Phase 7 Watershed Model Plans

CBPO Staff

Gopal Bhatt, Isabella Bertani, Joseph Delesantro, Lewis Linker and others

MWG

10/08/2024

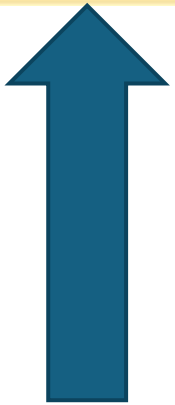
Watershed Model Plan – Big Picture

2022	2022	2022	2022	2023	2023	2023	2023	2024	2024	2024	2024	2025	2025	2025	2025	2026	2026	2026	2026
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Work plan			Build	Work plan	Build Models			Work plan	Build Models			Work plan	Build Models			Review Models			

Build Model Structure

Improve Models

Review Models

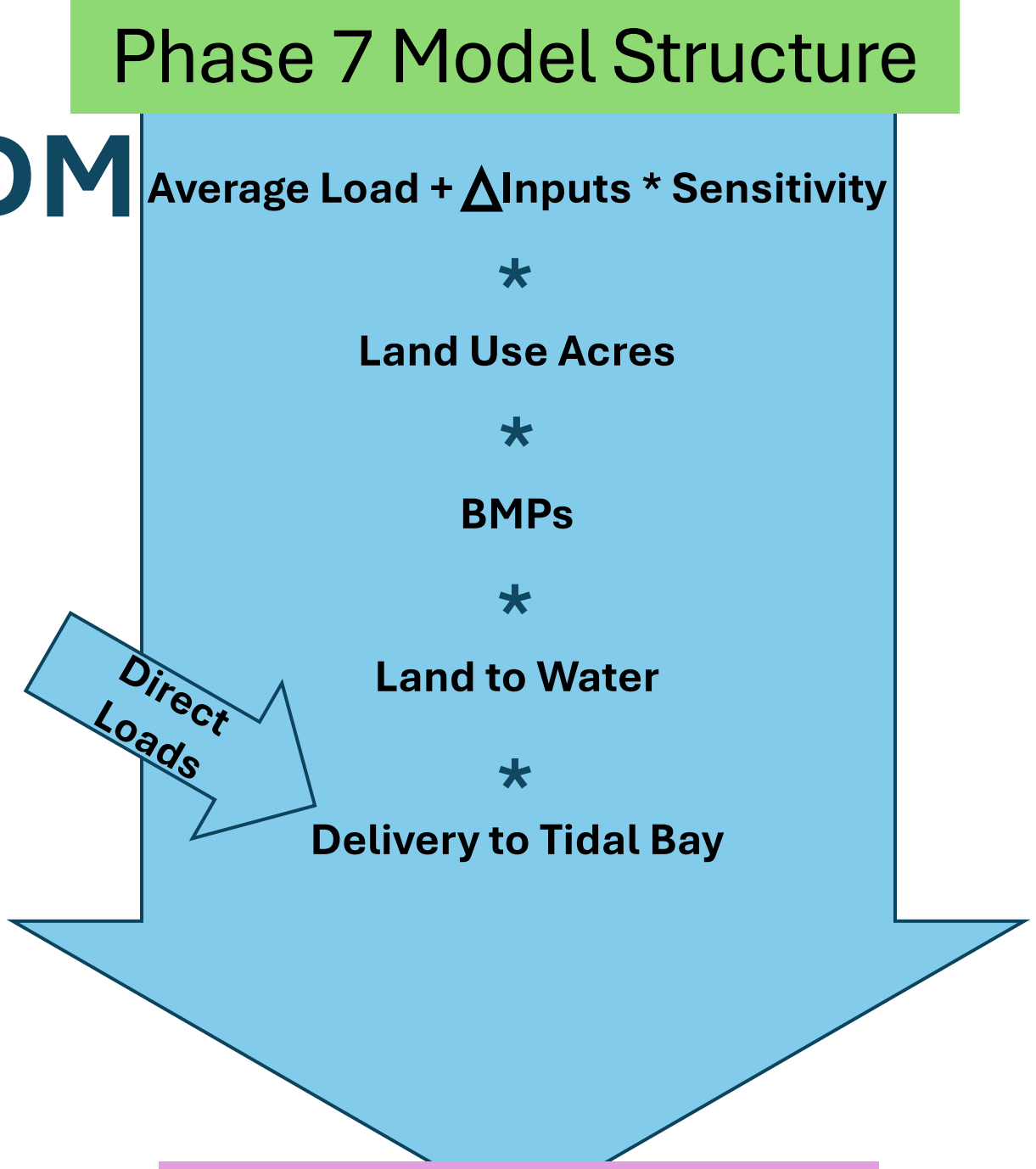


Cast/CalCast/DM

Phase 7

CAST

Deterministic Scenario Tool:
1 set of loads for 1 set of inputs



Phase 7 CAST Structure

Average Load
+
ΔInputs * Sensitivity
*
BMPs
*
Acres
*
Land to Water
*
River Delivery

Load by land-river segment and land use

Inform

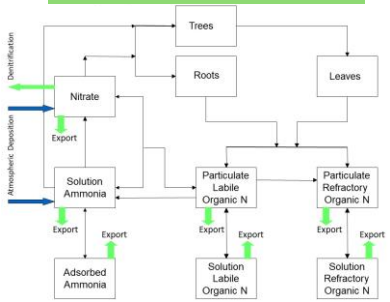
Constrain

CalCAST

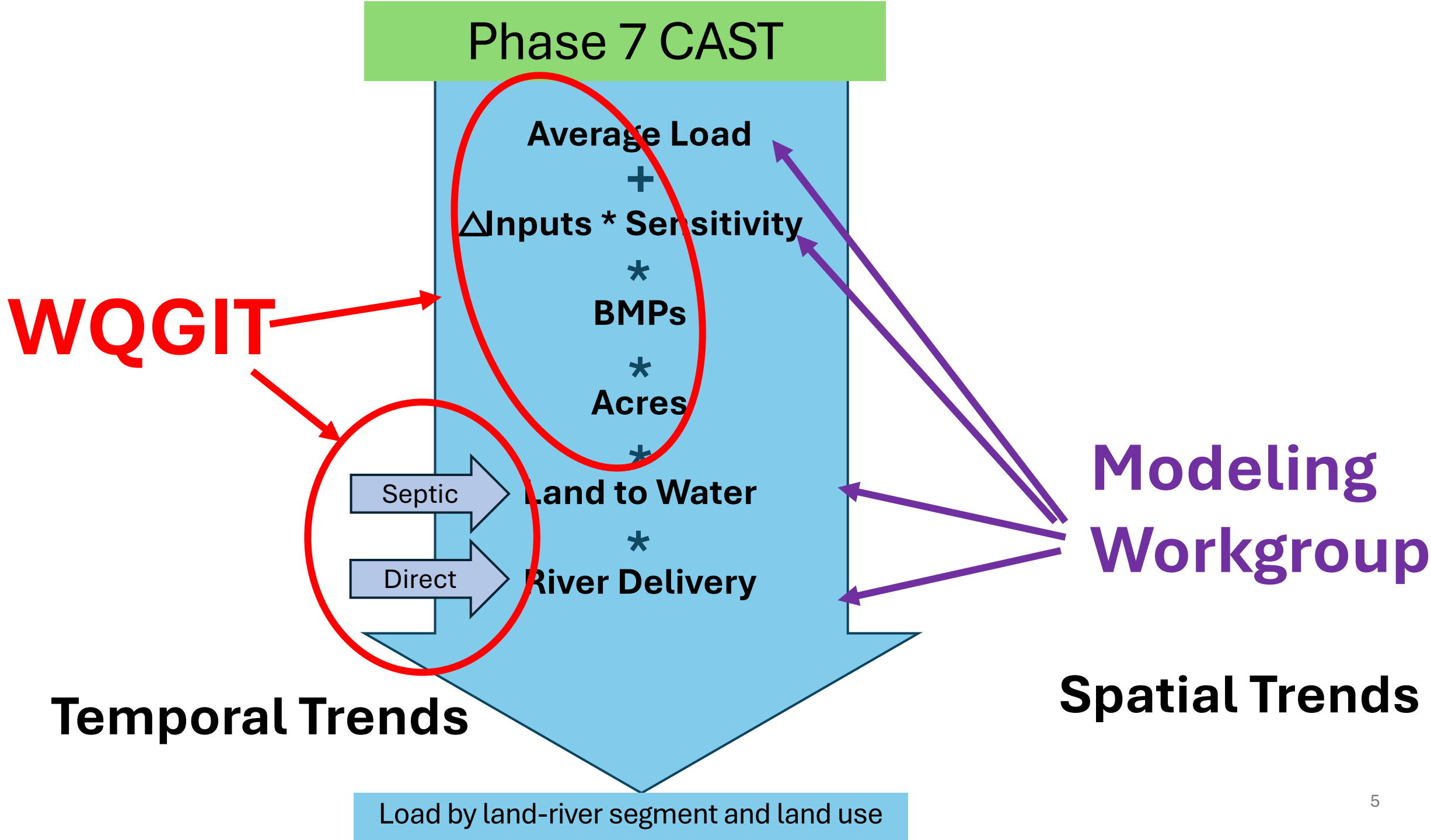
Average Load
+
Δ Inputs * Sensitivity
*
BMPs
*
Acres
*
Land to Water
*
River Delivery

Load by land-river segment and land use

Temporal downscaling model



CAST model documentation; section 1
https://cast.chesapeakebay.net/Documentation/ModelDocumentation

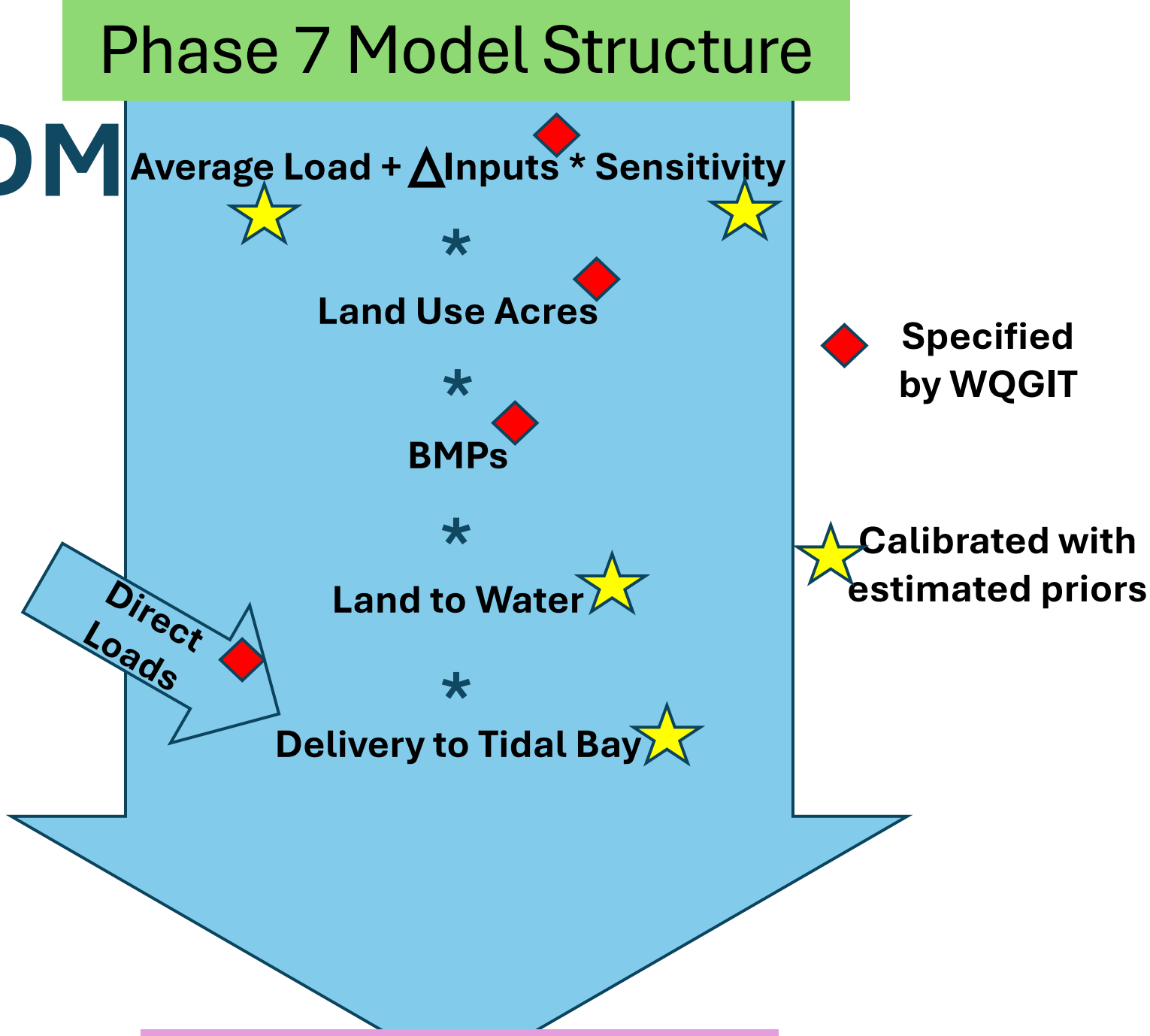

Phase 7 CAST
Average Load
+
ΔInputs * Sensitivity
*
BMPs
*
Acres
*
Land to Water
*
River Delivery
WQGIT
Septic
Direct
Modeling Workgroup
Temporal Trends
Spatial Trends
Load by land-river segment and land use

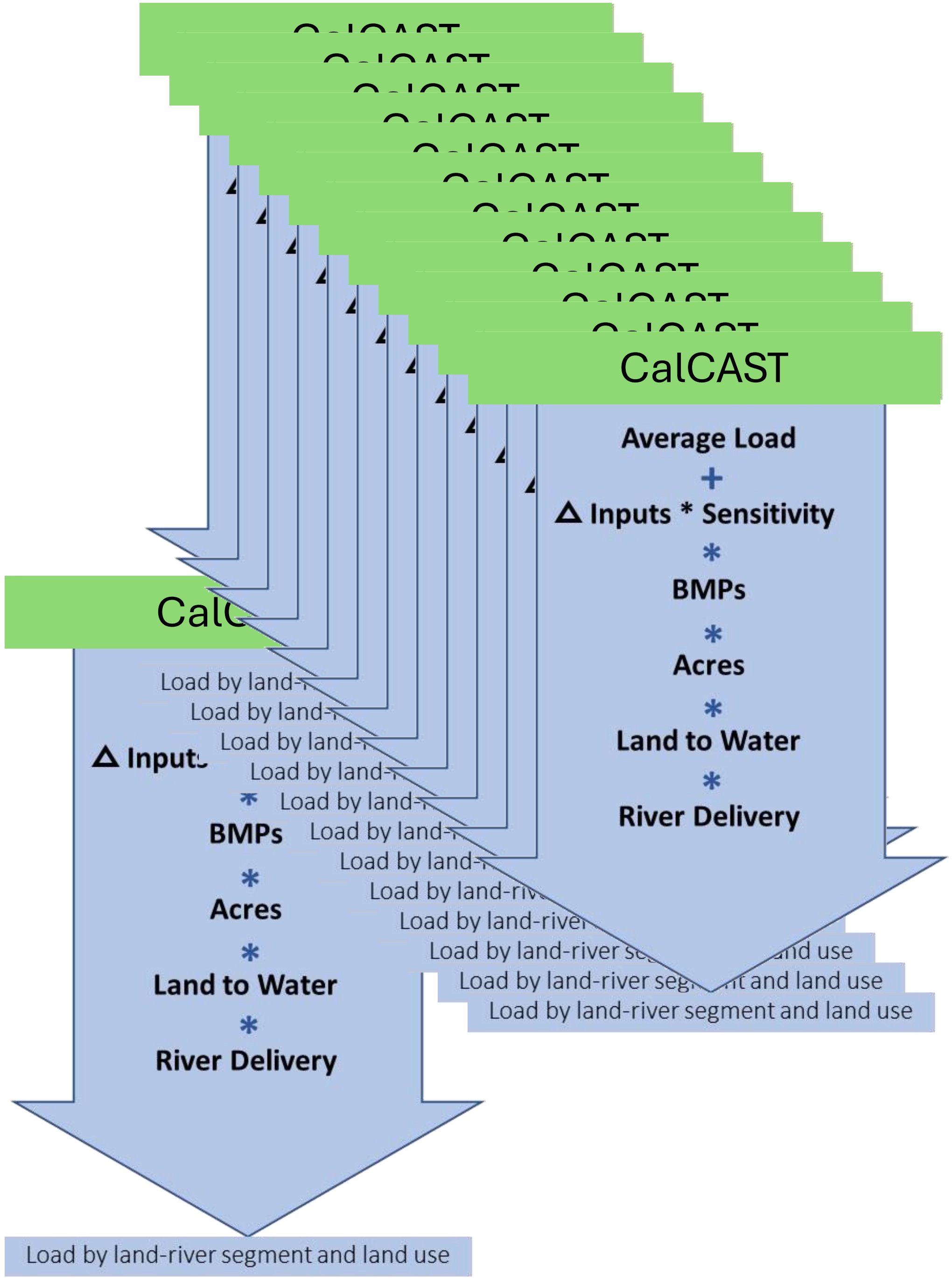
Cast/CalCast/DM

Phase 7
CalCAST

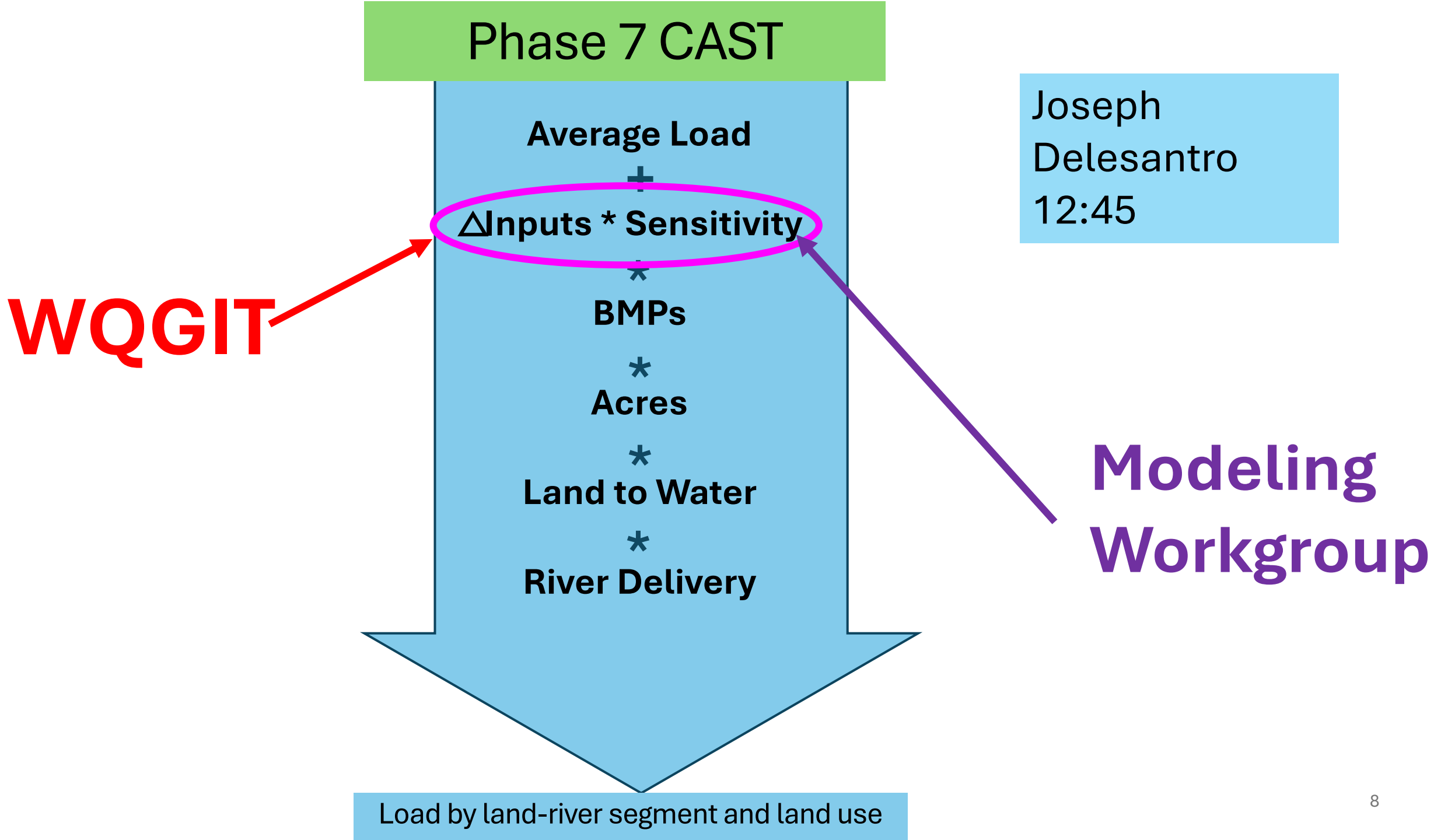
Tool for finding parameters that best match observations

Isabella Bertani 9:30





Constituent	Average Annual	Annual Flow-Normalized	Annual True Condition
Flow	X		X
Baseflow	X		X
Nitrogen	X	X	X
Phosphorus	X	X	X
Sediment	X	X	X

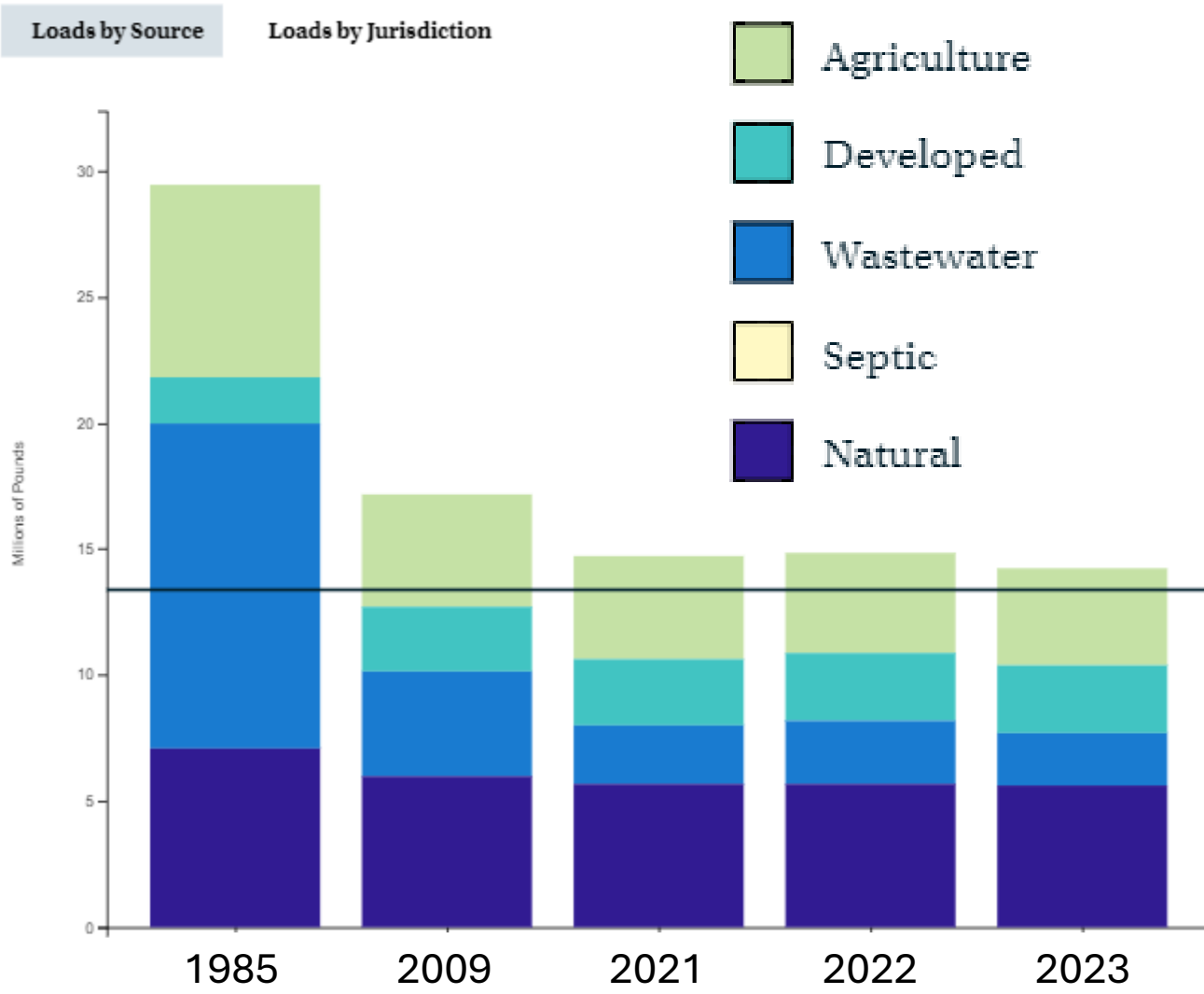

Phase 7 CAST
Average Load
+
ΔInputs * Sensitivity
*
BMPs
*
Acres
*
Land to Water
*
River Delivery
Load by land-river segment and land use
WQGIT
Modeling Workgroup
Joseph Delesantro 12:45

Observed

	Since 1985	Since 1995
Susquehanna	-3%	27%
Patuxent	-69%	-14%
Potomac	-26%	11%
Rappahannock	41%	63%
Mattaponi	5%	8%
Pamunkey	59%	27%
James	-32%	16%
Appomattox	94%	27%
Choptank	91%	111%

Trend Direction Improving Degrading

Expected

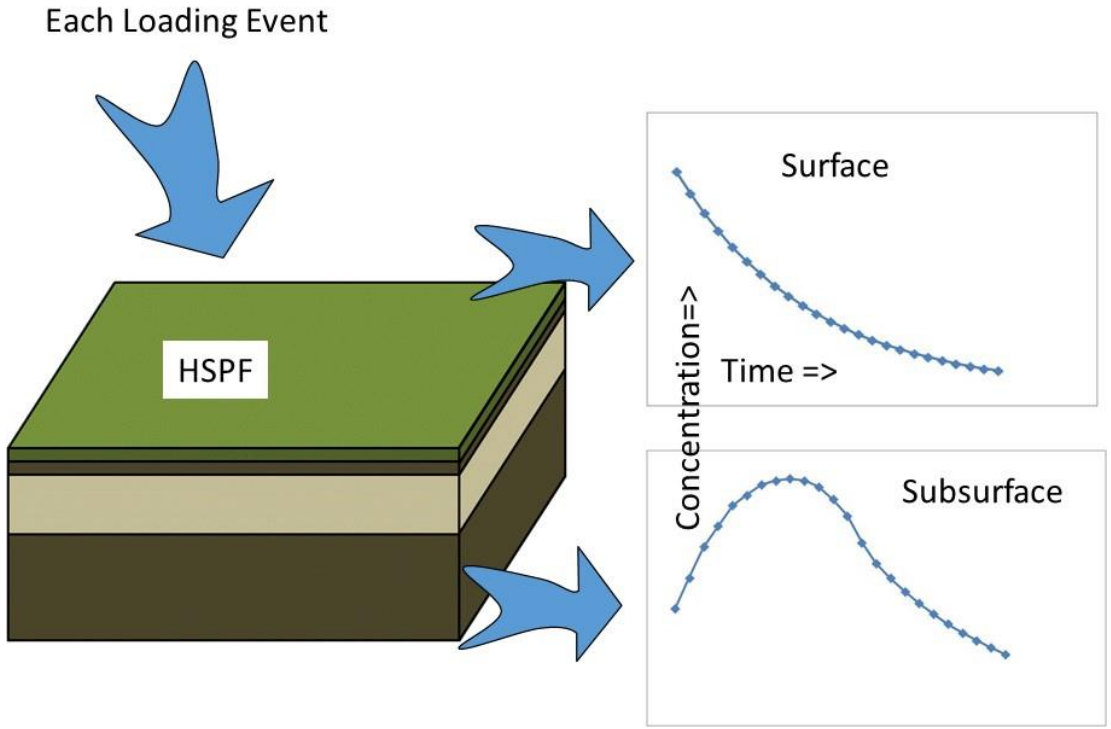


https://www.chesapeakeprogress.com/clean-water/watershed-implementation-plans

Cast/CalCast/DM

Phase 7
Dynamic Model

Tool for
- loading estuarine models
- Comparing against observations
- Other potential collaborative projects

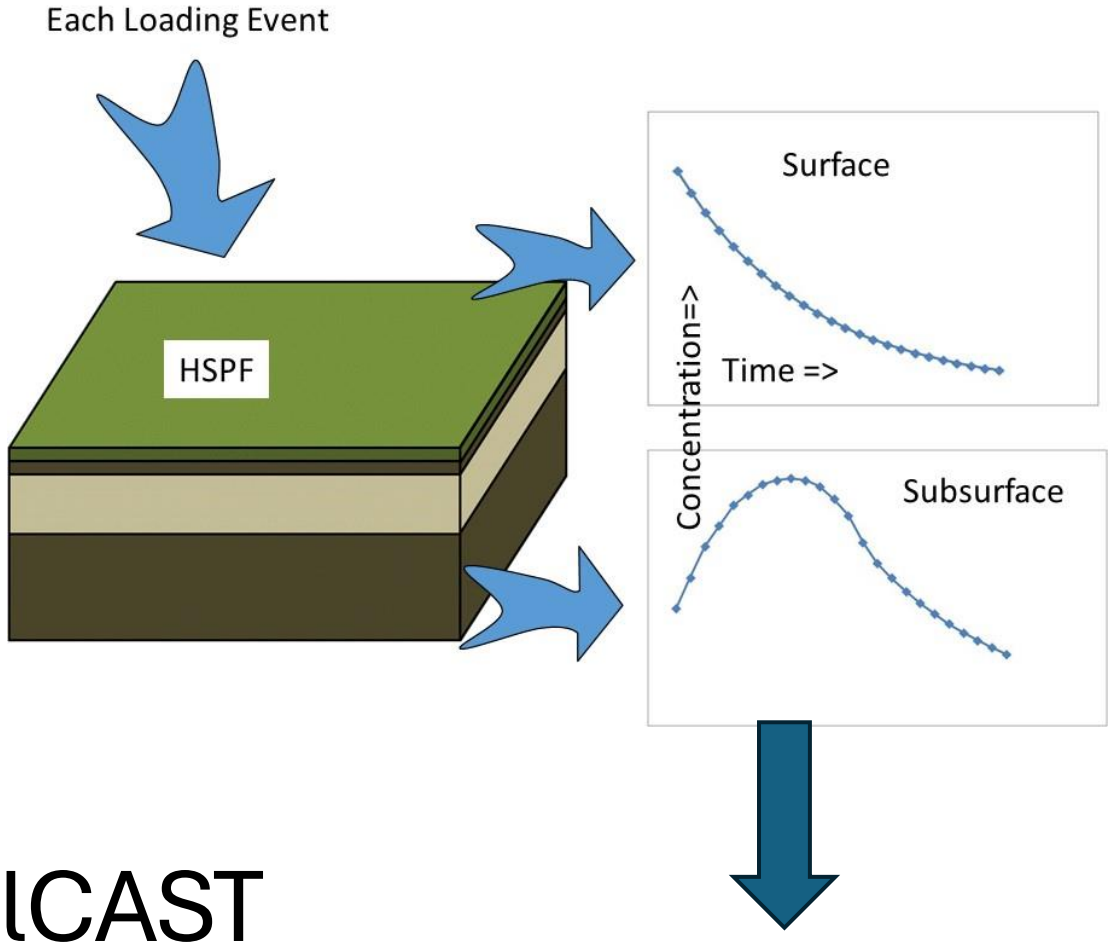


Gopal Bhatt 10:00

Cast/CalCast/DM

Phase 7

Dynamic Model



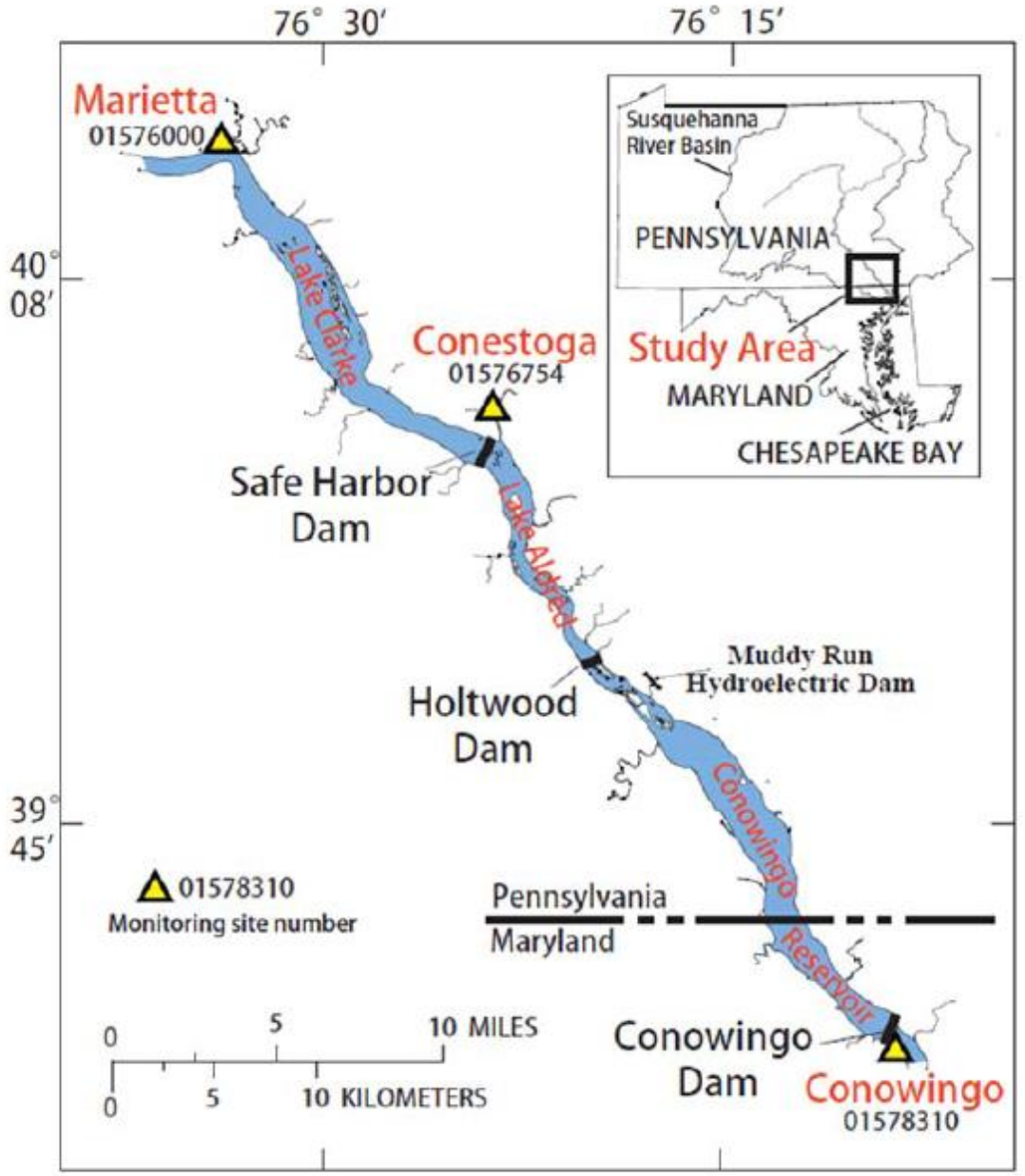
Specifications

- Long-term load = CAST/CalCAST
- Lag time = expected lag time
- Concentration distribution similar to observed

Stream and
River simulation

Gopal Bhatt

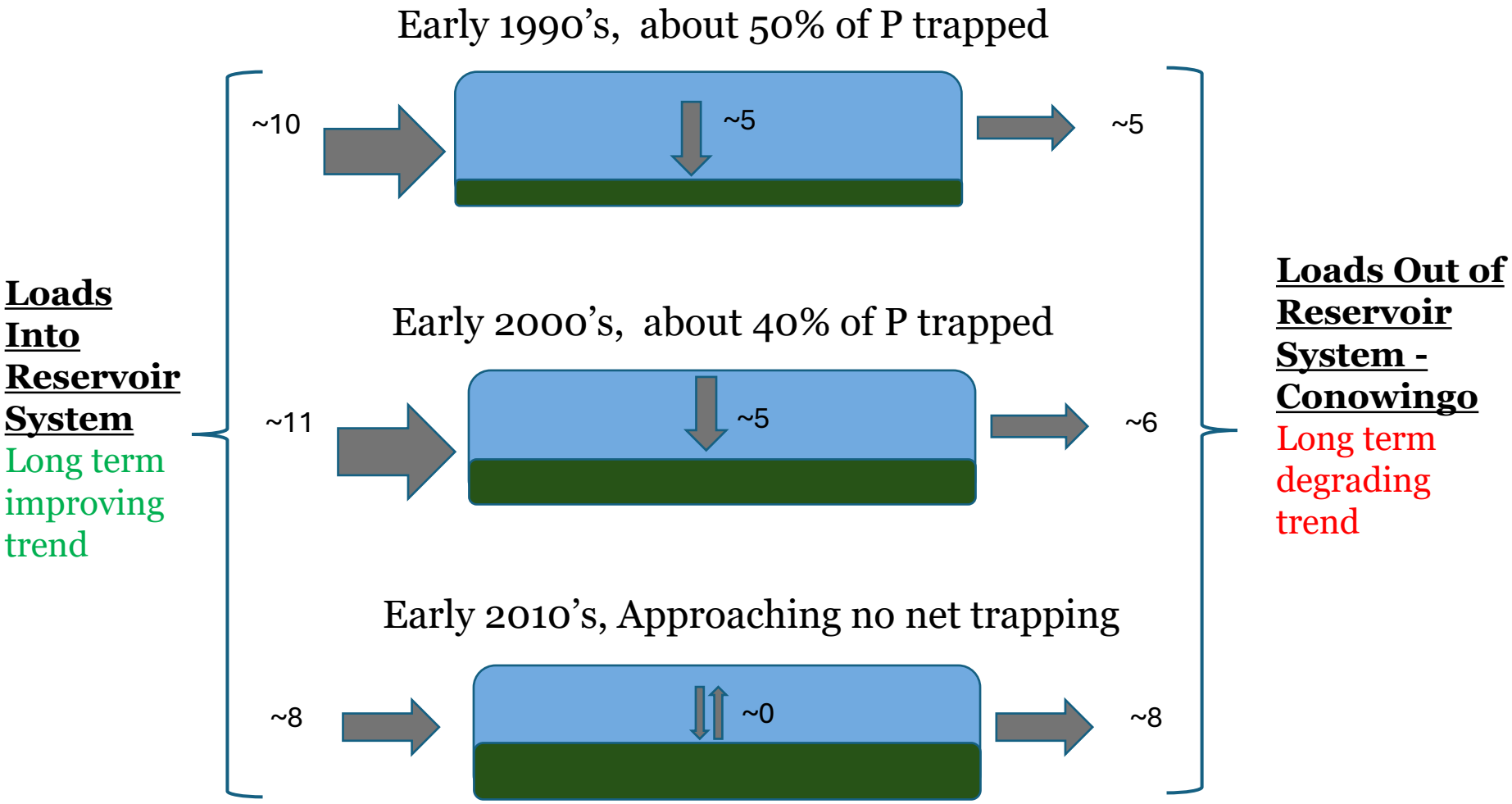
Lower Susquehanna River Reservoirs



Earl Hayter, Jodi Ryder, Matt Rowe

Sources: Langland, USGS, Bay Journal, Lower Susquehanna River Keeper

Phosphorus Loads Into, Trapped Within and Exiting the Reservoir System: 1990s-2010s

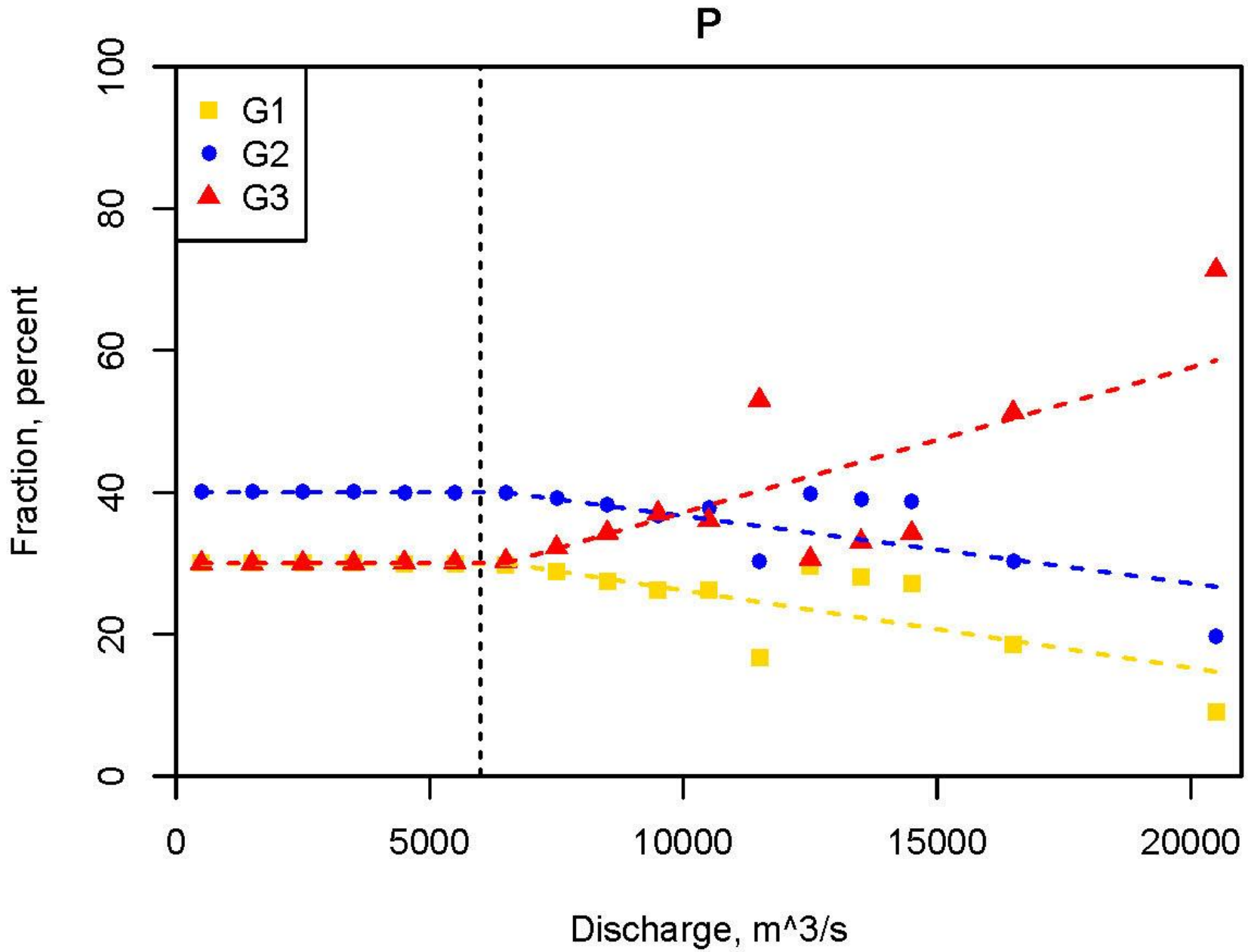


Source: Data from USGS (2016), http://cbrim.er.usgs.gov/loads_query.html
loads are approximate and in units of million lbs/year using estimates for 1992, 2002, and 2012

Conowingo Specifications

- During the 2/14/17 Modeling WG meeting agreement was reached
  - Conowingo is in equilibrium
  - WRTDS is appropriate for calibration use
  - HDR model supports constant delivery factor over nutrient reduction scenarios
  - HDR model could be used to describe G1/G2/G3 organics

G1G2G3: P

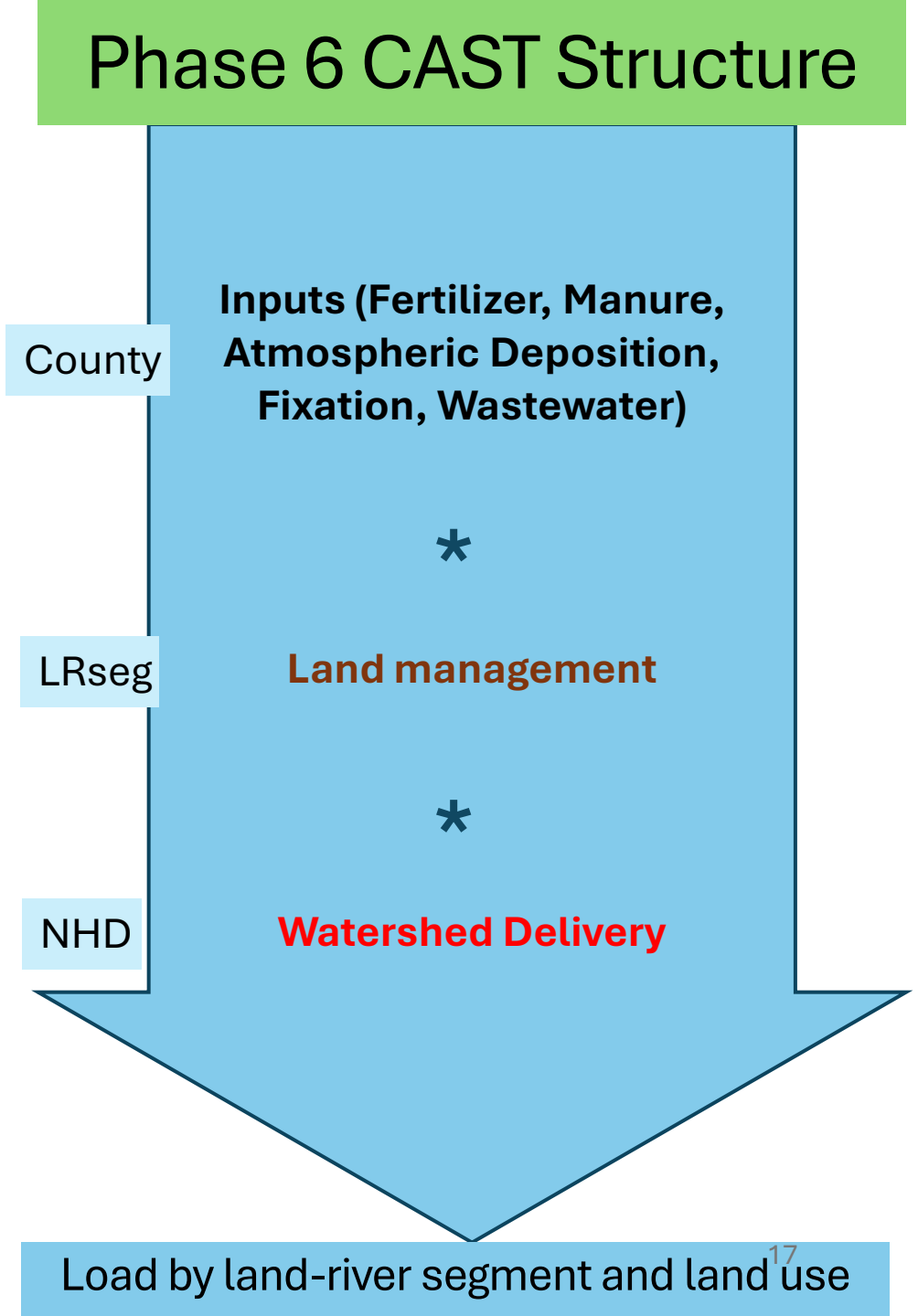

P
G1
G2
G3
Fraction, percent
0
20
40
60
80
100
0
5000
10000
15000
20000
Discharge, m^3/s

Watershed Models Scales

- **CalCAST** is being developed at the **NHD100k** scale to incorporate more monitoring data and to support finer scale modeling
- The **Dynamic Model** will run at the **NHD100k** scale because it is required by the estuarine model
- **Phase 7 CAST will be built at the scale that the WQGIT decides**
  - **WQGIT may decide in December 2024**

Multiple Scales in Phase 6

- In general,
  - Inputs are estimated at the county level
  - Land management is estimated at the LRseg level
  - Watershed delivery is estimated at the NHD level
- Information is upscaled or downscaled and calculations are made at the land-river segment scale



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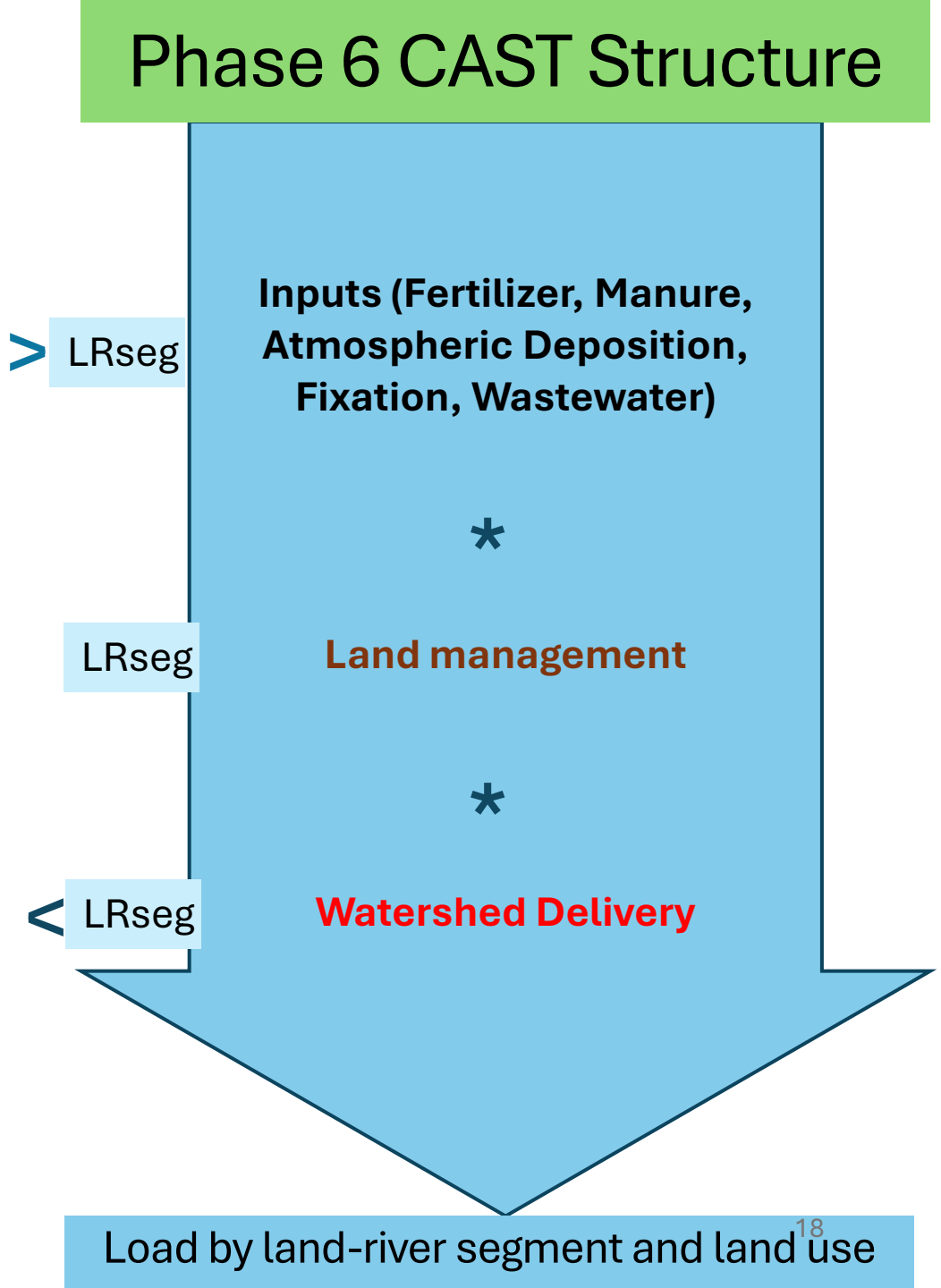
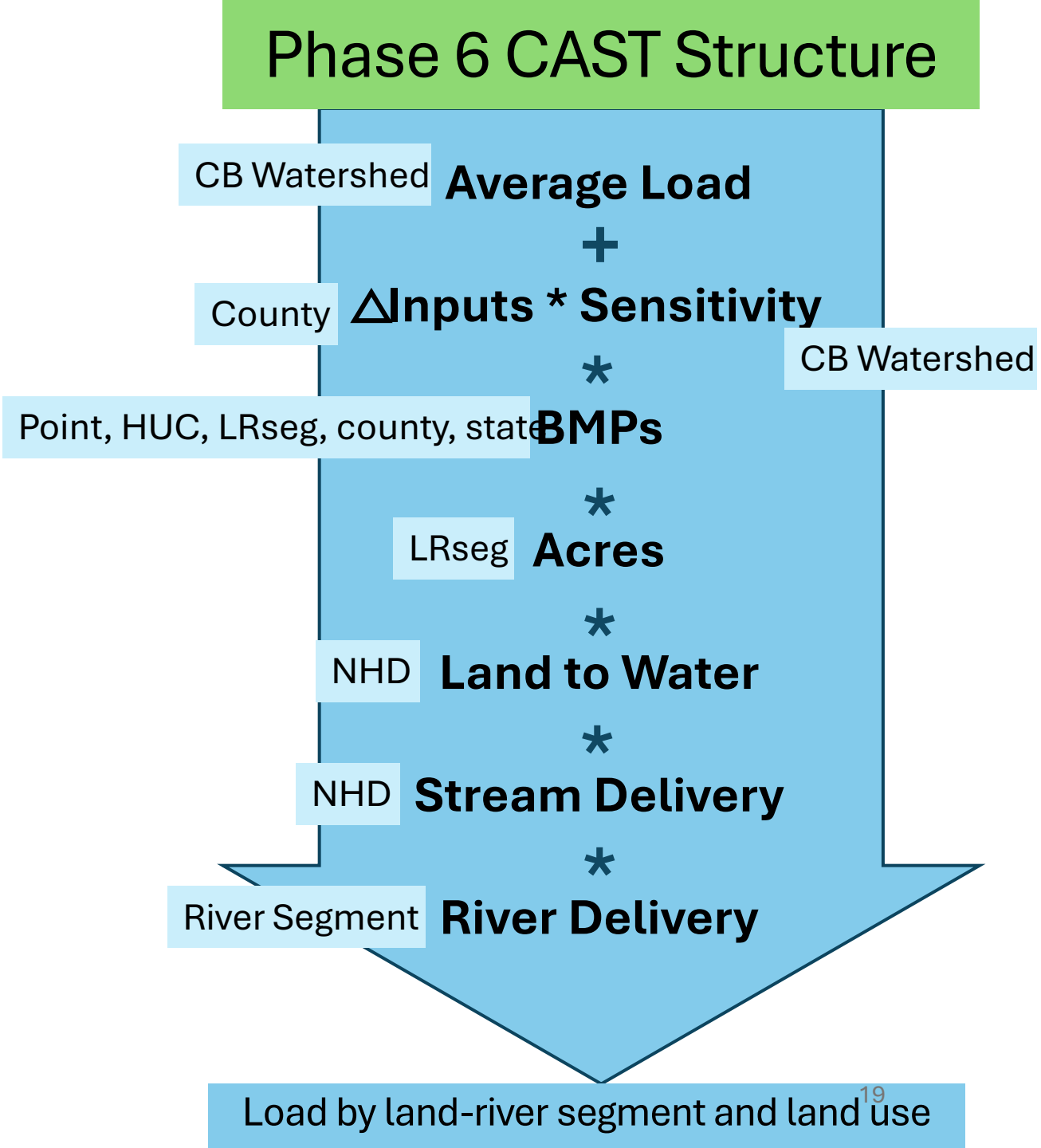


Multiple Scales in Phase 6

- The terms are known at various scales
- Computations are made at the land-river segment
- County-level data are disaggregated to land-river segment
- Watershed delivery is aggregated up to land-river segment



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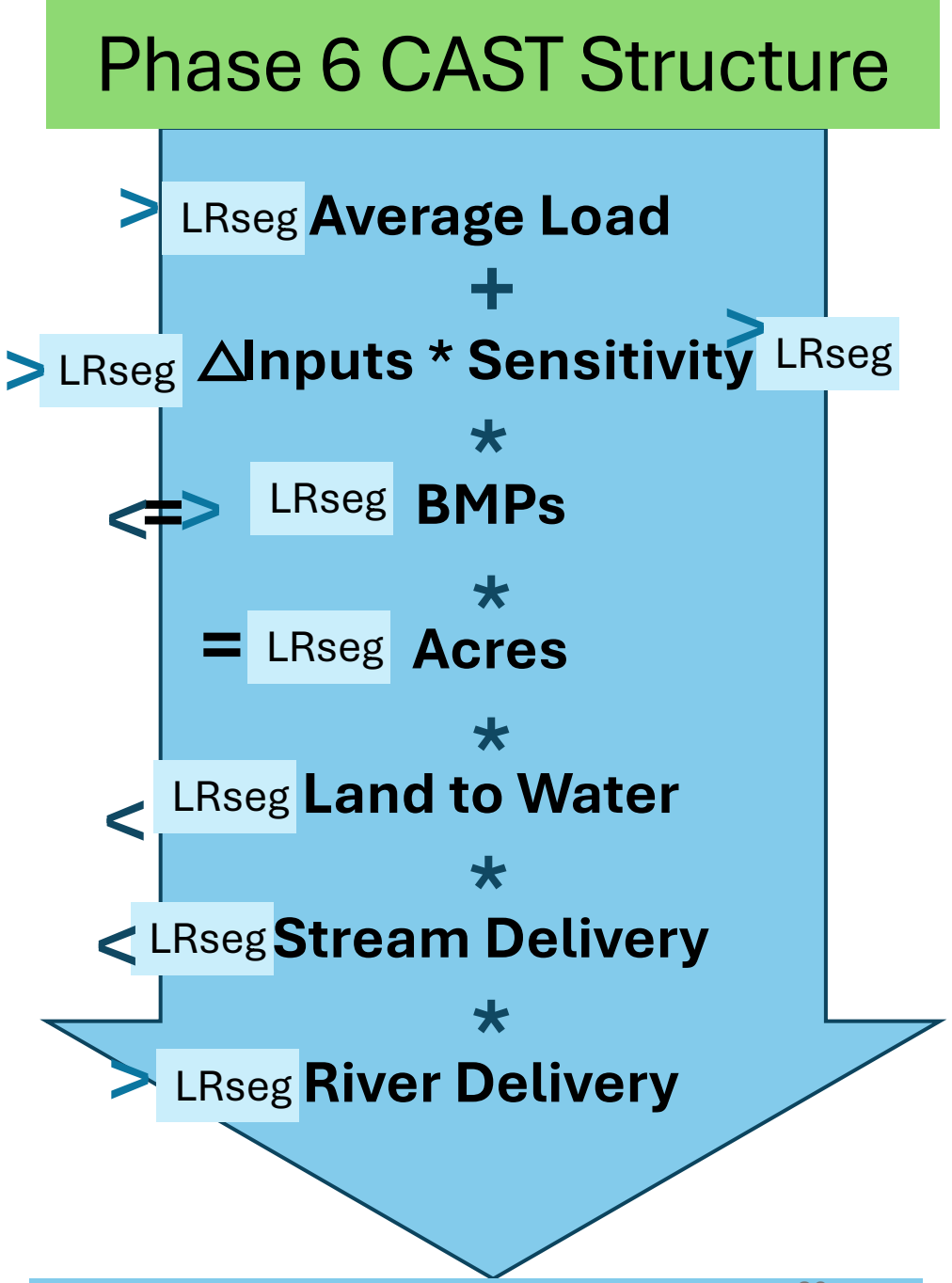
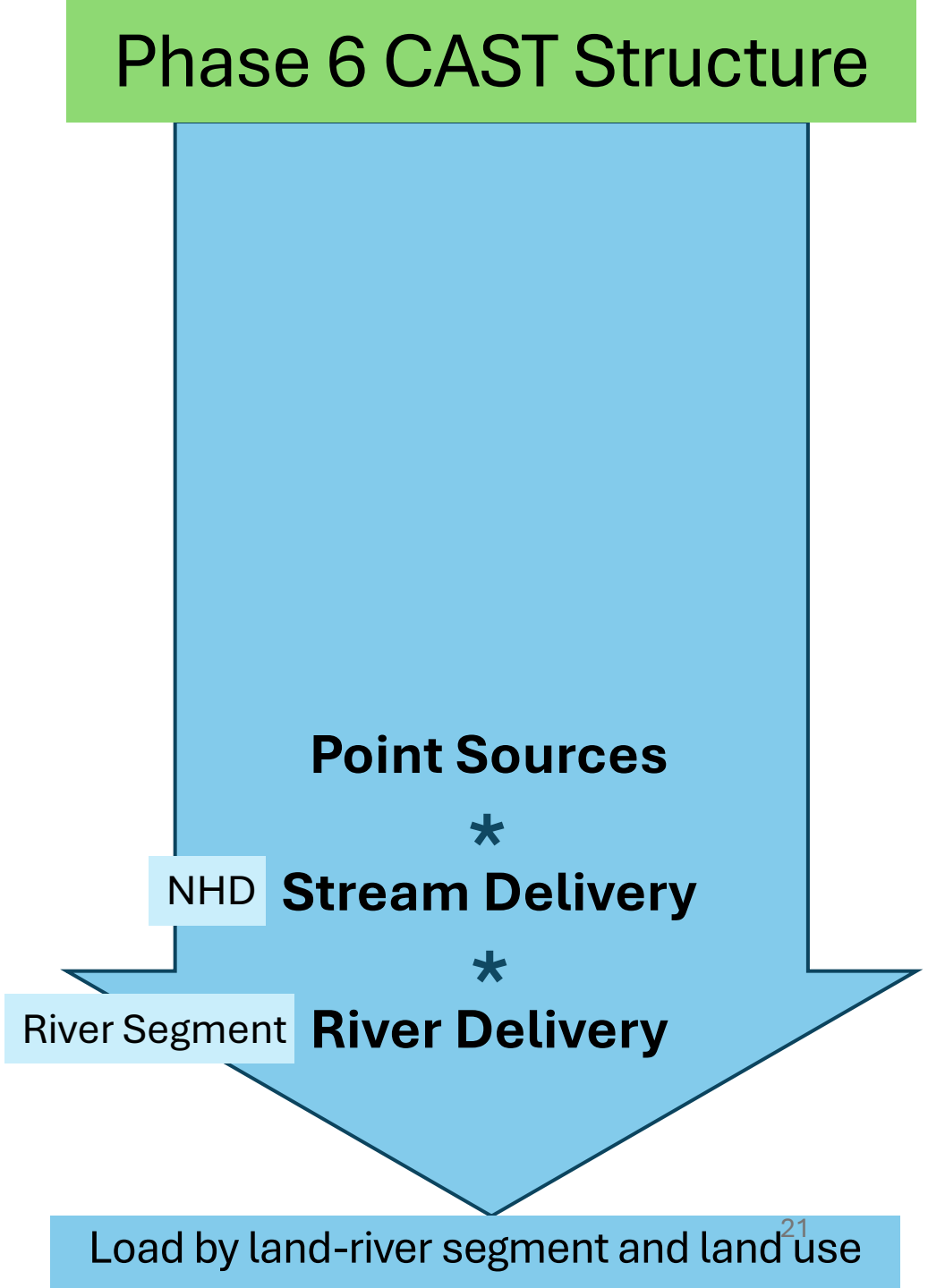


Multiple Scales in Phase 6

- Point Sources are kept a the NHD scale



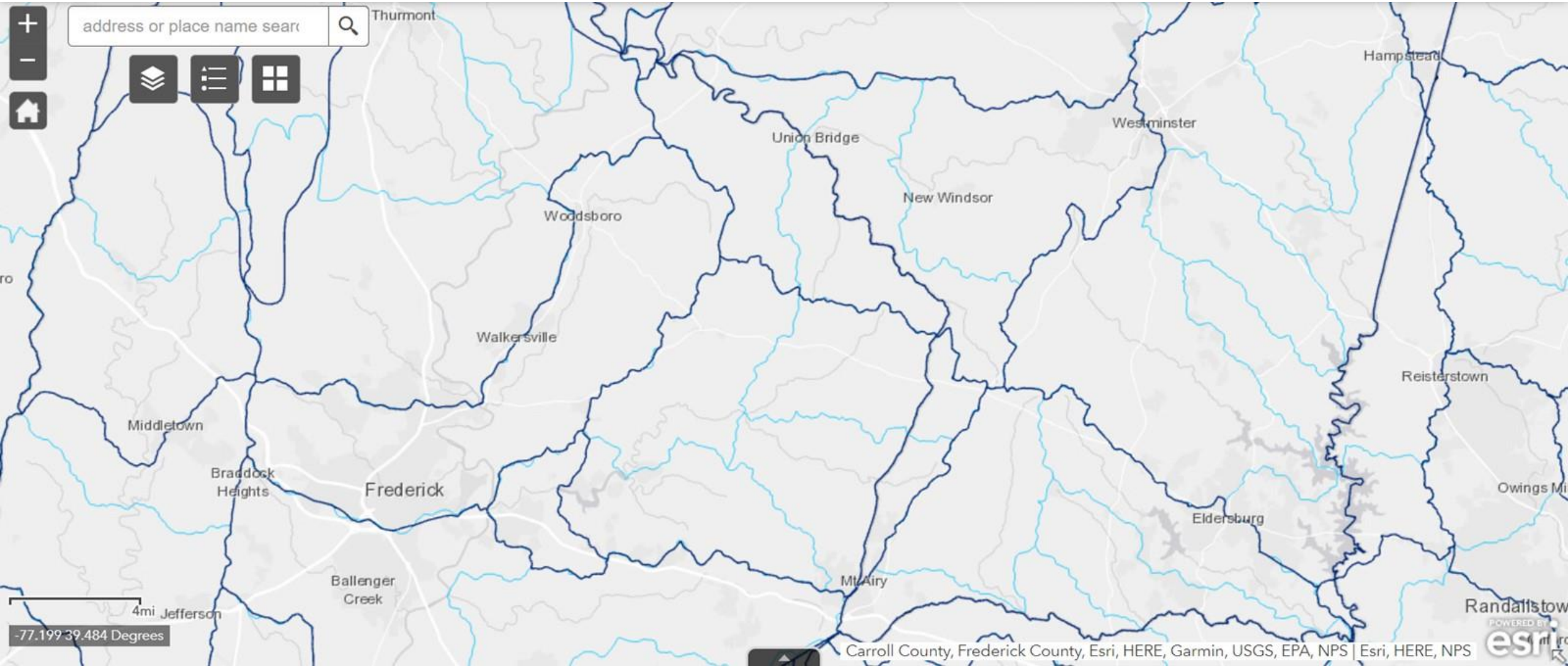
HUC12 Proposal for CAST scale in Phase 7

- HUC12 more standard than River segments
  - CBP river segments were created for phase 5 for lack of appropriate existing layer.
  - HUC12s are used as a management scale for several CBP states

- Goldilocks scale
  - Somewhat finer scale for CAST
  - Avoids NHD-scale issues for management:
    - Too much output
    - Lower confidence
    - Shenandoah coarser scale

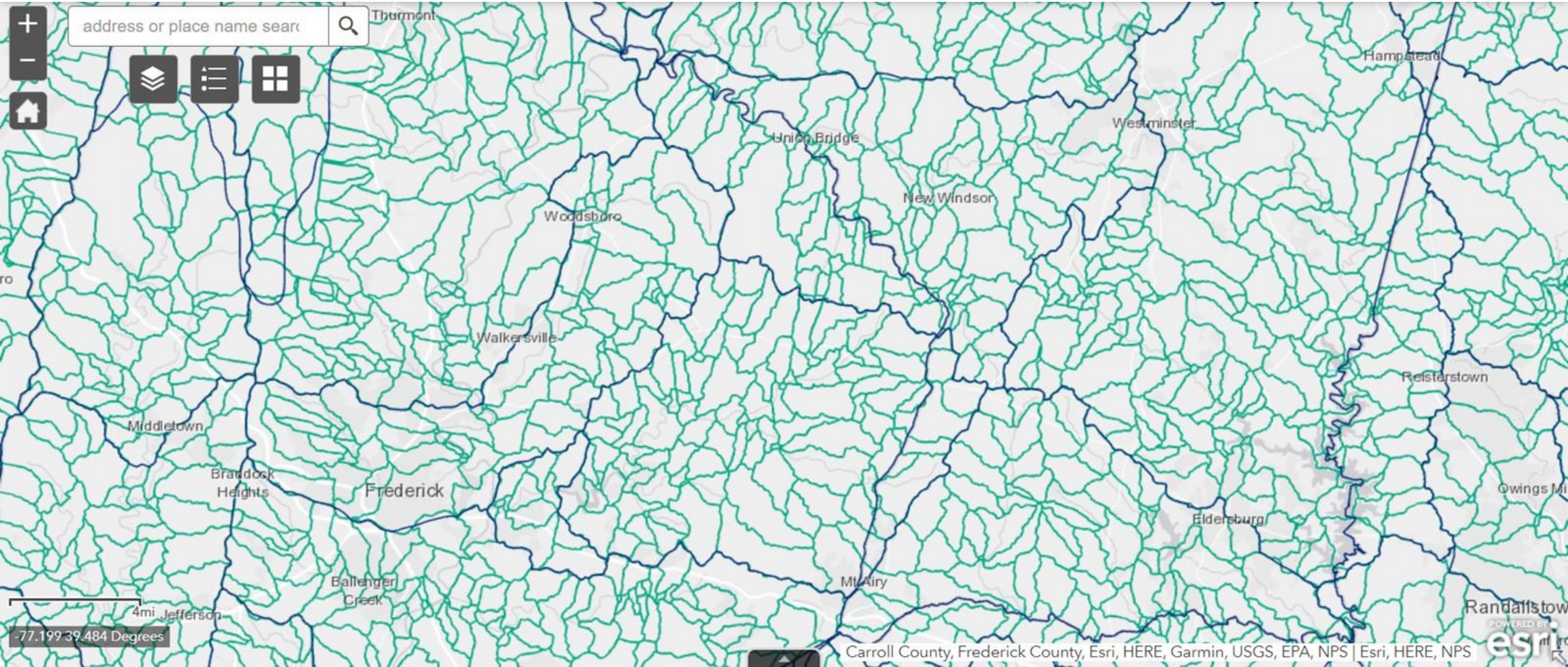
https://gis.chesapeakebay.net/modeling/

Current River segments and HUC 12s



https://gis.chesapeakebay.net/modeling/

Current River segments and NHD catchments



2026 Reviews – start to plan

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Work plan			Build	Work plan	Build Models			Work plan	Build Models			Work plan	Build Models			Review Models			
Build Model Structure				Improve Models												Review Models			

- Partner comments
  - Comment, response, discussion
- STAC reviews
  - Watershed Model?
  - Inputs?
  - Land Use?

2026 Initial Application

2022	2022	2022	2022	2023	2023	2023	2023	2024	2024	2024	2024	2025	2025	2025	2025	2026	2026	2026	2026
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Work plan			Build	Work plan	Build Models			Work plan	Build Models			Work plan	Build Models			Review Models			
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- Climate
- Integration with new interpolator
- Investigate assimilative capacity
- Investigate partnership shallow water priorities

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