Nutrient Panel Discussion

Wastewater Treatment Design Considerations

Presented by

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Montana – Proposed Standards

Ecoregion Based Nutrient Criteria

In-Stream Concentration Based Standards for Wadeable Streams and Rivers

Level III Ecoregion	Period When Criteria Apply	Nutrient Criteria			Benthic Algae Criteria
		Total P (mg/L)	Total N (mg/L)	NO_{2+3} (mg/L)	
Northern Rockies*	**July 1 – Sept. 30**	**0.012**	**0.233**	**0.081**	**150 mg Chl a/m^2 (36 g AFDW/m^2)**
Canadian Rockies*	**July 1 – Sept. 30**	**0.006**	**0.209**	**0.020**	**150 mg Chl a/m^2 (36 g AFDW/m^2)**
Middle Rockies	**July 1 – Sept. 30**	**0.048**	**0.320**	**0.100**	**150 mg Chl a/m^2 (36 g AFDW/m^2)**
Idaho Batholith	**July 1 – Sept. 30**	**0.011**	**0.130**	**0.049**	**150 mg Chl a/m^2 (36 g AFDW/m^2)**
Northwestern Glaciated Plains	**June 16 – Sept. 30**	**0.123**	**1.311**	**0.020**	**N/A**
Northwestern Great Plains, WY Basin	**July 1 – Sept. 30**	**0.124**	**1.358**	**0.076**	**N/A**

***Anticipated to be updated to be similar to Middle Rockies**

Scientific and Technical Basis of the Numeric Nutrient Criteria for Montana's Wadeable Streams and Rivers ~ Dr. Michael Suplee, et.al., November 2008

Minnesota – Standards

Phosphorus

- 2008 Ch. 7053
  - Lakes
  - New or Expanded Discharges
  - Specific Watershed Areas
- Minnesota River Basin
- Lake Pepin TMDL – Mississippi
- Pre TMDL Trading

Nitrogen

Coming

Other Concerns

- **Mercury – Lake Superior**
- **"Salty Discharge" Monitoring**

Manitoba – Standards

The Save Lake Winnipeg Act

Winnipeg's North End WWTF ~$400M upgrade

- December 31, 2014 compliance date
- TP = 1mg/L
- TN = 15 mg/L
- Seasonal ammonia standards

Red River Implications?

TN and TP Transformations

Organic Nitrogen → Ammonia → Nitrate → Nitrogen Gas

Atmosphere

Input: Oxygen Input: Carbon Source

Particulate and Dissolved Phosphorus → Particulate Phosphorus → **Solids Removal = TP Removal**

Input: Chemical (or PAO)

Total Phosphorus Removal

Biological – activated sludge

- More capital cost
- Less O&M cost
- System dependant (anaerobic digesters, etc)

Chemical – any treatment, even lagoons

- Low capital cost
- Chemical and sludge handling

Total Phosphorus Removal

1 mg/L

- Bio-P or Chem-P

<1 mg/L

- Bio-P or Chem-P with filters

<0.1 mg/L

- Add a water treatment plant on the back end!

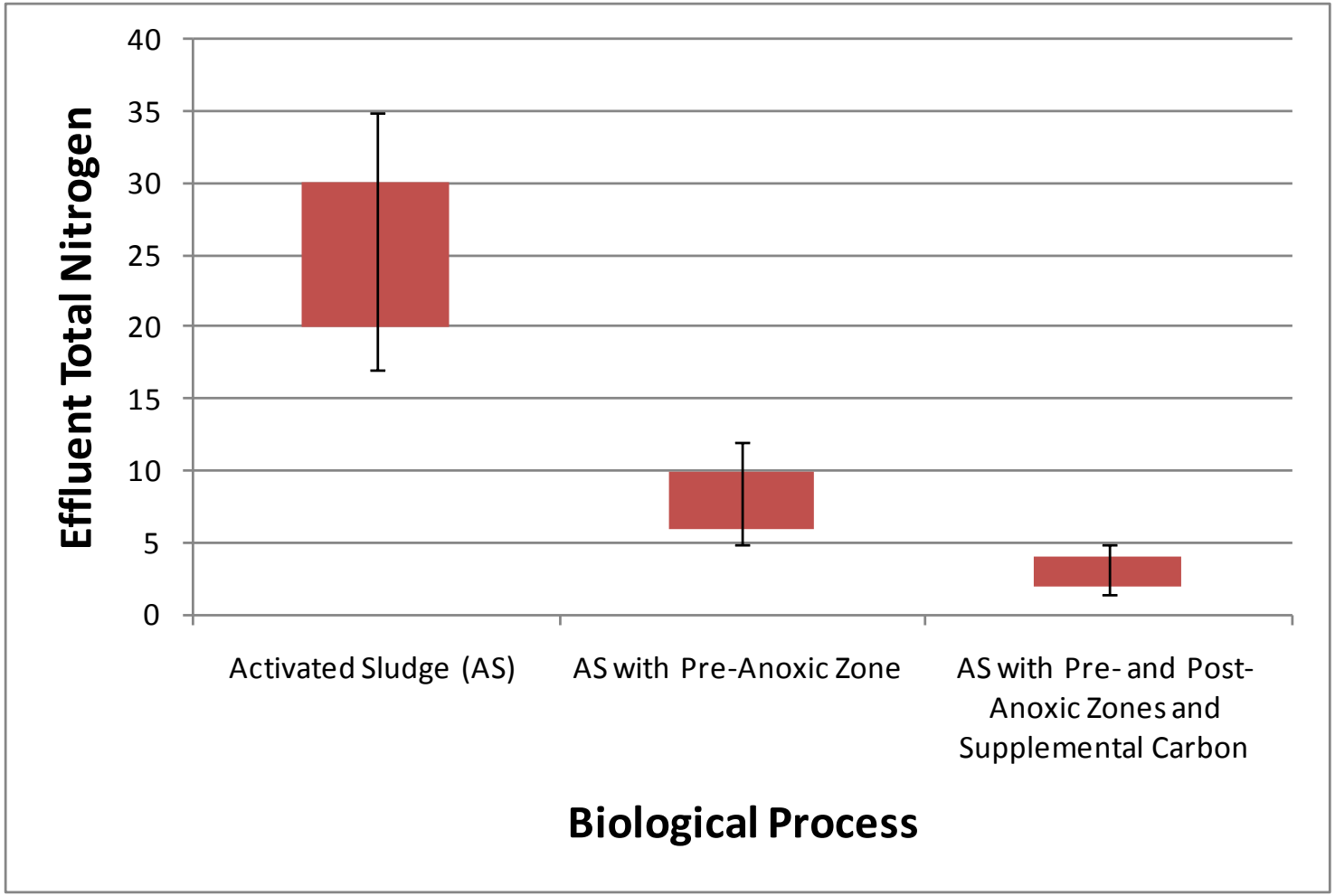
Total Nitrogen Removal

Air stripping with pH adjustment – not used

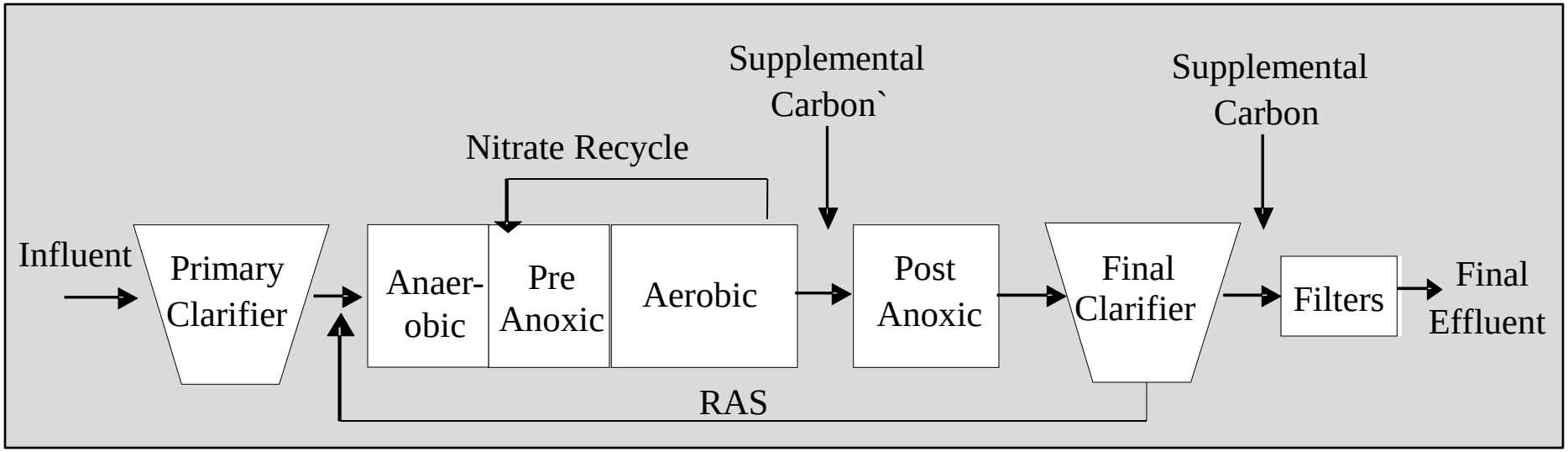
Biological

- Requires a mechanical plant
- Nitrification/denitrification
- Activated sludge
- Denitrification filters

Total Nitrogen Removal



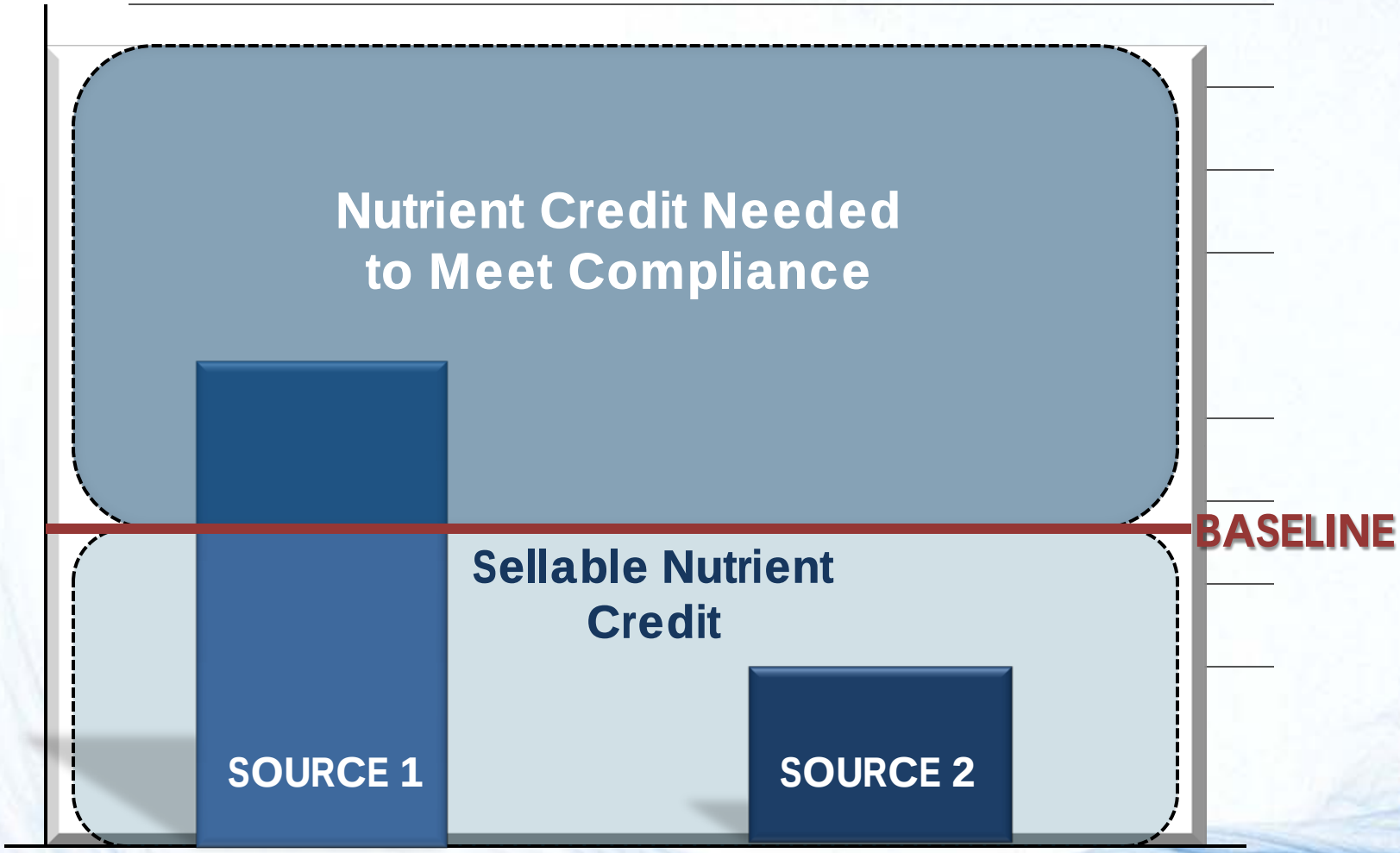
BNR in Many Flavors



Variations

- 4- or 5-Stage Bardenpho
- Modified Ludzack-Ettinger
- University of Cape Town
- A^2/O
- Johannesburg
- Virginia Institute Plant
- Sidestream treatments
- Others

Nutrient Trading
BASICS



Panel Discussion Questions