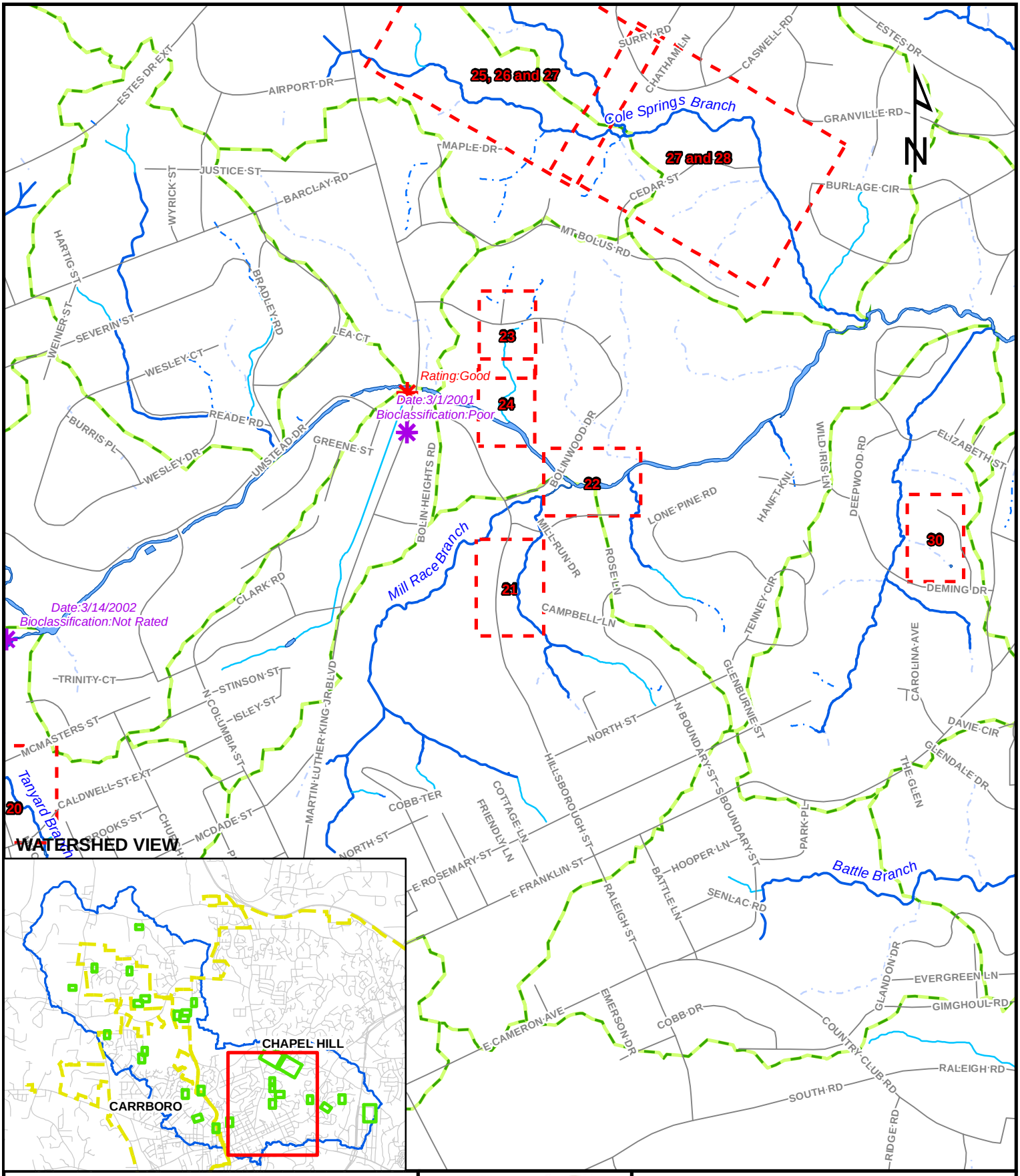
SITE 21

Restoration of Stormwater Outfall and Gulley off of Hillsborough St.

Index Sheet No.: 25
Raw Data Name: IJ 43

Estimated Construction Cost: $52,000



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 21
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 21	3.4	1.9	54.8%

Location

Site 21 is located off of Hillsborough Street, approximately 0.3 miles north of the intersection of Hillsborough St. and Rosemary St.

Problem Description

Site 21 consists of a deep, actively eroding gulley on a hillside below a stormwater pipe outlet from Hillsborough Street.

Stormwater runoff from Hillsborough Street and surrounding houses collects into a curb and gutter system along the street, and then is discharged at several outlets as the street runs downhill from the downtown area of Chapel Hill towards Bolin Creek. One of these outlets discharges at the top of a steep hill, with a drop of approximately 30 feet over a distance of approximately 100 feet. At the base of the hill is a tributary to Bolin Creek. There is no energy dissipation structure at this outlet, and thus the stormwater has concentrated as it flows downhill towards the steam, forming a massive gulley that is approximately 8 feet deep. The sides of this gulley are actively eroding, and likely contributing a large amount of sediment to the watershed each year.

Using the BANCS model, it is estimated that approximately 700 tons of sediment are being exported from the site each year. Concomitant nutrient export associated with the sediment has also been calculated and is listed in **Table 21.1**. In addition, pollutant loads have been calculated based on impervious area and land use, and are shown in **Table 21.1**.

Table 21.1

Pre-Treatment	
Estimated Total Sediment Export	701 tons/year
Erosion per length of Channel	7.7 tons/yr/ft
Pounds of Nitrogen	1402.1 lbs/year
Pounds of Phosphorus	701 lbs/year
Post-Treatment	
Estimated Total Sediment Export	0.1 tons/year
Erosion per length of Channel	0 tons/yr/ft
Pounds of Nitrogen	0.2 lbs/year
Pounds of Phosphorus	0.1 lbs/year

Proposed Solution

The target of treatment at this site is reduction of sediment caused by erosion, and thus the best solution is to restore the gulley into an "A" type-channel, which is stream type that would typically be found on a very steep slope (Rosgen, 1996). An "A" channel typically consists of large boulders and a run-pool sequence, with the direction and path of flow controlled by the location of rocks and boulders. These channels are typically very stable and are not a source of sediment export.

Constructing an "A" channel at this site would preclude the need to fill the existing gulley, as the channel could be constructed entirely within the gulley. At the bottom of the channel, a wet detention pond should be constructed with an energy dissipation pool. The water will potentially infiltrate through the bottom of the pond, providing base-flow augmentation to the perennial stream below, and overflow control will be provided by two level spreaders situated parallel to the stream channel. The level spreaders provide a distribution of flows that enter the stream. In addition to providing reduction in sediment export, the wet detention basin will serve to treat the pollutants in the stormwater runoff from Hillsborough St. An estimate of the reduction of sediment as a result of this practice has been calculated and is shown in **Table 21.2**. Pollutant reduction rates as a result of stormwater treatment are shown in **Table 21.2**.

Table 21.2

Site 21	Pollutant Load (lbs)		
	TN	TP	TSS
EXISTING CONDITION	16.82	2.66	357.95
WET DETENTION TREATMENT	25.00%	40.00%	85.00%
NET REDUCTION	4.21	1.06	304.26
FUTURE CONDITION	12.62	1.60	53.69

Constraints

The chief constraint of Site 21 is the difficulty of working in the existing gulley. Because of the steep side slopes and depth of the gulley, gaining access with equipment may be difficult.

Alternatives

Two alternatives are proposed for this site:

Alternative 1: Construct an "A" channel in the existing gulley, using large boulders and stone to define the channel. Construct a wet detention basin at the bottom of the hillslope, containing a permanent pool where the channel meets the basin, to provide energy dissipation. The depth of the basin should be higher in elevation than the bed of the stream, so that groundwater will discharge from the basin and recharge the stream. The bottom of the basin should consist of a porous soil media to allow infiltration through the soil. The overflow structure will be two level spreaders situated parallel to the stream.

Alternative 2: Construct a concrete-lined channel with friction blocks, rather than an "A" channel, and the wet detention basin and level spreaders described above.

Cost-Estimate Breakdown

Tables 21.3 and 21.4 show a conceptual itemized cost estimate for the two alternatives of Site 21. These costs represent construction costs only. The cost for the wet detention pond is derived from an equation developed by Brown and Schueler (1997). The contingency fee for this site has been increased due to the difficulty of access.

Table 21.3
SITE 21 Alternative 1

Pay Item Description	Estimated Quantity	Unit	Unit Bid Price	Bid Amount
Excavation	40.00	CY	15.00	$600
Wet Detention Pond	3518.0	CF	Equation Derived	$25,408
Site Preparation and Planting	0.10	Ac	7500.00	$750
Rip Rap Class B	5.00	Tons	45.00	$225
Filter Fabric	15.00	SY	5.00	$75
Boulders	25.00	Tons	200.00	$5,000
Silt Fence	100.00	LF	3.75	$375
Level Spreader	2.0	EA	3000.00	$6,000
Construction Safety Fence	300.00	LF	2.50	$750
Construction Entrance	1.00	Ea	2500.00	$2,500
			Total	$41,683
Mobilization (5%)	1.00	LS		$2,084
Contingencies (20%)	1.00	LS		$8,337
	Total +	Mobilization and Contingencies		**$52,104**
Maintenance Costs				
Maintenance (5% of base construction cost of BMP)	1.0	Year		**$1,270**

Table 21.4

SITE 21 Alternative 2

Pay Item Description	Estimated Quantity	Unit	Unit Bid Price	Bid Amount
Excavation	40.00	CY	15.00	$600
Wet Detention Pond	3518.0	CF	Equation Derived	$25,408
Site Preparation and Planting	0.10	Ac	7500.00	$750
Rip Rap Class B	5.00	Tons	45.00	$225
Filter Fabric	15.00	SY	5.00	$75
Silt Fence	100.00	LF	3.75	$375
Level Spreader	2.0	EA	3000.00	$6,000
Concrete Lined Channel with Friction Blocks	5.00	CY	500.00	$2,500
Construction Safety Fence	300.00	LF	2.50	$750
Construction Entrance	1.00	Ea	2500.00	$2,500
			Total	$39,183
Mobilization (5%)	1.00	LS		$1,959
Contingencies (20%)	1.00	LS		$7,837
	Total +	Mobilization and Contingencies		**$48,979**

Maintenance Costs

Maintenance (5% of base construction cost of BMP)	1.0	Year	**$1,270**

SITE 21

ALTERNATIVE 2:
CONSTRUCT CONCETE FLUME WITH
FRICTION BLOCKS

USE LARGE BOULDERS TO
DEFINE CHANNEL

HILLSBOROUGH ST

EXISTING
OUTLET

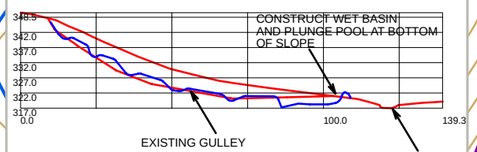
WET POND

LEVEL SPREADER

ALTERNATIVE 1: RECONSTRUCT EXISTING
GULLEY INTO "A" CHANNEL

LEVEL SPREADER

CONCEPTUAL PROFILE



CAMPBELL LN

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

SITE 21

ALTERNATIVE 2:
CONSTRUCT CONCETE FLUME WITH
FRICTION BLOCKS

USE LARGE BOULDERS TO
DEFINE CHANNEL

HILLSBOROUGH ST

EXISTING
OUTLET

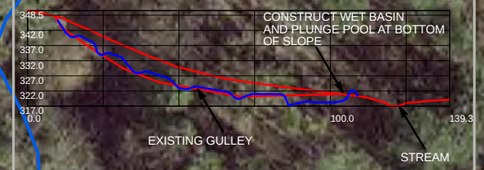
WET POND

LEVEL SPREADER

ALTERNATIVE 1: RECONSTRUCT EXISTING
GULLEY INTO "A" CHANNEL

LEVEL SPREADER

CONCEPTUAL PROFILE



CAMPBELL LN

Legend

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