

EPA Tech Memo Summary



- Data Quality Analysis
 - Sample Location and Classification adjustment (e.g. land locked area)
 - Analytical and Sampling Precision
 - Sample Grain Size Distribution with SSS texture
 - Laboratory QA/QC (TCMX)
 - Aroclor and Congeners
- Surface Sediment Concentrations
 - River Reach and River Section
 - Total and Tri+ evaluated
 - Figures - considered ease of use by others
 - Recoverable Sediments
 - Area Weighted Average (fish exposure)
 - Uncertainty analysis of Area-weighted Mean
- Sediment Trend Analysis
- Hot Spot Evaluation
 - Historical definition (50ppm)
 - ROD Criteria
 - Geostatistical Analysis

Hudson River PCBs Superfund Site

TECHNICAL MEMORANDUM

EVALUATION OF 2016 EPA/GE AND 2017 NYSDEC SURFACE SEDIMENT DATA

Prepared by:

Louis Berger US, Inc.

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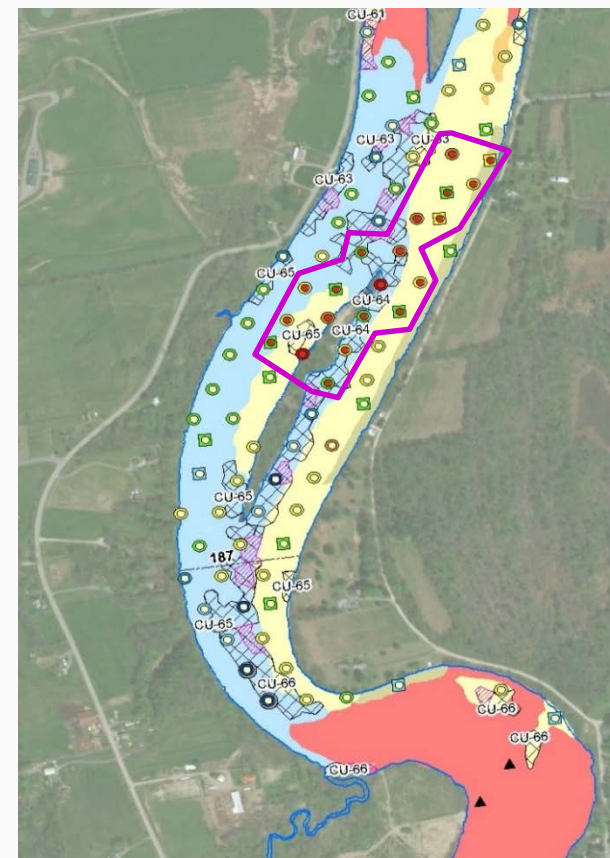
Kern Statistical Services, Inc.

April 2019

Surface Sediment



- Initial scope of work established in 2016
- Sediment samples to be collected every 5 Years – 2016, 2021, 2026, etc
- Program designed to detect 5% annual change in concentration after 10 years
 - Scope of work evaluated prior to each sampling event to confirm statistical power
 - Time is an important consideration in statistical power
- 2016/2017 EPA/NYSDEC Evaluation (>1,400 samples)
 - ~99% of samples are below ROD criteria in both dredged and non-dredged areas
 - 4 locations above ROD criteria
 - 8 locations above RS1 ROD criteria
 - Three localized “areas of interest” were identified - EPA will continue to track
 - As expected, some movement of sediment has occurred into dredged areas
 - Substantial reductions have occurred in surface sediment



Sampling Result Definitions



Successful Locations (Recoverable Sediment)

Sample Attempted → Collection Successful

Potential Data from Location

Gross Physical Observations	Detailed Physical Observations	Chemical Analytical Results
<ul style="list-style-type: none"> Side Scan Sonar Observed Sediment Texture Category Water Depth Vegetation 	<ul style="list-style-type: none"> Soil Classification Grain Size Analysis (if material available) 	<ul style="list-style-type: none"> PCB via M8082 [Aroclors] PCB via 1568c [Congeners]

Abandoned Locations (No Recoverable Sediment)

Sample Attempted → Collection Unsuccessful

Potential Data from Location

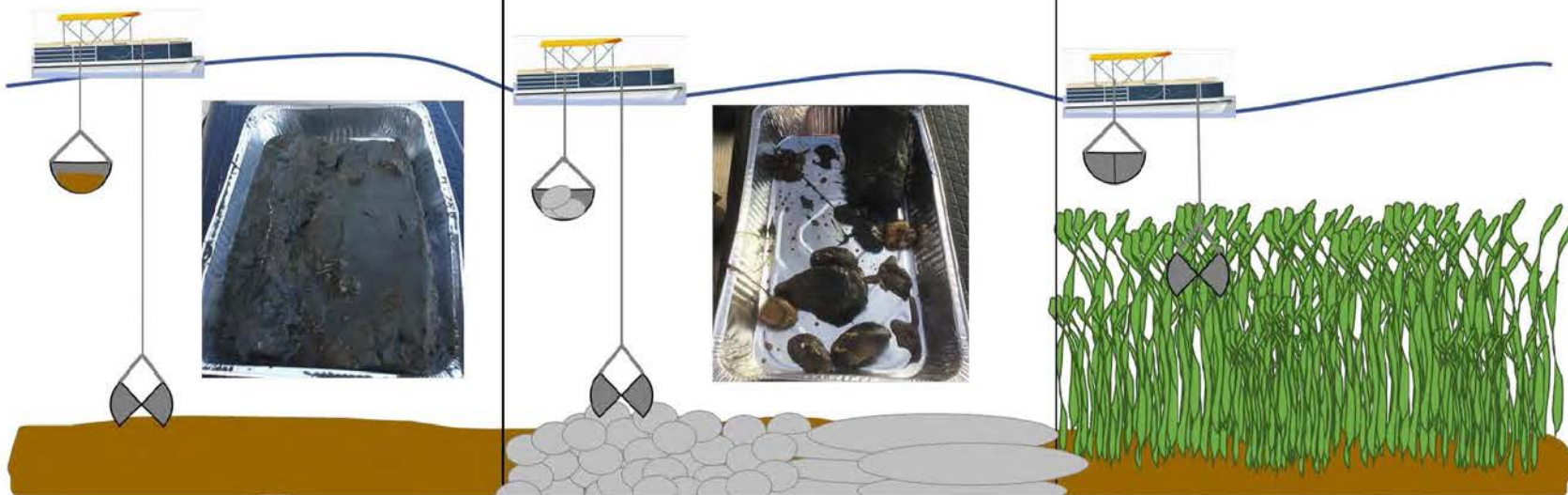
Gross Physical Observations	Detailed Physical Observations	Chemical Analytical Results
<ul style="list-style-type: none"> Side Scan Sonar Observed Sediment Texture Category Water Depth Vegetation 	<ul style="list-style-type: none"> Soil Classification Grain Size Analysis (if material available) 	<ul style="list-style-type: none"> None

Removed Locations (No Available Access to Sediment)

Sediment was not accessible due to vegetation or river conditions

Potential Data from Location

Gross Physical Observations	Detailed Physical Observations	Chemical Analytical Results
<ul style="list-style-type: none"> Side Scan Sonar Observed Sediment Texture Category Water Depth Vegetation 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None



Sample Location Types – Successful, Abandoned and Removed

Figure 2.1-2

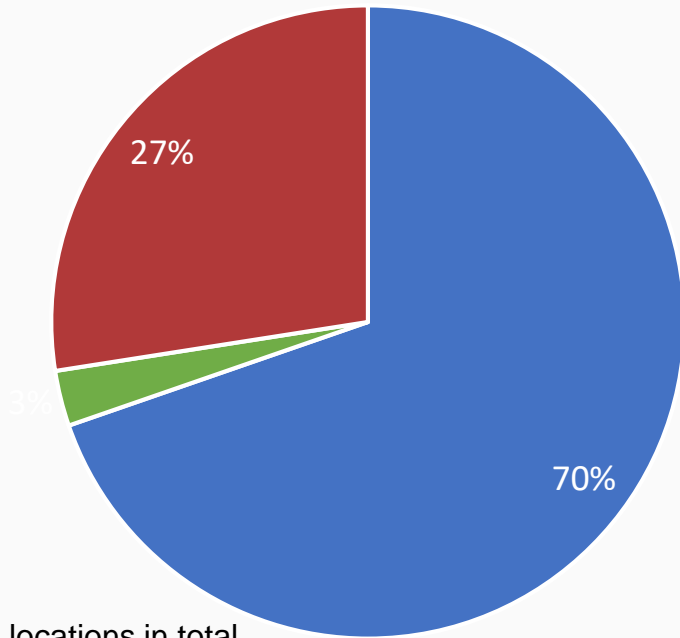
April 2019



Samples collected in 2016 & 2017



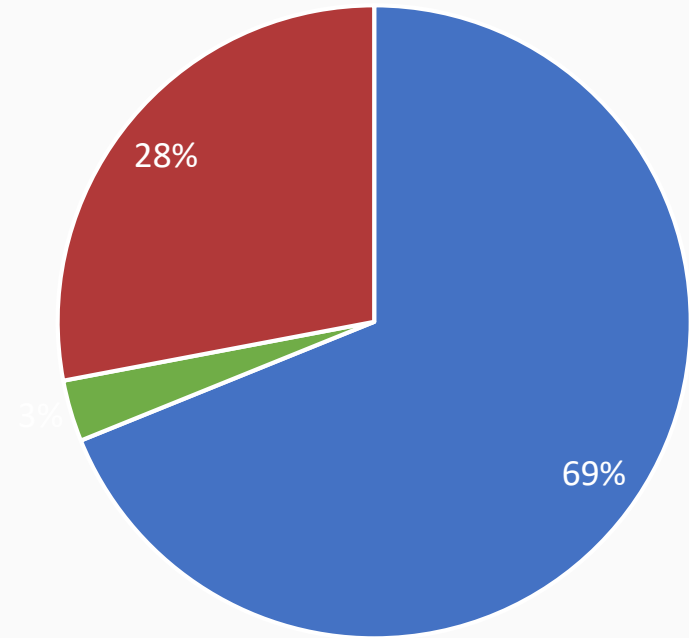
Combined EPA/GE and NYSDEC Sampling Locations for 2016-2017



1,871 locations in total
1,818 attempted locations

- Locations with Recoverable Sediment (Sampled Locations)
- Abandoned Locations (attempted but no sediment recovered)
- Removed Locations (not attempted due to various access issues)

2017 NYSDEC only



1,687 locations in total
1,634 attempted locations

NYSDEC and GE Data Agree within Uncertainty

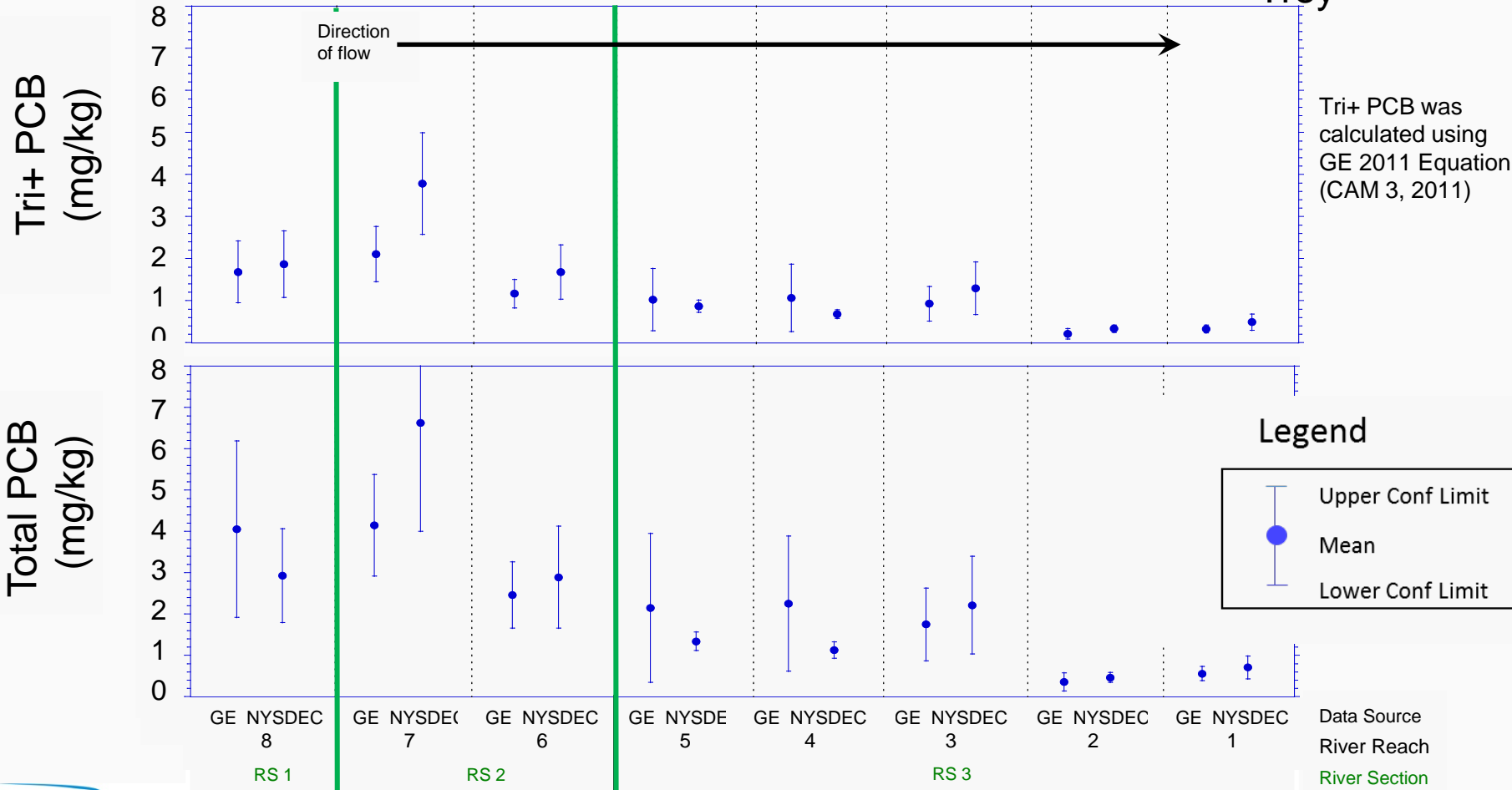


Method 8082
Results

Non-Dredged Areas

Ft Edward

0-2in Troy

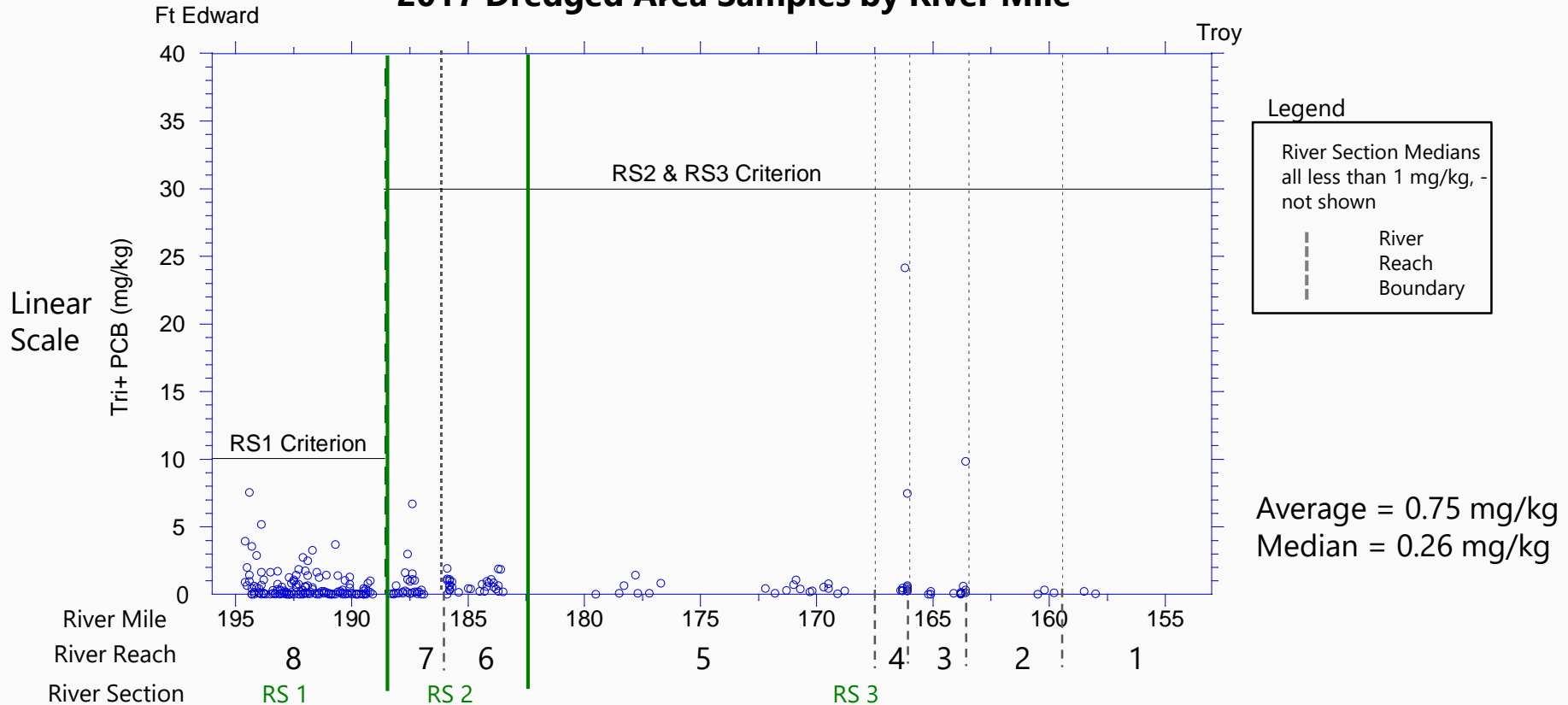


Backfilled Areas Remain at Low Levels:



No evidence for substantive recontamination

2017 Dredged Area Samples by River Mile

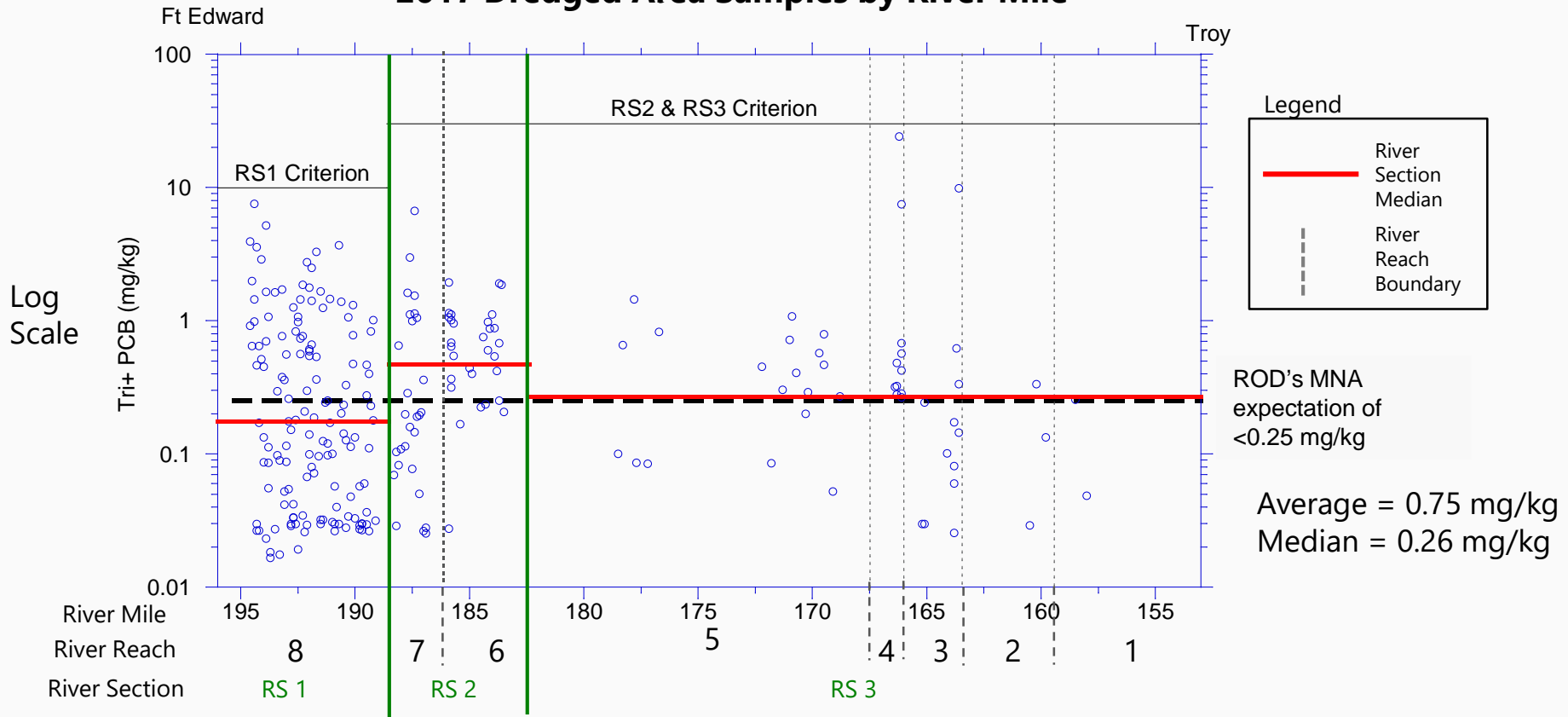


Backfilled Areas Remain at Low Levels



No evidence for substantive recontamination

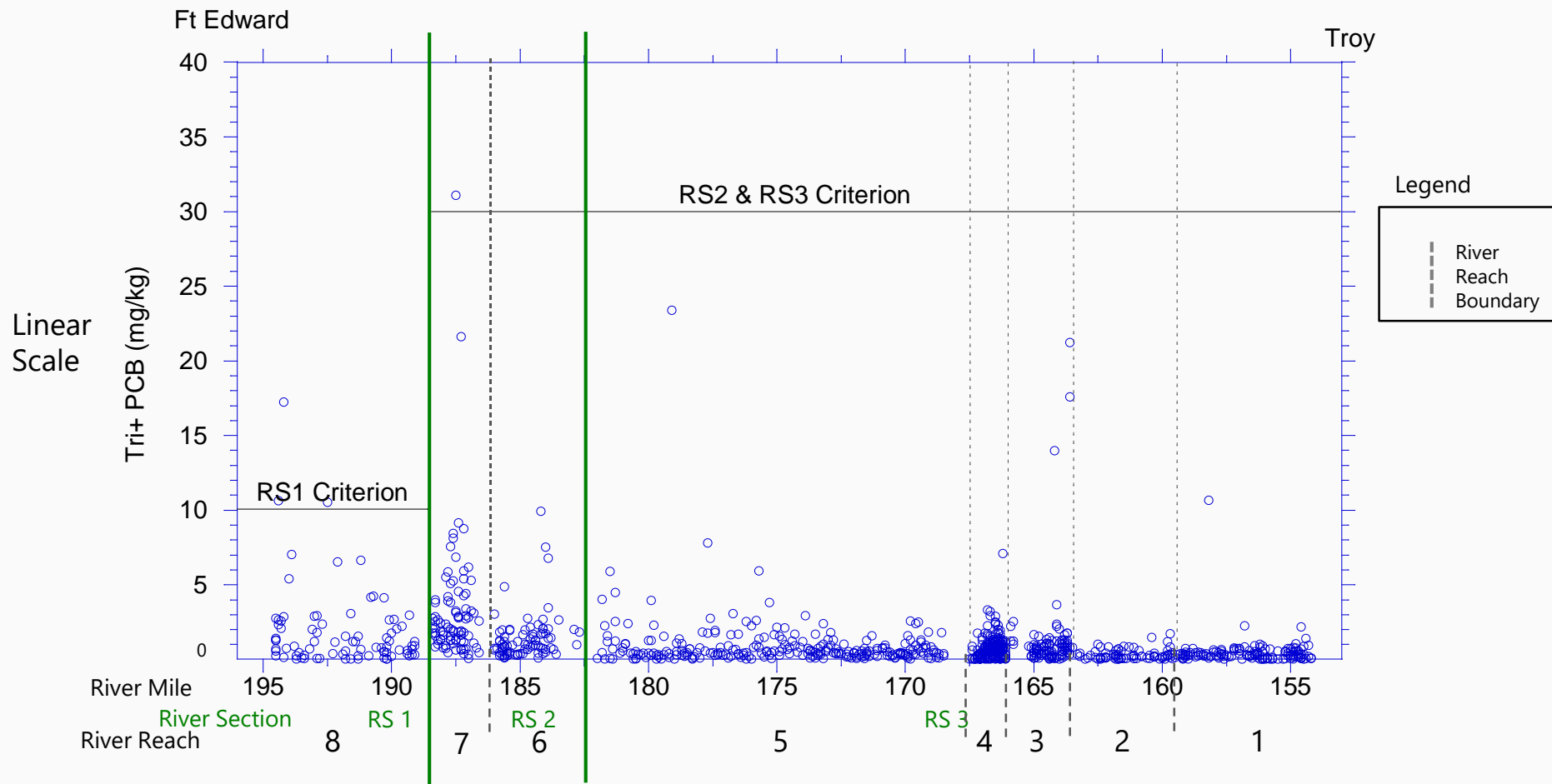
2017 Dredged Area Samples by River Mile



Non-Dredged Areas Generally Low and Decline Downstream:



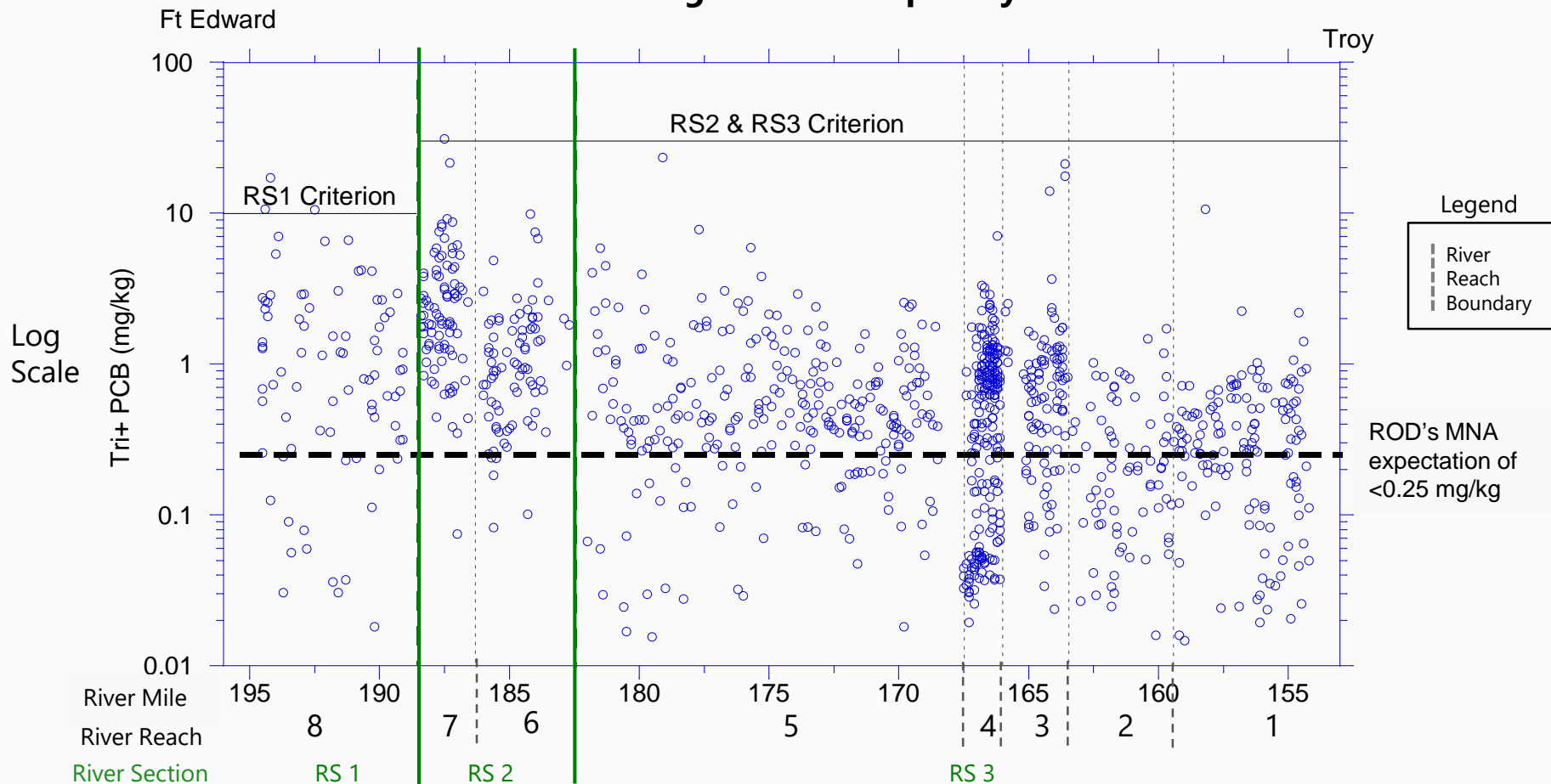
2016 & 2017 Non-Dredged Area Samples by River Mile



Non-Dredged Areas Generally Low and Decline Downstream:



2016 & 2017 Non-Dredged Area Samples by River Mile



ArcGIS “Optimized” Hot Spot Analysis Tool



- An ArcGIS software routine was used to identify statistically significant spatial clusters of higher Tri+ PCB concentrations.
- This routine works by examining each sample within the context of neighboring samples.
- Neighboring samples are identified by a user-specified search radius.
 - A search radius of 250 ft. was used in this analysis. A larger radius was shown to include large areas of low level contamination as hot spots and so was rejected.
- Both 2016 and 2017 surface sediment data were combined for this analysis.
- To be classified as a hot spot, an area must contain several locations whose concentrations are elevated relative to the average Tri+ PCB concentration.
- A single elevated location will not identified as a hot spot unless it is surrounded by other elevated locations.
- This analysis identified three areas where surface concentrations were statistically higher than the average.
 - Only a single location within all the identified areas exceeded the removal criteria.

Areas of Interest Based on “Hot Spot” Analysis



Areas of Interest Based on Hot Spot Analysis

X Exceedance of ROD Criteria

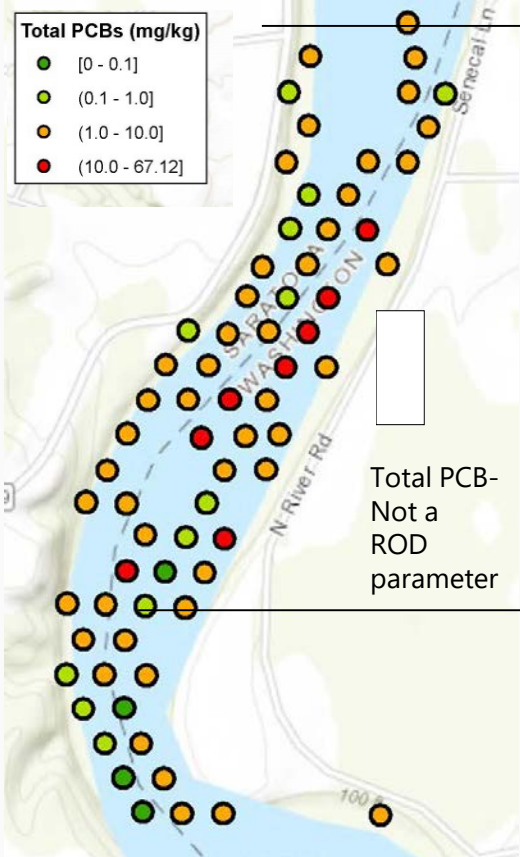
River Reach	Area	River Section 1 Criteria Tri+ PCB >10ppm	River Section 2 & 3 Criteria Tri+ PCB >30 ppm	Total PCB > 50ppm	Geostatistical Locations (include all other samples)	Sample ID	Tri+ PCB Exceedance	Total PCB Exceedance	Notes	Figure
8	Rogers Island	X			--	HR17-OU2-R8-182	17.2		Isolated Elevated Sample	5.2-1 Sheet 1
		X			--	HR17-OU2-R8-191	10.6			
	North of Route 4 Staging Area	X			--	OCU-RS1-9392-010	10.5		Isolated Elevated Sample	5.2-1 Sheet 2
7	Galusha Island	X	X	X	20	HR17-OU2-R7-050	31.1	58.5	Possibly area with relatively higher concentrations compared to the entire surface sediment data set. Other geostatistically-identified samples range between 3 and 10 ppm Tri+ PCBs.	5.2-1 Sheet 4
		X		X		HR17-OU2-R7-041	21.6	60.9		
6										
5	River Mile 179	X		X	--	OCU-RS3-8079-202	24.3	57	Isolated Elevated Sample	5.2-1 Sheet 8
4	Upper Mechanicville Dam	X		X	6	HR17-OU2-R4-060	24.2	67.1	Hot Spot driven by one sample inside dredge area, other samples near-by are less than 3ppm Tri+ PCB. Other geostatistically-identified samples range between 0.3 and 10 ppm Tri+ PCBs.	5.2-1 Sheet 14
3	North of Quack Island	X			--	HR17-OU2-R3-113	14		Isolated Elevated Sample	5.2-1 Sheet 15
	Lower Mechanicville Dam	X			7	HR17-OU2-R3-020	21.2		Possible area with relatively higher concentrations compared to the entire surface sediment data set. Other geostatistically-identified samples range between 0 and 10 ppm Tri+ PCBs.	5.2-1 Sheet 15
		X			--	HR17-OU2-R3-014	17.6			
2										
1	North of Kelts Grove	X			--	HR17-OU2-R1-135	10.7		Isolated Elevated Sample	5.2-1 Sheet 18
Count Total		11	1	4	33					

Area of Interest: Galusha Island (ND1)

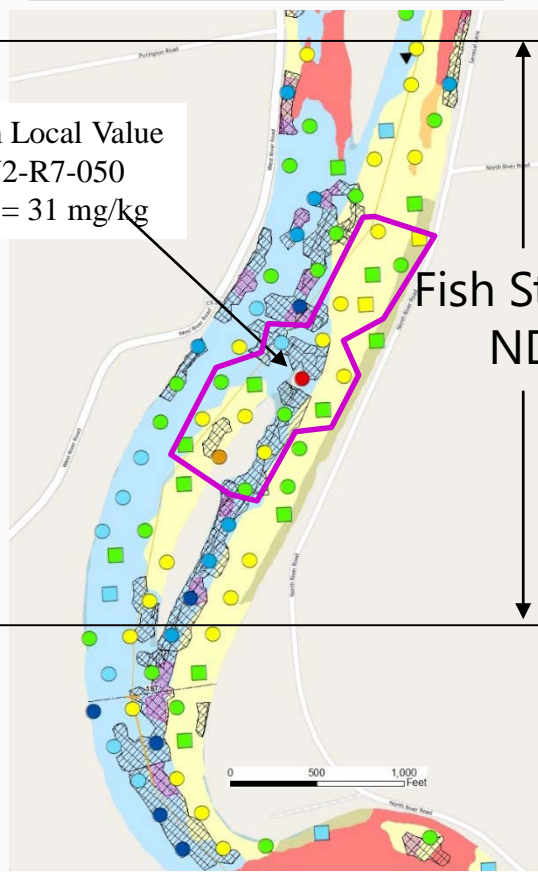


Left-hand panel taken from Scenic Hudson's presentation of Dr. Hennessey's major conclusions on 2017 sediment data, Figure 2.

Right-hand panel created by Louis Berger for USEPA.



Maximum Local Value
HR17-OU2-R7-050
Tri+ PCB = 31 mg/kg



Tri+ PCB-
All except
one
location
fall below
removal
criteria

Fish Station
ND1

Legend

Tri+ PCB Concentration (mg/kg) - $U=1/2RL*0.89$

Dark Blue	<math><0.1</math>
Light Blue	0.11-0.3
Medium Blue	0.31-1.0
Green	1.1-3.0
Yellow	3.1-10.0
Orange	10.1-30.0
Red	30.1-100.0

- NYSDEC Data
- GE Data
- ▲ NYSDEC Abandoned Loc
- ▼ GE Abandoned Loc
- Geostatistically Identified Samples

Diagonal Lines	Dredge Area	Light Blue	Silt
Horizontal Lines	Backfilled Area	Yellow	Silt and Sand
Vertical Lines	Capped Area	Orange	Gravel
Blue Outline	Dam/Lock	Light Green	Transitional
Red Outline	Shoreline	Red	Bed Rock

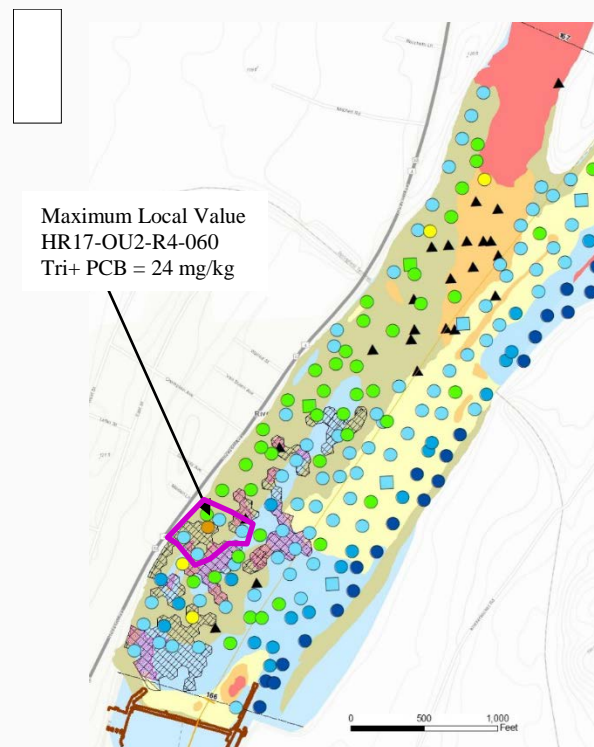
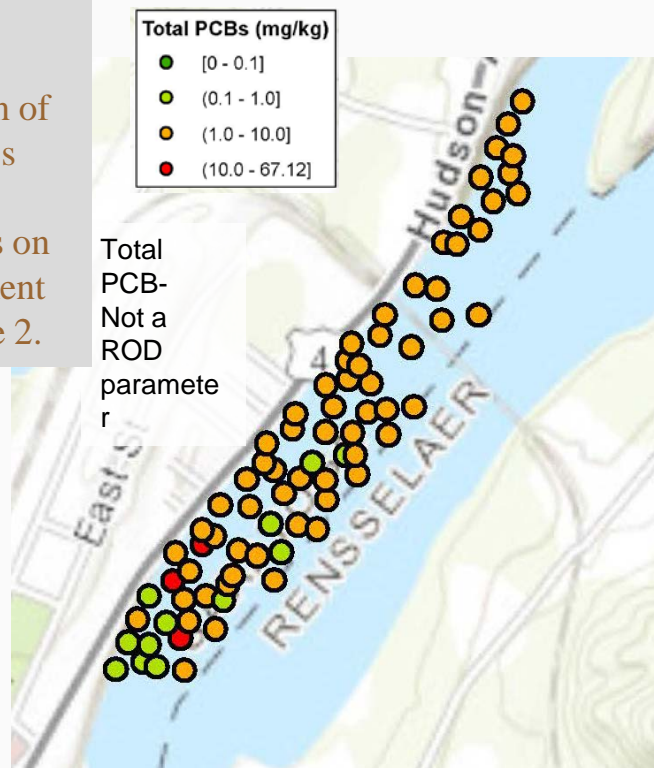
Total PCB (left) and Tri+ PCB (right) Concentrations

Area of Interest: Upper Mechanicville



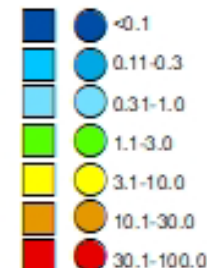
Right-hand panel created by Louis Berger for USEPA.

Left-hand panel taken from Scenic Hudson's presentation of Dr. Hennet's major conclusions on 2017 sediment data, Figure 2.



Legend

Tri+ PCB Concentration (mg/kg) - $U=1/2RL*0.89$



- NYSDEC Data
- GE Data
- ▲ NYSDEC Abandoned Loc
- ▼ GE Abandoned Loc
- Geostatistically Identified Samples

- | | |
|-------------------|----------------------|
| ▨ Dredge Area | Sediment Type |
| ▨ Backfilled Area | ■ Silt |
| ▨ Capped Area | ■ Silt and Sand |
| ▨ Dam/Lock | ■ Gravel |
| ▨ Shoreline | ■ Transitional |
| | ■ Bed Rock |

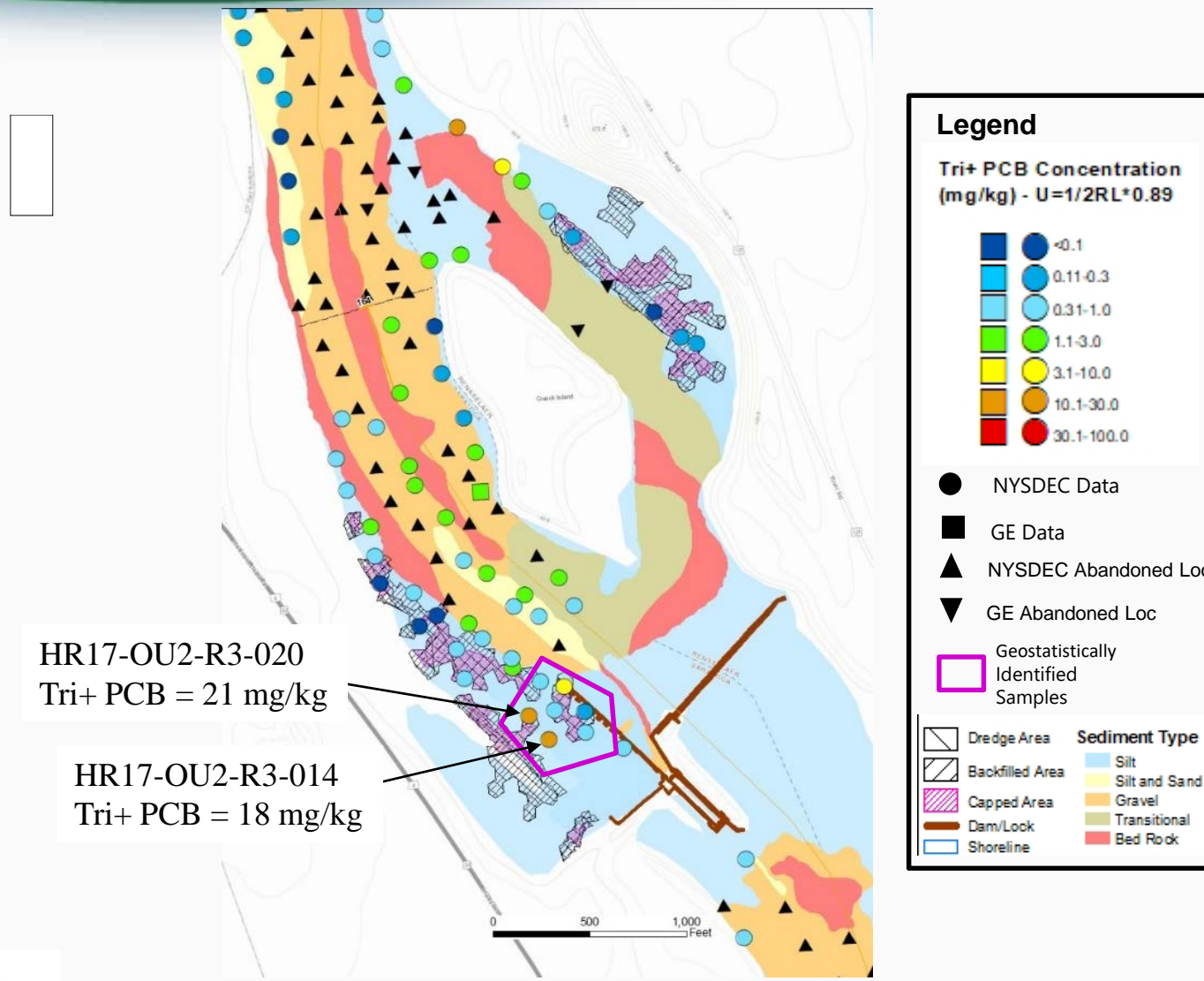
Total PCB (left) and Tri+ PCB (right) Concentrations

Area of Interest: Lower Mechanicville Dam

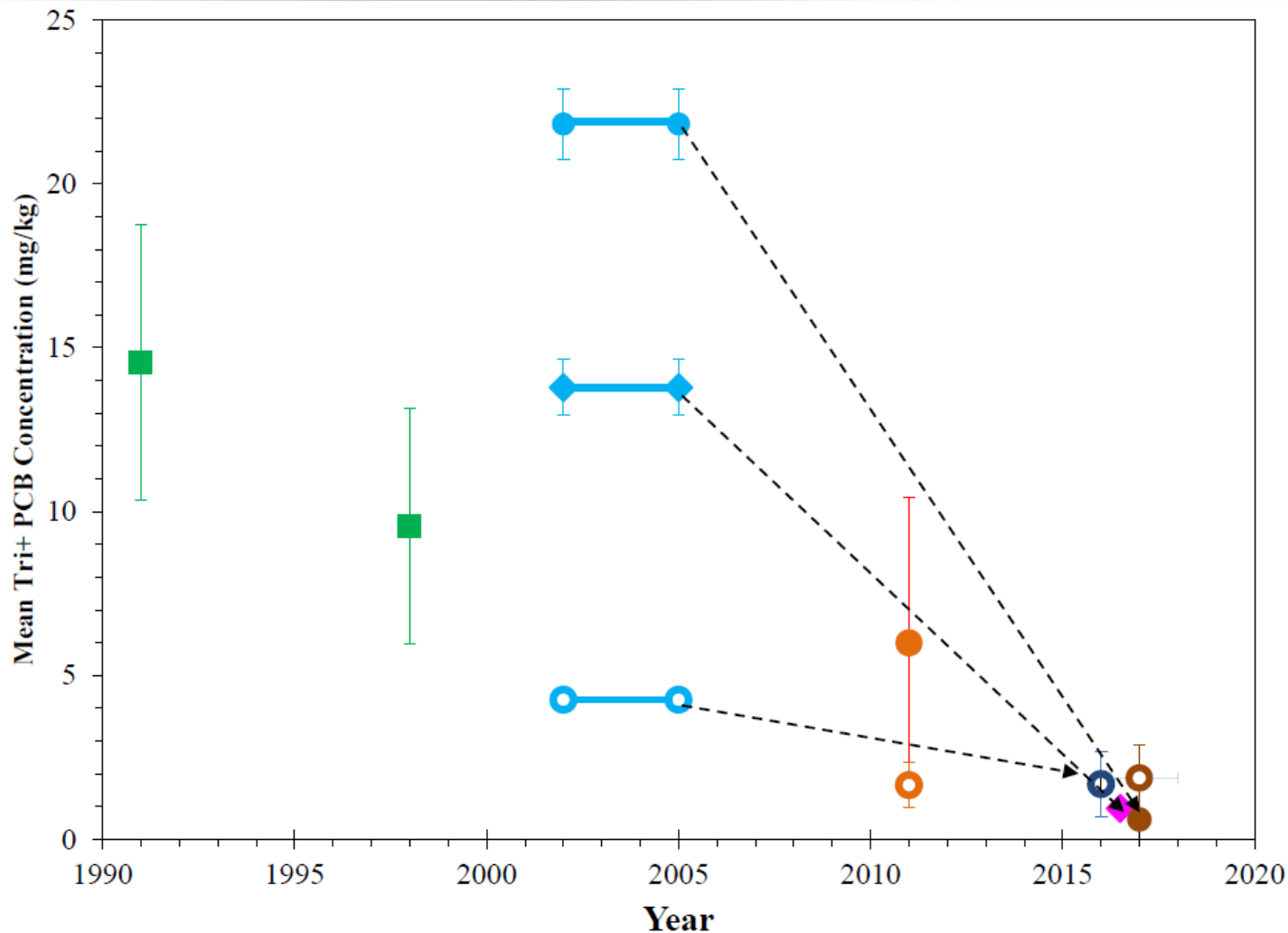


No comparable figure provided by Scenic Hudson for this area

Created by Louis Berger for USEPA.



Data Document a Substantial Reduction in Surface PCB Concentration



Legend

Symbol Shapes

- Dredged Area Average
- Non-Dredged Area Average
- Composite Sample Average
- ◆ Area-Weighted Average

Symbol Colors

- Green: GE Composite Sample Surveys 1991 & 1998
- Blue: GE SSAP Program 2002-2005
- Orange: GE DDS Survey 2011
- Dark Blue: GE OM&M Survey Non-Dredged Areas 2016
- Brown: NYSDEC Study 2017
- Pink: GE & NYSDEC Combined Surveys 2016 + 2017

Confidence Limits

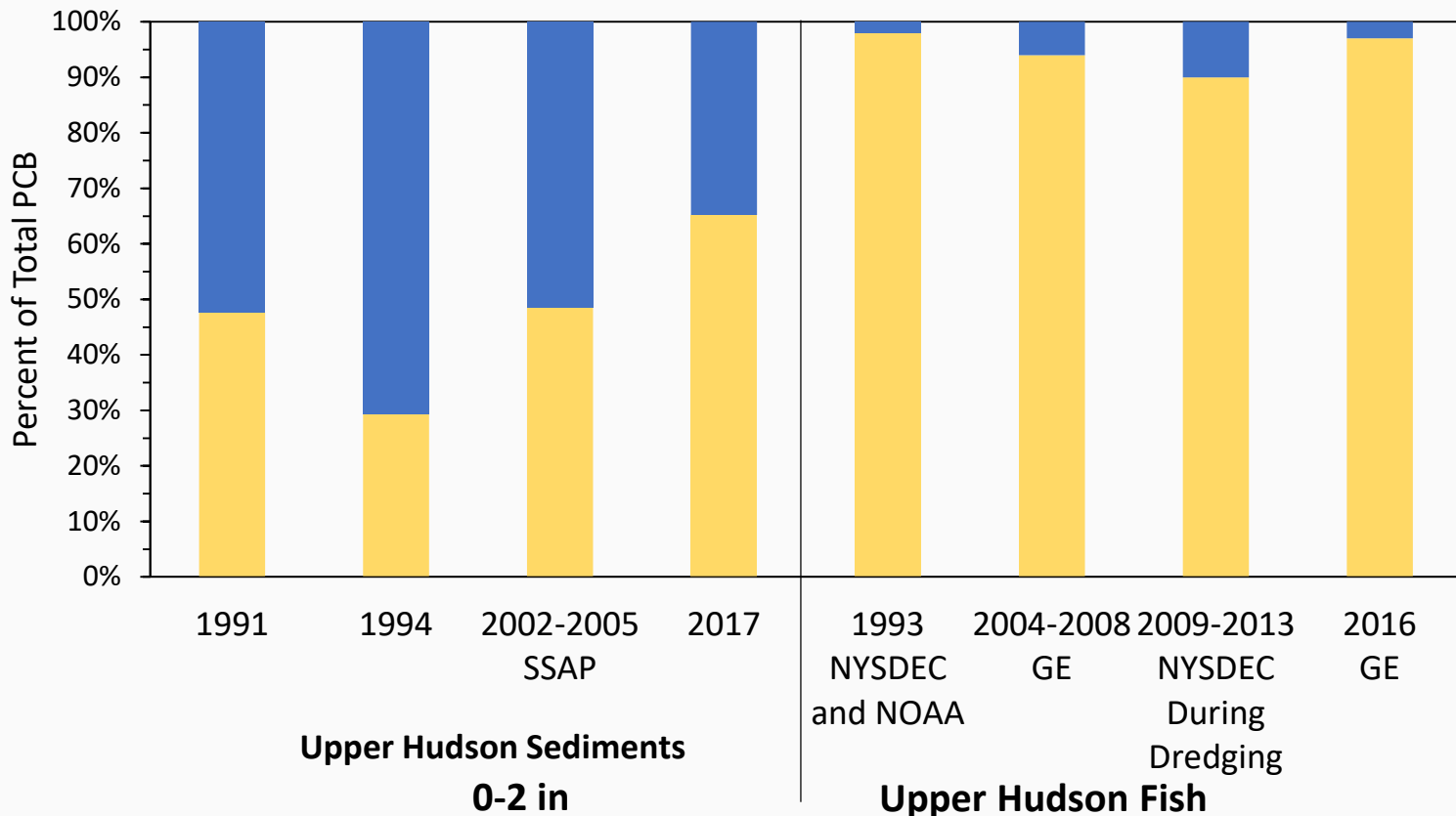
- Vertical line with caps: Upper Conf Limit
- Vertical line with dot: Mean
- Vertical line with caps: Lower Conf Limit

Note: Data sets were collected for various purposes. Therefore, comparison between data sets has limitations and needs proper consideration.

Tri+ PCBs Represent 98% of Fish Body Burdens



Comparison of Tri+ PCB Percentages in Fish and Sediment



ROD focuses on Tri+ PCBs since fish do not accumulate mono and dichloro congeners;

therefore little to no human exposure.

Data Analysis Summary



- GE and NYSDEC data yield similar estimates for sediment PCB concentrations
 - The data can be combined since sampling and analytical techniques as well as observations are the same or similar.
- The remedy significantly reduced PCB concentrations in targeted areas (dredged zones)
 - There has not been substantive recontamination of dredged areas.
- 4 locations exceed the removal criteria, out of a total of 1,800 locations occupied in all three river sections.
- RS 2 and RS 3 meet the RS 1 surface sediment criterion of 10 mg/kg Tri+ in all but 8 locations, out of more than 1,600 locations occupied in RS 2 and RS 3.
- While 3 areas of interest have been identified, there is not evidence for contaminant hot spots.
- Method 1668C comparisons to Aroclor method 8082 has been evaluated
- The 0-2 inch layer is the most appropriate layer for long term monitoring. Recovery of this layer is essential for fish tissue reductions.

Improvements to the System Understanding/ Next Steps



- Data show that dredging effort successfully met ROD criteria
- Minimal elevated surface concentrations in the dredged areas
- Essentially all Upper Hudson sampled locations meet RS 1 surface sediment criterion (10 mg/kg)
- Next sediment collection in 2022 – consideration include:
 - Bathymetric and side scan sonar surveys
 - Beryllium-7 data
 - Additional surface sediment
 - Statistical power needs
 - Areas of interest
 - Reach 7
 - Land cut areas
 - Water and fish data comparisons



Questions?

