Passaic Trading Formula

Passaic Trading Symposium
July 15, 2008
USEPA Targeted Watershed Grant Program
Formula for trading

• NJDEP guidance
  – The trading program should attain the same or better result as 0.4 mg/l long term avg. (LTA) TP from each discharger on an annual basis *.
    • System is more sensitive to concentration of discharge than the load
    • Trades must function to offset deviations of LTA from 0.4 mg/l
    • Best way to do this: base the trading allocation on discharger actual flow, rather than permitted flow
      – Trading allocation is < TMDL allocation
    • * Modified for Lower Passaic dischargers (seasonal limits)
Formula for trading (cont.)

- Recommended formula

  \[ Allocation = (0.4 \text{ mg/l LTA} \times \text{Anticipated Actual Discharger Flow}) \]


  \[ Balance = Allocation - \text{Load Discharged} \]

    - Actual load sold + Equalized load purchased
Formula for trading (cont.)

\[
(0.4 \text{ mg/l LTA} \times \text{Anticipated Actual flow}) - \text{Load Discharged}
\]

- Actual load sold + Equalized load purchased

• What if allocation is based on permitted flow?
  – Seller can take credit for more pounds than it has really removed; risk to stream

• Load discharged is function of actual LTA and flow from facility
Formula for trading (cont.)

BALANCE = Allocation – Load Discharged

- Actual load sold + Equalized load purchased

- Actual load sold
  - Load below allocation that seller has removed from effluent and sold

- Equalized load purchased =
  (Actual load sold * Trading ratio\text{seller to buyer})
  - Uses trading ratio to account for attenuation of TP between buyer and seller; all diversion conditions accounted for
  - Trading ratio of 0.5 means that 0.5 kg discharged from seller has same effect at target location as 1 kg discharged from buyer
  - Trading ratio table developed to guide all dischargers
Trading ratio table

- Grouped by management area and then point source zone
  - Three management areas
    - Upper Passaic, Pompton, Lower Passaic
  - Nine point source zones
    - Dead River Zone
    - Upper Passaic Zone 1
    - Upper Passaic Zone 2
    - Whippany Zone
    - Rockaway Zone
    - Pompton Headwaters Zone
    - Two Bridges Zone
    - Lower Passaic Zone 1
    - Lower Passaic Zone 2

Upper Passaic MA

Pompton MA

Lower Passaic MA
### Example of trading ratio table
(Based on No Diversion, Diversion, Extreme Diversion Scenarios)

<table>
<thead>
<tr>
<th>Seller</th>
<th>Buyer</th>
<th>Dead River Zone (UP MA)</th>
<th>Upper Passaic Zone 2 (UP MA)</th>
<th>Lower Passaic Zone 1 (LP MA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Passaic Zone 1 (UP MA)</td>
<td>Upper Passaic Zone 1 (UP MA)</td>
<td>0.90</td>
<td>0.78</td>
<td>0.57</td>
</tr>
<tr>
<td>Whippany Zone (UP MA)</td>
<td>Whippany Zone (UP MA)</td>
<td>0.82</td>
<td>0.77</td>
<td>0.52</td>
</tr>
<tr>
<td>Pompton Headwater Zone (Pompton MA)</td>
<td>Pompton Headwater Zone (Pompton MA)</td>
<td>0.49</td>
<td>0.43</td>
<td>0.29</td>
</tr>
<tr>
<td>Lower Passaic Zone 2 (LP MA)</td>
<td>Lower Passaic Zone 2 (LP MA)</td>
<td>0.87</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Derivation of trading ratios

- Omni Environmental performed attenuation analysis using calibrated TMDL model.
- Considered “no diversion”, “diversion”, and “extreme diversion” scenarios.
- Calculated attenuation of TP load from each zone as load moves downstream.
- Result: “Zonal persistence coefficient” or ZPC for each zone.
- ZPC is percent of discharged load that reaches target location.
Example – Persistence coefficient analysis

ZPC vs. location (annual load, Upper Passaic Zone 1, no diversion)
Derivation of trading ratios (cont.)

- Trading ratio = (Seller \(_{ZPC}\) / Buyer \(_{ZPC}\)), relative to common critical location.
  - Some ratios have 2 common critical locations; choose the critical location which yields the lower ratio.
- Calculate trading ratio for each diversion scenario, and select lowest ratio; max protection for WQ
  - Ratios further reduced by 10% as margin of safety
  - Experimented with “average” ratios, and “minimum” ratios in trade scenario simulations
    - Unsatisfactory results
Derivation of trading ratios: Example inter-MA trade, Pompton selling to Upper Passaic

• Seller: Two Bridges SA (Two Bridges Zone)
  – ZPC at Dundee Lake = 0.93, no diversion
  – ZPC at Dundee Lake = 0.47, diversion
  – ZPC at Dundee Lake = 0.25, extreme diversion
  – ZPC at Wanaque South = 1.00, extreme diversion
• Buyer: Warren Twp SA – Stage 5 (Dead Zone)
  – ZPC at Dundee Lake = 0.77, no diversion
  – ZPC at Dundee Lake = 0.62, diversion
  – ZPC at Dundee Lake = 0.37, extreme diversion
  – ZPC at Wanaque South = 0.13, extreme diversion
• Trading ratio = (Seller ZPC/Buyer ZPC)
  – No diversion, trading ratio = 1.21 = (0.93/0.77)
  – Diversion, trading ratio = 0.76 = (0.47/0.62)
  – Extreme diversion, trading ratio = 0.68 = min (0.25/0.37 , 1.0/0.13)
  – Select 0.90*0.68 as trading ratio = 0.61
Table 5-7: FINAL trading ratio matrix, based on 90% of inter-point source zone ratios in table 4-5 (sellers in rows, buyers in columns)

<table>
<thead>
<tr>
<th>Buyer Seller</th>
<th>Upper Passaic Management Area</th>
<th></th>
<th></th>
<th></th>
<th>Pompton Management Area</th>
<th></th>
<th></th>
<th>Lower Passaic Management Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dead Zone</td>
<td>1.00</td>
<td>0.85</td>
<td>0.78</td>
<td>0.87</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.54</td>
</tr>
<tr>
<td>Upper Passaic Zone 1</td>
<td>0.90</td>
<td>1.00</td>
<td>0.78</td>
<td>0.90</td>
<td>1.03</td>
<td>0.00</td>
<td>0.00</td>
<td>0.57</td>
</tr>
<tr>
<td>Upper Passaic Zone 2</td>
<td>0.92</td>
<td>0.90</td>
<td>1.00</td>
<td>0.96</td>
<td>1.09</td>
<td>0.00</td>
<td>0.00</td>
<td>0.61</td>
</tr>
<tr>
<td>Whippany Zone</td>
<td>0.82</td>
<td>0.80</td>
<td>0.77</td>
<td>1.00</td>
<td>1.03</td>
<td>0.00</td>
<td>0.00</td>
<td>0.52</td>
</tr>
<tr>
<td>Rockaway Zone</td>
<td>0.65</td>
<td>0.63</td>
<td>0.60</td>
<td>0.69</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.42</td>
</tr>
<tr>
<td>Pompton Headwater Zone</td>
<td>0.49</td>
<td>0.46</td>
<td>0.43</td>
<td>0.50</td>
<td>0.62</td>
<td>1.00</td>
<td>0.72</td>
<td>0.29</td>
</tr>
<tr>
<td>Two Bridges Zone</td>
<td>0.61</td>
<td>0.58</td>
<td>0.54</td>
<td>0.63</td>
<td>0.76</td>
<td>0.83</td>
<td>1.00</td>
<td>0.36</td>
</tr>
<tr>
<td>Lower Passaic Management Area</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Lower Passaic Zone 1</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.87</td>
</tr>
<tr>
<td>Lower Passaic Zone 2</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.87</td>
</tr>
</tbody>
</table>