Preliminary Risk-Based Remediation Goals (PRGs)

June 01, 2023 – CAG meeting presentation

Risk Assessment Conclusions (from 06/2021 CAG presentation)

Human Health

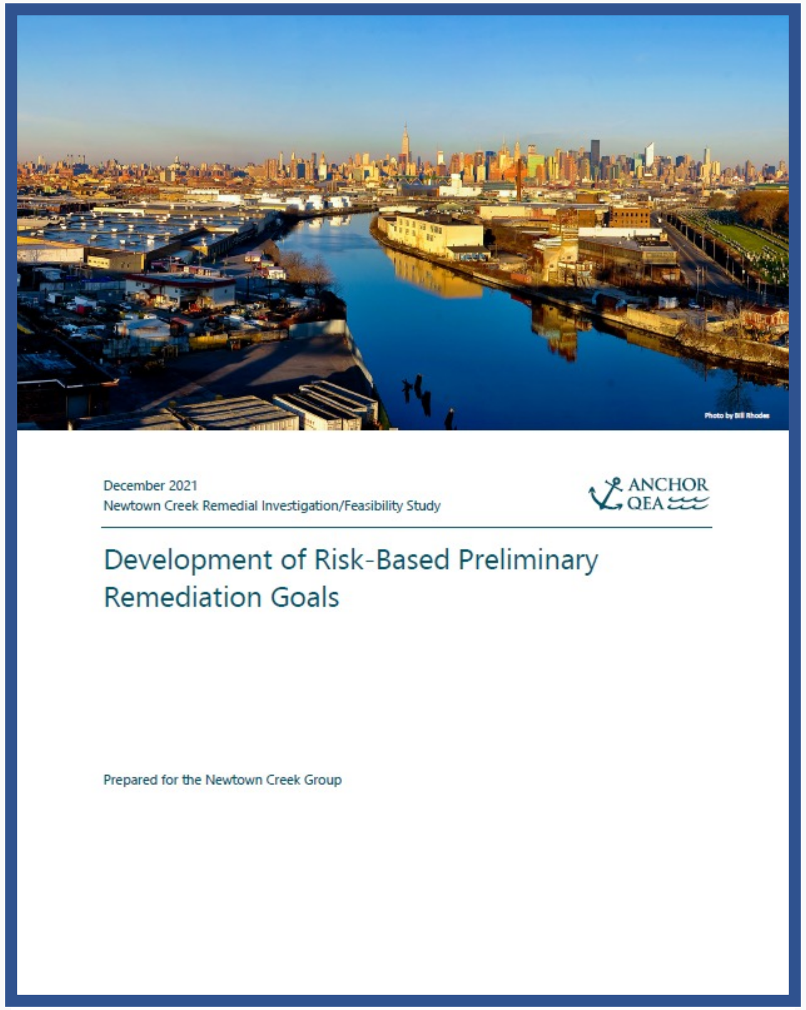
- Contaminants contributing the most to human health risks include polychlorinated biphenyls (PCBs) and dioxins due to the consumption of fish and blue crabs from Newtown Creek. Regional Maximum Exposure (RME) fish and blue crab consumption result in a lifetime excess cancer risk that exceeds the U.S. EPA acceptable excess cancer risk range of 10^{-4} to 10^{-6}. Noncancer hazards above the U.S. EPA threshold (HI of 1) were also associated with consuming fish and blue crabs from Newtown Creek.
- For all other recreational receptors, the cancer risks are below or within U.S. EPA's acceptable risk range and noncancer hazards are below the hazard threshold. The general construction worker was the only occupational receptor with noncancer hazards above the hazard threshold. Cancer risks for the general construction worker were within U.S. EPA's acceptable risk range.
- Unacceptable cancer risks and non-cancer hazards provides regulatory ability to pursue a remedial action

Ecological

- **Locations:** Turning Basin, English Kills, Maspeth Creek, East Branch, Dutch Kills are primary areas of elevated risk, with less impact in Creek Miles 0-2
- **Compounds:** Primarily PAHs and PCBs, with additional contributions of copper, lead and dioxin (2,3,7,8-TCDD)
- **Next Steps:** Results of BERA, HHRA and RI will be used to develop the Feasibility Study, which will identify remedial alternatives to address risk associated with areas and compounds listed above.

PRG Document Developed

- Document steered by EPA and identified each compound and receptor group associated with unacceptable human health or ecological risk
- Preliminary remediation goals were calculated to represent values associated with Hazard Quotients of 1 or Cancer Risks of 1 x 10-6 for each compound and receptor group
- The lowest value for each compound was selected as the risk-based preliminary remediation goal for use in the Feasibility Study
- Other values, such as ARARs, TBCs and/or background, are not included in this presentation


December 2021
Newtown Creek Remedial Investigation/Feasibility Study

ANCHOR QEA

Development of Risk-Based Preliminary Remediation Goals

Prepared for the Newtown Creek Group

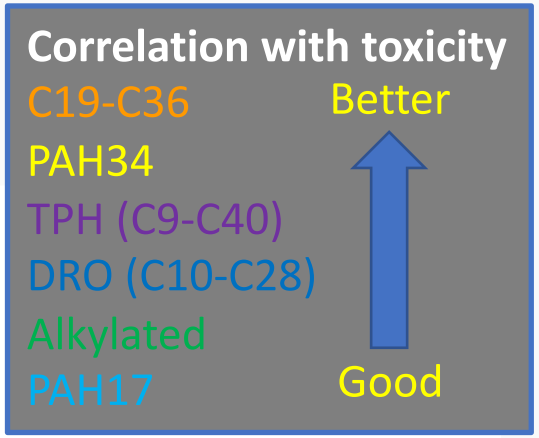
Preliminary Risk-Based Remediation Goals (PRGs)

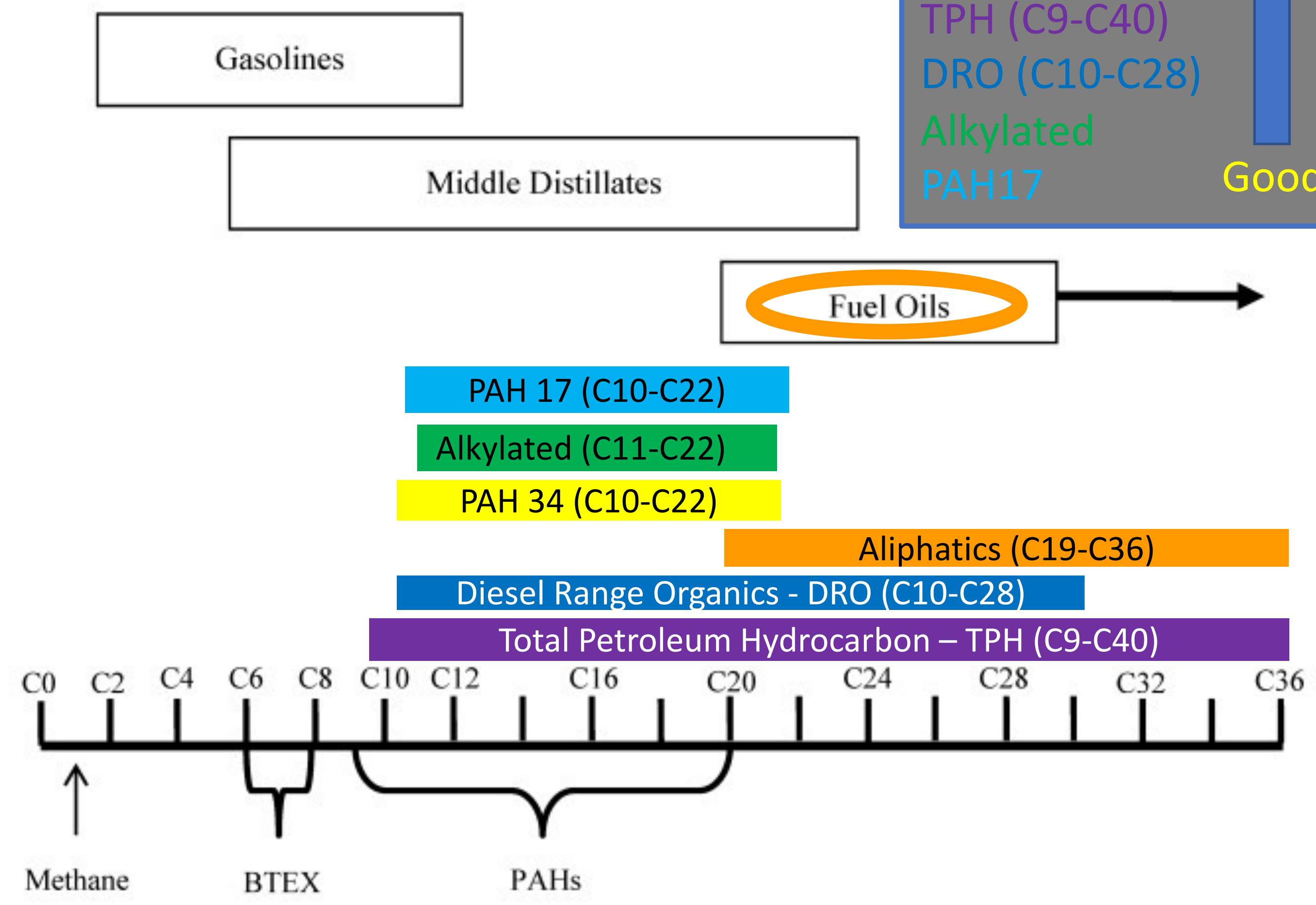
Contaminant of Concern	Risk-Based PRGs	Receptor(s) with Unacceptable Risk	Pathway Driving Risk	Most Sensitive Pathway	Cancer Risk	Non-cancer Hazard	Other Information
PCBs	0.30 mg/kg	Humans Birds	Fish/crab consumption	Crab consumption	4 x 10-4	20	A-20.9 g/d Adol-14 g/d C-7 g/d
Dioxin/Furan	18 ng/kg	Humans	Fish/crab consumption	Crab consumption	2 x 10-4	16	
Copper	490 mg/kg	Mummichog – spotted sandpiper	Diet – fish	Mummichog	-----	-----	Modeled value
Lead	340 mg/kg	Spotted sandpiper	Diet – bird	Spotted sandpiper	-----	-----	Modeled value
TPAH(34)	100 mg/kg	Benthic fish and macroinvertebrates	Sediment toxicity – invertebrates	Benthic macroinvertebrates	-----	-----	Site-derived from toxicity tests
C19-C36 aliphatic hydrocarbons	200 mg/kg	Benthic fish and macroinvertebrates	Sediment toxicity – invertebrates	Benthic macroinvertebrates	-----	-----	

*Applicable or Relevant and Appropriate (ARAR) and background values are not included at this time in the process.

Total Petroleum Hydrocarbons (TPH)

- BERA indicated that hydrocarbons (as measured by PAH34 in porewater) were related to unacceptable risk to benthic invertebrates and are a contaminant of concern (COC)
- TPH can be characterized based on the number of carbons in the ring structure (e.g., C4-C9, C9-C36) or summing specific constituents (e.g., PAH17, PAH34)





Comparison of PAH17 to PAH34

PAH17

- acenaphthene
- acenaphthylene
- anthracene
- benz[a]anthracene
- benzo[a]pyrene
- benzo[e]pyrene
- benzo[b]fluoranthene
- benzo[j]fluoranthene
- benzo[g,h,i]perylene
- benzo[k]fluoranthene
- chrysene
- dibenz[a,h]anthracene
- fluoranthene
- fluorene
- indeno[l,2,3-c,d]pyrene
- phenanthrene
- pyrene

PAH34

TABLE 1. List of PAHs Recommended for Analytical Measurement to Quantify "Total PAHs" (from U.S. EPA, 2003)

PAH	CAS*	Molecular Weight (µg/mol)
Naphthalene	91203	128.17
C1-Naphthalenes	-	142.20
Acenaphthylene	208968	152.2
Acenaphthene	83329	154.21
C2-Naphthalenes	-	156.23
Fluorene	86737	166.22
C3-Naphthalenes	-	170.25
Anthracene	120127	178.12
Phenanthrene	85018	178.23
C1-Fluorenes	-	180.25
C4-Naphthalenes	-	184.28
C1-Phenanthrene/anthracenes	-	192.26
C2-Fluorenes	-	194.27
Pyrene	129000	202.26
Fluoranthene	206440	202.26
C2-Phenanthrene/anthracenes	-	206.29
C3-Fluorenes	-	208.30
C1-Pyrene/fluoranthenes	-	216.29
C3-Phenanthrene/anthracenes	-	220.32
Benz(a)anthracene	56553	228.29
Chrysene	218019	228.29
C4-Phenanthrenes/anthracenes	-	234.23
C1-Benzanthracene/chrysenes	-	242.32
Benzo(a)pyrene	50328	252.31
Perylene	198550	252.31
Benzo(e)pyrene	192972	252.32
Benzo(b)fluoranthene	205992	252.32
Benzo(k)fluoranthene	207089	252.32
C2-Benzanthracene/chrysenes	-	256.23
Benzo(ghi)perylene	191242	276.23
C3-Benzanthracene/chrysenes	-	270.36
Indeno(1,2,3-cd)pyrene	193395	276.23
Dibenz(a,h)anthracene	53703	278.35
C4-Benzanthracene/chrysenes	-	284.38

* For C# PAHs CAS is not available.

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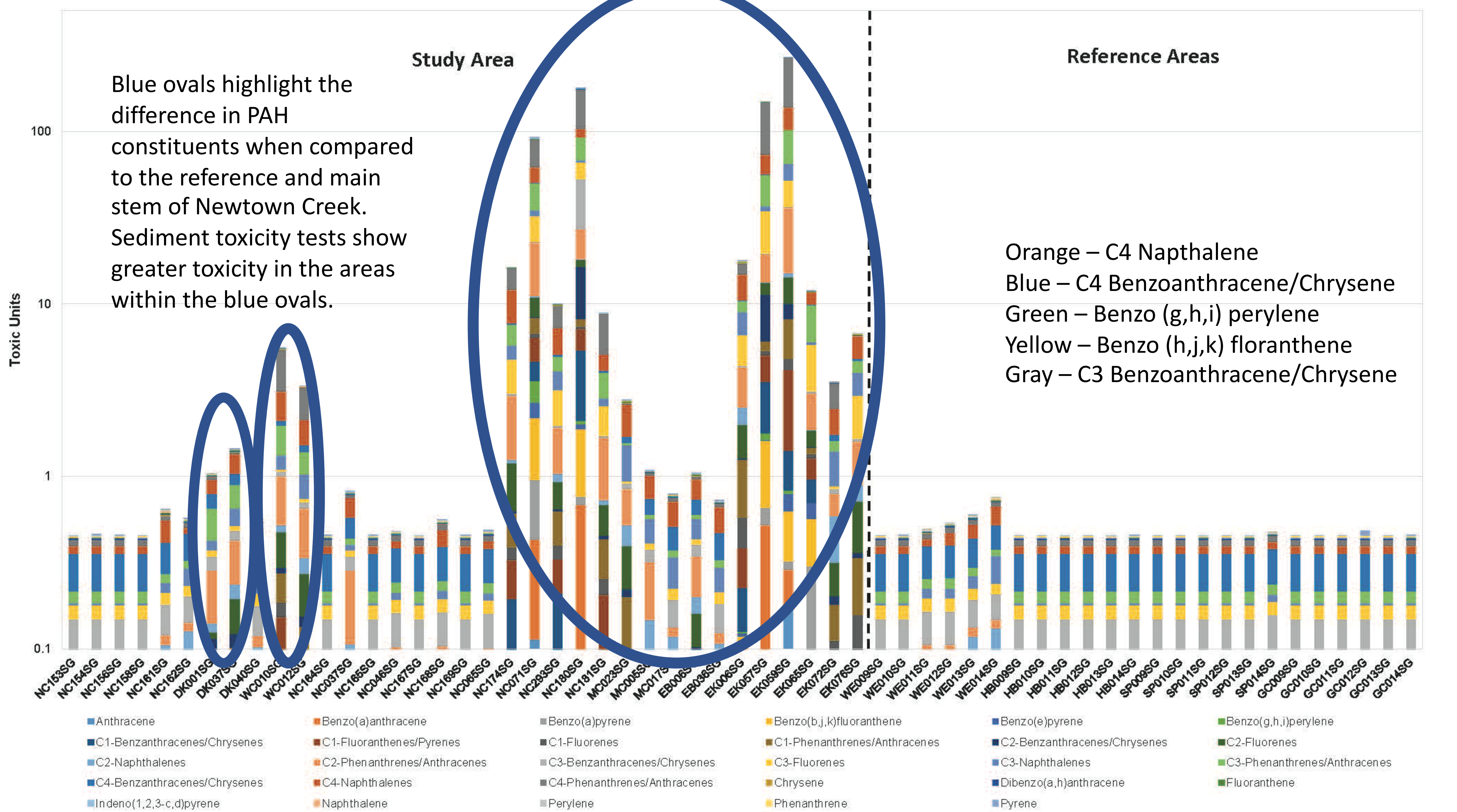
Blue ovals highlight the difference in PAH constituents when compared to the reference and main stem of Newtown Creek. Sediment toxicity tests show greater toxicity in the areas within the blue ovals.



Orange – C4 Napthalene
Blue – C4 Benzoanthracene/Chrysene
Green – Benzo (g,h,i) perylene
Yellow – Benzo (h,j,k) floranthene
Gray – C3 Benzoanthracene/Chrysene

Orange
Blue
Green
Yellow
Gray

Figure 8-36
PAHs in Porewater – SPME Samples
Baseline Ecological Risk Assessment
Newtown Creek RI/FS

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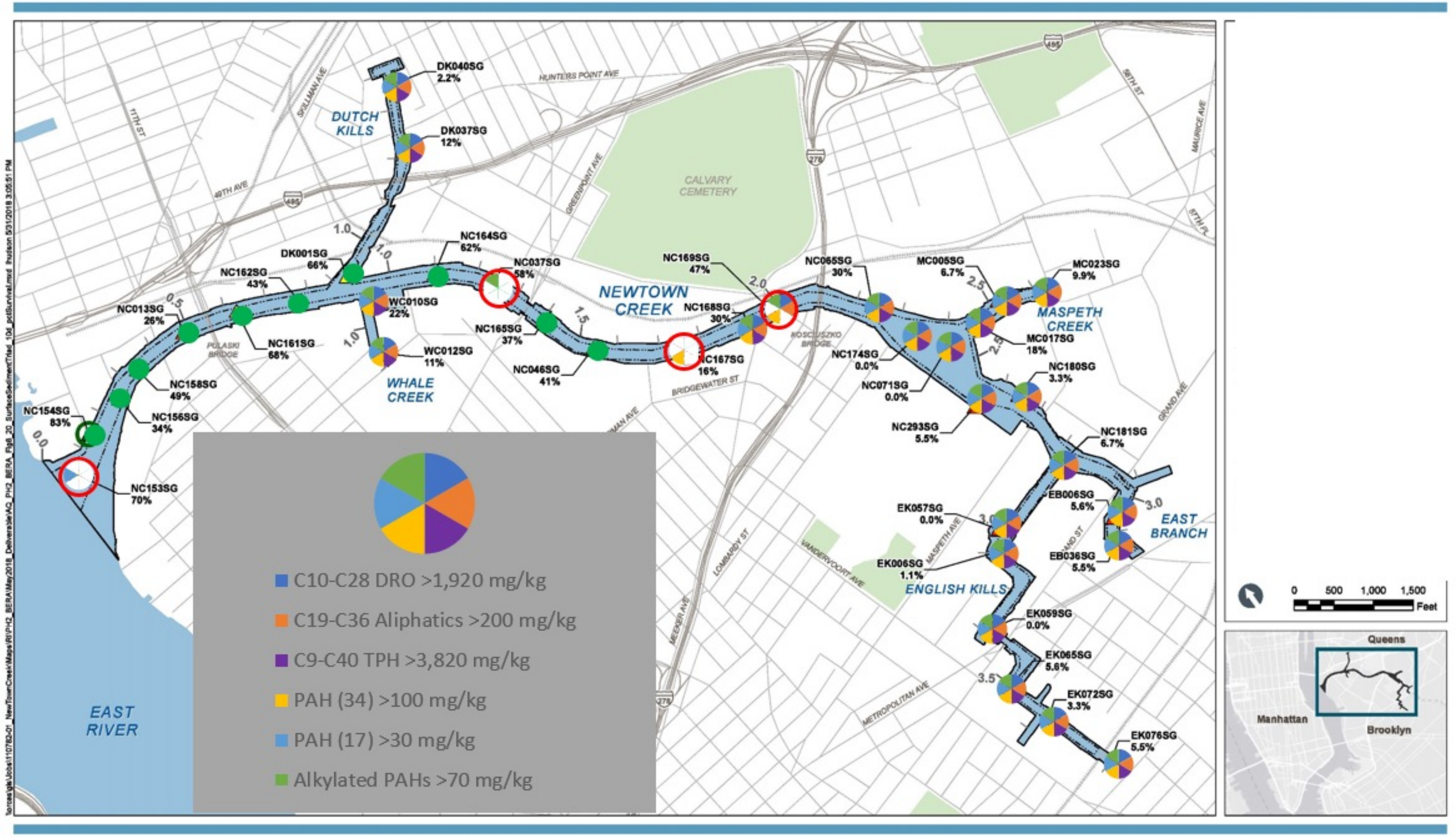
Risk-Based PRG Spatial Distribution

The risk-based PRGs were exceeded for all six hydrocarbon classes at all locations except the solid green circles

The red circles exceeded one or more PRGs



Hydrocarbon Risk-Based PRG Options

Station ID	28-Day Leptocheirus Survival (%)	C10-C28 Diesel-Range Organics (mg/kg dw) PRG=1,920	C19-C36 Aliphatics - unadjusted (mg/kg dw) PRG=200	C9-C40 Total Petroleum Hydrocarbons (mg/kg dw) PRG=3,820	Measured Bulk Sediment PAH (34) (ug/g dw) PRG=100	Measured Bulk Sediment PAH(17) (ug/g dw) PRG=30	Measured Bulk Sediment Alkylated PAHs (ug/g dw) PRG=70
DK001	88.6	0.71	0.82	0.70	0.92	0.80	0.98
DK037	12.9	3.59	9.80	3.85	1.93	2.05	1.88
DK040	13.3	3.11	5.60	3.53	1.96	1.80	2.03
EB006	9.9	1.64	9.50	1.87	3.64	3.13	3.86
EB036	8.6	5.21	8.85	5.71	3.05	2.54	3.27
EK006	3	15.94	47.95	12.91	19.29	7.74	24.24
EK057	9.1	9.01	1.93	7.85	8.75	3.94	10.81
EK059	1.5	15.57	85.00	12.54	18.09	5.18	23.63
EK065	6.8	6.77	18.15	6.62	3.91	2.42	4.55
EK072	8.3	6.30	17.90	6.15	7.08	3.87	8.45
EK076	0	9.48	60.50	8.51	6.81	2.81	8.52
MC005	25.8	2.74	5.60	3.19	2.21	1.77	2.39
MC017	15.9	3.36	18.20	4.03	2.52	1.65	2.89
MC023	7	3.60	9.80	3.48	3.94	2.73	4.46
NC037	77.3	0.78	0.23	0.75	0.99	0.85	1.05
NC046	86.7	0.83	0.38	0.01	0.73	0.59	0.79
NC065	43	1.97	4.58	2.16	1.64	1.48	1.71
NC071	0	10.21	9.95	8.12	12.89	4.02	16.69
NC153	76.6	0.29	0.21	0.29	0.95	0.99	0.94
NC154	95.5	0.50	0.12	0.49	0.70	0.62	0.74
NC156	83.6	0.52	0.38	0.50	0.81	0.80	0.81
NC158	78.1	0.41	0.23	0.43	0.51	0.49	0.52
NC161	90.2	0.59	0.14	0.54	0.72	0.68	0.74
NC162	75	0.64	0.10	0.62	0.72	0.59	0.78
NC164	96.2	0.73	0.18	0.70	0.58	0.50	0.62
NC165	97	0.73	0.12	0.71	0.71	0.56	0.77
NC167	60.2	0.92	1.50	0.92	0.77	0.53	0.87
NC168	66.4	1.22	1.67	1.45	1.81	2.16	1.65
NC169	76.6	1.52	0.61	1.48	1.05	0.84	1.15
NC174	0	6.41	2.90	5.10	8.03	2.06	10.58
NC180	5.5	4.54	10.20	4.21	6.78	2.84	8.47
NC181	12.9	11.20	16.85	9.58	5.51	2.85	6.65
NC293	0.8	5.31	4.89	4.48	12.30	5.21	15.35
WC010	54.7	1.88	2.39	1.62	1.49	1.33	1.56
WC012	64.4	1.76	2.04	1.56	2.37	1.10	2.91

- Dividing the current sediment concentrations of each hydrocarbon class by the PRG yields a ratio:
  - Green = <1
  - Light Yellow = 1-3
  - Darker Yellow = 3-6
  - Orange = 6-10
  - Red = >10

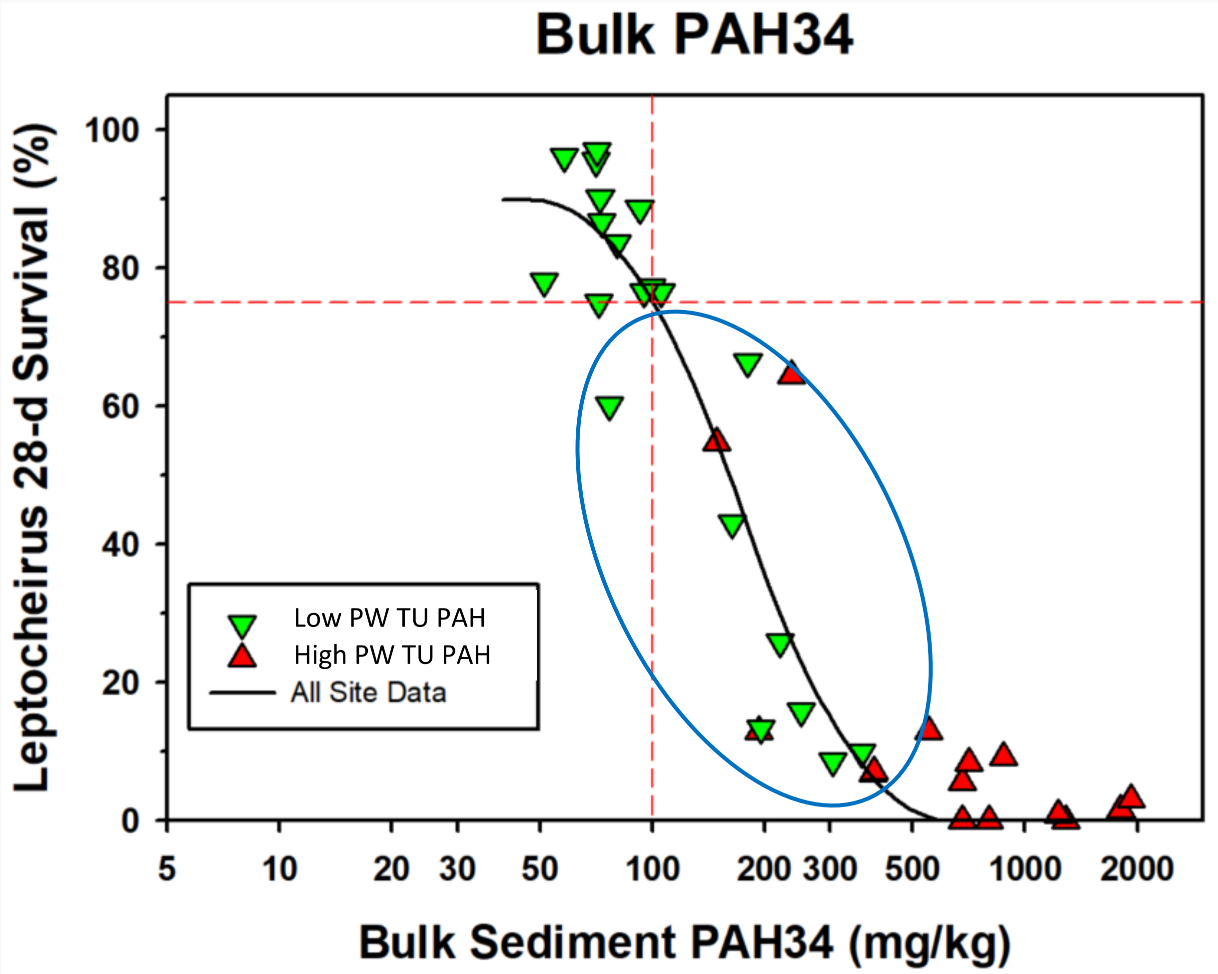
Hydrocarbon Risk-Based PRG Options

Station ID	28-Day Leptocheirus Survival (%)	C10-C28 Diesel-Range Organics (mg/kg dw) PRG=1,920	C19-C36 Aliphatics - unadjusted (mg/kg dw) PRG=200	C9-C40 Total Petroleum Hydrocarbons (mg/kg dw) PRG=3,820	Measured Bulk Sediment PAH (34) (ug/g dw) PRG=100	Measured Bulk Sediment PAH(17) (ug/g dw) PRG=30	Measured Bulk Sediment Alkylated PAHs (ug/g dw) PRG=70
DK001	88.6	NA	NA	NA	NA	NA	NA
DK037	12.9	0.37	1.00	0.39	0.20	0.21	0.03
DK040	13.3	0.56	1.00	0.63	0.35	0.32	0.11
EB006	9.9	0.17	1.00	0.20	0.38	0.33	0.39
EB036	8.6	0.59	1.00	0.64	0.34	0.29	0.18
EK006	3	0.33	1.00	0.27	0.40	0.16	0.29
EK057	9.1	4.67	1.00	4.07	4.53	2.04	1.93
EK059	1.5	0.18	1.00	0.15	0.21	0.06	2.67
EK065	6.8	0.37	1.00	0.36	0.22	0.13	0.99
EK072	8.3	0.35	1.00	0.34	0.40	0.22	0.50
EK076	0	0.16	1.00	0.14	0.11	0.05	0.90
MC005	25.8	0.49	1.00	0.57	0.39	0.32	0.43
MC017	15.9	0.18	1.00	0.22	0.14	0.09	0.29
MC023	7	0.37	1.00	0.36	0.40	0.28	0.25
NC037	77.3	NA	NA	NA	NA	NA	0.02
NC046	86.7	NA	NA	NA	NA	NA	0.53
NC065	43	0.43	1.00	0.47	0.36	0.32	0.72
NC071	0	1.03	1.00	0.82	1.30	0.40	1.64
NC153	76.6	NA	NA	NA	NA	NA	0.56
NC154	95.5	NA	NA	NA	NA	NA	0.36
NC156	83.6	NA	NA	NA	NA	NA	0.08
NC158	78.1	NA	NA	NA	NA	NA	0.11
NC161	90.2	NA	NA	NA	NA	NA	0.26
NC162	75	NA	NA	NA	NA	NA	0.40
NC164	96.2	NA	NA	NA	NA	NA	NA
NC165	97	NA	NA	NA	NA	NA	NA
NC167	60.2	0.61	1.00	0.62	0.51	0.35	NA
NC168	66.4	0.73	1.00	0.87	1.08	1.30	NA
NC169	76.6	NA	NA	NA	NA	NA	NA
NC174	0	2.21	1.00	1.76	2.77	0.71	NA
NC180	5.5	0.44	1.00	0.41	0.66	0.28	NA
NC181	12.9	0.66	1.00	0.57	0.33	0.17	NA
NC293	0.8	1.09	1.00	0.92	2.52	1.06	NA
WC010	54.7	0.78	1.00	0.68	0.62	0.56	NA
WC012	64.4	0.86	1.00	0.76	1.16	0.54	NA

- Assuming concentrations at all locations were below the C19-C36 PRG (200 mg/kg), and all classes were reduced by the same percentage
  - Shows most, but not all locations would yield a ratio <1
  - PAH(34) would have the most locations with a ratio >1

Concentrations at all locations below the PRGs for both C19-C36 and PAH(34) would bring all locations to a ratio <1

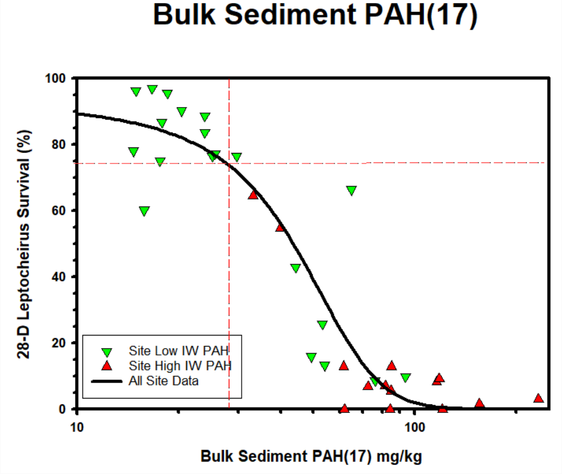
Bulk Sediment PAH(34) vs. Survival

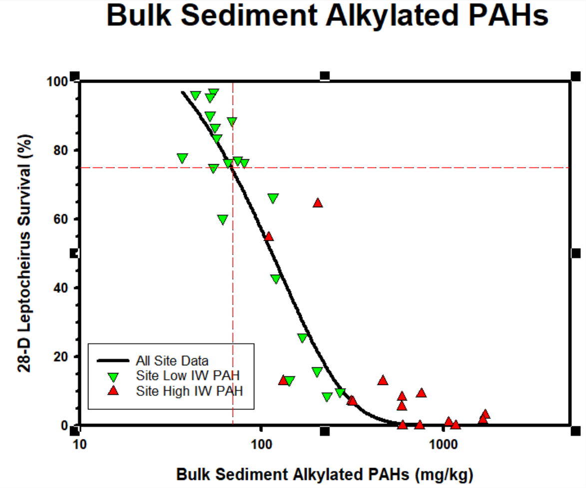


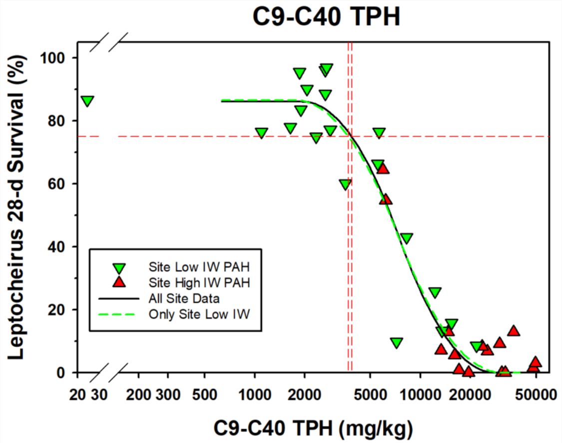
- Bulk sediment PAH(34) correlates well with toxicity
- 8 toxic samples did not have bioavailable PAHs (green triangles in oval had survival <75%)
- <75% survival is toxic
- Toxic to *Leptocheirus* at:

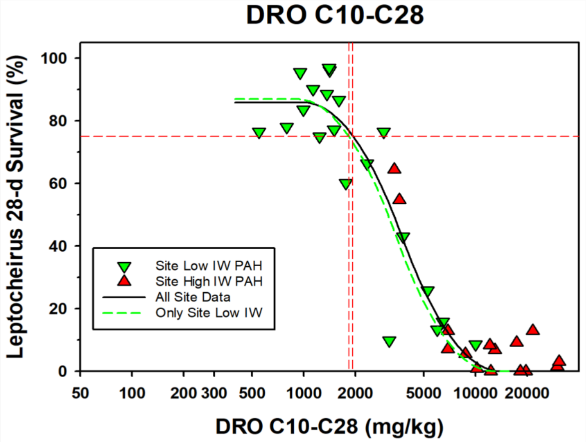
100 mg/kg dw PAH(34)

Bulk Sediment Hydrocarbons vs. Survival









- Bulk sediment concentrations of each class correlated well with toxicity
- Toxic to *Leptocheirus* at:

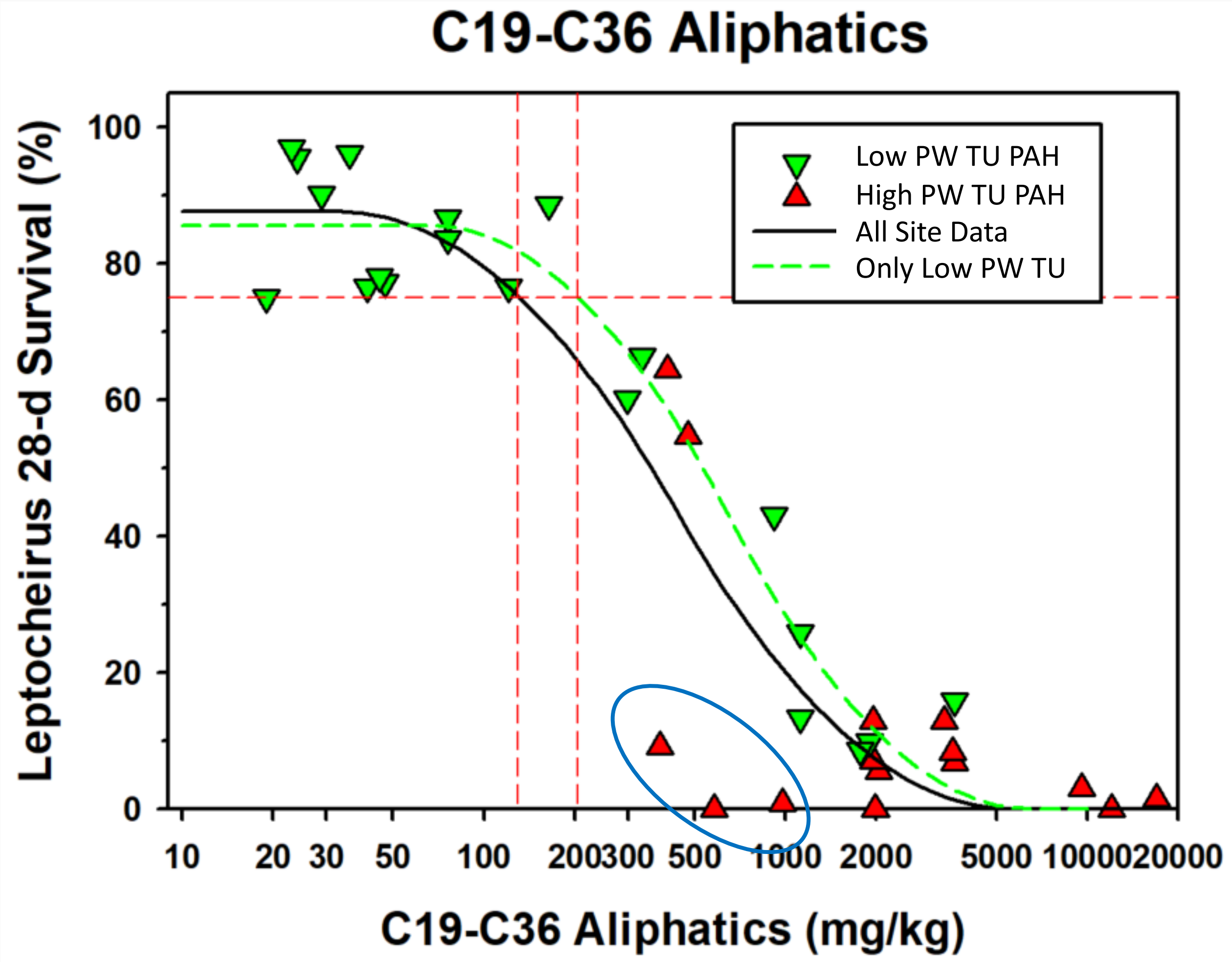
PAH (17): 30 mg/kg dw

Alkylated PAHs: 70 mg/kg dw

C9-C40 TPH: 3,820 mg/kg dw

C10-C28 DRO: 1,920 mg/kg dw

Bulk Sediment C19-C36 vs. Survival



- Bulk sediment C19-C36 aliphatic hydrocarbons correlate well with toxicity
- 3 samples with high PW TU PAH (34) and low survival in the oval at the center bottom pull the response curve down
- Removing site samples with the high PW PAH TUs (fitting the dashed green curve to only the green samples) moves the response curve to the right
- 75% survival line perfectly segregates toxic samples from nontoxic samples
- Toxic to *Leptocheirus* at:

200 mg/kg dw C19-C36