Draft Phase 6 Watershed Model

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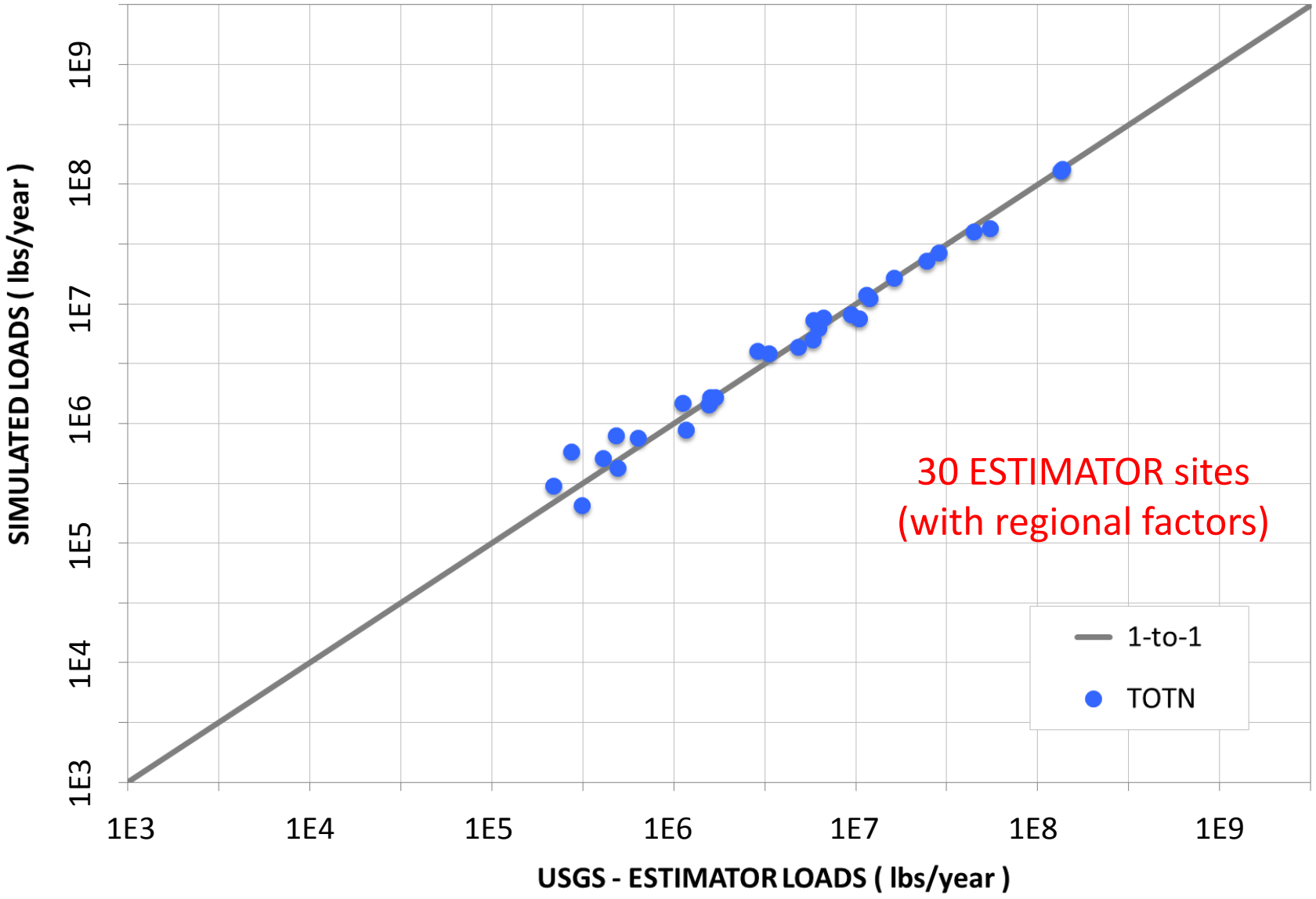
[1] Penn State, [2] USGS

PHASE 5

Phase 5.3.2

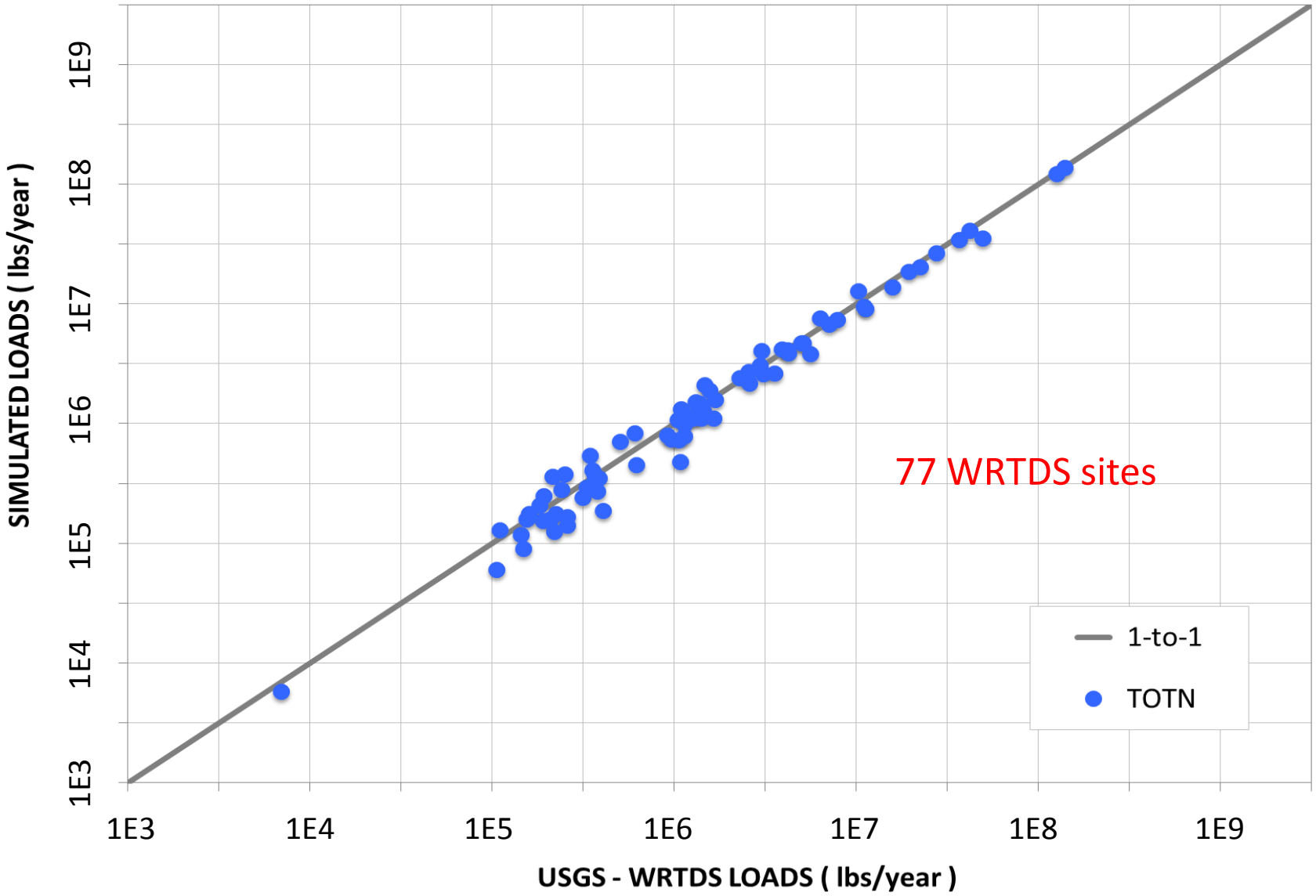
NITROGEN



BETA 4C

Beta 4 calibration

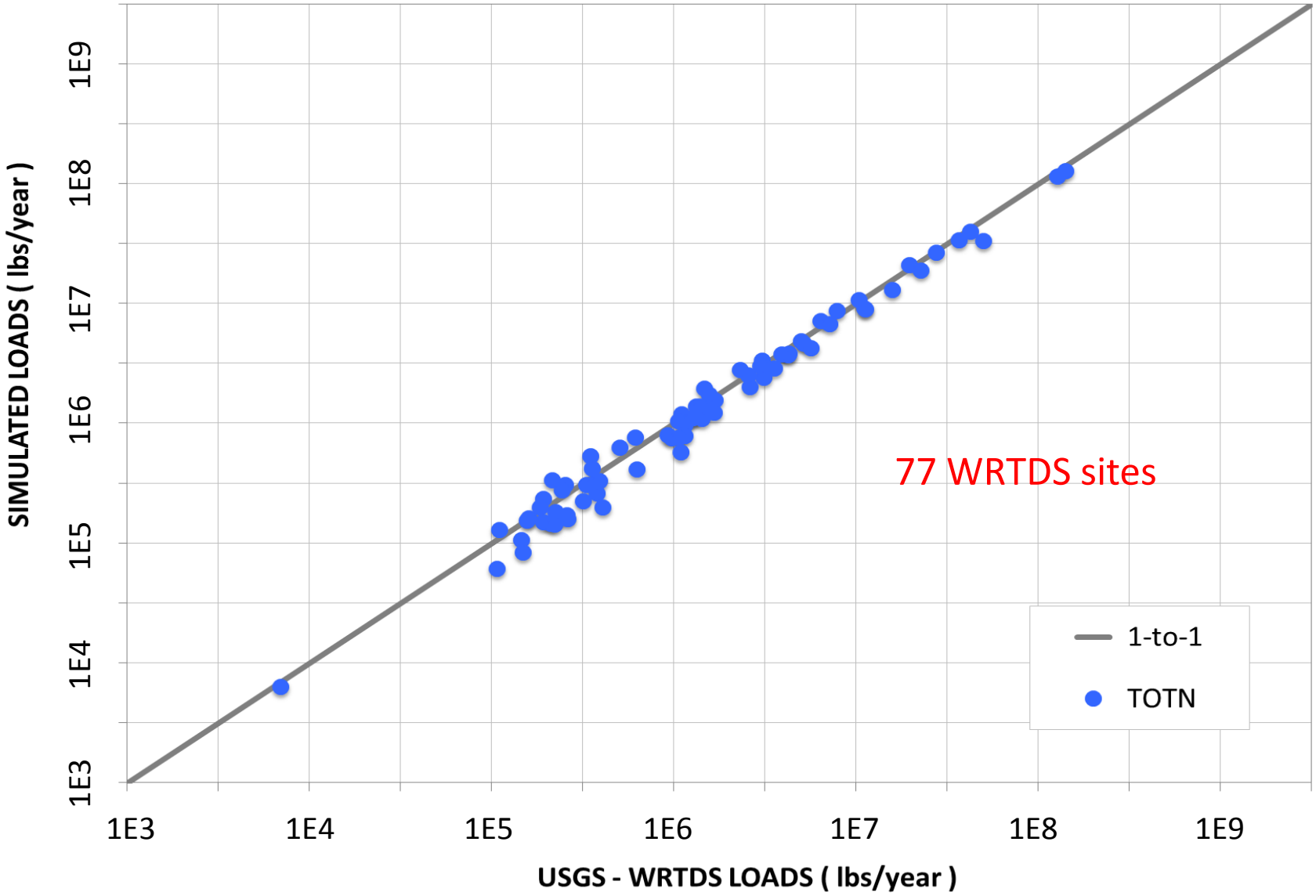
NITROGEN



DRAFT A

Revised inputs and model refinements

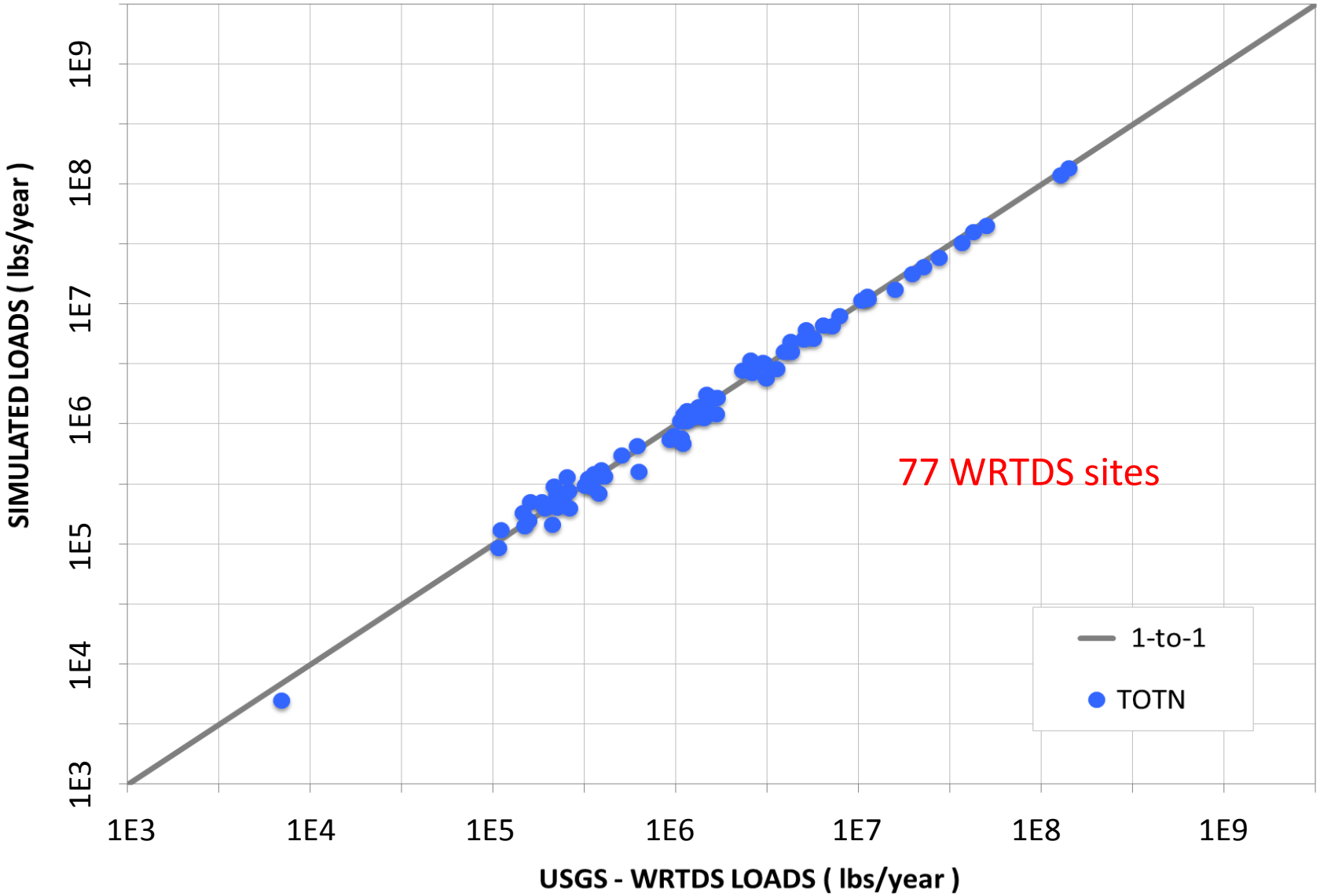
NITROGEN

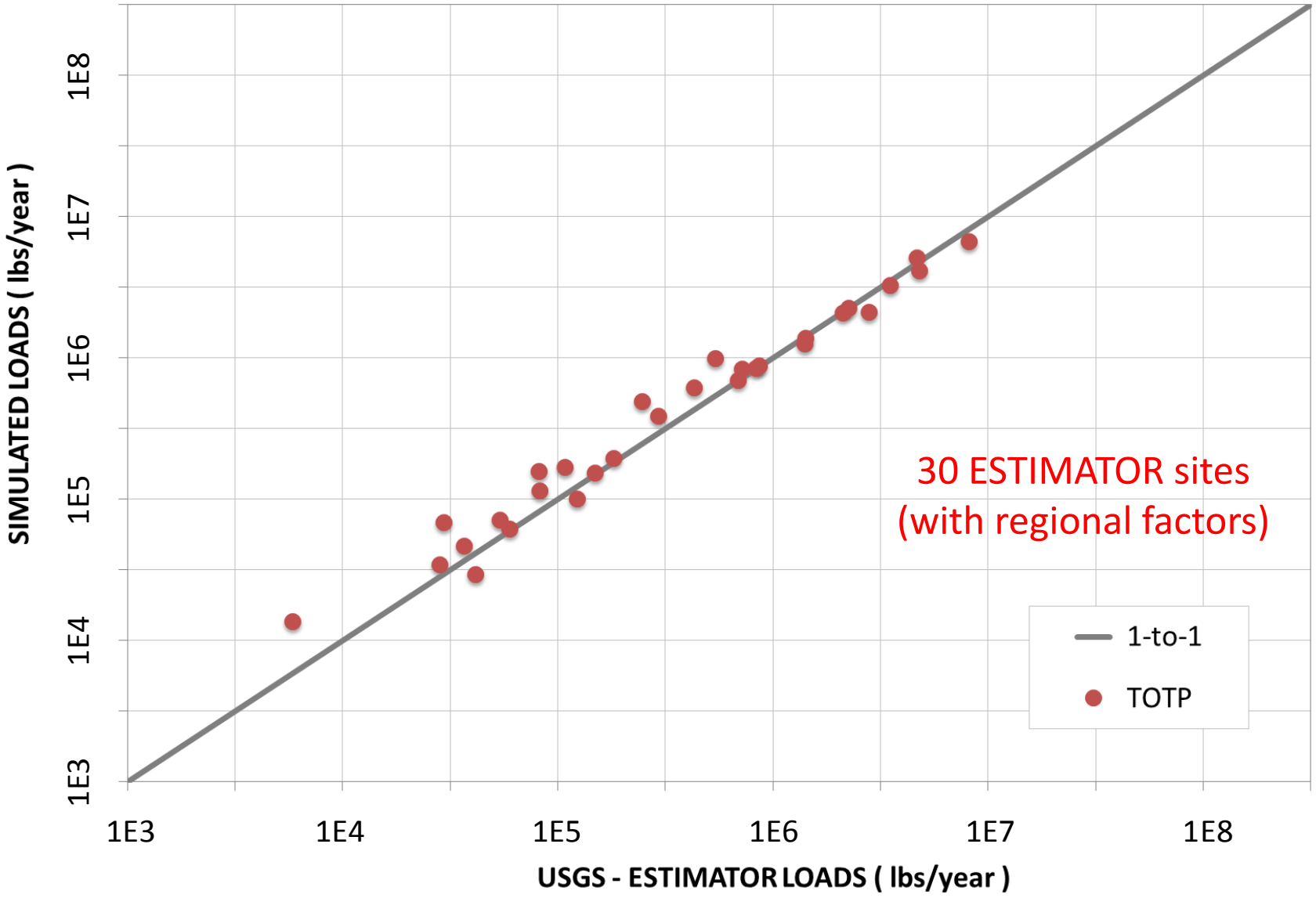


DRAFT G

Revised inputs, model refinements, and calibration methods

NITROGEN

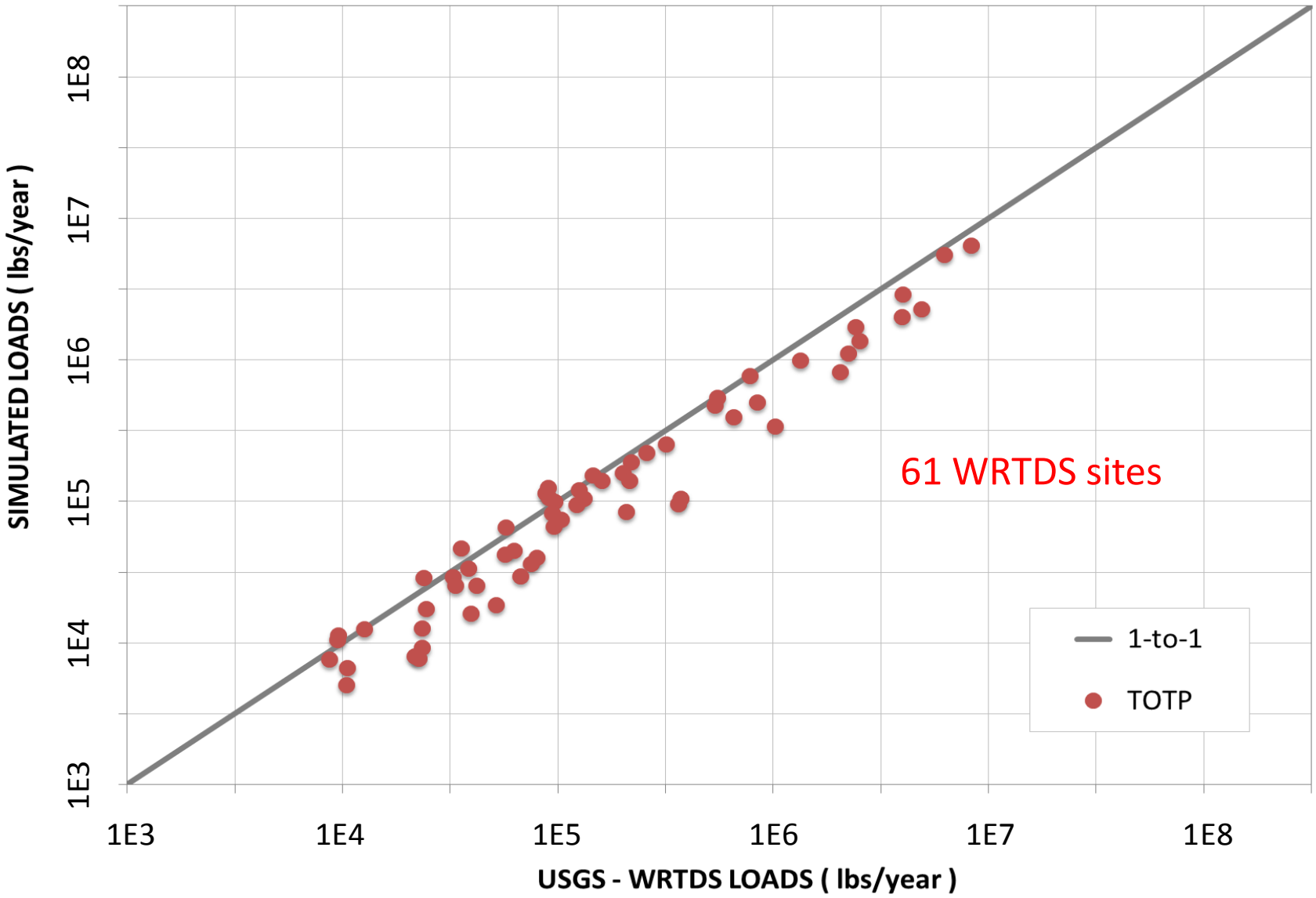



SIMULATED LOADS (lbs/year)
1E8
1E7
1E6
1E5
1E4
1E3
1E3
1E4
1E5
1E6
1E7
1E8
USGS - ESTIMATOR LOADS (lbs/year)
30 ESTIMATOR sites
(with regional factors)
1-to-1
TOTP

BETA 4C

Beta 4 calibration

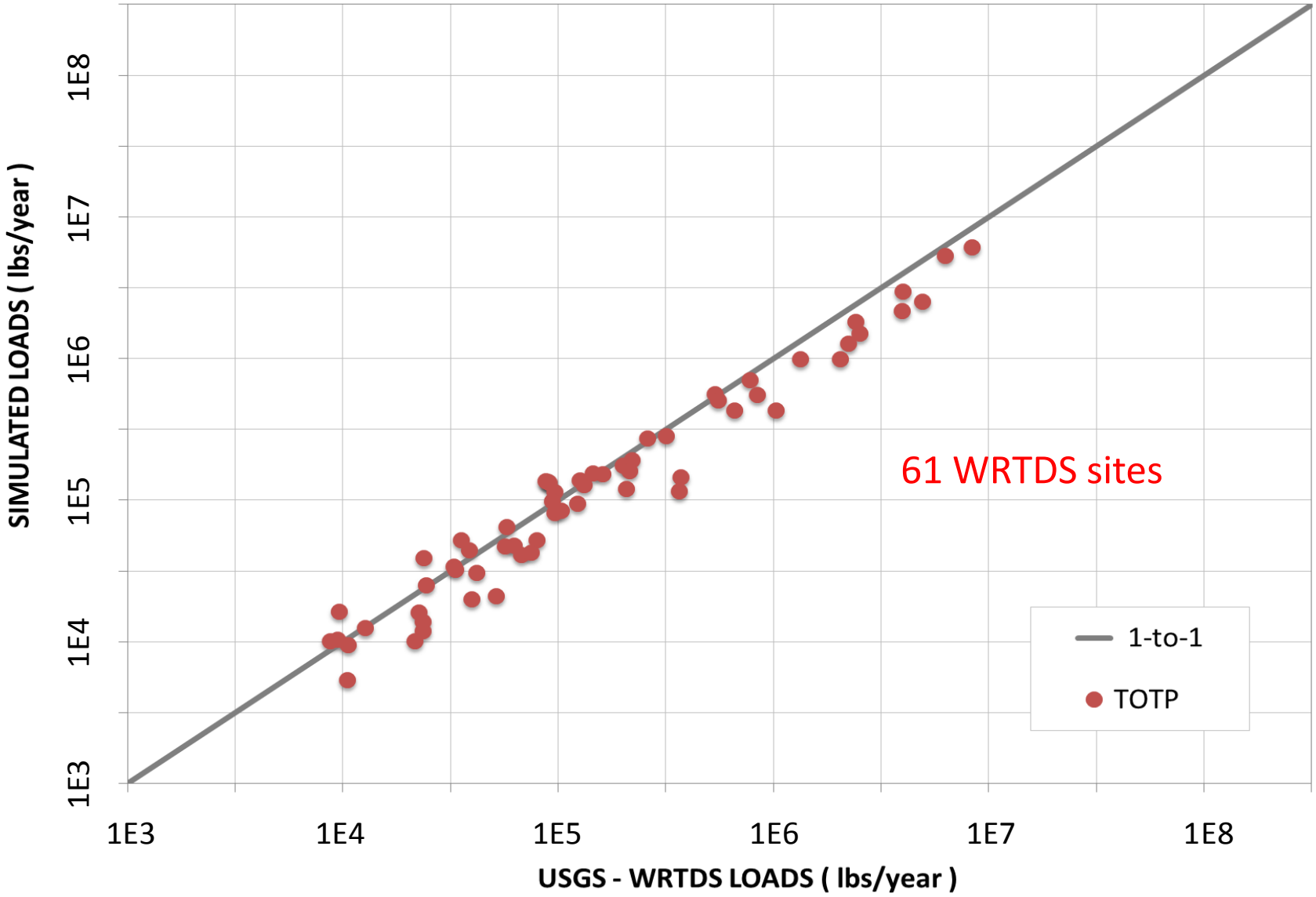
PHOSPHORUS



DRAFT A

Revised inputs and model refinements

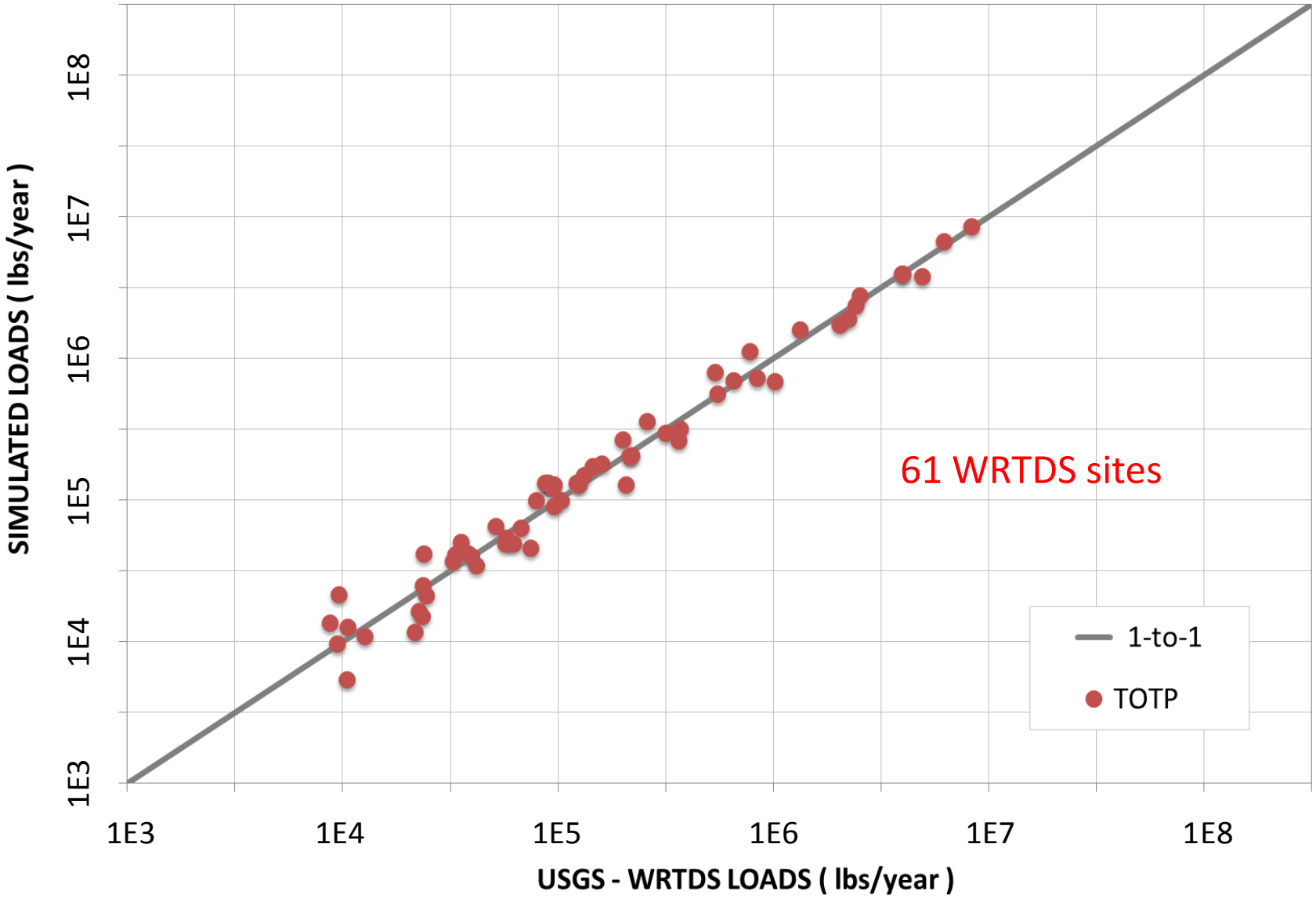
PHOSPHORUS

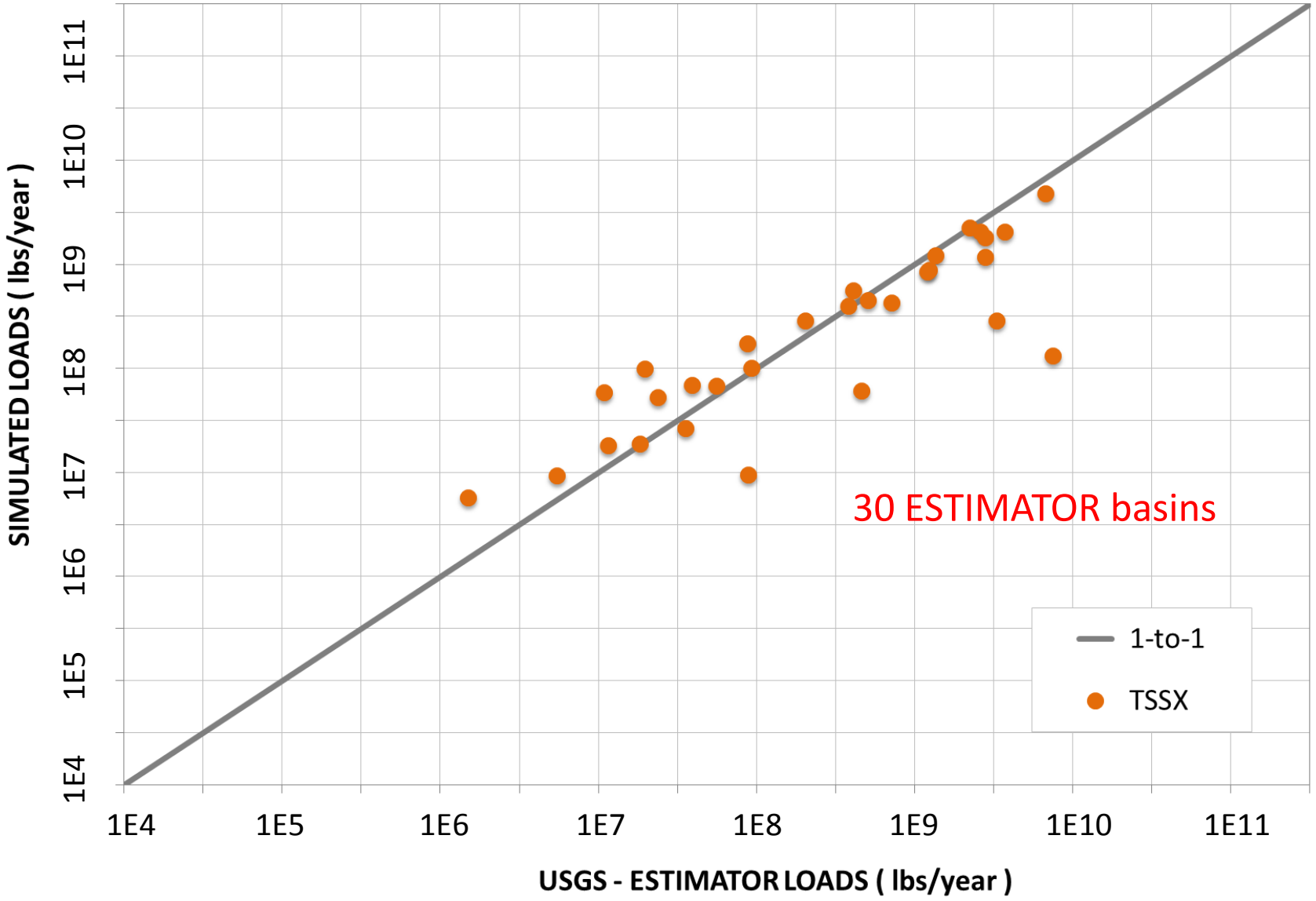


DRAFT G

Revised inputs, model refinements, and calibration methods

PHOSPHORUS

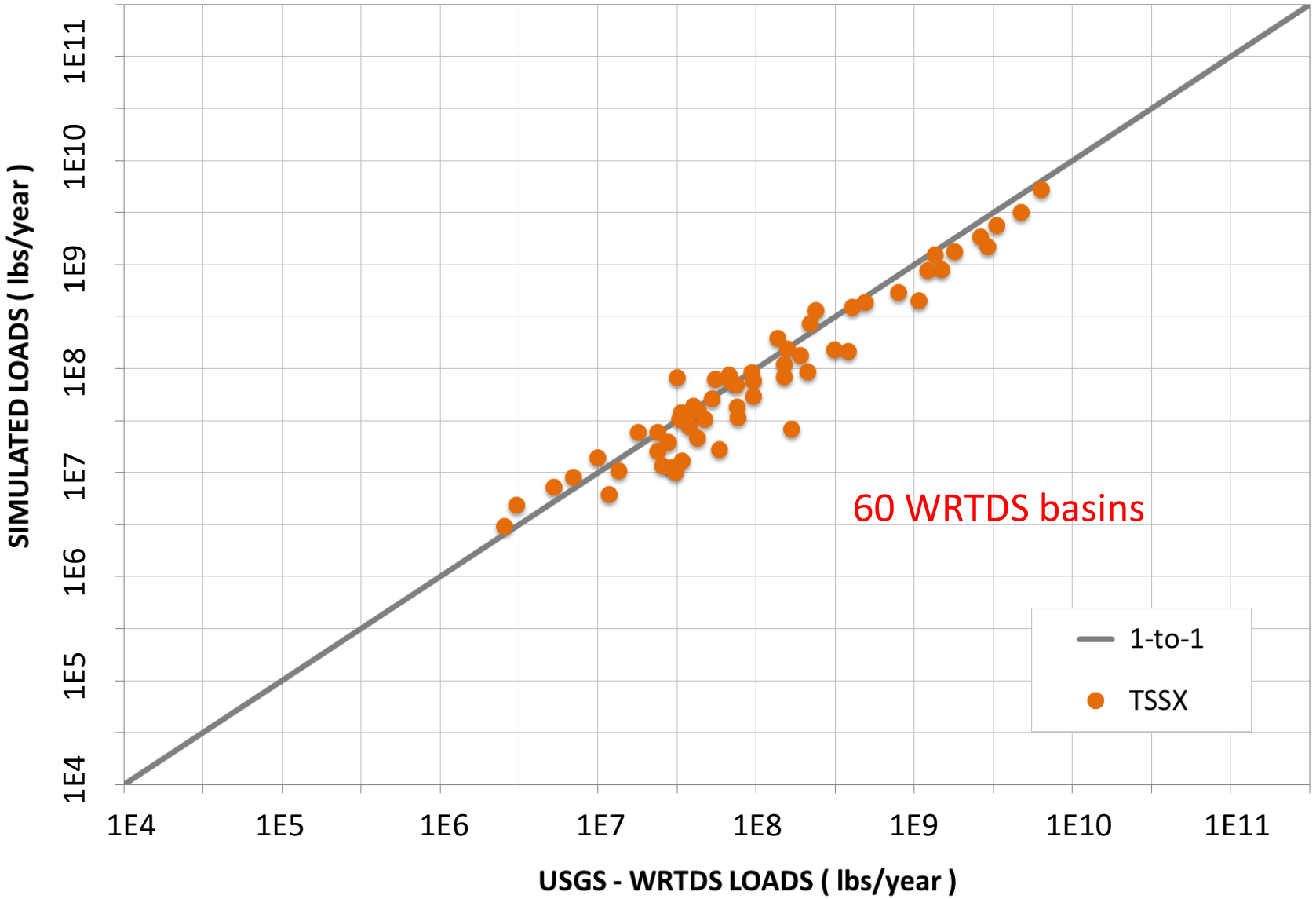



SIMULATED LOADS (lbs/year)
1E4
1E5
1E6
1E7
1E8
1E9
1E10
1E11
USGS - ESTIMATOR LOADS (lbs/year)
30 ESTIMATOR basins
1-to-1
TSSX

BETA 4C

Beta 4 calibration

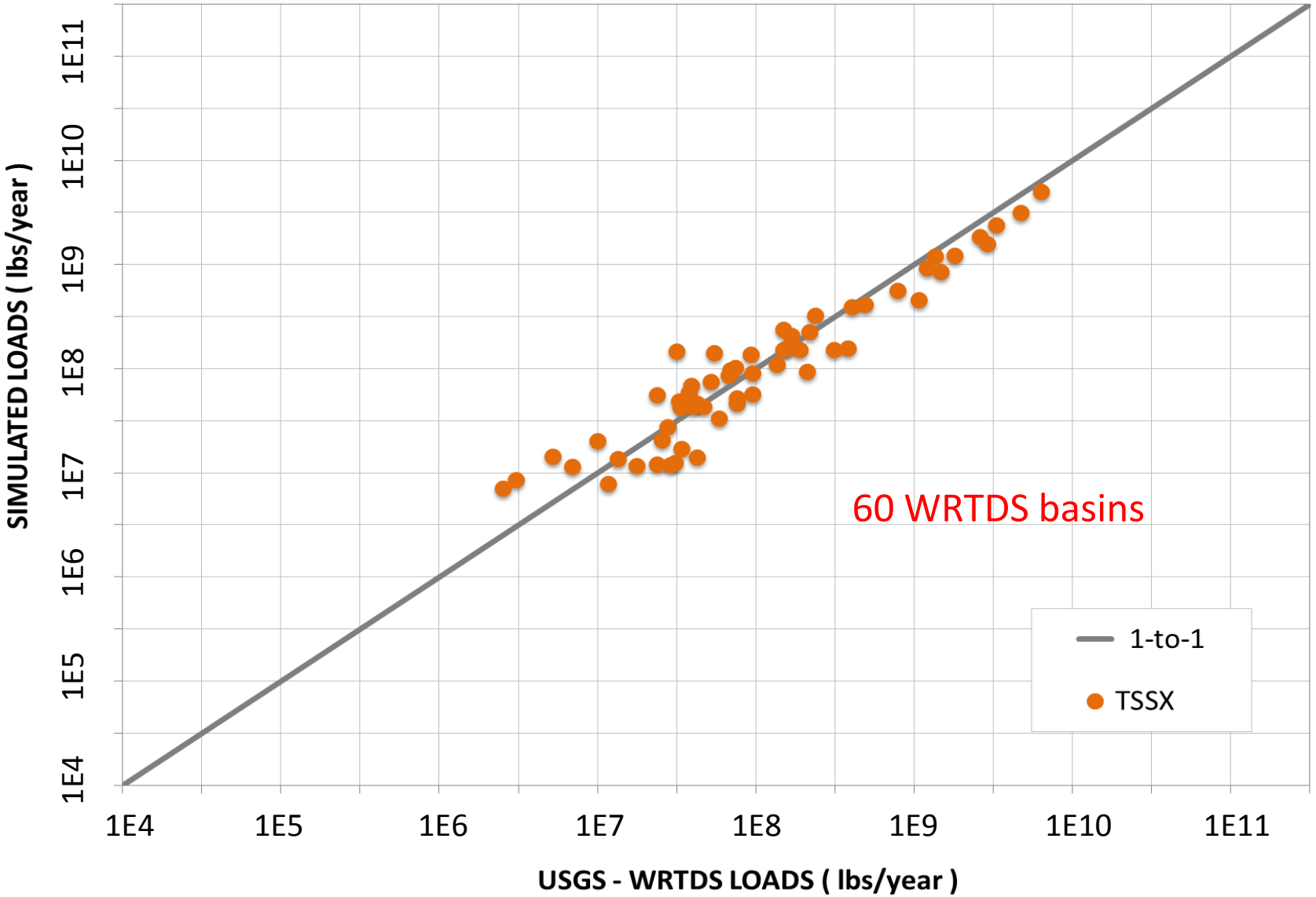
SEDIMENT



DRAFT A

Revised inputs and model refinements

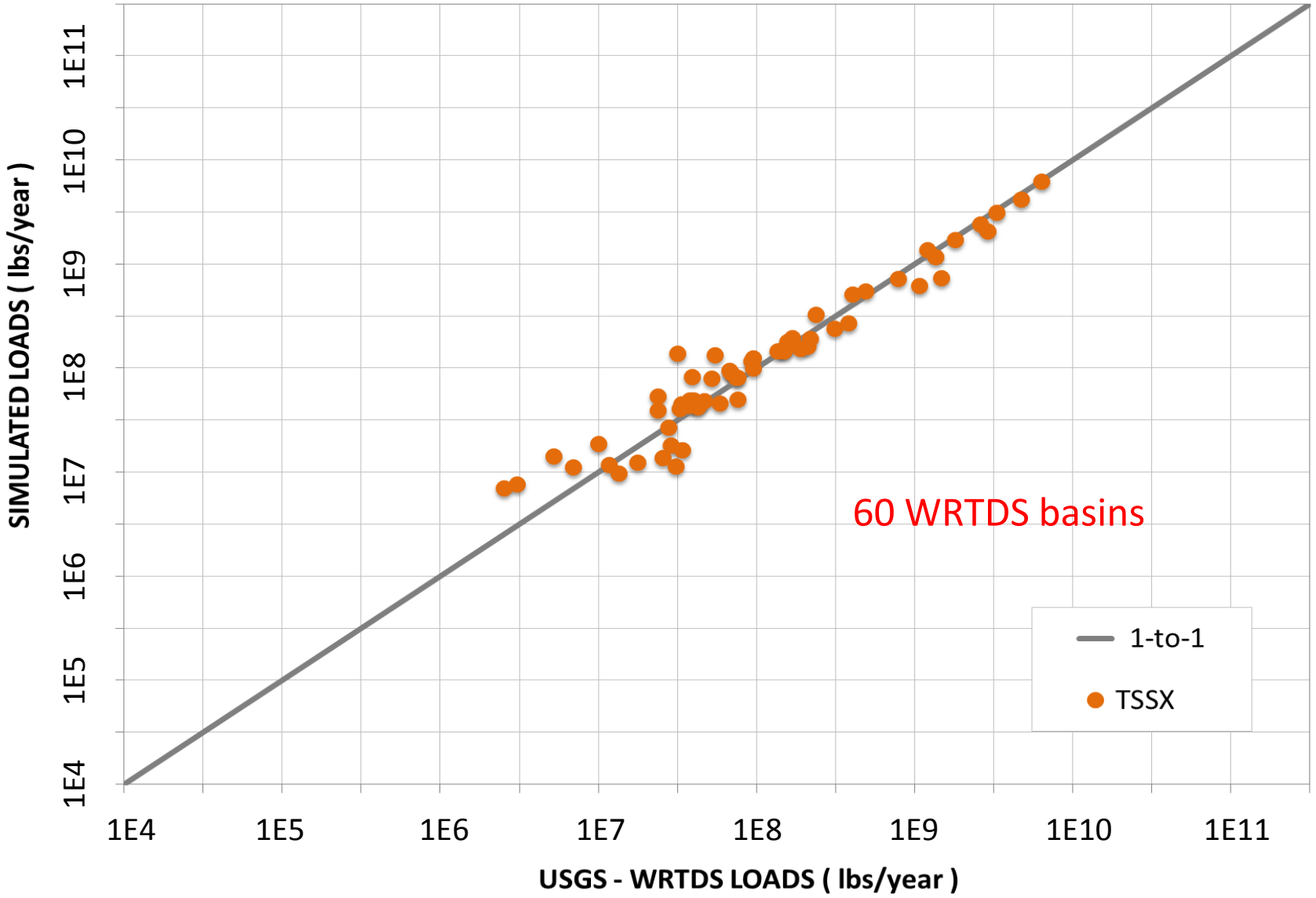
SEDIMENT



DRAFT G

Revised inputs, model refinements, and calibration methods

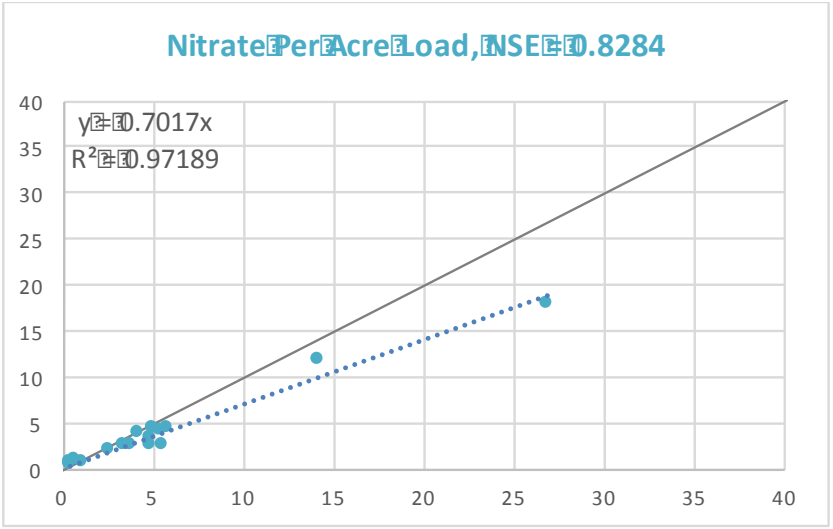
SEDIMENT

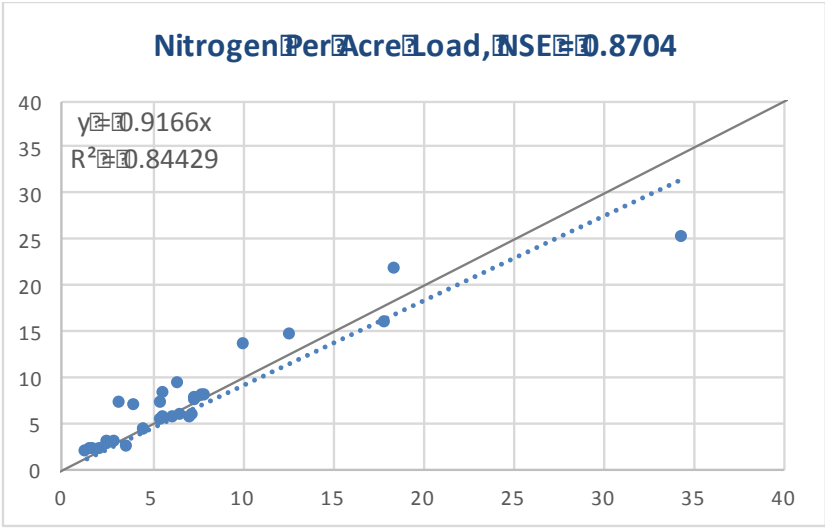


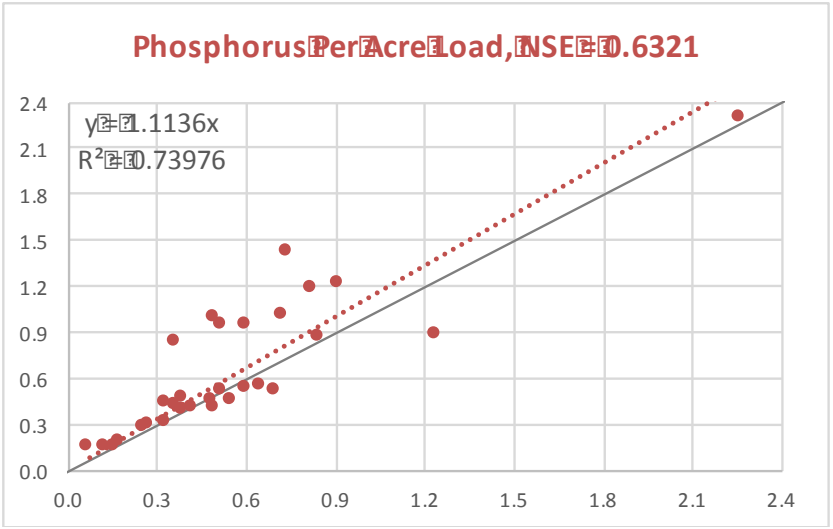
Review of geographic efficiencies

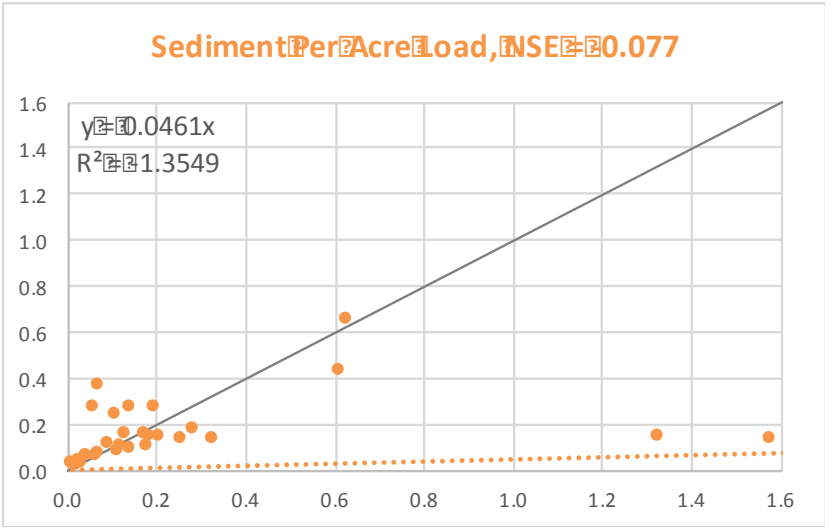
- WRTDS and simulated per acre loads are compared.
- Nash-Sutcliffe model efficiency was used to quantify the predictive power of the model across the watershed.
- An efficiency of 1 would indicate a perfect match in loads for all river basins (where WRTDS estimates are available).

Phase 5 – geographic efficiencies





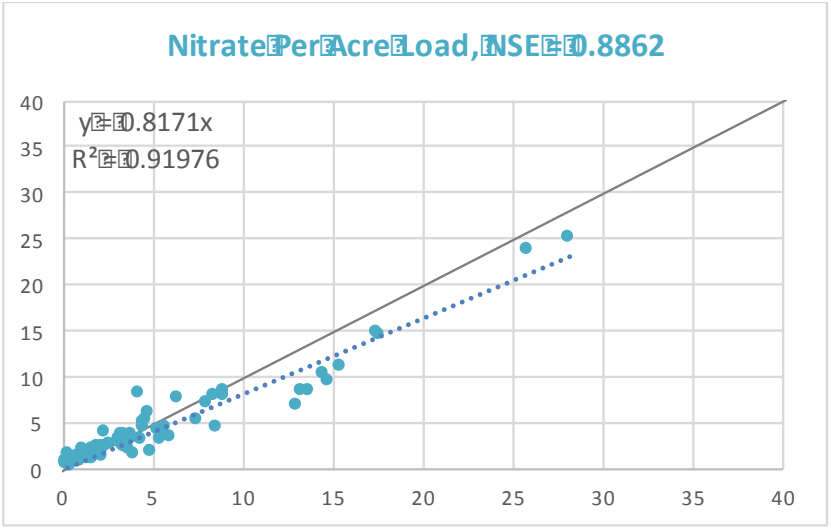


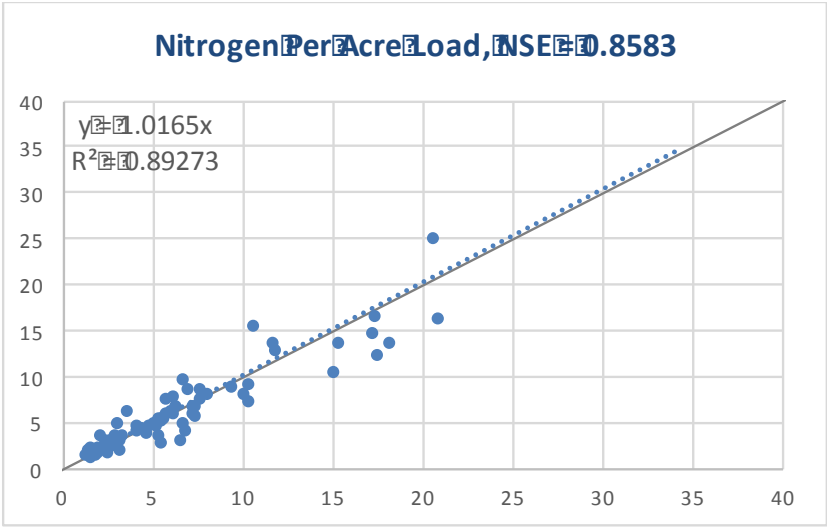


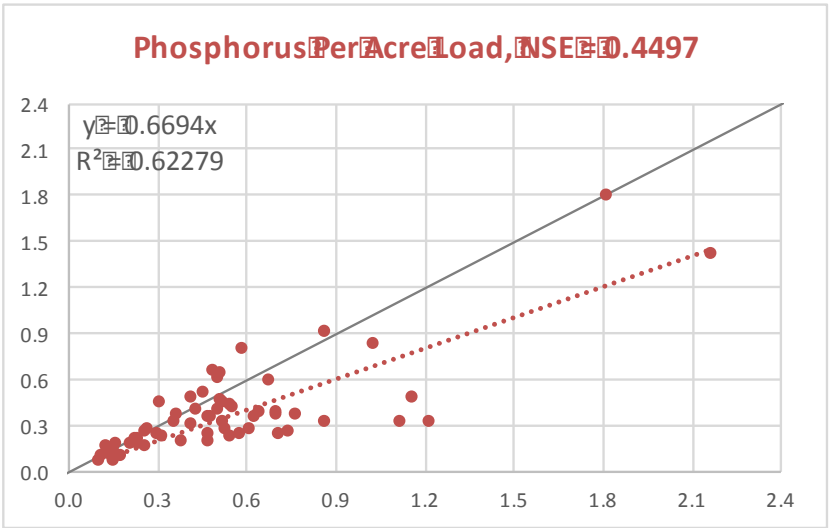
Simulated Per Acre Load

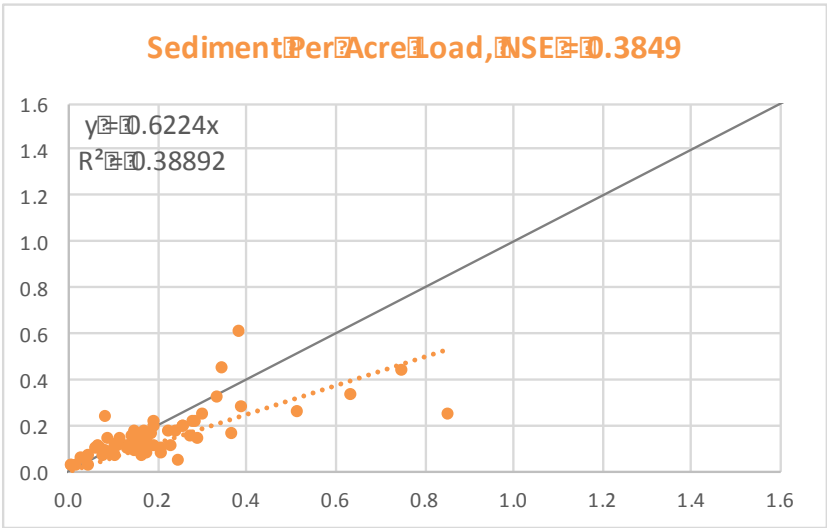
WRTDS Per Acre Load

Beta 4 – geographic efficiencies





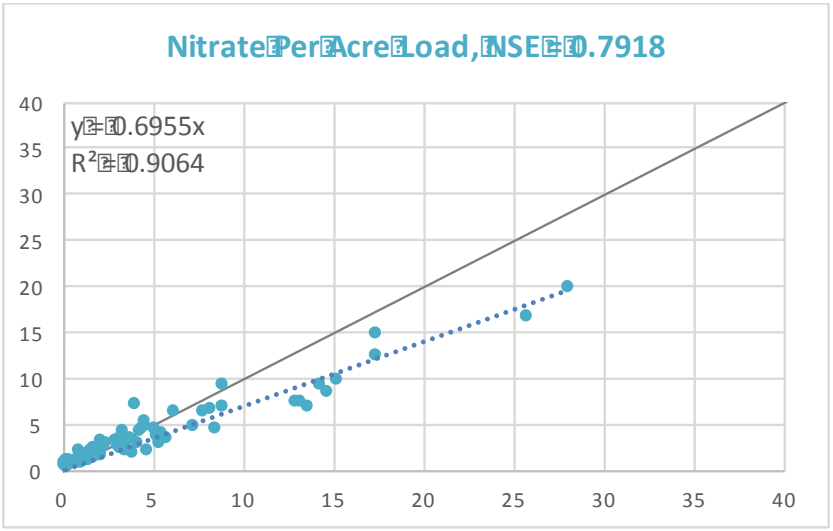


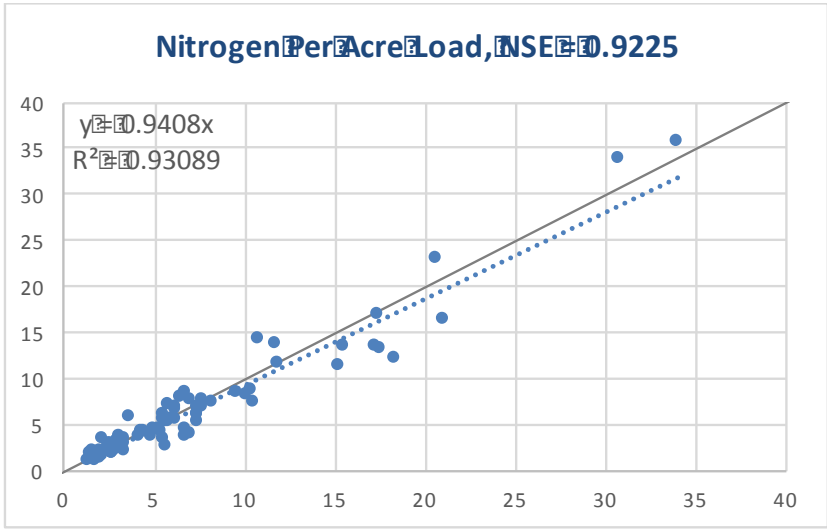


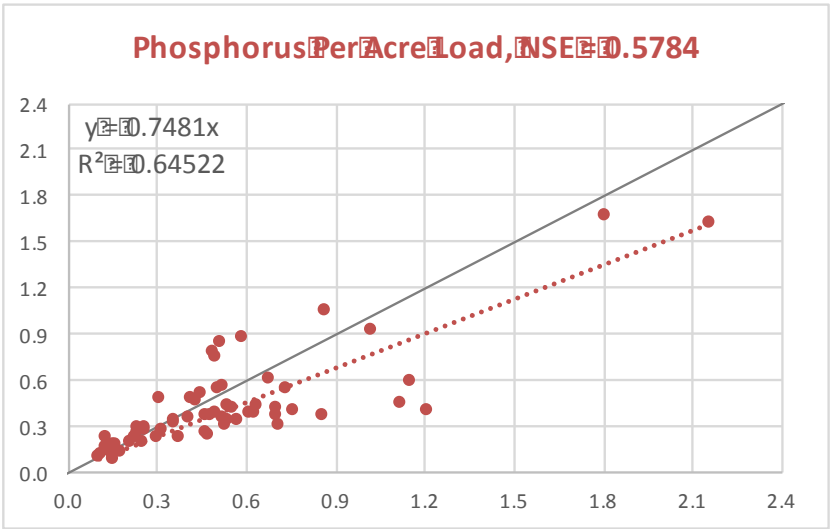
Simulated Per Acre Load

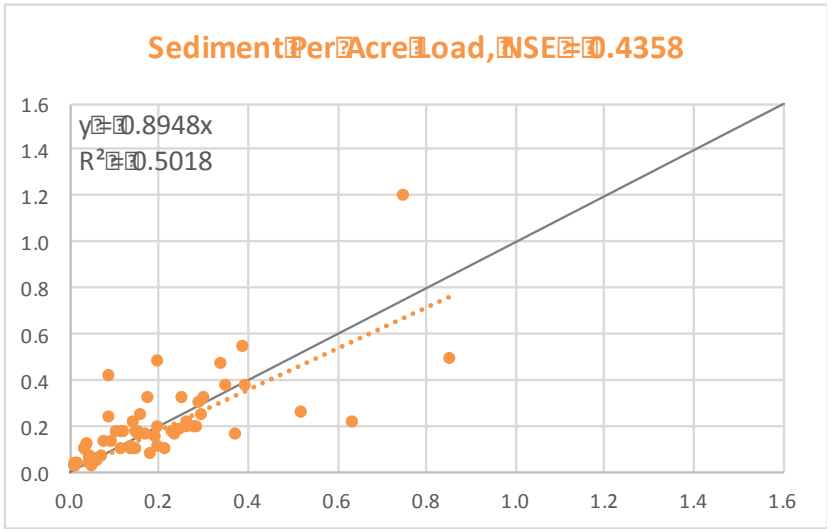
WRTDS Per Acre Load

DRAFT A – geographic efficiencies





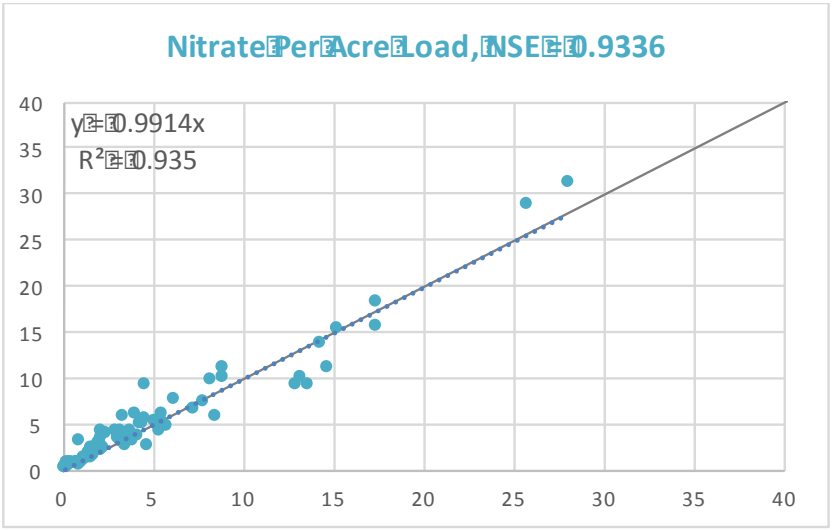


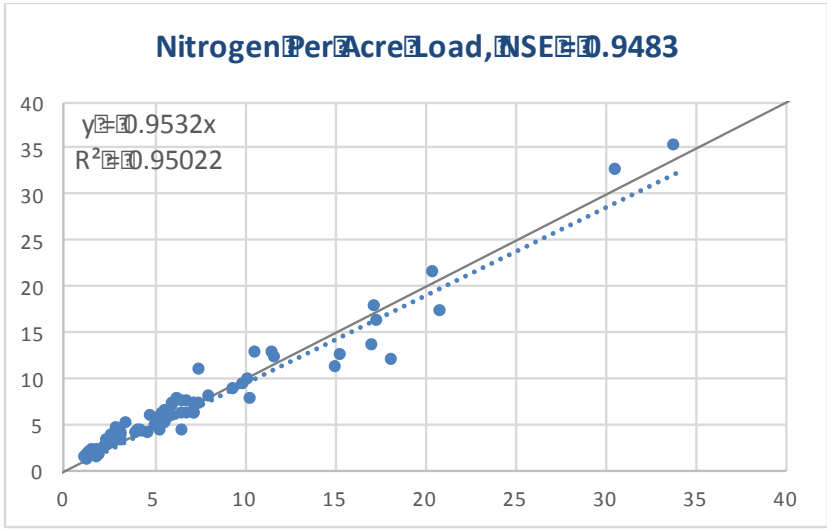


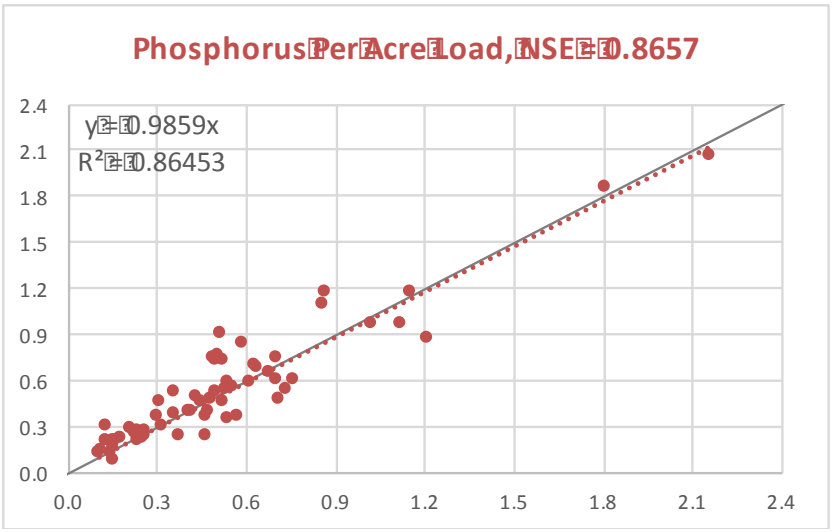
Simulated Per Acre Load

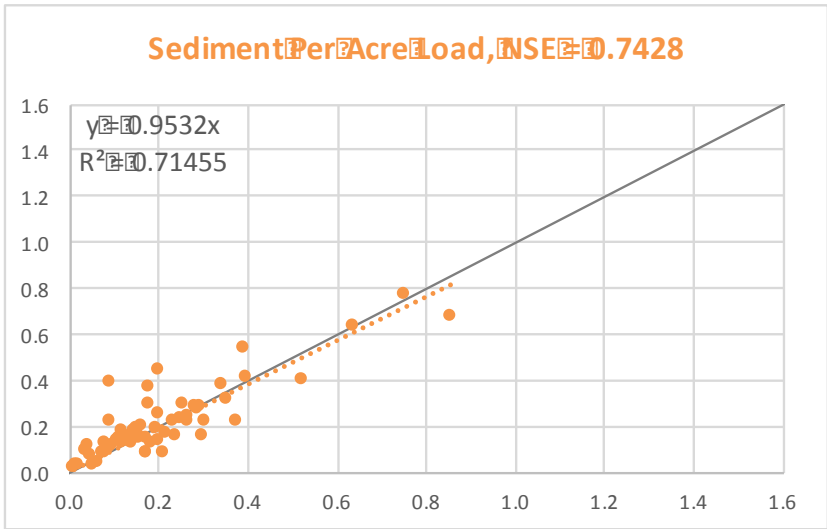
WRTDS Per Acre Load

DRAFT G – geographic efficiencies









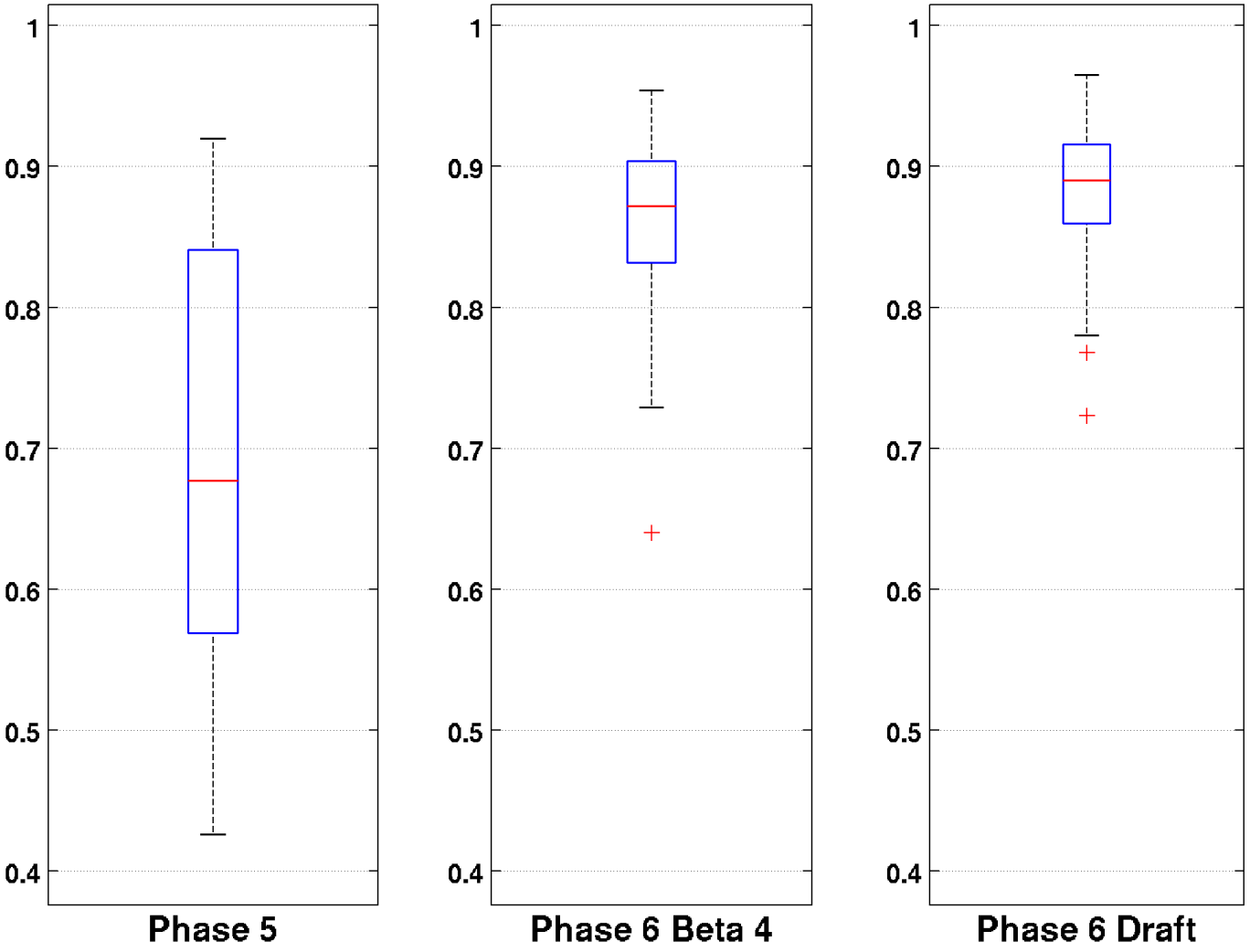
Simulated Per Acre Load

WRTDS Per Acre Load

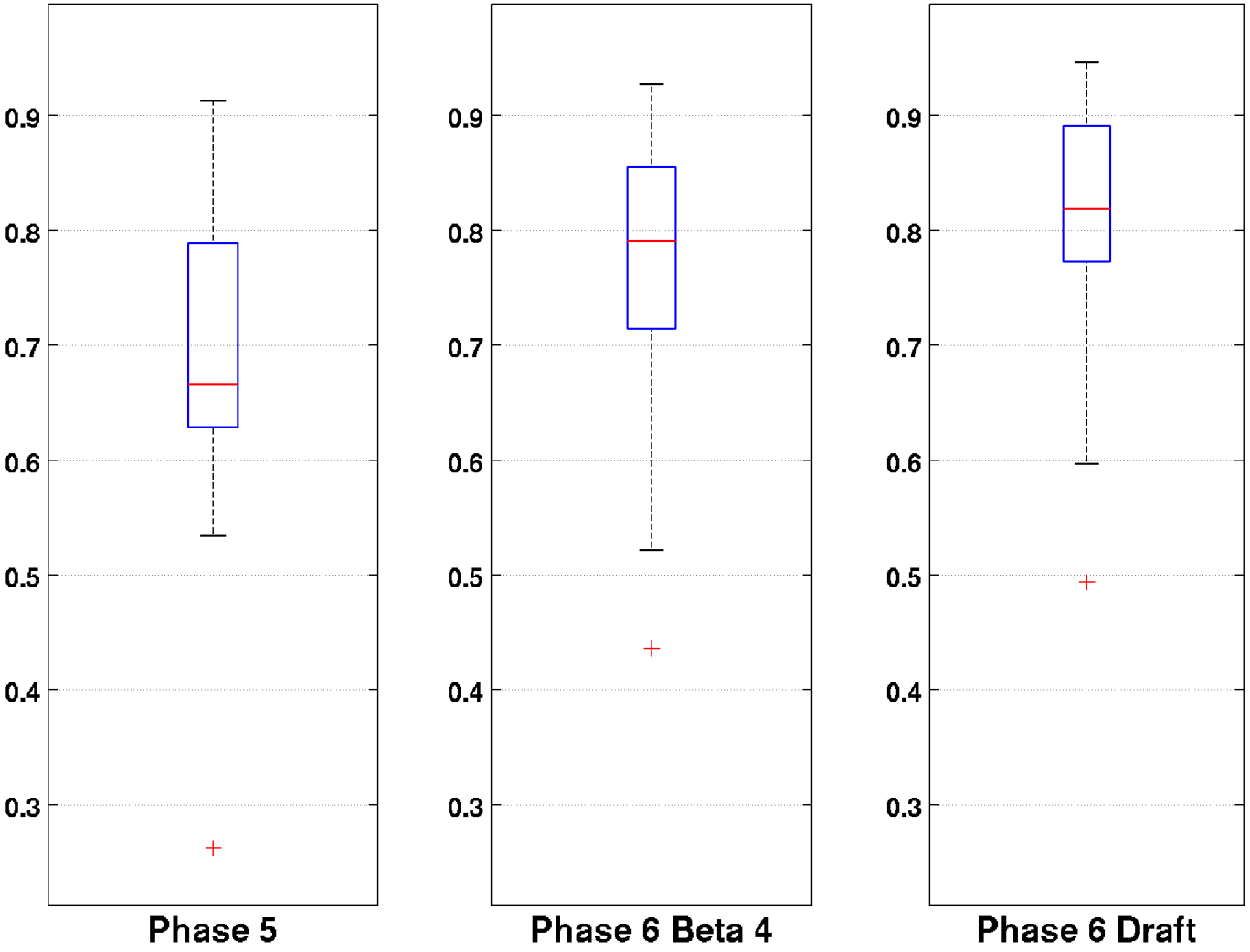
Summary of geographic efficiencies

Constituents	**Phase 5**	**Beta 4**	**Draft A**	**Draft G**
Nitrate	0.8284	0.8862	0.7918	0.9336
Nitrogen	0.8704	0.8583	0.9225	0.9483
Phosphorus	0.6321	0.4497	0.5784	0.8557
Sediment	-0.0770	0.3849	0.4358	0.7428

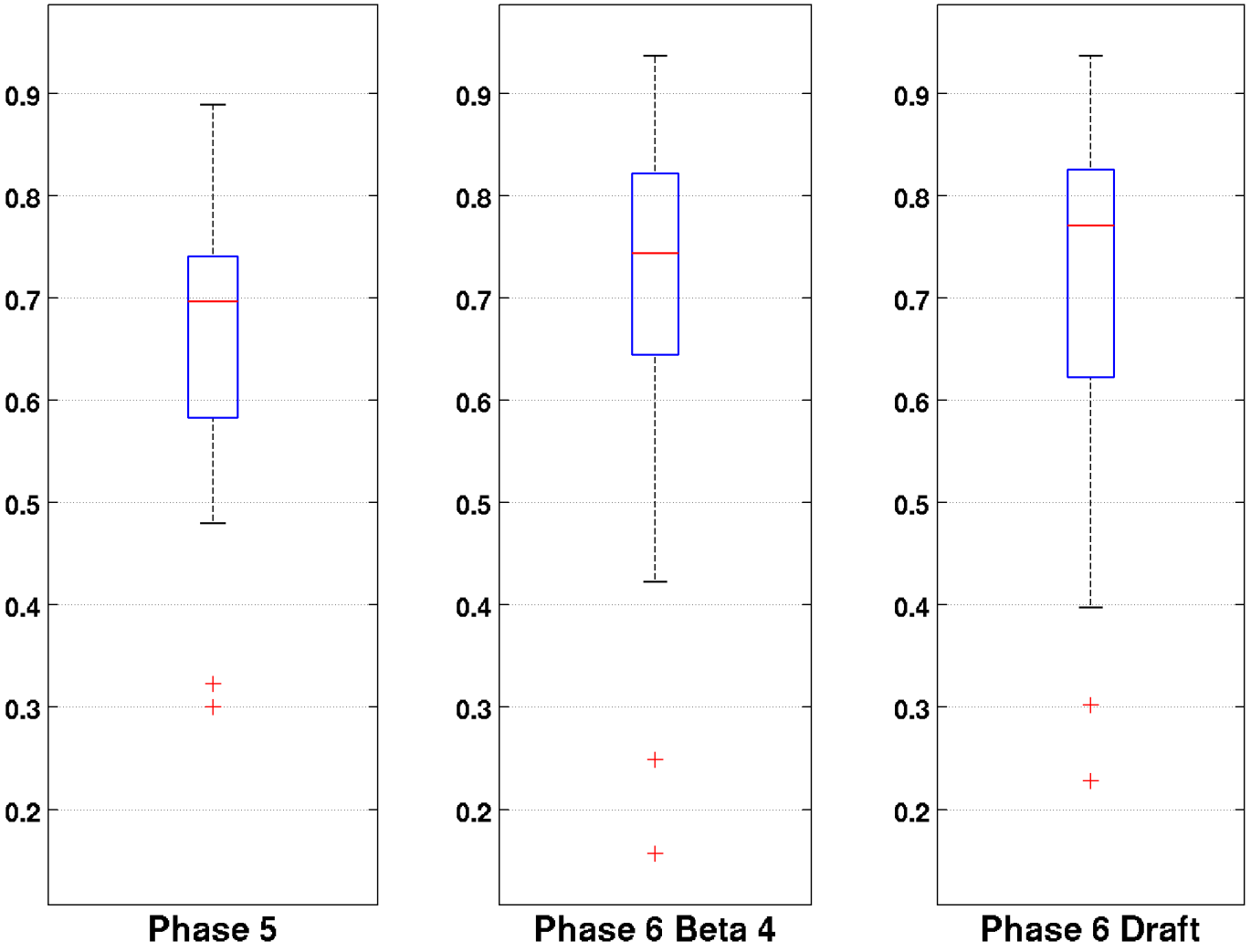
Monthly loads: total nitrogen



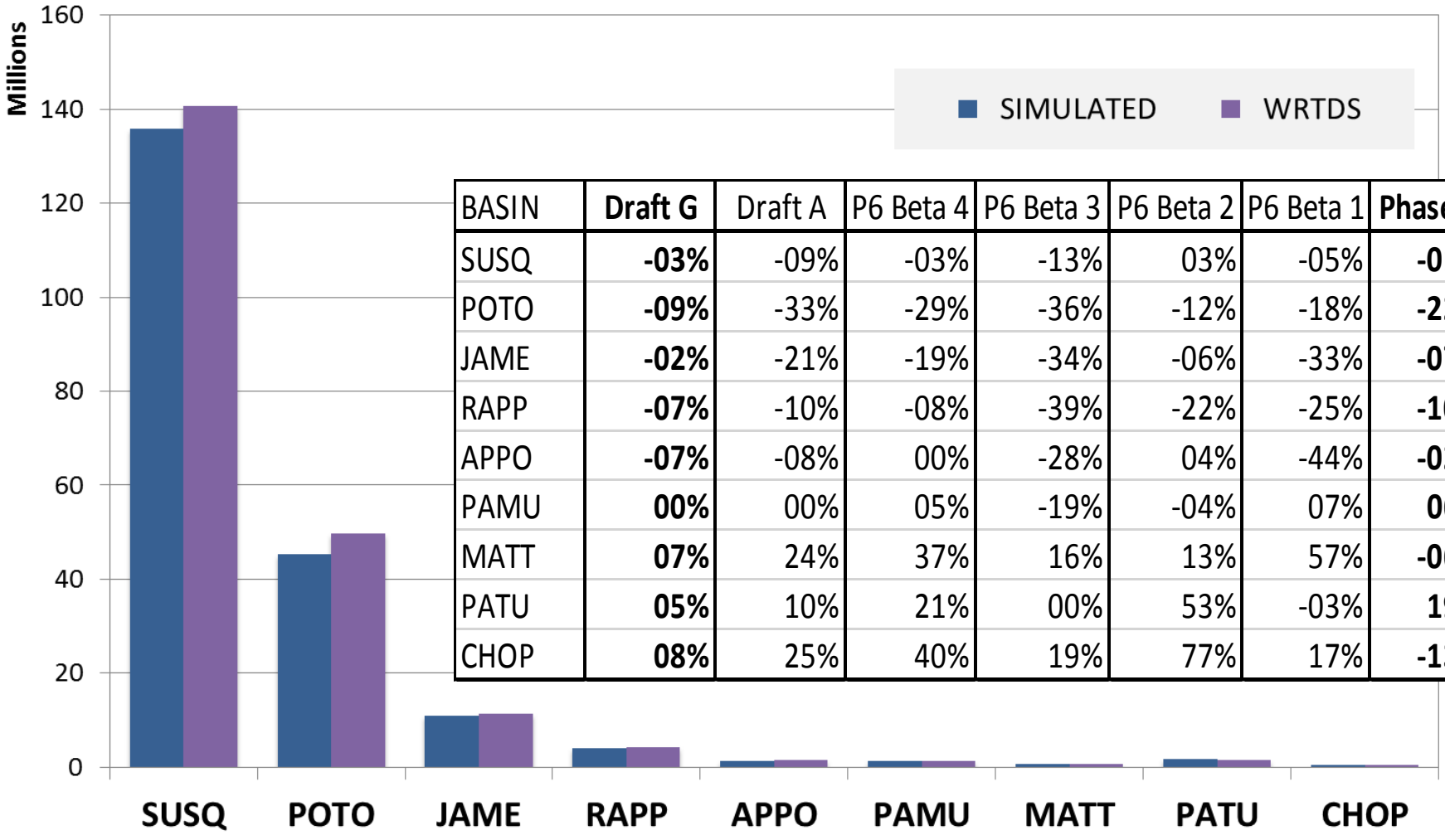
Monthly loads: total phosphorus



Monthly loads: sediment



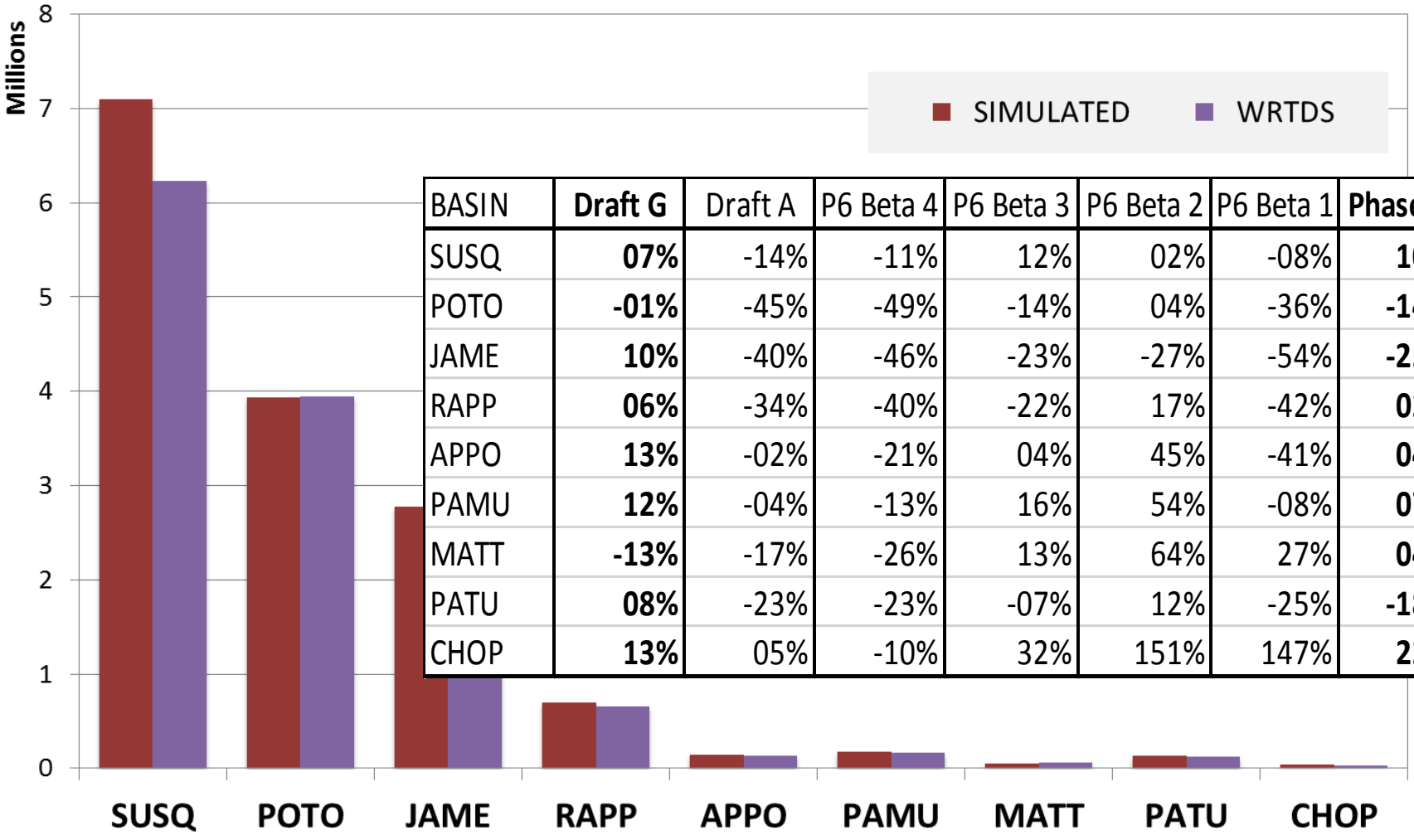
RIM loads: total nitrogen



BASIN	**Draft G**	Draft A	P6 Beta 4	P6 Beta 3	P6 Beta 2	P6 Beta 1	**Phase 5**
SUSQ	**-03%**	-09%	-03%	-13%	03%	-05%	**-01%**
POTO	**-09%**	-33%	-29%	-36%	-12%	-18%	**-22%**
JAME	**-02%**	-21%	-19%	-34%	-06%	-33%	**-07%**
RAPP	**-07%**	-10%	-08%	-39%	-22%	-25%	**-10%**
APPO	**-07%**	-08%	00%	-28%	04%	-44%	**-02%**
PAMU	**00%**	00%	05%	-19%	-04%	07%	**06%**
MATT	**07%**	24%	37%	16%	13%	57%	**-06%**
PATU	**05%**	10%	21%	00%	53%	-03%	**19%**
CHOP	**08%**	25%	40%	19%	77%	17%	**-13%**

assuming +/- 10% uncertainty in WRTDS estimates

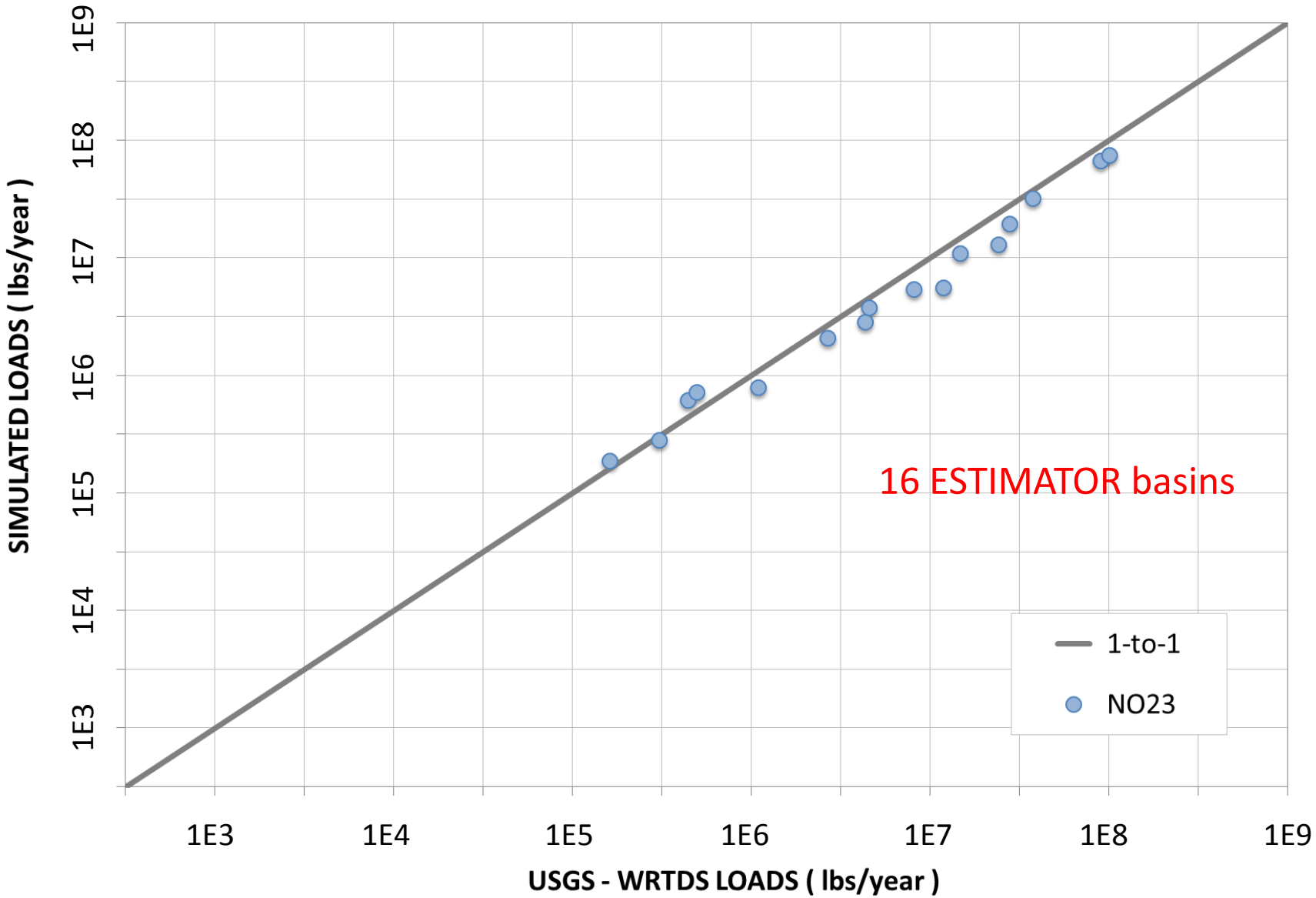
RIM loads: total phosphorus



BASIN	**Draft G**	Draft A	P6 Beta 4	P6 Beta 3	P6 Beta 2	P6 Beta 1	**Phase 5**
SUSQ	**07%**	-14%	-11%	12%	02%	-08%	**10%**
POTO	**-01%**	-45%	-49%	-14%	04%	-36%	**-14%**
JAME	**10%**	-40%	-46%	-23%	-27%	-54%	**-25%**
RAPP	**06%**	-34%	-40%	-22%	17%	-42%	**02%**
APPO	**13%**	-02%	-21%	04%	45%	-41%	**04%**
PAMU	**12%**	-04%	-13%	16%	54%	-08%	**07%**
MATT	**-13%**	-17%	-26%	13%	64%	27%	**04%**
PATU	**08%**	-23%	-23%	-07%	12%	-25%	**-18%**
CHOP	**13%**	05%	-10%	32%	151%	147%	**22%**

assuming +/- 15% uncertainty in WRTDS estimates

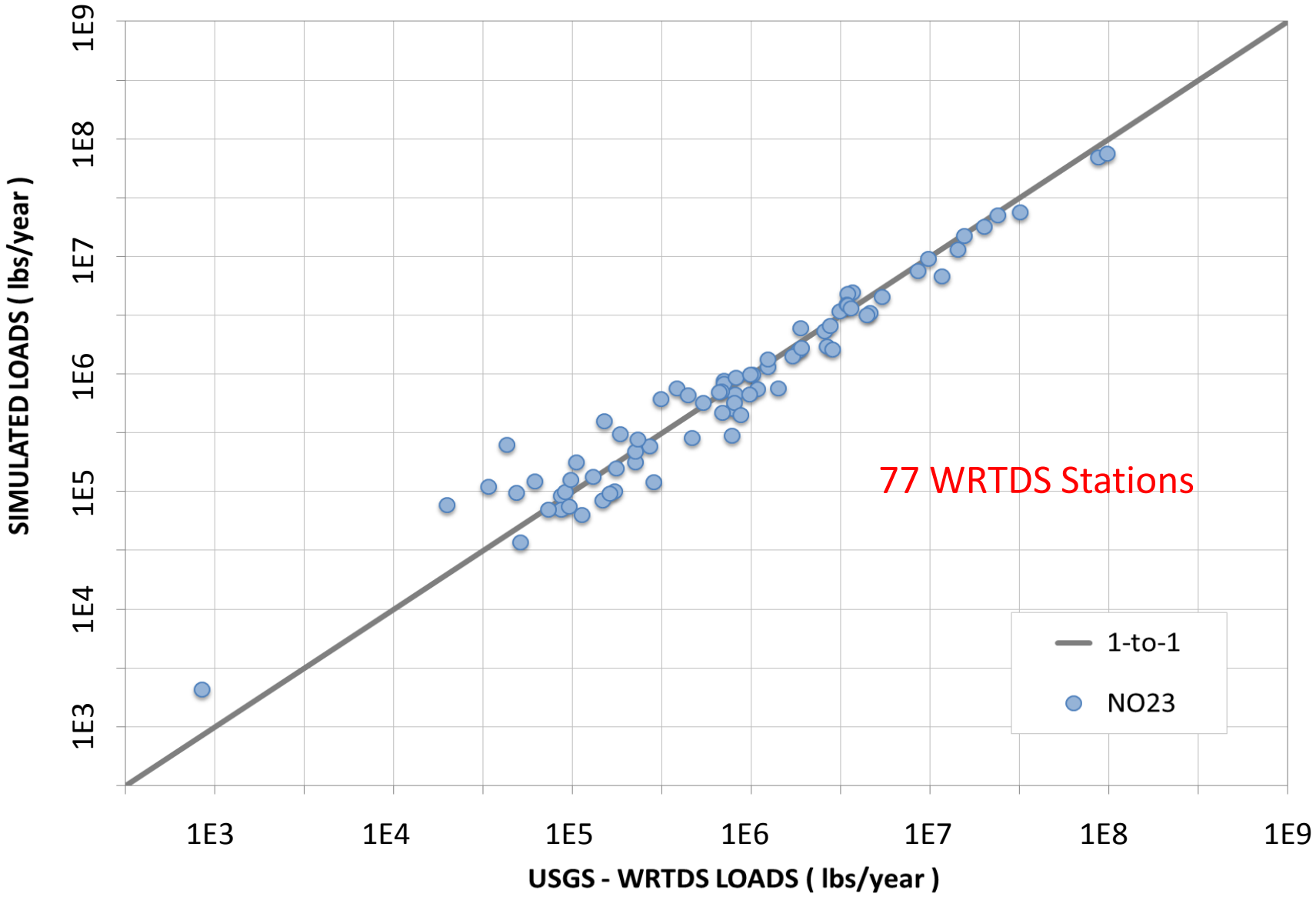
Appendices


SIMULATED LOADS (lbs/year)
1E9
1E8
1E7
1E6
1E5
1E4
1E3
1E3
1E4
1E5
1E6
1E7
1E8
1E9
USGS - WRTDS LOADS (lbs/year)
16 ESTIMATOR basins
1-to-1
NO23

BETA 4C

Beta 4 calibration

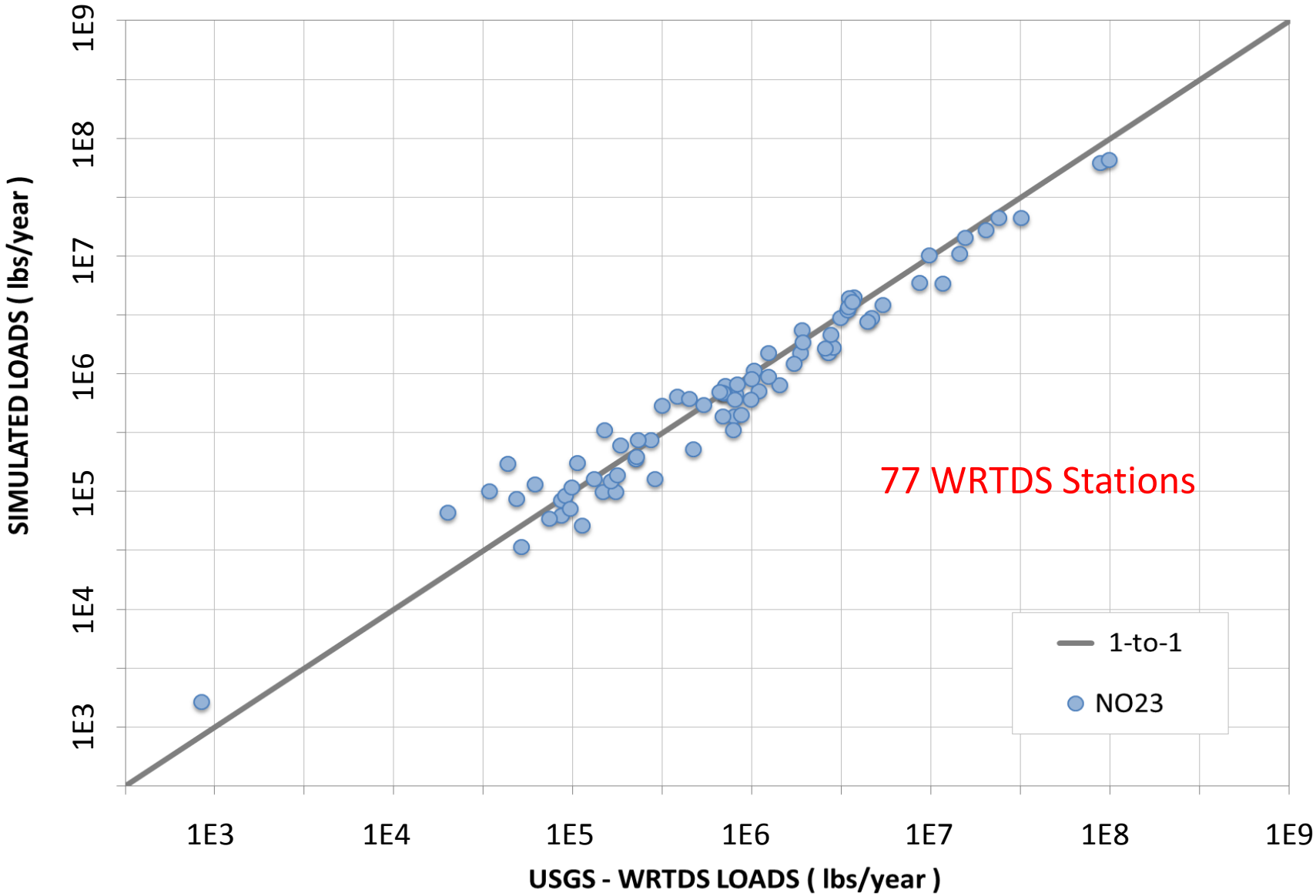
NITRATE



DRAFT A

Revised inputs and model refinements

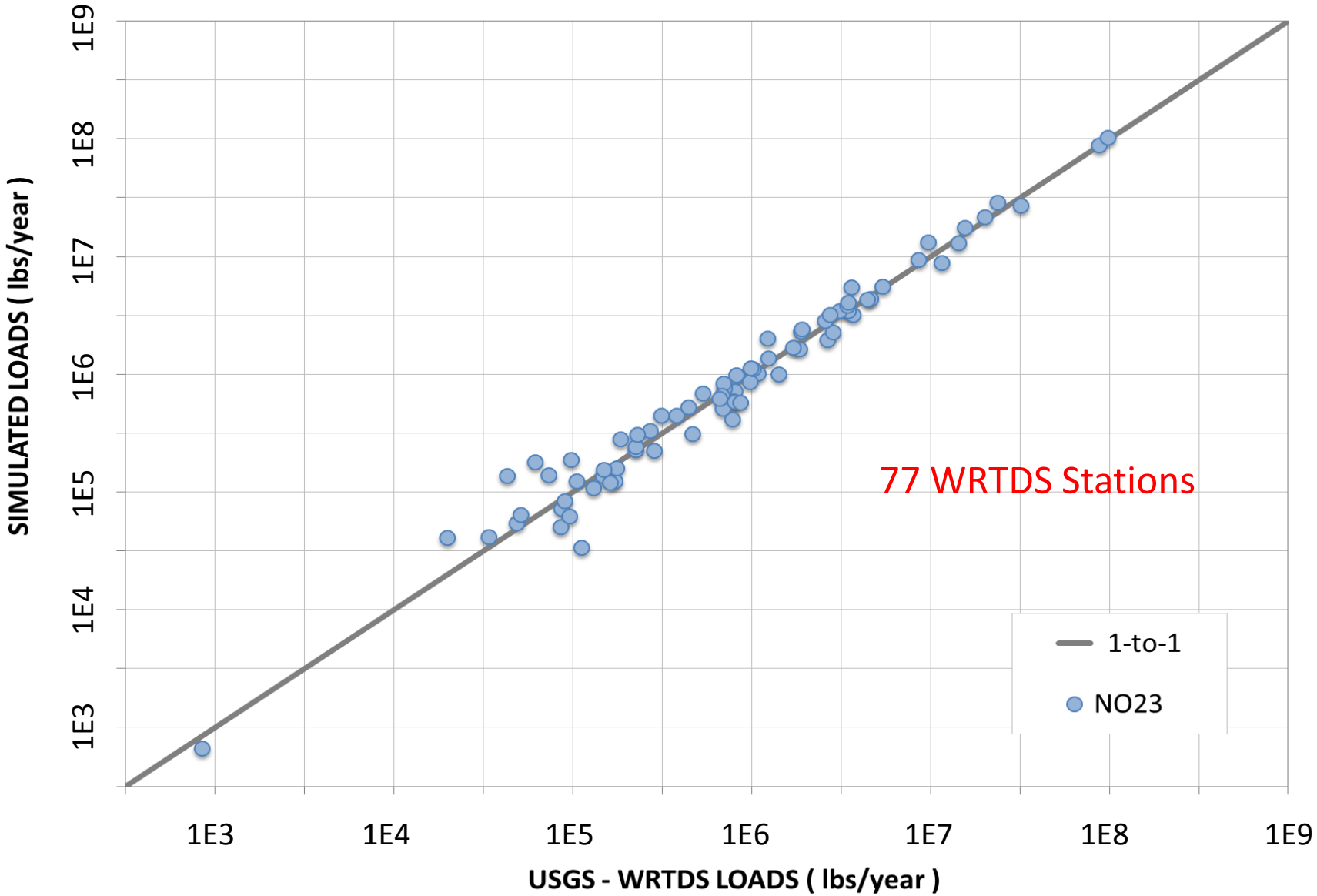
NITRATE



DRAFT G

Revised inputs, model refinements, and calibration methods

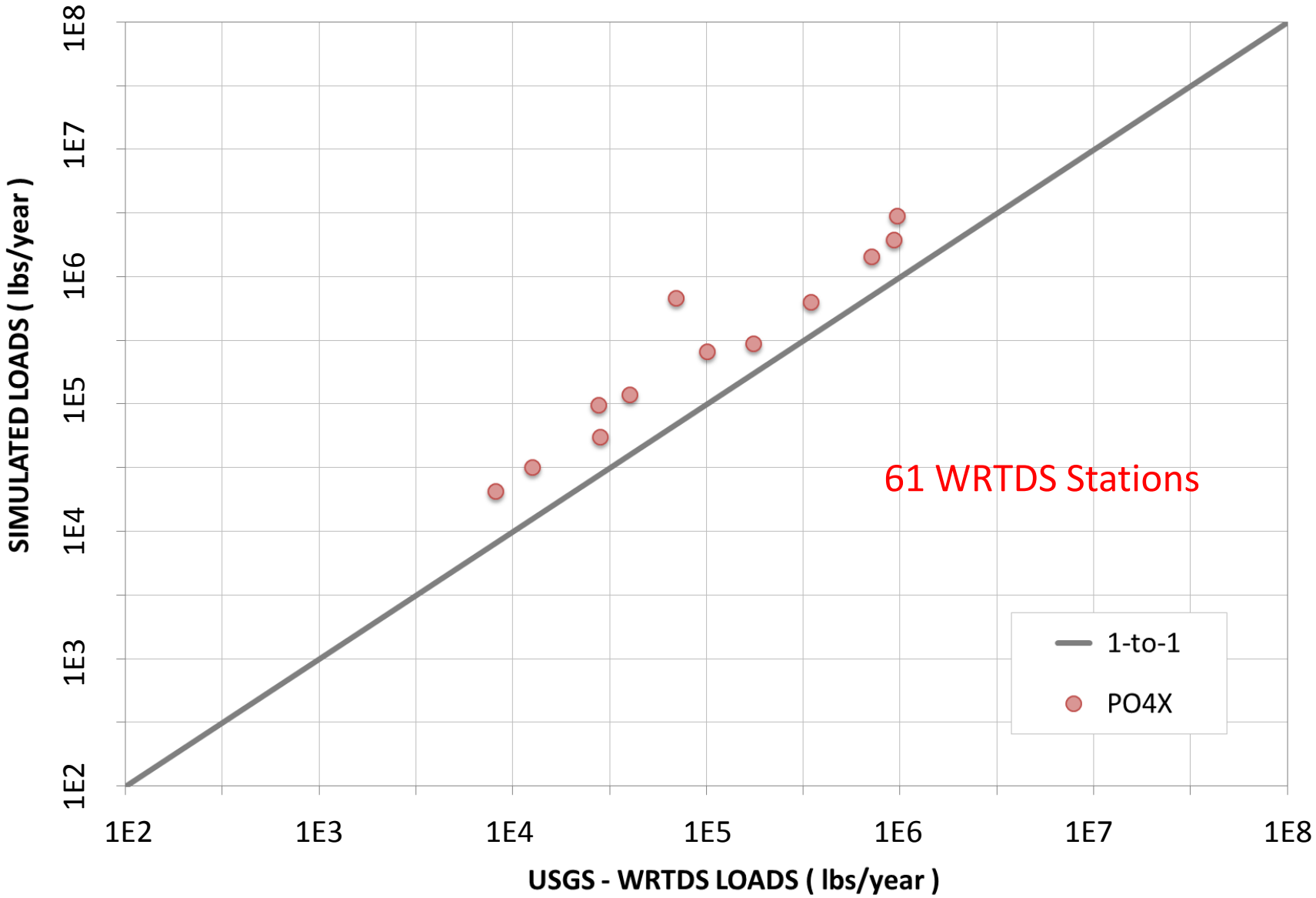
NITRATE



PHASE 5

Phase 5.3.2

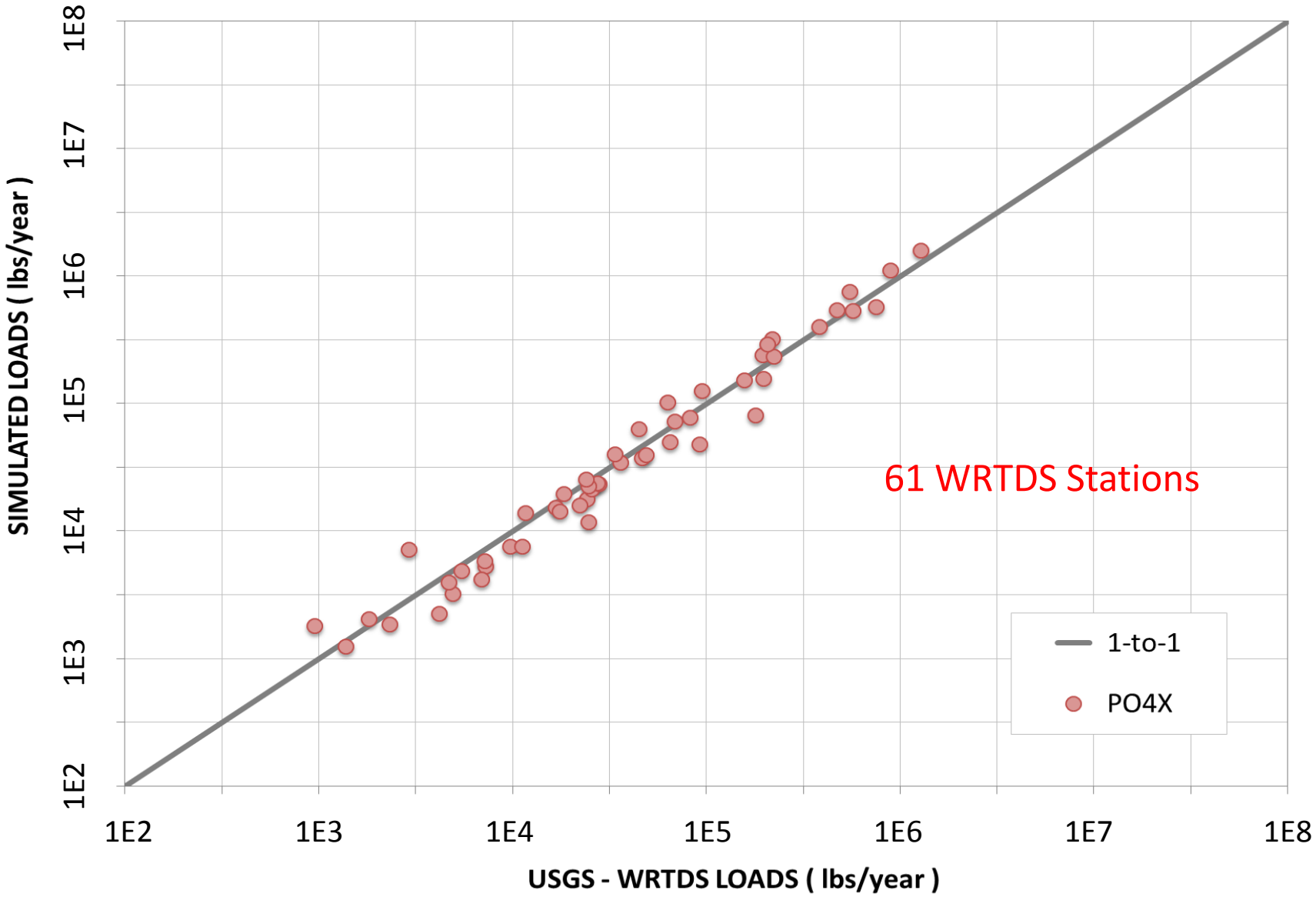
DISSOLVED PHOSPHATE



BETA 4C

Beta 4 calibration

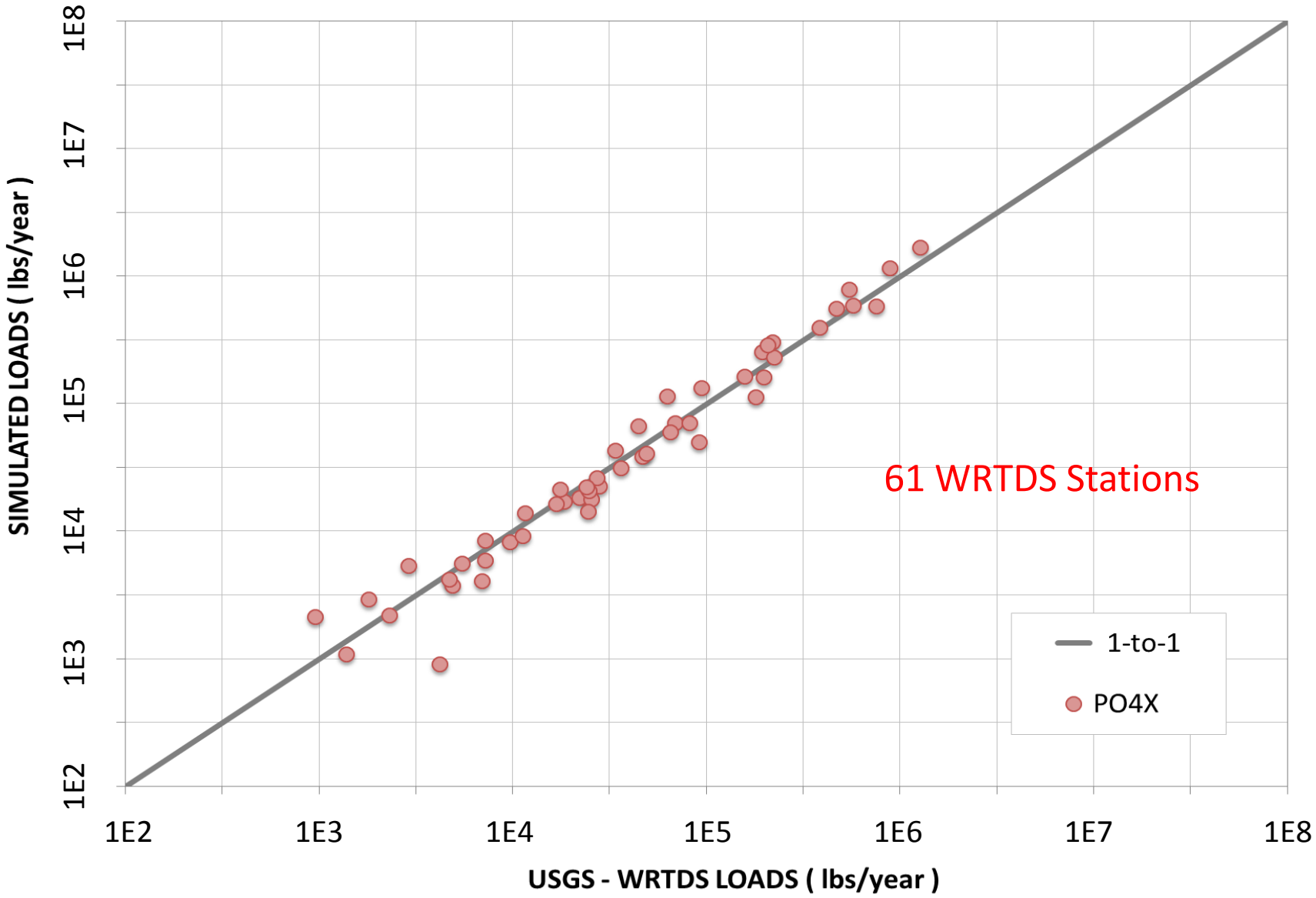
DISSOLVED PHOSPHATE



DRAFT A

Revised inputs and model refinements

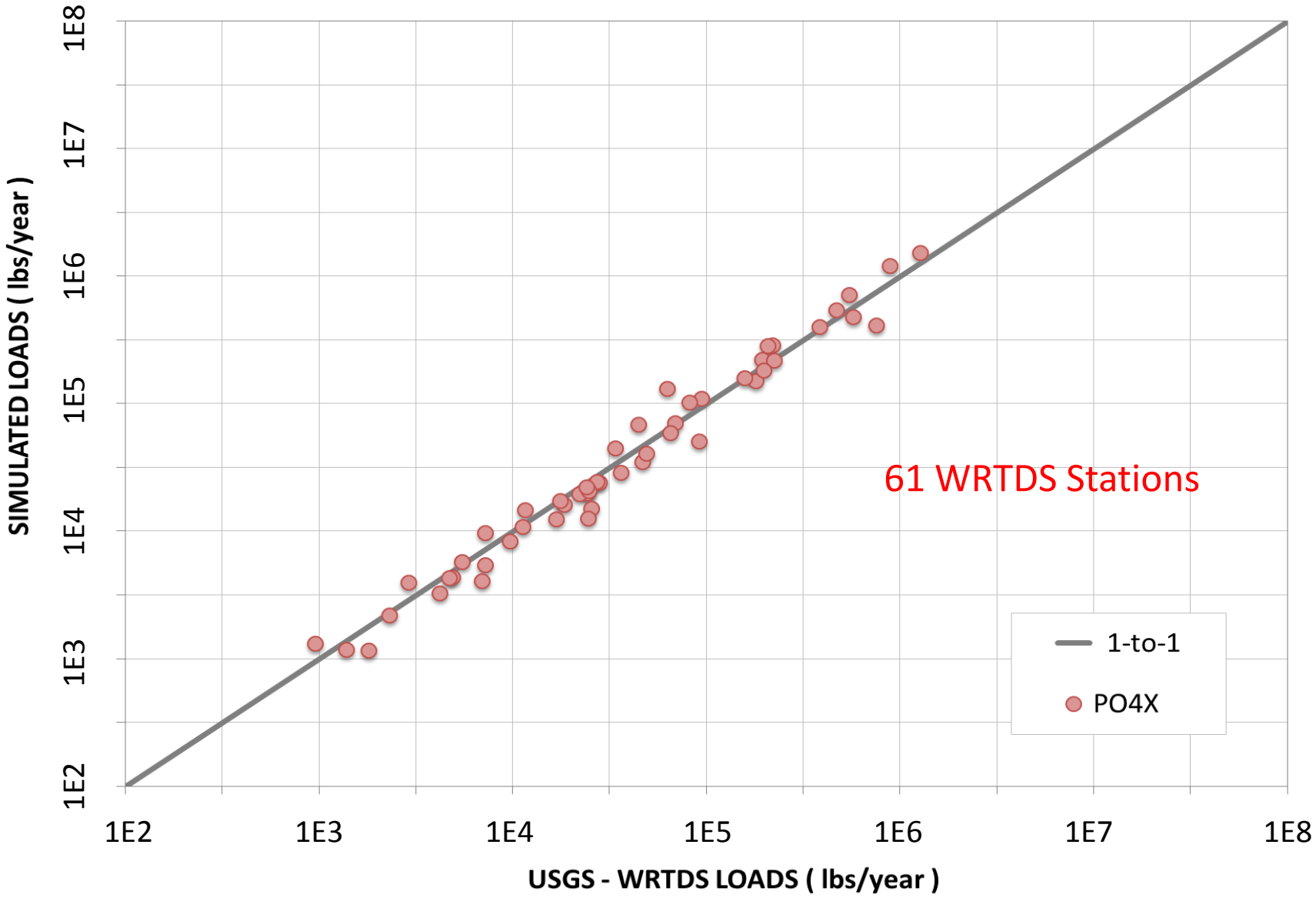
DISSOLVED PHOSPHATE



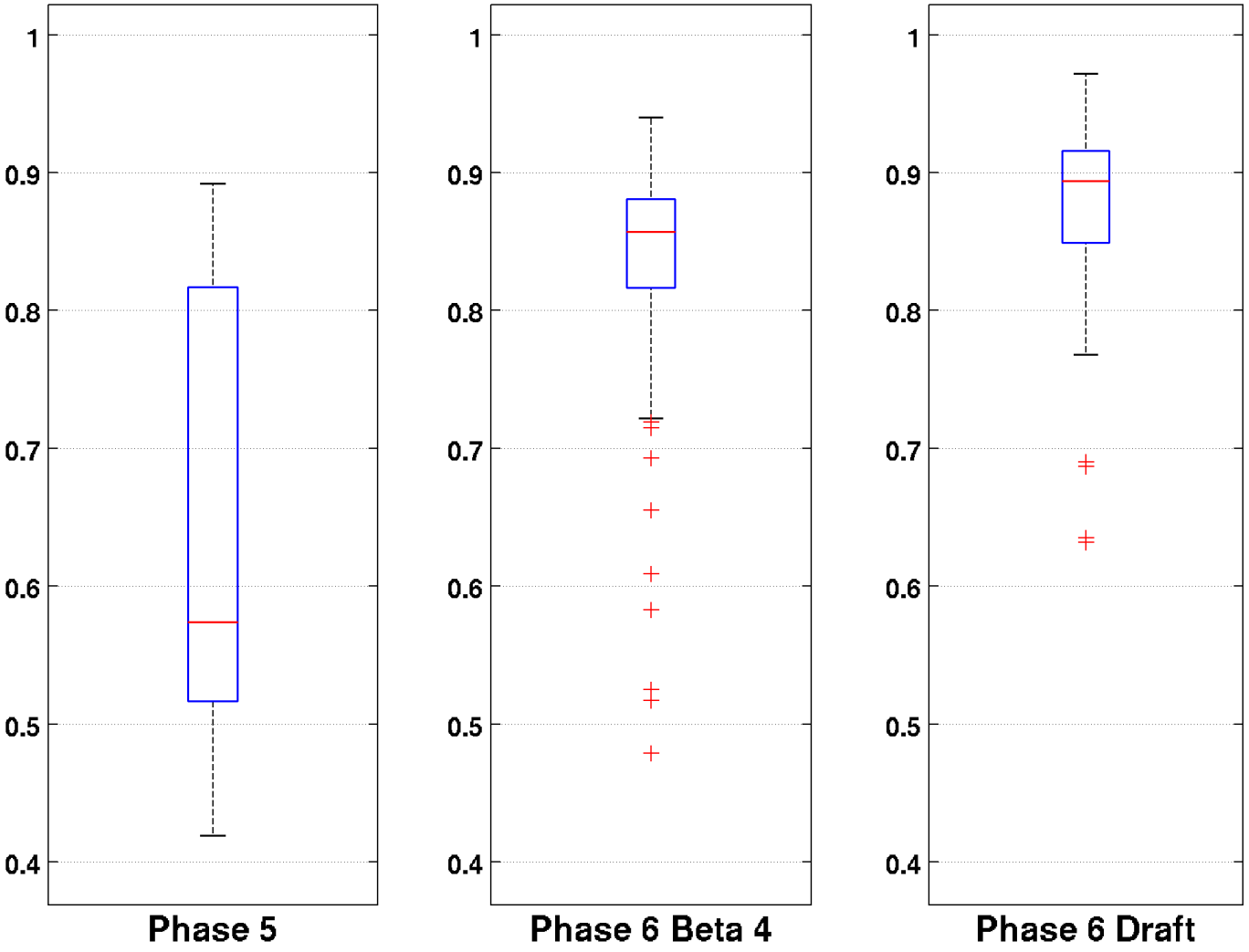
DRAFT G

Revised inputs, model refinements, and calibration methods

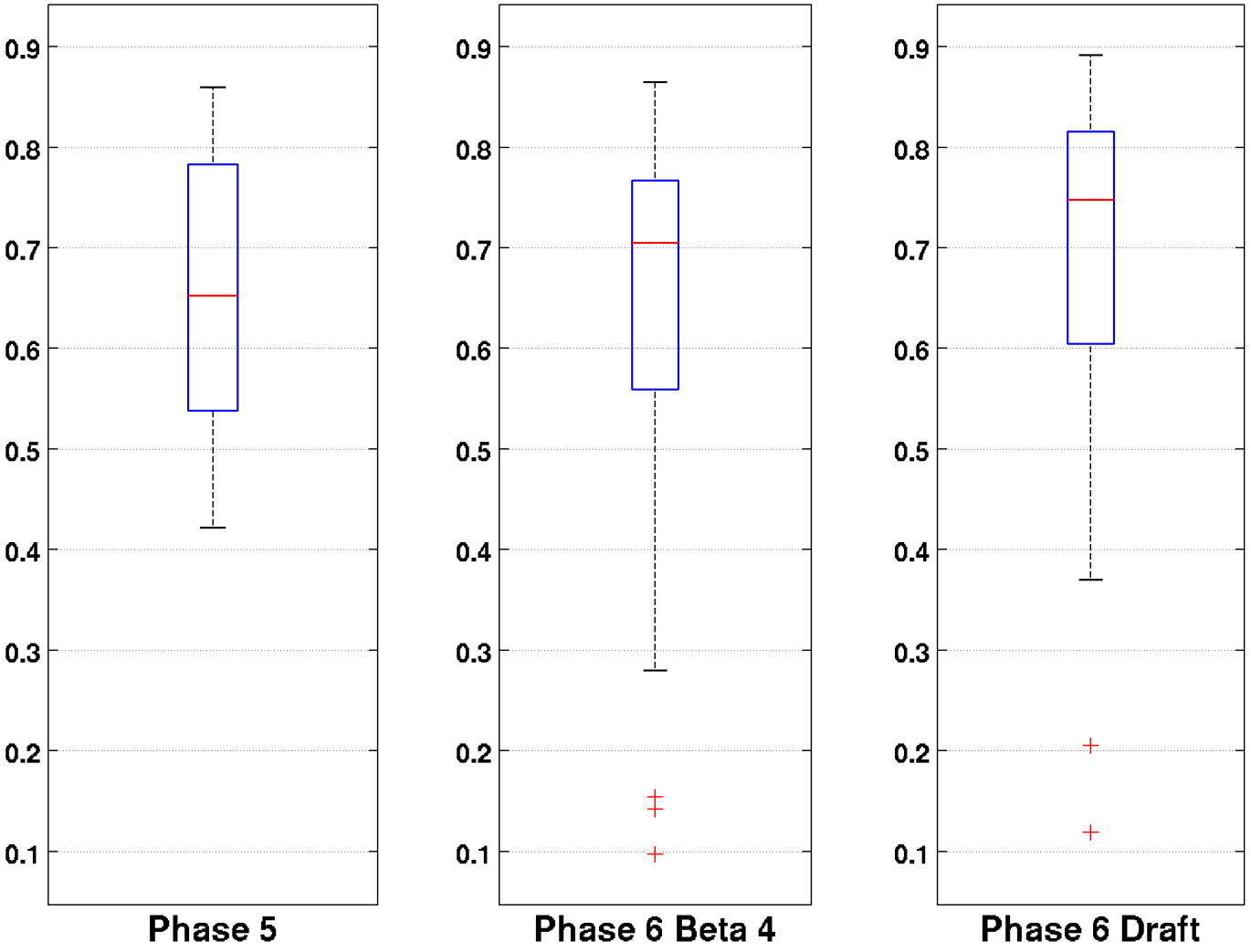
DISSOLVED PHOSPHATE



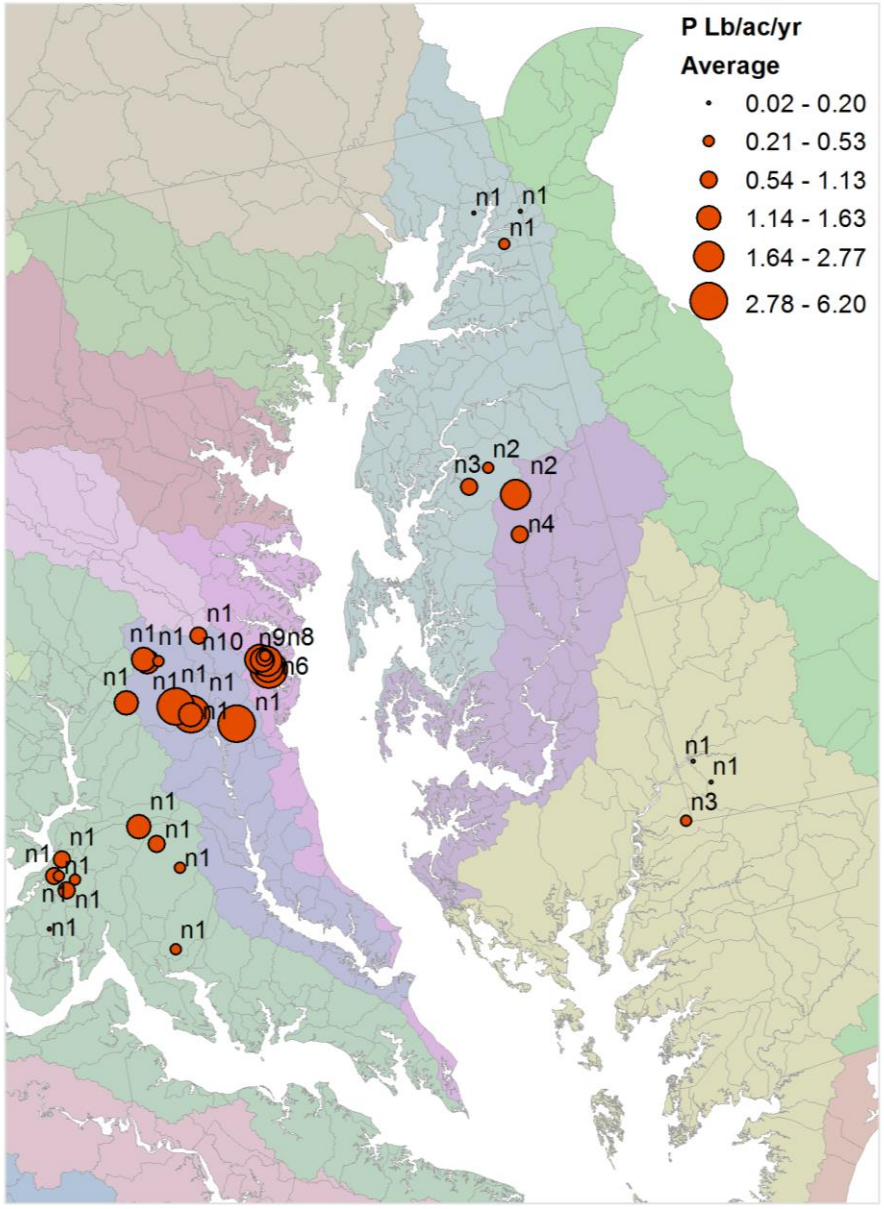
Monthly loads: nitrate



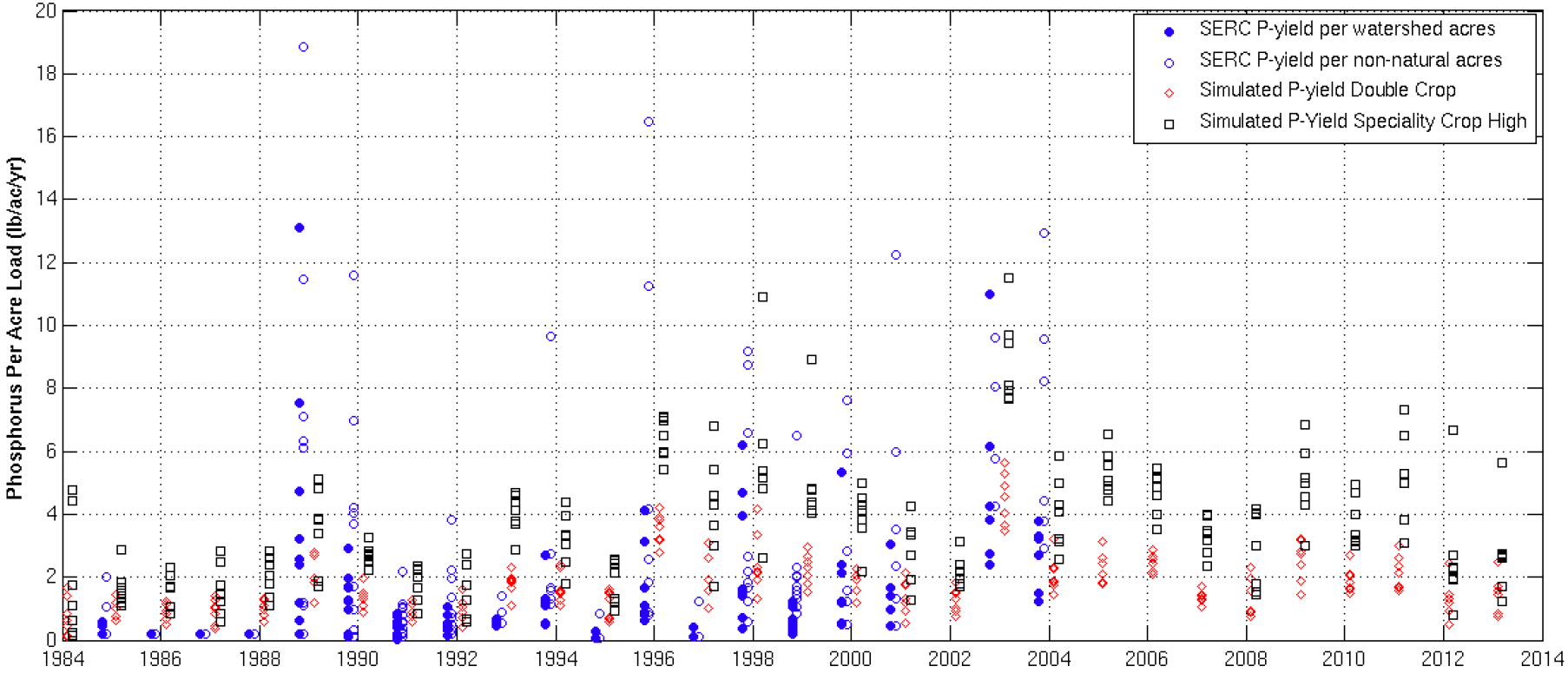
Monthly loads: dissolved phosphate



Annual Phosphorus Runoff

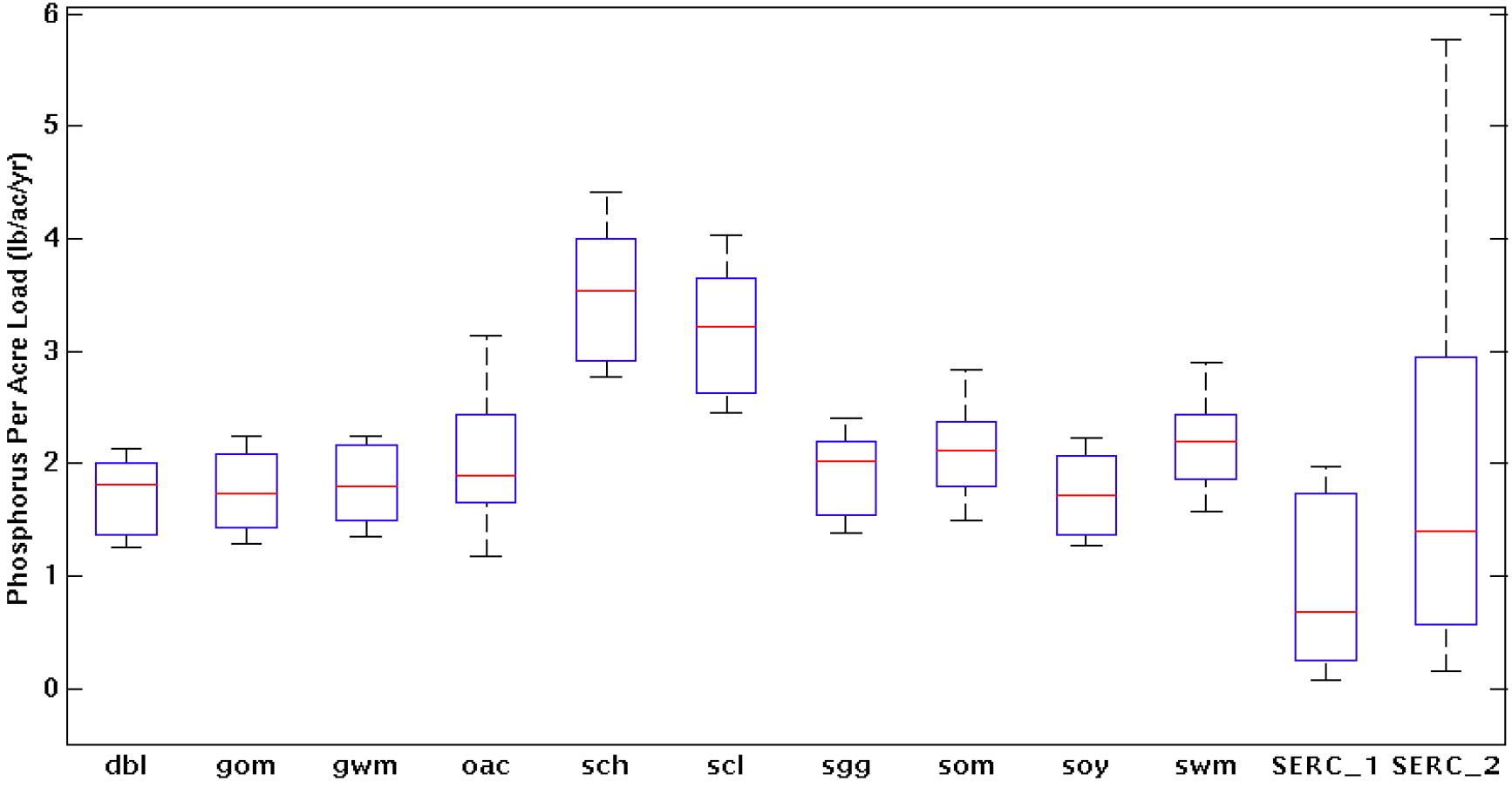


Major/Minor Basin	Nobs
Eastern Shore of Chesapeake Bay	19
Upper Eastern Shore	8
Middle Eastern Shore, including Choptank River	6
Lower Eastern Shore	5
Western Shore of Chesapeake Bay	71
Lower Western shore	71
Patuxent River Basin	9
Patuxent River below Bowie, Maryland	9
Potomac River Basin	10
Lower Potomac River, below Chain Bridge	10



- SERC data include estimates for phosphorus loads from 36 catchment
- These catchment intersect with 7 P6 land segments

  N10005,DE,SUSSEX
  N24003,MD,ANNE ARUNDEL
  N24015,MD,CECIL
  N24017,MD,CHARLES
  N24033,MD,PRINCE GEORGES
  N24035,MD,QUEEN ANNES
  N24045,MD,WICOMICO



SERC_1 – phosphorus per watershed acres

SERC_2 – phosphorus per non-natural acres