CBP Watershed Model Planning for 2017

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Management Modeling Maxims

- Absolute Rule #1
  - Always Improve and Never Change
- Absolute Rule #2
  - Include Everything and Keep it Simple

What We've Learned Through the WIP process

- Transparency (doesn't mean what we thought it did)
- Scalability
- User-Friendliness

"We want to be able to explain the WSM to our stakeholders and have it make sense."

Details We've Heard Already

- Multiple Models
- Incorporation of additional data
  - Non-cost shared BMP implementation data
  - Observed data past 2005
- Revisit land uses
- Nutrient use policies
- Lessen/explain regional factors
- Sensitivity to Inputs

EPA/USDA Work Plan

- Improve tracking and reporting of BMPs
- Investigate consistent land use estimates – particularly pasture and hay
- Investigate differences in fertilizer and manure input assumptions
- Investigate using CEAP to inform BMP effectiveness estimates

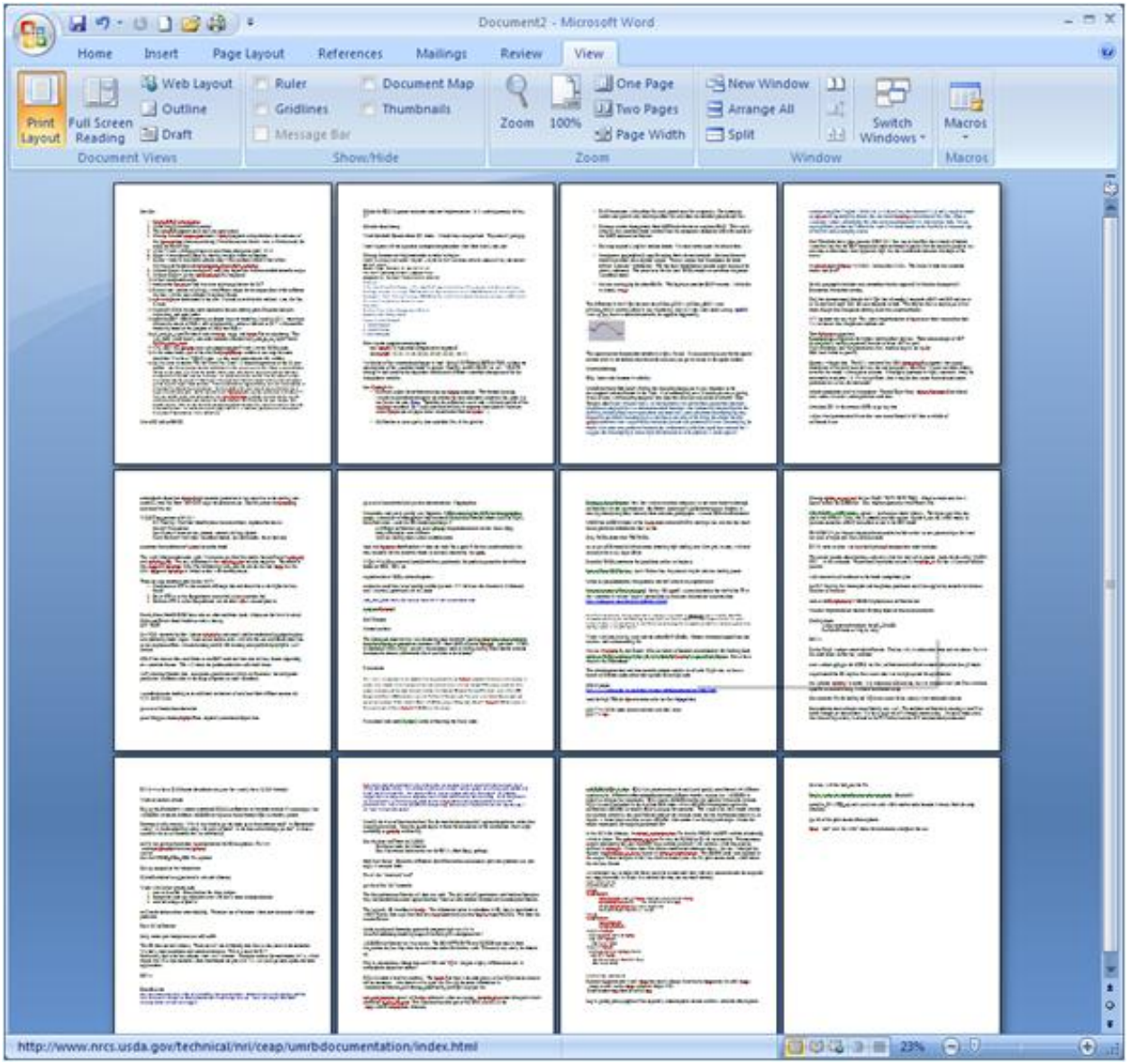
Panels

- Nutrient Management
- Stream Restoration
- Urban Fertilizer
- Poultry Litter
- Conservation Tillage
- Urban Retrofits
- Stormwater Performance Standards

STAC – Partial List of Relevant Products

- Multiple Models for Management - 2012
- Phosphorus Dynamics Panel – 2012
- Healthy Watersheds - 2012
- Review of LimnoTech Report – 2011
- Land Change Modeling 2010 and 2008
- Reduction Efficiencies - 2009
- Cover Crops - 2008
- Modeling in the CBP 2010 and beyond - 2008
- WSM review 2008 and 2005
- Atmospheric Deposition 2007
- Stream Restoration 2006

My Personal List



A Watershed Model Proposal for 2017

Multiple Models in a Management Context

Purposes of the watershed model

- Accounting tool
  - Add up loads from all land uses, subject to BMPs, in a flow-normalized manner
    - Exhaustive of land uses and BMPs
    - Include political and watershed boundaries
    - Calibrated to average load
    - Easy to use
- Load the estuarine models – original sole purpose
  - Must be fine scale spatially and temporally, but simulate over large space and time
  - Calibrated
- Discovery – can take many forms
  - First principles
  - Statistical
  - Can be any spatial extent or granularity
  - Can be any temporal extent or granularity

P5 Challenge
- Ease of use

- Once the input deck is create by a partner, they must get Jeff to pass off to Sucharith, and Sucharith to pass off to Jess or Ewnet, and Jess or Ewnet to pass off to Guido or Gary, and Guido or Gary to pass back to Sucharith or Guido, who pass to Jeff to check and then Victoria, Molly, or Megan to post on the web.
- 7 day turnaround time is not particularly user-friendly
- 100 processor-hours for the WSM is a problem – **What does the hourly simulation get us when we are making decisions on 10-year averages?**

P5 Challenges
- Ease of use

- AGCHEM calibration routine took 2-3 years to develop
- River calibration routine took 2 years to develop and includes regional factors that are hard to explain.
- Spend a lot of time shepherding scenarios, managing space, etc

P5 challenges
- Ease of Understanding

- **Which Description Works Best for Management?**
- **What's my reduction from Nutrient Management?**
  - Well, based on the rules developed by the partnership and the data supplied by national sources and the states, the balance of inputs and outputs for your land use is such that there is an overabundance of manure in your county, as opposed to the next county over where nutrient management has almost no effect. Now when you apply nutrient management, that will attract manure to the nutrient management land use, so it will have a higher load, but since it's pulling manure from other land uses, the total segment load will usually decrease, however in some circumstances when nutrient management is applied to pasture, it can push so much manure back on to other land uses, that the marginal effect …
- **What's my reduction from Cover Crops?**
  - Based on the Cover Crop Panel, who based their decision on multiple referenced data sources and models, your reduction for Early Drilled Barley in the Valley and Ridge Carbonate region is 38%

EOS Example

- Why is my edge of stream load 15 while theirs is 8 in the next county.
  - You're in the piedmont region on a class B soil with a 5% slope and have an atmospheric deposition rate of 14 lbs/ac/year. Based on a joint CSN/UMD/UA study, the proper load equation is: x + y * z, etc

Delivery Factor Example

- Why is my delivery ratio 0.8 while theirs is 0.4?
  - Initial Delivery factors are empirically derived from the Sparrow model at the NHD+ scale
  - The final delivery factors are calibrated to monitored loads by adjusting all estimated loads by the same percentage
- Why did my delivery factor increase over scenarios?
  - Based on a literature review, the phase 5 model, and the CEAP model, the delivery factor expert panel determined that phosphorus delivery factors remained constant while nitrogen delivery factors increased due to phosphorus load decreases.

Nutrient Management Example

- Why is my nutrient management plan resulting in a 4% decrease while theirs is resulting in a 15% decrease?
  - The Scenario Builder, designed according to the Nutrient Management Panel specifications, shows that the input/uptake balance in your county is 1.3 while theirs is 1.8. The MAWP determined that nutrient management effect was related to input/uptake balance, region, and soils by the following equation: …

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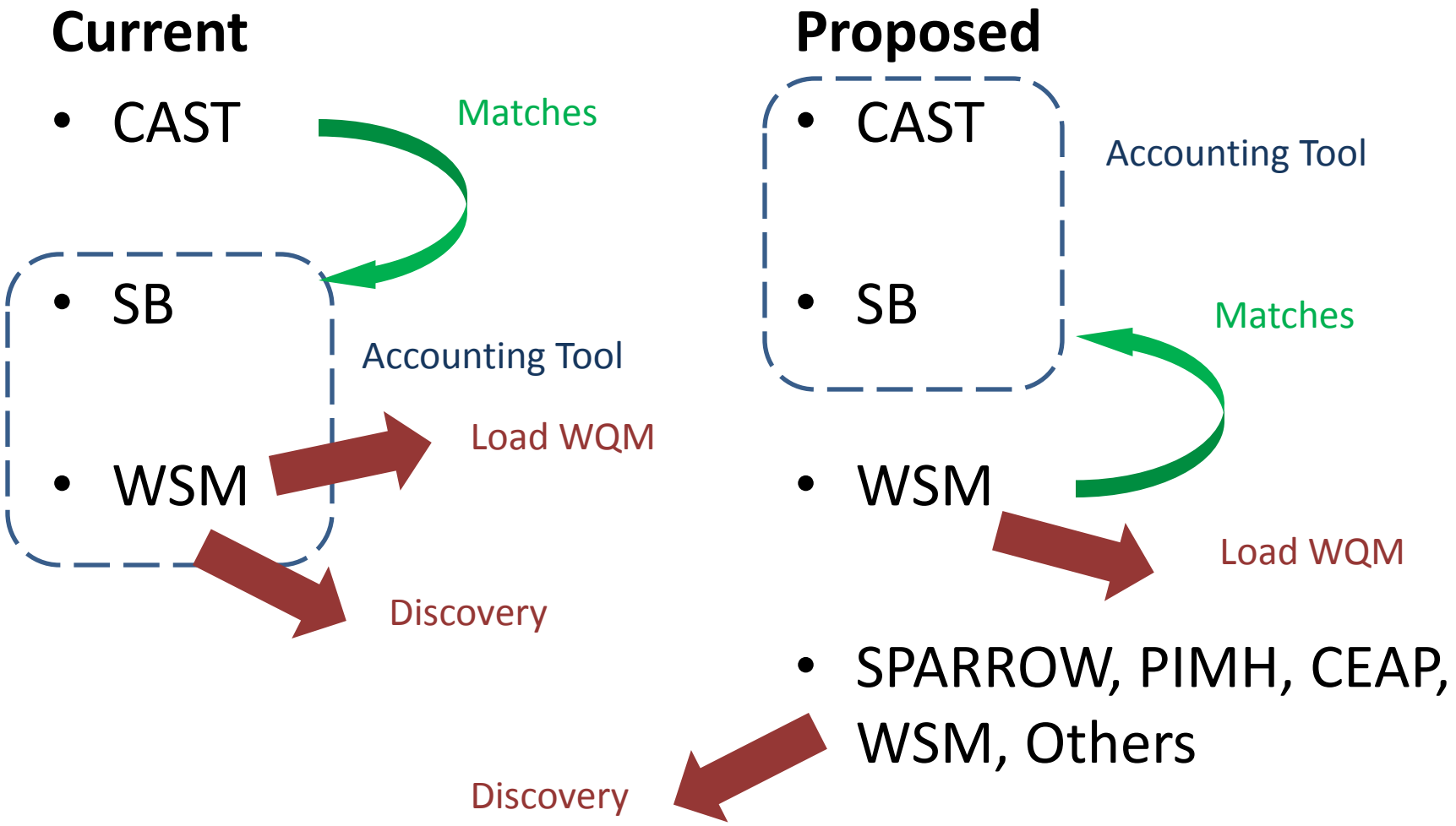
Proposal


Current
• CAST
Matches
• SB
Accounting Tool
Load WQM
• WSM
Discovery
Proposed
• CAST
Accounting Tool
• SB
Matches
• WSM
Load WQM
• SPARROW, PIMH, CEAP, WSM, Others
Discovery

Accounting Tool

- Database tool, similar to CAST and Scenario Builder
- All the functionality of the full Scenario Builder
- Sophisticated BMP application methods
- Each input and sensitivity would be well documented
- Calibrated to Estimated Loads
- Summary of knowledge gained from literature, observations, multiple models, and expert elicitation

Loading the Estuarine Models

- Scenario the data
  - Use WRDTS / LoadEST at RIM sites and modify them for scenarios
  - Use simple rainfall/runoff model BFL and fit Q/C relationship s.t. it meets the load from the accounting tool
- PQUAL/IQUAL version of phase 5
  - Can easily make this match any load predicted by the accounting tool

Discovery

- Keep AGCHEM version of phase 5 for large studies such as climate change
- Keep PQUAL/IQUAL version of phase 5 for large studies
- Develop first principles distributed model for small-scale studies
- Work with partners such as Universities, USDA, and USGS

Challenges

- Change in the way we do business.
  - Managers would have to get used to the idea
  - Change from incremental improvement of single model
- Data gaps exist
  - Currently, p5 will simulate effects where we don't have data
- Need to explicitly maintain consistency between accounting, loading, and discovery models.

Benefits

- Easily Understood
- Scalable
- Fast turnaround
- Explicit incorporation of multiple models to arrive at a single decision
- Not trying to stretch a single model to do accounting, loading, and discovery.

Benefits

- Recalibration almost trivial
- Vastly reduced need for calibration method research
- Uncertainty analysis more feasible
  - Evaluation time dramatically reduced
- Academic involvement
  - Accounting Tool will make data gaps clear