

City of Raleigh
Engineering
Services
Department



Simmons Branch
Drainage Improvement
Project - Phase 2

January 24, 2017



Dewberry®

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

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

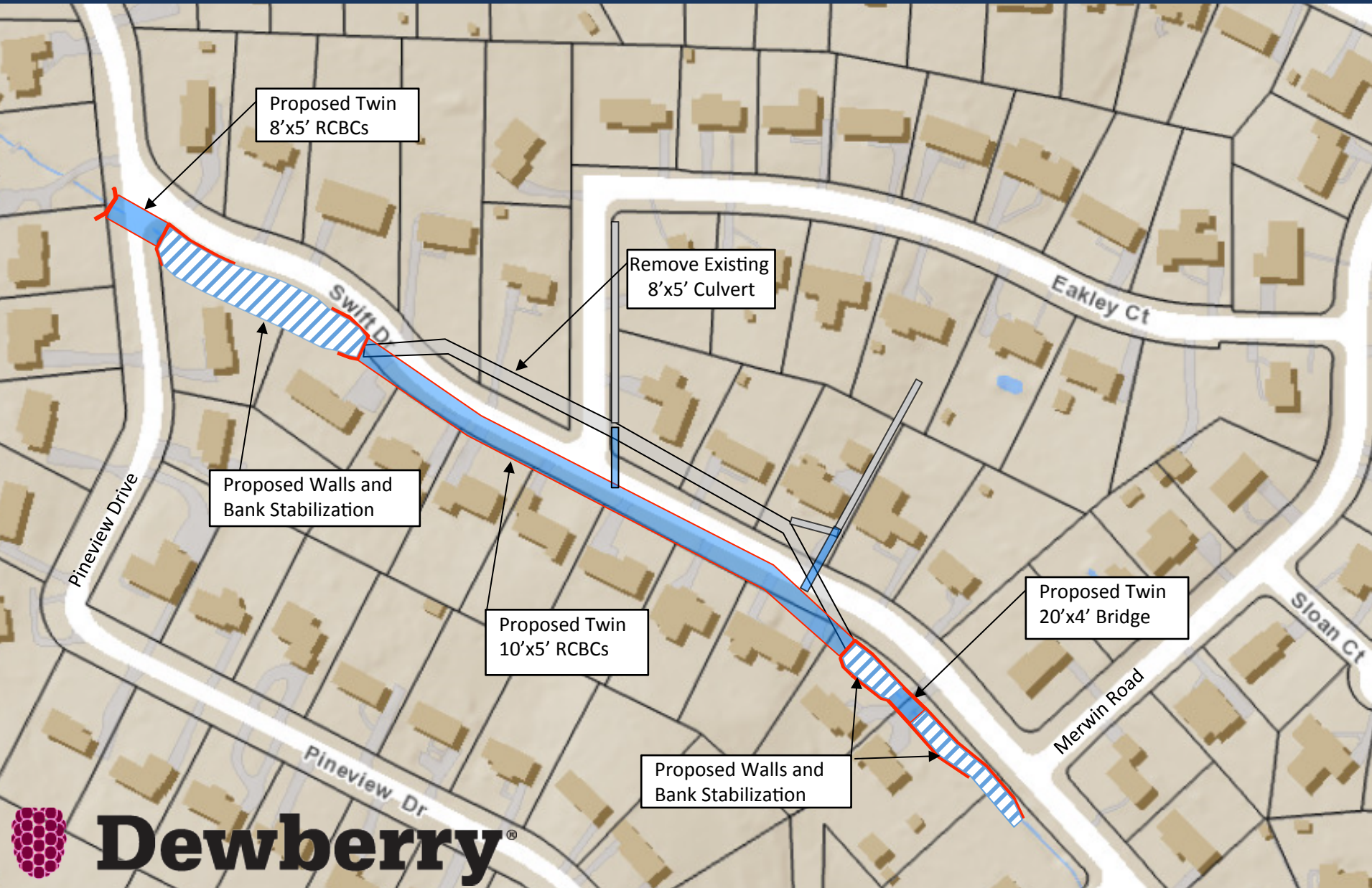


Example of bank erosion (near Merwin Road)



10-year floodplain

Previous Design



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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.

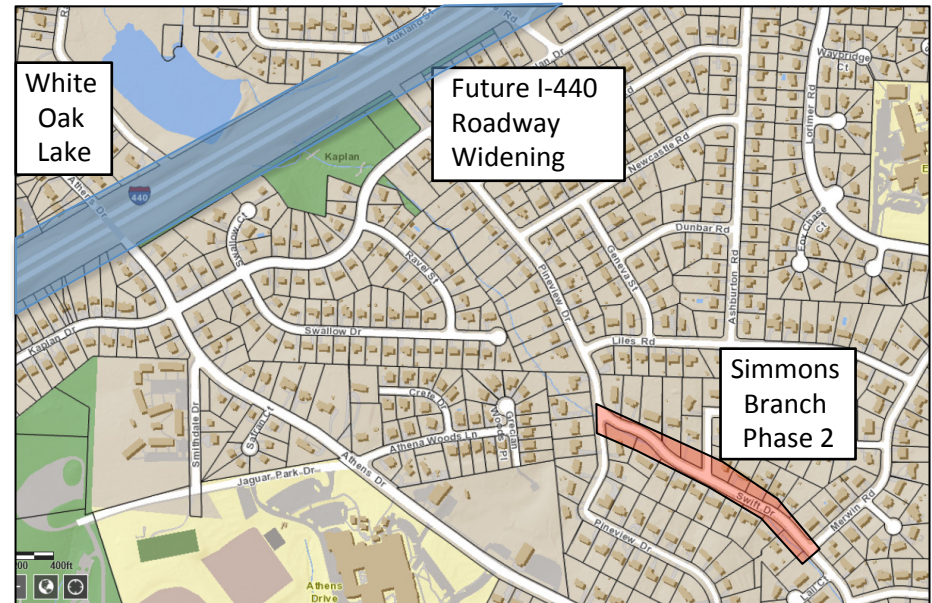
2012-2015: Easements and private utility relocation coordinated. Pineview Street & 3700 Swift Drive petitions added to the project.

2015: Current design finalized & construction cost estimate updated.

Taking a Second Look

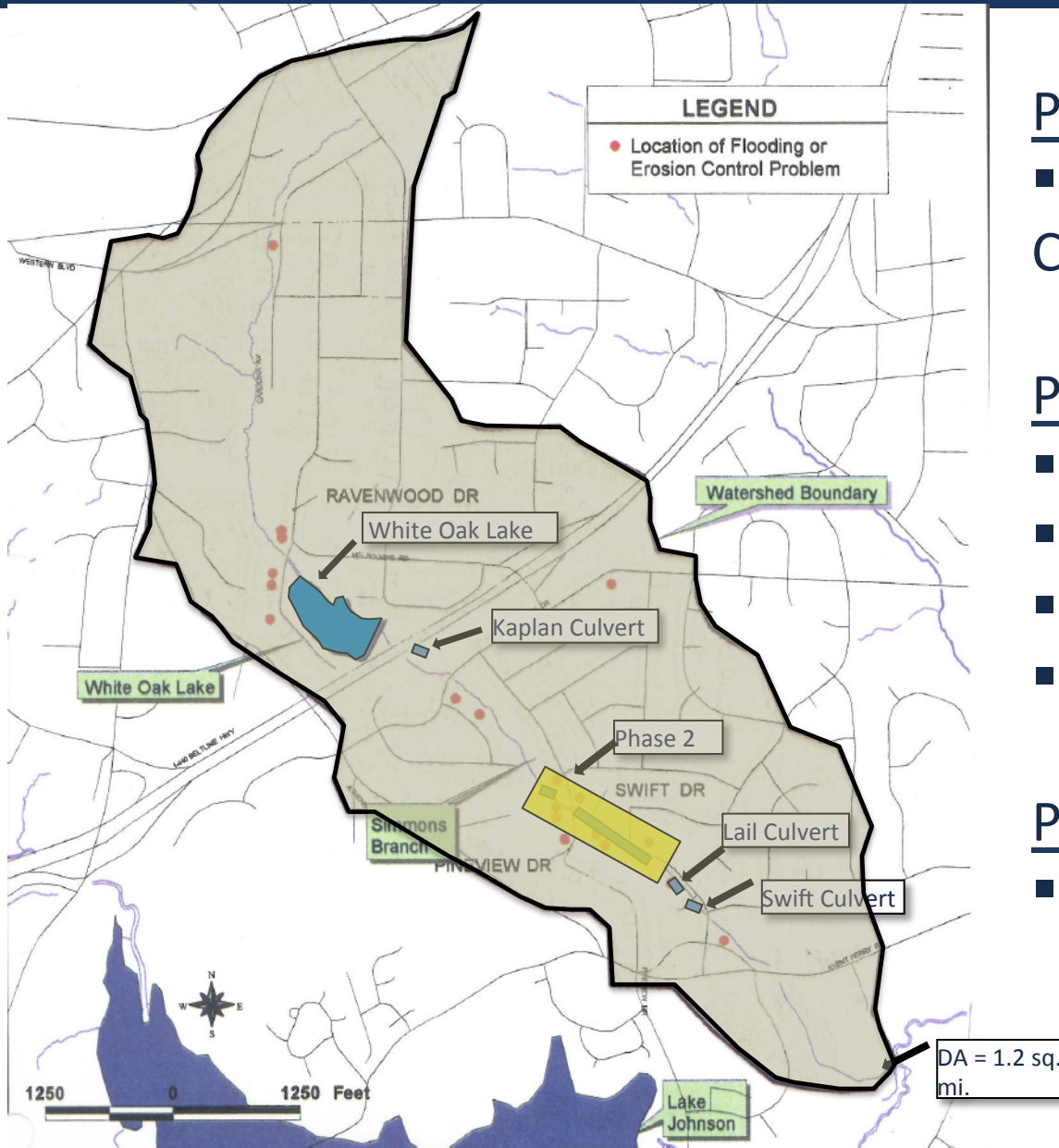


- Optimize White Oak Lake to lower downstream runoff volume
- Consider timing of NCDOT's I-440 Roadway widening project
- Efficiently spend funding to reduce flooding
 - Reduce rock blasting
 - Reduce utility relocations
 - Increase performance of the original design





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

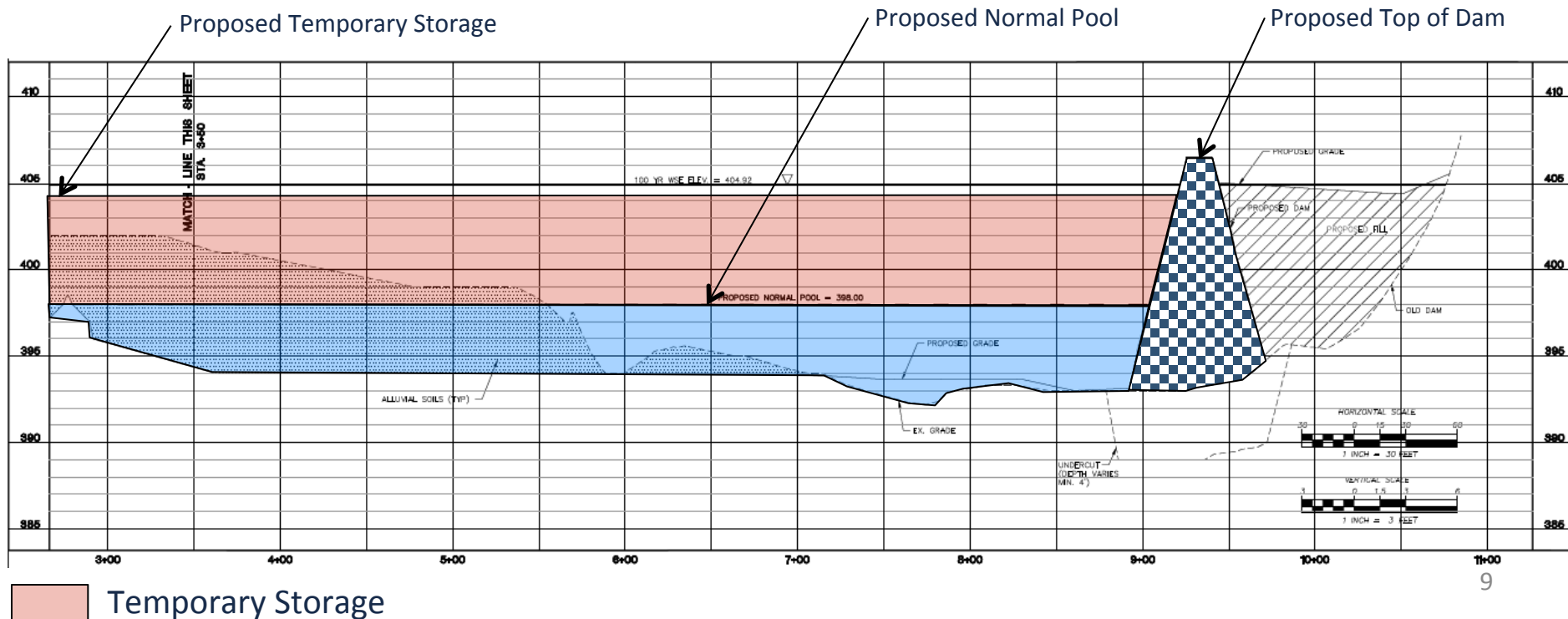
White Oak Lake Flood Reduction



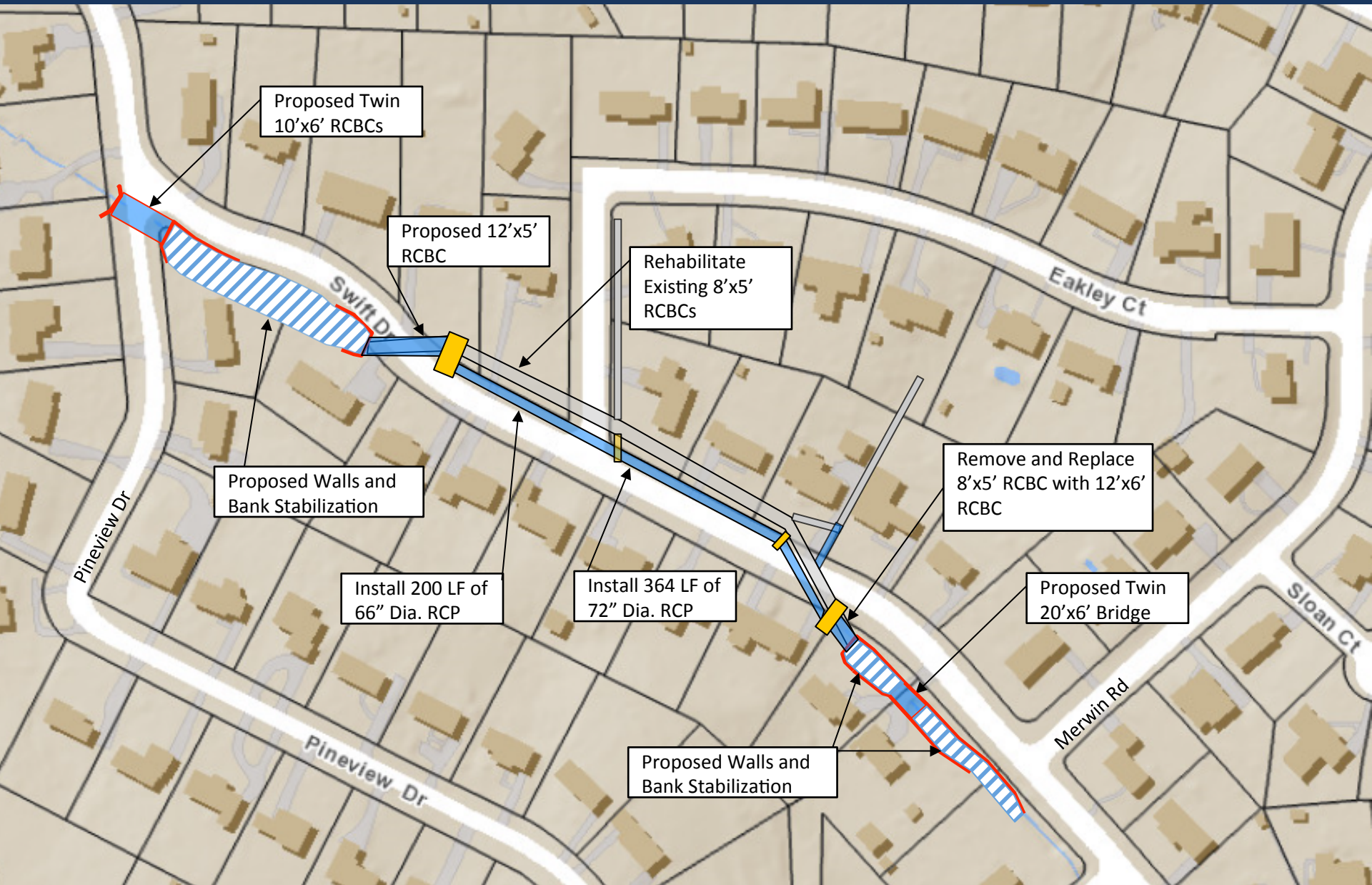
Flood Reduction Benefits



- 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 12'x5'
RCBC

Rehabilitate
Existing 8'x5'
RCBCs

Proposed Walls and
Bank Stabilization

Install 200 LF of
66" Dia. RCP

Install 364 LF of
72" Dia. RCP

Remove and Replace
8'x5' RCBC with 12'x6'
RCBC

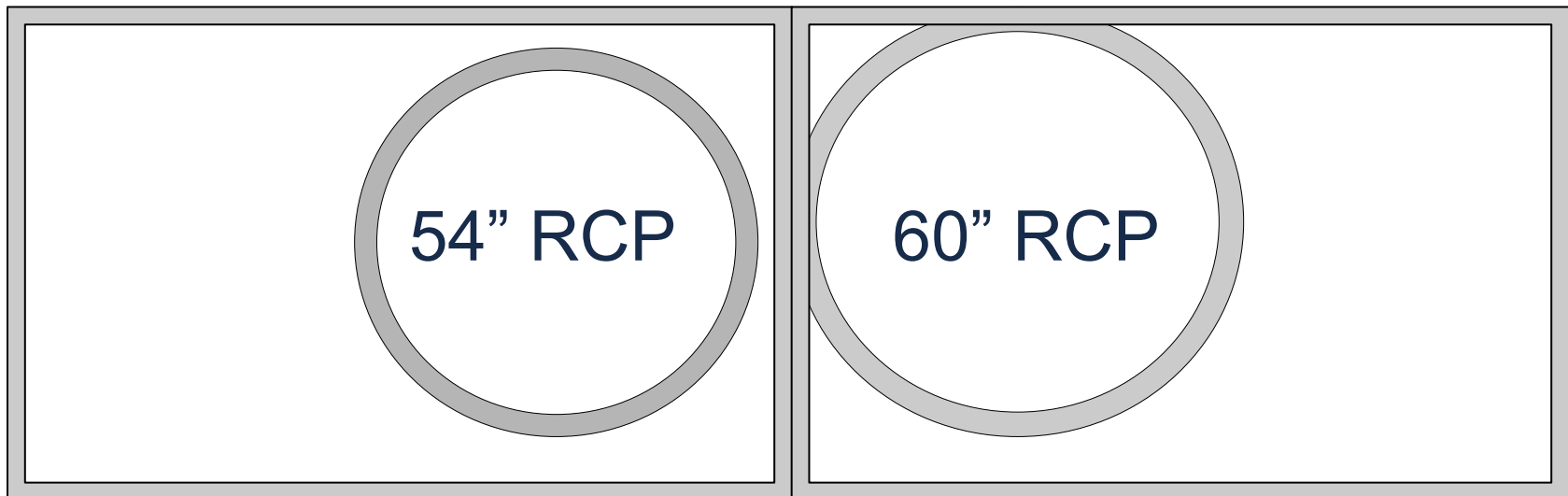
Proposed Twin
20'x6' Bridge

Proposed Walls and
Bank Stabilization

Culvert Change: Pineview Drive



Conditions	Culvert Size/ Material	Opening Area (sq. ft.)	Culvert Capacity (cfs.)	Total Flow Across Pineview Dr. (cfs.)	Upstream Invert (ft. NAVD '88)
Existing	54" and 60' RCPs	35.5	350	600	344.62
Proposed	Twin 10' x6' RCBCs	120	1155	600	343.62



Culvert capacity is designed to keep water underground and off the road

Flood Reduction Benefits: Pineview Drive



Table 1: Performance Comparison at Overtopping

Conditions	Culvert Size/Material	Culvert Capacity (cfs.)	Level of Service
Existing	54" and 60' RCPs	350	< 2-year
Prev. Design	Twin 8'x5'	740	10-year
Proposed	Twin 10'x6' RCBCs	1155	100-year

Table 2: WSEL Reductions

Storm Event	Ex. Conditions WSEL & Freeboard	Prev. Design WSEL & Freeboard	Proposed Design WSEL & Freeboard
10-year	353.78/ -1.78	350.49/1.51	349.23/2.77
25-year	354.07/ -2.07	352.09/ -0.09	350.38/1.62
50-year	354.22/ -2.22	353.17/ -1.17	351.11/0.89
100-year	354.42/ -2.42	353.57/ -1.57	351.65/0.35

(FFE @ 1422 Pineview Dr. = 352.0'; Road Overtops 353.03)

Flood Reduction Benefits: 3609 Swift



Table 1: Performance Comparison at Overtopping

Conditions	Bridge Size/Material	Bridge Capacity (cfs.)	Level of Service
Existing	8.7'x4' Concrete	260	< 2-year
Prev. Design	20'x4' Concrete	657	10-year
Proposed	20'x6' Concrete	1075	> 25-year

Table 2: WSEL Reductions




Storm Event	Existing Conditions WSEL & Freeboard	Prev. Design WSEL & Freeboard	Proposed Design WSEL & Freeboard
10-year	334.19/-0.69	333.35/0.15	331.70/1.80
25-year	334.44/-0.94	334.34/-0.84	333.02/0.48
50-year	334.58/-1.08	334.45/-0.95	333.78/-0.28
100-year	334.72/-1.22	334.57/-1.07	334.06/-0.56

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

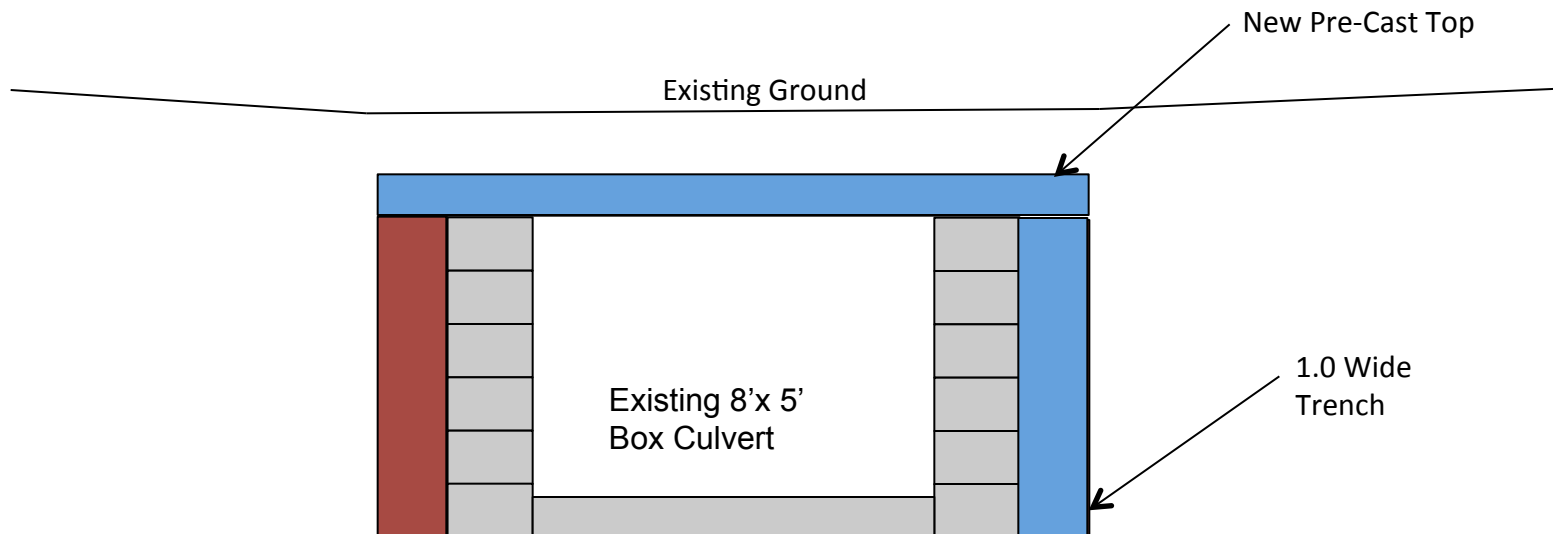


-  Proposed new top
-  Proposed reinforced concrete box culvert
-  Proposed top rehab

Culvert Rehabilitation: Top



- 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



Culvert Rehabilitation: Bottoms



- Repair the bottom part of the culvert that is failing to eliminate potential for sink holes:

Remove failed
bottom

Install cutoff
wall to
prevent piping

Inject polymer
resin to fill
voids

Install rebar
and wire mesh

Add in
additional
rebar

Pour new
concrete
bottom

Culvert Rehabilitation: Walls

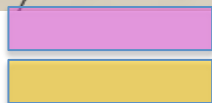
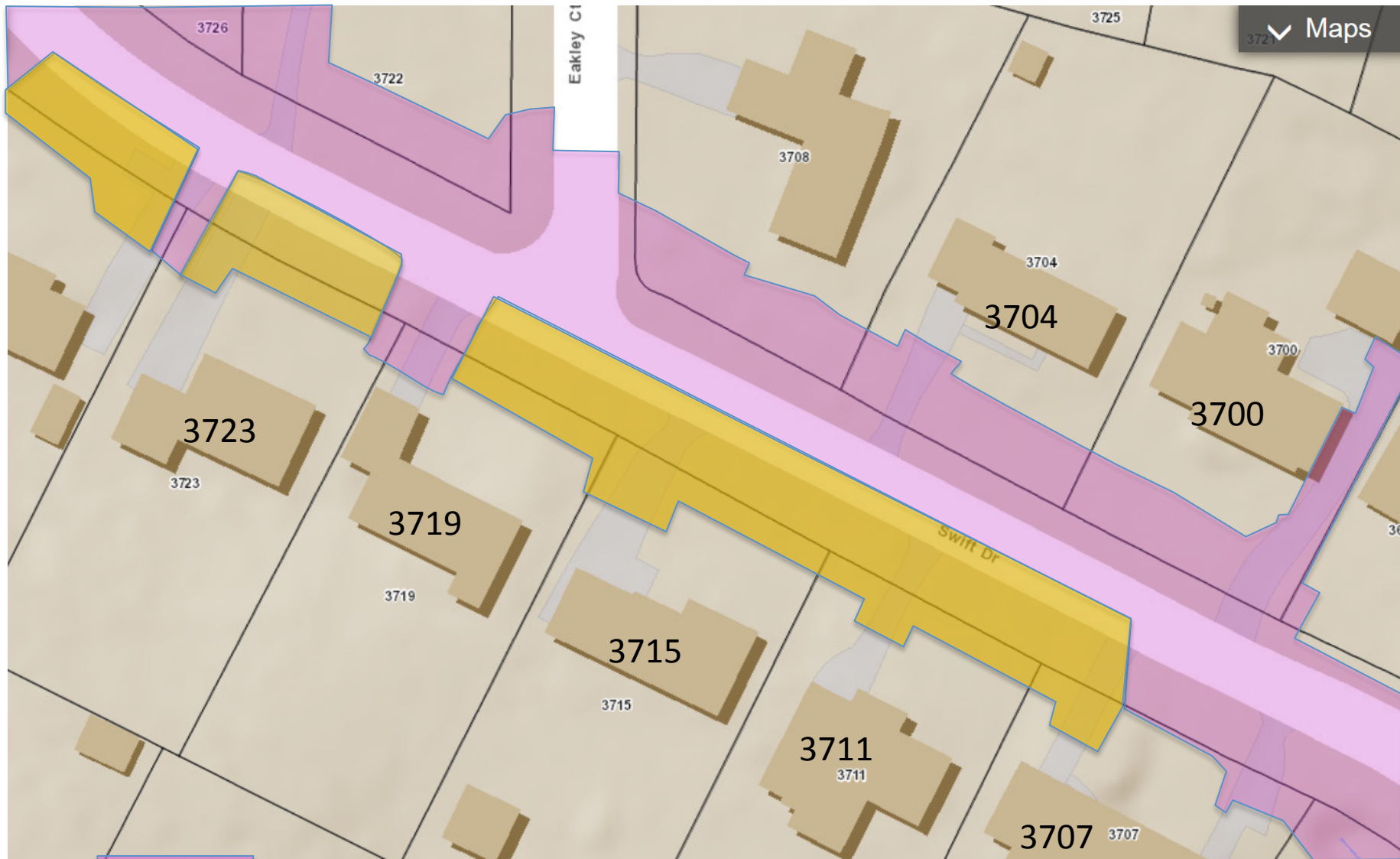


- Repair walls that are failing or bulging by:
 - Removing and replacing cinderblock wall
 - Installing carbon fiber wrap for structural support
 - Installing temporary vertical bracing to support top slab
 - Repairing bottom slab as needed
 - **Areas that are failing structurally will be replaced**



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

Project Schedule – White Oak Lake



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

Project Recap



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

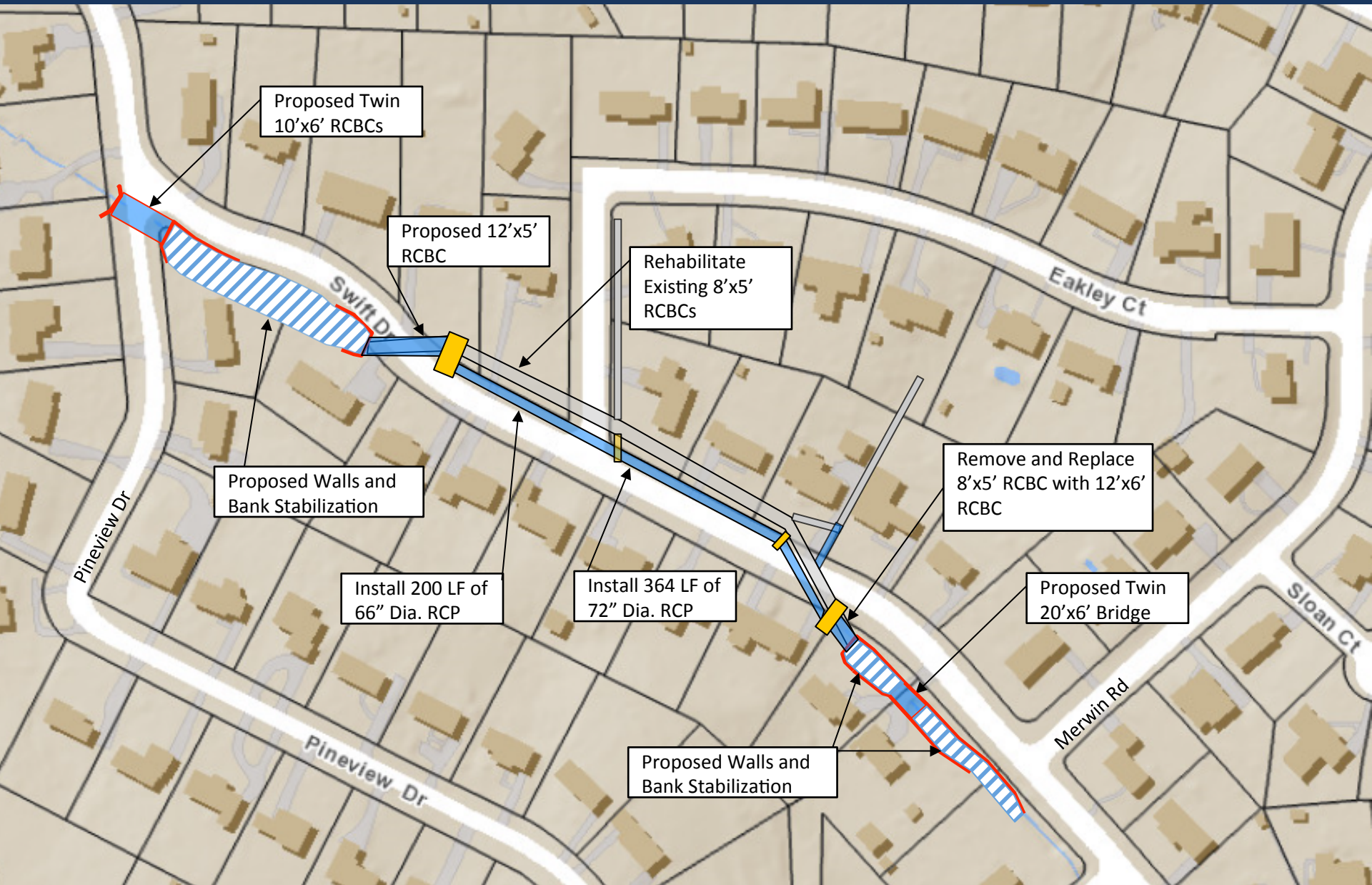
Reduced
Construction
Impacts

Increased
Level of Service

Lower
Costs

Accelerated
Completion

Questions?



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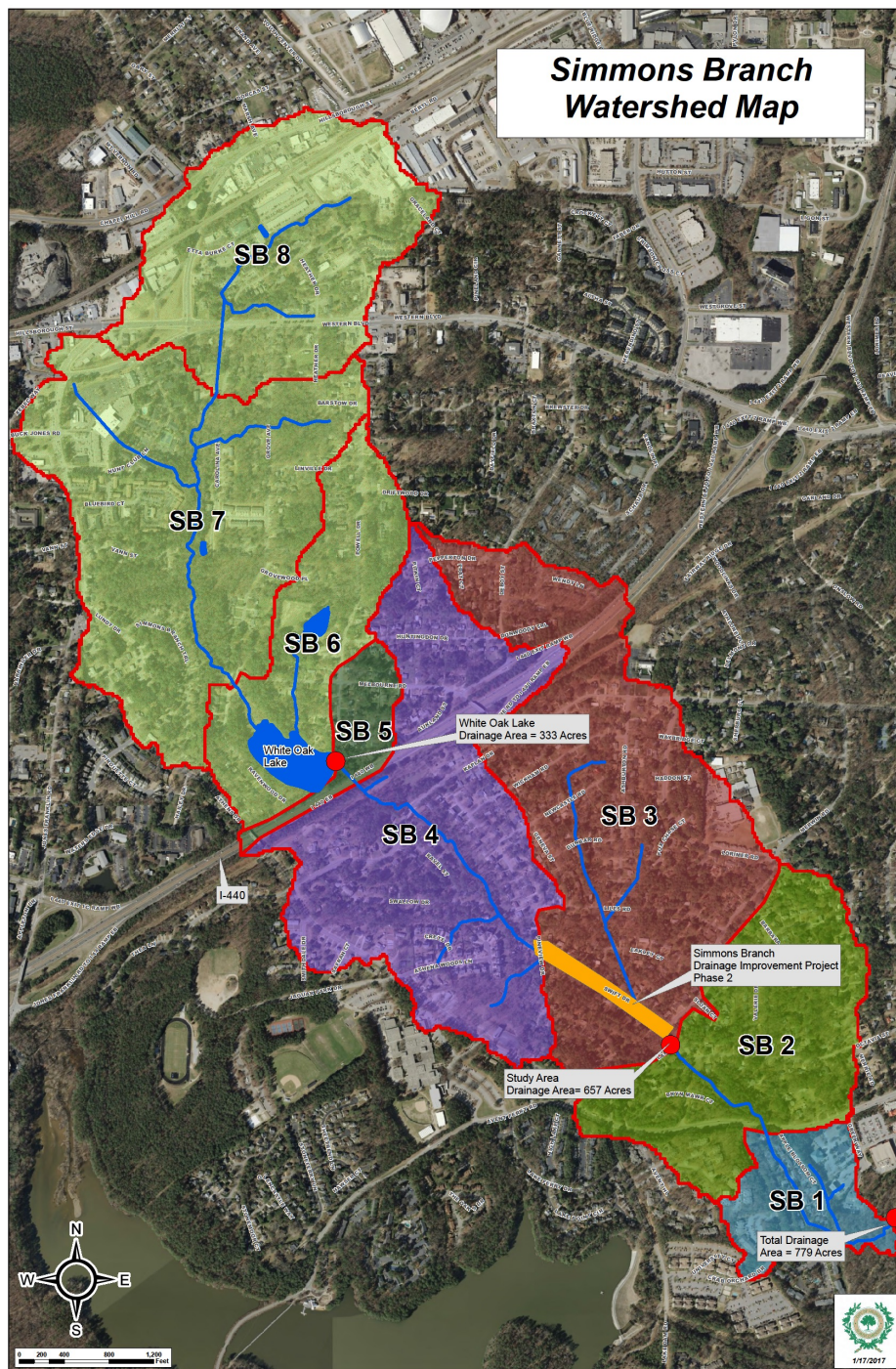


City of Raleigh
Stormwater Management Division

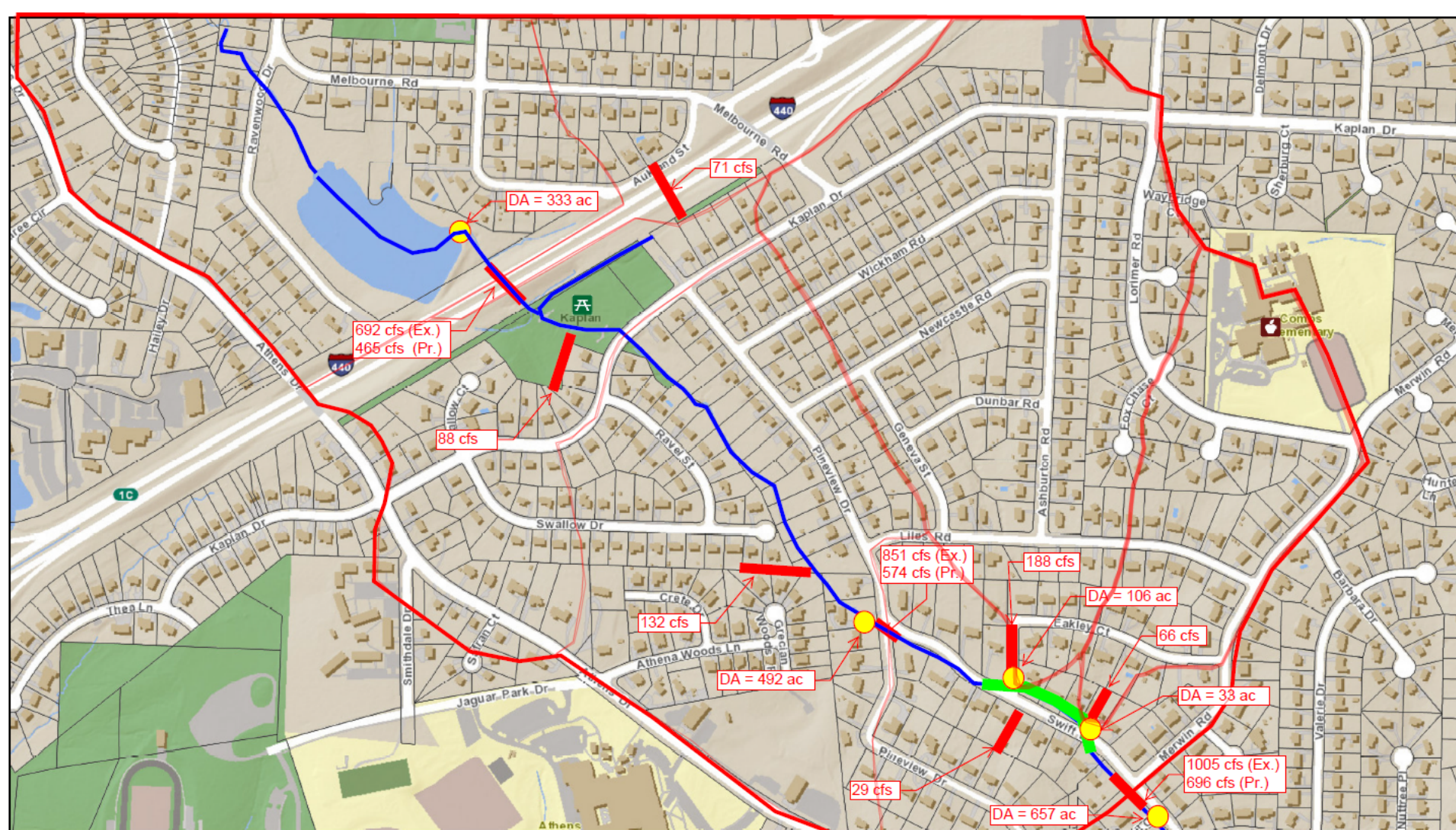
Raleighnc.gov (Search “Simmons Branch”)

RaleighStormwater@raleighnc.gov

919-996-3094



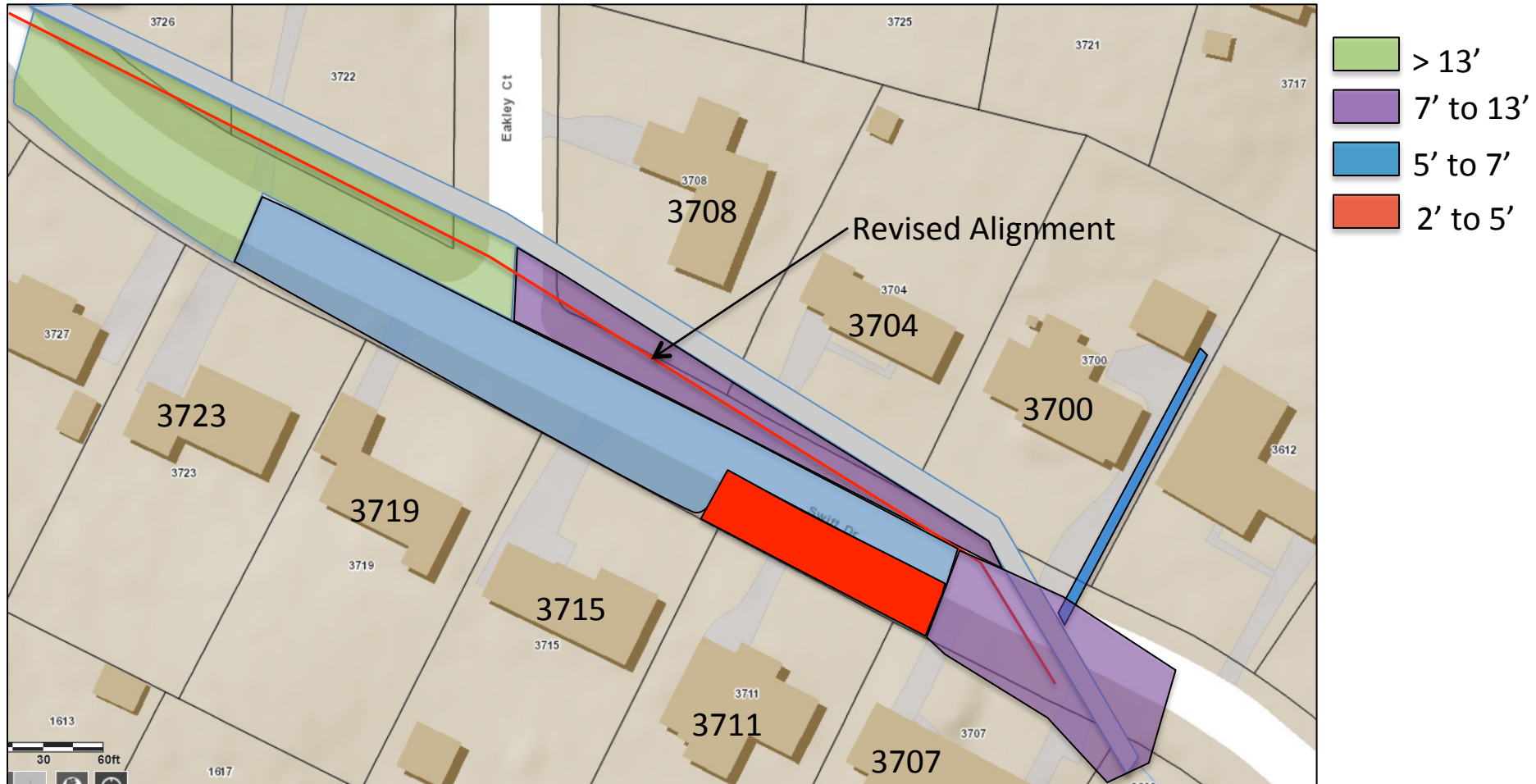
Contributing Flows in Lower Watershed





Carbon Fiber Wrap Installation

Rock Depth with Proposed Revised Alignment





Flood Reduction

