Opportunities for Trading in Missouri

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Geosyntec Consultants

MNLRS Meeting
May 12, 2015
Jefferson City, Missouri
Missouri Innovative Nutrient Trading Project (2013)

- Evaluate Potential for Implementing a Trading Program in Missouri
- Develop Framework for a Statewide Trading Program (Permitting)
- Conduct Simulated Trading Exercise
What is Water Quality Trading?

- Market-Based Compliance System Where One Discharger Buys or Sells Pollution Credits from Another
  - Point-to-Point
  - Point-to-Nonpoint
  - Not Only Nutrients

Diagram:
- Buyer (Wastewater Treatment Plant)
- Seller (Farm)
- Water Quality Credits
- Ancillary Benefits

- $$$
- Point-to-Point Source Trade
- Point-to-Nonpoint Source Trade

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# Cost-Effective Reductions

<table>
<thead>
<tr>
<th>Control Practice</th>
<th>$/lb Phosphorus</th>
<th>$/lb Nitrogen</th>
</tr>
</thead>
<tbody>
<tr>
<td>WWTF Upgrades</td>
<td>5 to 106</td>
<td>6 to 11</td>
</tr>
<tr>
<td>MS4 Retrofits</td>
<td>--</td>
<td>≈ 200</td>
</tr>
<tr>
<td>Conservation Tillage</td>
<td>≈ 7</td>
<td>≈ 1.50</td>
</tr>
<tr>
<td>Ag. Grass Buffer</td>
<td>≈ 20</td>
<td>≈ 1</td>
</tr>
<tr>
<td>Animal Waste/Runoff Control</td>
<td>≈ 31</td>
<td>≈ 4</td>
</tr>
<tr>
<td>Constructed Wetlands</td>
<td>≈ 2</td>
<td>≈ 2</td>
</tr>
</tbody>
</table>

Sources: Chesapeake Bay, EPA 2007; WERF 2005; WRI 2009
Looking for Examples…
Looking for Examples…

Trading Programs

Procedures, Frameworks, Rules

Trading Activity

NPDES
Permits
Despite More than 10 Years of State and Federal Agency Promotion, Demonstration Projects, and Research Nutrient Reductions Through NPS Trading has been Trivial

> 80% of All Trades are in Long Island Sound

Great Miami Water Quality Trading Program ("Flagship" Point-Nonpoint) Has Not Produced a Single Trade
- Sustained Through Grants
- Not Incorporated into NPDES Permits
Critical Program Design Factors

1) Trading margin
   How Much to Trade?

2) Trading area
   With Whom to Trade?

3) Trading ratio
   How Many Extra Credits to Meet the Goal?
Trading Margin: How Much to Trade?

- **Margin**
  - What are we trading from?
  - What are we trading to?
- **3 Potential Margins**
- **Defines Point Source Demand**

<table>
<thead>
<tr>
<th>Target Category</th>
<th>TP (mg/L)</th>
<th>TN (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without Nutrient Removal</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>Technology-Based</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Criterion</td>
<td>0.1</td>
<td>1</td>
</tr>
</tbody>
</table>

Without Advanced Nutrient Removal
Trading Area: Where to Trade?

- Facility Watershed Area
  - Minimum: 17 Ac.
  - Maximum: 215,000 Ac.
  - Average: 14,000 Ac.
  - Salt HUC: 776,000 Ac.

- Watershed-Wide: To Decrease Overall Loadings
- What Happens if We Restrict Trading to Upstream-Only?
  - To reduce hot spots
Hot Spots

Point Source

Direction of stream flow

BMP

Hot Spot
Domestic Discharges to Streams and Rivers

- Approximately 2000 C/U Facilities
  - 97% < 1.0 MGD = Most Incentive to Trade
Trading Ratio: How Many More Credits?

- Delivery Ratio
  - Instream attenuation
- Equivalency Ratio
  - Different forms of same pollutant
- Uncertainty Ratio
  - Issues in estimating nonpoint loadings
- Retirement Ratio
  - Net improvements

2:1 Trading Ratio

Purchased

Required in the absence of trading
Simulation Approach

- Evaluate PS-NPS and PS-PS trading feasibility in 2 Missouri basins

- How do three factors interact to affect
  - Potential supply
  - Potential demand
  - Overall costs

- Identify important principles for a MO WQT program
46 Domestic WWTPs
90% of PS Loading from 1/4 of WWTPs
First-Cut Feasibility Evaluation

![Graph showing loading in pounds per year for South Fork Salt River.]

- **TN**:
  - Point Sources: 446,000
  - Agricultural Sources: 4,400,000
- **TP**:
  - Point Sources: 89,300
  - Agricultural Sources: 621,000

**South Fork Salt River**
Estimating Nonpoint Source Credit Supply

- BMP removal efficiencies
- BMP implementation rates
- Producer participation

Potential Range of Nutrient Treatment Efficiencies for Cropland BMPs
### BMP Cost Estimates

#### Implementation Cost Factors
- Establishment & annual maintenance costs
- Opportunity costs
- Useful life

<table>
<thead>
<tr>
<th>Applicable Land Use</th>
<th>BMP</th>
<th>Annual Cost per Acre Treated</th>
<th>Annual Cost per Pound TN Removed (Salt/Spring)</th>
<th>Annual Cost per Pound TP Removed (Salt/Spring)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cropland</strong></td>
<td>Filter Strips</td>
<td>$6</td>
<td>&lt;$2/$2</td>
<td>&lt;$2/$4</td>
</tr>
<tr>
<td></td>
<td>Cover Crops</td>
<td>$65</td>
<td>$50/$53</td>
<td>$158/$85</td>
</tr>
<tr>
<td></td>
<td>Conservation Tillage</td>
<td>$65</td>
<td>$24/$26</td>
<td>$389/$209</td>
</tr>
<tr>
<td></td>
<td>Constructed Wetlands</td>
<td>$80</td>
<td>$21/$23</td>
<td>$143/$77</td>
</tr>
<tr>
<td><strong>Pasture</strong></td>
<td>Offstream Watering (S. Fk. Salt River)</td>
<td>$11</td>
<td>$15</td>
<td>$181</td>
</tr>
<tr>
<td></td>
<td>Offstream Watering (Spring River)</td>
<td>$11</td>
<td>$19</td>
<td>$181</td>
</tr>
</tbody>
</table>
Estimating Site-Specific Treatment Upgrade Costs

- 46 Facilities
- 3 Baseline Categories
- Flows from < 0.05 to 5 MGD

### Estimated WWTP Upgrade Costs

**Activated Sludge Facilities**

<table>
<thead>
<tr>
<th>Category</th>
<th>TP (mg/L)</th>
<th>TN (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≈ BNR</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>≈ ENR</td>
<td>0.5</td>
<td>5</td>
</tr>
<tr>
<td>RO</td>
<td>&lt; 0.02</td>
<td>&lt; 1</td>
</tr>
</tbody>
</table>

![Graph showing estimated costs for different categories and flows](image-url)
Interpreting Supply and Demand Estimates

**Hypothetical Spring River Basin TP Trading Example**

<table>
<thead>
<tr>
<th>Trading Scenario</th>
<th>Number of Facilities Trading</th>
<th>Total Watershed Abatement Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trading</td>
<td>18</td>
<td>$7.1 Million</td>
</tr>
<tr>
<td>No Trading</td>
<td>0</td>
<td>$8.5 Million</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Savings $1.4 Million</td>
</tr>
</tbody>
</table>

**Weighted Spring River Cropland BMP Cost = $83**

Individual Facility Upgrade Cost
Simulation Results: Impact of Trading Margin

- Impacts PS Credit Demand
  - A stringent margin is not cost-effective, especially for small WWTPs with high upgrade costs
    - Meet TBEL and trade remainder vs. trading entire margin
Simulation Results:  
Impact of Trading Area

South Fork Salt River Basin

- Trading Area Impacts NPS Credit Supply
- “Upstream-Only” Limits Trading Opportunities, Many WWTPs Want to Trade but Can’t
Simulation Results: Impact of Trading Ratios

- Science-Based Reasons for Including Some Ratios
  - Delivery/Location
  - Uncertainty
  - Equivalency
- Others are Less-Clear
  - Retirement Ratio
- Ratios Increases Cost of Trading
- Unjustified Ratios Affect Efficiency and Equity
Simulation Results: Area + Ratio + Margin

For Any Given Margin, Large Trading Areas and Low Trading Ratios Allow the Highest Number of Facilities to Trade
Point to Point Trading Example

Mexico Sells Credits to Smaller WWTPs

Trading Scenario
- Pt-NPt trading ratio = 2:1
- Pt-Pt trading ratio = 1:1
- Trading area = watershed
- Trading margin = existing to BNR

Mexico Treatment Costs
- BNR = $5/lb TN
- ENR = $9/lb TN
- Marginal cost = $24/lb TN

<table>
<thead>
<tr>
<th>Treatment Facility</th>
<th>Actual Flow (MGD)</th>
<th>Required TN Reduction (lbs/year)</th>
<th>Annual Nonpoint Source Trading Costs</th>
<th>Annual Treatment Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total Cost</td>
<td>Cost/lb</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total Cost</td>
</tr>
<tr>
<td>Mexico WWTP</td>
<td>2.6</td>
<td>94,570</td>
<td>$3,771,889</td>
<td>$40</td>
</tr>
<tr>
<td>Moberly East WWTP</td>
<td>2.1</td>
<td>76,711</td>
<td>$3,200,270</td>
<td>$30</td>
</tr>
<tr>
<td>Macou WWTP</td>
<td>1.5</td>
<td>54,754</td>
<td>$2,074,346</td>
<td>$38</td>
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<tr>
<td>Centralia WW Disposal Facility</td>
<td>0.505</td>
<td>18,847</td>
<td>$594,974</td>
<td>$80</td>
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<tr>
<td>Moberly Correction Center</td>
<td>0.307</td>
<td>11,214</td>
<td>$334,341</td>
<td>$30</td>
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<tr>
<td>Sturgeon WWTF</td>
<td>0.1</td>
<td>3,653</td>
<td>$168,906</td>
<td>$30</td>
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<tr>
<td>Cairo WWTF</td>
<td>0.045</td>
<td>1,644</td>
<td>$49,008</td>
<td>$30</td>
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<tr>
<td>Madison WWTF</td>
<td>0.04</td>
<td>1,401</td>
<td>$48,562</td>
<td>$30</td>
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<tr>
<td>Mexico Route D WWTF</td>
<td>0.033</td>
<td>1,205</td>
<td>$35,939</td>
<td>$30</td>
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<tr>
<td>City of Clark WWTF</td>
<td>0.022</td>
<td>804</td>
<td>$23,359</td>
<td>$30</td>
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<tr>
<td>Jacksonville WWTF</td>
<td>0.017</td>
<td>621</td>
<td>$18,514</td>
<td>$30</td>
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<tr>
<td>Monroe Co. PWSD#2, Holliday</td>
<td>0.0143</td>
<td>522</td>
<td>$15,574</td>
<td>$30</td>
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<tr>
<td>Monroe Co. PWSD#2, Rush Hill</td>
<td>0.0121</td>
<td>442</td>
<td>$13,178</td>
<td>$30</td>
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<tr>
<td>Skyline Village Inc.</td>
<td>0.01</td>
<td>365</td>
<td>$10,891</td>
<td>$30</td>
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<tr>
<td>Lakeside Estate HOA</td>
<td>0.00804</td>
<td>316</td>
<td>$9,409</td>
<td>$30</td>
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<tr>
<td>Elmwood Mobile Home Park</td>
<td>0.004</td>
<td>145</td>
<td>$4,356</td>
<td>$30</td>
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<tr>
<td>Freeman Hills Subd WWTF</td>
<td>0.00385</td>
<td>141</td>
<td>$4,193</td>
<td>$30</td>
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<tr>
<td>Dan Arnold Lagoon</td>
<td>0.002</td>
<td>72</td>
<td>$2,178</td>
<td>$30</td>
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<tr>
<td>Robert Stone</td>
<td>0.0015</td>
<td>55</td>
<td>$1,684</td>
<td>$30</td>
</tr>
<tr>
<td>Moberly LSD Church</td>
<td>0.00075</td>
<td>27</td>
<td>$817</td>
<td>$30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment Upgrade Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BNR Treatment Cost, in $/year</td>
<td>$511,778</td>
</tr>
<tr>
<td>ENR Treatment Cost, in $/year</td>
<td>$1,082,637</td>
</tr>
<tr>
<td>Marginal ENR Cost, in $/year</td>
<td>$570,859</td>
</tr>
<tr>
<td>BNR TN Reduction, in lbs/year</td>
<td>94,976</td>
</tr>
<tr>
<td>ENR TN Reduction, in lbs/year</td>
<td>118,720</td>
</tr>
<tr>
<td>Incremental ENR Reduction, in lbs/year</td>
<td>23,744</td>
</tr>
<tr>
<td>Marginal Cost for Incremental Credits, in $/lb</td>
<td>$24</td>
</tr>
</tbody>
</table>
Big River Trading

- Big River Trading Drivers May be Different than Small Streams
- Gulf of Mexico May be the Driver
- Up to 80% of Nutrients are from Agriculture
- Flexibilities to Address Downstream Impacts
Targeted NPS Trading

- Nine WWTPs contribute 80% of Load
  - Low Upgrade Costs
- PS Trading Opportunities
- NPS Trading: Large Pool of Low-Cost BMP Credits Needed

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Existing Treatment to BNR</th>
<th>Existing Treatment to ENR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Nitrogen, in lbs/year</td>
<td>4.6 Million</td>
<td>5.3 Million</td>
</tr>
<tr>
<td>Total Phosphorus, in lbs/year</td>
<td>18.2 Million</td>
<td>22.9 Million</td>
</tr>
</tbody>
</table>
Creating a Workable Trading Program

1) Trading Areas Should be as Large as Possible
2) Only Scientifically-Based Ratios Should be Used
3) Point-to-Point Trading is Cost-Effective in Some Situations
4) Big River Trading Drivers are Different
5) WWTPs Should be Free to Set the Top of the Margin
6) Administrative and Transaction Costs May Limit Trading
7) Liability, Monitoring, and Enforcement Require Special Consideration
8) Baselines Increase Trading Costs
Neuse River

- Nitrogen TMDL driven
- 19 members in bubble permit
  - Voluntary participation
  - Individual NPDES limit is waived
- Informal trading between partners
- Offset payments ($11/lb) ecological enhancement program
  - No violations to date/never used
- Internal enforcement policy
  - Fines (80% escrow)
  - Funds monitoring and capital improvement grants
- Flexibility – free to choose control strategies
EPRI Ohio River Basin Trading Project

- Working with Ohio, Indiana, and Kentucky
- Testing to determine if trading is economically and socially viable
- “Stewardship” credits – not for NPDES compliance

<table>
<thead>
<tr>
<th>Ohio River Basin Water Quality Trading Project - by the Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of credits (pounds) sold to date:</td>
</tr>
<tr>
<td>Number of farmers funded:</td>
</tr>
<tr>
<td>Pounds of Total Nitrogen Contracted:</td>
</tr>
<tr>
<td>Pounds of Total Phosphorus Contracted:</td>
</tr>
<tr>
<td>Acres of land under seasonal practices:</td>
</tr>
<tr>
<td>Credits available in May 2015 Auction:</td>
</tr>
</tbody>
</table>
Virginia Nutrient Credit Exchange Program

- Authorized by Governor in 2005
- Existing - acquire credits from other point sources
- New or Expanding must offset from:
  - One or more permitted facilities in the same tributary
  - Acquisition of NPS load allocations through the use of BMPs (2:1 ratio)
  - Water Quality Improvement Fund
- Water Quality Improvement Fund
  - Provides technical and financial assistance made available through grants provided from the fund
  - Project eligibility is limited to design and installation of nutrient reduction technology at Chesapeake Bay POTWs
Thank You


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