Examination of Sediment Stability 1989-2007

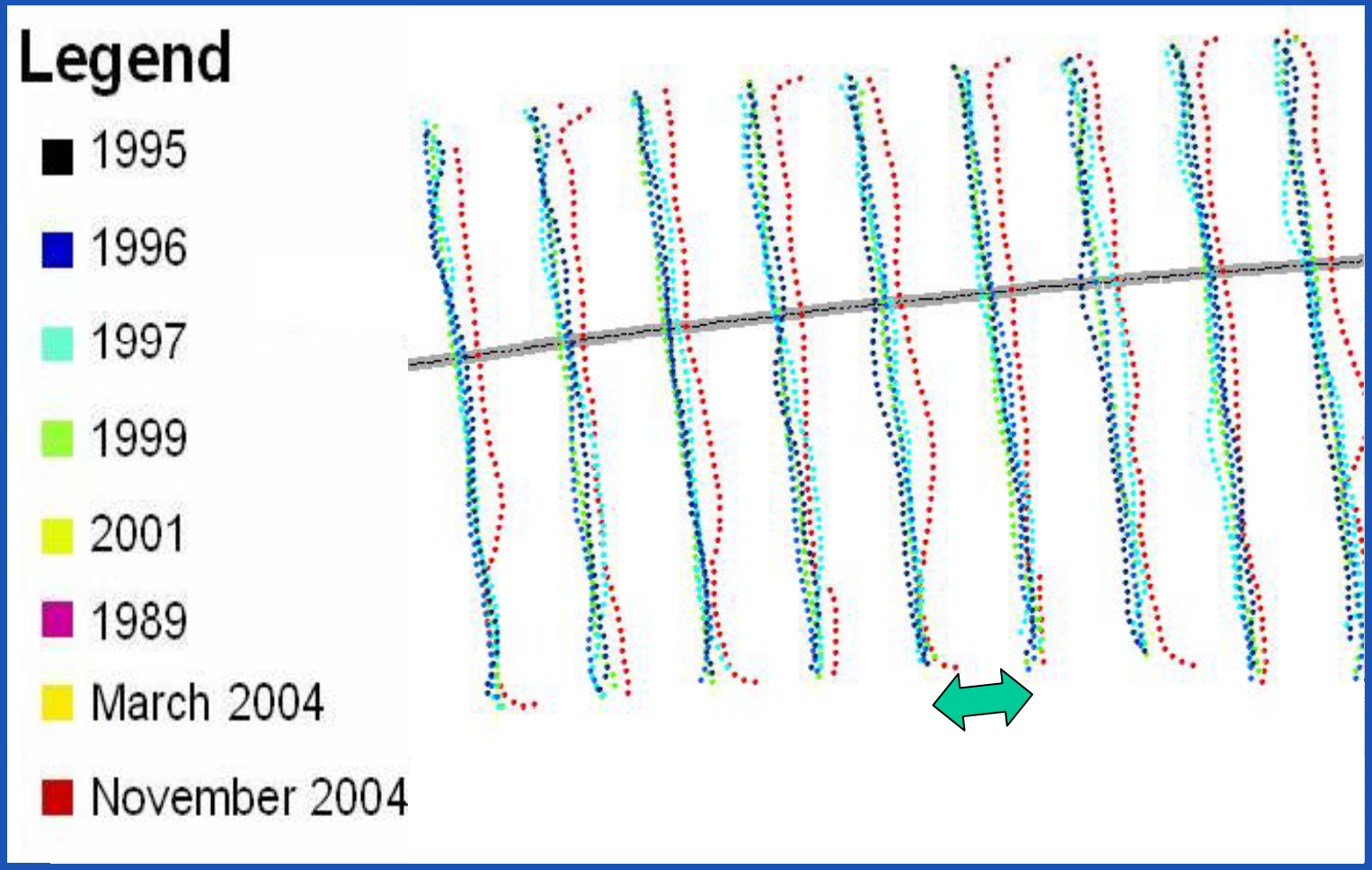
Presentation to Lower Passaic River Cooperating Parties Group

September 11, 2009

Draft for 9/11/09 Meeting

207084
R2-0016590

Bathymetric Survey Evaluation



(2007 Multibeam coverage is essentially continuous)

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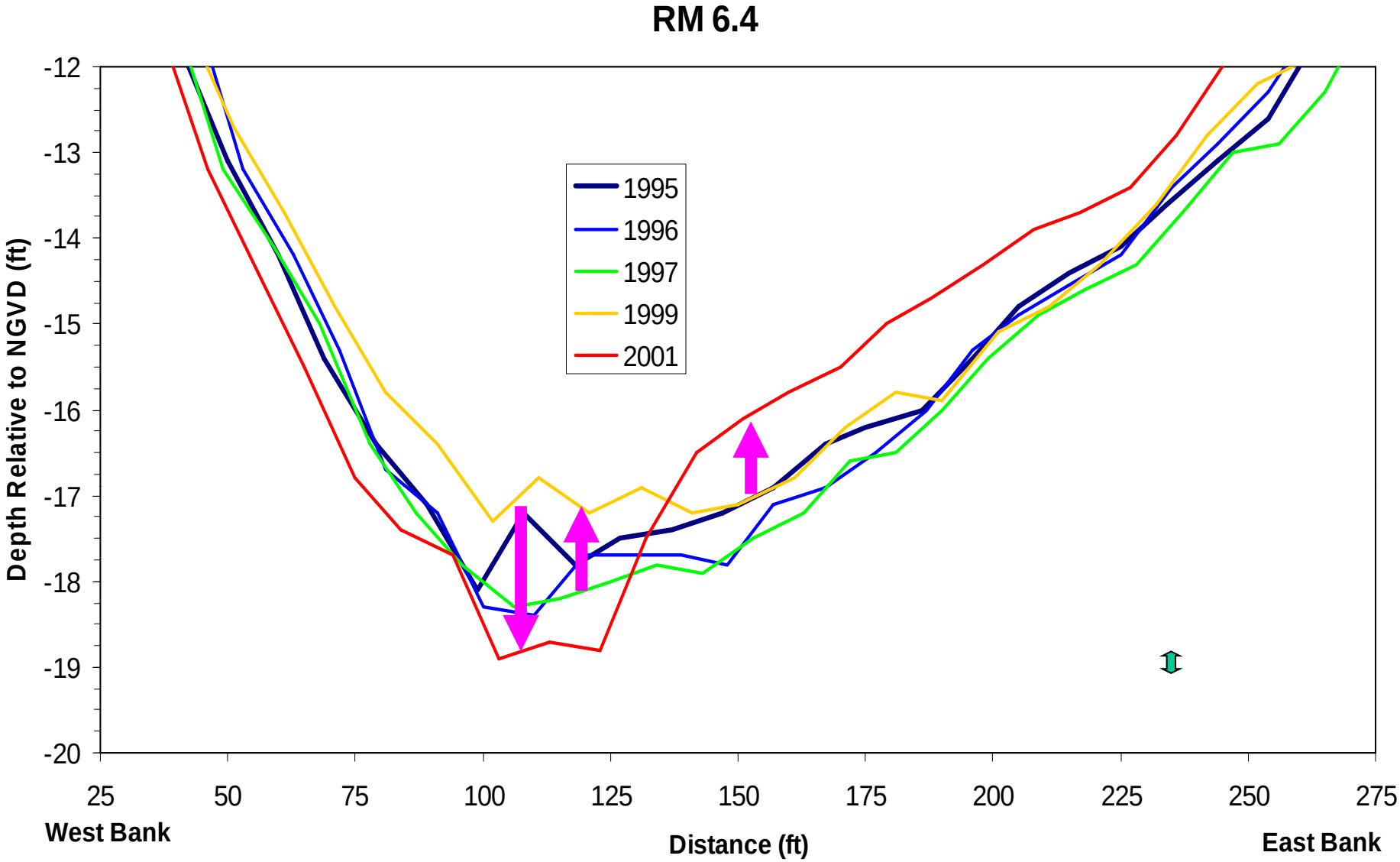
River Bottom Elevation Change over Time



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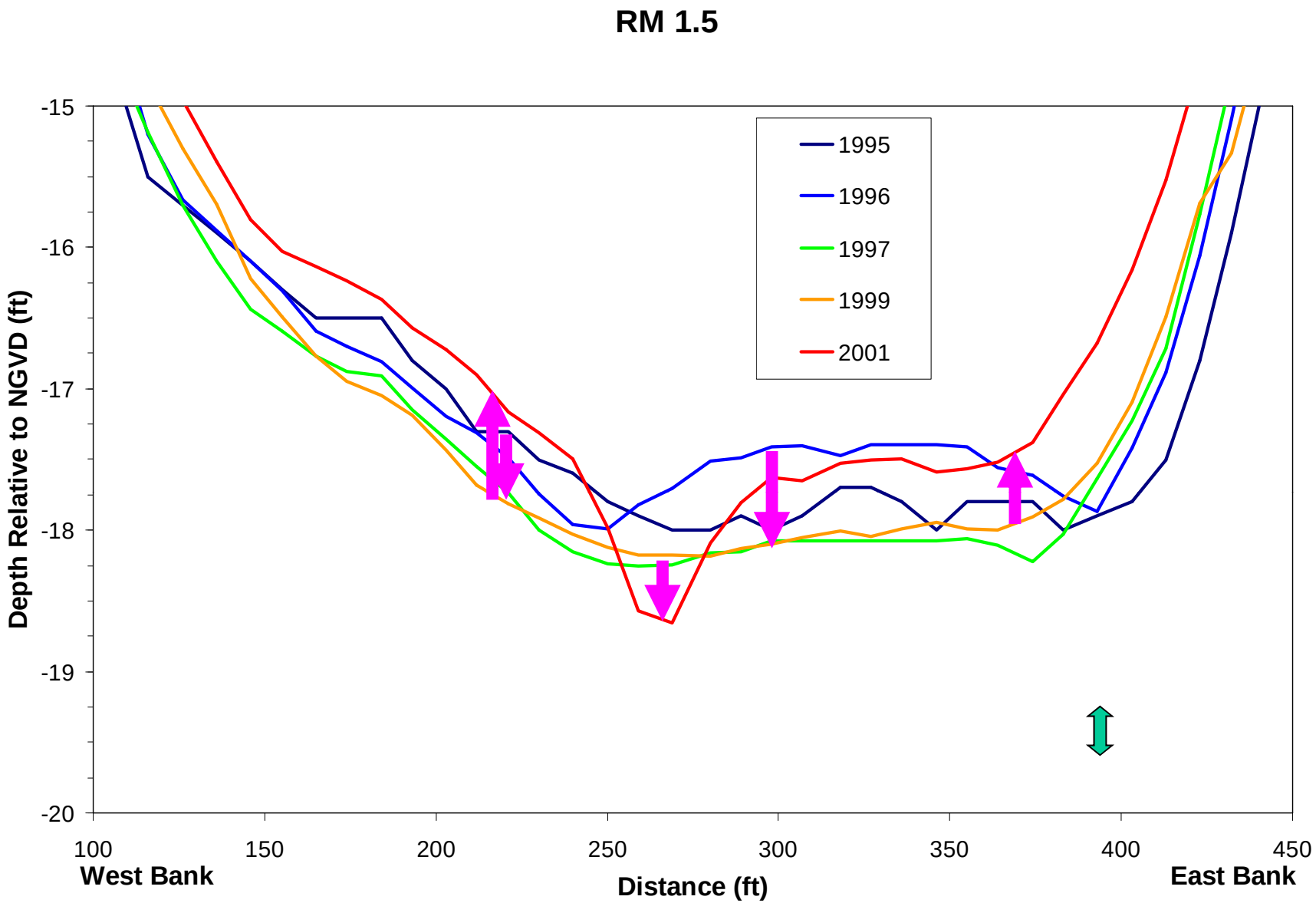
River Bottom Elevation Change over Time



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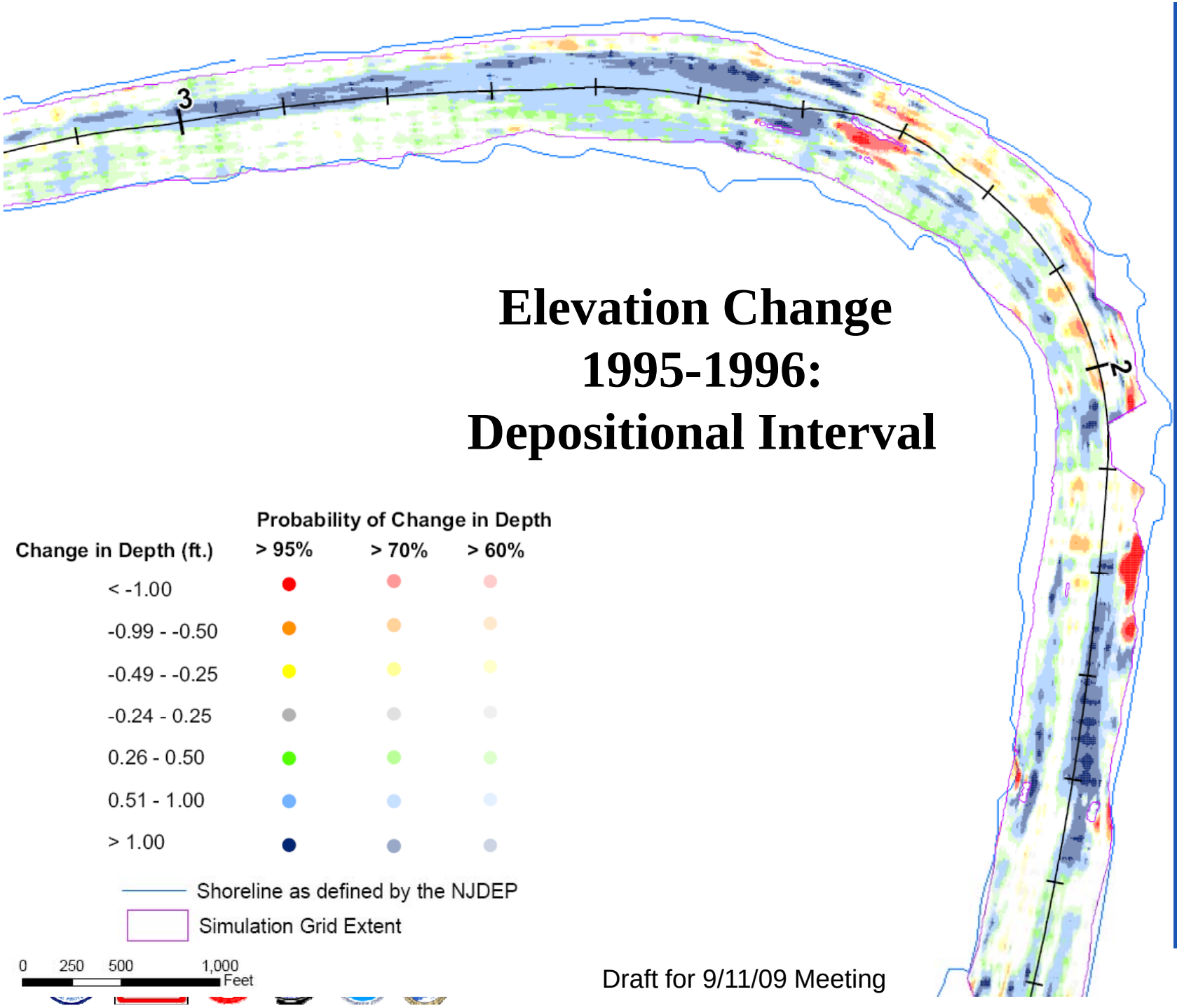
Conditional Simulation Steps

- For each bathymetric survey
  - Grid Straightening
  - Detrending
  - Semivariogram analysis
  - Calculating sediment erosion and deposition at scales of interest
  - Compilation of results into summary charts and tables ("roll-up")

Elevation Change 1995-1996: Depositional Interval



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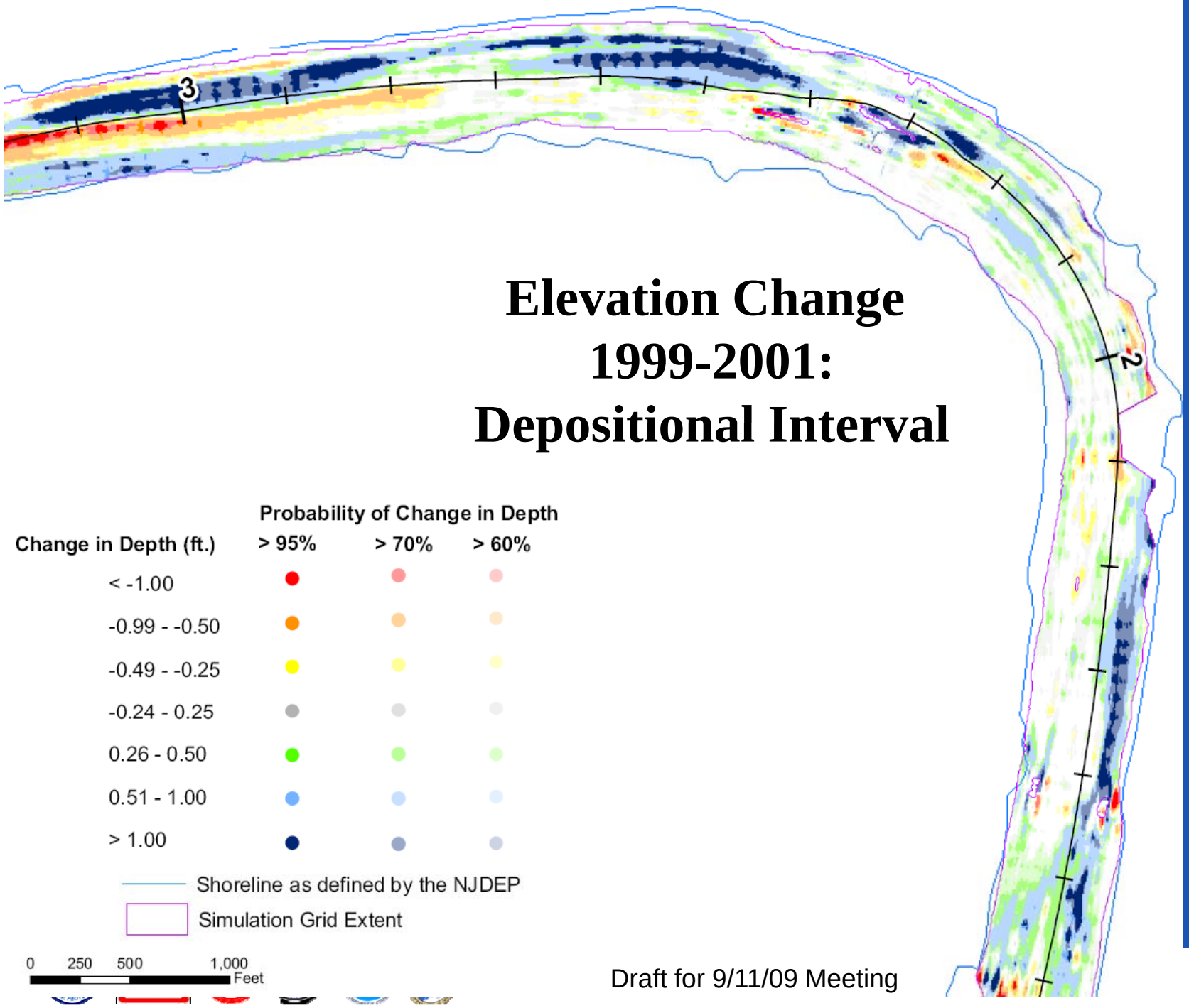
Elevation Change 1999-2001: Depositional Interval



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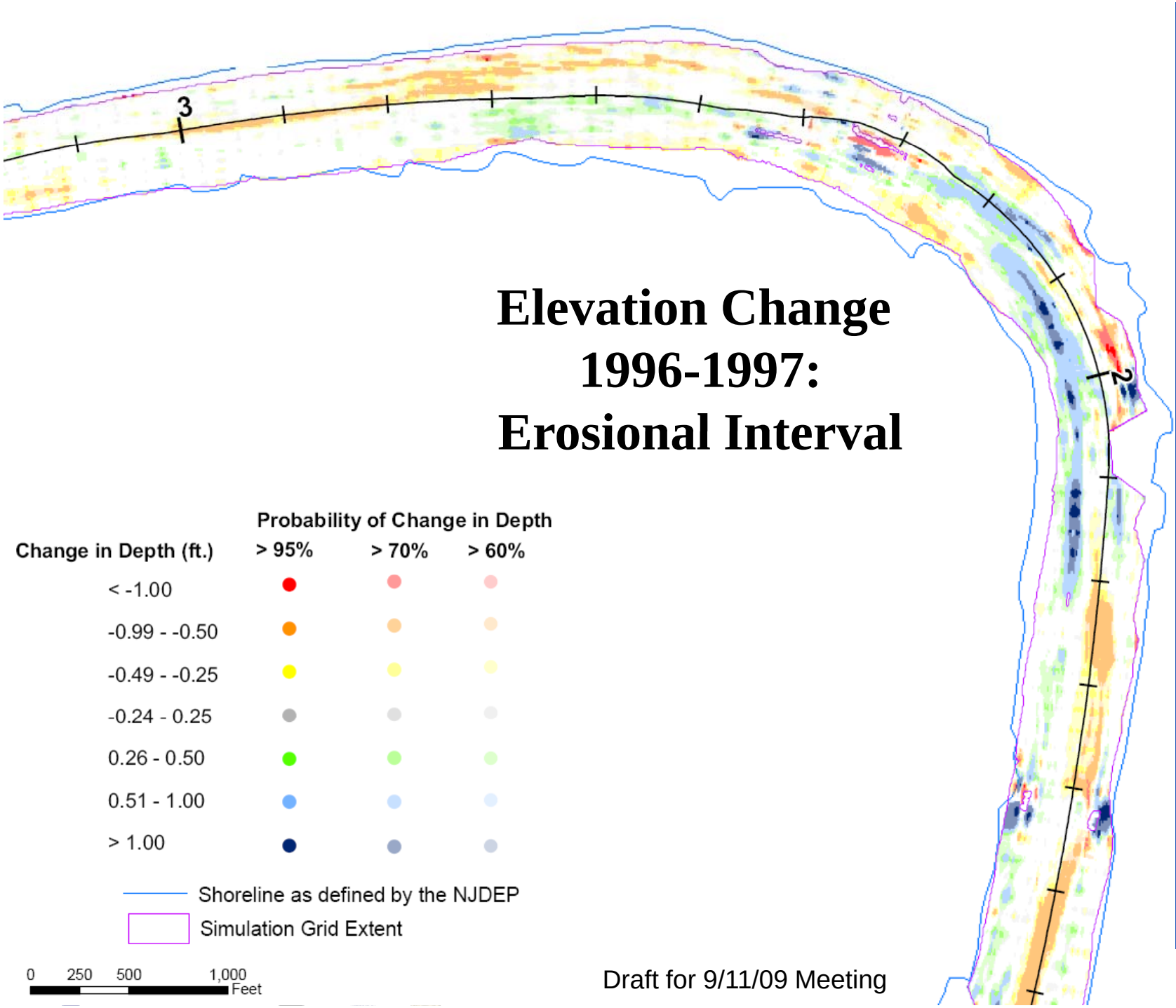
Elevation Change 1996-1997: Erosional Interval



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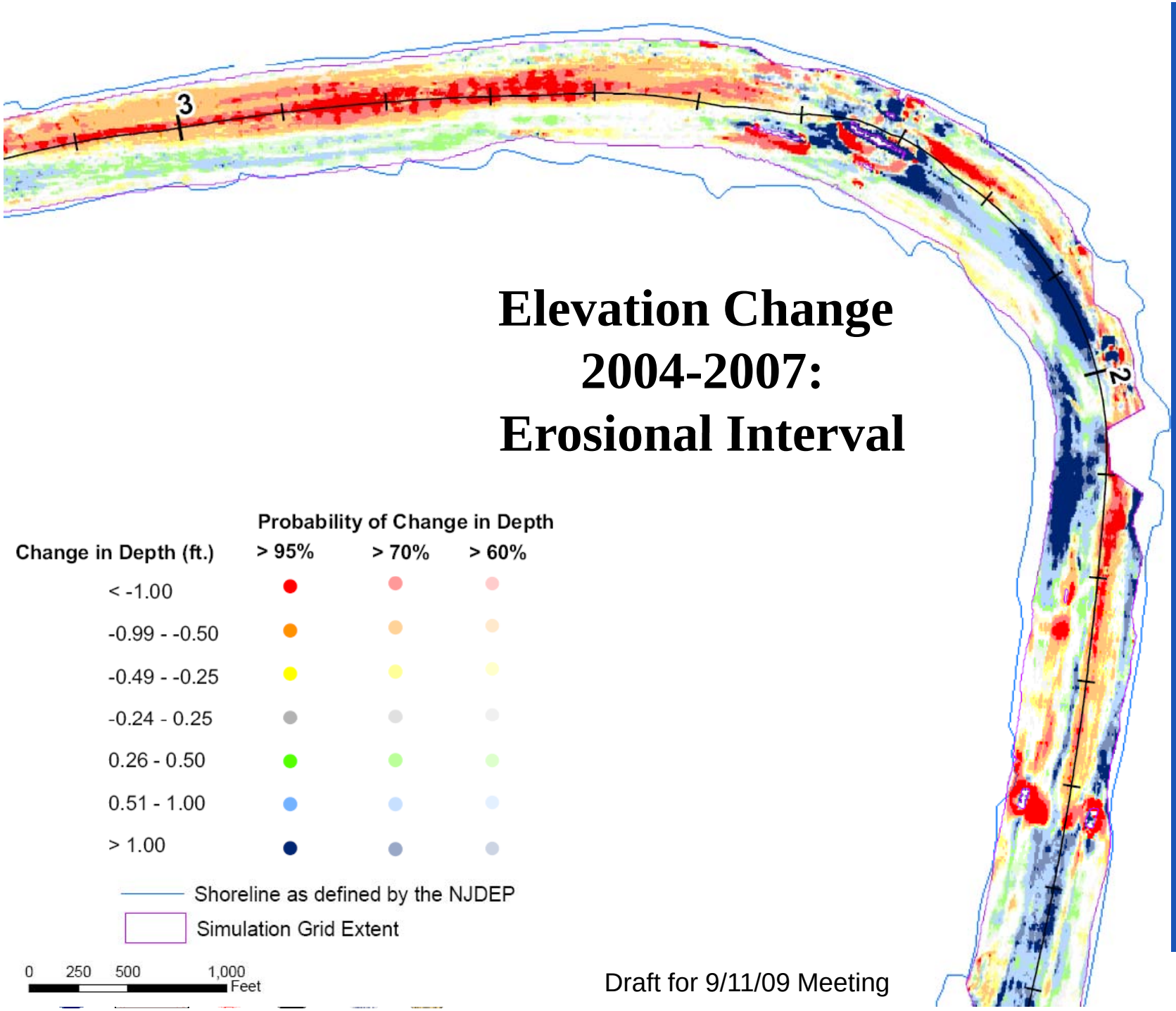
Elevation Change 2004-2007: Erosional Interval



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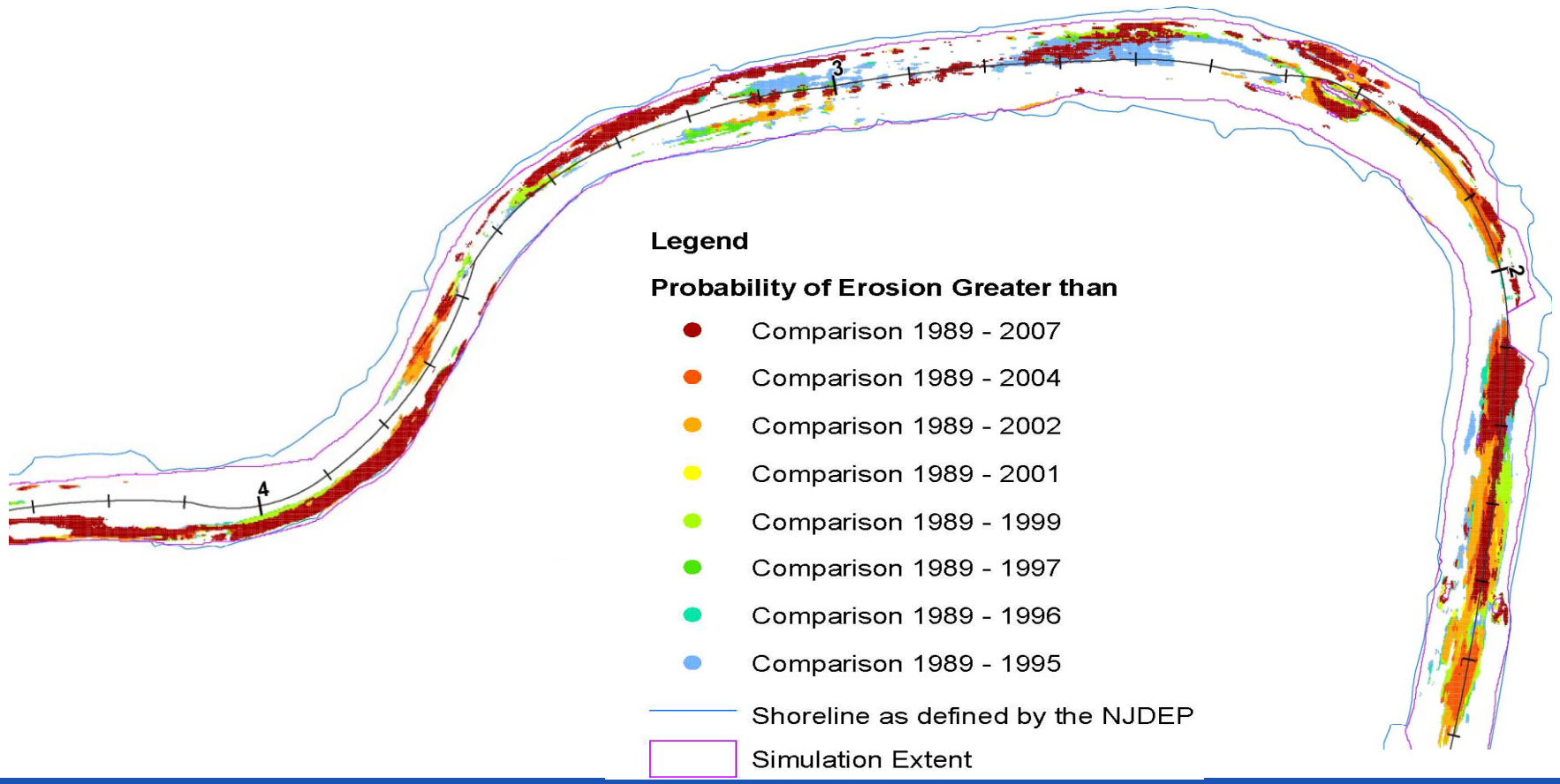
Areas Where Erosion Through the 1989 Surface was 3 inches or More

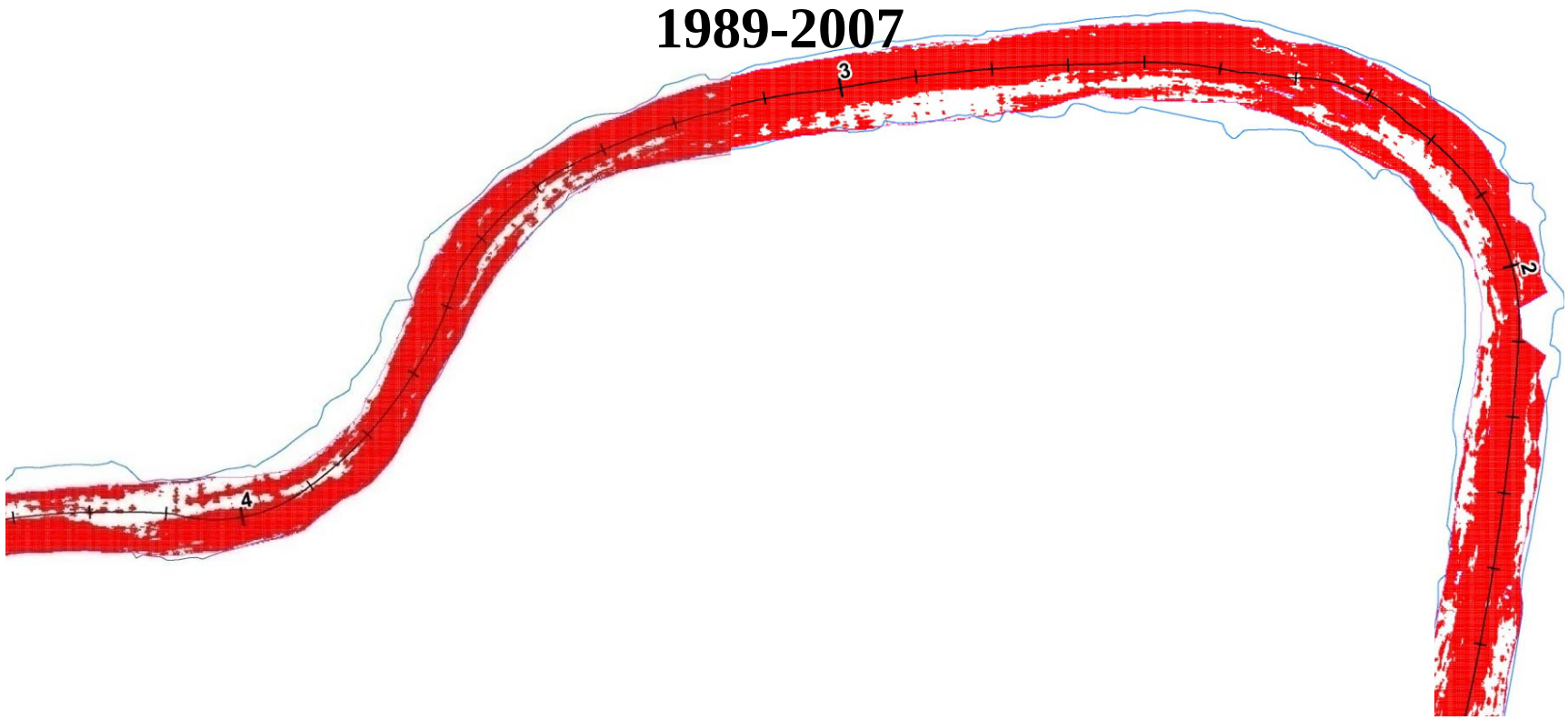


Conditional Simulation Results for RM 2-4.
Colored areas correspond to ≥ 70 percent probability of erosion of at least 3 inches relative to the 1989 surface.

Areas Subject to at Least One Erosional Event of 3 inches or More 1989-2007

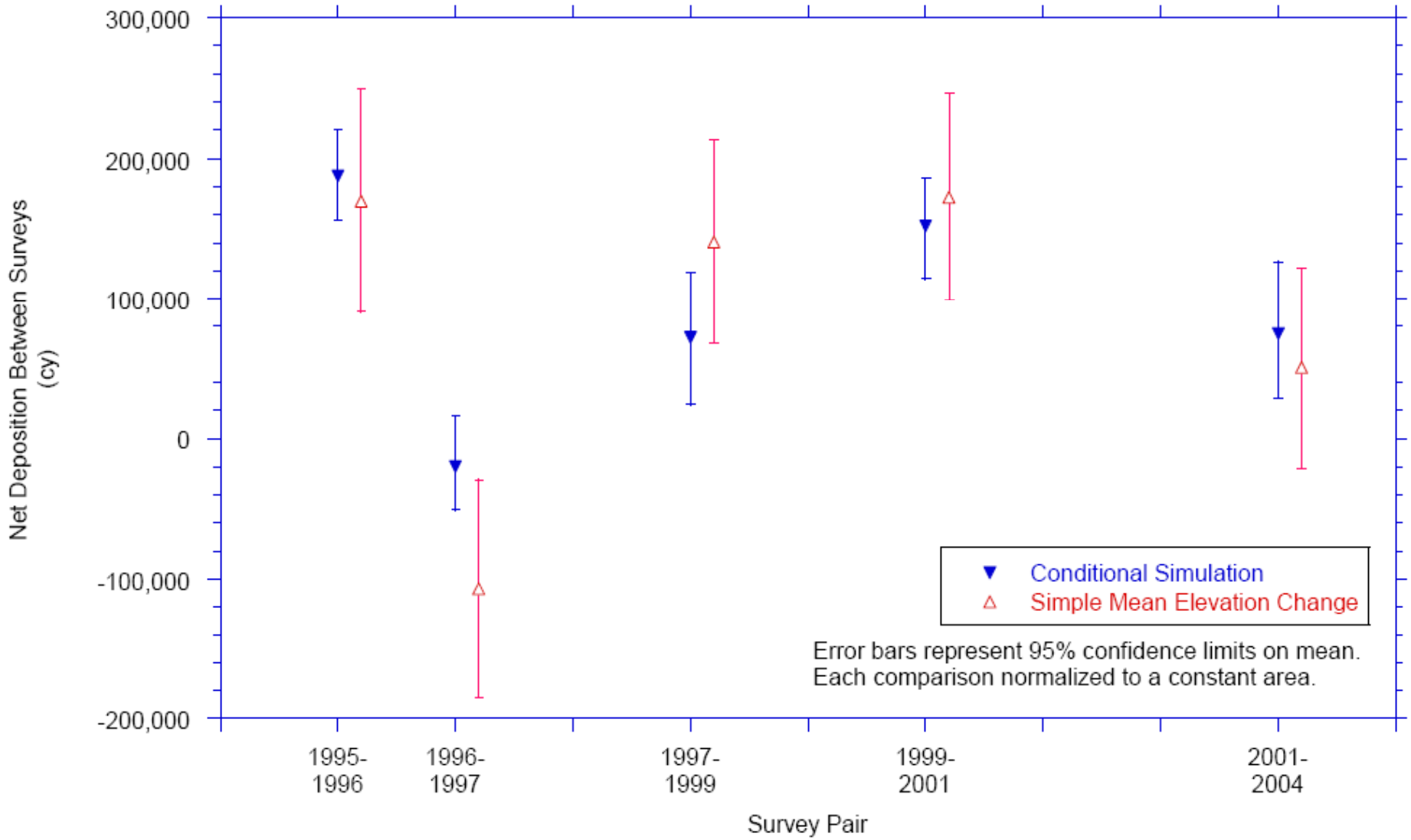
Conditional Simulation Results for RM 2-4.
Area in red corresponds to ≥70 percent probability of erosion of at least 3 inches for all combinations of bathymetric surveys

Areas Subject to at Least One Erosional Event of Any Magnitude 1989-2007



Conditional Simulation Results for RM 2-4.
Area in red corresponds to ≥70 percent probability of erosion (> 0 inch) for all combinations of bathymetric surveys.

Comparison of Net Deposition Estimates for RM 0 to 7 Conditional Simulation vs. Simple Mean Elevation Change



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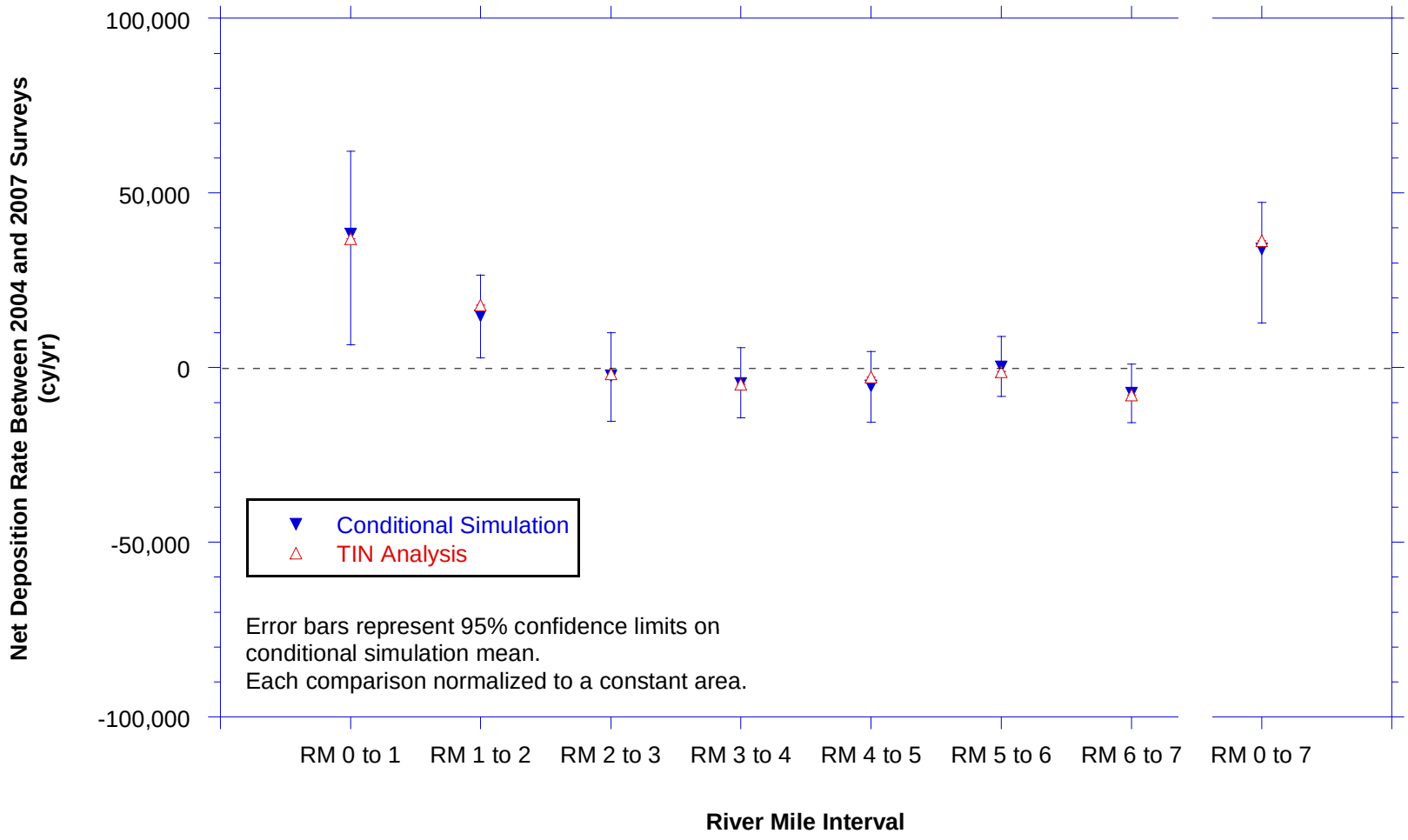
Comparison of Net Deposition Rates for RM0 to 7
Conditional Simulation *vs.* TIN Results
2004 to 2007 Survey Pair



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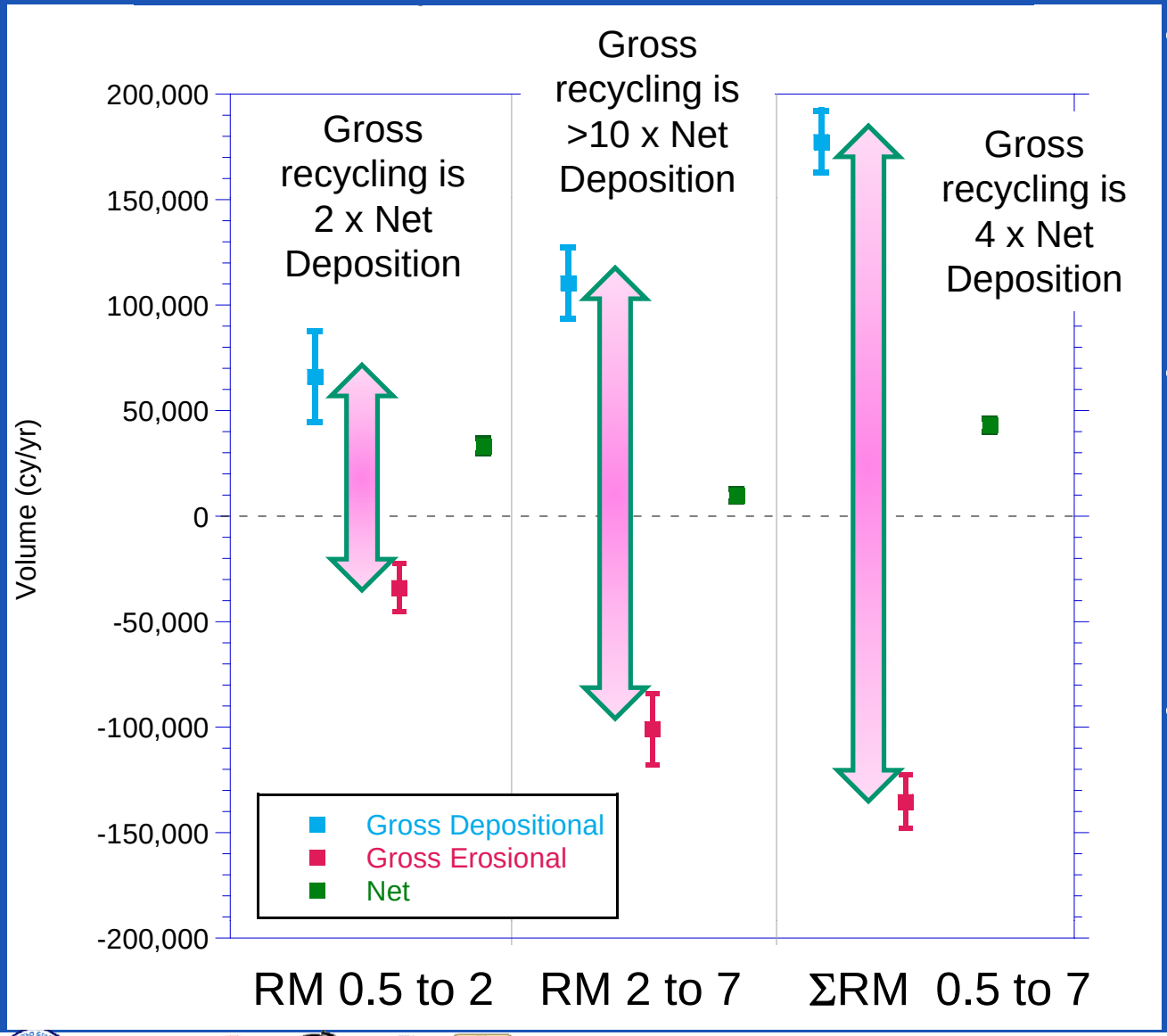
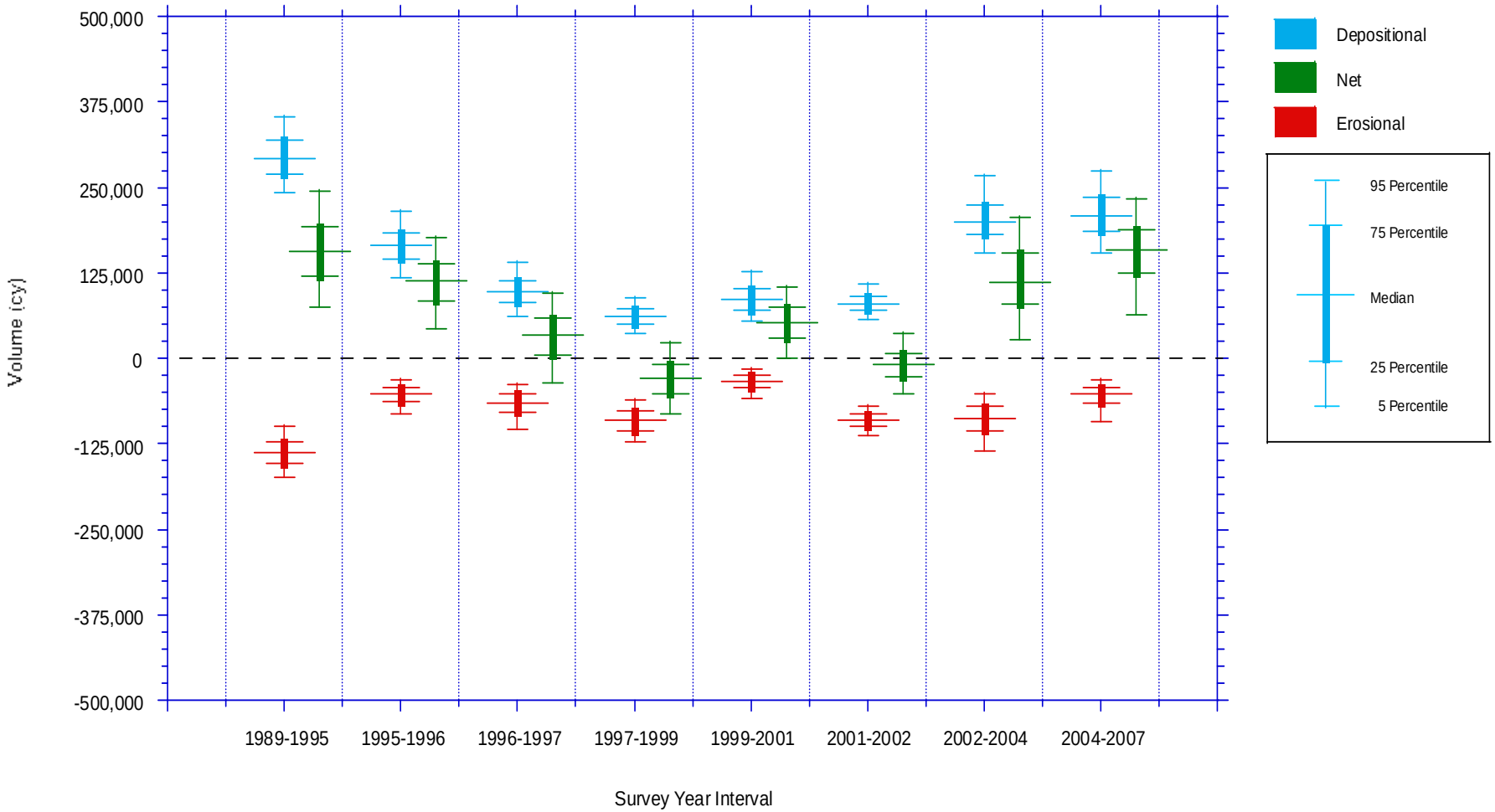
Depositional, Erosional and Net Sediment Volumes 1989 to 2007



- **Gross sediment recycling ~4 X net deposition**
- **>80% of net deposition occurs below RM 2**
- **Deposition in RM 2 to 7 is less than 1/3 inch/yr**

Summary

- Conditional simulation provides quantitative estimates of bathymetric elevation and uncertainty over entire river bottom
- Results provide quantitative basis to identify areas of erosion and deposition
- Comparisons to 1989 surface shows continued erosion of pre 1989 sediments to present day
- Erosion occurs nearly bank-to-bank throughout RM 1 to 7
- Gross sediment movements much greater than net deposition, especially from RM 2 to 7



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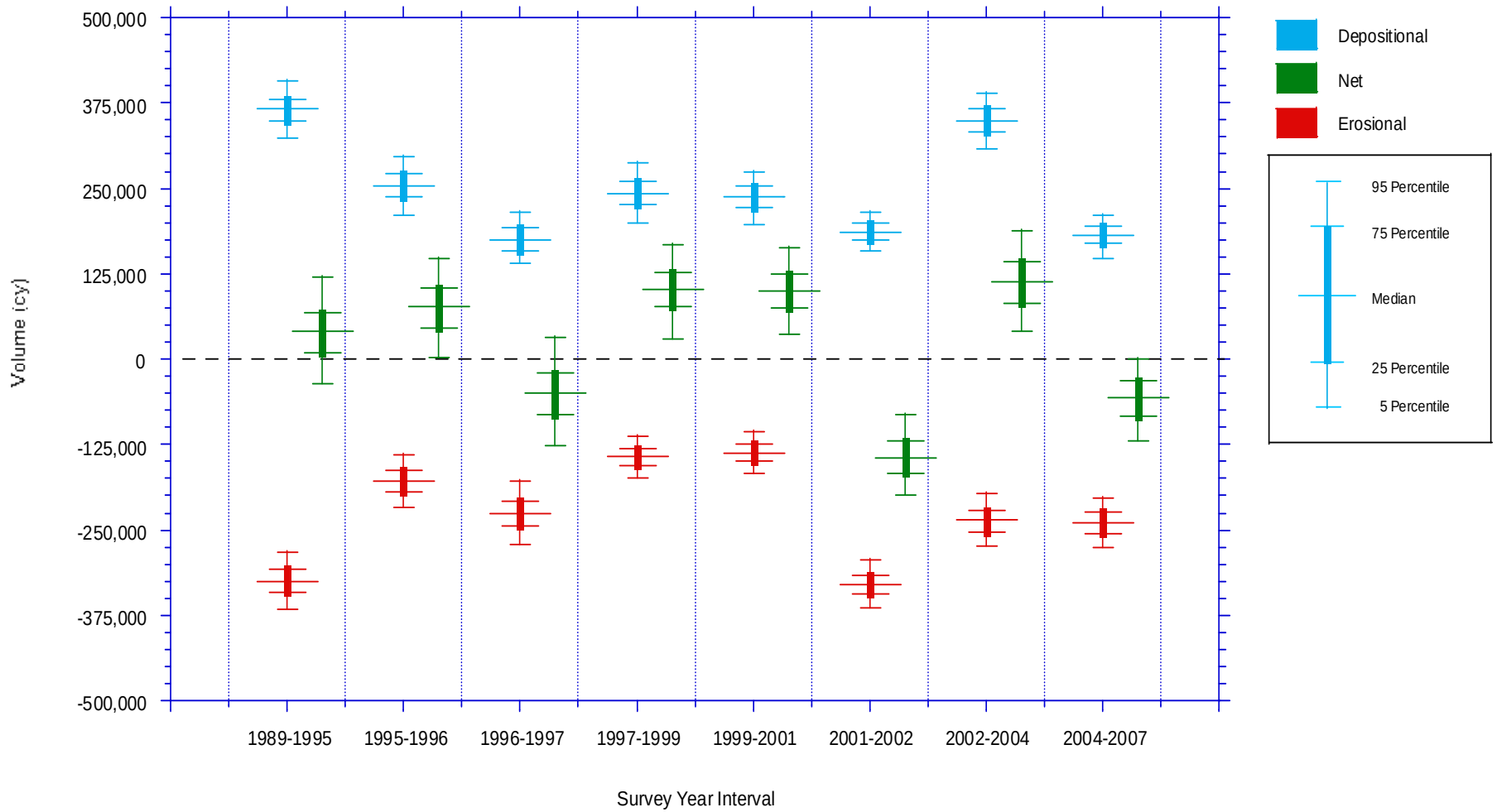
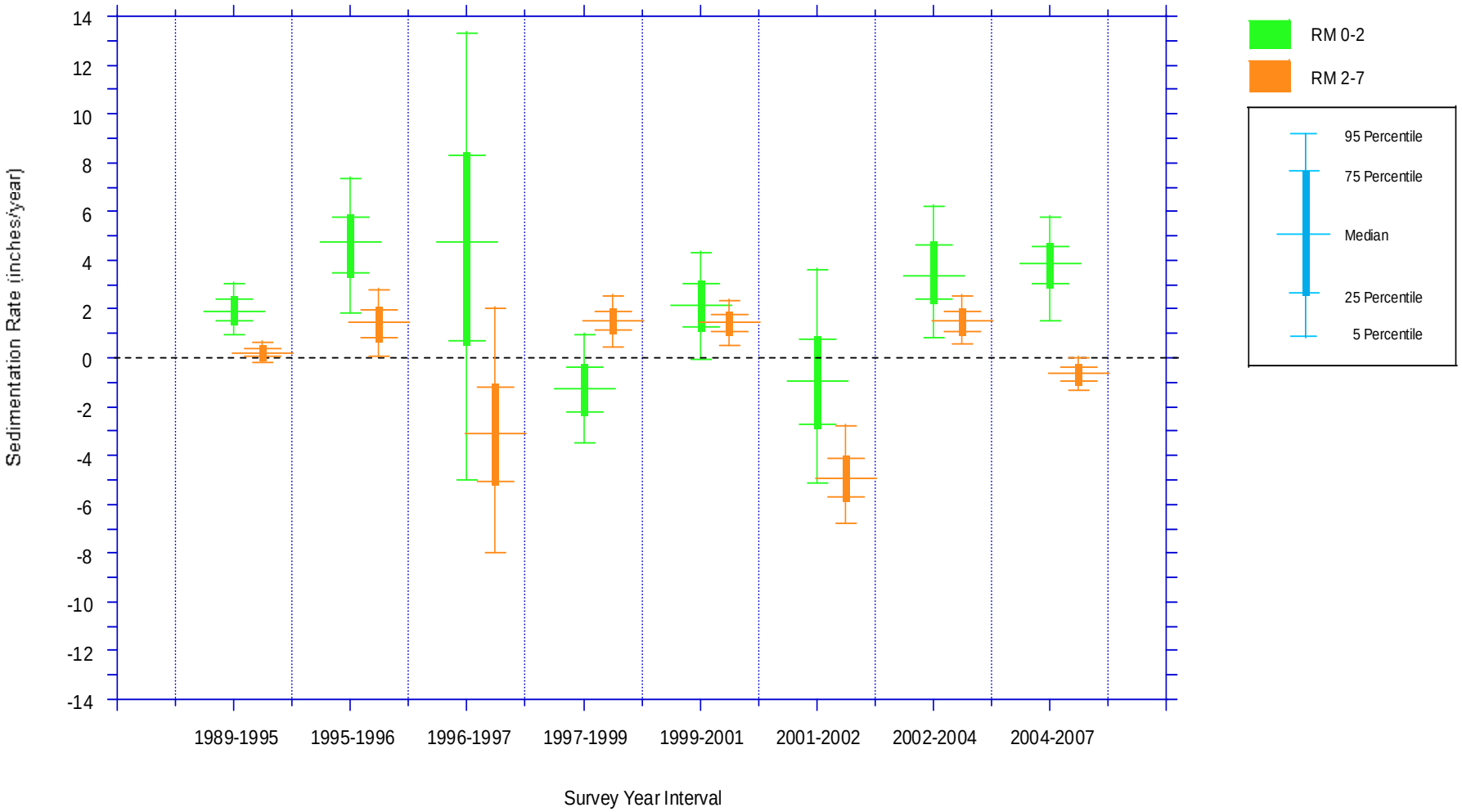
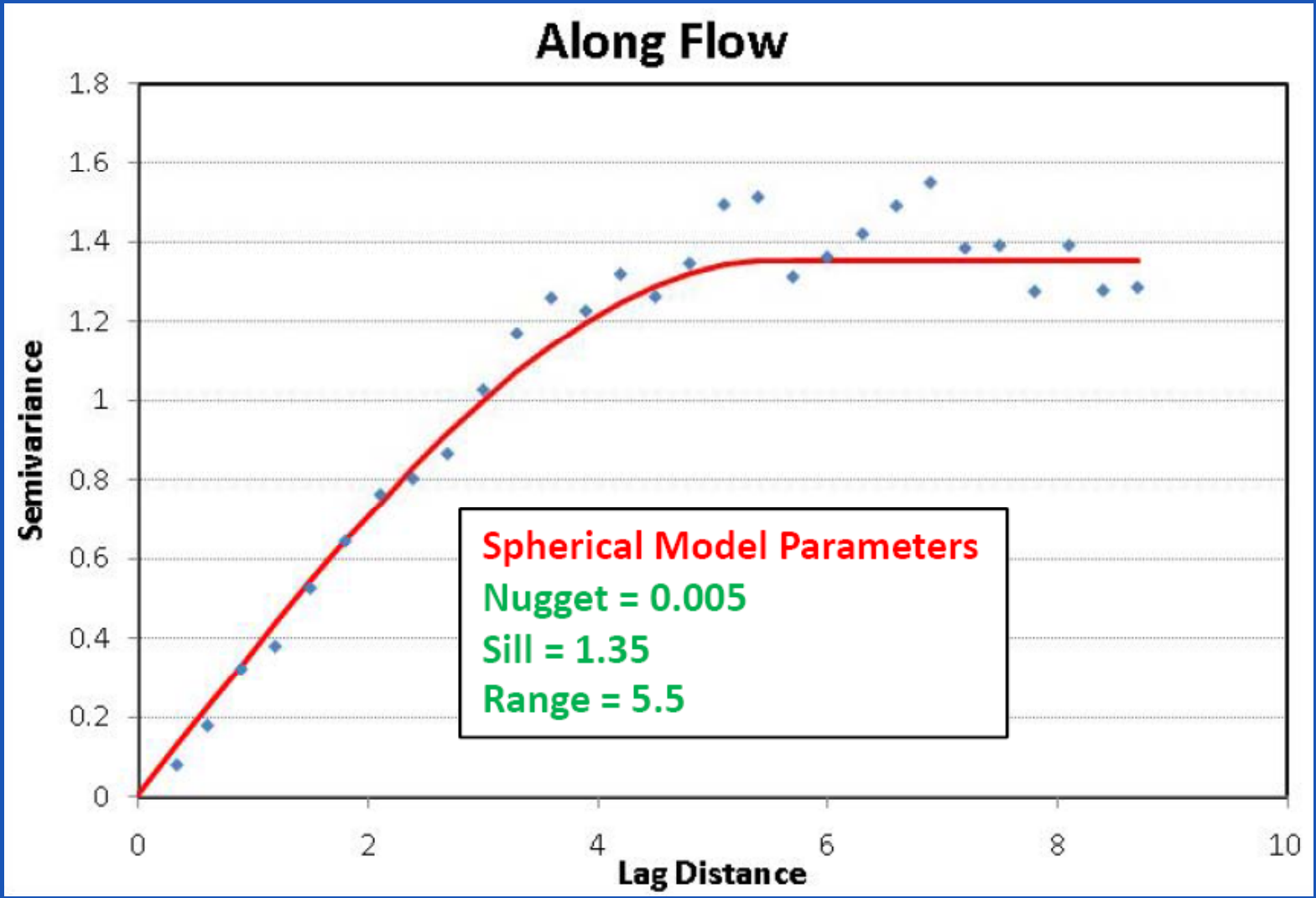

500,000
375,000
250,000
125,000
0
-125,000
-250,000
-375,000
-500,000
Volume (cy)
1989-1995
1995-1996
1996-1997
1997-1999
1999-2001
2001-2002
2002-2004
2004-2007
Survey Year Interval
Depositional
Net
Erosional
95 Percentile
75 Percentile
Median
25 Percentile
5 Percentile


14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
Sedimentation Rate (inches/year)
1989-1995
1995-1996
1996-1997
1997-1999
1999-2001
2001-2002
2002-2004
2004-2007
Survey Year Interval
RM 0-2
RM 2-7
95 Percentile
75 Percentile
Median
25 Percentile
5 Percentile

Directional Semivariogram and Fitted Model for 1995 Bathymetry



(Normal ScoresTransformed Residuals of Detrended Bathymetry)

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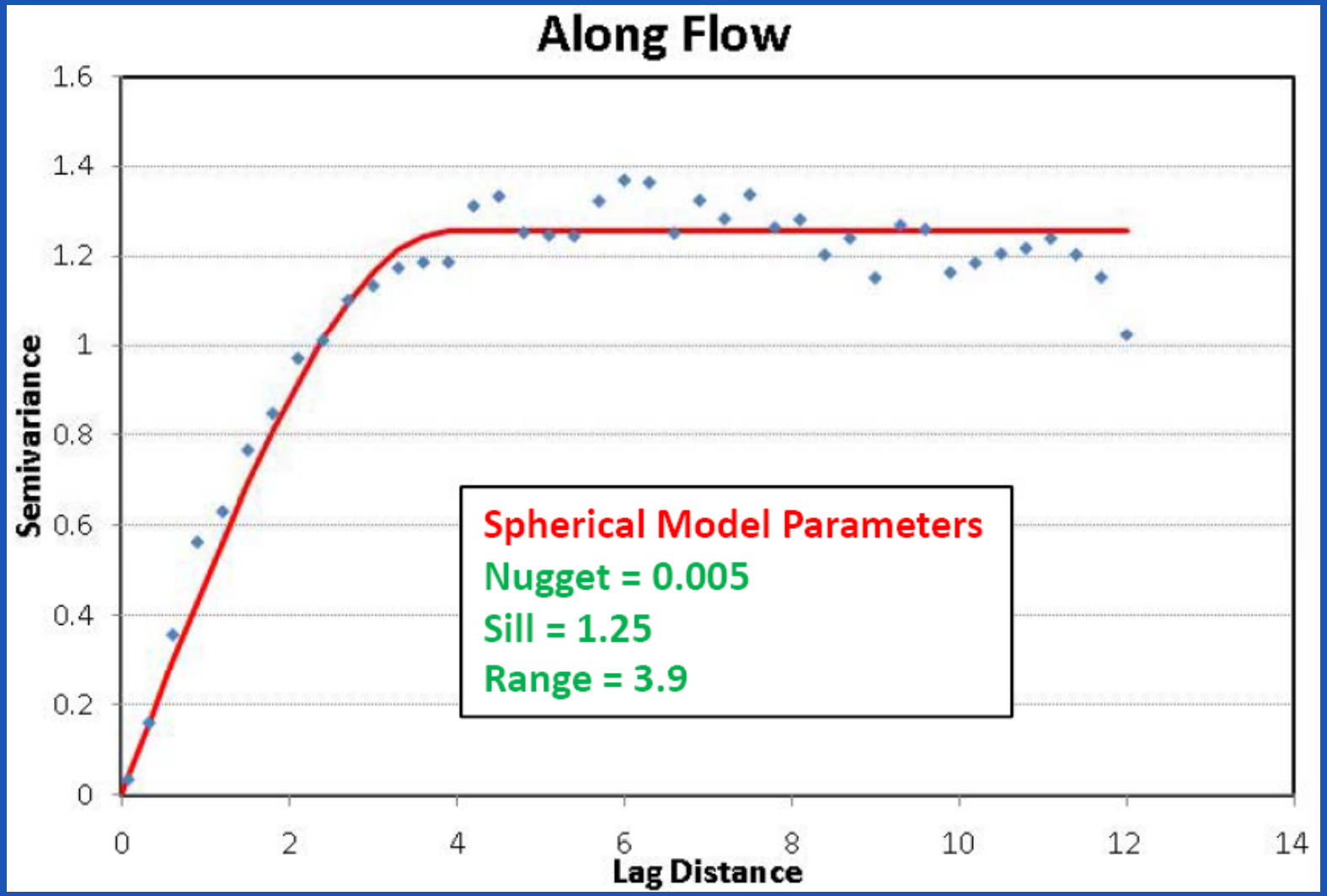
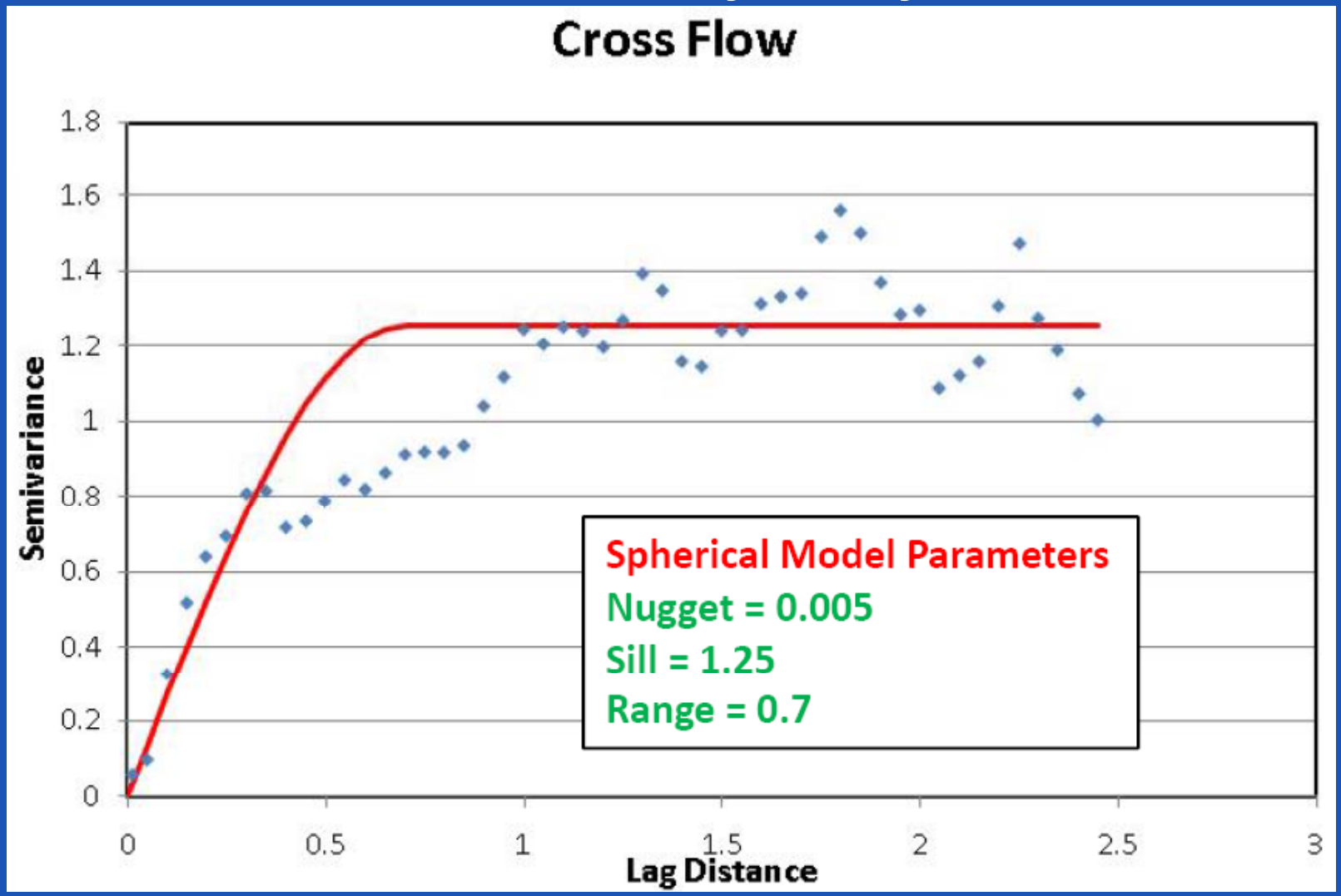
Directional Semivariogram and Fitted Model for 2004 Bathymetry

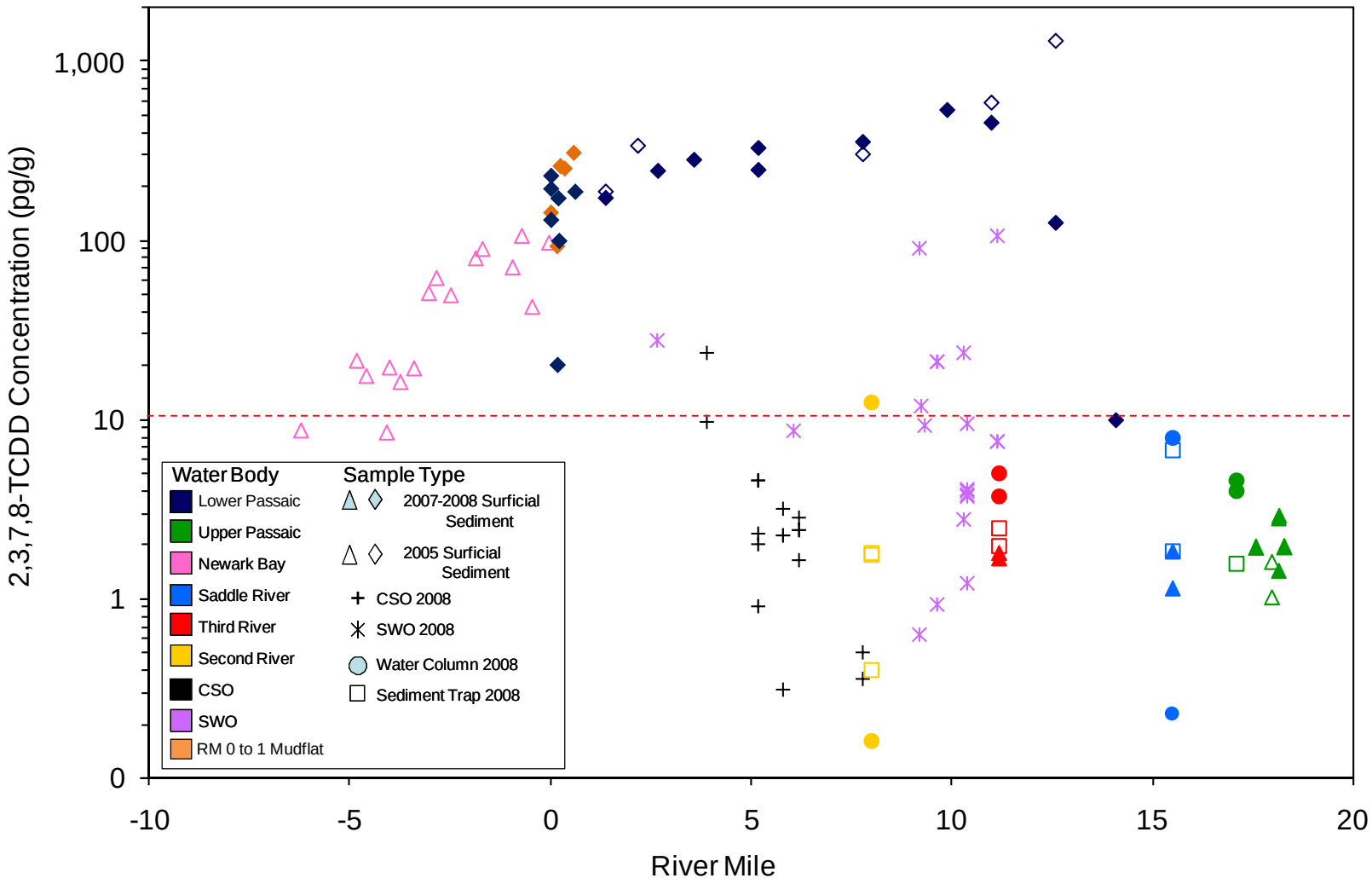


(Normal ScoresTransformed Residuals of Detrended Bathymetry)

Directional Semivariogram and Fitted Model for 2004 Bathymetry



(Normal ScoresTransformed Residuals of Detrended Bathymetry)



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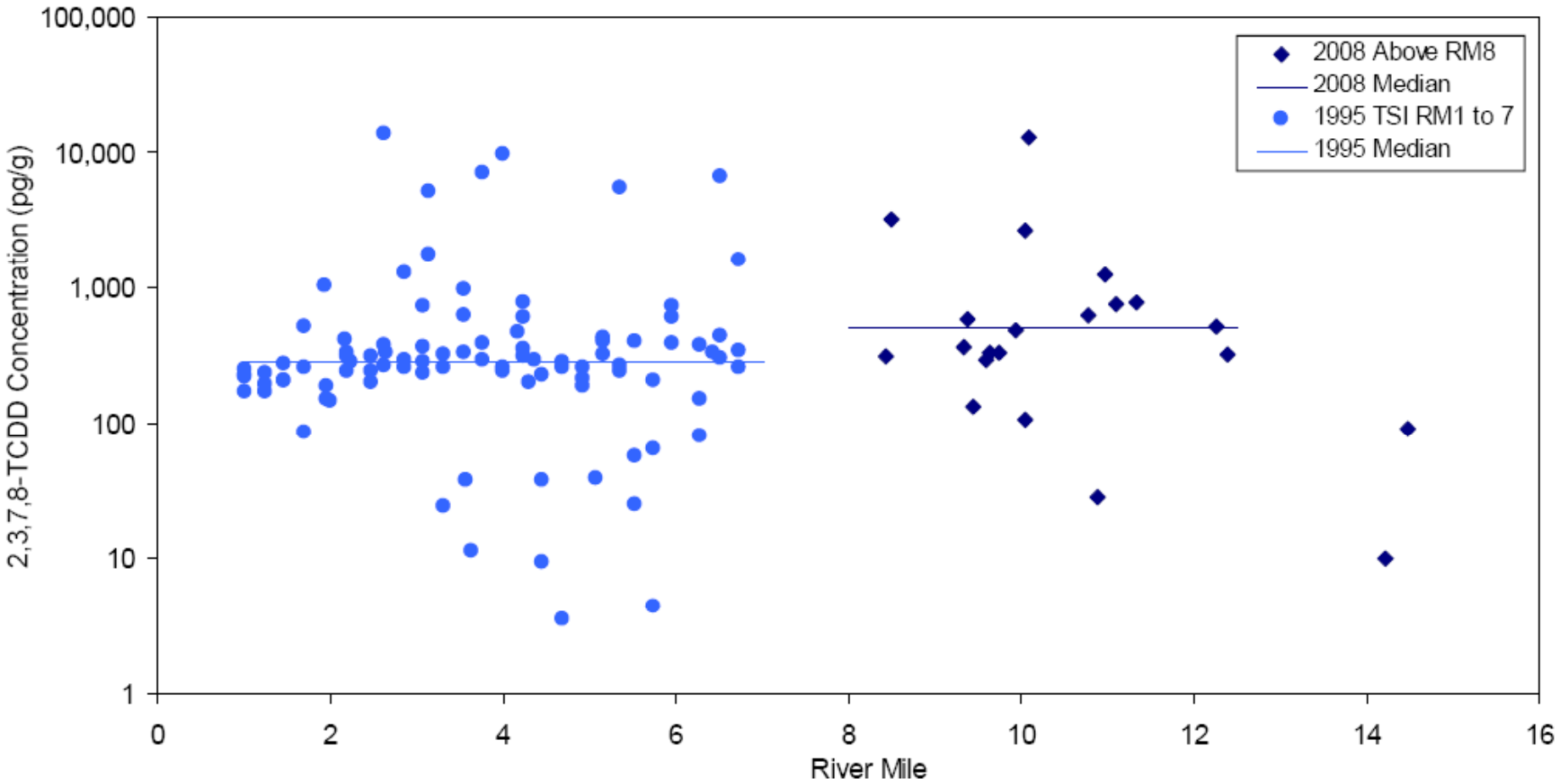

2,3,7,8-TCDD Concentration versus River Mile
0-6 inch Samples
EPA 2008 and TSI 1995 Results

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