

APPENDIX F. SURFACE WATER ANALYTE
MEMORANDUM

Lower Duwamish Waterway Group

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MEMORANDUM

To: Elly Hale, EPA
From: Windward on behalf of LDWG
Subject: Surface Water Analyte Evaluation
Date: January 25, 2018

The first three surface water sampling events of the Pre-Design Studies for the Lower Duwamish Waterway – the first dry baseflow and the first two storm events (without significant dam releases) – have been completed. The first dry baseflow samples were collected on August 28, 2017; the first storm event samples were collected on September 19, 2017; and the second storm event samples were collected on October 19, 2017.

Per the surface water quality assurance project plan (QAPP), the data from these three sampling events were reviewed to re-evaluate the surface water analyte list. The QAPP states that an analyte will be considered for deletion if the analyte's concentrations in the three 2017 events are below water quality applicable or relevant and appropriate requirements (ARARs), or if concentrations are not detected (regardless of whether the method detection limit [MDL] for a non-detected contaminant is greater than the applicable criteria).

This memorandum provides the results of the first three sampling events, and proposes analytes to be deleted from the analyte list for the remaining baseline sampling events, as stated in the QAPP (Windward 2017).

The surface water data for all three events are summarized in Tables 1, 2, and 3. The results for each analyte group are discussed below.

METALS AND ORGANOMETALS

Silver, thallium, and tributyltin (TBT) were not detected in any of the surface water samples. Eight metals were detected but with maximum concentrations that were well below all applicable water quality criteria (WQC) values, including marine aquatic life WQC and human health WQC (Table 1). Whereas, two metals were detected with concentrations above (inorganic arsenic for human health WQC) or similar to the criteria values (copper for marine aquatic life WQC).

Based on these results, for the remaining baseline sampling events, only inorganic arsenic and copper are proposed for analysis in the remaining baseline sampling events, with the exception of storm event 4. EPA has requested that the full metals list (including mercury) be analyzed in storm event 4 samples to assess naturally occurring metals during dam releases. TBT will not be included as an analyte for storm event 4.

POLYCYCLIC AROMATIC HYDROCARBONS

Of the 12 polycyclic aromatic hydrocarbon (PAH) compounds with water quality criteria, 6 were not detected in any of the surface water samples, and 5 were detected at concentrations that were well below their human health and aquatic life WQC (Table 1). Benzo(b)fluoranthene was the only PAH compound detected at concentrations above the human health WQC (but below the aquatic WQC) in one sample collected in the dry base flow event and another sample in the second storm event. The PAH analytical method includes all the PAHs. Therefore, by continuing to analyze benzo(b)fluoranthene, data for all PAHs will be generated in the remaining baseline sampling events, and no changes are proposed for PAHs.

PHTHALATES

Four of the five phthalate compounds were not detected in any of the surface water samples. Bis(2-ethylhexyl)phthalate (BEHP) was detected at a concentration above the human health WQC (but below the aquatic WQC) in one sample collected during the dry baseflow sampling event (Table 1). Based on these data, only BEHP is proposed for the remaining baseline sampling events; the other phthalates are not proposed for analysis. BEHP will be added to the analyte list for the PAH method (EPA 8270-SIM) for the remaining baseline sampling events.

OTHER SEMIVOLATILE ORGANIC COMPOUNDS

None of the other semivolatile organic compounds¹ (SVOCs) were detected in any of the surface water samples (Table 1). Therefore, these analytes are not proposed for analysis in the remaining baseline sampling events.

¹ The group of other SVOC compounds includes SVOC compounds that are not classified as PAHs and phthalates. The thirty compounds in the group are 1,2,4,5-tetrachloro-benzene, 2,2'-oxybis(1-chloro)propane, 2,4,5-trichlorophenol, 2,4,6-trichlorophenol, 2,4-dichlorophenol, 2,4-dimethylphenol, 2,4-dinitrophenol, 2,4-dinitrotoluene, 2-chloronaphthalene, 2-chlorophenol, 3,3'-dichlorobenzidine, 4,6-dinitro-o-cresol, 4-chloro-3-methylphenol, benzidine, bis(2-chloroethyl)ether, hexachlorobenzene, hexachlorocyclopentadiene, hexachloroethane, isophorone, n-nitrosodiethylamine, n-nitrosodimethylamine, n-nitroso-di-n-butylamine, n-nitroso-di-n-propylamine, n-nitrosodiphenylamine, n-nitrosopyrrolidine, nitrobenzene, nonylphenol (mixed isomers), pentachlorobenzene, pentachlorophenol, and phenol.

POLYCHLORINATED BIPHENYLS

Polychlorinated biphenyl (PCB) congeners were detected in all of the surface water samples. PCBs will therefore be retained as analytes for all remaining baseline sampling events.

ORGANOCHLORINE PESTICIDES

No organochlorine pesticides with WQC were detected in any of the surface water samples (Table 1). Therefore, these pesticides are not proposed for analysis in samples from the remaining baseline sampling events.

DIOXINS/FURANS

The only dioxin/furan congener with a WQC value is 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD). This congener was not detected in any of the surface water samples (Table 2). Of the remaining 18 congeners, 4 were detected in surface water samples. None of the detected congeners have water quality criteria.

Based on these findings, dioxins/furans are not proposed for analysis in samples from the remaining baseline sampling events.

ORGANOPHOSPHATE PESTICIDES AND CARBARYL

Per the QAPP, three organophosphate pesticides and the herbicide carbaryl were analyzed in samples collected during the first storm event. None of these compounds were detected in the water samples collected (Table 3); these compounds will not be analyzed in any of the remaining baseline sampling events.

CONCLUSIONS

The surface water data collected in the three 2017 sampling events were reviewed to identify analytes that were consistently not detected or detected at concentrations well below their WQC in order to reduce the analyte list for future sampling events, per the Work Plan and surface water QAPP (Windward 2017; Windward and Integral 2017).

Based on this review, Table 4 summarizes the analytes proposed for analysis in the remaining baseline sampling events.

REFERENCES

Windward. 2017. Baseline surface water collection and chemical analyses - quality assurance project plan. Final. Submitted to EPA on August 2, 2017. Lower Duwamish Waterway Pre-Design Studies. Windward Environmental LLC, Seattle, WA.

Windward, Integral. 2017. Pre-design studies work plan. Lower Duwamish Waterway Superfund site. Final. Prepared for the Lower Duwamish Waterway Group for

submittal to EPA Region 10 on August 28, 2017. Windward Environmental LLC and Integral Consulting Inc., Seattle, WA.

Table 1. Summary of the surface water results for the three 2017 surface water sampling events

Chemical	Detection Frequency		Detected Results		Non-detected Results	National Recommended AWQC - Marine		National Recommended Human Health	Washington State Criteria - Marine ^a		Washington State Human Health ^a
	Ratio	%	Minimum	Maximum	RL or Range of RLs	CMC (Acute)	CCC (Chronic)	Consumption of Organism Only	Acute	Chronic	Consumption of Organism Only
Metals (ug/L)											
Antimony	10/18	56	0.0315	0.273 J	0.306 - 0.765	—	—	640	—	—	90
Dissolved arsenic	18/18	100	0.607 J	2.1	na	69 ^b	36 ^b		69 ^b	36 ^b	
Arsenic (inorganic)	18/18	100	0.709	1.72	na			0.14			0.14
Dissolved cadmium	5/18	28	0.00300	0.123 J	0.003 - 1.02	33 ^b	7.9 ^b	—	42 ^b	9.3 ^b	—
Dissolved chromium	4/18	22	0.190	1.22	0.138 - 1.91	1,100 ^b	50 ^b	—	1,100 ^b	50 ^b	—
Dissolved copper	18/18	100	0.308	2.32	na	4.8 ^b	3.1 ^b	—	4.8 ^b	3.1 ^b	—
Dissolved lead	3/18	17	0.0660	0.121	0.383	210 ^b	8.1 ^b	—	210.0 ^b	8.1 ^b	—
Dissolved nickel	14/18	78	0.165	3.24	1.76	74 ^b	8.2 ^b	4,600	74.0 ^b	8.2 ^b	100
Dissolved selenium	3/18	17	0.046 J	0.0470 J	1.43	290 ^b	71 ^b	4,200	290 ^b	71.0 ^b	200
Dissolved silver	0/18	0	nd	nd	0.021 - 0.536	1.9 ^b	—	—	1.9 ^b	—	—
Thallium	0/18	0	nd	nd	0.041 - 0.102	—	—	0.47	—	—	0.27
Dissolved zinc	13/18	72	3.35 J	14.5	3.36 - 6.41	90 ^b	81 ^b	26,000	90 ^b	81 ^b	1000
Mercury (ng/L)											
Mercury	14/18	78	0.755	4.17	1.19 - 1.37	1800	940		1800	25	—
Organometals (ug/L)											
TBT as ion	0/18	0	nd	nd	0.0052	0.42	0.0074	—	—	—	—
PAHs (ug/L)											
Acenaphthene	15/18	83	0.0030 J	0.0080 J	0.01	—	—	90	—	—	30
Anthracene	2/18	11	0.0010 J	0.0050 J	0.0010 - 0.010	—	—	400	—	—	100
Benzo(a)anthracene	0/18	0	nd	nd	0.01	—	—	0.0013	—	—	0.00016
Benzo(a)pyrene	0/18	0	nd	nd	0.01	—	—	0.00013	—	—	0.000016
Benzo(b)fluoranthene	2/18	11	0.00060 J	0.0010 J	0.01	—	—	0.0013	—	—	0.00016
Benzo(k)fluoranthene	0/18	0	nd	nd	0.01	—	—	0.013	—	—	0.0016
Chrysene	3/18	17	0.0010 J	0.0010 J	0.01	—	—	0.13	—	—	0.016
Dibenzo(a,h)anthracene	0/18	0	nd	nd	0.01	—	—	0.00013	—	—	0.000016
Fluoranthene	12/18	67	0.0020 J	0.0060 J	0.0030 - 0.010	—	—	20	—	—	6
Fluorene	15/18	83	0.0020 J	0.0050 J	0.01	—	—	70	—	—	10
Indeno(1,2,3-cd)pyrene	0/18	0	nd	nd	0.01	—	—	0.0013	—	—	0.00016
Pyrene	12/18	67	0.0020 J	0.010 J	0.0020 - 0.010	—	—	30	—	—	8

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	Ratio	%	Minimum	Maximum	RL or Range of RLs	CMC (Acute)	CCC (Chronic)	Consumption of Organism Only	Acute	Chronic	Consumption of Organism Only
Phthalates (ug/L)											
Bis(2-ethylhexyl)phthalate	1/18	5.5	2.0 J	2.0 J	3.0	–	–	0.37	–	–	0.046
Butyl benzyl phthalate	0/18	0	nd	nd	1.0	–	–	0.1	–	–	0.013
Diethyl phthalate	0/18	0	nd	nd	1.0	–	–	600	–	–	200
Dimethyl phthalate	0/18	0	nd	nd	1.0	–	–	2,000	–	–	600
Di-n-butyl phthalate	0/18	0	nd	nd	1.0	–	–	30	–	–	8
Other SVOCs (ug/L)^c											
1,2,4,5-Tetrachloro-benzene	0/18	0	nd	nd	1.0	–	–	0.03	–	–	–
2,2'-oxybis(1-chloro)propane	0/18	0	nd	nd	1.0	–	–	0.2	–	–	0.02
2,4,5-Trichlorophenol	0/18	0	nd	nd	5.0	–	–	600	–	–	–
2,4,6-Trichlorophenol	0/18	0	nd	nd	3.0	–	–	2.8	–	–	0.28
2,4-Dichlorophenol	0/18	0	nd	nd	3.0	–	–	60	–	–	10
2,4-Dimethylphenol	0/18	0	nd	nd	3.0	–	–	3,000	–	–	97
2,4-Dinitrophenol	0/18	0	nd	nd	20	–	–	300	–	–	100
2,4-Dinitrotoluene	0/18	0	nd	nd	3.0	–	–	1.7	–	–	0.18
2-Chloronaphthalene	0/18	0	nd	nd	1.0	–	–	1000	–	–	100
2-Chlorophenol	0/18	0	nd	nd	1.0	–	–	800	–	–	17
3,3'-Dichlorobenzidine	0/18	0	nd	nd	5.0	–	–	0.15	–	–	0.0033
4,6-Dinitro-o-cresol	0/18	0	nd	nd	10	–	–	30	–	–	7
4-Chloro-3-methylphenol	0/18	0	nd	nd	3.0	–	–	2,000	–	–	36
Benzidine	0/18	0	nd	nd	10	–	–	0.011	–	–	0.000023
bis(2-chloroethyl)ether	0/18	0	nd	nd	1.0	–	–	2.2	–	–	0.06
Hexachlorobenzene	0/18	0	nd	nd	1.0	–	–	0.000079	–	–	0.000005
Hexachlorocyclopentadiene	0/18	0	nd	nd	5.0	–	–	4	–	–	1
Hexachloroethane	0/18	0	nd	nd	2.0	–	–	0.1	–	–	0.02
Isophorone	0/18	0	nd	nd	1.0	–	–	1,800	–	–	110
N-Nitrosodiethylamine	0/18	0	nd	nd	2.0	–	–	1.24	–	–	–
n-Nitrosodimethylamine	0/18	0	nd	nd	3.0	–	–	3	–	–	0.34
N-Nitroso-di-n-butylamine	0/18	0	nd	nd	1.0	–	–	0.22	–	–	–
n-Nitroso-di-n-propylamine	0/18	0	nd	nd	1.0	–	–	0.51	–	–	0.058
n-Nitrosodiphenylamine	0/18	0	nd	nd	1.0	–	–	6	–	–	0.69
N-Nitrosopyrrolidine	0/18	0	nd	nd	1.0	–	–	34	–	–	–
Nitrobenzene	0/18	0	nd	nd	1.0	–	–	600	–	–	100

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	Ratio	%	Minimum	Maximum	RL or Range of RLs	CMC (Acute)	CCC (Chronic)	Consumption of Organism Only	Acute	Chronic	Consumption of Organism Only
Nonylphenol (mixed isomers)	0/18	0	nd	nd	1.0	7	1.7	—	—	—	—
Pentachlorobenzene	0/18	0	nd	nd	1.0	—	—	0.1	—	—	—
Pentachlorophenol	0/18	0	nd	nd	10	13	7.9	0.04	13	7.9	0.002
Phenol	0/18	0	nd	nd	1.0	—	—	300,000	—	—	70,000
PCBs (ng/L)											
Total PCB Congeners	18/18	100	0.019J	5.701 J	na	—	30	0.064	10,000	30	0.007
Pesticides (ug/L)^d											
4,4'-DDD	0/18	0	nd	nd	0.05	—	—	0.00012	—	—	0.0000079
4,4'-DDE	0/18	0	nd	nd	0.05	—	—	0.000018	—	—	0.00000088
4,4'-DDT	0/18	0	nd	nd	0.05	0.13	0.001	0.00003	0.13	0.001	0.0000012
Aldrin	0/18	0	nd	nd	0.025	1.3	—	0.00000077	0.71 ^e	0.0019 ^e	0.00000041
Dieldrin	0/18	0	nd	nd	0.05	0.71	0.0019	0.0000012	0.71 ^e	0.0019 ^e	0.00000007
alpha-BHC	0/18	0	nd	nd	0.025	—	—	0.00039	—	—	0.000048
beta-BHC	0/18	0	nd	nd	0.025	—	—	0.014	—	—	0.0014
gamma-BHC	0/18	0	nd	nd	0.025	0.16	—	4.4	0.16	—	0.43
alpha-Chlordane	0/18	0	nd	nd	0.025	0.09 ^g	0.004 ^g	0.00032 ^g	0.09 ^f	0.004 ^f	0.000022 ^g
beta-Chlordane	0/18	0	nd	nd	0.025	0.09 ^g	0.004 ^g	0.00032 ^g	0.09 ^f	0.004 ^f	0.000022 ^g
alpha-Endosulfan	0/18	0	nd	nd	0.025	0.034 ^h	0.0087 ^h	30	0.034 ^g	0.0087 ^g	7
beta-Endosulfan	0/18	0	nd	nd	0.05	0.034 ^h	0.0087 ^h	40	0.034 ^g	0.0087 ^g	10
Endosulfan sulfate	0/18	0	nd	nd	0.05	—	—	40	—	—	10
Endrin	0/18	0	nd	nd	0.05	0.037	0.0023	0.03	0.037	0.0023	0.002
Endrin aldehyde	0/18	0	nd	nd	0.05	—	—	1	—	—	0.035
Heptachlor	0/18	0	nd	nd	0.025	0.053	0.0036	0.0000059	0.053	0.0036	0.00000034
Heptachlor epoxide	0/18	0	nd	nd	0.05	0.053	0.0036	0.000032	—	—	0.0000024
Methoxychlor	0/18	0	nd	nd	0.25	—	0.03	0.02	—	—	—
Mirex	0/18	0	nd	nd	0.05	—	0.001	—	—	—	—
cis-Nonachlor	0/18	0	nd	nd	0.05	0.09 ^g	0.004 ^g	0.00032 ^g	0.09 ^h	0.004 ^h	0.000022 ^g
trans-Nonachlor	0/18	0	nd	nd	0.05	0.09 ^g	0.004 ^g	0.00032 ^g	0.09 ^h	0.004 ^h	0.000022 ^g
Oxychlordane	0/18	0	nd	nd	0.05	0.09	0.004 ^g	0.00032 ^g	0.09 ^h	0.004 ^h	0.000022 ^g
Toxaphene	0/18	0	nd	nd	1.25	0.21	0.0002	0.00071	0.21	0.0002	0.000032

Note: Blue highlight indicates analyte was not detected in any of the surface water samples. Pink highlight indicates that the detected concentrations were well below the water quality criteria for the compound.

^a Washington State criteria include standards promulgated in WAC 173-201A and human health criteria consistent with NTR 40 CFR 131.45 as applied to Washington 40 CFR 131(d)(14), including the 40 CFR 131 criteria updated on November 28, 2016. These criteria were updated after publication of the ROD.

^b Criteria applied to dissolved fraction.

Surface Water Analyte Evaluation

January 25, 2018

- ^c Target analytes provided here. Two non-target analytes, 2,5-dinitrophenol and azobenzene, were reported by the laboratory as not detected in all samples. There are no water quality criteria for these chemicals.
- ^d Target analytes provided here. The laboratory also reported delta BHC, which was not targeted. This compound was detected in two samples with JN qualification indicating that the compound was tentatively identified and the concentration is estimated. There are no water quality criteria for this compound.
- ^e Criteria for sum of aldrin and dieldrin.
- ^f Criteria for total chlordane (sum of alpha chlordane, beta chlordane, oxychlordane, cis-nonachlor, and trans-nonachlor).
- ^g Criteria for sum of alpha-Endosulfan and beta-Endosulfan..

AWQC – ambient water quality criteria
BHC – benzene hexachloride
CCC – criterion continuous concentration
CMC – criterion maximum concentration
DDD – dichlorodiphenyldichloroethane

DDE – dichlorodiphenyldichloroethylene
DDT – dichlorodiphenyltrichloroethane
na – not applicable
nd – not detected
PAH – polycyclic aromatic hydrocarbon

PCB – polychlorinated biphenyl
RL – reporting limit
SVOC – semivolatile organic compound
TBT - tributyltin

Table 2. Summary of dioxin/furan results for surface water samples (pg/L)

Chemical	Detection Frequency		Detected Results		Non-detected Results	National Recommended Human Health	Washington State Human Health
	Ratio	%	Minimum	Maximum	RL or Range of RLs	Consumption of Organism Only	Consumption of Organism Only
2,3,7,8-TCDD	0/18	0	nd	nd	0.248 - 0.696	0.0051	0.014
1,2,3,7,8-PeCDD	0/18	0	nd	nd	0.248 - 0.514	—	—
1,2,3,4,7,8-HxCDD	0/18	0	nd	nd	0.248 - 0.827	—	—
1,2,3,6,7,8-HxCDD	0/18	0	nd	nd	0.248 - 0.827	—	—
1,2,3,7,8,9-HxCDD	0/18	0	nd	nd	0.248 - 0.827	—	—
1,2,3,4,6,7,8-HpCDD	8/18	44	1.80 J	9.78 J	0.803 - 2.01	—	—
OCDD	15/18	83	7.45 J	87.5	3.44 - 13.4	—	—
2,3,7,8-TCDF	0/18	0	nd	nd	0.248 - 0.514	—	—
1,2,3,7,8-PeCDF	0/18	0	nd	nd	0.248 - 0.629	—	—
2,3,4,7,8-PeCDF	0/18	0	nd	nd	0.248 - 0.514	—	—
1,2,3,4,7,8-HxCDF	0/18	0	nd	nd	0.248 - 0.514	—	—
1,2,3,6,7,8-HxCDF	0/18	0	nd	nd	0.248 - 0.514	—	—
1,2,3,7,8,9-HxCDF	0/18	0	nd	nd	0.248 - 0.514	—	—
2,3,4,6,7,8-HxCDF	0/18	0	nd	nd	0.248 - 0.514	—	—
1,2,3,4,6,7,8-HpCDF	8/18	44	0.407 J	1.91 J	0.345 - 0.928	—	—
1,2,3,4,7,8,9-HpCDF	0/18	0	nd	nd	0.248 - 0.550	—	—
OCDF	9/18	50	0.956 J	5.93 J	0.514 - 2.53	—	—

HpCDD – heptachlorodibenzo-*p*-dioxin
 HpCDF – heptachlorodibenzofuran
 HxCDD – hexachlorodibenzo-*p*-dioxin
 HxCDF – hexachlorodibenzofuran

nd – not detected
 OCDD – octachlorodibenzo-*p*-dioxin
 OCDF – octachlorodibenzofuran
 PeCDD – pentachlorodibenzo-*p*-dioxin
 PeCDF – pentachlorodibenzofuran

RL – reporting limit
 TCDD – tetrachlorodibenzo-*p*-dioxin
 TCDF – tetrachlorodibenzofuran
 TEF – toxic equivalency factor

Table 3. Summary organophosphate pesticides and carbaryl results for surface water samples (µg/L)

Chemical	Detection Frequency		RL or Range of RLs	National Recommended AWQC		Washington State Criteria	
	Ratio	%		Marine			
				CMC (Acute)	CCC (Chronic)	Acute	Chronic
Carbaryl	0/6	0	0.020	1.6	—	—	—
Chlorpyrifos	0/6	0	0.20–0.21	0.011	0.0056	0.011	0.0056
Diazinon	0/6	0	0.20–0.21	0.82	0.82	—	—
Malathion	0/6	0	0.20–0.21	—	0.1	—	—

AWQC – ambient water quality criteria
CCC – criterion continuous concentration

CMC – criterion maximum concentration

RL – reporting limit

Table 4. Baseline sampling event summary of analytes

Analyte	Baseline Sampling Event							
	1 (DB1)	2 (ST1)	3 (ST2)	4 (ST3) ^a	5 (ST4)	6 (WB1)	7 (WB2)	8 (DB2)
Metals and organometals	X	X	X	copper, inorganic arsenic	all metals (including mercury)	copper, inorganic arsenic	copper, inorganic arsenic	copper, inorganic arsenic
PAHs	X	X	X	X	X	X	X	X
Phthalates	X	X	X	BEHP	BEHP	BEHP	BEHP	BEHP
Other SVOCs	X	X	X	-	-	-	-	-
PCBs	X	X	X	X	X	X	X	X
Organochlorine pesticides	X	X	X	-	-	-	-	-
Dioxins/furans	X	X	X	-	-	-	-	-
Organophosphate pesticides and carbaryl	-	X	-	-	-	-	-	-

Note: An X indicates that an analyte will be analyzed in samples from a given baseline surface water sampling event.

^a Sample timing, location, and analyte list under discussion. If changes are made, the changes will be documented in a QAPP amendment.

BEHP – bis(2-ethylhexyl)phthalate

PCB – polychlorinated biphenyl

SVOC – semivolatile organic compound

DB – dry baseflow

QAPP - quality assurance project plan

WB – wet baseflow

PAH – polycyclic aromatic hydrocarbon

ST – storm