Simmons Branch Drainage Improvement Project - Phase 2

January 24, 2017
Meeting Goals

- Project Objective
- Previous Design
- Taking Another Look
- Watershed & White Oak Lake
- Flood Reduction Benefits
- Recommended Design
- Culvert Rehab. Plan
- Private Utility Relocation Plan
- Proposed Schedule
Project Objectives

1. Reduce flooding
   - Eliminate roadway flooding for a 10-year flood
   - Minimize flooding of homes and yards
2. Improve public safety
3. Address maintenance challenges with failing infrastructure
4. Stabilize stream banks of Swift Creek

Example of bank erosion (near Merwin Road)

10-year floodplain
Previous Design

- **Proposed Twin 8’x5’ RCBCs**
- **Proposed Twin 10’x5’ RCBCs**
- **Proposed Twin 20’x4’ Bridge**
- **Remove Existing 8’x5’ Culvert**
- **Proposed Walls and Bank Stabilization**
**Initial Project Timeline**

**2002-2004:** Analysis report completed; project classified as capital improvement.

**2006:** Conceptual plan study; design contract and plan established.

**2007-2010:** Public meetings held to inform and receive feedback from residents about petitions, cost, and submitted designs.

**Late 2011:** 95% design plans submitted to city.

**2012-2015:** Easements and private utility relocation coordinated. Pineview Street & 3700 Swift Drive petitions added to the project.

**2015:** Current design finalized & construction cost estimate updated.
Taking a Second Look

- Optimize White Oak Lake to lower downstream runoff volume
- Consider timing of NCDOT’s I-440 Roadway widening project
- Efficiently spend funding to reduce flooding
  - Reduce rock blasting
  - Reduce utility relocations
  - Increase performance of the original design
Watershed & Project Phases

Phase 1
- Lail, Kaplan, and Swift Culverts

Phase 2
- Pineview Culvert
- Swift Drive Culvert
- Driveway Bridge
- Bank Stabilization

Phase 3
- White Oak Lake
White Oak Lake Flood Reduction

- Proposed Lake
- Proposed Spillway
- Proposed Riser/Barrel
- Proposed Dam Embankment
- New NCDOT Right-of-Way Line
Flood Reduction Benefits

- Lower normal pool from 402.5’ to 398.0’
- Raise emergency spillway from 402.5’ to 404.2’
- Install new riser with 72” dia. Barrel
- Take temporary storage from 0 cf. to more than 1,500,000 cf.
- Peak flow is delayed by almost one hour
Recommended Design

- **Proposed Twin 10’x6’ RCBCs**
- **Proposed Twin 20’x6’ Bridge**
- **Proposed Walls and Bank Stabilization**
- **Proposed 12’x5’ RCBC**
- **Rehabilitate Existing 8’x5’ RCBCs**
- **Install 200 LF of 66” Dia. RCP**
- **Install 364 LF of 72” Dia. RCP**
- **Remove and Replace 8’x5’ RCBC with 12’x6’ RCBC**
- **Proposed Twin 20’x6’ Bridge**
- **Proposed Walls and Bank Stabilization**
## Culvert Change: Pineview Drive

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Culvert Size/ Material</th>
<th>Opening Area (sq. ft.)</th>
<th>Culvert Capacity (cfs.)</th>
<th>Total Flow Across Pineview Dr. (cfs.)</th>
<th>Upstream Invert (ft. NAVD ‘88)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing</td>
<td>54” and 60’ RCPs</td>
<td>35.5</td>
<td>350</td>
<td>600</td>
<td>344.62</td>
</tr>
<tr>
<td>Proposed</td>
<td>Twin 10’ x6’ RCBCs</td>
<td>120</td>
<td>1155</td>
<td>600</td>
<td>343.62</td>
</tr>
</tbody>
</table>

*Culvert capacity is designed to keep water underground and off the road*
# Flood Reduction Benefits: Pineview Drive

## Table 1: Performance Comparison at Overtopping

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Culvert Size/Material</th>
<th>Culvert Capacity (cfs.)</th>
<th>Level of Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing</td>
<td>54” and 60’ RCPs</td>
<td>350</td>
<td>&lt; 2-year</td>
</tr>
<tr>
<td>Prev. Design</td>
<td>Twin 8’x5’</td>
<td>740</td>
<td>10-year</td>
</tr>
<tr>
<td>Proposed</td>
<td>Twin 10’x6’ RCBCs</td>
<td>1155</td>
<td>100-year</td>
</tr>
</tbody>
</table>

## Table 2: WSEL Reductions

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>10-year</td>
<td>353.78/-1.78</td>
<td>350.49/1.51</td>
<td>349.23/2.77</td>
</tr>
<tr>
<td>25-year</td>
<td>354.07/-2.07</td>
<td>352.09/-0.09</td>
<td>350.38/1.62</td>
</tr>
<tr>
<td>50-year</td>
<td>354.22/-2.22</td>
<td>353.17/-1.17</td>
<td>351.11/0.89</td>
</tr>
<tr>
<td>100-year</td>
<td>354.42/-2.42</td>
<td>353.57/-1.57</td>
<td>351.65/0.35</td>
</tr>
</tbody>
</table>

(FFE @ 1422 Pineview Dr. = 352.0’; Road Overtops 353.03)
# Flood Reduction Benefits: 3609 Swift

## Table 1: Performance Comparison at Overtopping

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Bridge Size/Material</th>
<th>Bridge Capacity (cfs.)</th>
<th>Level of Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing</td>
<td>8.7’x4’ Concrete</td>
<td>260</td>
<td>&lt; 2-year</td>
</tr>
<tr>
<td>Prev. Design</td>
<td>20’x4’ Concrete</td>
<td>657</td>
<td>10-year</td>
</tr>
<tr>
<td>Proposed</td>
<td>20’x6’ Concrete</td>
<td><strong>1075</strong></td>
<td>&gt; 25-year</td>
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</table>

## Table 2: WSEL Reductions

<table>
<thead>
<tr>
<th>Storm Event</th>
<th>Existing Conditions WSEL &amp; Freeboard</th>
<th>Prev. Design WSEL &amp; Freeboard</th>
<th>Proposed Design WSEL &amp; Freeboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-year</td>
<td>334.19/-0.69</td>
<td>333.35/0.15</td>
<td>331.70/1.80</td>
</tr>
<tr>
<td>25-year</td>
<td>334.44/-0.94</td>
<td><strong>334.34/-0.84</strong></td>
<td>333.02/0.48</td>
</tr>
<tr>
<td>50-year</td>
<td>334.58/-1.08</td>
<td><strong>334.45/-0.95</strong></td>
<td>333.78/-0.28</td>
</tr>
<tr>
<td>100-year</td>
<td>334.72/-1.22</td>
<td><strong>334.57/-1.07</strong></td>
<td>334.06/-0.56</td>
</tr>
</tbody>
</table>

FFE @ 3609 = 334.70; 3605 = 334.72’; Bridge overtops at 333.50’
Why Rehabilitate?

- Technological advancements
- Expertise from structural engineers who specialize in sustainable culvert rehabilitation
- Reduced construction impacts
- Additional City experience gained over the last 5 years
Repair cracks that have formed on the outside of culvert by:
- Replacing concrete top slab at driveways and Eakley Court
- Installing sustainable epoxy resin joint sealant and carbon fiber wraps in cracks
Repair the bottom part of the culvert that is failing to eliminate potential for sink holes:

- Remove failed bottom
- Install rebar and wire mesh
- Install cutoff wall to prevent piping
- Add in additional rebar
- Inject polymer resin to fill voids
- Pour new concrete bottom
Culvert Rehabilitation: Walls

- Repair walls that are failing or bulging by:
  - Removing and replacing cinderblock wall
  - Installing carbon fiber wrap for structural support
  - Installing temporary vertical bracing to support top slab
  - Repairing bottom slab as needed
- Areas that are failing structurally will be replaced

Culvert at 3708 Swift Drive
Reduced Construction Footprint

Limit of disturbance for recommended design
Area to be removed from limit of disturbance from previous design
Private Utility Relocation

Completed utility relocation will reduce future relocation needs

Relocation coordination is underway

Residents may be impacted by additional and temporary relocation

Our intent is to avoid as much relocation as possible and to make the process seamless
May: 30% design complete

June – August: Public meeting scheduled

July - October: Private utility relocation, permit application, easement acquisition; finalized construction plan

November – January 2018: Project bid

February – March 2018: Project award

April 2018: Project construction

April 2019: Project completed
Project Schedule – Simmons Branch

Previous Design Timeline

January 24: Public meeting

February – March: Revise current plan

March -May: permit applications; finalize construction plans

June – October: Project bid and award

November 2017: Begin project construction

April 2019: Project completed

18 month project

Revised Design Timeline

January 24: Public meeting

February – March: 30% design plan developed

April – July: private utility relocation, permit applications & easement acquisition; finalize construction plans

August – December: Project bid and award

January 2018: Begin project construction

December 2018: Project completed

12 month project
Reduced Construction Impacts

Increased Level of Service

Lower Costs

Accelerated Completion

A Revised Simmons Branch Drainage Improvement Project - Phase 2 offers...
Questions?

- Proposed Twin 10'x6' RCBCs
- Install 364 LF of 72" Dia. RCP
- Rehabilitate Existing 8'x5' RCBCs
- Proposed Twin 20'x6' Bridge
- Remove and Replace 8'x5' RCBC with 12'x6' RCBC
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- Install 200 LF of 66" Dia. RCP
City of Raleigh
Stormwater Management Division
Raleighnc.gov (Search “Simmons Branch”)
RaleighStormwater@raleighnc.gov
919-996-3094
Contributing Flows in Lower Watershed
Carbon Fiber Wrap Installation
Rock Depth with Proposed Revised Alignment
Flood Reduction