Lower Rock Creek
3.3 Stoney Creek (NIH) Stormwater Pond

3.3.1 Introduction

The future Stoney Creek (NIH) Stormwater Management Pond will be on the Southeast corner of the National Institutes of Health (NIH) Campus and is within the Stoney Creek tributary that drains to the Lower Rock Creek Watershed. This new stormwater pond is planned to be completed in 2013. This project is intended to reduce downstream velocities and pollutant loads, capture trash, and improve aquatic habitat and water quality. However, due to property constraints and a very urban environment, these goals were not possible to monitor. As a result, it was only feasible to monitor temperature to determine if the pond introduces a thermal impact into stream it feeds.

Currently, uncontrolled stormwater discharges into an open channel that lacks a riparian buffer and is susceptible to temperature impacts during the summer months. Consequently, another goal of the project is to avoid introducing any further thermal impacts to the stream. The stream temperatures were monitored preconstruction upstream and downstream of the future pond in 2009 and 2010. This is a second year (2010) preconstruction report, documenting thermal stream conditions upstream and downstream of the future NIH stormwater pond.

Subwatershed facts

Subwatershed Drainage Area: 1,364 acres
Subwatershed Imperviousness: 30 percent

Project Facts

Project Area: This pond is a new stormwater facility that captures 215 acres of an existing stormwater drainage system from Bethesda, including the Bethesda Central Business District. The drainage area includes 54 percent impervious acreage consisting of 47 acres zoned for Business/Commercial; 36 acres zoned for high-rises and townhomes; 92 acres zoned for ¼ acre residential; and the NIH campus.

Costs (projected): Design ($367,552), Construction ($3,887,602), Funded in part through the Maryland Department of the Environment.

Completion Date (projected): April 2013

Property Ownership: Federal Government, National Institutes of Health Campus

Project Selection

This stormwater management pond project was identified as a priority site in the “Stormwater Management Study for the National Naval Medical Center” (August 1998) and the DEP Rock Creek Restoration Watershed Study (July 2001). The Stoney Creek (NIH) Stormwater Management Pond, was selected as a top priority site and presents a unique opportunity to treat runoff from the Bethesda Central Business District by creating aquatic habitat, capturing trash, reducing downstream velocities and significantly reducing downstream pollutant loads in Lower Rock Creek through nutrient uptake and sediment capture.
Pre-Restoration Conditions

The existing uncontrolled stormwater from Bethesda discharges to an open channel on the southeast portion of the NIH property and then enters twin 66-inch Reinforced Concrete Pipe (RCP) culverts under Woodmont Avenue and Wisconsin Avenue. Flows then continue under Glenbrook Parkway east of Wisconsin Avenue, and discharge into Stoney Creek at the intersection of Glenbrook Parkway and Jones Bridge Road. The open channel lacks a riparian buffer and is susceptible to temperature increases during the summer months.

Proposed Restoration Actions

The proposed Stoney Creek Stormwater Management Pond is a strategic location for capturing pollutants and reducing storm flows from the Bethesda Central Business District. Stoney Creek (NIH) Stormwater Management Pond is designed with a permanent wet pool providing water quality volume and channel protection volume. Design features for the pond also include two underground trash collection chambers for capturing trash and pollutants washing downstream from Bethesda, subsurface aerators to enhance pond water circulation, and native landscaping of trees, shrubs, herbaceous plants, grasses and wetland vegetation. In addition, a 700 foot long permanent, clean water diversion system beneath the pond is designed to divert incoming stream flows and stormwater runoff for future maintenance activities. The completed pond is anticipated to provide treatment of 59 percent of the channel protection volume (CPV) control for a 1-year storm. An expected water quality volume (WQV) of 3.9 acre-feet combined with an expected extended detention volume of 0.75 acre-feet gives a total of 4.65 acre-feet of water quality treatment.

3.3.2 Restoration Goals

The goals of the Stoney Creek (NIH) stormwater pond project are presented below in Table 3.3.1, along with the monitoring performed to characterize the pre-construction conditions. Even though it is intended for this project to have a positive effect on the aquatic habitat, water quality, and geomorphology of the receiving stream, property constraints limited what parameters could be monitored. The only feasible monitoring plan was to determine if the pond introduces a thermal impact downstream through pre- and post-construction water temperature monitoring.

Table 3.3.1 – Summary of Restoration Project Goals and Associated Monitoring

<table>
<thead>
<tr>
<th>Why: Restoration Goals</th>
<th>What: Monitoring Done to Evaluate Goal</th>
<th>When: Years Monitored</th>
<th>Where: Station or Location Monitored</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Avoid introduction of new thermal impacts in the Stoney Creek Tributary of Lower Rock Creek</td>
<td>• Stream temperature</td>
<td>2009, 2010</td>
<td>LRSC1013 (US) LRSC1011 (DS)</td>
</tr>
</tbody>
</table>
3.3.3 Methods to Measure Project Goals

Stream temperature monitoring data were collected at two sites in the vicinity of the future stormwater facility, LRSC1013 and LRSC1011. These two sites are located upstream and downstream of the future pond, respectively, and were monitored to examine preconstruction (baseline) water temperatures in 2009 and 2010. Rainfall and air temperature data for 2009 and 2010 were obtained from Weather Underground MC3648 weather station, located in Bethesda, MD, approximately 9 miles north of the monitoring location. All data presented in this report are considered pre-construction. Figure 3.3.1 shows the location of the monitoring stations.

This is a pre-restoration report and summarizes the pre-construction thermal conditions upstream and downstream of the Stoney Creek NIH Pond.

For more information on how stream temperature monitoring is performed, see the Methods (Section 2).
Figure 3.3.1 – Vicinity Map of Future Stoney Creek NIH Pond
Figure 3.3.2 – Map of Monitoring Locations Upstream and Downstream of Future Stoney Creek NIH Pond
3.3.4 Results and Analysis

Temperature

Table 3.3.2 below shows the minimum, maximum, and average stream temperature at both sites in 2009 and 2010. In both years, the minimum temperature was lower downstream of the proposed stormwater pond than above. In 2009, the maximum temperature was 2.2 degrees higher below the pond than above. In 2010, the maximum temperature was one degree lower downstream of the proposed pond than it was upstream. Differences in average stream temperature between the upstream and downstream sites in 2009 and 2010 were 0.5 and 0.6, respectively, with the downstream average being higher in both years.

<table>
<thead>
<tr>
<th>Location</th>
<th>Date</th>
<th>2009</th>
<th>2010</th>
<th>Δ*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Temperature (°F)</td>
<td>US</td>
<td>62.9</td>
<td>63.2</td>
<td>-0.3</td>
</tr>
<tr>
<td></td>
<td>DS</td>
<td>57.7</td>
<td>59.3</td>
<td>1.6</td>
</tr>
<tr>
<td>Maximum Temperature (°F)</td>
<td>US</td>
<td>85.8</td>
<td>88.0</td>
<td>2.2</td>
</tr>
<tr>
<td></td>
<td>DS</td>
<td>88.0</td>
<td>86.9</td>
<td>-1.1</td>
</tr>
<tr>
<td>Average Temperature (°F)</td>
<td>US</td>
<td>71.8</td>
<td>73.2</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>DS</td>
<td>72.3</td>
<td>73.8</td>
<td>1.5</td>
</tr>
<tr>
<td>Percentage of readings exceeding Use I standard (90°F)</td>
<td>US</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>DS</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

* the delta symbol (Δ) is used to represent change in temperature from upstream to downstream (a negative number means the temperature is cooler downstream; a positive number means the temperature is warmer downstream)

Figures 3.3.3 through 3.3.6 graphically display the stream temperatures up and downstream of the proposed Stoney Creek stormwater pond in the summers of 2009 and 2010, respectively. In both 2009 and 2010, the stream temperature generally followed the same pattern at both sites, fluctuating greatly between day and night.

In 2009, the downstream site was often much higher than the upstream site, at times over 10 degrees. The difference in temperature between sites was generally lower during or after rain events. The variance, or the measure of how far the dataset is from the mean, was 21 at the downstream site and 12 at the upstream site. Since air temperature tends to fluctuate more than water temperature this may be a good indication that the downstream logger was dewatered and collecting air temperature instead of stream temperature for much of the time. In mid-September, the upstream site had consistently warmer temperature readings, which may also indicate that the downstream logger was dewatered when air temperatures were cooler than water temperatures.

In 2010, average stream temperatures downstream were higher than they were upstream. In the early part of the summer, June to approximately mid-August the downstream logger had consistently higher readings in the warmest parts of the day, by about 5 degrees. After about August 27th, stream temperatures at the upstream site were
consistently warmer in the warmest parts of the days. It is likely that in the early part of the summer the downstream logger became dewatered and in the later part of the summer the upstream logger was dewatered.

Figure 3.3.3 – Stream Temperatures Upstream and Downstream of the Proposed Stoney Creek NIH Pond from June 1 to July 31, 2009

Figure 3.3.4 – Stream Temperatures Upstream and Downstream of the Proposed Stoney Creek NIH Pond from August 1 to September 30, 2009
A non-parametric paired t-test (Wilcoxon Signed-Rank) was performed on the 2009 and 2010 data, comparing temperature distributions between the upstream and downstream stations. These data were not normally distributed, which required this non-parametric test on ranked data. The test showed a statistically significant difference ($Z=-10.054$, $p<0.0001$) between temperature distributions upstream and downstream in 2009, with warmer temperatures more likely to be found downstream. The test showed a similar
result in 2010, with significant warmer temperatures also found downstream (Z=-8.519, p<0.0001).

Non-parametric unpaired t-tests (Wilcoxon Rank-Sum) were performed with a Bonferroni correction comparing the upstream and downstream temperature distributions between 2009 and 2010. The tests did not detect a statistically significant difference of temperature distributions within the stream over years (*Table 3.3.3*).

**Table 3.3.3: Wilcoxon Rank-Sum Test Results of Within Year and Station Comparisons**

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Z Statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009 LRSC1013 (US)</td>
<td>2010 LRSC1013 (US)</td>
<td>-1.260</td>
</tr>
<tr>
<td>2009 LRSC1011 (DS)</td>
<td>2010 LRSC1011 (DS)</td>
<td>-1.265</td>
</tr>
<tr>
<td>2009 LRSC1013 (US)</td>
<td>2010 LRSC1011 (DS)</td>
<td>-1.273</td>
</tr>
<tr>
<td>2010 LRSC1013 (US)</td>
<td>2009 LRSC1011 (DS)</td>
<td>-1.264</td>
</tr>
</tbody>
</table>

**3.3.5 Discussion**

Pre-restoration temperature monitoring upstream and downstream of the proposed Stoney Creek Pond showed a general trend of statistically higher temperatures downstream. However, it appears that one or both of the loggers were dewatered for a portion of the monitoring period, in both years. Therefore, it is difficult to discern whether baseline temperatures were really different between the two locations or whether the loggers were dewatered or the stream flows were too low at these sites to continuously record water temperature. It is recommended that an air logger be installed at this site to compare temperature records with the upstream and downstream loggers. Those values equal to the air temperature records will be removed to more accurately assess the monitoring goals. Although air temperature data was obtained from Weather Underground, these data consist of a daily average rather than continuous data, thus they are not appropriate to use for comparison to continuous stream temperature data. Regardless, all upstream and downstream stream temperatures did not exceed the Use I standard of 90°F.

Monitoring will continue after completion of the Stoney Creek (NIH) Pond project and reports will present whether the project goal of avoiding further increases in stream temperature was achieved. Reports will also include conclusions and if any recommendations may be needed to better achieve the project goal.