

# Memorandum

**Date:** March 10, 2005

**To:** Chris Dreps  
Upper Neuse River Basin Association

**From:** Sally Hoyt  
Center for Watershed Protection

**Re:** Summary of Field Work Activities in Little Lick  
Creek – January 2005

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## Introduction

The Little Lick Creek Watershed technical team conducted field assessment work from January 24 – 28, 2005 in support of the development of the Little Lick Creek Watershed Plan. The field work was primarily organized and headed up by the Center for Watershed Protection (CWP). Substantial and valuable support was also provided by Upper Neuse River Basin Association (UNRBA), NC Division of Water Quality, City of Durham Stormwater Services Division, and City of Durham Planning.

The purpose of this memo is to document the field activities, provide a general summary of preliminary findings from the fieldwork, and to map evaluated areas as well as the locations of potential restoration opportunities. Copies of field sheets and a CD-ROM containing photos taken during the assessments will be provided under separate cover.

This technical memo is organized into the following parts:

**Key Findings** – summarizes and groups the findings of the field work.

**Reach Conditions** – presents a description of the assessment protocol and scoring by reach.

**Restoration Projects** – discusses watershed restoration projects in general, addresses the organization of the field data, and presents potential restoration sites by stream reach and by restoration project type.

In this memo, conditions of the stream reaches are compared to the best reaches in the Little Lick Creek watershed, as the unique geology of the Triassic basin makes comparison to other area streams with different geologic characteristics difficult. For example, the Division of Water Quality and Durham Stormwater Services benthic macroinvertebrate studies in Little Lick Creek indicate that the creek is biologically impaired or has poor aquatic habitat conditions. However, the baseline macroinvertebrate presence for a watershed with the highly erodible soils and sandy substrate of Little Lick Creek is not well known.

The focus of this report is on active and recent impacts, where ongoing point or non-point sources impact water quality. Another major impact – active channel erosion – stems from changes in land use, which leads to an altered hydrologic regime associated with increased magnitudes and frequencies of flows.

Most of the potential restoration projects presented in this document are related to the active conditions observed during field work, though some restoration opportunities address historic impacts (e.g., reforestation of buffer areas that were historically logged or used for agricultural purposes). Notably, a number of reaches that show indications of historic disturbances appear to have now stabilized primarily as a result of having extensive forested buffers.

Several opportunities for implementation of watershed restoration practices were found during the stream corridor field assessment. Combining these opportunities with those that will be identified during the upland assessment (being conducted in March 2005) will provide the building blocks for a broad-based and balanced restoration approach for the watershed.

The field teams for the stream corridor assessment consisted of members of many of the project partner organizations, including:

- UNRBA (Chris Dreps)
- Center for Watershed Protection (Ted Brown, Sally Hoyt, Anne Kitchell, Paul Sturm)
- NC Division of Water Quality (Stratford Kay, Kathy Paull)
- City of Durham Stormwater Services Division (Jonathon Baker, Dave Brown, Jake Chandler, Bill Haley, Bobby Louque, Chris Outlaw)
- City of Durham Planning (Cherri Smith)



RCH2-1 Example of deeply incised, but currently stable stream bank

Field teams for each day of field work are listed below.

<b>Table 1: Field Teams and Schedules</b>					
Date	Mon 1/24	Tues 1/25	Wed 1/26	Thur 1/27	Fri 1/28
Team 1	<b>Subshed 3</b> Paul Sturm Dave Brown Kathy Paull Jonathon Baker	<b>Subshed 3</b> Sturm D. Brown Paull	<b>Subshed 6</b> Sturm Baker Chandler	<b>Subshed 6</b> Sturm Kay Baker	<b>Subshed 10 &amp; 11</b> Sturm Dreps
Team 2	<b>Subshed 1</b> Anne Kitchell Chris Outlaw Jake Chandler Stratford Kay	<b>Subshed 1</b> Kitchell Outlaw Chandler Kay	<b>Subshed 1 &amp; 4</b> Kitchell Paull	<b>Subshed 4</b> Kitchell Outlaw Paull	<b>Subshed 4 &amp; 9</b> Kitchell Outlaw
Team 3	<b>Subshed 2</b> Sally Hoyt Cherri Smith Bobby Louque Bill Haley Chris Dreps	<b>Subshed 2</b> Hoyt Louque Dreps	<b>Subshed 2 &amp; 5</b> Hoyt Smith D. Brown	<b>Subshed 8</b> Hoyt Chandler - D. Brown Louque	<b>Subshed 7, 12 &amp; 13</b> Hoyt Chandler - D. Brown Louque
Team 4			<b>Subshed 5</b> Ted Brown Kay	<b>Subshed 5 &amp; 7</b> T. Brown Dreps Smith	

### Key Findings

Several impacts to the watershed stood out as re-occurring problems. These impacts range from enforcement issues and design guidelines to the need for homeowner education regarding stewardship actions. The key findings relate to:

- Erosion and sediment control on active construction sites
- Sanitary Sewage Discharges from failing onsite septic systems and from damaged sewer laterals
- Other illicit discharges including wash water and cooking oil
- Trash dumping - trash heaps adjacent to homes and dumping of large items
- Impacted buffers with little or no undisturbed vegetation adjacent to the stream.
- Post-construction stormwater management and the opportunities for retrofit.

These key findings are summarized below with a description of the impact to the watershed, an example of the impact, and possible corrective actions.

**Erosion and Sediment Control**

Construction sites with poorly functioning or non-existent erosion and sediment controls discharge large quantities of sediment to Little Lick Creek and its tributaries. Without proper controls and enforcement, construction site erosion will continue to be a significant source of sediment load that will result in receiving stream impacts, given the planned level of development in the watershed over the next few years. Problems found during fieldwork are exemplified in the following sites:

- Cardinal Lake – a large, existing lake – found to be sediment laden due to active construction adjacent to the lake. Either sediment controls for the ongoing development were failing/inadequate or the lake was being used as a sediment basin. Excavated material was being stockpiled adjacent to the lake. This violates the Durham County standards regarding required effective buffer zones (Sec. 14-56 (1)a) and possibly the prohibition of the use of existing lakes as sediment basins (Sec. 14-65 (j)(3)).
- Sites which relied exclusively on sediment basins for sediment control, rather than using a combined approach that also considers preventing erosion through the establishment of effective ground cover and construction of stabilized conveyance channels.
- Failure to maintain erosion and sediment controls. For example, silt fences that were overtopped by sediment or undermined by erosion were noted. These devices should be inspected following storms greater than 0.5 inches to ensure that they are intact and functioning properly. Local ESC regulations/criteria should be explicit about maintenance and inspection requirements such as this.

Erosion and sediment control actions to consider for the Little Lick Creek watershed include: increasing the level of inspection and enforcement at active construction sites; reviewing and updating existing ESC criteria to be more explicit about maintenance and inspection obligations; providing training and certification programs for erosion control professionals; and advertising the use of a hotline for citizens to call in obvious violations such as failing practices and illicit discharges.



RCH2-9 Development is coming



RCH8-14 Cardinal Lake – Sediment laden; stockpiling adjacent to shore



*Little Lick Creek – USA Fieldwork*



RCH8-14 (left photo) and RCH8-12 (right photo) Sediment laden stream, downstream of Cardinal Lake



RCH2-12 Unmaintained erosion and sediment controls (left photo). Upstream area was graded and seeded, but has not yet stabilized. The sediment load carried down this hill overwhelmed the silt fence and is filling in the sediment basin (right photo).



RCH13-1 No ESC provided for on lot construction (Photographer standing adjacent to stream channel)

### **Sanitary Sewage Discharges**

Threats to water quality and public health are posed by the large number of sanitary sewage discharges in the watershed. Two distinct and notable sources of sewage in the streams are:

**Sand filters (on-site septic systems)** contribute to contaminant load when improperly maintained, such as failure to replace chlorination tablets. Many of these failing systems are located in close proximity to sanitary sewers, meaning that the households could be connected to the municipal treatment system, which would provide more reliable wastewater treatment.

**Sanitary sewer laterals** (house connections) laying above stream inverts so that the pipe is exposed in the stream channel. These laterals were often PVC or another material joined to PVC and failed as a result of improper pipe connections and fittings or from being smashed by debris and bedload carried by the stream.

The current City of Durham minimum guidelines for the design of sanitary sewers prefers placement of sewer lines below stream inverts and requires ductile iron pipe for aerial stream crossings. However, plans for individual house connections (service lines of 4" to one building) are not required to have a construction plan review under the development code. The inspection of these individual connections is handled by the Building Inspection Department and regulated by the North Carolina Plumbing Code. The current standards for systems in Durham County are not known at this time.



RCH2-10 Outfall of Failing Sand Filter



RCH3-2 Sanitary sewer leak: (UT3-1)



RCH5-8 PVC sanitary sewer laterals in stream (above and left)



**Other Illicit Discharges**

Other observed illicit discharges included wash water, cooking oil, and paint dumping. These sites require enforcement and education.



RCH3-4 Illicit discharge – wash water (left)  
RCH3-7 Illicit discharge - Paint dumped in stream (right)

**Trash Dumping**

A range of trash dumping behaviors were also observed including:

- Organic material (i.e., yard waste) and miscellaneous household trash along the stream corridor behind homes. This presents an opportunity for homeowner education and neighborhood stream clean-up. The City and County should also consider having stream clean-up days and large item trash pick up days on a regular basis (e.g., 2-4 times a year).
- Oil filters and other automotive trash found adjacent to an apartment complex. This suggests that the apartment complex would function well as a used motor oil and hazardous household waste collection site. Alternatively or in addition, the City and County can consider instituting a mobile oil recycling program that covers the watershed on a regular basis.
- Dumping of construction materials and dumping associated with commercial areas are items to target for enforcement and education. Advertising a hotline for these types of tips will facilitate the enforcement.



RCH2-10 Residential trash behind homes on Jones Circle (left). RCH13-1 Oil changing supplies stored 10' from stream (right)



RCH6-7 Construction Debris and lack of sediment control (left). RCH3-4 Battery in Stream (right).

### ***Impacted Buffers***

Buffer impacts observed include:

- Sanitary sewer lines running parallel to the stream, with less than 30' (this is the criteria identified in the 1997 Neuse Riparian Buffer Protection Rules) of undisturbed vegetative buffer between the cleared right-of-way and the top of bank.
- Residential developments with maintained lawn to the edge of bank.
- Stream channels converted to roadside ditches with driveway culverts.

Many of the existing impacts to the buffer would no longer be exempt activities under the Neuse Riparian Buffer Protection Rules which preserve a 50' buffer along stream channels. However, the effectiveness of the enforcement of this measure is unknown, as ongoing development was observed in the stream buffer.

The buffer rules do not require the creation of a buffer unless there is a change in use. However, targeted homeowner and property manager education may lead to opportunities for voluntary buffer restoration. Additionally, some effort could be put into identifying homeowner encroachment of buffer areas.



RCH2-3 Example impacts of sewer ROW





RCH2-11 Homeowners mowing to edge of stream (left). RCH5-10 Bank erosion at golf course accelerated by lack of buffer.(right)

### ***Stormwater Management***

Currently, few post-construction stormwater management facilities exist in the Little Lick Creek watershed. However, these numbers are quickly increasing as the rate of development increases. Where new development is occurring, many of these sites had poorly designed stormwater management controls that appeared to be mostly an afterthought. Many retrofit opportunities were preliminarily identified in the field and will be further assessed as part of the upland assessment work occurring in March 2005.

There are opportunities for visible, innovative retrofits in residential, commercial and institutional settings. These opportunities can demonstrate well-integrated stormwater management while improving water quality. With the numerous research and technology institutions nearby (e.g., Duke, North Carolina State University, University of North Carolina, and EPA), there should be many opportunities to partner with these groups to implement and monitor innovative post construction stormwater controls.



RCH1-13 Pendleton Apts SWM (left)

RCH2-12 Stormwater pond in use as sediment basin (right)

## Reach Conditions

On January 24-28, 2005 field teams documented stream corridor conditions for over XX linear stream miles in the Little Lick Creek Watershed. Crews conducted the Unified Stream Assessment (USA)—a comprehensive stream walk protocol for evaluating the physical riparian and floodplain conditions in small urban watersheds. Methods of conducting fieldwork and evaluating collected data can be found in Kitchell and Schueler (2004). The USA integrates qualitative and quantitative components of various stream survey and habitat assessment methods and is used to identify locations of suspected illicit connections, impacted stream buffers, severe stream bank erosion, excessive trash accumulation and dumping, and impacted stream crossings. While the USA helps to identify high quality streams for protection, its main benefit is in identifying restoration opportunities for discharge prevention, stream restoration, storm water retrofits, and riparian reforestation. In the field assessment of Little Lick Creek, the focus was on verifying riparian buffer conditions, characterizing stream bank stability and overall stream habitat condition, and identifying outfall locations that are suspected illicit discharges or potential retrofit opportunities.

Based on guidance from the Technical Team, crews focused initial efforts on the headwater areas of subwatershed 1 through subwatershed 8. Only a few stream reaches were assessed in the less developed subwatersheds – subwatershed 9 through subwatershed 13.

Project partners joined CWP staff in conducting the USA each day in field. Stream teams consisted of two or three crew per team. Teams generally covered 2-2.5 miles of stream per day, and assessed XX individual stream reaches.

Within each reach, teams evaluated overall reach habitat using a scoring system based on the EPA’s Rapid Bioassessment Protocol. Teams also identified and recorded basic information and restoration recommendation on outfall locations, severely eroded stream banks, utility crossings, impacted riparian buffers, trash dumping, and stream crossings.

To evaluate the results of the overall habitat assessments, a comparison of the highest scoring reaches to the others was made. The comparison was based upon the concept of a reference condition. The reference condition is considered to be the least impaired, best attainable condition for a stream in a given region. For this Little Lick Creek project, the highest rated sample reach in the study area was considered to be equivalent to reference conditions.

The best reach in the Little Lick watershed (RCH10-1) scored an overall habitat rating of 158 points (out of a possible 160 points). This can be considered a representative score for the best attainable condition for a reach within the study area. A score of at least 90% or greater of this number (>142) is considered comparable to the reference condition and represents excellent stream conditions. A score of 65% or less (<103) of the reference score is considered non-supporting or poor stream corridor conditions. Between these two extremes, 75% of the reference score (119) represents the divide between good and fair stream and associated floodplain conditions. The scoring criteria are shown in Table 2; reach classification are summarized in Table 3 below. While these criteria serve to place the sample stations in context, they are somewhat subjective. A reach scoring a few points higher than another may be placed in a higher category, but the qualitative aspects of the method makes differences of a few points insignificant.

<b>Score</b>	<b>Percentile</b>	<b>Classification</b>
158	High score	
>142	90%	excellent
>119	75%	good
≤119	75%	fair
<103	65%	poor



*Little Lick Creek – USA Fieldwork*



RCH8-13 Example of Excellent reach



RCH2-13 Example of Good reach



RCH10-2A Example of Good reach



RCH2-13/14 Transition between Good/Poor reach



RCH4-6 Example of Fair reach



RCH2-14 Example Poor reach (Mainstem)



Little Lick Creek – USA Fieldwork

Reach Classification Based on Overall Habitat Score							
Excellent		Good 119-142		Fair 103-119		Poor 1-103	
Reach ID	Total Score	Reach ID	Total Score	Reach ID	Total Score	Reach ID	Total Score
RCH8-13	145	RCH2-7	126	RCH1-6	108	RCH1-2	70
RCH8-15	148	RCH2-13	129	RCH2-5	104	RCH1-3	85
RCH10-1	158	RCH4-3	125	RCH2-6	108	RCH1-4	102
		RCH5-13	137	RCH2-9	113	RCH1-5	88
		RCH7-10	127	RCH2-11	107	RCH1-7	69
		RCH8-5	121	RCH2-12	112	RCH1-8	71
		RCH10-2A	136	RCH3-6	105	RCH1-10	82
		RCH12-1	141	RCH3-5	109	RCH1-11	100
		RCH12-2	133	RCH3-4	106	RCH1-12	87
				RCH3-3	104	RCH1-13	88
				RCH4-6	115	RCH1-15	98
				RCH5-5	114	RCH2-1	76
				RCH5-6	118	RCH2-2	61
				RCH5-7	106	RCH2-8	102
				RCH6-1	109	RCH2-4	0
				RCH7-1	103	RCH2-10	80
				RCH8-1	113	RCH2-14	31
				RCH8-2	118	RCH3-1	68
				RCH8-3	103	RCH3-2	99
				RCH8-4	108	RCH3-6	67
				RCH8-6	115	RCH4-1	86
				RCH8-14	112	RCH4-2	91
						RCH4-4	61
						RCH4-5	88
						RCH4-8	70
						RCH4-9	80
						RCH4-10	97
						RCH5-1	80
						RCH5-10A	97
						RCH5-3	76
						RCH5-4	82
						RCH5-9	101
						RCH5-8	53
						RCH5-11	41
						RCH5-12	57
						RCH5-14	84
						RCH6-8	100
						RCH6-6	83
						RCH6-3	94
						RCH10-3	61
						RCH10-4	95
						RCH11-1	100
						RCH12-3	92
						RCH13-4	11
						RCH13-1	74
						RCH13-2	90
						RCH13-3	72

## Restoration Projects

### ***Background***

The term “restoration practice” is defined as the application of structural or non-structural techniques in urban subwatersheds to improve stream health, as measured by improvements in physical, hydrological, chemical, ecology or social indicators. Several different techniques can potentially be used to restore urban subwatersheds; but they can be broadly classified into seven major groups of restoration practices, which are reviewed below. The seven major groups include:

1. Storm Water Retrofit Practices
2. Stream Repair and Restoration Practices
3. Riparian Management Practices
4. Discharge Prevention Practices
5. Pervious Area Management Practices
6. Pollution Source Control Practices
7. Municipal Practices and Programs

The choice of which combination of practices to apply depends on restoration goals, along with the restoration potential and development intensity within a subwatershed. In general, the first four restoration practices are applied to the stream corridor. The remaining three restoration practices are usually applied to upland areas in the subwatershed, although some onsite storm water retrofits can also be installed in upland areas.

### Storm Water Retrofit Practices

Storm water retrofits are structural practices installed within the stream corridor or upland areas to capture and treat storm water runoff before it is delivered to the stream. Storm water retrofits are the primary practice to restore subwatersheds, since they can remove and/or treat storm water pollutants, minimize channel erosion, and help restore stream hydrology. Retrofits can be further classified as to the subwatershed area that they treat. *Storage retrofits*, such as ponds, wetlands, filtering and infiltration practices, can typically treat subwatershed areas ranging from five to 1,000 acres. *On-site retrofits* capture runoff from individual source areas, such as rooftops, parking lots and street sections. Residential on-site retrofits are designed to treat areas as small as a few hundred square feet, whereas nonresidential retrofits normally serve areas up to two acres in size.

### Stream Repair

Stream repair practices include a large group of techniques used to enhance the appearance, structure or function of urban streams. These practices range from simple stream clean-ups and basic stream repairs to extremely sophisticated stream repair techniques, such as full channel design. Stream repair practices are often combined with storm water retrofits and riparian management practices to meet subwatershed restoration goals.

### Riparian Management

Riparian management practices involve eight basic techniques to restore the quality of forests and wetlands within the remaining stream corridor. The overall goal of the practice is to improve the continuity of streamside vegetation to maximize the many benefits that buffers provide (e.g., pollutant removal, shading, large woody debris, etc.). Given that urban stream corridors are heavily used and have multiple owners, many individual riparian management projects may need to be linked together to create a better riparian zone. Each riparian management project must be designed to address the unique stresses and disturbances that occur within the urban stream corridor, and maximize storm water infiltration and subsequent pollutant removal.

### Discharge Prevention Practices

The purpose of discharge prevention practices is to prevent sewage and other pollutants from entering the stream from illicit discharges, sewage overflows, or industrial and transport spills. Discharges can be continuous, intermittent, or transitory. Depending on the volume and type, discharges can cause extreme water quality problems in a stream. Sewage discharges can directly affect public health (bacteria), while other discharges can be toxic to aquatic life (e.g., oil, chlorine, pesticides, and trace metals).

### Pervious Area Management

Municipalities often own or manage as much as 10% of total subwatershed area in parks, open lands, golf courses, schools and tax delinquent parcels. Some of these areas are prime candidates for land reclamation, which improves soil quality by amending it to increase its capacity to infiltrate rainfall, and create better conditions for healthy plant growth.

### Pollution Source Control Practices

Source control is a broad restoration practice that seeks to prevent pollution from residential neighborhoods or storm water hotspots. Which source control practices are applied depends on the pollutants of concern and the major pollutant source areas identified in the subwatershed. Source control practices are implemented by focusing educational, enforcement and technical resources to change key residential behaviors or business operations that cause pollution.

### Municipal Practices and Programs

Municipalities can play a pivotal role in subwatershed restoration in at least six ways. First, communities maintain much of the physical infrastructure in a subwatershed, including roads, sewers, and storm drain systems. In many cases, communities can reduce or prevent pollutants from entering the subwatershed by changing their infrastructure maintenance policies. Second, municipalities set the rules governing how development and redevelopment proceed. When crafted properly, these rules can actively promote better development practices that support long-term subwatershed restoration goals. Third, municipalities are usually a significant landowner in most subwatersheds, and can practice better stewardship on the lands they own or control. Fourth, municipalities operate certain facilities that are well known storm water hotspots. Common examples include solid waste facilities, public works yards, fleet storage lots and maintenance depots. Many of these operations are required to implement source control or pollution prevention practices. Fifth, municipalities can act as the direct service provider to help residents and businesses practice better stewardship. Examples include local programs to conveniently dispose of yard wastes, used oil or household hazardous wastes. Lastly, municipalities can play a strong role in both education and enforcement to promote better stewardship by residents.

### ***Potential Restoration Projects***

Since the January field work concentrated primarily on the stream corridor, most of the restoration projects identified for potential implementation are those applicable to the stream corridor. The upland and retrofit inventory assessments that will be conducted in March 2005 will identify additional potential projects that cover the remaining areas of restoration practices. The potential projects fit into the restoration practice areas as follows:

1. Storm Water Retrofit Practices – Possible locations for stormwater retrofit were identified. These Sites and others will be revisited in March 2005.
2. Stream Repair and Restoration Practices – These sites are identified as Stream Restoration and Trash Cleanup sites.
3. Riparian Management Practices – Encompasses Buffer Restoration projects.
4. Discharge Prevention Practices – Included in the Inspection and Enforcement project type.



5. Pervious Area Management Practices – Though some areas have been identified during fieldwork, the identification of lands for protection will be conducted by UNRBA at a later date.
6. Pollution Source Control Practices – Identification of hotspots and associated source control is one focus of the March 2005 fieldwork.
7. Municipal Practices and Programs – Includes some of the Inspection and Enforcement items and the Maintenance project types.

Projects that were identified during the stream assessment work are described in the attached tables, organized both by reach and by project type. The alphanumeric identifiers can be used to match projects on this table to the locations on the watershed map. In total, field crews:

- Evaluated 113 outfalls—of which 38 were identified for maintenance, inspection and enforcement, and outfall or stormwater retrofitting.
- Evaluated 89 stream crossings—of which 17 were identified for maintenance, culvert replacement, stormwater retrofitting, or inspection and enforcement.
- Evaluated 39 utility crossings—21 which were identified for maintenance, inspection and enforcement, or discharge prevention.
- Identified 21 areas for buffer reforestation.
- Identified 16 sites for stream restoration or erosion control.
- Identified 16 locations for trash removal.
- Identified 12 locations for pollution or discharge prevention, monitoring, or homeowner education.
- Identified one location for wetland mitigation.

**Understanding the Nomenclature**

A key to the nomenclature used by field teams during the assessment work is provided in Table 3 for reference. Subwatershed ID, assessment types, and specific site identification examples are included to assist in decoding field sheets (provided under separate cover).

The naming convention is designed to be flexible for field teams and to immediately impart key information about the site. Identifiers consist of three parts: 1) the number of the subwatershed in which the site or reach is located, 2) the type of assessment conducted, and 3) a unique identifier that is employed sequentially as a team evaluates a subwatershed or reach (e.g. the first three outfalls encountered in one stream reach would be numbered 1,2,3... and so on).

<b>Table 4. Field Assessment Nomenclature Key</b>	
<b>Assessment Type</b>	<b>Reach/Site ID (Example)</b>
RCH = Stream Reach OT = Outfall ER = Severe Erosion SC = Stream Crossing UT = Utility Crossing IB = Impacted Buffer TR = Trash and/or Debris MI = Miscellaneous	<i>Reach ID</i> RCH, Subwatershed - # (RCH6-1)
	<i>Site ID</i> Assessment Type, Subwatershed - # (OT2-1)

**References**

- Barbour, M.T., J. Gerritsen, B.D. Synder, and J.B. Stribling. 1999. *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition*. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.
- City of Durham Public Works Department. 2003. *Reference Guide for Development*. Durham, NC.
- Dreps, Chris. 2004. “Little Lick Creek Watershed Plan Draft Memorandum #1.” Upper Neuse River Basin Association Research Triangle Park, NC.
- Kitchell and Schueler. 2004. *The Unified Stream Assessment: A Users Guide*. Manual 10 in the *Urban Subwatershed Restoration Manual Series*. Ellicott City, MD. downloadable at <http://www.cwp.org>

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Potential Restoration Projects				
Project Type	Subshed ID	Reach ID	Site ID	Description
Buffer Restoration	1	RCH1-1		Recommend a 25' to 50' buffer entire length of reach. Invasive species (kudzu) removal. Stream paralleled by sewer ROW. Mainly residential area.
		RCH1-13	IB1-2	Reforestation needed on right bank. Constrained by residential backyards.
		RCH1-15	IB1-4	Buffer through mobile home community.
		RCH1-5		Buffer needed entire length of left bank; constrained by homeowner fences and sheds.
		RCH1-7		Entire reach has no buffer on either side stream. Reforestation on the left bank restricted by sewer. Portions of right bank restricted by proximity of houses.
	2	RCH2-1	IB2-1	300 ft possible restoration but homes 25 ft from stream; results in low restoration potential; homeowner education on invasive Japanese stilt grass.
		RCH2-10		Backyards mowed to stream; homeowner education and reforestation needed.
		RCH2-14	IB2-10	Mobile home community with no buffer and moderately highly maintained landscaping -- one landowner work with them to maintain buffer
		RCH2-2		Possible 50 ft buffer; old agriculture property mowed to the stream edge; adjacent to a soon to be developed parcel
		RCH2-3		150 ft of inadequate buffer due to homeowner mowing
		RCH2-6	ER2-2	Eroded actively downcutting banks due to change in land use; parcel that has been cleared with less than 10 ft buffer. Find out if slated for development and have slopes protected and replanted.
	3	RCH3-1	IB3-1	Approximately 300' on the left bank and 350' on the right bank is restorable. 10-15' width buffer can likely be restored on left bank; 25-50' on right bank. Houses and agricultural land uses.
		RCH3-3	IB3-2	Small buffer (10'-25') existing on 1 residential buffer. Potential for bigger buffer. Stream is incised at this location.
	4	RCH4-3	IB4-1	Unbuffered segment upstream of Mansfield Rd (mowed to edge of stream on church property); noticeable aquatic vegetation; consider riparian buffer planting (nearby homeowner or church).
	5	RCH5-10B	IB5-5	+/- 1400 LF of buffer enhancement possible. Unstable banks make project more challenging, but can use a combination of trees and shrubs. Needs to be well planned with golf course architect so that trees are not located in areas likely to receive a lot of shots.
		RCH5-3	IB5-1	Potential reforestation in ROW, constrained by gas easement.
		RCH5-3	IB5-2	Buffer enhancement (but note location of sanitary). Some existing buffer reforestation.
	7	RCH7-1	IB7-1	Encroachment by new residential subdivision from both clearing and moving of fill resulting in small erosion channels. This buffer should be reestablished with new planting and future grading should be watched more closely to avoid similar impacts.
	10	RCH10-3	IB10-1	Reforestation on homeowner property.
		RCH10-4	IB10-2	Inadequate buffer. Reforestation.
11	RCH11-1		Not written in a form; whole reach is in power easement; no buffer; 300 ft	
13	RCH13-1	IB13-1	Building construction and fill material adjacent to stream; reforestation needed.	
	RCH13-2		Homes and trucking business mowed up to 10 ft from stream edge; beaver may be reforestation barrier	



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Project Type	Subshed ID	Reach ID	Site ID	Description	
Homeowner Education	1	RCH1-7	OT1-12	Residential area with home business, 15" drain from parking area/wash station to stream. Education or retrofit.	
		RCH1-7		Multiple outfalls including downspouts and other 4" PVC pipes. Homeowner education needed.	
	2	RCH2-13		Potential area for home owner education and stewardship downstream of Gibson Rd	
	4	RCH4-1		Oil filters in stream, backyards flooding, downspouts connected. Neighborhood built in 80's.	
		RCH4-2		Buffer encroachment in single family residential area; proper vehicle maintenance practices	
	5	RCH5-11		Stream channel runs through homeowners' front yard; need maintenance of buffer and turf management	
		RCH5-12		Stream channel runs through homeowners' front yard; need maintenance of buffer and turf management	
		RCH5-14		Stream channel runs through homeowners' front yard; need maintenance of buffer and turf management	
	6	RCH6-4	MI6-2	Cows and other farm animals in stream, upstream of Holder Rd.	
	13	RCH13-1	TR-13-1	Oil filter and oil sheen, buckets of yard waste and concrete	
	Inspection and Enforcement	1	RCH1-10	OT-1-13	Illicit discharge - sudsy water at 903 Midway Street
			RCH1-13	IB1-1	Cleared lot without ESC. Needs 50' buffer reforestation.
			RCH1-15	IB1-3	Buffer has been clear-cut. Kathy may call this in.
RCH1-3			SC1-3	Road crossing at South Adams St. Interlocking block used in headwall, not allowed.	
RCH1-5			UT1-1	Sanitary sewer crossing (8 inch clay pipe) partly exposed along bottom of stream; bubbling at pipe junction (leaking?)	
RCH1-7			OT1-11	Left bank, 4" PVC, flowing. Draining wet area below pond. Significant algae in pipe.	
RCH1-7			UT1-4	Sewer cleanout located in the stream.	
RCH1-9			UT1-5	Exposed manhole stack with erosion around it.	
RCH1-9			UT1-6	Exposed pipe with cleanout in the stream. Active erosion around pipe/cleanout.	
2		RCH2-10	OT2-2,14	Septic Sand filter discharges directly to stream. OT2-2 to OT2-14	
		RCH2-12		Existing wet pond; significant erosion issues in the pond	
		RCH2-12		Failing ESC measures in new construction off Gibson Rd.	
		RCH2-2	MI2-1	Uncovered septic tank	
		RCH2-2	UT2-1	Exposed 6 inch PVC sewer line -- needs protection	
		RCH2-3	OT2-2	3 inch PVC outfall with frozen discharge (305 Pleasant Drive); potential septic sand filter discharge	
3		RCH3-2	UT3-1	Leaking sewer behind house on Recon Place. Reported to authorities.	
		RCH3-2		Parcels in floodplain that are potentially not developable (wetlands and stream) -- new section of Rincon -- don't allow additional crossing either if possible	
		RCH3-3		Parcels in Floodplain that are potentially not developable (wetlands and stream) -- new section of Rincon -- don't allow additional crossing either if possible	
		RCH3-6	MI3-2	Wetland and an area that should have been part of stream buffer in platted lot; downstream of Pinnock Rd.	
		RCH3-6	OT3-7	Septic Leakage. Foul odor; 6 inch plastic tubing discharging sewage from 2 houses (likely more). Mockingbird Lane.	
		RCH3-7	MI3-3	Sudsy discharge; 6 inch black plastic pipe; active; wash water most likely	
		RCH3-7	MI3-2	Hand washing of clothes and direct discharge into stream	

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Project Type	Subshed ID	Reach ID	Site ID	Description
Inspection and Enforcement	3	RCH3-7	UT3-2	Sanitary sewer crossing about 2 foot above invert of stream; but in ok shape right now
		RCH3-7	OT3-8	6-7 inch PVC; possible swimming pool discharge; submerged
	4	RCH4-2	MI4-6	Homeowner has fenced off stream with privacy fence; fence right up to SS manhole's ROW
		RCH4-3	UT4-2	Exposed 4 " PVC above stream; no joint exposure
		RCH4-8	UT4-3	SS lateral; PVC and iron pipe connection with rubber joint; exposed above stream
		RCH4-8		Evidence of sediment deposition from upstream construction (Stonehill Estates? at Obsidian and Thornwood) Evidence of poor ESC; silt fence failing; SS ROW being used as entranceway; sediment on street; ESC basin no outlet structure, etc.
		RCH4-9	MI4-1	ESC basin off Lodestone Rd in Stonehill Estates, in OK shape now
		RCH4-9	MI4-2	Drainage from end of dirt cul-de-sac compromising silt fencing
		RCH4-9	MI4-3	Drainage from end of dirt cul-de-sac compromising silt fencing
		RCH4-9	OT4-32	This outfall and upstream ESC/SWM needs to be inspected. Roadway embankment failure & sediment deposition. Is it meeting design criteria for detention basin??
		RCH4-9	UT4-5	Drainage to SS ROW; sediment deposition on manhole; cleanout and relocate silt fence
		RCH4-9		Stonehill ESC(?)
	5		4-X	Residential neighborhood in progress - currently clearing/grubbing site - no controls.
		RCH5-10A		Exposed sanitary and other unknown pipe in stream
		RCH5-8	MI5-2	Failing sanitary sewer - SSO (4005 Tyne Ave). Reported to Durham Stormwater Services.
		RCH5-8	MI5-3	Several sanitary laterals crossing stream to tie into trunk line. Mostly PVC, subject to failure due to exposure; unprotected.
	6	RCH5-8	UT5-2	Broken sewer lateral. Raw sewage discharges directly to stream. 103 Whetstone Ct
		RCH6-3	MI6-1	Land owner clearing buffer; responsible party Durham County E and S
	7	RCH7-1	TR7-1	Rubble and fill has be moved to this area by contractor. All should be removed and outfall that is covered reestablished and stabilized. Indication that poor construction inspection and enforcement is practiced.
		RCH7-10	MI7-100	2 PVC pipes in ground by stream, 1 leads to pump house. Unclear if pumping to or from stream.
		RCH7-10	UT7-103	Sewer lateral cleanout on creek bank
		RCH7-10	SC7-108	Earthen and debris dam
	8	RCH8-14	OT8-105	Cardinal Lake is sediment laden, indicating that the upstream erosion and sediment controls are not functioning
		RCH8-16	OT8-106	Illicit discharge - detergent found in drainage ditch and followed upstream to 2111 Faith Dr. Sewage odor and gray organic material present.
		RCH8-16	OT8-110	2104 Faith Dr - possible illicit discharge; detergent smell and deposits that may have been lint and detergent. 2" PVC
		RCH8-16	OT8-111	2108 Faith Dr; - possible illicit discharge; detergent smell; whitish stain in black PVC
		RCH8-4	SC8-7	Stream crossing construction of railroad ties, corrugated black plastic pipes and 4" PVC pipes. Reason for installation unclear. Remove from stream.
10	RCH10-3	MI10-1	Strong septic odor and possible failing septic. Septic system not found. 4011 Suitt Ave	
12	RCH12-3	MI12-1	Cow pasture around stream; move fence to other property line	
13	RCH13-1		Home under construction, no ESC adjacent to stream	

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Project Type	Subshed ID	Reach ID	Site ID	Description	
Maintenance	1	RCH1-12	SC1-11	Triple culvert in need of debris removal (Carolyn Dr)	
		RCH1-12	SC1-12	Culvert blocked with severe woody debris.	
		RCH1-2	UT1-2	Exposed sanitary pipe below OT1-2. Determine whether this is an active line.	
		RCH1-3		Yard inlet in residential yard with associated sinkholes due to pipe failure.	
		RCH1-6	ER1-2	Headcut adjacent to manhole stack.	
		RCH1-7	SC1-7	Rowena Lane. Roadside ditch has collapsing areas (possibly due to piping along underground utility)	
	2	RCH2-1	OT2-1	Outfall 15 inch end section cracking and localized erosion	
		RCH2-1	SC2-1	Two 7 ft CMP culverts; broken headwall; massive erosion (ER2-1)	
		RCH2-6	OT2-5	Concrete chute off parking lot causing some erosion; trash dumping at bottom	
		RCH2-11	UT2-7	4 inch PVC exposed in tributary to main channel	
		RCH2-12	OT2-16	Outfall from newly constructed wet pond; channelized in floodplain;	
	3	RCH2-5	SC2-2	Culvert clogged with sediment	
		RCH3-5	SC3-3	Piping at upstream side of pipe will eventually cause a failing embankment. See sketch. Currently no headwall	
	4	N/A	SC4-11	Debris blockage to be removed	
		RCH4-1	OT4-4	Clean out outlets that are filled with yard debris.	
		RCH4-1	OT4-6	Clean out outlets that are filled with yard debris.	
		RCH4-1	UT4-1	Sewer RW is directly in the channel. Stream flows through tire ruts. Trees growing from sewer manholes in backyards.	
		RCH4-1	MI4-1	Invert of storm drain lower than the rest of reach, causing headcut to work upstream into individual's yard. Associated inlets have collapsed soil surrounding. Grates not attached. Potential for on-site retrofits.	
		RCH4-1	OT4-1	Outfall needs riprap due to bank erosion. Headcut starting to undermine pipe. Trash source. Location - Meadowcrest Dr	
		RCH4-10	SC4-17	One of two 48-inch CMP at Clayton Rd and Breedlove blocked by sediment; evidence of bank failure	
		RCH4-2	SC4-3	Yard collapsing around culvert at Melbourne St	
		RCH4-3	OT4-11	Outfall buried under pine straw, debris, or sediment	
		RCH4-5	OT4-15	24 inch RCP half filled with sediment. Large amounts of trash and sediment (associated with TR4-3 and ER4-2)	
		RCH4-5	OT4-18	Outfall located at eroding meander bend at Charlestown Rd. apartments. Pipe section has fallen off; sheet flow from parking area likely contributing to bank failure.	
		RCH4-6	SC4-8	Culvert maintenance at Charlestown Road crossing (unfinished road). Large tree growing around culvert in embankment. Headwall erosion and extensive sediment deposition on upstream side.	
		RCH4-8	OT4-23	24 inch RCP with heavy sediment deposits	
		RCH4-8	SC4-13	Rip-rap failing in residential yard; downstream pipe failure causing sinkholes in yard	
		RCH4-8	SC4-14	Culvert at Newland Ct. not flow-aligned; eroding headwall	
		RCH4-8	SC4-15	Two 24-inch RCP at Thornwood Dr. Clean out sediment deposited in culvert; likely from upstream construction	
		RCH4-8	SC4-16	Two 24-inch RCP at Bentwood that have excessive amounts of sediment likely from upstream construction	
		5	RCH4-9	UT4-4	SS lateral exposed below major headcut; exposed along
	RCH4-9		UT4-6	SS manhole missing cover.	
	RCH5-12			Utility easement immediately adjacent to the stream; telephone & cable lines now in stream	
			RCH5-3	MI5-1	Surface drainage/erosion from sheet flow to concentrated flows. Along backside of residential mobile home community.



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Project Type	Subshed ID	Reach ID	Site ID	Description
Maintenance	5	RCH5-4	ER5-5 and	Left bank paralleling sanitary sewer ROW, drainage ditches formed, started headcuts. Concern to utility.
		RCH5-5	OT5-2 and	24" RCP with flared end section; stable outfall but is source of channel scour after riprap; also source of trash/debris. Possible opportunity for stream team in neighborhood.
		RCH5-8	UT5-1	Manhole stack in channel, exposed to flow. Good condition.
		RCH5-9	OT5-6	24" CMP outfall well above stream invert has cover soil actively eroding. Easy maintenance repair, but important to address soon.
	6	RCH6-1	OT6-9	Clogged outfall; erosion of channel (ER6-1); possible retrofit
	8	N/A	MI8-100	Intersection of Cheek Rd and Medallion Dr. Culvert across Medallion is buried in sediment and crushed. Water ponding in drainage ditch and yard. Probably due to construction traffic at south end of Medallion.
		RCH8-14	OT8-105	Outfall of Cardinal Lake is severely undermined
		RCH8-14	UT8-100	New sewer easement is not yet stabilized. Silt fence in disrepair. Erosion of streambank due to flow down the steep easement. Located 40-50' downstream of the dam.
		RCH8-5	UT8-4	Gas line crossing stream causing erosion.
		RCH8-5	UT8-5	Utility crossing the stream has caused massive bank failure. Bank stabilization or culvert needed.
	9	RCH9-1	UT9-1	Exposed SS line in small stream that has been incised; brick supports hanging from pipe no longer attached to bank; line not likely active, however removal of bricks recommended.
		RCH9-1	UT9-2	Replace manhole cover; non-active line but near school
	12	RCH12-1	SC12-1	Dirt road; 6ft cast iron culvert; impounding water on upstream side of dirt road; culvert misshapen on downstream; fish barrier; 1.5 ft drop
	13	RCH13-1	SC13-4	Sidewalk crosses stream with own culvert; replace with one
		RCH13-4	SC13-8	Large drainage ditch with driveway culvert acting as culvert control with banks 6-8 ft high. Culvert repair, outlet stabilization; energy dissipation
Monitoring	4	RCH4-6	MI4-7	Diabase sill exposed; good habitat (caddisfly cases observed); consider using as station in Triassic biology study
	9	RCH9-1	MI9-1	Potentially a good site for Triassic basin sampling at outcrop; natural step pools; and large boulder/cobble riffle; send Stratford here
Pollution prevention	3	RCH3-4	MI3-1	Possible illicit at American Hero restaurant; poor storage of grease. Revisit for hotspot
Protection	4	RCH4-6	N/A	Consider forested area/large parcel around MI4-7 for conservation
Stormwater Retrofit	1	RCH1-13	OT1-18	Pendleton Apartments dry pond outfall. Level spreader needed - future problems likely. Retrofit.
		RCH1-15	OT1-20	Potential retrofit site, due to large flow from street drainage and availability of open space. Dead fish found and dissected.
		RCH1-4		Recent construction site (Pendleton Apartments). Dry ponds (2) recently redone - retrofit possibility.
		RCH1-5		Ball field on Lynn Rd - good site for demonstration retrofits where drainage ditch and culverts are located.
		RCH1-6	OT1-9	24" pipe outfall drains a large area. Potential retrofit. Riprapped and steep. Possible upstream residential retrofit at yard inlets. Trash and oil present.
		RCH1-6		Possible retrofits in park (in historic ponds?). Space for large storage area.
	2	RCH2-11	SC2-6	Existing in-stream dam; investigate age and reason for dam; either remove or incorporate into water quality purpose
		RCH2-14		Many outfalls to the stream -- open space for retrofits

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Project Type	Subshed ID	Reach ID	Site ID	Description
Stormwater Retrofit	3	RCH3-4	TR3-1	Junk yard; excess trash (gas tank, batteries, etc) in floodplain; one of largest sediment sources in the watershed. Also possible retrofit
	2	RCH2-3		Parcels in floodplain that are potentially not developable (i.e. wetlands); potential for water quality treatment here
	3	RCH3-2		Bioretention at the end of Rincon Rd.
		RCH3-4	OT3-5	Curb cut outfall from Phillips 76 gas station. Trash and car batteries in stream; Possible retrofit; potential perimeter sand filter.
	4	RCH4-1	MI4-1	Invert of storm drain lower than the rest of reach, causing headcut to work upstream into individual's yard. Associated inlets have collapsed soil surrounding. Grates not attached. Potential for on-site retrofits.
		RCH4-2	OT4-7	Potential for retrofit inventory; small existing wetland/floodplain area below OT4-7 could be expanded.
		RCH4-5	OT4-18	Outfall located at eroding meander bend at Charlestown Rd. apartments. Pipe section has fallen off; sheet flow from parking area likely contributing to bank failure.
	5	RCH5-10B	OT5-8	Large diameter 48" HDPE pipe drains stormwater runoff from upgradient neighborhood. Should be able to modify this pipe to back water up and provide a shallow marsh wetland or wet pond prior to discharge to stream.
		RCH5-10B	OT5-9	Twin HDPE 24" outfall shows signs of headcut. Good retrofit opportunity here to create a shallow marsh wetland area for treatment of residential and golf course runoff.
		RCH5-4	ER5-2 and	Culvert discharge creates eroded channel with or without headcut. Opportunity for SWM retrofit. Rain garden potential? Stilling basin?
		RCH5-6	SC5-2	Triple barrel 48" about 1/4 full of sediment (especially downstream end). Channel forced around sediment; needs to be dredged and possibly used as a large stilling basin needing frequent maintenance.
		RCH5-9	OT5-4	24" CMP outfall draining residential area is good potential location for retrofit (bioretention, swale)
	6	RCH6-1	OT6-9	Clogged outfall; erosion of channel (ER6-1); possible retrofit
7	RCH7-1	OT7-1	Outfall at end of street into riprap swale could be modified to provide enhanced water quality treatment.	
	RCH7-1	OT7-3	Uncontrolled runoff from residential development is causing some channel erosion in drainage ditch/intermittent channel. Look for opportunities to reduce runoff with onlot practices or perhaps with retrofit to cul-de-sac.	
8	RCH8-7	SC8-13	Ponded area behind earthen dam (possible logging road); 30" CMP acts as fish barrier	
9	RCH8-13	OT8-103	Dry detention basin - currently used as sediment basin. Drains to forested buffer before reaching high quality stream.	
	RCH9-1	MI9-2	Potential retrofit location near track at middle school. Area between northern ball field and track. Dumpster management.	
13	RCH13-1	OT13-3	Outfall from cul-de-sac goes to driveway culvert - potential water quality swale	
Stream Restoration	1	RCH1-2	ER1-1	6' headcut.
	2	RCH2-1	ER2-1	Massive erosion (12-14 ft high banks)
	3	RCH3-1	ER3-1	Bank failure with widening and downcutting. Intermittent channel in suburban area. Bank heights 6', with 65 to 90 degree banks.
		RCH3-5	SC3-3	Piping at upstream side of pipe will eventually cause a failing embankment. See sketch. Currently no headwall
		RCH3-6	ER3-2	Active downcutting and widening adjacent to homeowner property. 5 for severity and good access. Pouring paint in stream.
4	RCH4-3	ER4-1	Headcut (2.5 ft drop) in forested area migrating upstream from confluence with RCH4-4; access difficult (poison ivy, too)	

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Project Type	Subshed ID	Reach ID	Site ID	Description
Stream Restoration	4	RCH4-4		Length of reach, both sides for stream repair; right bank for buffer reforestation (200 ft) plus invasive plant removal on left bank.
		RCH4-5	OT4-18	Outfall located at eroding meander bend at Charlestown Rd. apartments. Pipe section has fallen off; sheet flow from parking area likely contributing to bank failure.
		RCH4-5	ER4-2	Headcut on steep slope associated with combined drainage from OT4-14 and OT4-15. Room in forested area for step pool or other control feature
		RCH4-9	ER4-3	Severe headcut with exposed sewer line crossing below
		RCH4-9	OT4-30	Localized stream repair; potential outfall retrofit; homeowner losing his backyard
	5	RCH5-10B	ER5-7	Same area as IB5-3. In addition to hard bank repair, another approach might include using rootwads
		RCH5-10B	ER5-8	Meander bend along 14th (?) hole is actively moving and eroding. Needs stream repair, but fairway is major constraint. Potential for rootwad revetment.
		RCH5-10B	ER5-9	Same area as IB5-5. Bank shaping is another option, with shrub plantings to bioengineer a more stable bank. Good floodplain access exists, but channel is still actively moving as evidenced by sanitary stack in middle of stream. Might be possible to provide relief by reestablishing abandoned channel to the east. Retrofit option here could include creating series of wetland cells, while reestablishing abandoned channel.
		RCH5-10B	IB5-3	Golf course hole #11 has no vegetative buffer which is causing severe erosion. Because near the green, shrubs or even a hardlined stream repair practice may be best alternative (e.g., bolder revetment, imbricated riprap)
		RCH5-10B	IB5-4	Buffer is absent along this stream crossing of the fairway. Shrub plantings should not measurably affect the hole. Consider bank shaping along with bioengineering to provide support.
		RCH5-13		Series of braided channels on City property -- possible locations for replanting and open up channel to floodplain
			ER5-3	
		ER5-7		
	6	RCH6-1	ER6-1	60ft of erosion; 4 ft banks on ephemeral channel; actively eroding with 3/4 severity (associated with OT6-9)
		RCH6-5	ER6-2	Sediment deposition in channel; some headcutting and source seems to be from a farm operation where sand is stockpiled; tractors; off of Holder Rd; Chris's friend
	10	RCH10-2	ER10-2	Steep headcut at the end of Suitt Rd. Bank heights 6' to 12'. Needs stabilization. Ranks 4 for severity.
		RCH10-3	ER10-3	300' of eroding stream with 6' to 10' banks. Stream restoration may be in design - KCI survey monuments and flagging found. Possible retrofit of homeowner - 1/2 ac of impervious on 1 ac lot.
		RCH10-4	ER10-4	Provide grade control in existing incised channel. Severity 4. Not an easy restoration project. 50' length of 30" CMP in stream.
	13	RCH13-3	ER13-1	150 ft eroded stream bank; left bank only; pasture abuts stream; eroding to fence
	Trash Cleanup	1	RCH1-11	TR
RCH1-3			TR11-1	2 pickups of trash including plastic, tires.
RCH1-14			TR	
RCH1-5			TR1-1	Recreation center off of Walton Street; large trash & debris removal needed.
RCH1-5				Cleanup along entire left bank

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Project Type	Subshed ID	Reach ID	Site ID	Description
Trash Cleanup	1	RCH1-6	TR1-2	Appliances and other residential trash dumped adjacent to local park. May require heavy equipment and local government involvement. Easy access.
	2	RCH2-10	TR2-1	Residential trash and yard waste dumped across stream from backyards; Housing authority issue
		RCH2-2	MI2-1	Large items including cars
		RCH2-6	OT2-5	Concrete chute off parking lot causing some erosion; trash dumping at bottom of chute.
	3	RCH3-4	OT3-5	Curb cut outfall from Phillips 76 gas station. Trash and car batteries in stream; Possible retrofit; potential perimeter sand filter.
		RCH3-4	TR3-2	Large items in stream (big pipe, tires, plastic, metal). Need heavy equipment
		RCH3-4	TR3-1	Junk yard; excess trash (gas tank, batteries, etc) in floodplain; one of largest sediment sources in the watershed. Also possible retrofit
		RCH3-6	TR3-3	Tires, automotive, metal and plastic in stream; 2 pickup truck loads
		RCH3-7	TR3-4	Entire reach, saw paint dumping, concrete and construction debris; 3-4 truck loads
	4	RCH4-1	OT4-1	Outfall needs riprap due to bank erosion. Headcut starting to undermine pipe. Trash source. Location - Meadowcrest Dr
		RCH4-1	TR4-1	Trash from outfall - good cleanup location.
		RCH4-1		Entire reach
		RCH4-2	TR4-2	Lots of trash below outfalls at Bentwood Apartments; lots of automotive parts and oil containers; volunteers could clean up; good education focus
		RCH4-5	TR4-3	Residential trash (plastic, furniture, etc) associated with outfalls OT4-14; OT4-15; and OT4-17. Access may be difficult due to fencing around apartment complex.
	5	RCH5-3	TR-1	Trash, organic debris and rubble in the floodplain. Not high priority dumping but correlates with the buffer enhancement (IB5-2).
		RCH5-5	OT5-2 and	24" RCP with flared end section; stable outfall but is source of channel scour after riprap; also source of trash/debris. Possible opportunity for stream team in neighborhood.
	Wetland Mitigation	4	RCH4-10	MI4-5



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Potential Restoration Projects				
Subshed ID	Reach ID	Site ID	Project Type	Description
1	RCH1-1		Buffer Restoration	Recommend a 25' to 50' buffer entire length of reach. Invasive species (kudzu) removal. Stream paralleled by sewer ROW. Mainly residential area.
	RCH1-10	OT-1-13	Illicit discharge	Illicit discharge - sudsy water at 903 Midway Street
	RCH1-11		Trash Cleanup	
	RCH1-12	SC1-11	Maintenance	Triple culvert in need of debris removal (Carolyn Dr)
	RCH1-12	SC1-12	Maintenance	Culvert blocked with severe woody debris.
	RCH1-13	IB1-1	Inspection and Enforcement	Cleared lot without ESC. Needs 50' buffer reforestation.
	RCH1-13	IB1-2	Buffer Restoration	Reforestation needed on right bank. Constrained by residential backyards.
	RCH1-13	OT1-18	Stormwater Retrofit	Pendleton Apartments dry pond outfall. Level spreader needed - future problems likely. Retrofit.
	RCH1-13	TR11-1	Trash Cleanup	2 pickups of trash including plastic, tires.
	RCH1-14		Trash Cleanup	
	RCH1-15	IB1-3	Inspection and Enforcement	Buffer has been clear-cut. Kathy may call this in.
	RCH1-15	IB1-4	Buffer Restoration	Buffer through mobile home community.
	RCH1-15	OT1-20	Stormwater Retrofit	Potential retrofit site, due to large flow from street drainage and availability of open space. Dead fish found and dissected.
	RCH1-2	ER1-1	Stream Restoration	6' headcut.
	RCH1-2	UT1-2		Exposed sanitary pipe below OT1-2. Determine whether this is an active line.
	RCH1-3	SC1-3	Inspection and Enforcement	Road crossing at South Adams St. Interlocking block used in headwall, not allowed.
	RCH1-3		Maintenance	Yard inlet in residential yard with associated sinkholes due to pipe failure.
	RCH1-4		Stormwater Retrofit	Recent construction site (Pendleton Apartments). Dry ponds (2) recently redone - retrofit possibility.
	RCH1-5	TR1-1	Trash Cleanup	Recreation center off of Walton Street; large trash & debris removal needed.
	RCH1-5	UT1-1	Inspection and Enforcement	Sanitary sewer crossing (8 inch clay pipe) partly exposed along bottom of stream; bubbling at pipe junction (leaking?)
	RCH1-5		Buffer Restoration	Buffer needed entire length of left bank; constrained by homeowner fences and sheds.
	RCH1-5		Stormwater Retrofit	Ball field on Lynn Rd - good site for demonstration retrofits where drainage ditch and culverts are located.
	RCH1-5		Trash Cleanup	Cleanup along entire left bank
	RCH1-6	ER1-2	Maintenance	Headcut adjacent to manhole stack.
	RCH1-6	OT1-9	Stormwater Retrofit	24" pipe outfall drains a large area. Potential retrofit. Riprapped and steep. Possible upstream residential retrofit at yard inlets. Trash and oil present.
	RCH1-6	TR1-2	Trash Cleanup	Appliances and other residential trash dumped adjacent to local park. May require heavy equipment and local government involvement. Easy access.
	RCH1-6		Stormwater Retrofit	Possible retrofits in park (in historic ponds?). Space for large storage area.
	RCH1-7	OT1-11	Inspection and Enforcement	Left bank, 4" PVC, flowing. Draining wet area below pond. Significant algae in pipe.
	RCH1-7	OT1-12	Homeowner Education	Residential area with home business, 15" drain from parking area/wash station to stream. Education or retrofit.
	RCH1-7	SC1-7	Maintenance	Rowena Lane. Roadside ditch has collapsing areas (possibly due to piping along underground utility)

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Potential Restoration Projects				
Subshed ID	Reach ID	Site ID	Project Type	Description
1	RCH1-7	UT1-4	Inspection and Enforcement	Sewer cleanout located in the stream.
	RCH1-7		Buffer Restoration	Entire reach has no buffer on either side stream. Reforestation on the left bank restricted by sewer. Portions of right bank restricted by proximity of houses.
	RCH1-7		Homeowner Education	Multiple outfalls including downspouts and other 4" PVC pipes. Homeowner education needed.
	RCH1-9	UT1-5	Inspection and Enforcement	Exposed manhole stack with erosion around it.
	RCH1-9	UT1-6	Inspection and Enforcement	Exposed pipe with cleanout in the stream. Active erosion around pipe/cleanout.
2	RCH2-1	ER2-1	Stream Restoration	Massive erosion (12-14 ft high banks)
	RCH2-1	IB2-1	Buffer Restoration	300 ft possible restoration but homes 25 ft from stream; results in low restoration potential; homeowner education on invasive Japanese stilt grass.
	RCH2-1	OT2-1	Maintenance	Outfall 15 inch end section cracking and localized erosion
	RCH2-1	SC2-1	Maintenance	Two 7 ft CMP culverts; broken headwall; massive erosion (ER2-1)
	RCH2-10	OT2-2 thru OT2-14	Inspection and Enforcement	Septic Sand filter discharges directly to stream.
	RCH2-10	TR2-1	Trash Cleanup	Residential trash and yard waste dumped across stream from backyards; Housing authority issue
	RCH2-10		Buffer Restoration	Backyards mowed to stream; homeowner education and reforestation needed.
	RCH2-11	SC2-6	Stormwater Retrofit	Existing in-stream dam; investigate age and reason for dam; either remove or incorporate into water quality purpose
	RCH2-11	UT2-7	Maintenance	4 inch PVC exposed in tributary to main channel
	RCH2-12	OT2-16		Outfall from newly constructed wet pond; channelized in floodplain;
	RCH2-12		Inspection and Enforcement	Existing wet pond; significant erosion issues in the pond
	RCH2-12		Inspection and Enforcement	Failing ESC measures in new construction off Gibson Rd.
	RCH2-13		Homeowner Education	Potential area for home owner education and stewardship downstream of Gibson Rd
	RCH2-14	IB2-10	Buffer Restoration	Mobile home community with no buffer and moderately highly maintained landscaping -- one landowner work with them to maintain buffer
	RCH2-14		Stormwater Retrofit	Many outfalls to the stream -- open space for retrofits
	RCH2-2	MI2-1	Inspection and Enforcement	Uncovered septic tank
	RCH2-2	MI2-1	Trash Cleanup	Large items including cars
	RCH2-2	UT2-1	Inspection and Enforcement	Exposed 6 inch PVC sewer line -- needs protection
	RCH2-2		Buffer Restoration	Possible 50 ft buffer; old agriculture property mowed to the stream edge; adjacent to a soon to be developed parcel
	RCH2-3	OT2-2	Inspection and Enforcement	3 inch PVC outfall with frozen discharge (305 Pleasant Drive); potential septic sand filter discharge
	RCH2-3		Buffer Restoration	150 ft of inadequate buffer due to homeowner mowing
RCH2-3		Stormwater Retrofit	Parcels in floodplain that are potentially not developable (i.e. wetlands); potential for water quality treatment here	
RCH2-5	SC2-2	Maintenance	Culvert clogged with sediment	
RCH2-6	ER2-2	Buffer Restoration	Eroded actively downcutting banks due to change in land use; parcel that has been cleared with less than 10 ft buffer. Find out if slated for development and have slopes protected and replanted.	

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Potential Restoration Projects				
Subshed ID	Reach ID	Site ID	Project Type	Description
2	RCH2-6	OT2-5	Trash Cleanup and maintenance	Concrete chute off parking lot causing some erosion; trash dumping at bottom of chute.
	RCH2-8			Small channel downstream of houses; parcel to be developed. Find out if slated for development
3	RCH3-1	ER3-1	Stream Restoration	Bank failure with widening and downcutting. Intermittent channel in suburban area. Bank heights 6', with 65 to 90 degree banks.
	RCH3-1	IB3-1	Buffer Restoration	Approximately 300' on the left bank and 350' on the right bank is restorable. 10-15' width buffer can likely be restored on left bank; 25-50' on right bank. Houses and agricultural land uses.
	RCH3-2	UT3-1	Inspection and Enforcement	Leaking sewer behind house on Recon Place. Reported to authorities.
	RCH3-2		Inspection and Enforcement	Parcels in floodplain that are potentially not developable (wetlands and stream) -- new section of Rincon -- don't allow additional crossing either if possible
	RCH3-2		Stormwater Retrofit	Bioretention at the end of Rincon Rd.
	RCH3-3	IB3-2	Buffer Restoration	Small buffer (10'-25') existing on 1 residential buffer. Potential for bigger buffer. Stream is incised at this location.
	RCH3-3		Inspection and Enforcement	Parcels in Floodplain that are potentially not developable (wetlands and stream) -- new section of Rincon -- don't allow additional crossing either if possible
	RCH3-4	MI3-1	Pollution prevention	Possible illicit at American Hero restaurant; poor storage of grease. Revisit for hotspot
	RCH3-4	OT3-5	Stormwater Retrofits and Trash Cleanup	Curb cut outfall from Phillips 76 gas station. Trash and car batteries in stream; Possible retrofit; potential perimeter sand filter.
	RCH3-4	TR3-1	Trash Cleanup and Stormwater Retrofit	Junk yard; excess trash (gas tank, batteries, etc) in floodplain; one of largest sediment sources in the watershed. Also possible retrofit
	RCH3-4	TR3-2	Trash Cleanup	Large items in stream (big pipe, tires, plastic, metal). Need heavy equipment
	RCH3-5	SC3-3	Maintenance and Stream Restoration	Piping at upstream side of pipe will eventually cause a failing embankment. See sketch. Currently no headwall
	RCH3-6	ER3-2	Stream Restoration	Active downcutting and widening adjacent to homeowner property. 5 for severity and good access. Pouring paint in stream.
	RCH3-6	MI3-2	Inspection and Enforcement	Wetland and an area that should have been part of stream buffer in platted lot; downstream of Pinnock Rd.
	RCH3-6	OT3-7	Inspection and Enforcement	Septic Leakage. Foul odor; 6 inch plastic tubing discharging sewage from 2 houses (likely more). Mockingbird Lane.
	RCH3-6	TR3-3	Trash Cleanup	Tires, automotive, metal and plastic in stream; 2 pickup truck loads
	RCH3-7	MI3-2	Discharge Prevention	Hand washing of clothes and direct discharge into stream
	RCH3-7	MI3-3	Illicit discharge	Sudsy discharge; 6 inch black plastic pipe; active; wash water most likely
	RCH3-7	OT3-8	Inspection and Enforcement	6-7 inch PVC; possible swimming pool discharge; submerged
	RCH3-7	TR3-4	Trash Cleanup	Entire reach, saw paint dumping, concrete and construction debris; 3-4 truck loads
RCH3-7	UT3-2	Discharge Prevention	Sanitary sewer crossing about 2 foot above invert of stream; but in ok shape right now	
4	N/A	SC4-11	Maintenance	Debris blockage to be removed
	RCH4-1	MI4-1	Maintenance and Stormwater Retrofit.	Invert of storm drain lower than the rest of reach, causing headcut to work upstream into individual's yard. Associated inlets have collapsed soil surrounding. Grates not attached. Potential for on-site retrofits.
	RCH4-1	OT4-1	Maintenance and Trash Cleanup	Outfall needs riprap due to bank erosion. Headcut starting to undermine pipe. Trash source. Location - Meadowcrest Dr
	RCH4-1	OT4-4	Maintenance	Clean out outlets that are filled with yard debris.

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4	RCH4-1	OT4-6	Maintenance	Clean out outlets that are filled with yard debris.
	RCH4-1	TR4-1	Trash Cleanup	Trash from outfall - good cleanup location.
	RCH4-1	UT4-1	Maintenance	Sewer RW is directly in the channel. Stream flows through tire ruts. Trees growing from sewer manholes in backyards.
	RCH4-1		Homeowner Education	Oil filters in stream, backyards flooding, downspouts connected. Neighborhood built in 80's.
	RCH4-1		Trash Cleanup	Entire reach
	RCH4-10	MI4-5	Wetland Mitigation	Open floodplain area at confluence of RCH4-9 and RCH4-10; stream incised; lots of available space; SS ROW may constrain, but allows easy access from Clayton Rd. Investigate further. Could become park for surrounding neighborhoods.
	RCH4-10	SC4-17	Maintenance	One of two 48-inch CMP at Clayton Rd and Breedlove blocked by sediment; evidence of bank failure
	RCH4-2	MI4-6	Inspection and Enforcement	Homeowner has fenced off stream with privacy fence; fence right up to SS manhole's ROW
	RCH4-2	OT4-7	Stormwater Retrofit	Potential for retrofit inventory; small existing wetland/floodplain area below OT4-7 could be expanded.
	RCH4-2	SC4-3	Maintenance	Yard collapsing around culvert at Melbourne St
	RCH4-2	TR4-2	Stream Cleanup	Lots of trash below outfalls at Bentwood Apartments; lots of automotive parts and oil containers; volunteers could clean up; good education focus
	RCH4-2		Homeowner Education	Buffer encroachment in single family residential area; proper vehicle maintenance practices
	RCH4-3	ER4-1	Stream Restoration	Headcut (2.5 ft drop) in forested area migrating upstream from confluence with RCH4-4; access difficult (poison ivy, too)
	RCH4-3	IB4-1		Unbuffered segment upstream of Mansfield Rd (mowed to edge of stream on church property); noticeable aquatic vegetation; consider riparian buffer planting (nearby homeowner or church).
	RCH4-3	OT4-11	Maintenance	Outfall buried under pine straw, debris, or sediment
	RCH4-3	UT4-2	Inspection	Exposed 4" PVC above stream; no joint exposure
	RCH4-4		Stream Restoration	Length of reach, both sides for stream repair; right bank for buffer reforestation (200 ft) plus invasive plant removal on left bank.
	RCH4-5	ER4-2	Stream Restoration	Headcut on steep slope associated with combined drainage from OT4-14 and OT4-15. Room in forested area for step pool or other control feature
	RCH4-5	OT4-15	Maintenance	24 inch RCP half filled with sediment. Large amounts of trash and sediment (associated with TR4-3 and ER4-2)
	RCH4-5	OT4-18	Maintenance, Stream Restoration, and Stormwater Retrofit	Outfall located at eroding meander bend at Charlestown Rd. apartments. Pipe section has fallen off; sheet flow from parking area likely contributing to bank failure.
	RCH4-5	TR4-3	Trash Cleanup	Residential trash (plastic, furniture, etc) associated with outfalls OT4-14; OT4-15; and OT4-17. Access may be difficult due to fencing around apartment complex.
	RCH4-6	MI4-7	Monitoring	Diabase sill exposed; good habitat (caddisfly cases observed); consider using as station in Triassic biology study
	RCH4-6	N/A	Protection	Consider forested area/large parcel around MI4-7 for conservation
	RCH4-6	SC4-10	Enforcement	Dead body found
	RCH4-6	SC4-8	Maintenance	Culvert maintenance at Charlestown Road crossing (unfinished road). Large tree growing around culvert in embankment. Headwall erosion and extensive sediment deposition on upstream side.
	RCH4-8	OT4-23	Maintenance	24 inch RCP with heavy sediment deposits
RCH4-8	SC4-13	Maintenance	Rip-rap failing in residential yard; downstream pipe failure causing sinkholes in yard	
RCH4-8	SC4-14	Maintenance	Culvert at Newland Ct. not flow-aligned; eroding headwall	



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Potential Restoration Projects				
Subshed ID	Reach ID	Site ID	Project Type	Description
4	RCH4-8	SC4-15	Maintenance	Two 24-inch RCP at Thornwood Dr. Clean out sediment deposited in culvert likely from upstream construction
	RCH4-8	SC4-16	Maintenance	Two 24-inch RCP at Bentwood that have excessive amounts of sediment likely from upstream construction
	RCH4-8	UT4-3	Inspection and Enforcement	SS lateral; PVC and iron pipe connection with rubber joint; exposed above stream
	RCH4-8		Inspection and Enforcement	Evidence of sediment deposition from upstream construction (Stonehill Estates? at Obsidian and Thornwood) Evidence of poor ESC; silt fence failing; SS ROW being used as entranceway; sediment on street; ESC basin no outlet structure, etc.
	RCH4-9	ER4-3	Stream Restoration	Severe headcut with exposed sewer line crossing below
	RCH4-9	MI4-1	Inspection and Enforcement	ESC basin off Lodestone Rd in Stonehill Estates, in OK shape now
	RCH4-9	MI4-2	Inspection and Enforcement	Drainage from end of dirt cul-de-sac compromising silt fencing
	RCH4-9	MI4-3	Inspection and Enforcement	Drainage from end of dirt cul-de-sac compromising silt fencing
	RCH4-9	OT4-30	Stream Restoration, Stormwater Retrofit	Localized stream repair; potential outfall retrofit; homeowner losing his backyard
	RCH4-9	OT4-32	Inspection and Enforcement	This outfall and upstream ESC/SWM needs to be inspected. Roadway embankment failure & sediment deposition. Is it meeting design criteria for detention basin??
	RCH4-9	UT4-4	Maintenance	SS lateral exposed below major headcut; exposed along
	RCH4-9	UT4-5	Inspection and Enforcement	Drainage to SS ROW; sediment deposition on manhole; cleanout and relocate silt fence
	RCH4-9	UT4-6	Maintenance	SS manhole missing cover.
	RCH4-9		Inspection and Enforcement	Stonehill ESC(?)
		4-X	Inspection and Enforcement	Residential neighborhood in progress - currently clearing/grubbing site - no controls.
5	RCH5-10A		Inspection and Enforcement	Exposed sanitary and other unknown pipe in stream
	RCH5-10B	ER5-7	Stream Restoration	Same area as IB5-3. In addition to hard bank repair, another approach might include using rootwads
	RCH5-10B	ER5-8	Stream Restoration	Meander bend along 14th (?) hole is actively moving and eroding. Needs stream repair, but fairway is major constraint. Potential for rootwad revetment.
	RCH5-10B	ER5-9	Stream Restoration	Same area as IB5-5. Bank shaping is another option, with shrub plantings to bioengineer a more stable bank. Good floodplain access exists, but channel is still actively moving as evidenced by sanitary stack in middle of stream. Might be possible to provide relief by reestablishing abandoned channel to the east. Retrofit option here could include creating series of wetland cells, while reestablishing abandoned channel.
	RCH5-10B	IB5-3	Stream Restoration	Golf course hole #11 has no vegetative buffer which is causing severe erosion. Because near the green, shrubs or even a hardlined stream repair practice may be best alternative (e.g., bolder revetment, imbricated riprap)
	RCH5-10B	IB5-4	Buffer Restoration; Stream Restoration	Buffer is absent along this stream crossing of the fairway. Shrub plantings should not measurably affect the hole. Consider bank shaping along with bioengineering to provide support.

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Potential Restoration Projects				
Subshed ID	Reach ID	Site ID	Project Type	Description
5	RCH5-10B	IB5-5	Buffer Restoration	+/- 1400 LF of buffer enhancement possible. Unstable banks make project more challenging, but can use a combination of trees and shrubs. Needs to be well planned with golf course architect so that trees are not located in areas likely to receive a lot of shots.
	RCH5-10B	OT5-8	Stormwater Retrofit	Large diameter 48" HDPE pipe drains stormwater runoff from upgradient neighborhood. Should be able to modify this pipe to back water up and provide a shallow marsh wetland or wet pond prior to discharge to stream.
	RCH5-10B	OT5-9	Stormwater Retrofit	Twin HDPE 24" outfall shows signs of headcut. Good retrofit opportunity here to create a shallow marsh wetland area for treatment of residential and golf course runoff.
	RCH5-11		Homeowner Education	Stream channel runs through homeowners' front yard; need maintenance of buffer and turf management
	RCH5-12		Homeowner Education	Stream channel runs through homeowners' front yard; need maintenance of buffer and turf management
	RCH5-12		Maintenance	Utility easement immediately adjacent to the stream; telephone & cable lines now in stream
	RCH5-13		Stream Restoration	Series of braided channels on City property -- possible locations for replanting and open up channel to floodplain
	RCH5-14		Homeowner Education	Stream channel runs through homeowners' front yard; need maintenance of buffer and turf management
	RCH5-3	IB5-1	Buffer Restoration	Potential reforestation in ROW, constrained by gas easement.
	RCH5-3	IB5-2	Buffer Restoration	Buffer enhancement (but note location of sanitary). Some existing buffer reforestation.
	RCH5-3	MI5-1	Maintenance	Surface drainage/erosion from sheet flow to concentrated flows. Along backside of residential mobile home community.
	RCH5-3	TR-1	Trash Cleanup	Trash, organic debris and rubble in the floodplain. Not high priority dumping but correlates with the buffer enhancement (IB5-2).
	RCH5-4	ER5-2 and	Stormwater Retrofit	Culvert discharge creates eroded channel with or without headcut. Opportunity for SWM retrofit. Rain garden potential? Stilling basin?
	RCH5-4	ER5-5 and	Maintenance	Left bank paralleling sanitary sewer ROW, drainage ditches formed, started headcuts. Concern to utility.
	RCH5-5	OT5-2 and	Maintenance and Trash Cleanup	24" RCP with flared end section; stable outfall but is source of channel scour after riprap; also source of trash/debris. Possible opportunity for stream team in neighborhood.
	RCH5-6	SC5-2	Stormwater Retrofit	Triple barrel 48" about 1/4 full of sediment (especially downstream end). Channel forced around sediment; needs to be dredged and possibly used as a large stilling basin needing frequent maintenance.
	RCH5-8	MI5-2	Inspection and Enforcement	Failing sanitary sewer - SSO (4005 Tyne Ave). Reported to Durham Stormwater Services.
	RCH5-8	MI5-3	Inspection and Enforcement	Several sanitary laterals crossing stream to tie into trunk line. Mostly PVC, subject to failure due to exposure; unprotected.
	RCH5-8	UT5-1		Manhole stack in channel, exposed to flow. Good condition.
	RCH5-8	UT5-2	Inspection and Enforcement	Broken sewer lateral. Raw sewage discharges directly to stream. 103 Whetstone Ct
	RCH5-9	OT5-4	Stormwater Retrofit	24" CMP outfall draining residential area is good potential location for retrofit (bioretention, swale)
	RCH5-9	OT5-6	Maintenance	24" CMP outfall well above stream invert has cover soil actively eroding. Easy maintenance repair, but important to address soon.
		ER5-3		
	ER5-7			
	OT5-3			

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Potential Restoration Projects				
Subshed ID	Reach ID	Site ID	Project Type	Description
6	RCH6-1	ER6-1	Stream Restoration	60ft of erosion; 4 ft banks on ephemeral channel; actively eroding with 3/4 severity (associated with OT6-9)
	RCH6-1	OT6-9	Maintenance; Stormwater Retrofit;	Clogged outfall; erosion of channel (ER6-1); possible retrofit
	RCH6-3	MI6-1	Inspection and Enforcement	Land owner clearing buffer; responsible party Durham County E and S
	RCH6-4	MI6-2	Homeowner Education	Cows and other farm animals in stream, upstream of Holder Rd.
	RCH6-5	ER6-2	Stream Restoration	Sediment deposition in channel; some headcutting and source seems to be from a farm operation where sand is stockpiled; tractors; off of Holder Rd; Chris's friend
7	RCH7-1	IB7-1	Buffer Restoration	Encroachment by new residential subdivision from both clearing and moving of fill resulting in small erosion channels. This buffer should be reestablished with new planting and future grading should be watched more closely to avoid similar impacts.
	RCH7-1	OT7-1	Stormwater Retrofit	Outfall at end of street into riprap swale could be modified to provide enhanced water quality treatment.
	RCH7-1	OT7-3	Stormwater Retrofit	Uncontrolled runoff from residential development is causing some channel erosion in drainage ditch/intermittent channel. Look for opportunities to reduce runoff with onlot practices or perhaps with retrofit to cul-de-sac.
	RCH7-1	TR7-1	Inspection and Enforcement	Rubble and fill has be moved to this area by contractor. All should be removed and outfall that is covered reestablished and stabilized. Indication that poor construction inspection and enforcement is practiced.
	RCH7-10	MI7-100	Inspection and Enforcement	2 PVC pipes in ground by stream, 1 leads to pump house. Unclear if pumping to or from stream.
	RCH7-10	SC7-108		Earthen and debris dam
	RCH7-10	UT7-103	Inspection and Enforcement	Sewer lateral cleanout on creek bank
8	N/A	MI8-100	Maintenance	Intersection of Cheek Rd and Medallion Dr. Culvert across Medallion is buried in sediment and crushed. Water ponding in drainage ditch and yard. Probably due to construction traffic at south end of Medallion.
	RCH8-14	OT8-105	Inspection and Enforcement	Cardinal Lake is sediment laden, indicating that the upstream erosion and sediment controls are not functioning
	RCH8-14	OT8-105	Maintenance	Outfall of Cardinal Lake is severely undermined
	RCH8-14	UT8-100	Maintenance	New sewer easement is not yet stabilized. Silt fence in disrepair. Erosion of streambank due to flow down the steep easement. Located 40-50' downstream of the dam.
	RCH8-16	OT8-106	Inspection and Enforcement	Illicit discharge - detergent found in drainage ditch and followed upstream to 2111 Faith Dr. Sewage odor and gray organic material present.
	RCH8-16	OT8-110	Inspection and Enforcement	2104 Faith Dr - possible illicit discharge; detergent smell and deposits that may have been lint and detergent. 2" PVC
	RCH8-16	OT8-111	Inspection and Enforcement	2108 Faith Dr; - possible illicit discharge; detergent smell; whitish stain in black PVC
	RCH8-4	SC8-7		Stream crossing construction of railroad ties, corrugated black plastic pipes and 4" PVC pipes. Reason for installation unclear. Remove from stream.
	RCH8-5	UT8-4	Maintenance	Gas line crossing stream causing erosion.
	RCH8-5	UT8-5	Maintenance	Utility crossing the stream has caused massive bank failure. Bank stabilization or culvert needed.
RCH8-7	SC8-13	Stormwater Retrofit	Ponded area behind earthen dam (possible logging road); 30" CMP acts as fish barrier	

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Potential Restoration Projects				
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8	RCH8-13	OT8-103	Stormwater Retrofit	Dry detention basin - currently used as sediment basin. Drains to forested buffer before reaching high quality stream.
9	RCH9-1	MI9-1	Monitoring	Potentially a good site for Triassic basin sampling at outcrop; natural step pools; and large boulder/cobble riffle; send Stratford here
	RCH9-1	MI9-2	Stormwater Retrofit	Potential retrofit location near track at middle school. Area between northern ball field and track. Dumpster management.
	RCH9-1	UT9-1	Maintenance	Exposed SS line in small stream that has been incised; brick supports hanging from pipe no longer attached to bank; line not likely active, however removal of bricks recommended.
	RCH9-1	UT9-2	Maintenance	Replace manhole cover; non-active line but near school
10	RCH10-2	ER10-2	Stream Restoration	Steep headcut at the end of Suitt Rd. Bank heights 6' to 12'. Needs stabilization. Ranks 4 for severity.
	RCH10-3	ER10-3	Stream Restoration	300' of eroding stream with 6' to 10' banks. Stream restoration may be in design - KCI survey monuments and flagging found. Possible retrofit of homeowner - 1/2 ac of impervious on 1 ac lot.
	RCH10-3	IB10-1	Buffer Restoration	Reforestation on homeowner property.
	RCH10-3	MI10-1	Inspection and Enforcement	Strong septic odor and possible failing septic. Septic system not found. 4011 Suitt Ave
	RCH10-4	ER10-4	Stream Restoration	Provide grade control in existing incised channel. Severity 4. Not an easy restoration project. 50' length of 30" CMP in stream.
	RCH10-4	IB10-2	Buffer Restoration	Inadequate buffer. Reforestation.
11	RCH11-1		Buffer Restoration	Not written in a form; whole reach is in power easement; no buffer; 300 ft
12	RCH12-1	SC12-1	Culvert replacement	Dirt road; 6ft cast iron culvert; impounding water on upstream side of dirt road; culvert misshapen on downstream; fish barrier; 1.5 ft drop
	RCH12-2	ER12-1		Not a real problem; 4 ft headcut occurring for unknown reasons in middle of forested reach
	RCH12-3	MI12-1		Cow pasture around stream; move fence to other property line
13	RCH13-1	IB13-1	Buffer Restoration	Building construction and fill material adjacent to stream; reforestation needed.
	RCH13-1	OT13-3	Stormwater Retrofit	Outfall from cul-de-sac goes to driveway culvert - potential water quality swale
	RCH13-1	SC13-4		Sidewalk crosses stream with own culvert; replace with one
	RCH13-1	TR-13-1	Homeowner Education	Oil filter and oil sheen, buckets of yard waste and concrete
	RCH13-1		Inspection and Enforcement	Home under construction, no ESC adjacent to stream
	RCH13-2		Buffer Restoration	Homes and trucking business mowed up to 10 ft from stream edge; beaver may be reforestation barrier
	RCH13-3	ER13-1	Stream Restoration	150 ft eroded stream bank; left bank only; pasture abuts stream; eroding to fence
	RCH13-4	SC13-8	Maintenance	Large drainage ditch with driveway culvert acting as culvert control with banks 6-8 ft high. Culvert repair, outlet stabilization; energy dissipation