

Sediment in P6

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Modeling Workgroup

4/27/165

Similar to nutrients but no sensitivity

Nutrients

Phase 6 Model Structure

Average Load + Δ Inputs * Sensitivity

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Land Use Acres

*

BMPs

*

Land to Water

*

Stream Delivery

*

River Delivery

Direct Loads

Sediment

Phase 6 Model Structure

RUSLE2 Estimate

*

Land Use Acres

*

BMPs

*

Land to Water

*

Stream Delivery

*

River Delivery

Direct Loads



Mass Balance at the L2W step rather than the average load step

Nutrients

Phase 6 Model Structure

Average Load + Δ Inputs * Sensitivity

Land Use Acres

BMPs

Land to Water

Stream Delivery

River Delivery

Direct Loads

Sediment

Phase 6 Model Structure

RUSLE2 Estimate

Land Use Acres

BMPs

Land to Water

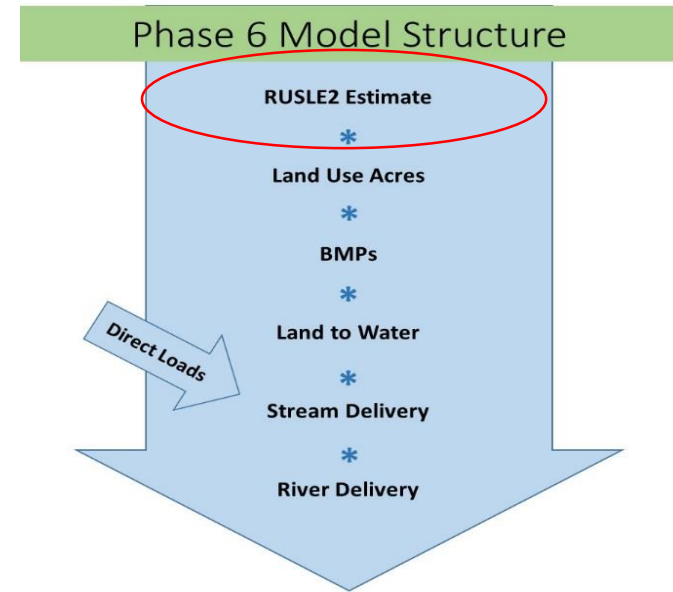
Stream Delivery

River Delivery

Direct Loads

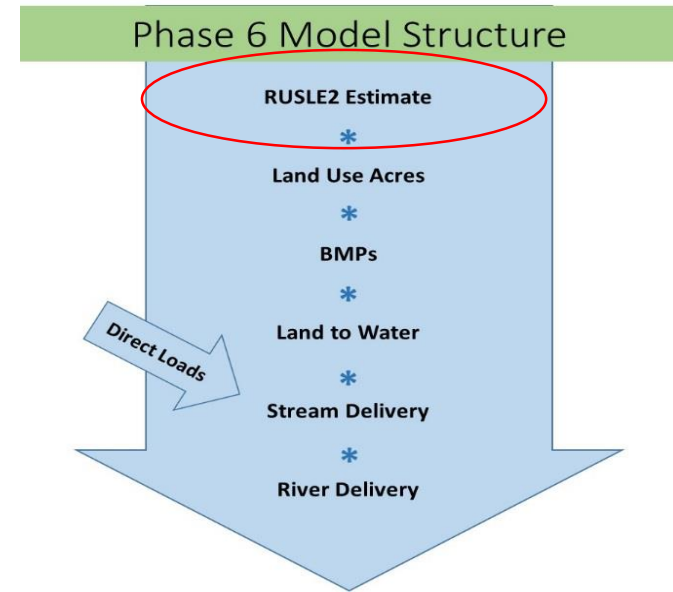
RUSLE2 = Edge-of-Field Loads

- Evaluated at the 10m Pixel Level
- Summarized to LRseg and land use
 - Forest
 - Open Space
 - Crop
 - Pasture
 - Turfgrass
 - Tree Canopy over Turfgrass



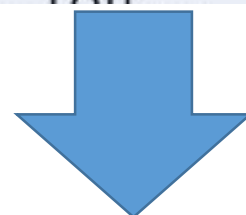
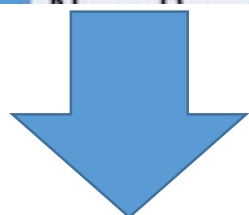
RUSLE2 => A = RKLSCP

- R = Runoff
 - $= 1.24P^{1.36}$ P from PRISM
- K = Erodibility
 - from STATSGO and gSSURGO
- LS = slope length
 - $= (\text{Flow Accumulation} \times \text{Cell Resolution} / 22.1)^{0.4}$
 $\times (\sin(\text{Slope} \times 0.01745) / 0.09)^{1.4} \times 1.4$
- C = Cover
 - from Tetrattech and ALULRSG
- P = Practice
 - = 1 since no action loads



Translation to P6 land uses

RUSLE2 Category	Phase 6 Land use	Factor
Forest	True Forest	1.0
Forest	Disturbed Forest	2.0
Forest	Harvested Forest	10.0
Forest	Palustrine Forested Wetland	1.0
Forest	Palustrine Scrub-Shrub Wetland	1.0
Open Space	Open Space	1.0
TC Turfgrass	Non-Regulated Tree Canopy over Turfgrass	1.0
TC Turfgrass	Non-Regulated Tree Canopy over Impervious	3.0
Turfgrass	Non-Regulated Roads	3.0
Turfgrass	Non-Regulated Bare Soil	3.0



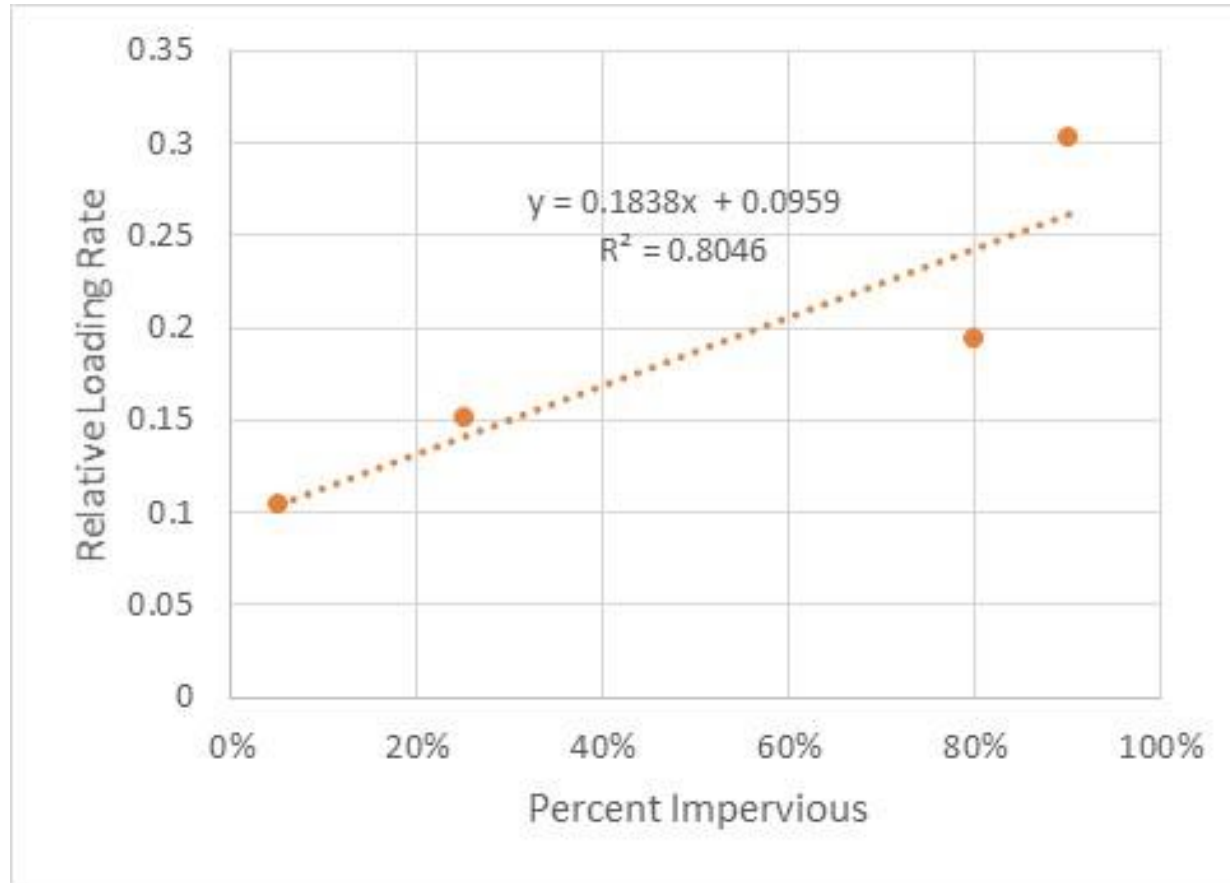
Translation to P6 land uses

RUSLE2 Category	Phase 6 Land Use	Factor
TC Turfgrass	Non-Regulated Tree Canopy over Turfgrass	1.0
TC Turfgrass	Non-Regulated Tree Canopy over Impervious	3.0
Turfgrass	Non-Regulated Roads	3.0
Turfgrass	Non-Regulated Buildings and Other	3.0
Turfgrass	Non-Regulated Turf Grass	1.0
TC Turfgrass	MS4 Tree Canopy over Turfgrass	1.0
Turfgrass	MS4 Tree Canopy over Impervious	3.0
Turfgrass	MS4 Construction	36.3



- Construction is set at 12 tons/acre/year as a global average by the Sediment and Erosion Control BMP Panel (Clark and others 2014). Turfgrass load is 0.33.

Land use factors

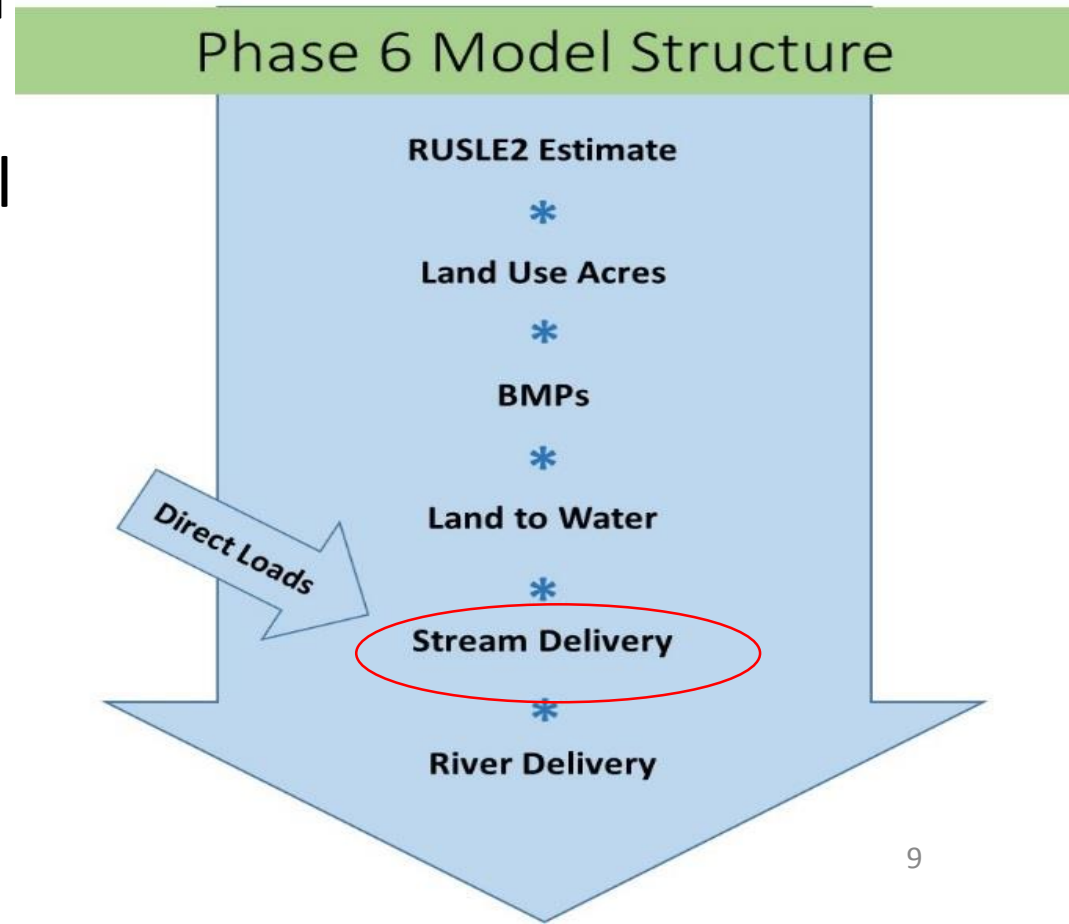


Factor
1.0
3.0
3.0
3.0
1.0

- Impervious is 3x the sediment load according to *outfall* data in the NSQD

Stream Delivery – Ag and Natural

- Will be Greg Noe / Peter Claggett stream mass balance
- Assumed to be 1 until completed



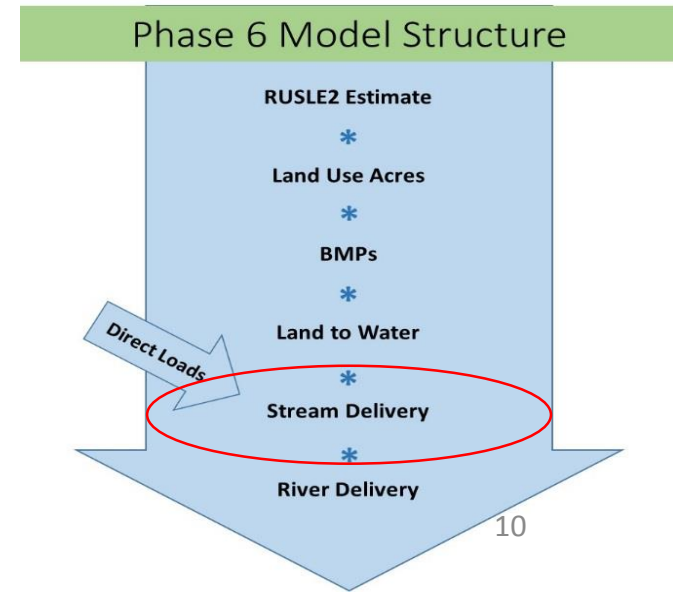
Stream Delivery – Developed

- Center for Watershed Protection Work

$$SSR = 1 - \frac{\text{Upland Load}}{\text{Total Watershed Load}}$$

Stream Source Load = Land Source Load * SSR / (1 – SSR)

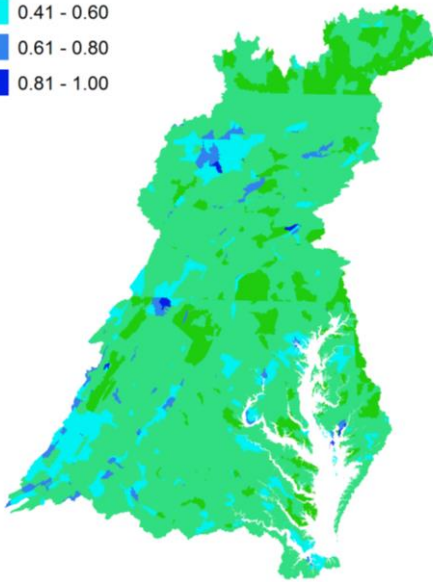
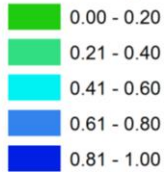
$$\begin{aligned} SSR = & 1.4085 * (\text{fraction Impervious}) \\ & + 0.5341 * (\text{fraction CD soils}) \\ & - 0.2828 \end{aligned}$$



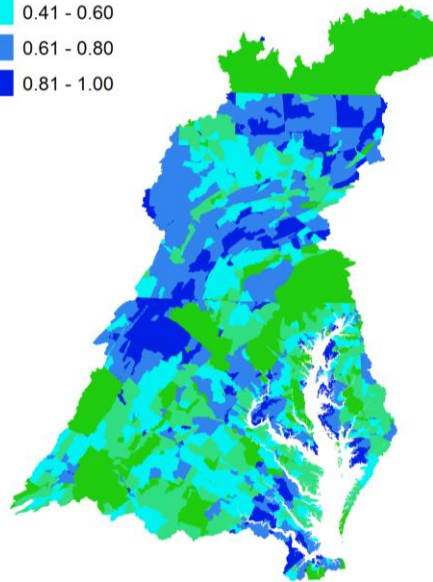
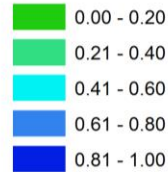
Stream Delivery – Developed

$$SSR = 1.4085 * Imp + 0.5341 * CD - 0.2828$$

Fraction Impervious

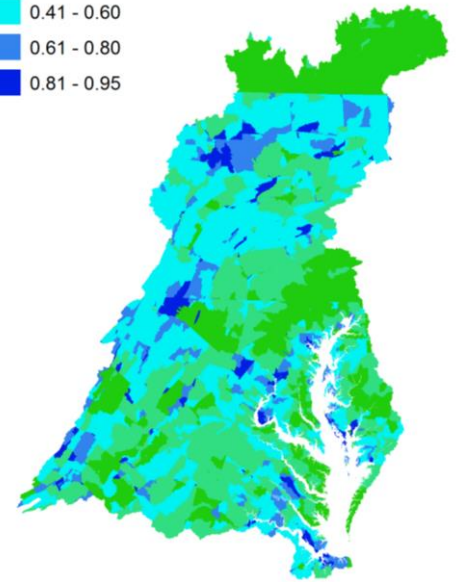
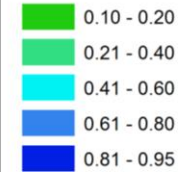


CD

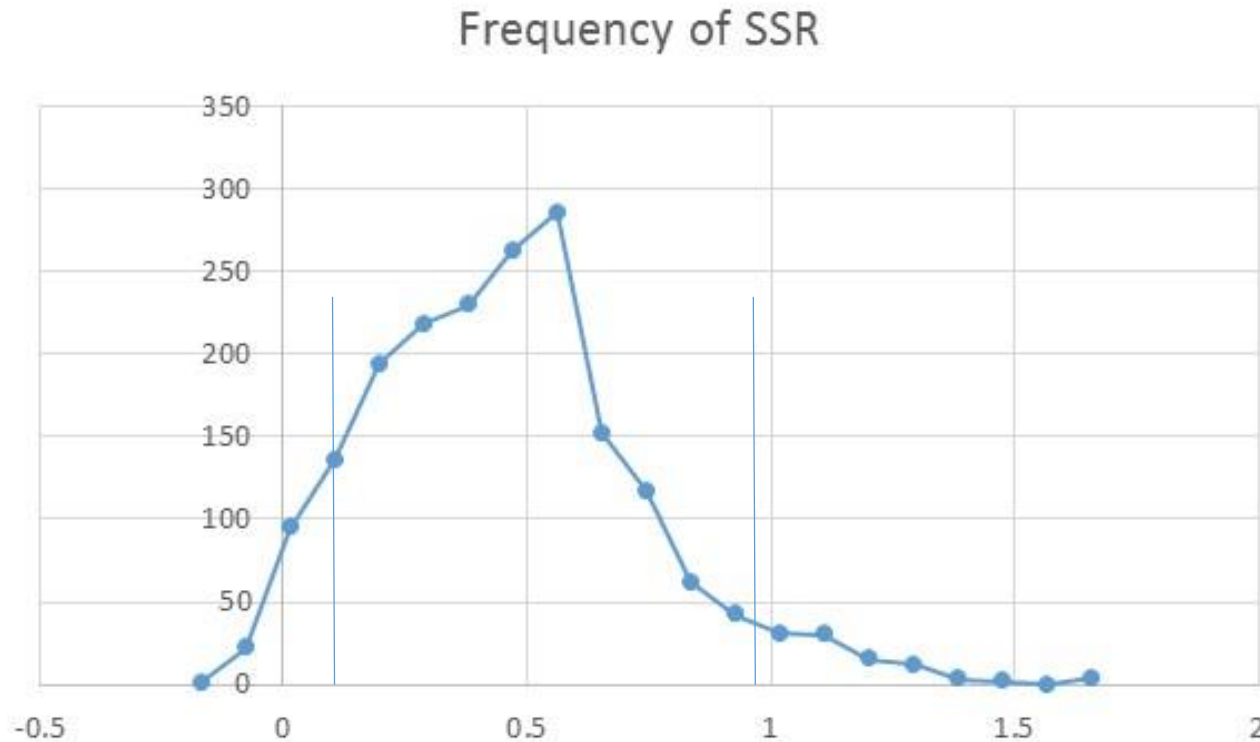


Known Issues
With this!

SSR



Stream Delivery – Developed

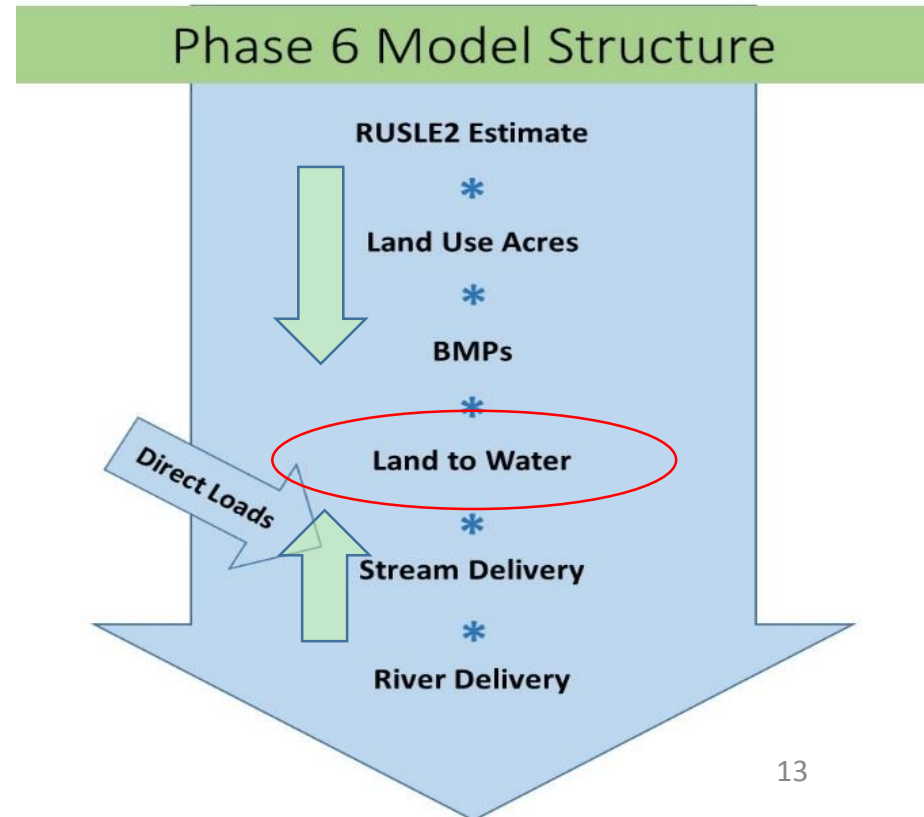


- Sediment Workgroup said SSR was in the range of 0 to 100%
- Langland and Cronin (2003) estimated SSR to be approximately two thirds on average.
- CWP (2015) found SSRs in the nine watersheds ranging from about 0.32 to 0.92.

$$\text{Stream Source Load} = \text{Land Source Load} * \text{SSR} / (1 - \text{SSR})$$

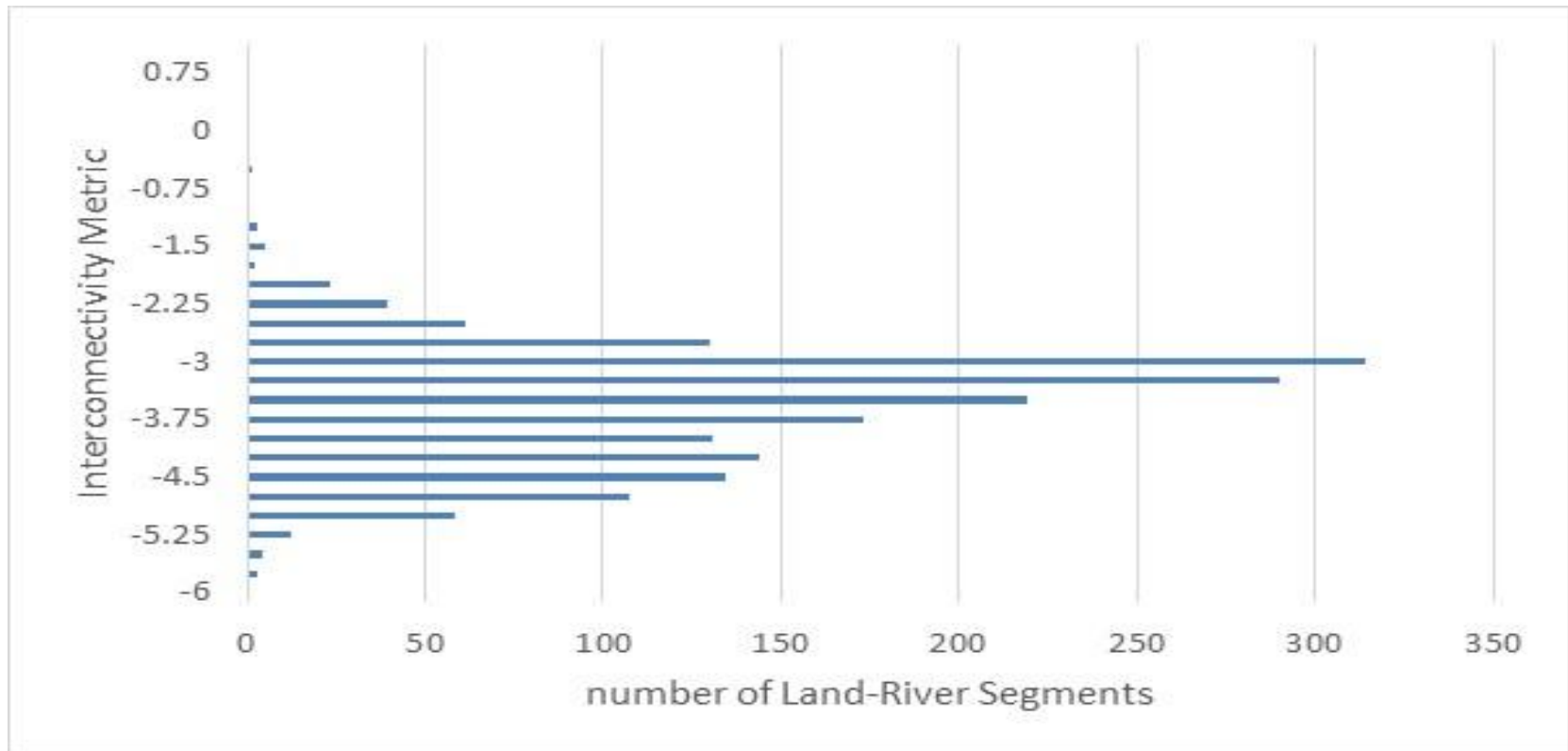
Land to Water – calculate average

- $[(\text{RUSLE2} * \text{acres} * \text{BMPs} * \text{L2W}) + \text{SD}] * \text{RD} = \text{RIM Load}$
- $\text{L2W} = [(\text{RIM} / \text{RD}) - \text{SD}] / (\text{RUSLE2} * \text{acres} * \text{BMPs})$
- $\text{L2W} = 0.25$



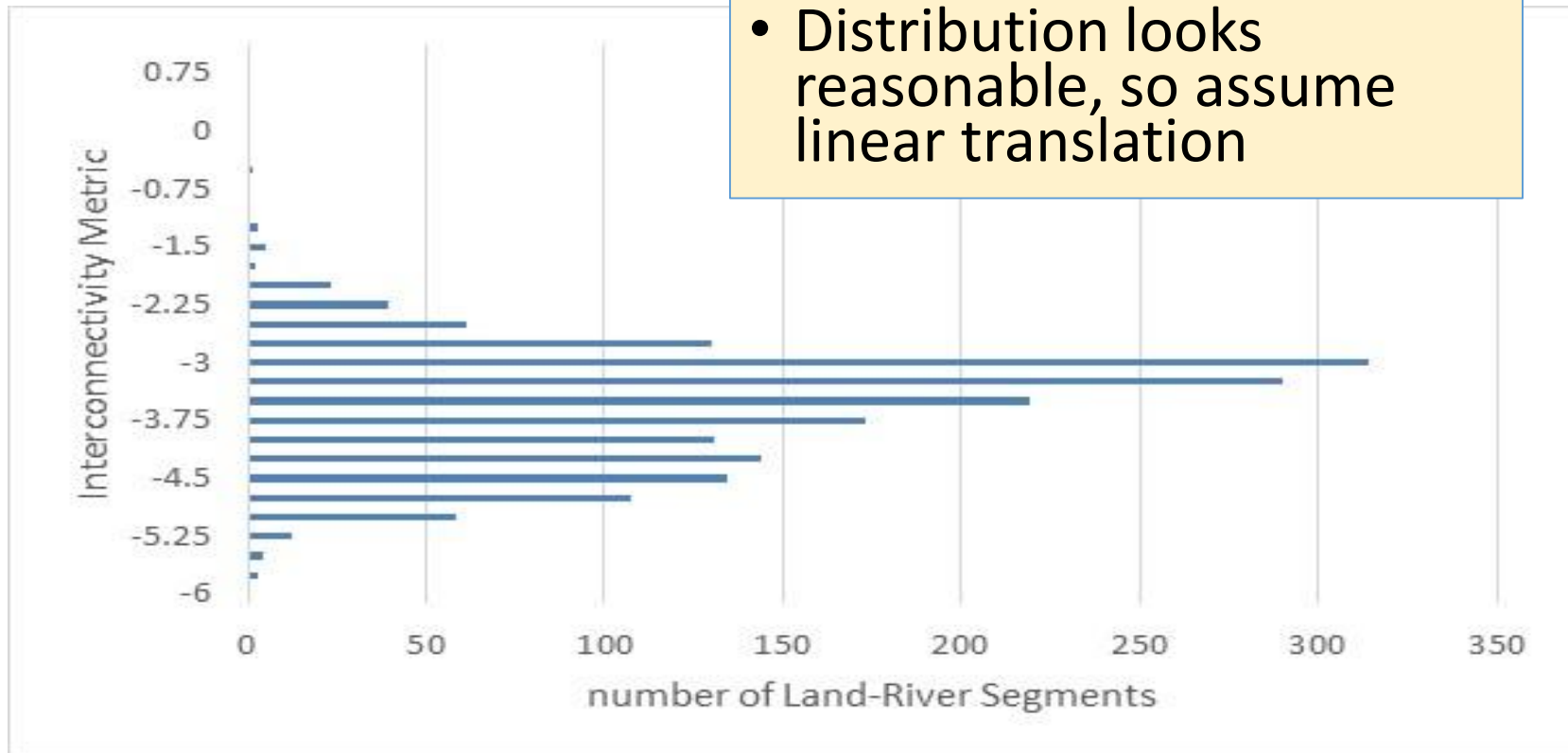
Interconnectivity Metric

Calculation related to Slope, Area,
Flowpath Length, and Roughness



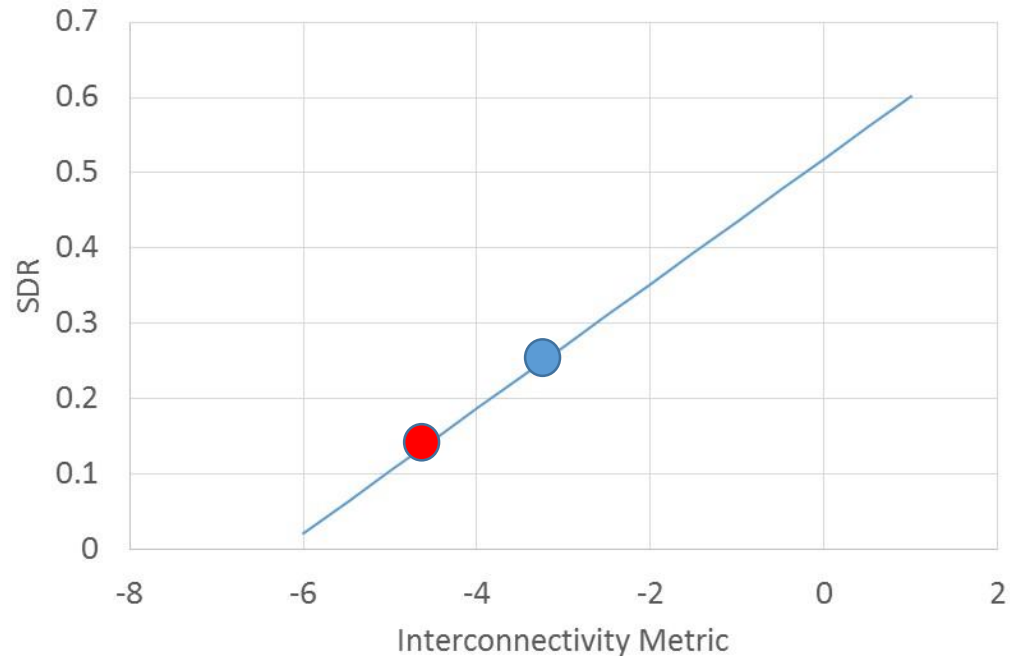
Sediment Delivery Ratio

- Need to convert to scale of 0 to 1 with an average of 0.25
- Distribution looks reasonable, so assume linear translation



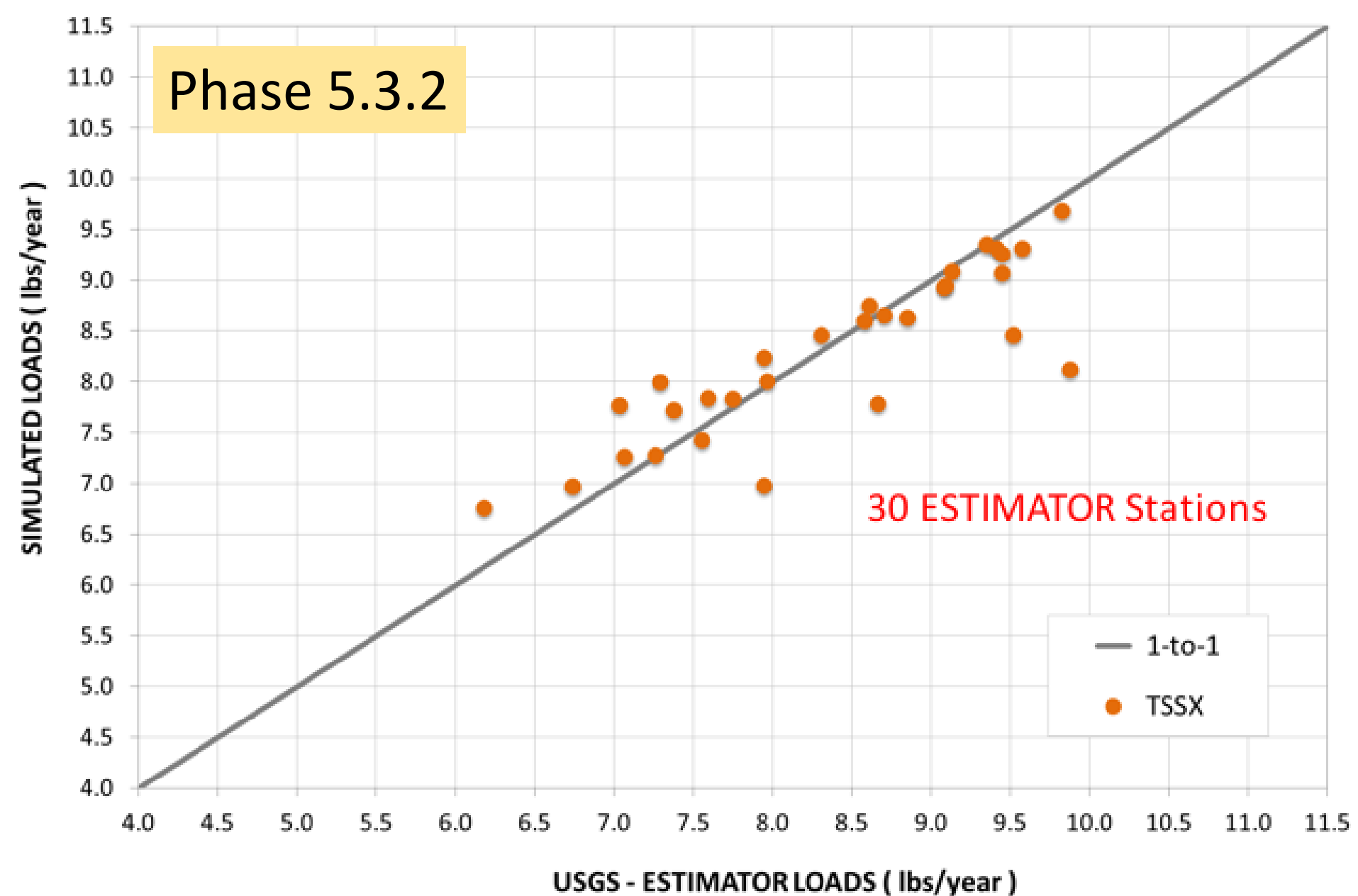
Interconnectivity Metric

- Center point at averages: (-3.2, 0.25) ●
- Second point at 1 Standard Deviation
 - SD of SDR from CEAP in the Upper Miss was 0.08 (8-digit HUC)
 - SD of P5.3.2 was 0.10
 - Choose 0.10
 - Establish second point at (-4.4, 0.15)



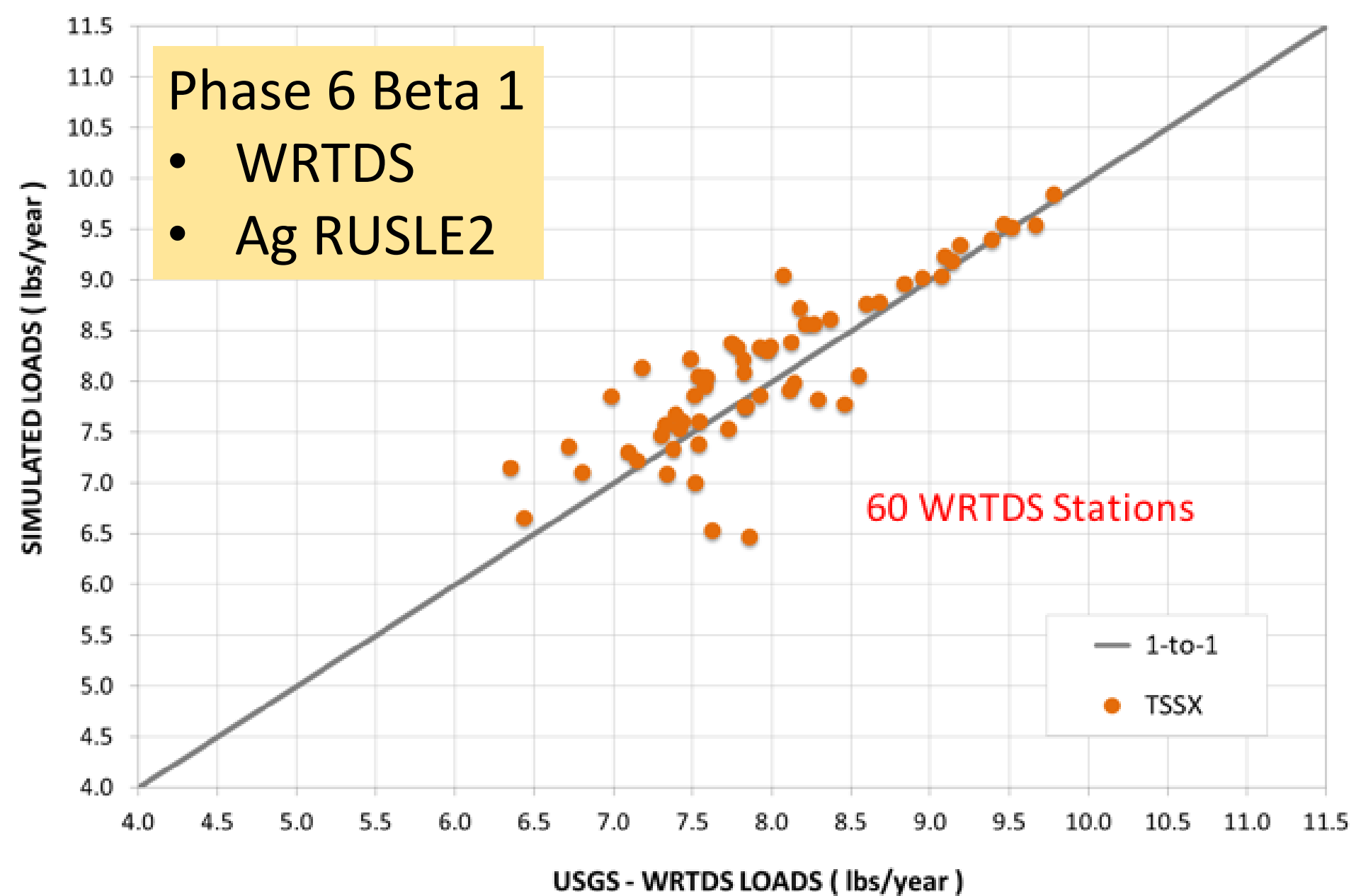
$$\text{SDR} = 0.083 * \text{IC} + .519$$

Phase 5.3.2



Phase 6 Beta 1

- WRTDS
- Ag RUSLE2



Phase 6 Beta 2 Early Version

- WRTDS
- All RUSLE2
- SDR

SIMULATED LOADS (lbs/year)

USGS - WRTDS LOADS (lbs/year)

60 WRTDS Stations

— 1-to-1

● TSSX