Review of the Technical Basis for Total Phosphorus Levels in the Portneuf River

Presented to the Portneuf River Watershed Advisory Group

November 20, 2007

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Question:

- What is the appropriate numeric phosphorus target that will help restore beneficial uses in the Portneuf River?

Phosphorus Targets

- The Idaho water quality standard for nutrients is narrative:
  - "Surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses."

- So what is an appropriate (useful) numeric target for total phosphorus (TP) to achieve this narrative standard?

Potential Options

- Look at how numeric targets have been developed for other similar waterbodies in Idaho.
- Evaluate the relationship between chlorophyll *a* and TP.
- Look to appropriate State or Federal guidance.

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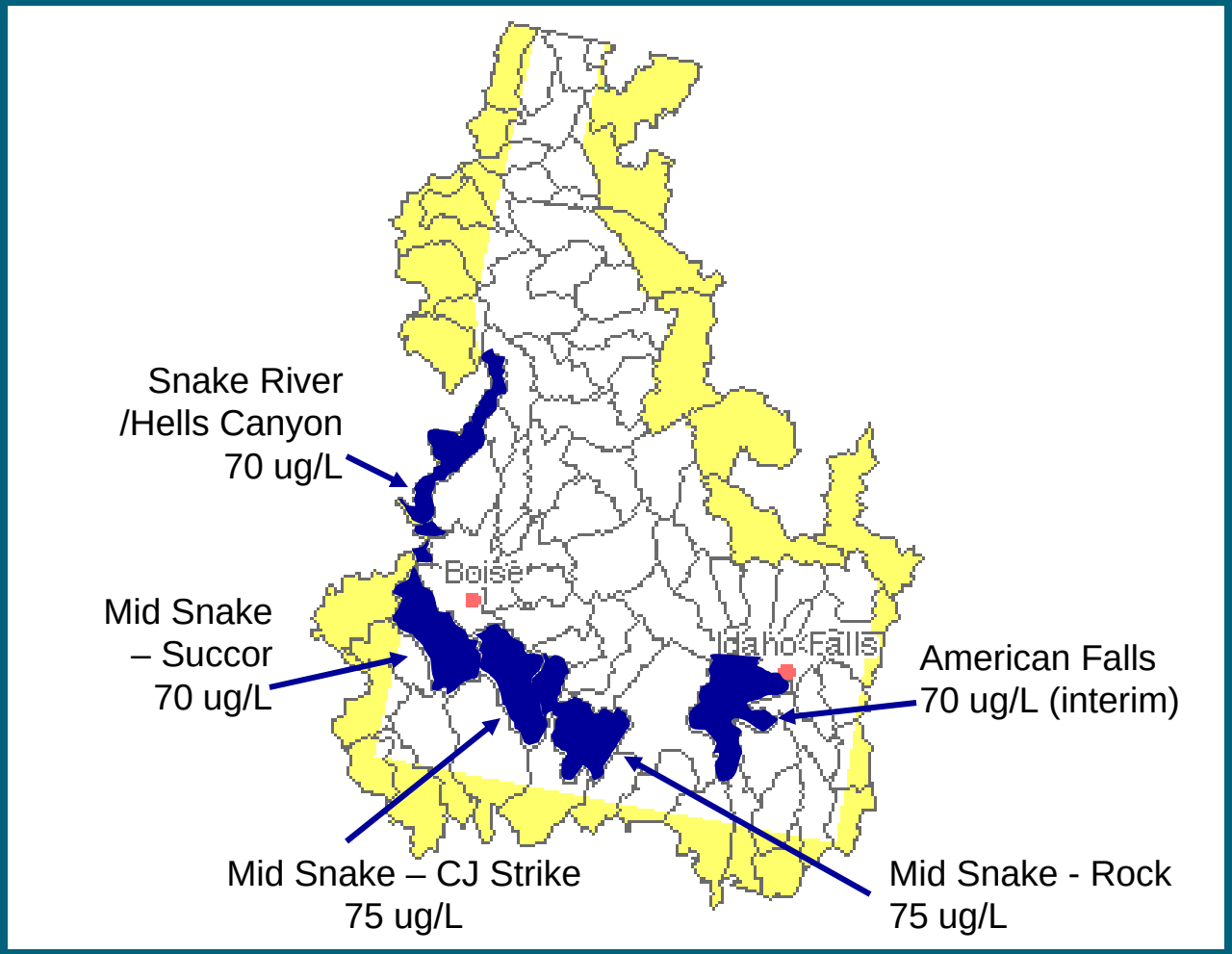
Other Idaho Waterbodies

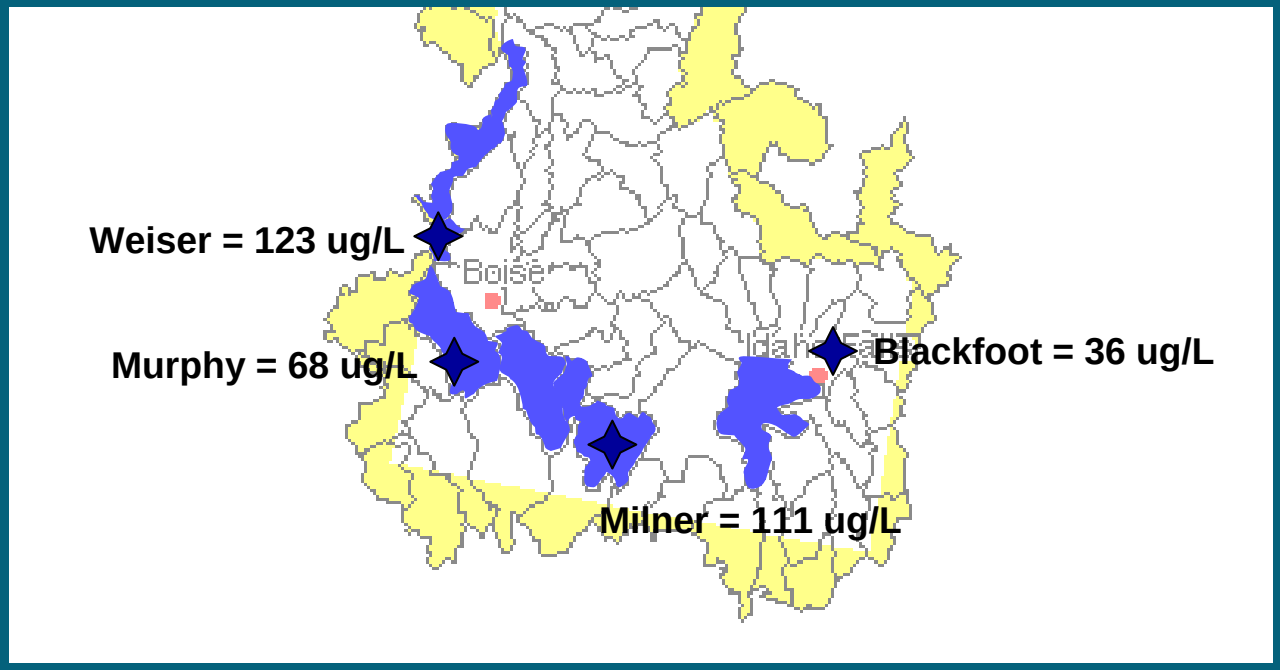
- Over the last 20 years, TP has been addressed in five Snake River TMDLs:
  - American Falls (1997-ongoing)
  - Mid Snake – Rock Creek (late 1980s - 2001)
  - Mid Snake – CJ Strike/Kings Hill (2001-2003)
  - Snake River – Hells Canyon (1998-2004)
  - Mid Snake – Succor Creek (2002-2006)

TP Targets for Other TMDLs



Are these TMDLs relevant?

- How do TP concentrations vary within the Snake River system?



- So, even though TP concentrations vary downstream, the TP targets are very similar.

What was the basis for these targets?

- Look at how numeric targets have been developed for other similar waterbodies in Idaho.

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- Evaluate the relationship between chlorophyll *a* and TP.

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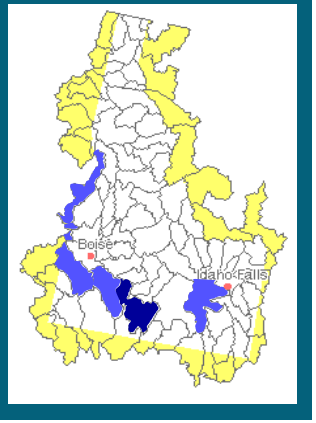
- Look to appropriate State or Federal guidance.

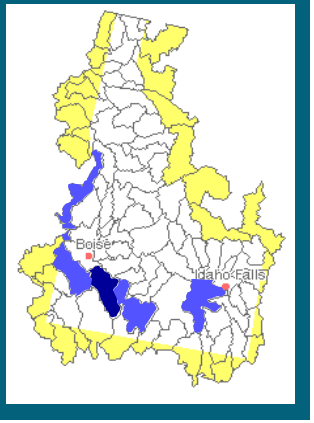
Mid Snake – Rock Creek

- Looked at two alternatives:
  - EPA 1986 Gold Book Standard
    - Free-flowing rivers = 100 ug/L
    - Tributaries to lakes= 50 ug/L
    - Lakes = 25 ug/L
      - Best professional judgment = 75 ug/L
  - EPA modeling
    - Deterministic prediction of macrophyte growth
    - Predicted improvements in TP = 73 ug/L
  - ***SELECTED TP TARGET = 75 ug/L***



Mid Snake – CJ Strike

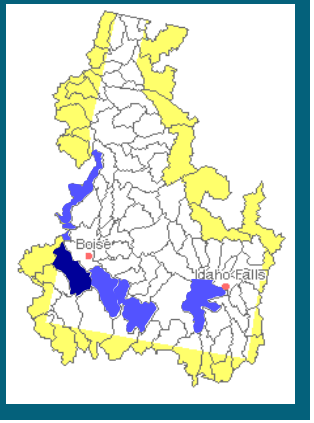
- Looked at two alternatives:
  - Mid Snake – Rock Creek Target = 75 ug/L
  - CJ Reservoir Modeling
    - CE-QUAL-W2 model compared in-reservoir TP target of 50 ug/L vs. 75 ug/L
    - Model predicted "very little detectable improvement" in dissolved oxygen with lower TP target
    - Predicted improvements in TP = 75 ug/L
  - ***SELECTED TP TARGET = 75 ug/L***



Mid Snake – Succor

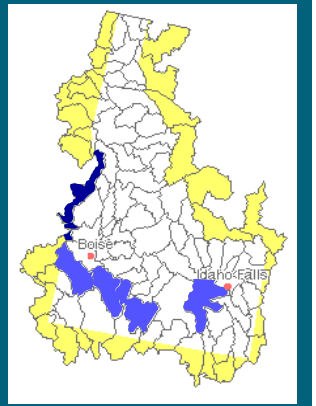
- Looked at two alternatives:
  - Mid Snake – Rock Creek Target = 75 ug/L
  - Snake River – Hells Canyon Target = 70 ug/L

  - ***SELECTED TP TARGET = 70 ug/L***



Snake River – Hells Canyon

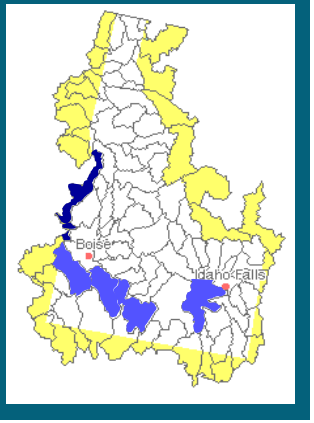
- Most detailed analysis of TP targets to date
- Used both Idaho and Oregon guidance
- Evaluated relationship between chlorophyll *a* and TP levels
- Chlorophyll *a* used as a reasonable surrogate to predict nuisance algal growth



Snake River – Hells Canyon

- Literature from other systems used to develop chlorophyll *a* targets
  - Aquatic life:
    - 10 - 15 ug/L chl *a* for salmonid waters
    - 25 - 40 ug/L chl *a* for non-salmonid waters
  - Recreation:

Chlorophyll a	Degree of Water Discoloration
< 10 ug/L	No water discoloration
10 – 15 ug/L	Some discoloration, some development of algal scum
20 – 30 ug/L	Deep discoloration, frequent algal scum formation
> 30 ug/L	Very deep discoloration, intense algal scum matting



Snake River – Hells Canyon

- Selected chlorophyll *a* target
  - Mean growing season = 14 ug/L chl *a*
  - Nuisance threshold = 30 ug/L chl *a*

- ***SELECTED TP TARGET = 70 ug/L***
  - Includes 13% margin of safety

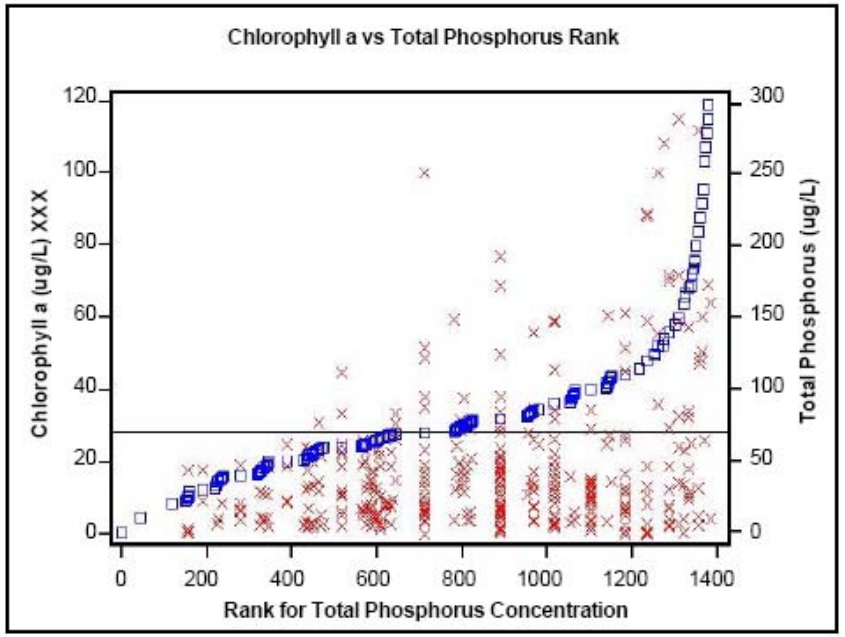


Figure 3.2.13 a. Chlorophyll *a* concentration data as correlated with increasing total phosphorus concentration for the Upstream Snake River segment (RM 409 to 335) of the Snake River - Hells Canyon TMDL.

Snake River – Hells Canyon

- Median TP concentrations below 70 ug/L typically produce median chlorophyll *a* concentrations below 15 ug/L

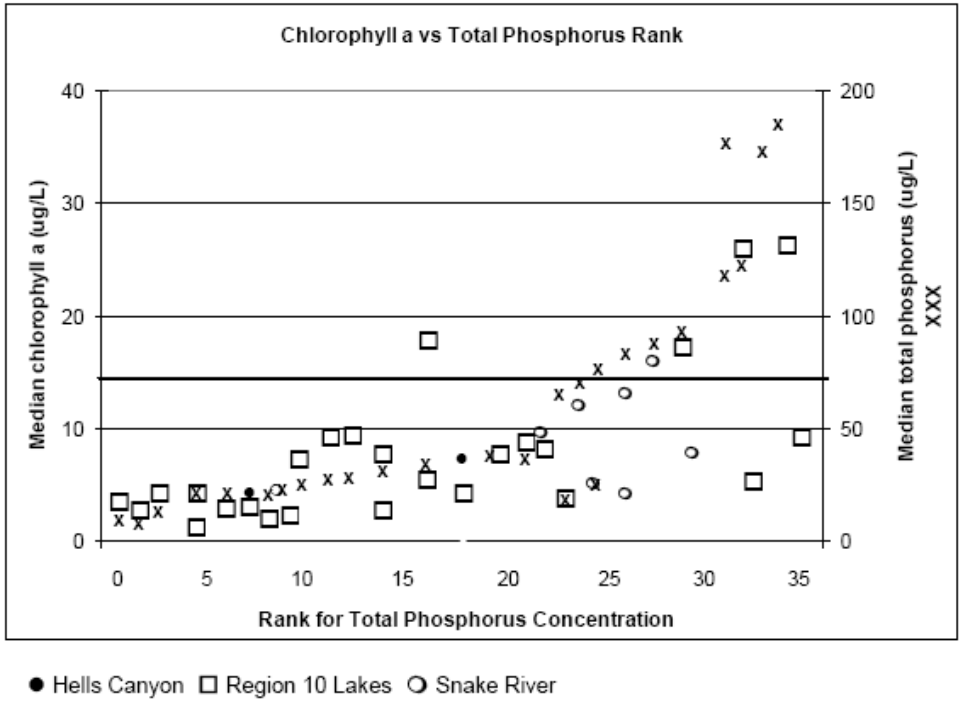
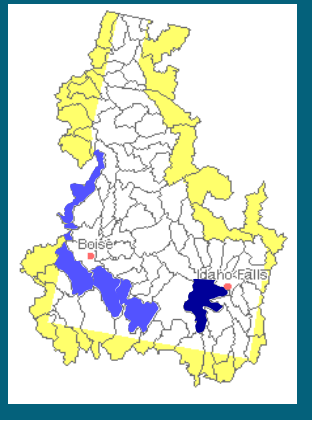


Figure 3.2.13 b. Comparison of median chlorophyll *a* concentration data as correlated with median total phosphorus concentration data for lakes and reservoirs in the Pacific Northwest.

American Falls

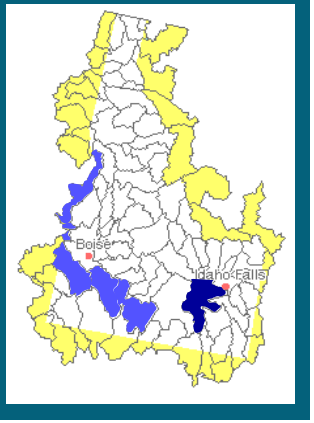
- In July 2006, targets developed based on a number of alternatives
- Chlorophyll *a* and dissolved oxygen were reservoir water quality targets
  - Chlorophyll *a*
    - EPA Ecoregion Ambient Criteria
      - In Xeric West, 25% percentile reference conditions range between 0 – 25 ug/L chl *a*
    - Snake River – Hells Canyon target = 14 ug/L chl *a*
    - Oregon threshold = 15 ug/L chl *a*
  - Selected chlorophyll *a* target = 15 ug/L chl *a*



American Falls

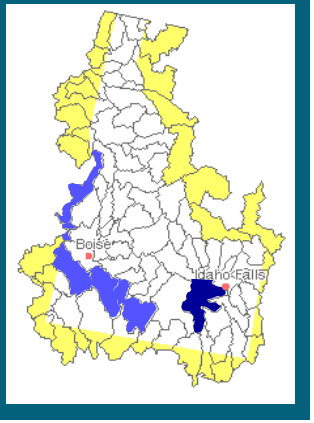
- TP analyzed as a interrelated parameter
  - EPA Gold Book = 50 ug/L TP
  - EPA Ecoregion Ambient Criteria
    - In Xeric West, 25% percentile reference conditions range between 10 – 55 ug/L TP

- ***SELECTED TP VALUE = 50 ug/L***



American Falls

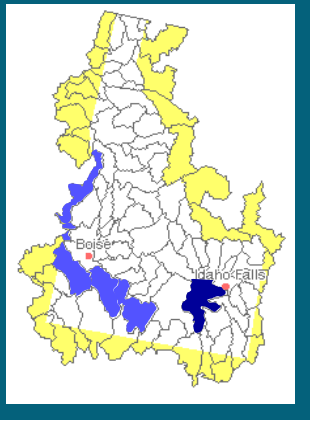
- Legal appeals of these targets caused a revision to the July 2006 TMDL
  - There are data gaps for recreational use impairment and there is no biological evidence of aquatic life or fishery impairment.
  - Data used to establish initial targets represent only severe drought conditions.
  - Reliance on EPA Gold Book or EPA ecoregion criteria does not provide valid targets.
  - EPA modeling did not match empirical data set and can't be used to predict reservoir responses. A more rigorous modeling or data analysis is needed.



American Falls

- In October 2007, the TP value revised to an interim TP concentration of 70 ug/L

- Why this value?
  - EPA Gold Book Guidance is outdated.
  - EPA Ecoregion Criteria are misapplied.
  - Oregon guidance is misapplied.



How good is EPA Gold Book Guidance?

- Free-flowing target (100 ug/L) represents a threshold that interferes with coagulation in water treatment plants.
- It has nothing to do with water quality and aquatic life or recreational beneficial uses.
- The tributary target (50 ug/L) is a transitional number between the free-flowing target (100 ug/L) and the reservoir target (25 ug/L). As such, it also has no scientific basis.

- So, the Mid Snake – Rock Creek target of 75 ug/L was a reasonably "right" number, but it was not based on water quality science via the EPA Gold Book. EPA's macrophyte modeling was a better technical basis.

How good are EPA Ecoregion Criteria?

- Values must be used with caution because they ignore site-specific cause and effect relationships.
- No distinction is made between lakes and reservoirs.
- Values for all seasons are combined, even though growing season values are much higher (seasonal 25% percentile is higher than annual 25% percentile).

- This approach has not been endorsed by the State IDEQ office for use in Idaho.

How good is Oregon nutrient guidance?

- Chlorophyll *a* target (15 ug/L) triggers only further analysis and potential development of a nutrient management plan.
- Oregon never intended the number to be used as a hard and fast criterion to be universally applied.
- Oregon recognized that environmental responses in arid Eastern Oregon might be different than wet Western Oregon, where the majority of the data were collected.
- Oregon policy is to not use data from severe/extreme droughts to determine if target is being exceeded.

What do all of these numbers mean?

- The best available science indicates a TP target of 70 ug/L will result in chlorophyll *a* concentrations of 10 – 15 ug/L.
- These chlorophyll *a* values are expected to result in a system that has enough, but not too much, algae.
- Such a system means that recreational beneficial uses and aquatic life beneficial uses may be able to be restored.

What about the Revised Portneuf TMDL?

- The Portneuf TMDL should be structured as a phased TMDL.
- If additional local empirical data suggest a different chlorophyll *a* threshold, then a different TP target can be determined.
- In the meantime, progress can be made to substantially reduce phosphorus loading to the Portneuf River system.

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