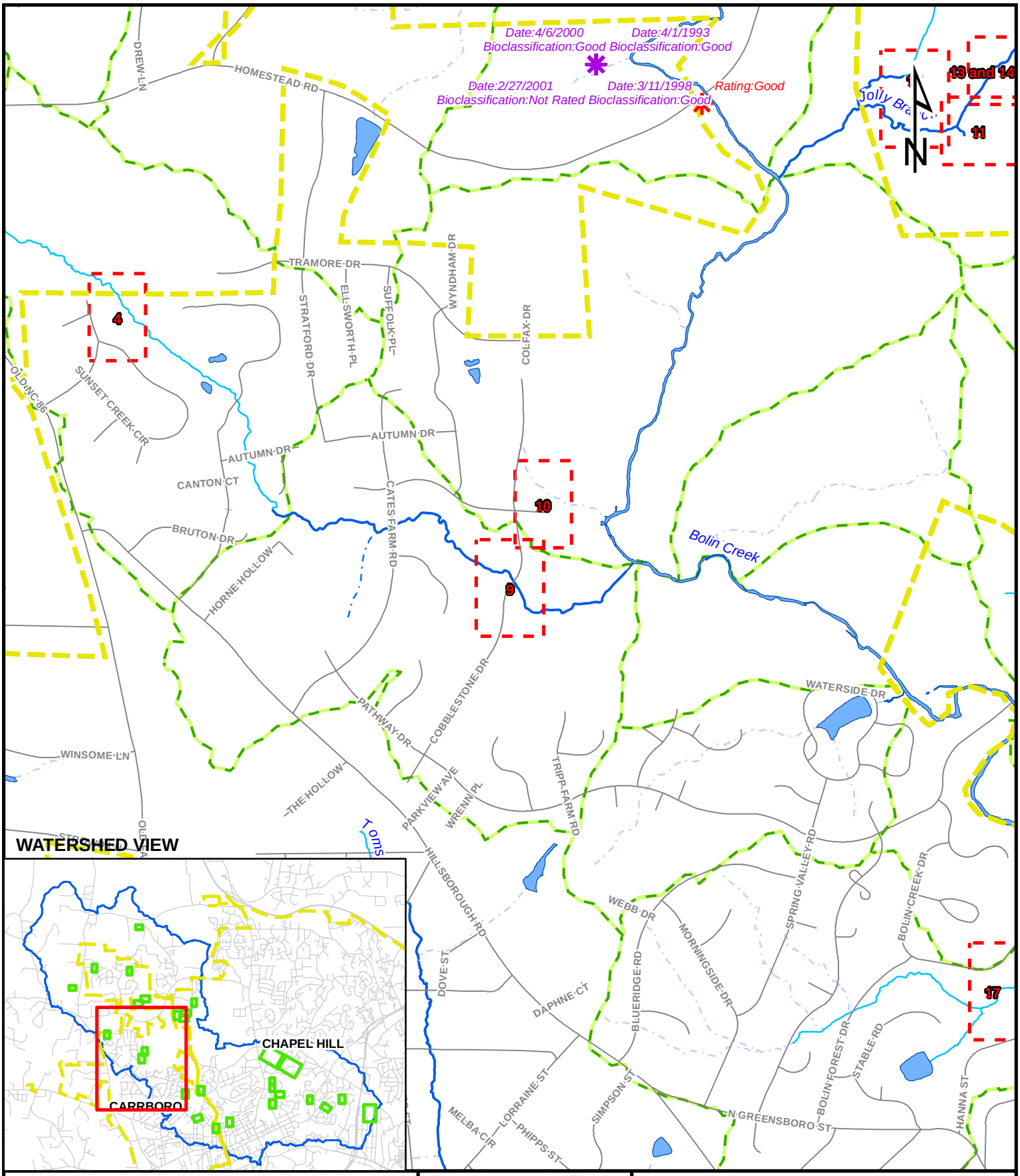
SITE 9

Bank Stabilization and Flow Attenuation

Index Sheet No.: 14
Raw Data Name: TA 5, TA 6 and TA 7

Estimated Construction Cost: $18,200



Legend

- Ambient Monitoring
- Benthic Monitoring
- Fish Sampling
- Municipal Boundary
- Orange County Roads
- Subwatersheds
- Perennial Stream
- Intermittent Stream
- Ephemeral Stream
- Stream, unknown flow

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SITE 9
VICINITY MAP

Geomorphic Analysis and Identification of Potential Sites for Stormwater BMPs
Orange County, North Carolina

0 500 1,000 2,000 Feet

1 inch equals 1,000 feet

Project Description

	Drainage Area (acres)	Impervious Area (acres)	% Impervious
Site 9	290.8	42.8	14.7%

Location

Site 9 is located on the west and east sides of Cobblestone Drive where the road passes over a tributary to Bolin Creek.

Problem Description

Site 9 consists of an approximately 70 feet long stretch of an unnamed tributary to Bolin Creek which is experiencing extreme bank erosion on both banks as it approaches a road crossing. The erosion is likely due to combination of effects to channel stability that are created from the road crossing, a lack of a vegetated riparian buffer that would otherwise provide root stabilization on the banks, and increased peak flows from the high impervious surface of the contributing drainage area. Downstream of the road crossing, an additional area of extreme bank erosion is present on the outside of a meander bend.

The extreme bank erosion has been estimated to be contributing approximately 95 tons of sediment per year, or approximately 1.4 tons per year per foot of channel. Concomitant nutrient export has also been calculated and is listed in **Table 9.1**. In addition, the lateral movement of the stream cross section is causing adjacent landowners to lose more of their property every year. Therefore, the severity of the problem at this site warrants immediate action.

Proposed Solution

As with other bank stabilization/restoration projects, this site could benefit mainly from a change in the stream cross-section that provides the following:

- a bankfull bench that gives the stream access to a small floodplain which reduces the depth of flow near the bank and thus significantly reduces near bank stress during above-bankfull events
- reduced bank slopes, at a maximum of 2:1
- vegetated banks with woody plants that will provide stabilization through rooting mass

By modifying the cross-section of the stream in this way for the length of the extreme eroding banks, the sediment export rates of this site could potentially be reduced to 0.2 tons per year, with a corresponding reduction in nutrient export. Calculated sediment and nutrient reductions are shown in **Table 9.1**.

In addition to the change in cross-section of the stream, a wide, abandoned floodplain area adjacent to the stream on the downstream side of the road crossing provides a good location for an offline stormwater wetland or wet detention pond. A weir or other diversionary device could be placed in the stream upstream of the wetland, and allow for a certain percentage of stormflow to be diverted into the wetland while not interfering with the continual baseflow of the stream. The primary benefit of this would be

reduction of peak flow during storm events, which could possibly reduce near bank stress on eroding banks downstream. A secondary benefit would be the possibility to augment baseflow by storing some of the runoff volume in the basin, which can be intentionally or passively discharged into the stream over longer periods of time.

Table 9.1

Pre-Treatment	
Estimated Total Sediment Export	95.1 tons/year
Erosion per length of Channe	1.4 tons/yr/ft
Pounds of Nitrogen	190.2 lbs/year
Pounds of Phosphorus	95.1 lbs/year
Post-Treatment	
Estimated Total Sediment Export	0.2 tons/year
Erosion per length of Channe	0 tons/yr/ft
Pounds of Nitrogen	0.4 lbs/year
Pounds of Phosphorus	0.2 lbs/year

Constraints

The primary constraint at this site is land acquisition and landowner cooperation, as it is located in a residential area with privately owned land on either side of the stream. Stormwater easements should be checked to see if work can be performed within the easements, primarily in laying back banks and revegetating the riparian area. In addition, a utilities easement is adjacent to the site, and thus a MOU or MOA may be required to be executed with the utilities entity to implement the project.

Alternatives

No alternatives are proposed for this site.

Cost-Estimate Breakdown

Table 9.2 shows a conceptual itemized cost estimate. These costs represent construction and maintenance costs only. The cost for stormwater wetlands is derived from an equation developed by Brown and Schueler (1997).

Table 9.2
Site 9 Construction Cost

Pay Item Description	Estimated Quantity	Unit	Unit Bid Price	Bid Amount
Excavation	62.0	CY	15.00	$930
Stormwater Wetland	2534.0	CF	Equation Derived	$7,159
Site Preparation and Planting	0.1	AC	7500.00	$750
Rip Rap Class B	10.0	Tons	45.00	$450
Filter Fabric	30.0	SY	5.00	$150
Silt Fence	200.0	LF	3.75	$750
Construction Safety Fence	260.0	LF	2.50	$650
Construction Entrance	2.0	Ea	2500.00	$5,000
			Total	$15,839
Mobilization (5%)	1.0	LS		$792
Contingencies (10%)	1.0	LS		$1,584
	Total + Mobilization and Contingencies			**$18,215**
Maintenance Costs				
Maintenance (5% of base construction cost)	1.0	Year		**$911**

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SITE 9

EXISTING 4-10 FT ERODING BANKS

BUILD BANKFULL BENCH AND LAY BACK BANKS

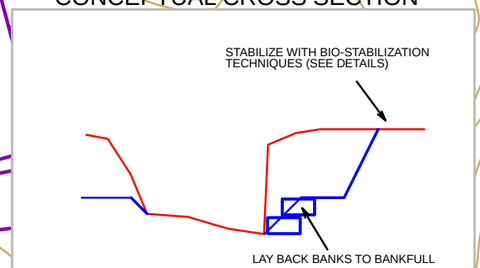
REVEGETATE BUFFER

INSTALL FLOW DIVERSION

CONSTRUCT OFFLINE STORMWATER WETLAND FOR FLOW ATTENTUATION

COBBLESTONE DR

CONCEPTUAL CROSS SECTION



NOT TO SCALE

Legend

- Stormwater Lines
- Impervious Surfaces
- Perennial Stream
- Intermittent Stream
- Ephemeral Stream
- Stream, unknown flow
- Contours

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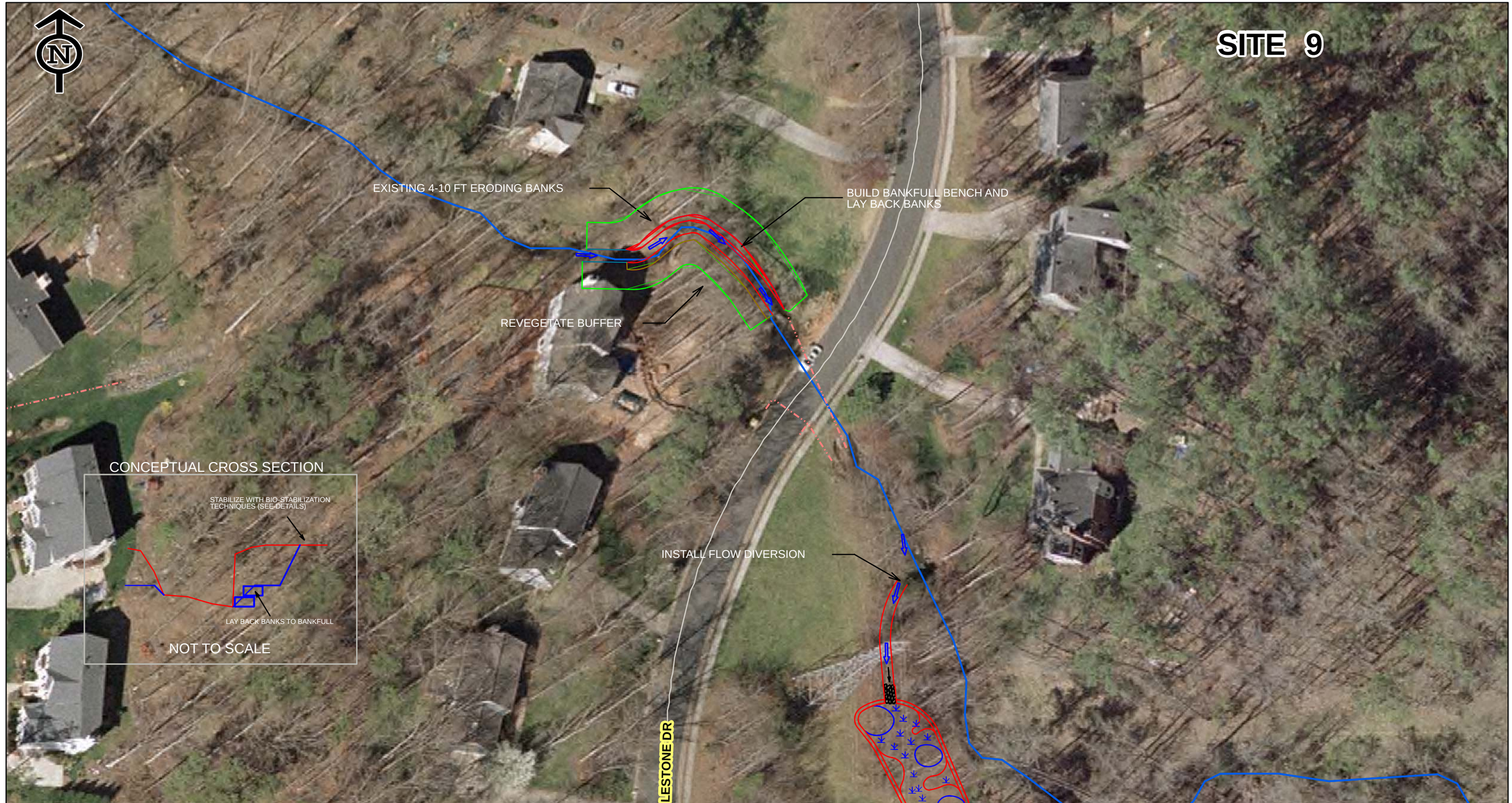
CONCEPTUAL PLAN VIEW
BOLIN CREEK WATERSHED
Geomorphic Analysis and Potential Site Identification For
Stormwater Structures and Retrofits

0 25 50 100 Feet

1 inch equals 50 feet



Legend

- Stormwater Lines
- Perennial Stream
- Intermittent Stream
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AERIAL PHOTO VIEW

BOLIN CREEK WATERSHED
Geomorphic Analysis and Potential Site
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0 25 50 100 Feet

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