US Army Corps of Engineers
Pittsburgh District

Mahoning River, Ohio
Environmental Dredging Project
Feasibility Study

EASTGATE
Regional Council of Governments

Mahoning River, OH

Sediment Characterization

December 17, 2003

Presented by Michael J. Saffran, P.E.

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- **Project Overview**
- **Mahoning River Recognized as one of the most polluted rivers in U.S.**
- **Pittsburgh District Authorization Section 312 WRDA**
- **Remove and remediate contaminated sediment from navigable waters of U.S.**
- **Reconnaissance Study**
- **Feasibility Study – USACE Project Planning Process**
- **Plan of Study**

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Figure 2- Project Location Map
Mahoning River, Ohio

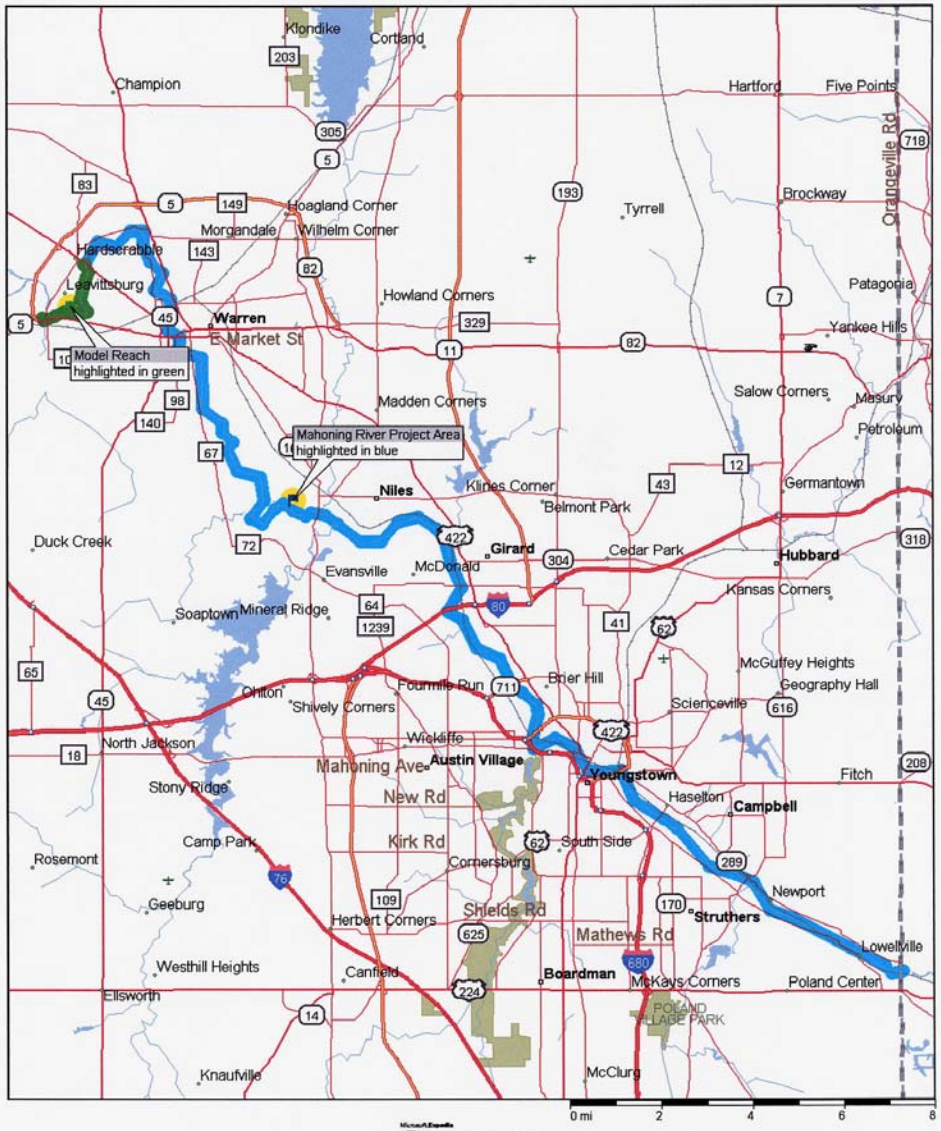

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Figure 2

Project Location Map

• Project Study Plan - Objective

"Restore the aquatic ecosystem and biotic integrity of the Mahoning River within the project area to a level existing on a "Model Reach" on the Mahoning River just upstream of the project area and to eliminate the Ohio Department of Health Human Health Advisory currently in effect."

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Sediment Characterization -Objective

- ***A. Determine the horizontal and vertical distribution of in-river contaminated sediments and contaminated bank material exceeding model reach conditions throughout the study area;***
- ***b. Describe the physical and chemical characteristics of the contaminated sediments (in-river and bank material); and***
- ***c. Determine the volume of in-river and bank contamination.***

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Sampling and Analysis Plan

- 87 Transects
- 9 to 10 Continuous Core Samples – Max area fine sediments
- Geologist Delineate/Describe Soil Horizons
- Select Discreet Samples for Chemical Analysis
- Collect composite samples for Geotech and Chem

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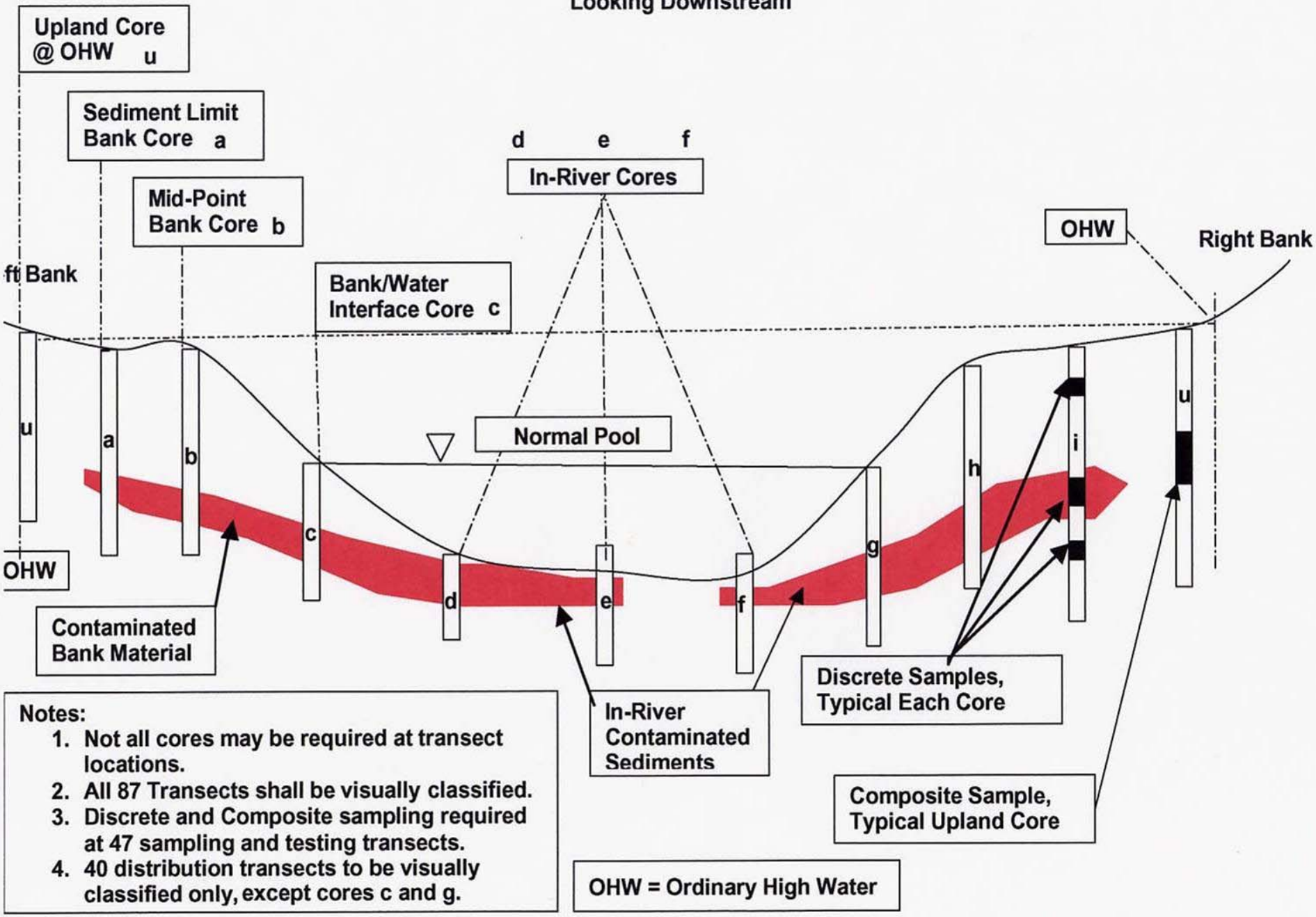
TABLE B-1

TYPICAL TRANSECT

Looking Downstream



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Field Sampling

- **Altech Role**
- **Coleman Engineering Role**
- **Probe rod**
- **Lexan® tube or Macro-Core®**

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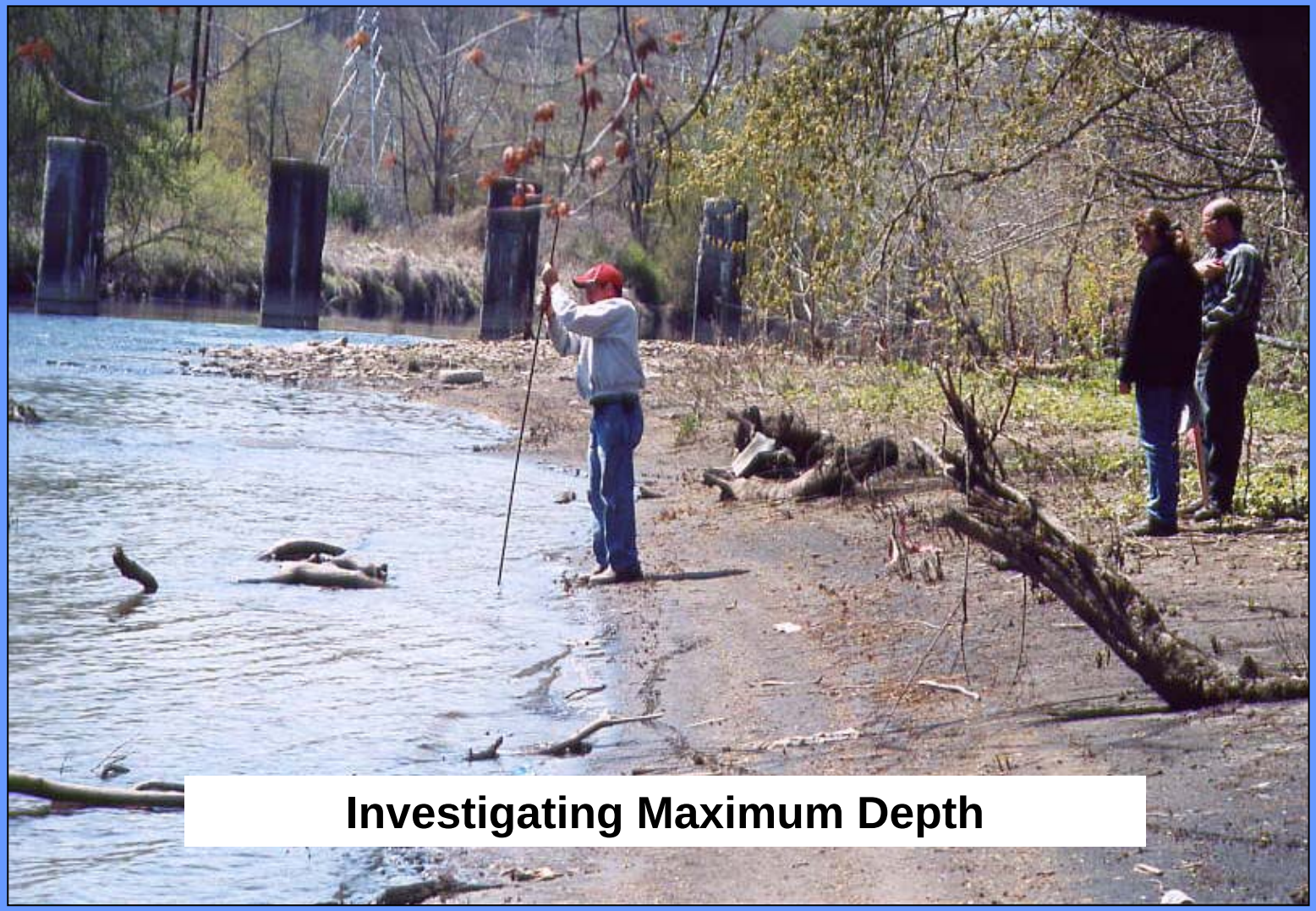

Investigating Maximum Depth

Hole No. 68c

BORING LOG	DIVISION: Lakes and Rivers	INSTALLATION: Pittsburgh District	SHEET 1 OF 1 SHEETS

1. PROJECT	Mahoning River Feasibility Study
2. LOCATION (Coordinates or Station)	N 2484785.91 E 521661.99
3. DRILLING AGENCY	Coleman Eng. Co.
4. HOLE NO. *(As shown on drawing title and file number)*	68c
5. NAME OF DRILLER	Doug Lantagne
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN (ft)	7.2
8. DEPTH DRILLED INTO ROCK (ft)	0.0
9. TOTAL DEPTH OF HOLE (ft)	7.2
10. SIZE AND TYPE OF BIT	2-inch x 8-feet Lexan
11. MANUFACTURER'S DESIGNATION OF DRILL	Manual Drive - Slide Hammer
12. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	COMPOSITE 0 / DISCRETE 4
13. DEPTH GROUND WATER (ft)	NR
14. ELEVATION GROUND WATER (ft)	NR
15. SURFACE ELEVATION (ft)	824.0
16. DATE HOLE	STARTED 6/20/03 / COMPLETED 6/20/03
17. TOTAL CORE RECOVERY FOR BORING	69 %
18. GEOLOGIST	Melissa Cruickshank

DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	Sample I.D.	CHEMICAL RESULTS
0.0					
0.1		Soft, grayish brown, Silty Clay, wet, (CL).	69	68c1	TRPH TRPH = 420 mg/kg
		Soft, grayish green, Clayey Silt, fine sand, wet, (ML).		68c2	TRPH TRPH = 580 mg/kg
2.5		Soft, brown, Silty Clay, saturated, (CL).		68c3	TRPH TRPH = 850 mg/kg
5.0		Soft, black, Silty Clay, saturated, (CL) Oily sheen, odor, refusal at 7.2 ft, potential contamination from 5 to 7.2 ft.		68c4	TRPH TRPH = 1400 mg/kg
7.2					

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Project

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Example of Boring Log

NOTE: 4 distinct layers, each sampled for TRPH.

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Contamination Assessment

- Ohio EPA Generic Concentration Numbers – Human Health Criteria
- Model Reach Chemical Conditions – Criteria to Restore Biotic Integrity

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Sediment Characterization

- **Leavittsburg - Leavitts Street Dam Pool**
- **Transect 1**
- **Leavittsburg - Lover's Lane Dam Pool**
- **Transects 2, 3 and 4**
- **Warren - North River Road Dam Pool**
- **Transects 5 through 12**
- **Warren - Summit Street Dam Pool**
- **Transects 13 through 19**

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Example of Coring Location Plan

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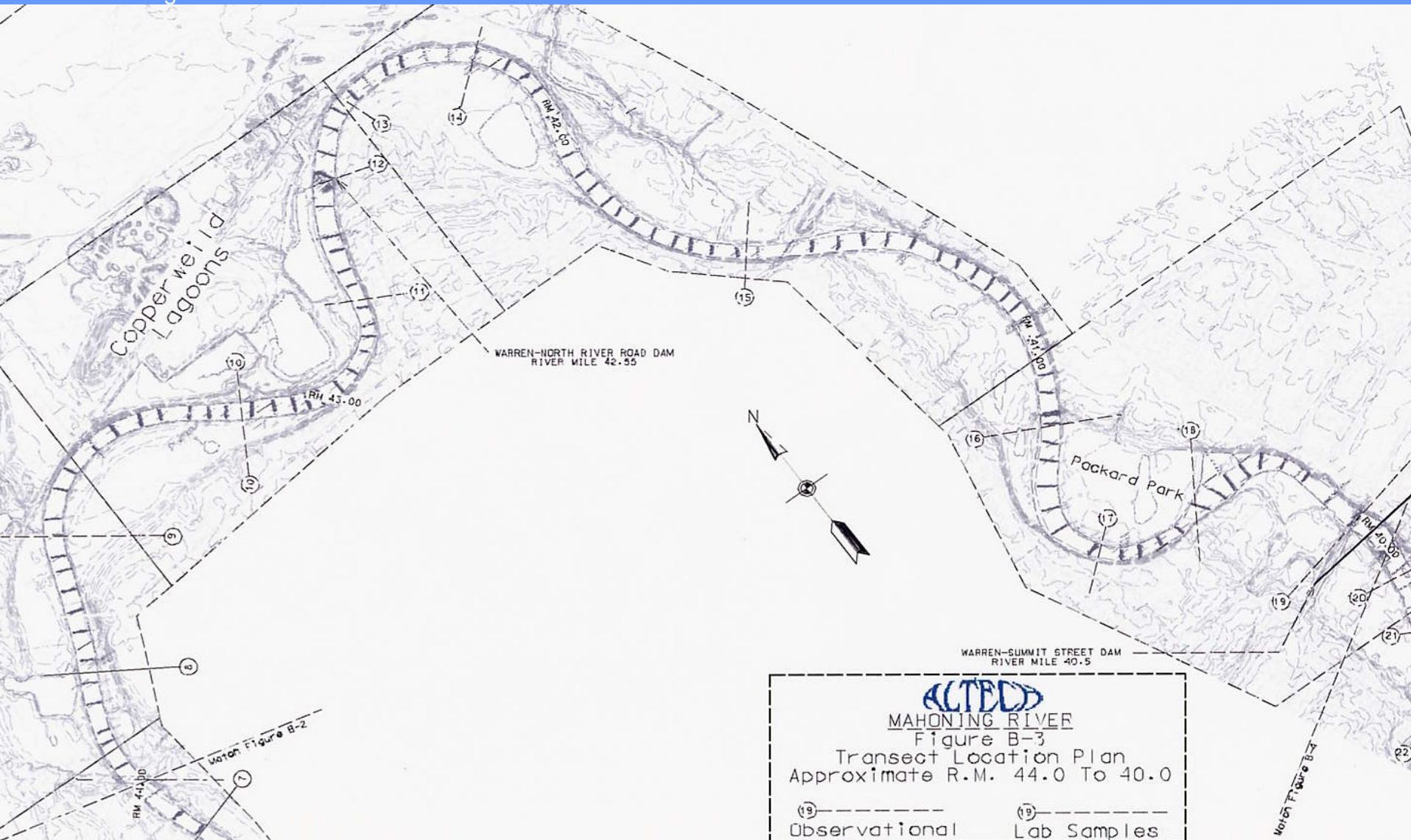

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Sediment Characterization

- Appendix A – Subsurface Exploration Records
- Appendix B – Geotechnical Laboratory Analyses
- Table – Transect By Transect Summary

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Girard – Liberty Street Dam Pool

Looking Upstream at Reliant Energy Power Plant

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Sediment Characterization

- **Warren – Main Street Substation Dam Pool**
- **Transects 20 through 26**
- **Girard - Liberty Street Dam Pool**
- **Transects 27 through 51**
- **Youngstown - Crescent Street Dam Dam Pool**
- **Transects 52 through 58**
- **Youngstown - Mahoning Avenue Dam Dam Pool**
- **Transects 59 through 62**

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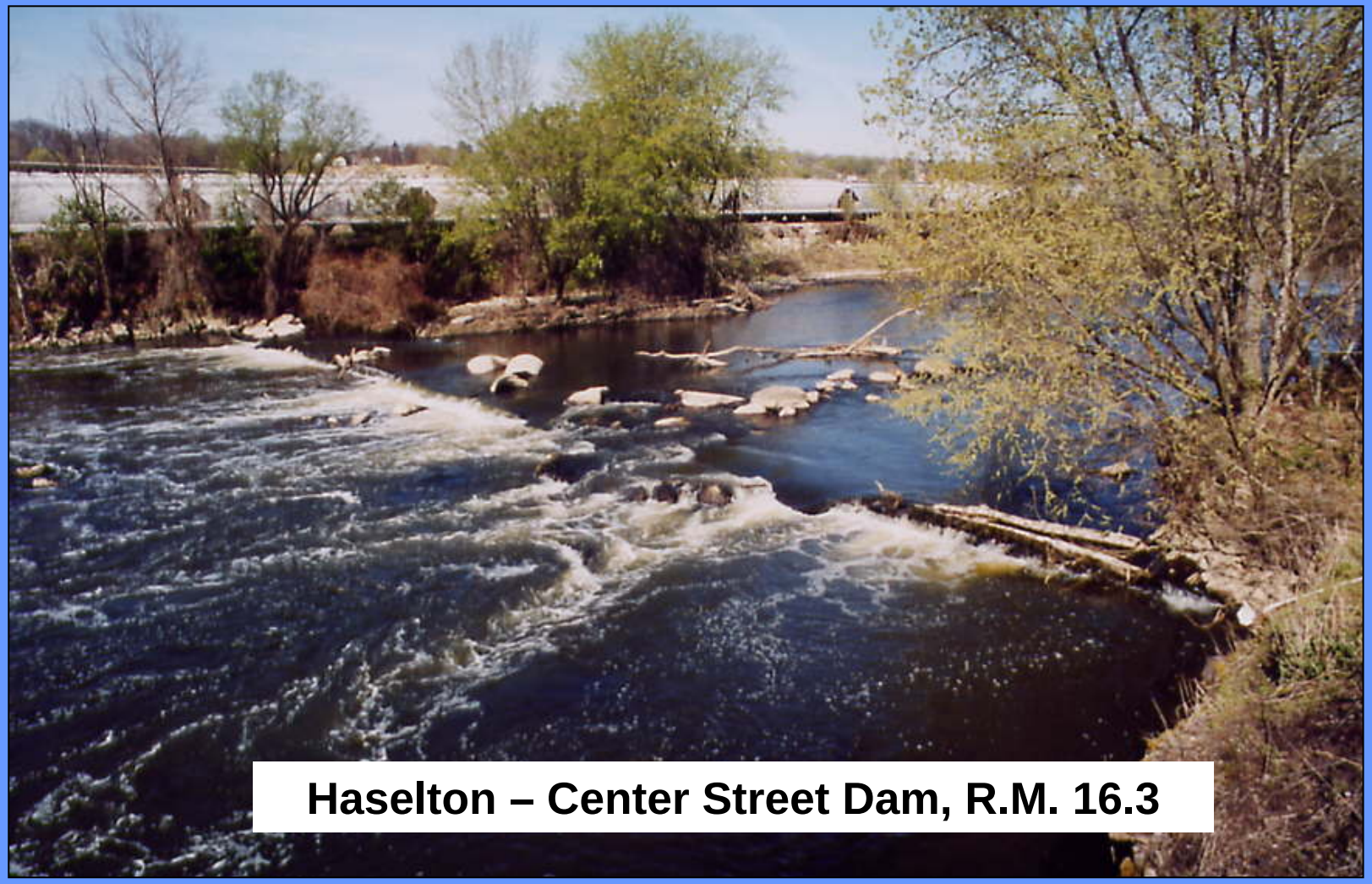

Haselton – Center Street Dam, R.M. 16.3

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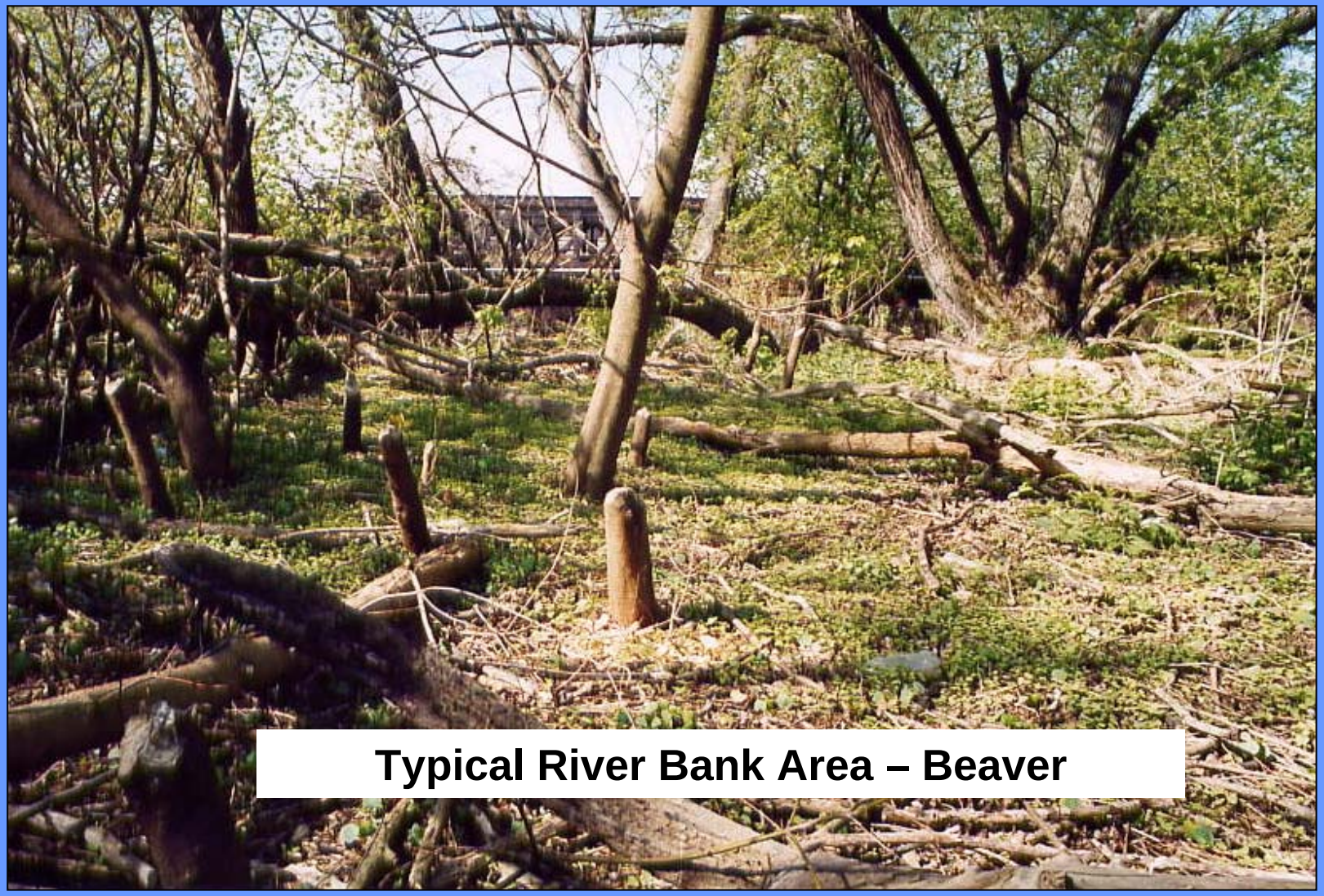

Typical River Bank Area – Beaver

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Remnants of Dam @ PA/OH State Line

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Target Analyte Groups and Corresponding USEPA SW-846 Analysis Methods and Number of Field Samples Budgeted

Analyte Group	USEPA/SW-846 Method	# Samples
Total Recoverable Petroleum Hydrocarbons (TRPH)	418.1	1600
Polynuclear Aromatic Hydrocarbon compounds (PAHs)	8270C	413
Polychlorinated Biphenyls (PCB)	8082	413
Herbicides	8151A	413
Pesticides	8081A	413
Target Analyte List Metals (TAL Metals)	6010B	413
Hexavalent Chromium	7196A	413
Toxic Characteristic Leaching Procedure (TCLP)	Methods Above	13
Radioisotopes (Total alpha, beta & gamma)	900.0	17

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Table C1 - Mahoning River Discrete Sample TRPH Analysis Results (mg/Kg)

Sample ID	1-A-1	1-A-1	1-A-2	1-B-1	1-B-1	1-B-2	1-B-3	1-C-1	1-C-1	1-C-2	1-C-2
Work Order	306025	306220	306220	306025	306220	306220	306220	306025	306218	306025	306218
Date Sampled	6/3/03	6/23/03	6/23/03	6/3/03	6/23/03	6/23/03	6/23/03	6/3/03	6/23/2003	6/3/03	6/23/2003
Percent Solid (%)	72	72	68	55	66	65	69	53	55	53	60
Percent Moisture	28.5	27.91	31.8	44.8	33.57	35.49	31.48	47.06	1.03	46.57	39.92
TRPH (mg/kg)	**34 U**	**34 U**	**36 U**	**88**	**37 U**	**51**	**44**	**57**	**33**	**91**	**46**

Sample ID	FD-1=1-C-2	1-C-3	1-C-3	1-D-1	1-D-1	1-D-2	1-D-3	1-E-1	1-E-2	1-E-3	1-F-1
Work Order	306218	306025	306218	306025	306220	306220	306220	306218	306218	306218	306025
Date Sampled	6/23/03	6/3/03	6/23/03	6/3/03	6/23/03	6/23/03	6/23/03	6/23/03	6/23/2003	6/23/03	6/3/2003
Percent Solid (%)	71	79	90	37	42	79	36	42	37	82	58
Percent Moisture	28.97	20.64	10.14	63.24	57.89	20.87	64.41	58.28	62.55	17.61	41.81
TRPH (mg/kg)	**35**	**98**	**210**	**110**	**58 U**	**180**	**520**	**520**	**200**	**53**	**62**

Sample ID	1-F-1	1-F-2	1-F-3	1-G-1	1-G-1	1-G-2	1-G-3	1-H-1	1-H-1	FD-2=1-H-1	1-H-2
Work Order	306218	306218	306218	306025	306218	306218	306218	306025	306218	306218	306218
Date Sampled	6/23/03	6/23/03	6/23/03	6/3/03	6/23/03	6/23/03	6/23/03	6/3/03	6/23/2003	6/23/03	6/23/2003
Percent Solid (%)	44	67	85	78	47	55	82	79	80	82	79
Percent Moisture	55.83	33.23	15.06	22.28	53.38	44.79	18.05	21.5	19.56	17.92	21.14
TRPH (mg/kg)	**94**	**310**	**32**	**51**	**470**	**44 U**	**30 U**	**450**	**490**	**60**	**32**

Sample ID	1-I-1	1-I-1	1-I-2	2-C-1	2-C-1	2-C-2	2-C-2	2-C-3	2-C-3	2-G-1	2-G-1
Work Order	306025	306218	306218	306025	306220	306025	306220	306025	306222	306025	306222
Date Sampled	6/3/03	6/23/03	6/23/03	6/3/03	6/23/03	6/3/03	6/23/03	6/3/2003	6/23/03	6/3/03	6/23/2003
Percent Solid (%)	72	58	76	59	83	79	83	56	83	70	72
Percent Moisture	27.92	42.31	23.85	41.11	16.76	21.01	17.08	44.03	17.12	30.29	28.32
TRPH (mg/kg)	**50**	**110**	**32 U**	**41 U**	**30 U**	**79**	**30 U**	**49**	**30 U**	**110**	**90**

Sample ID	2-G-2	3-C-1	3-C-1	3-C-2	3-C-2	3-C-3	3-C-3	3-G-1	3-G-1	3-G-2	3-G-2
Work Order	306222	306025	306222	306025	306222	306025	306222	306025	306222	306025	306222
Date Sampled	6/23/03	6/3/03	6/23/03	6/3/03	6/23/03	6/3/03	6/23/03	6/3/03	6/23/2003	6/3/03	6/23/2003
Percent Solid (%)	78	60	71	72	78	78	82	58	47	67	43
Percent Moisture	21.57	40.35	28.93	28.17	22.13	22.11	18.4	41.69	52.59	32.63	56.84
TRPH (mg/kg)	**31 U**	**65**	**200**	**34 U**	**32 U**	**32 U**	**30 U**	**79**	**52 U**	**36**	**57 U**

J = Estimated value
U = Indicates TRPH not detected above listed Reporting Limit for analys
* = Transect 56 Sample IDs labeled backward in field. Sample IDs shown are corrected for consistency with project labeling system.

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Contamination Assessment

- Ohio EPA Generic Concentration Numbers – Human Health Criteria
- Model Reach Chemical Conditions – Criteria to Restore Biotic Integrity

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Figure 1
Mean and 95% UCL For Mean TRPH Concentration in Discreet Samples By Transect

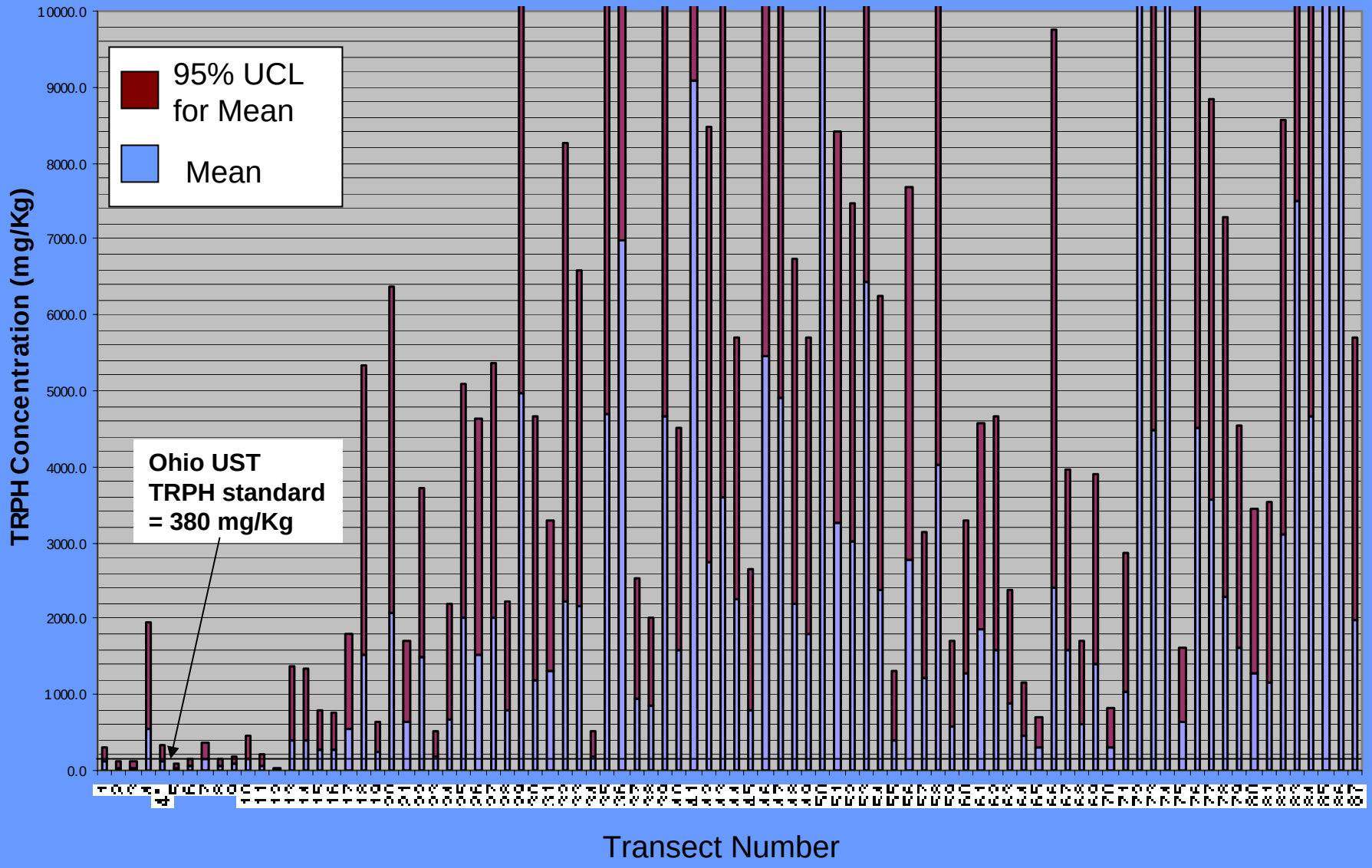


Figure 2
Mahoning River Sediment TRPH Concentrations by Pool

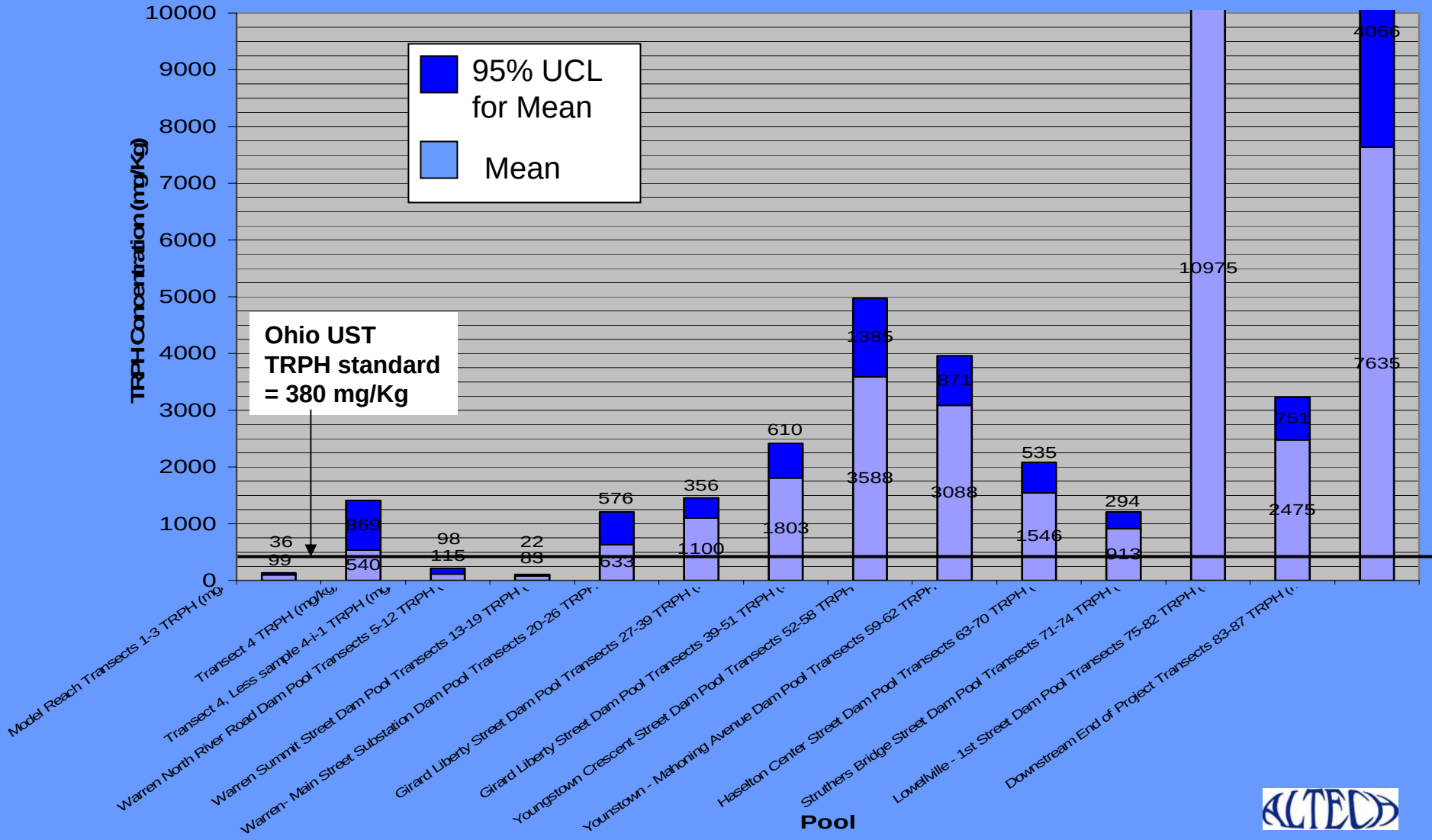


Figure 3
Surface Sediment TRPH Concentrations By Pool

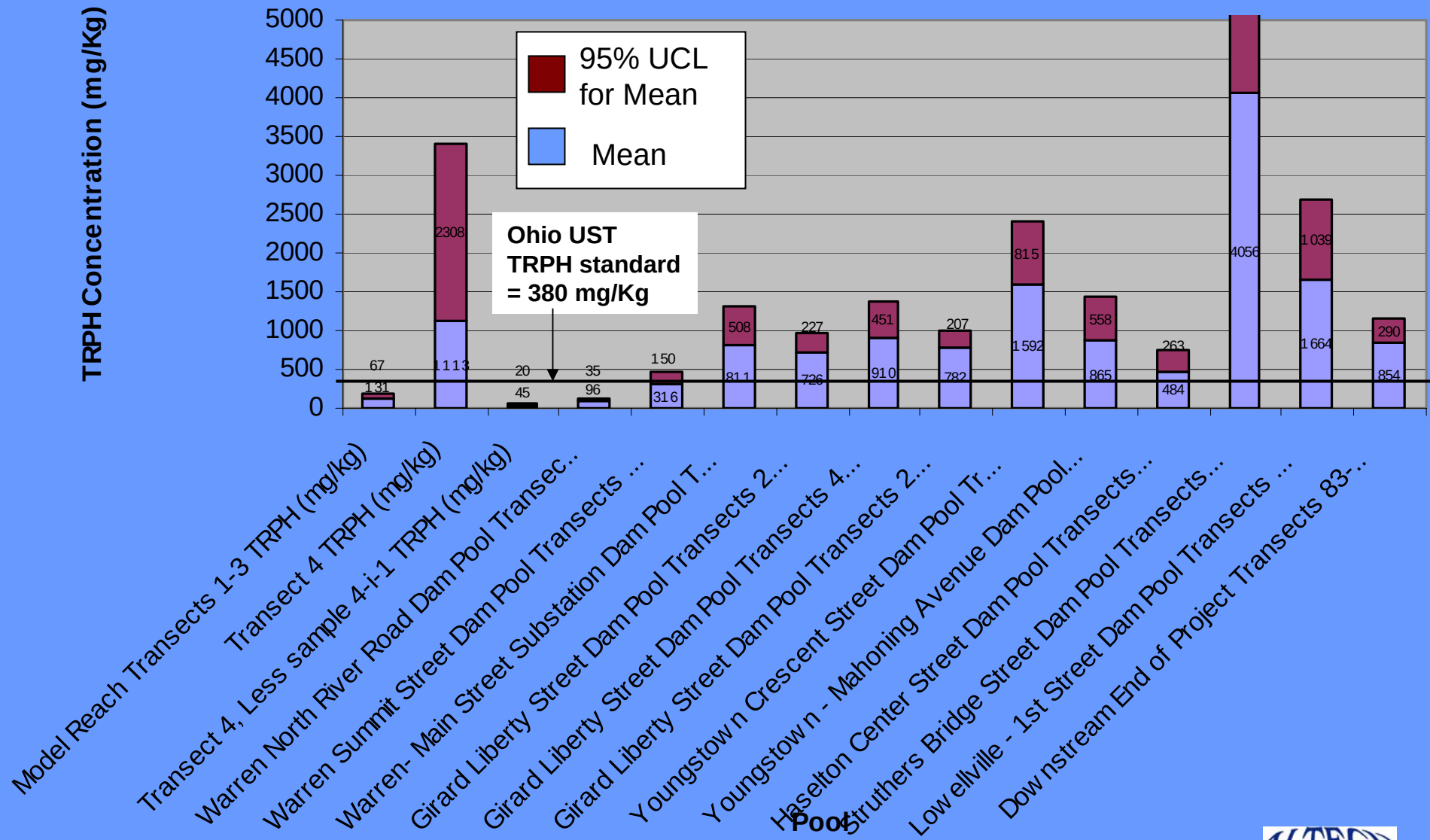


Figure 4
On Bank Surface Sediment TRPH Concentrations By Pool

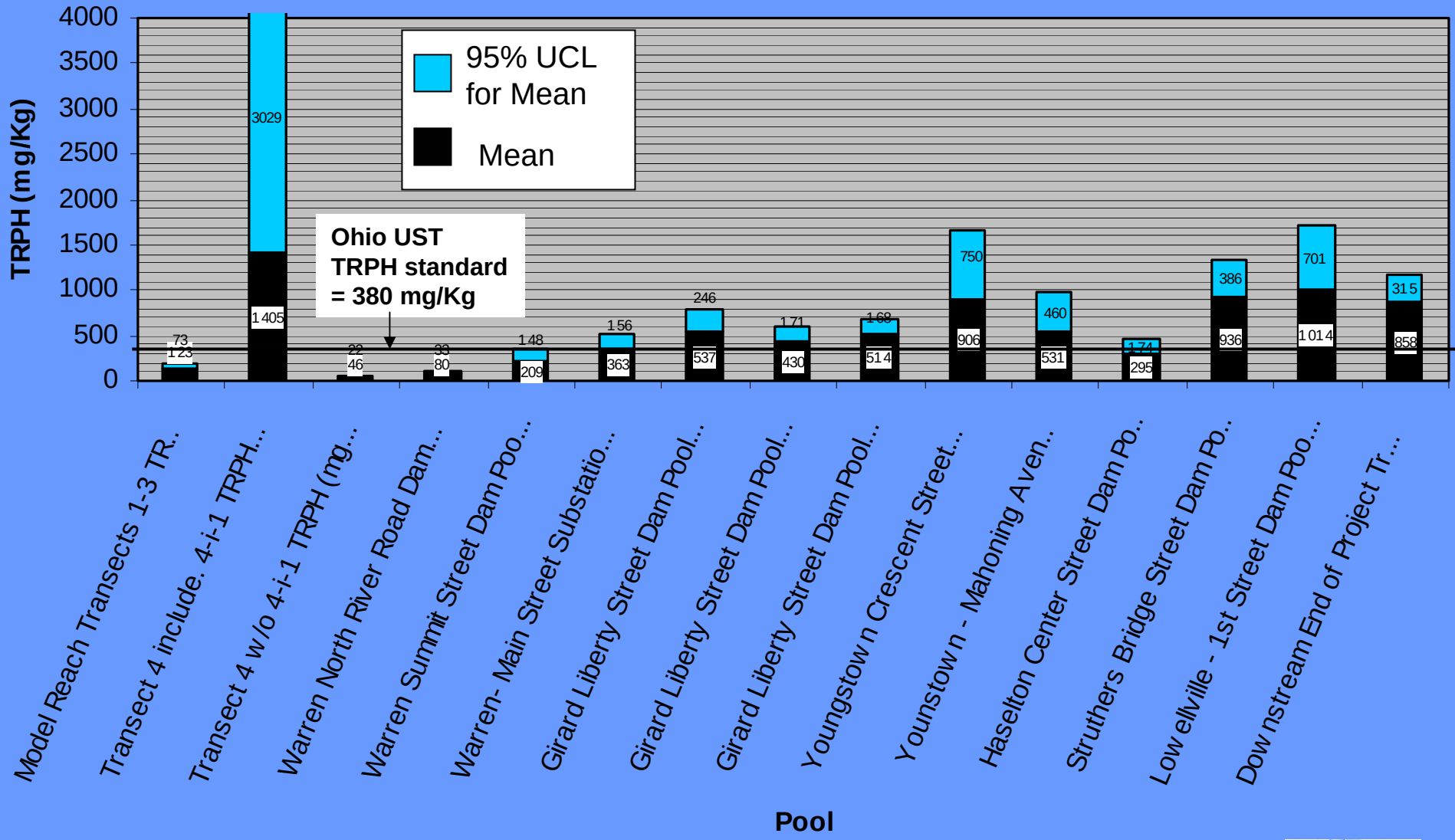


Figure 5
In-River Surface Sediment TRPH Concentrations By Pool

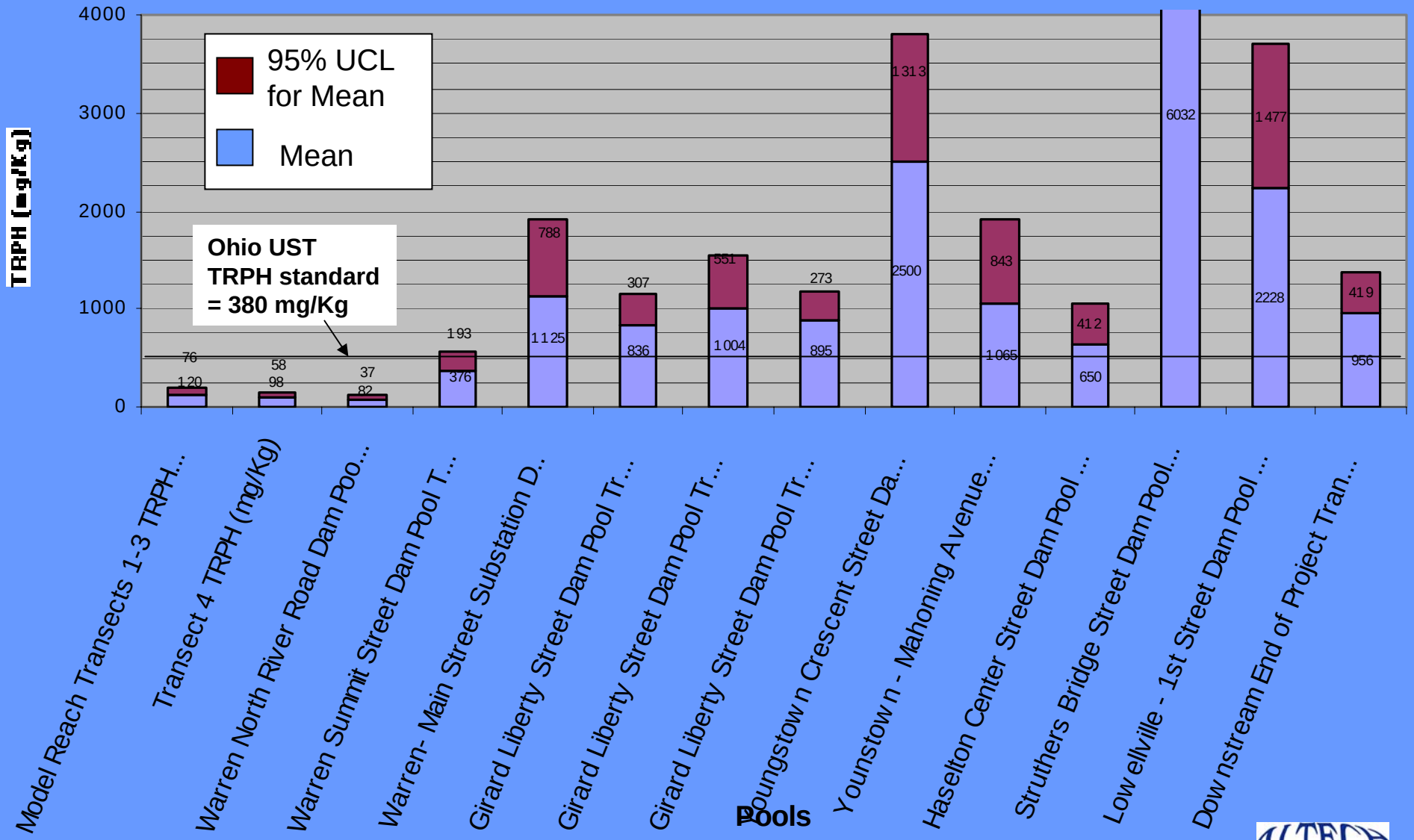


Figure 6
Subsurface Sediment TRPH Concentrations By Pool

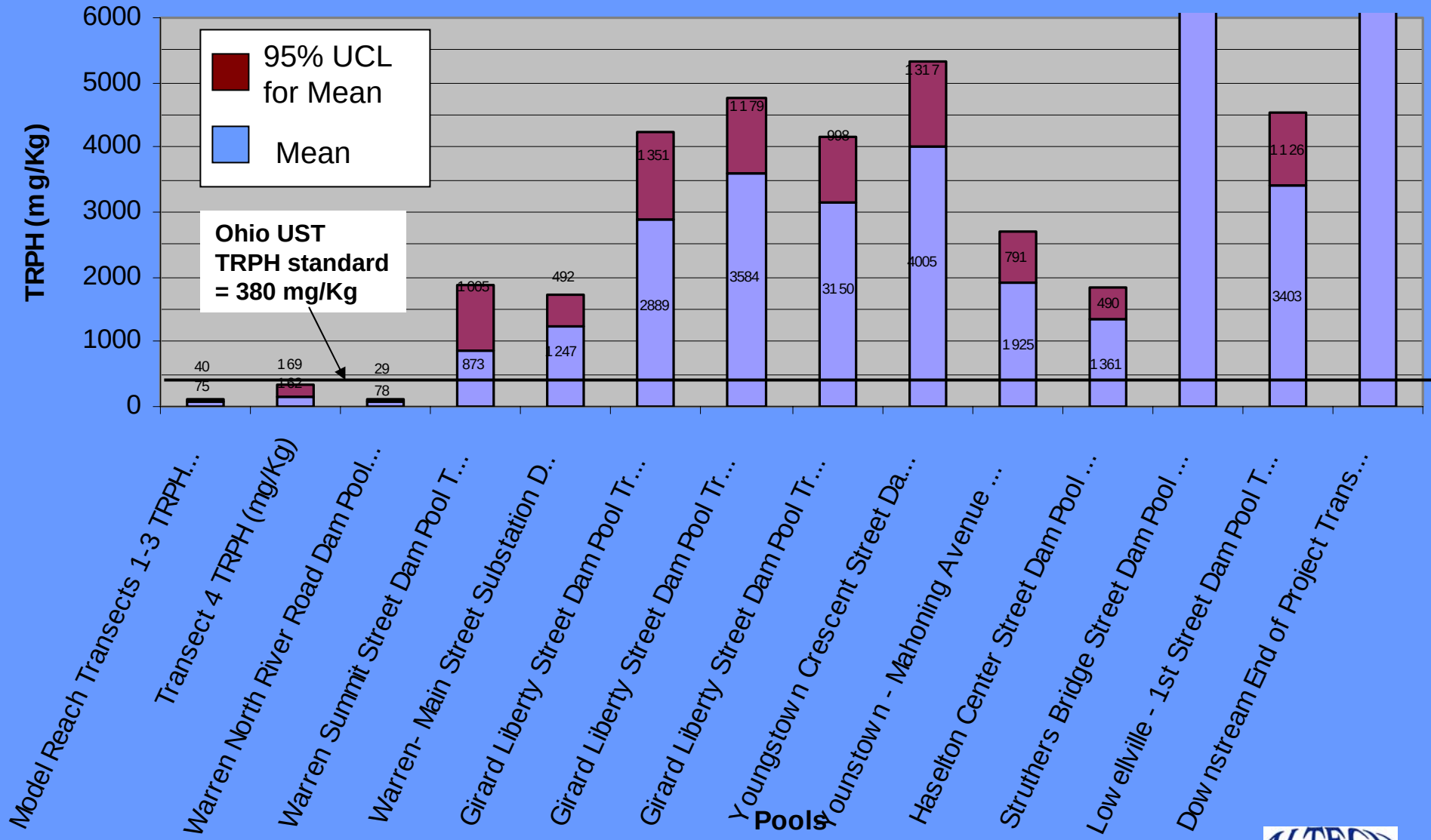


Table 7b - 95% UCL for Mean Value for Anthracene, Benzo(a)anthracene, Benzo(a)pyrene and Benzo(b)fluoranthene By Transect

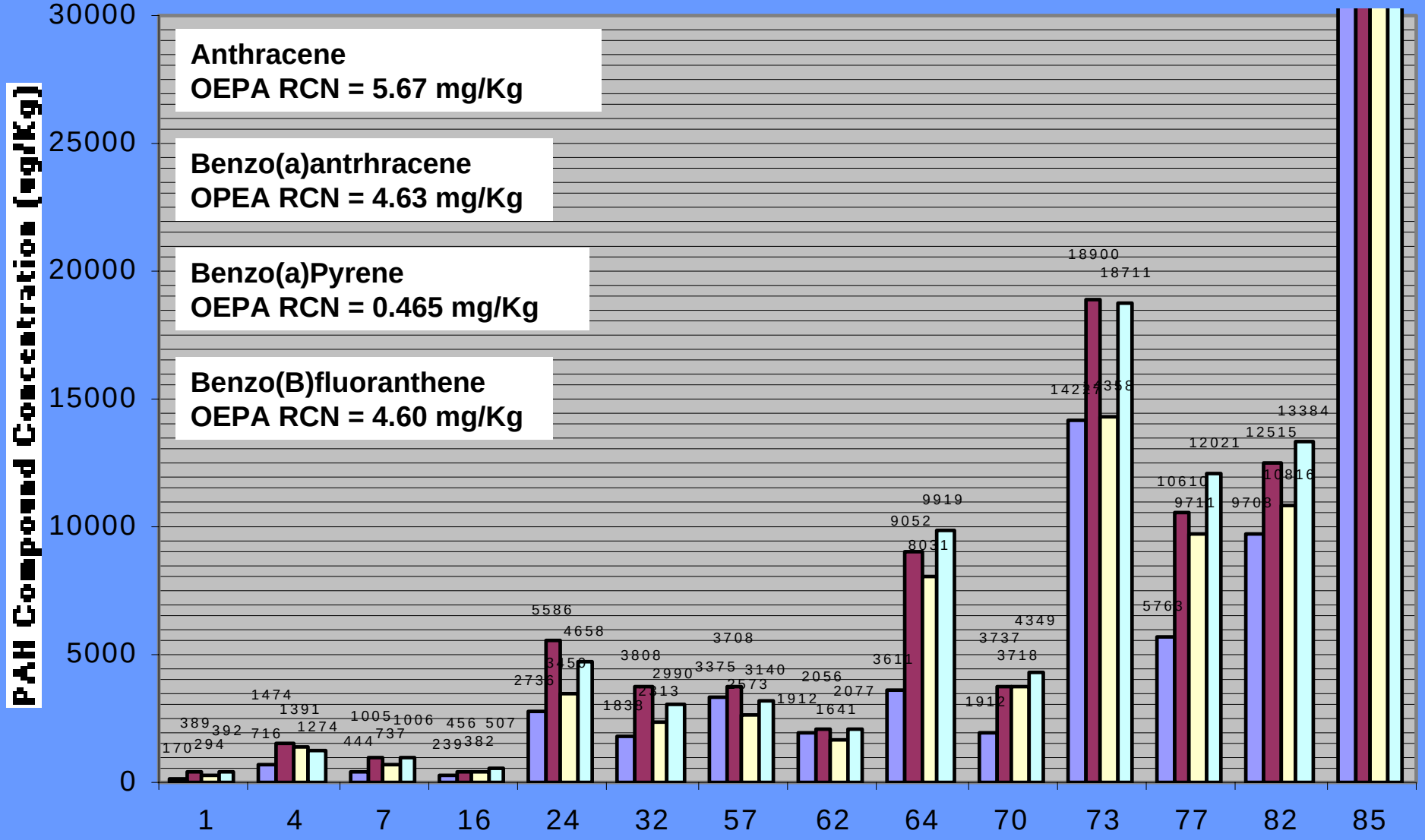
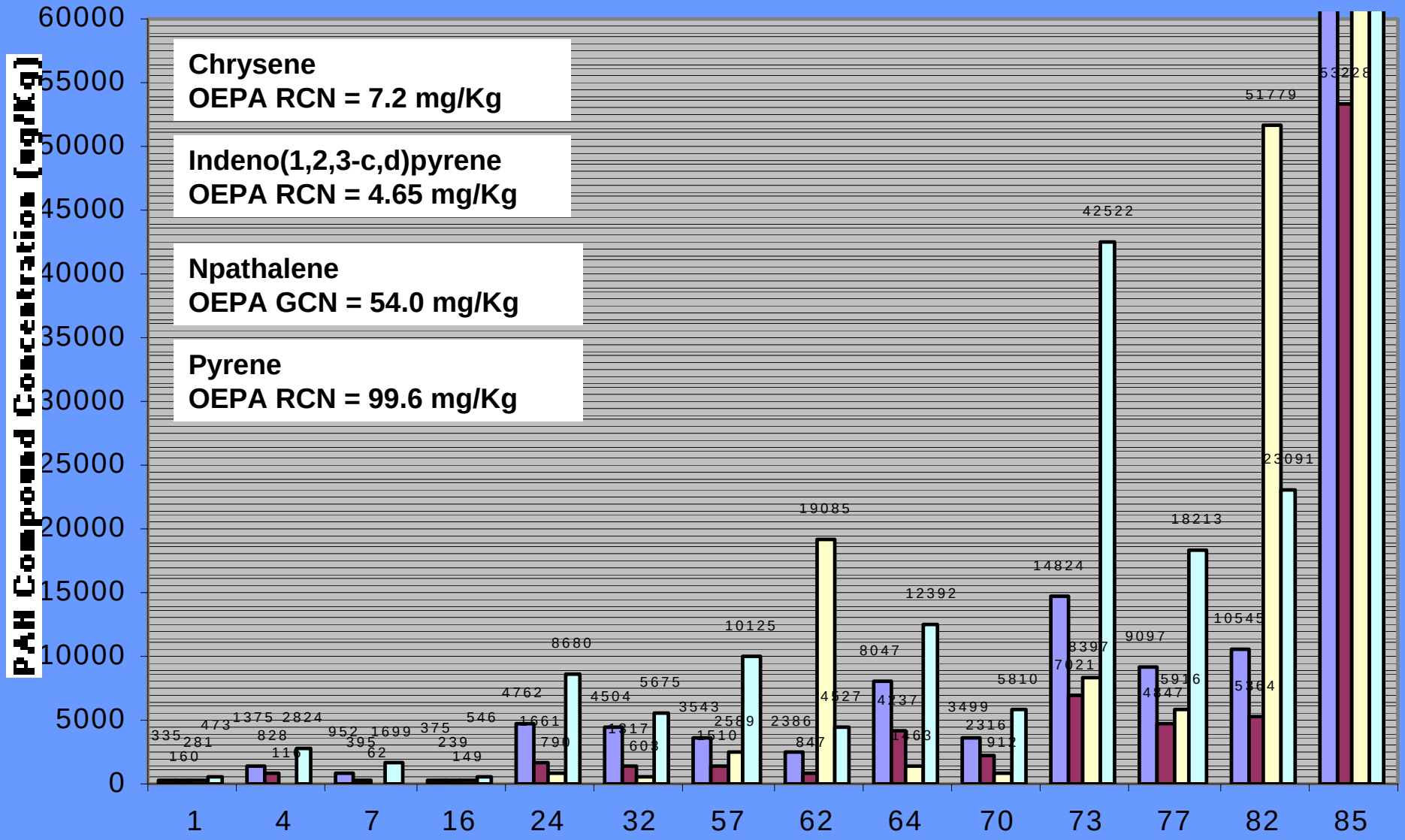
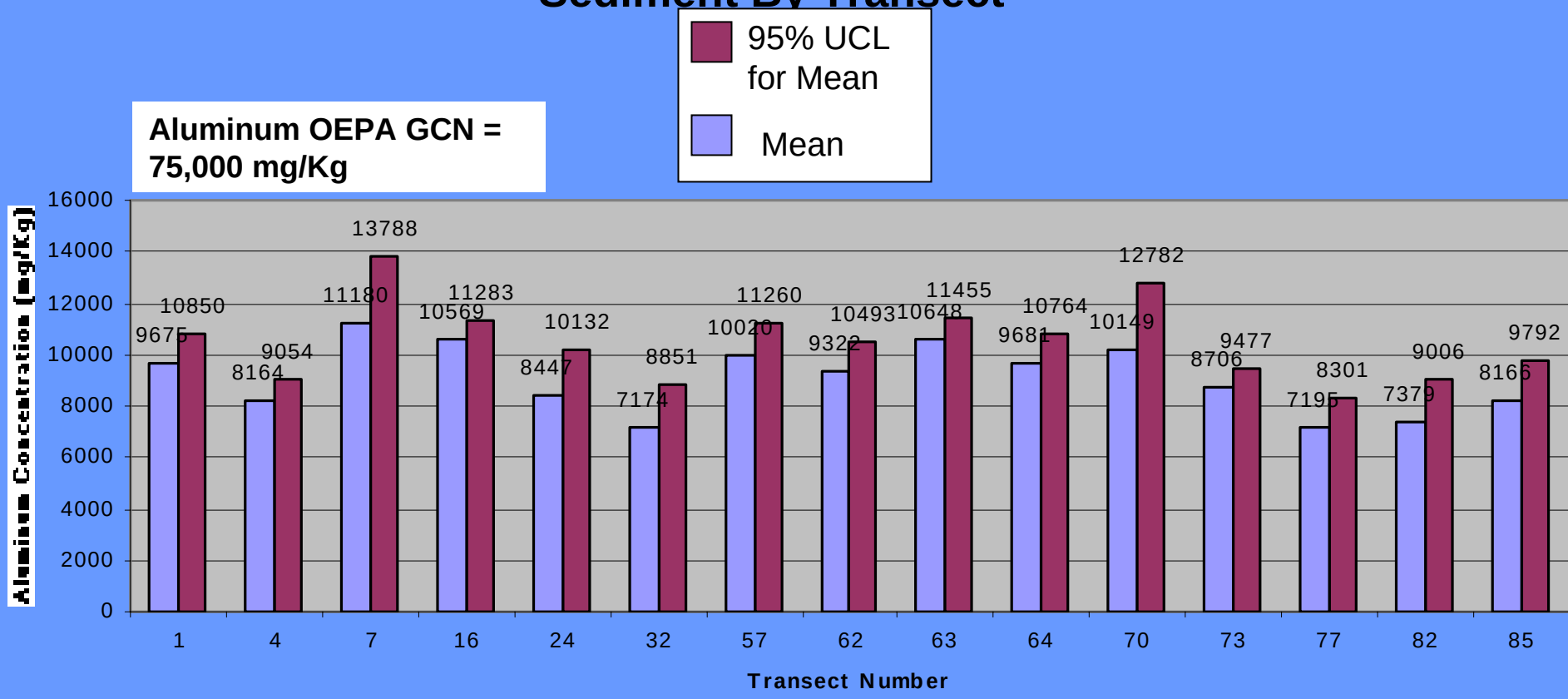


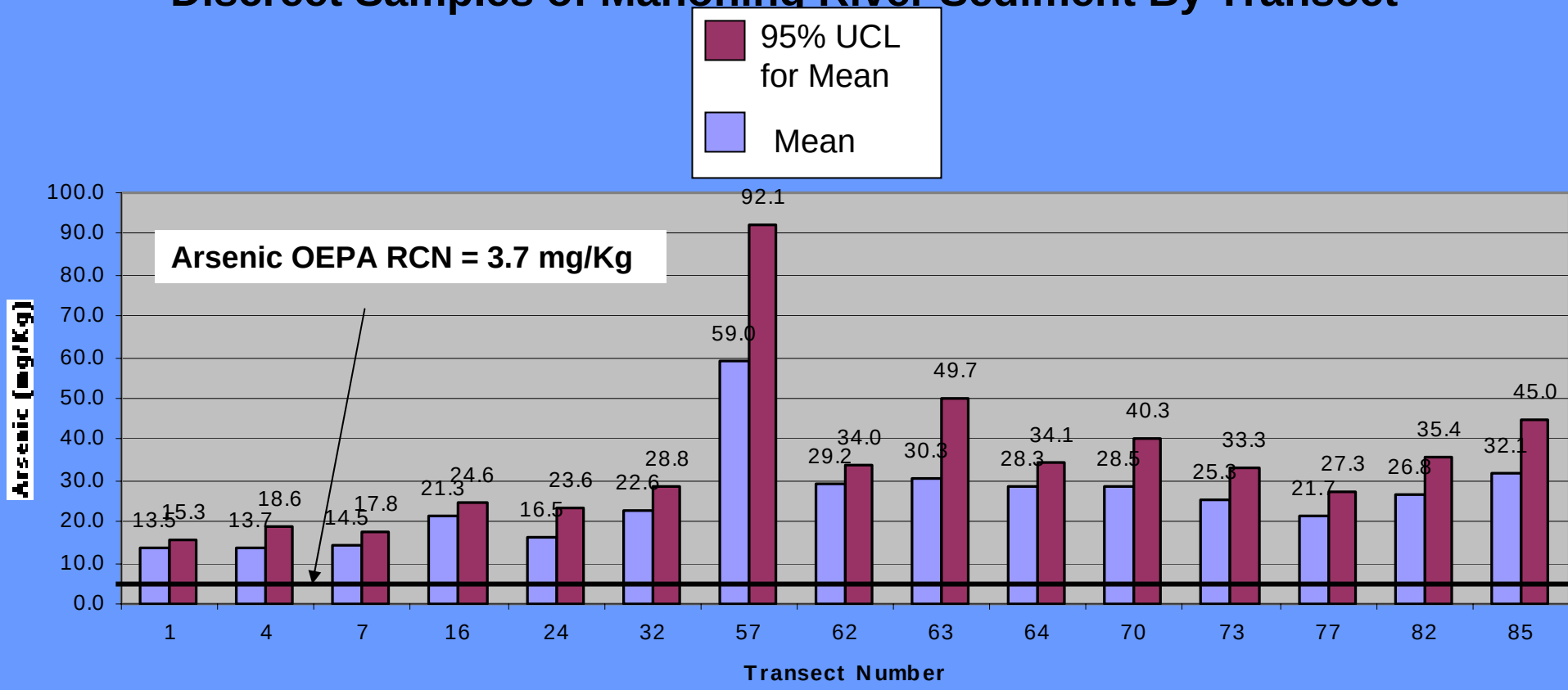
Table 7d - 95% UCL for Mean Value for Chrysene, Indeno(1,2,3-c,d)pyrene, Napthalene and Pyrene By Transect



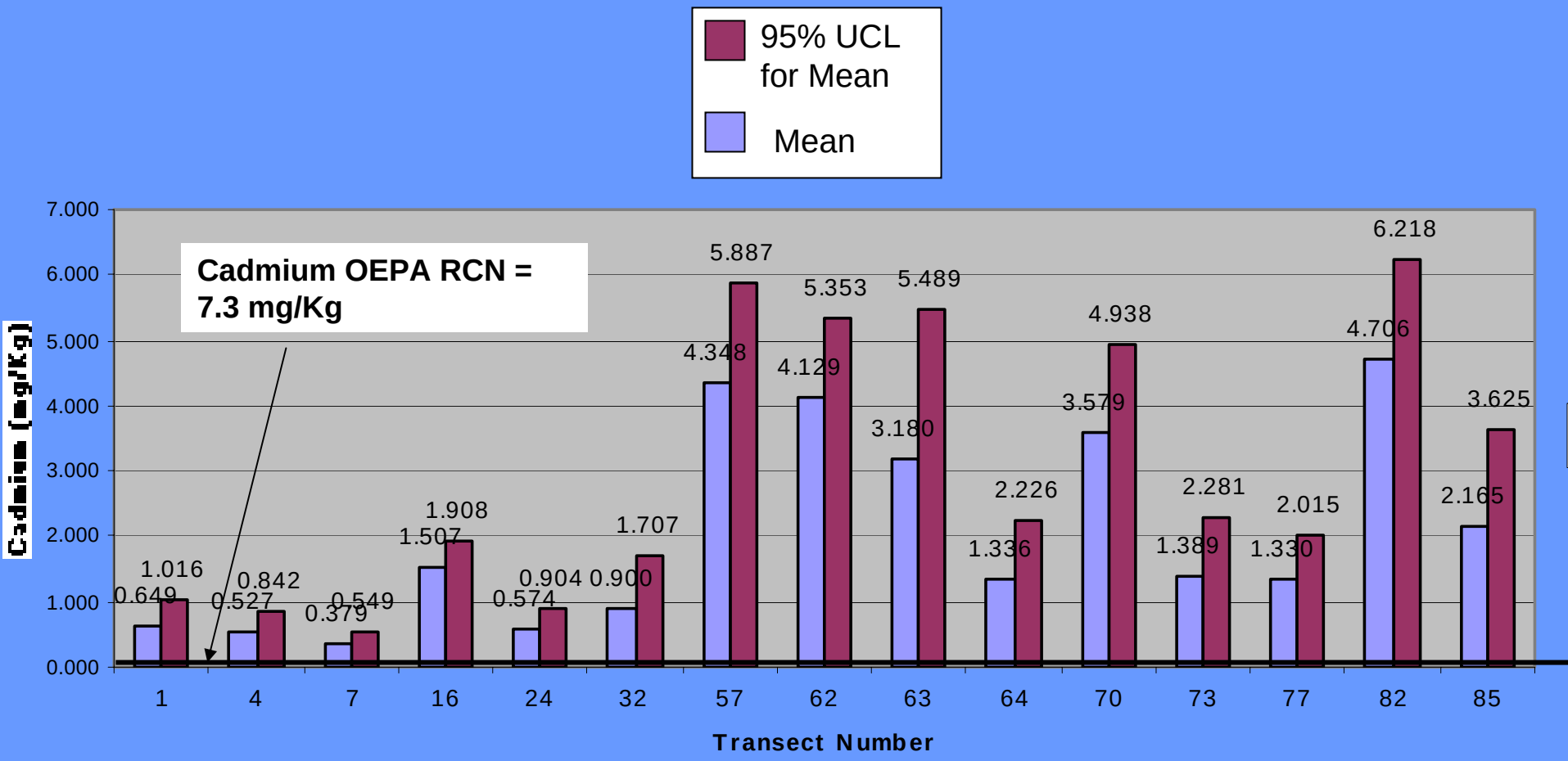
Mean and 95% UCL for Mean Concentrations of **Aluminum** in Discreet Samples of Mahoning River Sediment By Transect



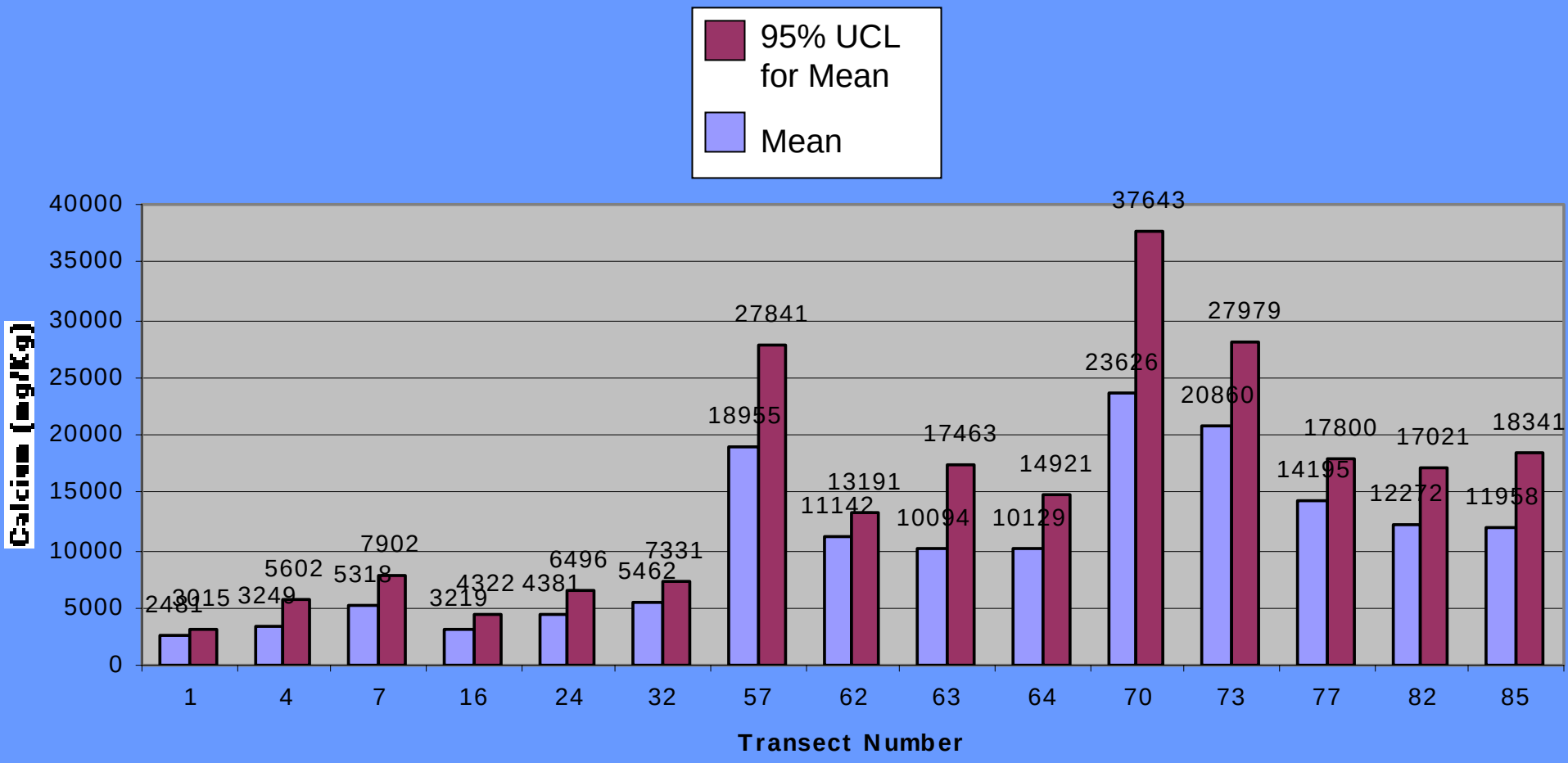
Mean and 95% UCL for Mean Concentrations of **Arsenic** in Discreet Samples of Mahoning River Sediment By Transect



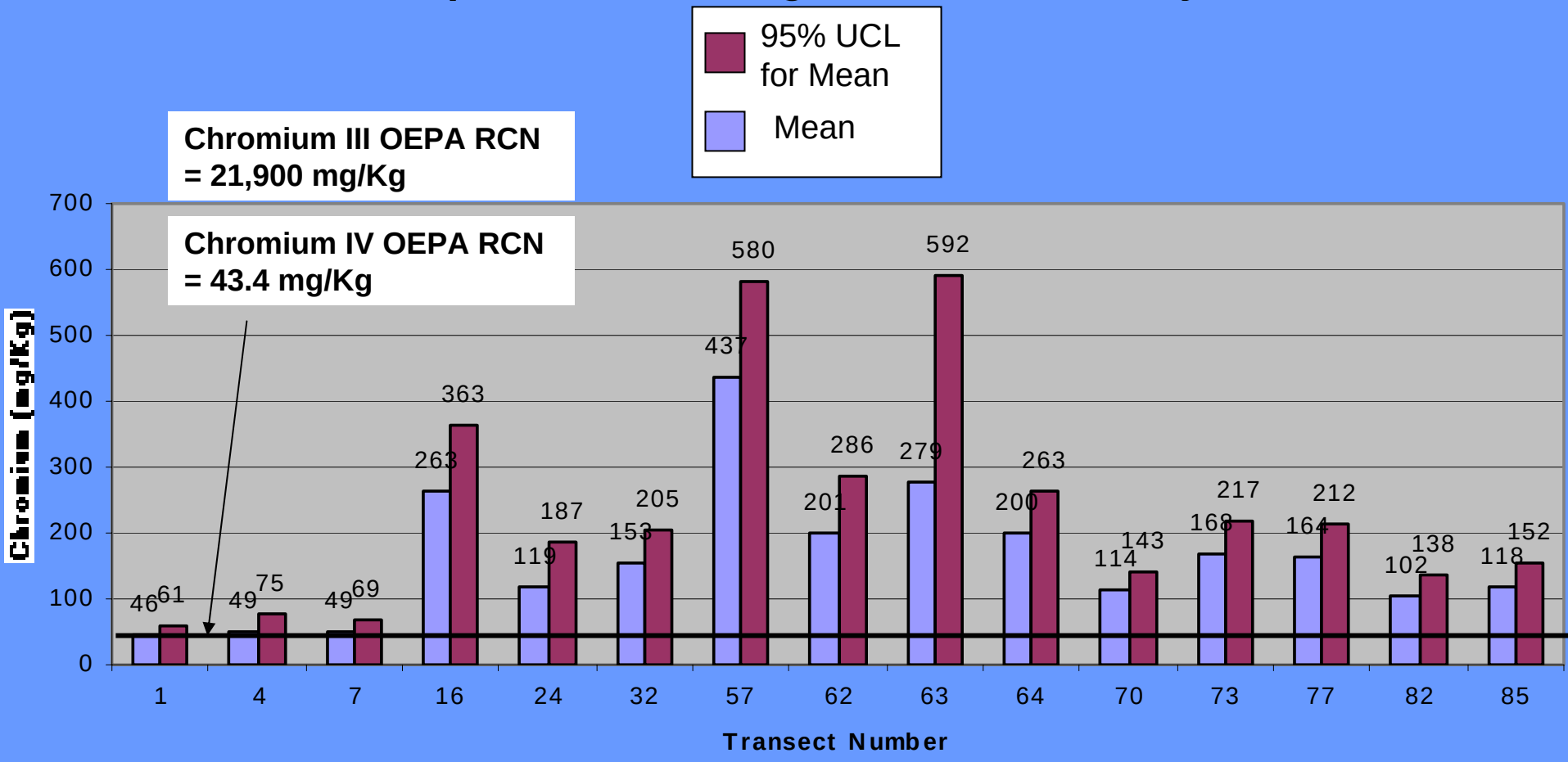
Mean and 95% UCL for Mean Concentrations of Cadmium in Discreet Samples of Mahoning River Sediment By Transect



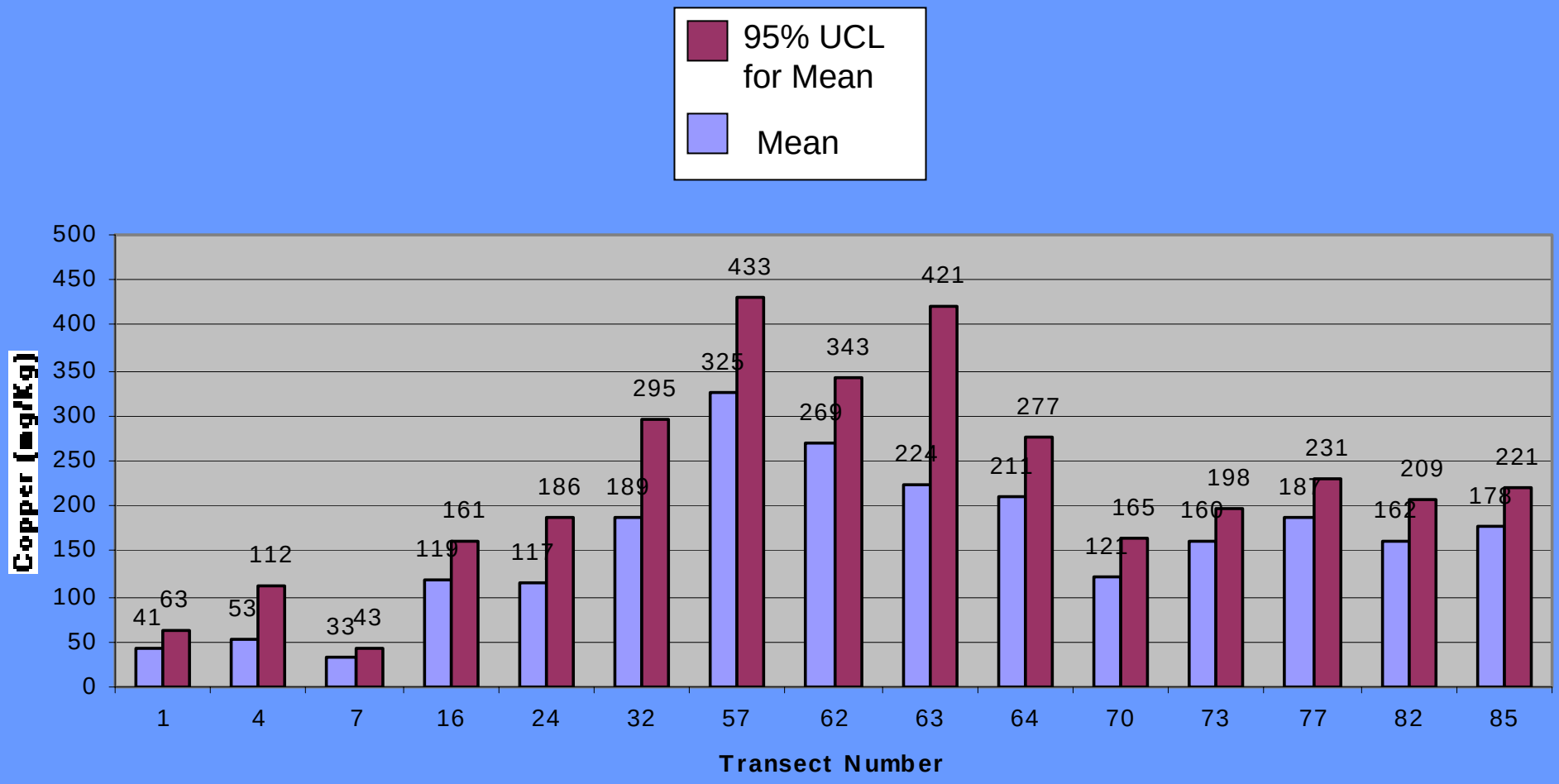
Mean and 95% UCL for Mean Concentrations of **Calcium** in Discreet Samples of Mahoning River Sediment By Transect



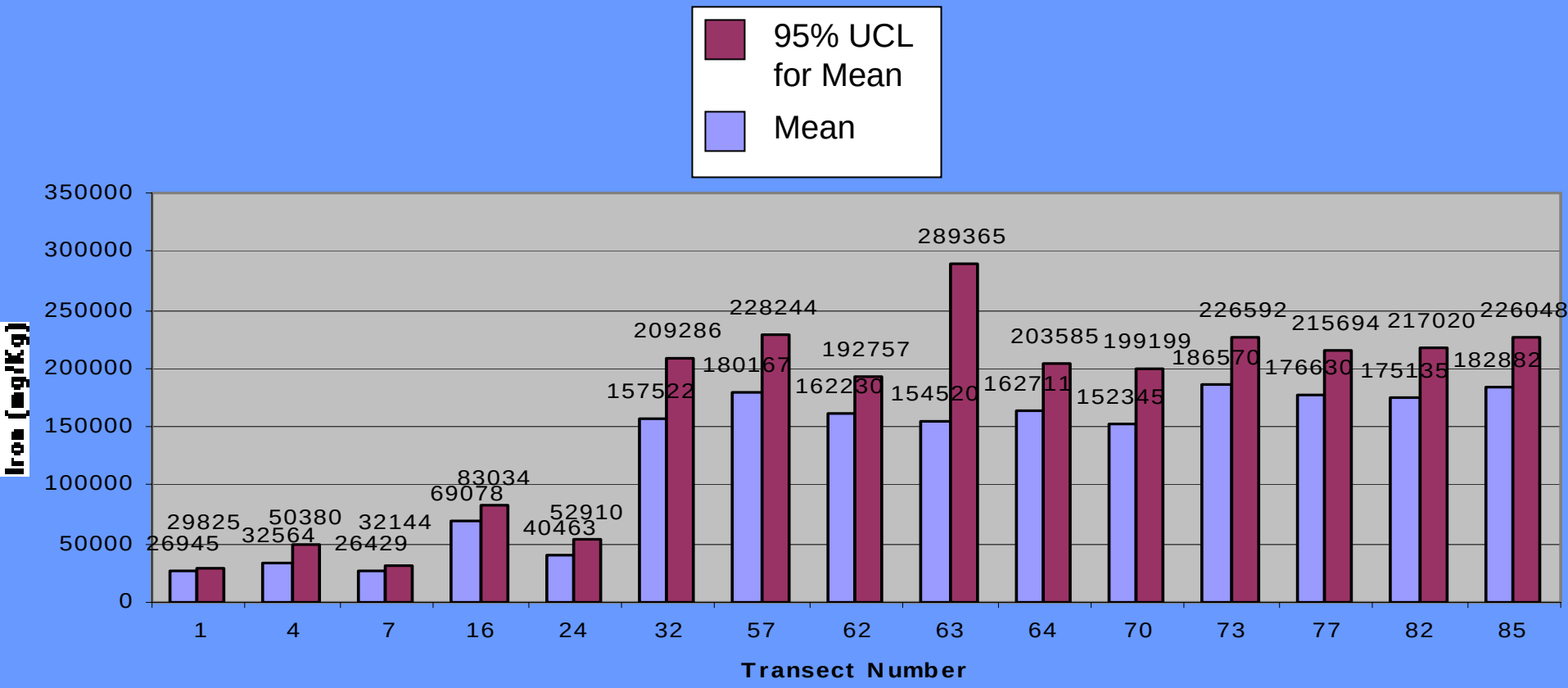
Mean and 95% UCL for Mean Concentrations of **Chromium** in Discreet Samples of Mahoning River Sediment By Transect



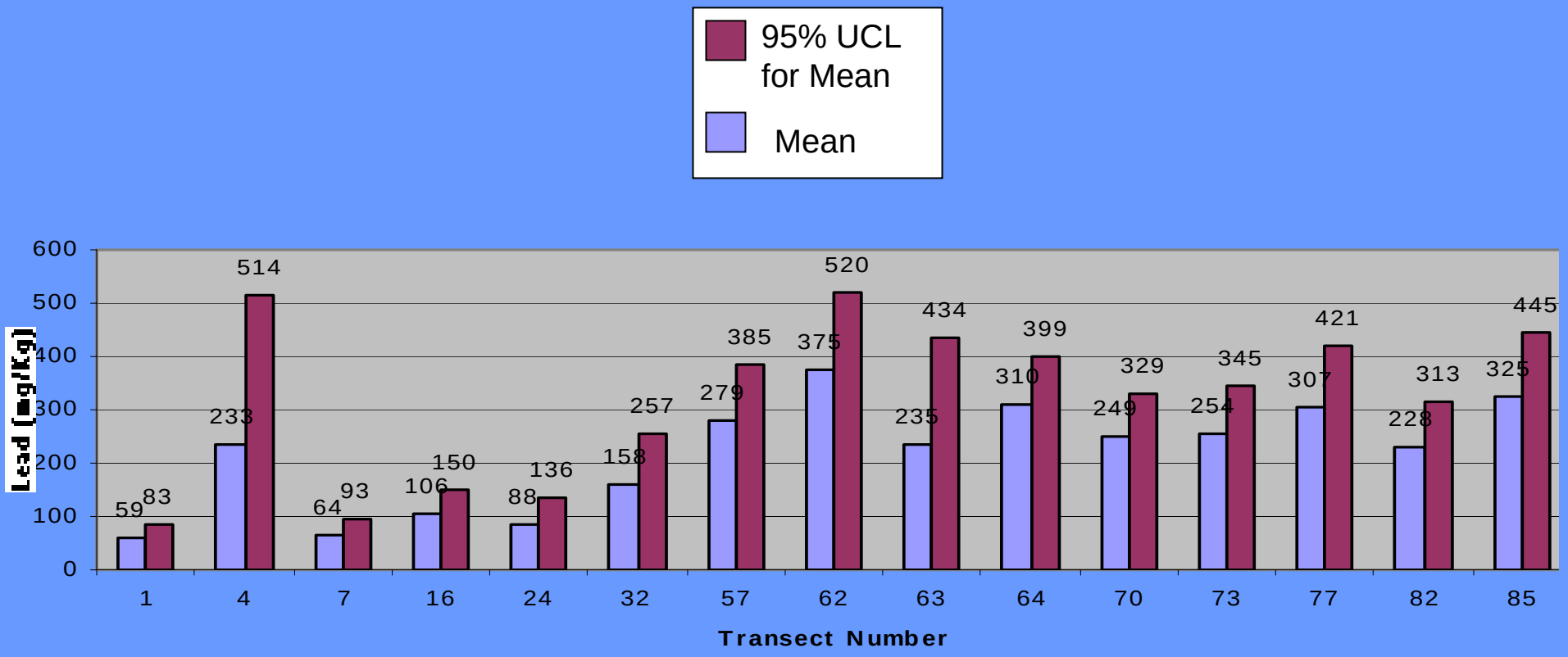
Mean and 95% UCL for Mean Concentrations of Copper in Discreet Samples of Mahoning River Sediment By Transect



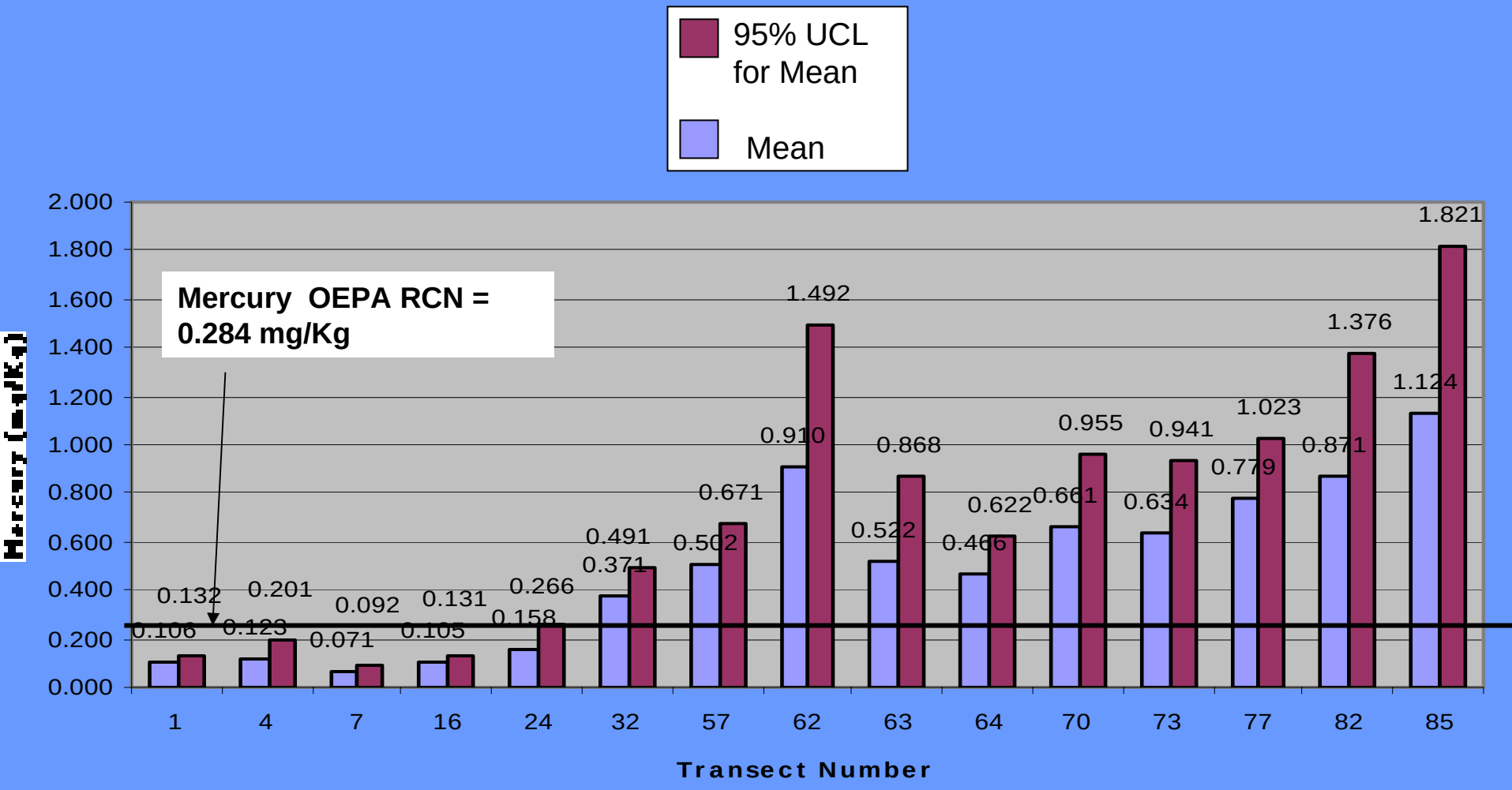
Mean and 95% UCL for Mean Concentrations of Iron in Discreet Samples of Mahoning River Sediment By Transect



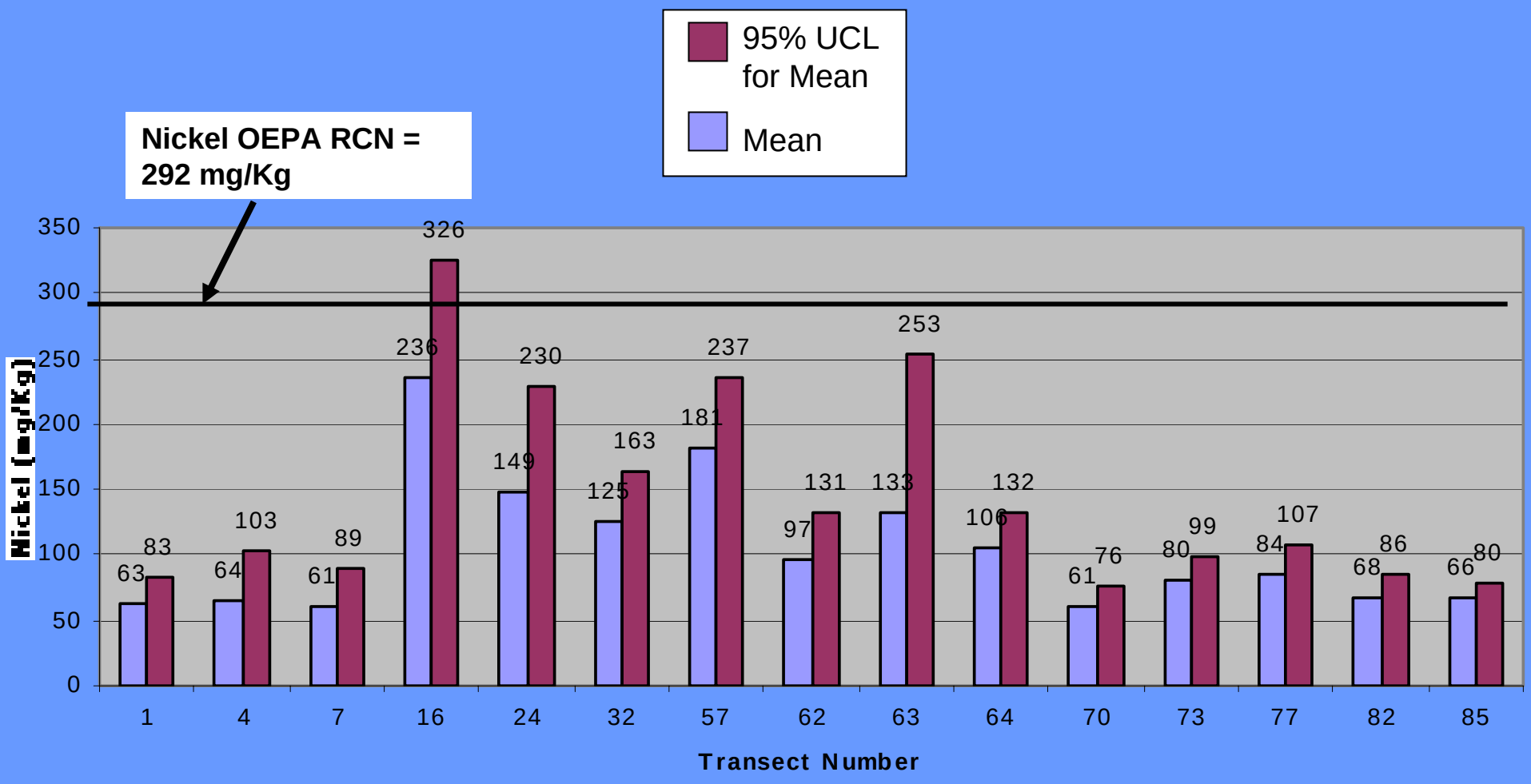
Mean and 95% UCL for Mean Concentrations of **Lead** in Discreet Samples of Mahoning River Sediment By Transect



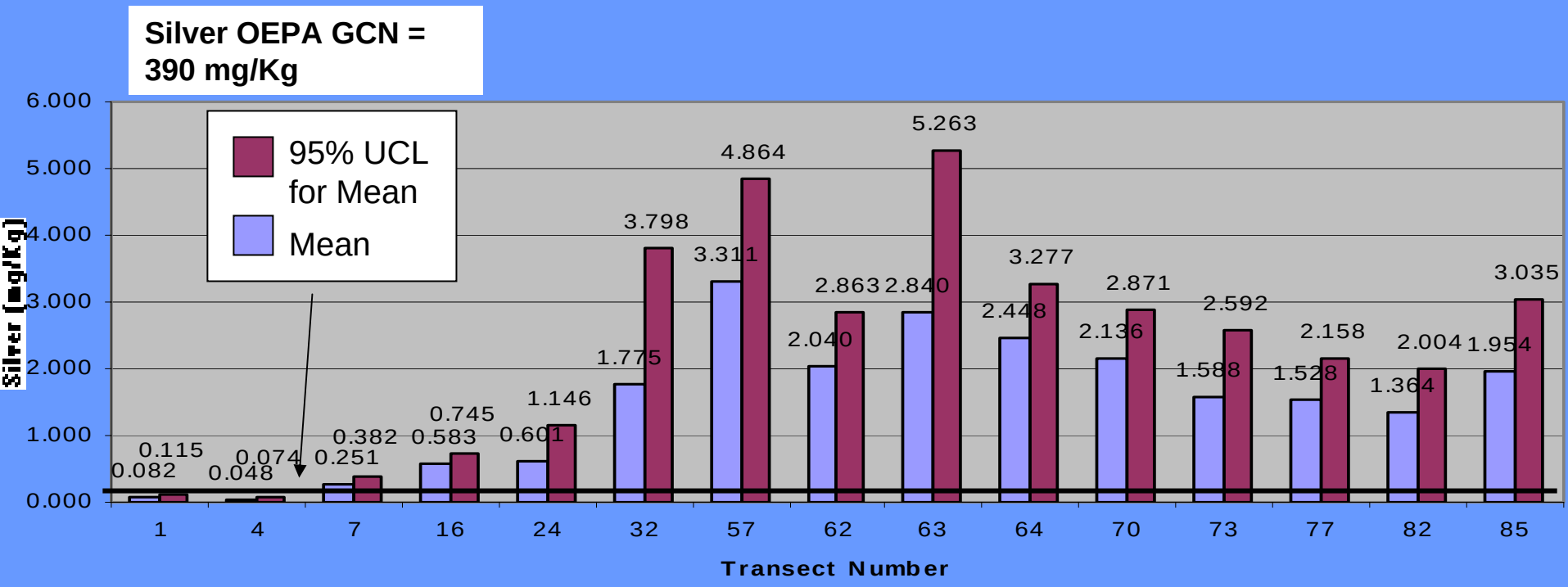
Mean and 95% UCL for Mean Concentrations of Mercury in Discreet Samples of Mahoning River Sediment By Transect



Mean and 95% UCL for Mean Concentrations of Nickel in Discreet Samples of Mahoning River Sediment By Transect

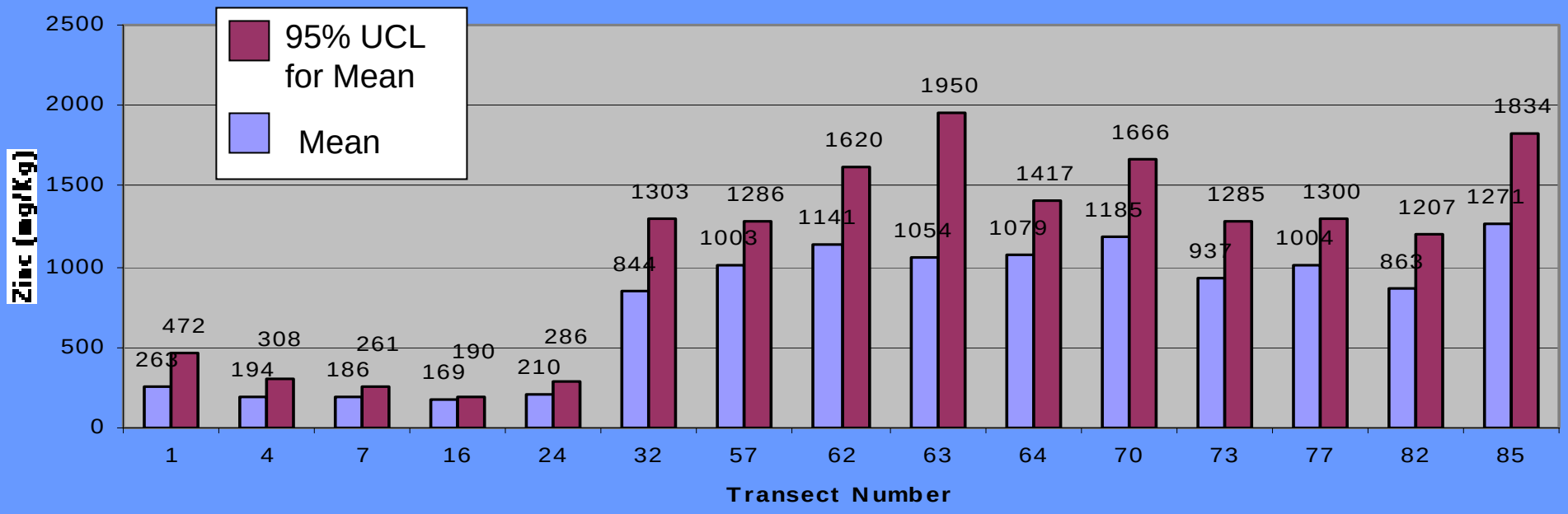


Mean and 95% UCL for Mean Concentrations of **Silver** in Discreet Samples of Mahoning River Sediment By Transect



Mean and 95% UCL for Mean Concentrations of Zinc in Discreet Samples of Mahoning River Sediment By Transect

Zinc OEPA GCN = 23,000 mg/Kg



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Contamination Assessment

- Ohio EPA Generic Concentration Numbers – Human Health Criteria
- Model Reach Chemical Conditions – Criteria to Restore Biotic Integrity

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Conclusions

- **Contamination**
- Primary Contaminants of Concern – TRPH, PAH Compounds, PCBs and Mercury
- Contamination increases with distance below Model Reach,
- Above Transect 13 – isolated – Transect 4
- Below Transect 13 – wide spread w/increasing concentrations.
- All pools below North River Road Dam TRPH far above Model Reach levels
- Subsurface TRPH concentrations higher than surface concentrations everywhere but Model Reach, where no significant differences
- Subject pools, On-bank TRPH surface levels lower than in-river everywhere but Model Reach, where same

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