Hudson River PCBs Site

Revised Engineering Performance Standards For Phase 2

Prepared for:

US Environmental Protection Agency, Region 2

and

US Army Corps of Engineers, Kansas City District

Prepared by:

The Louis Berger Group, Inc.

December 2010

Table of Contents

List of Tables

Chapter 2 – Statement of the Revised Engineering Performance Standards for Phase 2

Chapter 3 – Residuals Performance Standard

Chapter 4 – Overview of Resuspension Standard for Phase 2

Chapter 7 – Estimation of PCB Mass in Phase 2 Remediation Areas

List of Figures

Chapter 3 – Residuals Performance Standard

Chapter 4 – Overview of Resuspension Standard for Phase 2

Chapter 7 – Estimation of PCB Mass in Phase 2 Remediation Areas

TABLES

CHAPTER 1 TABLES

There are No Tables Associated with this Chapter

CHAPTER 2 TABLES

Table 2.4-1 Proposed Special Studies for Phase 2

WHAT	WHY	HOW
What are the objectives of the Special Study	*Rationale to explain why a particular Special Study is necessary*	*Identify the methods and procedures that will be implemented to perform the Special Study*
Proposed 2011 Special Studies for Residuals Standard		
Establish accuracy of design surface in targeting the 1 mg/kg TPCB elevation	Are the cores that define DoC adequate in removing targeted inventory of PCBs with minimum dredge passes and dredge cuts?	Compare targeted and actual cut lines after residuals sampling shows compliance with Residuals Standard
To quantify and evaluate stability of resettled and redistributed sediments associated with PCBs released during dredging	Are sediments resuspended during dredging redepositing in non-dredge areas?	1. Collocate sediment traps and shallow high-resolution cores based in locations upstream and downstream of areas targeted for dredging for use in sediment trap studies during Phase 2 dredging. 2. Collect sediment samples from the sediment traps and sediment cores for use in the sediment trap studies. 3. Analyze sediment and core samples for the listed parameters for the study using the procedures outlined in the QAPP after segmenting them as planned.
Proposed 2011 Special Studies for Resuspension Standard		
Evaluate the impact of automated sample techniques on PCB concentrations on the collected sample.	Does collection of a water sample using automated techniques alter the PCB concentration of sample, as compared to manual collection methodology?	Composite and individual samples collected using manual methodology will be compared to to composite and individual samples obtained using the automated station.
Characterize the NAPL in sediments slated for removal during Phase 2.	How can the impacts of NAPL in sediments delineated for removal in Phase 2 be addressed?	Collect cores during 2011 at locations occupied during the SSAP/SEDC programs where NAPL was observed. Extract the NAPL from all core sections, and analyze for physical and chemical properties for sections where the sediment TPCB concentration is 500 mg/kg or greater.
Establish baseline surface sediment concentrations.	What are the current surface sediment concentrations downstream of dredging?	Collect surface sediment samples and analyze for radionuclides to locate areas of likely recent or near-recent deposition. Analyze recently-deposited material for PCBs.
Evaluate PCB losses during transport to the far-field	What mechanisms and conditions result in the loss of PCBs from the water column during	Collect samples along boat-run transects in the near-field for comparison to far-field transects.

Table 2.4-1 Proposed Special Studies for Phase 2

WHAT	WHY	HOW
What are the objectives of the Special Study	*Rationale to explain why a particular Special Study is necessary*	*Identify the methods and procedures that will be implemented to perform the Special Study*
	transport from the near-field to the Waterford far-field station?	Time of travel will be considered to ensure that the same parcel of water is obtained in both locations. Also collect depth-integrated, 12 to 24 hour composite and large volume samples upstream and downstream of major tributaries during the far-field transect studies.
Estimate PCB losses from water column over dams.	Could volatilization of PCB NAPLs especially at dam locations potentially explain observed PCB losses in the downstream direction that exceed losses which might be attributed to conventional gas exchange?	Measure PCB concentrations upstream and downstream of dam. Use Lock 5 station as downstream station. Compare with TI Dam and other stations. Sample when NAPL is observed in TIP.
Determine PCB concentrations on suspended matter and dissolved phase concentrations above and below reaches where tributaries enter the river.	Does resuspension and additional solids input from tributaries downstream of the dredging scavenge dissolved PCBs and settle to the sediment bed?	Use vertically-integrated samples over 12 or 24 hours to represent upstream and downstream conditions
Establish the nature of PCB release due to dredging and ancillary activities in the near-field.	What are the properties and phase distribution of Hudson River PCBs in the near- and far-fields?	Instantaneous, vertically-integrated water samples will be collected on boat-run transects in the near-field to evaluate split-phase PCB concentrations, TSS, POC, DOC, grain size distribution, and particle settling speeds.
Proposed 2011 Special Study for Fish		
To evaluate the effect of Pumpkinseed age to the distribution of the PCB concentratons.	Does the age of Pumkinseed explain the wide distribution in PCB concentrations tissue samples in the previous study?	Record the age of individual Pumpkinseed upon yearly sample collection.

CHAPTER 3 TABLES

Table 3.4-1
Compilation of Data for Compliance with Residual Performance Standard

Compliance Category	Use in Nodal Capping Index	River Bottom Category					
		1 Structural offsets	2 Cultural resource areas	3 Shoreline areas	4 Exposed bedrock areas	5 Exposed glacial Lake Albany	6 Silt/Sand/ Gravel Areas
Inventory capped in place	Include in Numerator	o	o	o	o	o	X
Elevated residuals capped	Include in Numerator	o	o	o	o	o	X
Compliant area backfilled	None	o	o	o	o	o	o
Total Node Tally	Include in Denominator	o	o	X	X	X	X

Notes:

o : Area compiled in monthly and annual reporting.

X: Area compiled in monthly and annual reporting and nodes tabulated as part of Nodal Capping Index calculation.

Table 3.4-2 – Total Capped Area Percentage

Acres Dredged	Evaluation Level %	Control Level %
Up to 40.0	13.3	14.7
50.0	13.2	14.6
60.0	13.1	14.5
70.0	13.0	14.4
80.0	12.9	14.3
90.0	12.9	14.1
100.0	12.8	14.0
110.0	12.7	13.9
120.0	12.6	13.8
130.0	12.5	13.6
140.0	12.4	13.5
150.0	12.3	13.4
160.0	12.2	13.3
170.0	12.1	13.2
180.0	12.1	13.0
190.0	12.0	12.9
200.0	11.9	12.8
210.0	11.8	12.7
220.0	11.7	12.6
230.0	11.6	12.4
240.0	11.5	12.3
250.0	11.4	12.2
260.0	11.3	12.1
270.0	11.3	11.9
280.0	11.2	11.8
290.0	11.1	11.7
300.0	11.0	11.6
310.0	11.0	11.5
320.0	11.0	11.3
330.0	11.0	11.2
340.0	11.0	11.1
350.0	11.0	11.0
360.0	11.0	11.0
370.0	11.0	11.0
380.0	11.0	11.0
390.0	11.0	11.6
400.0	11.0	11.0
410.0	11.0	11.0
420.0	11.0	11.0
430.0	11.0	11.0
440.0	11.0	11.0

Table 3.4-3 – Inventory Capped Area Percentage

Acres Dredged	Evaluation Level %	Control Level %
Up to 40.0	3.6	4.0
50.0	3.6	4.0
60.0	3.6	4.0
70.0	3.5	3.9
80.0	3.5	3.9
90.0	3.5	3.9
100.0	3.5	3.8
110.0	3.5	3.8
120.0	3.4	3.8
130.0	3.4	3.7
140.0	3.4	3.7
150.0	3.4	3.7
160.0	3.3	3.6
170.0	3.3	3.6
180.0	3.3	3.6
190.0	3.3	3.5
200.0	3.2	3.5
210.0	3.2	3.5
220.0	3.2	3.4
230.0	3.2	3.4
240.0	3.1	3.4
250.0	3.1	3.3
260.0	3.1	3.3
270.0	3.1	3.3
280.0	3.0	3.2
290.0	3.0	3.2
300.0	3.0	3.2
310.0	3.0	3.1
320.0	3.0	3.1
330.0	3.0	3.1
340.0	3.0	3.0
350.0	3.0	3.0
360.0	3.0	3.0
370.0	3.0	3.0
380.0	3.0	3.0
390.0	3.0	3.0
400.0	3.0	3.0
410.0	3.0	3.0
420.0	3.0	3.0
430.0	3.0	3.0
440.0	3.0	3.0

CHAPTER 4 TABLES

Table 4.2-1
Summary of Resuspension Standard Criteria (Phase 2)

Action Level	Parameter	Required Action
Advisory Level (TSS Concentrations)	• 100 mg/L TSS concentration above ambient as measured in a depth-integrated cross sectional composite sample at the 300 m downstream near-field station.	EPA will determine if operational changes or other response actions are warranted including: • Visual observations of operations; • Discussions with project personnel; • Review of operations records; • Examination of the integrity of containment barriers (if in use); • Examination of barge loading system and barge integrity; • Examination of resuspension associated with tugs, barges, and other support vessels; and • Additional monitoring and/or sampling.
Control Level (Tri+PCB Net Loads)	<u>Cumulative/Seasonal Net Tri+ Loads</u> • The cumulative/seasonal net load criteria for each dredging season are based on 2 percent (at the first far field station which is at least 1 mile downstream of the dredging) and 1 percent (as monitored at the Waterford station) of the Tri + PCB mass to be removed during the dredging season, regardless of stream flow rates <u>Daily Net Tri+ Loads</u> • At all far-field stations except Waterford daily net load of 2 percent or 3 percent of Tri+ PCB mass removed, if concurrent stream flows measured at Fort Edward are under 5000 cfs or above 5,000 cfs, respectively. • At Waterford daily net load of 1 percent or 2 percent of Tri+ PCB mass removed, if concurrent stream flows measured at Fort Edward are under 5000 cfs or above 5,000 cfs, respectively.	If cumulative/seasonal annual PCB load standards is/are exceeded, EPA may require GE to conduct evaluations of the dredging operations and/or implement operational changes in the subsequent seasons If daily loads are exceeded for a sustained period of 21 consecutive days at Waterford or 14 consecutive days at other far-field stations, EPA may require: • Engineering evaluations of the dredging operations • Implementation of operational changes which include slowdown of dredging operations

Table 4.2-1
Summary of Resuspension Standard Criteria (Phase 2)

Action Level	Parameter	Required Action
Control Level (Total PCB Concentration)	• 500 ng/L Total PCBs (confirmed far-field occurrence)	If Total PCB Concentration exceeds 500 ng/L EPA may require: • Evaluations of the dredging operations • Implement BMPs that do not require slow down or shut down the dredging operations If Total PCB Concentration exceeds 500 ng/L for a sustained period of 5 days out of seven, EPA may require: • Initiate dredging operational changes including slowdown or shutdown • Engineering Evaluations • Engineering Solutions

Note: Values for the cumulative load standard for the dredging season and associated daily loads will be calculated when the target mass removal for the season is available.

Table 4.2-2
Far-Field Water Sampling Program Summary

Station	Sampling Method	Analyte and Frequency					
		Water Quality[1]	PCBs, DOC, POC		TSS	Metals and Hardness[1,2]	
		DO, Temp., pH, Conductivity, Turbidity	Routine	Contingency	Routine	Routine	Contingency
Bakers Falls	Manual depth integrated composite at centroid (~center channel)	Monthly	Monthly (7 day. TAT)	NA	Monthly	NA	NA
Rogers Island	Manual (grab) at centroid (~center channel)	Weekly	Weekly (7 day TAT)	Daily manual grab if TI or SV > 500 ng/L, 2 day minimum; TAT reduced to 24 hrs. (only PCBs analyzed)	Weekly (7 day TAT)	NA	NA
Thompson Island	Automated EDI Transect	Continuous	Daily 24-hr composite (PCBs by Aroclor; 8 hr. TAT; POC/DOC 24-hr TAT). Twice/week 24-hr composite (mGBM PCBs, 7 day TAT). Daily 24-hr composite at TI (mGBM PCBs, 24-hr TAT) if both Waterford and Halfmoon on Troy water	2 12-hr. composites/day if flow at FE > 8,000 cfs (Aroclor PCBs; 8 hr TAT) unless both Waterford and Halfmoon are on Troy water. Submit PCB samples in triplicate on next day if PCBs are > 500 ng/L at TI or SV.	Daily 24-hr composite (2 12-hr composites/day if flow at FE >8,000 cfs, unless both Waterford and Halfmoon are on Troy water); all 24-hr TAT	Daily 24-hr composite for total and dissolved Cd and Pb (24 hr. TAT from time of collection)	2 12-hr composites/day (for total and dissolved Cd & Pb) if flow at FE > 8,000 cfs (unless Waterford and Halfmoon are on Troy water). If exceedance, submit composites/day in triplicate for all TAL metals (total and dissolved) plus Hg & Cr6 (24 hr. TAT from time of collection)
Schuylerville	Automated EDI Transect	Continuous	Daily 24-hr composite (24 hr. TAT)	Submit samples for Aroclor PCBs (8 hr. TAT) if TI station down; 2 12-hr. composites/day if flow at FE > 5,000 cfs and TI station is down -- not applicable ifboth Waterford and Halfmoon on Troywater. Submit PCB samples in triplicate on next day if PCBs are > 500 ng/L at TI or SV. No contingency for POC/DOC.	Daily 24-hr composite (2 12-hr composites/day if flow at FE> 5,000 cfs and TI station is down, unless both Waterford and Halfmoon are on Troy water); all 24 hr TAT	Daily 24-hr composite for total and dissolved Cd and Pb(24 hr. TAT from time of laboratory receipt)	2 12-hr composites/day (for total and dissolved Cd & Pb) if flow at FE > 5,000 cfs and TI station is down (unless Waterford and Halfmoon are on Troy water). If exceedance, submit composites/day in triplicate for all TAL metals(total and dissolved) plus Hg & Cr6 (24 hr. TAT from time of laboratory receipt)
Stillwater	Manual EDI Transect	Weekly	Weekly (7 day TAT)	NA	(Same as PCBs)	NA	NA
Waterford	Automated Single Point	Continuous	Daily 24-hr composite (72 hr. TAT)	PCB TAT reduced to 24 hr. if PCBs > 500 ng/L at TI or SV	(Same as PCBs)	Daily 24-hr composite (72 hr. TAT from time of laboratory receipt)	4 6-hr. composites/day (24 hr. TAT from time of laboratory receipt)
Mohawk River	Manual depth integrated composite at centroid (~center channel)	Every other month (May-Nov)	Every other month (May-Nov; 7 day TAT)	If Albany PCBs > WF, collect one sample as soon as practicable. If Mohawk PCBs increase significantly, sample at same frequency as Albany	(Same as PCBs)	NA	NA
Albany/ Troy	Manual depth integrated composite at centroid (~center channel)	Monthly	Monthly (7 day TAT)	Sampling increased to weekly with 24 hr. TAT if PCBs at Waterford > 350 ng/L	(Same as PCBs)	NA	NA
Poughkeepsie	Manual depth integrated composite at centroid (~center channel)	Monthly	Monthly (7day TAT)	Sampling increased to weekly with 24 hr. TAT if PCBs at Albany > 350 ng/L	(Same as PCBs)	NA	NA

Notes:
NA = not analyzed/applicable.
1 These parameters are part of the Water Quality Requirements for In-River Releases of Constituents Not Subject to Performance Standards. Subject to further discussions and negotiations with New York State Department of Environmental Conservation
2 Hardness, total lead and cadmium and dissolved lead and cadmium reported routinely; if criterion for lead or cadmium is exceeded chromium, all TAL total and dissolved metals by EPA Method 208, and hexavalent chromium and mercury added.

Source: Hudson River PCBs Site Phase 1 Remedial Action Monitoring Program Quality Assurance Project Plan, May 2009. Table 2-6.

Table 4.2-3
Off-Season Water Sampling Program Summary[1]

Station	Hudson RM	Sample Type	PCBs, Dissolved OC, Suspended OC, TSS	DO, Temp, pH, Conductivity, Turbidity
Bakers Falls	197.0	Manual at centroid (~center channel)	Monthly	Monthly
Rogers Island	194.2	Manual at centroid (~center channel)	Weekly	Weekly
Thompson Island	187.5	Automated or Manual EDI Transect	Weekly	Weekly
Schuylerville	181.4	Automated or Manual EDI Transect	Weekly (Only performed if elevated PCB loading is observed at TI)	Weekly (Only performed if elevated PCB loading is observed at TI)
Waterford	156	Automated station or Manual EDI Transect	Weekly	Weekly
Mohawk River	--	Manual at centroid (~center channel)	Every other month	Every other month
Albany/ Troy	145	Manual at centroid (~center channel)	Monthly	Monthly
Poughkeepsie	75	Manual at centroid (~center channel)	Monthly	Monthly

Notes:

[1] *Sampling will only be performed when weather/ice conditions permit working safely.*

Source: Hudson River PCBs Site Phase 1 Remedial Action Monitoring Program Quality Assurance Project Plan, May 2009, Table 2-10.

CHAPTER 5 TABLES

There are No Tables Associated with this Chapter

CHAPTER 6 TABLES

There are No Tables Associated with this Chapter

CHAPTER 7 TABLES

Table 7.3-1. Symbols Used in Mathematical Specification of Mass Estimation.			
Symbol	**Definition**	**Units**	**Measurement or calculations**
i	index for core location		
j	index for sections within cores		
L_{ij}	Corrected length of j^{th} core section at i^{th} location	Inches	Measured length of section divided by the fraction of sediment recovered per location.
C_{ij}	PCB in j^{th} core section at i^{th} location	(mg/kg)	Analytical measurement of total PCB concentraiton in each core section
F_{ij}	Fraction solids in j^{th} core section at i^{th} location	Unitless	Measured value for each core section
δ_i	Wet bulk density at the i^{th} core location	(Wet-weight kg/m^3)	Calculated by weighing core tubes and subtraction of mass of overlying water in the tube as well as the mass of the core tubing.
B_i	Dry bulk density at i^{th} location	(Dry-weight kg/m^3)	Calculated value based on fraction solids in each core section and volume and mass of the core at each location. This value is not specific to the core sections, but rather is a fixed value per location.
m_i	mass per unit volume at ith location	(Dry-weight mg/m^3)	
V	In place volume of sediment removed	CY wet sediment	Total volume of sediment removed per certification unit measured by subtraction of pre- and post-dredge bathymetric surveys.
k	Units conversion factor	7.6456E-07	Converts mass estimate from measured units to dry kg PCB

Table 7.3-2. Example Calculation of Length Weighted Average Concentration and Percent Solids.

Depth Interval	Apparent Length (in)	Corrected Length[1] (in)	PCB (mg/kg)	Fraction Solids	Target[2] Section (mg/kg)	Corrected[3] Target Length (L_i)	Weighted tPCB	Weighted Solids	Length Weighted PCB Concentration (C_i) (mg/kg)	Length Weighted Fraction Solids (F_i)
0-2	2	2.5	15.4	0.2	1	2.5	38.5	0.5		
2-12	10	12.5	1.5	0.4	1	12.5	18.75	5		
12-24	12	15	0.8	0.6	1	15	12	9		
Depth of Contamination										
24-36	12	15	0.053	0.6	0	0	0	0		
Total						30	69.25	14.5	2.3	0.48

Notes:

1) For this example the fraction of sediment recovered (recovery) was 0.8, each core section is expanded by a factor of 1/0.8=1.25

2) Target core sections include all core sections shallower than the 1 mg/kg tPCB depth, defined as bottom of the shallowest core section below which no sample value exceeds 1 mg-t**PCB**/kg-sediment dry weight .

3) The target length is corrected for incomplete recovery and is used to define the elevation of contamination and depth of contamination for subsequent mass calculations.

FIGURES

CHAPTER 1 FIGURES

There are No Figures Associated with this Chapter

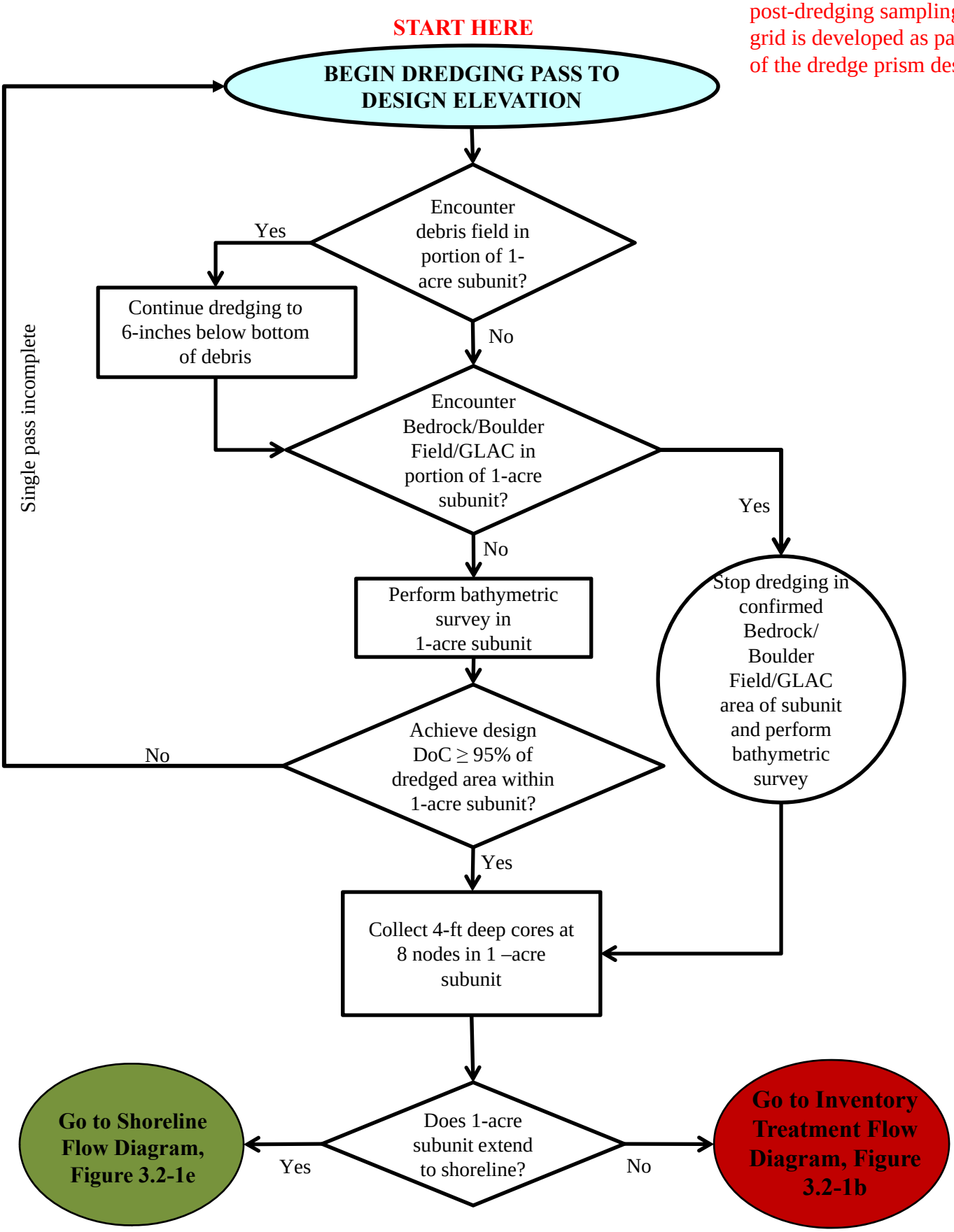
CHAPTER 2 FIGURES

There are No Figures Associated with this Chapter

CHAPTER 3 FIGURES

For 1-Acre Subunit

Assumes proper layout of post-dredging sampling grid is developed as part of the dredge prism design

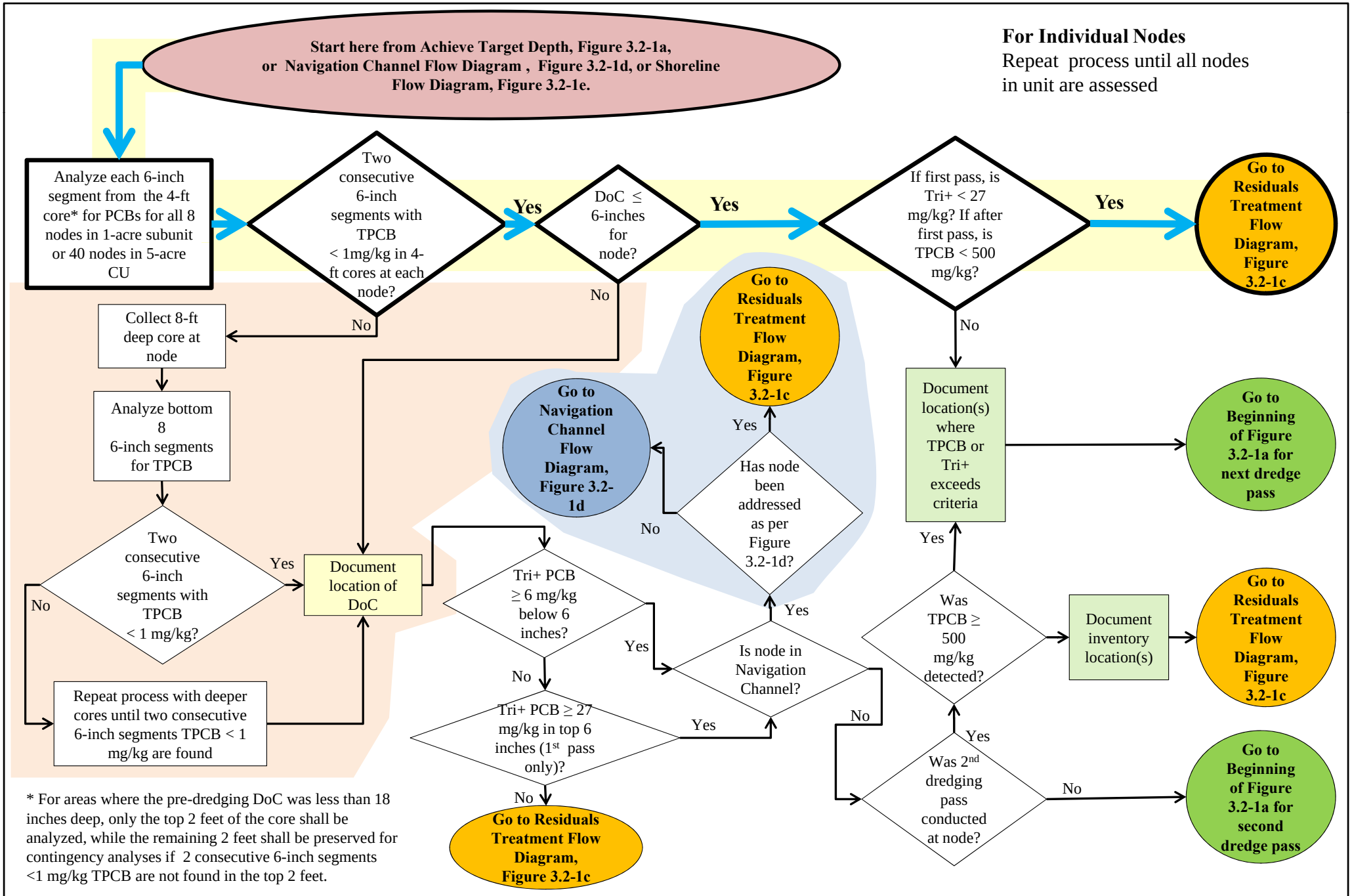


Residuals Standard Flow Diagram for Achieving Target Dredging Elevation

Figure 3.2-1a

Revised EPS for Phase 2 -Hudson River PCBs Site

December 2010



* For areas where the pre-dredging DoC was less than 18 inches deep, only the top 2 feet of the core shall be analyzed, while the remaining 2 feet shall be preserved for contingency analyses if 2 consecutive 6-inch segments <1 mg/kg TPCB are not found in the top 2 feet.

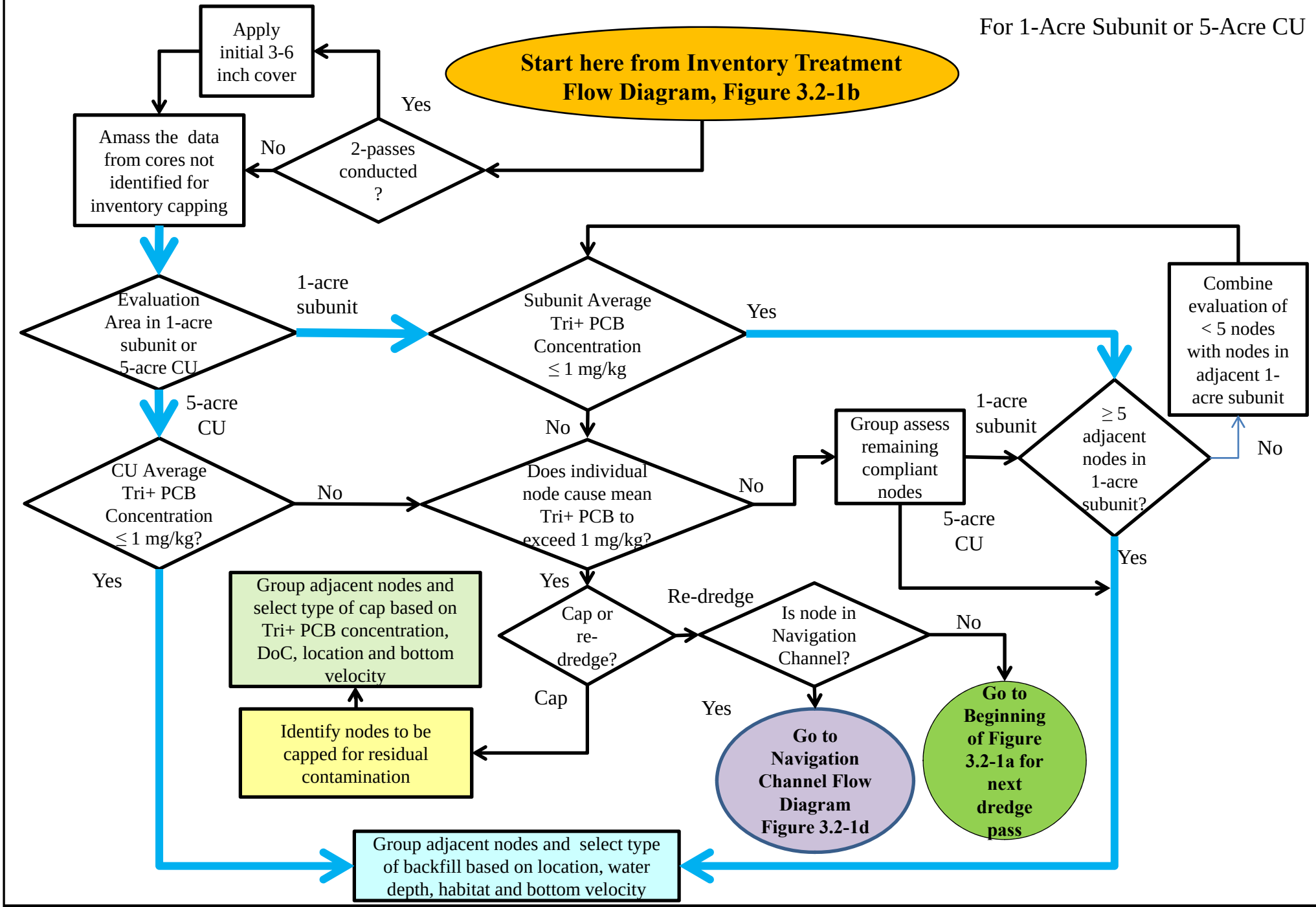
Residuals Standard Flow Diagram (Inventory Treatment)

EPA Revised EPS for Phase 2 - Hudson River PCBs Site

Figure 3.2-1b

December 2010

For 1-Acre Subunit or 5-Acre CU

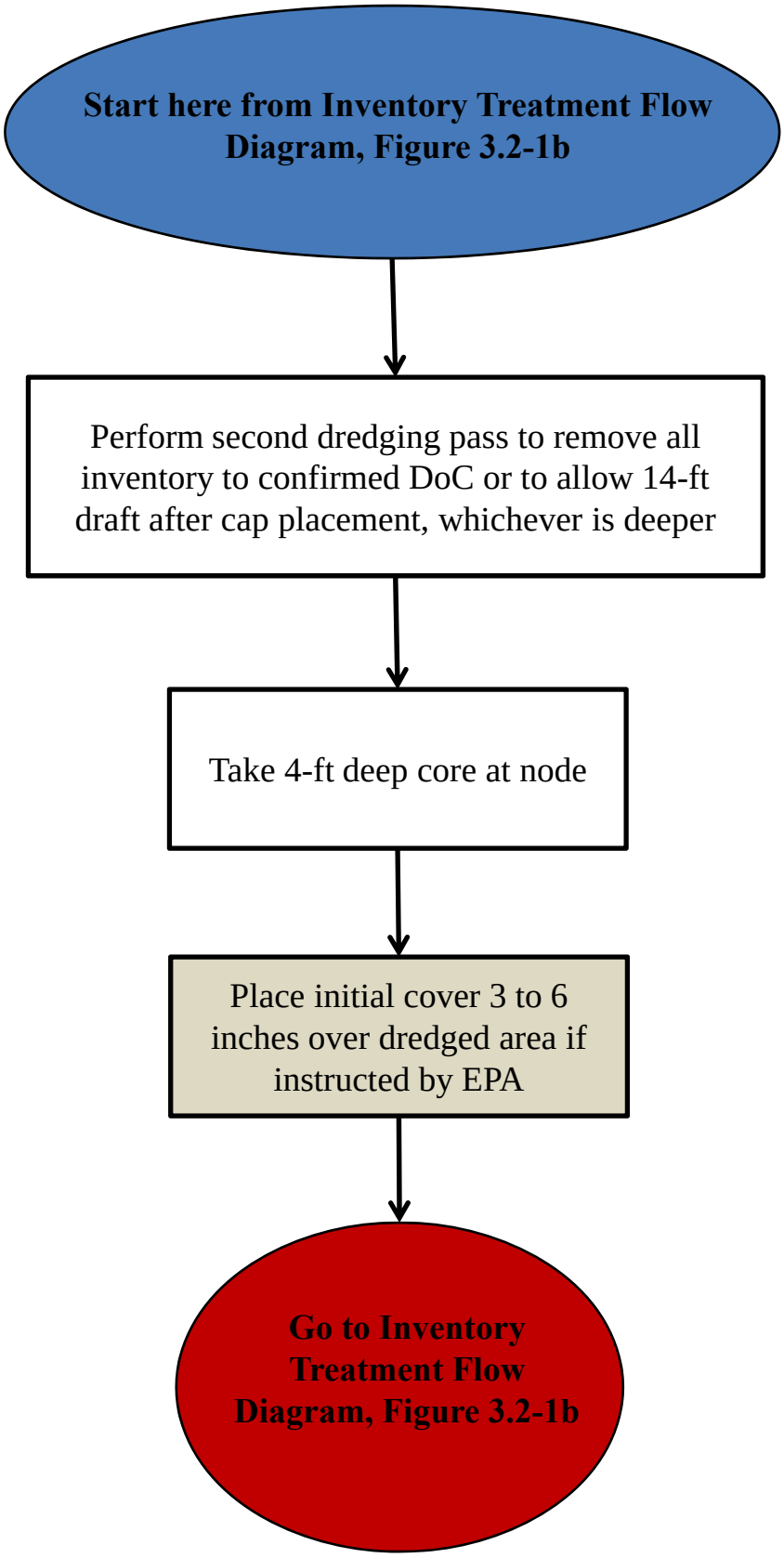


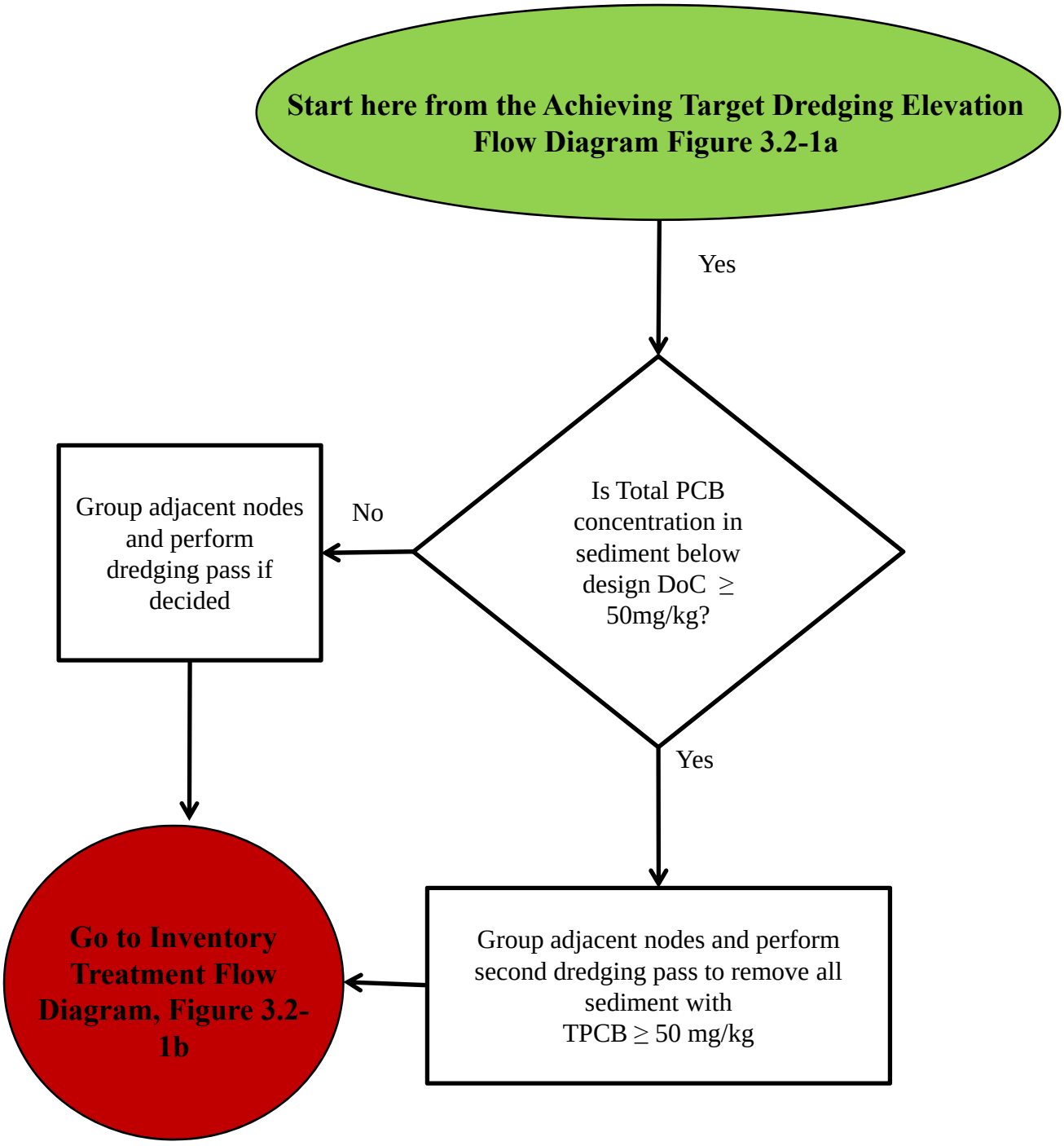
Residuals Standard Flow Diagram (Residuals Treatment)

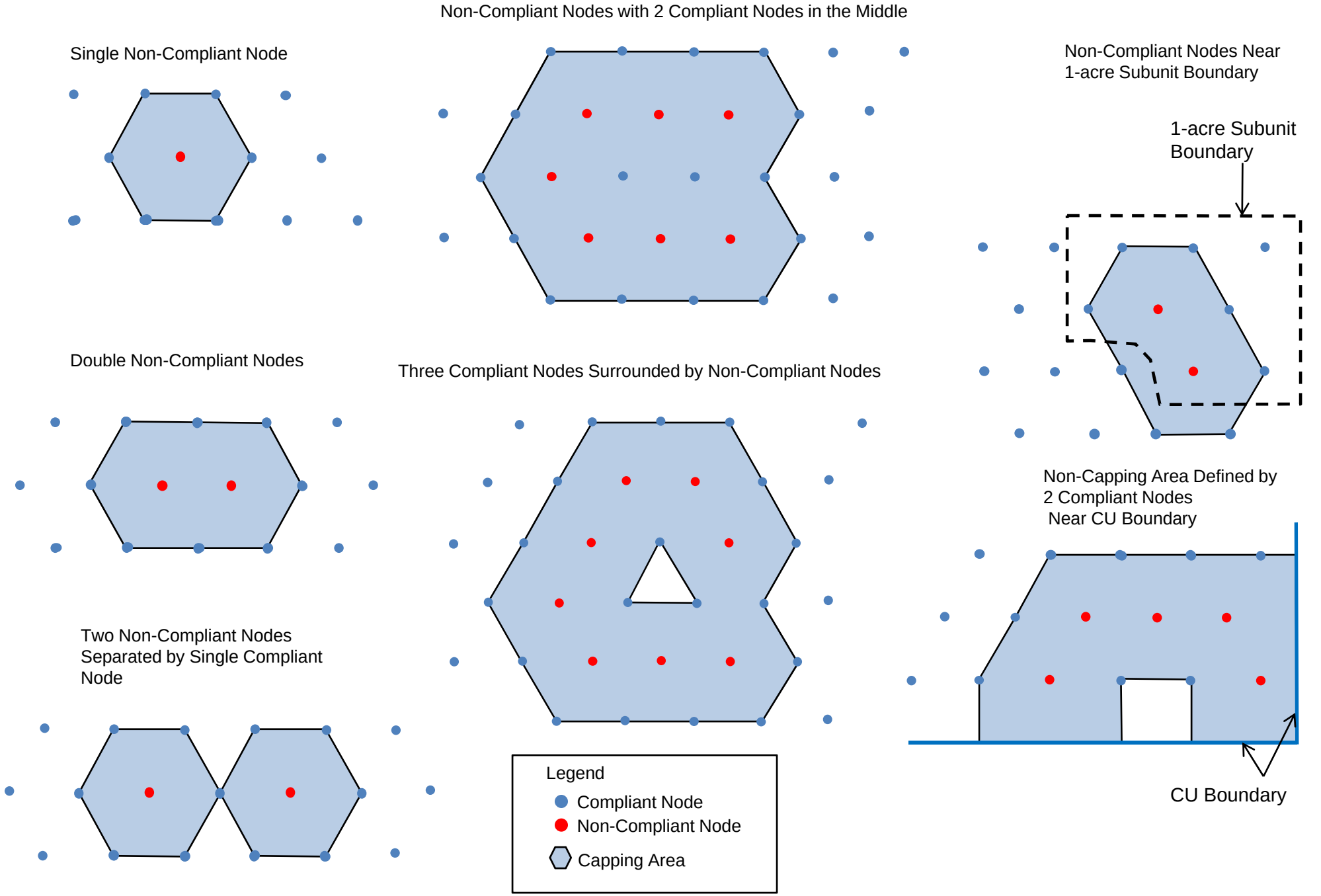
Revised EPS for Phase 2 - Hudson River PCBs Site

Figure 3.2-1c

December 2010


Start here from Inventory Treatment Flow Diagram, Figure 3.2-1b
Perform second dredging pass to remove all inventory to confirmed DoC or to allow 14-ft draft after cap placement, whichever is deeper
Take 4-ft deep core at node
Place initial cover 3 to 6 inches over dredged area if instructed by EPA
Go to Inventory Treatment Flow Diagram, Figure 3.2-1b


Start here from the Achieving Target Dredging Elevation Flow Diagram Figure 3.2-1a
Yes
Is Total PCB concentration in sediment below design DoC ≥ 50mg/kg?
No
Group adjacent nodes and perform dredging pass if decided
Yes
Group adjacent nodes and perform second dredging pass to remove all sediment with TPCB ≥ 50 mg/kg
Go to Inventory Treatment Flow Diagram, Figure 3.2-1b

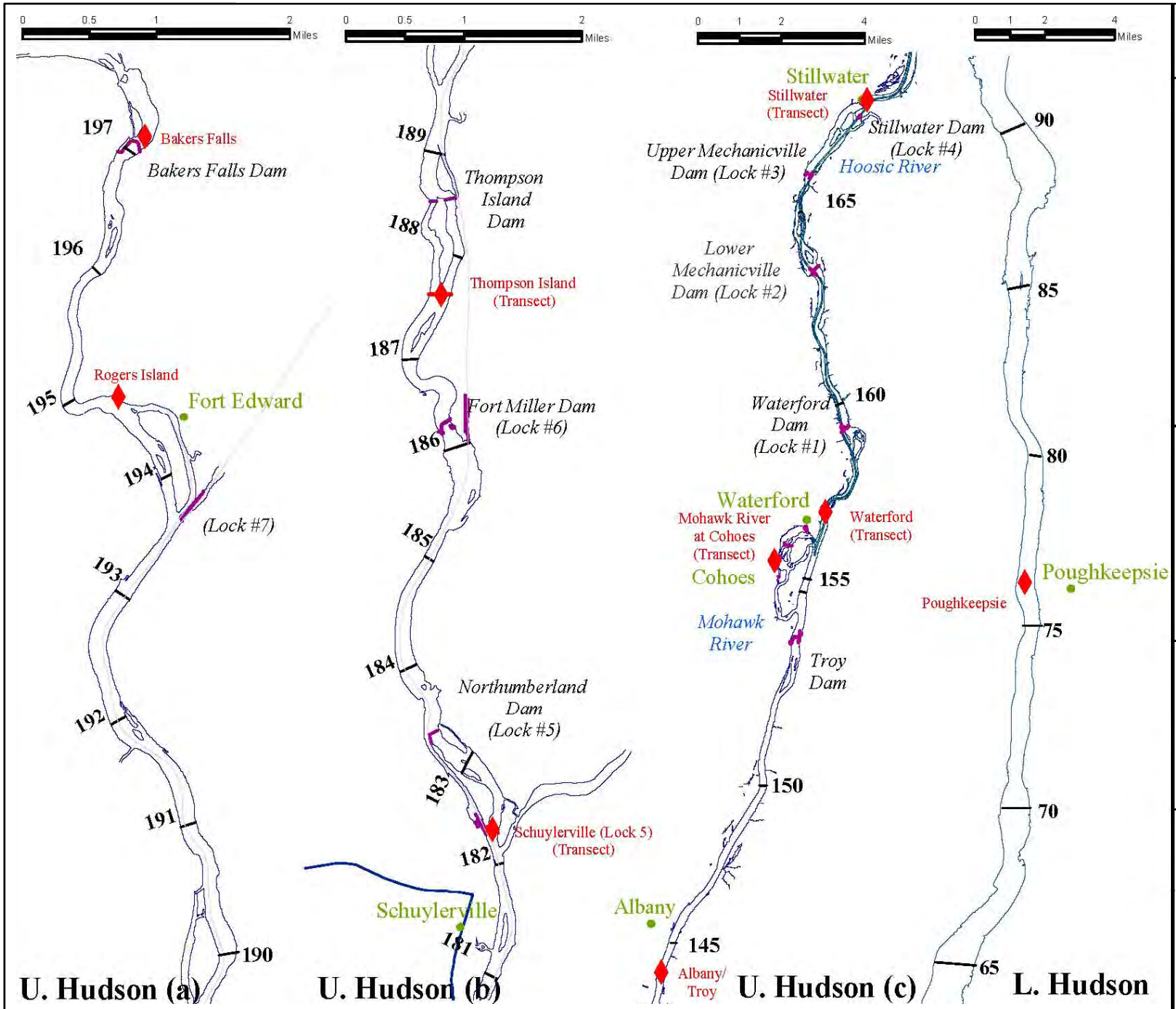


Example Capping Configurations for Phase 2

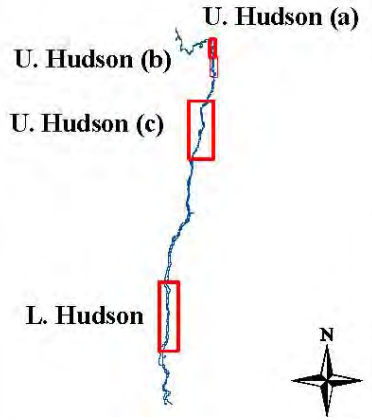
Figure 3.3-1

December 2010

CHAPTER 4 FIGURES



LOCATOR MAP OF THE HUDSON RIVER



LEGEND

- Monitoring Stations
- Champlain Canal
- Dams and Locks
- Shoreline
- River Miles

Source: Anchor QEA ,2009. Phase 1 Remedial Action Monitoring Program Quality Assurance Project Plan. Hudson River PCBs Site. Figure 2-13. May 2009.

Note: River miles measured from the Battery (0.0).

Far-Field Water Monitoring Stations

Revised EPS for Phase 2 - Hudson River PCBs Site

Figure 4.2-1

December 2010

CHAPTER 5 FIGURES

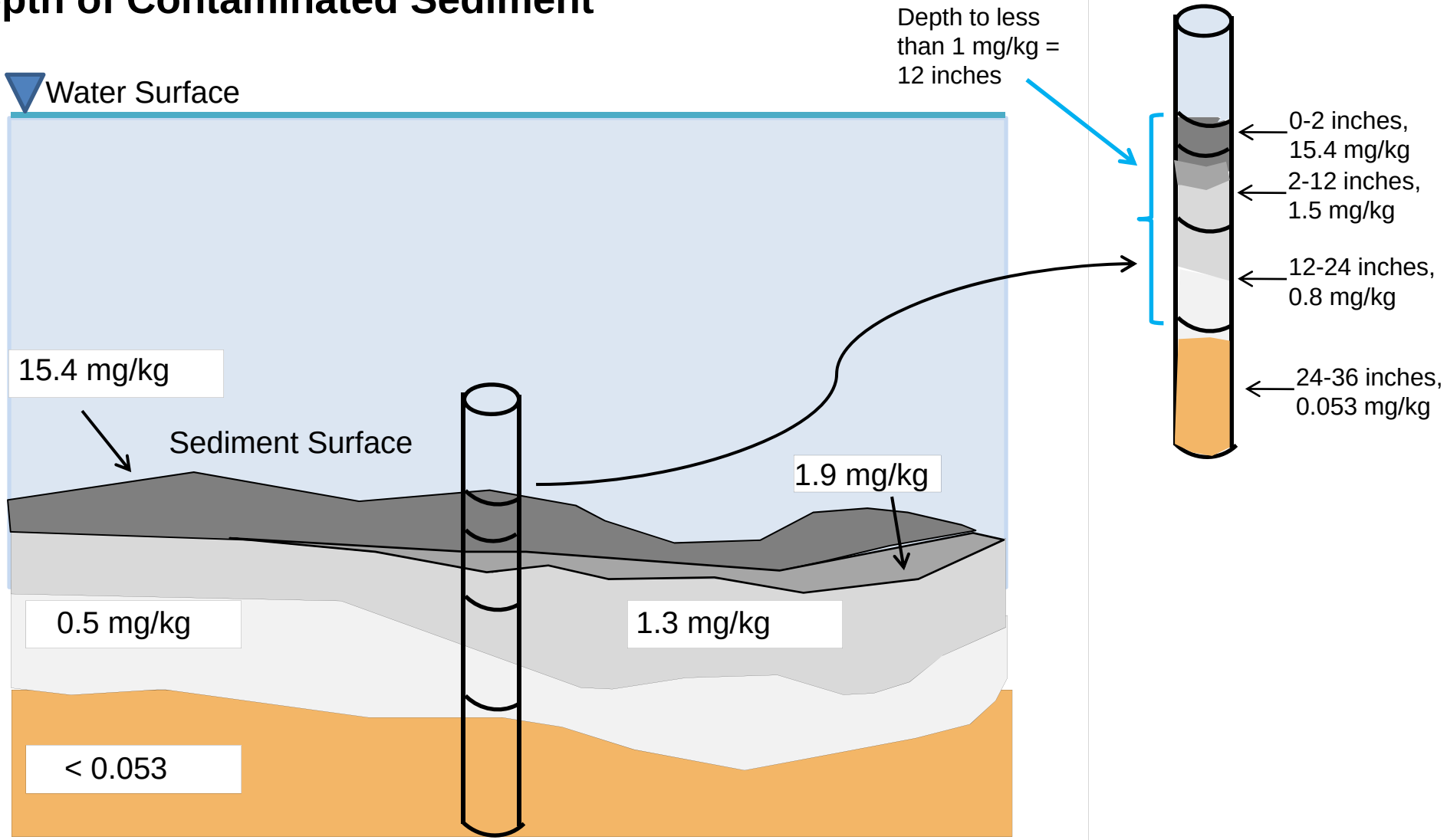
There are No Figures Associated with this Chapter

CHAPTER 6 FIGURES

There are No Figures Associated with this Chapter

CHAPTER 7 FIGURES

Depth of Contaminated Sediment



Note: Depth of contamination is defined as the top of the shallowest core section with total PCB less than 1 mg/kg and no subsequent core section with total PCB exceeding 1 mg/kg. In this case the DoC is at the top of the third core section.