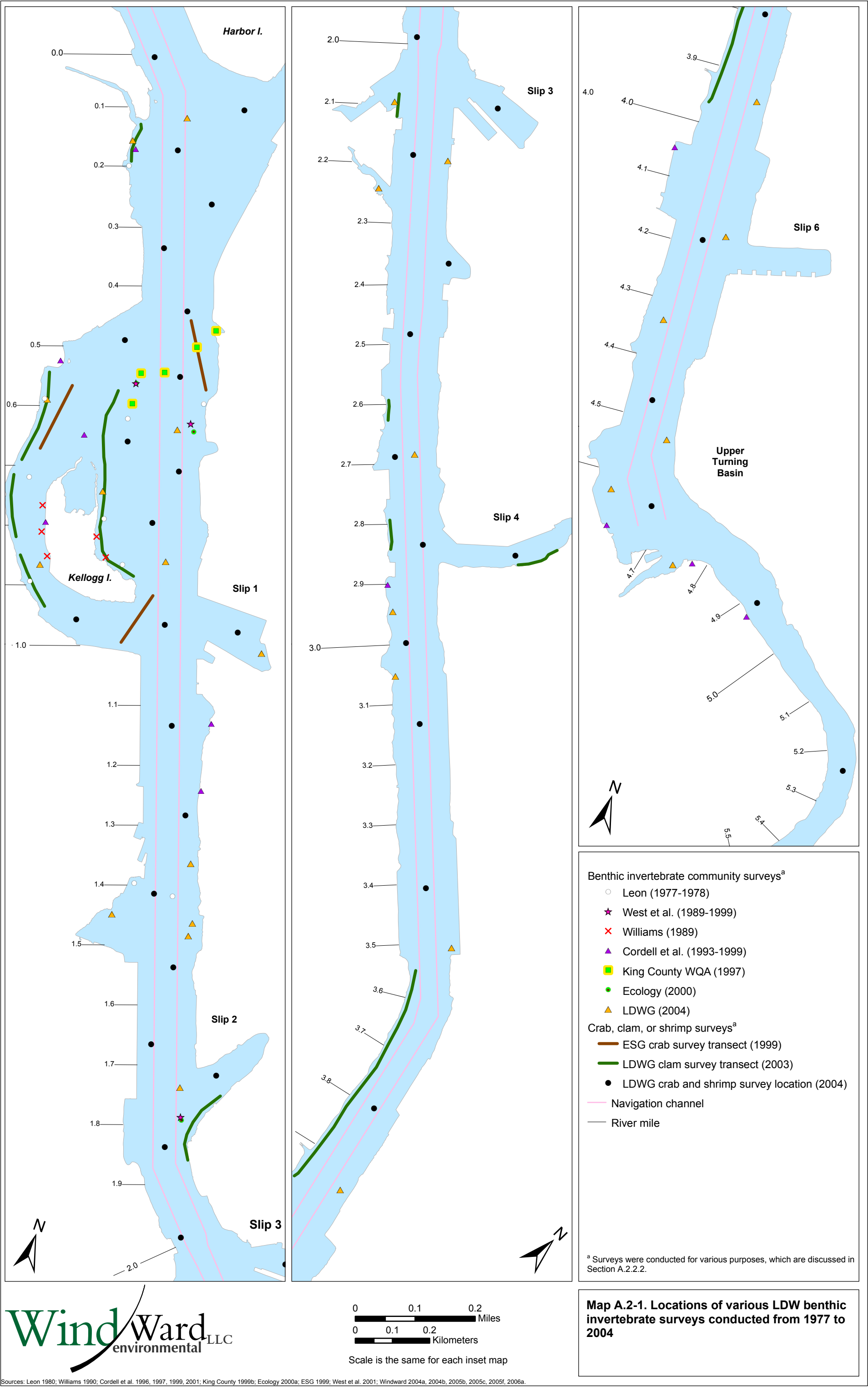
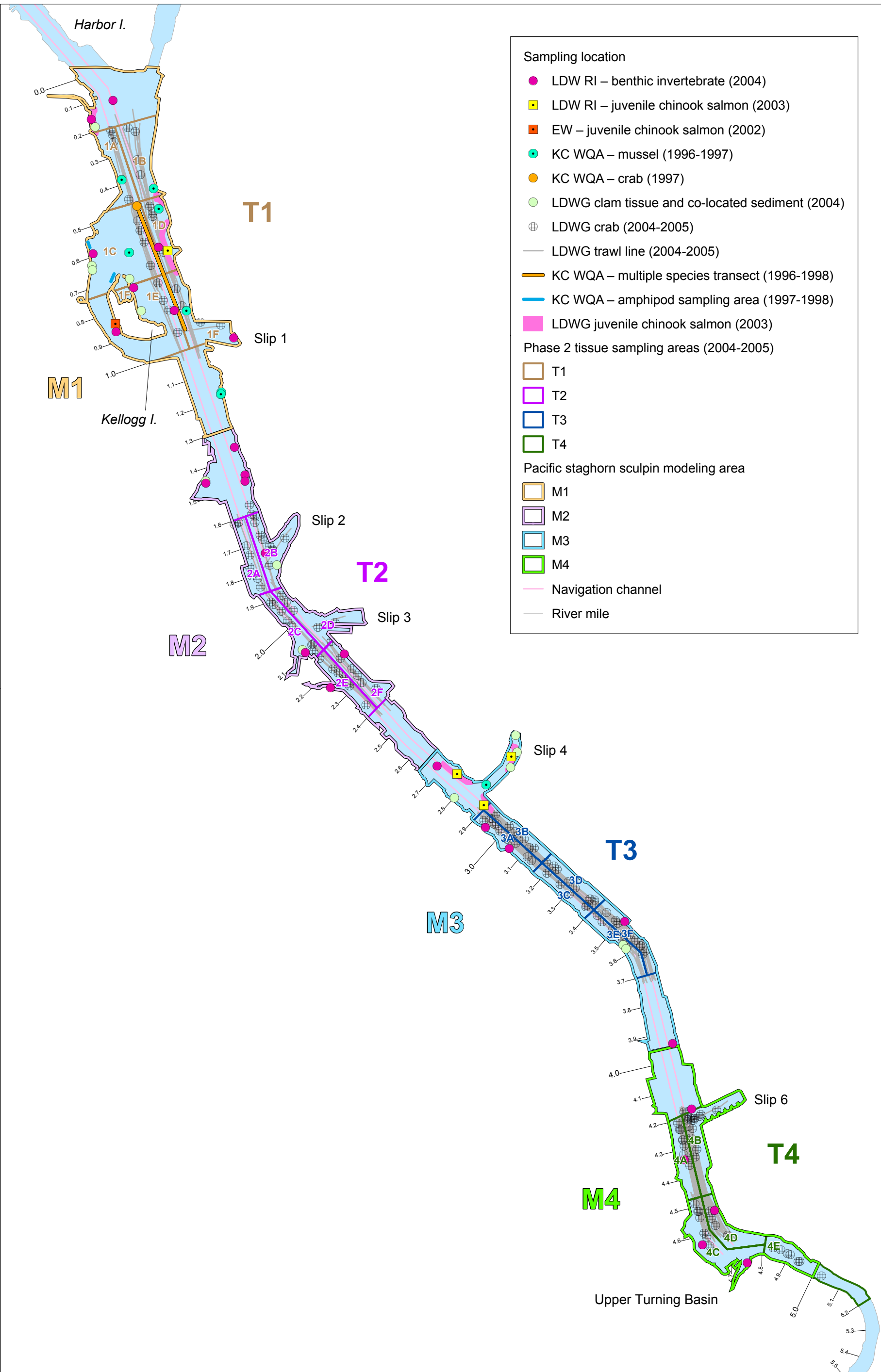


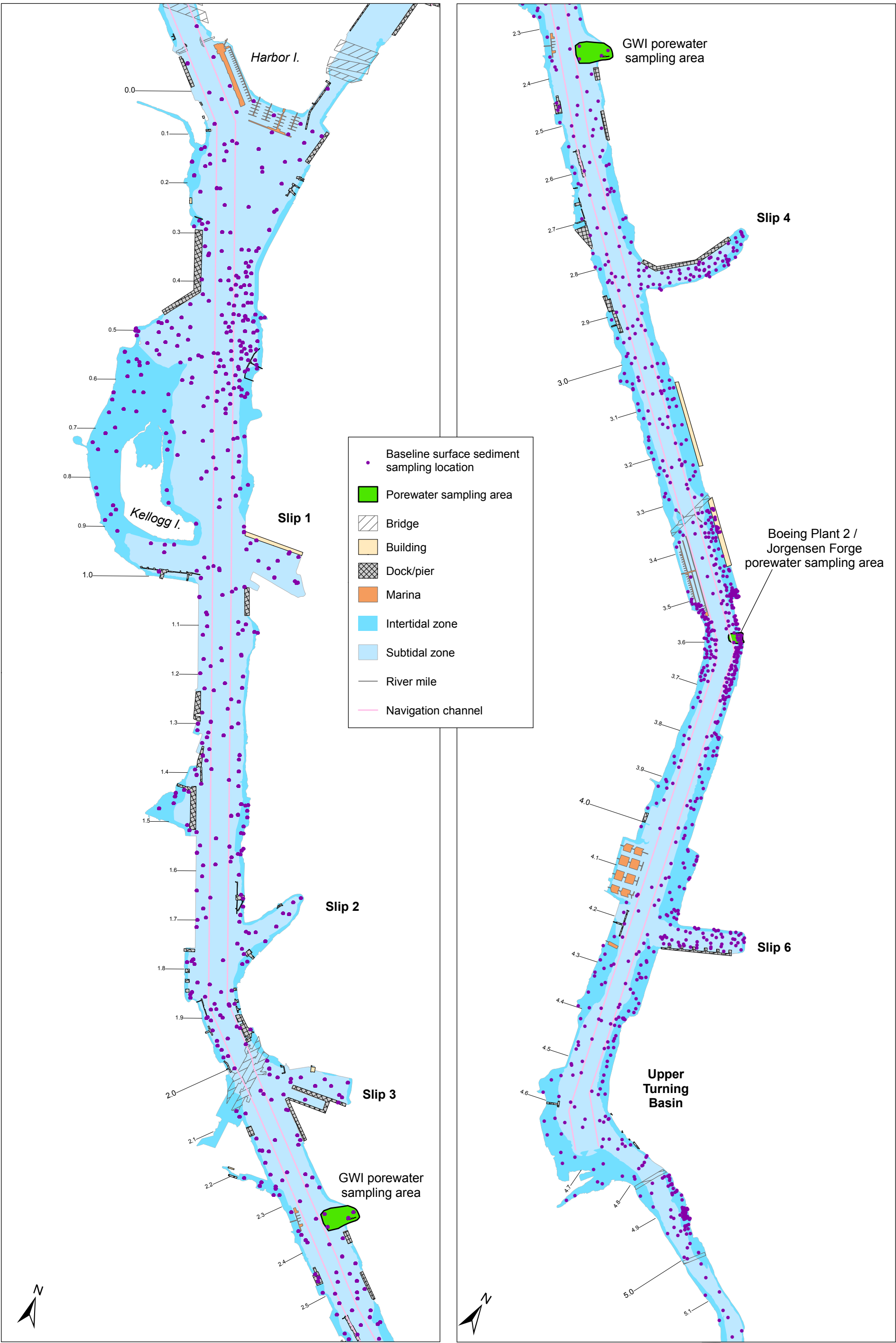


LDW study area
Navigation channel
River mile

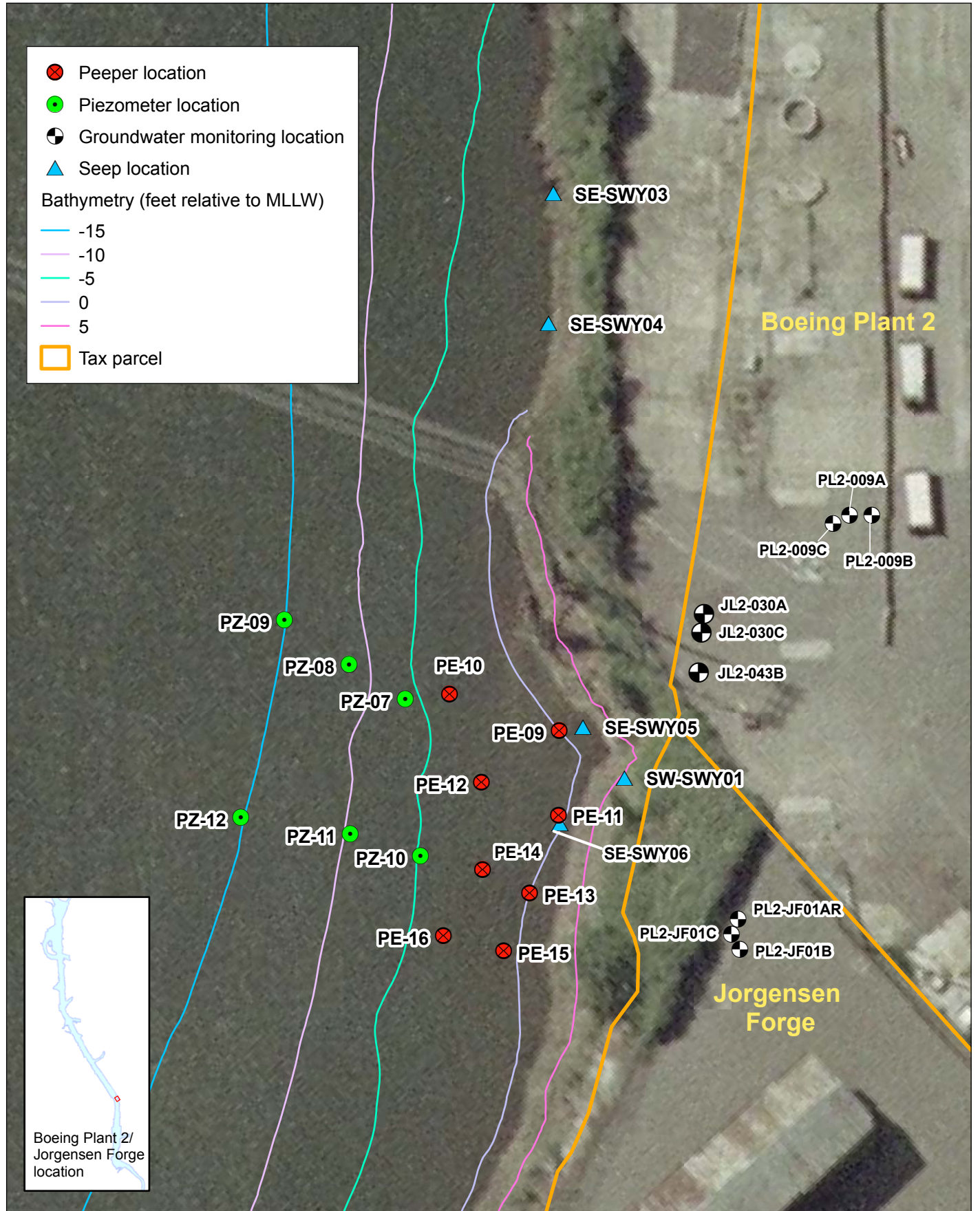
Map A.1-1. Lower Duwamish Waterway study area



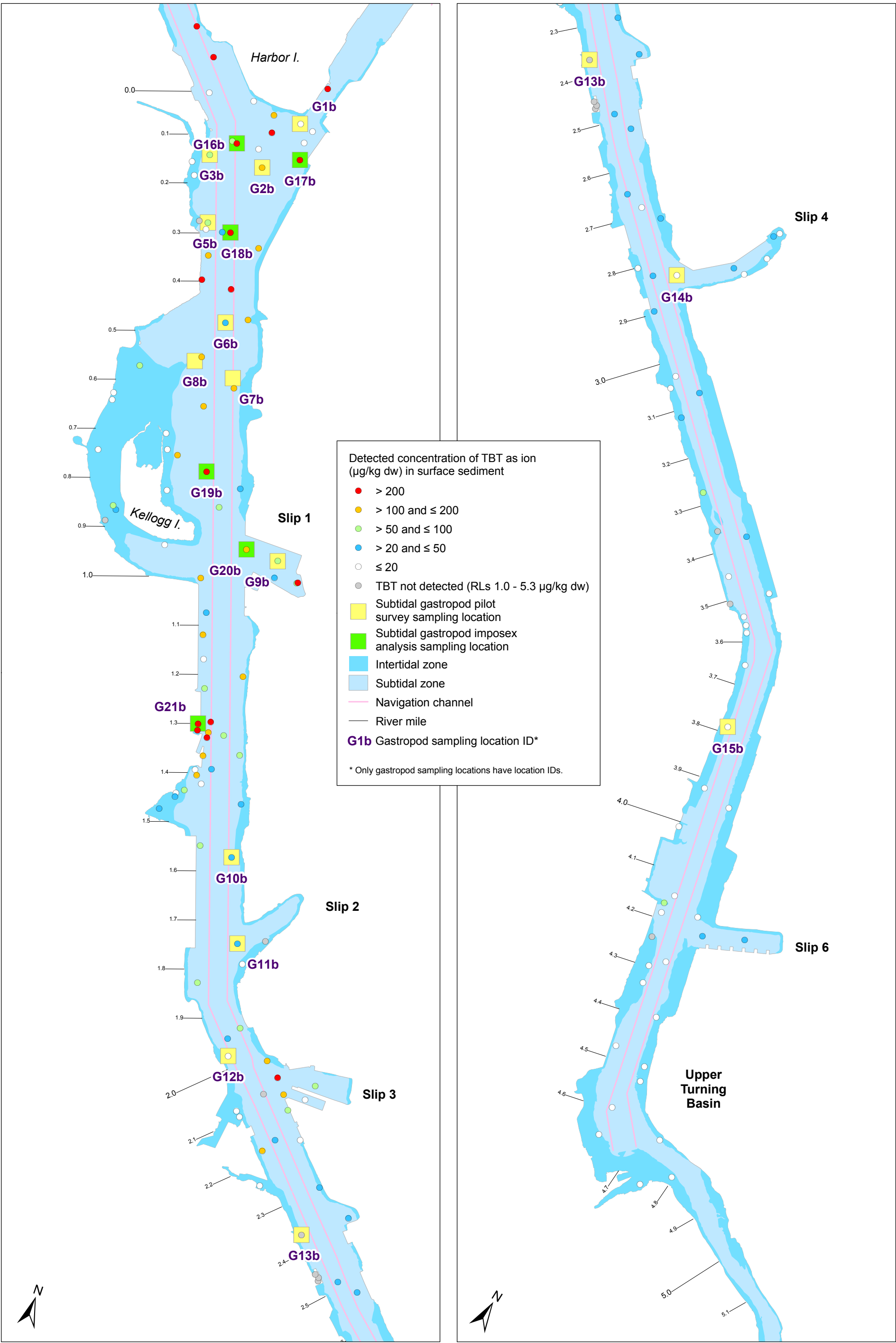


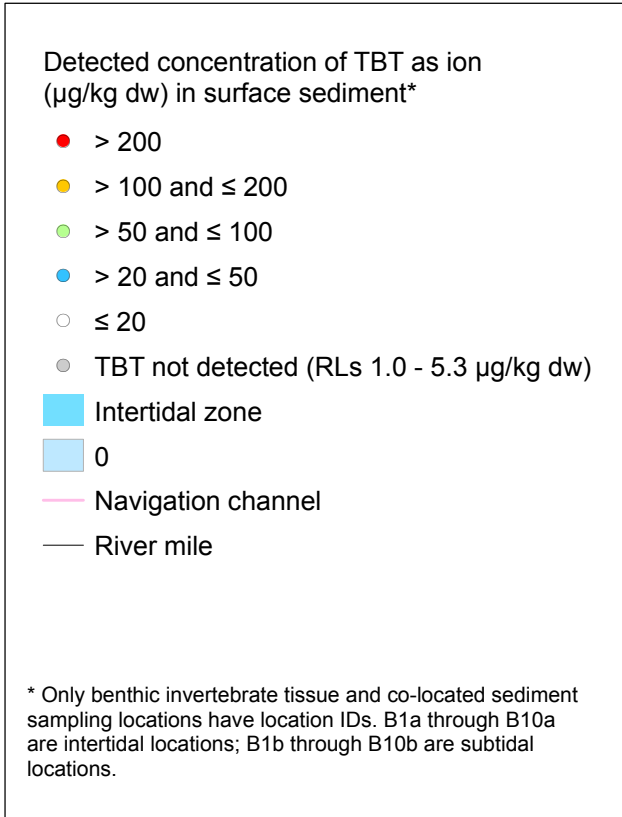
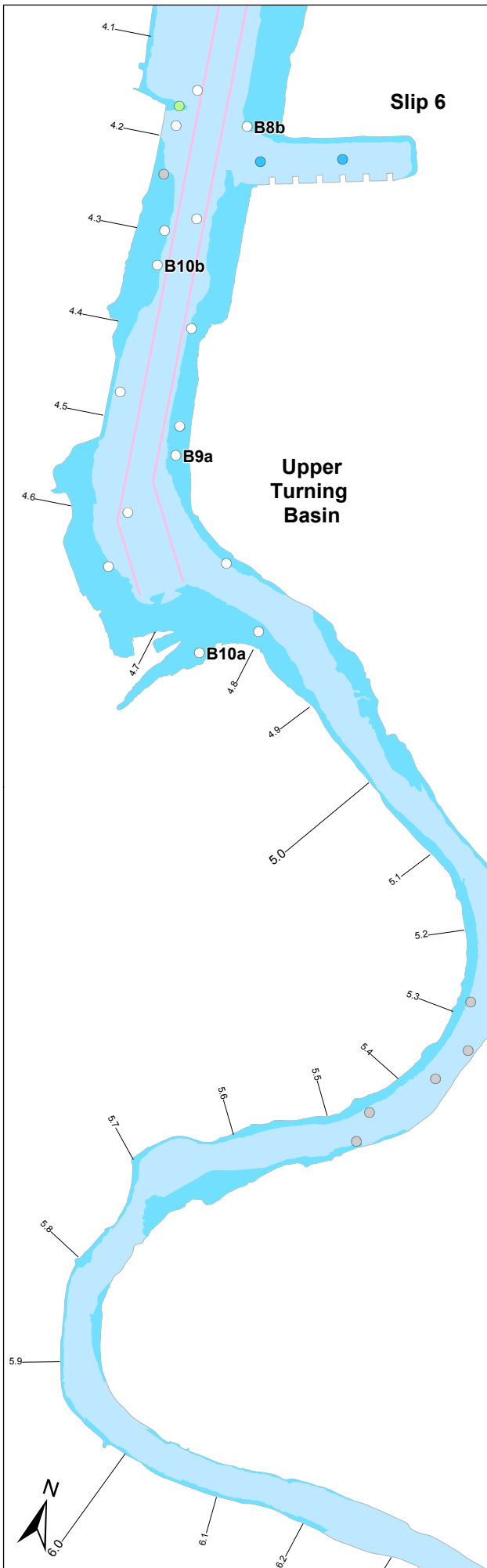
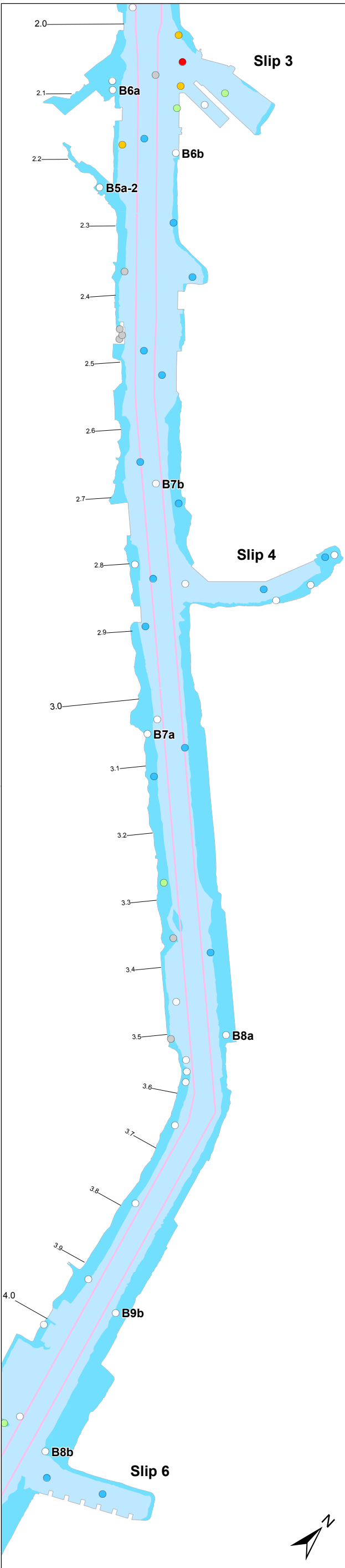
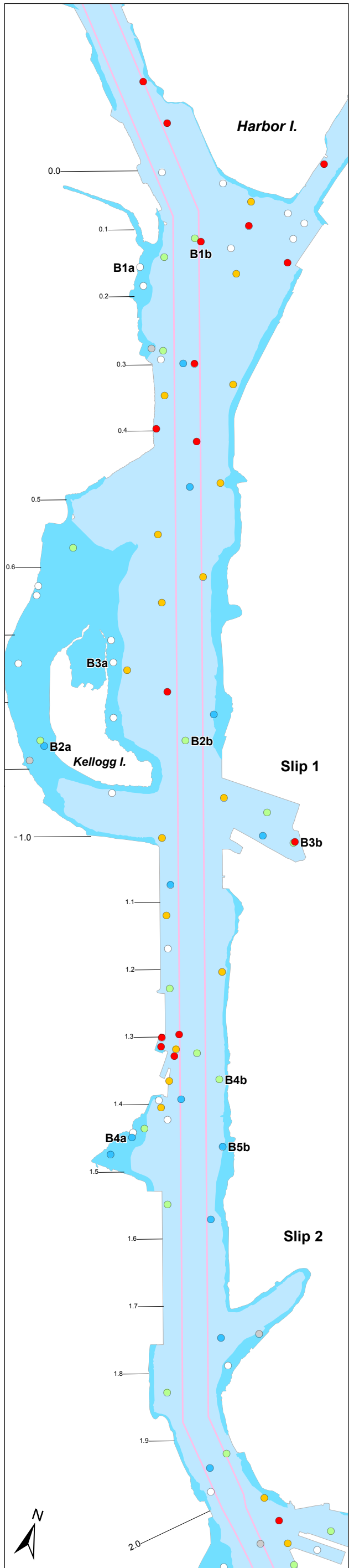


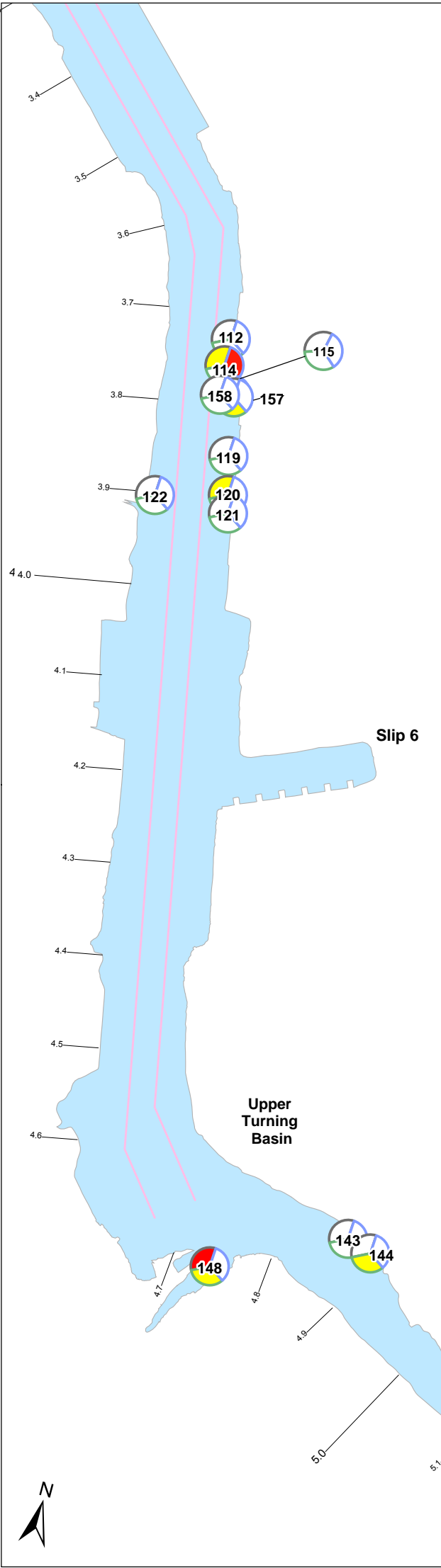
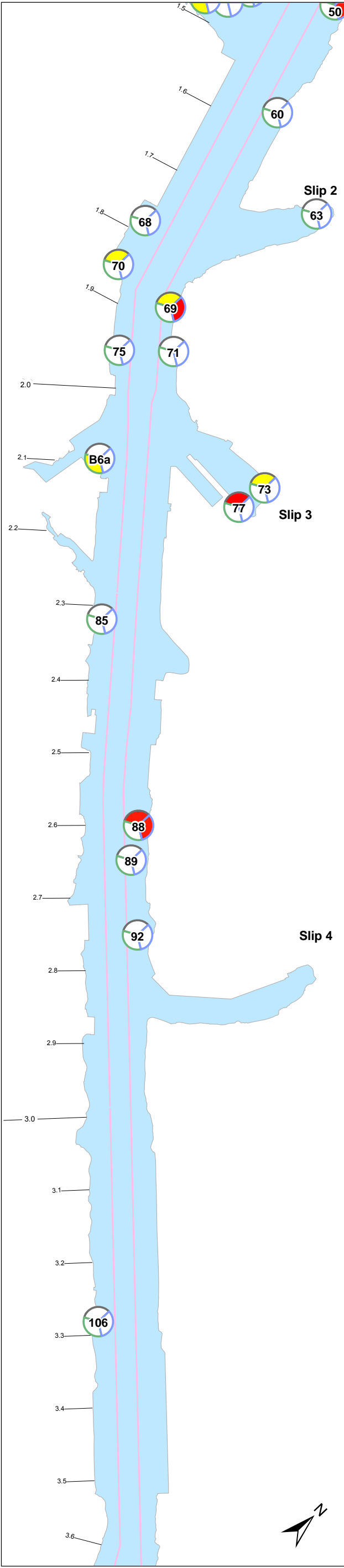
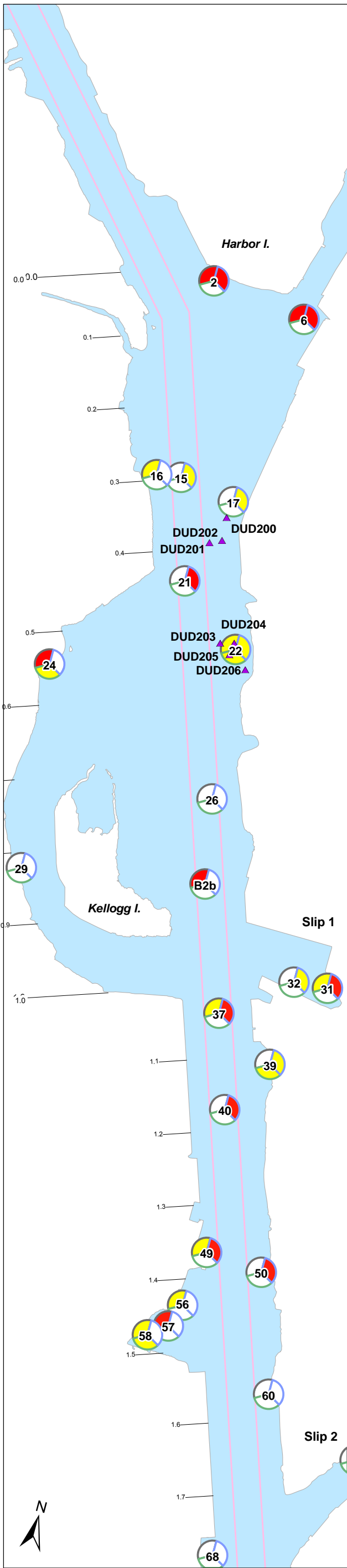




Map A.3-2. Porewater sampling locations at Boeing Plant 2 / Jorgensen Forge










LDWG toxicity test results (2005)*

bivalve  amphipod 
polychaete 

 > CSL
 > SQS and ≤ CSL
 ≤ SQS

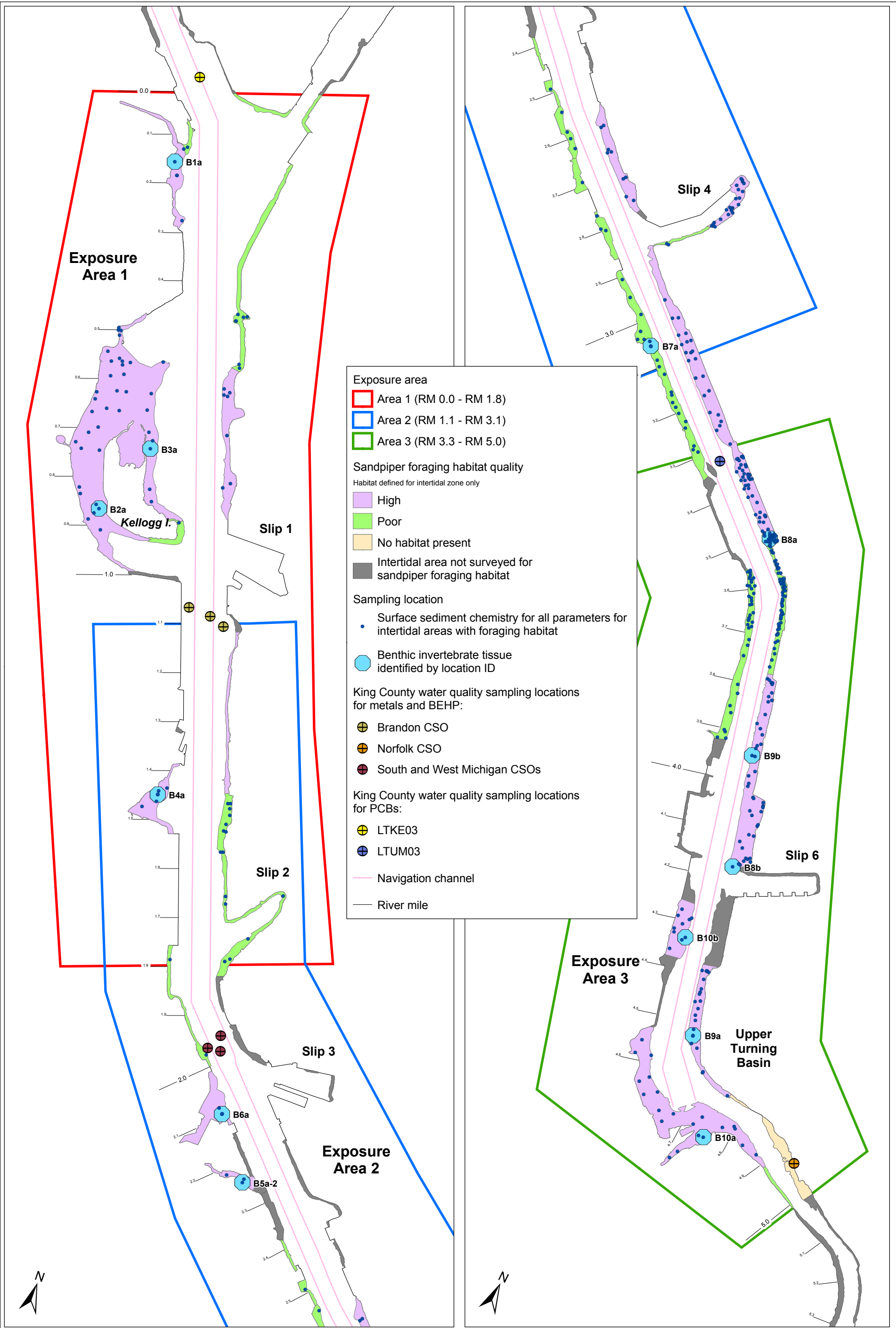
▲ King County (2000)
DUD206 > SQS and ≤ CSL for echinoderm and polychaete toxicity tests; DUD200 through DUD205 no exceedances

— River mile

— Navigation channel

* Symbol oriented along the north-south axis in each frame.

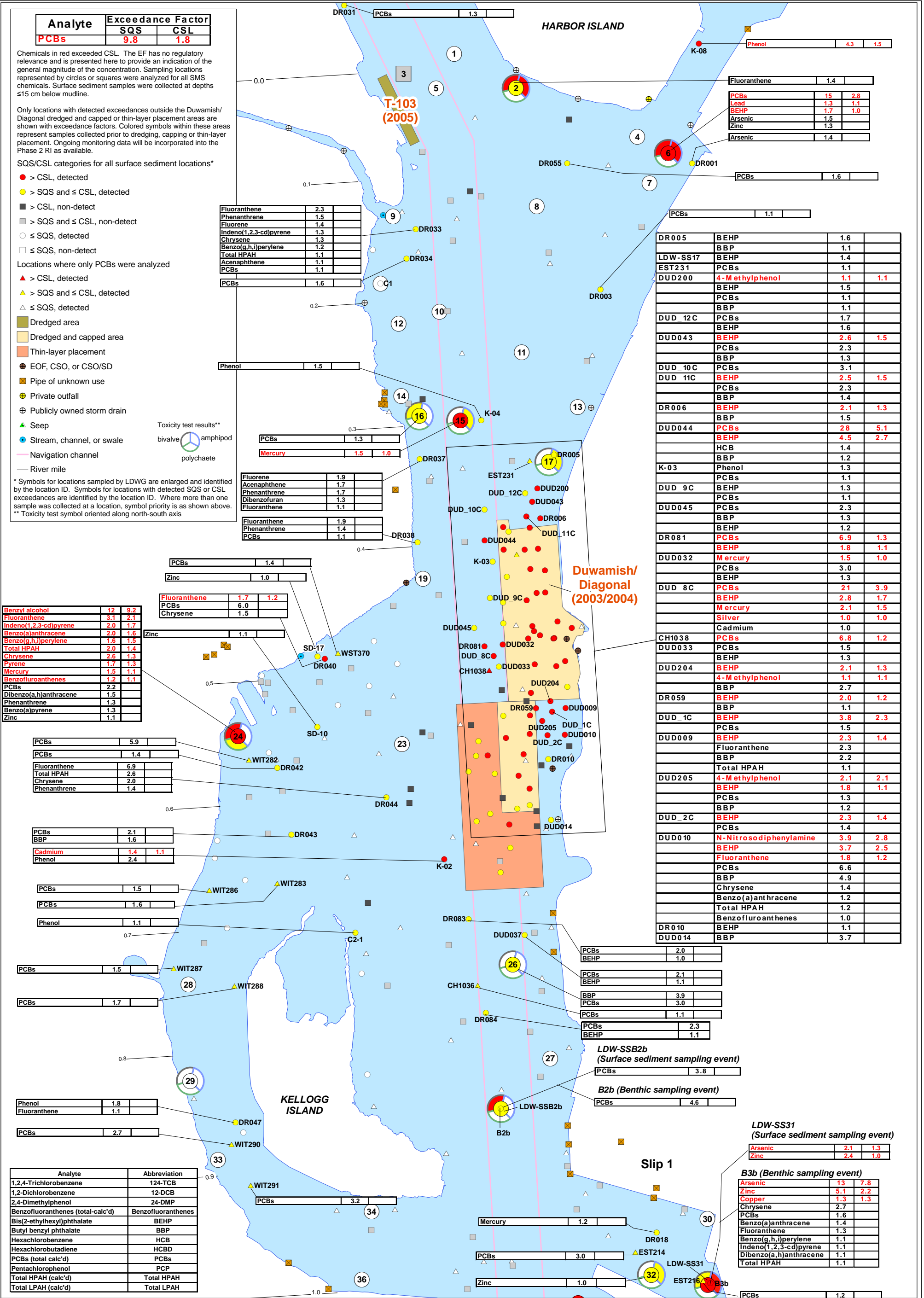
Map A.3-5. Results of baseline toxicity testing conducted with LDW surface sediment samples



Map A.5-1. Exposure areas and sampling locations of data used in the spotted sandpiper exposure assessment

Prepared by STS 05-16-06, mod CEH 08-10-06, STS 12-20-06, CEH 02-05-07, 08/03/07, Map 2283, 'data\gsr\Phase 2'

Sources: King County 1999a; Mickelson and Williston 2006; Windward 2004f, 2005b; sources for baseline surface sediment data provided on Map A.2-2.



Analyte	Abbreviation
1,2,4-Trichlorobenzene	124-TCB
1,2-Dichlorobenzene	12-DCB
2,4-Dimethylphenol	24-DMP
Benzofluoranthenes (total-calc'd)	Benzofluoranthenes
Bis(2-ethylhexyl)phthalate	BEHP
Butyl benzyl phthalate	BBP
Hexachlorobenzene	HCB
Hexachlorobutadiene	HCBD
PCBs (total calc'd)	PCBs
Pentachlorophenol	PCP
Total HPAH (calc'd)	Total HPAH
Total LPAH (calc'd)	Total LPAH

PCBs	18	3.4
Mercury	1.7	1.2

Fluoranthene	3.9	2.7
Pyrene	1.6	1.3
Total HPAH	1.5	1.1
PCBs	1.8	
Chrysene	1.5	
Benzo(a)anthracene	1.2	

Acenaphthene	16	4.6
Fluorene	10	3.0
Dibenzofuran	11	2.9
2-Methylnaphthalene	4.2	2.5
Total LPAH	4.6	2.2
Phenanthrene	7.5	1.6
Naphthalene	2.6	1.5
Fluoranthene	5.3	
PCBs	2.7	
Total HPAH	2.2	
Chrysene	1.6	
Benzo(a)anthracene	1.5	
Mercury	1.1	
Benzofluoranthenes	1.1	
Benzo(a)pyrene	1.0	

Mercury	2.7	1.8
---------	-----	-----

PCBs	2.3	
------	-----	--

PCBs	1.2	
BEHP	1.0	

Copper	3.2	3.2
Zinc	1.9	
BEHP	1.6	
Arsenic	1.2	

Copper	3.4	3.4
Arsenic	2.8	1.7
Zinc	2.1	

BEHP	1.1	
BBP	1.0	

Arsenic	14	8.7
Copper	3.6	3.6
Zinc	6.9	2.9
Lead	1.7	1.5
Mercury	1.9	1.3
Chrysene	1.3	
Fluoranthene	1.3	
Phenanthrene	1.3	
BEHP	1.2	
Acenaphthene	1.1	
BBP	1.1	

Arsenic	3.0	1.8
Copper	1.6	1.6
Zinc	1.9	

Fluoranthene	3.1	
Phenanthrene	1.4	
Chrysene	1.1	
Total HPAH	1.0	

PCBs	5.5	1.0
Arsenic	2.8	1.7
Zinc	1.5	

LDW-SSB4a
(Surface sediment sampling event)

PCBs	3.8	
PCP	1.1	

B4a (Benthic sampling event)

Fluoranthene	2.9	
Benzo(g,h,i)perylene	1.4	
PCBs	1.4	
Total HPAH	1.4	
Indeno(1,2,3-cd)pyrene	1.3	
Chrysene	1.2	
Phenanthrene	1.2	

Analyte	Exceedance Factor	
	SQS	CSL
PCBs	9.8	1.8

Chemicals in red exceeded CSL. The EF has no regulatory relevance and is presented here to provide an indication of the general magnitude of the concentration. Sampling locations represented by circles or squares were analyzed for all SMS chemicals. Surface sediment samples were collected at depths ≤15 cm below mudline.

Only locations with detected exceedances are shown with exceedance factors.

SQS/CSL categories for all surface sediment locations*

- > CSL, detected
- > SQS and ≤ CSL, detected
- > CSL, non-detect
- > SQS and ≤ CSL, non-detect
- ≤ SQS, detected
- ≤ SQS, non-detect

Locations where only PCBs were analyzed

- > CSL, detected
- > SQS and ≤ CSL, detected
- ≤ SQS, detected
- ≤ SQS, nondetect

- Dredged area
- Dredged area with thin-layer placement

- EOF, CSO, or CSO/SD

- Pipe of unknown use

- Private outfall

- Publicly owned storm drain

- Seep
- Stream, channel, or swale

- Navigation channel

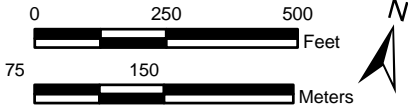
- River mile

Toxicity test results**
bivalve
amphipod
polychaete

* Symbols for locations sampled by LDWG are enlarged and identified by the location ID. Symbols for locations with detected SQS or CSL exceedances are identified by the location ID. Where more than one sample was collected at a location, symbol priority is as shown above.

** Toxicity test symbol oriented along the north-south axis

Map A.6-1b. Phase 2 sediment toxicity test results compared to SMS biological effects criteria and detected chemical concentrations at baseline surface sediment locations compared to SMS chemical criteria (RM 1.0-2.0)



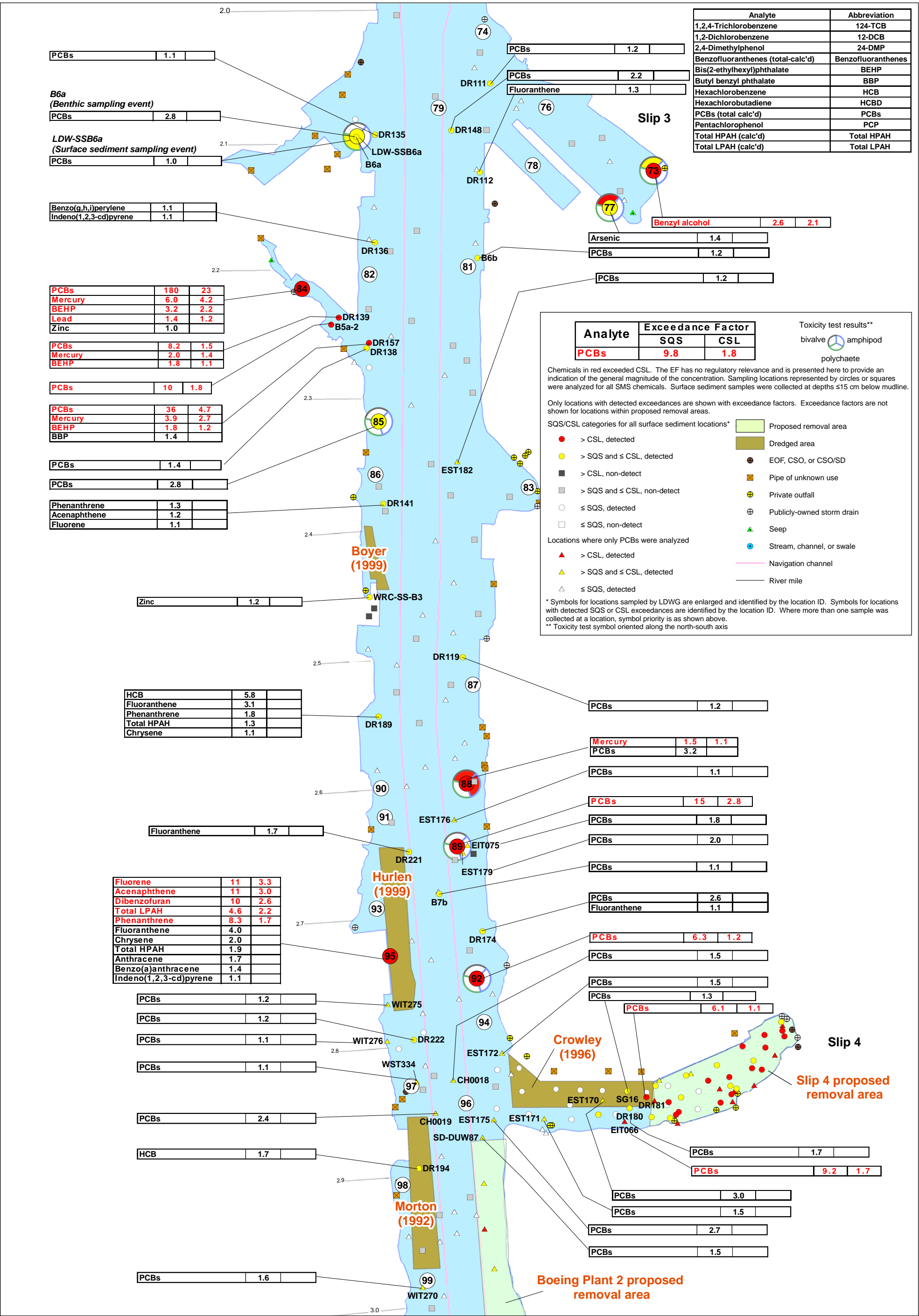
WindWard
environmental LLC

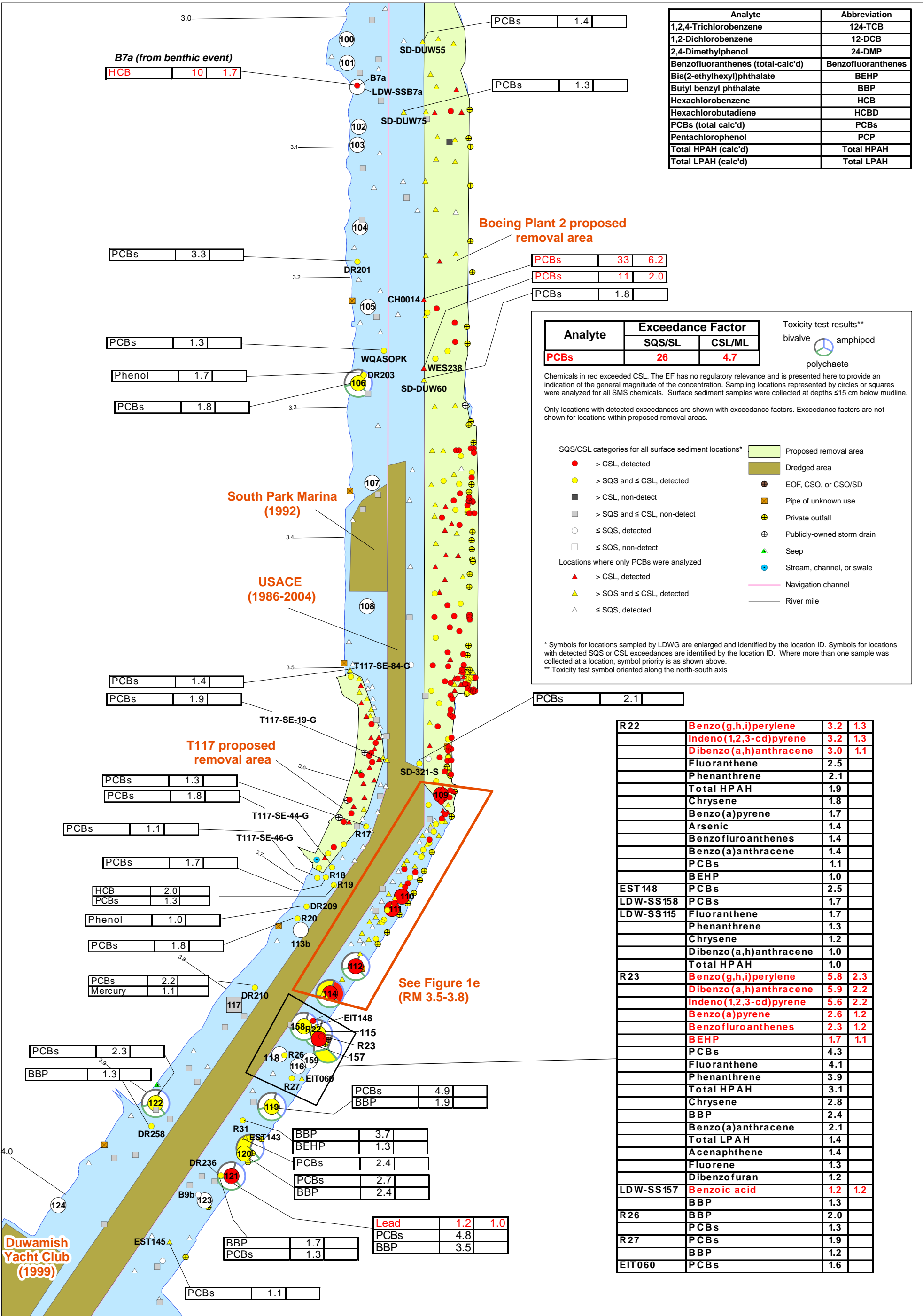
Prepared by STS 06/30/06, mod CEH 08/30/06; Map 2293

Source information provided by EPA and Ecology based on a preliminary file search. Tax parcel information provided by Seattle Public Utilities, May 2002. Some tax parcel polygons were edited by Windward to conform to the LDW shoreline for the purpose of map presentation. The locations of outfalls and other pipes shown on this figure were identified during a City of Seattle survey conducted during May-June 2003 (Herrera 2004). As part of the survey, the locations of permitted outfalls were first identified using available drainage and outfall maps for waterfront properties obtained from the Washington

Department of Ecology National Pollutant Discharge Elimination System (NPDES) permit files. Outfalls and pipes that were observed in the field during low tides were then surveyed in the field to establish their locations. The status of permitted outfalls is currently being verified by the Lower Duwamish Waterway Group (LDWG) through interviews with agency personnel and individual LDWG members' staff, as appropriate. In the future, known outfalls will be designated as either "combined sewer overflow, combined sewer overflow/storm drains, or emergency overflows,"

"publicly owned storm drains;" or "private outfalls." Private outfalls will include two categories: 1) NPDES-permitted outfalls (e.g., storm drains, non-contact cooling water, process wastewater), and 2) other outfalls that are not included under an active NPDES permit. Outfalls whose discharge has been terminated and that are no longer included under an active NPDES permit will be identified as "formerly permitted outfalls." Pipes that cannot be identified as an outfall through agency permit file records review will be identified as "pipes of unknown use." A comprehensive survey of property owners will not be conducted.





Map A.6-1d. Phase 2 sediment toxicity test results compared to SMS biological effects criteria and detected chemical concentrations at baseline surface sediment locations compared to SMS chemical criteria (RM 3.0-4.0)

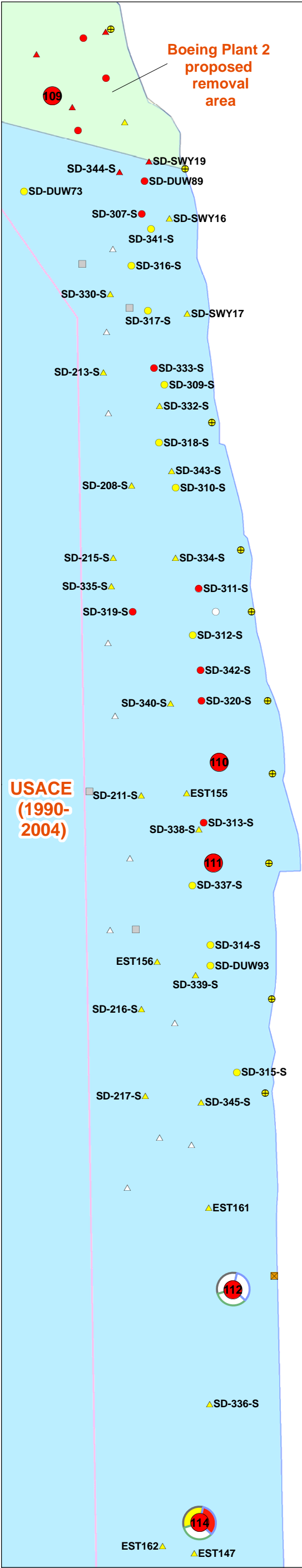


Prepared by STS 06/30/06, CEH 08/30/06; Map 2293

Source information provided by EPA and Ecology based on a preliminary file search. Tax parcel information provided by Seattle Public Utilities, May 2002. Some tax parcel polygons were edited by Windward to conform to the LDW shoreline for the purpose of map presentation. The locations of outfalls and other pipes shown on this figure were identified during a City of Seattle survey conducted during May-June 2003 (Herrera 2004). As part of the survey, the locations of permitted outfalls were first identified using available drainage and outfall maps for waterfront properties obtained from the Washington

Department of Ecology National Pollutant Discharge Elimination System (NPDES) permit files. Outfalls and pipes that were observed in the field during low tides were then surveyed in the field to establish their locations. The status of permitted outfalls is currently being verified by the Lower Duwamish Waterway Group (LDWG) through interviews with agency personnel and individual LDWG members' staff, as appropriate. In the future, known outfalls will be designated as either "combined sewer overflow, combined sewer overflow/storm drains, or emergency overflows,"

"publicly owned storm drains;" or "private outfalls." Private outfalls will include two categories: 1) NPDES-permitted outfalls (e.g., storm drains, non-contact cooling water, process wastewater), and 2) other outfalls that are not included under an active NPDES permit. Outfalls whose discharge has been terminated and that are no longer included under an active NPDES permit will be identified as "formerly permitted outfalls." Pipes that cannot be identified as an outfall through agency permit file records review will be identified as "pipes of unknown use." A comprehensive survey of property owners will not be conducted.



Analyte	Abbreviation
1,2,4-Trichlorobenzene	124-TCB
1,2-Dichlorobenzene	12-DCB
2,4-Dimethylphenol	24-DMP
Benzofluoranthenes (total-calc'd)	Benzofluoranthenes
Bis(2-ethylhexyl)phthalate	BEHP
Butyl benzyl phthalate	BBP
Hexachlorobenzene	HCB
Hexachlorobutadiene	HCBD
PCBs (total calc'd)	PCBs
Pentachlorophenol	PCP
Total HPAH (calc'd)	Total HPAH
Total LPAH (calc'd)	Total LPAH

SD-SWY 19	PCBs	9.2	1.7
SD-344-S	PCBs	36	6.6
SD-DUW89	Zinc	8.5	3.6
	PCBs	10	1.8
SD-DUW73	PCBs	1.6	
SD-307-S	PCBs	10.0	1.8
	Zinc	3.4	1.4
	Fluorene	3.0	
	Fluoranthene	3.1	
	Chrysene	2.7	
	Phenanthrene	2.2	
	Total HPAH	2.1	
	Benzo(a)anthracene	1.9	
	Benzofluoranthenes	1.4	
	Total LPAH	1.4	
	Phenol	1.0	
SD-SWY 16	PCBs	3.7	
SD-341-S	PCBs	4.4	
SD-316-S	PCBs	3.5	
SD-330-S	PCBs	2.7	
SD-317-S	Phenol	2.6	
	PCBs	2.5	
SD-SWY 17	PCBs	1.3	
SD-333-S	Copper	1.2	1.2
	PCBs	2.5	
SD-213-S	PCBs	2.3	
SD-309-S	PCBs	2.2	
	Fluorene	1.6	
	Phenanthrene	1.5	
	Dibenzofuran	1.3	
SD-332-S	PCBs	1.3	
SD-318-S	PCBs	3.8	
	Phenol	1.9	
SD-343-S	PCBs	1.1	
SD-208-S	PCBs	1.9	
SD-310-S	PCBs	2.3	
SD-215-S	PCBs	4.5	
SD-334-S	PCBs	1.6	
SD-335-S	PCBs	1.7	
SD-311-S	PCBs	15	2.8
	Phenol	2.9	1.0
SD-319-S	PCBs	15	2.8
SD-312-S	PCBs	3.9	
	Fluorene	1.6	
	Phenol	1.5	
	Phenanthrene	1.5	
	Dibenzofuran	1.2	
SD-342-S	PCBs	21	3.9
	Lead	1.9	1.6
SD-320-S	PCBs	46	8.5
SD-340-S	PCBs	1.2	
LDW-SS110	PCBs	48	8.8
	Lead	1.9	1.6
EST155	PCBs	1.6	
SD-211-S	PCBs	2.3	
SD-313-S	Chromium	2.2	2.2
	Lead	1.4	1.2
	PCBs	4.3	
	Phenol	1.5	
	Zinc	1.3	
SD-338-S	PCBs	3.3	
LDW-SS111	PCBs	12	2.2
	Chromium	1.8	1.7
	Lead	1.4	1.2
	Phenanthrene	1.4	
	Fluorene	1.2	
	Zinc	1.1	
SD-337-S	PCBs	5.4	
SD-314-S	PCBs	3.8	
EST156	PCBs	1.2	
SD-DUW93	PCBs	2.8	
SD-339-S	PCBs	2.3	
SD-216-S	PCBs	1.5	
SD-315-S	BBP	1.8	
	PCBs	1.4	
SD-217-S	PCBs	1.3	
SD-345-S	PCBs	1.2	
EST161	PCBs	1.6	
LDW-SS112	Arsenic	8.4	5.2
	BBP	2.4	
	PCBs	2.2	
	Fluoranthene	1.2	
SD-336-S	PCBs	1.3	
LDW-SS114	Arsenic	19	12
	BEHP	1.7	
	PCBs	4.5	
	Fluoranthene	1.3	
	Indeno(1,2,3-cd)pyrene	1.1	
	Chrysene	1.1	
EST162	PCBs	1.3	
EST147	PCBs	4.4	

Analyte	Exceedance Factor	
	SQS	CSL
PCBs	9.8	1.8

Chemicals in red exceeded CSL. The EF has no regulatory relevance and is presented here to provide an indication of the general magnitude of the concentration. Sampling locations represented by circles or squares were analyzed for all SMS chemicals. Surface sediment samples were collected at depths ≤15 cm below mudline.

Only locations with detected exceedances are shown with exceedance factors. Exceedance factors are not shown for proposed removal areas.

SQS/CSL categories for all surface sediment locations*

- > CSL, detected
- > SQS and ≤ CSL, detected
- > CSL, non-detect
- > SQS and ≤ CSL, non-detect
- ≤ SQS, detected
- ≤ SQS, non-detect

Locations where only PCBs were analyzed

- > CSL, detected
- > SQS and ≤ CSL, detected
- ≤ SQS, detected

Dredged area

Proposed removal area

EOF, CSO, or CSO/SD

Pipe of unknown use

Private outfall

Publicly owned storm drain

Seep

Stream, channel, or swale

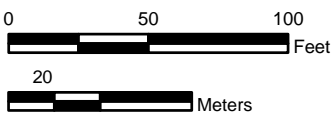
Navigation channel

River mile

Toxicity test results**
bivalve
amphipod
polychaete

* Symbols for locations sampled by LDWG are enlarged and identified by the location ID. Symbols for other locations with detected SQS or CSL exceedances are identified by the location ID. Where more than one sample was collected at a location, symbol priority is as shown above.
** Toxicity test symbol oriented along the north-south axis

Map A.6-1e. Phase 2 sediment toxicity test results compared to SMS biological effects criteria and detected chemical concentrations at baseline surface sediment locations compared to SMS chemical criteria (RM 3.5-3.8)

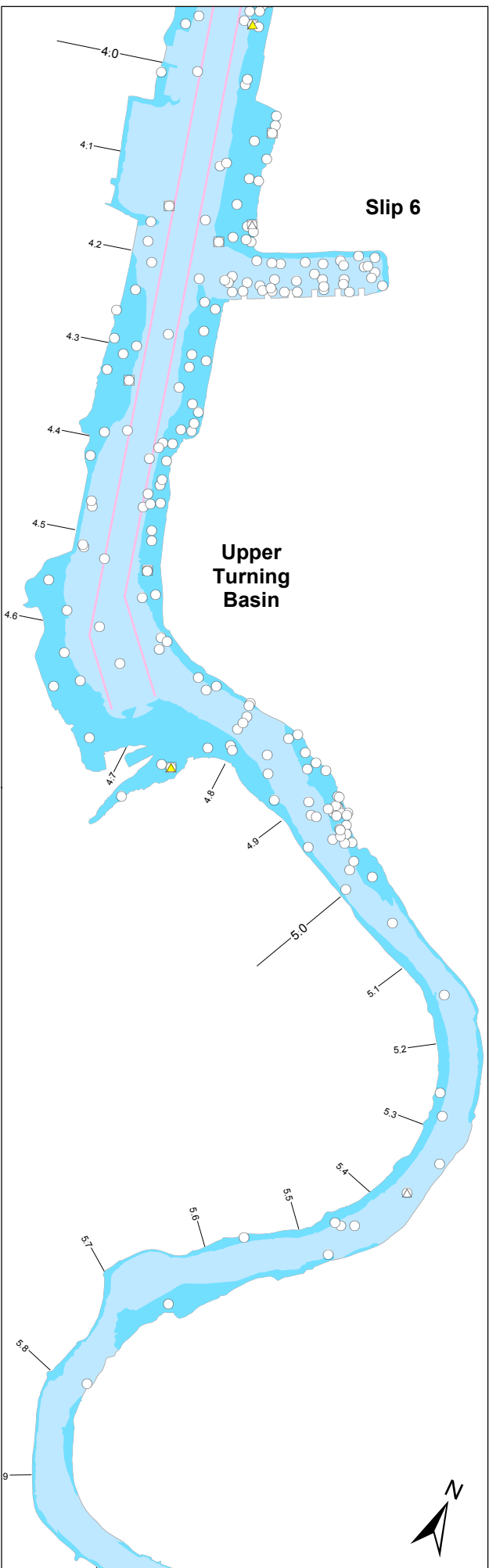
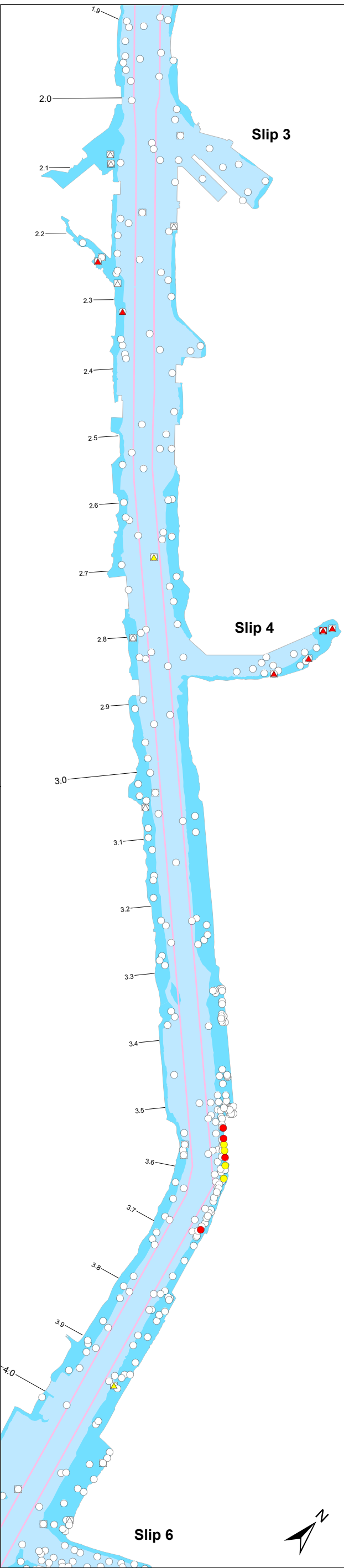
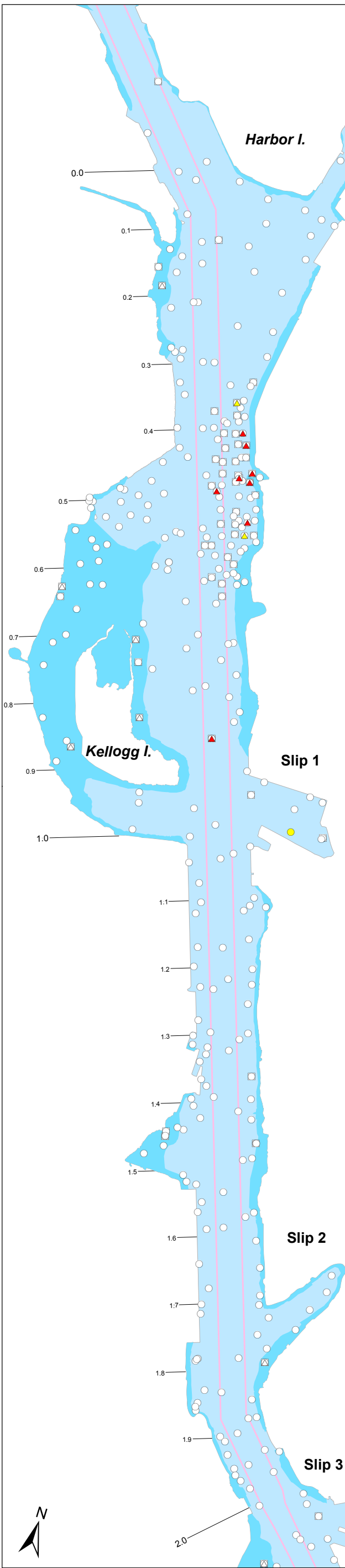


Prepared by STS 06/30/06, mod CEH 08/30/06; Map 2293

Source information provided by EPA and Ecology based on a preliminary file search. Tax parcel information provided by Seattle Public Utilities, May 2002. Some tax parcel polygons were edited by Windward to conform to the LDW shoreline for the purpose of map presentation. The locations of outfalls and other pipes shown on this figure were identified during a City of Seattle survey conducted during May-June 2003 (Herrera 2004). As part of the survey, the locations of permitted outfalls were first identified using available drainage and outfall maps for waterfront properties obtained from the Washington

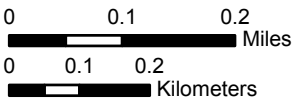
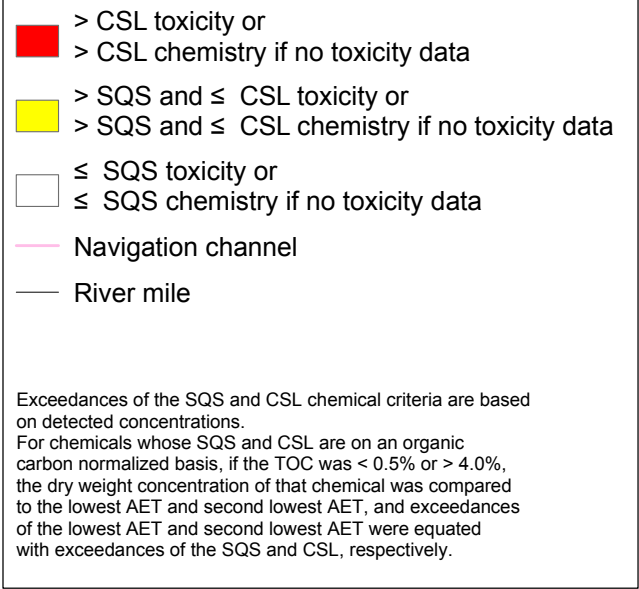
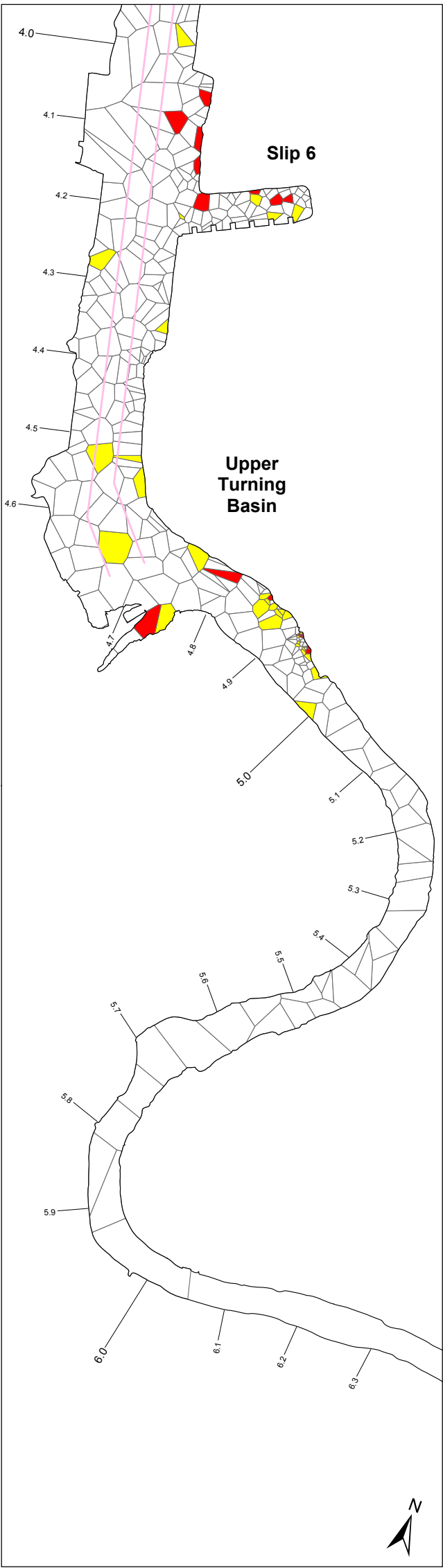
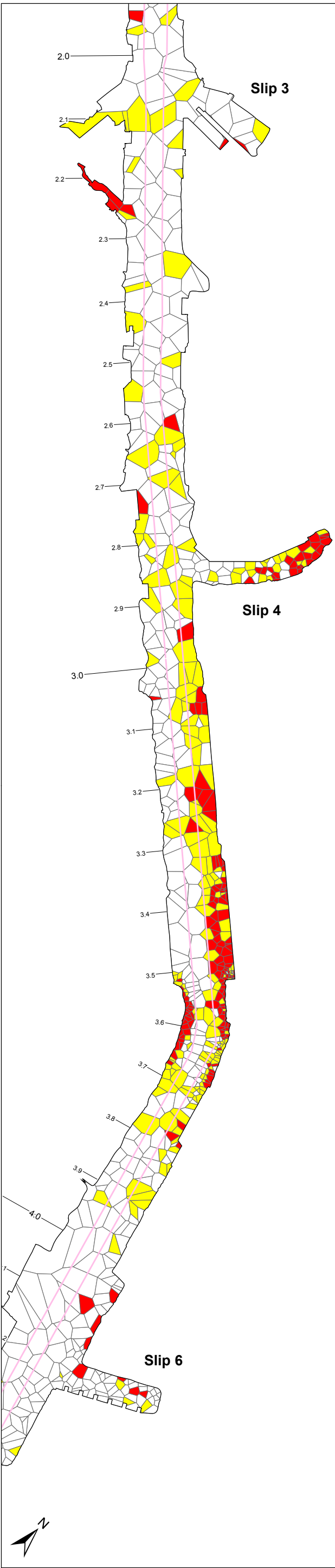
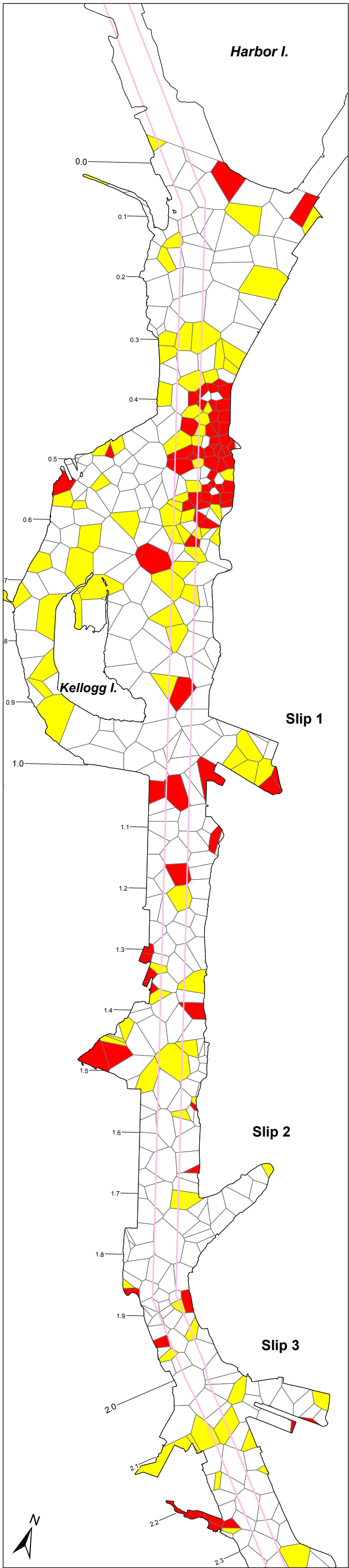
Department of Ecology National Pollutant Discharge Elimination System (NPDES) permit files. Outfalls and pipes that were observed in the field during low tides were then surveyed in the field to establish their locations. The status of permitted outfalls is currently being verified by the Lower Duwamish Waterway Group (LDWG) through interviews with agency personnel and individual LDWG members' staff, as appropriate. In the future, known outfalls will be designated as either "combined sewer overflow, combined sewer overflow/storm drains, or emergency overflows,"

"publicly owned storm drains;" or "private outfalls." Private outfalls will include two categories: 1) NPDES-permitted outfalls (e.g., storm drains, non-contact cooling water, process wastewater), and 2) other outfalls that are not included under an active NPDES permit. Outfalls whose discharge has been terminated and that are no longer included under an active NPDES permit will be identified as "formerly permitted outfalls." Pipes that cannot be identified as an outfall through agency permit file records review will be identified as "pipes of unknown use." A comprehensive survey of property owners will not be conducted.



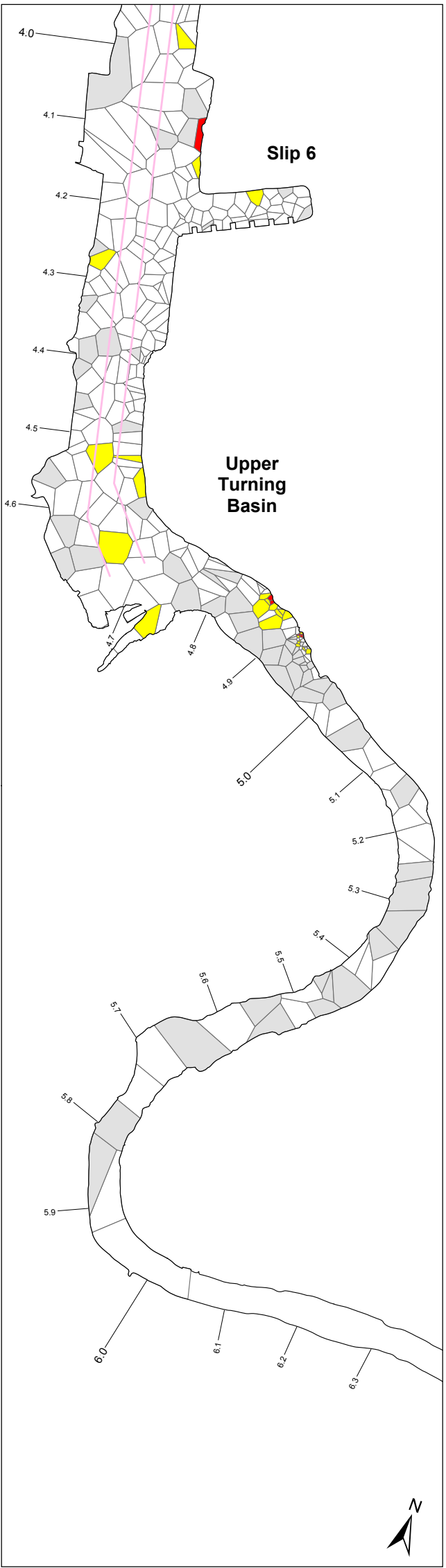
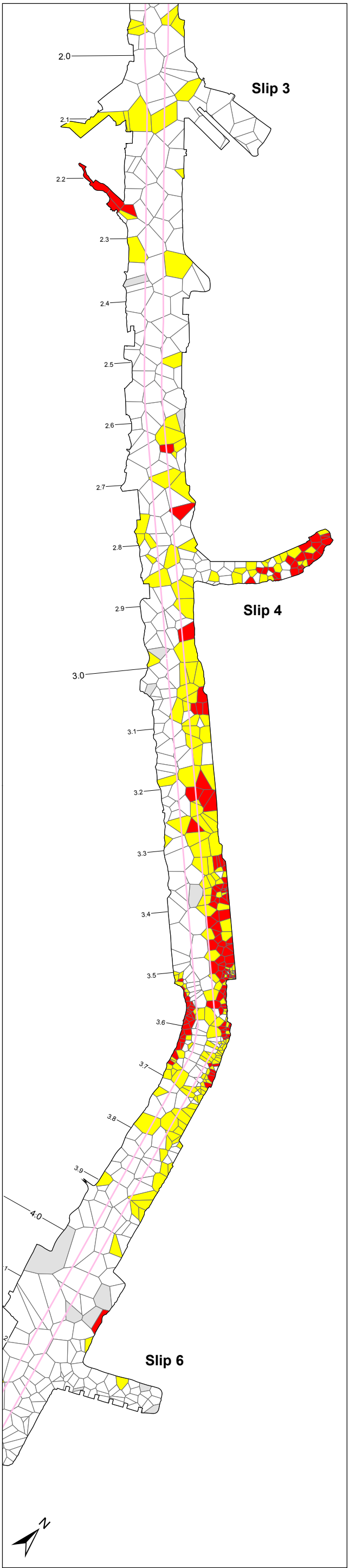
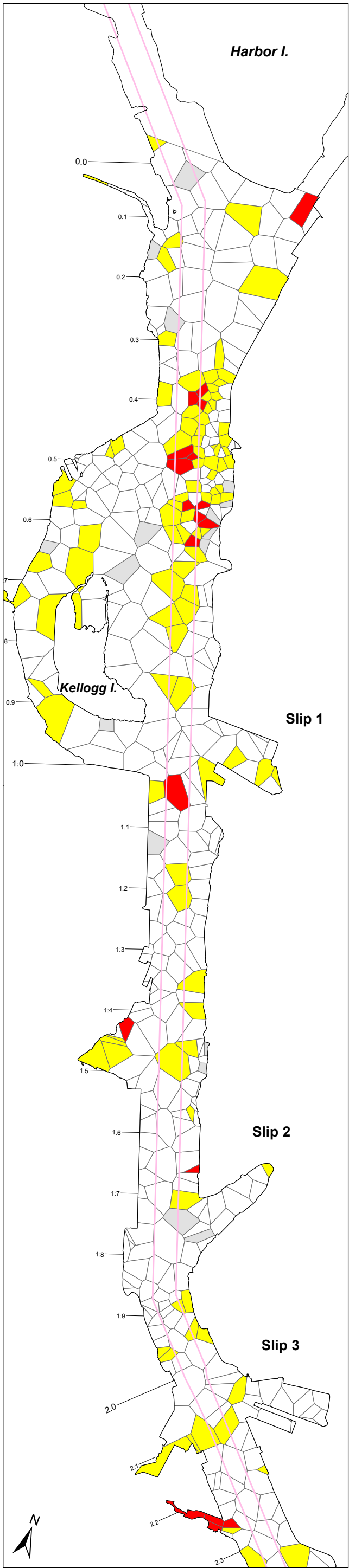
- Nickel**
- > ML, detect
 - > SL and ≤ ML, detect
 - ≤ SL, detect
- Total DDTs**
- > LOAEL, detect
 - ≤ NOAEL, detect
- Total chlordane**
- ▲ > LOAEL, detect
 - ▲ > NOAEL and ≤ LOAEL, detect
 - △ ≤ NOAEL, detect
- Intertidal zone
- Subtidal zone
- Navigation channel
- River mile

Note: Multiple symbols are shown at a single location if more than one of these chemicals was detected.



Scale is the same for each inset map

Map A.6-3. Exceedances of SQS and CSL (chemical criteria and toxicity combined) using Thiessen polygons for the LDW baseline surface sediment dataset

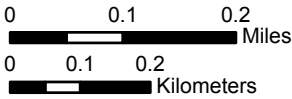


PCBs
SQS = 12 mg/kg OC
CSL = 65 mg/kg OC

For locations with TOC < 0.5% or > 4.0%
Lowest AET = 130 µg/kg dw
Second lowest AET = 1,000 µg/kg dw

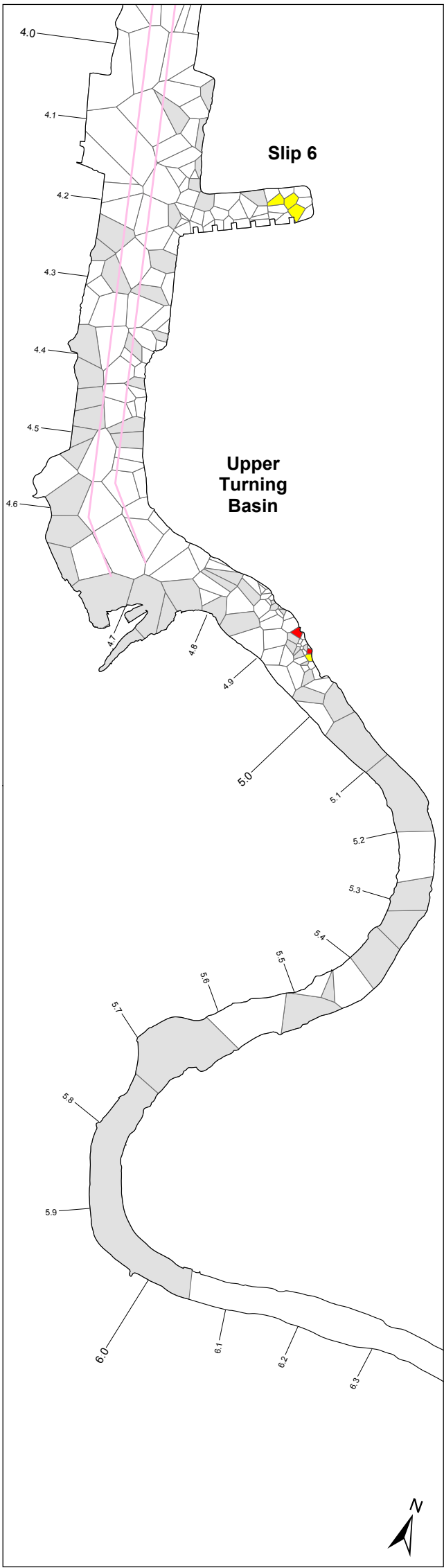
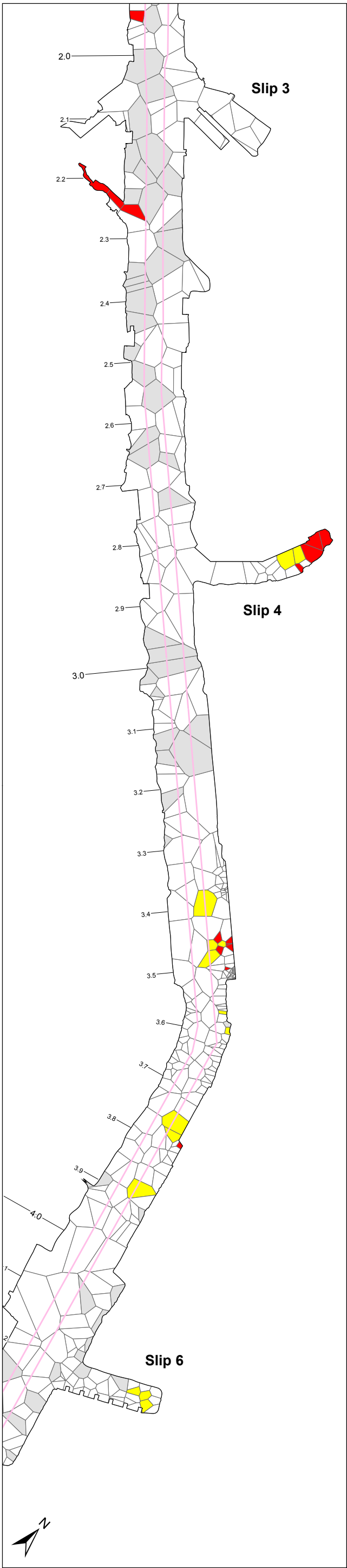
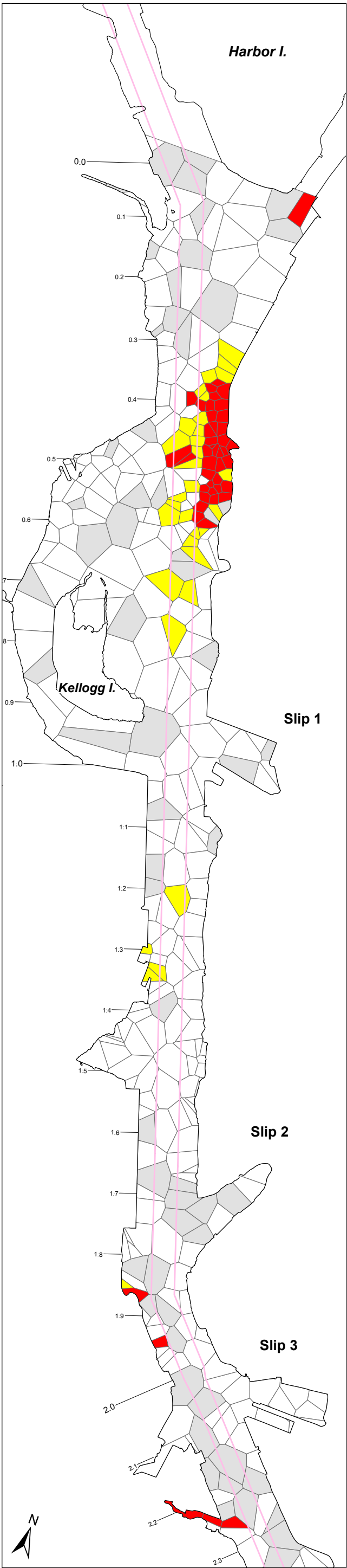
> CSL, detected
> SQS and ≤ CSL, detected
≤ SQS, detected
Non-detect
Navigation channel
River mile

Exceedances of the SQS or CSL chemical criteria are shown even if toxicity tests for that sample demonstrated no toxicity, which would override any exceedances of the SQS or CSL chemical criteria.



Scale is the same for each inset map

Map A.6-4. Exceedances of SQS and CSL chemical criteria using Thiessen polygons for PCBs in the LDW baseline surface sediment dataset



Bis(2-ethylhexyl) phthalate
SQS = 47 mg/kg OC
CSL = 78 mg/kg OC

For locations with TOC < 0.5% or > 4.0%
Lowest AET = 1,300 µg/kg dw
Second lowest AET = 1,900 µg/kg dw

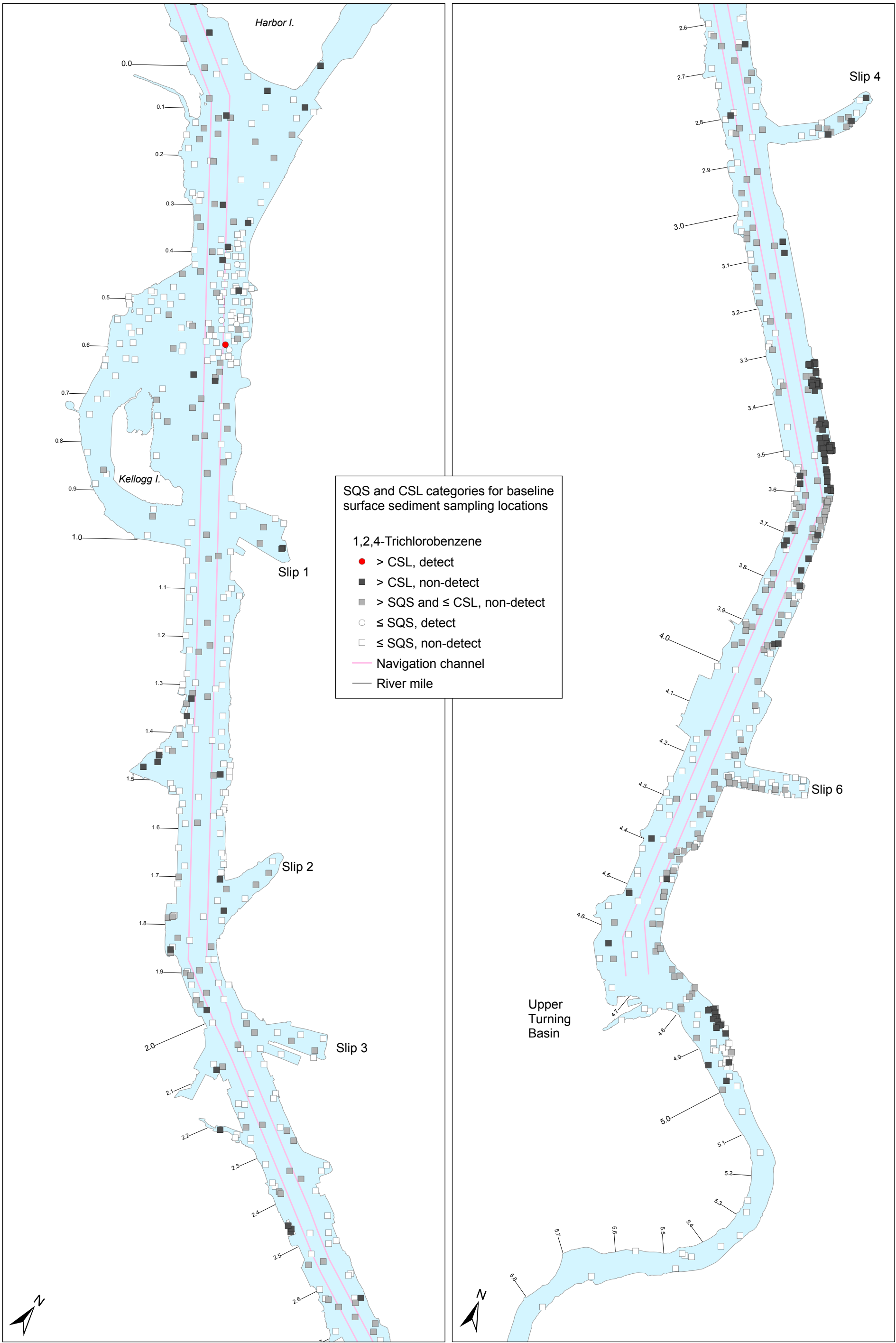
> CSL, detected
> SQS and ≤ CSL, detected
≤ SQS, detected
Non-detect
Navigation channel
River mile

Exceedances of the SQS or CSL chemical criteria are shown even if toxicity tests for that sample demonstrated no toxicity, which would override any exceedances of the SQS or CSL chemical criteria.

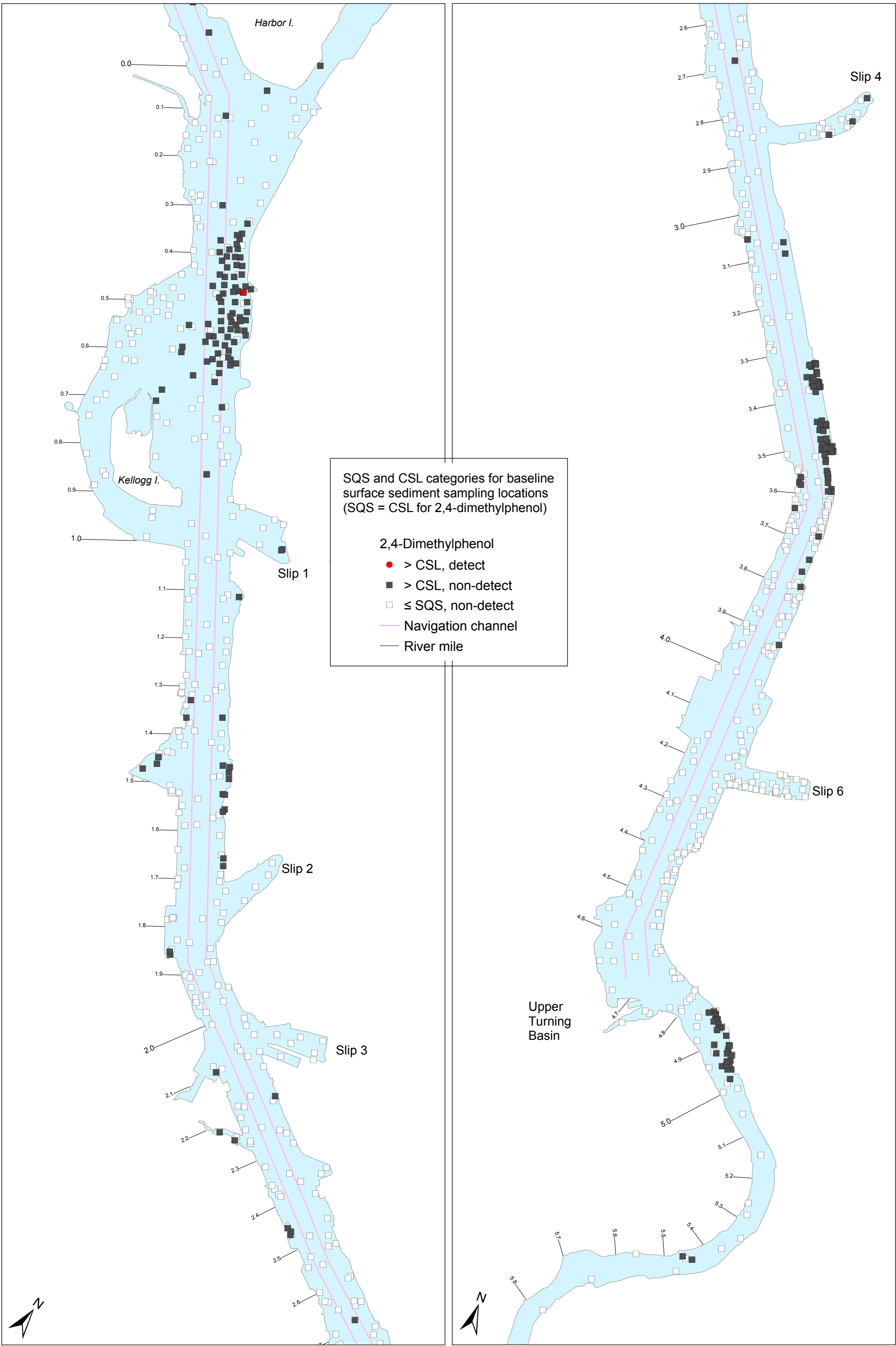


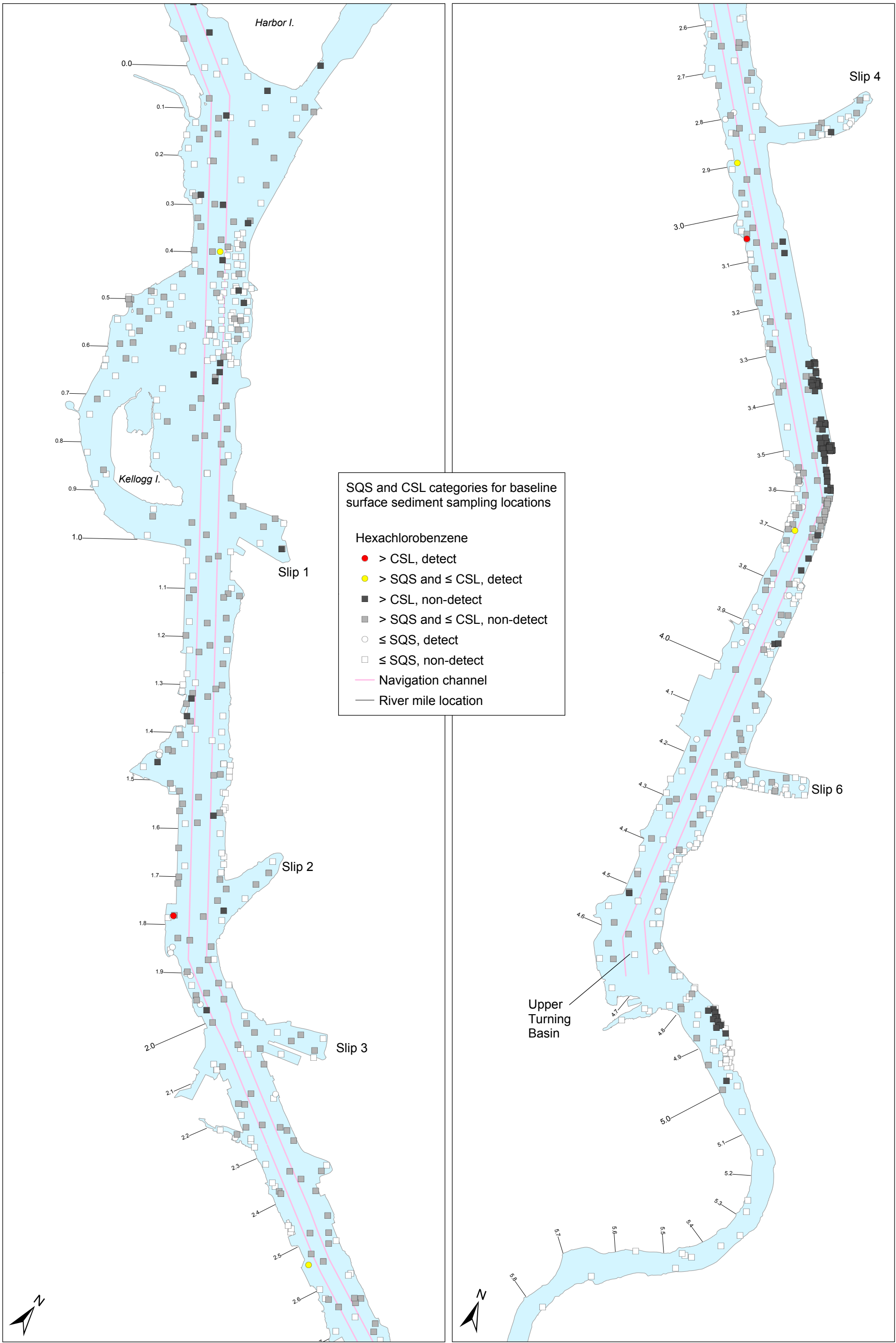
Scale is the same for each inset map

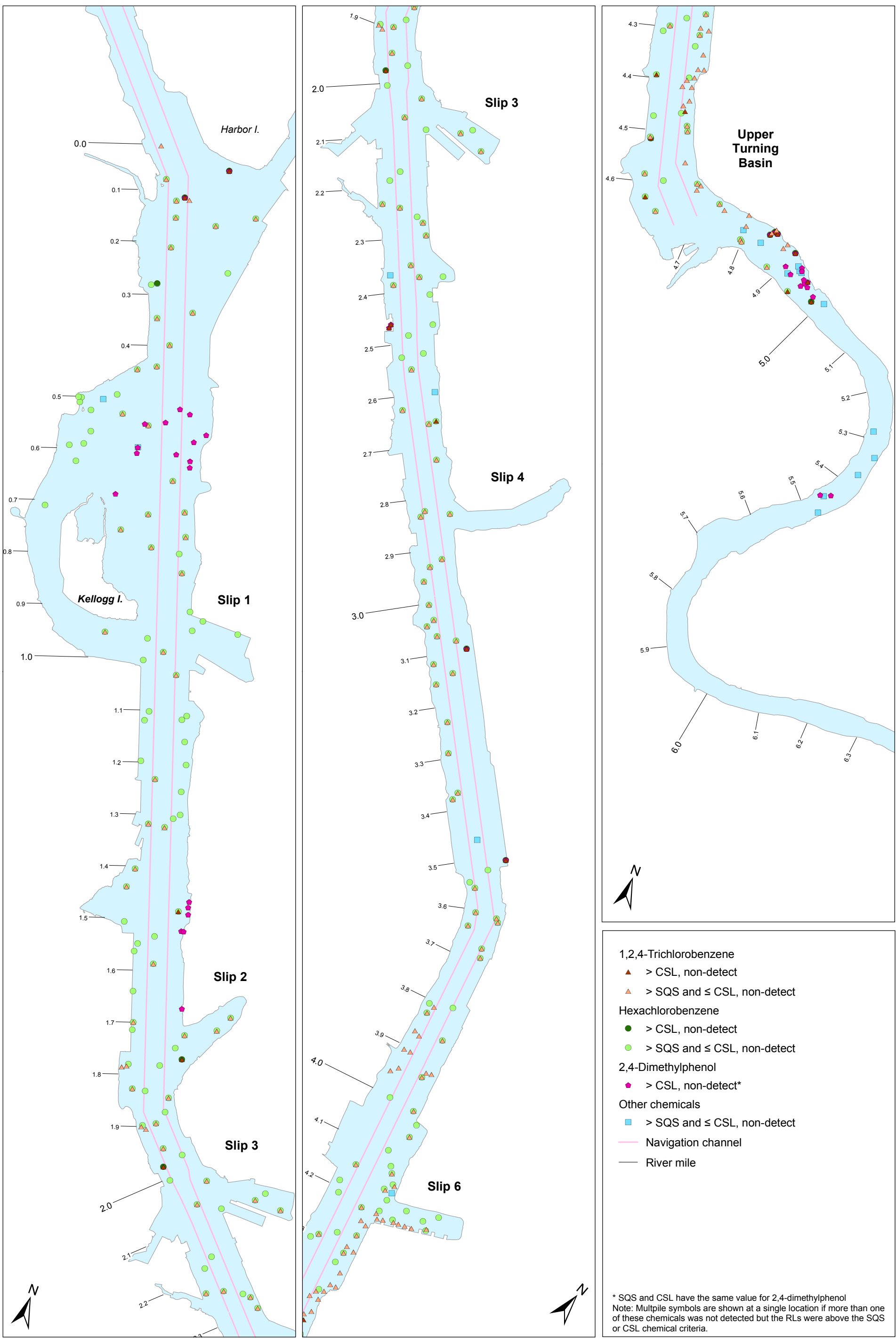
Map A.6-5. Exceedances of SQS and CSL chemical criteria using Thiessen polygons for bis(2-ethylhexyl) phthalate in the LDW baseline surface sediment dataset



Map A.6-6. 1,2,4-Trichlorobenzene detected concentrations and RLs compared to SQS and CSL chemical criteria at baseline surface sediment sampling locations







1,2,4-Trichlorobenzene

- ▲ > CSL, non-detect
- ▲ > SQS and ≤ CSL, non-detect

Hexachlorobenzene

- > CSL, non-detect
- > SQS and ≤ CSL, non-detect

2,4-Dimethylphenol

- ◆ > CSL, non-detect*

Other chemicals

- > SQS and ≤ CSL, non-detect

Navigation channel

River mile

* SQS and CSL have the same value for 2,4-dimethylphenol
Note: Multiple symbols are shown at a single location if more than one of these chemicals was not detected but the RLs were above the SQS or CSL chemical criteria.

Map A.6-9. Baseline surface sediment sampling locations with only non-detect RLs (no detected chemicals) greater than SQS or CSL chemical criteria

