Development Plan for Phase 7 WSM and AgWG Role

Gary Shenk – CBPO

7/15/21

Ag Workgroup

CBP Watershed Modeling Products

	Existing	Long term
TMDL tracking	CAST6-2017 CAST6-2019… CAST6-2025	CAST7-2025

Opportunity

Fine-scale landscape metrics

Land Use

Computing Power

New Science

Fine-scale tools (field doc)

Partnership Need

PSC directives

WQGIT needs

STAC recs

Other GIT needs

Water supply partners

CAST7-2025

P7 CAST DM

Partnership Need

PSC directives

1. Reassess 2035 climate in 2025
2. Don’t change planning targets until 2025

Water supply partners

NHD100k hourly flow & temperature
Low flow extremes ; Reservoirs

Other GIT needs

CAST inputs and outputs at NHD100k or NHD24k
Time-averaged N, P, S, flow, temp characteristics

STAC recs

Finer scale
Better characterize sources and sinks
Uncertainty Quantification (including BMPs)
Formalized optimization of CAST calibration

Revolutionize sediment
Match with monitoring data
More models in ensemble

WQGIT needs

Science needs database – 1 science need: Finer Scale

1) refine urban phosphorus sensitivities
2) investigate the impact of urban BMPs using SWAT and/or SWMM models.

P7 CAST DM

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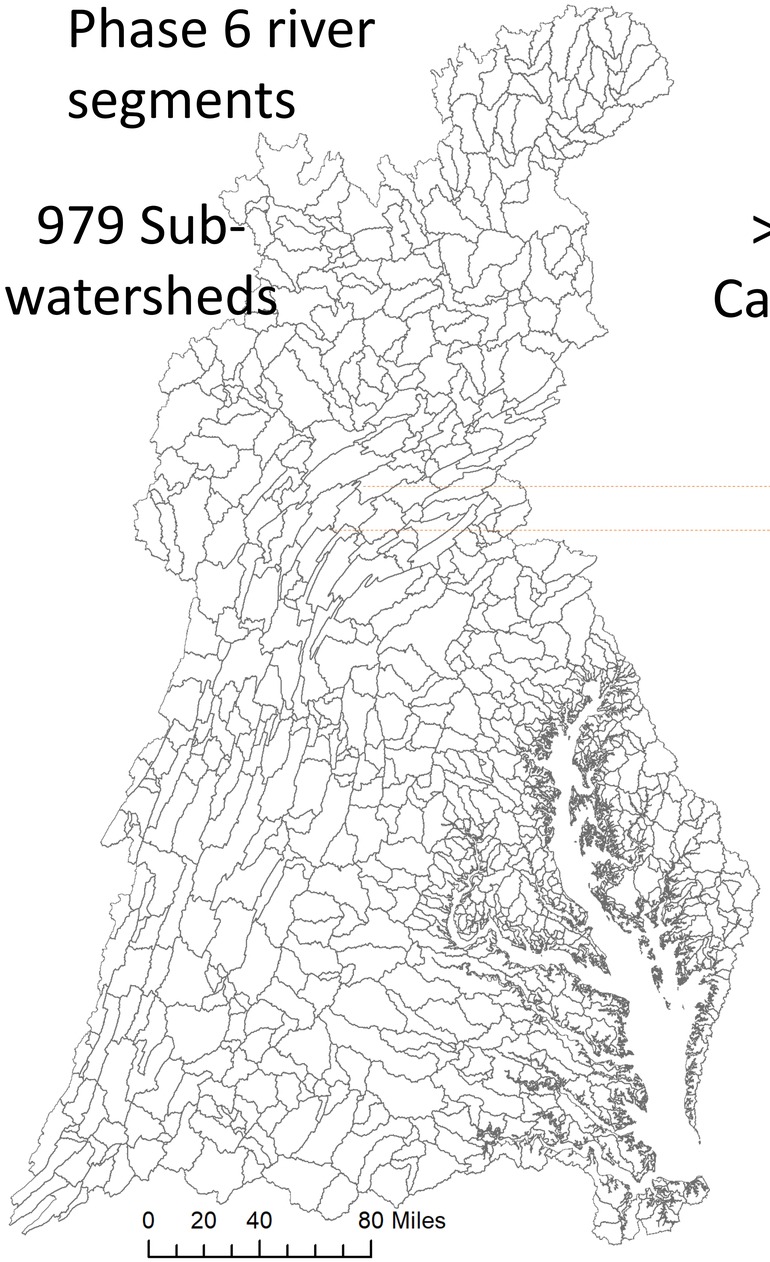
Scale – Phase 6 vs. Phase 7

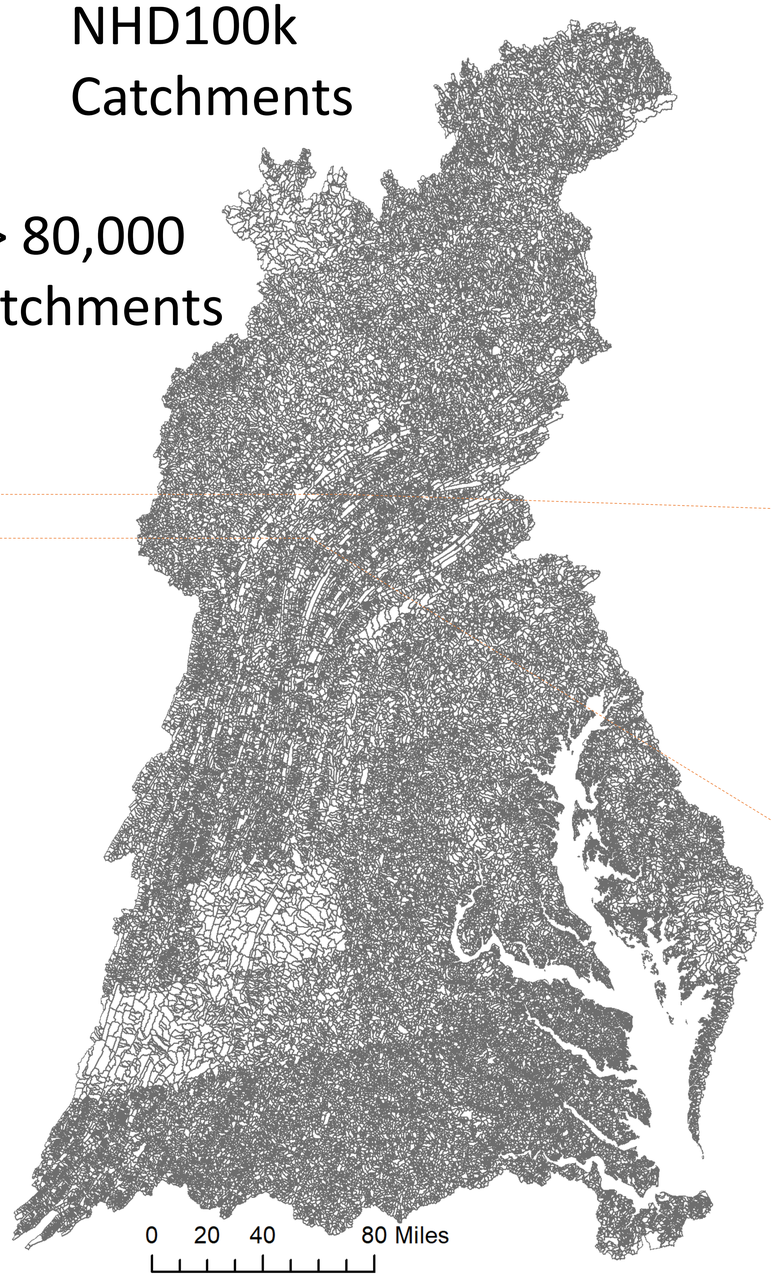
Phase 6 river segments

979 Sub-watersheds



NHD100k Catchments

> 80,000 Catchments



CBP Watershed Modeling Products

	Existing	Long term
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Calibration, Estuarine loading Water supply	P6 Dynamic Model	P7 Dynamic Model
Fine-scale		P7 Pixel Model

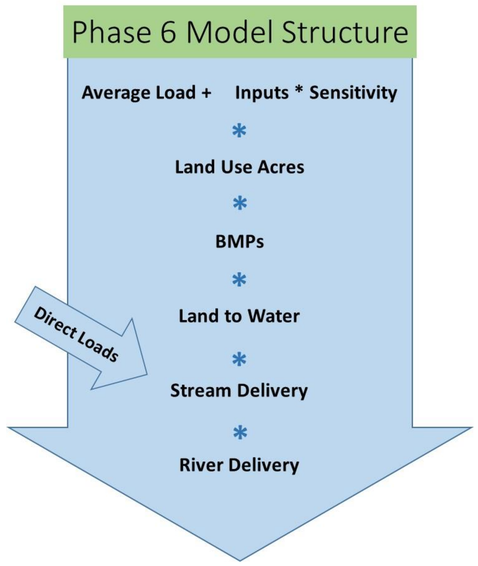
CBP **Phase 6** Model – Nutrient Scenario Mode

Land-river segment

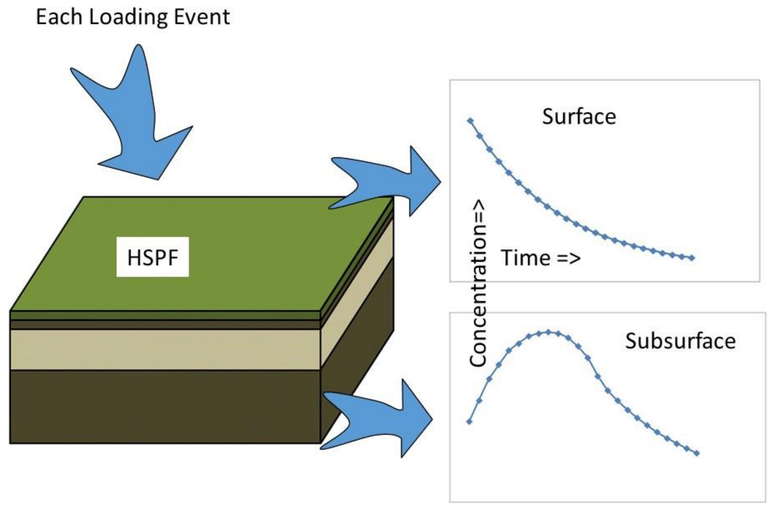
CAST 6

Land-river segment

Dynamic Model 6



CAST determines CBP official scenario loads



CAST loads are temporally disaggregated for estuarine model

CBP **Phase 7** Model – Nutrient Scenario Mode

10m pixel

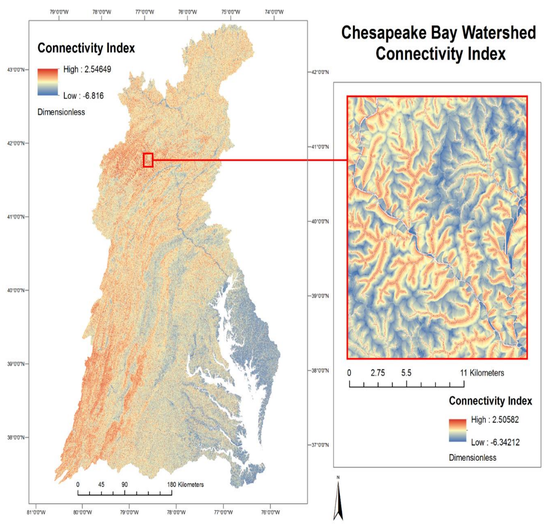
NHD 100k

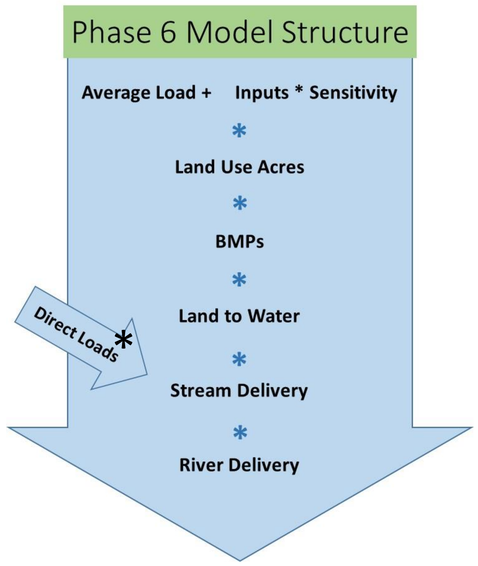
NHD 100k

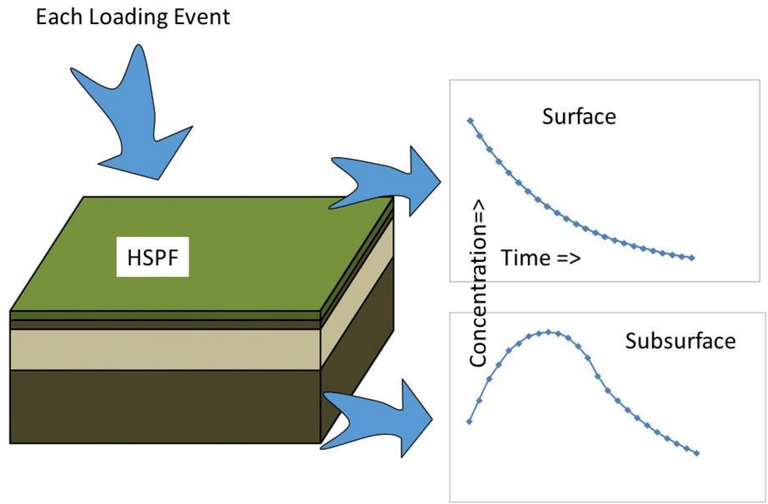
Pixel Model 7

CAST 7

Dynamic Model 7







CAST loads can be downscaled to finer scale to apply differential BMP crediting

(if credible methods are found)

CAST determines CBP official scenario loads

CAST loads are temporally disaggregated for estuarine model

2021 2022
Hydrology
Sediment

- Inputs
- Structure

- Improvements

2022 2023
Nitrogen
Phosphorus

- Improvements
- Scale consistency

2024
Review
Refine

- STAC review
- Partnership review

- Refinements

2025
Apply

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PSC
directives

2021 2022
Hydrology
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2022 2023
Nitrogen
Phosphorus

2024
Review
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2025
Apply

- WQGIT gives priorities – October 2021
  - Climate change!
  - Scale?
  - Uncertainty?
  - AgWG Priorities?
  - Something else?

1. TMDL implementation deadline 2025
2. Reassess 2035 climate in 2025
3. Don’t change planning targets until 2025

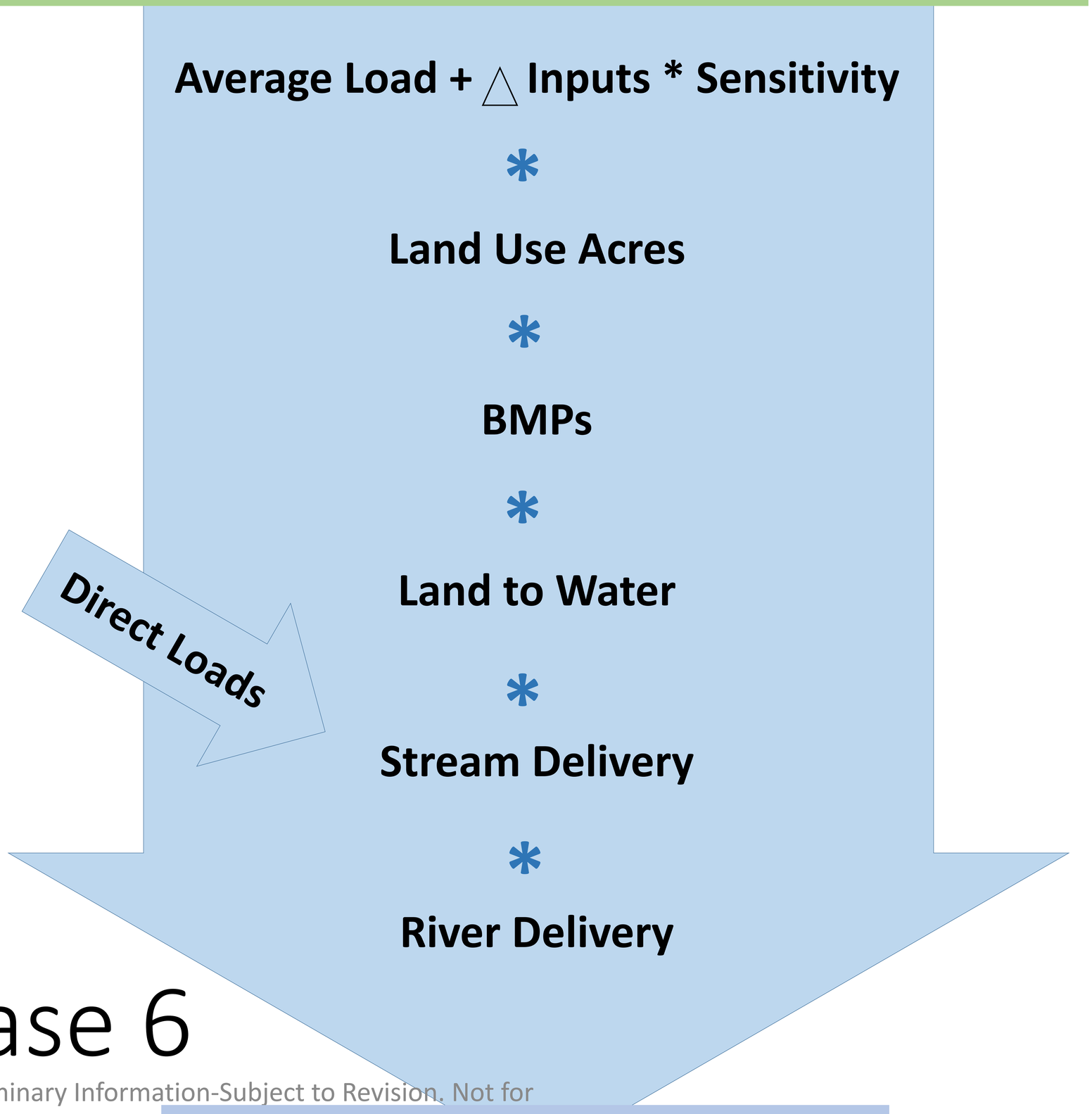
PSC directives

Ag WG role in Phase 7

- Advise the WQGIT on priorities
- Modify calculations for ag-related inputs?
  - Manure
  - Fertilizer
  - Fixation
  - Crop removal
- Change land use aggregations?

Phase 6 Model Structure

Structure



Phase 6

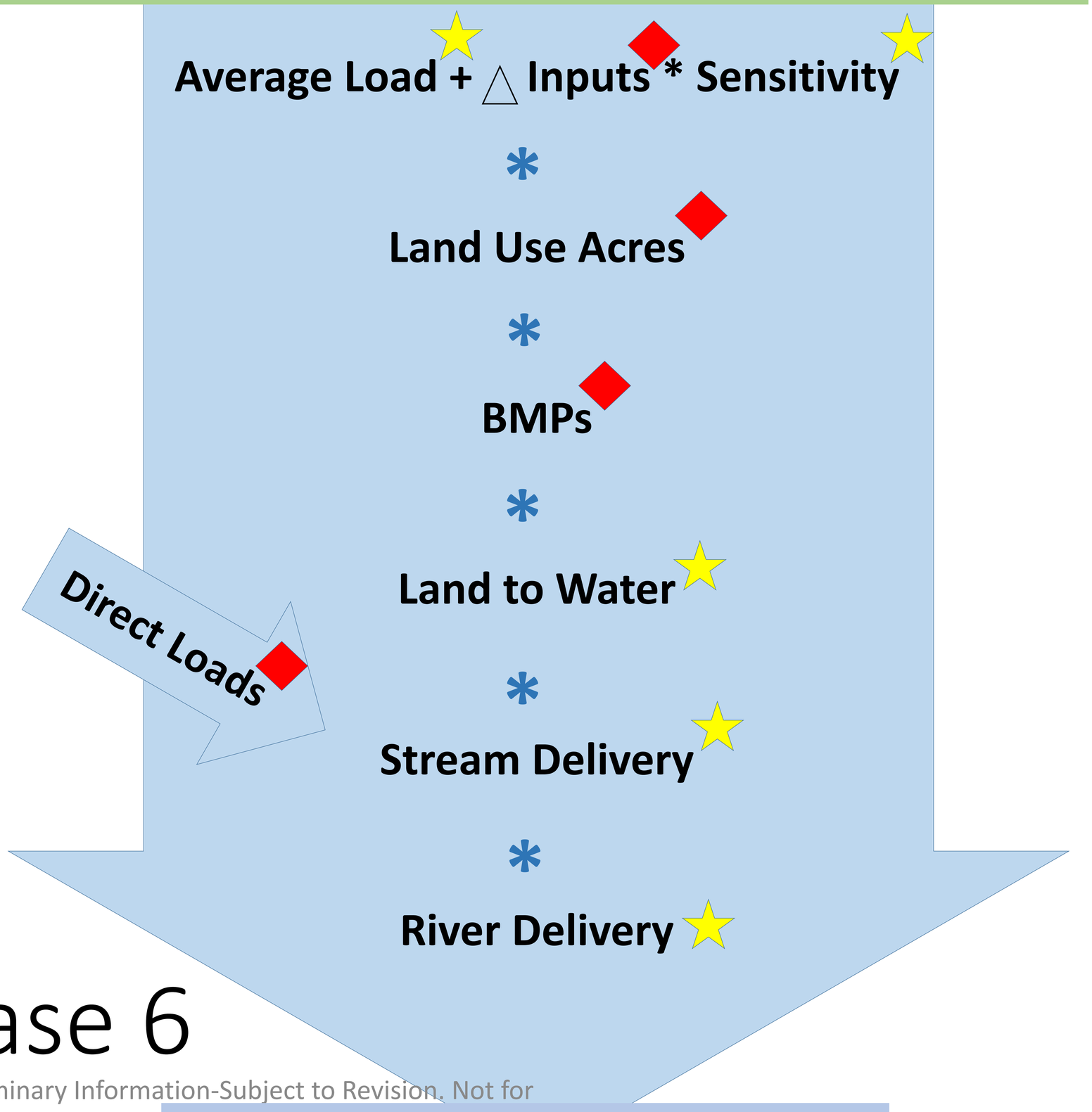
Load by land-river segment and land use

Phase 6 Model Structure

Structure

◆ **Specified by WQGIT**

★ **Estimated by MWG**



Phase 6

Load by land-river segment and land use

Phase 6 development

Partnership Feedback on Modeling

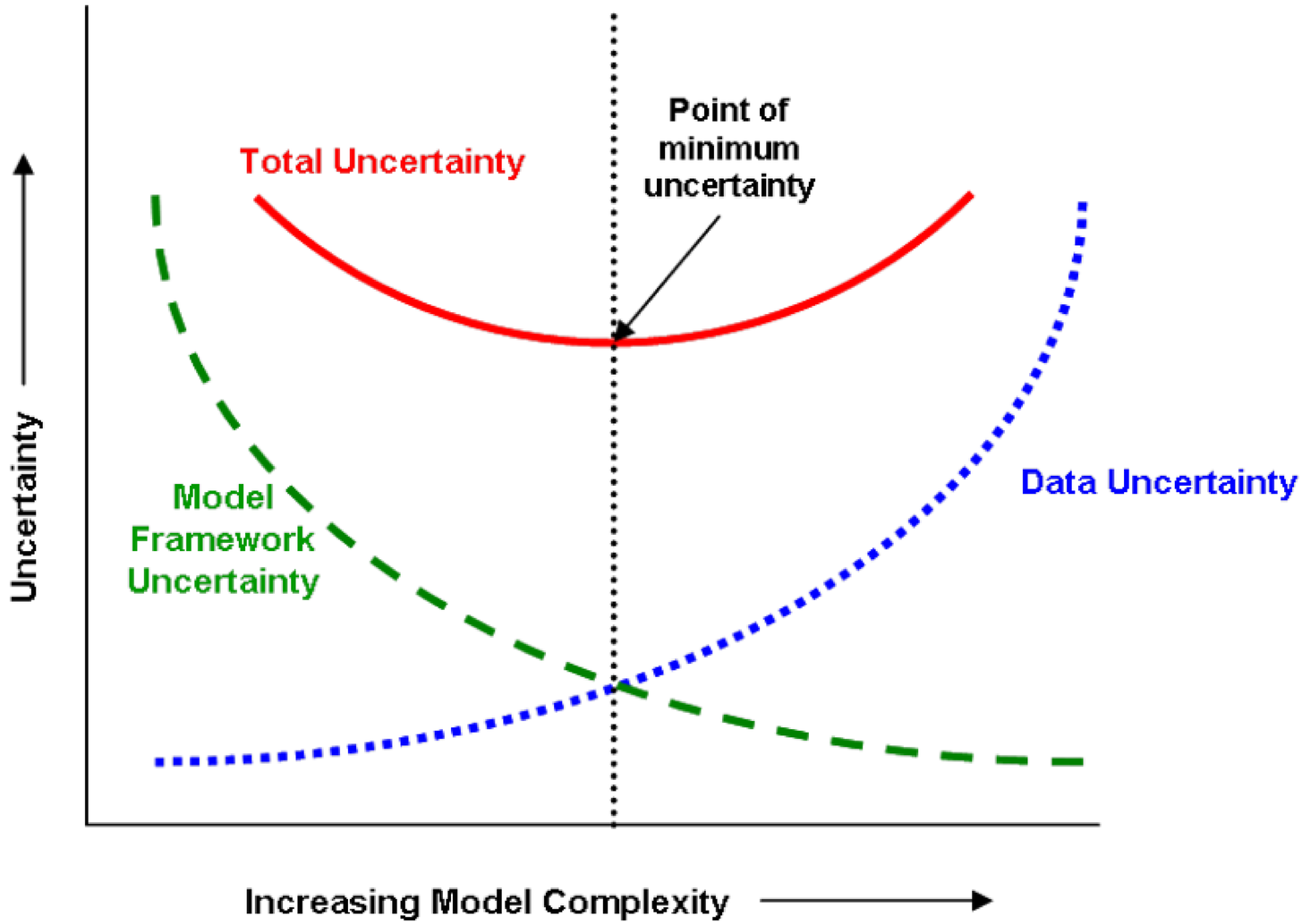
- **Water Quality Managers**
  - Need more **transparent and easier** to understand decision-support tools to enable successful engagement of local partners

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

Keep it Simple!!

Include Everything!!!

“Everything should be as simple as it can be, but not simpler”
Einstein (probably)



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https://www.epa.gov/sites/production/files/2015-09/documents/mod8-saua-mod-final.pdf

Keep It Simple

Average Load + △ Inputs * Sensitivity

*

Land Use Acres

*

BMPs

*

Land to Water

*

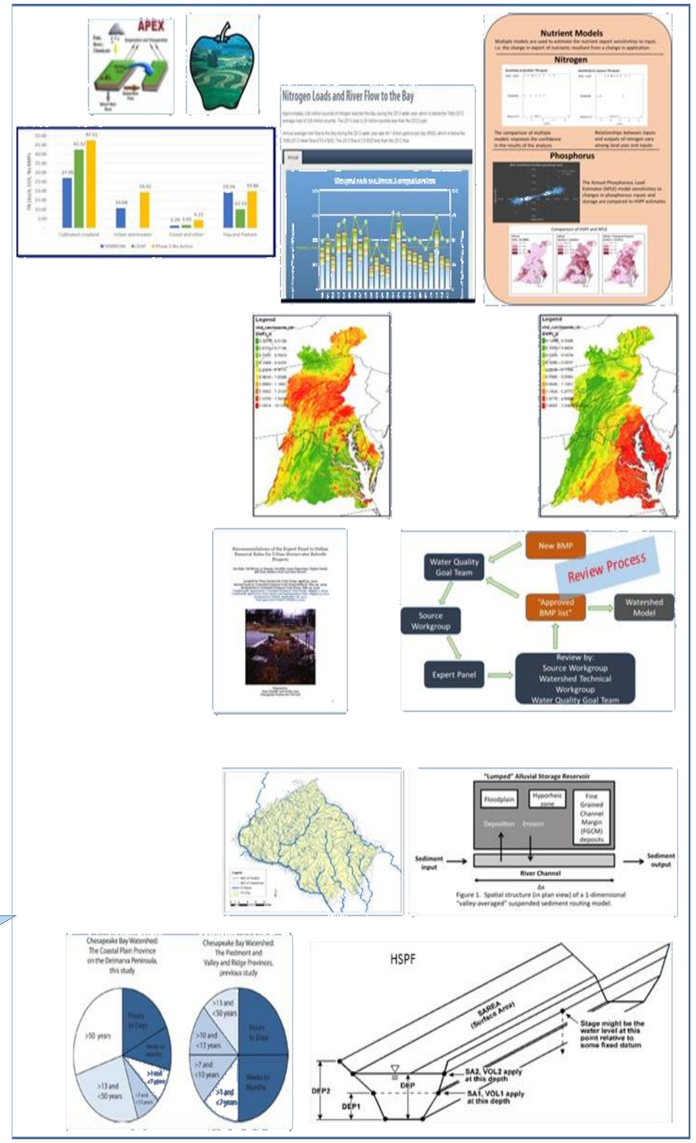
Stream Delivery

*

River Delivery

Direct Loads

Include Everything



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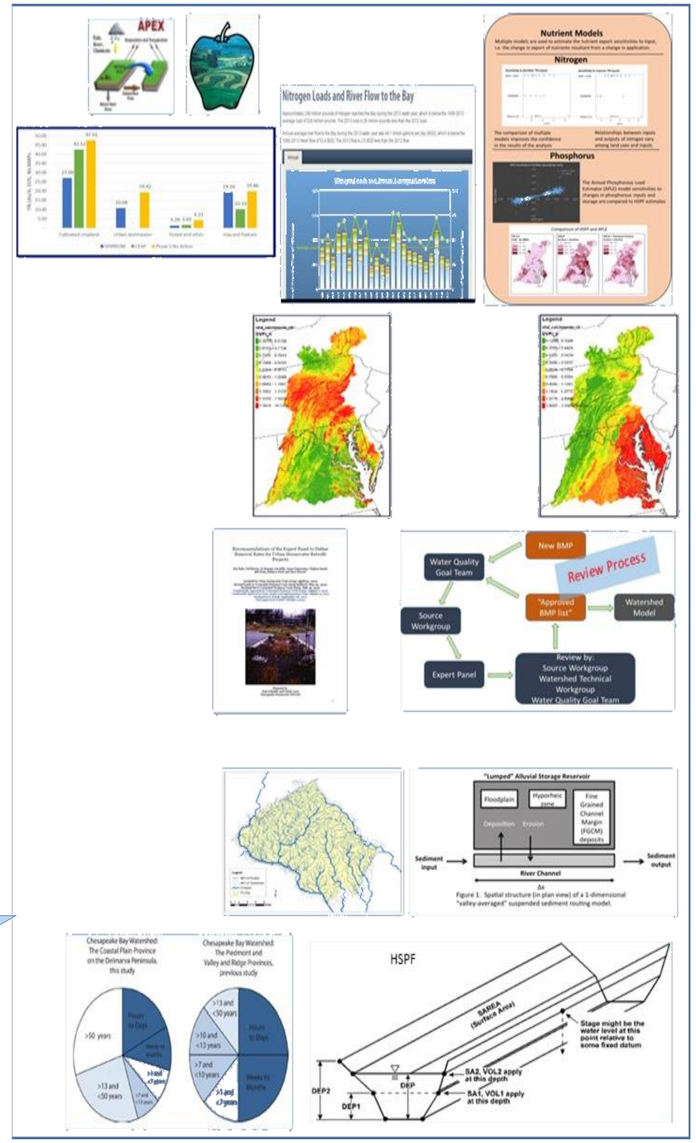

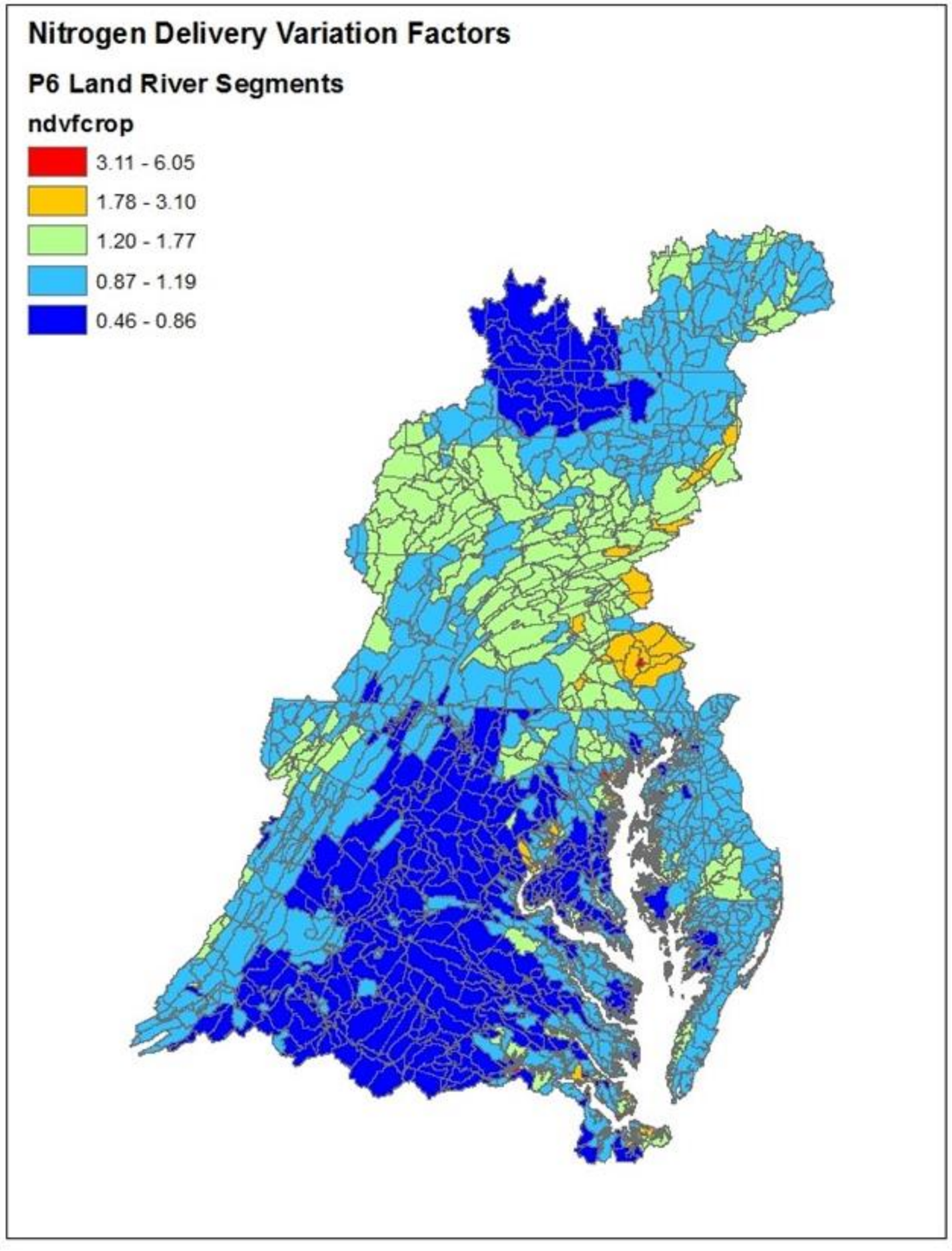

Land to Water factors

Nitrogen

Groundwater recharge ⬆
Piedmont Carbonate ⬆
Available water capacity ⬇

ln[Mean soil AWC (fraction)]	-0.829
ln[Groundwater recharge (mm)]	0.707
ln[Piedmont carbonate (percent of area)]	0.158

Ator, S.W., Brakebill, J.W., and Blomquist, J.D., 2011, Sources, fate, and transport of nitrogen and phosphorus in the Chesapeake Bay watershed: An empirical model: U.S. Geological Survey Scientific Investigations Report 2011–5167, 27 p.

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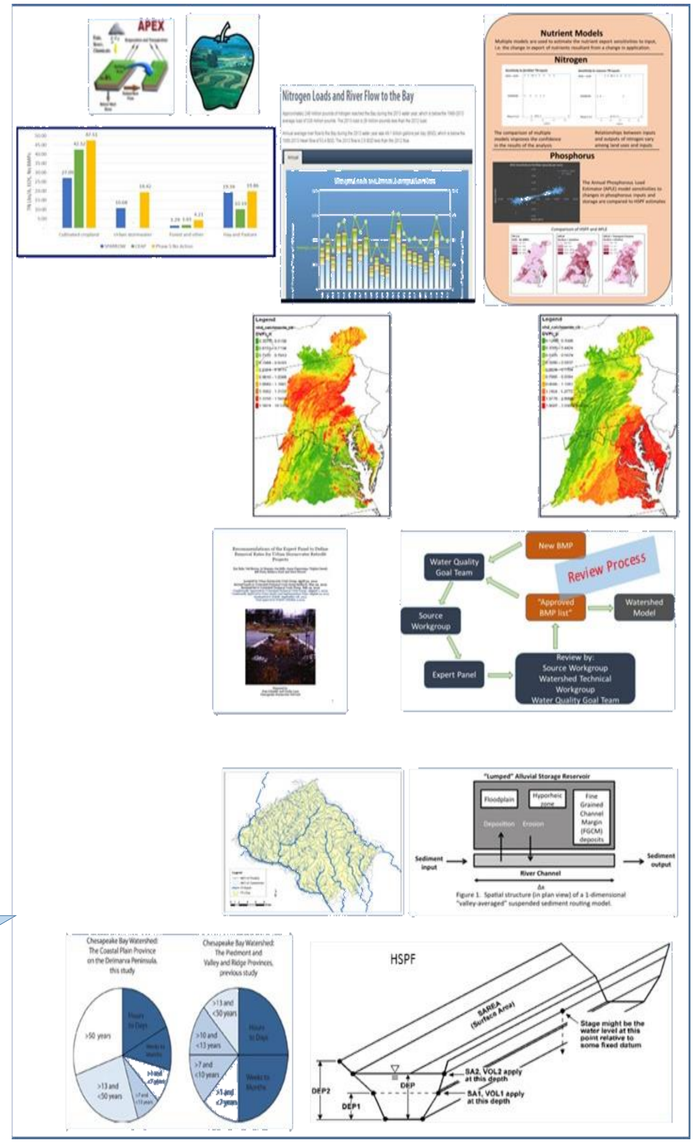
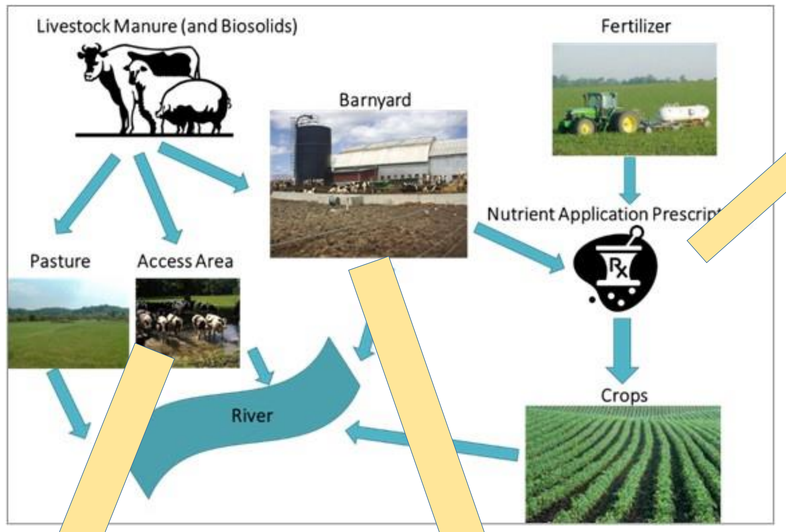
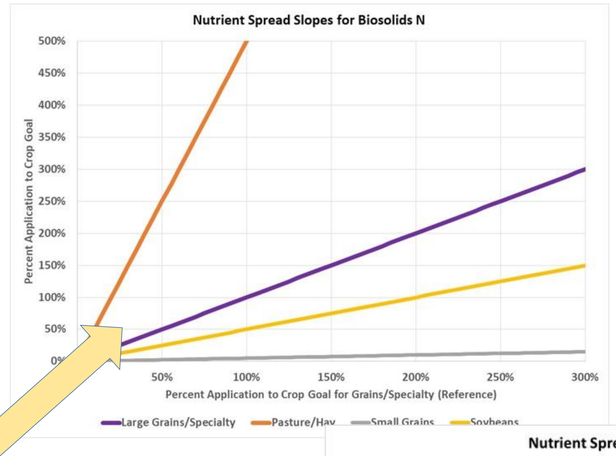
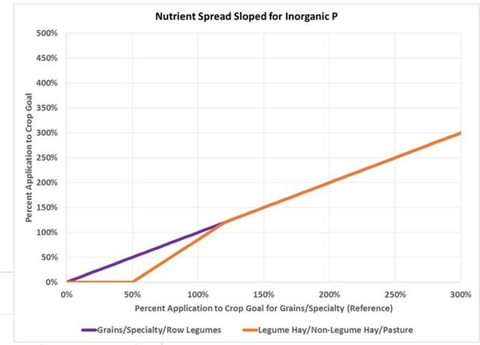
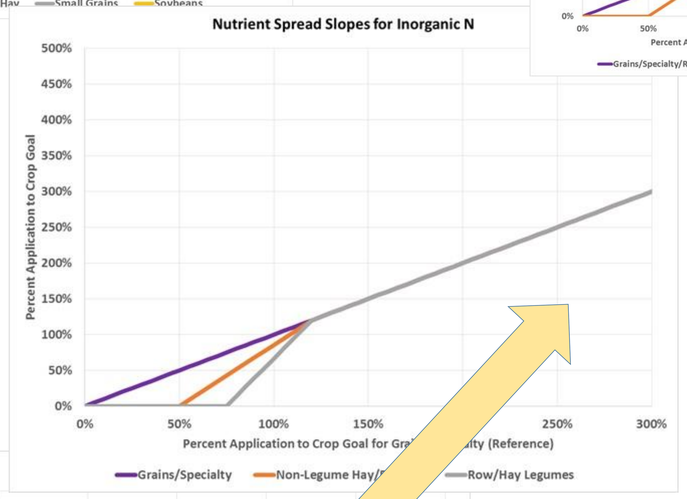


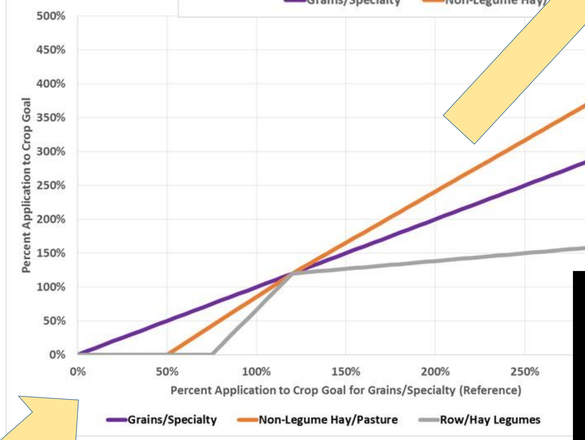
Nutrient Applications

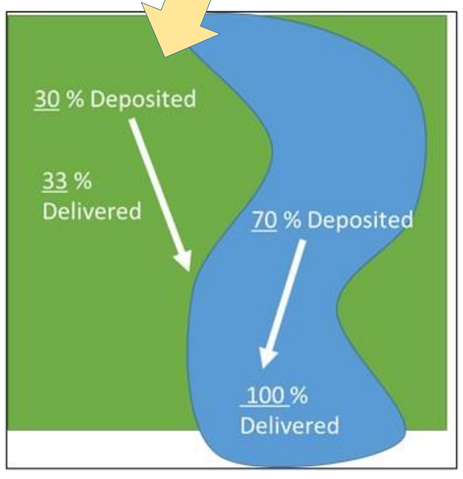


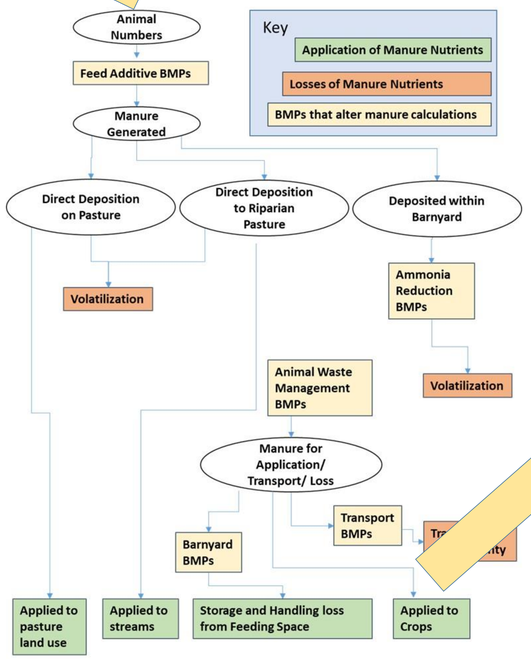


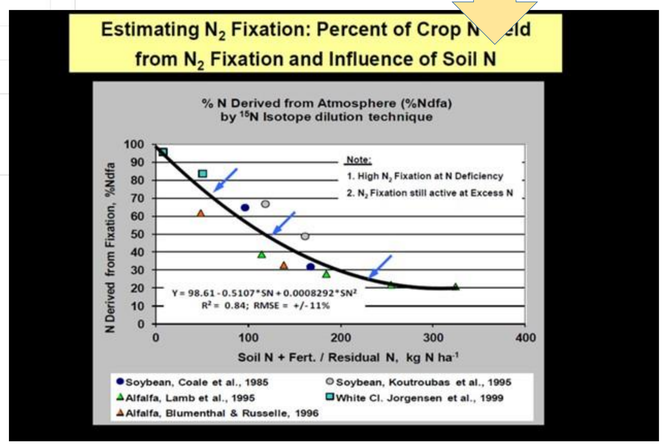






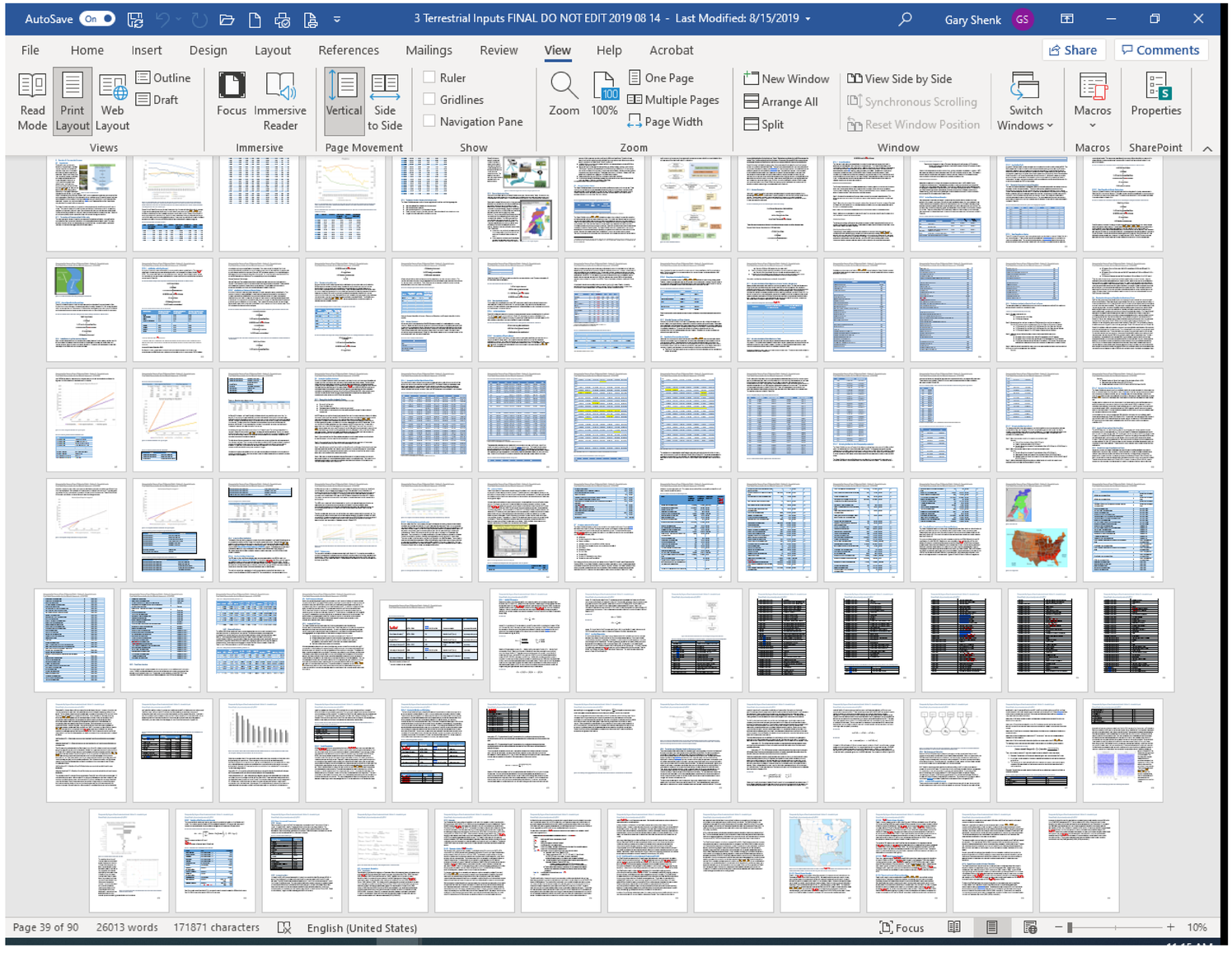






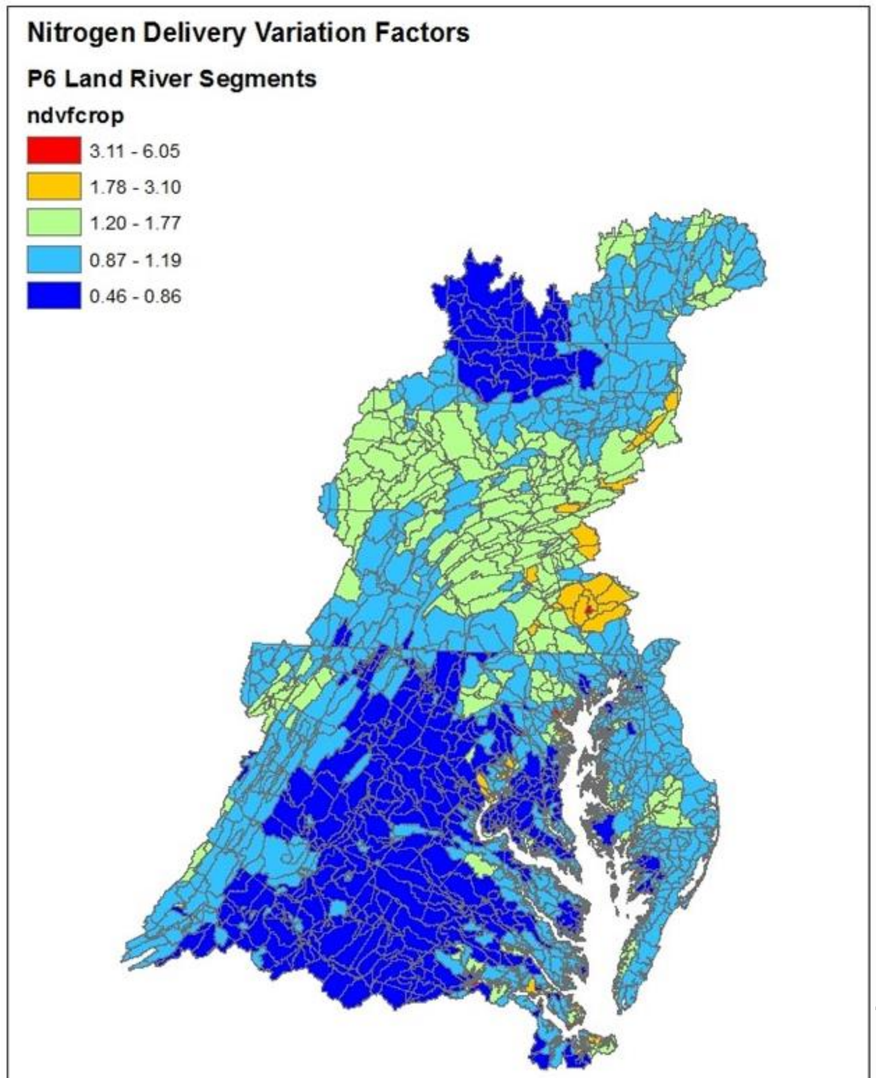
All documented in this 90-page report

+ 229 pages of appendices!



How much time do we spend on these topics?

Land to Water factors



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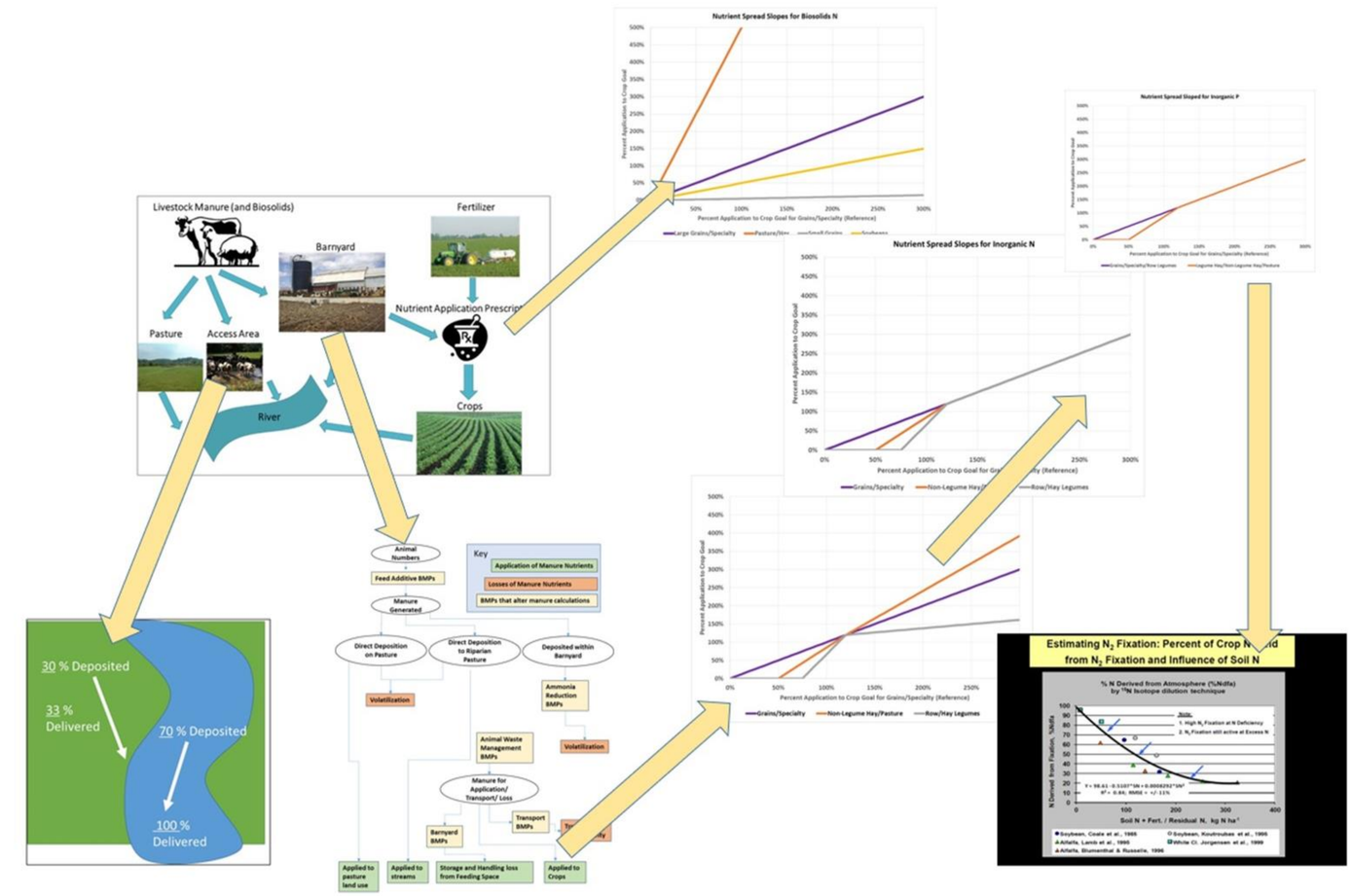

How much time do we spend on these BMPs?

Cover Crop Efficiencies

BMPFullName	HydroGeomorphicRegion	AvgNitrogenEfficiencyPct
Cover Crop Commodity Early	Appalachian Plateau Carbonate	5.00
Cover Crop Commodity Early	Blue Ridge	4.00
Cover Crop Commodity Late	Appalachian Plateau Carbonate	15.00
Cover Crop Commodity Late	Blue Ridge	12.00
Cover Crop Commodity Normal	Appalachian Plateau Carbonate	10.00
Cover Crop Commodity Normal	Blue Ridge	8.00
Cover Crop Traditional Annual Legume Early Aerial	Appalachian Plateau Carbonate	4.00
Cover Crop Traditional Annual Legume Early Aerial	Blue Ridge	3.00
Cover Crop Traditional Annual Legume Early Drilled	Appalachian Plateau Carbonate	7.00
Cover Crop Traditional Annual Legume Early Drilled	Blue Ridge	5.00
Cover Crop Traditional Annual Legume Early Other	Appalachian Plateau Carbonate	6.00
Cover Crop Traditional Annual Legume Early Other	Blue Ridge	5.00
Cover Crop Traditional Annual Legume Normal Drilled	Appalachian Plateau Carbonate	6.00
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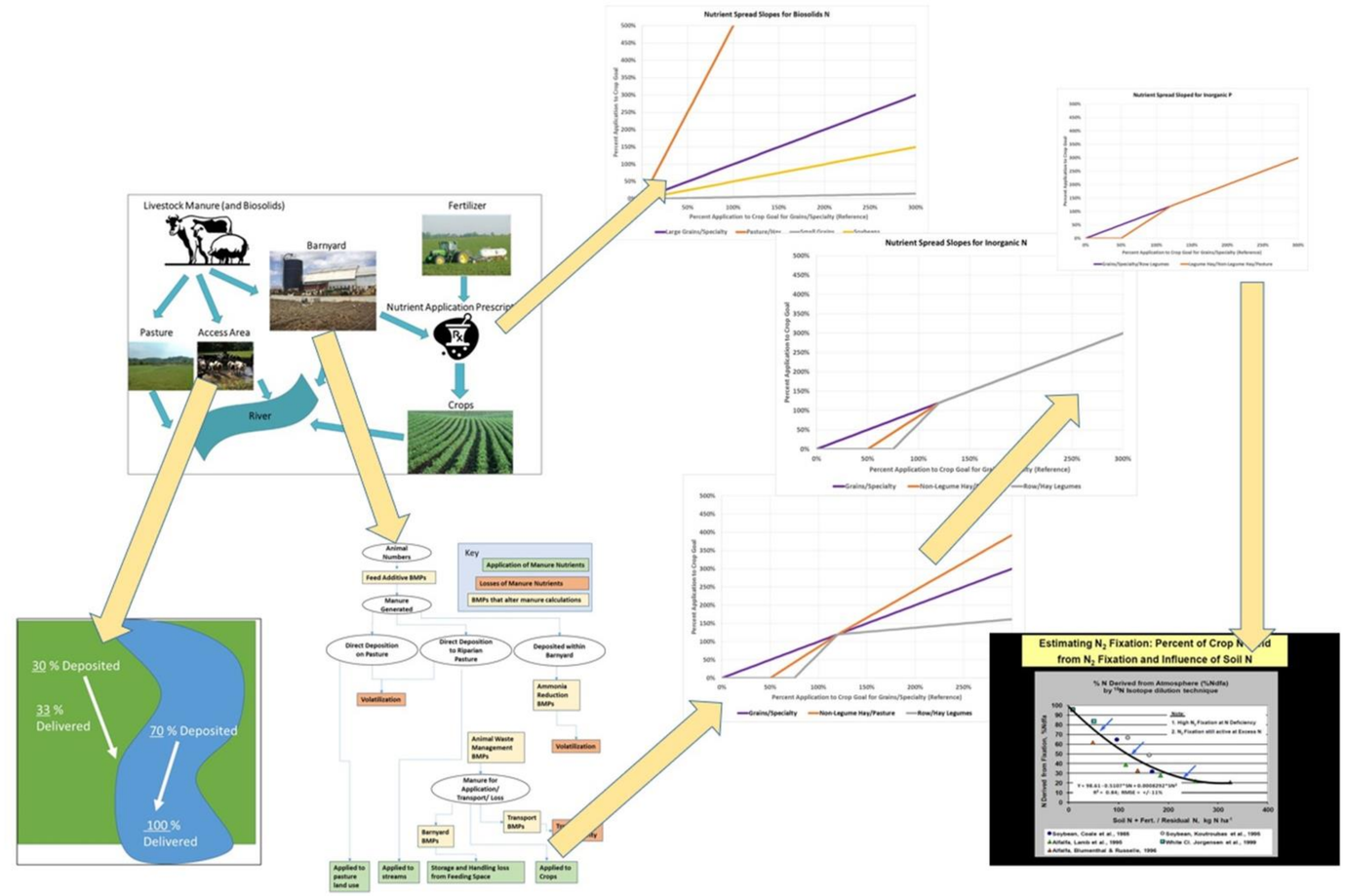
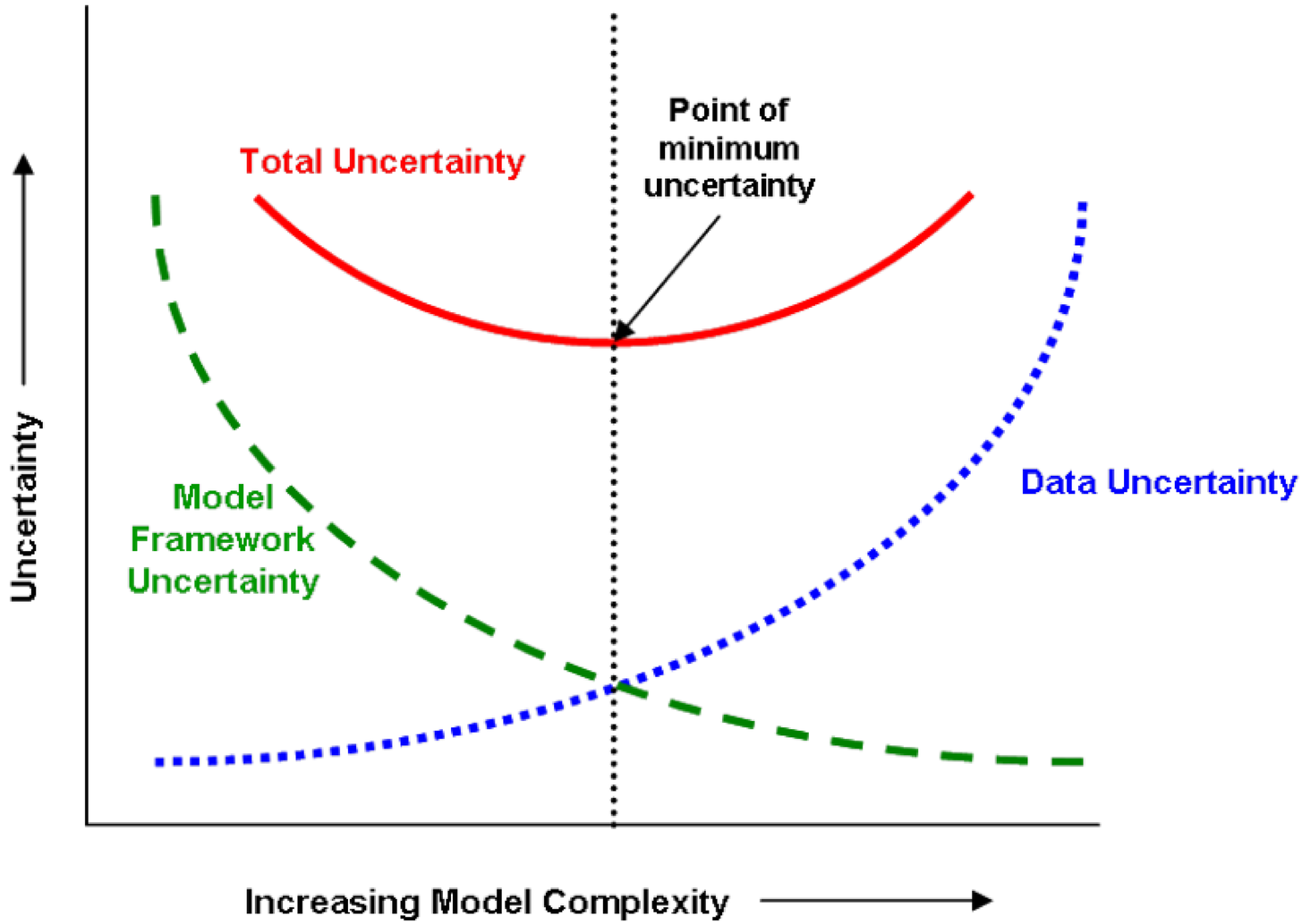
Cover Crop Traditional Annual Legume Normal Other	Appalachian Plateau Carbonate	6.00
Cover Crop Traditional Annual Legume Normal Other	Blue Ridge	4.00
Cover Crop Traditional Annual Ryegrass Early Aerial	Appalachian Plateau Carbonate	16.00
Cover Crop Traditional Annual Ryegrass Early Aerial	Blue Ridge	12.50
Cover Crop Traditional Annual Ryegrass Early Drilled	Appalachian Plateau Carbonate	30.00
Cover Crop Traditional Annual Ryegrass Early Drilled	Blue Ridge	22.00
Cover Crop Traditional Annual Ryegrass Early Other	Appalachian Plateau Carbonate	25.00
Cover Crop Traditional Annual Ryegrass Early Other	Blue Ridge	19.00
Cover Crop Traditional Annual Ryegrass Normal Drilled	Appalachian Plateau Carbonate	27.00
Cover Crop Traditional Annual Ryegrass Normal Drilled	Blue Ridge	20.00
Cover Crop Traditional Annual Ryegrass Normal Other	Appalachian Plateau Carbonate	23.00
Cover Crop Traditional Annual Ryegrass Normal Other	Blue Ridge	18.00
Cover Crop Traditional Barley Early Aerial	Appalachian Plateau Carbonate	21.00
Cover Crop Traditional Barley Early Aerial	Blue Ridge	16.00
Cover Crop Traditional Barley Early Drilled	Appalachian Plateau Carbonate	38.00
Cover Crop Traditional Barley Early Drilled	Blue Ridge	29.00
Cover Crop Traditional Barley Early Other	Appalachian Plateau Carbonate	32.00
Cover Crop Traditional Barley Early Other	Blue Ridge	25.00

Nutrient Management



Phase 6 development



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