Stream Corridor Sediment Contribution

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CENTER FOR WATERSHED PROTECTION

Chesapeake Bay Program
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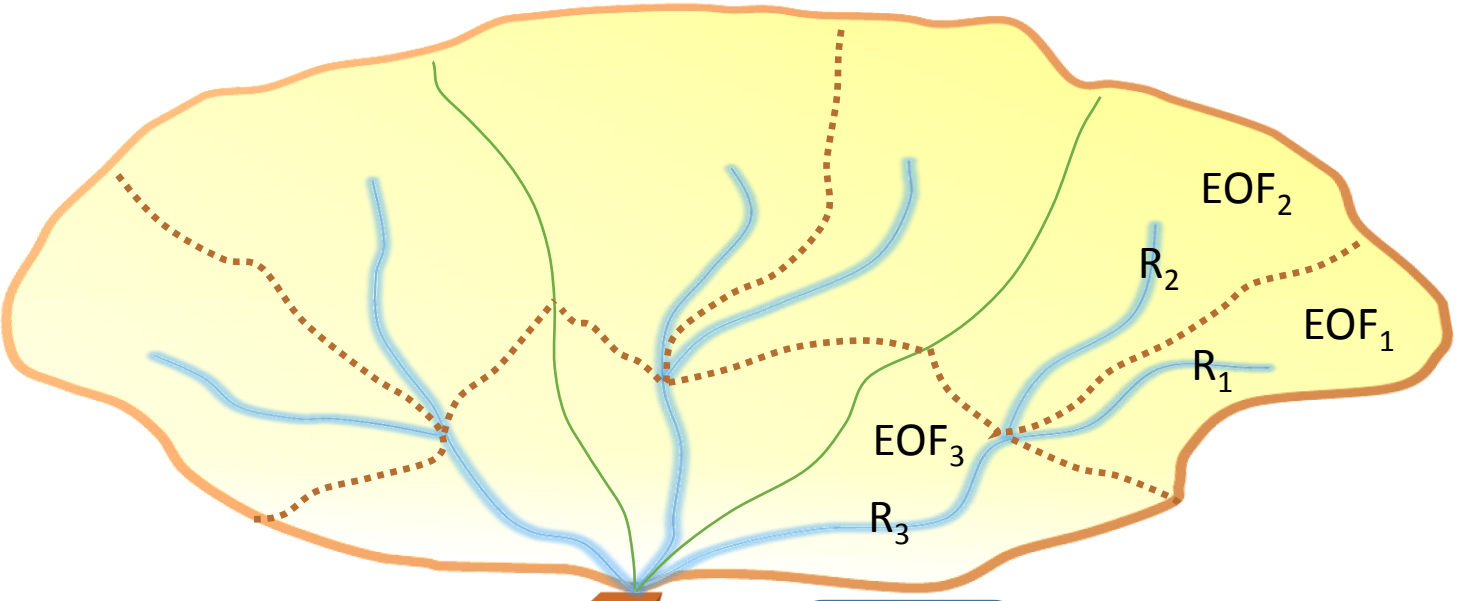
Key Findings from PoP STAC Workshop

- NSQD database
  - TSS concentrations from all urban land uses were at least an order of magnitude lower than what is observed in urban streams, suggesting that other downstream sources are responsible for the urban sediment budget
- Research studies
  - Urban stream channel erosion is a major component of the urban sediment budget; 20 – 60% on average
  - Magnitude of stream channel erosion in any given urban watershed are strongly influenced by local factors, such as watershed impervious cover and the physical properties of the urban stream corridor

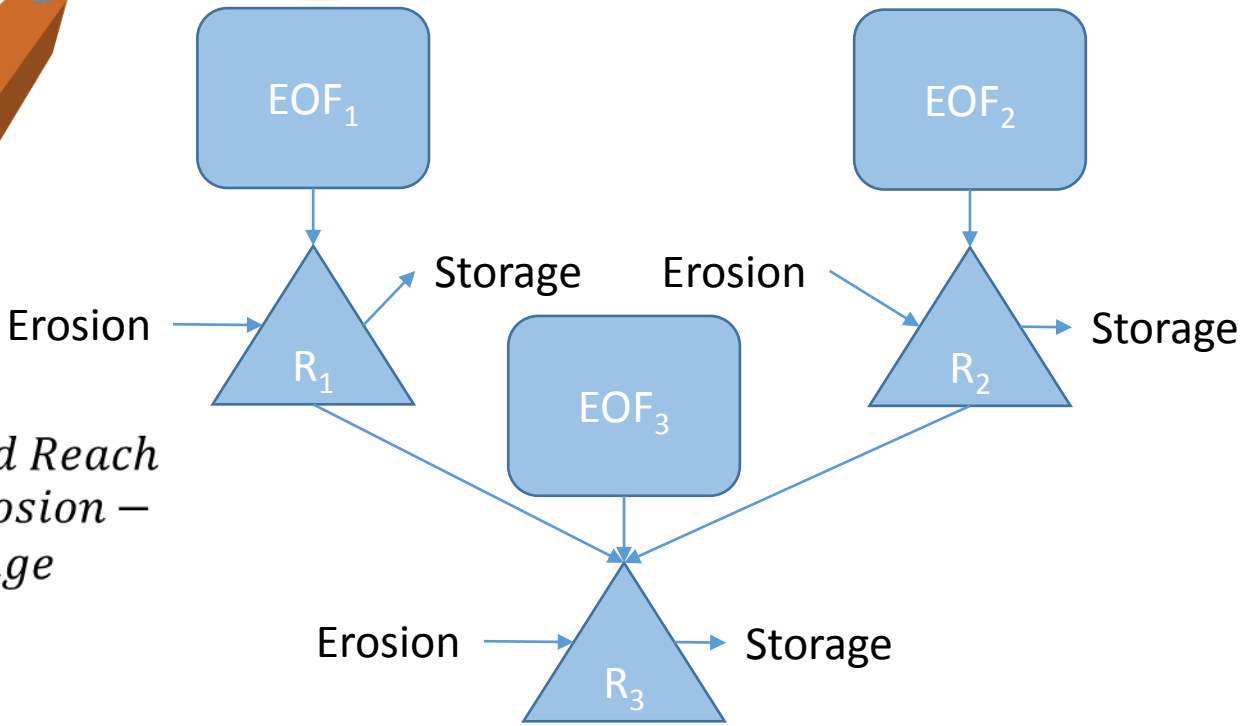
Goals of Proposed Approach

- More explicitly account for stream corridors as sources of sediment
- Improve apportionment of load reduction potential from upland and in-stream BMPs
- Address, to some degree, the interaction between upland and in-stream (i.e., catchment hydrology and stream processes)

Drainage Network



Simulated River
(Existing Model)



$$Sediment\ into\ Simulated\ Reach = \sum_{i}^{n} EOF + Stream\ Erosion - Stream\ Storage$$

Addressing Source Breakdown with a Stream Source Ratio (SSR)

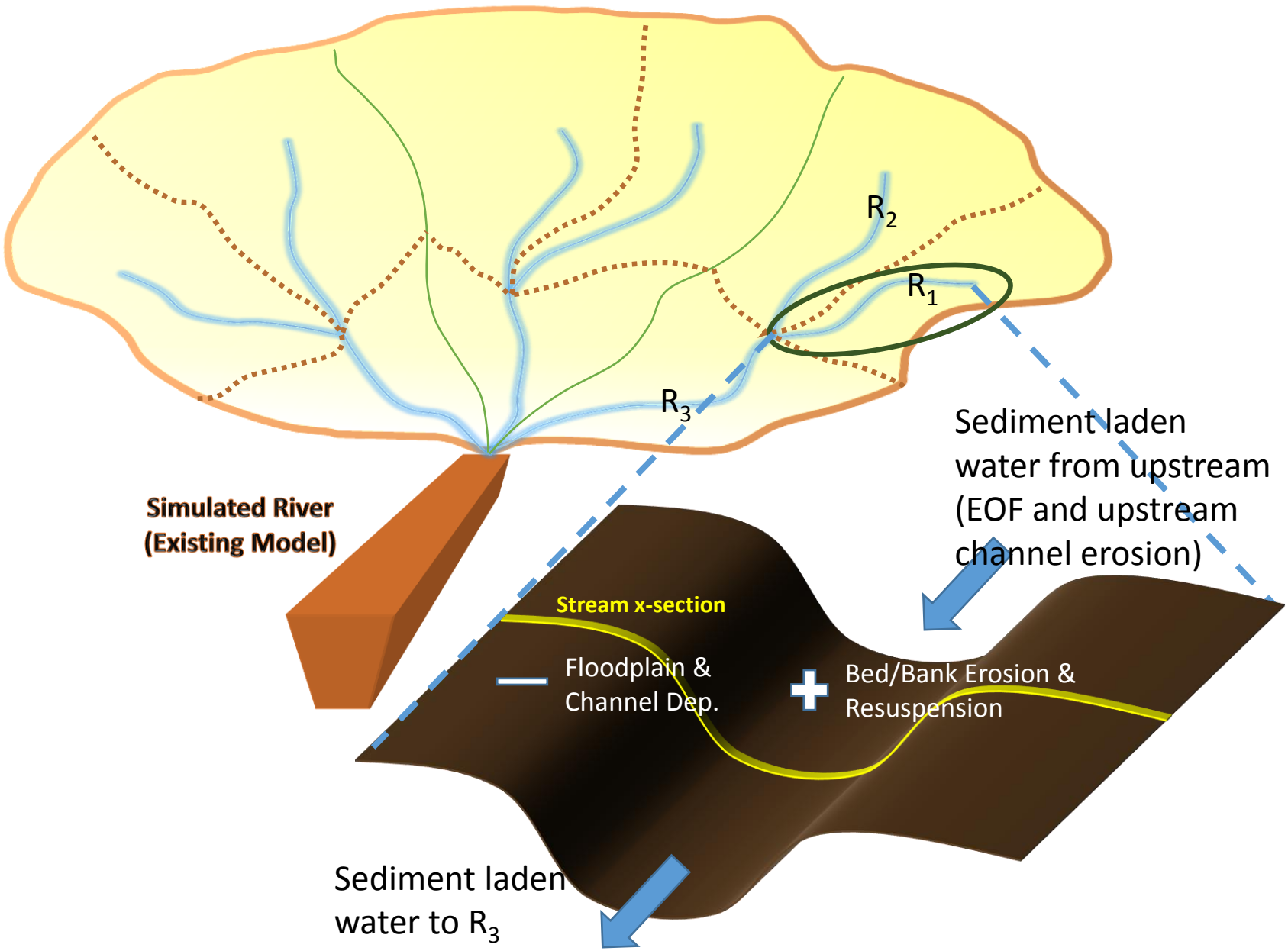
- Two methods being pursued
  1. Build SSR database based on available monitoring data
     - Stepwise multiple regression
       - Watershed and stream corridor characteristic parameters
     - SSR is the predicted variable
  2. Extension of USGS Sediment Budget work (Schenk et al., 2013)
- Validating, at a regional scale, using SPARROW

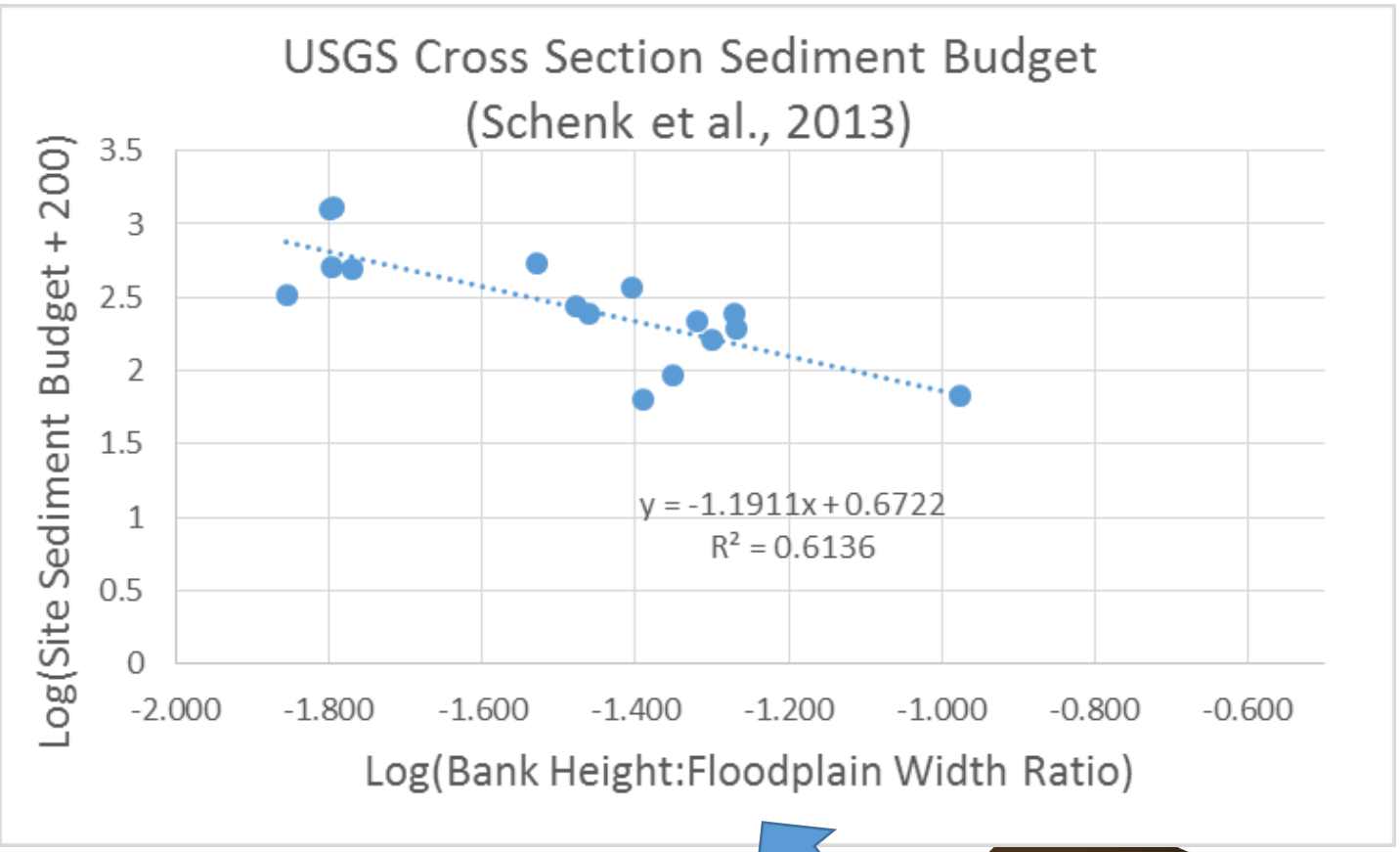
$$SSR = Fraction\ of\ sediment\ coming\ from\ the\ stream\ corridor$$

Potential stepwise regression parameters for Stream Source Ratio (SSR)

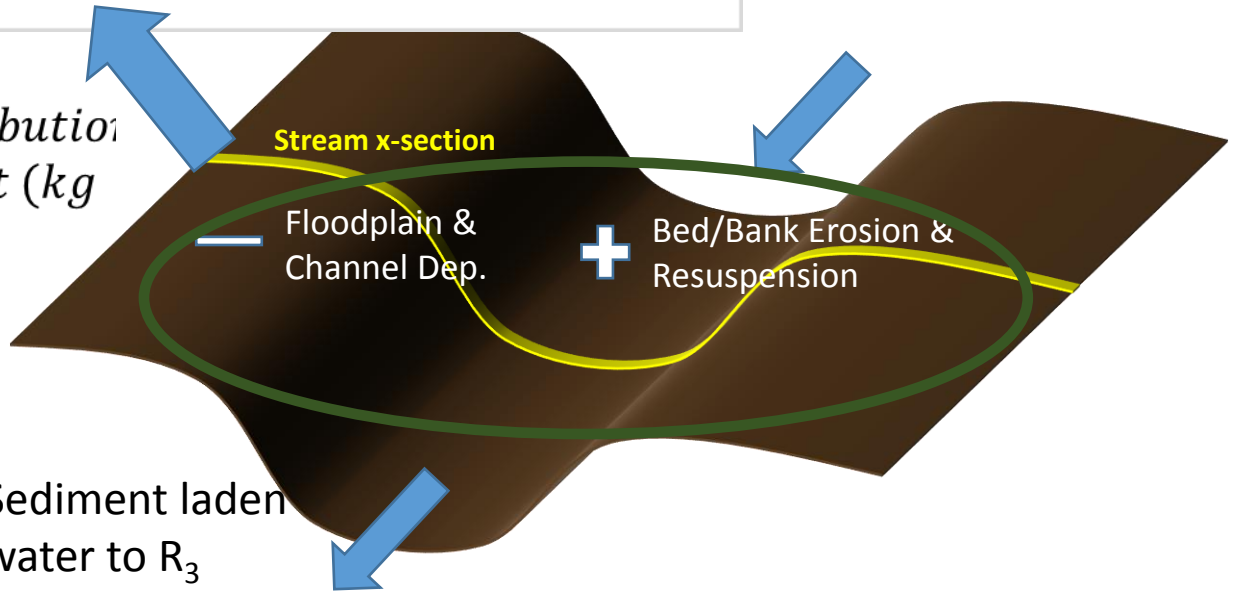
Catchment data – variables affecting sediment contribution	
Parameter	Data Source
Impervious cover	Local data – planimetric; NLCD
Storm drainage density	Local/ MS4 data; connectivity indicator
Density of outfalls	Local/ MS4 data
Forest Cover (watershed)	Anderson Level II (from State e.g. MDP)
Riparian land cover/buffers	Local data
Soil type	SSURGO
BMP implementation	Local/MS4 data; % IC treated or other
Stream density	Connectivity indicator
Stream corridor – variables affecting sediment contribution	
Sinuosity	Derived
Floodplain width	USGS
Bank height	USGS
Channel slope	Derived
Source/sink	USGS-Schenk method

For Both Methods





$$Annual\ Reach\ Sediment\ Contributio = Median\ Cross\ Section\ Budget\ (kg/m) * Length\ of\ Reach\ (m)$$



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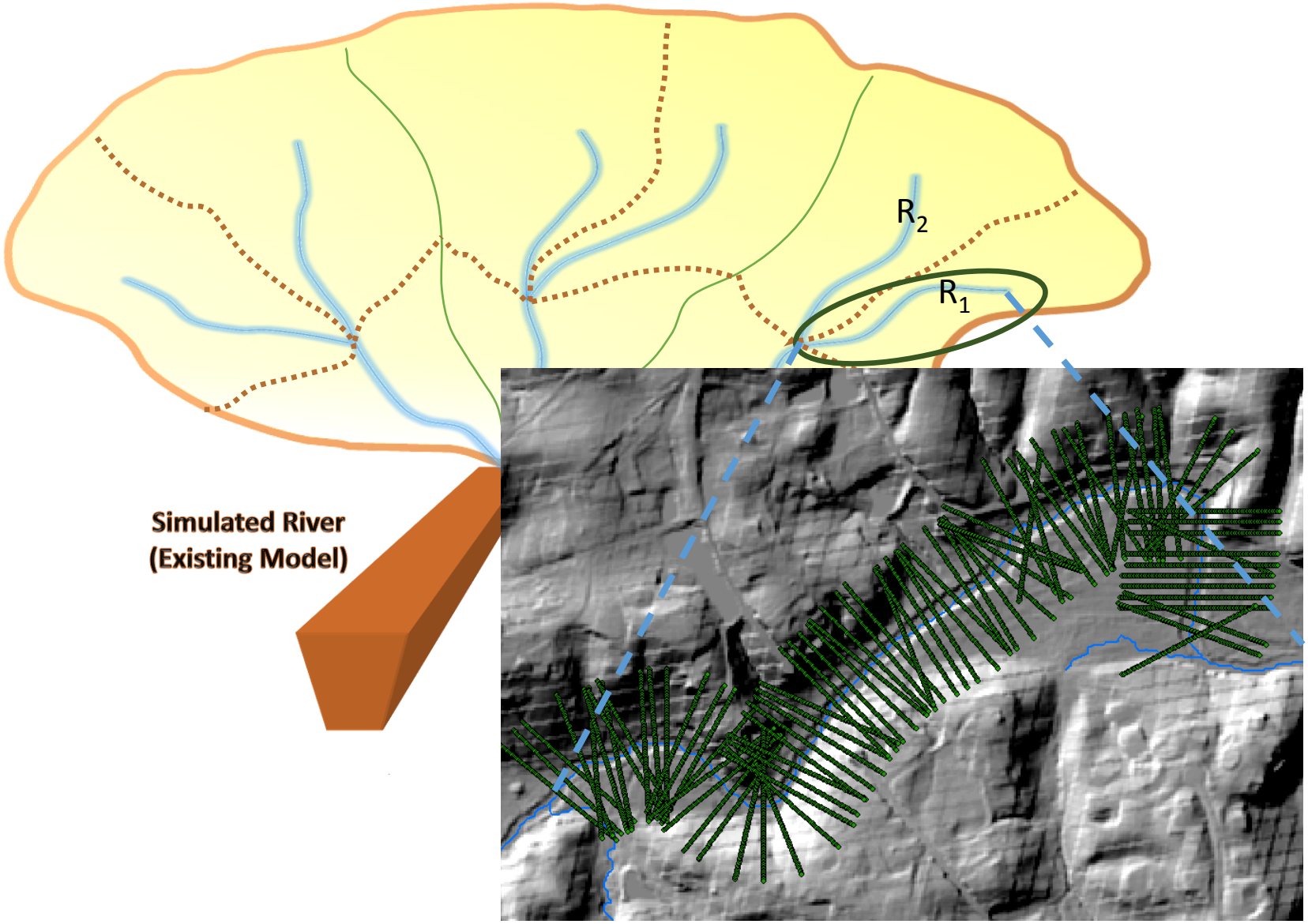
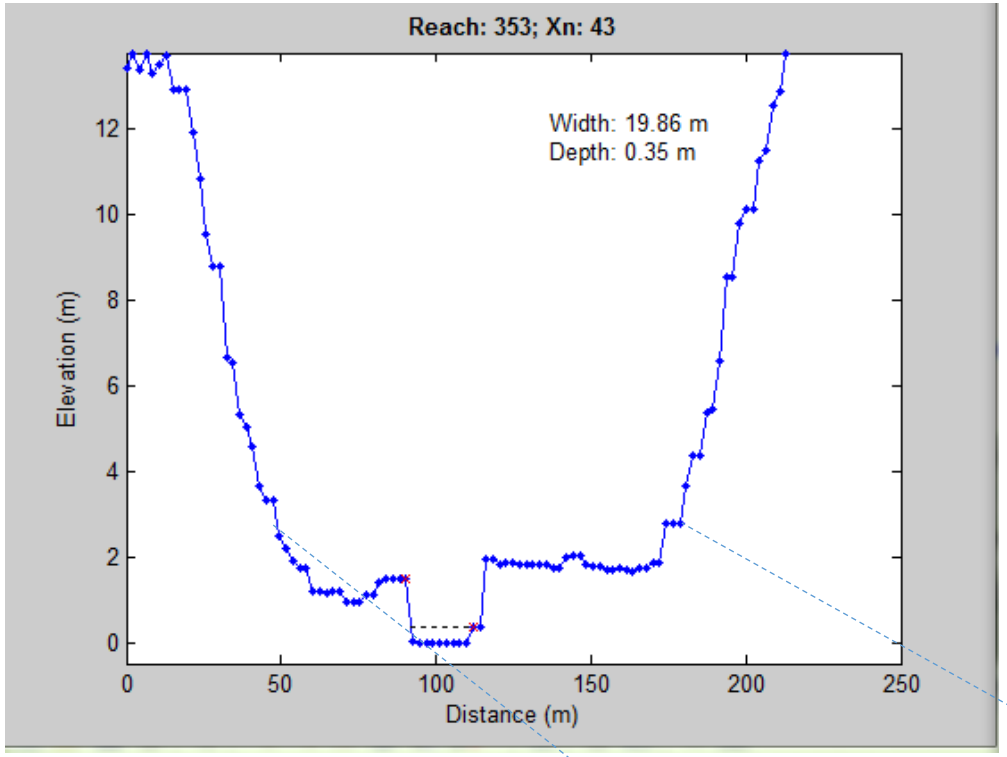
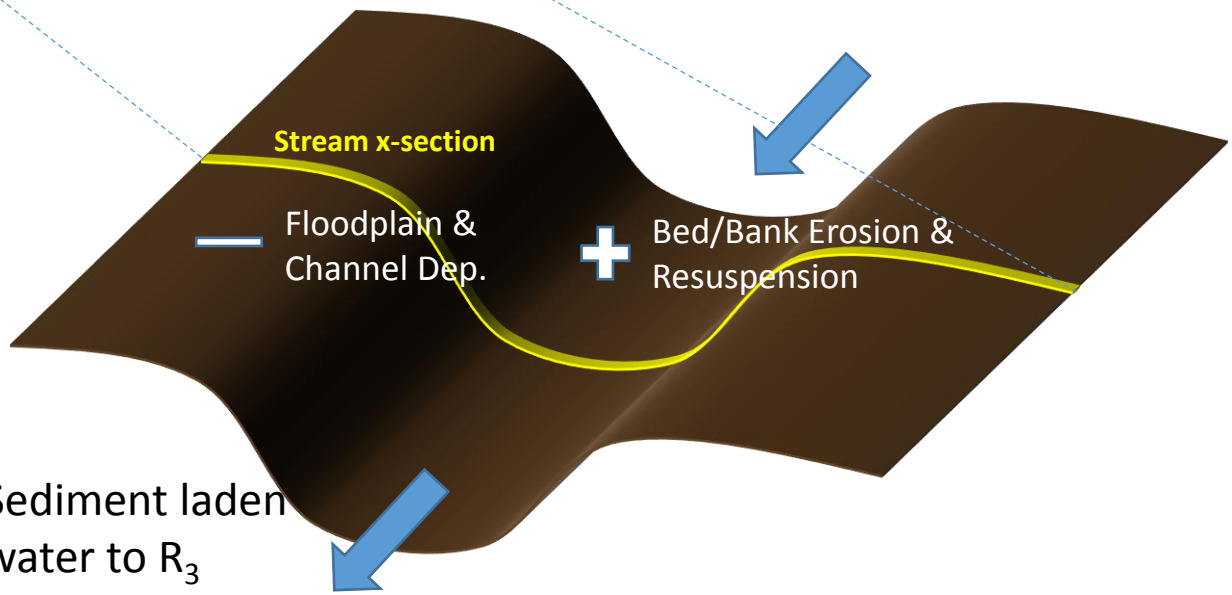
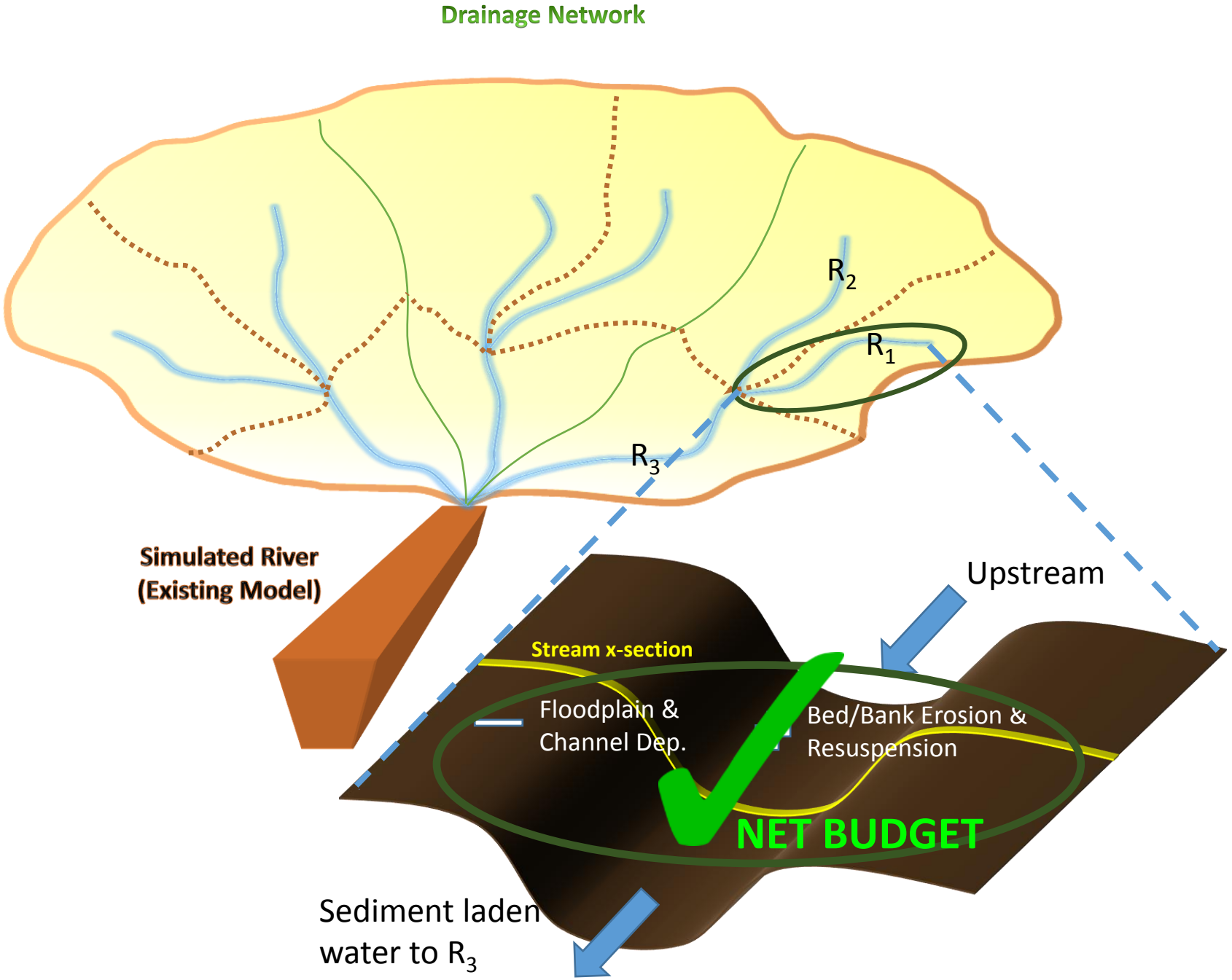



Reach: 353; Xn: 43
Width: 19.86 m
Depth: 0.35 m
Elevation (m)
Distance (m)
0
2
4
6
8
10
12
0
50
100
150
200
250


Stream x-section
Floodplain &
Channel Dep.
Bed/Bank Erosion &
Resuspension
Sediment laden
water to R_3


Drainage Network
R2
R1
R3
Simulated River
(Existing Model)
Upstream
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NET BUDGET
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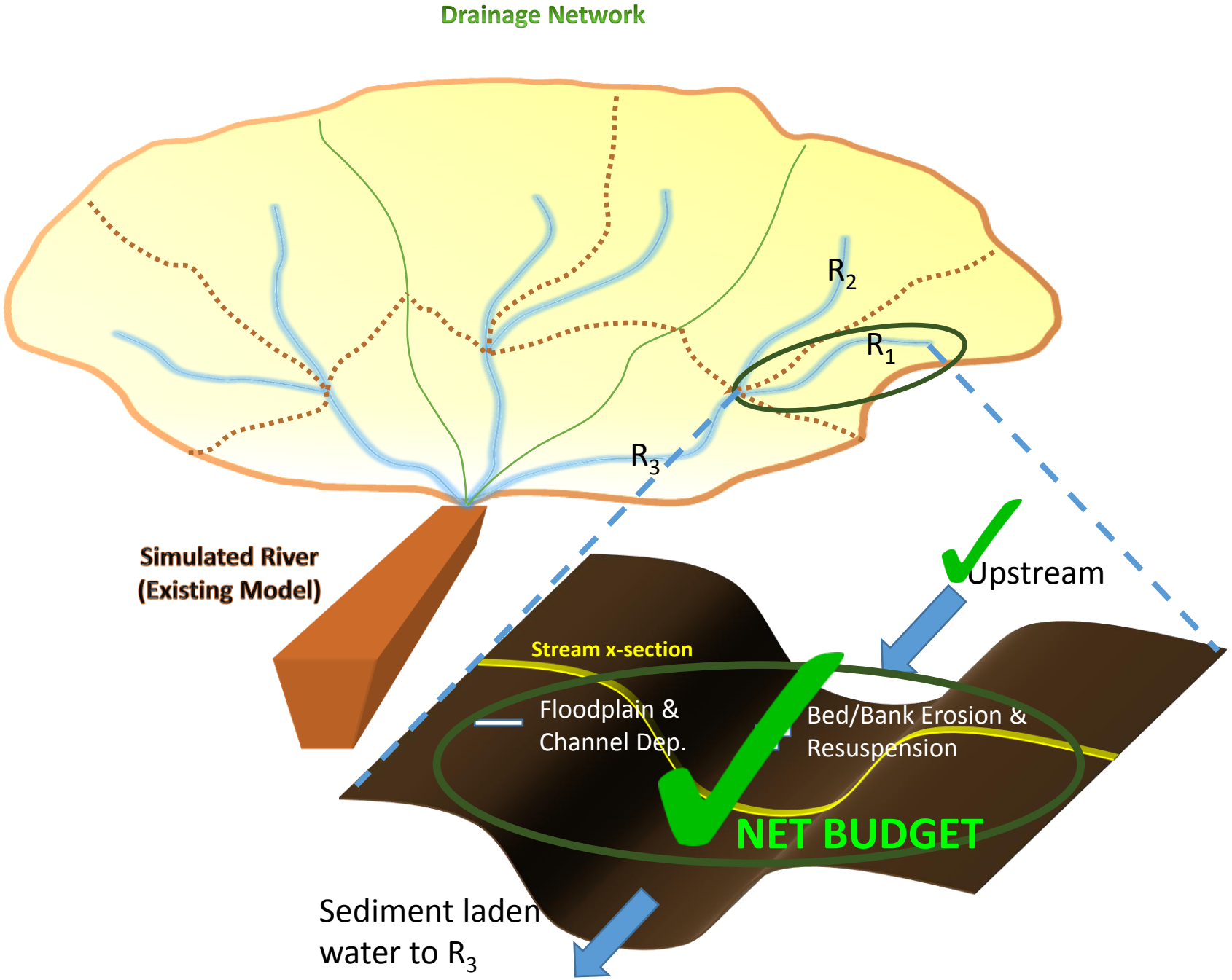
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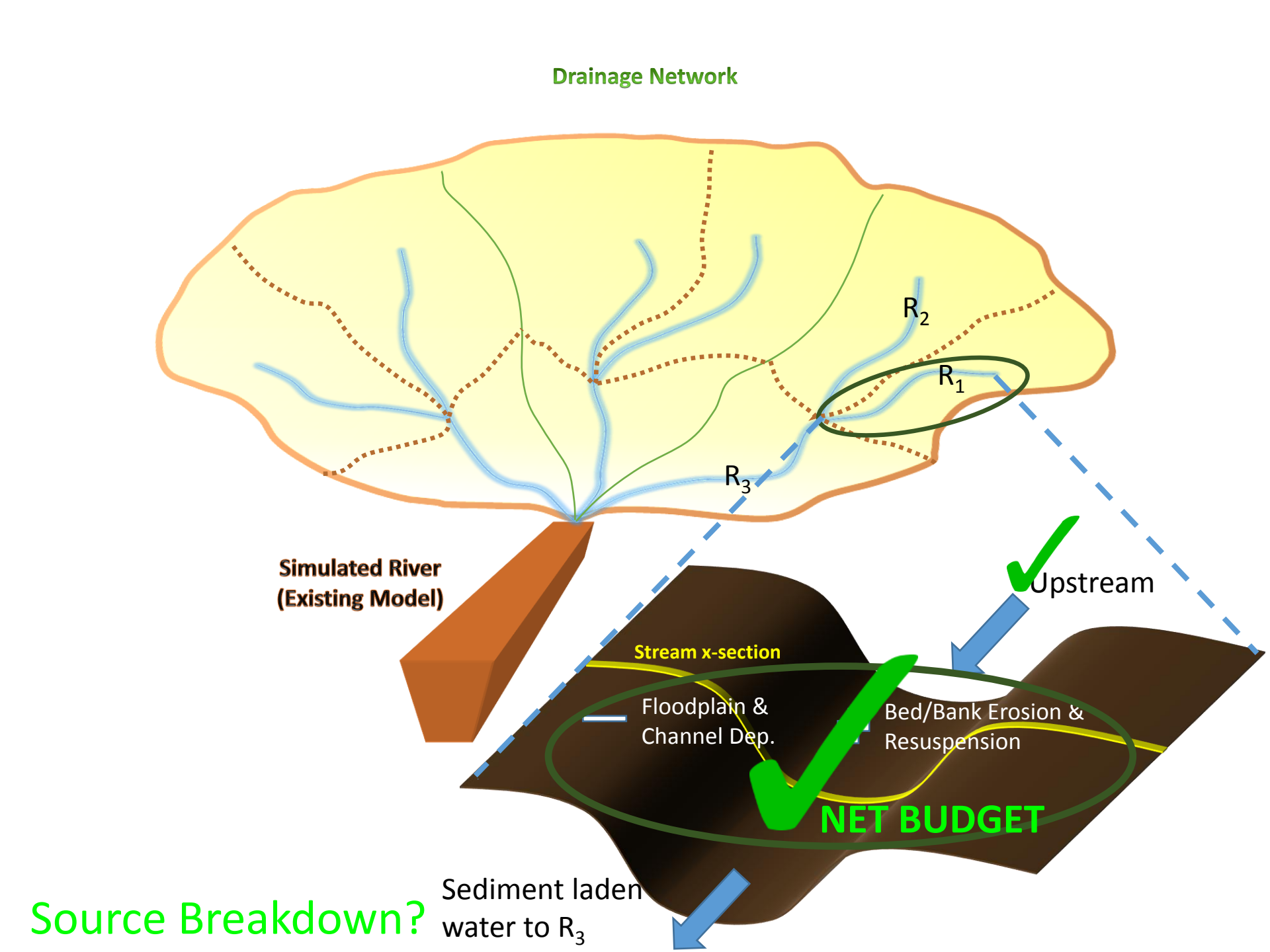
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Source Breakdown?

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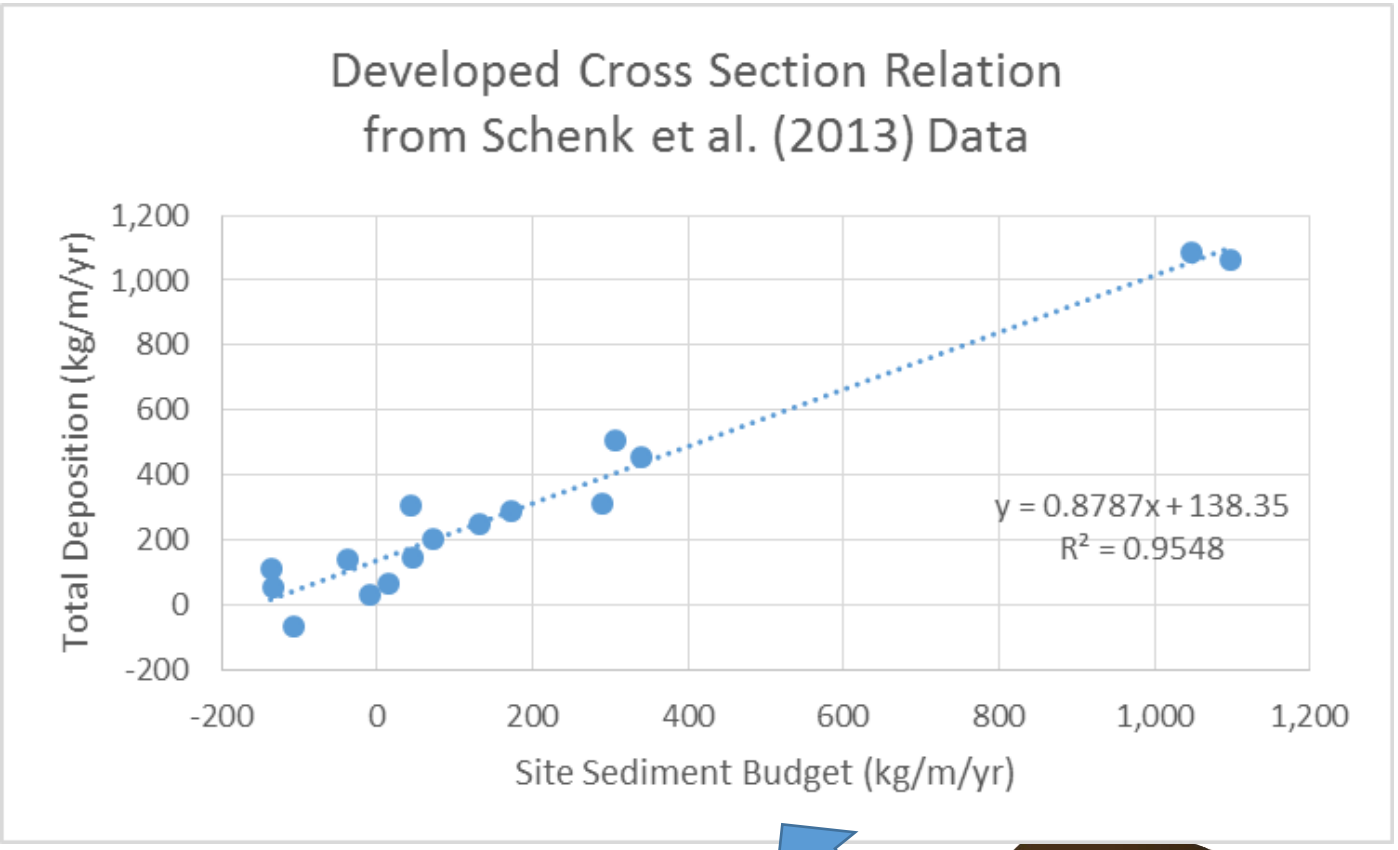
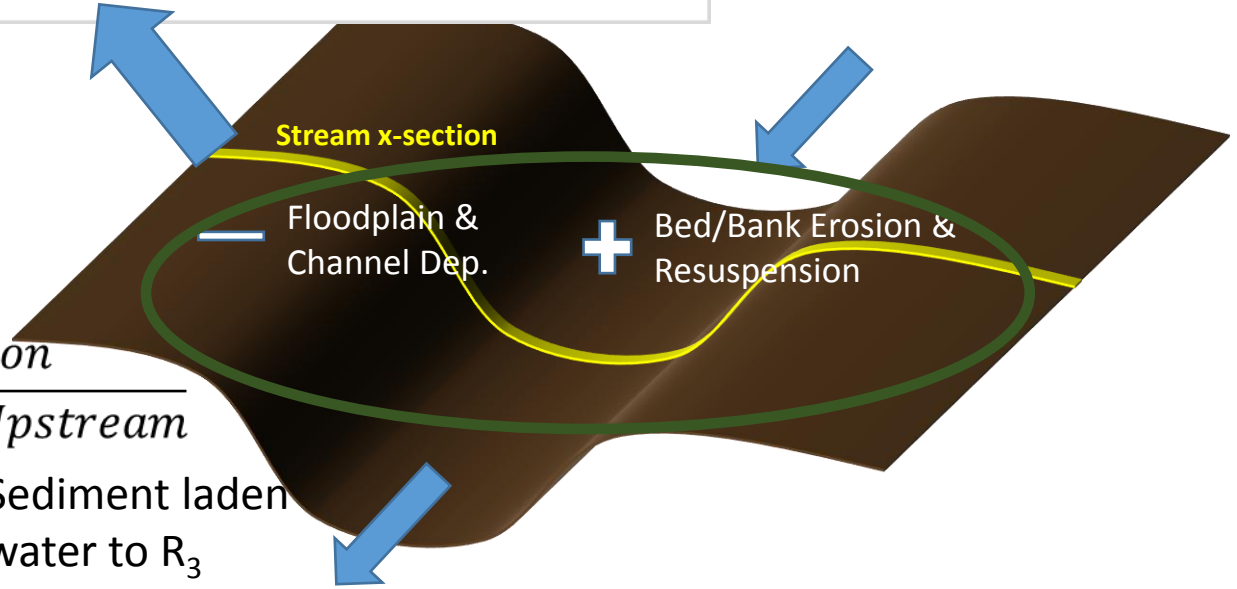
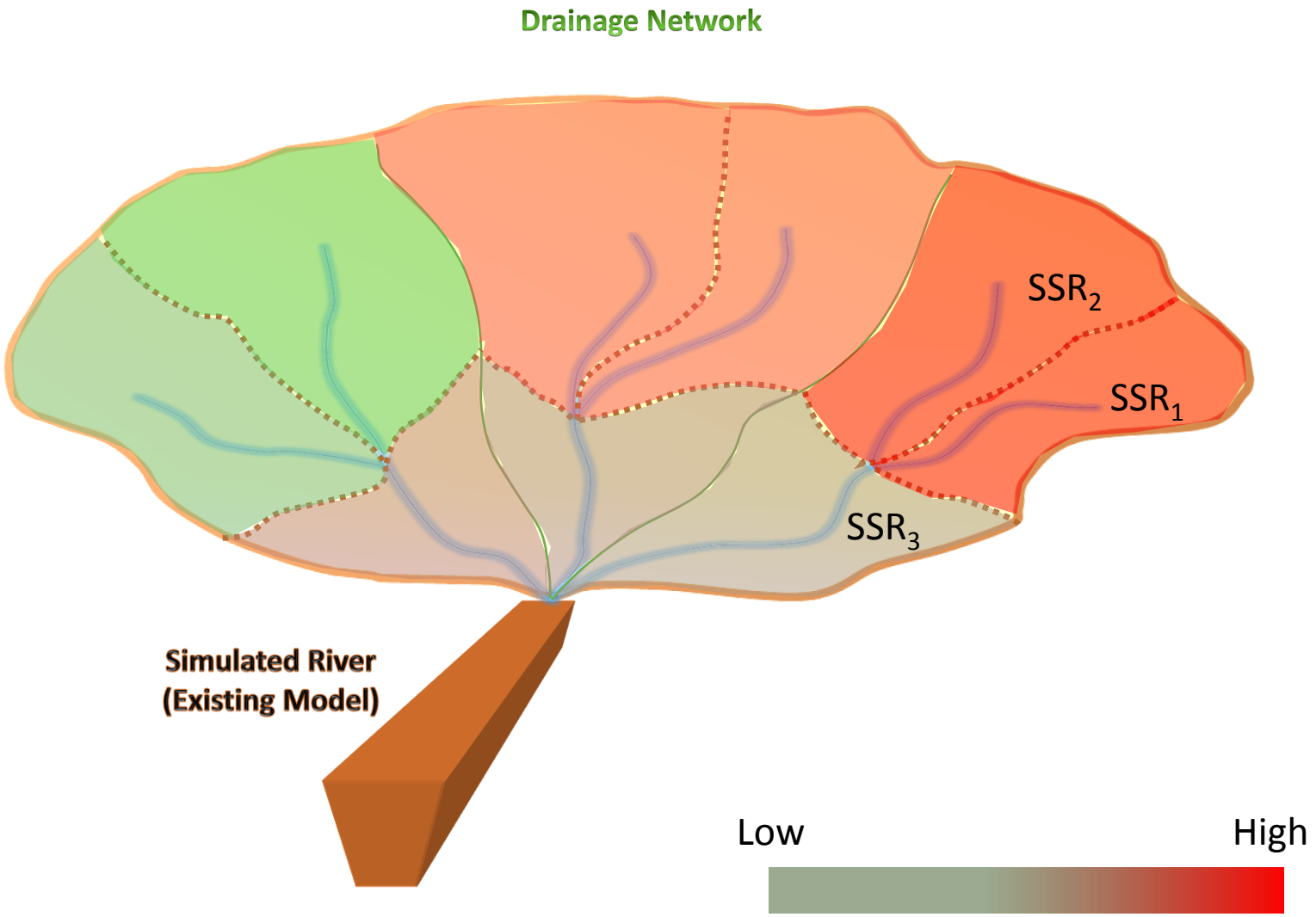


$$Bed\ \&\ Bank\ Erosion = Site\ Sediment\ Budget - Total\ Deposition$$

$$SSR = \frac{Bed\ \&\ Bank\ Erosion}{Bed\ \&\ Bank\ Erosion + Upstream}$$



Stream Source Ratio (SSR) Result



Sediment Delivery Factor (SDF) Result