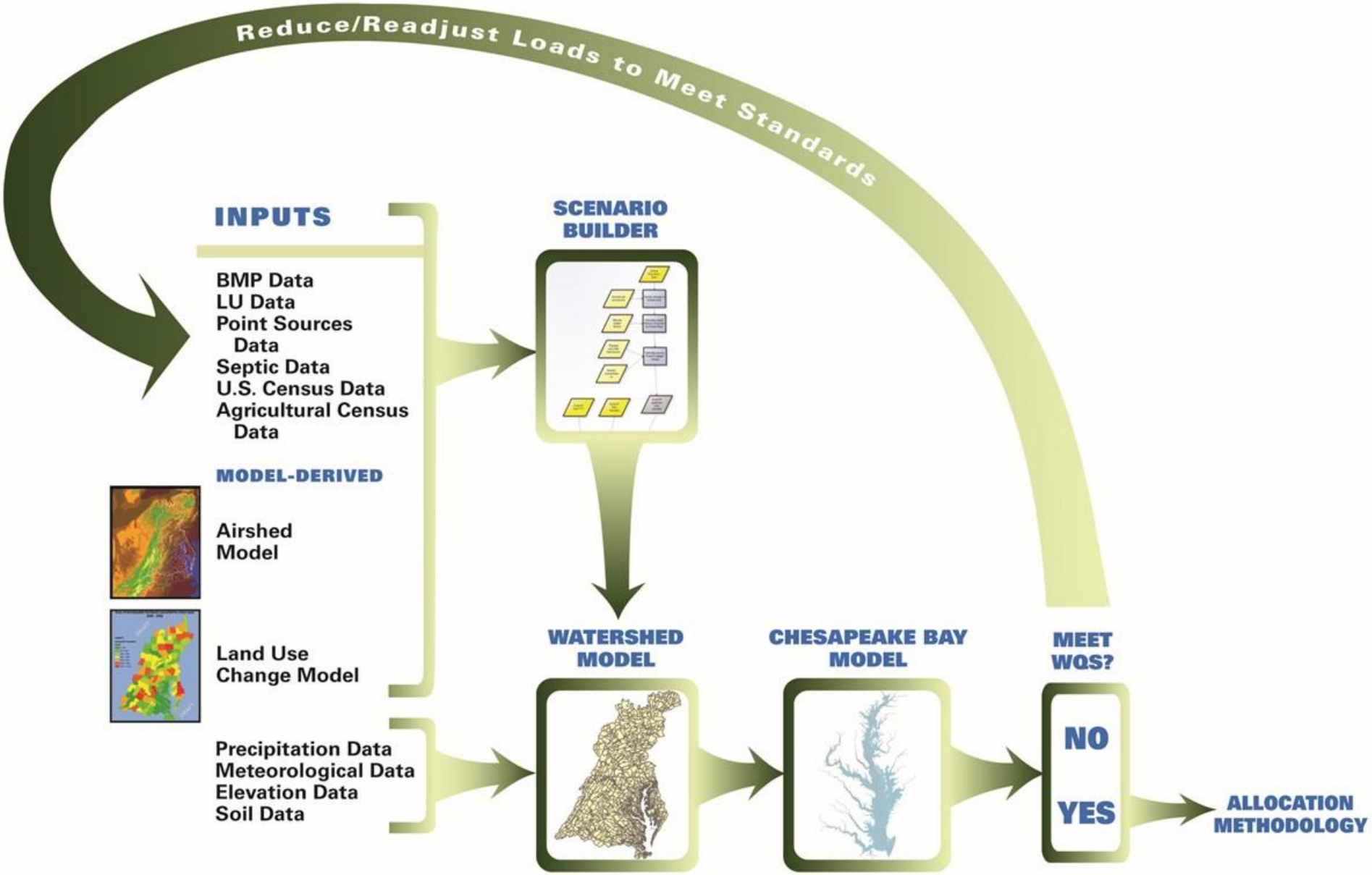
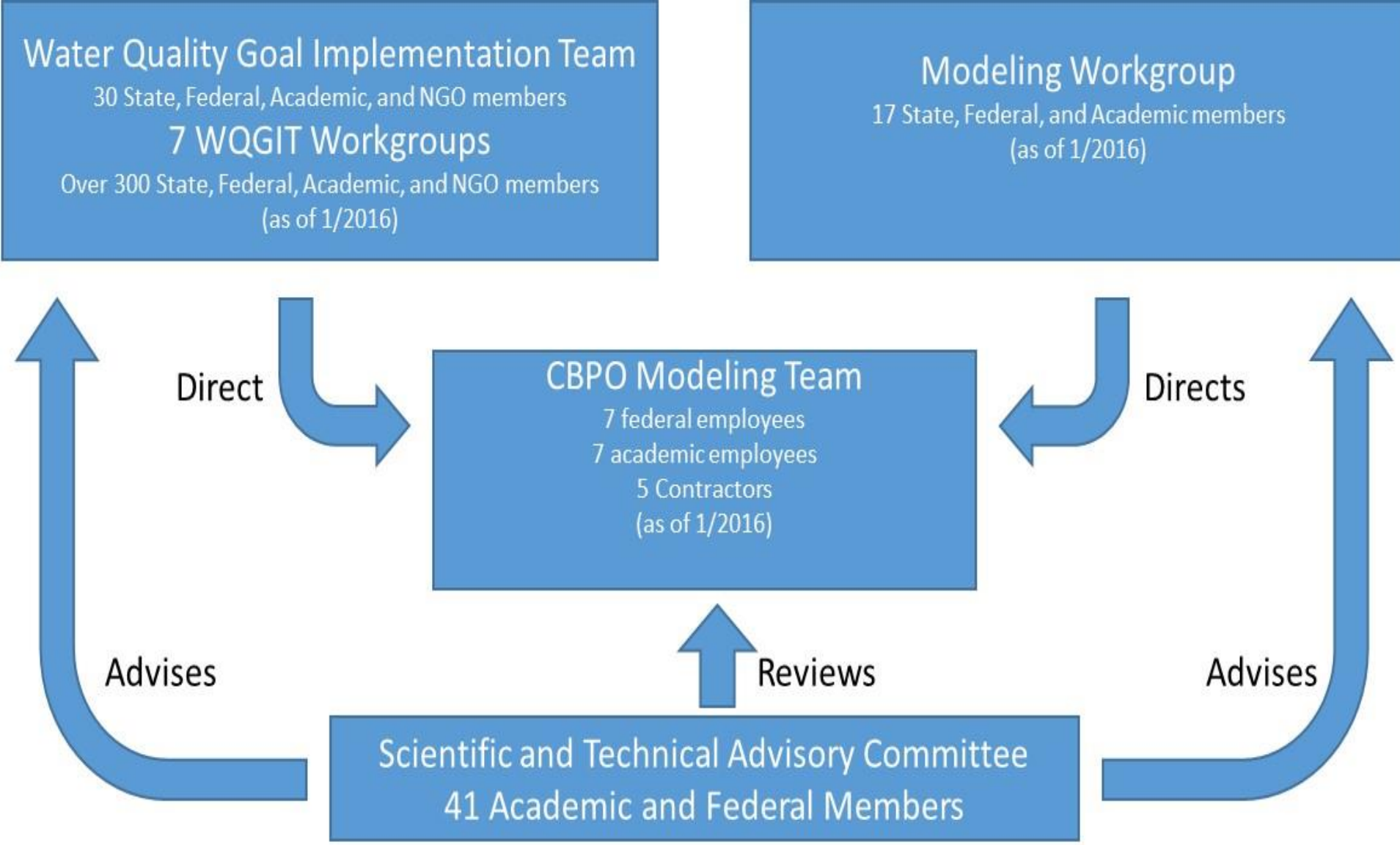
Chesapeake Bay Partnership Models



Continual Updates to Models

Year	Model Phase	Goal
1987	1	40% reduction
1992	2	40% of controllable loads
1997	4.1	Confirm 1992 loads
2003	4.3	Reallocation
2010	5.3.0	TMDL
2011	5.3.2	Phase 2 WIP targets
2017	6	Phase 3 WIP targets
2025?	7?	???


Water Quality Goal Implementation Team
30 State, Federal, Academic, and NGO members
7 WQGIT Workgroups
Over 300 State, Federal, Academic, and NGO members
(as of 1/2016)
Modeling Workgroup
17 State, Federal, and Academic members
(as of 1/2016)
Direct
CBPO Modeling Team
7 federal employees
7 academic employees
5 Contractors
(as of 1/2016)
Directs
Advises
Reviews
Advises
Scientific and Technical Advisory Committee
41 Academic and Federal Members

Partnership Feedback on Modeling

- **Water Quality Managers**
  - Need more **transparent and easier** to understand decision-support tools to enable successful engagement of local partners

- **Scientific and Technical Advisory Committee**
  - Multiple Models
  - Phosphorus
  - Complex Reservoir Dynamics
  - Fine-scale processes

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  - Phosphorus
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Keep it Simple!!

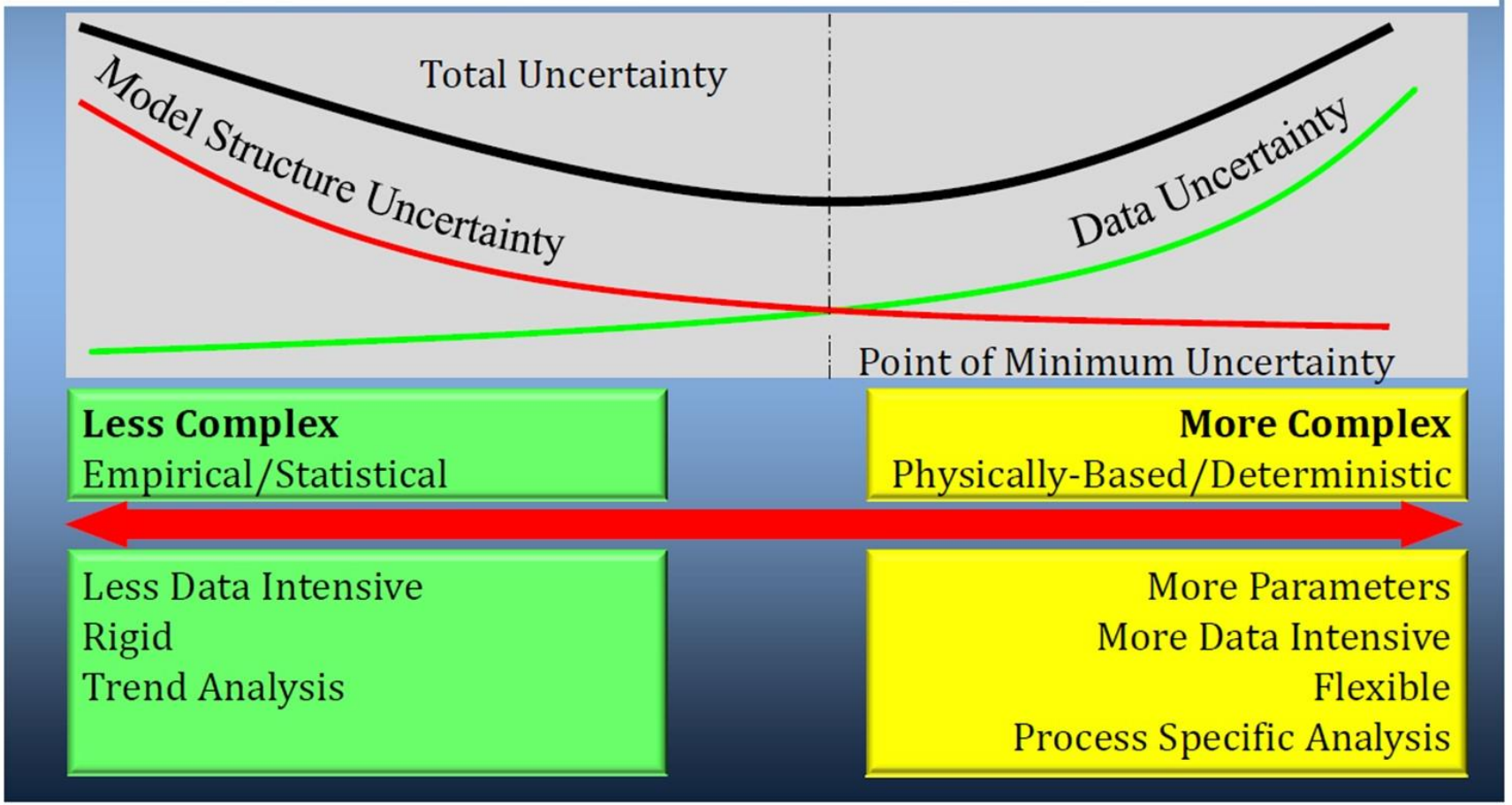
Include Everything!!!

Main Prediction of the Watershed Model for decision support

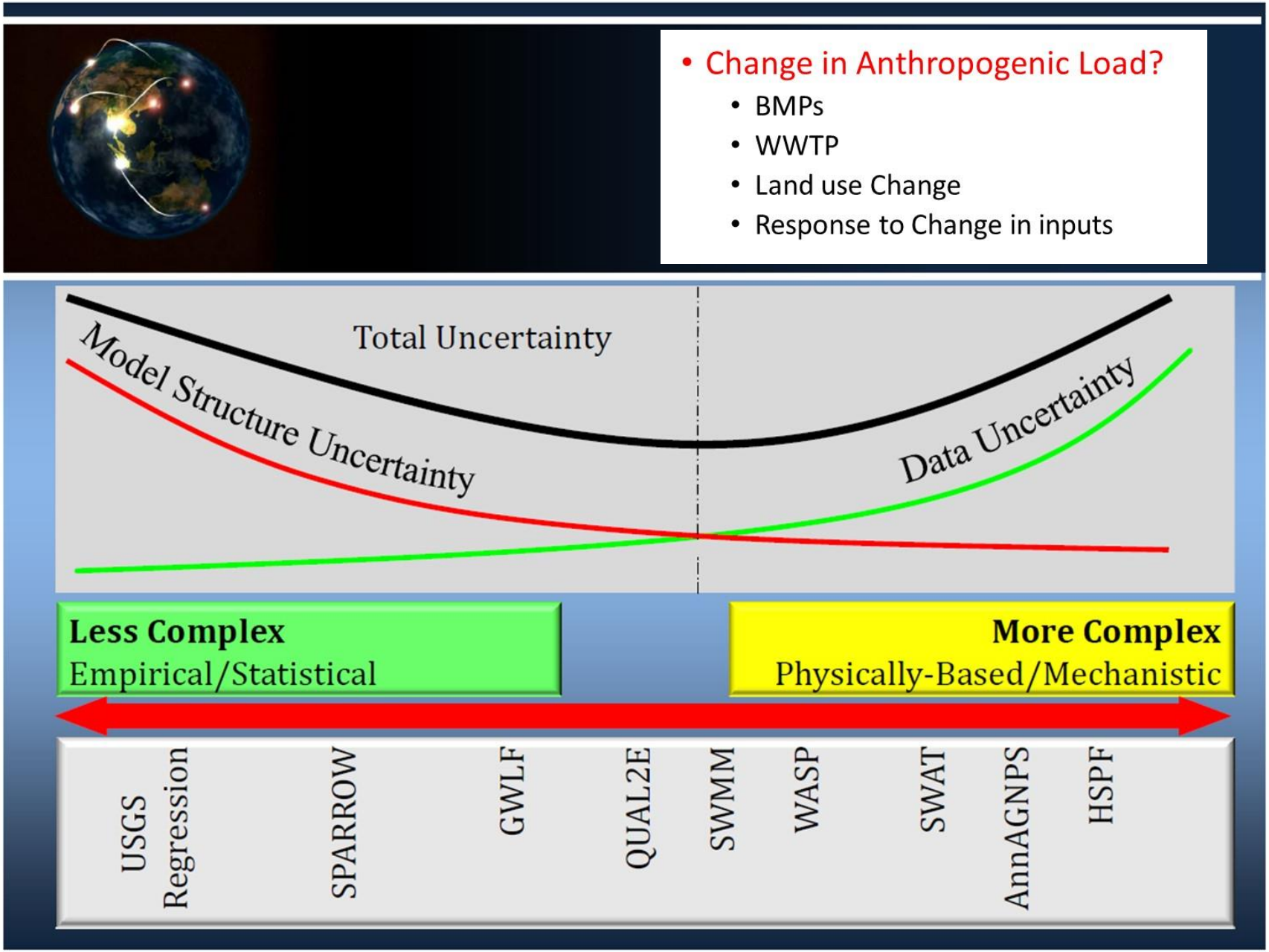
- Change in Anthropogenic Load
  - BMPs
  - WWTP
  - Land use Change
  - Response to Change in inputs

- How to keep it simple and include everything?

Model Continuum



Slide from Mazdak Arabi



Slide from Mazdak Arabi





Phase 6 Model Structure

Average Load + Δ Inputs * Sensitivity

*

Land Use Acres

*

BMPs

*

Land to Water

*

Stream Delivery

*

River Delivery

Direct Loads

Phase 6

Keep It Simple

Include Everything

Average Load + ΔInputs * Sensitivity

*

Land Use Acres

*

BMPs

*

Land to Water

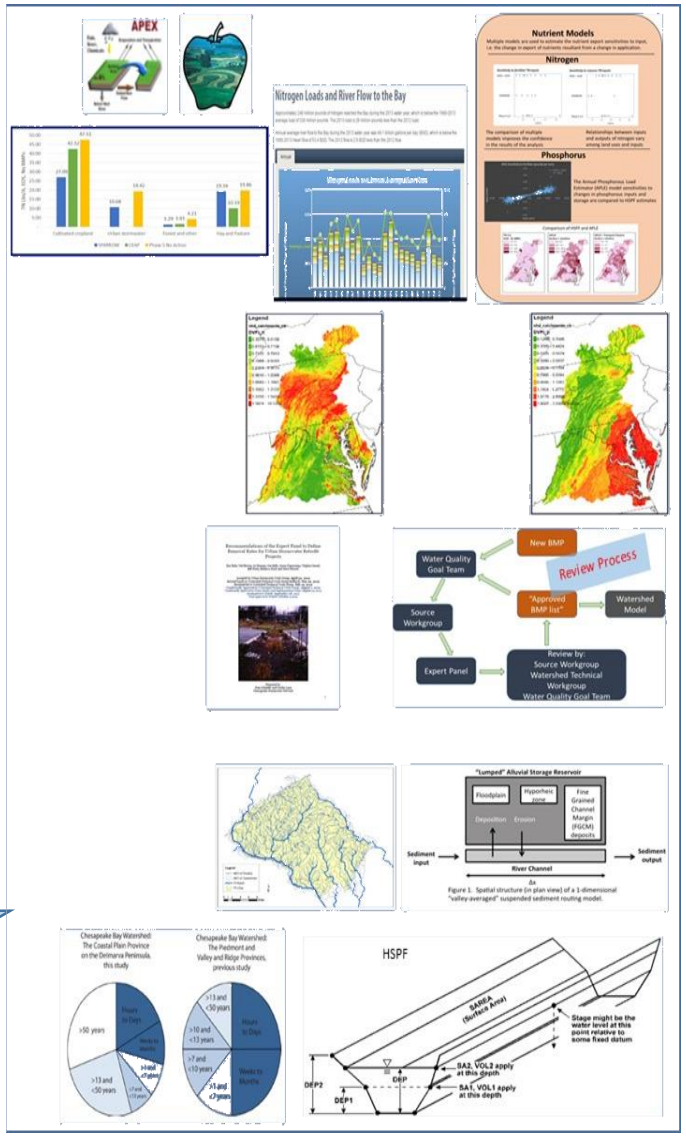
*

Stream Delivery

*

River Delivery

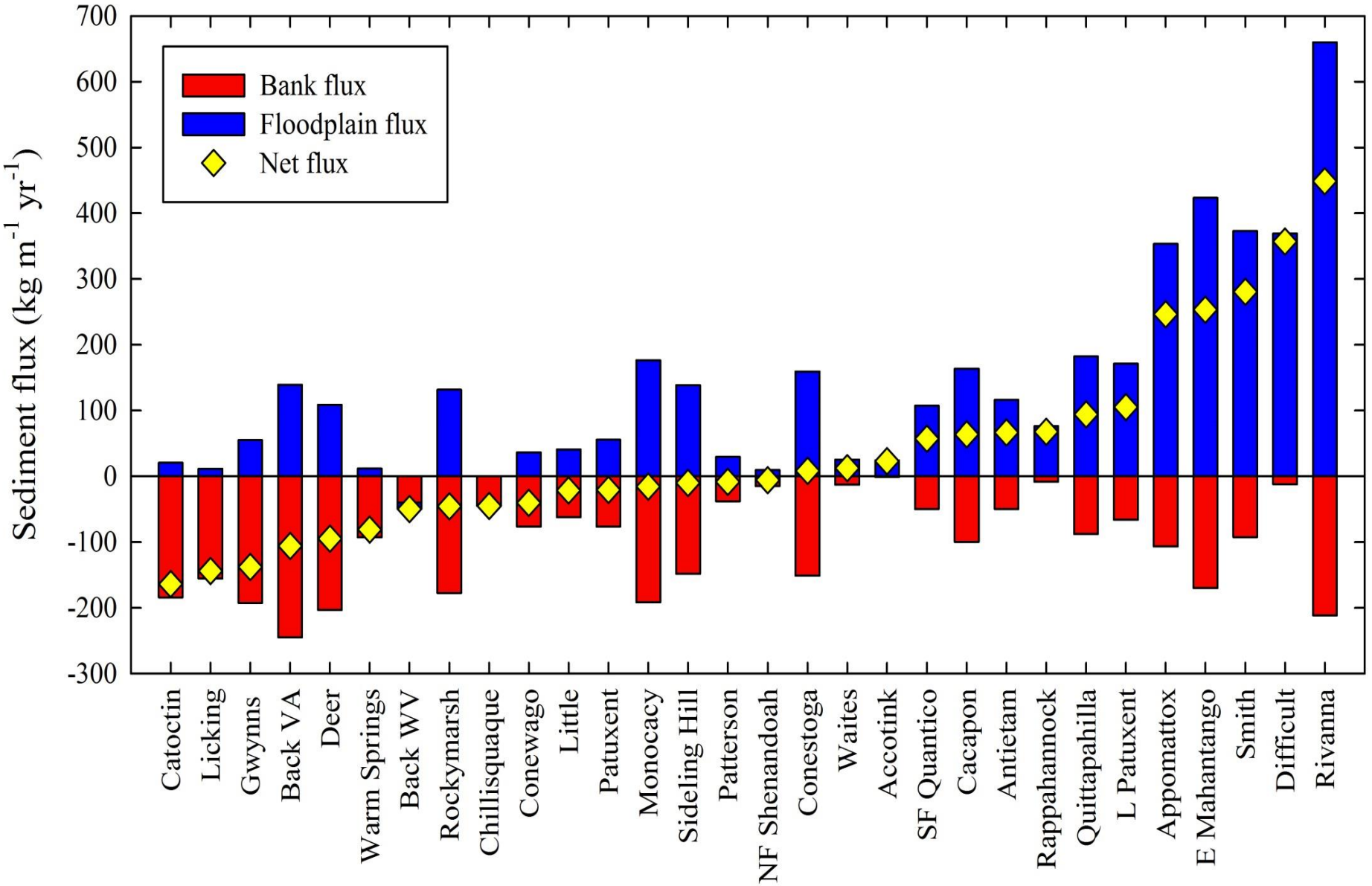
Direct Loads



Use of Multiple Models
for Nitrogen Export Rate

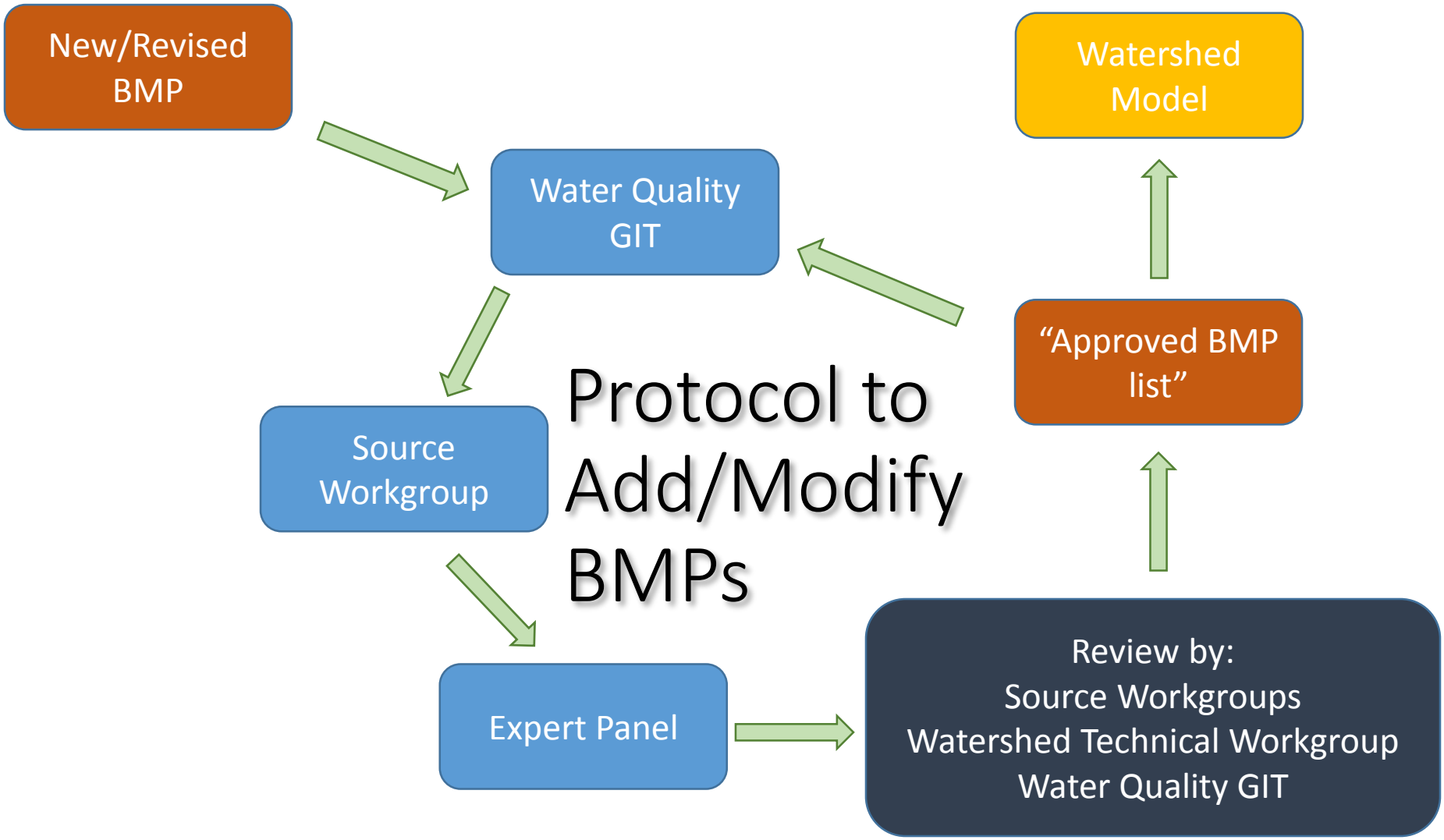
Sector	Crop	Pasture/ Hay	Developed	Natural
CBP Phase 5 model	47.5	19.9	19.4	4.2
USDA-CEAP Model	42.5	10.2	Not used	1.6
USGS- SPARROW Model	22.9	10.2	8.9	0.4
Average Ratio to Crop Rate	1.00	0.37	0.40	0.05

USGS Chesapeake Floodplain Network



Chesapeake Bay Program
A Watershed Partnership

Collaborative Stakeholder Processes



Keep It Simple

Include Everything

Average Load + ΔInputs * Sensitivity

*

Land Use Acres

*

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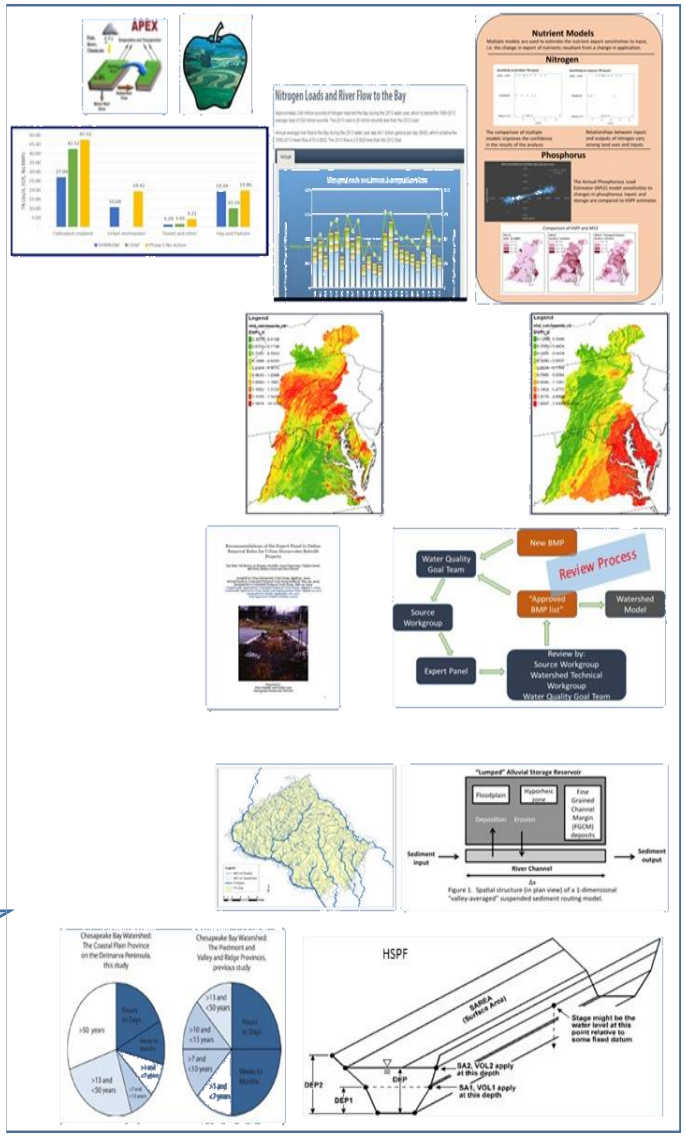
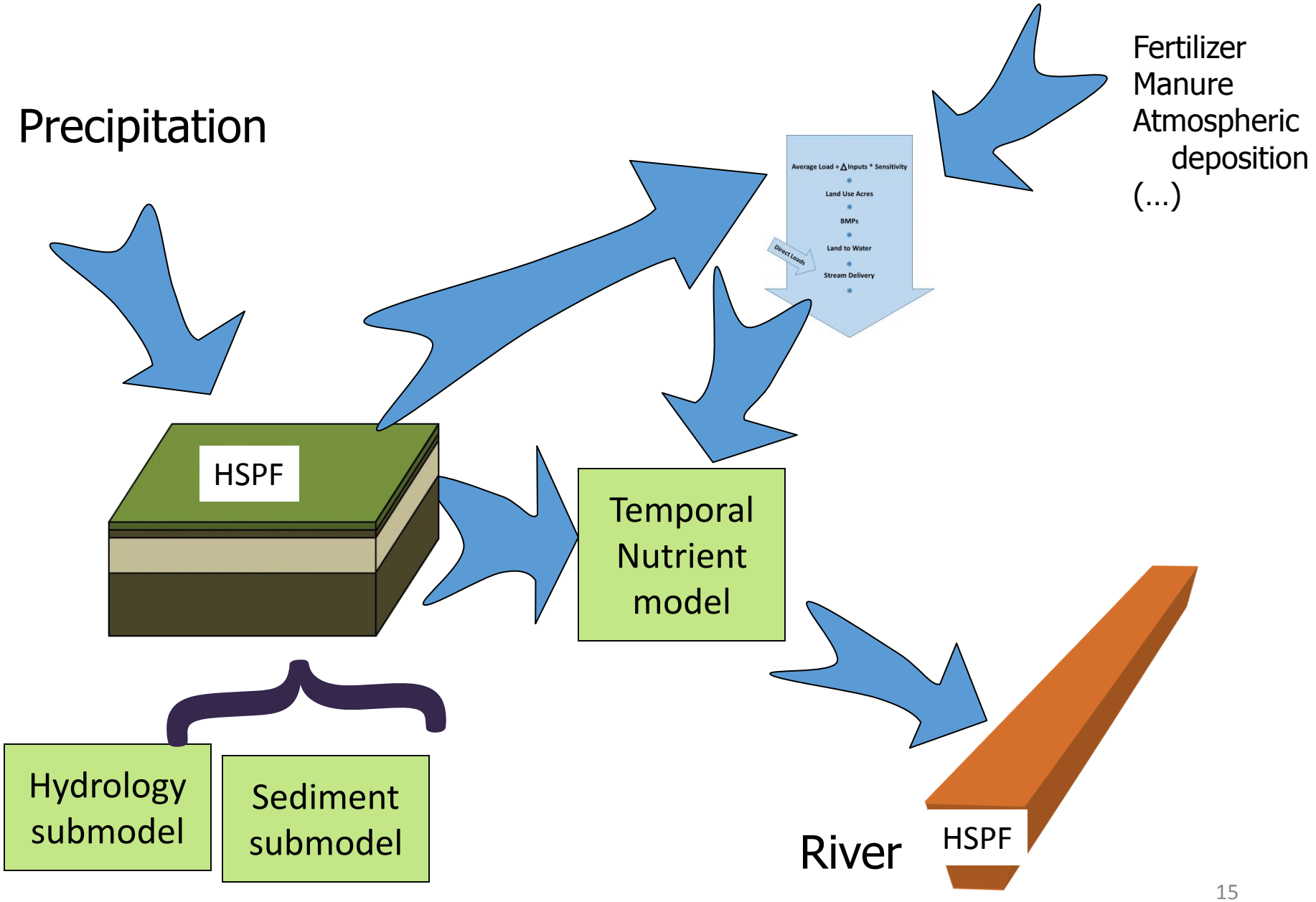
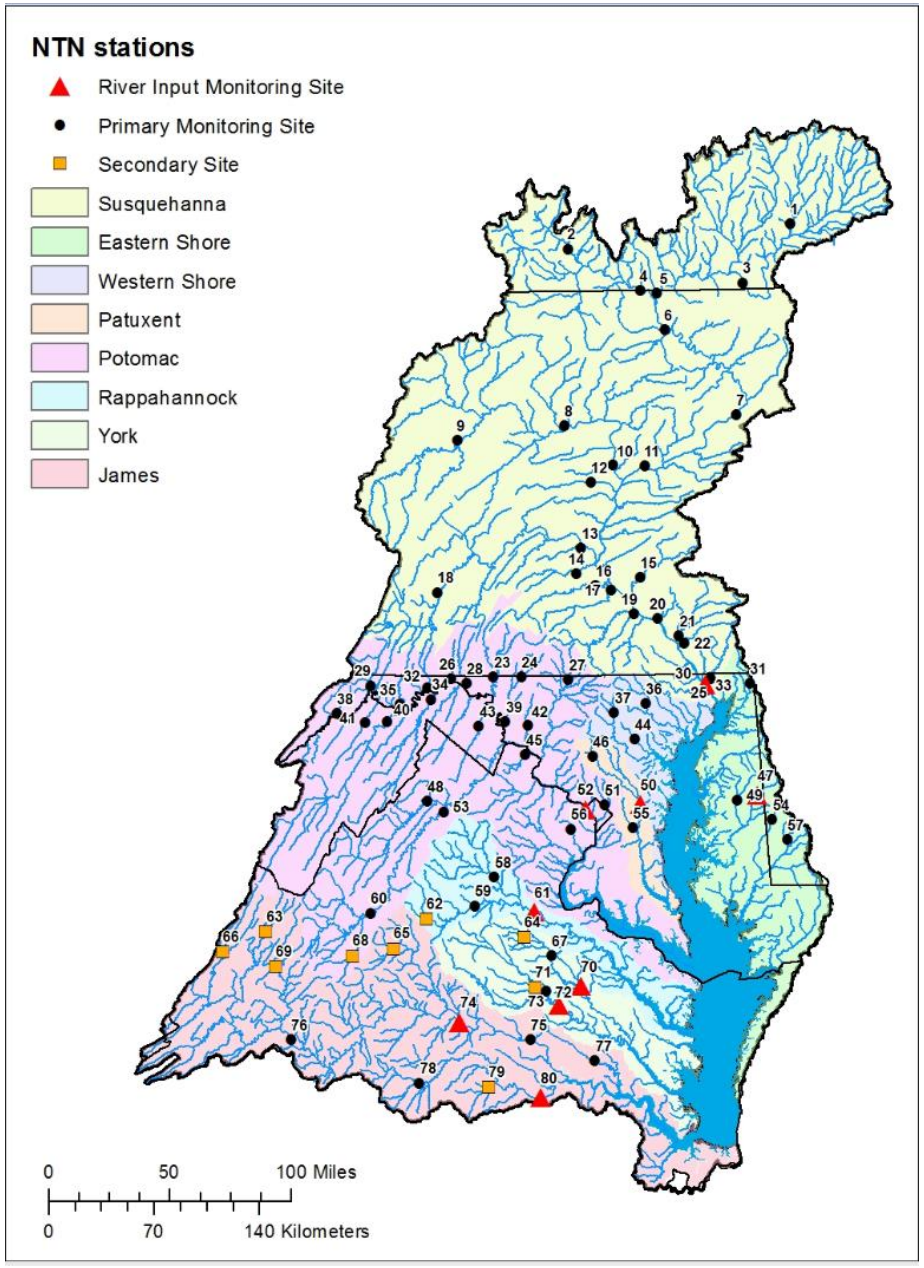
Direct Loads



Model to compare against Observations

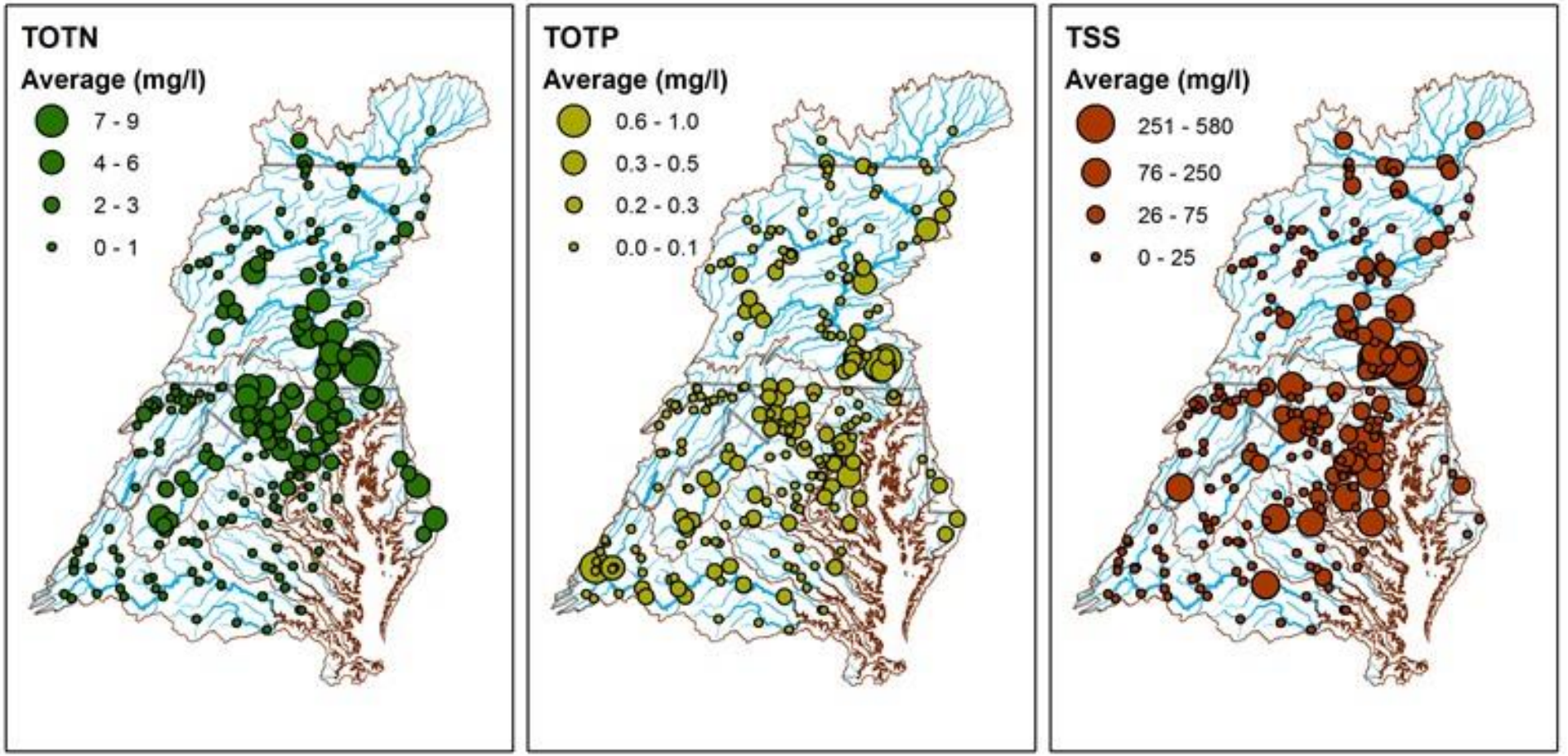


Chesapeake Bay Nontidal Monitoring Network



- 1990s – begin widespread monitoring
- 2000s – create nontidal network
- Early 2010s – develop method to determine trends
- Mid-2010s – explain trends
  - BMPs
  - land use change
  - atmospheric deposition
  - lag times
  - natural factors

Monitoring Stations



Stakeholder Science

- Transparent science is more palatable to stakeholders
- Multiple lines of evidence has scientific support

… but does it work?

Compare

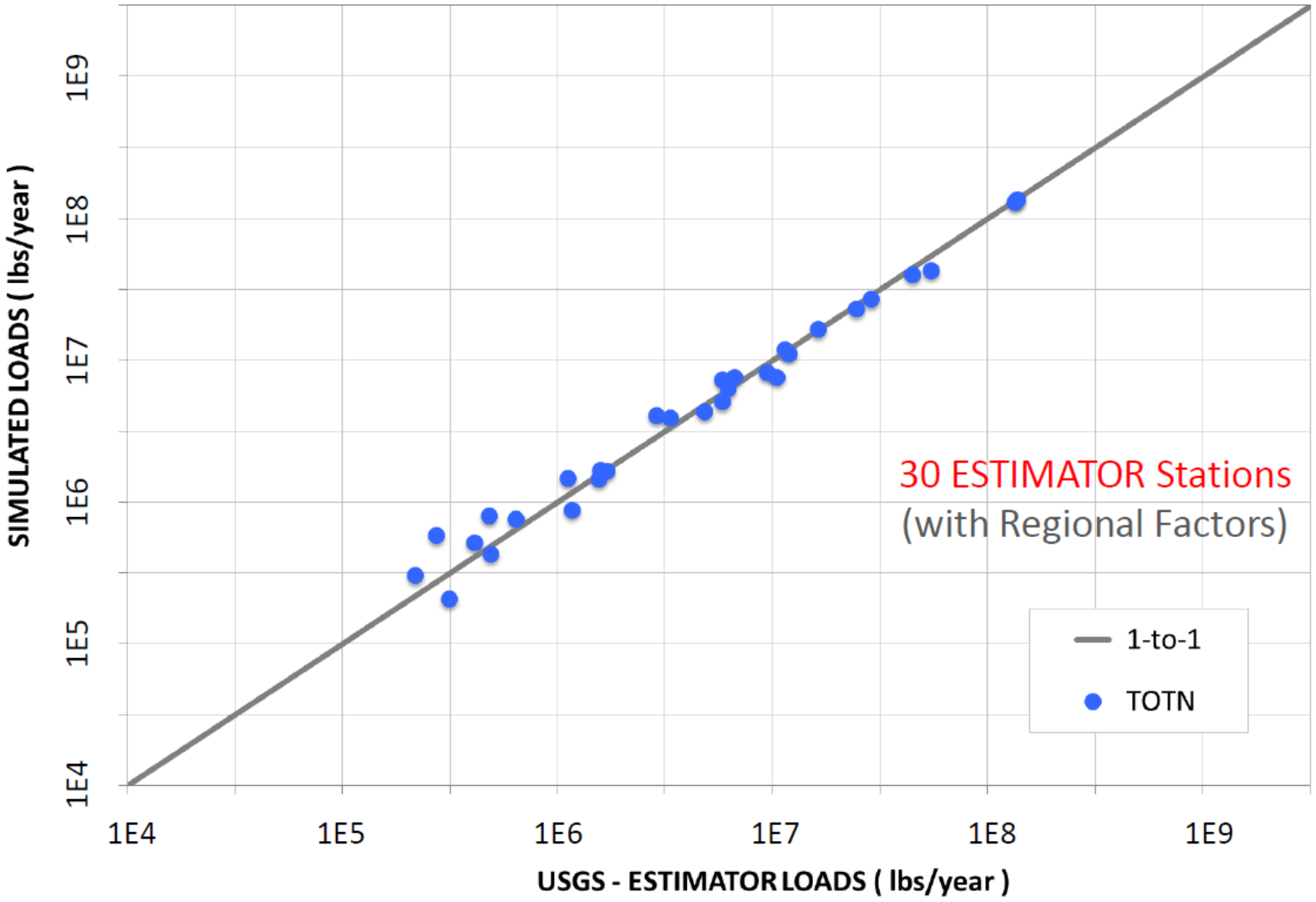
Heavily-Calibrated Process Model

Lightly-Calibrated Stakeholder Model

PHASE 5

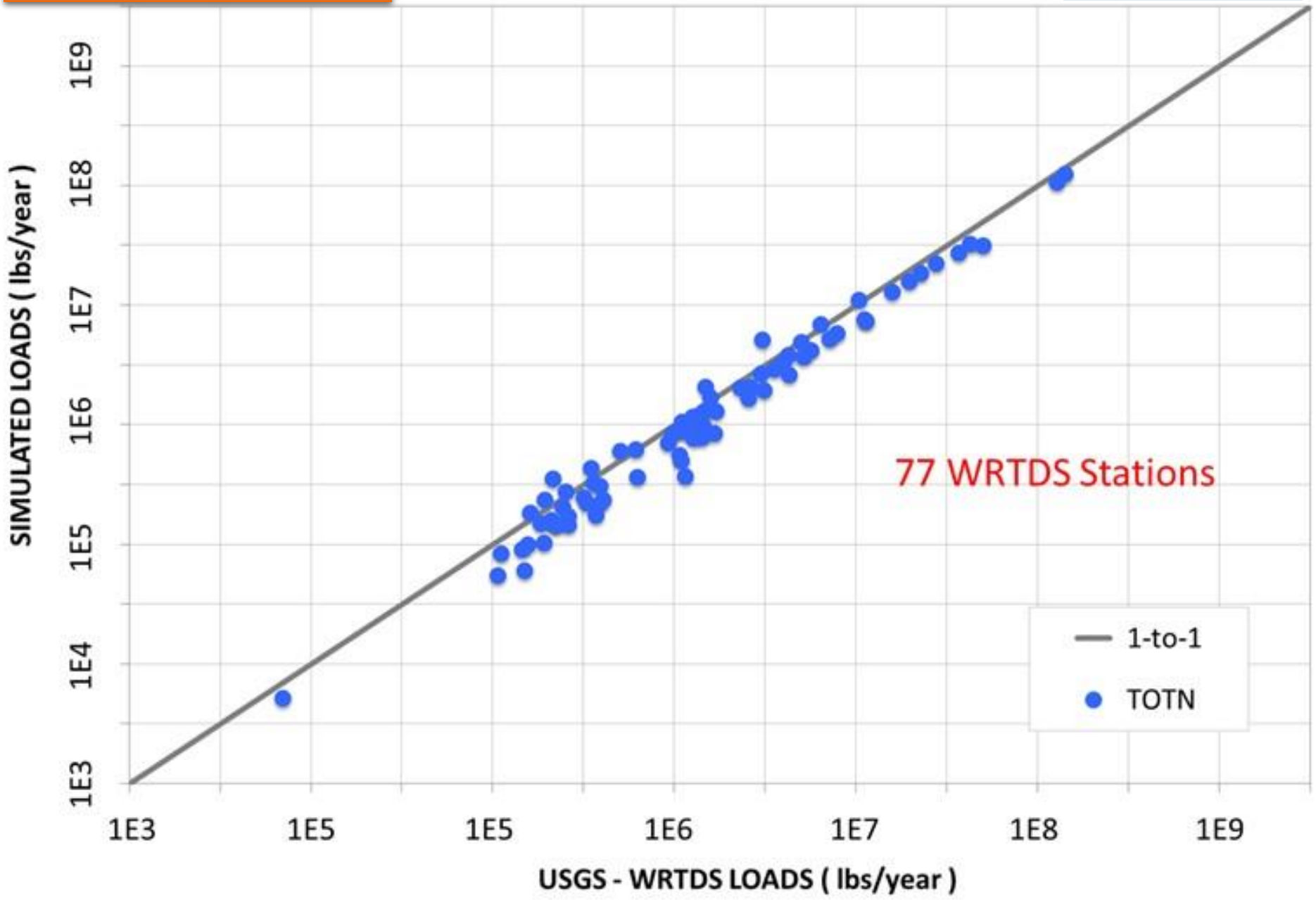
NITROGEN

Load



Phase 6 Beta 3

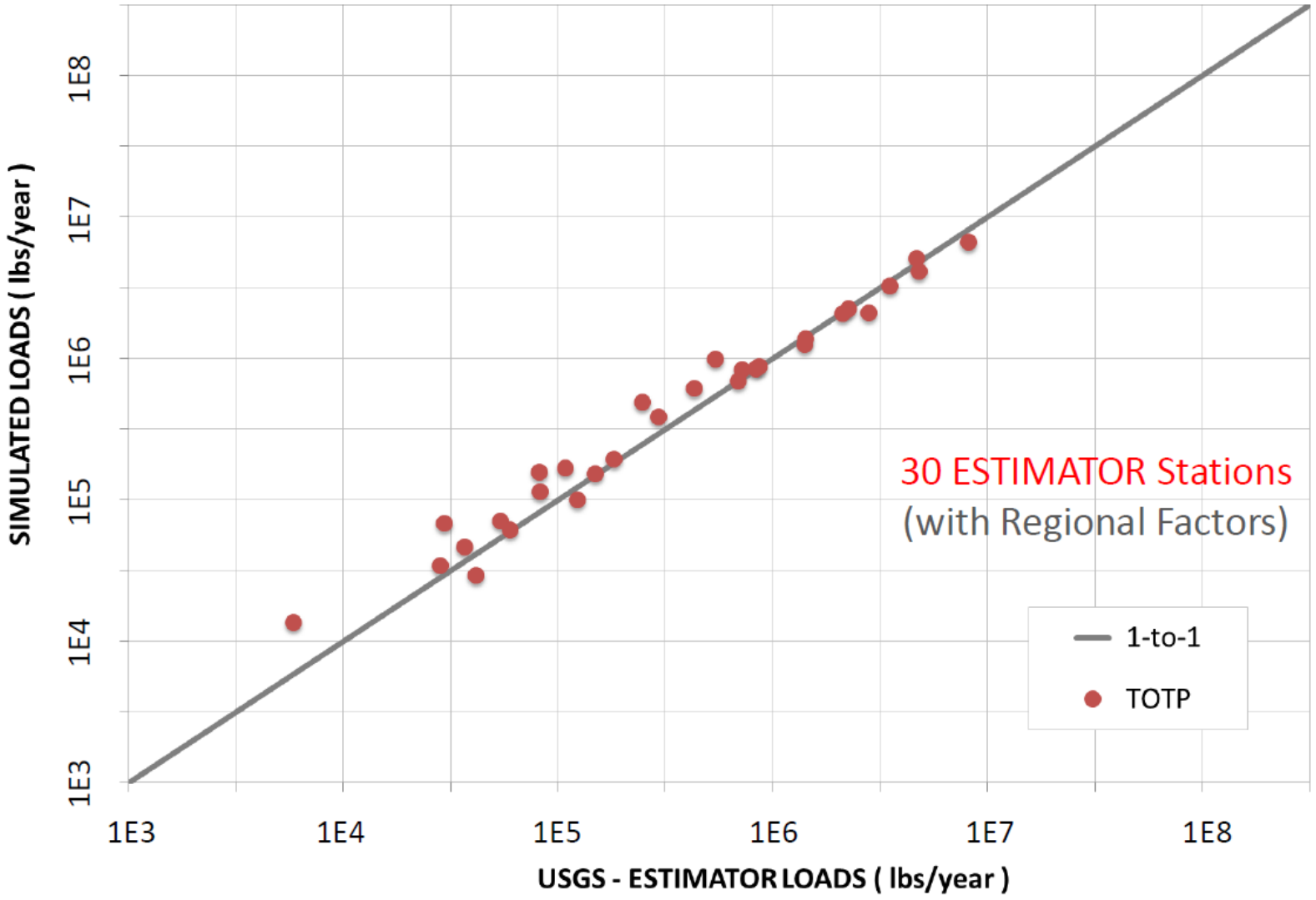
Nitrogen



PHASE 5

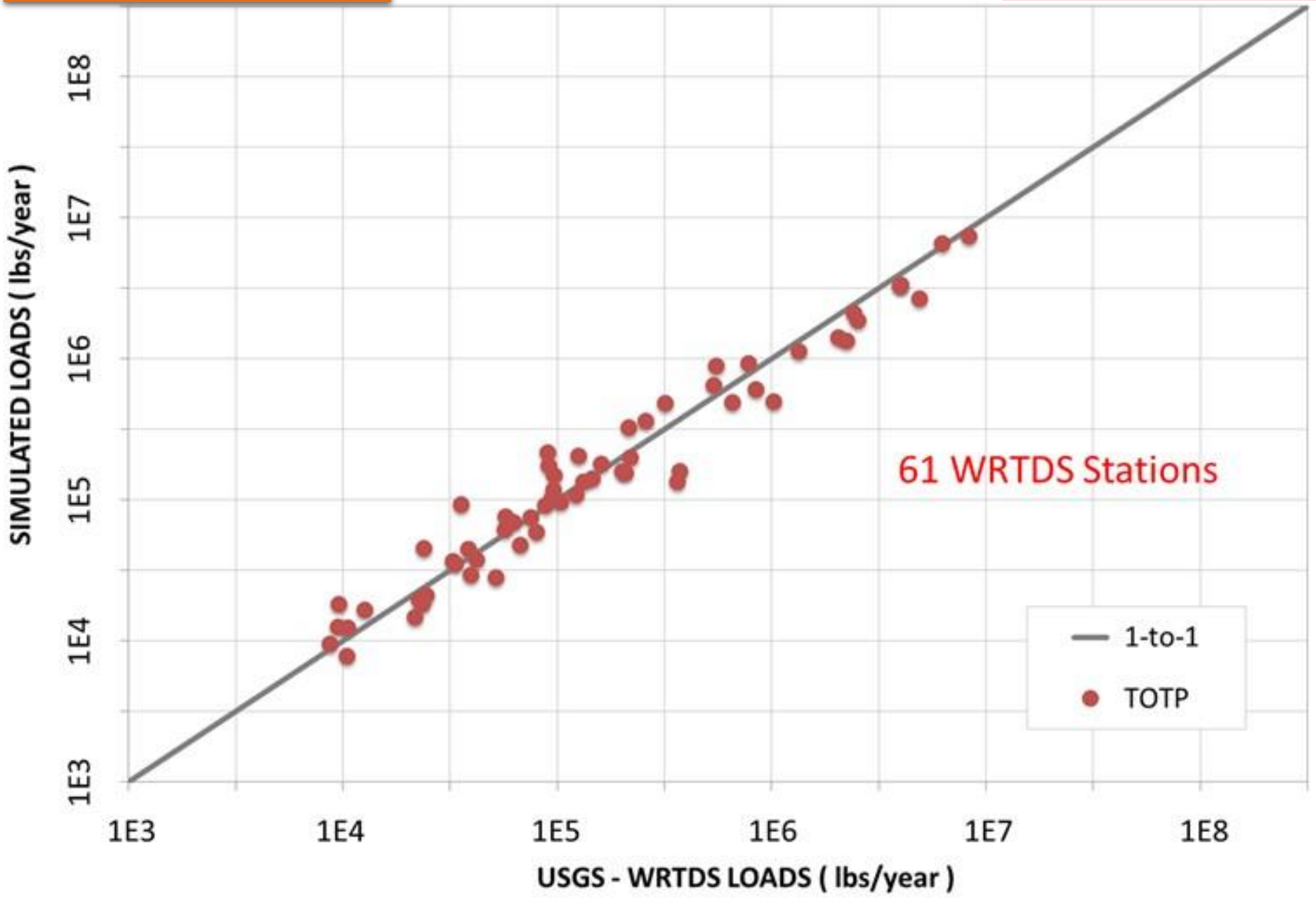
PHOSPHORUS

Load



Phase 6 Beta 3

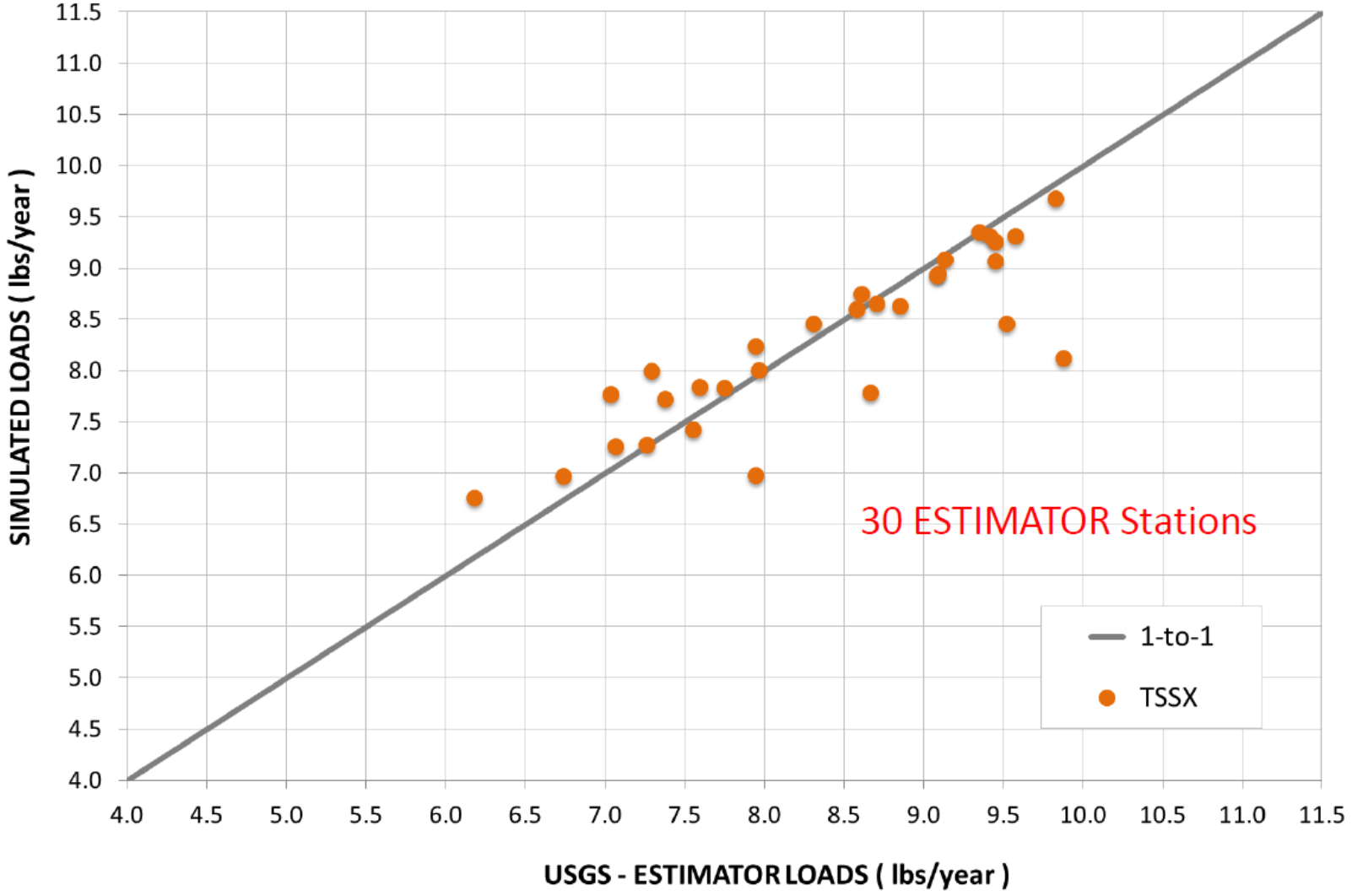
Phosphorus



PHASE 5

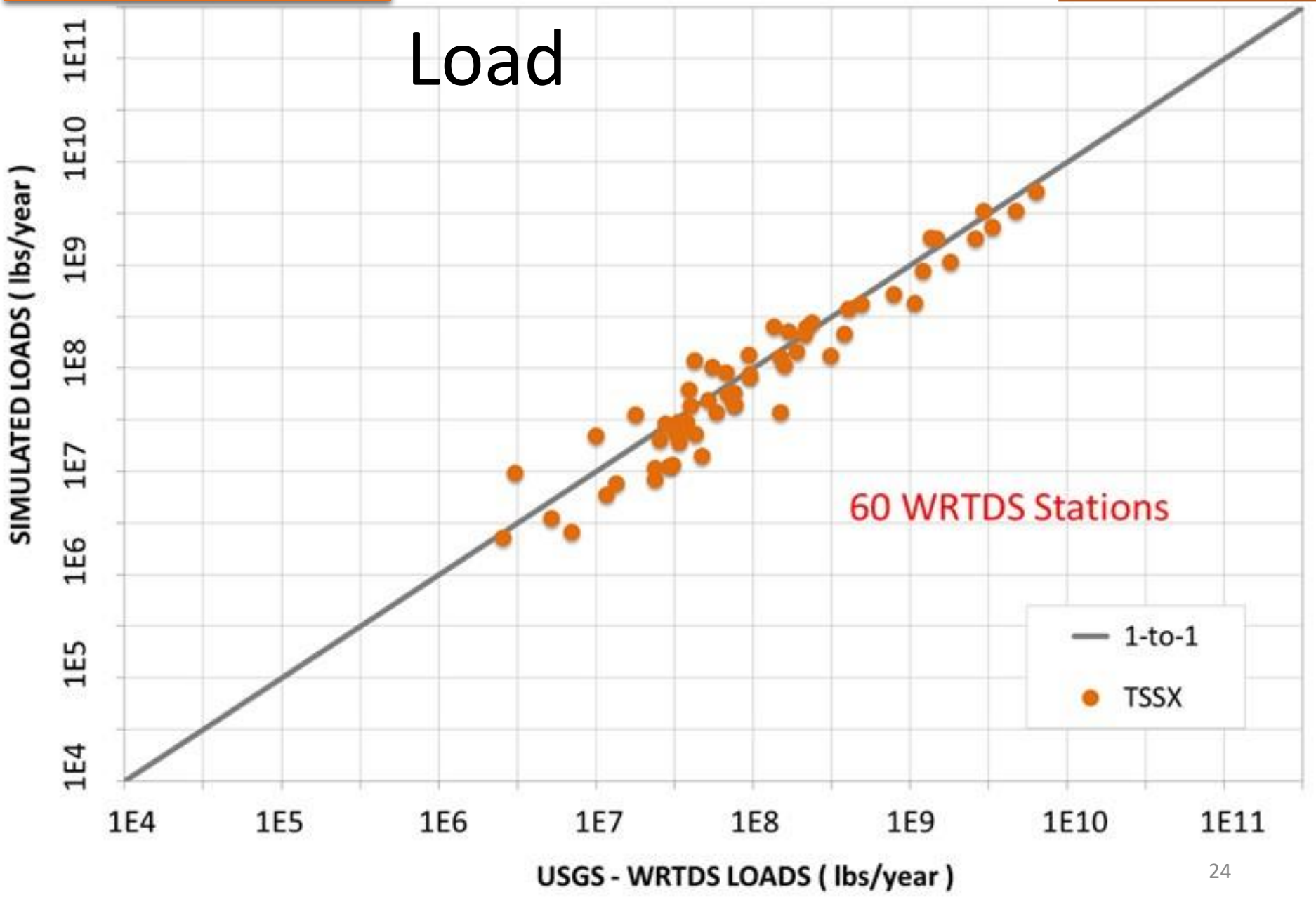
SEDIMENT

Load

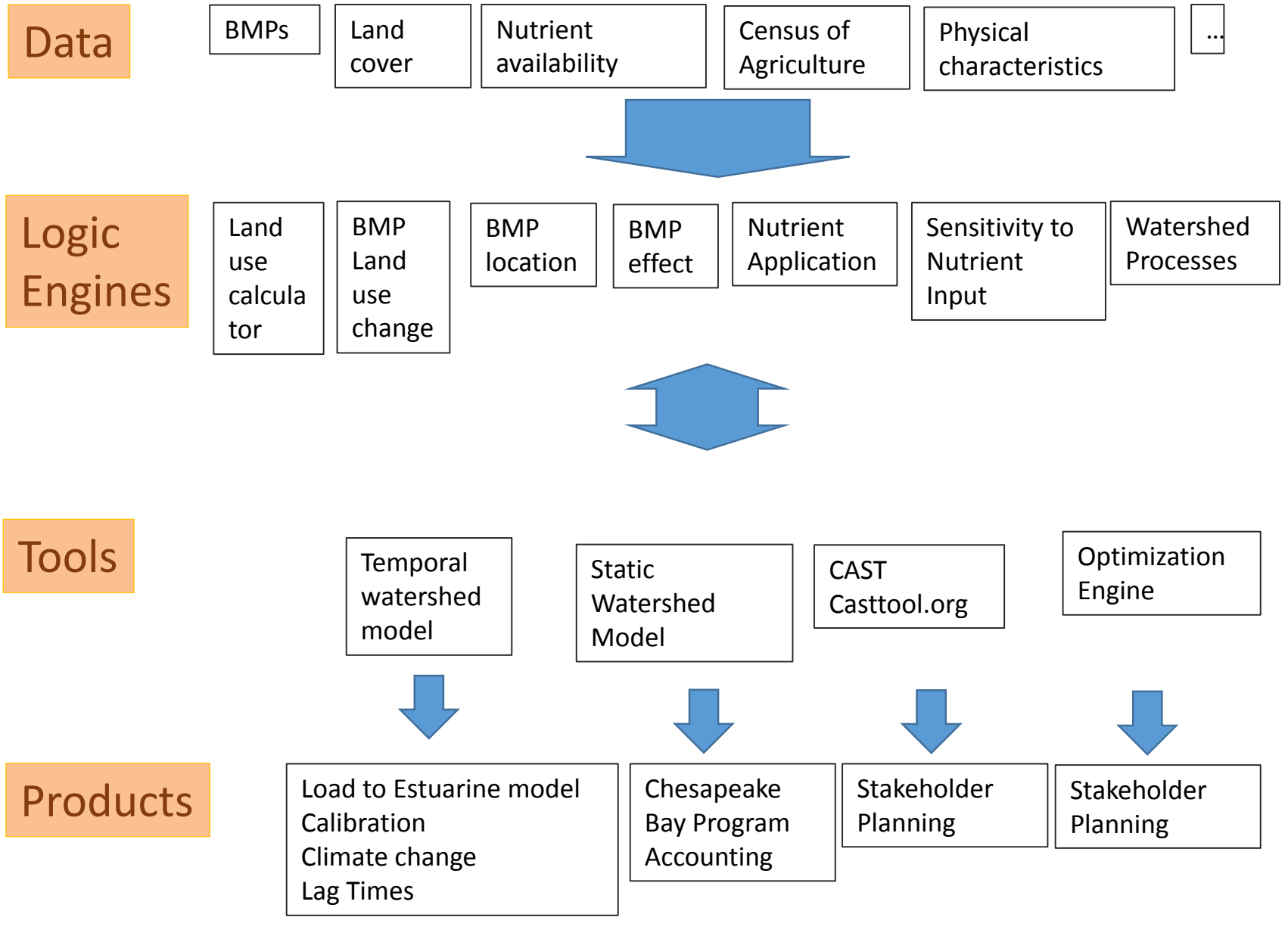


Phase 6 Beta 3

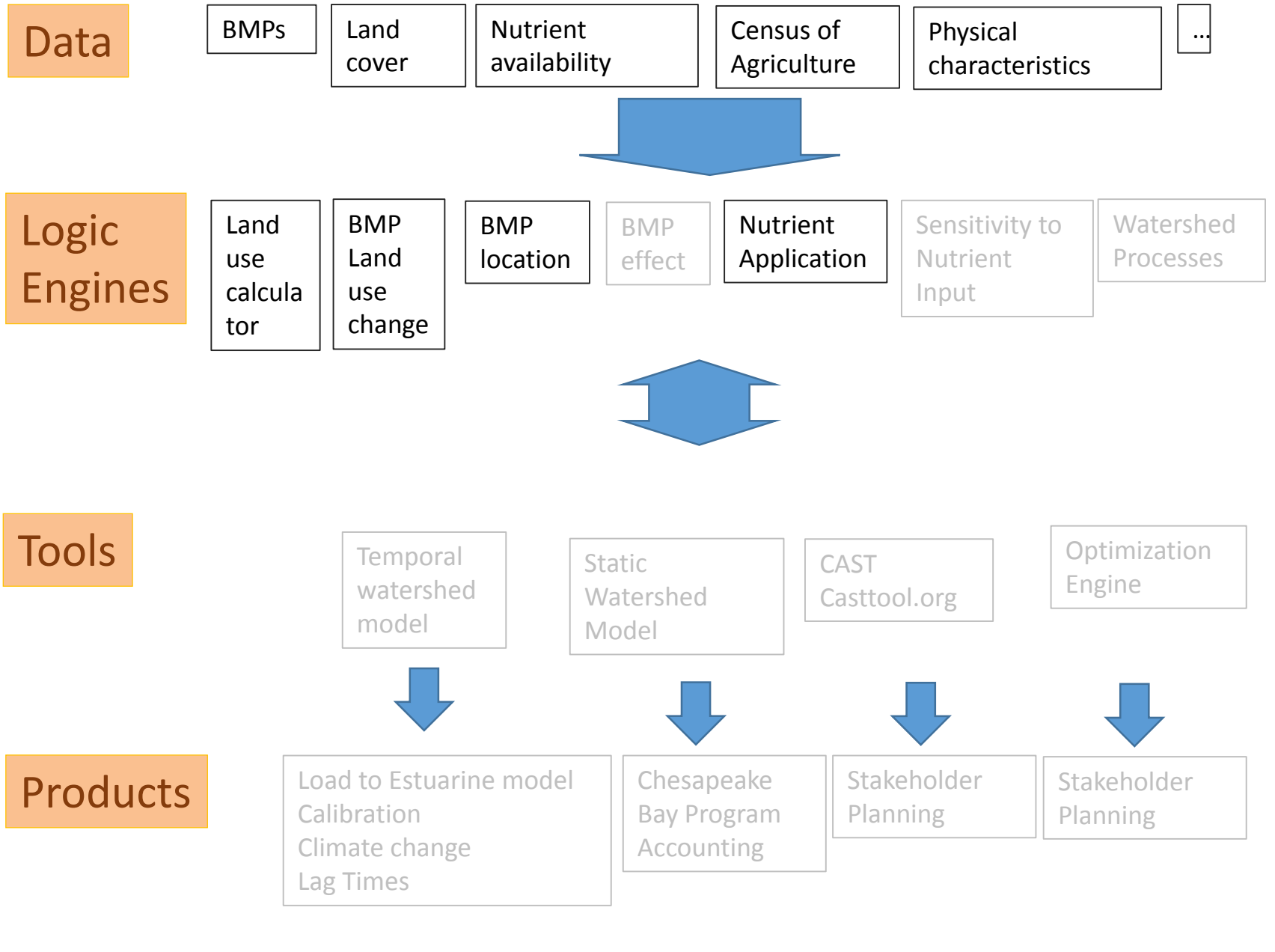
Sediment



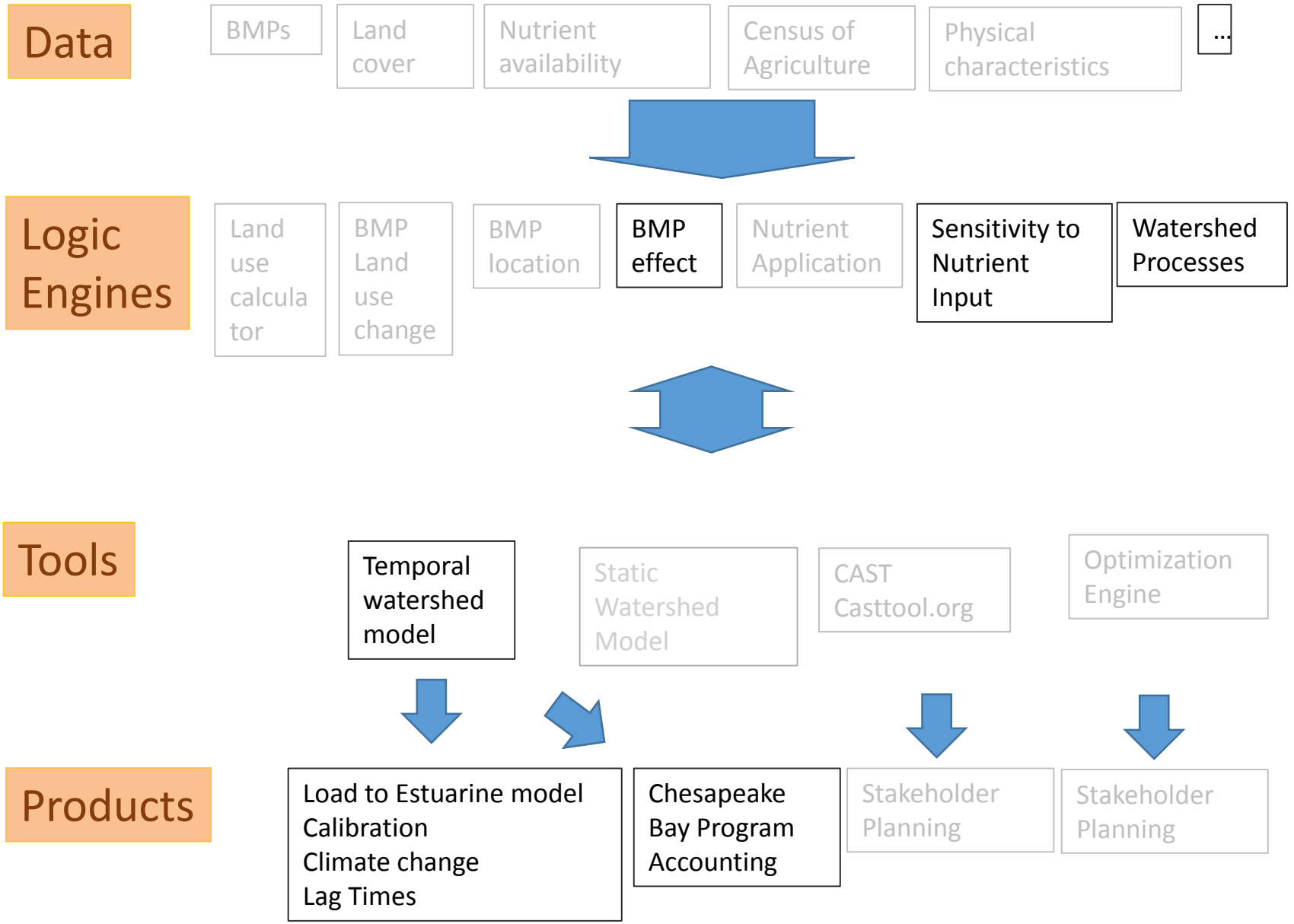
CBP Watershed Simulation



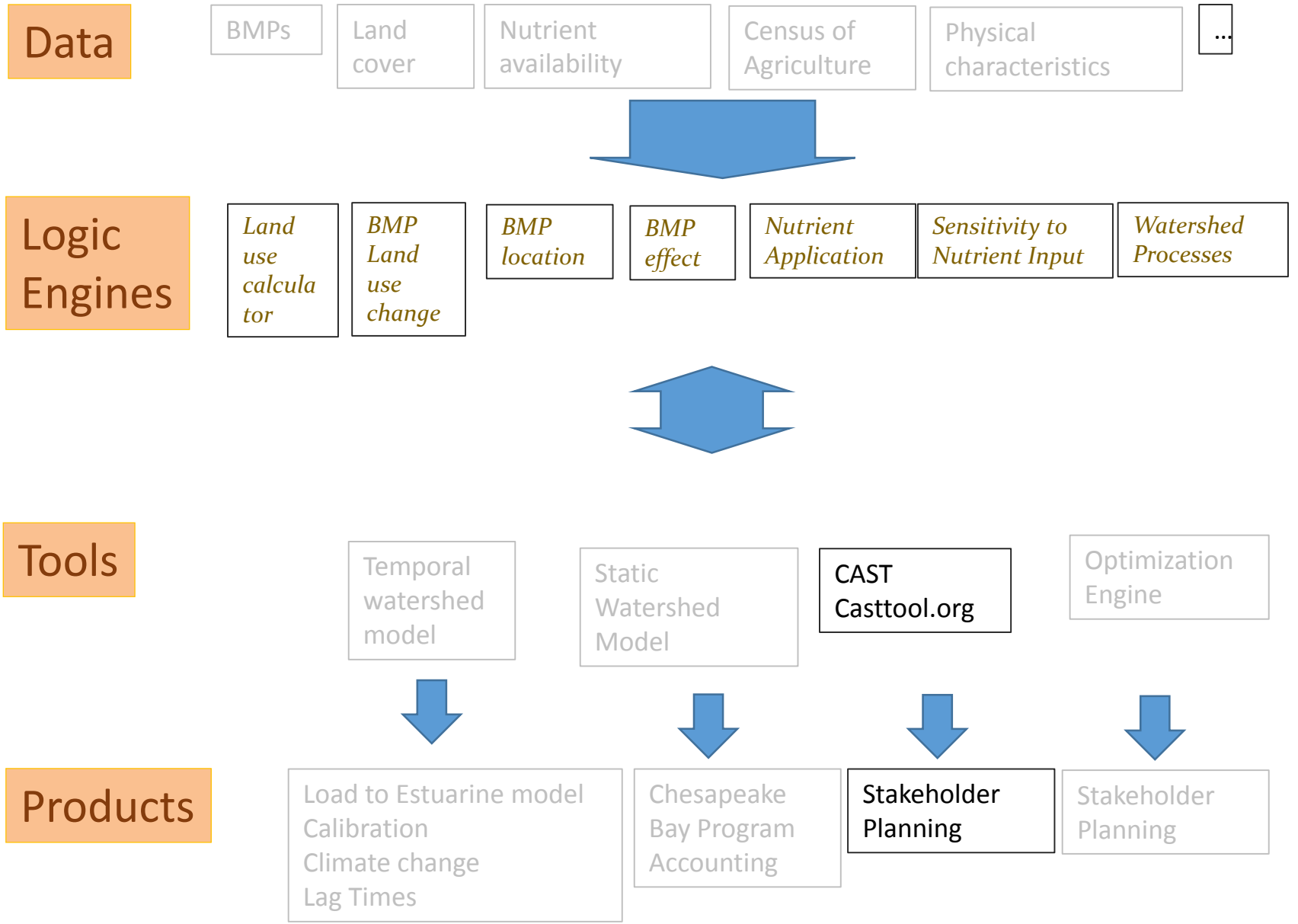
‘ Phase 5 Scenario Builder’



‘ Phase 5 Watershed Model’



‘Phase 5 CAST’


Data
BMPs
Land cover
Nutrient availability
Census of Agriculture
Physical characteristics
...
Logic Engines
Land use calculator
BMP Land use change
BMP location
BMP effect
Nutrient Application
Sensitivity to Nutrient Input
Watershed Processes
Tools
Temporal watershed model
Static Watershed Model
CAST
Casttool.org
Optimization Engine
Products
Load to Estuarine model
Calibration
Climate change
Lag Times
Chesapeake Bay Program Accounting
Stakeholder Planning
Stakeholder Planning

CAST = WSM = Scenario Builder