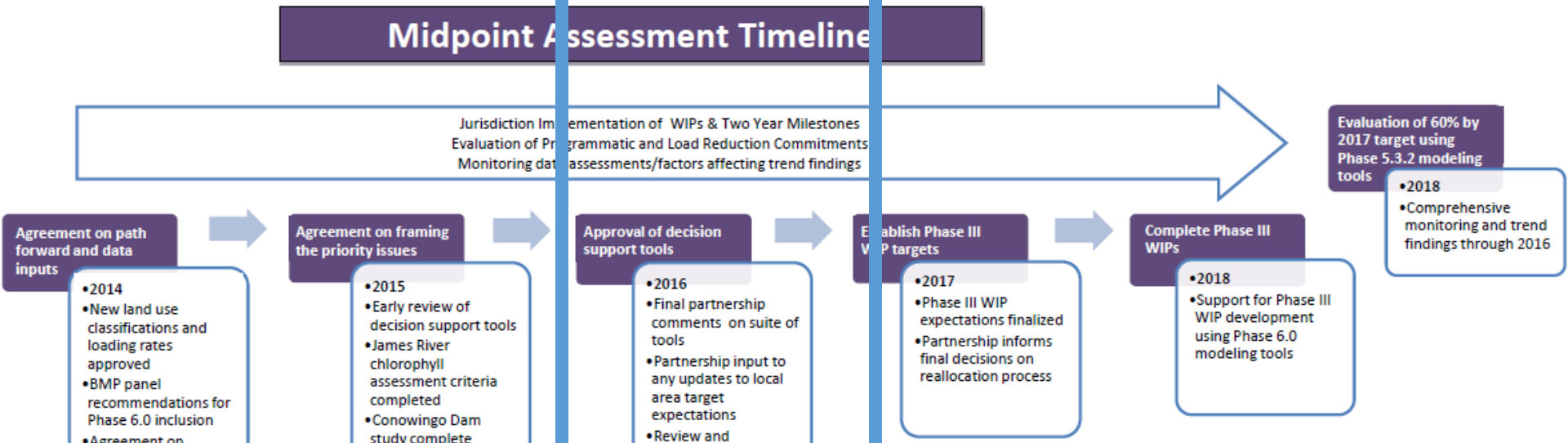
Overview of Phase 6 Beta 4 Modeling Effort

Gary Shenk – USGS - Chesapeake Bay Program

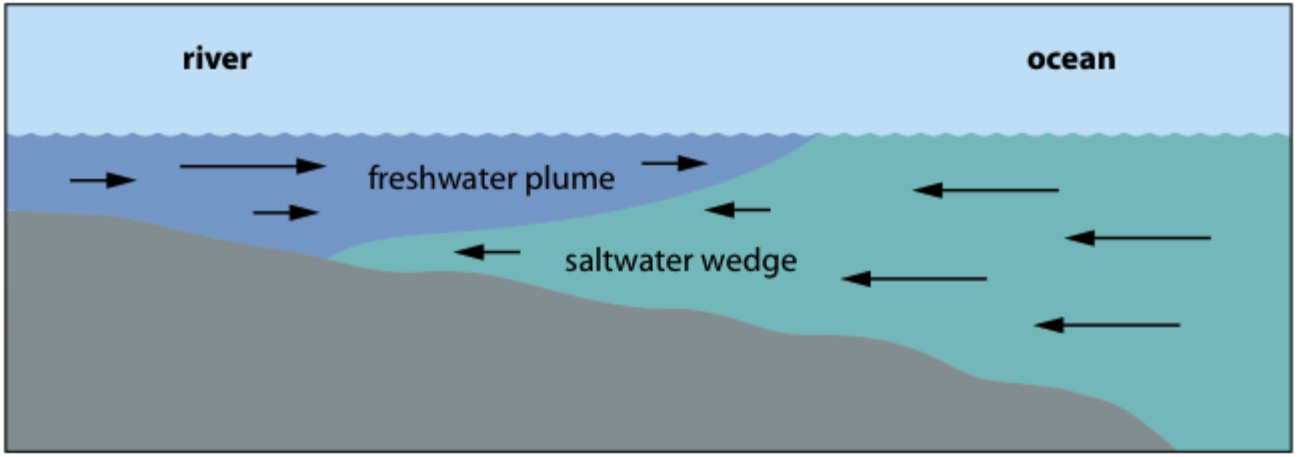
12/14/16



CREATE
The Models

REVIEW
The Models

USE
The Models



Agreement on path forward and data inputs

- 2014
- New land use classifications and loading rates approved
- BMP panel recommendations for Phase 6.0 inclusion
- Agreement on Midpoint Assessment Schedule

chlorophyll assessment criteria completed
- Conowingo Dam study complete
- Review and incorporate decisions of climate change impacts
- BMP panel recommendations for Phase 6.0 inclusion

- Partnership input to any updates to local area target expectations
- Review and incorporate decisions of climate change impacts

final decisions on reallocation process

hase III
nent
.0
modeling tools

Evaluation of 60% by 2017 target using Phase 5.3.2 modeling tools

- 2018
- Comprehensive monitoring and trend findings through 2016

CREATE
The Models

REVIEW
The Models

USE
The Models





Phase 6 Model Structure

Average Load + ΔInputs * Sensitivity

*

Land Use Acres

*

BMPs

*

Land to Water

*

Stream Delivery

*

River Delivery

Direct Loads

Phase 6

Setting

Calculation

Science Quality

Delivered Load from a land use =

Avg No BMP Nutrient Load

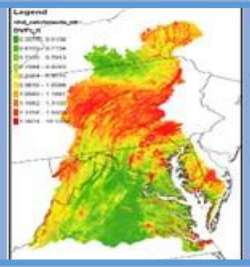
+

Sensitivity * Change in Inputs

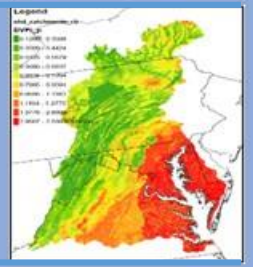
*****

Land to water

SPARROW
For nitrogen:
Soil, vegetation,
and climate variables



SPARROW
For Phosphorus
Soil, slope,
and climate
variables



*****

BMPs

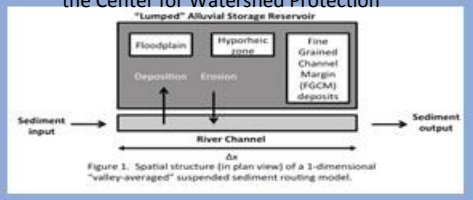
Effect of BMPs

*****

Stream Delivery

Sparrow

Potential models from USGS and
the Center for Watershed Protection



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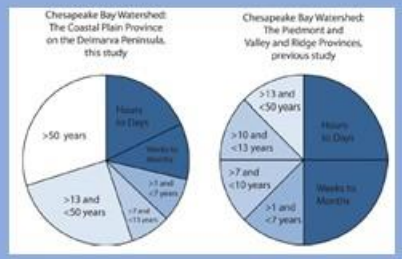
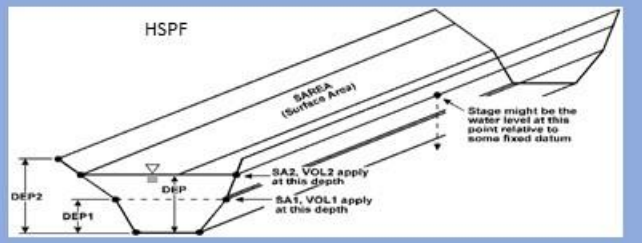
River Delivery





Finished

Potentially Finished

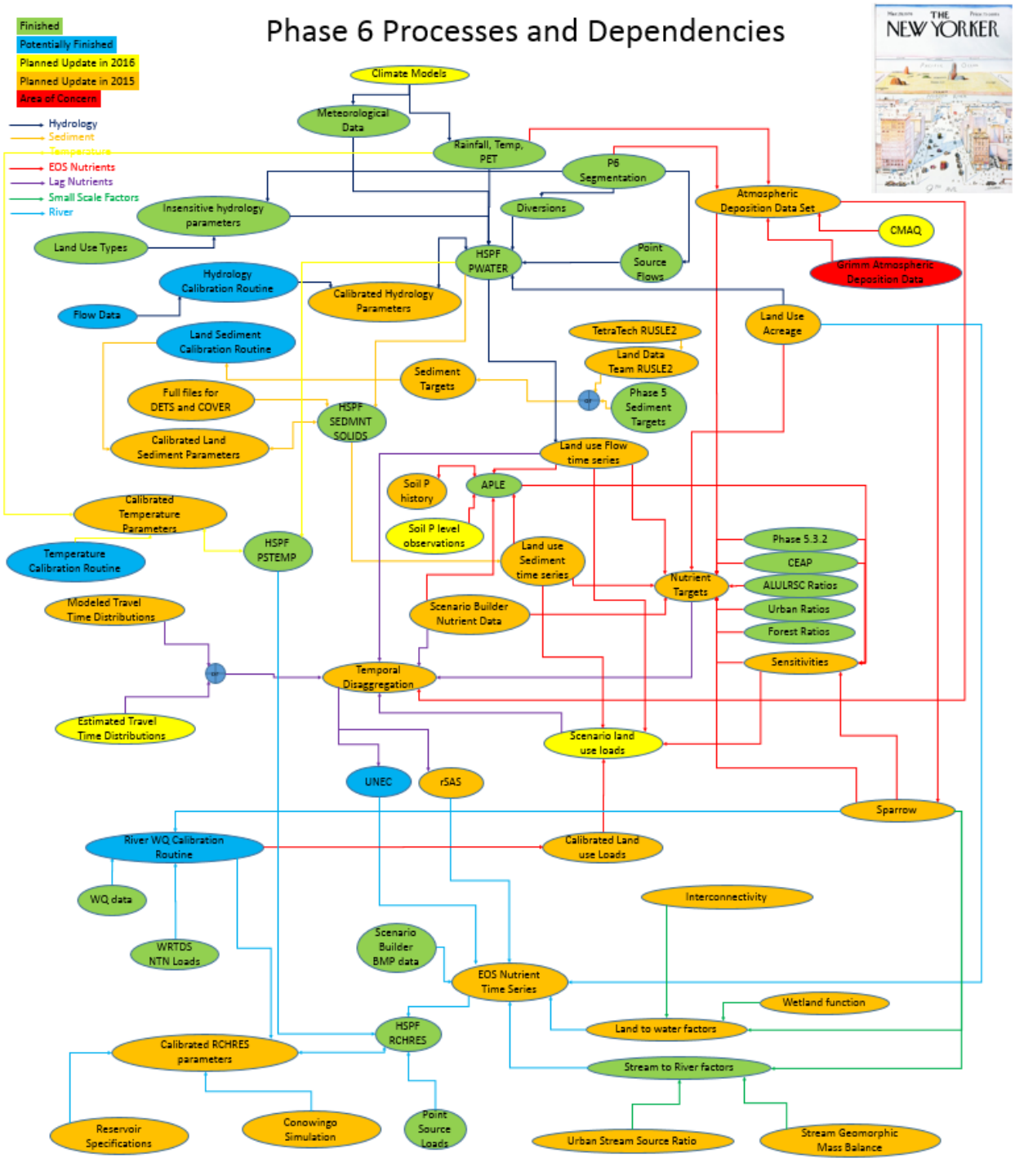
Planned Update in 2016

Planned Update in 2015

Area of Concern

Each box represents a dataset, model, or process

9/3/15



Beta 1 – January 2016

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

Finished

Potentially Finished

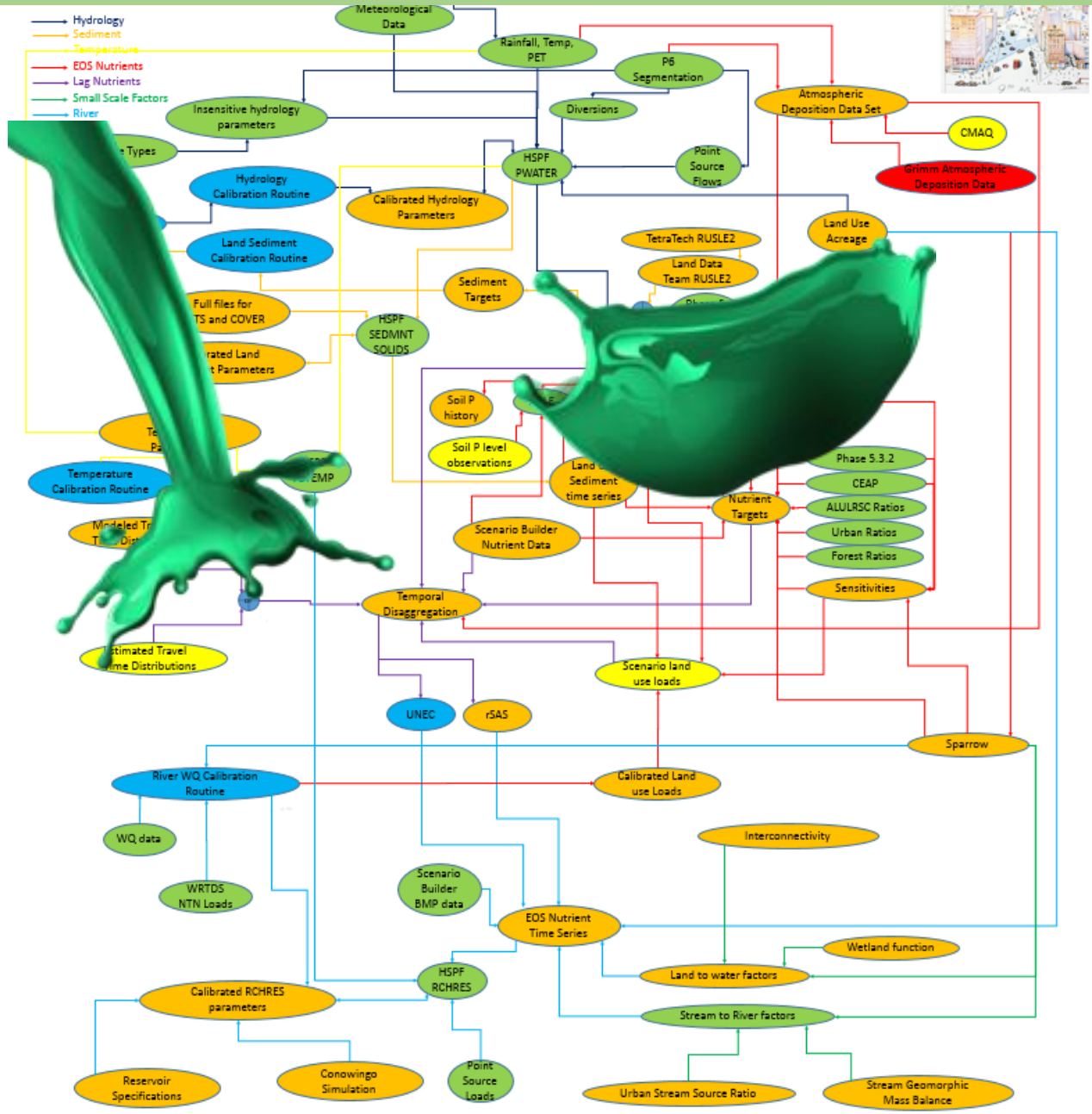
Planned Update in 2016

Planned Update in 2015

Area of Concern

Beta 2 – April 2016

Each box represents a dataset, model, or process



http://www.vectorhq.com/psd/green-liquid-psd-433097

Beta 3 – August 2016





Average Load + ΔInputs * Sensitivity

*

Land Use Acres

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BMPs

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Land to Water

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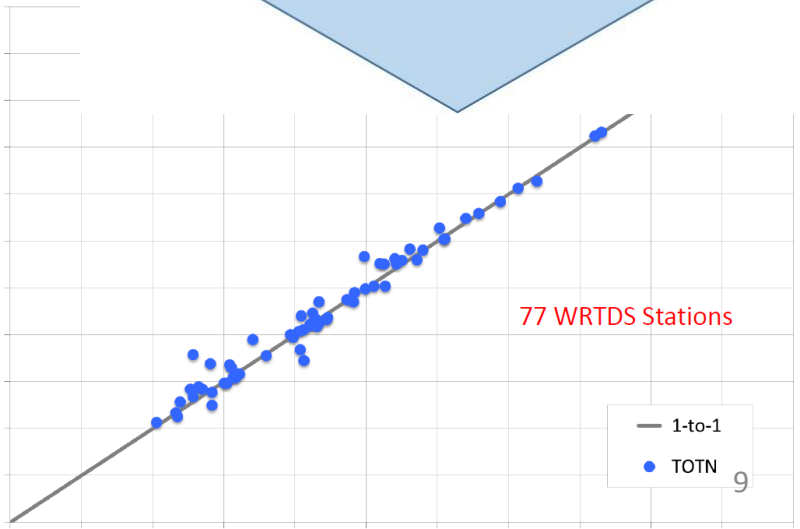
Stream Delivery

*

River Delivery

Direct Loads



http://dsfe.wikia.com/wiki/File:Chief_Inspector_brb.png

Beta 4 – December 2016

Average Load + Δ Inputs * Sensitivity

*

Land Use Acres

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BMPs

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Land to Water

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Stream Delivery

*

River Delivery

Direct Loads

Phase 6

Type here to create a task...

Active	Completed	Due today	Late	All	Created by me
13	21	0	0	34	13

Sort by Project

~~Fix LUGx to print all nutrient constituent for AtDep~~	-	Phase 6 WSM - Beta 4	1
~~Add missing Conowingo Sediment data from USGS-MDL~~	-	Phase 6 WSM - Beta 4	1
~~P620161110WQa~~	-	Phase 6 WSM - Beta 4	1
~~fix the issue with TSSX observation data~~	-	Phase 6 WSM - Beta 4	1
~~Include RIM WRTDS data for other nutrient species for stats calculation~~	-	Phase 6 WSM - Beta 4	
New input source - Small Stream Nutrient and Sediment (Noe/Claggett)	-	Phase 6 WSM - Beta 4	
~~Revised L2W and S2R factors~~	-	Phase 6 WSM - Beta 4	3
~~Update the treatment of BOD~~	-	Phase 6 WSM - Beta 4	3
~~S2R factors to Direct Loads - RIB~~	-	Phase 6 WSM - Beta 4	1
~~New input source - RIB~~	-	Phase 6 WSM - Beta 4	5
~~S2R factors to Direct Loads - Septic~~	-	Phase 6 WSM - Beta 4	2
~~S2R factors to Direct Loads - RPA~~	-	Phase 6 WSM - Beta 4	1
change nomenclature	-	Phase 6 WSM - Beta 4	2
investigate source of differences in Sumout and WQM Input	-	Phase 6 WSM - Beta 4	
~~Ensure UNEC changes are in place for uptake~~	-	Phase 6 WSM - Beta 4	2
sumout vs. wqm input: (a) check for consistency (b) rpa loads	-	Phase 6 WSM - Beta 4	
dissolve all geo linkage between WSM and WSM	-	Phase 6 WSM - Beta 4	1
~~Beta 4 Land use changes:~~	-	Phase 6 WSM - Beta 4	2
Evaluate the effect of SURO on P targets	-	Phase 6 WSM - Beta 4	1
~~Revise handling of BOD, estimate just before loads are added to river~~	-	Phase 6 WSM - Beta 4	1
~~Atmospheric deposition loads summary scripts~~	-	Phase 6 WSM - Beta 4	1
Denitrification does not have temperature dependence - Bohlke	-	Phase 6 WSM - Beta 4	1
lower kSEED,kMXSTAY to address issue with 0 phytoplankton / Chla?	-	Phase 6 WSM - Beta 4	
Calibrate to WRTDS seasonal concentration i.e. 12 data points	-	Phase 6 WSM - Beta 4	1

34 tasks

My Projects (10)

- Phase 6 WSM - Version 2015-07
- Integrated Climate Change Analysis
- Others
- Phase 6 Documentation
- Phase 6 WSM - A Future Build
- Phase 6 WSM - Beta 1
- Phase 6 WSM - Beta 2
- Phase 6 WSM - Beta 3
- Phase 6 WSM - Beta 4
- Phase 6 WSM - Beta 5

Labels (4)

- Climate-Change
- Version-2015-07
- Version-2015-12
- Version-2016-04

Finished

Potentially Finished

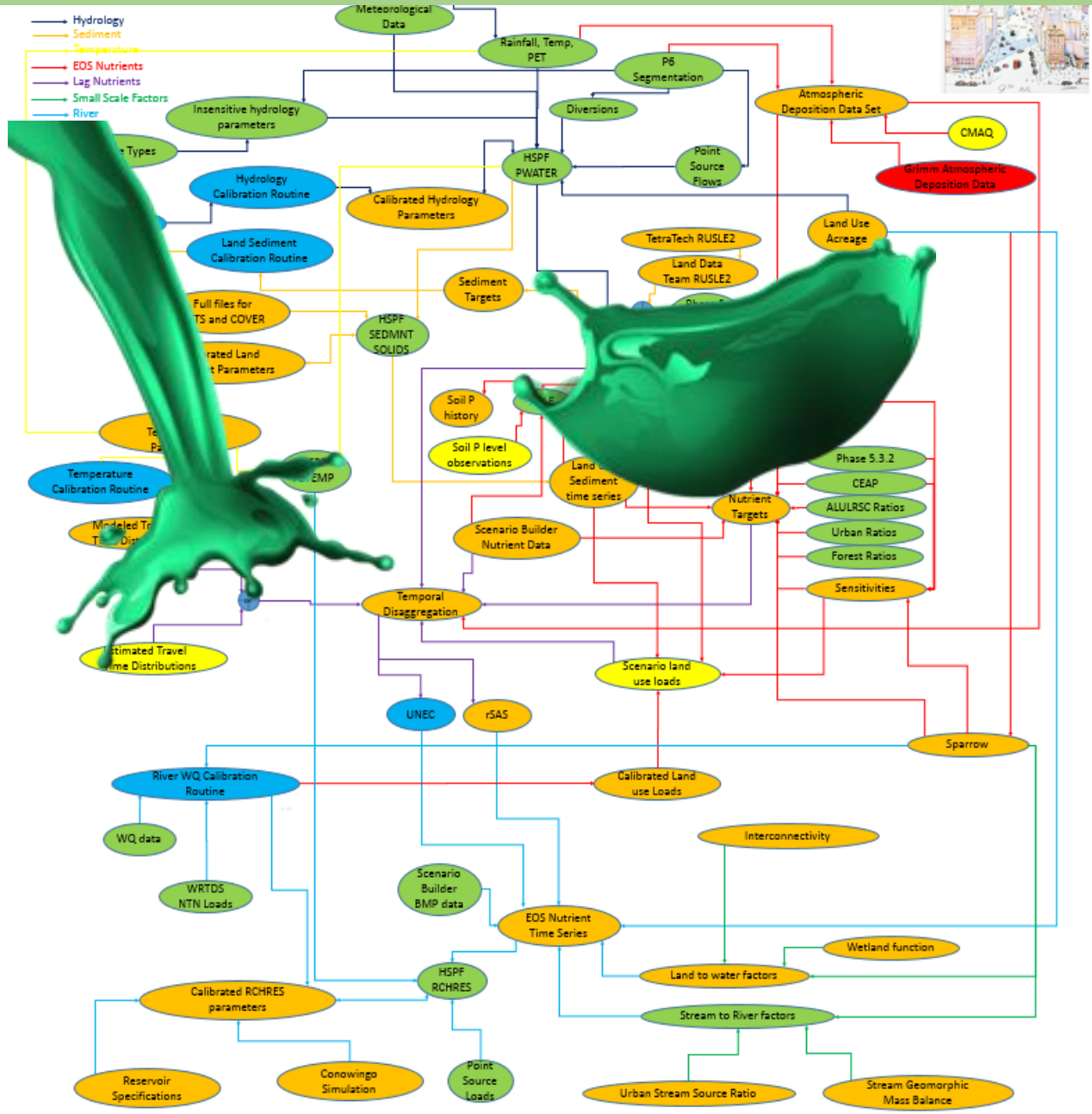
Planned Update in 2016

Planned Update in 2015

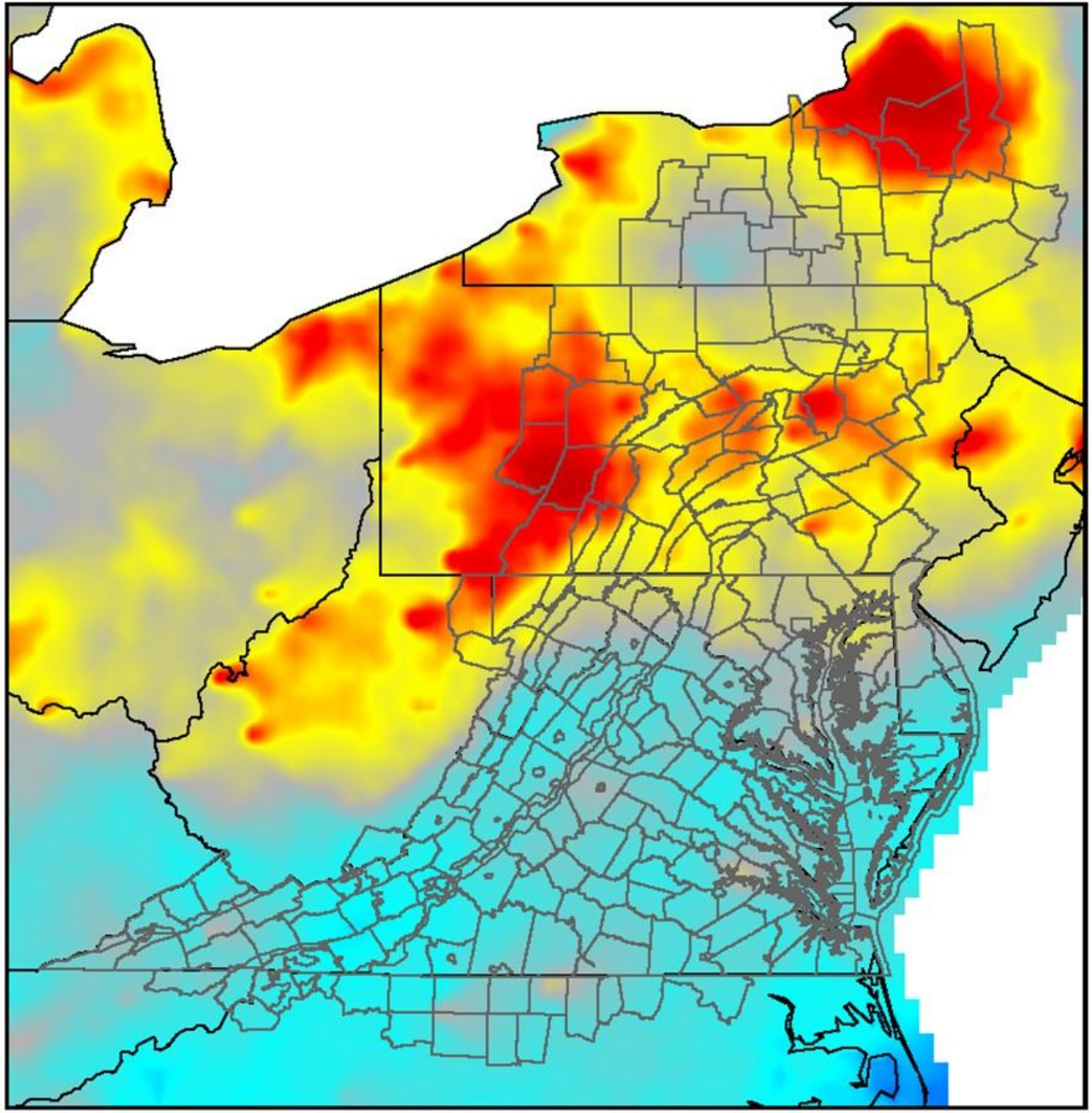
Area of Concern

Beta 4 – December 2016

Each box represents a dataset, model, or process



http://www.vectorhq.com/psd/green-liquid-psd-433097


Mean Annual Nitrate Wet Deposition (kg/ha): 1984-1991
0
3
6
9
12
15
18
21
24
27
>30

Beta 4 – December 2016

Average Load + ΔInputs * Sensitivity

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Land Use Acres

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BMPs

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Land to Water

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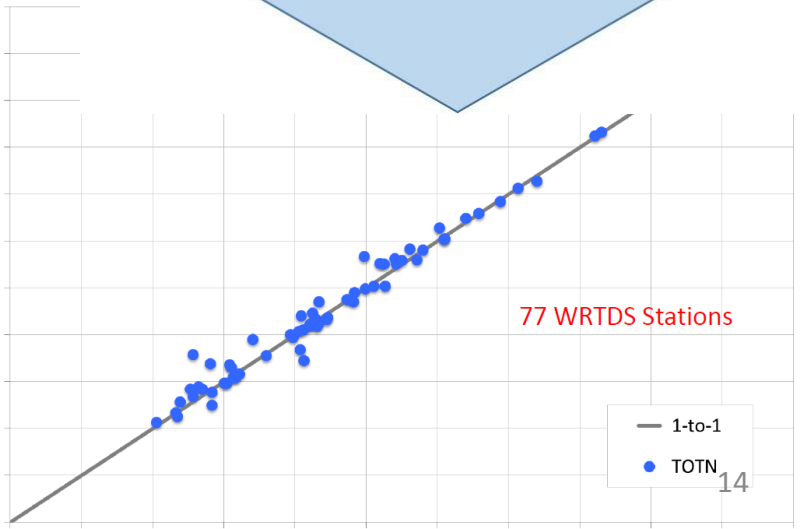
Stream Delivery

*

River Delivery

Direct Loads



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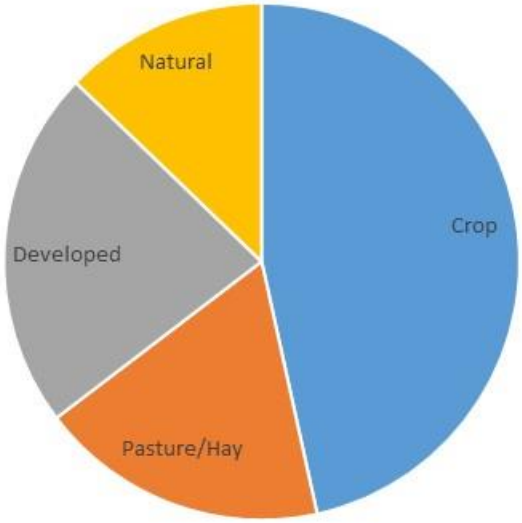
Average Loads

Average Loads – Average edge-of-small-stream loading rate for a given land use for the entire CB watershed



Divide into Broad Classes

Modeling Workgroup

Multiple models

Phase 5.3.2

Sparrow

CEAP





Draft Phase 6 – April 2017

Average Load + ΔInputs * Sensitivity

*

Land Use Acres

*

BMPs

*

Land to Water

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Stream Delivery

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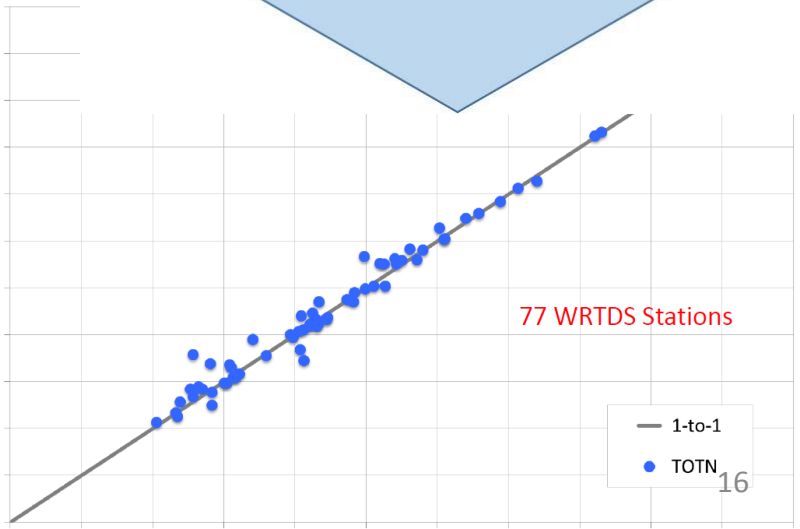
River Delivery

Direct Loads



http://dsfe.wikia.com/wiki/File:Chief_Inspector_brb.png





STAC Review

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

*

Section 5: Land Use

*

Section 6: BMPs

*

Section 7: Land to Water

*

Section 9: Stream Delivery

*

Section 10: River Delivery

Section 1: Overview

Section 8: Direct Loads

Section 11: Applications

Phase 6 Review Questions

Don Scavia (U Mich)
Zach Easton - VT

Pete Kleinman and Doug Smith - ARS

*

Section 5: Land Use

*

Section 6: BMPs

*

Section 8: Direct Loads

Rich Alexander – USGS

and

Larry Band - UNC

*

Claire Welty – UMBC
Jim Pizzuto – U Del
Kathy Boomer - TNC





Phase 6 Review Questions

Sediment:
Jim Pizzuto
Andy Miller - UMBC

Recommendations for the future
- All

What opportunities do we have with the 1m land use?
- Boomer and Band

Documentation Comments
- All

Section 8: Direct Loads

Climate Change
Easton, Scavia, Miller

Conowingo
Miller and ??

Draft STAC review – Major points

- Documentation needs work
  - Rationale for model structure
  - Explain use of multiple models
  - Clarity
- Uncertainty analysis
  - Skill assessment of underlying models
  - Steady-state structure enables UA
  - BMP panels should evaluate uncertainty
- Future sediment models need a different concept
- Develop down-scaled local models

Today's Agenda -- Updates

- 1:00 Climate change – update on WQGIT presentations
- 1:30 Atmospheric deposition CMAQ model
- 2:50 Visualization tools





Work on Phosphorus Simulation

Average Load + Δ Inputs * Sensitivity

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Land Use Acres

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BMPs

*

Land to Water

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Stream Delivery

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River Delivery

Direct Loads

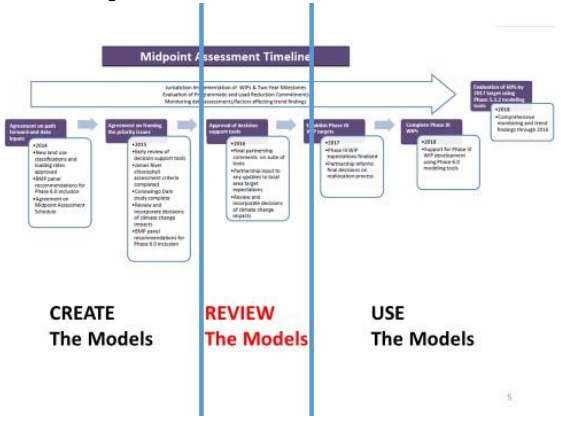
Phase 6

2:30 – Soil Phosphorus History

Table 1. Phosphorus Loss APLE Model Sensitivity to change in inputs

Inputs	Units	MEDIAN SLOPE	MEDIAN SR	Relative Sensitivity
Mehlich	ppm	0.015	0.696	Sensitive
Sediment	ton/ac	0.168	0.633	Sensitive
Runoff	inches	0.057	0.403	Moderately sensitive
~~Manure~~	~~lbs/acre~~	~~0.007~~	~~0.111~~	Slightly sensitive
~~Fertilizer~~	~~lbs/acre~~	~~0.004~~	~~0.068~~	Slightly sensitive
~~Uptake~~	~~lbs/acre~~	~~0~~	~~0~~	Insensitive

Local load = Average Load + ΔInputs * Sensitivity



11:40 – Water Extractable P

Table 1. Phosphorus Loss APLE Model Sensitivity to change in inputs

Inputs	Units	MEDIAN SLOPE	MEDIAN SR	Relative Sensitivity
Mehlich	ppm	0.015	0.696	Sensitive
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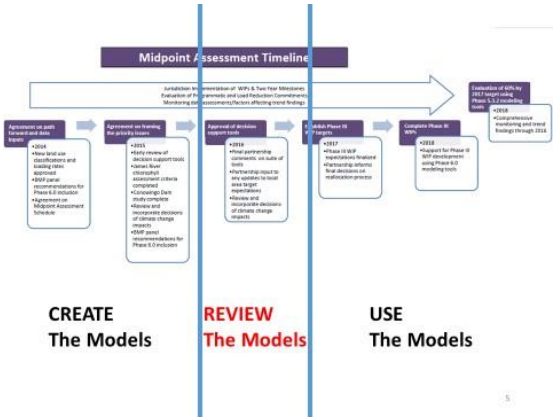
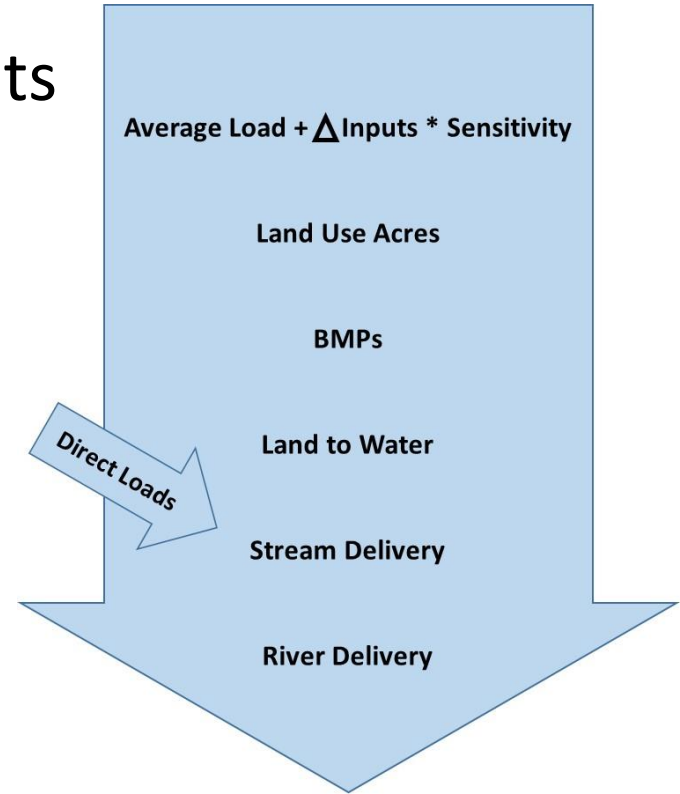
~~Manure~~	~~lbs/acre~~	~~0.007~~	~~0.111~~	Slightly sensitive
~~Fertilizer~~	~~lbs/acre~~	~~0.004~~	~~0.068~~	Slightly sensitive
~~Uptake~~	~~lbs/acre~~	~~0~~	~~0~~	Insensitive

New sensitivity Proposed



Regional Factors

- Modeling workgroup hoped to not use them. Caused sharp changes in loads spatially that were difficult to explain.
- Phase 6 structure explicitly accounts for spatial differences



Regional Factors

- 10:40 – Beta 4 watershed model comparison with loads
- 10:45 tomorrow – Test of WQSTM with different inputs
  - Loaded by WRTDS
  - Loaded by WSM ratioed to WRTDS
  - Loaded by WSM
  - Answers the question: How accurate do we need to be?

Regional Factors – scenario methods for WQSTM

- Loaded by WRTDS
  - Time series decomposition – projects changes in total load, flow-dependence, and seasonality from model scenarios onto WRTDS
- Loaded by WSM ratioed to WRTDS
  - Keep the ratios throughout scenarios.
- Loaded by WSM
  - Same method as P5, no translation needed.

Regional Factors – Decision (early next year)