MEMO

ARCADIS Design & Consultancy for natural and built assets

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Arcadis Project No.:

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Subject:

PFAS Short-Term Water Characterization Update
RACER Buick City Site Flint, Michigan

This memo provides a status update of the sampling conducted pursuant to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) March 13, 2019 letter requiring a Short-Term Water Characterization (STWC) for the Buick City Site (Site) to assess potential per- and poly-fluoroalkyl substances (PFAS) impacts associated with the Site.

In addition to the status of the required sampling, this memo also summarizes the results of recent flow monitoring activities completed to evaluate the potential relative PFAS contribution from several of the outfalls. This information is intended to assist in establishing priorities for investigation and remedial work going forward. Please note that the calculated mass loadings have been estimated only to compare the relative contribution of each outfall for the purposes of establishing priority rankings to focus further evaluations on the most important outfalls. These estimates are not meant to represent an accurate assessment of the actual loadings. More work on flow measurements and further data collection would be necessary for that purpose.

DRY AND WET WEATHER SAMPLE STATUS

Storm sewer sample locations at the Site are shown on **Figure 1**. Due to weather conditions no additional samples have been collected since the August 8, 2019 STWC update was submitted. As previously presented dry weather PFAS sampling at each outfall has been completed where possible. **Table 1**

presents the dry weather sampling results for PFOA and PFOS. Samples could not be collected at six outfalls due to dry weather conditions and insufficient flow to sample, or if the storm sewers are situated above the water table.

Wet weather sampling has been completed at four outfalls (001, 003, 010, and 011), as shown on **Table 2**. Wet weather samples have not yet been collected from Outfalls 007, 007A, 008 and 012 due to the elevated river level. One wet weather sample has been collected from each of the remaining outfalls (Outfall 002, 004, 004A, 005, 005A, 006, and 013). The wet weather results for PFOA and PFOS are presented on **Table 2**.

FLOW AND MASS FLUX EVALUATION

The evaluation of PFAS contributions to the Flint River is focused on dry weather/base flow, because this represents the majority of flow discharged to the river. However, PFAS loading to the river during wet weather flow events was also considered. To assess the relative dry weather/base flow PFAS contributions from each outfall to the Flint River, flows in select storm sewers were estimated.

Outfalls 003, 005, 010, and 013 were prioritized for the flow study based on the concentrations of PFOS and estimated flows based on visual observations, the size of the associated drainage area, and historic flow data. In addition, for purposes of this evaluation flows at Outfall 001, 002, 006, and 011 were estimated based on visual observations and depth of water in pipe (where available).

Table 3 presents the dry weather flow and the dry weather PFOS concentration used to estimate the mass discharge per day for each outfall. A brief discussion of the rough estimates of mass discharge at each outfall is presented below.

Outfall 010

Outfall 010 has the highest estimated PFOS mass discharge, ranging from 110 to 210 milligrams per day (mg/day) at the outfall. The estimated mass discharge is based on the average dry weather flow ranging from 10 to 20 gallons per minute (gpm) from the two-month flow study (**Table 3**).

Table 4 shows the result of a wet weather sample collected during the flow study. The mass discharge estimated during this wet weather event was 90 mg/day. There is not a significant change in mass discharge between the wet and dry weather events, which is likely due to Outfall 010's small drainage area. The Outfall 010 storm sewer main is relatively short (approx. 600 feet) with a small (3 acre) drainage area.

Additional sampling is planned along the storm sewer to aid in identify the area of PFOS impact and determine how it can be addressed.

Outfall 011

As noted above at outfalls where flow data was not available, the flow has been estimated based on visual observations. At manhole MH 11-6 the flow is estimated to be between 175 and 475 gpm, based on sewer video and field observations (**Table 3**). The estimated mass discharge of PFOS at manhole MH 11-6 ranges from approximately 100 to 260 mg/day.

The Outfall 011 drainage area is currently 31 acres (14 acres on-Site, which includes former RACER property now owned by Lear). The PFOS impacts at Outfall 011 appear to be related to two laterals along Hamilton Ave that may still service the Site.

In addition, a recent review of storm sewer video indicates that there is flow entering Outfall 011 from the former Outfall 009 storm sewer. The Outfall 009 storm sewer was previously physically disconnected from Outfall 011 approximately 100 feet north of manhole 11-6; however, there is still a small (estimated at about 5-10 gpm based on the video) discharge to manhole 11-6. Additional investigation is being completed and once the areas of PFOS impact have been confirmed, the laterals are planned to be bulkheaded to eliminate the Sites PFOS contribution to the storm sewer.

Outfall 001

Based on measurements collected at manhole MH 1-1 the flow is approximately 500 to 520 gpm (**Table 3**). The estimated dry weather mass discharge at Outfall 001 is, therefore, about 80 to 85 mg/day. The Outfall 001 storm sewer drainage area is 205 acres (19 acres on-Site, which includes former RACER property now owned by ASW). Moreover, an attempt was recently made to collect a sample from the manhole at the Site downgradient property boundary; however, the flow was so low it was not possible to collect a sample. On the basis of flow alone the Site is not a meaningful contributor of PFAS at Outfall 001.

Outfall 002

Measurements collected at manhole MH 2-3 show the flow is approximately 15 to 25 gpm (**Table 3**). Outfall 002 has an estimated dry weather mass discharge ranging from 50 to 85 mg/day. The Site's contribution to the Outfall 002 storm sewer was bulkheaded at downgradient property boundary in 2013. The Outfall 002 drainage area is currently 171 acres, all of which is offsite. Therefore, it is unlikely impacts at Outfall 002 are related to the Site.

Outfall 003

Outfall 003 has an estimated dry weather mass discharge ranging from 65 to 78 mg/day based on dry weather flow ranging from 100 to 120 gpm which was estimated using field flow measurements (**Table 3)**. The Outfall 003 storm sewer drainage area is 411 acres (97 acres on-Site). Installation of a new sealed storm sewer reroute and lining of a portion of an existing storm sewer is planned for Outfall 003 to mitigate the site's contribution to Outfall 003.

Outfall 013

Outfall 013 has a dry weather mass discharge estimated at about 12 to 20 mg/day based on average dry weather flow of 25 to 40 gpm which was estimated from the two-month flow study (**Table 3)**. The Outfall 013 drainage area is currently 189 acres (64 acres on-Site, which includes former RACER property now owned by Lear). Some of the impacts at Outfall 013 may be associated with a lateral that services the Site.

Additional sampling activities are planned to better define the possible source of PFOS impacts in the Outfall 013 storm sewer.

Outfall 006

As noted above at outfalls where flow data was not available, the flow has been estimated based on visual observations. The estimated flow at Outfall 006 is between 8 and 33 gpm (**Table 3**). The mass discharge estimated at Outfall 006 ranges from approximately 4 to 17 mg/day. The Outfall 006 storm sewer drainage area is 9 acres (1 acre on-Site). It is uncertain whether the impacts at Outfall 006 are related to the Site.

Outfall 005

Outfall 005 has an estimated dry weather mass discharge ranging from 10 to 12 mg/day based on average dry weather flow of 35 to 45 gpm from the two-month flow study (**Table 3)**.

While Outfall 005 storm sewer drainage area is 24 acres (3 acres on-Site), the storm sewer video shows that Outfall 005 receives the majority of its' flow from the French drains located behind the Leith Street underpass retaining walls. Also, sampling completed to date along the Outfall 005 storm sewer detected the highest concentrations of PFOS in the French drain on the north side of Leith Street.

Table 4 shows the results of samples collected during the flow study the day after a wet weather event and during dry weather flow. The mass discharges estimated during these events are both about 8 mg/day.

As the majority of the storm sewers' flow and PFOS concentrations are coming from the French drain, the flows and concentrations measured at the outfall are not significantly affected by rain events.

Additional investigation activities are ongoing to determine how the impacts can be addressed.

NEXT STEPS

Future progress reports will be provided as the work moves forward.

Attachments:

Figure 1 – Storm Sewer Sample Locations

Table 1 - Dry Weather Outfall Sampling Summary
Table 2 - Wet Weather Outfall Sampling Summary
Table 3 - Flow and Mass Flux Summary
Table 4 - Mass Flux During Flow Study

Table 1 - Dry Weather Outfall Sampling Summary
RACER Trust, Buick City Site, Flint, Michigan

Outfall	Dry Weather Sampling Status (Collected from Outfall unless otherwise noted)	Dry Weather Result
001	Completed	PFOA - 32 ng/L PFOS - 30 ng/L
002	MH 2-1	PFOA - 38 ng/L PFOS - 620 ng/L
003	Completed	PFOA - 10 ng/L PFOS - 120 ng/L
004	Completed	DRY
004A	Completed	DRY
005	Completed	PFOA - 10 ng/L PFOS - 50 ng/L
005A	Completed	DRY
006	Completed	PFOA - 13 ng/L PFOS - 96 ng/L
007	Completed	DRY
007A	Completed	DRY
008	Completed	DRY
010	Completed	PFOA - 200 ng/L PFOS - 2,000 ng/L
011	Completed	PFOA - 10 ng/L PFOS - 100 ng/L
012	Completed	DRY
013	MH 13-2	PFOA - 9.1 ng/L PFOS - 85 ng/L

Notes:
ND - Not detected
ng/L - nanograms per liter
J - Result is less that the RL but greater than or equal to the MDL and the concentration is an approximate value
I - Value is the estimated mazximum possible concentration

Table 2 - Wet Weather Outfall Sampling Summary
RACER Trust, Buick City Site, Flint, Michigan

Outfall	Sampling Location	Wet Weather Result	Wet Weather Result
001	Outfall	PFOA - 6.2 ng/L PFOS - 7.9 ng/L	PFOA - 32 ng/L PFOS - 30 ng/L
002	MH 2-1	PFOA - 12 ng/L PFOS - 400 ng/L	--
003	MH 3-1	PFOA - 10 ng/L PFOS - 60 ng/L	PFOA - 9.8 ng/L PFOS - 36 ng/L
004	MH 4-2	PFOA - ND PFOS - 1.8 ng/L	--
004A	MH 4A-1	PFOA - 12 ng/L PFOS - 46 ng/L	--
005	MH 5-1	PFOA - 11 ng/L PFOS - 51 ng/L	--
005A	Outfall	PFOA - 0.86 JI ng/L PFOS - ND	--
006	Outfall	PFOA - 2.8 ng/L PFOS - 11 ng/L	--
007	Outfall	--	--
007A	Outfall	--	--
008	MH 8-1	--	--
010	MH 10-1	PFOA - 150 ng/L PFOS - 1,500 ng/L	PFOA - 150 ng/L PFOS - 1500 ng/L
011	MH 11-6	PFOA - 7.2 ng/L PFOS - 70 ng/L	PFOA - 24 ng/L PFOS - 170 ng/L
012	Outfall	--	--
013	MH 13-2	PFOA - 37 ng/L PFOS - 630 ng/L	--

Notes:
ND - Not detected
ng/L - nanograms per liter

Table 3 - Flow and Mass Flux Summary
RACER Trust, Buick City Site, Flint, Michigan

Outfall	Approximate Dry Weather Flow (gpm)	Dry Weather PFOS Result (ng/L)	Approximate Dry Mass Discharge (mg/day)
001*	500-520	30	80-85
002*	15-25	620	50-85
003	100-120	120	65-78
004	DRY	NA	NA
004A	DRY	NA	NA
005	35-45	50	10-12
005A	DRY	NA	NA
006**	8 -33	96	4-17
007	DRY	NA	NA
007A	DRY	NA	NA
008	DRY	NA	NA
010	10-20	2000	110-210
011**	175-475	100	100-260
012	DRY	NA	NA
013	25-40	85	12-20

Notes:
NA -Not available
gpm - gallons per minute
ng/L - nanograms per liter
mg/day - milligrams per day
* Flow calculated based on gauged depth of water.
** Unable to gauge. Estimated flow based on visual observations from storm sewer videos and photos of manholes near the outfalls and/or flow at the outfall, where possible.

Table 4 - Mass Flux During Flow Study
RACER Trust, Buick City Site, Flint, Michigan

Outfall	Date/Time	Flow (gpm)	PFOS conc (ng/L)	Mass Flux (mg/day)
005				
005 day after wet weather	7/16/2019 10:00 AM	39	40	8
005 Dry Weather	8/1/2019 9:15 AM	36	43	8
010				
010 - Wet Weather	7/2/2019 11:00 AM	11	1500	90

Notes:
gpm - gallons per minute
ng/L - nanograms per liter
mg/day - milligrams per day

APPROXIMATE LOCATION
OF WATER INTAKE

LEGEND:

- PROPERTY BOUNDARY
- PROPERTY PREVIOUSLY OWNED BY RACER
- AREA ASSUMED TO BE PART OF OUTFALL DRAINAGE AREA
- AREAS WITH NO DIRECT DRAINAGE TO THE STORM SEWER
- 001 OUTFALL DRAINAGE AREA AND NUMBER
- STORM SEWER SAMPLE LOCATIONS

ASW Property

Lear Property 1

Lear Property 2

ANDREW STREET

INDUSTRIAL AVENUE

NORTH STREET

FIREFIGHTING TRAINING AREA

FORMER PAINTING AREA

FORMER WWTP AREA

PICKLING AND ENAMELING

ASSEMBLY AND PAINT PAINT SHOP

AOI 36-2
AOI 36-1 GP
AOI 36-5
AOI 36-1 MS
AOI 10-4
AOI 10-1
AOI 03-1
AOI 81-2
AOI 02-B
AOI 40-A
AOI 40-B
AOI 16-C
AOI 05-5
AOI 05-1
AOI 83/84-2
AOI 83/84-4

1 MILE 1 MILE

0 450' 900'
APPROXIMATE SCALE IN FEET

NOTES:

1. BASE MAP INFORMATION FROM A SURVEY BY BMJ, INC. DATED APRIL 2001, AT A SCALE OF 1:100. AERIAL IMAGE FROM ARCGIS 10 ONLINE MAPPING, ACCESSED 6/12/2013.
2. BASED ON INFORMATION AVAILABLE AS OF JUNE 2016.
3. MH4-20-2 DOWN GRADIENT PLUG'S 24-INCH LINE WAS BLOCKED WITH SEDIMENT, YIELDING NO FLOW PRIOR TO PLUG INSTALLATION. PLUG IS MADE UP OF NATURALLY PACKED SEDIMENT IN PIPE.
4. BULKHEADS AND PLUGS INSTALLED DECEMBER 2017.

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STWC PFAS UPDATE MEMO

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FIGURE 1