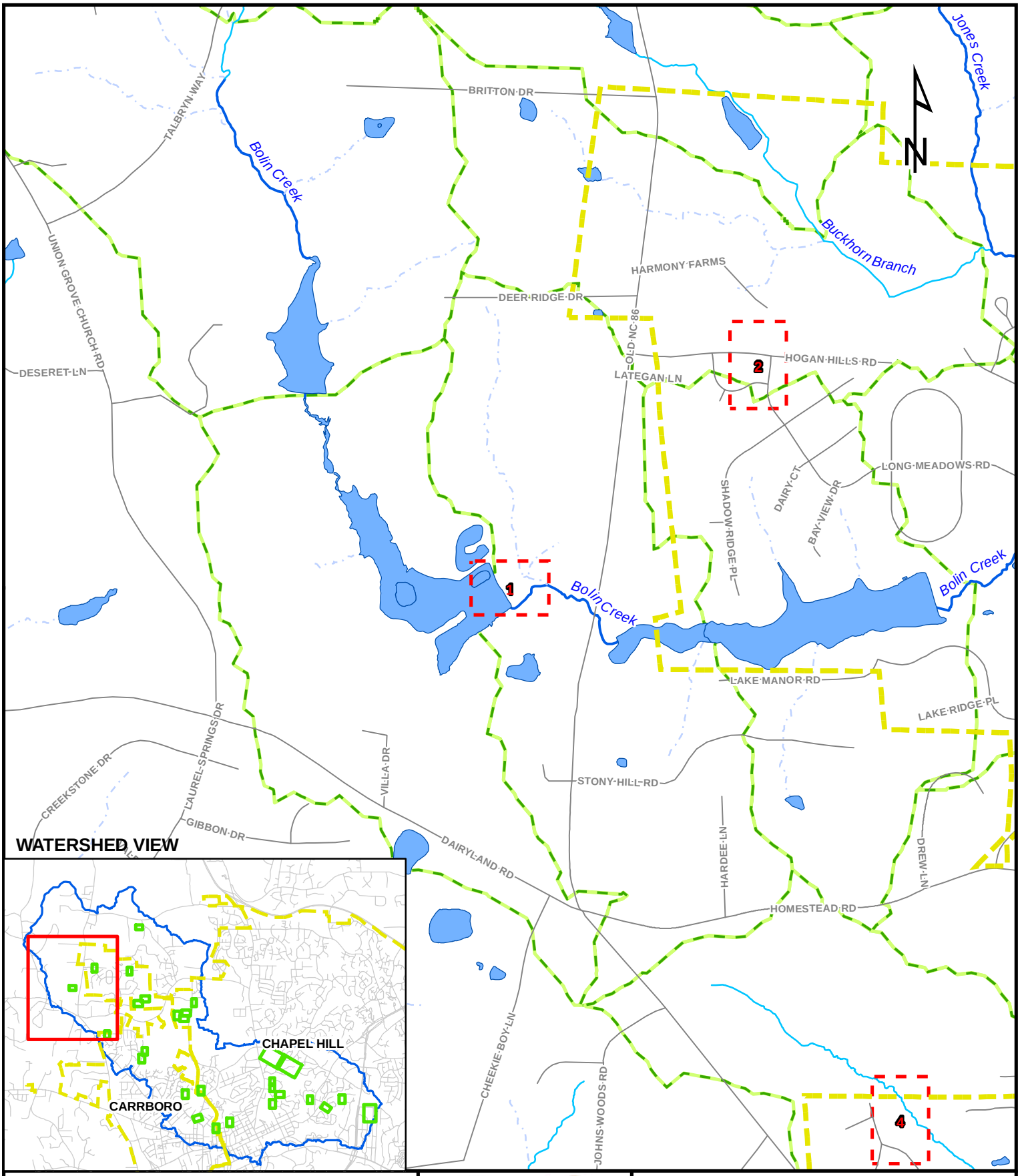
SITE 1

Dam Outfall Repair on Bolin Creek

Index Sheet No.: 4
Raw Data Name: IJ 04

Estimated Construction Cost: $31,000



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 1
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
Site1	553.9	20.5	3.7%

Location

Site 1 is located to the west of Old NC 86. To access Site 1, park along the shoulder of Old NC 86 just before it crosses Bolin Creek and follow Bolin Creek upstream until reaching a dam.

Problem Description

Site 1 consists of an actively eroding, deeply incised pond spillway outlet situated on Bolin Creek. The outlet channel is approximately 250 feet in length, and has dimensions of approximately 8 feet wide by 6 feet deep. This spillway is improperly constructed and serves as the only outlet for the relatively large lake on Bolin Creek. The slope of the spillway channel is approximately 4% which is too steep to serve as a constant flow channel of native soils with no hardening of the channel. The spillway invert has down-cut approximately 3 feet over the years and a beaver dam now sets the headwater elevation for the lake, which his approximately 2 feet above the invert

The chief problem with this site is the significant amount of sediment that is estimated to be exported by the site, due to the instability of the spillway channel. During site visits, Earth Tech consistently observed that the channel downstream of the lake was covered in a fine, red clay sediment. As the lake itself is a significant barrier to suspended sediment, the downstream siltation is an indicator of the massive sediment loading that is occurring to Bolin Creek due to this relatively short reach. Using a modified BANCS model for predicting streambank erosion rates (Rosgen, 2006), a total bank erosion rate of 1444.4 tons/year was estimated for this site, as shown in **Table 1.1**.

A secondary problem with this site is the observed loss of base flow due to the hydrologic disconnect created by the lake. In July of 2007, a slight base flow was observed in Bolin Creek at locations immediately upstream of the un-named lake that is in-line. The lake is presumed to have a higher rate of evaporation than it does incoming flow, as there was no baseflow discharge from the lake during the afore mentioned observation period. Also, the saturated hyporheic zone indicated a steady drawdown of water surface in the lake during the observation visit. Thus, indications are that the lake has terminated the baseflow in Bolin Creek during dry summer months. Active baseflow conditions were observed within a few hundred feet downstream of Old NC 86.

Table 1.1

Pre-Treatment	
Estimated Total Sediment Export	1444.4 tons/year
Erosion per length of Channel	5.8 tons/yr/ft
Pounds of Nitrogen	2888.9 lbs/year
Pounds of Phosphorus	1444.4 lbs/year
Post-Treatment	
Estimated Total Sediment Export	1.3 tons/year
Erosion per length of Channel	0 tons/yr/ft
Pounds of Nitrogen	2.5 lbs/year
Pounds of Phosphorus	1.3 lbs/year

Proposed Solution

The solution to limiting erosion rates at this site is to construct new pond outlets consisting of a vertical riser in the pond and a properly designed overflow spillway, and to fill and vegetate the existing outfall channel (See Plan View). Filling the outfall channel should reduce erosion rates to nearly 0 tons/yr, as the chief source of sediment at this point is the outfall channel itself.

In addition to the benefits received by reducing sediment export rates, this project could potentially provide a location for base flow augmentation, which was observed to be a major water quality problem in this area. Creating an incremental, controlled discharge from the pond would provide a steady flow of water that could augment the missing baseflow. This would have a beneficial effect on the stream biota downstream.
In order to provide the controlled discharge of water from the pond, and in order to gain landowner cooperation, it will likely be necessary to raise the maximum water level of the pond, by raising the elevation of the top of the dam. This extra storage would provide the volume than can be used to restore baseflow downstream of the lake via a controlled release for an extended period of up to a few weeks. Specific design parameters of this site would dictate the actual time of delayed discharge and further Proposed Solution is necessary to accurately plan for this baseflow augmentation effort. The landowner most likely uses the pond for fishing and other recreation, and relies on the current water level for these activities. Installing a means of continuously discharging water would lower the water level, thereby impacting the landowner's use of the pond. By raising using a temporary storage volume above the existing permanent pool elevation, the goal of baseflow augmentation can be met while also meeting the needs of the landowner. The lake elevation will actually be higher on average than it is today, and the surface area and depth would increase, both of which are likely to be desirable to the landowner for fish pond management. As long as frequent rainfall occurs, the landowner will actually have a larger volume of water that is continually maintained in his lake.

With stability of the existing outlet in question, the landowner will also benefit from the assurance that his pond dam is less likely to be irreversibly damaged by a major rainfall event.

Constraints

The chief constraint at this site is landowner cooperation. The primary outlet will be somewhat limiting, as it will require the dewatering of the lake to complete. Dam safety considerations must be addressed and the proper agencies made aware of the retrofit to the outlet. In addition, vegetation removal will be required for some of the work to be completed.

Alternatives

No alternatives are anticipated at this site.

Cost-Estimate Breakdown

Table 1.2 shows a conceptual itemized cost estimate. These costs represent construction and maintenance costs only.

Table 1.2

SITE 1 Construction Costs

Pay Item Description	Estimated Quantity	Unit	Unit Bid Price	Bid Amount
Concrete Overflow Structure	1.0	Ea	3000	$3,000
Excavation	400.0	CY	15.00	$6,000
Site Preparation and Plantings	0.1	AC	7500.00	$750
Rip Rap Class B	5.0	Tons	45.00	$225
Filter Fabric	15.0	SY	5.00	$75
Silt Fence	300.0	FT	3.75	$1,125
Construction Safety Fence	500.0	LF	2.50	$1,250
Construction Entrance	1.0	Ea	2500.00	$2,500
Pond Outlet Structure	1.0	Ea	12000.00	$12,000
			Total	$26,925
Mobilization (5%)	1.0	LS		$1,346
Contingencies (10%)	1.0	LS		$2,693
	Total + Mobilization and Contingencies			**$30,964**
Maintenance Costs				
Maintenance (5% of base construction cost)	1.0	Year		**$1,548**

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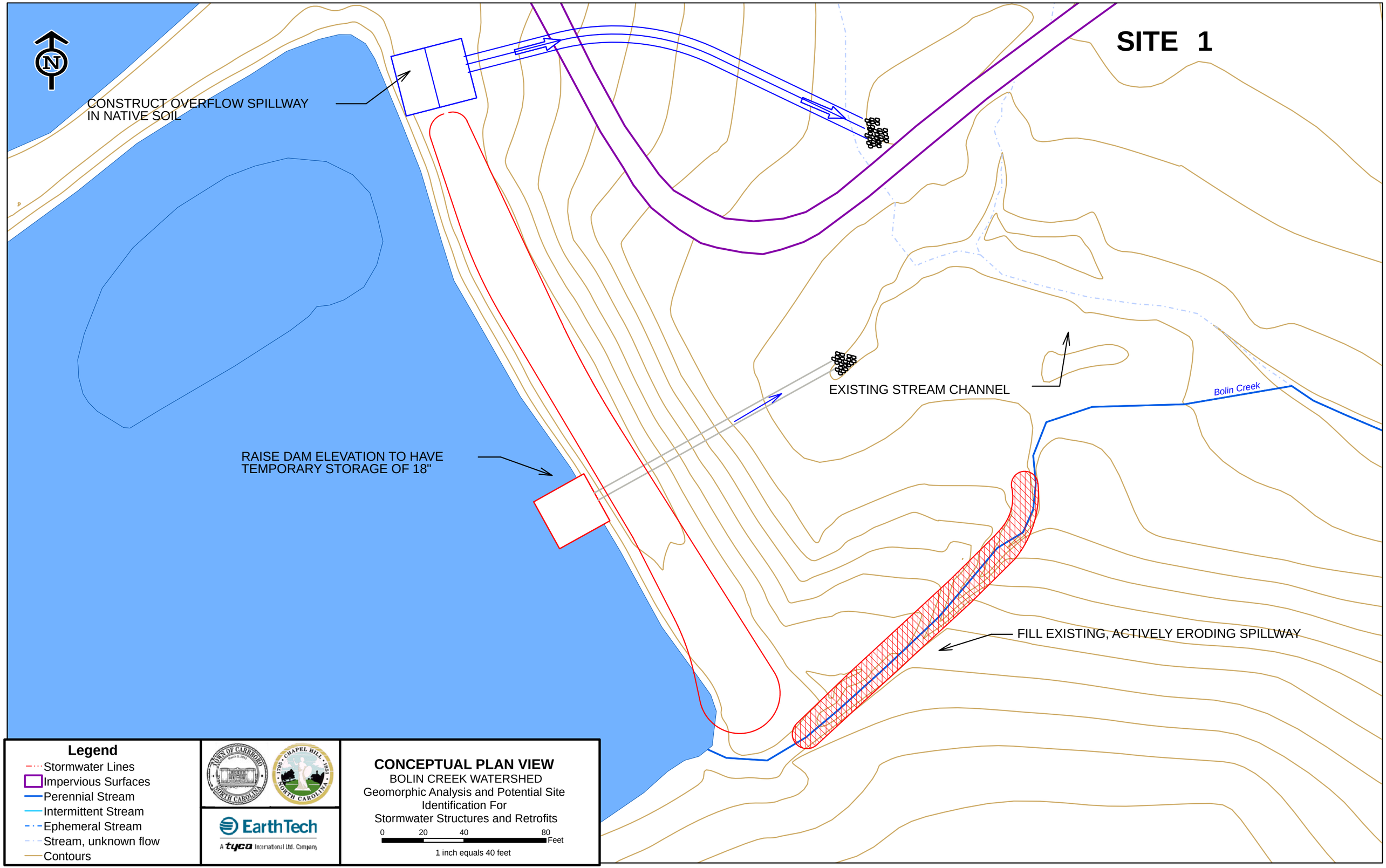
SITE 1
N
CONSTRUCT OVERFLOW SPILLWAY
IN NATIVE SOIL
EXISTING STREAM CHANNEL
Bolin Creek
RAISE DAM ELEVATION TO HAVE
TEMPORARY STORAGE OF 18"
FILL EXISTING, ACTIVELY ERODING SPILLWAY
Legend
Stormwater Lines
Impervious Surfaces
Perennial Stream
Intermittent Stream
Ephemeral Stream
Stream, unknown flow
Contours
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CONCEPTUAL PLAN VIEW
BOLIN CREEK WATERSHED
Geomorphic Analysis and Potential Site
Identification For
Stormwater Structures and Retrofits
0 20 40 80 Feet
1 inch equals 40 feet

Legend

- Stormwater Lines
- Perennial Stream
- Intermittent Stream
- Ephemeral Stream
- Stream, unknown flow

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AERIAL PHOTO VIEW

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

0 20 40 80 Feet

1 inch equals 40 feet