

STAC Review of Chesapeake Bay Program Phase 6 Watershed Model

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Partnership Feedback on Modeling

- **Water Quality Goal Implementation Team**

- 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

Partnership Feedback on Modeling

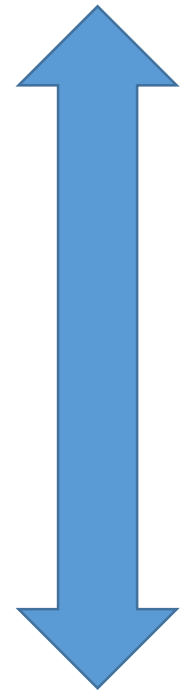
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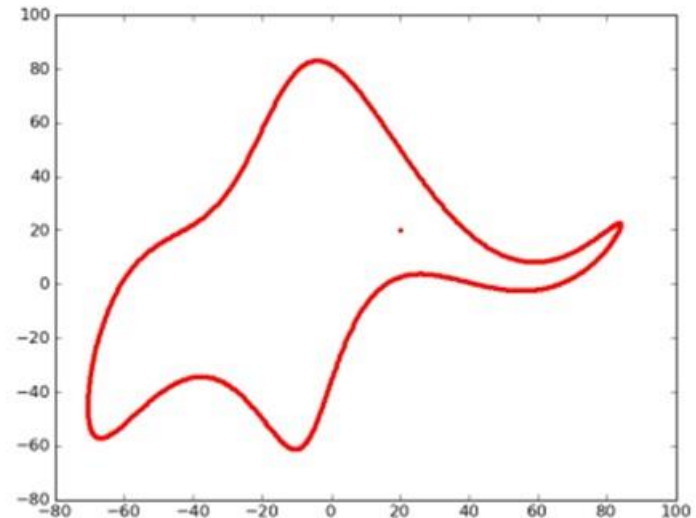
Keep it Simple!!



Include Everything!!!

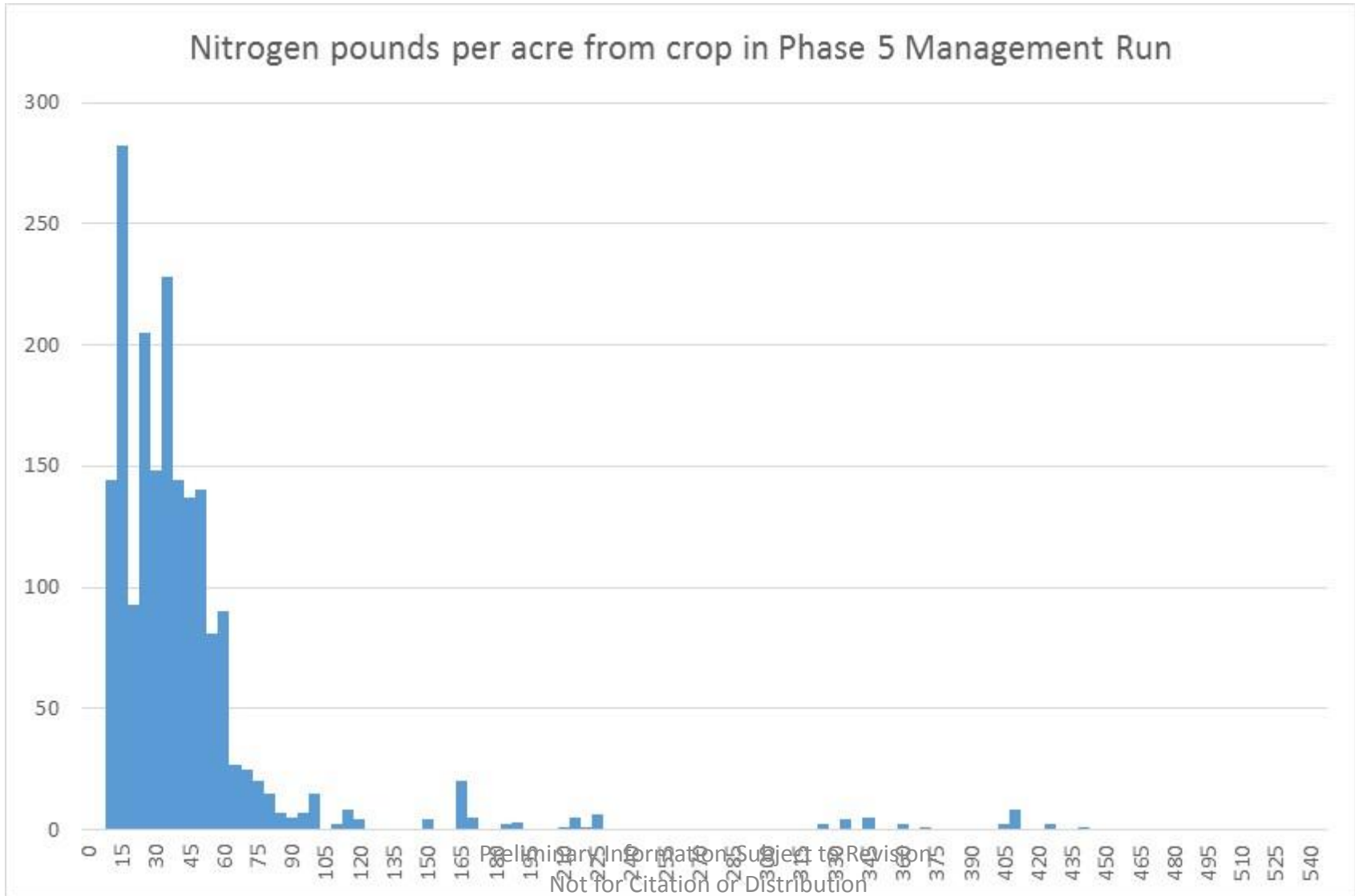
Model Complexity

- Von Neumann: With four parameters I can fit an elephant, and with five I can make him wiggle his trunk.

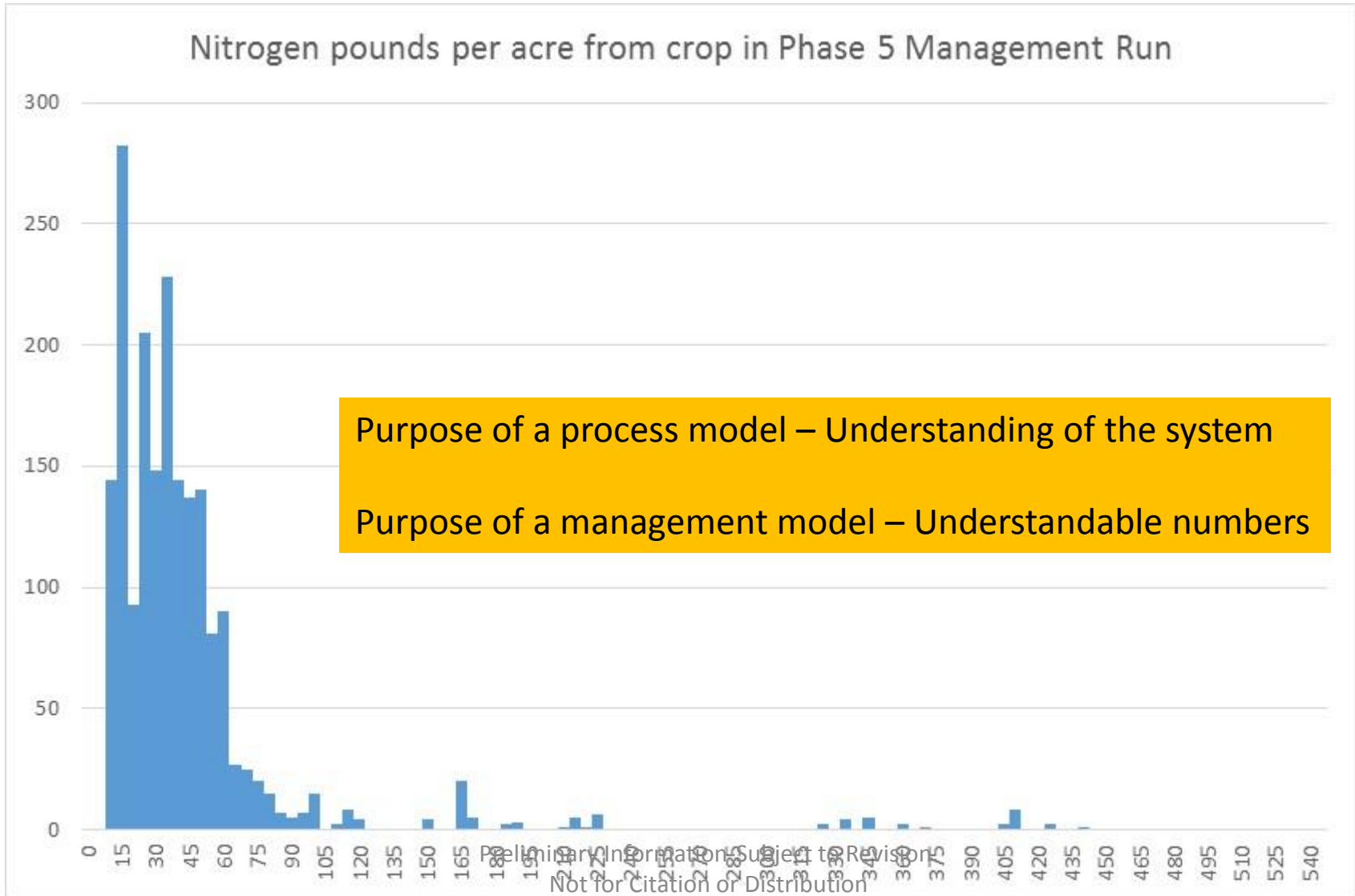


“Drawing an elephant with four complex parameters”
by Jurgen Mayer, Khaled Khairy, and Jonathon
Howard, Am. J. Phys. 78, 648 (2010),
DOI:10.1119/1.3254017

Wiggling Trunks in Phase 5



Wiggling Trunks in Phase 5



Phase 6 Model Structure

Average Load + Δ Inputs * Sensitivity

*

Land Use Acres

*

BMPs

*

Land to Water

*

Stream Delivery

*

River Delivery

Direct Loads

Phase 6

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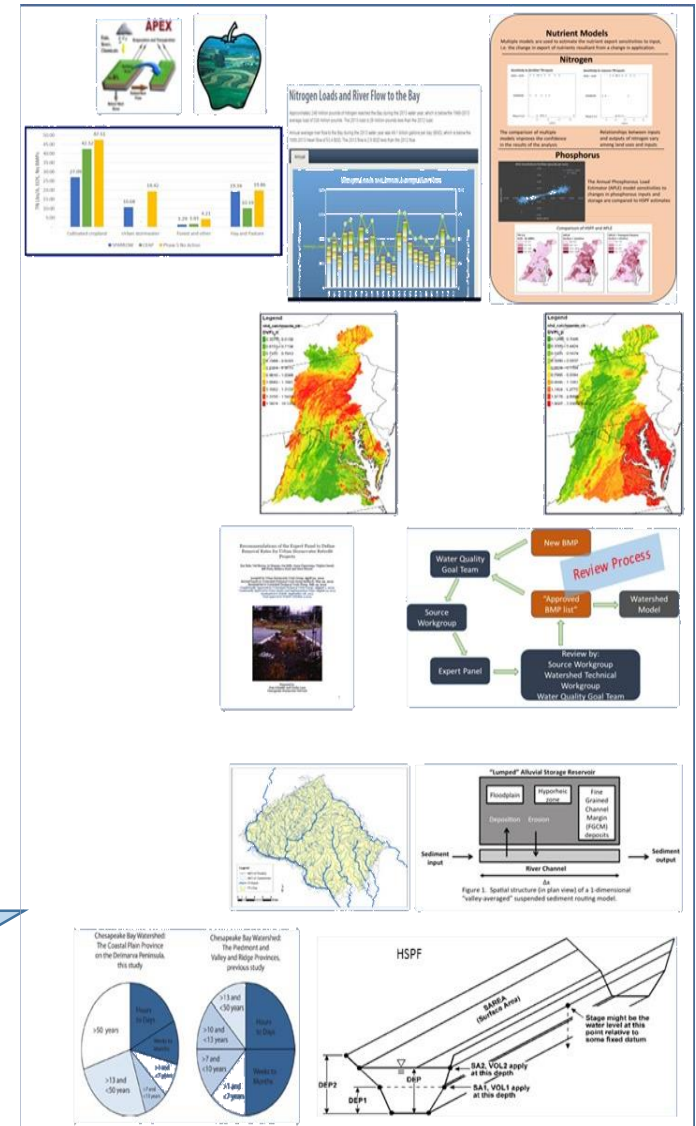
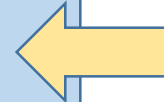
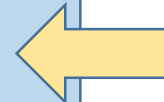
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Stream Delivery

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River Delivery

Direct Loads



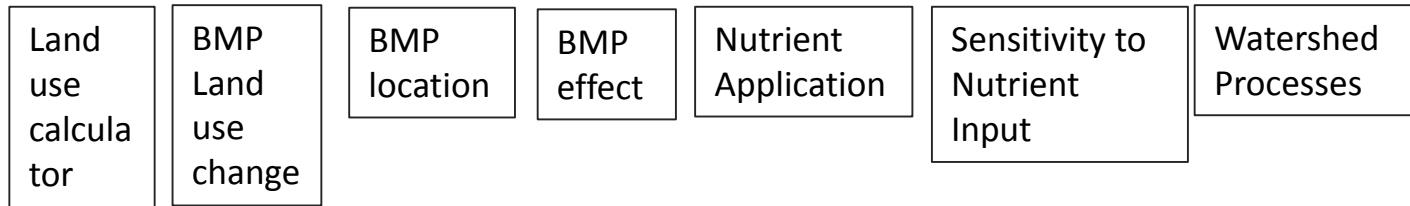
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CBP Watershed Simulation

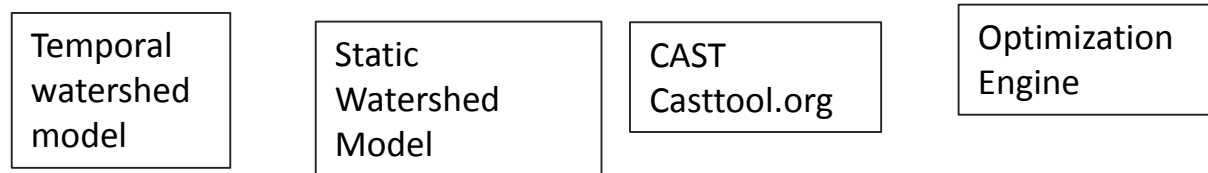
Data



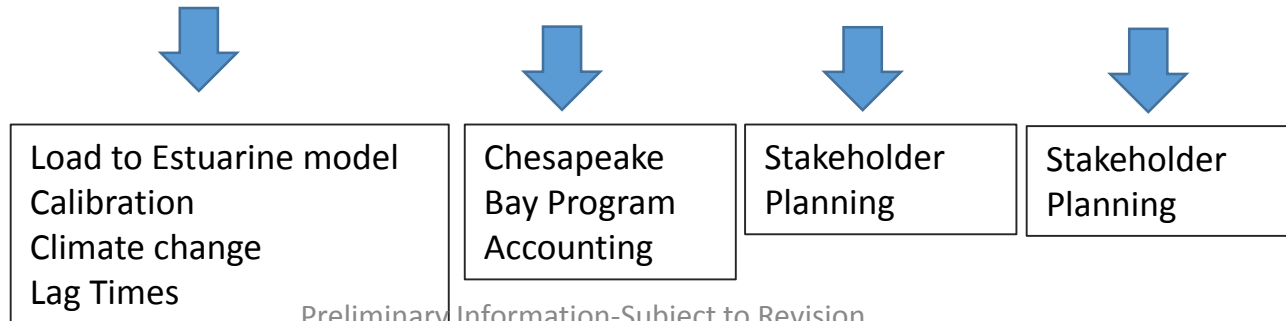
Logic Engines



Tools



Products



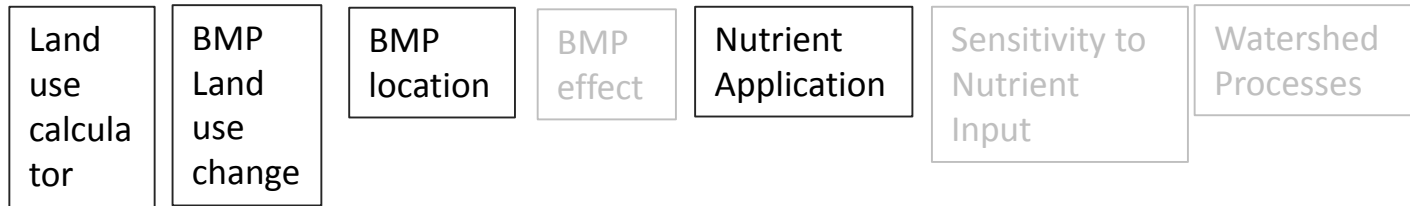
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'Phase 5 Scenario Builder'

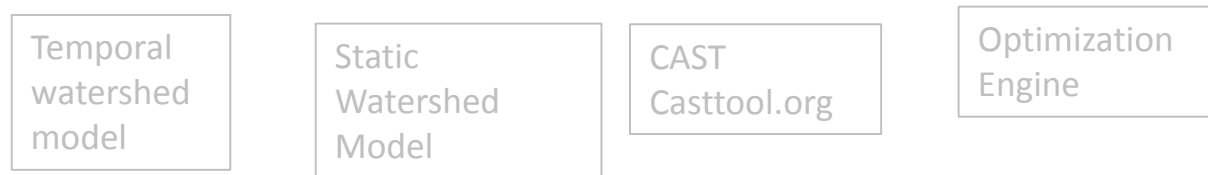
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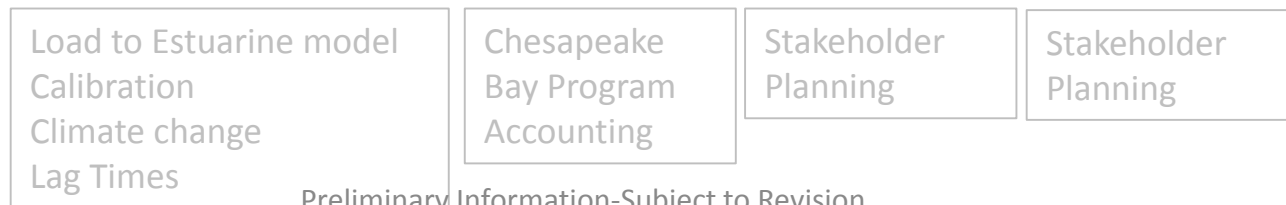
Logic Engines



Tools



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'Phase 5 Watershed Model'

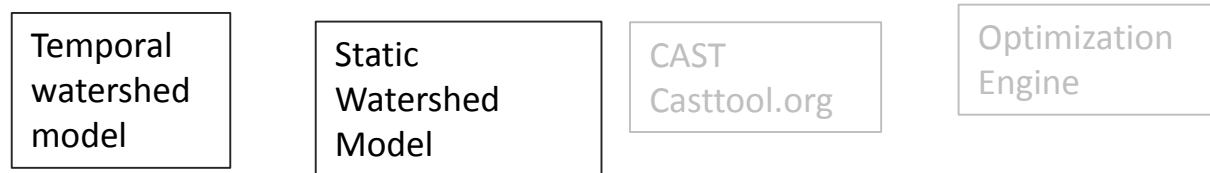
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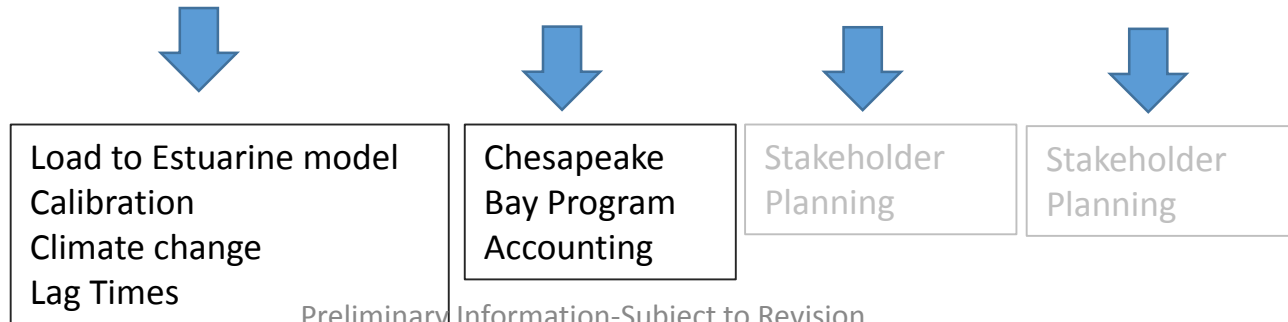
Logic Engines



Tools



Products



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'Phase 5 CAST'

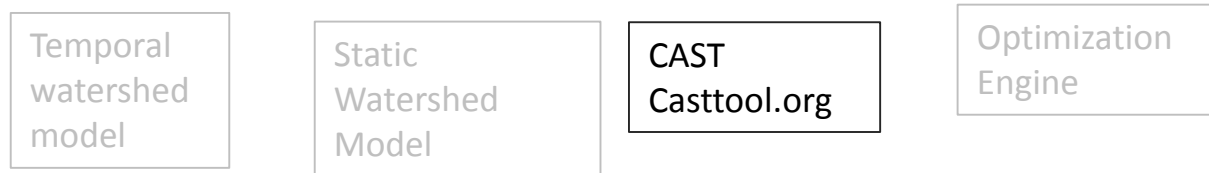
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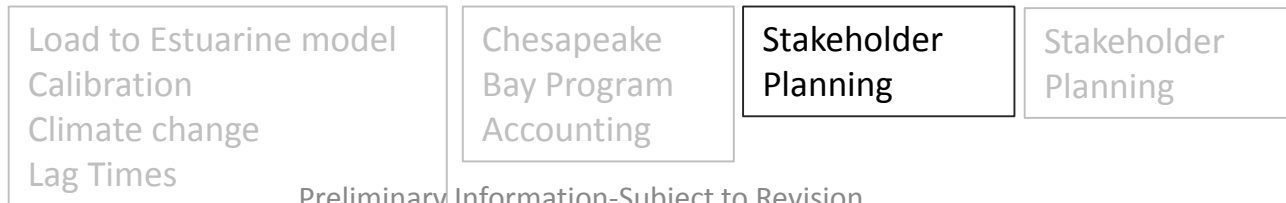
Logic Engines



Tools



Products



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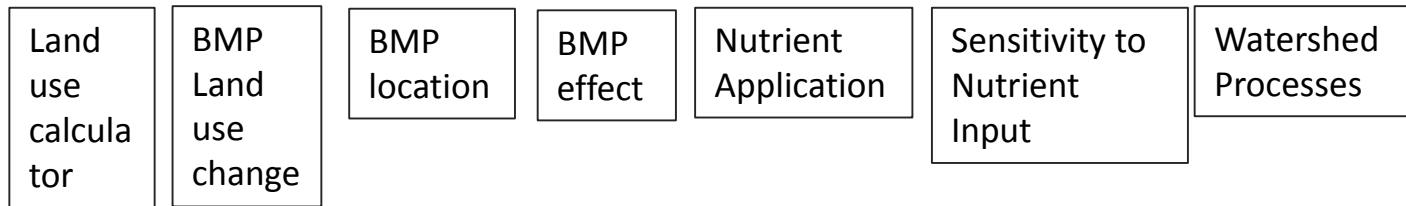
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CAST = WSM = Scenario Builder

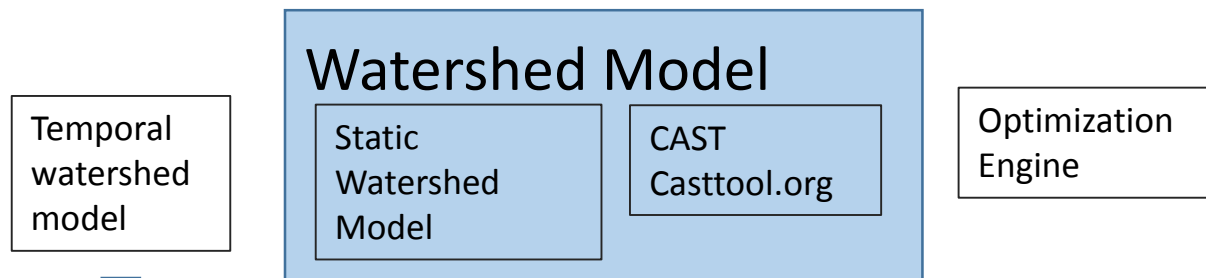
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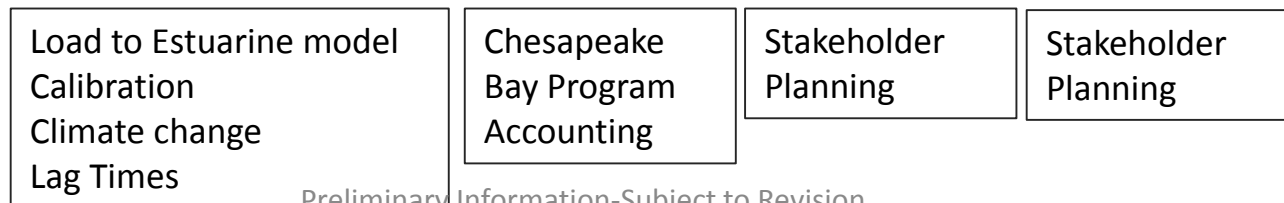
Logic Engines



Tools



Products



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Phase 6 Model Structure

Average Load + Δ Inputs * Sensitivity

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Land Use Acres

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BMPs

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Land to Water

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Stream Delivery

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River Delivery

Direct Loads

Phase 6

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Phase 6 Model Documentation



Section 1:
Overview

Section 11:
Applications

Section 2:
Average
Loads + Section 3:
Inputs * Section 4:
Sensitivity

Section 5: Land Use

Section 6: BMPs

Section 8:
Direct Loads

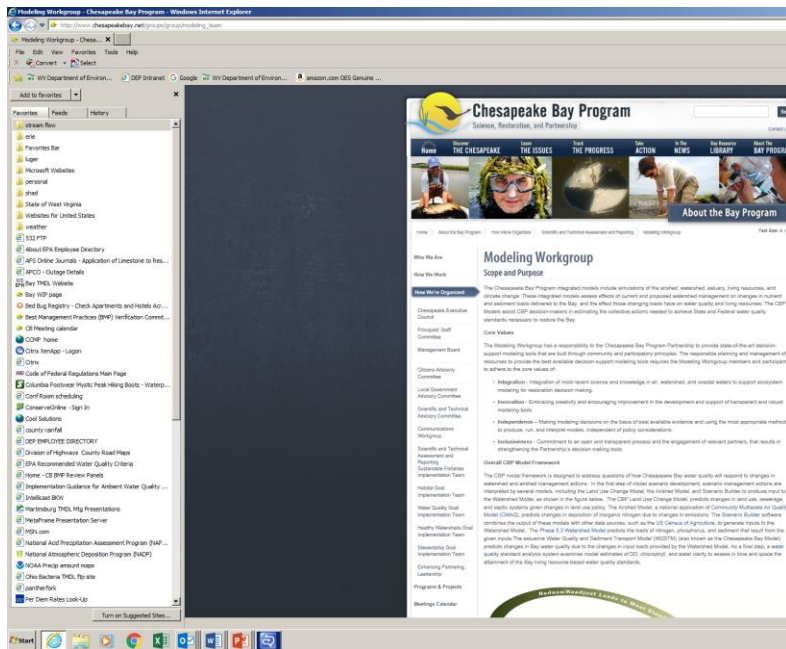
Section 7: Land to Water

Section 9: Stream Delivery

Section 10: River Delivery

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Documentation



- See MWG Webpage
- http://www.chesapeakebay.net/groups/group/modeling_team
- Will be periodically updated
- Webinars here too

Phase 6 Beta 2 Draft Documentation - June 2016

The Phase 6 Beta 2 Watershed Model is available for partnership review. The purpose of making the draft documentation available to the Partnership is to provide the Partnership with a written record of the results of the many partnership decisions that have been made in the Management Board, the Modeling Workgroup, the Water Quality Goal Implementation Team, and the WQGIT's many workgroups.

Documentation

Documentation pdf and excel files can be found here:
ftp://ftp.chesapeakebay.net/Modeling/Phase6/Ph6Calibration_Beta2/20160401/Documentation/

Calibration Plots

Graphics showing the calibration to individual stations and aggregate statistics are found here: ftp://ftp.chesapeakebay.net/Modeling/gbhatt/Phase_6_Beta_2/

Inputs

Inputs for Beta 2 were produced in April and do not reflect the latest versions of the nutrient spread and other partnership decisions that will be included in Beta 2. Inputs used in Beta 2 are available here: ftp://ftp.chesapeakebay.net/Modeling/Phase6/Ph6Calibration_Beta2/20160401/inputs/. A more conveniently summarized version of the the Beta 2 inputs can be found in excel files at this ftp site: ftp://ftp.chesapeakebay.net/Modeling/Phase6/Ph6Calibration_Beta2/20160401/inputs/ScenarioBuilder/

Load Outputs

The 'AllLoads' excel files are the annual average loads in raw format and can be found at this FTP site: ftp://ftp.chesapeakebay.net/Modeling/Phase6/Ph6Calibration_Beta2/20160401/

Phase 6 Beta 1 - January 2016

The Phase 6 Beta 1 Watershed Model is available for partnership review. Draft documentation files are available in the series of attached documents below. Calibration plots are available on the CBP FTP site by constituent, or in a single file (hyperlinks below). Information and data regarding Scenario Builder inputs can also be accessed from another linked FTP below.

Calibration Plots, by

Constituent: ftp://ftp.chesapeakebay.net/Modeling/gbhatt/Phase_6_Beta_1/20151231_Calibration_Graphics/

All Calibration Plots (large file

size): http://ftp.chesapeakebay.net/Modeling/gbhatt/Phase_6_Beta_1/20151231_Calibration_Graphics/Calibration%20Graphics%20Binder%2020151231.pdf

Scenario Builder Inputs: <ftp://ftp.chesapeakebay.net/Modeling/Phase6>

Phase 6 Model Documentation



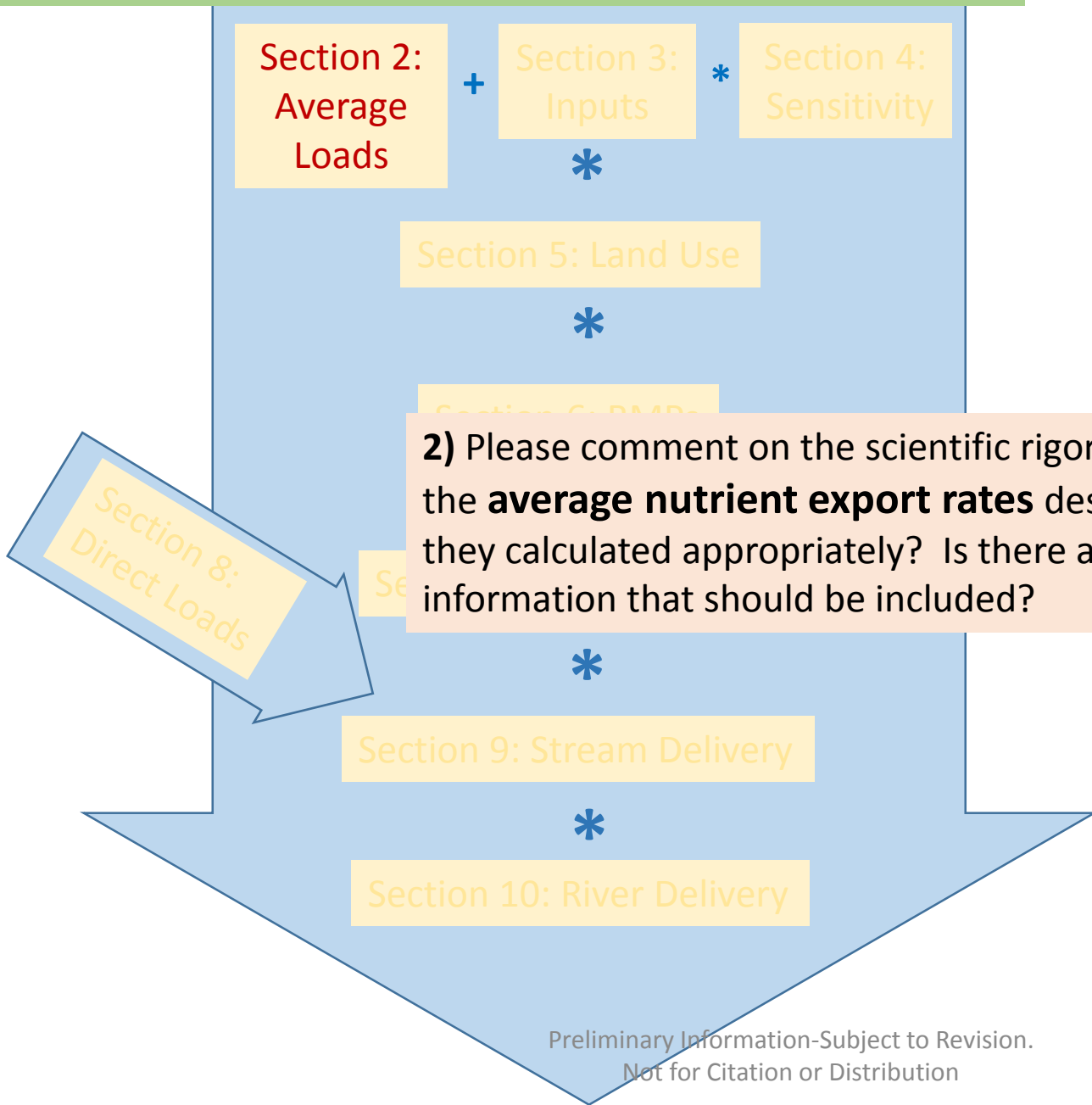
Section 1:
Overview



1) Please comment on the **overall appropriateness of the approach** taken in the Phase 6 structure of a deterministic hydrology and sediment transport management model combined with a nutrient model informed by **multiple models and multiple lines of evidence** as described in Section 1. Please comment on the multiple model structure of the Phase 6 nutrient simulation particularly to its utility to watershed management in the Chesapeake restoration? How can the Phase 6 multiple model approach be **improved going forward**?

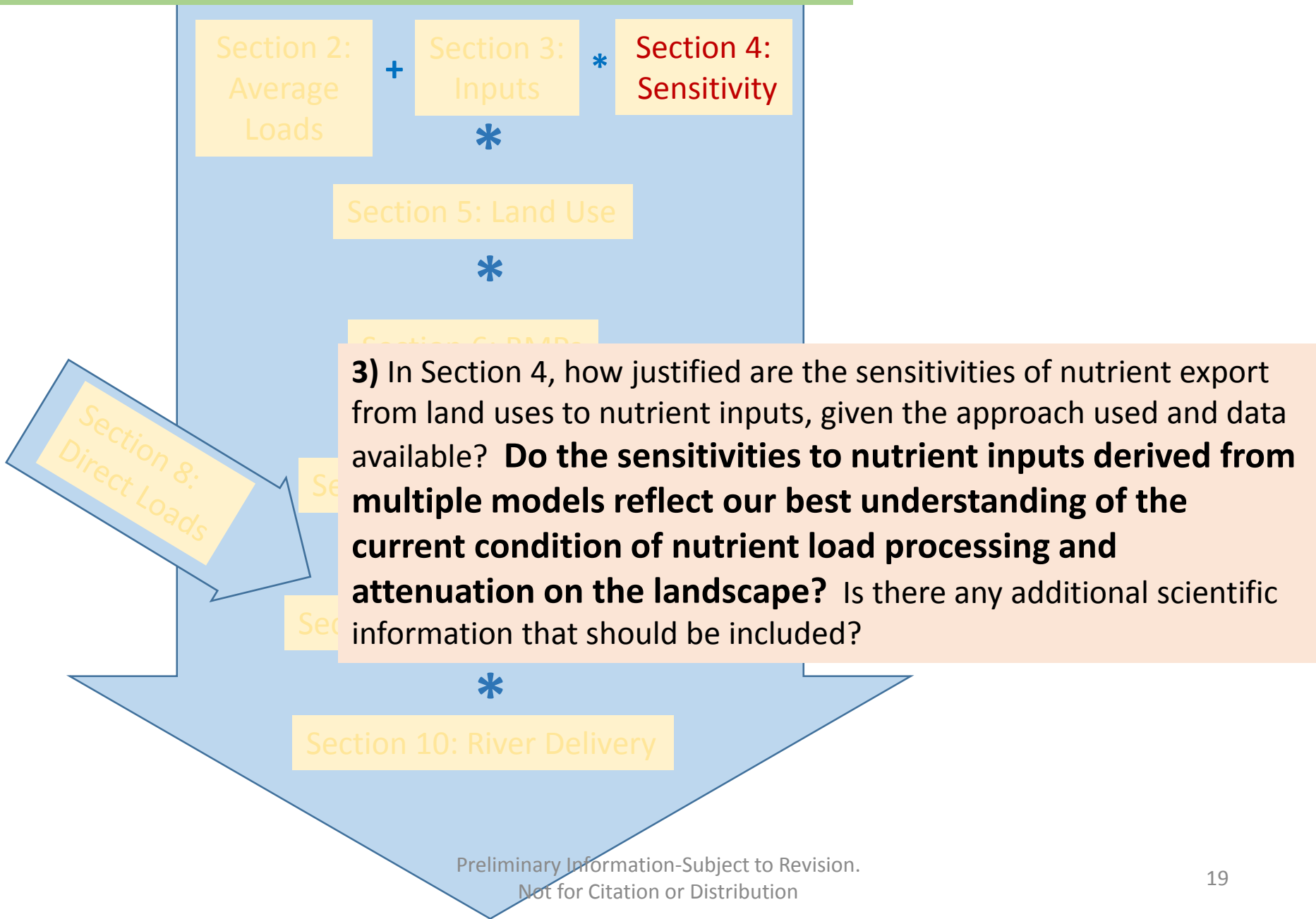
Section 11:
Applications

Phase 6 Model Documentation

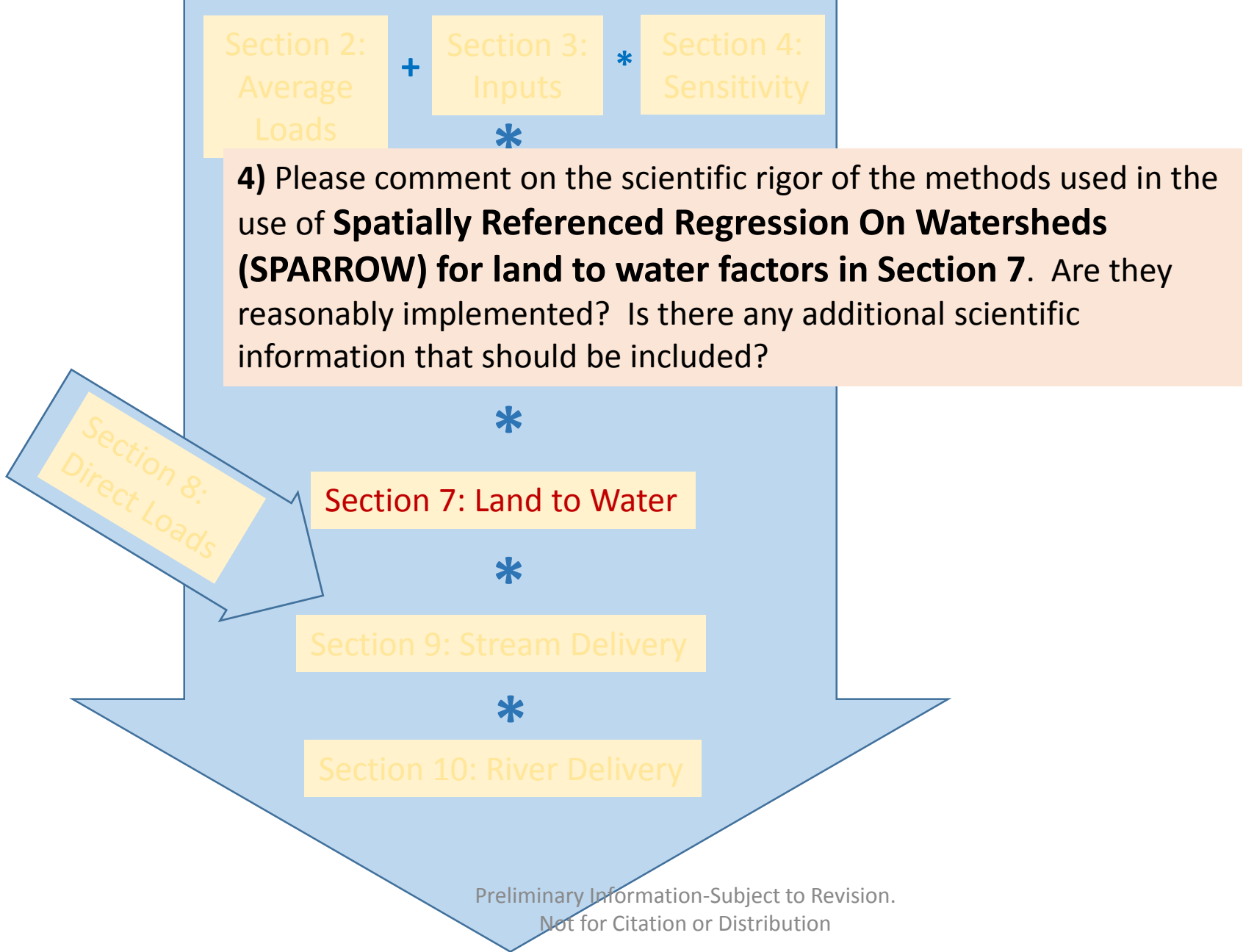


2) Please comment on the scientific rigor of the methods used for the **average nutrient export rates** described in Section 2. Are they calculated appropriately? Is there any additional scientific information that should be included?

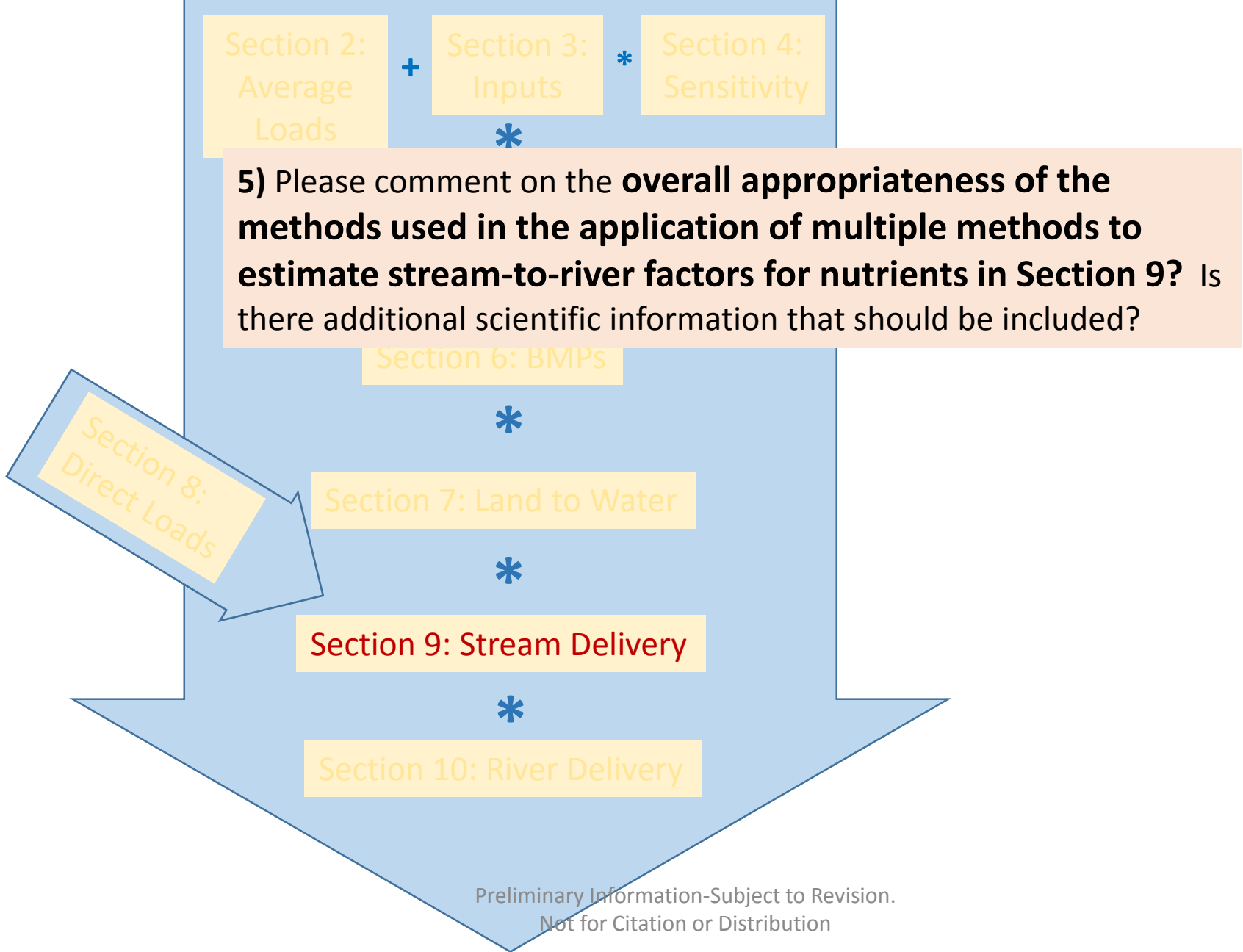
Phase 6 Model Documentation



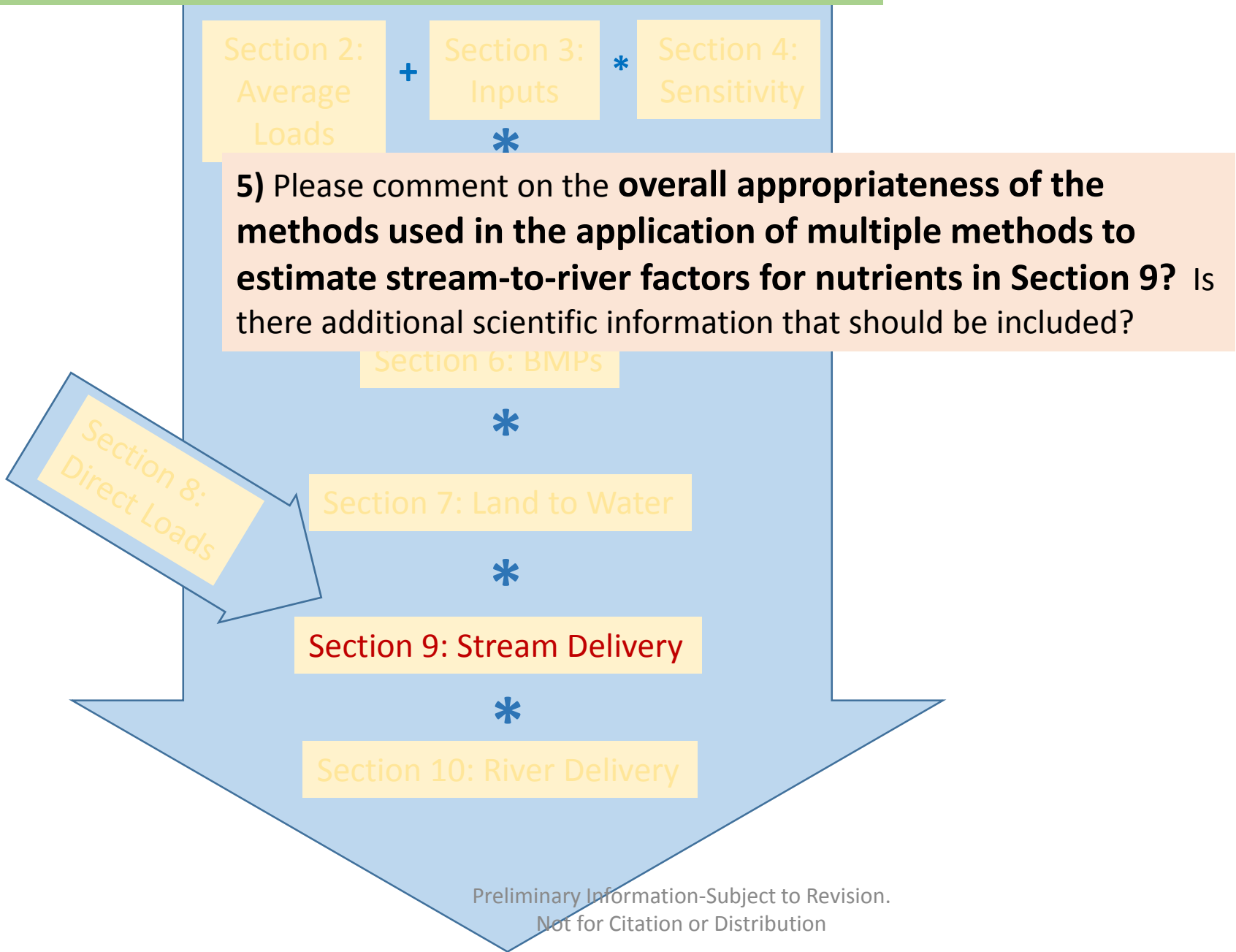
Phase 6 Model Documentation



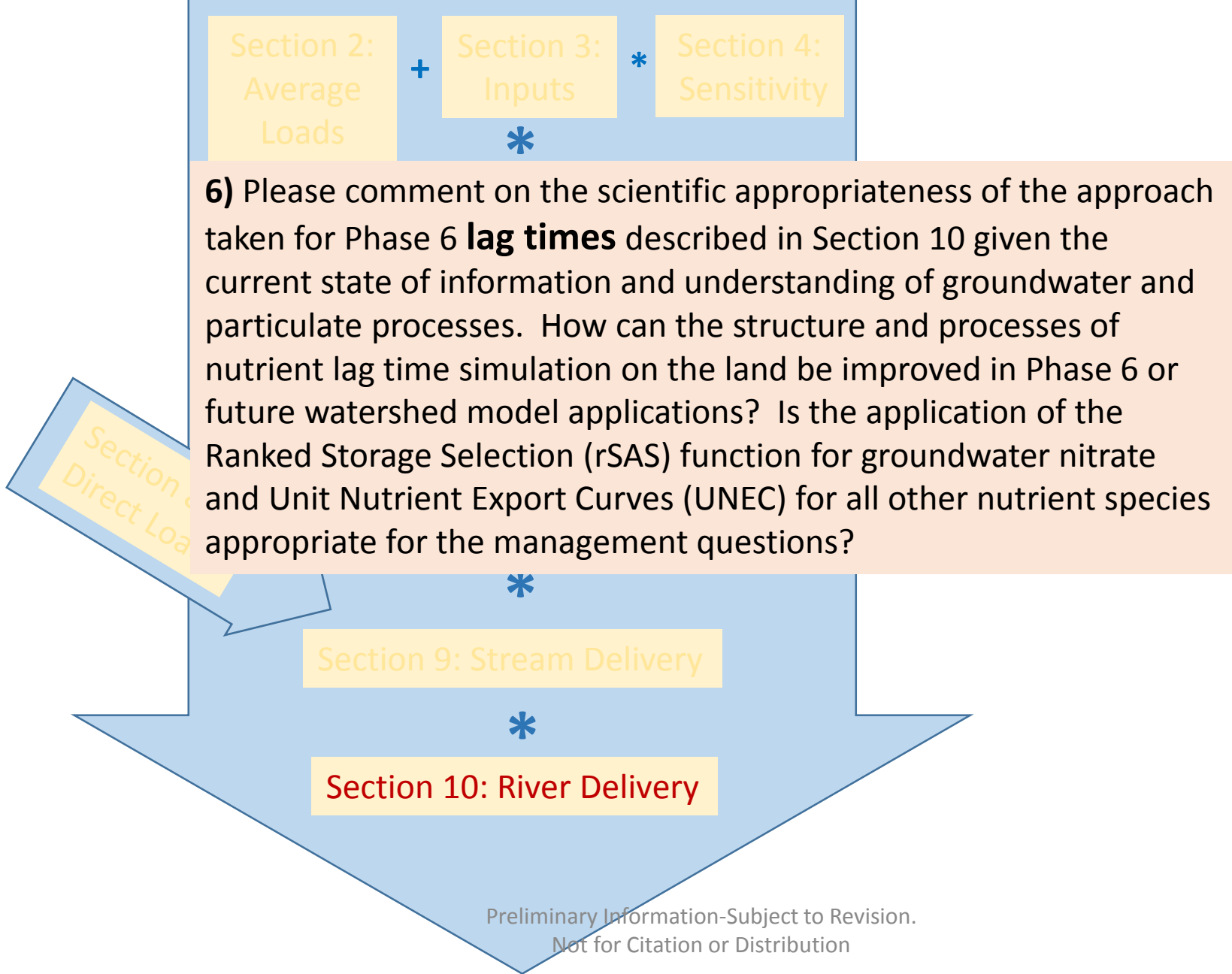
Phase 6 Model Documentation



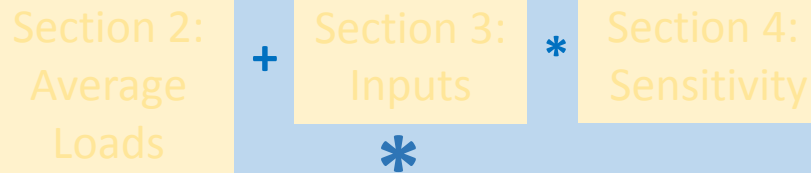
Phase 6 Model Documentation



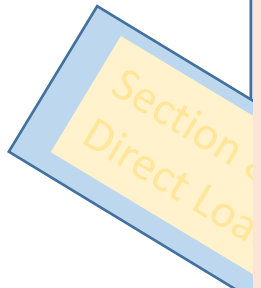
Phase 6 Model Documentation



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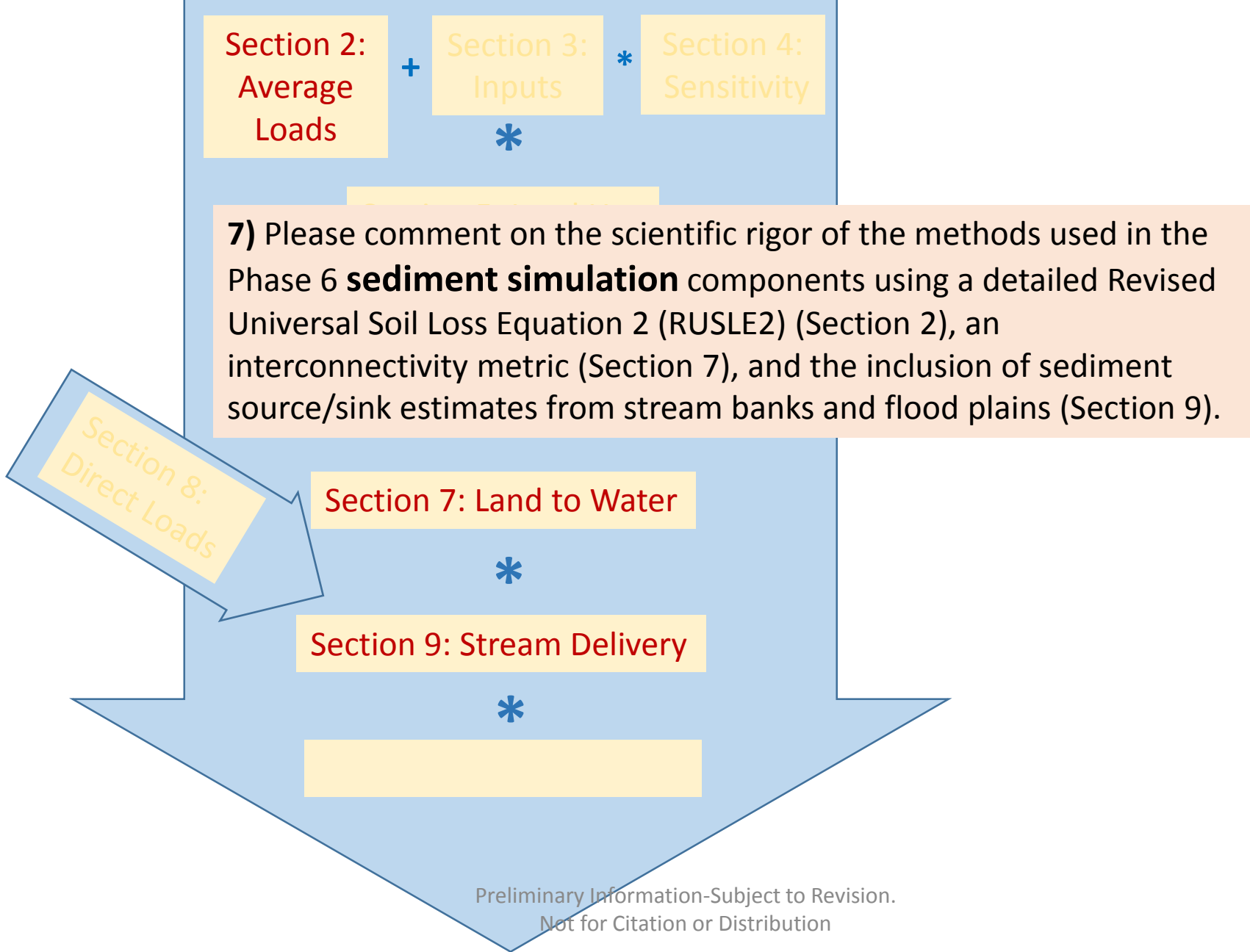


9) Better simulation of the deposition and scour processes in the reservoir reach of the Lower Susquehanna is an important feature of the Phase 6 Model. It is crucial to 2017 Midpoint Assessment decision making to be able to properly represent the net deposition of sediment, nitrogen, and phosphorus in this reach of the Susquehanna. Does the Phase 6 representation of the dynamics of the reservoir system rely on the best science available at this time? Do the simulations approximately represent the observed changes in storage of sediment, nitrogen and phosphorus as seen in the historical record from the last few decades? How can the representation of Conowingo infill be improved going forward beyond the Phase 6 Model?

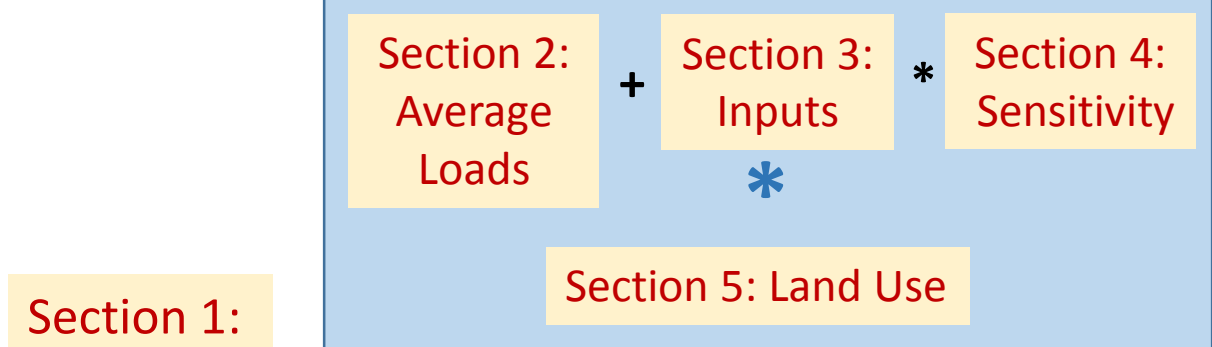


Section 10: River Delivery

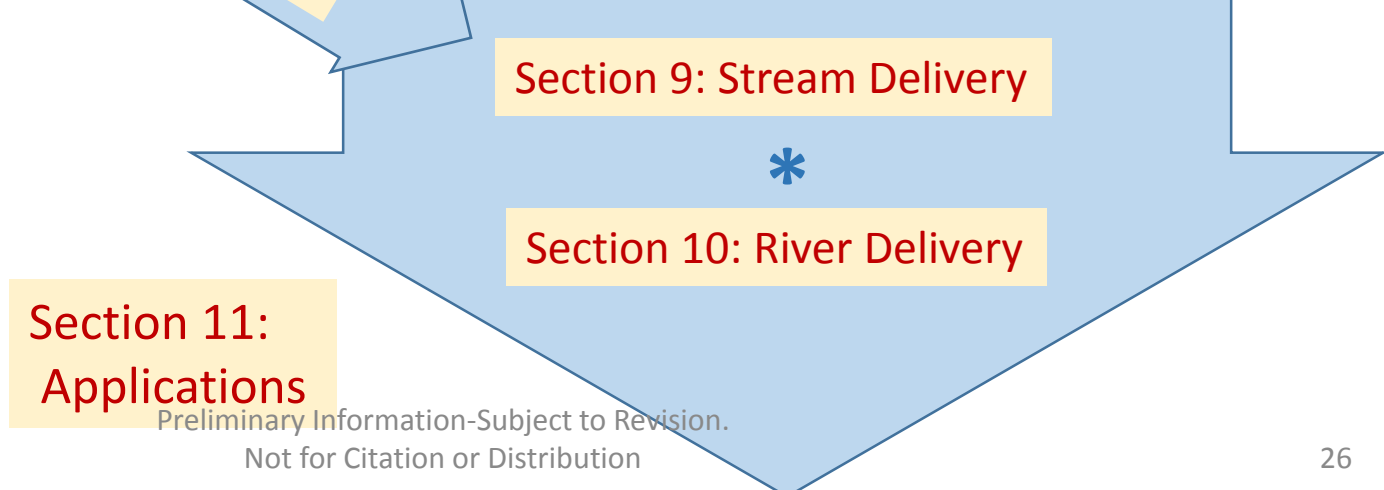
Phase 6 Model Documentation



Phase 6 Model Documentation



10) Please comment on the scientific appropriateness of the methods used in the representation of **climate change** in watershed nutrient and sediment loads estimated for the 2025 and 2050 time periods. How well to the models used for producing future climate scenarios show skill in hindcasting the actual climatic and hydrologic changes that have happened over the past several decades?



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Phase 6 Model Documentation

Section 2:
Average

+

Section 3:
Inputs

*

Section 4:
Sensitivity

11) For longer term CBP considerations, how can the overall approaches and procedures used in Phase 6 be improved and what alternative approaches and data gathering might you recommend?

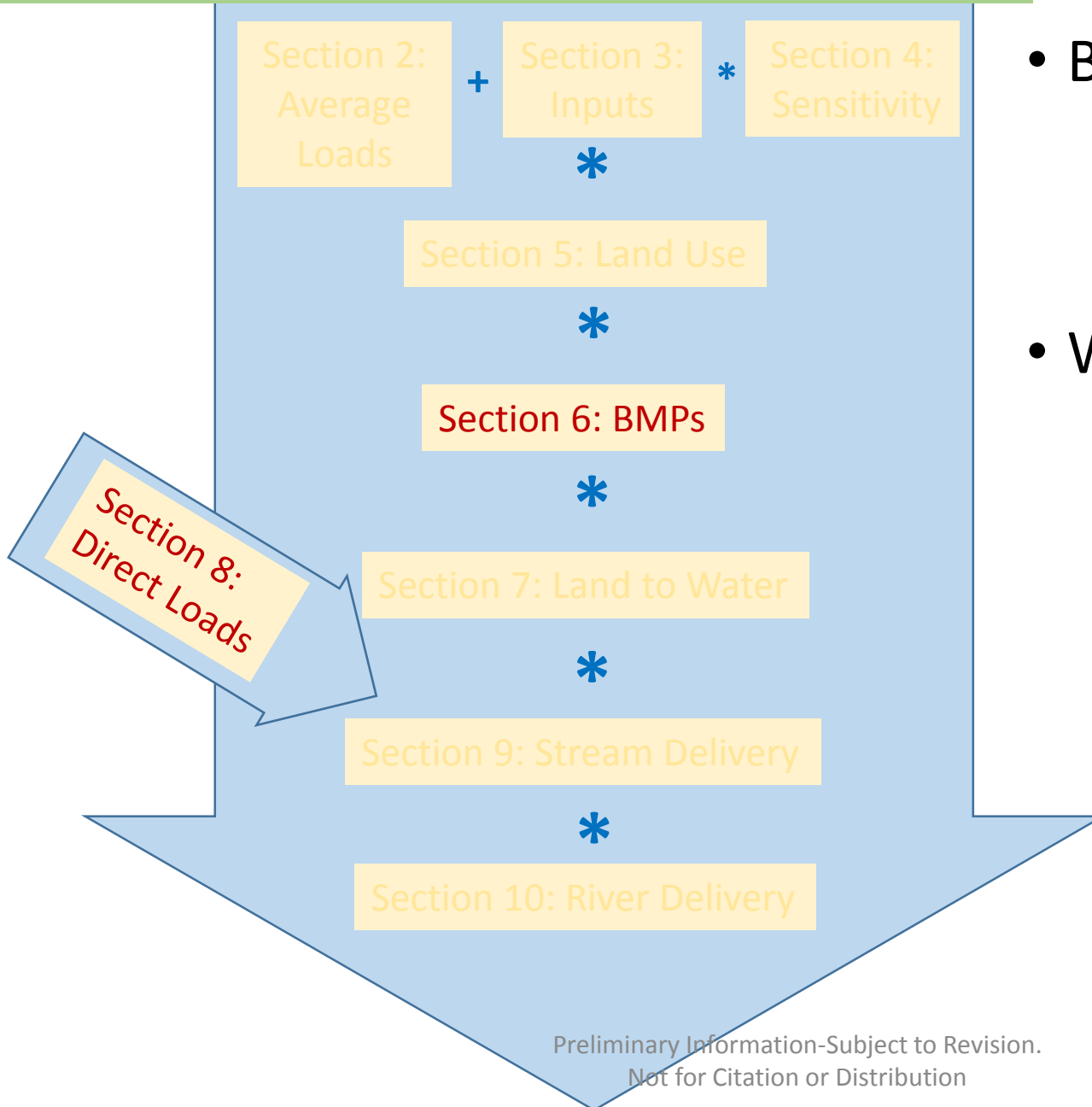
12) Please comment on the Phase 6 documentation. Is it clear, well organized, concise, and complete (taking into account that it is the second Beta out of an expected four Beta versions and about a year ahead of final release)?

8) Given the fine scale 1m x 1m land use data that's used in Phase 6, what opportunities does this open to the CBP and scientific community in the next phase of watershed model development? What are the advantages in a distributed representation of hydrology, land cover, and sediment? Given the availability of nutrient inputs from Agricultural Censes at the county scale only does a higher resolution of the watershed model make sense?

Section 11:
Applications

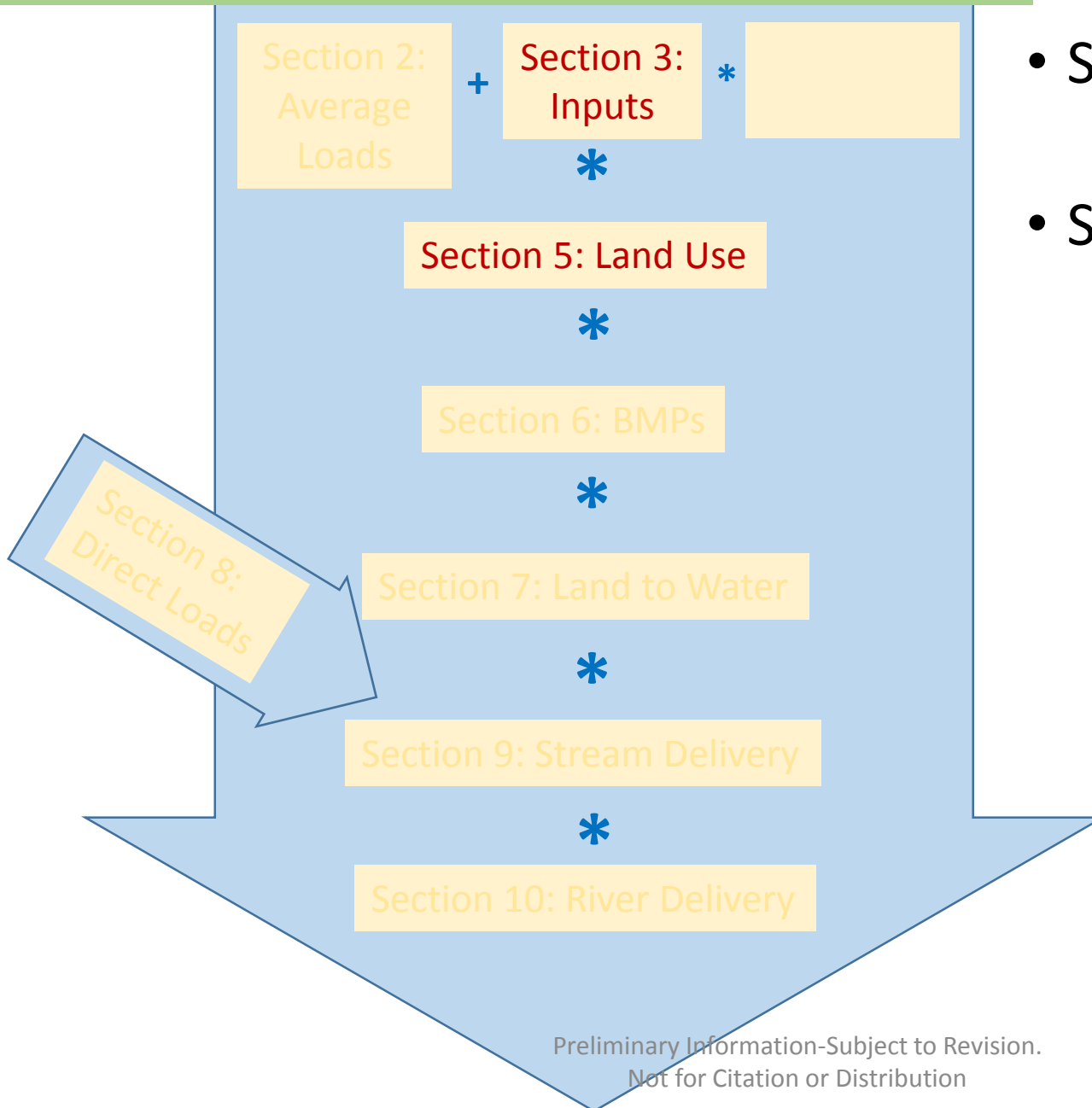
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Phase 6 Model Documentation



- BMPs
 - Section 6 BMPs
 - Separate review process
- WWTP
 - Section 8 Direct Loads
 - Submitted Data

Phase 6 Model Documentation



- Section 3: Inputs
 - Scenario Builder
- Section 5: Land Use
 - CBLCM