Watershed Access Lab Projects

12-4-2007

Palmer River Water Discharge and Nutrient Study

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Conducted by Dighton-Rehoboth Regional High School Environmental Science Class
PALMER RIVER WATERSHED (AS YELLOW DASHED LINE) SHOWING RIVER WITH TRIBUTARIES

(TOPOGRAPHY BASED ON DIGITAL ELEVATION DATA)

Water Features in Blue

REHOBOTH TOWN BOUNDARY

ROUTE 118

ROUTE 44

PROVIDENCE STREET

WATERSHED DISCHARGE POINT
What we looked for:

• **Stream Discharge**: Width x Depth x Velocity

• **Nutrient concentration** (mg/L)

• **Load**: Discharge x Concentration

  • **Nutrients examined**:
    - Phosphates
    - Nitrates
    - Dissolved Oxygen
    - pH
    - Temperature
More tools!

Velocity Sensor & Depth Rod

Wooden Float & Anchor
For Mooring sensors
Overnight

Life Jackets for Analysts going
Into Deeper waters. Yikes!

2 of our fearless leaders: Mr. Evans & Mrs. Borges-Dubois
Site 1: Wilmarth Bridge Road

- Located just off of Route 44 approximately ¾ the way to Seekonk
- Rehoboth is <10% Impervious cover
- Very quiet, low population density neighborhood
Sarah, Christy, Alida, Janine, Leslie, Alyssa, Patrick, Joe, Mark, Devin, & Kirk
Wilmarth Bridge Road site

Legend:
- Rivers and Streams
- Lakes and Ponds
- Shoreline
- Hydrologic Connection
- Mean Low Water Line
- Wetland Limit
- Closure Line
- Marsh/Bog
- Wooded marsh
- Cranberry Bog
- Salt Marsh
- Open Water
- Reservoir (with PWSID)
- Tidal Flats
- Beach/Dune
- All Underground Storage Tanks
- Elevation in Feet

USGS DATA COLLECTION STATIONS:
- DEP WATER QUALITY STATIONS
- Surface Street
- Underpass
- Access Road
- Access Road Underpass
- Railroad
- Abandoned Railroad
- Railroad Underpass
- Abandoned Railroad Underpass
- Town
- Interstate
- Coast
- Towns

Wilmarth St. bridge
Wilmarth Bridge Road site
Wilmarth: pH vs. Time

Time (2pm)

pH Series1
- Located in southern Rehoboth – Near Swansea
- Site of the Shad Factory Pond
- Less than 10% Impervious cover
- Site of Fish Ladder Reconstruction project
Colin, Jeremy, Kristen, Lindsey, Josh, Tyler, Ryan, Spencer, Meghan, Kevin, & Ryan
Comparison of the 2 sites

• While the Wilmarth Bridge Road segment is one of many contributors to the overall Palmer River [as well as its downstream Reed Street counterpart], their significance may be partially inferred from the following:
<table>
<thead>
<tr>
<th>Primary Habitat Characteristics</th>
<th>Wilmath Bridge Road</th>
<th>Reed Street</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Cobble</td>
<td>20-34% (fair)</td>
<td>&gt;50% (Excellent)</td>
</tr>
<tr>
<td>Velocity</td>
<td>&lt;0.5 fps (poor)</td>
<td>Same (though other regimes were present within the immediate stretch of river)</td>
</tr>
<tr>
<td>Embeddedness</td>
<td>0-25% (excellent)</td>
<td>Same</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Primary Habitat Characteristics</th>
<th>Significance of Characteristic</th>
</tr>
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<tbody>
<tr>
<td>% Cobble</td>
<td>Indicator of sediment deposition &amp; load carried by river</td>
</tr>
<tr>
<td>Velocity</td>
<td>Figures into Discharge &amp; acts as a selective force on the native Biota</td>
</tr>
<tr>
<td>Embeddedness</td>
<td>Indicator of microhabitats available for different types of biota. Ex: algae, scraper-insects</td>
</tr>
</tbody>
</table>
### Secondary Habitat Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Wilmarth Bridge Road</th>
<th>Reed Street</th>
</tr>
</thead>
<tbody>
<tr>
<td>Velocity/Depth Regimes</td>
<td>2 of 4 present, fast-shallow dominant (good-fair)</td>
<td>All 4 present (excellent)</td>
</tr>
<tr>
<td>Riffle Characteristics</td>
<td>40-60% of segment is riffle, riffle is as wide as the stream, but its length is &lt;2x the stream width (good)</td>
<td>Same</td>
</tr>
<tr>
<td>Conditions of Banks (% eroding)</td>
<td>&lt;10%, mostly healed (good)</td>
<td>Same</td>
</tr>
<tr>
<td>Bank Vegetation</td>
<td>&gt; 90% (excellent)</td>
<td>Same</td>
</tr>
<tr>
<td>Overhead Canopy</td>
<td>&gt; 75% (excellent)</td>
<td>50-75% (good)</td>
</tr>
</tbody>
</table>

### Significance of Characteristic

<p>| | |</p>
<table>
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<tbody>
<tr>
<td>Velocity/Depth Regimes</td>
<td>Indicator of the # of microhabitats available → can indicate relative level of biodiversity possible &amp; available base for local food chain</td>
</tr>
<tr>
<td>Riffle Characteristics</td>
<td>Indicator of relative saturation of dissolved gasses (O2, CO2)</td>
</tr>
<tr>
<td>Conditions of Banks (% eroding)</td>
<td>Indicates ability of Riparian plants to maintain root integrity as well as how local precipitation affects discharge levels</td>
</tr>
<tr>
<td>Bank Vegetation</td>
<td>Indicates soil fertility and overall health of Riparian buffer zone</td>
</tr>
<tr>
<td>Overhead Canopy</td>
<td>Indicates the relative degree of the temperature-mitigating properties of local Flora</td>
</tr>
</tbody>
</table>
Inferred significance I

- **Observation:** Reed Street maintained a higher Temperature than Wilmarth and exhibited fewer variations

- **Hypothesis:** This may be because of the higher discharge. The high *Specific Heat Capacity* of water combined with the shear *Volume* helped Reed street retain the heat & exhibit less day/night variation
Inferred significance II

- **Observations:**
  1. There was no significant overnight lowering of pH in either site.
  2. Wilmarth Bridge Road site exhibited more basic pH’s than Reed Street

**Hypotheses:**
1. Turbulent (rather than laminar) flow helped keep gas concentrations from being highly variable. This, in turn, kept CO2 levels from contributing to acidity overnight (Carbonic acid)

2. There may be an underlying geological reason: perhaps the area surrounding this site contains Basic rock and/or weathered Bicarbonate (HCO3-) ions; which can slow the effects of acidification by neutralizing contributors like acid rain and contaminated runoff.
Inferred Significance III

• Observations:

1. Both sites dO2 levels drop off in the evening hours.

2. Wilmarth Bridge Road’s drop-off seems to occur earlier.

Hypotheses:

1. Halted photosynthetic activity (sunset) coupled with continued respiration shifts a balance of gasses to an output of CO2 (respiration) with no O2 input (due to halted photosynthesis).

2. Perhaps the higher percent of canopy cover at this site provided significant shade to halt photosynthesis earlier in the evening than at Reed Street.
Noted patterns & irregularities for Phosphate levels

1. No data was available for Wilmarth Bridge road at 8AM or at Reed St. at midnight.
   - The analysis registered an airspike for these samples
2. All values were AT or BELOW detection limits
   - This would suggest that phosphates are at a low enough level to be a limiting factor for both sites
N-NO3 concentration vs. Time - both sites

Wilmarth
Reed St.
Noted patterns & irregularities for Nitrate (NO3) levels

• 1. All levels were above detection limits of the analyzing device
  - This suggests that NO3 is NOT a limiting factor for either site

• 2. Concentrations were higher at Reed Street.
  - With higher discharge, we would expect lower concentrations. So this tells us that between these 2 sites, there must have been a significant addition of NO3 to the Palmer River
  - Between the 2 sites are farmland, wooded marshes, a golf course, and low-density residential areas
Inferred Significance IV

**Observation:** Bent shape to Riparian Trees at both sites

**Hypothesis:** Trees have corrected their growth toward the sun (phototropism) in response to erosion taking the soil around their roots away
Significance of Load

- Load is higher at Reed street: This is at least partially (though not proportionally) due to the increased discharge $\Rightarrow Q=wdu$
- Lower amounts of PO4 suggest that this IS a limiting factor in the Palmer River.
- Increased amounts of NO3 could be attributable to runoff from nearby farms &/or the Golf course.
- These levels suggest a low-average level for BOTH nutrients examined
The best parts of any Field Trip...

Pretending to be a troll under the bridge!

Keeping warm & playing Hide n’ seek!

Wondering if the Teacher Can be the first to get Wet!

Pretending to have ‘hand-feet’
AND OF COURSE.....

Hot Dunkies’ on a COLD morning!!!