A Brief Consideration of Some Ecological Flow Regimes, Water Supply Systems, and Planning:

The “Big River” Watershed Scenario
Rocky River, Siler City site - Percentage (weighted equally for each season) of Guilds/Species with Less Than 80% of Unregulated Index B Value

NOTE: On this chart, the stacked bar percentage for a given season is NOT the same as the percentage for that season alone. Instead they have been weighted to put ALL SEASONS COMBINED on a scale of 0 to 100%.

Flow Scenario

--- Percentage Average Flow as Min. Flow ------
--- Percentage of Inflow as Flow-by ------
FIGURE 2

Existing Conditions

First Creek

Second Creek

Tarheelia

Big River

Third Creek

Devilville

Wolftown
<table>
<thead>
<tr>
<th>Scenario</th>
<th>“Tarheelia”</th>
<th>“Wolftown”</th>
<th>“Devilville”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present Demand (Vol. Equivalent to 20% 7Q10)</td>
<td>3.6 cfs (2.3 mgd)</td>
<td>2.8 cfs (1.8 mgd)</td>
<td>2.0 cfs (1.2 mgd)</td>
</tr>
<tr>
<td>50-YR Demand</td>
<td>15.5 cfs (10 mgd)</td>
<td>12.3 cfs (7.9 mgd)</td>
<td>6.0 cfs (3.8 mgd)</td>
</tr>
<tr>
<td>Present Wastewater Return (86%)</td>
<td>3.0 cfs (1.9 mgd)</td>
<td>0.0</td>
<td>1.7 cfs (1.0 mgd)</td>
</tr>
<tr>
<td>Future Wastewater Return (86%)</td>
<td>13.3 cfs (8.5 mgd)</td>
<td>0.0</td>
<td>5.1 cfs (3.2 mgd)</td>
</tr>
</tbody>
</table>

TABLE 1
<table>
<thead>
<tr>
<th>NODE</th>
<th>DA (mi²)</th>
<th>“EFLOW” Flow-By Regime</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40</td>
<td>Monthly Median or Inflow, whichever’s less</td>
</tr>
<tr>
<td>2</td>
<td>92</td>
<td>60 Percent Annual Average or Inflow, whichever’s less</td>
</tr>
<tr>
<td>3</td>
<td>109</td>
<td>75 Percent Inflow</td>
</tr>
<tr>
<td>4</td>
<td>189</td>
<td>80 Percent Inflow</td>
</tr>
<tr>
<td>5</td>
<td>158</td>
<td>70 Percent Inflow</td>
</tr>
<tr>
<td>6</td>
<td>356</td>
<td>50 Percent Annual Average or Inflow, whichever’s less</td>
</tr>
<tr>
<td>7</td>
<td>366</td>
<td>85 Percent Inflow</td>
</tr>
</tbody>
</table>
FIGURE 4

TOWN OF "TARHEELIA" FLOW REGIME, NODE 1, "FIRST CREEK"

"EFLOW" = LESSER OF MONTHLY MEDIAN, OR INFLOW (UNALTED)
PRESENT DEMAND = VOL. EQUIVALENT TO 20% 7Q10 = 3.6 CFS (2.3 MGD)
FUTURE DEMAND = 50-YR PROJECTION = 15.3 CFS (10 MGD)
FIGURE 6

TOWN OF "WOLFTOWN" FLOW REGIME, NODE 2, "SECOND CREEK"

"EFLOW" = LESSER OF 60% OF YEAR AVG. FOR PERIOD, OR INFLOW (UNALTERED)
PRESENT DEMAND = VOLL. EQUIVALENT TO 20% 7Q10 = 2.8 CFS (1.8 MGD)
FUTURE DEMAND = 50-YEAR PROJECTION = 12.3 CFS (7.9 MGD)
FIGURE 7

Existing Conditions

First Creek
Second Creek
Tarheelia
Third Creek
Big River
Devilville
Wolftown
FIGURE 8

TOWNS OF "TARHEELIA"/"WOLFTOWN" FLOW REGIME, NODE 3, "BIG RIVER"

"EFLOW" = 75% OF INFLOW (UNALTERED)
PRESENT DEMAND = CUMULATIVE VOL. EQUIVALENT TO 20% TQ10 = 6.4 CFS (4.13 MGD)
FUTURE DEMAND = CUMULATIVE 50-YEAR PROJECTION = 27.8 CFS (17.9 MGD)
FIGURE 10

TOWNS OF "TARHEELIA"/"WOLFTOWN" FLOW REGIME, NODE 4, "BIG RIVER"

"EFLOW" = 80% OF INFLOW (UNALTED)

PRESENT DEMAND = CUMULATIVE VOL. EQUIVALENT TO 20% 7Q10 = 6.4 CFS (4.13 MGD)
FUTURE DEMAND = CUMULATIVE 50-YEAR PROJECTION = 27.8 CFS (17.9 MGD)
WASTEWATER RETURN = 80% OF "TARHEELIA" WITHDRAWAL

FLOW (CUBIC FEET PER SECOND)

DATE (WATER YEAR: OCT - SEP) (FLOWS BASED ON DAILY AVG.)

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- Q W/ 50-YR DEMANDS & RETURN
- "EFLOW"
- Q W/ 20% 7Q10 W/DS & RETURN
- Q UNALTED
FIGURE 11

Existing Conditions

Wolftown

Second Creek

Big River

Tarheelia

Third Creek

Devilville

First Creek
FIGURE 12

TOWN OF "DEVILVILLE" FLOW REGIME, NODE 5, "THIRD CREEK"

"EFLOW" = 70% OF INFLOW (UNALTED)
PRESENT DEMAND = VOL. EQUIVALENT TO 20% TQ10 = 2.0 CFS (1.3 MGD)
FUTURE DEMAND = 50-YEAR PROJECTION = 6.0 CFS (3.9 MGD)
FIGURE 14

TOWNS OF "TARHEELIA"/"WOLFTOWN"/"DEVILVILLE" FLOW REGIME, NODE 6, "BIG RIVER"

"EFLOW" = LESSER OF 50% OF ANNUAL AVERAGE FOR PERIOD, OR INFLOW (UNALTED)
PRESENT DEMANDS = CUMULATIVE VOL. EQUIVALENT TO 20% OF TQ10 = 8.4 CFS (5.4 MGD)
FUTURE DEMANDS = 50-YEAR PROJECTION = 33.8 CFS (21.9 MGD)
"TARHEELIA" WASTEWATER RETURN = 86% OF WITHDRAWAL = 3 CFS (1.9 MGD) // 13.3 CFS (8.5 MGD)
FIGURE 15

First Creek

Second Creek

Third Creek

Tarheelia

Big River

Devilville

Wolftown

Existing Conditions
FIGURE 16

TOWNS OF "TARHEELIA"/"WOLFTOWN"/"DEVILVILLE" FLOW REGIME, NODE 7, "BIG RIVER"

"EFLOW" = 85% OF INFLOW (UNALTERED)
PRESENT DEMANDS = CUMULATIVE VOL. EQUIVALENT TO 20% OF 7Q10 = 8.4 CFS (5.4 MGD)
FUTURE DEMANDS = CUMULATIVE 50-YEAR PROJECTIONS = 33.8 CFS (21.9 MGD)
"TARHEELIA"/"DEVILVILLE" CUMULATIVE WASTEWATER RETURNS = 86% OF WITHDRAWAL = 4.7 CFS (2.8 MGD) // 18.4 CFS (11.8 MGD)
POINTS TO PONDER:

- Nodes on “unaltered” streams and protected watersheds?

- Alterations in the upper watershed are attenuated in the lower watershed by intervening drainage and discharges. Nodes in lower watershed may not raise a “red flag”.

- When is the “red flag” raised? Any time EFlow is breached? Frequency? Duration? %Q? Seasonal?

- Capturing Secondary & Cumulative Impacts?:
  - NC(S)EPA Minimum Criteria: “Improvements to water treatment plants that involve less than 1,000,000 gallons per day added capacity and total design withdrawal less than one-fifth of the 7-day, 10-year low flow of the contributing stream;”
  - Unregulated withdrawals;
  - Land use; etc.;

- High-flow skimming. There’s a lot of available water during high-flow events.

- Tidal waters?