South R.Sediment Transport and Geomorphology Studies

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Phase I & II

- I - Quantify silt and clay sediment budget
- II – Explore dynamics of erosion, transport, deposition, and resuspension
- Complete I this year
- Design approach to II….

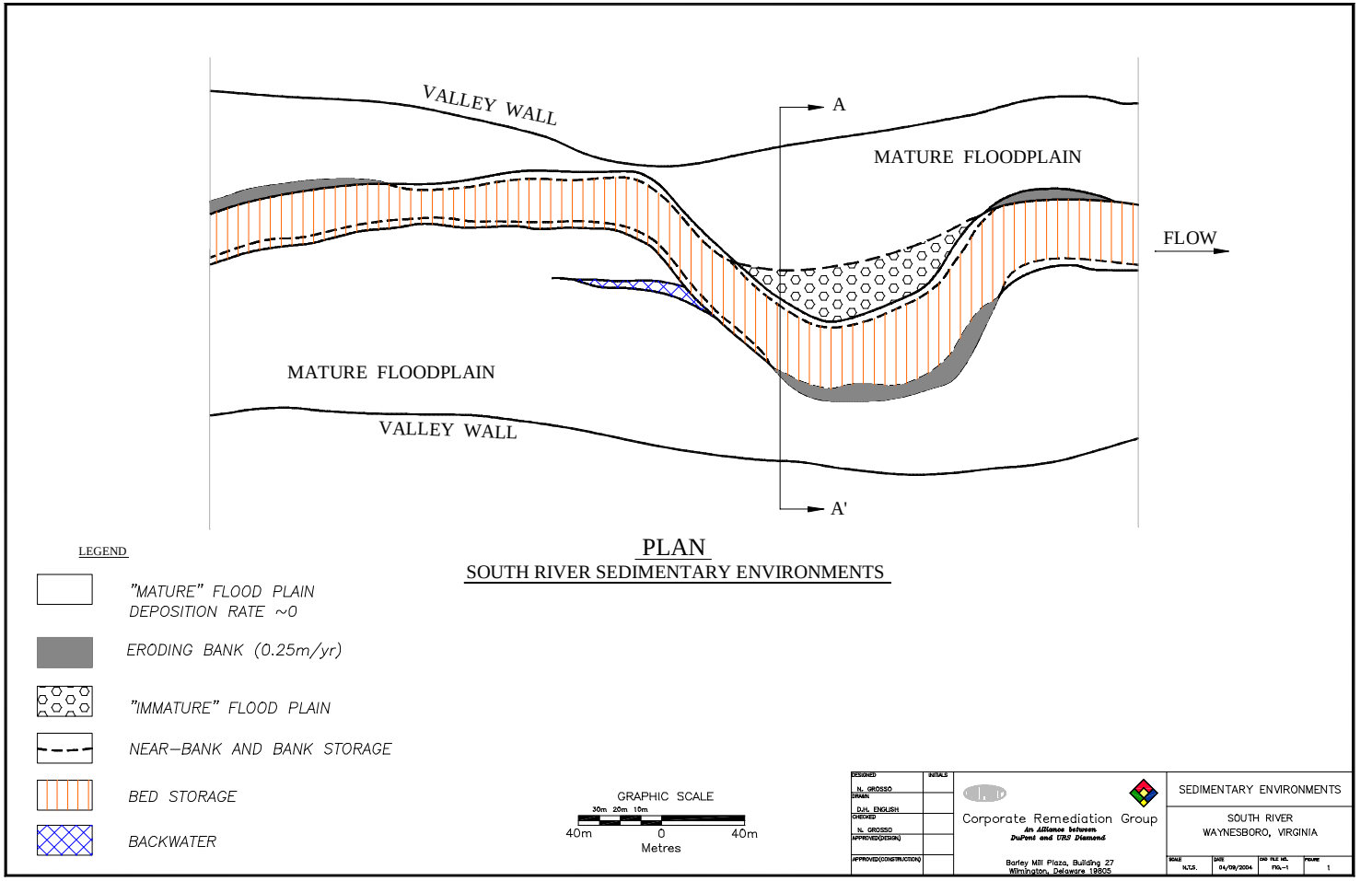
Goals for Phase I

- Evaluate and refine a silt-clay sediment budget for the study area
- Quantify volume sediment in storage reservoirs and rates of transfer between reservoirs.
- Initiate development of 1+ dimensional numerical model to determine annual and decadal rates of fine-grained sediment movement from Waynesboro to Port Republic.

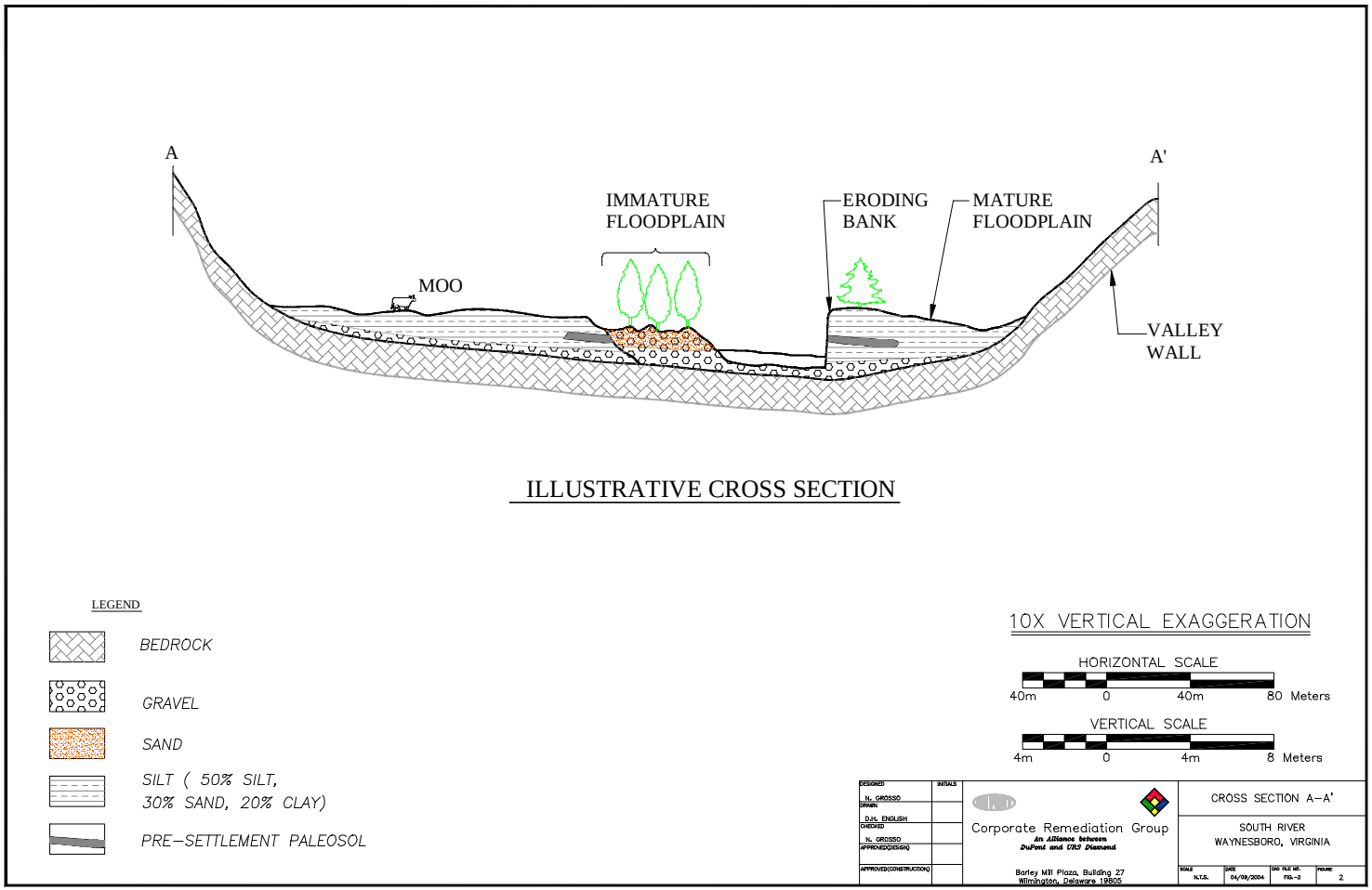
Study Area

- S. River and floodplain from Waynesboro to Port Republic

Review – Geomorphic Elements in Plan

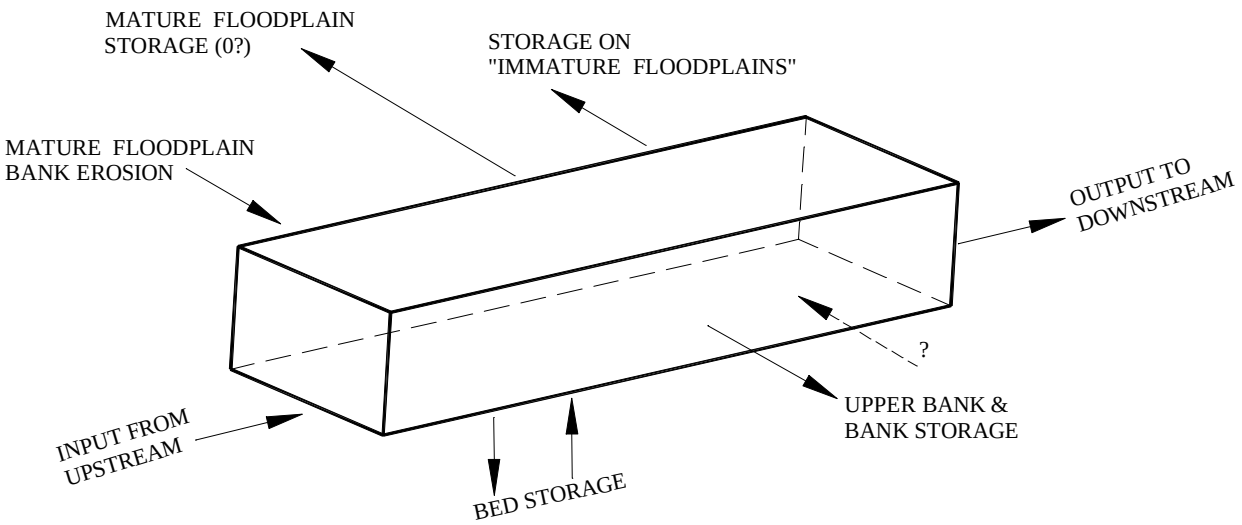


Review – Geomorphic Elements in Cross-section



Review – Sediment Budget

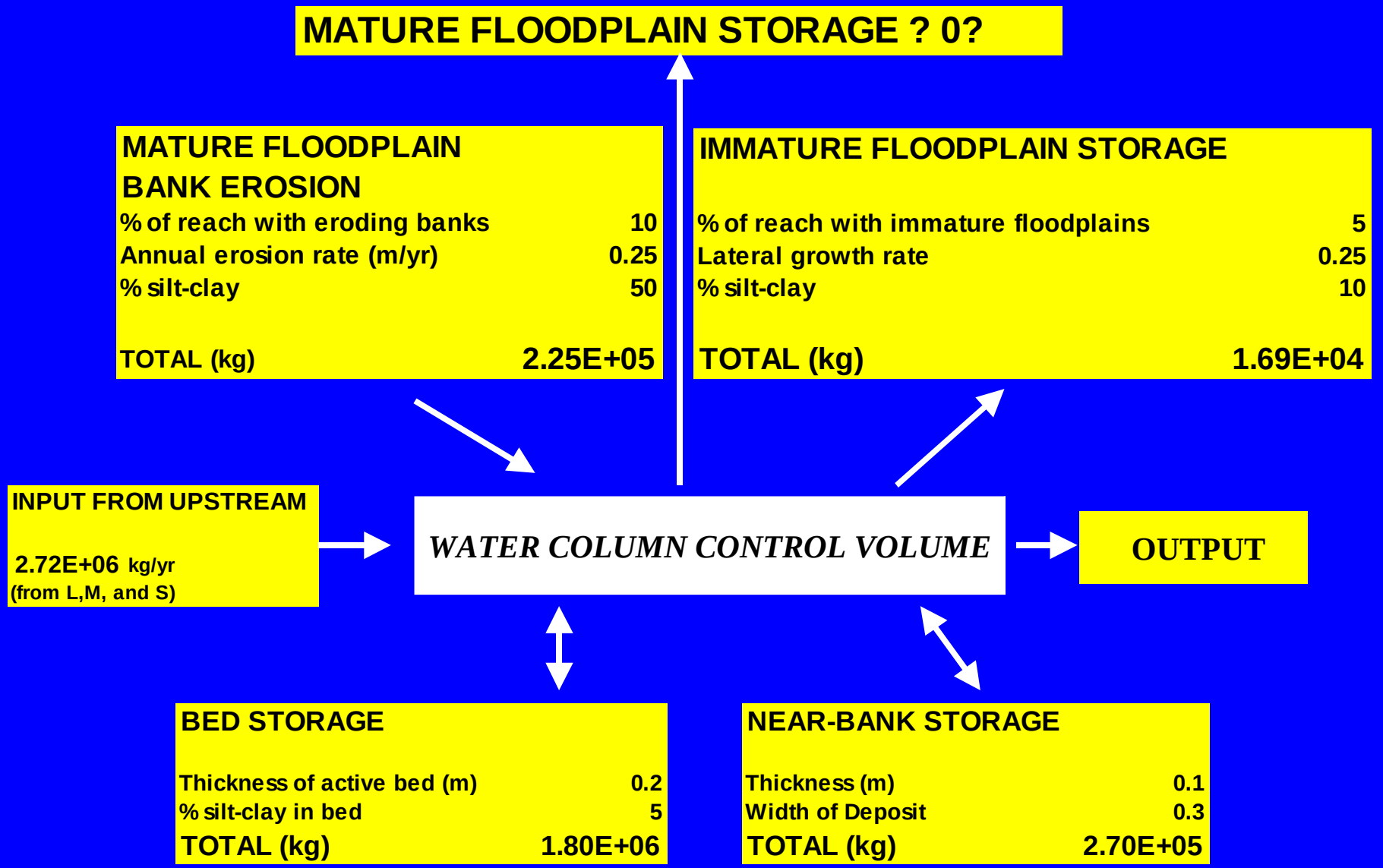
ANNUAL WATER COLUMN SEDIMENT BUDGET FOR SILT AND CLAY



DESIGNED N. GROSSO	INITIALS	Corporate Remediation Group *An Alliance between DuPont and URS Diamond* Barley Mill Plaza, Building 27 Wilmington, Delaware 19805	WATER COLUMN SEDIMENT FOR SILT & CLAY SOUTH RIVER WAYNESBORO, VIRGINIA
DRAWN D.H. ENGLISH			
CHECKED N. GROSSO			
APPROVED(DESIGN)			
APPROVED(CONSTRUCTION)			

SCALE	DATE	CAD FILE NO.	FIGURE
N.T.S.	04/08/2004	FIG.-3	3

Review – Silt/Clay Sediment Budget



Hypotheses to Test

- Bank erosion is a significant source of suspended sediment to the study area, though it is likely less significant than input from upstream.
- Suspended silt and clay entering the study area is stored for 0.5-2 years in the bed and near bank regions before leaving the study area.
- Annual rates of storage on mature and immature floodplains are low enough to be neglected in an annual budget.

List of Tasks

- Map sediment storage areas in the valley at present and decades in the past
- Obtain basic geomorphic data for the study area (cross-sections, slope, bed material grain size, longitudinal profile)
- Quantify rates of bank erosion
- Quantify rates of floodplain sedimentation
- Measure volume of silt and clay stored in bed and near bank areas
- Develop methods to measure the residence time of silt and clay in the channel perimeter
- Improve estimates of supply of sediment into reach from upstream
- Model development and implementation

Phase II – Dynamics – the problem is…

- Theory suggests that once silt and clay are entrained, it will immediately leave the watershed.
- This is clearly wrong, but existing knowledge is insufficient to determine what really happens
- New observations, data, and theory are needed.

Some possible approaches

- Direct measurements of deposition and resuspension in the channel perimeter
  - We will initiate some of these…
- Sediment mass balance approach during high flow events.
- Use of Hg as a tracer during transport events
- Use of other tracers

Sediment Mass Balance During High Flow Events

- Measure inputs from upstream, bank erosion, etc., outputs, change in storage in the water column, etc.
- Compute missing term: resuspension from channel perimeter
- Problem: input and output are by far the biggest terms, and are difficult to measure with required precision.
- Quantity to be determined is a small difference between large numbers with significant errors

Hg as a tracer during storms

- Advantage: terms of interest (bank erosion, deposition/resuspension from channel perimeter) are likely large
- Is Hg sufficiently conservative? (Help…)
- Need well defined spatial and temporal sampling resolution…(expensive)
- Are analyses affordable?

Other tracers…

- Be7, ½ life of 53.3 days is being used elsewhere in studies of reservoirs
- Only really useful if storage “reservoirs” on South River are sufficiently “isolated” from the atmosphere for extended periods of time.
- Utility does not seem promising

Summary

- Phase I – quantification of annual sediment budget completed during next 18 months
- Phase II – transport dynamics will be explored.
- Phase II will require
  - Additional field data to better define relevant questions (we will do this as part of Phase I)
  - Addition measurement program to resolve relevant processes