Watershed Model Structure

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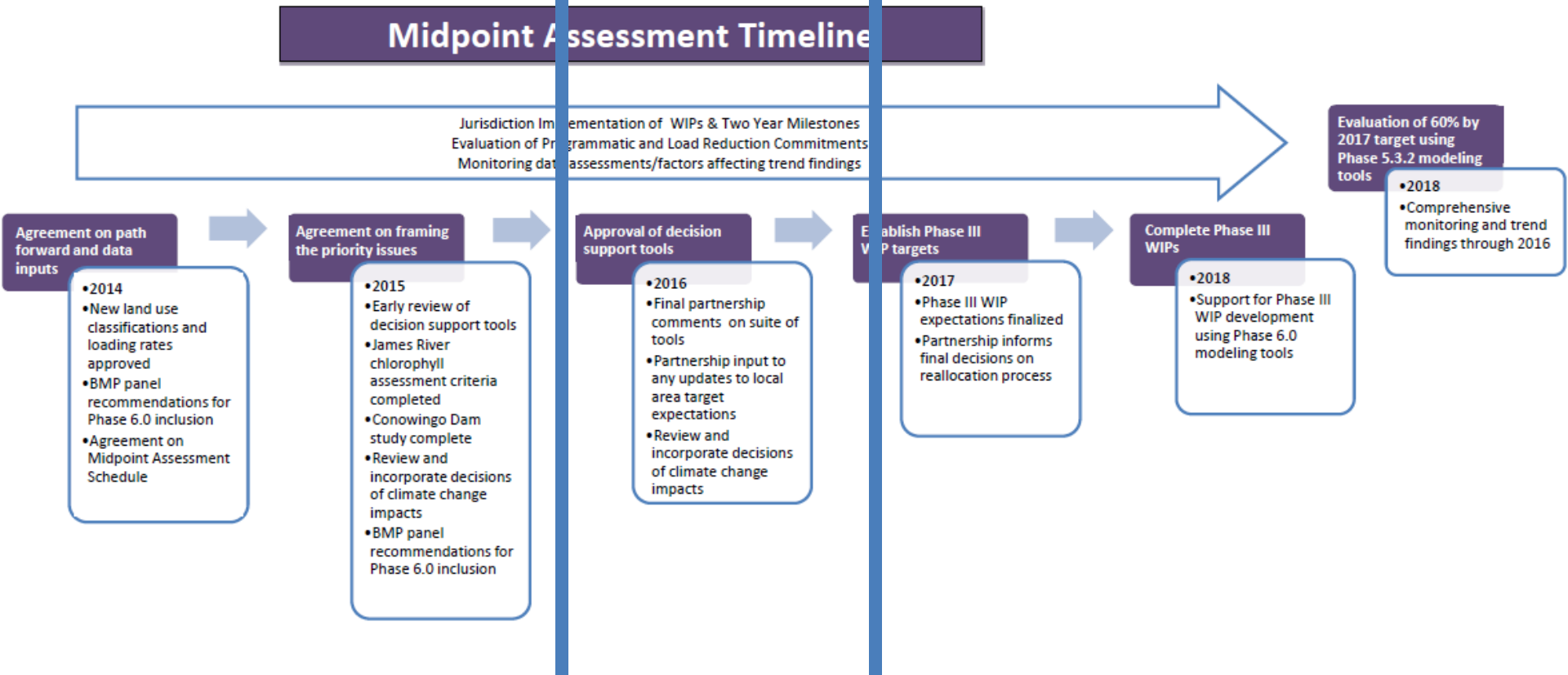
WQGIT 10/7/2014



CREATE
The Models

REVIEW
The Models

USE
The Models

A way to think about model updates

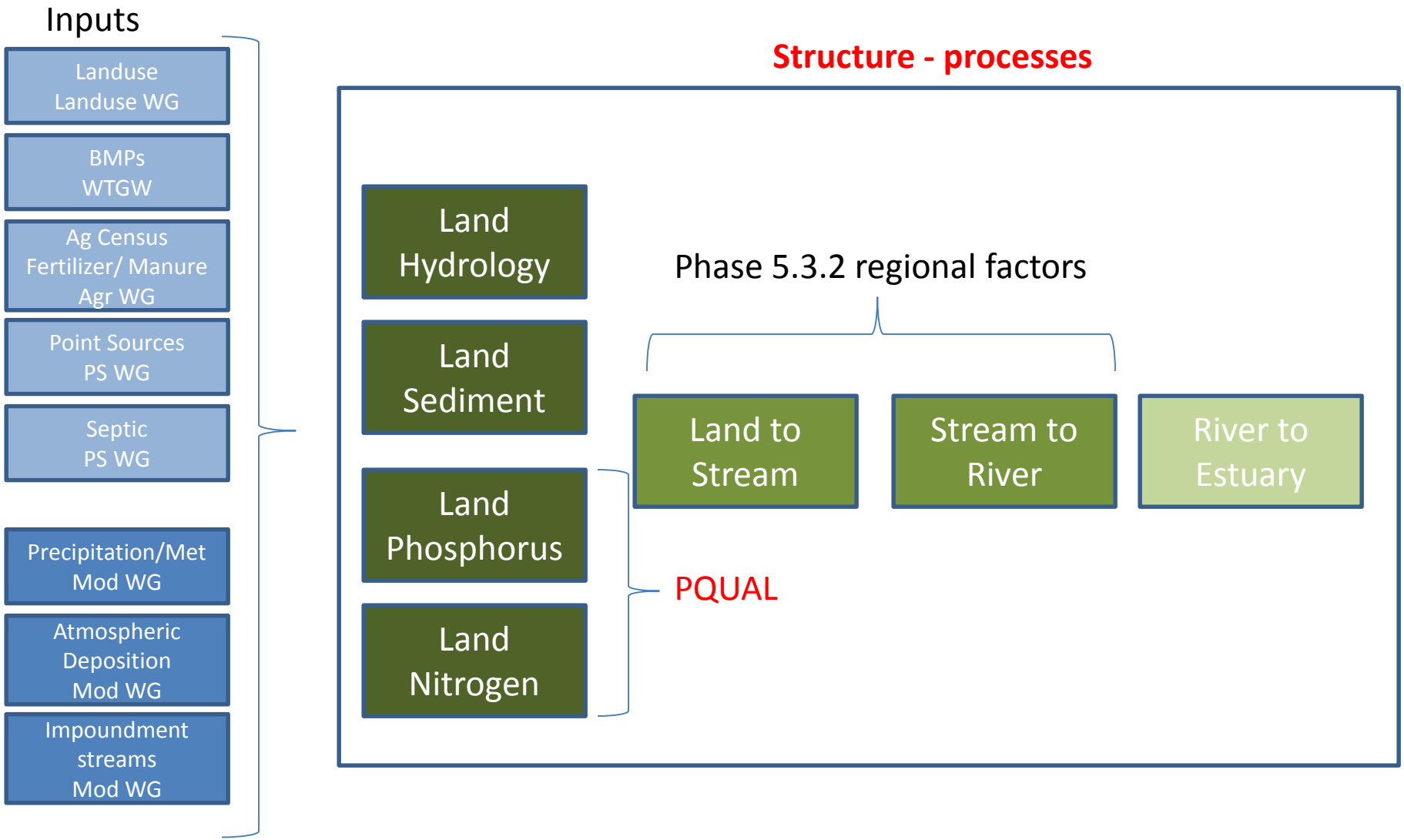
- **Model Structure** – simulating the physical processes (Converting inputs to outputs - **sensitivities**)
- **Model Inputs** – The amount of manure, fertilizer, atmospheric deposition, land type, etc. (changes in inputs result in changes in outputs)
- **Calibration** – Making sure the outputs agree with observations (Setting land loading targets and reaching agreement with monitored river loads)

P6 Watershed Model Structure

- Within modeling workgroup
  - Minimal changes to
    - Segmentation
    - How we simulate hydrology
    - How we simulate land sediment processes
    - How we simulate river processes
  - Updates to
    - Nitrogen and phosphorus land simulation - move to PQUAL concept supporting multiple model approach
    - Regional factors - move to factors based upon physical process
- Updates result in an increase in
  - Transparency, because regional factors represent physical processes and sensitivities facilitate clear explainable linkage between inputs and outputs
  - Accuracy, as the use of sensitivities, instead of AgChem, provide a mechanism to include multiple models thus strengthening the science supporting our decision tools

Watershed model

Watershed Model **Inputs** and **Structure**



Partnership Priorities for the WSM

- Make it simpler
- Make it understandable
- Make it more predictable
- Use more local information

How the Phase 5 Model Works

Precipitation

Fertilizer
Manure
Atmospheric deposition

Management filter

Runoff

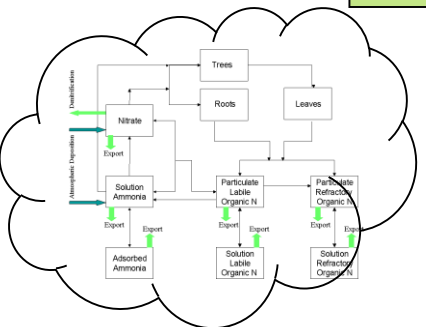
River

Hydrology submodel

Sediment submodel

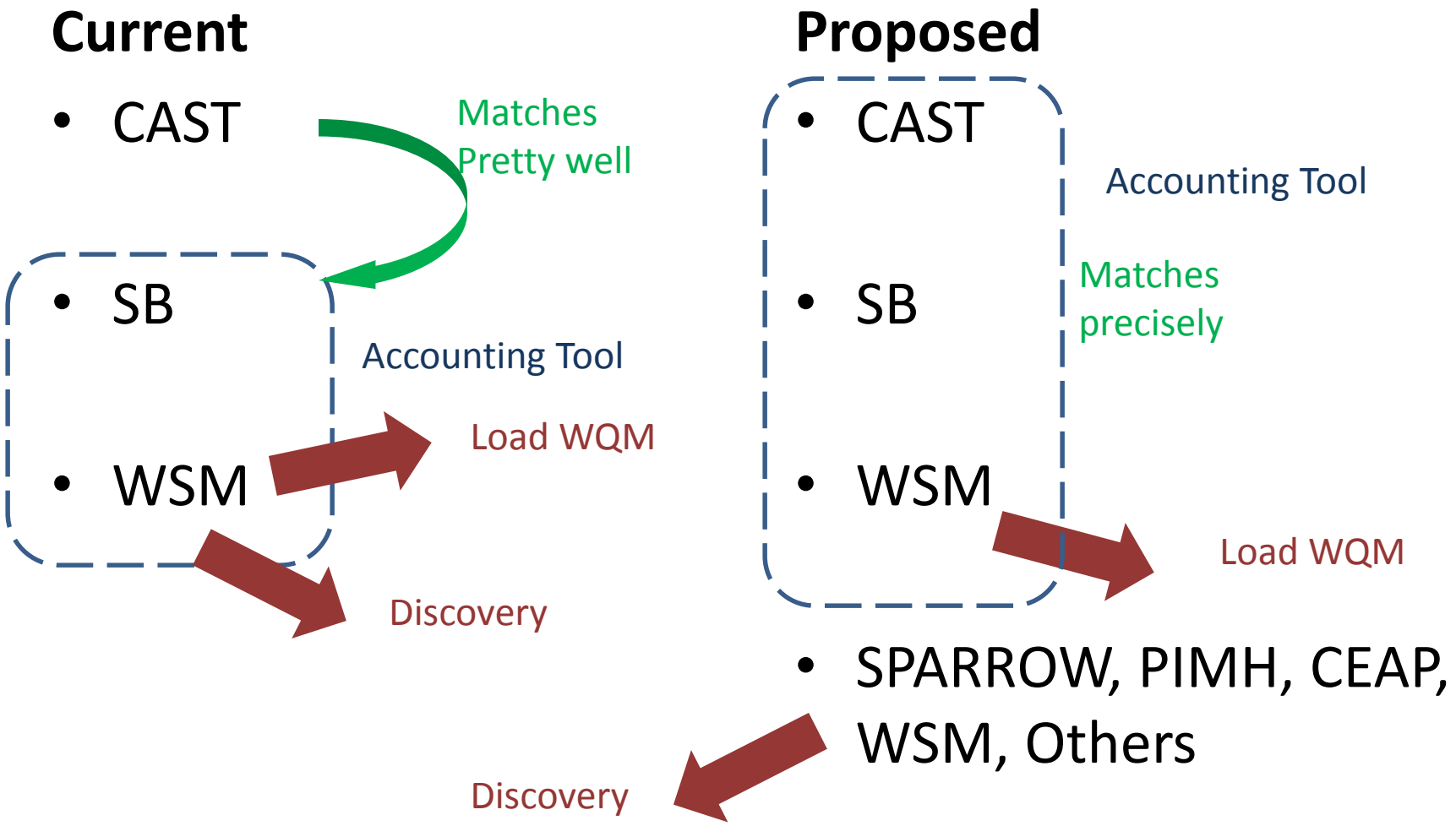
Phosphorus submodel

Nitrogen submodel

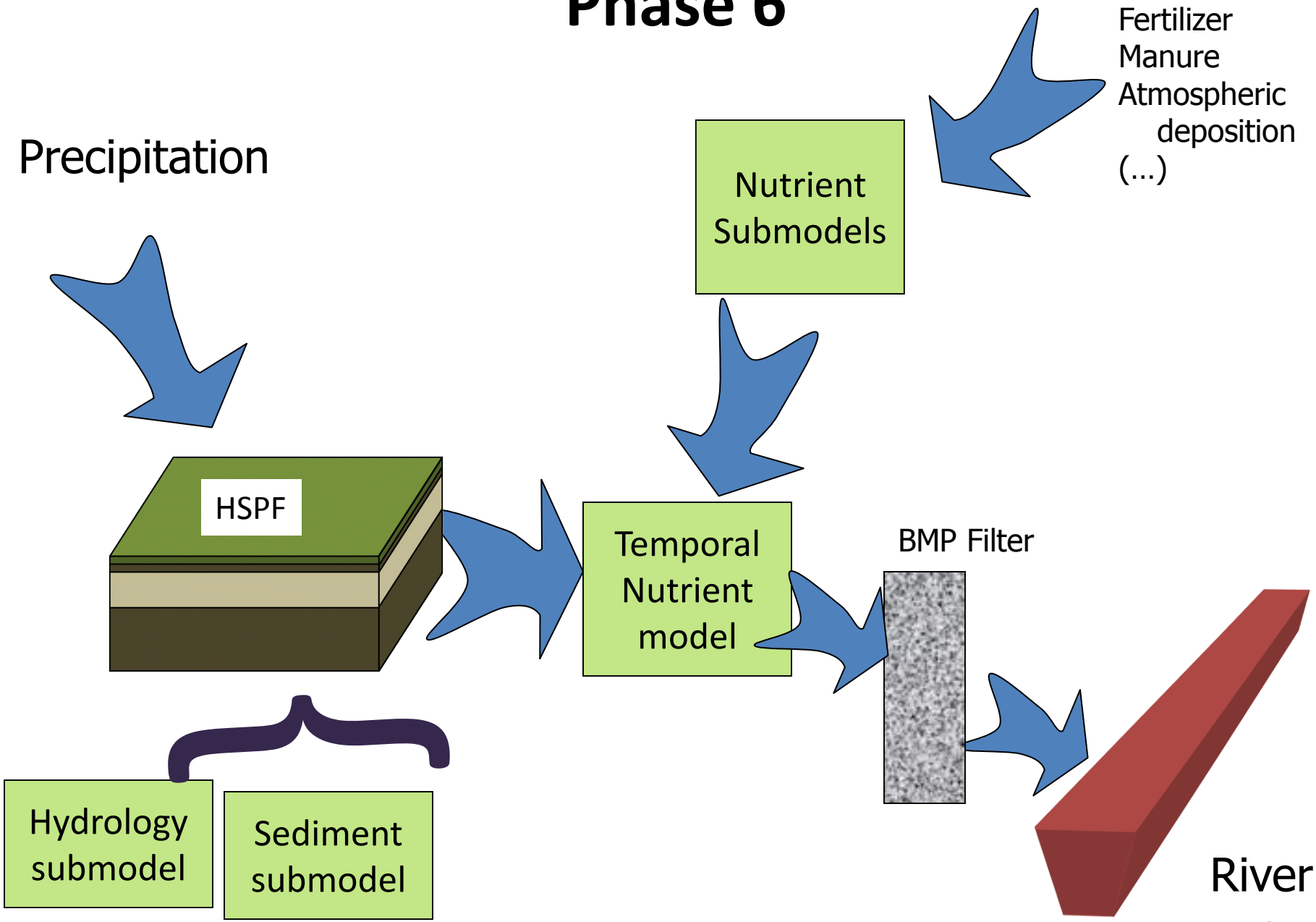


hourly

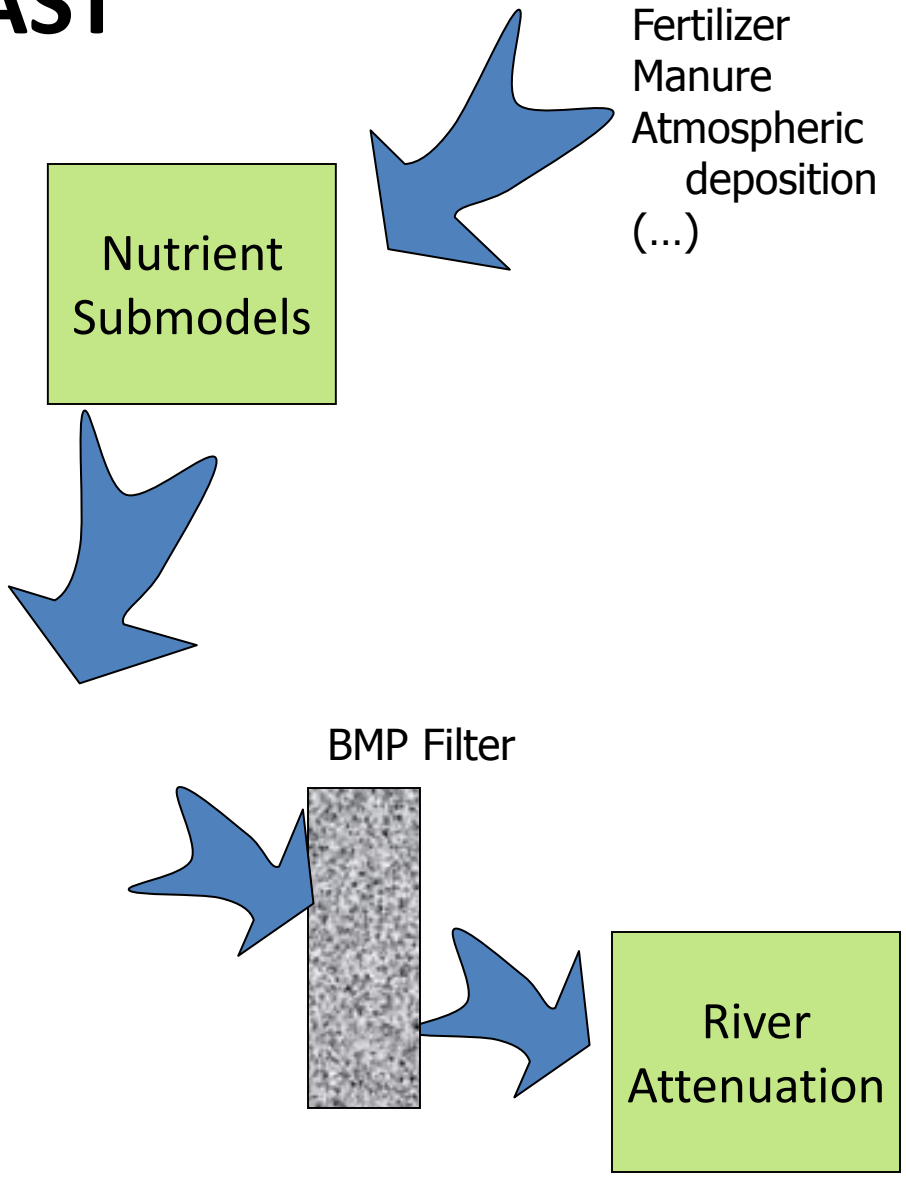
Possible Re-configuration



Phase 6


Fertilizer
Manure
Atmospheric deposition
(…)
Nutrient Submodels
Precipitation
HSPF
Temporal Nutrient model
BMP Filter
Hydrology submodel
Sediment submodel
River

CAST


Fertilizer
Manure
Atmospheric deposition
(…)
Nutrient Submodels
BMP Filter
River Attenuation

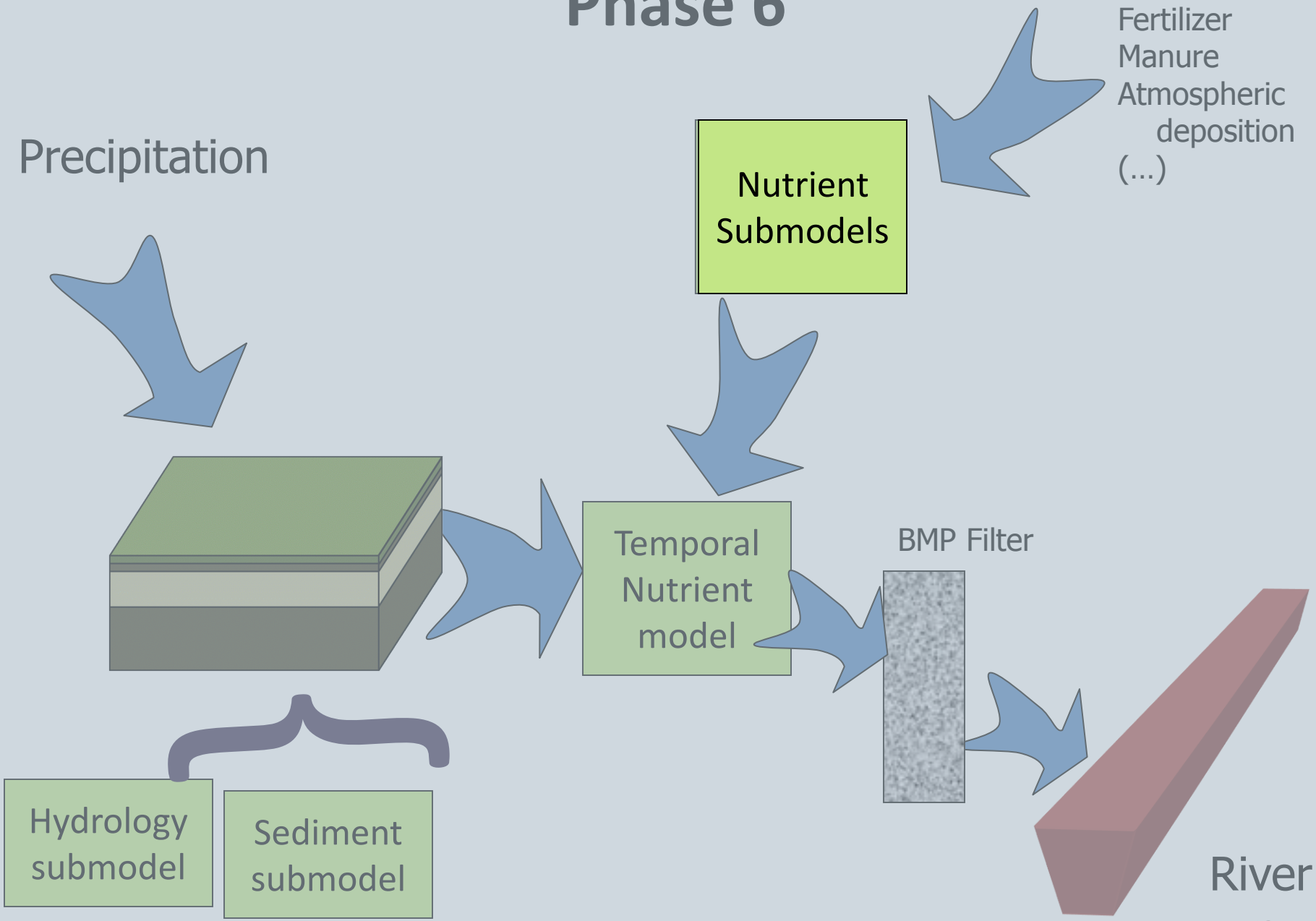
Watershed Model

- Change in load due to management
- Calibration sets parameters needed for WSM and CAST
  - Land use loads
  - Load attenuation
  - Sensitivity to inputs
- Loads the Estuarine model

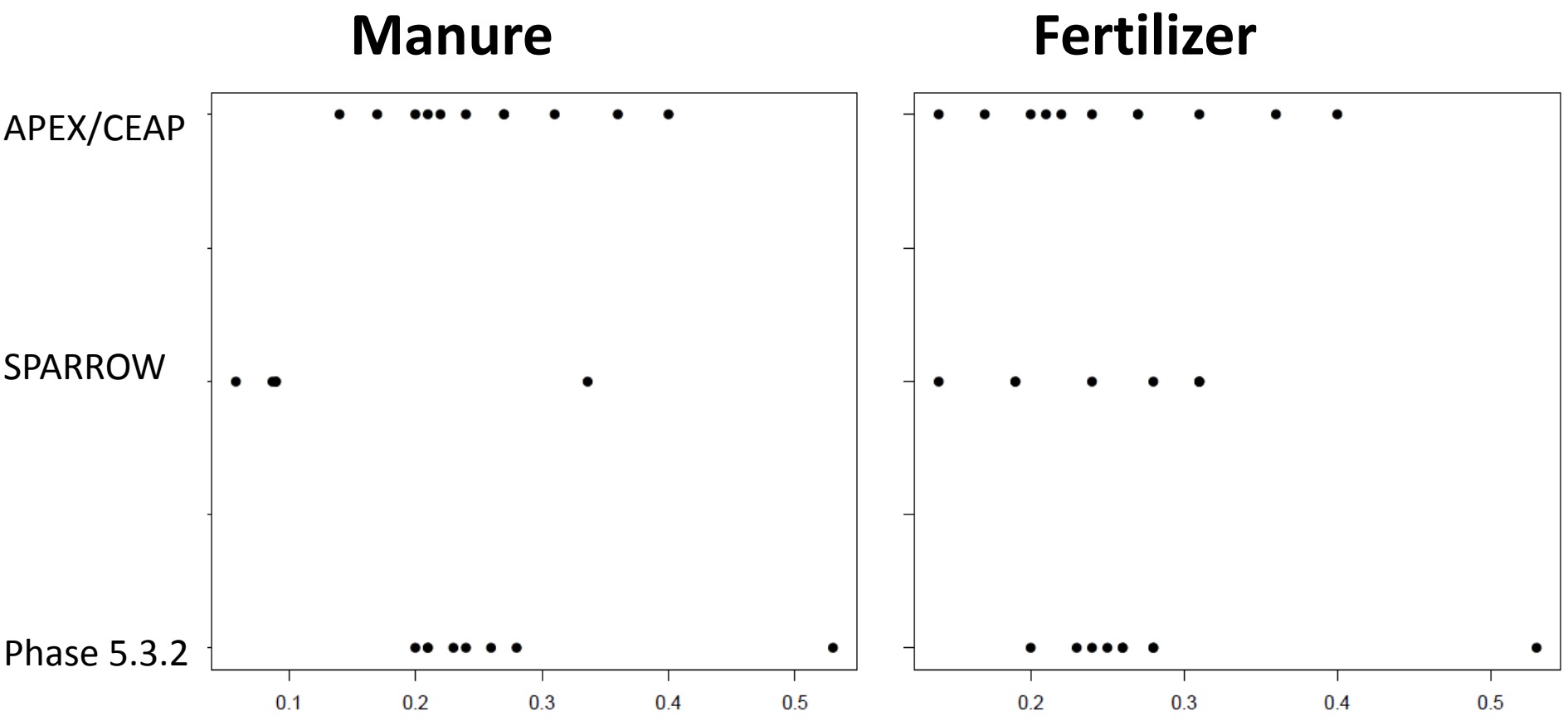
CAST

- Change in load due to management

Phase 6

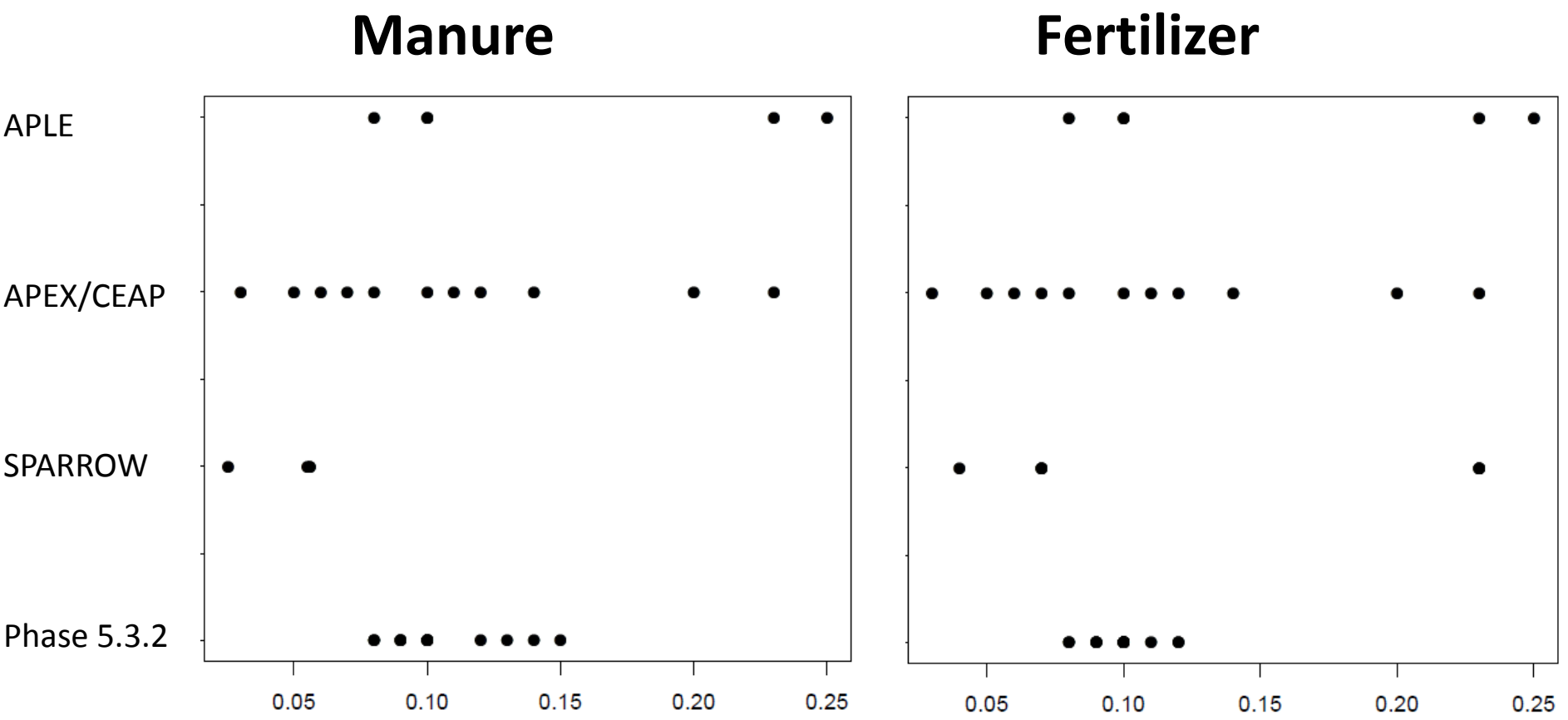

Fertilizer
Manure
Atmospheric deposition
(…)
Nutrient Submodels
Precipitation
Temporal Nutrient model
BMP Filter
Hydrology submodel
Sediment submodel
River

Nutrient Submodels - Nitrogen



Change in pounds exported per change in pounds applied

Nutrient Submodels - Phosphorus

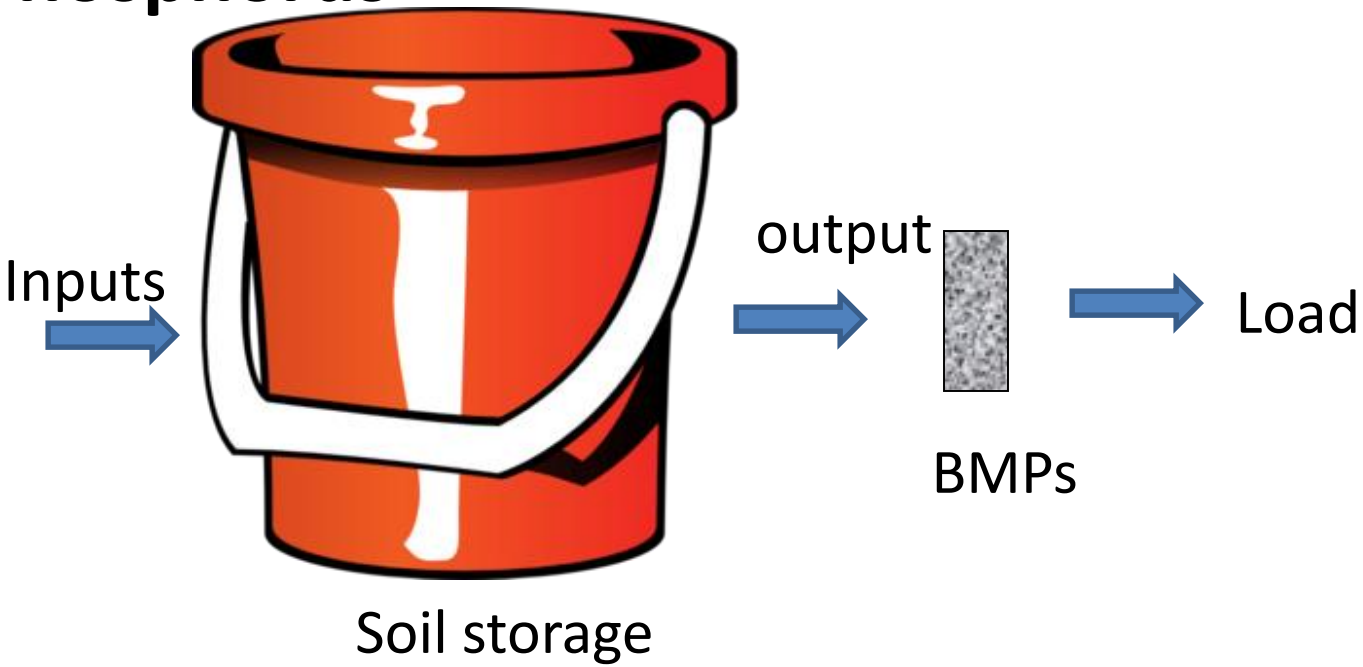


Change in pounds exported per change in pounds applied

STAC Phosphorus Report

- Gather Soil Data
- Adjust Simulation – Investigating APLE

Phosphorus



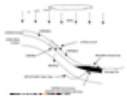
Constant Delivery Factors

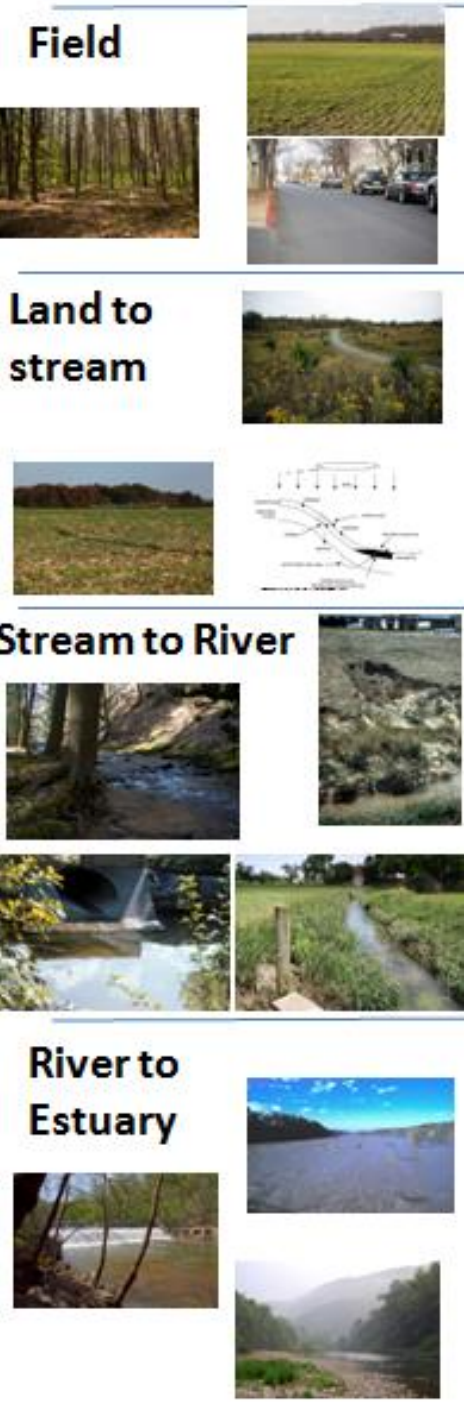
- 2011 - WQGIT made Delivery Factors constant for all management scenarios for Phase 2 WIPs and beyond
- 2012 – still some discussion in the WQGIT of how loads changed
- 2013 – kept the CDF approach

Model Segmentation

- No Plans to change land-river segmentation scheme.
- Federal lands will be land uses rather than federal segments
  - Can accommodate more agencies
  - Can accommodate changes in federal land extent through time

Scale in the Chesapeake Bay Program Watershed Model

Landscape	Phase 5 Nutrients	Phase 5 Sediment	Phase 6 Nutrients	Phase 6 Sediment	Sparrow	Other Data Sources
Field   		**AG and Forest:** Used RUSLE2 to estimate EOF sediment targets **Urban**: Used Langland and Cronin To estimate pervious vs impervious loading	*Can we estimate EOF loads directly based on available information?*	*Should we update the sediment EOF estimates?*	Sources (fertilizer, manure, atdep, urban area) multiplied by global coefficients	Literature Reviews from TetraTech Sources in Phase 5 documentation Sensitivity documentation CEAP APLE
Land to stream   	Field-level, hillslope, and small stream processes are all combined in the Edge-of-Stream nutrient estimates No EOF is simulated EOS estimates are a combination of regional factors and field-scale process simulation calibrated to average export rates Informed by inputs and calibration	Hillslope and small stream processes are combined in a sediment delivery ratio that is based on the average distance between each major land use type and a major river, adjusted for the coastal plain.	*Can we estimate watershed delivery based on landscape parameters?*		Land to Water factors such as soil parameters and slopes	ICPRB/USGS Sparrow Land Data team Connected Impervious Land Data team Urban Tree Canopy
Stream to River    			*Can we estimate small stream effects?*		Explicitly simulated to NHD+ level	ICPRB/USGS Sparrow Land Data team Urban Stream Corridor Land Data team Riparian Forest Land Data team Riverine Wetlands Center for Watershed Protection CBP Grant
River to Estuary   	Directly Simulated in HSPF for river averaging at least 100 cfs Calibrated to WQ data		Directly Simulate in HSPF for river averaging at least 100 cfs Calibrate to WQ data		Explicitly simulated	Calibrate to sparrow DFS or loads?



Phase 5

Nutrients

Field-level, hillslope, and small stream processes are all combined in the Edge-of-Stream nutrient estimates

EOS estimates are a combination of regional factors and field-scale process simulation calibrated to average export rates

Sediment

Edge of field is explicitly simulated

Sediment delivery ratio based on the average distance between each major land use type and a major river.

Directly Simulated in HSPF for river averaging at least 100 cfs

Calibrated to WQ data

Phase 6

Nutrients

Can we estimate EOF loads directly based on available information?

Sediment

Should we update the sediment EOF estimates?

Can we estimate watershed delivery based on landscape parameters?

Can we estimate small stream effects?

Directly Simulated in HSPF for river averaging at least 100 cfs

Calibrated to WQ data

Sources of Information

Sparrow sources coefficient (fertilizer, manure, atdep, urban area) multiplied by global coefficients

Literature Reviews from TetraTech
Sources in Phase 5 documentation
Sensitivity documentation
CEAP
APLE

Sparrow Land to Water factors

Land Data team Connected Impervious

Land Data team Riparian Forest

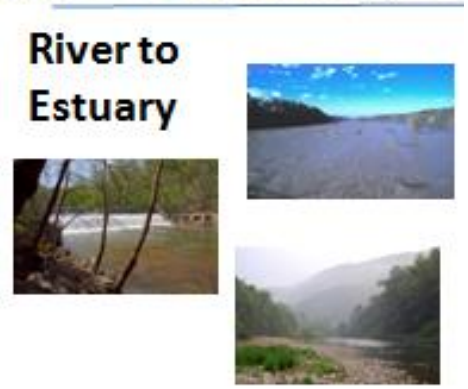
Land Data team Urban Tree Canopy

Land Data team Riverine Wetlands

Land Data team Urban Stream Corridor

Sparrow simulated to NHD+ level

Center for Watershed Protection CBP Grant

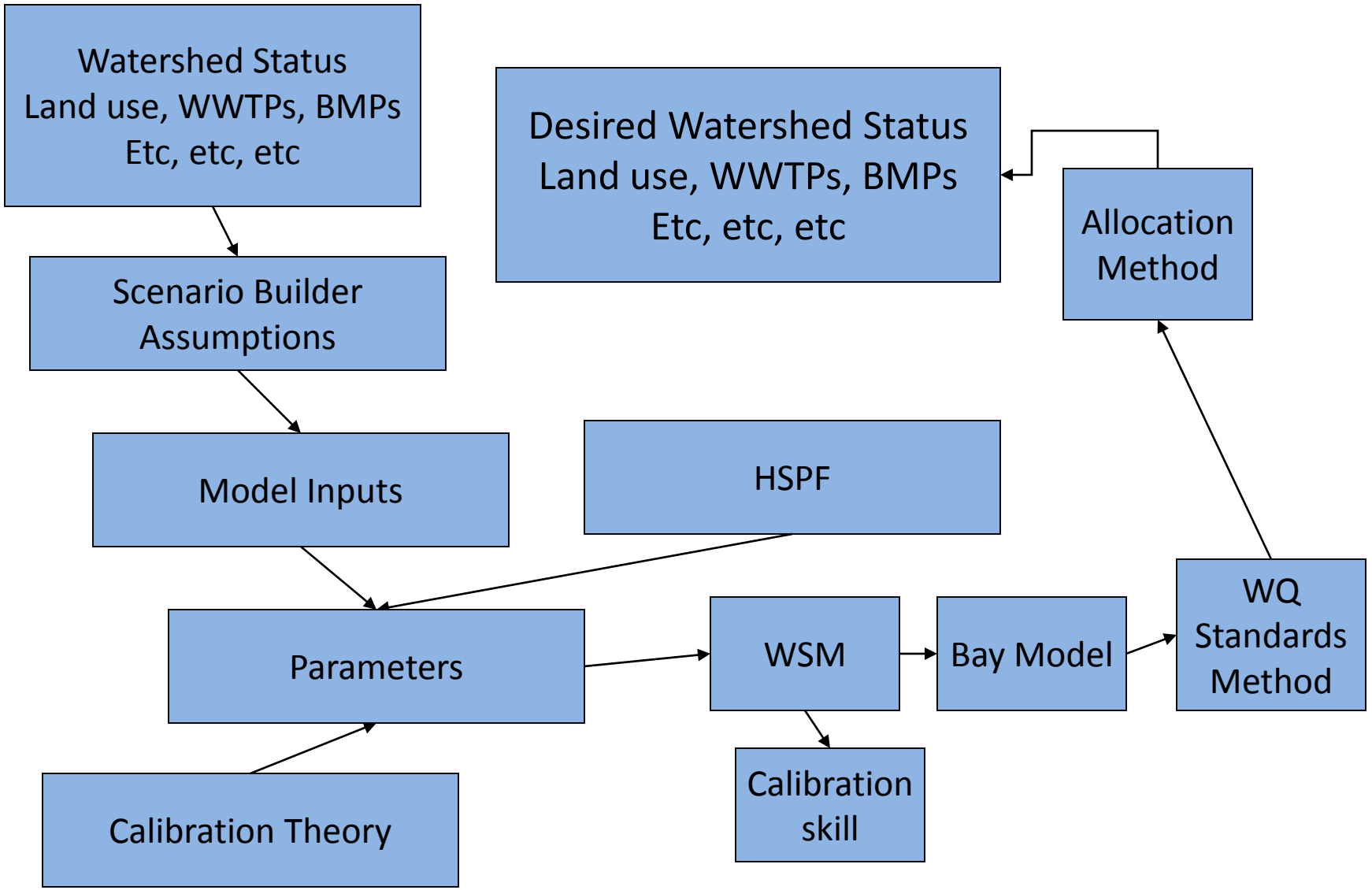


Longer calibration perdiod

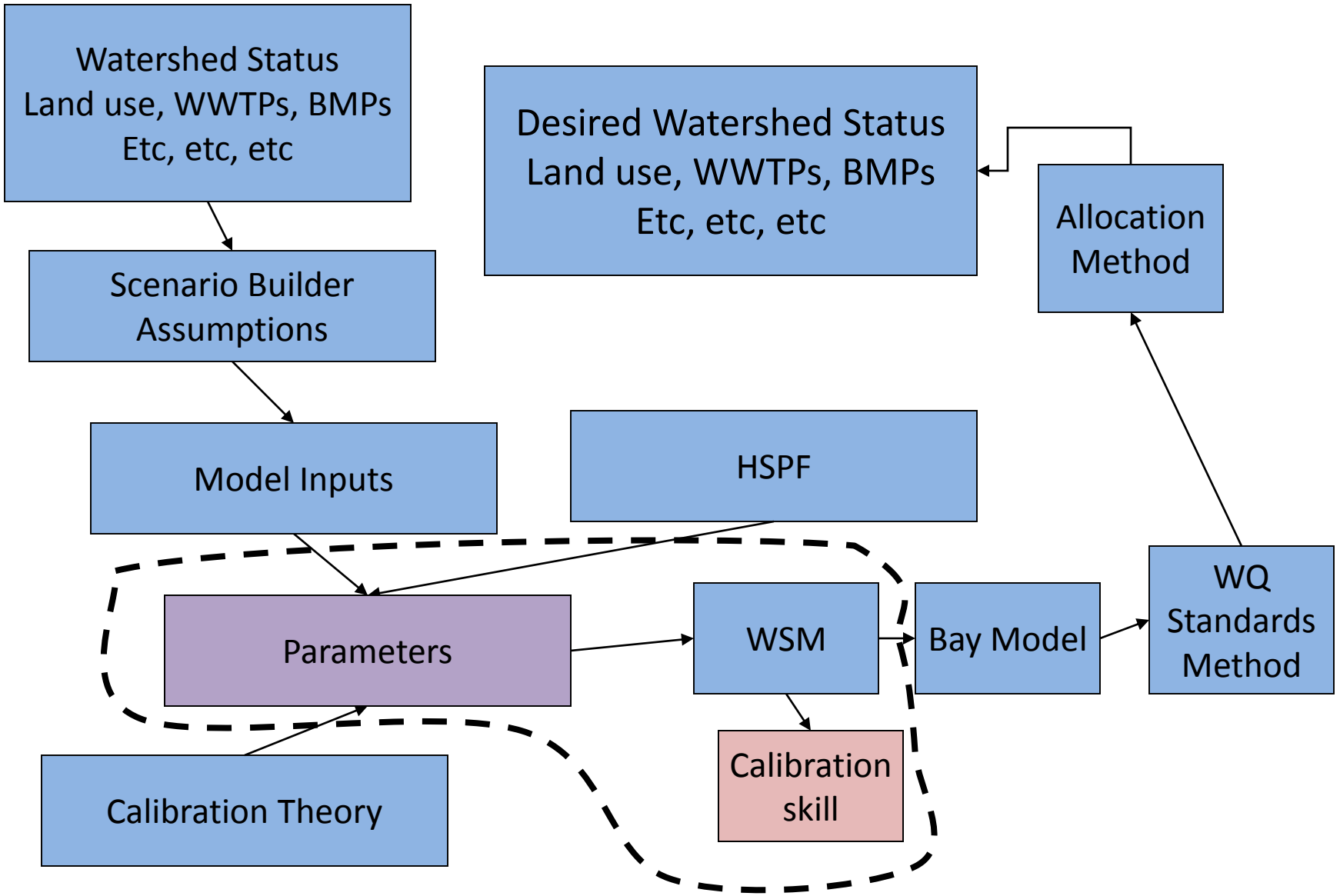
Uncertainty Analysis

- Difficult to undertake
- Can’t realistically start before 2016
- Need for management to define question

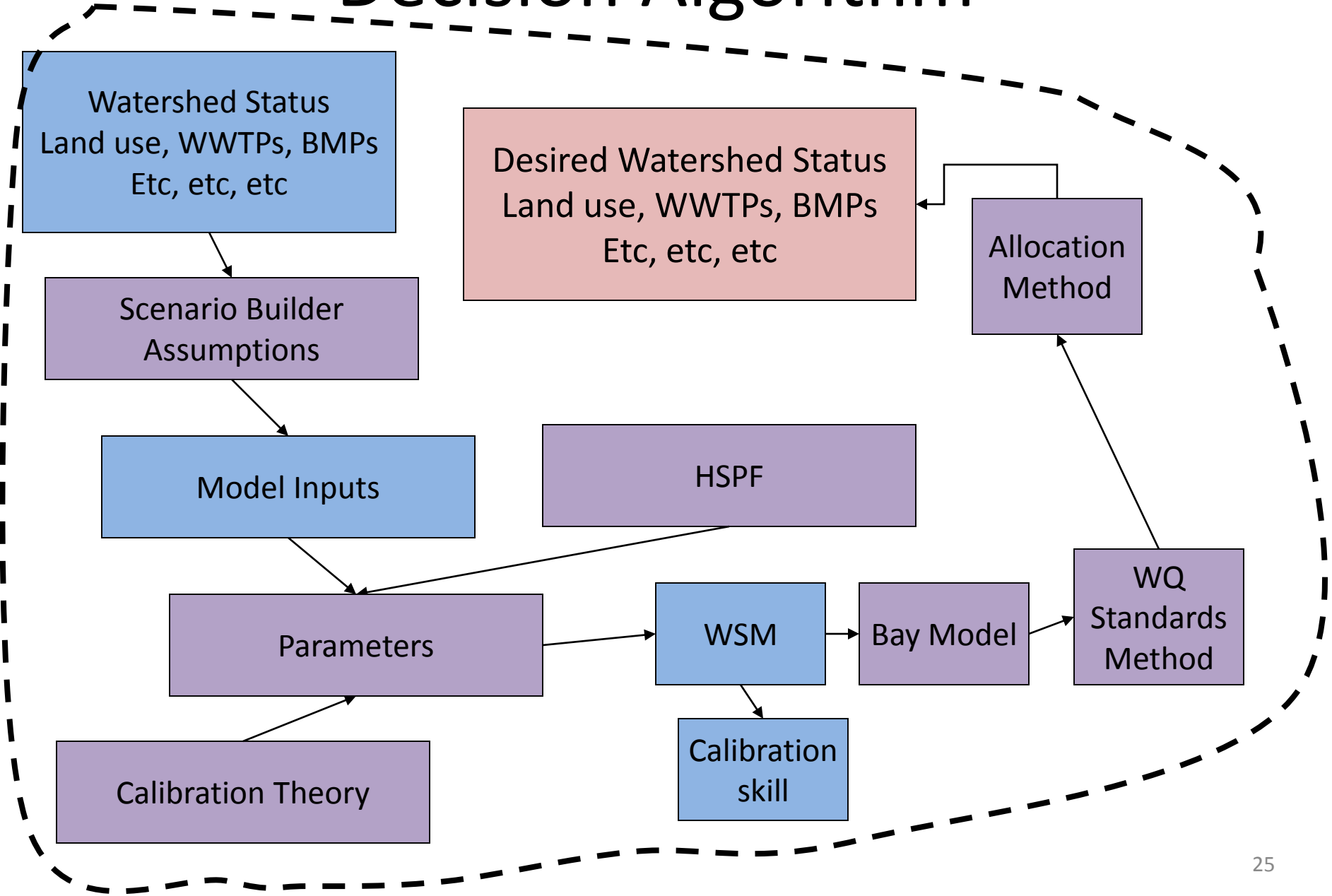
Decision Algorithm



Traditional Uncertainty Analysis



Decision Algorithm



Review and Validation

- Continual Review in WQGIT Workgroups
- Continual Review in Modeling Workgroup
- STAC review in early 2016
- Year of partnership review in 2016
- Validation to follow reserved data method recommended by STAC in 2008

Documentation

- During Development
  - Midpoint Assessment Model Webpage
  - Workgroup Minutes
  - Presentations

- Evaluation Period
  - Create full documentation in 2016

Who We Are
How We Work
How We're Organized
- Chesapeake Executive Council
- Principals' Staff Committee
- Management Board
- Citizens Advisory Committee
- Local Government Advisory Committee
- Scientific and Technical Advisory Committee
- Communications Workgroup
- Scientific and Technical Analysis and Reporting

Scenario Builder and Watershed Model Plan for the MPA

In preparation for the 2017 Mid-Point Assessment, the CBP Partnership has expressed priorities for the Phase 6 watershed model development which are detailed in documents under the 'Projects and Resources' tab on the Water Quality GIT page. Initial priorities were set in the October 2012 water quality GIT meeting. These priorities have been updated and refined by recommendations from subsequent workshops and CBP meetings. The MPA master schedule lists these priorities in a table format. Additional documents on the web page are specific work plans to accomplish these tasks.

Out of necessity, phase 6 development is occurring along multiple parallel paths. These must eventually meet in a draft phase 6 watershed model and scenario builder that will be ready for full partnership review beginning January 1 2016. These parallel paths encompass all of the CBP priorities.

This document summarizes the priorities and identifies lead researchers for each effort. The descriptions here are brief with links to more detailed workplans.

Efforts

Below are the efforts related to the Scenario Builder and Watershed Model Plan for the Mid-Point Assessment

- **BMP effectiveness**
- **BMP Implementation Accounting**
- **Fertilizer and Manure Applications**
- **Land Use Types and Acreage**
- **Land Use Loading Rates**

MPA Web Site

- Web site to keep the Partnership up-to-date on model development
- Continual updates
- Your name is on the page
  - You own the content.

File Edit View History Bookmarks Tools Help

Climate Change - Chesape... | New Tab | Water Quality Goal Implem...

www.chesapeakebay.net/groups/group/water_quality_goal_implementation_team

amy freitag

Water Quality Goal Implementation Team (GIT 3)

Scope and Purpose

The charge of the Water Quality Goal Implementation Team (WQGIT) is to evaluate, focus, and accelerate the implementation of practices, policies, programs that will restore water quality in the Chesapeake Bay and its tributaries to conditions that support living resources and protect human health. The Team reports to the Management Board and Principals' Staff Committee. Functions include:

- Provide a forum for discussion, exchange of information, and evaluation among federal, state, and local agencies, river basin commissions, industry groups, universities, and other interested parties on water quality goals, data, modeling, authorities, and restoration efforts.
- Evaluate and promote strategies to reduce nutrient, sediment, and chemical contaminant loads from municipal, industrial and onsite wastewater; agricultural lands and animal operations; urban and suburban stormwater; forested lands; tidal and in-stream sediment; and air emissions.
- Promote consistent, uniform and transparent processes to model, track, report, and verify water quality restoration efforts.
- Identify, define, quantify, and incorporate pollutant reduction and conservation practices into the Chesapeake Bay Program decision support system.
- Provide technical expertise and leadership to support the development, implementation, and tracking of the Chesapeake Bay TMDL, Watershed Implementation Plans, and two-year milestones that support long-term Bay restoration goals.

BMP Review Protocol

The Water Quality Goal Implementation Team (WQGIT) is responsible for approving the loading rates, and percentage adjustments to these rates, used in the Chesapeake Bay Watershed Model (CBWM). Through the Protocol for Development, Review and Approval of Loading and Effectiveness Estimates for Nutrient and Sediment Controls (BMP Review Protocol), newer practices and technologies are considered and evaluated for inclusion in the Chesapeake Bay Program partnership modeling tools. Existing practices are re-evaluated to ensure they reflect the best available scientific data and information.

A table depicting the BMPs identified for review, and the status of these reviews, is available here.

Midpoint Assessment

New **web page** summarizes the priorities and identifies lead researchers for each effort. The descriptions are brief with links to more detailed workplans.

Guiding Principles working draft 11.26.12 (96.89 KB)

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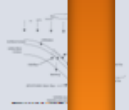
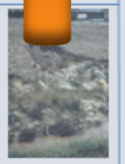
Land to stream   	Field[illegible], hillslope, [illegible] stream [illegible] are all com[illegible] in the Edge-of-St[illegible] esti[illegible] No B[illegible]simulate EOS[illegible]ates are com[illegible]on of reg[illegible] facte[illegible]d field-sc[illegible] process simulation calibrated to average export rates Informed by inputs and calibration	Hillslope and small stre[illegible] are co[illegible]ment delivery ratio t[illegible] based on the[illegible]e di[illegible]ch n[illegible] and use[illegible] and a[illegible] river[illegible]ed fo[illegible]	*Can we e[illegible]te watershe[illegible]very [illegible]ased on[illegible]cape [illegible]ramet[illegible]*	*Can we estimate small stream effects?*	La[illegible]ater factors su[illegible]oil parameters a[illegible]pes Explicitly simulated to NHD+ level	ICPRB/USGS Sparrow Land Dat[illegible]n Connected [illegible]mpervio[illegible] [illegible]nd Data[illegible] Urban Tree Canopy
Stream to River    						ICPRB/USGS Sparrow Land Data team Urban Stream Corridor Land Data team Riparian Forest Land Data team Riverine Wetlands Center for Watershed Protection CBP Grant
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Thank You