Lower Boise Watershed Phosphorus TMDL Technical Advisory Meeting

Perspectives on Selecting Aquatox Model Conditions

May 28, 2014

Michael Kasch, PE, PH

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Setting TMDL Allocations

- How should the Aquatox model be used to evaluate phosphorus scenarios compared to targets?
  - Only use the 2012-2013 Aquatox model with changes to phosphorus

  Or

  - Use the 2012-2013 Aquatox model with changes to phosphorus and to “other” conditions?

What might “other” conditions be?

- Flow
- Temperature
- Turbidity

Investigated Flow

- If a scenario meets targets using the 2012-2013 Aquatox model, would that scenario need to meet targets at a lower flow?
  - Lower flows are generally thought to be critical for water quality conditions, is this true for periphyton?

Flows Modeled

- 2012 flow conditions for the periphyton growing season of July through September are approximately average, or 50th percentile, for the period from 1987 through 2012
- 2001 flow conditions for this periphyton growing season are approximately the 92th percentile low flow, for the period from 1987 through 2012

Model Scenarios

- For both 2012 and 2001 flows:
  - Non-point sources total phosphorus at 70 μg/L, unless existing lower
  - Groundwater total phosphorus at 70 μg/L, unless existing lower
  - Point sources total phosphorus
    - 22 μg/L (general xeric west ecoregion)
    - 70 μg/L (Snake River-Hells Canyon)
    - 300 μg/L (BNR wastewater treatment)
  - Remaining model setup same as calibrated model

Aquatox Periphyton Predictions

Scenario	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2012 EC												
AU-6b	35	75	144	31	38	84	95	**153**	**165**	**207**	**162**	**152**
AU-6	34	95	142	13	24	86	89	124	133	139	**172**	**161**
2012 22												
AU-6b	23	26	48	4	8	23	29	142	**176**	**163**	**162**	**162**
AU-6	27	28	52	7	9	34	58	122	**156**	110	101	107
2012 70												
AU-6b	22	26	48	4	7	29	30	133	**200**	**154**	119	141
AU-6	28	36	43	9	13	46	83	137	**175**	135	76	101
2012 300												
AU-6b	28	26	31	4	11	31	45	**158**	**192**	**190**	99	133
AU-6	28	36	43	9	13	46	83	137	**175**	135	76	101
2001 22												
AU-6b	52	42	63	14	7	16	47	79	54	39	65	57
AU-6	43	34	47	13	11	24	58	94	48	39	54	41
2001 70												
AU-6b	56	41	37	10	12	15	26	62	50	65	37	51
AU-6	46	26	44	12	16	23	31	58	48	48	40	49
2001 300												
AU-6b	51	66	76	12	10	19	40	56	52	66	41	51
AU-6	34	44	47	10	16	26	33	59	48	58	45	42

EC = 2012-13 Existing Conditions
Values greater than 150 mg/m2 bold
Monthly averages selected for illustration
Assessment units (AU) Middleton to Indian Creek AU-6b and Indian Creek to mouth AU-6 selected for illustration

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Model predictions suggest a low flow condition may not correspond with critical conditions that support excessive periphyton growth.

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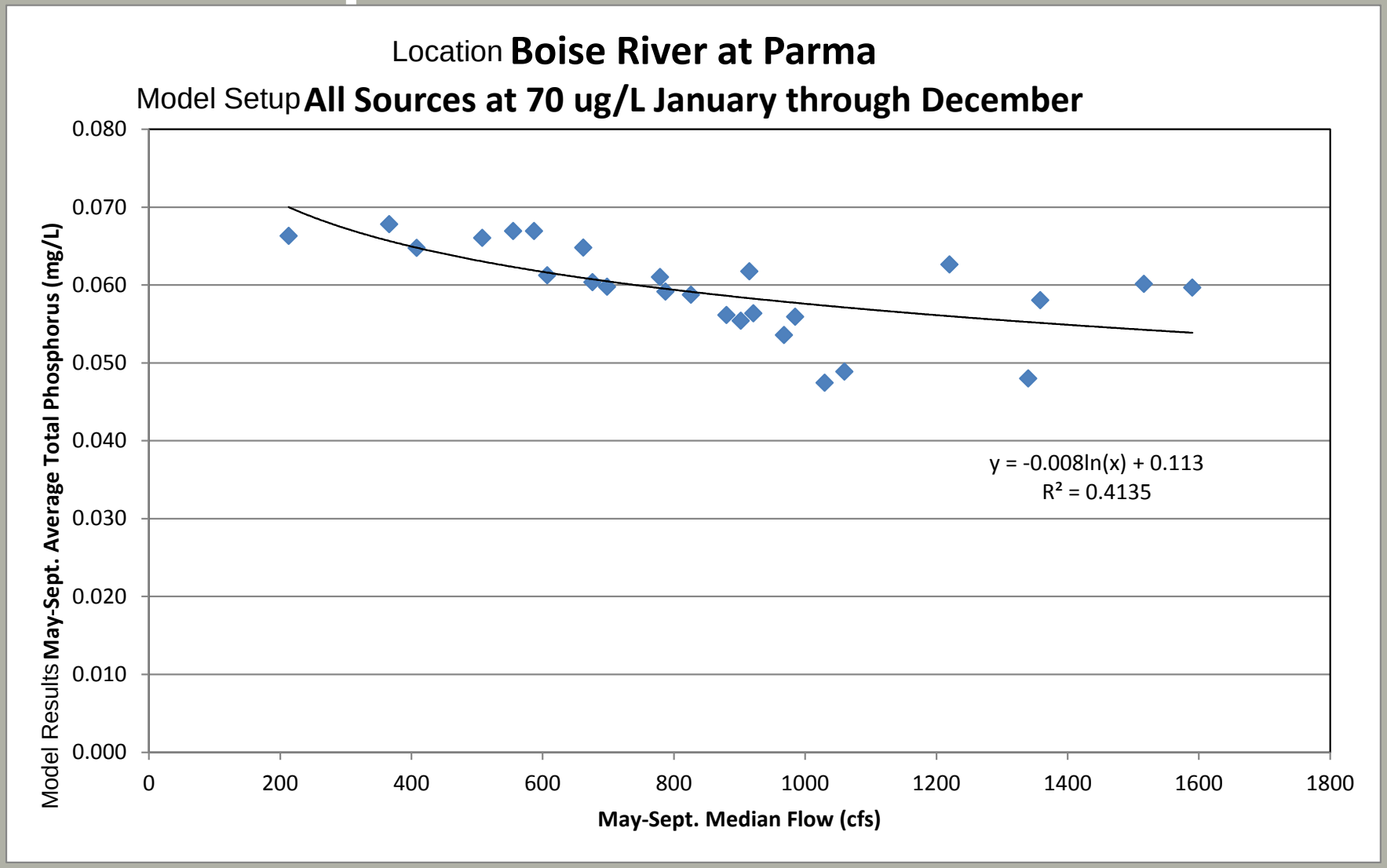
Values greater than 150 mg/m2 bold
Monthly averages selected for illustration
Assessment units (AU) Middleton to Indian Creek AU-6b and Indian Creek to mouth AU-6 selected for illustration

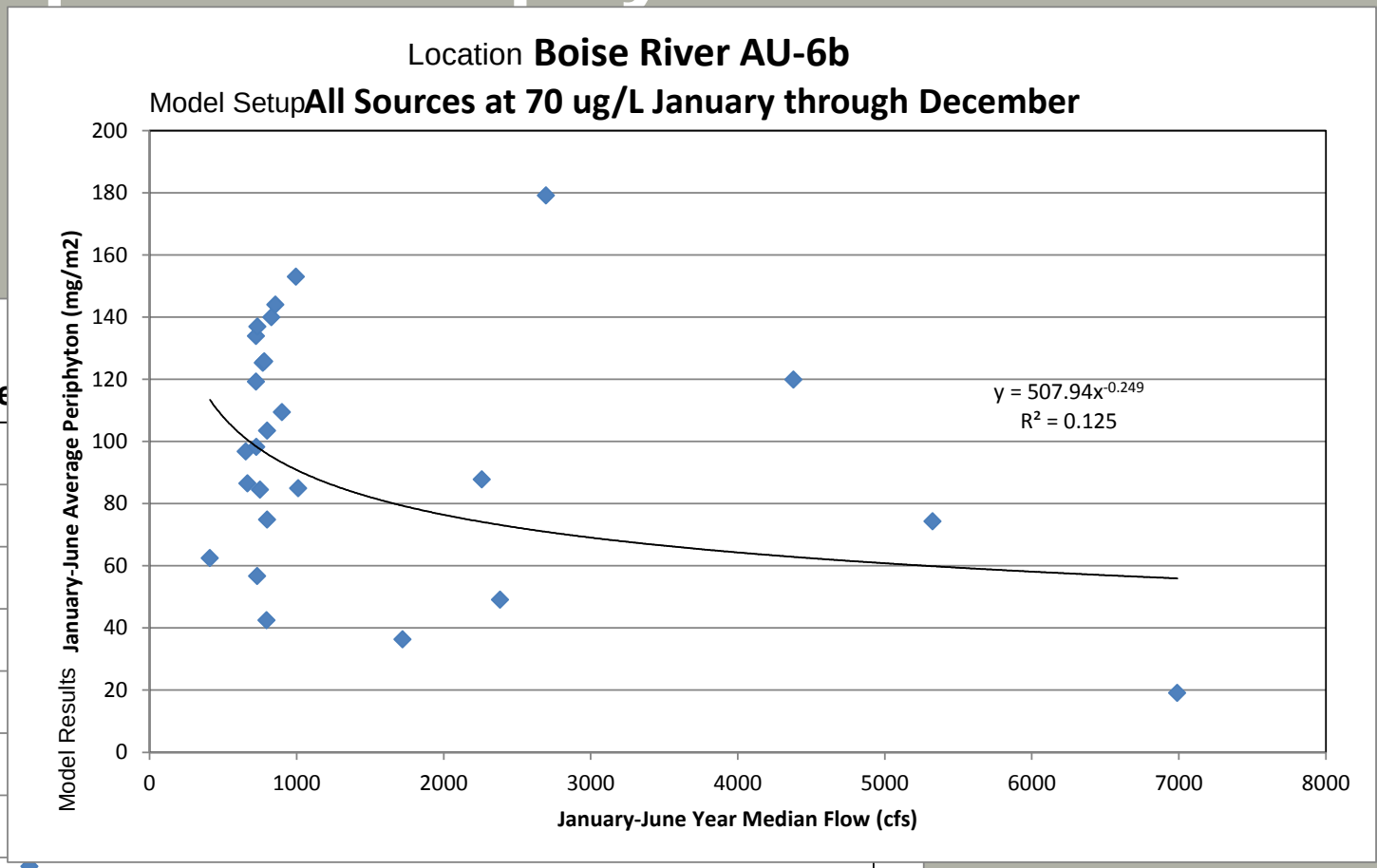
Critical Conditions

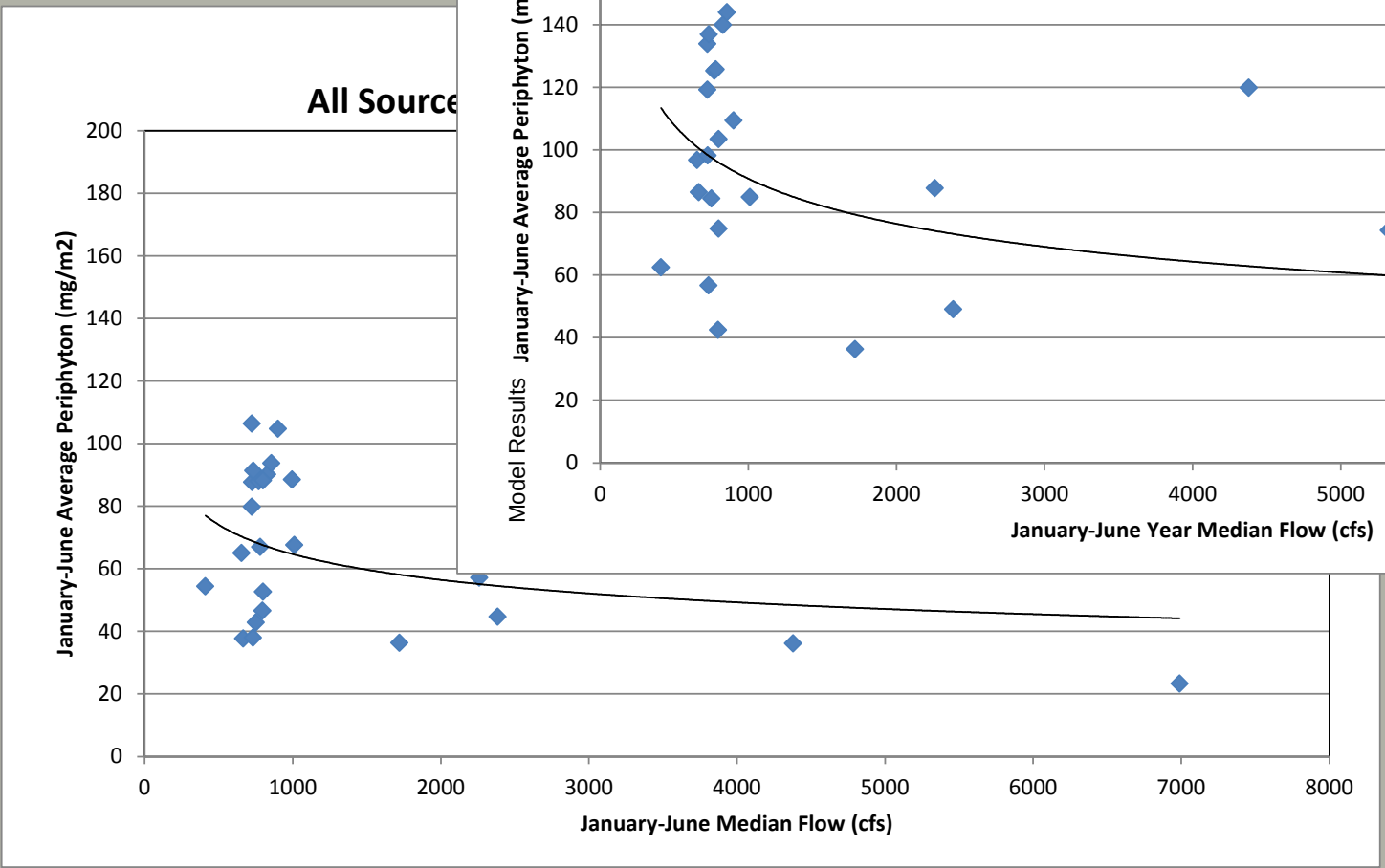
- Is it possible to identify a critical flow condition resulting in critical excessive periphyton growth?
  - Model 26-years of flow from 1987 through 2012
  - Repeat the 2012 water quality data for each of the 26 years
    - The same water quality data for the different flows

26-Year Aquatox TP Prediction



26-Year Aquatox Periphyton Prediction





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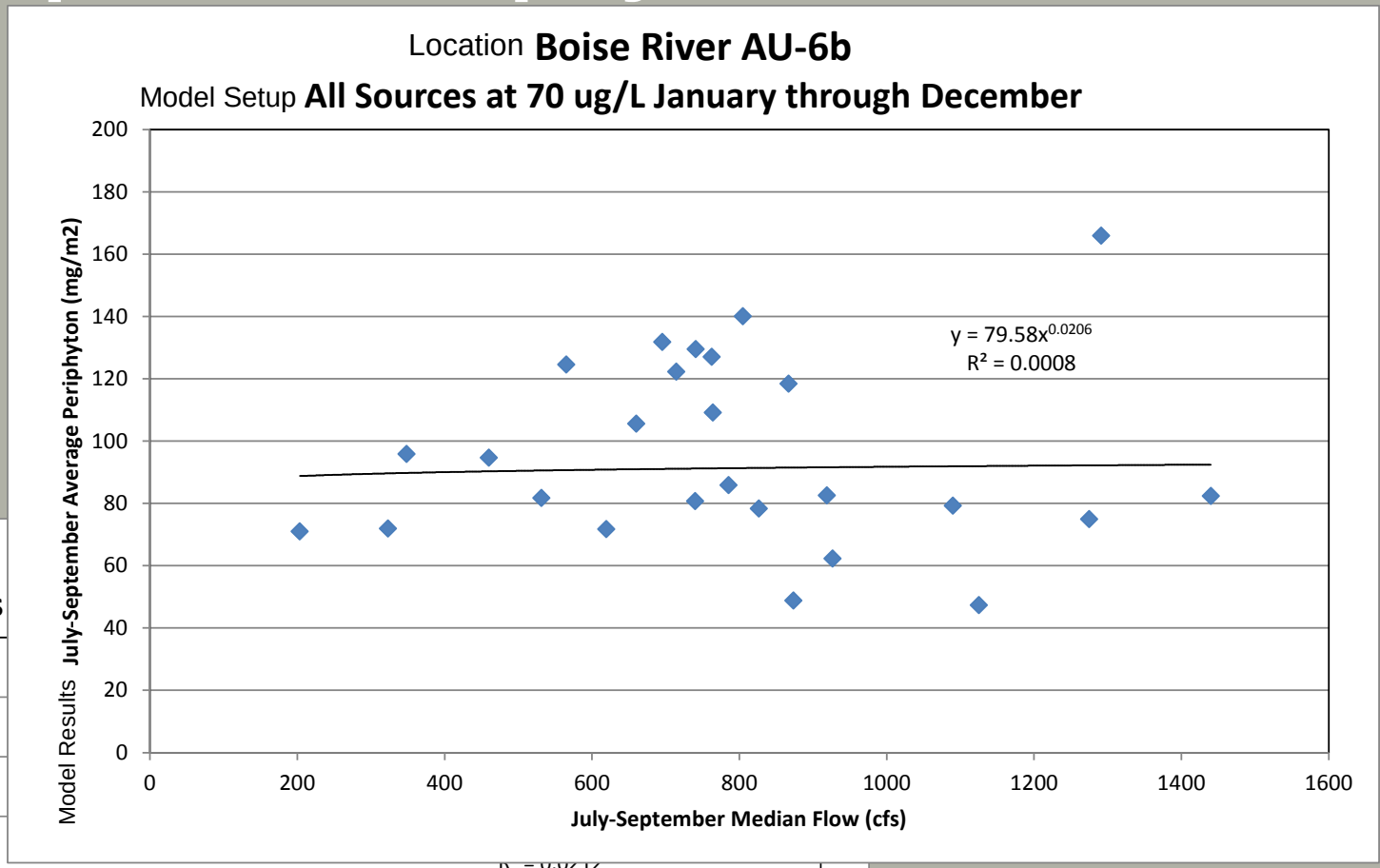

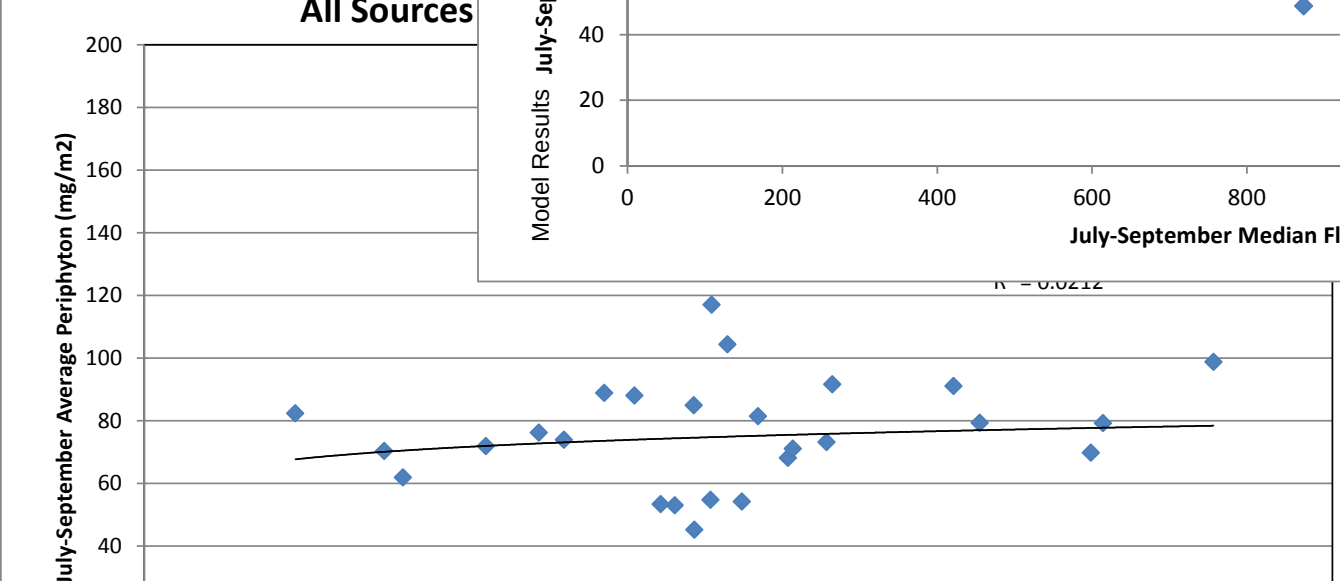

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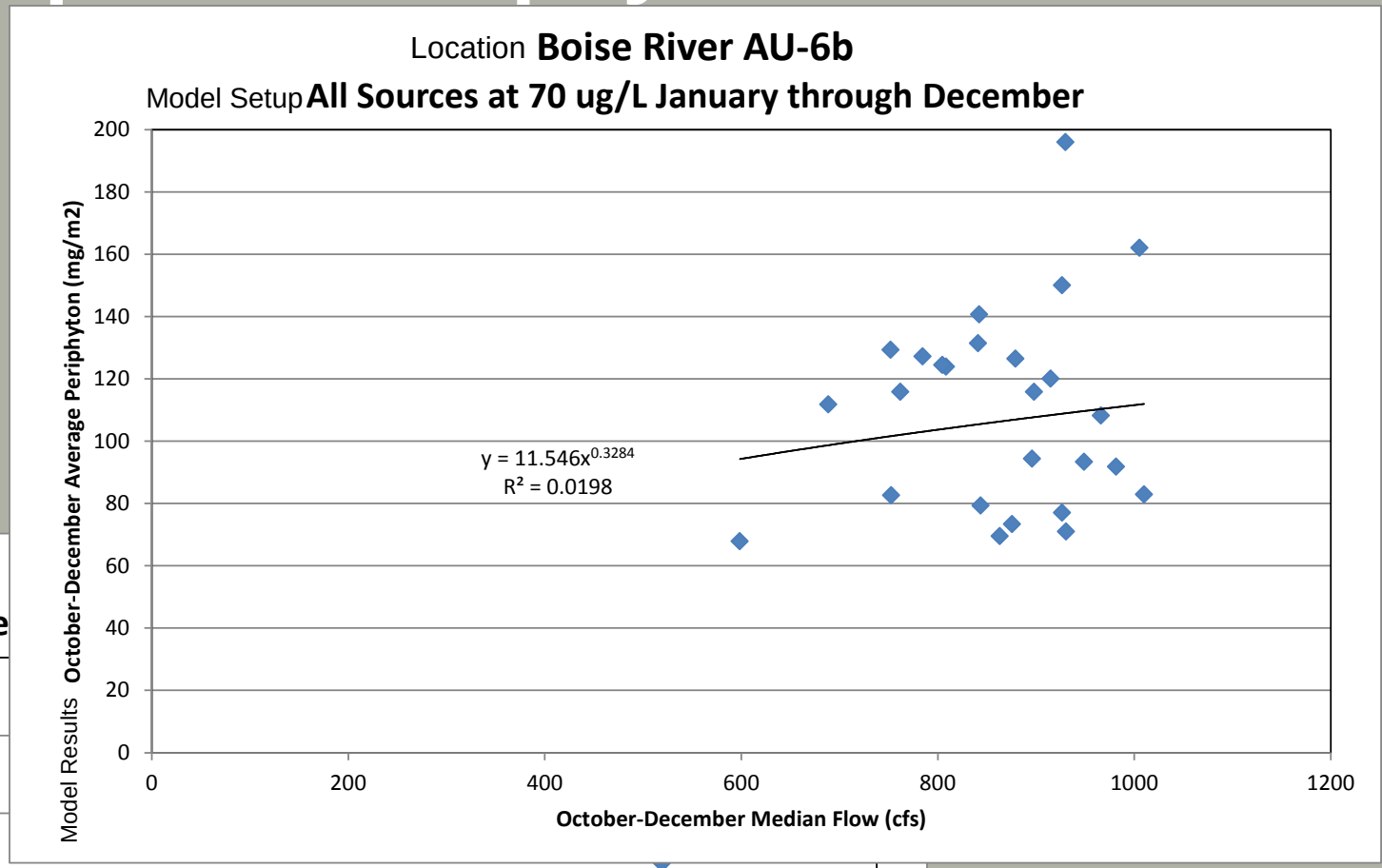

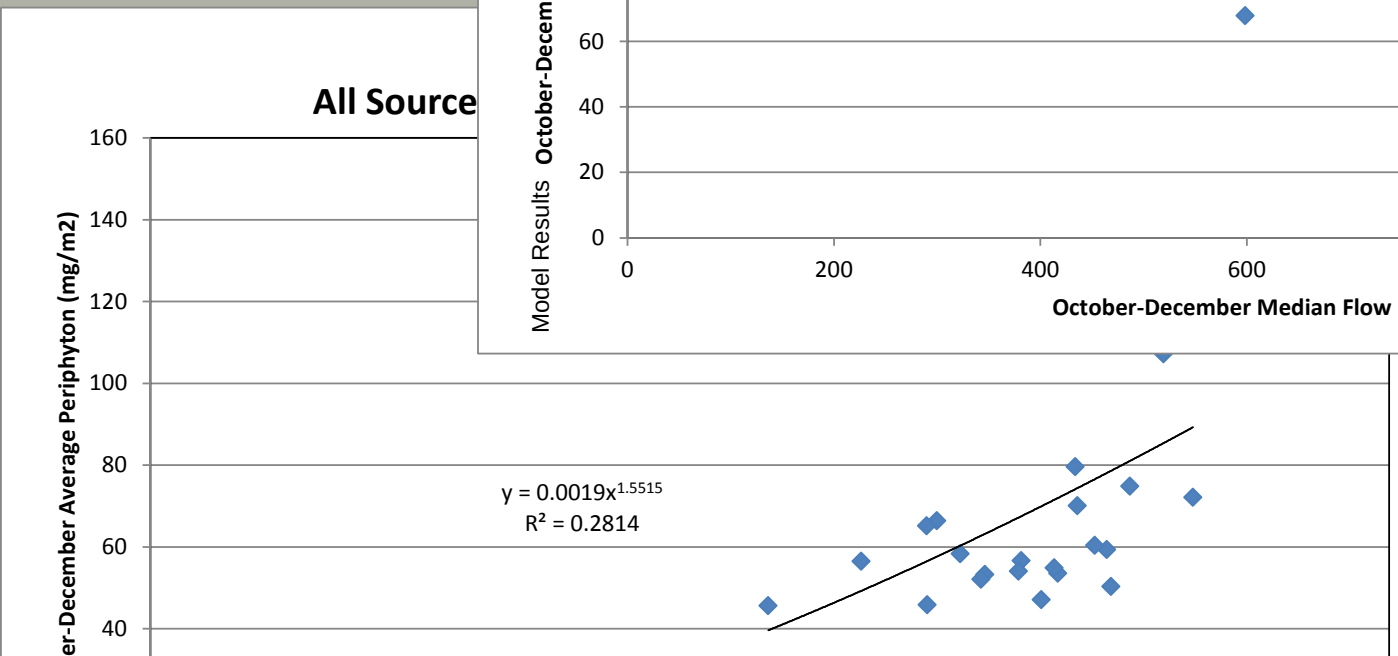

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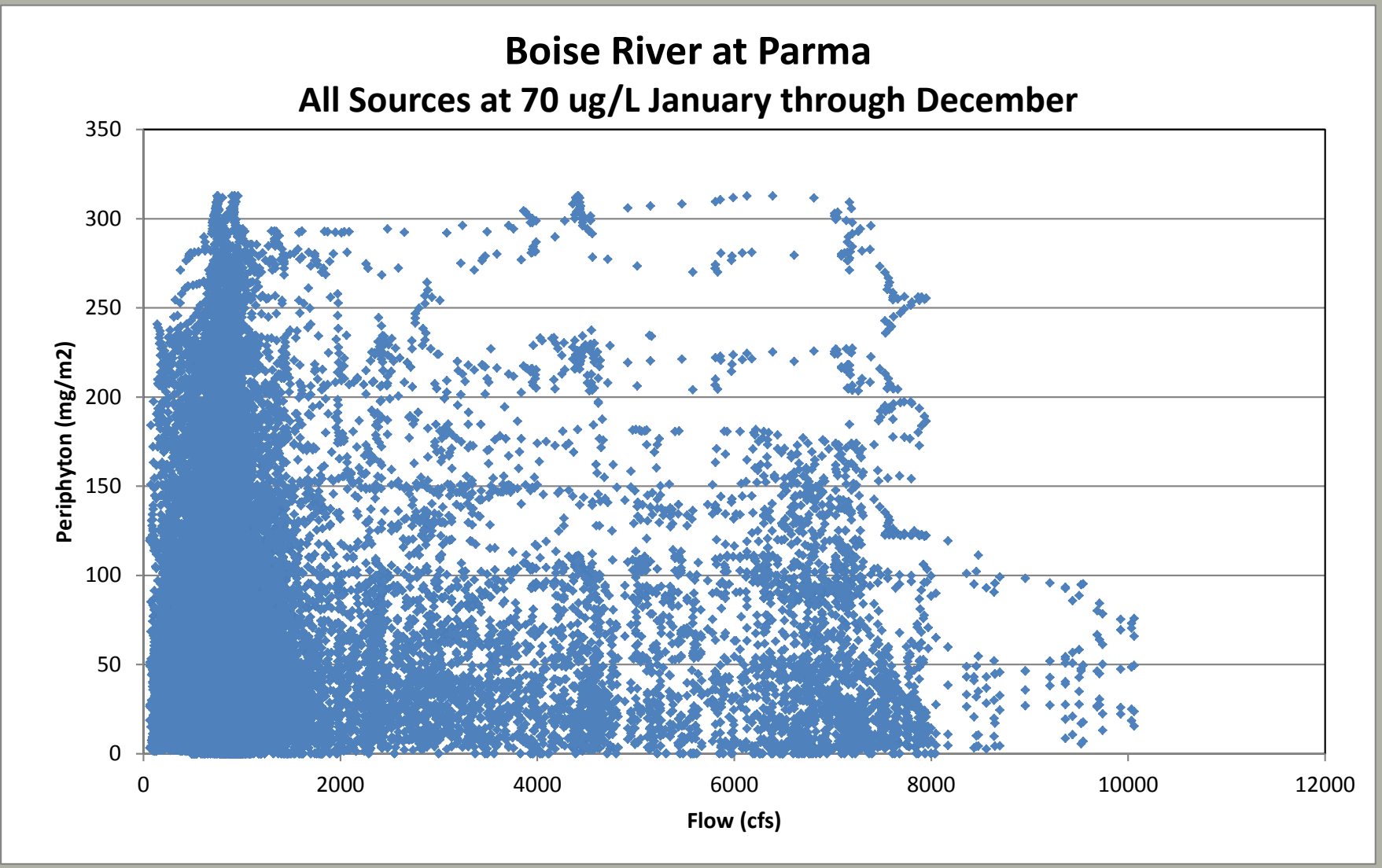
26-Year Results

- Critical periphyton flow not apparent from 26-Year Aquatox simulations
- Periphyton is highly variable and in the Aquatox model, the change in algal biomass is a function of the loading, photosynthesis, respiration, excretion or photorespiration, non-predatory mortality, ~~grazing or predatory mortality~~, sloughing, and washout

26-Year Daily Periphyton Results



TMDL Scenarios

- Use the 2012-2013 Aquatox model?

Or

- Use 26-Year Aquatox model?

Metrics for Assessing 26-Year Results

- Potential structure of targets…
- Average periphyton concentration over a period (say monthly, seasonally) less than 150 mg/m^2
- Duration of periphyton concentrations greater than 150 mg/m^2 less than a period (say 2 weeks, 1 month)
- Frequency of periphyton concentration greater than 150 mg/m^2 less than 50-percent of the time

26-Year Periphyton Results

AU	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
AU-6b												
Magnitude												
Min	3	6	4	1	2	4	1	6	9	16	21	11
Harmean	44	63	46	37	22	31	33	73	82	88	89	82
Geomean	79	94	88	73	53	56	71	88	93	99	100	101
Median	111	132	136	93	85	77	89	98	104	108	111	118
Average	104	114	116	90	84	79	88	97	102	108	110	113
Max	209	253	238	207	224	217	194	193	191	238	234	214
Duration >150												
Min	1	1	1	5	1	1	2	1	1	1	2	1
Harmean	7	4	7	10	4	2	4	3	2	3	6	3
Geomean	18	9	13	12	7	5	5	4	3	5	9	6
Median	23	16	23	13	6	8	6	5	3	5	6	7
Average	23	15	19	15	11	10	7	6	4	8	13	11
Max	31	28	31	30	31	30	18	14	14	24	30	31
Frequency >150												
Days	234	210	249	74	98	76	71	64	64	120	114	131
Percentage	29	29	31	9	12	10	9	8	8	15	15	16

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Refinement of Metrics

- Include percentiles, say 90th or other
- Include frequency 1 in X years (say 3 or 5 years)
- Include all days in duration