Development of Phase 6 Model Land Use Export Rate Targets

Modeling Workgroup Conference Call

March 26, 2015

Olivia Devereux

Outline

- Source sector workgroup progress
- Methods for using sensitivities in targets
- Current status
- Global targets-*decision requested*
- Scale of developed land use targets-*decision requested*

Export Rates and Targets

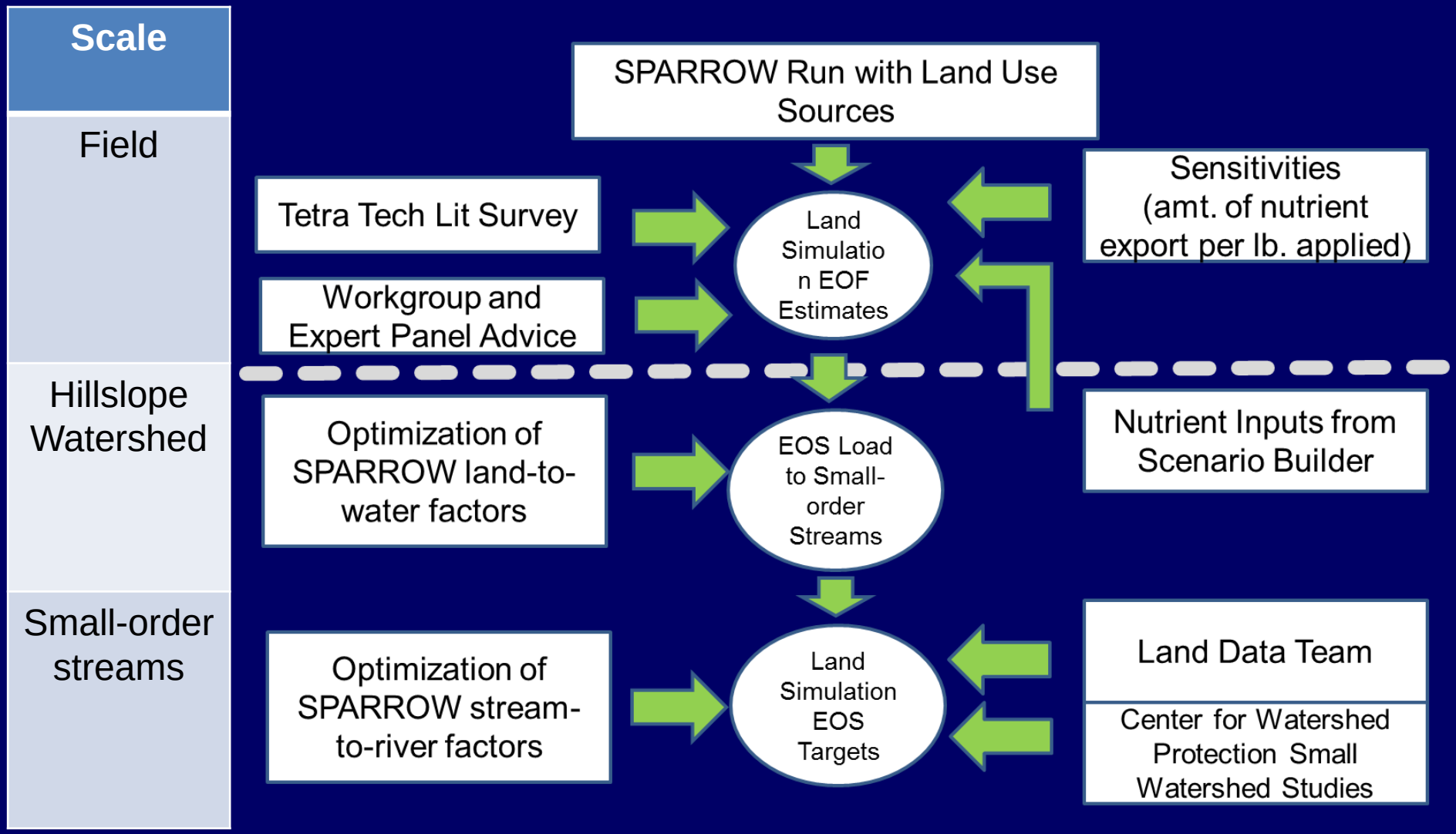
- Export rates from multiple models and literature are used to inform the targets.

- Targets are a type of export rate used to calibrate the Phase 6 Watershed Model.

Calibration Targets

- For each species of nitrogen and phosphorus and sediment.
- Long-term annual, not one for each year. Annual variation comes through hydrology and nutrient inputs.
- Order the influence of different land uses.
- Vary geographically based on nutrient and hydrology inputs.
- Do not include BMPs.
- Subject to modification through calibration: actual rate adjusted while relative differences maintained.

Land Simulation Development



Method of Applying Sensitivities

- Land segment lb/A =
  target + sensitivity * ∑ (lseg input rate–median input for CBWS)

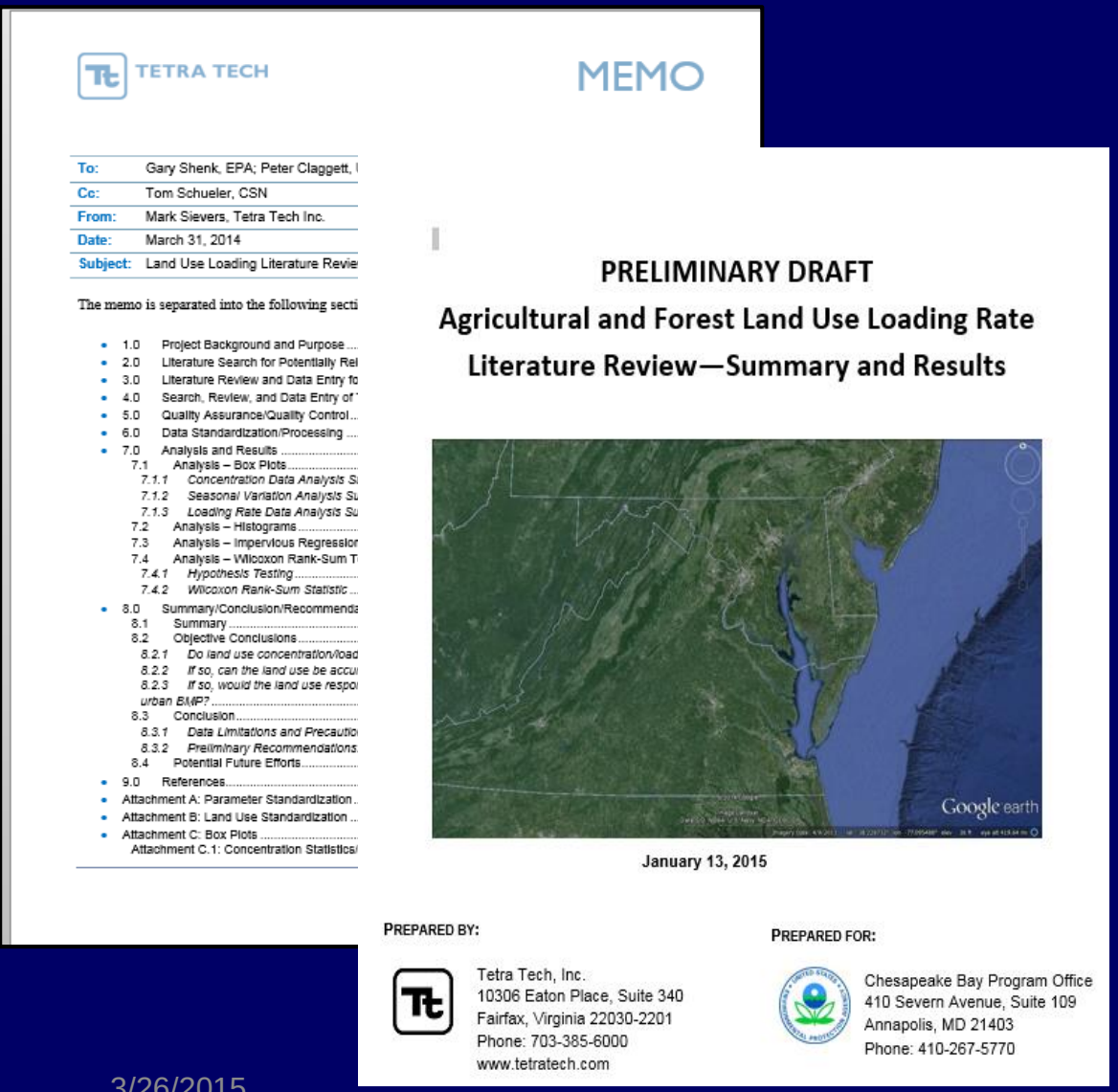
- Sensitivities are determined by the Modeling Team from the Phase 5.3.2 WSM.

- Updated sensitivities will be incorporated into the final targets. Current version is from 2013.

Role of Workgroups

Chesapeake Bay Program committees, goal implementation teams, workgroups, and action teams	Meeting Date
Modeling Review	9/30/2014, 1/29/2015, 3/26/2015, 4/22/2015
Modeling Team Meeting	9/15/2014, 1/20/2015, ongoing weekly
Water Quality Goal Implementation Team	4/13/2015, 5/11/2015
Land Use Workgroup	9/25/2014; 2/26/2015
Watershed Technical Workgroup	10/2/2014, 3/5/2015
Forestry Workgroup	10/1/2014, 3/4/2015, 3/20/2015
Wetlands Expert Panel	11/12/2014
Urban Stormwater Workgroup	10/21/2014, 12/16/2014, 3/3/2015
Agricultural Workgroup	10/9/2014, 10/22/2014, 2/19/2015, 3/18-19/2015, 4/16/2015
Agricultural Modeling Subcommittee	9/16/2014,12/16/2014, 2/12/2015, 2/18/2015
Agricultural Loading Rate Review Subgroup	3/25/2015

Reviews of Scientific Literature and local TMDLs: Developed, Natural and Agricultural Land Uses



TETRA TECH

MEMO

To:	Gary Shenk, EPA; Peter Claggett,
Cc:	Tom Schueler, CSN
From:	Mark Sievers, Tetra Tech Inc.
Date:	March 31, 2014
Subject:	Land Use Loading Literature Revie

The memo is separated into the following secti

- 1.0 Project Background and Purpose ...
- 2.0 Literature Search for Potentially Rel
- 3.0 Literature Review and Data Entry fo
- 4.0 Search, Review, and Data Entry of
- 5.0 Quality Assurance/Quality Control...
- 6.0 Data Standardization/Processing ...
- 7.0 Analysis and Results .....
  - 7.1 Analysis – Box Plots .....
    - *7.1.1 Concentration Data Analysis S*
    - *7.1.2 Seasonal Variation Analysis Su*
    - *7.1.3 Loading Rate Data Analysis Su*
  - 7.2 Analysis – Histograms.....
  - 7.3 Analysis – Impervious Regressior
  - 7.4 Analysis – Wilcoxon Rank-Sum T
    - *7.4.1 Hypothesis Testing .....*
    - *7.4.2 Wilcoxon Rank-Sum Statistic ...*
- 8.0 Summary/Conclusion/Recommenda
  - 8.1 Summary .....
  - 8.2 Objective Conclusions.....
    - *8.2.1 Do land use concentration/load*
    - *8.2.2 If so, can the land use be accu*
    - *8.2.3 If so, would the land use respo*

  urban BMP? .....
  - 8.3 Conclusion.....
    - *8.3.1 Data Limitations and Precautio*
    - *8.3.2 Preliminary Recommendations*
  - 8.4 Potential Future Efforts.....
- 9.0 References.....
- Attachment A: Parameter Standardization ..
- Attachment B: Land Use Standardization ...
- Attachment C: Box Plots .....

  Attachment C.1: Concentration Statistics/

PRELIMINARY DRAFT

Agricultural and Forest Land Use Loading Rate Literature Review—Summary and Results

January 13, 2015

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Available on line on the Midpoint Assessment Website

https://www.chesapeakebay.net/about/wmp_for_mpa_effort/land_use_load_literature_reviews

(or Google “CBP midpoint assessment literature review”)

Phase 6 Draft Land Uses—Developed

All are also divided by federal, MS4-regulated, and Combined Stormwater Sewer (CSS)

- Impervious
  - Roads
  - Buildings, parking lots, etc.
- Pervious
  - Turf
  - Open space
- Urban Tree canopy
- Construction
- Abandoned/Reclaimed Mines – newly proposed
- Active Mines – newly proposed

Phase 6 Draft Land Uses—Natural

- Forests
  - True Forest
  - Harvested
  - Disturbed (e.g.: insect, fire)
- Water

- Wetlands
  - *Tidal emergent ?*
  - *Fresh emergent ?*
  - *Non-tidal woody ?*

Disturbed*:* Literature not yet identified to support a different loading rate

Wetlands Expert Panel making progress, but not yet finished determining land uses

Phase 6 Land Uses—Agricultural

Approved by the Ag Workgroup 3/18/2015

- Corn or sorghum grain – w/ and w/o manure
- Corn or sorghum silage - w/ and w/o manure
- *Sm gr & soybean – no manure
- Full season soybean – no manure
- Sm gr & grain - elig. for manure

- Other Agronomic crops
- Specialty - high input
- Specialty - Low input

- Pasture – direct dep; elig. for manure
- Legume (or legume-grass mix) Hay
- Other Hay

- Ag open space

- Non-permitted feeding operation space
- Permitted (or NOI) feeding operation space

- *Impervious farmstead*
- *Pervious farmstead*

Nutrient Input Differences

- Address through AgChem sensitivities and nutrient application differences, in addition to the limited data from the literature review.
  - Legume and non-legume forage, pasture and hay.
  - Manured vs. non-manured.

- For manured, Ag Census provides percent of crops receiving manure.
  - Need to determine a valid method to project the ratio of manure eligible to non-manured crops.

Source Sector Workgroup Activities In Process

- Wetland Literature Review (conducted in conjunction with the Wetland Expert Panel)
  - Review for wetland efficiency
  - Potential wetland land uses
  - Review for loading rates
- Agriculture
  - Land Use Approval—last week
  - New Relative Loading Rate Review Subgroup of the Agricultural Modeling Subcommittee
  - "Grey" Literature collected by Water Stewardship under a CBW-ROC grant
    - Unpublished, not peer reviewed
    - Negative results are generally considered to be systematically censored in peer-reviewed publications; meta-analysis from peer-reviewed sources may be systematically biased
- Forestry
  - Urban Tree Canopy Expert Panel
  - Forester with geochemistry training is reviewing the literature review
  - Disturbed forest
- Developed
  - Extractive land use—abandoned/reclaimed and active are under consideration

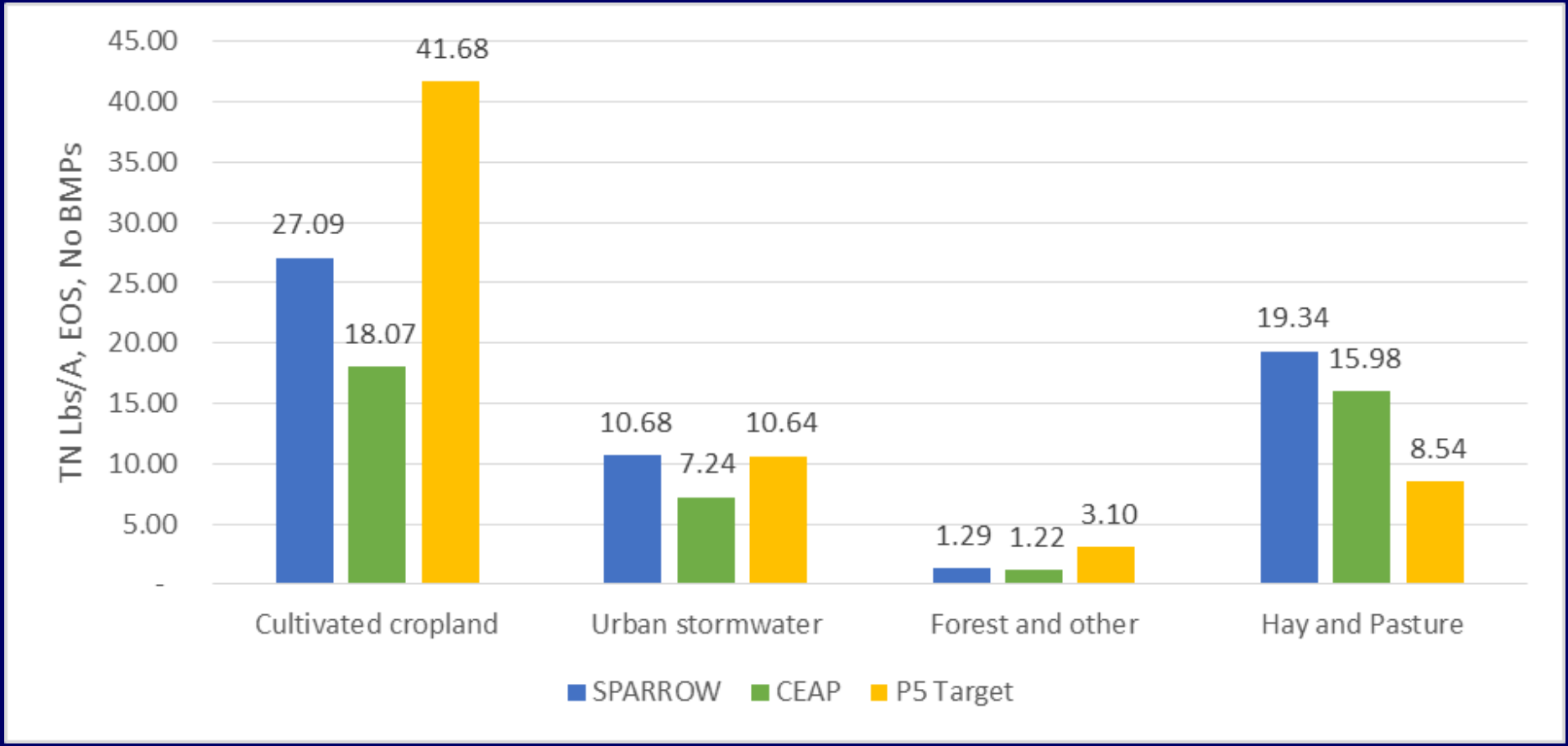
Status

Sector	Land Uses (No.)	Targets for proposed land uses	Targets TBD	Percent of Total Land Uses
Developed	8	5	3	26%
Natural	5	3	2	16%
Agricultural	18	0	18	58%
Total	31	8	23	100%
Percent complete		***26%***		

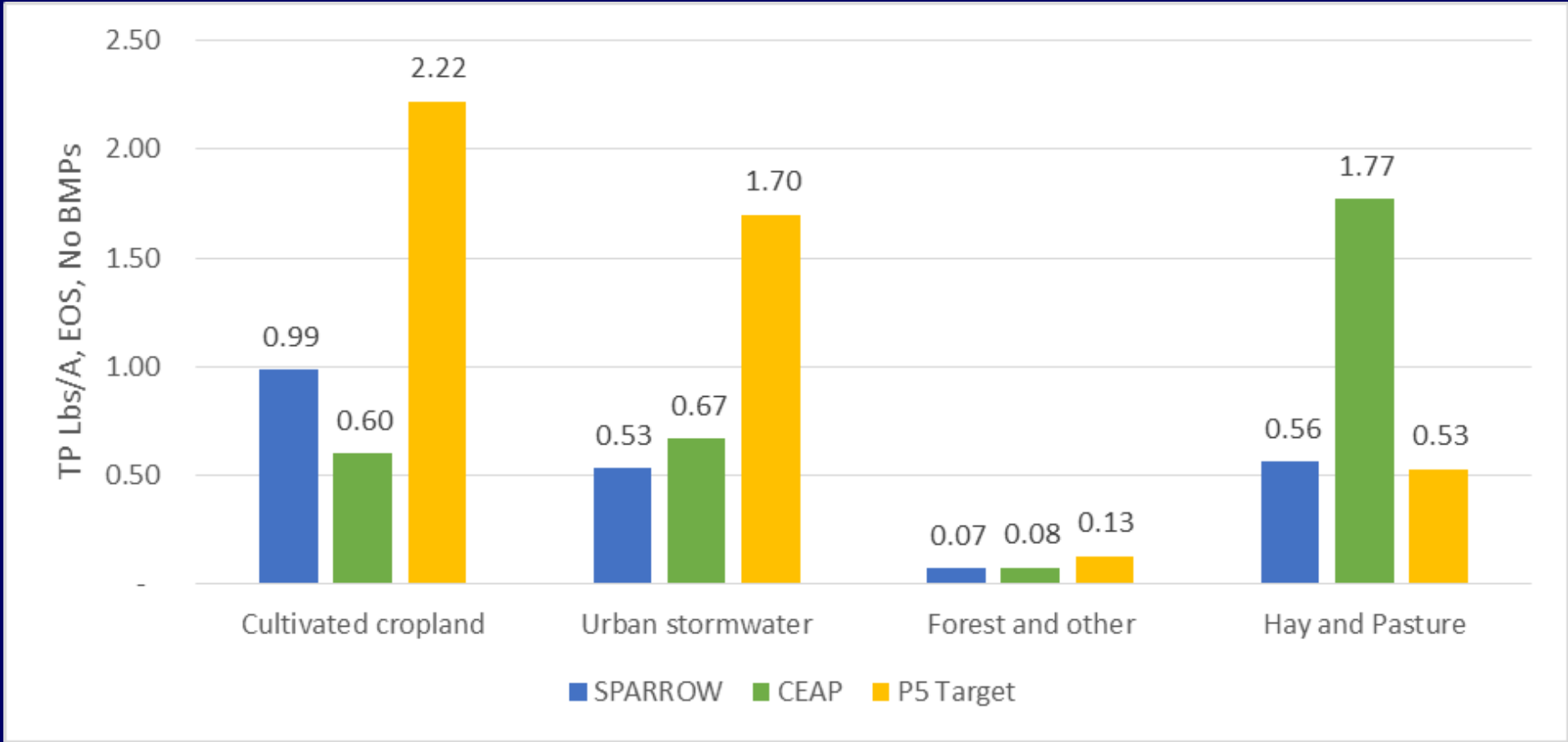
Scaling across Sectors Using Global Targets

- Incorporate multiple models.
- Set developed, natural, and agricultural sectors relative to each other.
- SPARROW's strengths are indicating the differences among land use categories.
  - When SPARROW is run with land uses as the regression parameters, then the regression coefficients are equivalent to export rates at an edge of small stream scale.
  - Remove BMP effects by applying percent change between WSM 2002 Cal Yr. and No Action to SPARROW loads.
    - 2002 Cal Yr will be updated once BMP history is revised.
- CEAP 2013 Average annual loads delivered to watershed outlets (8-digit HUCs) for no-practice scenario.
- Phase 5.3.2 Targets.

Developing Global Targets—TN



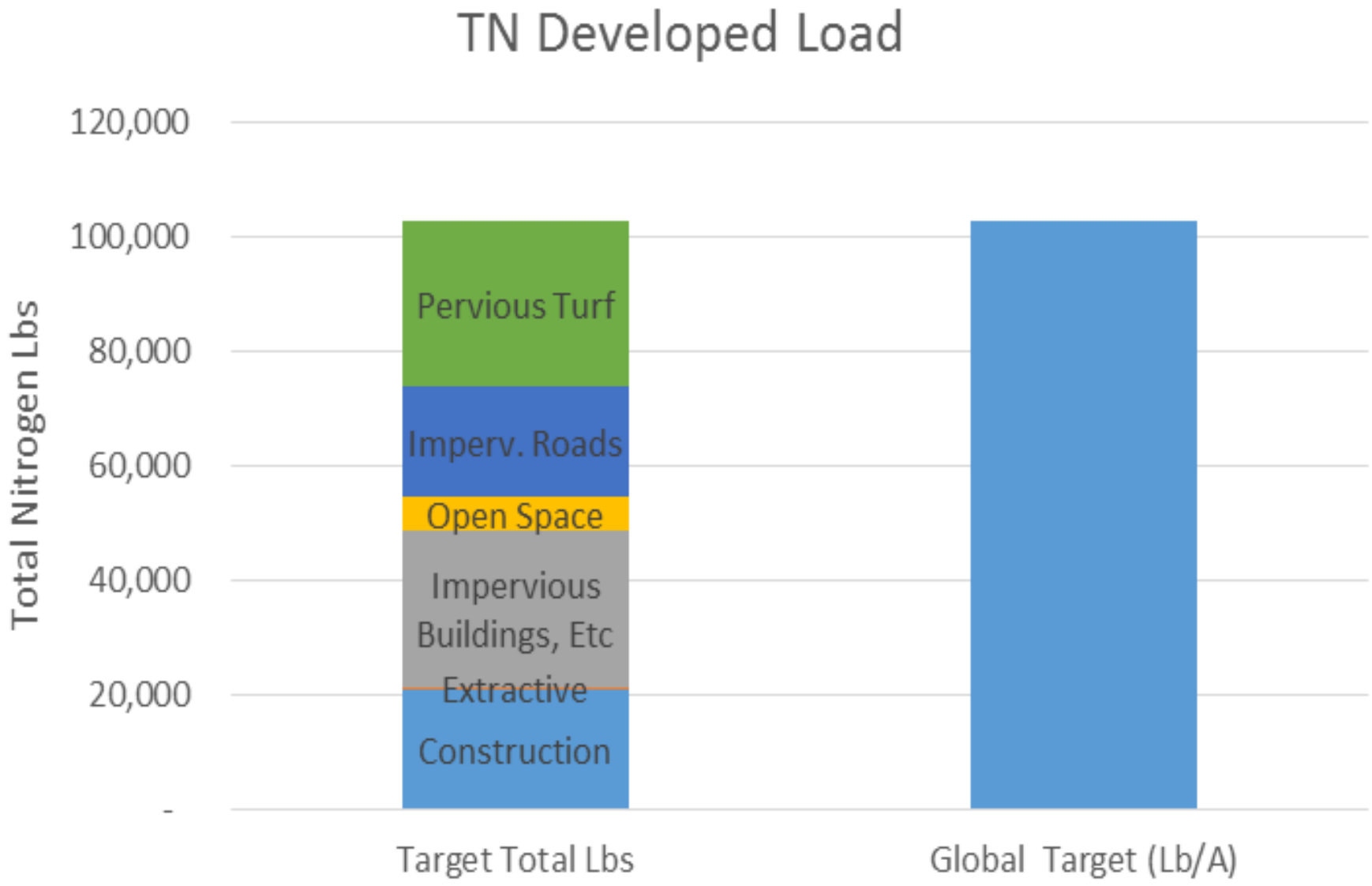
Developing Global Targets—TP



Developing Global Targets

- Global targets represent the aggregation of specific land uses within a large land use group.
- Determine relative difference among literature review targets within each global targets category (e.g.: crop, pasture and hay, urban stormwater, forest).
- Weight by acres of each land use so each target within the global land use category sums to the global target total pounds.

Example of Global Target Use

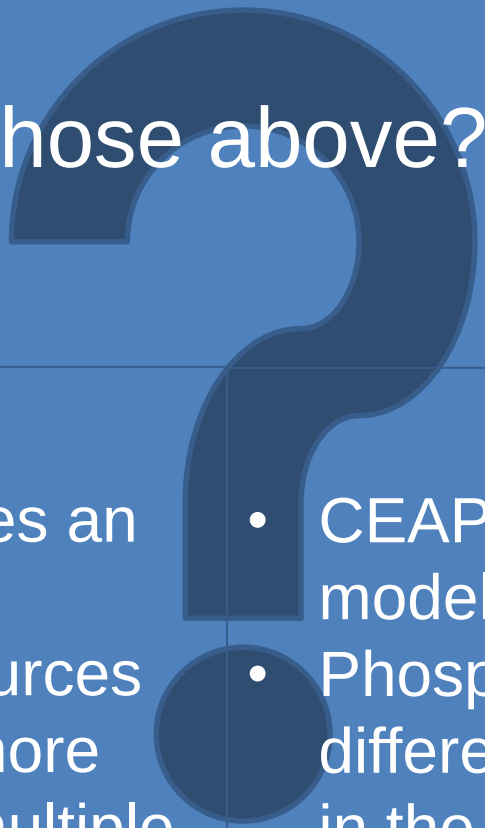


Example

Global LU	Global Target (Lb/A)	Lit. Review LU	Lit Review Amt	Relative to Turf	Acres	Target Weighted by Acres (Lb/A)	Target Total Lbs	Scale
urban	10.68	Construction	26.40	2.58	900	23.12	20,805	EOS
		Extractive	0.99	0.10	500	0.87	433	EOS
		Impervious Buildings Parking Lots Etc	17.39	1.70	1,800	15.23	27,409	EOF
		Pervious Open Space	3.01	0.29	2,200	2.64	5,798	EOF
		Impervious Roads	22.11	2.16	1,000	19.36	19,360	EOF
		Pervious Turf	10.25	1.00	3,200	8.98	28,721	EOF
		Total			9,600		102,528	

Determine Global Target

- Use SPARROW and/or CEAP and/or Phase 5
- Use average of those above?
- Alternatives?



Pros

- Using SPARROW gives an empirical load.
- Averaging multiple sources for a global target is more robust, where those multiple sources are reliable.

Cons

- CEAP is not designed to model urban areas.
- Phosphorus is handled differently in Phase 5.3.2 than in the proposed Phase 6 model.

Phase 6 Draft Land Uses—Developed

All are also divided by federal, MS4-regulated, and Combined Stormwater Sewer (CSS)

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  - Roads
  - Buildings, parking lots, etc.
- Pervious – EOF
  - Turf
  - Open space
- Urban Tree canopy – EOS
- Construction – EOS
- Abandoned/Reclaimed Mines – EOS
- Active Mines – EOS

Any undesirable outcomes with using these two different scales within the global targets

Next Steps

- Finalize land uses
- Finalize literature review data with input from source sector workgroups
- Determine differences between manure-eligible and nonmanured land uses
- Complete the refinements based on sensitivities to nutrient inputs
- Set literature review loads as relational within Global Targets
- Address scale issues of Edge of Field, Edge of Small Stream and Edge of Stream in literature review data.
- Determine differences in loads by depth (surface, interflow, groundwater)
- Determine differences in loads by nutrient species
- QA/QC checks