Six Years of Intensive Monitoring of the 1st PRB to Treat a Mixed Waste Plume: USCG Site in Elizabeth City, NC

Robert W. Puls and Richard T. Wilkin
U.S. Environmental Protection Agency
Office of Research and Development
National Risk Management Research Laboratory
Ada, OK

Site Characteristics

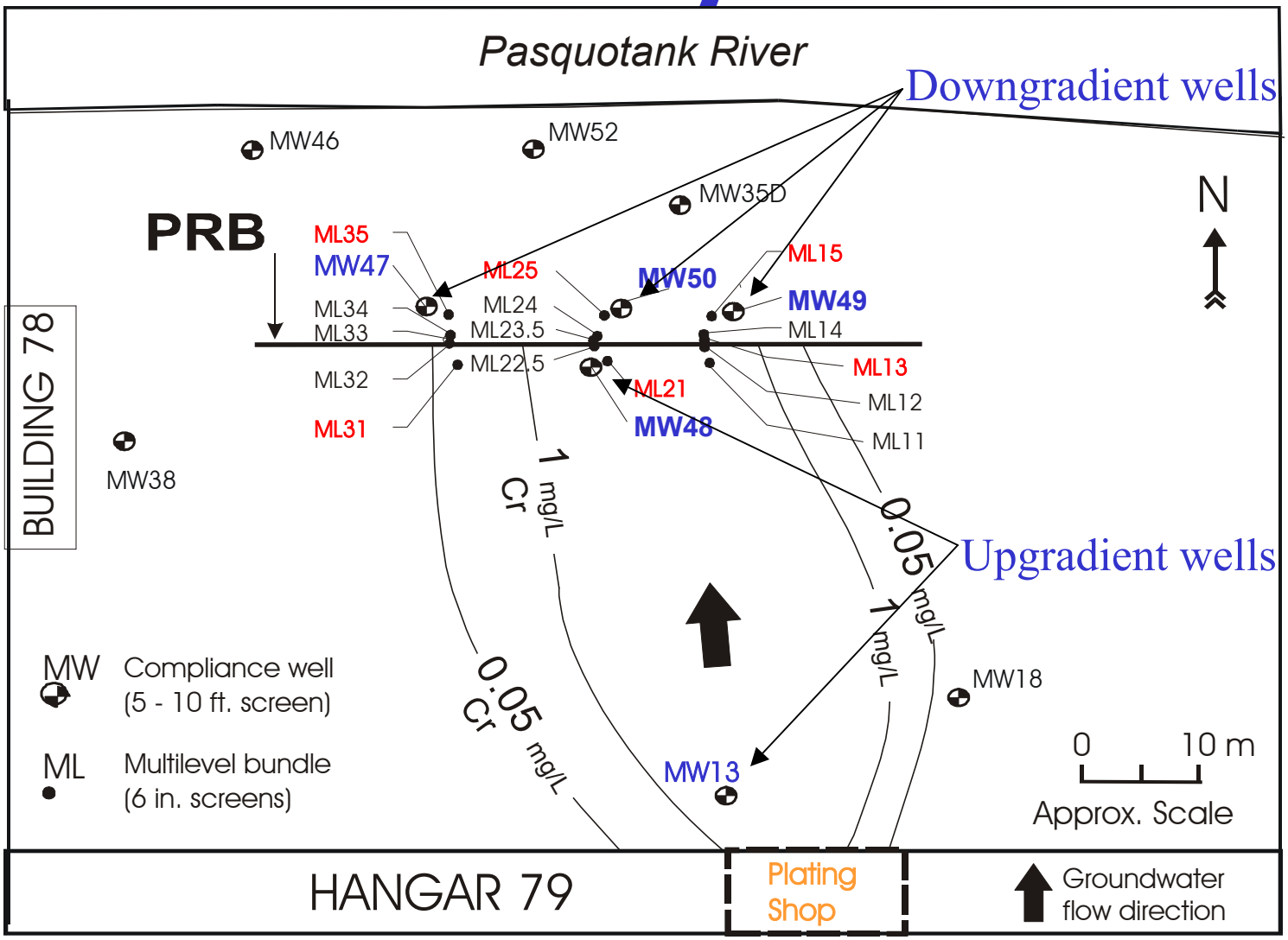
U.S. Coast Guard Base, Elizabeth City (NC)

- Continuous wall – installed (6/96) with deep trencher, 150 ft Length, 24 ft depth, 2 ft thick
- Contaminants
  - Cr(VI) up to 4 mg/L
  - TCE (& degradation products) up to 15 mg/L
- Chemistry
  - Total Dissolved Solids: <400 mg/L
  - Dissolved oxygen: <1 mg/L
  - pH: ~6

Overview

- Consistent degradation of contaminants over 6+ y
- Cr completely removed, never above MCL (0.1 mg/L) in any downgradient sampling points
- Organic compounds removed to less than MCL in most sampling points most of the time
- The iron wall has achieved containment of chrome plating shop plume (source area now being addressed)
- Multiple sources of chlorinated organic compounds in evidence at the site

Elizabeth City USCG Site



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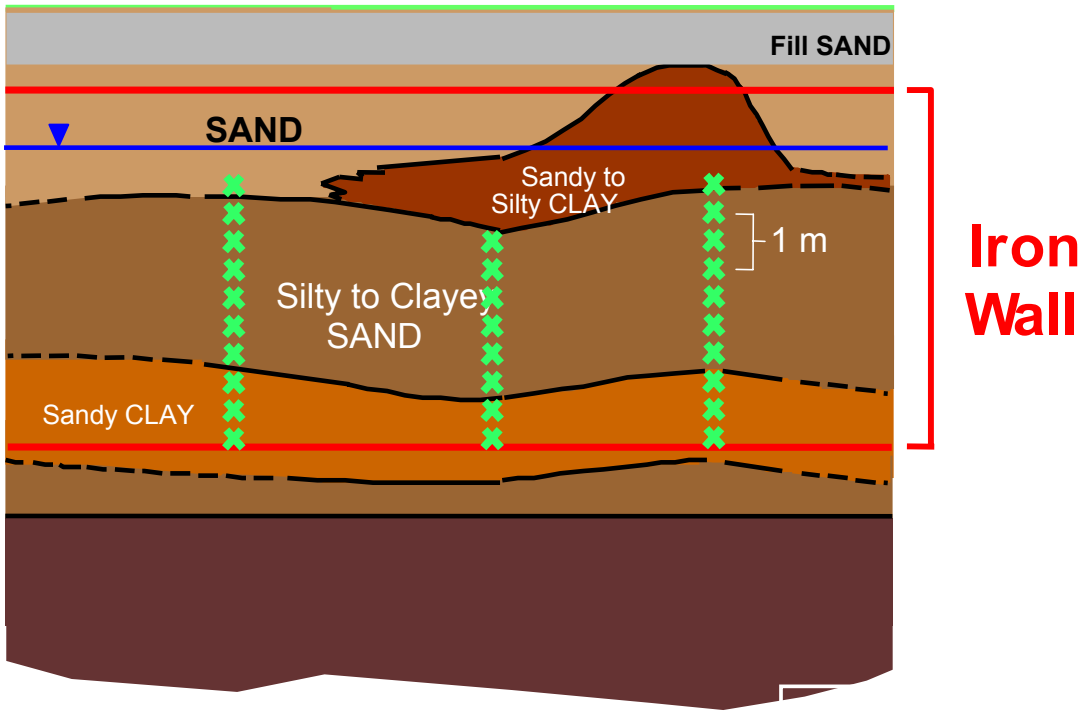
Multi-Level Samplers



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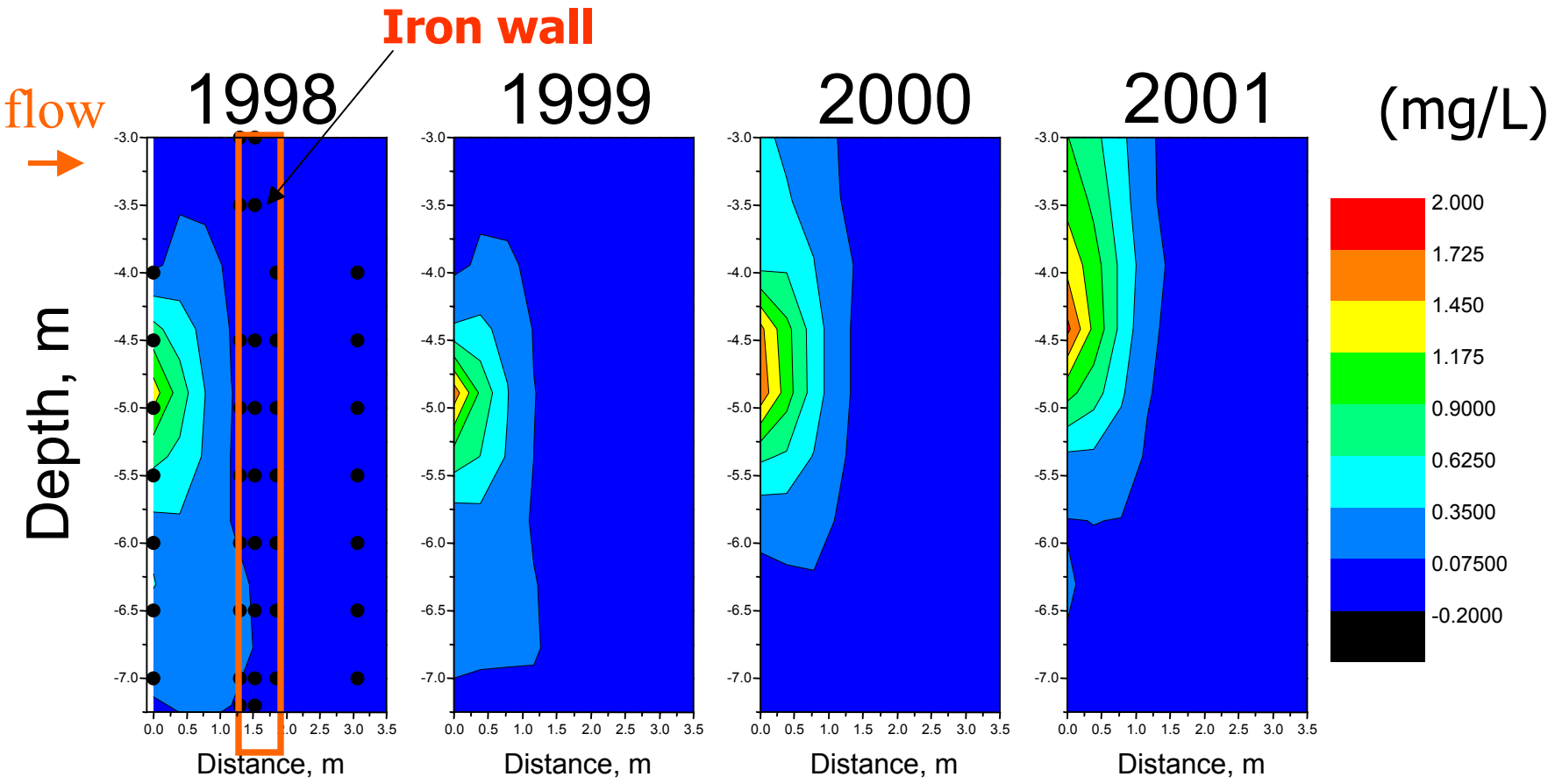
Elizabeth City – Cr distribution



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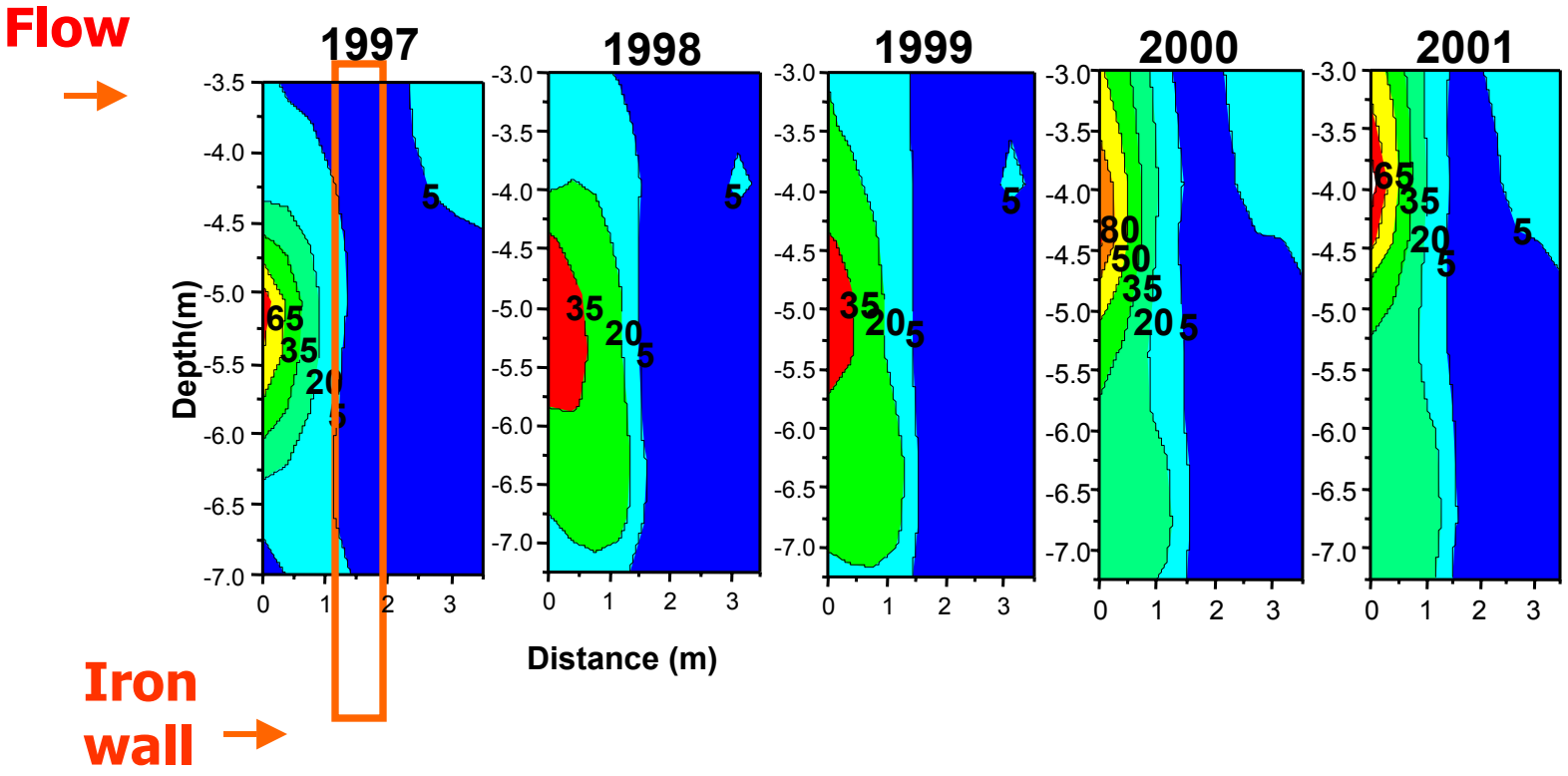
Elizabeth City – SO_4 Distribution



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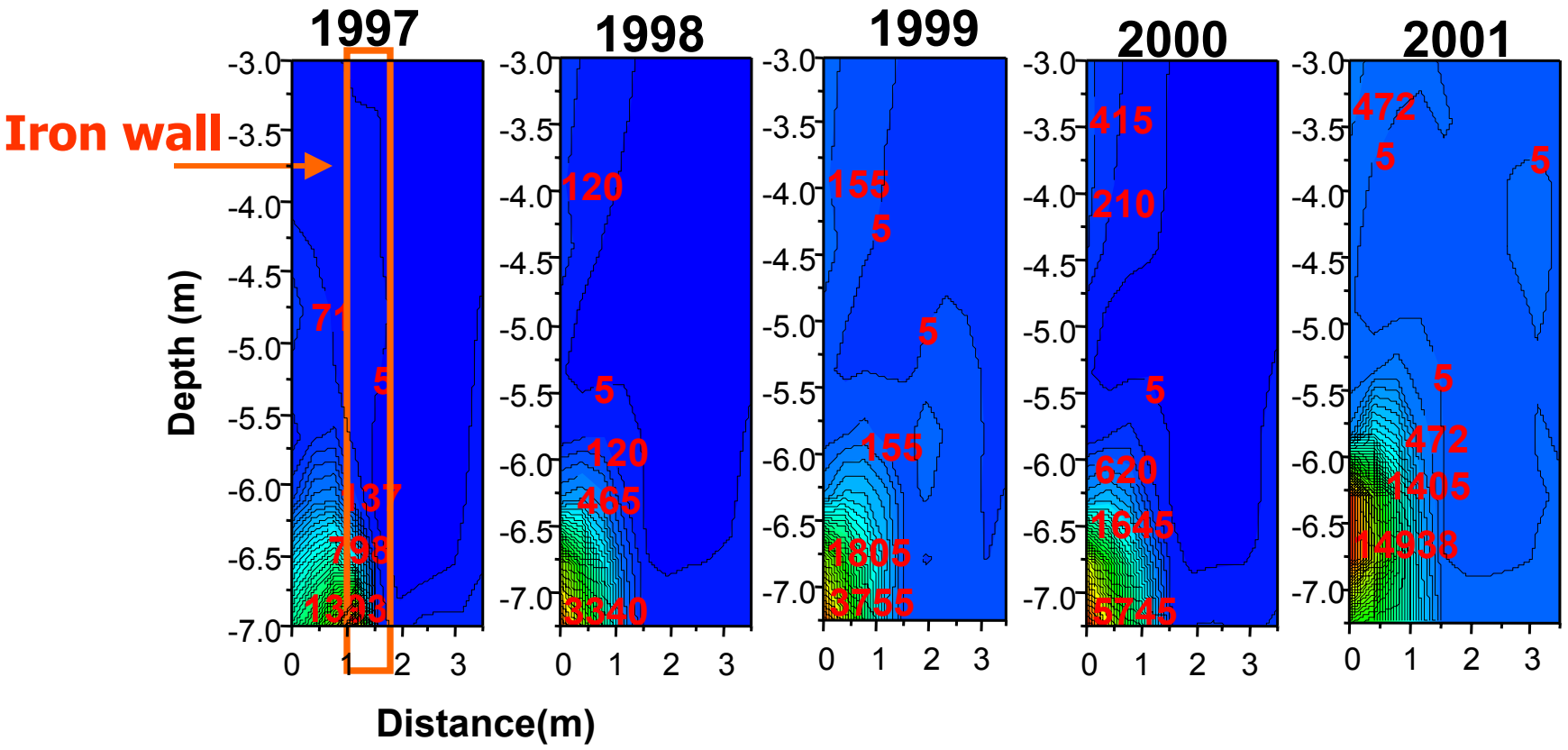
Contaminant Removal:Inorganics

- **Cr continues to be completely removed after 6+ years**
- **The Cr plume has risen in elevation over time (SO4 also) in the central portion of the wall**
- **Cr removal documented by iron corrosion process, ppt as mixed Cr-Fe hydroxide**
- **Cr capacity estimates for wall exceed 20 year lifetime**

Elizabeth City – TCE Distribution



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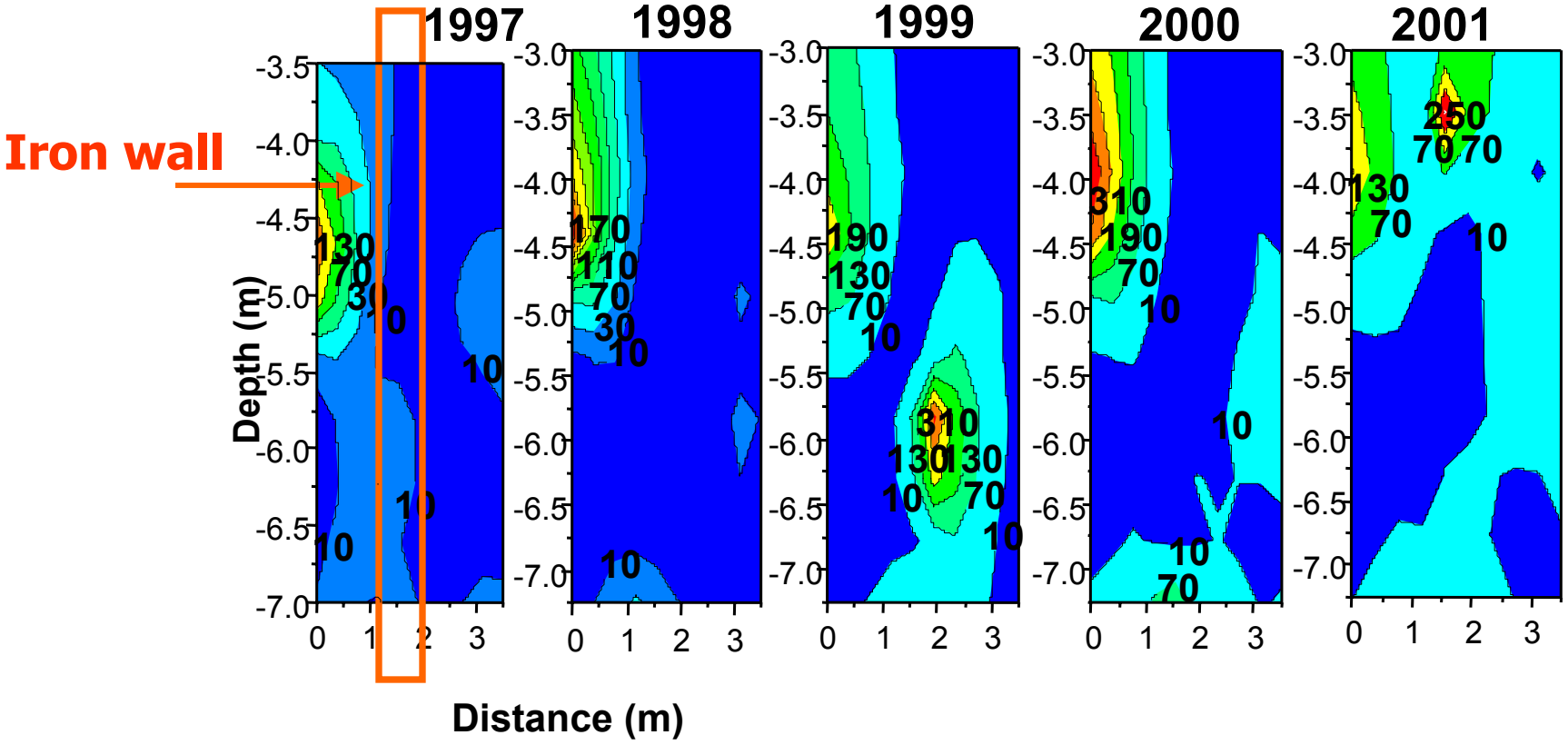
Elizabeth City – c-DCE Distribution



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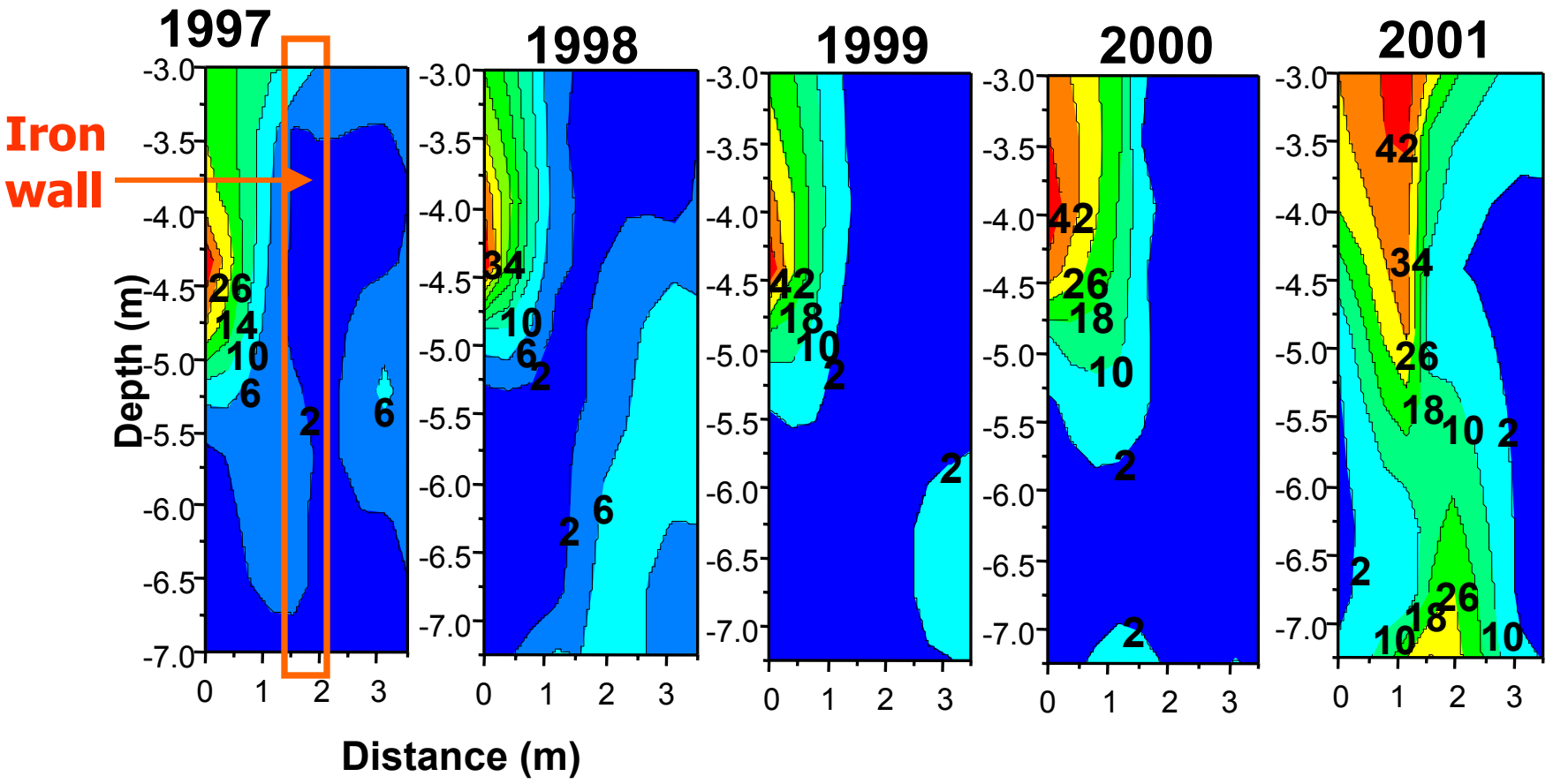
Elizabeth City – VC Distribution



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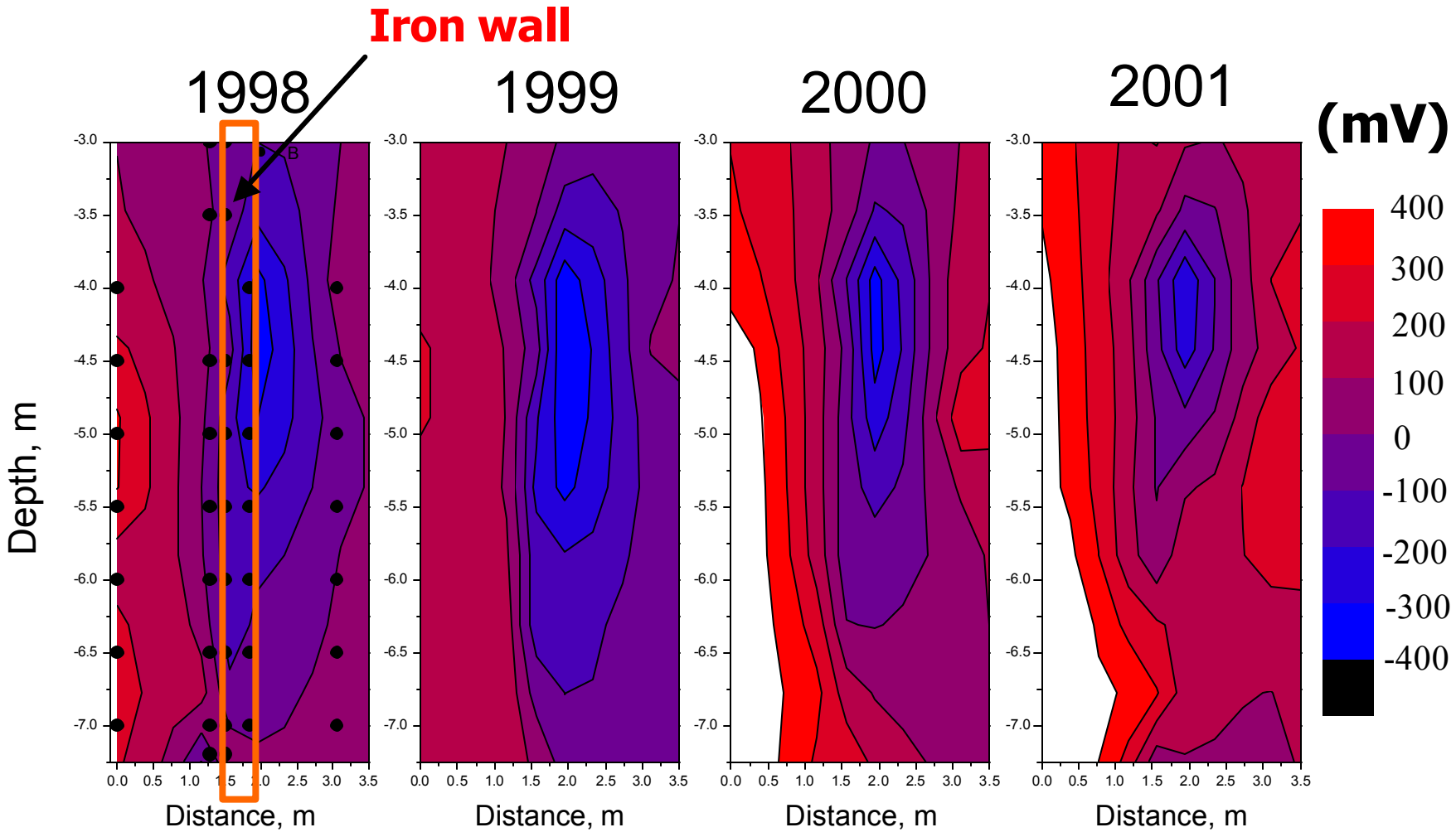
Contaminant Removal - Organics

- **All 3 organic compounds (TCE, cis-DCE, VC) continue to be removed to less than MCL in most locations**
- **Increasing trend of TCE concentration coming into lower (deeper) part of the wall**
- **Two distinct plumes appear to enter wall**
  - **Shallow plume (> 5.5 m) w/ lower conc, natural degradation in evidence**
  - **Deeper plume (< 6.0 m) w/ high conc., little evidence of natural degradation**

Contaminant Removal - Organics

- Cl concentrations support 2 (or multiple) chlorinated plume idea
- Some increase in c-DCE concentrations at back end of wall after 6 years
  - Is this a trend ??
- Some increase in VC concentrations at back end of wall after 6 years
  - Is this a trend ??

Elizabeth City - Eh



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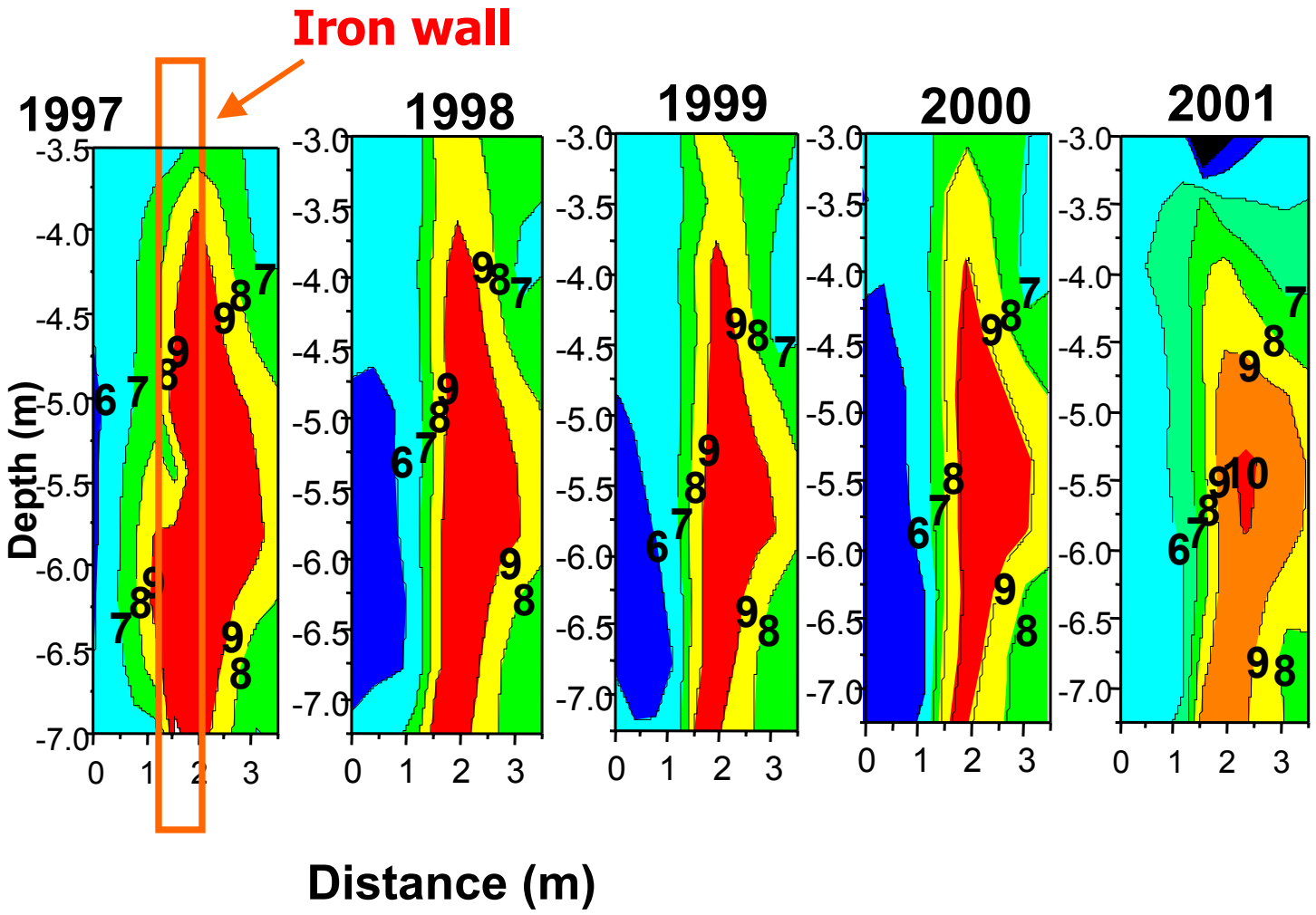
Elizabeth City - pH



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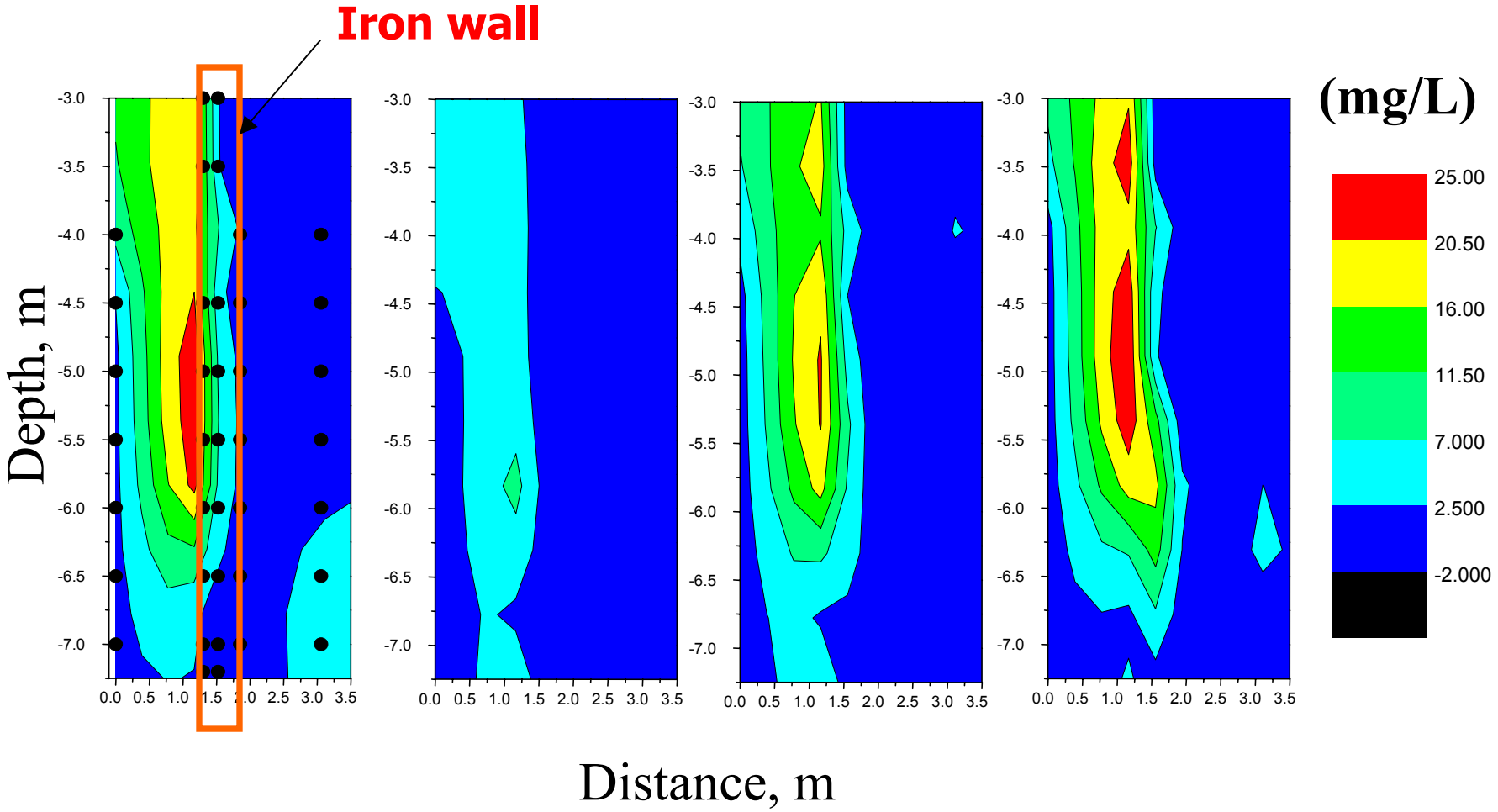
Elizabeth City – Iron(II)



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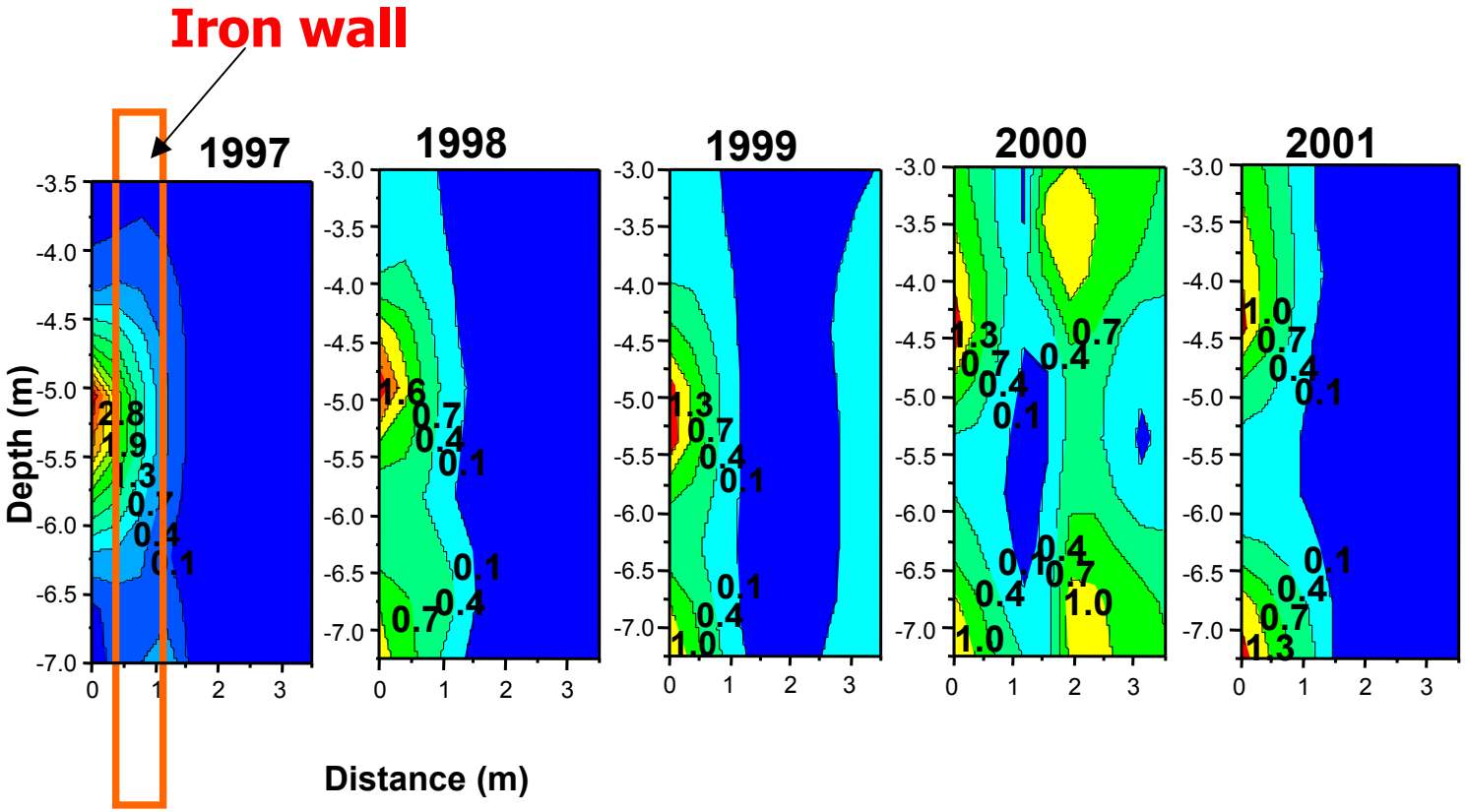
Elizabeth City – NO3



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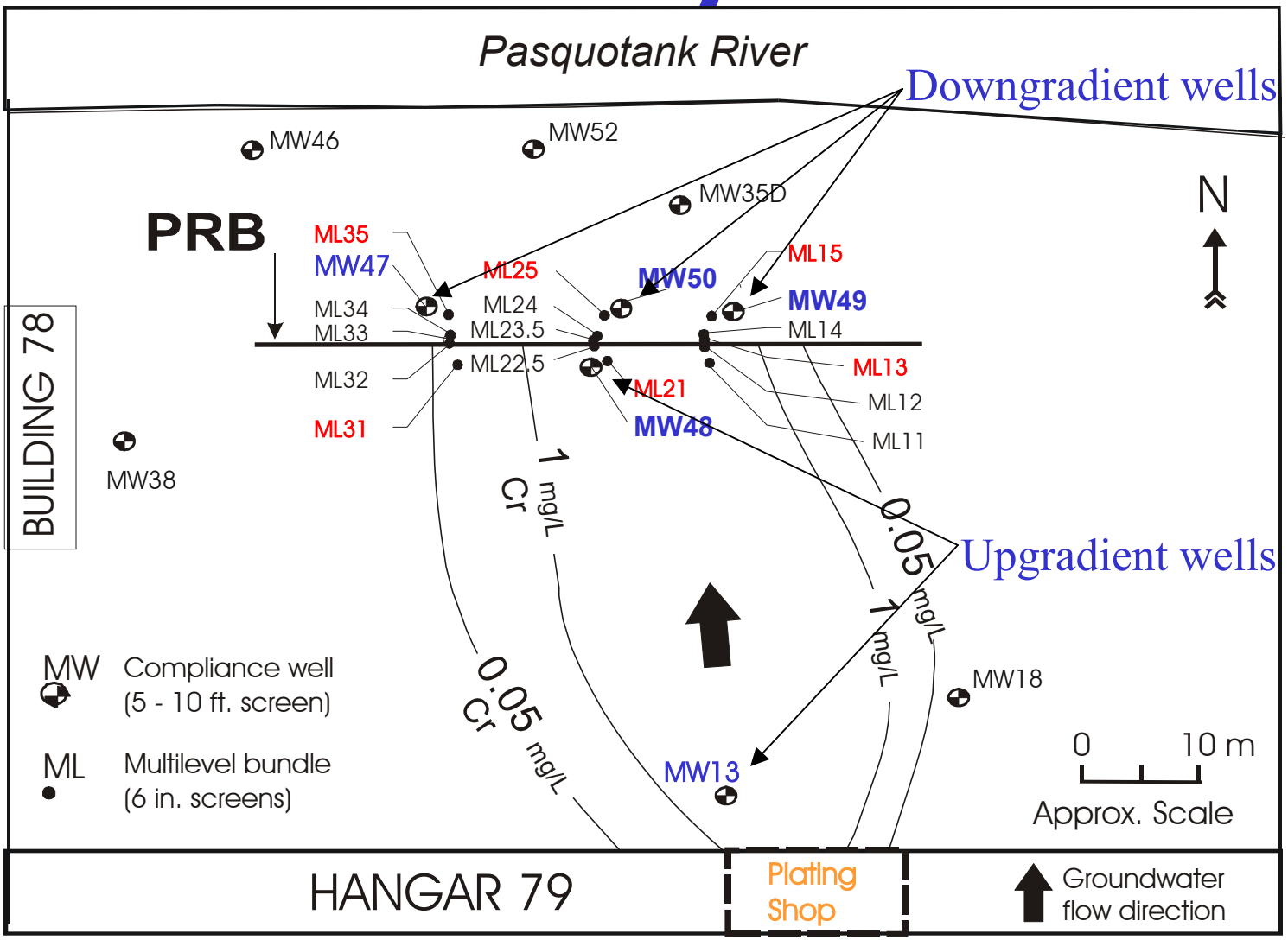
Geochemical Parameters

- **Eh has changed little over 6+ years**
- **pH is increasing (> 10) at the back end of the wall and aquifer interface**
- **Fe2+ continues to be removed through the wall**
- **NO3 increased slightly in the wall in 2000, absent again in 2001**

Elizabeth City USCG Site



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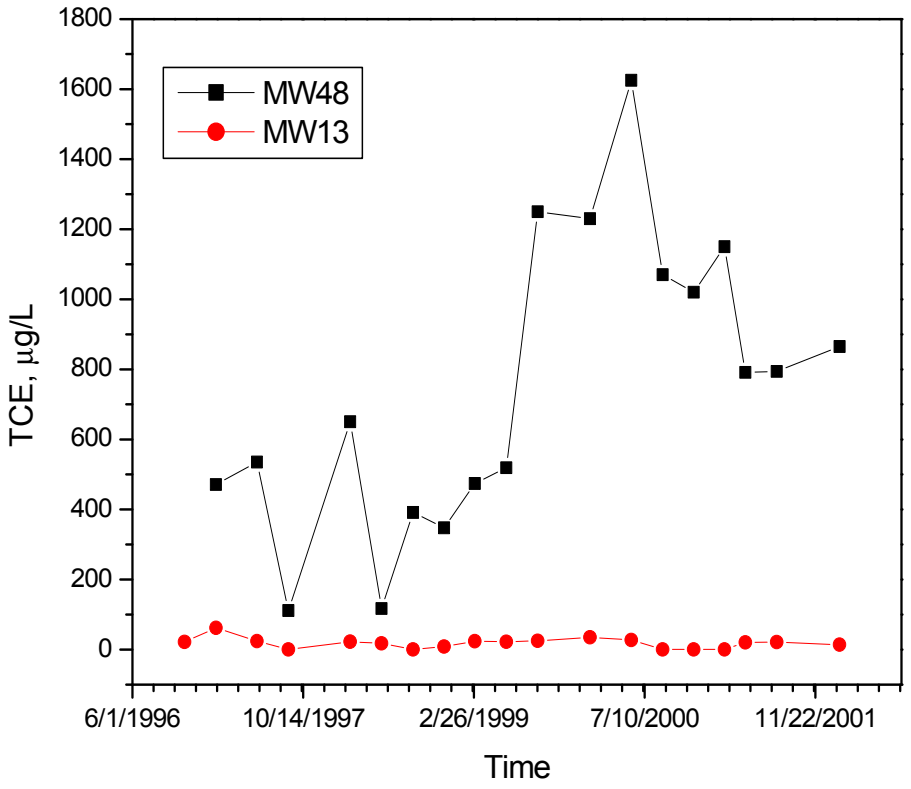
Upgradient TCE Concentrtions in MW's



- **Concentrations variable over time, averaged over 5 ft screen interval**
- **MW 48 concentrations track MLS values but about 1 order of magnitude less than highest observed in MLS ports**
- **Large difference between TCE concentrations entering wall versus near the plating shop**

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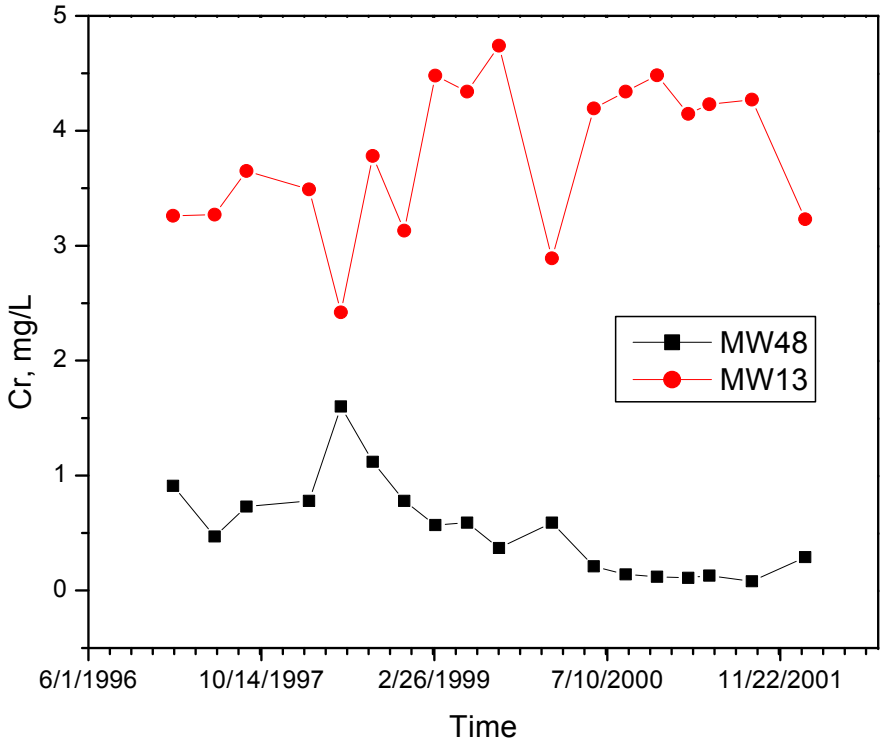
Upgradient Cr Concentrtions in MW's



- **Difference between Cr concentration near the plating shop and wall are less than observed for TCE**
- **Cr concentrations less variable over time**
- **Cr concentrations in MW 48 similar to MLS values**

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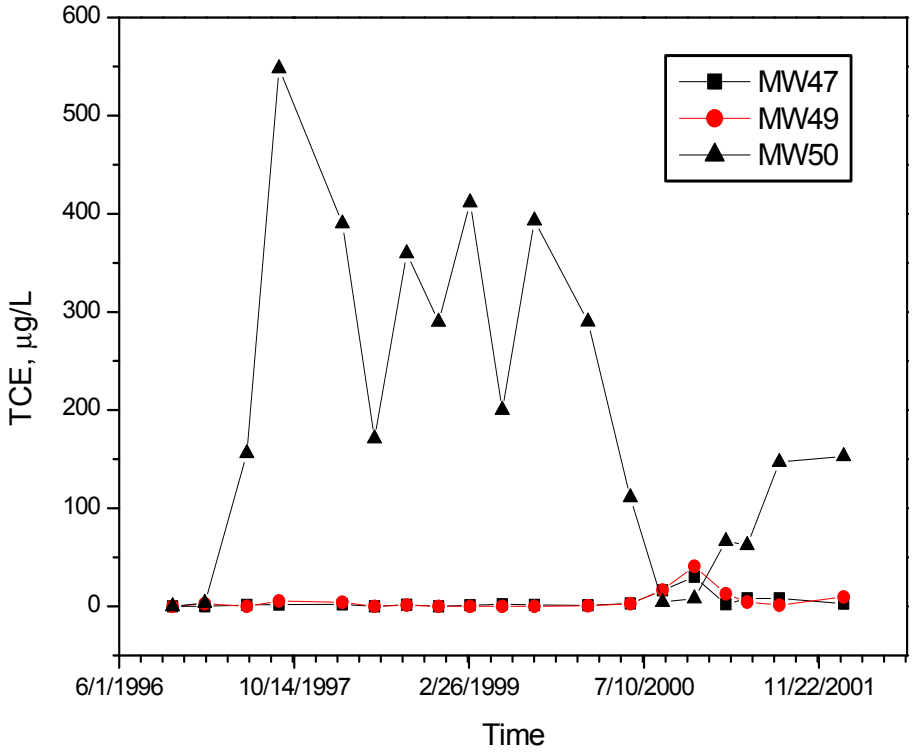
Downgradient TCE Concentrations in MW's



- **TCE consistently detected in MW50 , screened below the wall**
- **Concentrations in MW50 variable over time, but perhaps decreasing**
- **Concentrations in MW50 less than 0.1 times upgradient concentrations at same depth below the wall**

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Downgradient Cr Concentrations in MW's

- **Most are below detection limits (<0.002 mg/L)**
- **Where detected (9%), avg concentration was 0.003 mg/L**
- ***It's gone***

Contaminant Concentrations in Downgradient MW's

Well	Contaminant	n_{total}	$n_{detected}$	Average
MW47	Cr (mg/L)	18	2	0.002
	TCE (ug/L)	18	15	6
	c-DCE (ug/L)	18	17	7.0
MW49	Cr (mg/L)	18	4	0.003
	TCE (ug/L)	18	11	9
	c-DCE (ug/L)	18	4	1.6

Contaminant Concentrations in Downgradient MLS's

Well	Contaminant	n_{total}	$n_{detected}$	Average
ML15	Cr (mg/L)	32	2	0.004
	TCE (ug/L)	32	8	1.8
	c-DCE (ug/L)	32	9	1.5
MW25	Cr (mg/L)	32	0	0.003
	TCE (ug/L)	32	15	16
	c-DCE (ug/L)	32	30	14

n = sample numbers

Summary

- Consistent degradation of contaminants over 6+ y
- Cr completely removed, ***never*** above MCL in ***any*** downgradient sampling points
- The iron wall has achieved site goal: containment/treatment of chrome plating shop plume
- Chrome plating shop moving toward site closure
- Multiple sources of chlorinated organic compounds in evidence at the site
    - Recommend identification of additional sources and placement of additional iron for treatment

Acknowledgments

- **USCG for field support**
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- **ManTech analytical**