5/04/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	< 8.9	0.075 b	0.072	< 1.4	20	< 10
	5/06/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	< 8.9	0.098	0.13	< 1.5	90	20
	5/08/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	11.7 j	0.11 b	0.10	< 1.4	740	90
	5/10/2018		0.40 j	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	< 8.9	0.095 b	0.11 b	< 1.4	140	70
	[1] Detections: 1-Methylnaphthalene 12.0, 2-Methylnaphthalene 17.2, Fluorene 3.1 j, Naphthalene 9.7, Phenanthrene 4.0. SVOC Parameters: 2-Methylphenol 5.7 j, 3/4-Methylphenol 10.9, Phenol 32.2 [2] Detections: Phenanthrene 1.2 j																
21st St. Impoundment Upstream of Weir SW-4 Discontinued 5/10/18	4/29/2018		5.8	0.81 j	7.3	5.7	< 0.40	3.2	1.1	1.8 j	8.6 a[1]	141	2.7	0.55	< 1.4	170 *	590
	4/30/2018		2.5	0.20 j	3.3	1.3 j	< 0.40	0.99 j	0.84 j	1.1 j	ND	111	2.7	0.95	2.8 j	180	650
	5/02/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	31.7 j*	0.30	0.16	< 1.4	100	150
	5/02/2018		< 0.34	< 0.14	0.20 j	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	21.8 j*	0.29	0.17	< 1.6	80	110
	5/04/2018		< 0.34	< 0.14	0.43 j	< 0.24	< 0.40	< 0.14	< 0.18	0.67 j	ND	37.3 j	0.30	0.18	< 1.5	70	100
	5/06/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	52.0 jb	0.25	0.18	< 1.5	80	70
	5/08/2018		< 0.34	< 0.14	0.56 j	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	54.4 j	0.28	0.15	< 1.4	120	60
	5/08/2018	Duplicate	< 0.34	< 0.14	0.54 j	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	49.7 j	0.27	0.15	< 1.4	120	60
	5/10/2018		0.39 j	< 0.14	0.68 j	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	17.2 j	0.22 b	0.18	< 1.5	160	110
	5/10/2018	Duplicate	0.38 j	< 0.14	0.70 j	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	16.9 j	0.21	0.18	< 1.5	150	100
	[1] Detections: 1-Methylnaphthalene 3.8 j, 2-Methylnaphthalene 3.6 j, Phenanthrene 1.2 j																
21st St. Impoundment Plunge Pool SW-4 Ongoing (PFAS Only after 6/18/18)	5/15/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	59.1 jb	0.24	0.16	--	210	100
	5/15/2018	Duplicate	< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	49.1 jb	0.27	0.17	--	220	110
	5/21/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	--	32.2 jb	0.27	0.16	--	180	100
	5/23/2018		--	--	--	--	--	--	--	--	ND	--	--	--	--	--	--
	5/23/2018		--	--	--	--	--	--	--	--	ND	--	--	--	--	--	--
	5/29/2018		< 0.34 h	< 0.14 h	< 0.17 h	< 0.24 h	< 0.40 h	< 0.14 h	< 0.18 h	< 0.42 h	ND	24.3 jh	0.17 bh	0.14 bh	--	170	60
	6/04/2018		0.13 j	< 0.14	0.19 j	< 0.31	< 0.16	< 0.20	< 0.12	< 0.48	ND	10.9 j	0.13 b	0.089	--	290	30
	6/12/2018		< 0.10	< 0.14	0.13 j	< 0.31	< 0.16	< 0.20	< 0.12	< 0.48	ND	15.5 jb	0.26 b	0.14	--	120	30
	6/18/2018		0.30 j	< 0.14	0.14 j	< 0.31	< 0.16	< 0.20	< 0.12	< 0.48	ND	< 8.9	0.070 b	0.079	--	130	20
	6/18/2018	Duplicate	0.29 j	< 0.14	0.17 jb	< 0.31	< 0.16	< 0.20	< 0.12	< 0.48	ND a[1]	< 8.9	0.071 b	0.079	--	130	20
	6/25/2018		--	--	--	--	--	--	--	--	--	--	--	--	--	50	20
	7/02/2018		--	--	--	--	--	--	--	--	--	--	--	--	--	220	30
	7/02/2018	Duplicate	--	--	--	--	--	--	--	--	--	--	--	--	--	270	30
	7/09/2018		--	--	--	--	--	--	--	--	--	--	--	--	--	40	10
	[1] Detections: SVOC parameter Bis(2-ethylhexyl)phthalate (DEHP) 5.5 j																
11th St - Newton Creek SW-3 Discontinued 6/18/18	4/27/2018		11.2	1.8	14.0	11.0	< 0.40	5.8	1.6	3.5 j	ND	227	--	--	< 1.4	--	--
	4/28/2018		4.4	0.73 j	5.5	4.6	< 0.40	2.5	0.82 j	1.6 j	3.6 a[1]	150	--	--	1.4 j	--	--
	4/29/2018		< 0.34	< 0.14	0.29 j	< 0.24	< 0.40	0.21 j	0.35 j	< 0.42	ND	45.2 j	0.70	0.32	< 1.5	90	670
	4/30/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	9.0 j	0.56	0.22	< 1.4	100	210
	5/02/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	24.1 j*	0.21	0.11	< 1.4	50	90
	5/04/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	19.2 j	0.21	0.11	< 1.4	80	80
	5/06/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	32.0 jb	0.20	0.14	< 1.5	60	60
	5/08/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND a[2]	25.5 j	0.21	0.11	< 1.4	60	70
	5/10/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	< 8.9	0.19	0.16	< 1.4	90	70
	5/15/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	40.5 jb	0.20	0.13	--	100	80
	5/21/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	--	32.1 jb	0.22	0.13	--	90	80
	5/23/2018		--	--	--	--	--	--	--	--	ND	--	--	--	--	--	--
	5/29/2018		< 0.34 h	< 0.14 h	< 0.17 h	< 0.24 h	< 0.40 h	< 0.14 h	< 0.18 h	< 0.42 h	ND	27.8 jh	0.16 bh	0.13 bh	--	130	40
	6/04/2018		< 0.10	< 0.14	< 0.083	< 0.31	< 0.16	< 0.20	< 0.12	< 0.48	ND	15.2 j	0.11 b	0.084	--	250	20
	6/12/2018		< 0.10	< 0.14	< 0.083	< 0.31	< 0.16	< 0.20	< 0.12	< 0.48	ND	15.4 jb	0.24 b	0.15	--	200	30
	6/18/2018		< 0.10	< 0.14	0.086 jb	< 0.31	< 0.16	< 0.20	< 0.12	< 0.48	ND	< 8.9	0.070 b	0.081	--	110	10
	[1] Detections: 1-Methylnaphthalene 2.4 j, Phenanthrene 1.2 j [2] Detections: SVOC parameter Bis(2-ethylhexyl)phthalate (DEHP) 8.7 j																
3rd St - Newton Creek SW-2 Ongoing (PFAS Only after 6/18/18)	4/26/2018		41.9	4.3	54.3	25.7	< 0.40	8.8	2.1	7.5	15.8 a	297	1.3	--	6.4	--	--
	4/27/2018		6.8	1.1	8.7	7.0	< 0.40	4.0	1.0	2.6 j	ND	148	--	--	< 1.4	--	--
	4/28/2018		2.0	0.33 j	2.5	< 0.24	< 0.40	1.1	0.40 j	0.92 j	ND	328	--	--	< 1.5	--	--
	4/29/2018		< 0.34	< 0.14	0.22 j	< 0.24	< 0.40	0.14 j	< 0.18	< 0.42	ND	11.1 j	0.56	0.22	< 1.5	60	300
	4/30/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	< 8.9	0.60	0.26	< 1.4	50	200
	5/02/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	< 8.9	0.14	0.089	< 1.4	30	60
	5/04/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	11.7 j	0.11 b	0.069	< 1.4	20	40
	5/06/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	22.7 jb	0.13	0.11	< 1.5	20	40
	5/08/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	22.2 j	0.16	0.089	< 1.4	30	40
	5/10/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	13.8 j	0.15	0.14	< 1.4	60	40
	5/15/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND a[1]	22.0 jb	0.16	0.11 b	--	60	60
	5/21/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	--	28.3 jb	0.18	0.12	--	50	60
	5/23/2018		--	--	--	--	--	--	--	--	ND	--	--	--	--	--	--
	5/29/2018		< 0.34 h	< 0.14 h	< 0.17 h	< 0.24 h	< 0.40 h	< 0.14 h	< 0.18 h	< 0.42 h	ND	19.6 jh	0.13 bh	0.10 bh	--	80	30
	6/04/2018		< 0.10	< 0.14	< 0.083	< 0.31	< 0.16	< 0.20	< 0.12	< 0.48	ND	< 8.9	0.093 b	0.084	--	120	20
	6/12/2018		< 0.10	< 0.14	< 0.083	< 0.31	< 0.16	< 0.20	< 0.12	< 0.48	ND	15.9 jb	0.16 b	0.11	--	260	30
	6/18/2018		< 0.10	< 0.14	0.10 jb	< 0.31	< 0.16	< 0.20	< 0.12	< 0.48	ND	< 8.9	0.079 b	0.11	--	60	10
	6/25/2018		--	--	--	--	--	--	--	--	--	--	--	--	--	80	20
	7/02/2018		--	--	--	--	--	--	--	--	--	--	--	--	--	140	20
	7/09/2018		--	--	--	--	--	--	--	--	--	--	--	--	--	80	10
	[1] Detections: 1-Methylnaphthalene 5.2 j, 2-Methylnaphthalene 6.0 j, Naphthalene 4.6 j. SVOC Parameters: 2-Methylphenol 3.6 j, 3,4-Methylphenol 2.7 j, Phenol 5.2. [2] Detections: SVOC parameter Bis(2-ethylhexyl)phthalate (DEHP) 6.2 j																
Newton Creek Mouth SW-1 Discontinued 6/18/18	4/27/2018		7.5	1.3	9.9	8.1	< 0.40	4.6	1.2	2.9 j	ND	182	--	--	1.6 j	--	--
	4/28/2018		2.1	0.37 j	2.5	< 0.24	< 0.40	< 1.2	0.40 j	0.95 j	ND	66.7 j	--	--	< 1.4	--	--
	4/29/2018		< 0.34	< 0.14	0.32 j	< 0.24	< 0.40	0.22 j	< 0.18	< 0.42	ND	15.6 j	0.74	0.25	< 1.5	220	230
	4/30/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	< 8.9	0.73	0.53	< 1.4	50	160
	5/02/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	< 8.9	0.15	0.096	< 1.4	30	60
	5/04/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	< 8.9	0.11 b	0.079	< 1.5	< 10	20
	5/06/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	15.6 jb	0.098	0.11	< 1.4	10	20
	5/06/2018	Duplicate	< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	< 8.9	0.11	0.12	< 1.5	10	10
	5/08/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	23.6 j	0.15	0.11	< 1.4	10	20
	5/10/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	< 8.9	0.14	0.13	< 1.5	50	30
	5/15/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	26.2 jb	0.14 b	0.12 b	--	40	40
	5/21/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	--	9.2 jb	0.073 b	0.082 b	--	< 10	< 10
	5/21/2018	Duplicate	< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	--	11.0 j	0.075	0.085	--	< 10	< 10
	5/23/2018		--	--	--	--	--	--	--	--	ND	--	--	--	--	--	--
	5/29/2018		< 0.34 h	< 0.14 h	< 0.17 h	< 0.24 h	< 0.40 h	< 0.14 h	< 0.18 h	< 0.42 h	ND	16.2 jh	0.12 bh	0.11 bh	--	80	30
	5/29/2018	Duplicate	< 0.34 h	< 0.14 h	< 0.17 h	< 0.24 h	< 0.40 h	< 0.14 h	< 0.18 h	< 0.42 h	ND	15.8 jh	0.12 bh	0.11 bh	--	60	20
	6/04/2018		< 0.10	< 0.14	< 0.083	< 0.31	< 0.16	< 0.20	< 0.12	< 0.48	ND	< 8.9	0.081 b	0.072	--	130	20
	6/04/2018	Duplicate	< 0.10	< 0.14	< 0.083	< 0.31	< 0.16	< 0.20	< 0.12	< 0.48	ND	< 8.9	0.088 b	0.083	--	140	10
	6/12/2018		< 0.10	< 0.14	< 0.083	< 0.31	< 0.16	< 0.20	< 0.12	< 0.48	ND	10.7 jb	0.062 b	0.085 b	--	< 10	< 10
	6/18/2018		< 0.10	< 0.14	0.10 jb	< 0.31	< 0.16	< 0.20	< 0.12	< 0.48	ND	< 8.9	0.063 b	0.074	--	50	10
Faxon Creek	4/29/2018		< 0.34	< 0.14	< 0.17	< 0.24	< 0.40	< 0.14	< 0.18	< 0.42	ND	< 8.9	0.069 b	0.12	< 1.5	< 10	< 10

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

Barr Standard Footnotes and Qualifiers

--	Not analyzed/Not available.
ND	Not detected.
*	Estimated value, QA/QC criteria not met.
a	Estimated value, calculated using some or all values that are estimates.
b	Potential false positive value based on blank data validation procedures. Concentrations identified as potential false positive are excluded from calculations.
h	EPA recommended sample preservation, extraction or analysis holding time was exceeded.
j	Estimated detected value. The reported value is less than the stated laboratory quantitation limit but greater than the laboratory method detection limit.